Mattawa River, Town of Mattawa

Watershed-Based Resource Management Strategy

December 2024

NORTH BAY - MATTAWA
CONSERVATION
AUTHORITY

Table of Contents

List of Tables

List of Figures

Acknowledgement of Traditional, Ancestral and Treaty Lands

As we work towards reconciliation with Indigenous people, we respectfully acknowledge that we are in Robinson-Huron Treaty territory and the land on which we live and work is the Traditional Territory and Treaty Lands of the Nbisiing Anishinaabeg (ah-nish-nah-beg) as well as the unceded and ancestral Traditional Territory of the Algonquin People and the Metis Nation.

As shared stewards of Ontario's land and water resources – along with these First Nations communities – the North Bay-Mattawa Conservation Authority appreciates and respects the history and diversity of the land and its peoples and are grateful to have the opportunity to live in this Territory.

Acknowledgments and Authors

The Watershed-based Resource Management Strategy (**"Watershed Strategy"**) for the North Bay-Mattawa Conservation Authority (NBMCA) was developed following Conservation Ontario's Guidance on the Conservation Authority Mandatory Watershed-based Resource Management Strategy, the Conservation Authorities Act and its regulations, and draft content from other Conservation Authorities.

Watershed partners and the NBMCA Board of Directors are sincerely appreciated for their valuable input and feedback during the development of the NBMCA Watershed Strategy.

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1. Legislative Background

The North Bay-Mattawa Conservation Authority (NBMCA) was formed under the Conservation Authorities Act of Ontario in 1972 at the request of its member municipalities. The NBMCA is a community-based, environmental organization dedicated to conserving, restoring, developing and managing renewable natural resources on a watershed basis. It is one of 36 conservation authorities (CAs) in Ontario and is governed by a Board of Directors comprised of its ten member municipalities. NBMCA is a member of Conservation Ontario, the network organization of all CAs.

The Conservation Authorities Act and accompanying regulations have been amended by the Province of Ontario since 2017, including updates made in 2021. CA programs and services are categorized per legislation as follows:

- **General Functions: Corporate-wide services that support several/all program areas**
- **Category 1: Mandatory programs and services**
- **Category 2: Municipal programs and services provided on behalf of a municipality**
- **Category 3: Programs and services advisable by the CA to implement in the CA's jurisdiction.**

Ontario Regulation (O. Reg.) 687/21 and Sections 21.1.1 and 21.1.2 of the Conservation Authorities Act established a requirement for Transition Plans (including a Program and Service Inventory) and Agreements to carry out CA Programs and Services.

O. Reg. 686/21 sets out the mandatory programs and services which must be delivered by CAs in Ontario. Specifically, section 12(1)3 of the regulation requires all Conservation Authorities to prepare a "Watershed-based Resource Management Strategy" ("**Watershed Strategy**").

The Watershed Strategy includes Category 1 programs and services provided by the CA. It may also include both Category 2 and Category 3 programs and services, where the relevant agreement permits the inclusion of these programs or services in the Watershed Strategy. Sections 12(4)-(7) of O. Reg. 686/21 set out the required components to be included in the Watershed Strategy.

Components of the Watershed Strategy specified in the regulation include:

- Guiding principles and objectives that inform the design and delivery of Conservation Halton's programs and services;

- A summary of existing technical studies, monitoring programs, and other information on the natural resources the authority relies on to directly inform and support the delivery of programs and services;

- A review of the CA's programs and services to 1) determine if the programs and services comply with the regulations, 2) identify and analyze issues and risks that limit the effectiveness of the delivery of these programs and services, and 3) identify actions to address the issues and

mitigate the risks identified by the review and providing a cost estimate for the implementation of those actions; and

- A process for the periodic review and updating of the Watershed Strategy that includes procedures to ensure stakeholders and the public are consulted during the review and update process. (Taken from Conservation Halton)

2. Watershed Strategy Overview

2.1 Purpose

The purpose of the Watershed Strategy is to provide guidance to the Board and North Bay-Mattawa Conservation staff with the delivery of Category 1 programs and services, and where the relevant agreements allow, Category 2 and 3 programs and services.

2.2 Goal

The goal of the Watershed Strategy is to design and deliver cost-effective programs and services that protect people and property from natural hazards and climate change impacts, protect municipal drinking water sources, conserve nature, and provide opportunities for outdoor recreation and education across the NBMCA watershed. NBMCA applies an integrated watershed management approach to protect natural resources and address escalating challenges from the impacts of climate change and urbanization.

2.3 Framework

The NBMCA Watershed Strategy is developed using a data-based framework, from which knowledge is derived. This informs planned actions throughout the watershed, through a collaborative partnership approach. Figure 1 provides the overarching framework.

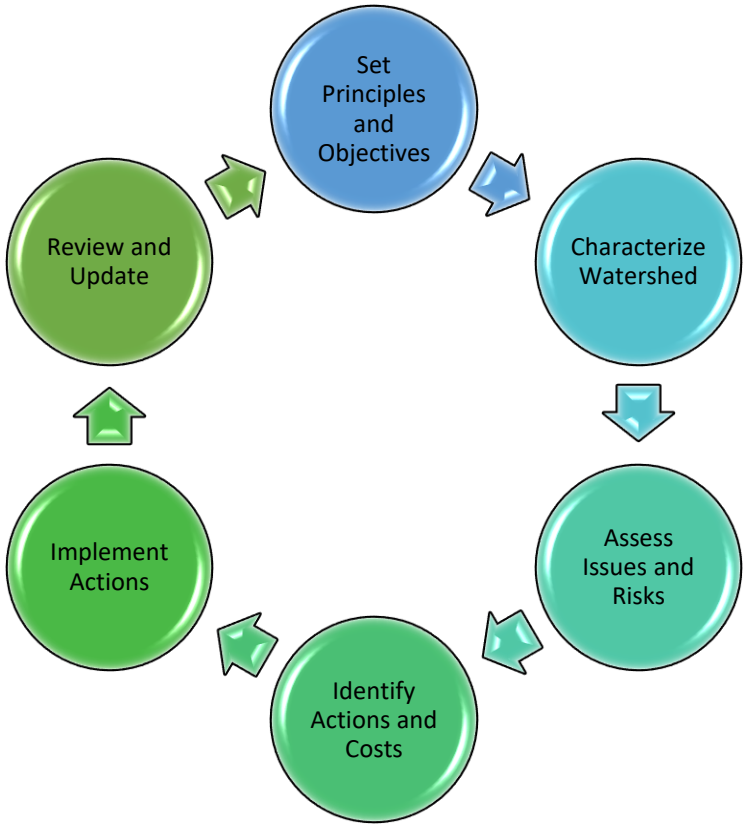

Figure 1: Framework of the Watershed-based Resource Management Strategy

The Watershed Strategy enables us to take a long-term, strategic view of the collective actions needed to address the key watershed natural resource issues and alleviate or mitigate risks within our watershed. The Watershed Strategy framework begins with setting guiding principles and objectives which reflect the issues of the watershed. The watershed is characterized through a summary of existing science-based studies and information. The next step is to identify and assess issues and risks that may impact the effective delivery of Category 1 mandatory programs and services, while also identifying gaps in addressing the issues/risks (i.e., whether additional programs and services are needed). Actions to address such risks are then identified and implemented throughout the watershed. To support continuous improvement, the Watershed Strategy is reviewed and updated periodically. Consultations with stakeholders and the public is required during the development of the Strategy and its subsequent reviews/updates.

The Watershed Strategy may be used to identify actions and Category 2 and 3 programs and services, with cost estimates, that are recommended to support the delivery of mandatory CA programs and services. It provides a mechanism to update the NBMCA programs and services inventory and helps to identify opportunities for improving and/or maintaining watershed health.

3. Guiding Principles and Objectives

This section describes the guiding principles and objectives that inform the design and delivery of NBMCA's mandatory programs and services, per O. Reg. 686/21 Section 12(4)(1).

NBMCA continues working towards gaining a better understanding of its watersheds, building on work completed in NBMCA Integrated Watershed Management Strategy, 2015.

3.1 Guiding Principles

The following are the guiding principles of the NBMCA's programs and services:

- The watershed forms the basis of conservation, restoration, development, and management of natural resources by the NBMCA.
- The Watershed Strategy is the framework to identify and assess resource conditions, trends, risks, and issues and to implement programs and services to manage them.
- The Watershed Strategy informs policy and decision-making by the Conservation Authority and other partners.
- Water and other natural resources are vital natural assets that help manage climate change impacts, mitigate natural hazards, filter contaminants, assimilate waste, sustain biodiversity, and provide green spaces for recreation and other community benefits.
- Resource management decisions are transparent and take into consideration a broad range of community uses, needs, and values, including ecosystem needs.

3.2 Objectives

The objectives are set to underpin a performance evaluation framework that will effectively measure the Watershed Strategy's value. The objectives are aligned to the legislated scope of the Watershed Strategy, reflecting Category 1 programs and services and, where supported through agreements, Category 2 and 3 programs and services.

The objectives of the NBMCA Watershed Strategy are:

- To characterize groundwater and surface water resource systems and other natural resources of the watershed.
- To identify and understand key resource issues and primary stressors that cause them.
- To eliminate or mitigate the risk to life and property from flooding, erosion, and other natural hazards and from the impacts of a changing climate.
- To mitigate the risk to municipal drinking water sources and to ensure a sustainable and clean water supply for communities.
- To conserve nature and provide opportunities for outdoor recreation and education.

4. Governance and Jurisdiction

The NBMCA was formed under the Conservation Authorities Act of Ontario in 1972 at the request of its member municipalities. The NBMCA has responsibilities under three pieces of legislation with different areas of jurisdiction:

- Conservation Authorities Act
- Clean Water Act, 2006
- Ontario Building Code Act.

4.1 Conservation Authorities Act

NBMCA administers its objects and responsibilities defined in the Conservation Authorities Act within a 2900 sq km area, based on the watersheds within the Lake Nipissing and the Ottawa River Basins. A map of the area of Conservation Authorities Act jurisdiction is shown in Figure 2. Highlights of the NBMCA's jurisdictional area include the shoreline of Lake Nipissing within the City of North Bay and the Municipality of Callander, Trout Lake, Wasi Lake, the North Bay Escarpment, the Widdifield Forest Provincial Park, Mattawa River Provincial Park, Samuel de Champlain Provincial Park, Amable du Fond Provincial Park, and northern parts of Algonquin Provincial Park.

The NBMCA is governed by a Board of Directors comprised of 12 members representing ten participating municipalities as listed below. Representation on the board is based on the population of the municipality located within the NBMCA watershed jurisdiction.

- City of North Bay: 3 members
- Municipality of Callander: 1 member
- Municipality of Calvin: 1 member
- Municipality of East Ferris: 1 member
- Municipality of Mattawan: 1 member
- Municipality of Powassan: 1 member
- Town of Mattawa: 1 member
- Township of Bonfield: 1 member
- Township of Chisholm: 1 member
- Township of Papineau-Cameron: 1 member.

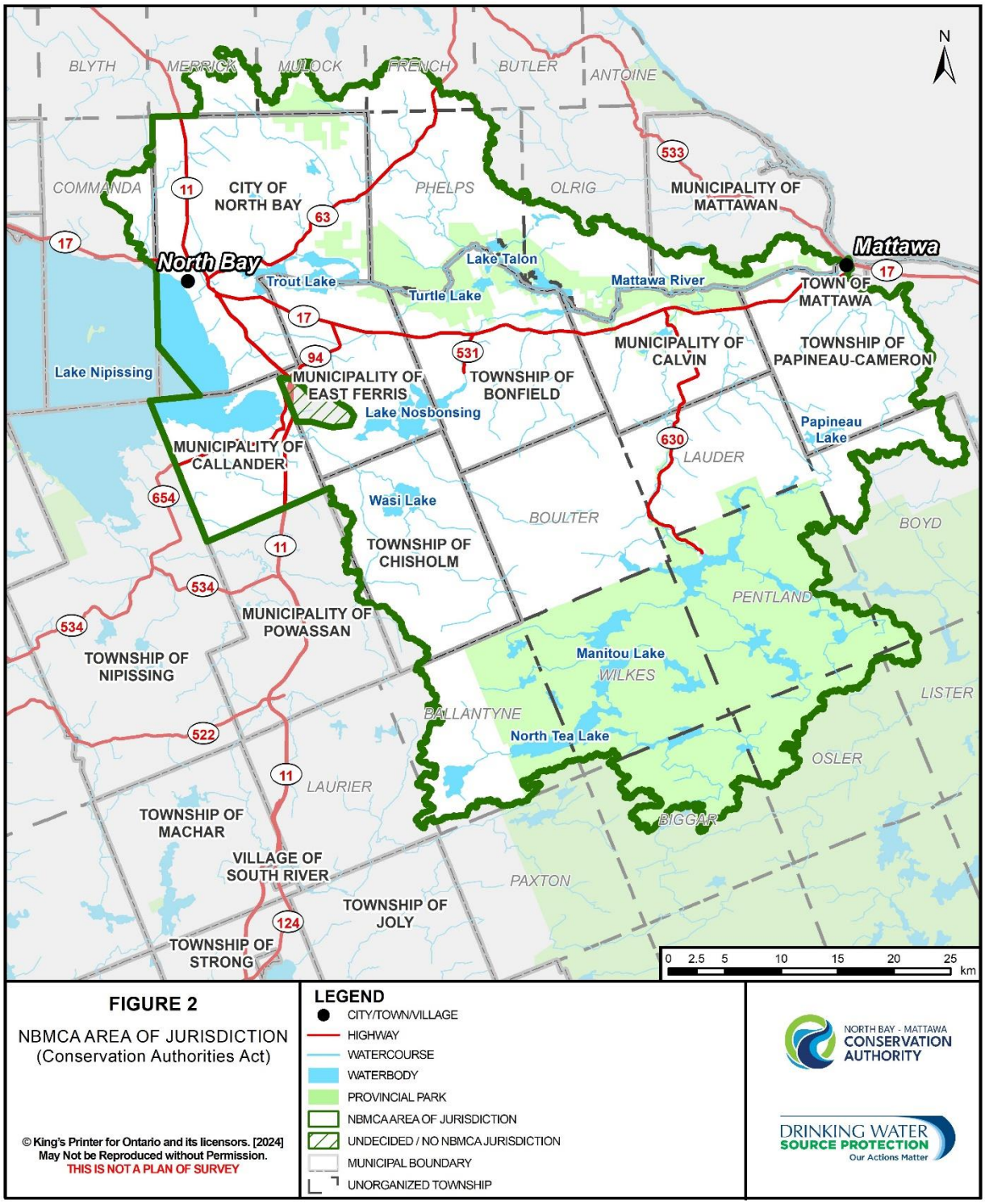

Figure 2: North Bay-Mattawa Conservation Authority Area of Jurisdiction under the Conservation Authorities Act

4.2 Clean Water Act, 2006

Under the Clean Water Act, 2006, the 4,000 square kilometer jurisdiction is called the North Bay-Mattawa Source Protection Area (NBMSPA), which is governed by the North Bay-Mattawa Source Protection Authority. This jurisdictional boundary is shown in the Figure 3 map. The North Bay-Mattawa Source Protection Authority includes the ten member municipalities under the Conservation Authorities Act, above, and additionally includes members from the Village of South River, Township of Nipissing, and Township of StrongFigure 3.

