Making Nature Count

IDENTIFYING BARRIERS AND OPPORTUNITIES WITHIN PROFESSIONAL PLANNING PRACTICE IN ONTARIO

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UNIVERSITY OF WATERLOO

INVEST IN NATURE

The Municipal Natural Assets Initiative (MNAI) is changing the way municipalities deliver everyday services, increasing the quality and resilience of infrastructure at lower costs and reduced risk. The MNAI team provides scientific, economic and municipal expertise to support and guide local governments in identifying, valuing and accounting for natural assets in their financial planning and asset management programs, and in developing leading-edge, sustainable and climate resilient infrastructure.

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Executive Summary

In light of increasing concerns over aging infrastructure and urban growth, local governments are looking for ways to improve management of municipal assets that supply community services. At the same time, many communities are experiencing widespread decline in ecosystem quality. Municipal Natural Asset Management (MNAM) has been proposed as offering a sustainable solution to this multifaceted problem. Natural assets (NAs) refer to natural resources and ecosystems that contribute to the provision of one or more services required for the health, economic performance and long-term sustainability of a community and its residents. Planners were identified as having a potentially important role within MNAM due to their diverse and interdisciplinary field, as well as their key involvement with land use decision-making. Accordingly, the primary objective of this study was to identify the top five barriers and opportunities in professional planning norms and standards that stand to affect the refinement, replication, and scaling up of MNAM projects in an Ontario context. To more deeply comprehend the identified planning opportunities and barriers, a secondary objective of this study was to acquire a greater understanding of the role of planners in MNAM.

Fifteen interviews were conducted in 2017-2018 with planners and other relevant professionals from municipalities, Conservation Authorities (CAs), and Municipal Natural Asset Initiative convening partner organizations. From these interviews, a list of the top five barriers and opportunities to implementing MNAM from a planning perspective in Ontario was derived as follows:

Barrier 1	Natural features are not generally conceptualized as service providing assets within planning policy
Barrier 2	Natural features are more complex and their outcome more uncertain than engineered assets, creating the perception of risk
Barrier 3	Inter-departmental and inter-jurisdictional collaboration is hindered by rigidly defined roles and responsibilities
Barrier 4	The requirement to balance interests amongst various stakeholders can lead to the adoption of priorities that do not align easily with MNAM
Barrier 5	Current allocation of resources in municipalities contributes to the perception that there is a lack of resources for MNAM implementation
Opportunity 1	Strong champions provide the leadership necessary to push MNAM through Council and municipal departments
Opportunity 2	CAs already have a cross-jurisdictional foundation and collaborate with multiple municipalities, providing a foundation for cross-jurisdictional collaboration and systems thinking
Opportunity 3	A mandate for sustainability, and the requirement to protect certain natural features, already exists within current planning policy, providing a stepping stone for MNAM processes
Opportunity 4	Drawing on resources from interest groups and governmental programs can greatly reduce resource pressures on municipalities
Opportunity 5	The five-year revision cycle of Official Plans creates the opportunity for greater integration of policies supportive of MNAM

To address these barriers and opportunities, action steps were identified and assigned to specific stages of the MNAM implementation processes. All participants confirmed that planners had a role to play, but ambiguity set in when exploring what role that would be, as varying opinions arose. From participants' responses, three general functions of planners regarding MNAM were identified: 1) facilitation among specialists and management of interdisciplinary networks; 2) policy formulation and implementation; and 3) a technical role in MNAM. Interview results also suggested that the types of planners that would be the most involved in MNAM are land use planners, environmental planners and policy-based planners.

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Municipal natural assets are those natural features that provide services used by municipalities akin to those delivered by traditional engineered infrastructure.

1. Introduction and Background

1.1 Municipal Natural Asset Management: An Overview

In light of increasing concerns over ageing infrastructure and urban growth, local governments are looking for ways to improve management of critical municipal assets that supply community services. At the same time, many communities are experiencing widespread decline in ecosystem quality due to, among other factors, development pressures to meet the needs of rising populations. The increasing impact of climate change will only act to compound these issues. **Municipal Natural Asset Management (MNAM)** has been proposed as offering a sustainable solution to this multifaceted problem.

Natural assets (NAs) refer to the natural resources and ecosystems that contribute to the provision of one or more services required for the health, economic performance, and long-term sustainability of a community and its residents. Municipal NAs are those natural features that provide services used by municipalities akin to those delivered by traditional engineered infrastructure (Table 1). MNAM views natural features through this asset management lens, conceptualizing municipal natural features as service providing assets that would otherwise need to be provided by a municipality, or other form of government. MNAM recognizes that, just as with engineered assets, municipal NAs need not only to be protected, but also to be effectively managed to ensure the long-term provisioning of their vital services. Indeed, when sustainably managed, these municipal NAs have the potential to provide services to a community with no capital cost, and their required maintenance or operating expenditures are often a fraction of the cost of an engineered replacement.

Table 1: Examples of municipal natural assets, their engineered replacements, and the services they provide in a water management context. (Source: MNAI, 2017)

Municipal Service	Municipal Natural Asset	Engineered Replacement
Drinking water supply	Aquifer and source water area	Pipes for bringing in water supply
Drinking water treatment	Wetlands; forests; vegetation	Water treatment plant
Stormwater management	Wetlands; forests; vegetation	Stormwater pipes; culverts; storm drains; stormwater ponds
Flood mitigation	Wetlands; forests; vegetation	Dams; retaining walls; embankments
Protection from sea water surges	Foreshore; dunes	Seawalls

The Municipal Natural Asset Initiative (MNAI) is a convening partnership of agencies that provides scientific, economic and municipal expertise to support and guide local governments in identifying, valuing and accounting for NAs in their financial planning and asset management programs. It has developed a six-step prototype methodology for MNAM, closely resembling those steps and activities involved with traditional engineered asset management to begin providing guidance on how the management of municipal NAs could be undertaken (Figure 1).

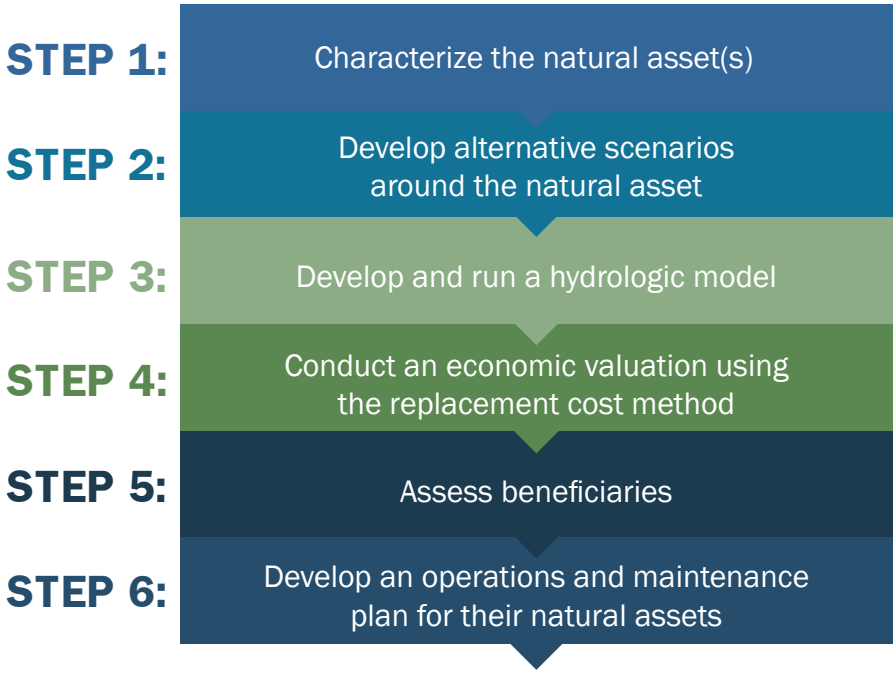


Figure 1: A generalized six-step prototype methodology has been developed for Municipal Natural Asset Management. Although this prototype methodology was designed around managing the provisioning of storm-water management services, the general process can be applied to the management of a wide variety of MNAs.

MNAM is already being implemented by several municipalities across Canada. In 2014, the coastal town of Gibsons in British Columbia was the first municipality in North America to formally conceptualize natural features as service providing municipal assets, and subsequently provide them the same level of management as conventional engineered assets. Based on Gibsons' experience, five municipalities across Canada, including two in Ontario, volunteered and were selected by the MNAI for participation in MNAM pilot projects. The management questions and expected outcomes were adapted to the specific needs and conditions of each municipality. These projects are expected to be completed in 2018. Despite the fact that MNAM is already being undertaken by several municipalities, understanding of factors that will hinder or facilitate widespread implementation of the approach is still limited. Such information would greatly aid the formulation of NA policies and methods to measure the services delivered by NAs. It would also contribute to the development of effective management strategies to ensure durable and sustainable NA service delivery.

1.2 Planners and Municipal Natural Asset Management: Scope of this Study

This study aims to address a knowledge gap relating to factors that affect the success of MNAM from a planning perspective. Planners have been identified as having a potentially important role in MNAM due to their diverse and interdisciplinary field, as well as their key involvement with land use decision-making. Therefore, the **primary objective** of this study was to **identify the top five barriers and opportunities in professional planning norms and standards that stand to affect the refinement, replication, and scaling up of MNAM projects in an Ontario context**. To more deeply comprehend the identified planning opportunities and barriers, a secondary objective of this study was to acquire a greater understanding of the potential role of planners in MNAM.

Defining *planners* and *planning* is challenging as the profession encompasses a diverse range of fields and job definitions. Historically, formal planning was more narrowly defined than it is today; its role was perceived more in administrative and technocratic terms. However, more recently, planning has acquired a more facilitative role and interfaces with a diverse range of disciplines. Therefore, there exist a variety of definitions for *planning*. The Canadian Institute of Planners (CIP) defines planning comprehensively as *"the scientific, aesthetic, and orderly disposition of land, resources, facilities and services with a view to securing the physical, economic and social efficiency, health and well-being of urban and rural communities."* (Canadian Institute of Planners, n.d.). The Ontario Professional Planners Institute (OPPI) has slightly adapted the CIP definition: planning "*includes the scientific, aesthetic and orderly disposition of land, resources, facilities and services, with a view to securing physical, economic and social efficiency, a sound environment, health and well-being*" (Government of Ontario, 1994). These definitions highlight the wide breadth of what is considered *planning*, as well as how planners are involved with and influence a wide range of public sector interventions, including land use designation and natural resource conservation, fields that are directly linked to MNAM.