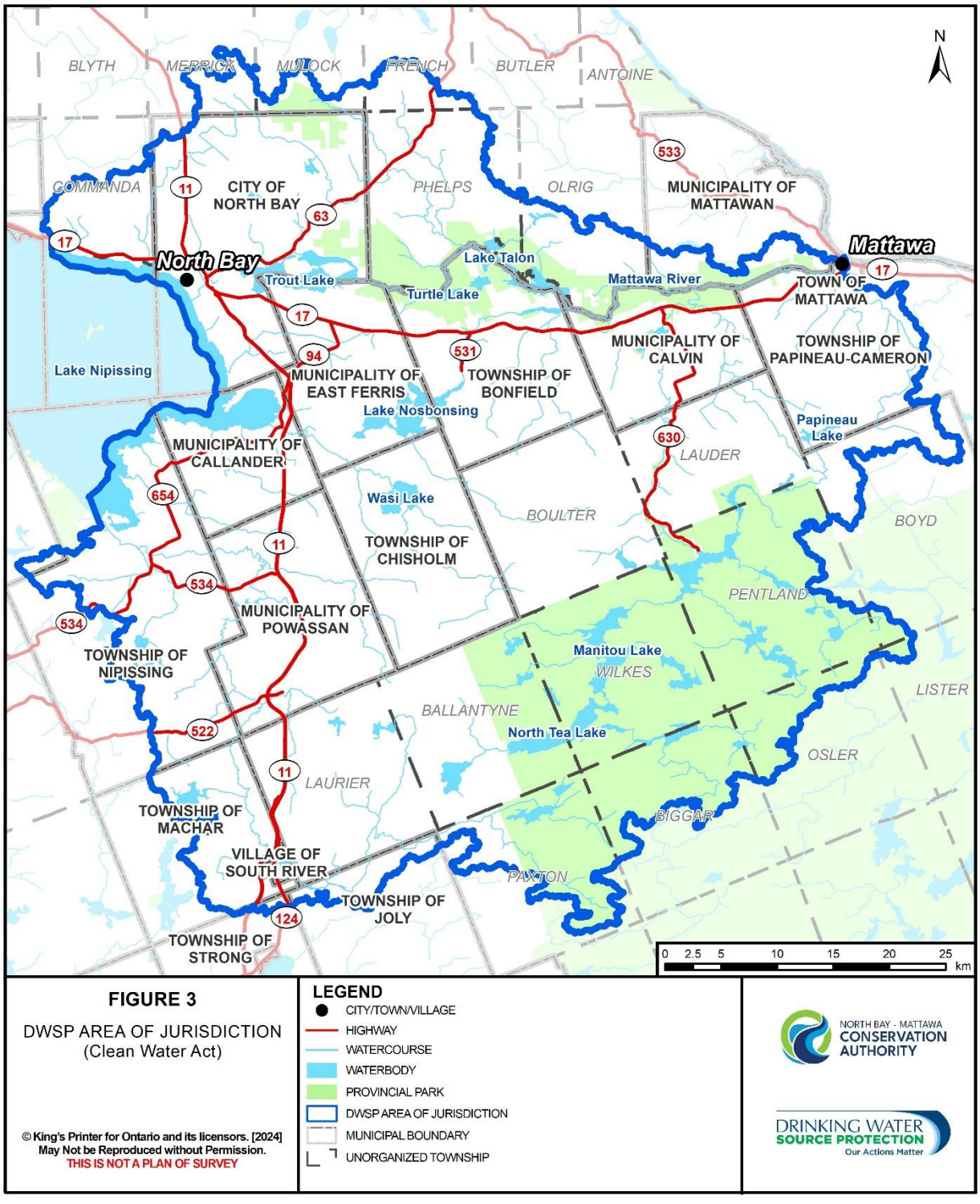

Figure 3: North Bay-Mattawa Source Protection Authority Jurisdiction under the Clean Water Act, 2006

4.3 Ontario Building Code Act

The Ontario Building Code Part 8 appoints NBMCA as the delivery agent for the On-site Sewage System (OSS) program across more than 20,000 square km of jurisdiction, which is shown in Figure 4. The NBMCA OSS program is delivered in the Districts of Nipissing and Parry Sound (excluding the Township of the Archipelago) as well as portions of Algonquin Park.

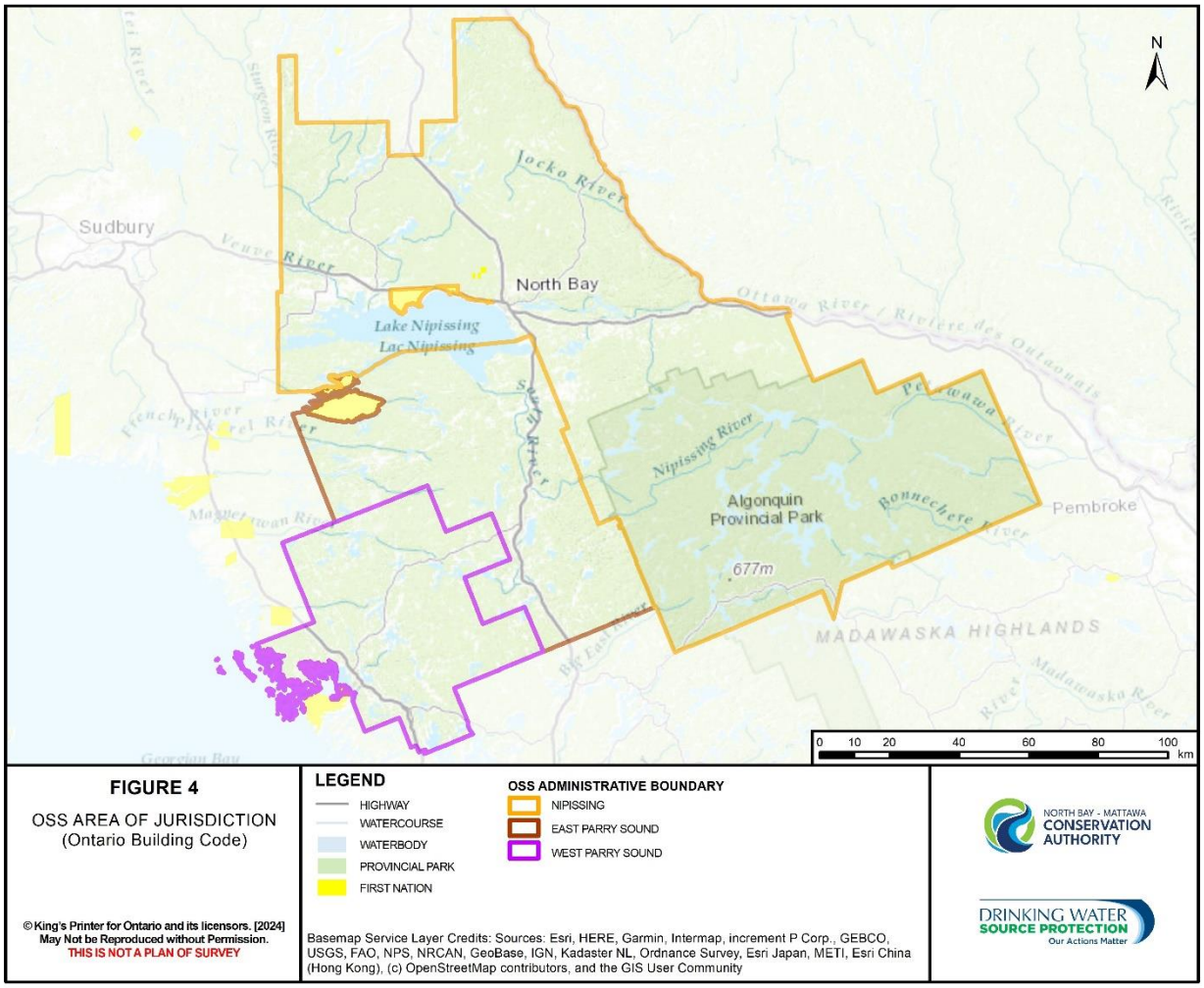

Figure 4: North Bay-Mattawa Conservation Authority Jurisdiction under the Ontario Building Code Part 8 – On-site Sewage System Program

5. Programs and Services Descriptions

5.1 Overview of NBMCA Programs and Services

The Conservation Authorities Act and accompanying regulations were amended by the Province of Ontario since 2017, including a new categorization of Conservation Authority (CA) programs and services. The NBMCA Programs and Services Inventory was updated accordingly, per the requirements of the Conservation Authorities Act.

- **Category 1:** Mandatory programs and services
- **Category 2:** Municipal programs and services provided on behalf of a municipality
- **Category 3:** Programs and services advisable by the CA to implement in the CA's jurisdiction.

The **Error! Reference source not found.** below provides an overview summary of the program areas as provided currently by NBMCA.

Table 1: Overview of NBMCA Programs and Services

Program Area	General Description
Category 1 (Mandatory)	
A. Corporate Services ("General Functions" per O. Reg. 402/22) **Category 1 (Mandatory)**	These are operational activities and capital works that provide a corporate-wide supporting function that are not related to the provision of a specific program or service. They include governance support, finance, human resources, geographical information systems (GIS), information technology (IT), communications, legal expenses, office equipment and supplies, administrative office buildings, vehicle fleet, asset management, etc.
B. Planning and Regulations **Category 1 (Mandatory)**	The main goal of the Planning and Regulations operational program is to protect life and property from natural hazards specified in O. Reg. 686/21. They include natural hazard input and review for member municipalities, planning boards, and unincorporated areas; Section 28 permitting process; and technical studies such as updating the regulated areas.
C. Water Resources Management **Category 1 (Mandatory)**	The main goal of the Water Resources Management program is to protect life and property from natural hazards specified in O. Reg. 686/21. They include operational activities and capital works covering flood forecasting and warning, Water Erosion Control Infrastructure (WECI) provincial grant funded projects, other flood and erosion control projects, ice management, natural hazard infrastructure operational plan and asset management plan, low water response, watershed-based

Program Area	General Description
	resource management strategy, and watershed monitoring (provincial partnership surface water and groundwater monitoring programs).
D. Conservation Areas and Lands **Category 1 (Mandatory)**	The main goal is to protect, conserve and manage conservation areas and lands owned by NBMCA, including operational activities and capital works to provide safe, passive recreation to the public through the management of NBMCA owned lands including public parks and trails, Section 29 enforcement, maintenance of assets such as bridges, benches, pavilions, etc., tree planting on NBMCA lands, land inventory, conservation area strategy, policy for land acquisition and disposition, Planning Act comments as the land owner.
E. Source Protection Authority (SPA) **Category 1 (Mandatory)**	These are operational activities to protect existing and future municipal drinking water sources in the North Bay-Mattawa Source Protection Authority (NBMSPA) per the Clean Water Act, 2006. They include governance support to a Source Protection Committee and to the NBMSPA, technical studies, policy updates/development, proposal review and comments, plan input and review, and significant threat policy implementation.
F. On-site Sewage System (OSS) Program **Category 1 (Mandatory)**	These are operational activities to regulate existing and new septic systems to protect the environment per the Building Code Act, 1992, Part 8. They include permitting and compliance for on-site sewage systems (septic systems) in municipalities and unorganized townships, and mandatory maintenance inspections to over 500 properties identified under the Clean Water Act, 2006.
Category 2 (Delegated by a Municipality)	
G. Watershed-Municipal Programs **Category 2 (Delegated by a Municipality)**	These are operational activities that include watershed-wide monitoring that supplement the mandatory watershed monitoring (under Water Resources Management program area), and septic system reinspection program under the Trout Lake Management Plan.
Category 3 (Non mandatory; advisable by NBMCA)	
H. Watershed-Support Programs	These are operational activities and capital works that NBMCA has determined are advisable to provide to further the purposes of the Conservation Authorities Act. They include benthic monitoring, watershed report card, land acquisition and disposition, land lease and

Program Area	General Description
Category 3 (Non mandatory)	agreement management, stewardship and restoration, Miskwaadesi (Painted Turtle site), septic systems related plan input and review, Mattawa River Canoe Race.
I. Ski Hill **Category 3 (Non mandatory)**	These are operational activities and capital works that support the Laurentian Ski Hill Snowboarding Club, which is operated by a separate Board and staff. NBMCA owns most of the major capital assets.

6. Watershed Characterization

NBMCA is a watershed science-based organization that utilizes and relies on studies, monitoring programs and other information on the state of the natural resources within its watershed jurisdiction to support the delivery of mandatory programs and services. Examples of such studies that help characterize the watershed are the NBMCA Integrated Watershed Management Strategy 2015, watershed plans, subwatershed plans, assessment reports prepared under the Clean Water Act, 2006, and watershed report cards, too numerous to list here.

- **Appendix A** provides a summary of existing technical studies and other natural resource information relied upon by NBMCA for mandatory and non-mandatory programs.
- **Appendix B** provides an overview of monitoring programs.