There are several roles that fall, to varying degrees, under the responsibility of planners, which have the potential to impact the success of MNAM. Primary among these roles is planners' involvement with the preparation of land-use plans and the adoption of land use bylaws. These plans designate the spatial distribution of land uses within a municipality, determining what land uses are allowed while taking into account their interactions. Therefore, these plans have a major impact on the preservation and prioritization of natural features. If NAs, such as forests and wetlands, are to be managed for the services they provide, development must be prevented in these sites. If a NA is to be incorporated into an asset management framework, the land on which that asset resides cannot be designated for an alternative land-use. By regulating land use, planners can therefore play a key role in the protection of NAs.

There are several other reasons why planners are identified as having the potential to influence MNAM. Firstly, planners are heavily involved in the formulation of Official Plans (OPs). OPs identify the long-term vision for a municipality or region, the goals that will be pursued under the mandate of that vision, as well as the steps required to achieve these goals (see a more detailed discussion of OPs in Section 2.1). It is thus OPs that express major planning decisions made by local and regional municipalities, including NA strategies. Therefore, OPs are directly relevant to MNAM. Other mechanisms through which planners can affect MNAM include their role as facilitators of interdisciplinary teams and projects involving different constituencies, as well as their involvement with public engagement. Although these are all roles through which a planner can have an impact on MNAM, the strength of this influence is unknown, and there are likely many more mechanisms through which planners can catalyze and shape the MNAM process. Therefore, to complement the information on barriers and opportunities to implementing MNAM from a planning perspective, the study also identified the many roles planners can play within MNAM (see Section 6).

2. The Ontario Planning Framework

To provide the reader with further background on planning from an Ontario context, the following section details the legislative and jurisdictional foundation of planning in Ontario.

2.1 Planning in Ontario

In Canada, provinces have autonomy over land use planning within their provincial borders. In Ontario, the provincial government directs planning activities within the province through its own direct interventions and its control over the decisions of planners and municipalities. The Ontario Planning Act provides the foundation for planning in Ontario. It outlines the Province's interests, visions, and goals, and helps balance competing interests and community goals within Ontario. This act sets up the basic framework for planning within Ontario and includes aspects such as roles of the government and planning requirements for municipalities (Government of Ontario, 2017b).

Provincial Policy Statement (PPS) stems from the Planning Act and provide policy directions on community development and growth within Ontario. It contains policy directions on matters of provincial interest related to land use planning and development (Government of Ontario, 2014). The Planning Act mandates that the PPS be reviewed every 10 years and requires that decisions affecting planning matters "*shall be consistent with*" policy statements issued under the Act (Government of Ontario, 2017b).

The Planning Act also mandates that municipalities adopt an Official Plan (OP). An OP lays out the land use objectives of a municipality and details how its land will be used. OPs are expected to include policies on growth management, services and infrastructure, community improvement initiatives, and zoning by-laws (Ministry of Municipal Affairs and Housing, 2015). An OP highlights the main issues on which municipal planners will focus, and provide direction to their future land development decisions. OPs must comply with the Planning Act, PPS, and any other regional planning/environmental legislation relevant to their location, such as the Growth Plan of the Greater Golden Horseshoe (GGH), the Greenbelt Act, and the Conservations Authorities Act.

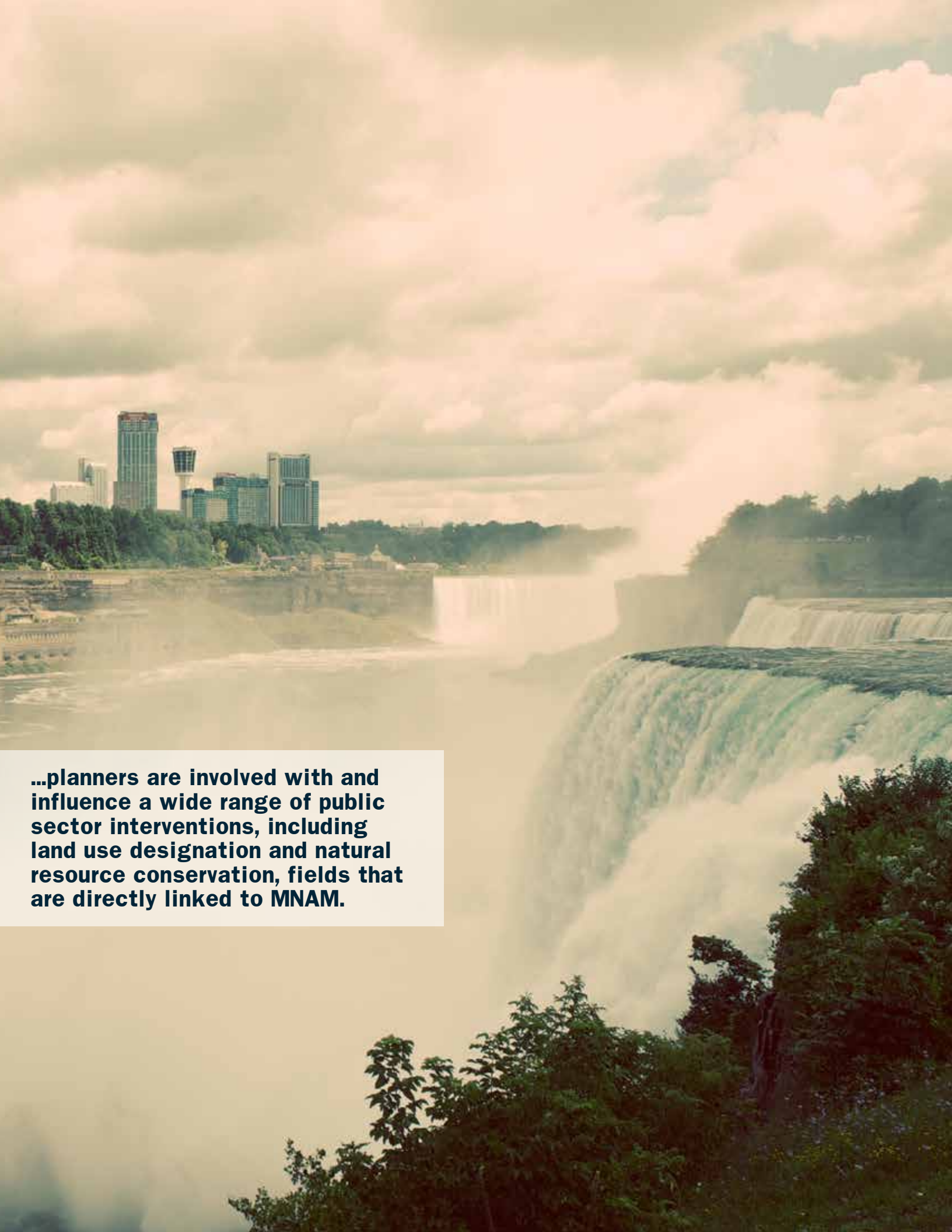
Municipalities can be either one-tiered or two-tiered administrative structures. Two-tiered municipalities have an upper-tier municipality (regional/county) and multiple lower-tier municipalities (city/community). All tiers must have their own OP. City councils make decisions on municipal policies, services, and financing, while committees of adjustments are delegated approval authorities for minor variances and land severances/consent at the local level. Regional councils deal with upper tier

responsibilities.

Conservation Authorities (CAs) also play a significant role in municipal planning. Within Ontario, 36 CAs, based on watersheds, are mandated under the Conservation Authorities Act, 1946, s.20 *"to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals"* (Government of Ontario, 2017a). Historically, CAs managed water for the purpose of protecting human life and property, but their mandate has since been expanded to include natural resources that are indirectly linked to water management, areas of intervention that have many linkages with human wellbeing. Following from this mandate, CAs are critical actors in local and cross-jurisdictional planning decisions, as well as key players in protecting NAs.

2.2 Planning Professional Practices: the Canadian Institute of Planners and the Ontario Professional Planners Institute

In Canada, CIP, and its provincial and territorial affiliates, exist as professional organizations that operate as a voice, advocate, and governing body for professional planners. Practicing under this organization by becoming a Registered Professional Planner (RPP) is an option; it is not mandatory for practicing planning in Canada. Provincial and territorial planning institutes and associations are responsible for upholding CIP standards, as well as the standards specific to the province/territory. In Ontario, these specific standards are put in place by the OPPI. Most provincial and territorial associations, including the OPPI, govern the right to the title RPP. Although this title is not mandatory to practice planning, the number of planners acquiring membership within provincial planning institutes is growing due to the high level of knowledge and skills, dedication, accountability, and professionalism that the title of RPP represents to employers, clients, and the general public. In Ontario, a large portion of practicing planners are hired within the public sector, mostly by municipalities and CAs.



...planners are involved with and influence a wide range of public sector interventions, including land use designation and natural resource conservation, fields that are directly linked to MNAM.

3. Methods and Results

This study consisted of a five-step methodological process leading to a final prioritized list of the top five barriers and opportunities to implementing MNAM from an Ontario planning perspective (Figure 2) (for a detailed description of each step in this methodological process, see Appendix 1). An initial literature review regarding MNAM, professional planning practice and policy, and other relevant areas was first undertaken to identify a list of potential barriers and opportunities, and subsequently informed the development of an interview questionnaire (Step 1). Fifteen interviews were then conducted in 2017-2018 with planners and other relevant professionals from municipalities, CAs, and MNAI convening partner organizations (Step 2). Through these interviews, a wide range of perspectives were gathered relating to the primary MNAM implementation barriers and opportunities. All barriers and opportunities identified in interviews were analyzed using two distinct ranking methods based on the frequency with which each variable was mentioned by participants (Steps 3 and 4).