The maps, content of existing studies, monitoring programs and other information provide a baseline of existing knowledge which NBMCA utilizes to support activities delivered by the mandatory programs and services. These resources directly assist with watershed characterization, identifying any triggers or issues within the watershed and relevant guiding principles and objectives, and assessing and mitigating risks. This also enables NBMCA to review programs and services to evaluate knowledge gaps and develop budgets and workplans.

6.1 Physical Geography

The NBMCA watershed is located between the eastern shores of Lake Nipissing and extends to the confluence of the Mattawa River and Ottawa River. A major watershed divide cuts through the area from north to south directing water flow either west to Lake Nipissing and the French River watershed or east towards the Mattawa River and the Kipawa River – Upper Ottawa River watershed. These two large watersheds within the NBMCA area of jurisdiction under the Conservation Authorities Act are subdivided into 20 subwatersheds as shown in Figure 5.

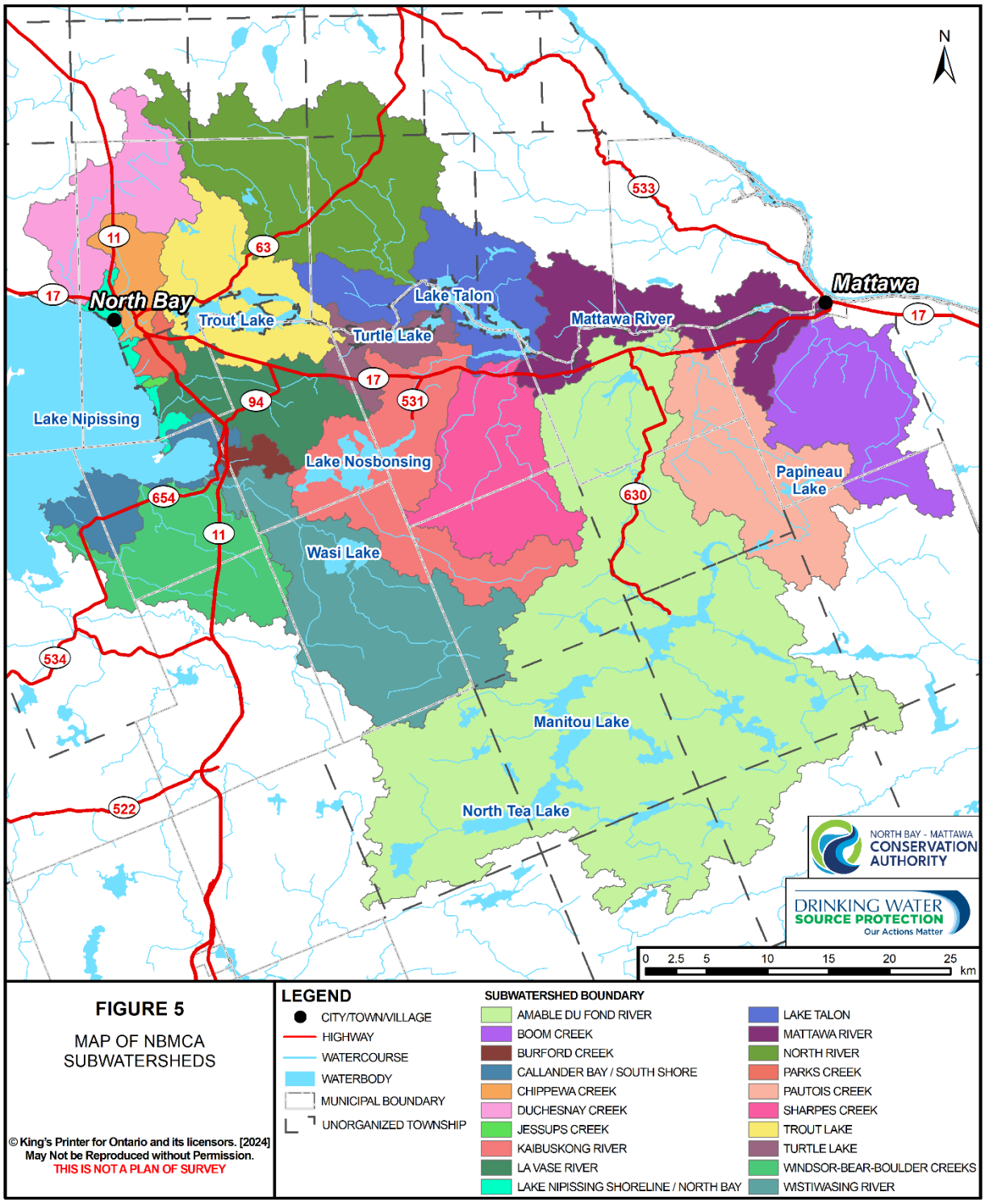

Figure 5: Map of NBMCA subwatersheds

Table 2: NBMCA subwatershed areas

Subwatershed	Tertiary Watershed	Significant Tributaries and Waterbodies	Area Within NBMCA Jurisdiction (km^2)	Area Outside NBMCA Jurisdiction (km^2)
Duchesnay Creek	French River	Duchesnay Creek Canadore Creek	101.65	
Chippewa Creek	French River	Chippewa Creek Eastview Creek Johnson Creek Golf Club tributary North Airport tributary	37.77	
Parks Creek	French River	Parks Creek	14.01	
Jessups Creek	French River	Jessups Creek	1.31	
La Vase River	French River	La Vase River Cook Creek	90.76	
Lake Nipissing Shoreline / North Bay	French River	Lake Nipissing Pinewood Parkway Creek Bond Street tributary Gauthier Wetland tributary	16.61	
Callander Bay/South Shore	French River	Callander Bay (Lake Nipissing) Cranberry Creek Centennial Creek Lansdowne Creek	30.03	34.83
Burford Creek	French River	Burford Creek	1.22	11.67
Wistiwasing (Wasi) River	French River	Wasi River Graham Creek Wasi Lake	234.38	
Windsor / Boulder / Bear Creeks	French River	Windsor Creek Boulder Creek Bear Creek	67.12	59.61

Subwatershed	Tertiary Watershed	Significant Tributaries and Waterbodies	Area Within NBMCA Jurisdiction (km^2)	Area Outside NBMCA Jurisdiction (km^2)
Trout Lake	Kipawa River – Upper Ottawa River	Trout Lake Armstrong tributary Lees Creek Doran Creek Four Mile Creek Four Mile Lake Long Lake Mattawa River	131.67	
Turtle Lake	Kipawa River – Upper Ottawa River	Turtle Lake Pine Lake Mattawa River	45.08	
North River	Kipawa River – Upper Ottawa River	North River Balsam Creek Otter Lake	247.77	
Kaibuskong River	Kipawa River – Upper Ottawa River	Kaibuskong River Depot Creek Lake Nosbonsing	181.88	
Lake Talon	Kipawa River – Upper Ottawa River	Lake Talon Mattawa River	130.09	
Sharpes Creek	Kipawa River – Upper Ottawa River	Sharpes Creek Blueseal Creek	136.88	
Amable du Fond River	Kipawa River – Upper Ottawa River	Amable du Fond River Kelly Creek Smith Lake	964.41	
Pautois Creek	Kipawa River – Upper Ottawa River	Pautois Creek Bronson Creek Papineau Lake Thompson Lake	175.78	
Boom Creek	Kipawa River – Upper Ottawa River	Boom Creek Landis Creek	137.86	

Subwatershed	Tertiary Watershed	Significant Tributaries and Waterbodies	Area Within NBMCA Jurisdiction (km^2)	Area Outside NBMCA Jurisdiction (km^2)
Lower Mattawa River	Kipawa River – Upper Ottawa River	Mattawa River Lake Chant Plein Earl's Lake Tributary Earl's Lake	143.39	
Total Area			**2889.67***	**106.11**

* excludes the small portion of the Little Sturgeon River at the north end of the City of North Bay

6.1.1 Land Cover

Only about 7.5% of the NBMCA jurisdiction is classified as human land use in the forms of settlement infrastructure or agricultural pasture/cropland, as shown in Table 3. As much as 78% of the NBMCA watershed is forested and 10% is open water. Dominant tree species include Red Pine, Eastern White Pine, Eastern Hemlock, Yellow Birch, Maple species, and Red Oak. The distribution of land cover classes is also shown in Figure 6 and Figure 7.

Table 3: Vegetative Land Cover in the North Bay-Mattawa Jurisdiction

Land Classification	Land Cover and Type	Area (km^2)	% Coverage	% Coverage by Class
Human Land Use	Settlement Infrastructure	66.5	2.2	7.5
	Pasture/Abandoned fields	158.1	5.3	
Forested	Dense Mixed Forest	1134.7	38.2	77.8
	Dense Deciduous Forest	764.9	25.8	
	Dense Coniferous Forest	289.6	9.8	
	Sparse Forest	118.3	4.0	
Wetland	Treed Bog	61.5	2.1	2.2
	Open Bog	0.8	0.0	
	Treed Fen	1.7	0.1	
Other	Other	59.7	2.0	2.3
	Cutovers	9.6	0.3	
	Burns	0.4	0.0	
Water	Water – Deep or Clear	299.8	10.1	10.1
Bare Rock	Bedrock Outcrop	1.8	0.1	0.1
Total		2967.5	100.0	100.0

Forests provide resiliency to climate change. They help improve air quality, protect biodiversity, prevent soil erosion, mitigate flooding, and regulate ecosystems. Forest Condition is characterized using three indicators: overall percent forest cover of each subwatershed, percent forest interior, and percent of forested riparian zone. To be included, a forest must be more than 0.5 ha in size. Windbreaks, urban street trees, shrublands, thickets, and newly maturing woodlands or plantations do not count as forest cover for the purposes of the Watershed Report Cards. Interior forest is the portion of a forest that is more than 100 m from the forest edge and is a habitat indicator of whether the forest is continuous or broken into

smaller pieces across the landscape. Forested riparian zone is an indicator of natural vegetation within 30 m of lakes, rivers, and streams, and the protection it provides.

The grading system for Northern Ontario used in the Watershed Report Cards targets 70 % overall forest cover. The Environment Canada (2013) How Much Habitat is Enough? report targets 10 % forest interior to support species habitat requirements and recommends 75 % of stream length be naturally vegetated, which this is typically split between 50 % forest cover and 25 % marsh, meadow, and thicket in healthy systems. The available Provincial Land Cover GIS layers for this area have not been updated since 2000.

Table 4: Forest and Wetland cover indicators, data from 2023 Watershed Report Card

Subwatershed	Forest Cover (%)	Forest Interior (%)	Forested Riparian Zone (%)	Wetland Cover (%)
Duchesnay Creek	87.6	66.7	82.5	17.1
Chippewa Creek	49.9	21.3	51.9	8.3
Parks Creek	58.7	27.7	62.4	19.0
Jessups Creek	80.1	53.5	90.6	31.2
La Vase River	80.7	53.8	76.1	17.5
Lake Nipissing Shoreline/North Bay	39.3	23.5	53.5	15.2
Callander Bay/South Shore	74.4	40.2	62.9	26.1
Burford Creek	91.1	72.5	83.1	21.1
Wistiwasing (Wasi) River	78.6	59.6	76.3	15.2
Windsor/Boulder/Bear Creeks	83.6	59.7	79.4	22.3
Trout Lake	69.8	46.9	68.2	8.7
Turtle Lake	83.7	63.0	76.4	12.5
North River	94.5	78.7	91.1	8.0
Kaibuskong River	75.9	56.2	73.5	11.2
Lake Talon	83.8	69.5	80.9	5.4
Sharpes Creek	86.8	72.4	85.9	9.1
Amable Du Fond River	85.6	71.5	83.5	10.2
Pautois Creek	89.1	74.3	84.0	10.1
Boom Creek	93.0	75.8	90.3	14.9
Lower Mattawa River	84.7	64.6	74.3	5.8

Riparian areas are the lands found along shorelines. The term refers to the transition zone between upland areas, such as fields, and water features, such as streams, wetlands, lakes, and rivers. The zone may be intermittently inundated supporting wet meadow, marshy or swampy vegetation. Riparian areas are frequently ecologically diverse, providing important habitat and physical attributes that stabilize shorelines and reduce contaminants in overland flows. Residential development or agricultural activities have often resulted in alterations to shoreline

areas. Large portions of the SP Area are unpopulated with riparian areas in their natural state, but there has been little data collection or assessment of those. If a 100 m strip along every shoreline were to be identified as a riparian buffer, it would amount to almost 12% of the NBMCA watershed.

Wetlands provide nature-based solutions for climate change. They are an important landscape feature, providing diverse habitat, improving water quality, and help protect land from flooding. Wetlands are special areas that cross the boundary between aquatic (i.e., lakes or ponds, and rivers or streams) and upland terrestrial landscapes, including marshes, swamps, bogs, and fens. Swamps, thickets, and closed bogs are wetlands dominated by trees and are also included in the forest cover indicators. Wetland cover is calculated using the best available GIS information. A wetland delineation project in 2018 improved mapping based on refined wetland boundaries for the NBMCA watershed. Environment Canada (2013) recommends restoring wetlands to 6 % of subwatersheds and 10 % of major watersheds, or to 40 % of the historical percent of wetlands of the landscape. Landscapes dominated by steep and hilly terrain may naturally have lower wetland cover compared to lower, flat landscapes. Due to the rural and undeveloped nature of the North River, Lake Talon, Sharpes Creek, and Lower Mattawa River subwatersheds, as seen with the high percent of forest cover in these areas, it is believed that these subwatersheds naturally have lower wetland cover.

Wetland distribution is relatively uniform across the SP Area with high concentrations of treed fens and treed bogs around Lake Nipissing in the Bear-Boileau Creeks and La Vase River watersheds. Approximately 64 km^2 of wetland covers the NBMCA jurisdiction, or 2.2% of the area. Of the wetlands that have been evaluated, 11 are classified as Provincially Significant. They include the Callander Bay Wetland, Chippewa Creek Conservation Area Wetland, Duchesnay Creek Wetland Complex, Gauthier Creek Marsh, La Vase Portage Conservation Area, Parks Creek Wetland, Rice Bay Wetland, and the Upper Wasi River Swamp. In addition, locally significant wetlands have been identified in most SP Area subwatersheds.