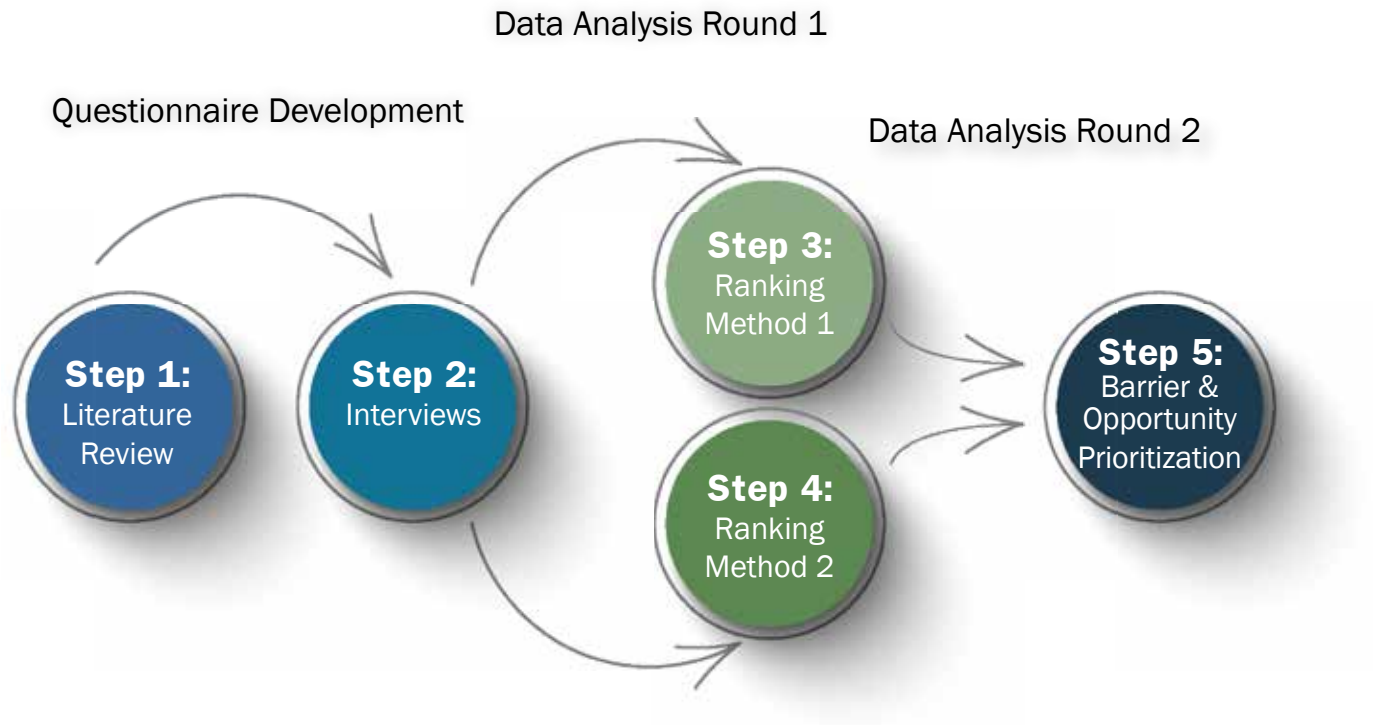


Figure 2: An overview of the five-step methodological process used in this research.

The final step involved a second round of data analysis in which the top barriers and opportunities identified in Steps 3 and 4 were further examined and prioritized based on the order in which barriers would need to be overcome, and opportunities should be acted upon, to promote the greatest success of MNAM (Step 5). This last step resulted in a final list of the top five barriers and opportunities to implementing MNAM from a planning perspective in Ontario (Table 2). Each of these factors is discussed in detail in the following section.

Table 2: A prioritization of the top five barriers and opportunities to implementing Municipal Natural Asset Management from an Ontario planning perspective.

Prioritized Rank	Barriers
Barrier 1 (B1)	Natural features are not generally conceptualized as service providing assets within planning policy
Barrier 2 (B2)	Natural features are more complex and their outcomes more uncertain than engineered assets, creating the perception of risk
Barrier 3 (B3)	Interdepartmental and inter-jurisdictional collaboration is hindered by rigidly defined roles and responsibilities
Barrier 4 (B4)	The requirement to balance interests amongst various stakeholders can lead to the adoption of priorities that do not align easily with MNAM
Barrier 5 (B5)	Current allocation of resources in municipalities contributes to the perception that there is a lack of resources for MNAM implementation
Prioritized Rank	**Opportunities**
Opportunity 1 (O1)	Strong champions provide the leadership necessary to push MNAM through Council and municipal departments
Opportunity 2 (O2)	CAs already have a cross-jurisdictional foundation and collaborate with multiple municipalities, providing a foundation for cross-jurisdictional collaboration and systems thinking
Opportunity 3 (O3)	A mandate for sustainability, and the requirement to protect certain natural features, already exists within current planning policy, providing a stepping stone for MNAM processes
Opportunity 4 (O4)	Drawing on resources from interest groups and governmental programs can greatly reduce resource pressures on municipalities
Opportunity 5 (O5)	The five-year revision cycle of Official Plans creates the opportunity for greater integration of policies supportive of MNAM

4.0 Primary Barriers and Opportunities to Implementing Municipal Natural Asset Management

4.1 Primary Barriers

4.1.1 Barrier 1: Natural features are not generally conceptualized as service providing assets within planning policy

A failure to conceptualize natural features as **assets** that provide valuable and concrete services to the community is still common within municipalities. This shortcoming is reflected in planning and municipal policy documents. Within such documents, natural features and areas tend to be discussed exclusively from the perspective of their protection. The reasoning provided to justify this protection is

usually very vague, failing to encompass the range of their benefits to human wellbeing. For example, in many OPs, wetlands are said to be "important for the environment" in a general sense, but there is often little or no mention of the many specific **services** (e.g. water purification) provided by these NAs. The link between the natural feature and the services it provides is lacking. When natural features are discussed in greater detail, it is usually only in relation to the aesthetic value of that feature. This aspect of NAs can be perceived as frivolous by some and, therefore, it might be concluded easily that the NA can be dispensed with. In addition, these natural features are often viewed and managed in isolation, with little consideration given to their cumulative benefits and relationships.

The focus on aesthetics, and lack of systems thinking, can frequently be seen in development plans, such as subdivision plans, which tend to refer to aesthetic value as the only benefit of natural features. Such emphasis promotes the removal and replacement of natural features with other, often engineered features, considered to be more aesthetically pleasing. In most cases, however, the replacement does not provide the full scope of the original functions of the natural feature and, practically speaking, many such functions are impossible to replace (e.g. specific species-at-risk habitat). There are, of course, exceptions to this focus on aesthetics. For example, the value of natural features pertaining to municipal water sources is gaining much attention in planning documents as concern about water quality and quantity is rising among municipalities. In addition, the work of CAs promotes the understanding of the value of interconnected waters systems, which need to be managed holistically. However, the language used in plans that do discuss the value of natural features to human wellbeing often fails to account for the advantages derived from the active use of these features. This language presents NAs as providing only passive benefits, thus overlooking the many possible contributions to human wellbeing associated with their active utilization and management. Until planners and municipalities fully understand natural features as service providing assets, overcoming the subsequent barriers will be extremely difficult. Therefore, the lack of conceptualization of NAs as providing services was ranked as the primary barrier to implementing MNAM from a planning perspective.

4.1.2 Barrier 2: Natural features are more complex and their outcomes more uncertain than engineered assets, creating the perception of risk

MNAM has not been widely practiced and NAs are generally associated with a much higher degree of complexity than engineered assets. These factors contribute a high degree of perceived uncertainty regarding MNAM. This results in municipalities, which are highly risk averse, to shy away from adopting such processes. This aversion to risk was occasionally stated as a barrier by participants. More commonly, however, it appeared to underlie responses without being explicitly named as a barrier. Indeed, many participants indicated that MNAM was currently too uncertain for widespread application. In addition, the functions and interconnected nature of natural features within municipal boundaries are significantly less well understood than the services and functions of engineered assets. Therefore, it is believed that it is more difficult to control or measure the contributions of NAs to society. After Barrier 1 is overcome and natural features are acknowledged for the value of their services, a deeper and more widespread understanding of their complex relationships is needed to overcome the perception that engaging with MNAM is 'risky' (the object of Barrier 2). In addition, a better comprehension of this complexity will lead to a greater understanding of the full potential of NAs. Subsequently, their service contributions relative to more engineered options can be more fully assessed.

4.1.3 Barrier 3: Interdepartmental and inter-jurisdictional collaboration is hindered by rigidly defined roles and responsibilities

MNAM is a multi-disciplinary approach that will require collaboration among different governmental jurisdictions, as well as a range of internal departments. This need for collaboration will increase complexity associated with managing NAs and, if it does not occur, such collaboration could make MNAM processes more cumbersome. Current municipal structure often fails to foster collaboration among agencies and among internal departments, which frequently have different, sometimes even conflicting, goals and mandates. Perceived roles and responsibilities of each department and agency can also hinder collaboration if agencies and departments assume that the responsibility for certain transboundary NAs is not theirs and/or is already taken care of by another agency or department, potentially creating 'orphan' NAs. Additionally, the effectiveness of MNAM for transboundary NAs might be decreased if one municipality is engaging in MNAM but the adjacent municipality is not.

4.1.4 Barrier 4: The requirement to balance interests amongst various stakeholders can lead to the adoption of priorities that do not align easily with MNAM

Municipal planners are often required to balance the interests of a wide variety of stakeholder groups, including varying interests within the public, the development industry, and the province. The influence of these different interests will vary depending on the municipality, but development interests, which often do not align easily with MNAM, tend to be extremely powerful. The need to accommodate these interests was identified as a primary inhibitor to implementing MNAM. However, once natural features are conceptualized as assets, and their value is acknowledged, interests in support of MNAM are likely to carry more weight in decision-making.

4.1.5 Barrier 5: Current allocation of resources in municipalities contribute to the perception that there is a lack of resources for MNAM implementation

The majority of participants stated that the resources required for the implementation of MNAM are currently lacking. This resource deficiency was thought to relate less to a real lack of overall resources than to an absence of resources that could currently be allocated to MNAM projects. Insufficient opportunity for resource allocation is likely a result of all four aforementioned barriers, but primarily a result of Barrier 1 (see Section 4.1.1), a lack of appreciation of the services provided by natural features, and of the value of these services. Consequently, MNAM might be seen as lacking cost-effectiveness. Although a lack of resources for MNAM implementation is clearly a significant barrier, it was ranked lowest among the top five barriers because it was believed that overcoming the previous four barriers would help alleviate the perception of low cost effectiveness and ensuing resource constraints. However, even if other barriers were addressed, resource limitation was still thought to present a significant obstacle due to ongoing general municipal resource constraints and competition for these resources within the municipality.

4.2 Primary Opportunities

4.2.1 Opportunity 1: Strong champions provide the leadership necessary to push MNAM through Council and municipal departments

Acting upon existing legislation, liaising with other institutions, pursuing funding, and changing policies for the benefit of MNAM will require significant action on the part of individuals. In addition, MNAM requires major shifts in current practices and traditional ways of thinking. Because of these two factors, engaging with MNAM can be expected to require a significant amount of commitment, particularly at the initiation phase. Therefore, identifying a champion to push MNAM through Council, municipal departments, or other organizational structures, was thought to be a prerequisite to MNAM. Participants who had been involved with pilot projects attributed a large proportion of their success to the presence of an individual who championed the initiative. In addition, several participants who were not currently involved with MNAM believed that a champion would be key to a project's success. Such a champion could emerge in the form of either an influential person (e.g. the mayor or a member of Council) who backs the project, allowing it to be allocated the necessary funding, or an innovative planner or other professional within a municipality who takes a leadership role within the project. Because of the interdisciplinary nature of their roles, planners would appear to represent ideal candidates to become champions of MNAM, who can take the necessary steps to lead the project and mobilize support for it. Therefore, the identification of a forward-thinking, innovative planner to fulfill this position was thought to present the foremost opportunity to implementing MNAM from a planning perspective.