Figure 6: Wooded Land Cover in the North Bay-Mattawa Source Protection Area

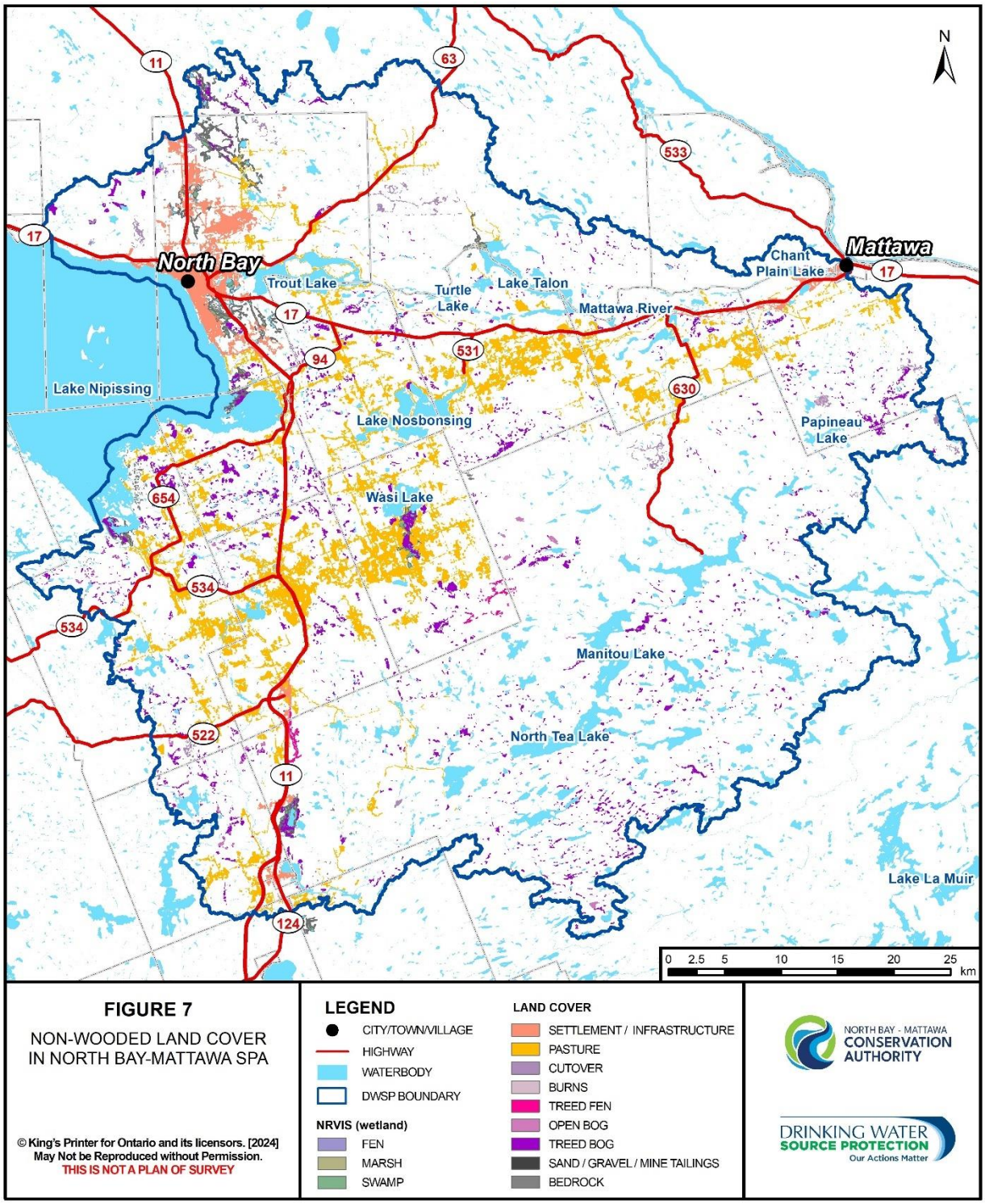

Figure 7: Non-Wooded Land Cover in the North Bay-Mattawa Source Protection Area

6.2 Population

Historic settlement and development of the area was driven by the nature of the landscape, which directed access routes, limited agricultural activities and provided challenges to road construction. The Mattawa River extends from west to east across the northern portion of the NBMCA watershed. It provided a major transportation link from Lake Nipissing in the Great Lakes watershed across to the Ottawa River, traditionally for First Nations and later for European fur traders. Much of the terrain is rugged and otherwise difficult to navigate. The City of North Bay was established on the divide at the only point east of Lake Nipissing where road and (eventual) rail access from south to north was possible without a major bridge.

The total population residing within the NBMCA watershed is estimated at 66,200 (Statistics Canada, 2021). This population is culturally diverse with over 90 languages spoken and approximately 24% of the population is bilingual in English and French (City of North Bay, 2023). Population distribution and changes within the NBMCA watershed for the period 1996 to 2021 are indicated in Table 5. Note that since population data is reported based on political boundaries (municipalities, etc.) while the NBMCA watershed is defined by watershed boundaries, the total population for the NBMCA watershed is an estimate.

Table 5: Population Distribution and Change within the North Bay-Mattawa Conservation Authority Jurisdiction (Statistics Canada, 2021)

Name	Municipal Designation	Population						% Change
		1996	2001	2006	2011	2016	2021	1996-2021
Bonfield	Township	1,765	2,064	2,009	2,016	1,990	2,146	21.6%
Callander	Municipality	3,168	3,177	3,249	3,864	3,863	3,964	25.1%
Calvin	Municipality	562	603	608	568	516	557	-0.9%
East Ferris	Municipality	4,139	4,291	4,228	4,512	4,862	4,946	19.5%
Mattawa	Town	2,281	2,270	2,003	2,023	1,993	1,881	-17.5%
North Bay	City	54,332	52,771	53,966	53,651	51,553	52,662	-3.1%
Subtotal:		**66,247**	**65,176**	**66,063**	**66,634**	**64,777**	**66,156**	**-0.1%**
Townships only partially within NBMCA Area (population of entire territory)								
Chisholm	Township	1,197	1,230	1,318	1,263	1,291	1,312	9.6%
Mattawan	Municipality	115	114	147	162	161	153	33.0%
Papineau-Cameron	Township	973	997	1,058	978	1,016	982	0.9%
Powassan	Municipality	3,311	3,252	3,309	3,378	3,455	3,346	1.1%
Subtotal:		**4,399**	**4,363**	**4,514**	**4,518**	**4,632**	**4,481**	**1.9%**
Total:		**70,646**	**69,539**	**70,577**	**71,152**	**69,409**	**70,637**	**0.0%**

Approximately 73% of the population of the NBMCA watershed resides in the City of North Bay which is the only major urban centre in the NBMCA watershed. Most of the rest live in the towns and hamlets. However, depending on the municipality, there may be a significant portion of the population on rural properties. A large portion of the NBMCA watershed is virtually uninhabited. Population distribution and density is indicated in Table 6. The overall population growth trend experienced between 2016-2021 is expected to continue, with an increase of newcomers moving to the community (City of North Bay, 2023).

Table 6: Population Density within the North Bay-Mattawa Conservation Authority Jurisdiction (Statistics Canada, 2021)

Name	Municipal Designation	2021 Population	Census Calculated Land Area (km^2)	Density 2021 (pop/km^2)
Municipalities Located Completely within the NBMCA Jurisdiction				
Bonfield	Township	2,146	206.22	10.4
Callander	Municipality	3,964	102.98	38.5
Calvin	Municipality	557	140.13	4.0
East Ferris	Municipality	4,946	151.94	32.6
Mattawa	Town	1,881	3.67	512.5
North Bay	City	52,662	315.53	166.9
Subtotal:		**66,156**	**920.47**	**71.9**
Municipalities Located Partially within the NBMCA Jurisdiction				
Chisholm	Township	1,312	205.77	6.4
Mattawan	Municipality	153	200.12	0.8
Papineau-Cameron	Township	982	564.23	1.7
Powassan	Municipality	3,346	223.26	15.0
Subtotal:		**4,481**	**987.61**	**4.54**
TOTAL:		**70,637**	**1,908**	**37.0**

6.3 Climate

Existing climate data for the NBMCA watershed have been provided by Gartner Lee (2008). From a climate change perspective, these data are valuable for the climate baseline they provide and for comparing observed climate trends against projected trends.

For the NBMCA watershed, Gartner Lee (2008) provided data on climate stations, average annual precipitation, precipitation distribution, metrological zones, evapotranspiration, and long-term historic temperature and precipitation trends and averages. This information is contained within the Section 2.5 Conceptual Water Budget of the 2024 Draft Proposed Update of the Assessment Report for the North Bay-Mattawa Source Protection Area. Estimated annual

precipitation and evapotranspiration within the area is provided in Figure 8 and Figure 9, respectively.

Current, reliable, climate data is being recorded by two stations, both located at the North Bay Airport (data provided through Environment and Climate Change Canada's Meteorological Service of Canada). There is a tipping bucket associated with the Water Survey of Canada hydrometric gauge at the Wasi River, though it is poorly sited and provides unreliable data, and a tipping bucket maintained by NBMCA, located at a Provincial Groundwater Monitoring Network (PGMN) site in Feronia, which did not have telemetry for remote data access until late 2024. An overview of current data sources is available in Appendix B – Overview of NBMCA monitoring programs, and locations of climate data collection sites are shown in Figure 10.

These data will be useful for conducting region-specific analyses of climate change scenarios, which is beyond the scope of this report. For example, using temperature and precipitation data from the North Bay weather station, OCCIAR (2010) found that annual mean temperature in the North Bay area increased over the period 1938 to 2008, and that total annual precipitation increased by 110 mm during this same time period.

Environment and Climate Change Canada (2024) has released updated climate normal data for the 1991-2020 period for data collected at the North Bay Airport. Annual average temperature over the 30-year period was 4.4 °C, ranging from average daily minimum of -17.3 °C in January to maximum of 24.3 °C in July. Average total annual precipitation over the 30-year period was 1020 mm, with 798 mm as rain and 312 cm as snow. September is the wettest month with 114 mm of rain, and February is the driest with total precipitation of 54 mm, in a combination of rain and snow.

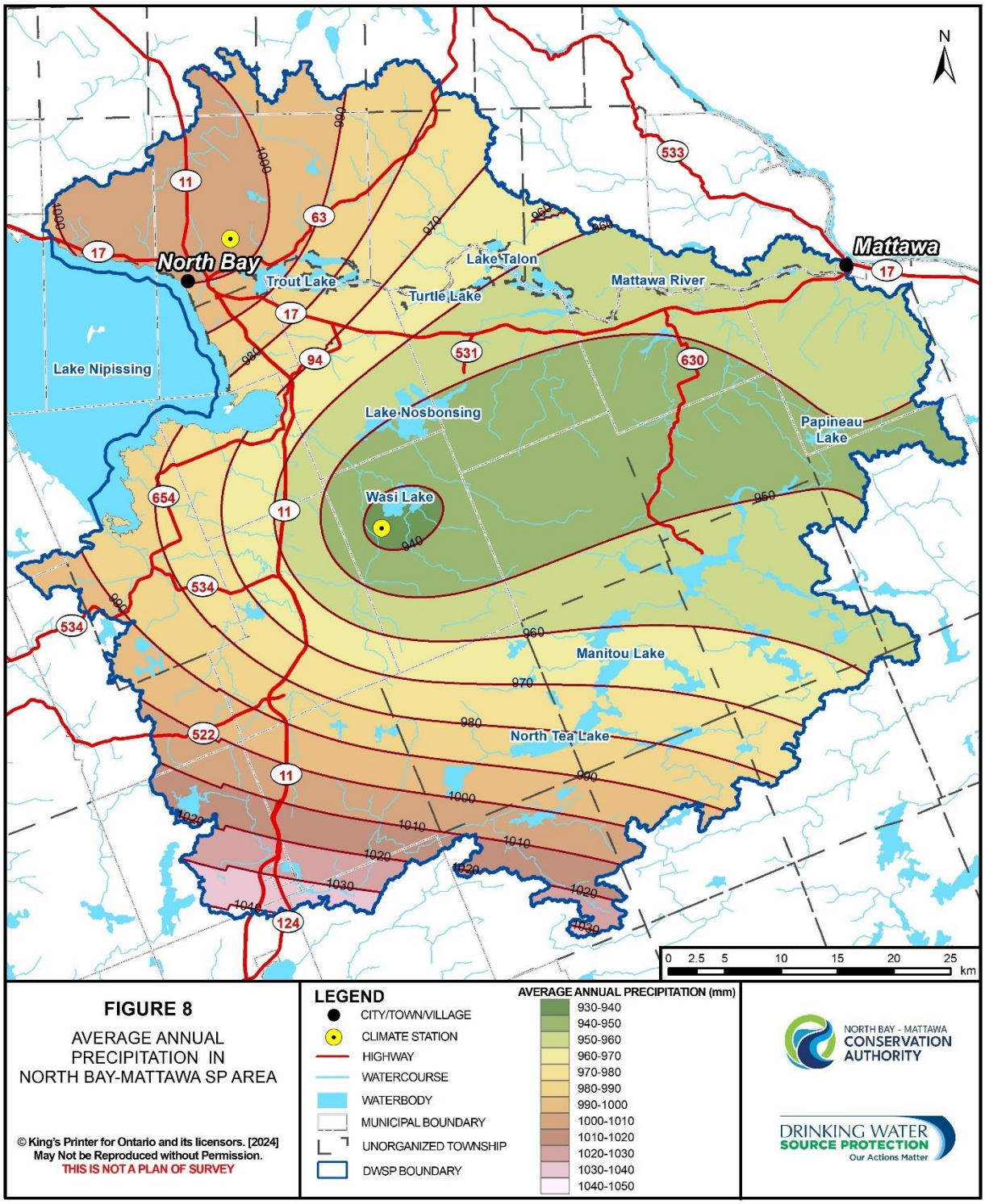

Figure 8: Precipitation in the North Bay-Mattawa Conservation Authority Watershed