4.2.2 Opportunity 2: Conservation Authorities already have a cross jurisdictional foundation and collaborate with multiple municipalities, providing a foundation for cross-jurisdictional collaboration and systems thinking

The misalignment of jurisdictional borders with the areas covered by NAs was identified as a major barrier to implementing MNAM. Overcoming this inhibiting factor will require a high degree of coordination among various jurisdictions. CAs already have a cross-jurisdictional foundation, collaborating with municipalities in an effort to, among other responsibilities, most effectively manage the environment at the watershed level. Utilizing this existing collaborative nature of CAs to promote cooperative management of large-scale NAs was thought to present a significant opportunity to overcoming inter-jurisdictional difficulties. This kind of collaboration is needed for efficient and effective identification and management of NAs right from the initiation phase of MNAM. It is also a key opportunity in the gathering of evidence necessary for procuring funding and influencing policy. Therefore, it was ranked above opportunities relating to more technical and specific factors.

4.2.3 Opportunity 3: A mandate for sustainability, and the requirement to protect certain natural features, already exists within current planning policy, providing a stepping stone for MNAM processes

Many NAs (e.g. wetlands) are already under some form of protection by the Province and many provincial planning policies (e.g. the GGH Growth Plan) list sustainability, and related policy orientations such as climate resiliency, as key aspects of urban planning interventions. Such policies act as opportunities for implementing MNAM because the

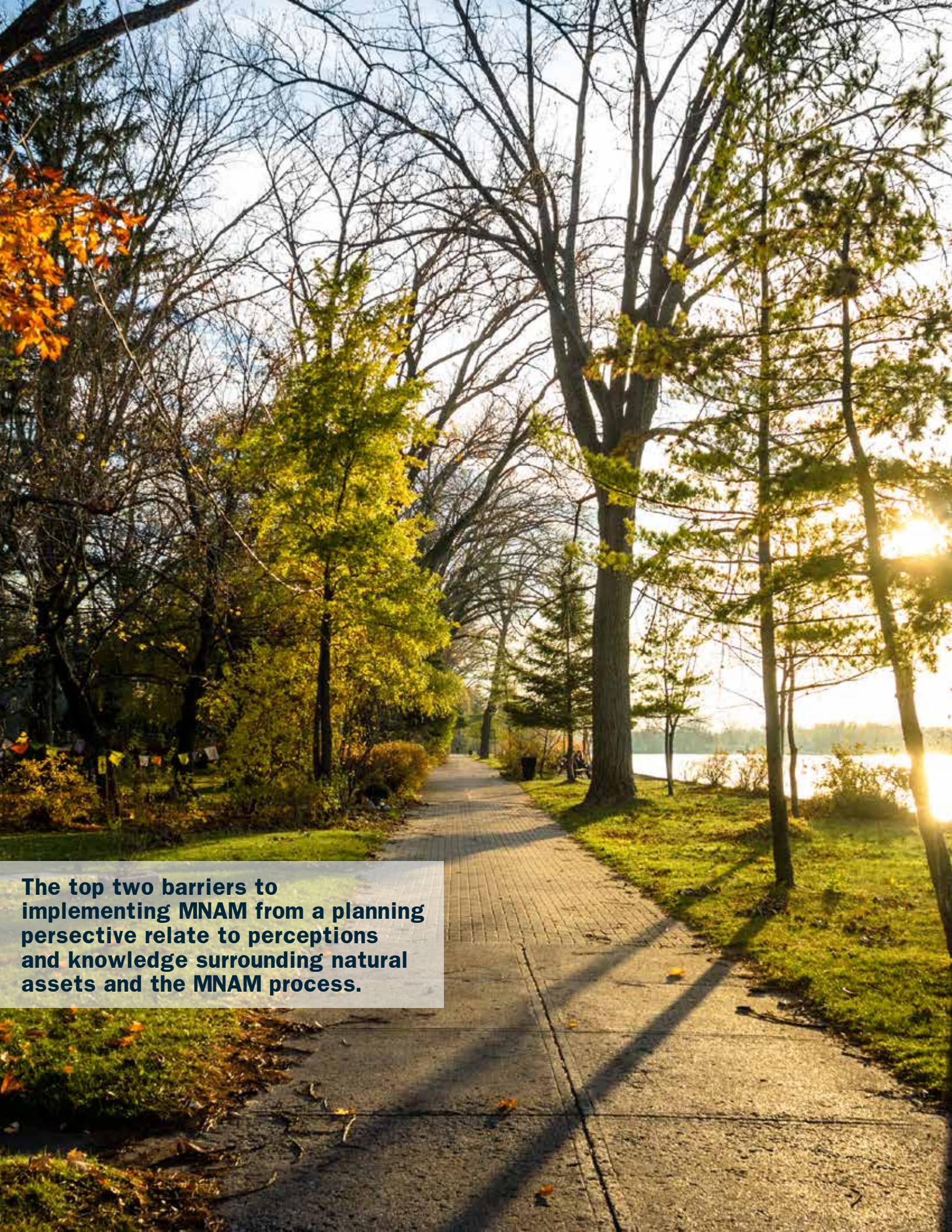
goals and foundation of MNAM align with the mandates of these policies and the protection of natural features and resources. In addition, as climate change and its subsequent impacts increase in severity and frequency, the MNAM process is expected to be perceived as more relevant. Subsequently, the pressure on governments to implement adaptive and mitigative strategies will be expected to grow, likely increasing the receptiveness of governments to novel strategies such as MNAM. The alignment of MNAM with existing planning policy can be used as evidence to garner support. In addition, current policies relating to NAs may have made planners more cognisant of the importance of some natural features, hopefully increasing their acceptance of MNAM. Champions and collaborative bodies should, therefore, seek to clearly identify specific mechanisms through which MNAM supports current policy, of a planning nature or otherwise, to broaden support for MNAM.

4.2.4 Opportunity 4: Drawing on resources from interest groups and governmental programs can greatly reduce resource pressures on municipalities

Once the link between existing policy and MNAM is clearly articulated, champions, and other individuals and agencies involved with MNAM, can seek to secure funding and access to other resources from a range of sources. First, funding and grants that align with MNAM from government incentive programs and environmental interest groups can be pursued, such as those originating from the Federation of Canadian Municipalities (FCM) Municipal Asset Management Program. Second, in some cases, large amounts of data relating to NAs (e.g. inventories) have already been collected by governmental agencies and environmental interest groups. Participants frequently indicated that utilizing such sources of information, rather than collecting all their data from scratch, could save MNAM projects a significant amount of time and money. Finally, even in cases where data have not already been collected, interest groups such as universities and some environmental non-governmental organizations (ENGOs) have research teams in place ready to engage with novel, innovative opportunities. Collaborating with such organizations could represent an additional avenue through which MNAM projects could save resources.

4.2.5 Opportunity 5: The five-year revision cycle of Official Plans creates the opportunity for greater integration of policies supportive of MNAM

The fifth ranked opportunity relates specifically to the integration of MNAM supportive policies within OPs. The fact that OPs are required to be updated and revised every five years provides frequent opportunities for the inclusion of new policies in support of MNAM. The more evidence collected relating to the benefits of MNAM, the more likely it is that OPs will be updated to include policies relating to MNAM. The five-year revision cycle allows MNAM projects to procure such evidence and lobby for its integration within OPs over relatively short time scales. It is thought that the inclusion of MNAM within OPs would greatly increase its uptake among planners since OPs are intended to guide everyday planning practice.



The top two barriers to implementing MNAM from a planning persective relate to perceptions and knowledge surrounding natural assets and the MNAM process.

5. The Way Forward: Action Steps to Address Barriers and Opportunities

To aid in the successful implementation of MNAM, a wide variety of action steps can be taken in an effort to overcome the aforementioned barriers and act on opportunities. Different actions are needed at present, when MNAM is still a novel and not widely recognized process, compared to when it becomes more readily utilized by municipalities. First, action steps targeting education and knowledge sharing are likely to be necessary for overcoming barriers related to misconceptions of NAs and the MNAM process. During this Pre-MNAM implementation phase (Phase 1), the dissemination of information surrounding MNAM and NAs could facilitate its initial adoption. Once the process is taken up by a range of municipalities, pushing MNAM into the Implementation Phase (Phase 2), a wide variety of actions could be taken to overcome barriers, such as resource constraints and a lack of standardized processes, related to initial implementation. Finally, after MNAM has become a widely accepted and utilized process, a number of actions could improve its efficiency, long term sustainability and success (Phase 3). These three phases, their associated action steps, and the specific barriers/opportunities addressed by these actions, are discussed in detail in the following sections (Figure 3).