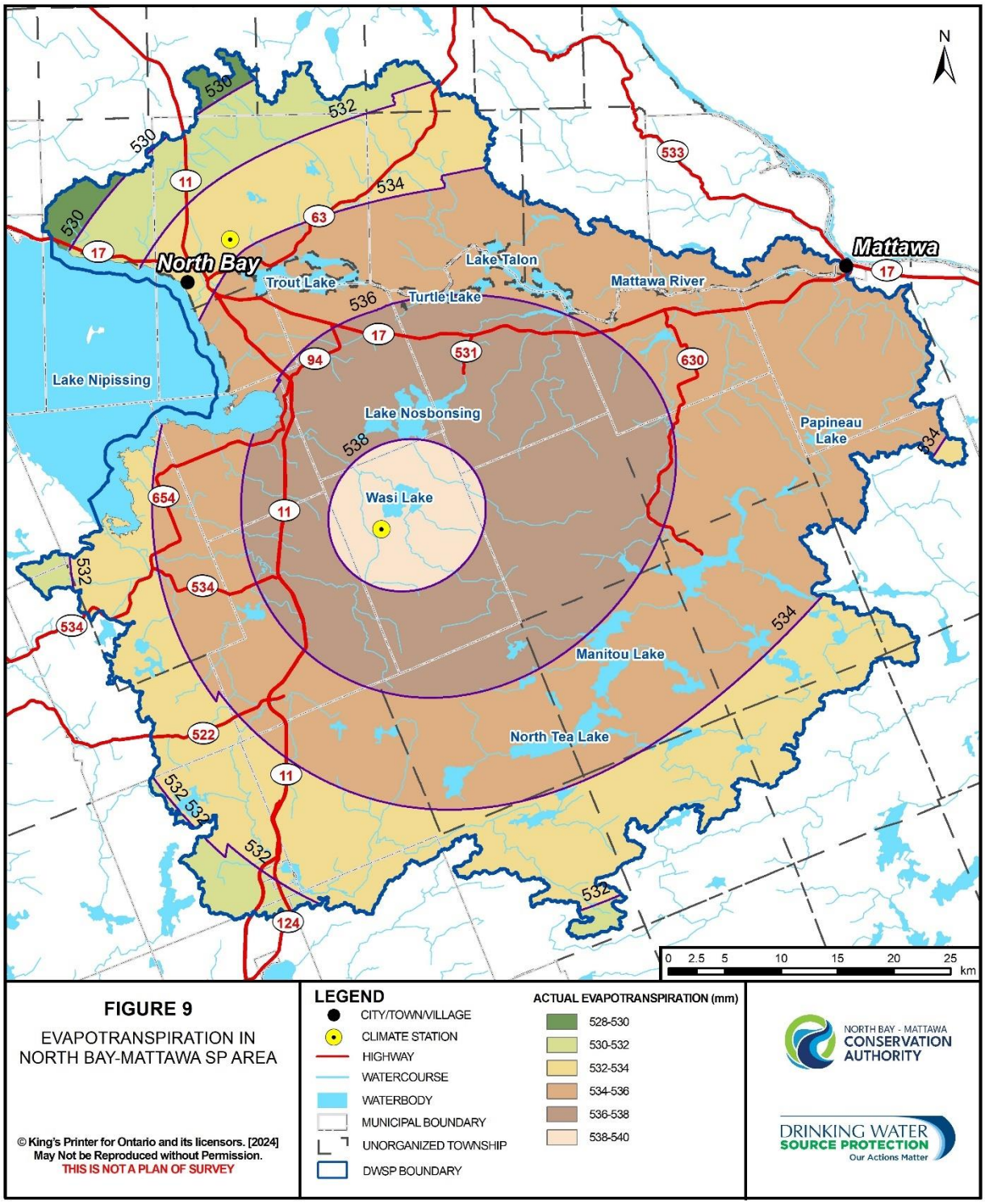

Figure 9: Evapotranspiration in the North Bay-Mattawa Conservation Authority Watershed

6.4 Water Quantity

6.4.1 Surface Water

NBMCA relies on the Water Survey of Canada's (WSC) hydrometric gauge network for water level data. A few additional gauges have available data at the MNRF dams and a privately operated dam on the Mattawa River. Data is available from 10 hydrometric stations, however a current relationship to derive streamflow is only available at 3 locations at this time. The historic data for Mattawa River below Bouillon Lake was exclusively discharge data; recent preliminary data is water level only, with a discharge relationship in progress. An overview of water level and discharge is presented in Table 7. Additional information is presented in Appendix B – Overview of NBMCA monitoring programs and shown in Figure 11. The datasets from MNRF and OPG do not get the same quality control assessment and are not presented here. Several historic hydrometric stations have been discontinued by WSC, including two on the Amable du Fond River, the largest subwatershed in the NBMCA jurisdiction.

Table 7: Water level and discharge (data from Water Survey of Canada)

Subwatershed	Lake or River	Water Level (m)			Discharge (m^3/s)	
		Data period	Min.	Max.	Min.	Max.
Chippewa Creek	Chippewa Creek	1974-2024	13.08	14.62	0.0 (est)	11.6 (est)
La Vase River	La Vase River	1974-2024	10.46	12.25	0.002	24.5
Lake Nipissing Shoreline/North Bay	Lake Nipissing	1933-2024	194.31	196.94		
Mattawa River	Mattawa River	1971-1998; 2023-2024			0.71	176
Adjacent to Mattawa River	Ottawa River at Mattawa	1908-2024	149.95	155.78		
Wistiwasing (Wasi) River	Wasi River	2007-2024	7.84	9.48	0.15	30.4

The communities of North Bay, Callander, and Mattawa are vulnerable to flood events. For the City of North Bay and Municipality of Callander, this risk largely comes from high water levels in Lake Nipissing. The outlet of Lake Nipissing is controlled by Public Services and Procurement Canada (PSPC), and the Sturgeon River is a major tributary with dams operated by Ontario Power Generation, Ministry of Natural Resources and Forestry (MNRF), and a few private dam operators.

NBMCA operates a backflood control structure at the mouth of Parks Creek to protect the many homes and businesses in the Parks Creek floodplain, preventing high water in Lake Nipissing from travelling upstream. More information is available through the Natural Hazard Infrastructure Operational and Asset Management Plan. Parts of the City of North Bay are also

vulnerable to riverine flooding, particularly from Chippewa Creek which is flashy in its response to rain and snowmelt events.

The Town of Mattawa is located at the confluence of the Mattawa River and Ottawa River. There are three dams operated by the MNRF along the Mattawa River and a privately-operated dam in the lower reaches of the Mattawa River. In the Town of Mattawa and adjacent parts of the Municipality of Mattawan and Township of Papineau-Cameron, high flows on the Ottawa River cause the water at the outlet of the Mattawa River to rise triggering flooding. Local groundwater dynamics enhance flooding when surface water levels are high, causing flooding in homes and low-lying areas that are not directly flooded by the river water.

Spring freshet 2019 caused significant flooding in both the Lake Nipissing and Mattawa areas. Daily average water levels on Lake Nipissing peaked at 196.579 m, the third highest water level since existing water control structures at the outlet were constructed in 1949. Of the top 20 highest annual daily average water levels in Lake Nipissing, nine have occurred since 2000.

Similarly, in Mattawa, the daily average water level during the 2019 freshet peaked at 155.548 m, the fourth highest since the upstream Temiskaming Dam Complex was built in 1913. Of the top 20 highest annual daily average water levels on the Ottawa River at Mattawa, four have occurred since 2000.

6.4.2 Snowpack

The spring freshet is a significant event in the NBMCA watershed. Snowpack is sampled from three locations, all near the major watershed divide between the French River and Kipawa River – Upper Ottawa River watersheds. A map of these locations is provided in Figure 10 within Appendix B – Overview of NBMCA monitoring programs. Generally speaking, the snowpack often has a steady build between early December, peaking between March 1 and 15th, followed by a more rapid melting. Normal maximum snow water equivalent in the snowpack is between 75 and 150 mm, accompanied by about 40 to 60 cm depth. Maximum snow depth was recorded as 95 cm in North Bay in March 2019. Maximum snow water equivalent has been recorded as 238 mm in 2023, also in North Bay. Freshet 2019 caused significant flooding, while for freshet 2023 the snow melted before spring rains could enhance the flood risk.

6.4.3 Groundwater

NBMCA monitors groundwater at six monitoring wells in partnership with the MECP's Provincial Groundwater Monitoring Network (PGMN). Water level is monitored at all six of these sites and water quality is sampled at four of these wells as outlined in Table 8. Additional information about the groundwater monitoring program is provided in Appendix B – Overview of NBMCA monitoring programs and Figure 15. Complete analyses have yet to be conducted on water quantity from the long-term water level dataset available from all six monitoring wells.

Table 8: Provincial Groundwater Monitoring Network (PGMN) wells

ID #	Subwatershed	Location	Depth (m)	Static Water Level (mbtoc)	Continuous Water Level since (year)	Water Quality
W272-1	La Vase River	Fabrene Inc., North Bay	24.7	5.43	2003	No
W274-1	Parks Creek	Marshall Avenue at Booth Rd, North Bay	5.18	2.94	2003	Yes
W277-1	Chippewa Creek	Trans Canada Pipeline, Hwy 11 N, North Bay	10.8	7.31	2003	Yes
W390-1	Wistiwasing (Wasi) River	Beach Rd, public beach, Chisholm	141	2.32	2006	No
W391-1	Sharpes Creek	Grand Desert Rd and Boundary Rd, Bonfield	79.3	9.94	2006	Yes
W392-1	Trout Lake	Cemetery Rd and Hwy 63, Feronia	91.9	10.39	2006	Yes

6.5 Water Quality

6.5.1 Surface Water

Integrated watershed management issues and needs can be determined from an understanding of current watershed health, recent trends and successful management actions to affect improvements. A review of the 2015 IWMS was completed to determine which subwatersheds require more baseline data and analysis to effectively manage resource protection needs.

Total phosphorus (TP) and Chloride concentrations are used as indicators of surface water health. The interim Provincial Water Quality Objectives (PWQO) for total phosphorus is 30 µg/L to avoid excessive plant growth in rivers and streams, 20 µg/L during the ice-free period to avoid nuisance concentrations of algae in lakes, and 10 µg/L during the ice-free period in lakes which are naturally below this value to provide a high level of protection against aesthetic deterioration. The Canadian Water Quality Guidelines (CWQGs) for the Protection of Aquatic Life established by the Canadian Council of Ministers of the Environment (CCME) are an acute, short-term concentration of 640 mg/L and chronic, long-term concentration of 120 mg/L.

Recent water quality results for lakes and rivers are presented in 9 and Table 10. Additional information about these monitoring programs are presented in Appendix B – Overview of NBMCA monitoring programs, Figure 12 and Figure 13. At many sites within the NBMCA watershed, chemical parameters are usually below limits established by PWQOs or the CWQGs. These low concentrations reflect the generally undeveloped conditions and relative lack of pollutant sources in the area. Water quality results in developed landscapes show evidence of degradation with some samples exceeding water quality objectives and guidelines.

Table 9: Spring phosphorus samples (2017-2021); data from Lake Partner Program. Water quality guideline exceedances are shown in bold and italicized (>20 µg/L)

Subwatershed	Lake	No. years	Total Phosphorus (µg/L)
Amable Du Fond River			
Boom Creek			
Burford Creek			
Callander Bay/South Shore	Callander Bay	3	***20.3***
Chippewa Creek	Delaney Lake	1	***36.1***
Duchesnay Creek			
Jessups Creek			
Kaibuskong River	Lake Nosbonsing	3	15.4
La Vase River			
Lake Nipissing Shoreline/North Bay	Lake Nipissing	1	11.1
Lake Talon	Lake Talon	2	11
Mattawa River	Earl's Lake	1	17.7
	Chant Plein Lake	1	13.1
	Taggart Lake	1	17.6
North River			
Parks Creek	Circle Lake	1	14.1
	Depensier's Lake	1	17.8
Pautois Creek	Papineau Lake	2	8.3
Sharpes Creek			
Trout Lake	Four Mile Lake	1	8.2
	Trout Lake	3	5.3
Turtle Lake	Pine Lake	1	7.2
	Turtle Lake	1	6.2
Windsor/Boulder/ Bear Creeks			
Wistiwasing (Wasi) River	Wasi Lake	3	***20.5***

Phosphorus is usually the limiting nutrient for algae growth in aquatic systems and is a parameter of concern at both high and low concentrations in local subwatersheds. The Wasi River has consistently exhibited high levels of total phosphorus along with Wasi Lake and Callander Bay into which it drains. Eutrophication, as evident in excessive growth of algae, in the latter waterbodies has been an ongoing concern for many years. Callander Bay is the source for the municipal drinking water supply for Callander and has experienced blooms of toxic cyanobacteria (often referred to as blue-green algae).

Table 10: Water quality results for Chloride and Total Phosphorus, 2007-2024. Water quality guideline exceedances are shown as bold and italicized (>120 mg/L for Chloride and >30 µg/L for Total Phosphorus)

Subwatershed	Creek or River	Chloride (mg/L)				Total Phosphorus (µg/L)			
		No. samples	Min.	Median	Max.	No. samples	Min.	Median	Max.
Amable Du Fond River	Amable Du Fond River	132	0.2	1.5	2.8	155	2.0	10.4	20.0
Boom Creek	Boom Creek	15	0.5	1.5	3.6	38	12.0	***31.0***	***67.0***
Burford Creek	Burford Creek	23	5.8	31.3	109.0	118	8.0	***30.6***	***239.3***
Callander Bay/South Shore	Lansdowne Creek	7	111.0	***145.0***	***181.0***	70	12.0	26.1	***171.9***
Chippewa Creek	Chippewa Creek	150	11.6	91.9	***404.0***	177	7.0	18.3	***525.0***
Duchesnay Creek	Duchesnay Creek	133	1.9	12.2	71.0	156	2.0	18.0	***162.0***
Jessups Creek	Jessups Creek	8	31.5	47.3	69.0	8	31.5	***47.3***	***69.0***
Kaibuskong River	Kaibuskong River	117	2.6	5.3	49.6	139	3.0	16.1	***70.6***
La Vase River	Cook Creek	7	44.1	102.0	***261.0***	7	24.0	***36.0***	***66.0***
	La Vase River	51	11.7	26.6	77.2	69	18.5	***38.9***	***361.0***
Lake Nipissing Shoreline/North Bay									
Lake Talon									
Mattawa River	Mattawa River	120	2.0	3.4	5.9	142	2.0	11.0	***112.0***
North River	Balsam Creek	15	5.9	9.1	96.0	37	2.0	14.0	***212.0***
	North River	15	3.6	6.8	11.7	38	4.0	18.5	***84.0***
Parks Creek	Parks Creek	15	59.5	91.9	***135.0***	37	8.0	27.0	***73.0***
Pautois Creek	Pautois Creek	15	1.2	2.8	5.1	37	10.0	19.0	***47.0***
Sharpes Creek	Sharpes Creek	15	0.5	1.5	2.5	38	3.0	21.5	***87.0***
Trout Lake	Four Mile Creek	23	2.5	13.2	26.7	140	2.0	15.0	***160.0***
	Lees Creek	7	19.6	21.1	39.8	7	4.0	10.0	***73.0***
Turtle Lake									
Windsor/Boulder/Bear Creeks	Bear Creek	15	9.1	23.7	47.7	37	22.0	***51.0***	***106.0***
	Boulder Creek	15	4.3	10.4	30.2	37	19.0	***42.0***	***81.0***
	Windsor Creek	23	27.4	71.6	***133.0***	121	15.0	***43.9***	***154.0***
Wistiwasing (Wasi) River	Wasi River	146	1.8	4.2	22.2	170	11.0	***34.2***	***305.0***

Trout Lake is the other area that has been closely monitored for phosphorus. Trout Lake is a deep, cold, oligotrophic lake of very low nutrient status. The City of North Bay has consistently supported the monitoring of phosphorus levels in Trout Lake at eight sites since 1986. Sampling was conducted from June to August on a weekly basis up until 2017. In 2018 and 2019, sampling occurred weekly from May to September, and since 2021, sampling has occurred monthly May to October. Over the period of record phosphorus levels have remained relatively consistent and do not display any obvious trends.

6.5.2 Groundwater

NBMCA monitors samples groundwater at four of six monitoring wells through the MECP's Provincial Groundwater Monitoring Network (PGMN) which are outlined in Table 8. Additional information about the groundwater monitoring program is provided in Appendix B – Overview of NBMCA monitoring programs and Figure 15.

Generally, where there are Ontario drinking water quality guidelines, objectives, or standards, water quality from these wells is below these established thresholds. A few aesthetic objectives are exceeded at W274-1 and W277-1.

There are limitations with regards to assessing accurate trends relating to water quality in the NBMCA watershed. Provincial programs such as the PWQMN and PGMN each involve the collection of surface water and groundwater samples, respectively, with the overall goal of water quality monitoring and assessment. Although these are useful tools and data from other monitoring work over the past several years has improved the amount of data currently available within the NBMCA watershed, the data set remains too sparse to determine dominant trends in most areas. Monitoring will continue towards an accurate statistical analysis of water quality parameters within the broader NBMCA watershed.

7. Resource Issues

7.1 Overview

Watershed resource issues and needs can be determined from an understanding of current subwatershed health, recent subwatershed trends, the current level of management being provided, and the successes of management actions to affect improvements. These characterizations are only possible if adequate information is available. Impacts anticipated within the planning horizon are identified for each system. Subwatershed needs and issues are presented from multiple perspectives to explore a more holistic understanding of their environmental, societal, and economic values. Refining the understanding of NBMCA features, conditions, processes, resource values and stresses over time will aid in refining the description of resource and protection needs.

Resource issues are identified in the following sections. Significant baseline data gaps exist in many subwatersheds that hamper the identification of management needs. Subwatersheds that have been within the NBMCA's jurisdiction since its inception have received preliminary assessment work including preliminary hydrologic and erosion evaluations. Some subwatersheds have received preliminary resource evaluation work such as wetland evaluation, stream habitat characterization or basic water quality data collection; or have benefited from regional studies. Subwatersheds added to the NBMCA in 2002 have significant information deficits. A summary of resource issues and the subwatersheds in which they occur is provided in Table 13.

NBMCA has identified key resource issues that will be addressed in the 2024 Watershed-Based Resource Management Strategy. These issues are identified in the context of climate change and based on a review of environmental monitoring data, technical reports and studies, and the expertise of NBMCA staff.

7.2 Summary of Key Natural Resource Issues

7.2.1 Climate Change

Climate change is overarching and influences the other resource issues. Changes to climatic conditions impact the return period of storm events for flood design criteria, habitat suitability for invasive species, natural hazards, and water quality. An overview of the potential impacts of climate change are presented in Table 11.

Table 11: Potential Impacts of Climate Change

Type of Change	Potential Impacts of Change
Frequency of extreme rainfall events	• greater frequency of waterborne diseases • increased transportation of contaminants from the land surface to water bodies
Runoff	• increased stress on fish habitat due to reduced streamflow • reduced water quality because less water is available for dilution of sewage treatment plant effluents and runoff from agricultural and urban land • increased erosion from flashier stream flows • increased water treatment costs due to decreased water quality • increased competition and conflict over reduced water supplies during drought periods • increased frequency of flooding-related damage due to more high intensity storms
Lake levels	• changes to coastal wetland form and function because of declining lake levels • decreased water quality resulting from lower water volume, increased non-point source pollution, and increased chemical reactions between water, sediments and pollutants • increased water treatment costs due to reduced lake water quality • increased costs associated with moving water supply intakes • increased need for dredging of harbours and channels • reduced hydropower production due to lower flows between connecting channels
Ice cover	• longer navigation season due to reduced ice thickness and shorter ice cover season • increased shore erosion and sedimentation • increased water temperatures due to decreased ice cover
Water temperature	• increased stress on fish habitat due to increases in water temperature • reduced water quality (e.g., increased algae production) as water temperature increases • greater frequency of taste and odour problems in drinking water supplies

Type of Change	Potential Impacts of Change
Groundwater recharge and discharge	• changes to wetland form and function as discharge decreases • greater costs for groundwater-dependent communities, industries and rural residents associated with deepening wells • increased conflict because of additional competition for scarcer supplies • increased frequency of shallow wells drying up in rural areas • greater frequency of low flows in streams dependent on baseflow, causing increased competition and conflict, and increased stress on aquatic ecosystems
Soil moisture	• increased stress on plants due to decreased summer soil moisture • increased demand for irrigation to supplement soil moisture on drought prone soils

Changing meteorologic patterns

The changes to storm patterns, include precipitation intensity, frequency, and seasonality. Together, these will define hydrologic conditions across the landscape. The combined influence of temperature will particularly affect winter and spring conditions with regards to snow accumulation, lake ice formation, and melt. Under high emissions scenarios, future Spring and Autumn precipitation are expected to increase, with the greatest increases in the spring and no notable change in the summer precipitation relative to current climate conditions (Climate Risk Institute and Dillon Consulting Limited, 2023). Winter total precipitation and the proportion of precipitation that falls as rain are both expected to increase (Climate Risk Institute and Dillon Consulting Limited, 2023).

With extreme precipitation, more localized variability can be expected, and it is important to acknowledge regional averages do not always reflect specific communities or experiences within one watershed (Climate Risk Institute and Dillon Consulting Limited, 2023). In the future, 1-day maximum precipitation amounts are projected to increase, reflected in higher frequency scores by the end of the century (2080s) (Climate Risk Institute and Dillon Consulting Limited, 2023).

According to the 2015 IWMS, the subwatersheds that drain into Lake Nipissing (through City of North Bay and Municipality of Callander) have overall higher scoring for sensitivity to climate change than those draining towards the Mattawa River and some subwatersheds are highly vulnerable to climate change too (Stantec Consulting Ltd., 2015). These are identified in Table 13.

Flood design criteria

With changing meteorological patterns, the return period of storm events of a given magnitude or intensity are changing. What was once a regulatory event with a 1:100 year return period

will become more frequent and new criteria for the regulatory event will need to be updated. This has impacts on floodplain mapping and stormwater infrastructure planning needs. To better understand and predict flood forecasting more gauges and data collection are required on a watershed level. Current hydrometric gauges are shown in Figure 11 in Appendix B – Overview of NBMCA monitoring programs. The installation of more local gauges that can transmit data to flood management staff will help to create a better understanding of current conditions.

7.2.2 Natural Hazards

Riverine flooding

Flooding associated with waterways and smaller inland lakes is considered riverine flooding. Areas that have high exposure and high consequence of flood impacts are known as Flood Damage Centres. There are several areas in NBMCA's jurisdiction which are particularly prone to flooding, including urban rivers through the City of North Bay and the confluence of the Mattawa River and Ottawa River in the Town of Mattawa, which are summarized in Table 12. An overview by subwatershed is presented in Table 13.Multiple factors, such as late or rapid snowmelts, deep frost, excessive rainfall, ice jams, and/or dam failures can contribute to flooding. High water levels on Lake Nipissing impact the flood risk in the lower reaches of Chippewa Creek, Parks Creek, Jessups Creek, and the La Vase River. The area surrounding Parks Creek is particularly vulnerable and there is a backflood control structure to limit upstream riverine flooding during high lake water levels.

Table 12: Flood Damage Centres and their floodwater source

Municipality	Flood Source
City of North Bay	Lake Nipissing shoreline Pinewood Parkway Creek Chippewa Creek Parks Creek Jessups Creek La Vase River
Town of Mattawa	Mattawa River Ottawa River

Extreme precipitation intensity and magnitude events can trigger flash flooding. Due to the localized nature of extreme precipitation associated with convective thunderstorms, they can be difficult to forecast. The impact of these extreme events will vary with urban landscapes where the land is more impervious, and drainage is dependent on local storm sewers and their capacity to handle the event flow and their rate of discharge to local streams will determine flood risk.

Floodplain and flood damage centre mapping is crucial to comprehensive flood preparedness efforts. Regular updates to floodplain mapping are imperative, ensuring alignment with evolving conditions and integrating climate change projections, particularly in areas where mapping has not yet been conducted. Risk assessment of unmapped floodplains should be conducted to help identify hazards and inform municipalities of potential flooding areas.

Conditions in 2019 were notable. Precipitation was above normal over the winter which was accompanied by considerable snowpack that for many dates remain the maximum relative to historical record. Significant rainfall through April and May 2019 (202 % and 137 % of normal, respectively relative to 1981-2010) in addition to the melting of significant snowpack resulted in riverine flooding throughout the watershed. The Ottawa River at Mattawa reached its third highest recorded peak water level (after 1960 and 1979) since water regulation began in 1952 at the Otto Holden Dam on the Ottawa River upstream of Mattawa.

Other factors contribute to riverine flooding, as was experienced in 2022 when a beaver dam let go on Lansdowne Creek in East Ferris and Callander. Damages were significant such that the lower reaches of the creek (an underground conveyance system) needed to be reconstructed.

Shoreline flooding

Shoreline flooding occurs along the boundaries of larger inland lakes such as Lake Nipissing. It is a critical concern, particularly for the dynamic beaches along Lake Nipissing's shoreline, where hazards such as flooding, wave uprush, overtopping along shorelines, erosion (exacerbated by wave action), sediment displacement, and ice-related damage prevail. variable weather patterns can lead to changes in storm surge dynamics, further heightening the vulnerability of shoreline areas to inundation and erosion. This poses significant threats to local communities, ecosystems, and infrastructure.

In addition to riverine flooding previously mentioned in 2019, shoreline flooding was also significant along the Lake Nipissing shoreline that year. Water levels were similarly the third highest (after 1960 and 1979) since full dam construction at the Lake Nipissing outlet was completed in 1948. Water levels on Lake Nipissing were elevated for an extended period of time such that the Parks Creek Backflood Control Structure was in continuous operation for six weeks. Numerous shoreline properties were damaged during this event.

Low water / drought

Historically, periods of dry weather and low water levels or drought are relatively uncommon in Ontario (about every 10-15 years). However, studies on changing weather patterns indicate that low water levels may become more common, potentially compounded by the province’s steadily increasing demands for water and by climate change (OMNR, 2010). An overview of the risk by subwatershed is presented in Table 13.

The Ontario Provincial Climate Change Impact Assessment Technical Report (Climate Risk Institute and Dillon Consulting Limited, 2023) indicates drought conditions are expected to have slight increases in moisture deficit across all regions of Ontario. However, drought is particularly

challenging to represent due to the need to factor in evapotranspiration and the numerous definitions of drought used by various communities (e.g., climatological, agricultural drought, etc.). It is expected that the impact of drought conditions on local wildfire risk will lead to the return period frequency to become 2.5 to 3 times that of the baseline conditions (Climate Risk Institute and Dillon Consulting Limited, 2023).

Changes to storm patterns can mean fewer, but larger magnitude events can lead to longer periods of dry conditions, while total precipitation may or may not change. Storms of greater intensity may increase runoff and decrease groundwater recharge. This is of concern for several municipal water supplies, as well as for the many residents who rely on private wells. There can be increased competition and conflict over reduced water supply during periods of drought. Drought conditions will also increase demand for irrigation in agricultural areas.

The Ontario Low Water Response program is designed to monitor streamflow and precipitation for early signs of potential drought conditions. Currently available data are limited in the NBMCA watershed, with only three hydrometric stations reporting streamflow (one is newly reactivated and does not have discharge available yet), all located in the western portion of the watershed and one precipitation station with long-term, year-round, and reliable data. These are shown in Table 7 and Figure 10 and Figure 11 of Appendix B – Overview of NBMCA monitoring programs.

Wetlands

The North Bay-Mattawa Conservation Authority defines a wetland as land that

> a) is seasonally or permanently covered by shallow water or has a water table close to or at its surface,
>
> b) directly contributes to the hydrological function of a watershed through connection with a surface watercourse,
>
> c) has hydric soils, the formation of which has been caused by the presence of abundant water, and
>
> d) has vegetation dominated by hydrophytic plants or water tolerant plants, the dominance of which has been favoured by the presence of abundant water.

However, a wetland does not include periodically soaked or wet land that is used for agricultural purposes and no longer exhibits a wetland characteristic referred to in clause c) or d).