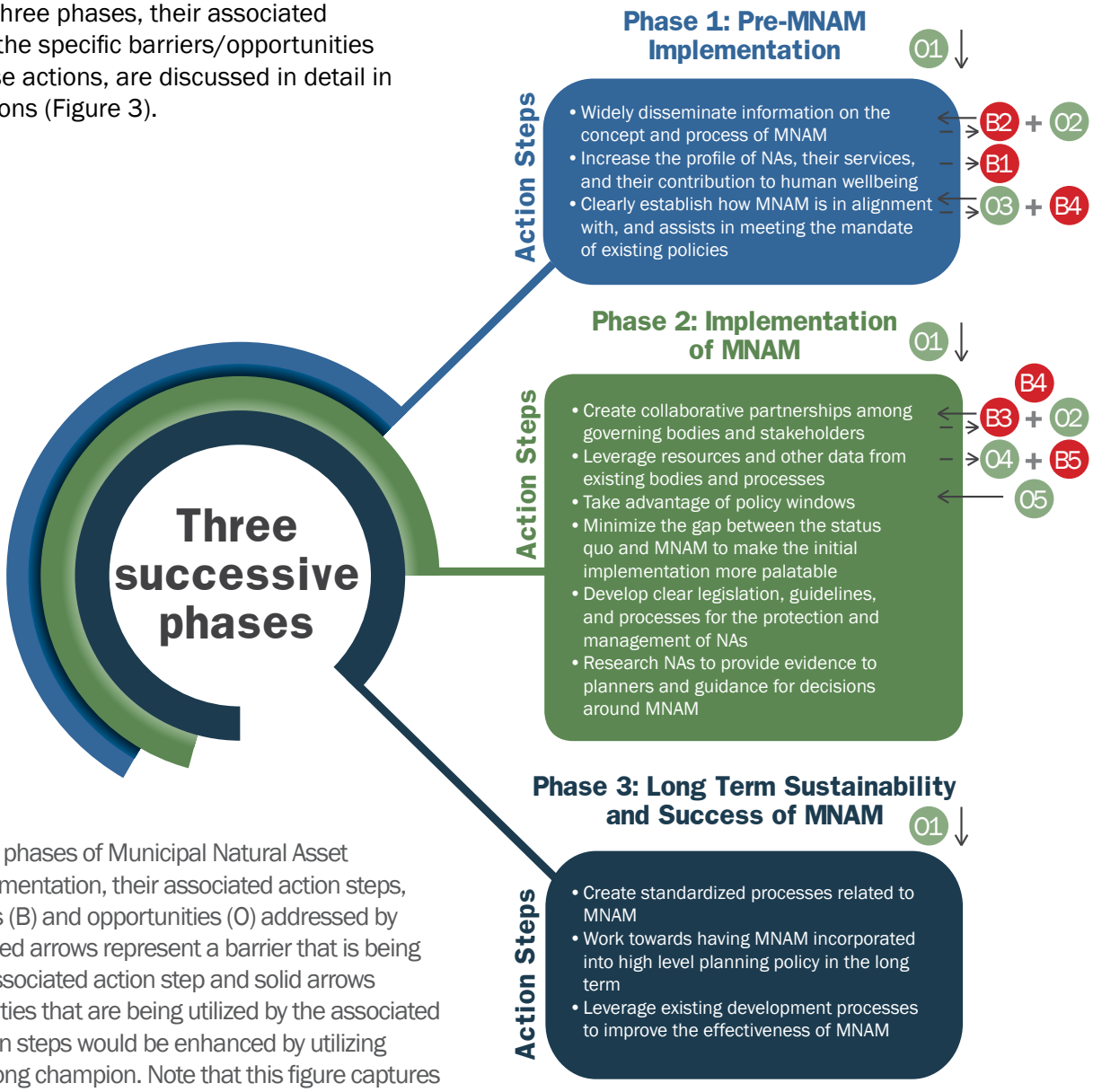


Figure 3: The three phases of Municipal Natural Asset Management implementation, their associated action steps, and specific barriers (B) and opportunities (O) addressed by these actions. Dashed arrows represent a barrier that is being addressed by the associated action step and solid arrows represent opportunities that are being utilized by the associated action step. All action steps would be enhanced by utilizing Opportunity 1, a strong champion. Note that this figure captures only the most direct links between barriers/opportunities and action steps, although many connections exist.

5.1 Phase 1: Pre-Municipal Natural Asset Management Implementation

The top two barriers to implementing MNAM from a planning perspective relate to perceptions and knowledge surrounding NAs and the MNAM process. It therefore follows that the majority of recommended action steps in this phase of MNAM implementation revolve around education and knowledge sharing. These types of actions are important if MNAM is to move beyond this first phase and become a widely utilized process.

5.1.1 Widely disseminate information on the concept and process of MNAM

In the pre-MNAM implementation phase, widely disseminating information on the concept and process of MNAM is important in order to increase awareness, reduce the perception of risk, and gain support. First, presentations about MNAM at conferences, expos, and other knowledge sharing collaborative opportunities (e.g. interjurisdictional learning groups such as Grand River Conservation Authorities' Water Managers Working Group) could be important. These dissemination activities have the potential to make people aware of the process and the fact that it is not just a hypothetical idea, but has already been implemented successfully in several locations. It is at these types of events that forward-thinking planners, and other professionals, who have the potential to become champions of MNAM, will be looking for novel ideas they can bring back to their municipalities and organizations. Indeed, participants involved in pilot projects indicated that it was at such events that they, or another member of their agency, first became aware of MNAM. Particularly useful will be those events that target, or are available to, a wide audience as this increases the range of stakeholders who are likely to attend. Targeting a wide variety of stakeholders is important because MNAM is an interdisciplinary process and, therefore, its success is influenced by a wide variety of actors (e.g. Council, the public, developers, and planners). Additionally, not only is it important to communicate with stakeholders from a variety of sectors, but also with decision-makers from all levels of government. Implementing MNAM is likely to require both a bottom-up and top-down approach. While support from high-level policy could greatly aid MNAM success, planners on the ground could equally benefit MNAM by being proactive champions and facilitators of this approach.

Several stakeholder groups were identified as being particularly important to target for the introduction of the MNAM process. First, CAs, whose potential to facilitate cross-jurisdictional collaboration and learning was identified as one of the primary opportunities, will be a primary agency to which information on MNAM should be disseminated. Second, connections should be made with local interest groups (e.g. ENGOs) to gain public support for MNAM, one avenue through which to influence Council's decision-making. Third, because they determine the priorities of their staff, upper management, senior officials, and other decision makers within municipalities should be involved. Fourth, environmental planners are likely to already have a knowledge base that lends itself to understanding MNAM and recognizing its value. This knowledge base would benefit from being reinforced. Finally, both the FCM (Federation of Canadian Municipalities, 2018) and Green Infrastructure Ontario (Green Infrastructure Ontario, n.d.) were identified by participants as having the potential to be useful to those wishing to undertake MNAM, as they are highly supportive of novel asset management and green design strategies. These organizations may also provide funding and resources for MNAM.

When disseminating information on the MNAM process, several actions can be taken to improve both the receptiveness of stakeholders, and the clarity of the main messages. First, deriving an inventory of who is carrying out MNAM, publicizing successes, and documenting how challenges were overcome, would be useful in reducing the perception that MNAM is 'risky' (see Barrier 2, 4.1.2). This will highlight that not only is the process already being implemented, but also that municipalities are seeing the benefits. Second, creating a simplified (blue-print) version of the MNAM process that can be easily shared and understood would be useful in decreasing the perceived level of implementation difficulty for municipalities for which this is a completely new concept. A more flexible definition of NAs within this blue-print version would make implementation of the process seem less daunting. Participants indicated that expanding the concept of NAs to include other forms of green infrastructure could help municipalities to conceptualize how MNAM could fit within their existing growth strategies and OP.

Finally, participants identified two specific messages that need to be transmitted when circulating information on MNAM. First, a clear balance sheet of the costs and benefits should be provided for decision makers and planners. Strong evidence needs to be presented as to how MNAM will provide benefits to a municipality above what is currently in place. For example, since many NAs are already under some form of protection (e.g. wetlands), the added benefit of MNAM needs to be clearly articulated. It was stressed by participants that if it is demonstrated that a new process is 'better' (e.g. saves resources, improves sustainability), planners will likely advocate for its introduction. Second, it will be useful to demonstrate how MNAM aligns with the mandate of multiple jurisdictions and departments. Since MNAM will require significant inter-jurisdictional and interdepartmental collaboration, it will be important to show how MNAM will help these different agencies in meeting their respective objectives.

5.1.2 Increase the profile of natural assets, their services, and their contribution to human wellbeing

The primary barrier to implementing MNAM was identified as being an overall lack of conceptualization of natural features as service providing assets within planning policy (see Barrier 1, 4.1.1). Therefore, just as disseminating information on the MNAM process itself is important in the pre-implementation phase, so too is improving awareness of the contributions of natural features to human wellbeing, and of the mechanisms through which this occurs. In general, this objective will require widely disseminating information on NAs, what they are, the services they provide, and their value (monetary or otherwise depending on the audience). In addition, the interconnected nature of natural features and the services they provide, both within a municipality and between jurisdictions, must be made clear to instil a broader, systems-level understanding of the functioning of NAs. This includes clearly communicating how changes in one NA can have significant effects on surrounding NAs and services, and subsequently affect human wellbeing. Specific examples of such chain reactions could help to solidify a systems mindset by contextualizing connections, and their implications, in the real world. Several actions were identified as having the potential to hasten improvements in levels of environmental literacy with regards to NAs. First, the use of creative and novel campaigns and public education tools that connect a community to its ecosystems can assist in illustrating human dependence on NAs. At the basis of many of these approaches lie efforts to help people notice nature. A promising approach that was recently launched is the 30x30 Nature Challenge sponsored by the David Suzuki Foundation. This initiative asks people to spend at least 30 minutes outdoors in contact with nature for 30 days in May of each year. By motivating people to spend time outside, this initiative aims to connect people to their local natural environment. Next to increasing human wellbeing, this approach

is expected to have the potential to foster public support for the protection of local natural features. People must be made aware of the environment and their relationships with it, before they may be ready to accept their reliance on natural features and willing to ascribe value to them. Consequently, it is important not only to publicize the environmental benefits of restoration/conservation activities, but also their benefits to human wellbeing.

The creation of an educational tool that compares NAs to engineered assets that provide similar services would also be useful. Such information would increase awareness of the services provided by NAs by comparing and contrasting them with those provided by the more conventional engineered infrastructure of which people are more aware. Through this comparison, the educational tool should also make clear the importance of managing, not only protecting, NAs, just as a municipality manages conventional infrastructure. All of these activities articulate the link between human wellbeing, economic prosperity, and the functions of NAs. Since reference to public pressure can help planners influence Council decisions, making communities aware of their ecosystems, and showing them how they are a part of and dependent on it, may support policy changes that could benefit MNAM.

5.1.3 Clearly establish how MNAM is in alignment with, and assists in meeting, the mandate of existing policies

A final action step that could be taken within the pre-implementation stage involves establishing, and taking advantage of, linkages between MNAM and existing policies. Sustainability mandates within existing policies were identified as stepping-stones for the adoption of MNAM (see Opportunity 3, Section 4.2.3). Participants pointed to several mechanisms through which this opportunity could emerge. First, before MNAM becomes more widely utilized, and integrated within formal policies, municipalities wishing to engage with the process could leverage existing policies to promote, and gain Council's support, for the implementation of MNAM. For example, the PPS recognizes that the "*Province must ensure that its resources are managed in a sustainable way to conserve biodiversity, protect essential ecological processes and public health and safety, provide for the production of food and fibre, minimize environmental and social impacts, and meet its long-term needs"* (Provincial Policy Statement, 2014, p.4). It also states *"Taking action to conserve land and resources avoids the need for costly remedial measures to correct problems and supports economic and environmental principles." (Provincial Policy Statement, 2014, p.5)*. Both of these statements align with MNAM goals and, therefore, represent links between existing policies and MNAM that could be leveraged to gain support for MNAM.

One action that can aid municipalities in taking advantage of the widespread mandate for sustainability to promote MNAM would be the creation of a document that identifies links between MNAM and existing policies (e.g. The Greater Golden Horseshoe Growth Plan, Wetlands Policy). An inventory of these connections would constitute a significant asset for planners and other actors wishing to promote MNAM as it would demonstrate how MNAM is consistent with current OPs and other regulatory policy.