Wetlands are an essential natural resource. In Northern Ontario, wetlands are a prevalent and integral component of the ecology. They are amongst the most biologically diverse ecosystems on earth. Wetlands have a wide range of functions, including filtering surface water, floodwater attenuation and then either slowly releasing it, even significantly later during drier periods or infiltrating it into the groundwater system.

Wetlands contribute to the maintenance of water quality by filtering and capturing pollutants, sediments, soil-bound nutrients, etc. Wetlands, particularly in Northern Ontario, are a significant support for flora and fauna. Wetlands contribute economic, cultural, social well-being by ensuring a healthy environment and providing people the opportunity to enjoy and appreciate its qualities.

Activities on lands adjacent to wetlands will typically impact these wetlands. Land use change can lead to impaired ecosystem functions (e.g., loss of natural benefits and services), reduced resiliency to impacts of climate change, and biodiversity loss. The appropriate maintenance and management of wetlands will contribute to community sustainability into the future. Sound wetland management contributes to a healthy environment. Wetlands can only be appropriately managed through awareness and the collective cooperative efforts of public agencies, private sector interests and residents.

Unstable slopes

Slope instability is a process that can result in ground loss or ground movement. These movements can affect the structures and natural features that are present at the top of the slope, the base of the slope, or on the slope face. Ground movement or instability can cause the loss of ground support damaging buildings, roads, and utilities. Unstable slopes also increase the risk to public safety.

Soils have unique, site-specific qualities that determine their stability. Detailed assessments, including geotechnical engineering reports, are generally required for sites where slopes are high and steep (i.e., greater than 3 m high and steeper than 3 horizontal units to 1 vertical unit) for further review and consideration. The sudden movement of ground can also cause and lead to erosion and sedimentation.

Erosion

Erosion is the process by which a material moves from its parent location due to the force of an erosive agent. Erosion is often caused by natural processes such as water and wind movement as well as anthropogenic activities including boat wake. Natural erosion rates are accelerated by land use activities that leave soils exposed, like agriculture and land development (Toronto and Region Conservation Authority, 2019). As erosion is accelerated, soil particles – often referred to as sediment – are suspended and carried away by overland flow and deposited into receiving waterbodies and waterways. Eroded sediments are deposited through sedimentation processes.

Hydrology is often studied in conjunction with erosion to consider how the scouring forces of flowing water affect the stream's morphology (Stantec Consulting Ltd., 2015). Safe setbacks are established near steep or unstable stream banks or in relation to meander belt zones. Erosion and sedimentation impact water quality (suspended solids and nutrients), aquatic habitat, and sediment accumulation in waterbodies and waterways. This then impacts flood risk and can have economic impacts for maintaining ditches, culverts, and marinas, for example.

7.2.3 Water Quality

Surface water

Several subwatersheds were reported to have "many parameters" including phosphorus and potentially bacteria levels that exceed Provincial Water Quality Objectives (PWQO), per 2015 IWMS, such that developing management objectives was recommended (Stantec Consulting Ltd., 2015). Phosphorus concentration can be correlated to sediment transport and is of particular concern across the watershed with seven of sixteen sampled subwatersheds (four subwatersheds have no stream sample locations) averaging above the TP PWQO in the 2023 Watershed Report Card. Lake capacity assessments along with regular water sampling can provide a feedback mechanism to maintain water quality. Planning and legislative tools can be used to help manage the continued pressure for shoreline and rural development near higher risk water sources

Phosphorus is a nutrient that can contribute to blue-green algae blooms, which have been a recurring issue in several area lakes, including Callander Bay, the source for Callander municipal supply. Shallow, warm-water lakes and embayments (such as Callander Bay, Wasi Lake, and Lake Nosbonsing) have issues with oxygen depletion, and this anoxia triggers phosphorus release from lake sediments, impacting fish habitat and water quality alike. Climate change impacts could enhance these lake processes. The Issue Contributing Area (ICA) needs continued monitoring to target areas where initiatives can be undertaken to reduce nutrient loading.

Chloride is another parameter of concern, particularly for the protection of aquatic life. The Canadian Council of Ministers of the Environment (CCME, 2011) have established long-term chronic exposure and short-term acute exposure water quality guidelines of 120 mg/L and 640 mg/L, respectively. The long-term dataset from Chippewa Creek indicates maximum concentration in non-winter (April to November) samples exceed the long-term exposure guideline (182 mg/L) and median concentration of winter (December to March) samples is equal to the long-term exposure guideline (120 mg/L). Limited non-winter samples at Parks Creek and Windsor Creek also indicate elevated chloride concentrations. These latter sites have not been sampled in the winter. Additional and continuing sampling is required for robust analysis to understand changes and trends that occur in each watershed.

Groundwater

This section is based on water quality data available from four groundwater monitoring wells. Generally, where there are Ontario drinking water quality guidelines, objectives, or standards, water quality from these wells is below these established targets. Exceptions are as follows: maximum copper detected in W274-1 and W277-1 (both shallow wells with limited standing water) has been above the Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG) aesthetic objective for copper (1.0 mg/L). All results for dissolved organic carbon (DOC) and iron at W274-1 have exceeded the ODWSOG aesthetic objectives (5 mg/L DOC; 300 µg/L iron). Lastly, median and maximum values for total dissolved solids at W274-1 also exceed ODWSOG aesthetic objectives (500 mg/L).

PFAS

There are concerns with per- and poly-fluoroalkyl substances (PFAS) contaminants in the groundwater around the Jack Garland Airport in North Bay and nearby streams which flow into Trout Lake, the municipal water supply for the City of North Bay. An overview of resource issues by subwatershed shown in Table 13. PFAS are a large class of synthetic chemicals that are a concern for both environmental and human health (Environment and Climate Change Canada and Health Canada, 2023). Within the context of the DWSP program, PFAS cannot be included as a drinking water threat until a drinking water quality guideline is established and the Ministry of Environment, Conservation and Parks incorporates it as a prescribed drinking water threat.

7.2.4 Other Issues

Anthropogenic Pressures

In addition to the environmental issues, there are development, industrial, and recreational pressures on the landscape. Development pressures include urban expansion, intensification, and redevelopment of seasonal-use properties to permanent residences, as well as future highway expansion. Industrial pressures include aggregate extraction, forestry and logging activities, agricultural land use, including traditional and hobby farms, peat production, small-scale hydroelectric production, and the Trans-Canada pipeline. Future development and industrial activities should consider the cumulative downstream and groundwater conditions in addition to the impacts of climate change on resource issues, particularly as it relates to water quantity (e.g., erosion and flood risk), quality (e.g., drinking water and habitat), and wetland protection. Best management practices should be used to mitigate these downstream effects.

Land use change is a primary factor in the development process. Changes may include the removal of vegetation, stripping of topsoil and alterations to topography and drainage patterns. Without careful planning focused on minimizing the potential impacts of these activities, anthropogenic pressures such as construction, can have adverse impacts on adjacent and downstream natural features and private properties.

Recreational pressures stem from the vast areas of natural landscape in the North Bay-Mattawa watershed from residents and visitors alike. Some of these pressures include cottaging, boating, fishing (and ice fishing), hunting, off-road motorized vehicles (i.e., ATVs and snowmobiles), camping, swimming, and hiking. These activities, among others, can also enable the transport of invasive species into this area.

An overview of resource issues is detailed by subwatershed in Table 13. Information was primarily sourced from 2015 Integrated Watershed Management Strategy and supplemented with recent water quality results where phosphorus issues were previously unknown. Phosphorus data is reported in the 2023 Watershed Report Card and accompanying Explanatory Document.

Data and knowledge

There are few long-term historic datasets in the area to establish subwatershed baseline conditions. This would entail climatological data, hydrological data, and water chemistry data (surface and groundwater). As of the 2015 Integrated Watershed Management Strategy (IWMS), 13 of 20 subwatersheds lacked or had very limited data available (Stantec Consulting Ltd., 2015). This especially applies to the subwatersheds that were added to the NBMCA in 2002 as well as those in rural organized and unorganized townships. Limited water quality data has since been collected in some of these, but full baseline characterization (parameters detailed in the 2015 Integrated Watershed Management Strategy) remains a challenge. This hampers the identification of management needs. Resource management strategies need to consider cumulative downstream impacts. Of the subwatersheds with existing watershed management plans, many recommendations have not been fully implemented (as of 2015). Some subwatersheds may appear to have stable conditions, but with unknown risk factors and baseline conditions, future conditions remain uncertain.

Additionally, the absence of real-time precipitation data underscores the need for enhancements in data availability and accuracy to bolster flood forecasting and response capabilities.

Table 13: Resource issues by subwatershed, as identified in the 2015 Integrated Watershed Management Strategy. Double checkmark signifies "very high" land use change vulnerability.

Resource Issue	Duchesnay Creek	Chippewa Creek	Parks Creek	Jessups Creek	La Vase River	Lake Nipissing Shoreline / North Bay	Windsor / Boulder / Bear Creeks	Burford Creek	Callander Bay / South Shore	Wistiwasing (Wasi) River	North River	Trout Lake	Turtle Lake	Kaibuskong River	Lake Talon	Sharpes Creek	Amable du Fond River	Pautois Creek	Boom Creek	Lower Mattawa River
Baseline data lacking	✓						✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Existing management plan insufficient		✓	✓			✓			✓	✓				✓						
Climate change - high sensitivity	✓	✓	✓		✓	✓			✓	✓										
Climate change - high vulnerability		✓							✓	✓				✓						
Flooding	✓	✓	✓	✓	✓	✓			✓	✓	✓				✓		✓			✓
Floodplain mapping	✓	✓			✓		✓	✓	✓	✓	✓			✓			✓	✓		✓
Stormwater management	✓	✓	✓	✓	✓	✓			✓			✓								
Low water conditions					✓				✓			✓	✓		✓					
Groundwater overburden aquifer	✓	✓									✓			✓		✓				
Water quality concerns	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓					
Erosion and sediment transport	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓						
Phosphorus		✓	✓	✓	✓	✓	✓	✓	✓	✓				✓					✓	
Chloride		✓	✓				✓		✓											
Surface water bacteria objectives		✓	✓	✓	✓	✓		✓												
Blue-green algae									✓	✓				✓	✓					
Oxygen depletion									✓	✓		✓								
Per- and poly-fluoroalkyl substances (PFAS)		✓										✓								
Land use change - high vulnerability					✓				✓	✓				✓✓	✓			✓		✓
Development pressures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Highway expansion		✓	✓		✓								✓	✓		✓	✓	✓	✓	✓
Industrial development	✓			✓	✓							✓								✓
Aggregate extraction	✓	✓					✓			✓	✓	✓		✓	✓	✓	✓	✓		✓
Forestry and logging		✓								✓	✓			✓	✓	✓	✓	✓	✓	✓
Agricultural land use					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peat production												✓								
Hydroelectric production																	✓			✓
Trans-Canada pipeline	✓	✓										✓	✓	✓		✓	✓	✓	✓	✓
Recreational pressures	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Invasive species									✓											

8. Programs and Services Assessment

8.1 Compliance Review

NBMCA delivers programs and services in compliance with Section 40 (1) (b) of the CA Act that address mandatory programs and services as prescribed by the legislation. They are also aligned with the various MOUs for the delivery of Category 2 and 3 programs and services approved by the NBMCA Board and signed between NBMCA and its member municipalities including the City of North Bay, Municipality of Callander, Municipality of East Ferris, Municipality of Powassan, Township of Chisholm, Township of Bonfield, Township of Calvin, Township of Papineau-Cameron, Township of Mattawan and Town of Mattawa.

These high-level MOUs, signed in 2023 and 2024, support "the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources," in accordance with NBMCA's statutory purpose as stated in the CA Act. The Watershed Strategy addresses the full range of programs and services required by legislation as well as those supported in the MOUs.

8.2 Compliance Review

The existing programs and services delivered by NBMCA play an important role in managing the key watershed natural resource issues. However, the effective delivery of these programs and services can be substantially improved by:

- enhancing the scope and reach of existing programs and services;
- renewing outdated watershed management plans and strategies;
- improving scientific and technical knowledge about natural hazards and drivers of key watershed natural resource issues;
- modernizing data collection techniques by testing and incorporating new digital technologies, sensors, and platforms;
- updating and expanding the use of analytical and predictive modelling tools;
- identifying and prioritizing management options for addressing key watershed natural resource issues; and
- building additional partnerships to pool resources and fund programs and services that meet mutual resource management objectives.

These opportunities were considered in defining the future actions that are included in the Watershed Strategy to improve the delivery and outcomes of NBMCA's programs and services in addressing the key natural hazard and natural resource issues

9. Actions to Address Issues and Mitigate Risks

As part of the development of the Watershed Strategy and its component reports, NBMCA identified and evaluated gaps, vulnerabilities, and risks that hamper effective program and service delivery. This process led to 17 actions that 1) enhance the effectiveness of NBMCA's existing programs and services in addressing key watershed natural resource issues and reducing or mitigating identified risks and vulnerabilities, and 2) advance the overall goal and guiding principles and objectives that underpin the Watershed Strategy, shown in Table 14. These actions have been grouped using the same categories applied to the programs and services inventory. The following pages identify each action by category, the guiding principles and objectives the action supports, and the issues it targets. These actions form the core of the Watershed Strategy.

Table 14: Overview of actions to address key natural resource issues. Actions are categorized as Water Resources Management (WRM), Planning and Regulations (P&R), Conservation Area Land (CAL), and Corporate Services (CS). Funding sources are categorized as Municipal Levy (M), Self-generated revenue (S), and Grants, Donations, or other (G).