5.2 Phase 2: Implementation of Municipal Natural Asset Management

Following the pre-implementation stage, barriers generally tend to revolve around the specific mechanics and requirements of the MNAM process, such as resource constraints, balancing stakeholder pressures, and ensuring collaboration between key departments. Action steps at this stage mostly address these obstacles.

5.2.1 Create collaborative partnerships among governing bodies and stakeholders

Collaborative partnerships among governing agencies and relevant organizations (e.g. ENGOs) are helpful not only during the pre-implementation stage, but also during the implementation of MNAM. Such collaboration will allow these agencies and organizations to share knowledge relating to the MNAM process, including best practices for implementation, and how challenges can be overcome. Of course, collaborations should include a wide range of stakeholders to help integrate diverse perspectives and alleviate the potential perception of a biased process. Collaborative partnerships will also increase communication across jurisdictional boundaries, thus assisting in the management of NAs that cross such borders. Information can be communicated through workshops and other sharing opportunities, but should probably be of a more formalized and lasting, or recurring, nature. In addition, to encourage a systems approach, working committees could be formed through these partnerships to facilitate opportunities for interjurisdictional collaboration needed to coordinate management of NAs that cross jurisdictions. Lastly, internal collaborative opportunities within a municipality are also necessary for the success of MNAM due to its interdisciplinary requirements. To this end, municipalities need to create opportunities for interdepartmental collaboration for the successful management of NAs. Depending on the prevailing departmental structure of a municipality or agency, such collaboration may require some interdepartmental adjustments among departments, or the use of knowledge brokers that can facilitate communication and collaboration between departments or organizations.

5.2.2 Leverage resources and other data from existing bodies and processes

Leveraging existing resources, processes, and data could greatly reduce the amount of resources a municipality will need to invest itself. This directly pertains to Opportunity 4 (see Section 4.2.4) while addressing Barrier 5 (see Section 4.1.5), both of which relate to the absence of resources required for implementing MNAM. Procedural tools already in place within municipalities that are undertaking similar processes, such as other assets management or natural heritage programs, can be made use of in this regard, as they are already familiar to the municipality and can act as a stepping-stone towards MNAM. Internal processes such as the inventories required during OP and secondary plan updates can be leveraged to include natural features, which are of interest for MNAM. Indeed, utilizing ongoing inventories of priority natural features conducted by the provincial government, local CAs, regional municipalities, and neighbouring local municipalities can reduce the resources required to investigate and monitor NAs. Of course, such exchange of information may require carefully constructed data sharing agreements that stipulate data access and use rights and ensure ethical data use. Additionally, interest groups such as Green Infrastructure Ontario (Green Infrastructure Ontario, n.d.) or local naturalist clubs, and other influential bodies, such as the FCM, can provide support. This support can come in the form of existing databases on local natural features, knowledge and guidance on the local environment, manpower for public education programs and data collection, or via direct funding. Currently, FCM has a Municipal Asset Management Program that provides education, guidance and funding for municipalities wanting to undertake a more formalized asset management program, including the full spectrum of green infrastructure assets (Federation of Canadian Municipalities, 2018). In addition, the Canadian Institute of Planners has recently initiated a training series for planners to help them gain the knowledge and skill set required to undertake formal asset management (Canadian Institute of Planners, 2018).

5.2.3 Take advantage of policy windows

Municipalities could take advantage of policy windows, such as the required five-year OP review in Ontario, to introduce policy in support of MNAM (see Opportunity 5, Section 4.2.5). Acknowledging MNAM within OPs is extremely important and, therefore, lobbying for such inclusion within upcoming five-year OP revision cycles is critical. Securing the support of commissioners, who in turn report to the Chief Administrative Officer (CAO), would greatly assist in this endeavour. Alternatively, lobbying could also be undertaken through Council, which would require strong community support. Trigger events such as extreme weather events can also provide policy windows. By highlighting insufficiencies of conventional infrastructure, the public could get motivated to push for policy changes that would be reflected in MNAM.

5.2.4 Minimize the gap between the status quo and MNAM to make the initial implementation more palatable

Starting small and not being too ambitious might be an effective strategy for the initial implementation of MNAM, especially if a municipality is risk averse. Such a gradual approach could address concerns relating to uncertainty around the MNAM process and the extent of its benefits. For example, municipalities could initially focus on NAs over which they already have control. It would be easier in such circumstances to understand and manage these NAs. Municipalities could also start with NAs that are most similar to their engineered counterparts, for which they already have considerable information and management experience. Lastly, by concentrating on NAs that are more visible or enjoy public awareness, municipalities can tap existing public acceptance and support.

5.2.5 Develop clear legislation, guidelines, and processes for the protection and management of natural assets

To support efficient and effective implementation of MNAM, participants highlighted the need for clear legislation and regulation, as well as simple, standardized guidelines and procedures for undertaking the MNAM process. Emphasis was placed on keeping regulation and guidelines concise and straightforward so that municipalities could easily undertake MNAM. Legislation and policy should incorporate a long-term MNAM plan and vision, focused on performance goals, not minimum requirements as these minimums can often be negotiated down during the development review process. A clear management plan should also be attached to all NAs, which includes steps for both long- and short-term inventories of natural features as well as the phases in which this management should take place. Lastly, clear strategies should be put in place for the management of natural features that border or cross properties that are not under municipal control. Incentive schemes for protecting or conserving such NAs, particularly those on private land, were identified as being useful in this regard, as well as municipal investment in land acquisition of priority assets that provide critical linkages between natural features.

5.2.6 Research natural assets to provide evidence to planners and guidance for decisions around MNAM

Planners emphasized the need for municipality-specific information on NAs to provide planners with evidence on the benefits of MNAM to that particular municipality, and to guide them in the implementation of MNAM. To this end, research should focus on inventorying the specific services a natural feature provides to a municipality, identifying

critical linkages between NAs on private and public land within a municipality, describing key inter-municipal and ecosystem linkages, informing on the benefits of enhancing historically degraded NAs, and identifying neighbouring land uses and their impact on NAs.

5.3 Phase 3: Long Term Sustainability and Success of Municipal Natural Asset Management

Once MNAM has become more widely implemented, action steps should be targeted at mechanisms that will improve and further standardize the process. These steps will make initial implementation of MNAM easier and, therefore, hopefully raise widespread municipal interest in MNAM.

5.3.1 Create long-term standardization of related processes for MNAM

To ensure ease of implementation, standardized processes for inventorying, valuing, and managing NAs should be developed. However, flexibility should be incorporated throughout these processes to allow municipalities to adapt these standards to their specific needs. Standardization should be focused on helping to attain best practice management, but should allow for flexibility to provide municipalities with the ability to satisfy their specific requirements and take advantage of local opportunities. The development of a toolkit or guidebook for MNAM implementation, informed by experiences of pilot projects and other past experiences, is essential for the long-term success of MNAM. An important step to be included within this standardized process is the monitoring of NAs to measure their possible depreciation over time, thus allowing formulation of plans for NA maintenance.

5.3.2 Work towards having MNAM incorporated into high level planning policy in the long term

Integrating MNAM into OPs is an important step in the widespread application of the process (see Section 5.2.3). However, in the long term, those wanting to promote MNAM should work towards having the process embedded in higher level planning policies. Integrating MNAM within the PPS and the Planning Act would be particularly beneficial due to the high degree of influence of these policies over all aspects of planning across Ontario. To provide planners with the evidence and power to effectively carry out MNAM, it needs to eventually be formally integrated within such high level provincial policies. In addition, to assure that references to MNAM within such legislation are effective, it is important that they go beyond **encouraging** municipalities to manage NAs. Instead these policies should actually **enable** municipalities, or even **require** them to carry out MNAM.

5.3.3 Leverage existing development processes to improve the effectiveness of MNAM

Land use planners can utilize existing development processes and regulations to improve the effectiveness of MNAM. In Ontario, municipalities have the ability to require developers to conform to certain conditions as part of their development applications. Through these development processes, planners can require developers to secure maintenance funds for development land abutting or including NAs, or require long-term monitoring systems to be put in place.

6. Planners' Role in Municipal Natural Asset Management

Besides identifying barriers and opportunities to implementing MNAM, interviews were also targeted at exploring the extent to which planners are likely to be involved with MNAM, and the mechanisms through which this involvement would occur. To this end, participants were asked whether planners had a place within MNAM and, if so, to explain the form this involvement could take. All participants agreed that planners had a role to play, but there were varying opinions relating to what exactly that role would be. The responses relating to the exact role of the planner seemed to be strongly influenced by the current internal structure of the agency to which a participant belonged. Despite this variation, however, three types of planners were identified as most likely to be involved in MNAM: land use planners, environmental planners, and policy-based planners. Additionally, responses could generally be categorized into three overarching functions a planner would play in the MNAM process: a role in facilitation, a role in policy generation, and a role in the technical aspects of MNAM. One theme that emerged throughout the majority of responses, and across these three categories, was that, by taking on a leadership role within the MNAM process, planners could significantly increase its level of success. In their capacity as champions of the process, planners could take proactive measures and actively engage different stakeholders to promote MNAM and foster continued interest in this process.

6.1 Facilitation Among Specialists and the Management of Interdisciplinary Networks

The role of planners within the MNAM process that was most frequently cited by interviewees was that of facilitators of knowledge transfer and knowledge integration among specialists and stakeholders. This facilitator role was also seen as leading interdepartmental and inter-jurisdictional collaboration. As emphasized throughout this document, a planner's work tends to be highly multidisciplinary in nature. Indeed, planners have to consider and understand the interests and concepts of a wide variety of stakeholders and disciplines. The generalist nature of a planner's job places them in an excellent position to view projects through a 'big picture' lens. It also allows them to facilitate collaboration among a diversity of key stakeholders and combine information from different fields, thereby generating holistic options. In the case of MNAM, planners would be able to evaluate NA management strategies in terms of how they align with growth targets and assess whether these strategies are realistic when development pressures, and other land use conflicts, are considered. A strong champion of the MNAM process is needed for this facilitator role to reach its full potential.

Through facilitation among different levels of government and other stakeholders, planners can be involved in the development of MNAM strategies and assist in the exploration of management issues, as well as in the identification of desired management outcomes. Subsequently, planners are likely to be heavily involved in the identification of the specific type of expertise required to inventory and assess the current state of relevant NAs. Another role planners can play consists in the recruitment of actors capable of assuring the implementation of MNAM. In addition, planners were also thought to play a key role in amalgamating the information delivered by specialists and integrating it to provide sustainable NA management options. It is expected that planners will also facilitate discussion among specialists on the most effective way to holistically manage the variety of NAs, or through soliciting and incorporating feedback to MNAM management plans. In Ontario, this form of planner involvement is already seen in some natural heritage programs and certain aspects of watershed planning.

6.2 Role with Policy Reformation and Implementation

Planners will also have an important role to play in MNAM in relation to policy, both at the provincial and municipal level. Incorporating MNAM into land use policy, such as municipal OPs, as well as higher level policy, including the Planning Act and PPS, were identified as important for successful implementation of MNAM (see the Action Steps in Sections 5.2.3 and 5.3.2). These policies embody long-term visions of municipalities and of the province, and thereby will have a significant impact on how NAs are viewed, valued, and managed. For example, communities whose OPs emphasize sustainability and the preservation of natural resources are likely to be more receptive to MNAM. Planners are key players in policy review and reform through their involvement with organizations such as the Ontario Ministry of Municipal Affairs and Housing, the Ontario Ministry of Infrastructure and the FCM and, therefore, can play an important role in influencing the level of alignment between these policies and MNAM.

First, planners have an important advisory role in review processes related to high level, provincial planning policy. In this role, planners can improve the success of MNAM by promoting policy that aligns with MNAM's conceptual basis, grant NAs greater levels of protection, or facilitate MNAM implementation through some other means. At the municipal and regional level, planners have more of a bottom-up role to play in promoting MNAM supportive policy development and reform. By demonstrating the benefits of changes in policy to Council and their superiors within the municipality, planners can contribute to shifts in land use designations and bylaws (e.g. zoning) that are favourable to MNAM. For example, after assessing and evaluating different watershed land use scenarios to determine those that would have the greatest conservation effect for important NAs, planners could recommend corresponding changes in land use designation policy by highlighting the benefits of these shifts for municipalities. Through this process, OPs, and other municipal level policy related to land use, can be reformed. After decision-makers integrate MNAM within OPs, and other municipal level policy, planning expertise is also important to determine where, and in what context, MNAM would best fit to have the greatest influence over day-to-day, practical decision-making. Policy and environmental planners are particularly well placed to fulfill these roles in policy review and reform.

Another mechanism through which planners can influence policy change at the municipal level relies on support from the public. Planners are often involved in presenting the voice of the community to Council and advising on the best course of action to meet the needs of different interests. In this regard, determining what these varying interests are, and mediating conflicting interests, through public engagement is a vital function of planners relating to any proposed changes to land use policy. Within the context of MNAM, this engagement is important to educate community members, local politicians and other stakeholders about NAs and their importance (see the Action Steps in Sections 5.1.1 and 5.1.2), as well as to receive feedback on the MNAM strategy. Since the services providing functions of NAs is not as widely understood as that of conventional engineered assets, working towards changing how NAs are perceived and understood by stakeholders is a crucial role of planners. This knowledge will contribute substantially to the overall level of stakeholder support for MNAM. Community planners are expected to be important in this stakeholder engagement role of planners.

In addition to their role in policy reformation, planners can also influence the success of MNAM through their role in the implementation of policy. First, before MNAM policy is formulated, using existing policy as a stepping-stone for MNAM implementation was identified as a primary opportunity (see Opportunity 4.2.3). By leveraging such policy in the development review process for the benefit of NA conservation and management, planners can aid in the successful implementation of MNAM. An example of an existing

policy that could be leveraged is policy related to Natural Heritage Systems, which directs planners to consider how and where growth occurs next to natural areas. The creation of a document that inventories links between existing policy and MNAM would greatly aid planners in this regard (see Action Step 5.1.3). All of the aforementioned policy related roles of the planner highlight the benefits that can come from planners acting as champions of the MNAM process. By working towards policy change, or leveraging existing policy that aids MNAM, planners can significantly contribute to its success at all phases of implementation.

Although the active role of planners in facilitating MNAM success was stressed by participants as being paramount, it is important to note that planners will also play in their day-to-day implementation of land use policy a more passive role within MNAM. One of the primary responsibilities of land use planners within a municipality is the implementation of land use designation policy stipulated in OPs through the development review process. Therefore, once MNAM specific policy is integrated within OPs, this new policy will influence the decisions of land use planners relating to NAs.

6.3 The Technical Role

There were contradictory responses among participants regarding the extent of planners' involvement with the technical aspects of MNAM. These conflicting views are thought to be a result of significant variation in the current roles of planners within their departments, some taking on a much more technical role than others. Some participants thought that planners could be involved with inventorying, delineating, and assessing the condition of NAs. Certain types of planners, such as environmental planners, are already involved with identifying NAs, for example, in sub-watershed planning. Other participants thought that planners could be directly involved with the physical management of these assets. Indeed, within some planning departments, the planner's role does extend to physical management of certain NAs (e.g. street trees, natural heritage systems). Therefore, particular types of planners can be expected to be involved with these technical aspects. In fact, although inventorying and designing life cycle management plans for traditional assets (e.g. bridges, water treatment facilities) does not typically fall within the scope of a planner's job, the tight link of NAs with land uses, suggests that planners will have a greater role in technical responsibilities when it comes to natural features.

7. Conclusions

Planners will play a key role in the successful implementation of MNAM, particularly due to the significant impact the spatial distribution and interaction of land uses will have on the preservation and prioritization of natural features. However, the specific role of planners will vary based on the internal structure of municipalities. Widespread misconceptions relating to NAs, their ability to provide municipal services, and their complexities, were found within planning policy and to be held by stakeholders who affect the planning process. Overcoming these hindrances through educational strategies will greatly alleviate other barriers, such as those related to resource constraints, collaboration among agencies, and conflicting interests. In order for MNAM to be successful, strong champions are needed to drive the process, overcome challenges, and push MNAM implementation through various levels of government. Due to the interdisciplinary nature of their position, planners are ideally placed to take on this leadership role. Specific opportunities that could compound the benefits of identifying a leader of the MNAM process include taking advantage of the inter-jurisdictional nature of CAs, leveraging existing policies and resources, and taking advantage of the five-year OP revision cycle. A multitude of steps can be taken to overcome barriers and act on opportunities to improve the ultimate success of MNAM implementation. Action strategies should be actively pursued at all phases of the MNAM implementation process.

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Appendices

Appendix 1: Detailed Research Methodology

The following sections provide detailed information on each of the five steps in the methodological process applied in this research (Figure 1).

Step 1: Literature Review and Questionnaire Development

The first step in this study was to conduct a detailed review of all relevant literature, legislation, and other resources relating to MNAM, professional planning practice and policy in Ontario, and related subjects to identify a preliminary list of potential barriers and opportunities to implementing MNAM. As part of this search, three primary pieces of Ontario planning legislation were examined: The Planning Act, the PPS, and OPs from both pilot and non-pilot project municipalities. Other planning resources and guidelines were also investigated: CIP's Code of Practice and resource databases from CIP, OPPI, and a sample of CAs. In addition, two asset management documents were examined: Ontario's 2012 document *Building Together: Guide for Municipal Asset Management Plans*, and a subsequent proposal that would require all municipalities to start implementing assets management strategies by the beginning of 2019 (Government of Ontario, 2017b). A search for the terms *natural asset*, *eco-assets*, *natural capital,* and *green infrastructure* on official Government of Ontario websites, Google, and Google Scholar was undertaken as well. Finally, an examination of the curriculums of all undergraduate and masters level planning degrees in Ontario was performed. Each of these documents and resources were examined to identify potential factors acting to facilitate or inhibit MNAM. The following lists highlight the primary potential opportunities and barriers to implementing MNAM in an Ontario planning context identified from this initial scoping literature review:

Potential **Opportunities** for Implementing MNAM:

- The fundamentals of MNAM align with provincial interests laid out in provincial planning legislation, promoting municipal adoption of MNAM.
- The management style and priorities of Ontario CAs, as well as protections put in place by the Conservation Authorities Act, both have the potential to be utilized for the benefit of MNAM.
- The current support provided by the Province for municipal implementation of asset management, and proposed changes to municipal asset management (MAM) regulations, are primary opportunities for encouraging municipalities to incorporate MNAM.

Potential **Barriers** to Implementing MNAM:

- The lack of resources provided by the Canadian Institute of Planners and the Ontario Professional Planning Institute on asset management, and a lack of resources on NAs/MNAM in general, are primary barriers to the implementation of MNAM by planners.
- The lack of concepts similar to, or on par with, NAs within provincial resources could be a barrier in implementing MNAM.
- Proposed changes to provincial regulations surrounding asset management could

act as a barrier to implementing MNAM if provisions relating to how NAs are too rigid.
- A deficiency in environmentally focused courses in undergraduate and graduate Ontario planning education could create a lack of knowledge for the effective management of NAs.
- A lack of planner involvement with traditional asset management and the need for greater integration of asset management plans within Official Plans.

This list of potential barriers and opportunities was used to guide the development of the interview questionnaire and inform the researchers on factors potentially underlying participant responses in their interpretation of the results.

Step 2: Interviews

Using the questionnaire developed in Step 1, fifteen semi-structured interviews were conducted with a range of participants in Ontario from November 2017 to January 2018. Nine participants were from municipalities, four were from Conservation Authorities (CA), and two were part of the MNAI convening partner organizations. Eight participants had 'Planner' in their job title, two held Director positions, and four had positions that had planning-like duties relevant to MNAM. Interviewees had varying levels of familiarity with MNAM, ranging from direct involvement with pilot projects, to no knowledge of MNAM. This range allowed a wide variety of perspectives to be captured. Through the evaluation of interview transcripts, 26 barriers and 18 opportunities were identified and subsequently divided into 7 broad themes: 1) scale/cross-jurisdictional factors, 2) government and political structure, 3) education and perceptions, 4) regulation and legislation, 5) resources, 6) technical factors, and 7) ecological factors (see Appendix 2, Table 1). The analysis of these data for the identification and prioritization of top factors is discussed in Steps 3-5 below.

Steps 3 & 4: Ranking Barriers and Opportunities Based on Identification Frequency

The first two methods of ranking barriers and opportunities were exclusively based on a variable's 'identification frequency', the total number of participants by whom it was identified. After calculating this identification frequency, variables were ranked accordingly, from the highest to the lowest number of times identified. Ranking method one included all identified variables, whereas only those variables deemed 'most important' by participants were included in ranking method 2. The specific criteria applied in each method, and the resulting list of the top 5 barriers and opportunities are shown below.

Step 3: Results of Ranking Method 1

For the first method, barriers and opportunities were considered to have been identified by a participant if a) participants explicitly stated that a particular factor acted as a barrier or opportunity, b) participants implied or indicated that such a barrier or opportunity existed, though did not explicitly state it as such, or c) participants demonstrated the existence of a barrier or opportunity by their own attitude or action (e.g. if they stated that NAs do not need management) (Appendix 1, Table 1).

Table 1: Raw frequencies, and subsequent ranking, of the most commonly identified barriers and opportunities to implementing Municipal Natural Asset Management from a planning perspective in Ontario.

Rank	Frequency	Barriers
1	10/15	Lack of resources available for initial implementation of MNAM projects
2	8/15	Large amount of resources needed for maintenance of MNAM framework
2	8/15	Lack of standardized ecological and monetary valuation methods inhibits the conveyance of evidence to planners
2	8/15	Natural features are not generally conceptualized as service providing assets within planning policy
2	8/15	The requirement to balance interests amongst various stakeholders can lead to pressures that do not align easily with MNAM
Rank	**Frequency**	**Opportunity**
1	10/15	Some NAs already have tools and policies in place for their protection that can act as stepping stones towards MNAM
2	9/15	Climate change will increase the relevance of MNAM
3	7/15	Strong champions provide the leadership necessary to push MNAM through council and municipal departments
3	7/15	Some current tools and policy within the Planning Act and Provincial Policy Statement facilitate MNAM
4	6/15	Putting a value on NAs and the services produced by them will increase interest in MNAM as everyone can relate to a monetary value

Step 4: Results of Ranking Method 2

A barrier or opportunity was considered to be 'most important' to a participant if it was a) included in their response to the question, "From a planning perspective what are the greatest 3-5 barriers and opportunities?" or b) emphasized by participants or repeatedly stated throughout the interview (Appendix 1, Table 2). The list of top opportunities

consists of six rather than five variables due to equal identification frequencies.

Table 2: Total frequencies, and subsequently ranking, of the most commonly identified greatest barriers and opportunities to implementing Municipal Natural Asset Management from a planning perspective in Ontario.

Rank	Frequency	Barrier
1	7/15	Lack of resources available for initial implementation of MNAM projects
2	4/15	A large amount of resources is needed for maintenance of MNAM framework
2	4/15	Natural features are more complex and uncertain than engineered assets creating the perception of risk
2	4/15	Many NAs cross jurisdictional lines (e.g. region, city, CA), making holistic management difficult
2	4/15	Lack of standardized ecological and monetary valuation methods inhibits the conveyance of evidence to planners
Rank	**Frequency**	**Opportunity**
1	4/15	Some NAs already have tools and policies in place for their protection that can act as stepping stones towards MNAM
2	3/15	Strong champions provide the leadership necessary to push MNAM through council and municipal departments
3	2/15	Established joint bodies can facilitate coordination of MNAM between jurisdictions
3	2/15	Conservation authorities already have a cross-jurisdictional foundation and collaborate with multiple municipalities providing a foundation for cross-jurisdictional collaboration and systems thinking mindset
3	2/15	Climate change will increase the relevance of MNAM
3	2/15	The five-year revision cycle of official plans creates the opportunity for greater integration of policies supportive of MNAM

Ranking Methods 1 and 2: Comparison of Results and Limitations

Three out of the five top identified barriers in ranking method 2 were consistent with ranking method 1. Similarly, three of the top opportunities identified in ranking method 2 aligned with those in ranking method 1. These results suggest that the findings fairly reliably represent the most significant barriers and opportunities to implementing MNAM from a planning perspective in Ontario. However, the ranked identification frequency derived from methods 1 and 2 was not taken as a prioritization of the order in which these factors should be acted upon due to several limitations. First, participants did not individually prioritize one variable over another. Indeed, in most cases, variables were identified with equal frequencies, making prioritization impossible based on these methods alone. In addition, participants were generally thought to view MNAM from a rather narrow perspective, influenced heavily by their personal experiences and the jurisdictional scope of the agency in which they worked. This narrow focus could have resulted in sources of bias such as 'group think', in which participants repeat commonly held sentiments rather than critically evaluating the issue in their own right. Due to

these limitations, factors needed to be examined through a more holistic lens in order to deliver a comprehensive prioritization that accurately reflects widespread barriers and opportunities. To deliver a prioritization based on this overarching perspective, another methodological step was needed in which all top barriers and opportunities identified by participants were examined simultaneously, and subsequently prioritized based on a comparison of factors relative to each other.

Step 5: Prioritization of barriers and opportunities

This final component of the methodological process, prioritization of top barriers and opportunities, consisted of several steps. Because of slight discrepancies between the list of barriers identified in ranking methods 1 and 2, more than five barriers and opportunities comprised the final list of top factors when the lists from both methods were combined. In total, this final list consisted of seven barriers and seven opportunities. Therefore, the first step in variable prioritization was a careful examination of all fourteen top factors, and interview transcripts related to them, to determine their relationship to each other, and ascertain whether each variable actually represented a distinct issue. Through this process, it was determined that both barriers relating to a lack of resources were in reality two manifestations of the single issue of **perceived** resource deficiencies. Currently, the management of NAs is ascribed far less importance than that of conventional engineered assets and, therefore, the costs of MNAM implementation are perceived as extra spending relative to the current municipal budget, rather than a cost-effective process in which the municipality **should** invest resources. On the opportunities side, it was thought that the increased relevance of MNAM as a result of climate change, and the fact that many NAs are already protected to some extent, would both belong to the same opportunity, the fact that a mandate for sustainability exists and that it can be acted upon as a stepping stone for MNAM. These opportunities and barriers were, therefore, amalgamated to better reflect their common nature. This step decreased the size of the total list to six top barriers and six top opportunities.

The selection of five top barriers/opportunities, and their prioritization, was carried out by examining all six remaining factors through the lens of the question “in which order do barriers need to be overcome, and opportunities acted upon, to promote the greatest success of MNAM?” Broadly, it was determined that barriers related to the conceptualization and understanding of NAs would need to be overcome before NAs could be appropriately valued within policy and decision-making, and subsequently be allocated sufficient resources in the context of MNAM. For opportunities, gaining the support of individuals and collaborative bodies was considered to be necessary prior to attempting to acquire resources and funding, and build on, or modify, existing policy. Applying these criteria, all factors were prioritized and the lowest prioritized factor was dropped from each list. Through this process, a final prioritized list of the top five barriers and opportunities to implementing MNAM was created (see Table 1, main text).

Appendix 2: Complete List of Barriers and Opportunities Identified by Participants

Table 1: Thematically organised full list of identified barriers and opportunities to implementing Municipal Natural Asset Management from a Planning Perspective in Ontario.

1. Scale and Cross Jurisdictional Factors	
Barriers:	
B1.1	Many NAs cross jurisdictional lines (e.g. region, city, CA), making holistic management difficult
B1.2	Competing values among agencies increase management complexity
B1.3	Difficult to manage NAs under private ownership
B1.4	Interjurisdictional collaboration is hindered by rigidly defined roles and responsibilities
B1.5	Lack of systems thinking hinders the management of NAs that cross jurisdictions
Opportunities:	
O1.1	Established joint bodies can facilitate coordination of NAM between jurisdictions
O1.2	Conservations Authorities (CA) already have a cross-jurisdictional foundation and collaborate with multiple municipalities providing a foundation for cross jurisdictional collaboration and systems thinking mindset
2. Government and Political Structure	
Barriers:	
B2.1	Variation in the role of planners between municipalities could create ambiguity in a planner's role within MNAM
B2.2	Interdepartmental collaboration is hindered by rigidly defined roles and responsibilities
B2.3	The short term focused nature of the political structure conflicts with the long-term commitments and benefits associated with MNAM
B2.4	The requirement to balance interests amongst various stakeholders can lead to pressures that do no align easily with MNAM
Opportunities:	
O2.1	Public support for environmental preservation can be utilized to drive council towards decisions in alignment with MNAM
O2.2	The Province of Ontario is generally supportive of novel sustainable practices which support planners and municipalities in the implementation of MNAM
3.0 Education and Perception	
Barriers:	
B3.1	Insufficient environmental literacy within the public leads to underappreciation and undervaluation of NAs and their services
B3.2	Inconsistent environmental literacy among planners often results in a lack of the necessary knowledge needed to implement MNAM
B3.3	Failure of the public to conceptualize natural features as assets leads to an underappreciation of their value

B3.4	The widespread belief that NAs do not require management if protected is inconsistent with the MNAM framework
B3.5	Inconsistencies in vocabulary surrounding natural asset causes confusion and inconsistencies in MNAM implementation
B3.6	Public resistance to pay for management of natural features could limit municipal support for MNAM

Opportunities:

O3.1	Importance of NA services to human health & well-being is well documented in the literature, offering evidence in support of MNAM
O3.2	NAs, ecosystem services, and natural capital are “hot topics”, providing an opening for the discussion of MNAM with municipalities
O3.3	Current MNAM pilots are raising awareness among planners

4.0 Regulation and Legislation

Barriers

B4.1	Planners follow the Planning Act and Provincial Policy Statement ,which are development-oriented creating conflict relating to the protection of natural features
B4.2	A lack of regulation and guidance around NAM inhibits the application of the framework
B4.3	No mechanisms for creating deals with developers to save natural features not currently under legislative or regulatory protection
B4.4	Structure of Ontario’s planning framework makes it challenging to change higher level legislation

Opportunities

O4.1	Some NAs already have tools and policies in place for their protection that can act as stepping stones towards MNAM
O4.2	The five-year revision cycle of OPs creates the opportunity for greater integration of policies supportive of MNAM
O4.3	A formal goal and priority setting process, such as a Strategic Plan, can act as a beneficial tool for implementing MNAM
O4.4	Ontario is currently pursuing asset management policies which could provide some guidance and direction for MNAM
O4.5	Certain policy within the Planning Act and Provincial Policy Statement can be utilized to support MNAM

5.0 Resources

Barriers

B5.1	A lack of resources available for initial implementation
B5.2	A large amount of resources is needed for maintenance of framework
B5.3	Culture of resource ‘cutting’ within municipalities inhibits the implementation of new initiatives

Opportunities

O5.1	Many studies have already been completed on natural features which can be leveraged for data
O5.2	Support from local interest groups can be used as a resource

05.3	Pursuing available grants, funding, and other support (e.g. tool-kits) from interest groups and the government can reduce resource pressures on municipalities
05.4	Strong champions provide the leadership necessary to push MNAM through council and municipal departments

6.0 Technical Factors

Barriers

B6.1	Lack of standardized and ecological and monetary valuation methods inhibits the conveyance of evidence to planners
B6.2	Natural features are more complex and uncertain than engineered assets creating the perception of risk
B6.3	Lack of clarity as to the planner's role within the MNAM process

Opportunities

06.1	Putting a value on NAs and their services will increase the accessibility of MNAM as everyone can relate to a monetary value

7.0 Ecological Factors

Barriers

B7.1	Range of NAs differs substantially between municipalities meaning there can be no 'one size fits all' management strategy

Opportunities

07.1	Climate change will increase the relevancy of MNAM

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