Actions to Address Key Natural Resource Issues	Natural Resource Issue Focus	Program Category	Funding sources
WRM (a) - To better predict, forecast and respond to extreme weather and low flow events and appropriately respond to climate change impacts, NBMCA should 1) enhance the network of stream gauges and weather and climate stations, 2) upgrade analytical tools and hydrologic and hydraulic models, and 3) renew the low water response program.	Riverine Flooding; Valley Erosion; Drought	1	M, G
WRM (b) - To optimize water management infrastructure and operations, NBMCA should continue to regularly assess the design and capacity of NBMCA's infrastructure.	Riverine Flooding; Valley Erosion; Drought	1	M, G
WRM (c) - To protect life and property from flooding and erosion hazards, NBMCA should support and collaborate with municipalities to explore flood mitigation opportunities.	Riverine Flooding; Valley Erosion; Drought	1	M, G
WRM (d) - To better understand hazard risk along the Lake Nipissing shoreline, NBMCA should undertake a technical assessment of the impacts of changing water levels and climate change on lakeshore flooding, erosion, and nearshore biophysical processes.	Riverine Flooding; Valley Erosion; Drought, Invasive Species, Biodiversity Loss	1	M, G
WRM (e) - To detect climate change effects on and risks to drinking water sources, NBMCA should identify and assess risks and vulnerabilities for drinking water wells and intakes.	Surface water quality, groundwater quantity and quality	1	G

Actions to Address Key Natural Resource Issues	Natural Resource Issue Focus	Program Category	Funding sources
WRM (f) - To improve water quality in drinking water sources, NBMCA should be prepared to make updates to drinking water source protection policies as soon as PFAS is recognized as a drinking water threat and standardized guidelines from Health Canada are available.	Surface water quality, groundwater quantity and quality	1	G
WRM (g) - To appropriately characterize key watershed resource issues, trends, and risks, NBMCA should evaluate the watershed monitoring program to ensure that data collected is complete, relevant, dependable, and valid and incorporate traditional knowledge.	All issues	1, 2, 3	M
WRM (h) - To enhance data interpretation and evaluation, NBMCA should implement robust and applicable analytical tools and databases.	All issues	1, 2, 3	M
WRM (i) - To enhance scientific understanding of the 1) drivers of resource issues, 2) resource conditions, trends, and risks, 3) climate change effects on the water budget, natural hazards, biodiversity, invasives, and species at risk, NBMCA should increase collaboration with scientific and research institutions and Indigenous communities.	All issues	1, 2, 3	M
WRM (j) - To provide monitoring results that inform programs and services and support decision making, NBMCA should provide timely reporting using clear messaging and appropriate communication tools and digital platforms.	All issues	1, 2, 3	M
WRM (k) - To increase accessibility to NBMCA data sets and analyses, NBMCA should explore and implement new digital technologies and platforms that better meet the needs of partners and the public.	All issues	1, 2, 3	M, G
P&R (a) - To support more precise identification of potential risks to life and property from natural hazards and to develop appropriate policies for implementing the CA Act and O Reg 41/24, NBMCA should continue to update regulatory and hazard mapping and undertake flood risk mapping in flood vulnerable areas to 1) support technical review and assessment of NBMCA permits and municipal planning applications, 2) identify potential risks to property damage and public safety, and 3) support municipal flood preparedness and emergency planning.	Natural hazards (flooding, erosion, dynamic beaches, unstable soils, and unstable bedrock)	1	M, S, G
CAL (a) - To manage the impacts of extreme weather events, NBMCA should design, create, and maintain sustainable infrastructure (both passive and active) to withstand these forces.	Conservation Areas Management	1, 3	M, G

Actions to Address Key Natural Resource Issues	Natural Resource Issue Focus	Program Category	Funding sources
CAL (b) - To improve community access to NBMCA lands while protecting environmentally sensitive sites and providing a range of societal benefits (e.g., connection to nature, relief from heat stress, and availability of recreational opportunities), NBMCA should update its master plans and land acquisition and land management policies and strategies.	Conservation Areas Management	1	M
CAL (c) - To integrate NBMCA lands and trails systems with adjacent municipalities or other publicly accessible lands and trails, NBMCA should work collaboratively with other public agencies.	Conservation Areas Management	1, 3	M
CS (a) - To integrate social, environmental, and economic sustainability into all aspects of NBMCA's business, NBMCA should develop a corporate sustainability plan.	All issues	1	M, G
CS (b) - To decrease NBMCA's carbon footprint and greenhouse gas emissions, NBMCA should adopt new business practices and processes (e.g., such as those relating to energy consumption, building and facility retrofits, fleet management, procurement policies, etc.).	All issues	1	M, G

10. Consultation and Engagement Approach

O Reg 686/21 directs conservation authorities to ensure stakeholders and the public are consulted during the preparation of the Watershed Strategy in a manner that the authority considers advisable. It also requires the CAs to outline their public consultation process and procedures for the periodic review and updating of the Watershed Strategy.

For the development of the 2024 Watershed Strategy development, a drafted version of the document was posted to the NBMCA website and on social media for public review. Additionally, a survey was sent to municipal partners via email. Responses were limited.

10.1 Public Consultation Process for Periodic Review and Update

The Watershed Strategy will be reviewed every five years, or as necessary, to reflect any legislative changes or provincial directives. Prior to reviewing and updating the Watershed Strategy, municipalities, First Nations, and other partners and stakeholders will be actively engaged as NBMCA deems advisable.

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Appendix A – Summary of existing technical studies and other natural resource information

Appendix A provides a summary of existing technical studies, and other information on the natural resources the authority relies on within its area of jurisdiction or in specific watersheds that directly informs and supports the delivery of the NBMCA's mandatory programs and services. This fulfils the requirement of O. Reg. 686/21 Subsection 12(4)2.

MANDATORY PROGRAM AREA

B. Planning and Regulations

A summary of existing technical studies, monitoring programs and other information on the natural resources the authority relies on within its area of jurisdiction or in specific watersheds that directly informs and supports the delivery of the Conservation Authority's mandatory programs and services (s.12(4) paragraph 2).

The summary should include the nature of the studies, programs and information relied upon that directly informs delivery of the Planning and Regulations programs.

B (1) Plan Input and Review (Current)

NBMCA is governed under the Conservation Authorities Act and Regulations. The purpose of the CA Act is to provide for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario. The Regulations under the Act guide specific programs including Regulations and Planning.

1. **Provincial Acts & Regulations**
    - Conservation Authorities Act, R.S.O. 1990, c. C.27
        i. O. Reg. 686/21: MANDATORY PROGRAMS AND SERVICES
        ii. Ontario Regulation 177/06: NORTH BAY-MATTAWA CONSERVATION AUTHORITY: REGULATION OF DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES
        iii. O. Reg. 97/04 CONTENT OF CONSERVATION AUTHORITY REGULATIONS UNDER SUBSECTION 28 (1) OF THE ACT: DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

2. **NBMCA Policies, Guidelines**

    These internal policies and guidelines directly inform and support the delivery and administration of NBMCA's Ontario Regulation 177/06 under Section 28 of the

Conservation Authorities Act. These policies also guide NBMCA's review of official plans, zoning bylaws and planning applications under the Planning Act.

North Bay-Mattawa Conservation Authority (NBMCA). 2006. *Determination of Approximate Regulated Area.* North Bay, Ontario.

North Bay–Mattawa Conservation Authority (NBMCA). 2012. *Environmental Impact Study Guidelines Final Report*.

North Bay-Mattawa Conservation Authority (NBMCA). November 2012. *NBMCA EIS Guidelines Final Report*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2016. *Customer Service Charter*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). November 2019. *NBMCA Planning and Development Fees Policy and Schedules*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2020. *NBMCA Policies for the Administration of Ontario Regulation 177/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2020. *Planning & Development Administrative Procedural Manual*. North Bay, Ontario

North Bay-Mattawa Conservation Authority (NBMCA). 2020. *The North Bay-Mattawa Conservation Authority Hearings and Procedural Manual,* North Bay, Ontario.

3. NBMCA Technical Studies

The purpose of the Integrated Watershed Management Strategy (IWMS) is to plan and coordinate the management of the subwatersheds within NBMCA's jurisdiction for the next 20 years. The IWMS evaluates the needs of 20 NBMCA subwatersheds that fall within 11 municipalities and 15 unorganized townships. These watersheds are assessed from a variety of perspectives to define environmental, social and economic needs in recognition of their interconnectedness.

North Bay – Mattawa Conservation Authority (NBMCA). 2013. *Integrated Watershed Management Strategy – Technical Background Report*. North Bay, Ontario.

North Bay – Mattawa Conservation Authority (NBMCA). 2015. *Integrated Watershed Management Strategy*. North Bay, Ontario.

Subwatershed Studies

A subwatershed study protects, maintains and enhances ecological processes and functions and significant natural features of the subwatershed using sustainable methods. It promotes an ecosystem approach to environmental planning in the watershed. These studies inform land use planning decisions within NBMCA's area of jurisdiction.

Aquafor Beech Limited. (2000). Final Report Jessups Creek Subwatershed and Stormwater Management Plan.

Aquafor Beech Limited. 2001. *Lees Creek and Golf Club Creek Tributary: Subwatershed/Stormwater Management Plans*. Brampton, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 1991. *Parks Creek Watershed Environmental Assessment, A Preliminary Assessment of Management Issues, Draft Document.*

Proctor & Redfern Limited, 1996. Chippewa Creek Watershed Management Study Final Report.

Totten, Sims, Hubicki. 1999. North Bay Escarpment Management Plan. Resource Inventory and Digital Mapping – Next Steps Planning Guide. North Bay, Ontario.

Northland Engineering Ltd. and Beak Consultants Ltd. 1993. Lake Nosbonsing Watershed Management Plan, Summary Report and Implementation.

Totten, Sims, Hubicki, 1997. La Vase River Watershed Management Study

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1988. Wistiwasing River Management Study: Final Report, Management Strategy and Master Drainage Plan

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1984. Wasi River Management Study Background Technical Report #1, Limnology and Water Quality

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1984. Wasi River Management Study Background Technical Report #2, Wetland Resources

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1986. Wasi River Management Study Background Technical Report #3, Fishery Resources

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1986. Wasi River Management Study Background Technical Report #4, Hydrology

The Environmental Applications Group Ltd and A.J. Robinson and Associates. 1986. Wasi River Management Study Background Technical Report #5, Physical Controls on Wistiwasing Lake Dissolved Oxygen and Temperature Regimes

Floodplain and Erosion (Natural Hazard) Studies

Floodplain and erosion studies are used for determining the risks associated with development that is proposed in a location that may be subject to flooding and/or erosion hazards. These studies directly inform planning decisions and land development proposals through Regulation 177/06.

Aquafor Beech Limited in Association with Northland Engineering, Beak International Inc., and Settlement Surveys Ltd. 2000. *Final Report, Jessups Creek Subwatershed and Stormwater Management Plan*, prepared for the City of North Bay.

Baird & Associates. 1991. *Development of a Shoreline Management Strategy*, prepared for the North Bay – Mattawa Conservation Authority.

Baird & Associates. 1994. *Storm Surge in Lake Nipissing Draft Report*, prepared for the North Bay-Mattawa Conservation Authority.

Baird & Associates. 2009. *North Bay Waterfront Assessment Final Report*.

Dawdy, Blake. 1987. *Earl's Lake Floodplain Estimates.*

Dawdy, Blake. 1988. *Duchesnay Creek Flood Elevations at Cooks Mills Road.*

Dawdy, Blake. 1988. *Four Mile Lake Regulatory Floodlines.*

Dawdy, Blake. 1988. *Lake Talon Flood Elevations.*

Dawdy, Blake. 1988. *La Vase River Flood Hazard and Floodway* – prepared for the North Bay-Mattawa Conservation Authority.

Dawdy, Blake. 1988. *Regulatory Flood Elevations on Passmore Lake.*

Dawdy, Blake. 1988. Smith Lake Flood Elevations.

Dawdy, Blake F. 1991. *Supporting Document Technical Basis for Amending City of North Bay Official Plan Implementation of Provincial Two-Zone Concept Flood Plain Management*. North Bay.

Dawdy, Blake. 1993. *Regulatory Flood Elevations - Kaibuskong River at Sheedy Lake.*

Dawdy, Blake. 1997. *Hydraulic Analysis and Design of Two Culverts on Pinewood Fingers Drainage Course*, prepared for the City of North Bay and NBMCA.

MacLaren Plansearch and Lavalin. 1981. Flood Reduction Study for the Sturgeon River/Lake Nipissing/French River System, Summary, report to Ontario Ministry of Natural Resources and Environment Canada.

M.M Dillon Limited Consulting Engineers and Planners. 1975. *North Bay – Mattawa Flood Plain and Fill Line Mapping*.

M.M. Dillon Ltd. 1975. *Report on Erosion control and Bank Stabilization Study – La Vase River*.

Northland Engineering Limited. 1982. *West Ferris Flood Plain Management Study*.

Proctor and Redfern Group. 1982. *Town of Mattawa Floodplain Management Study.*

Technical Volume 1: Background Studies. 1981.

Technical Volume 2: Analysis of Existing System and Development of a Management Plan. 1981

Totten, Sims, Hubicki. 1992, *Parks Creek Watershed Flood Damage Reduction Study, Environmental Study Report*, prepared for the North Bay – Mattawa Conservation Authority.

Totten, Sims, Hubicki Associates. 1996. *Floodline Mapping Study Parks Creek and Circle Lake, Depensiers Lake, McLean lake and Twinline Lake.*

Totten, Sims, Hubicki Associates. 1998. *Floodline Mapping Study La Vase River and Tributary at Corbeil.*

Water's Edge Environmental Solutions Team. 2015. *Chippewa Creek Erosion Control Study and Inventory.*

4. Provincial Policies, Guidelines

Technical studies and guidelines undertaken by the provincial government and other technical groups inform decisions made related to land use planning and the Section 28 program.

Drainage Act and Conservation Authorities Act Protocol. 2012.

Ontario Ministry of the Environment (MOE). March 2003. *Stormwater Management Planning and Design Manual*. Queen's Printer for Ontario.

Ontario Ministry of Municipal Affairs and Housing (MMAH). 2023. Provincial Planning Statement. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources (MNR). 2001. *Understanding Natural Hazards: Great Lakes – St. Lawrence River System and large inland lakes, river and stream systems and hazardous sites*. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources a (MNR a). 2002. *Technical Guide – River and Stream Systems: Erosion Hazard Limit*. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources b (MNR b). 2002. *Technical Guide – River and Stream Systems: Flooding Hazard Limit*. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 1987. *Guidelines for Developing Great Lakes Shoreline Management Plans*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 1993a. *Ontario Wetland Evaluation System: Northern Manual*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 1996. *Hazardous Sites Technical Guide*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 1996a. *Hazardous Sites Technical Guide.*

Ontario Ministry of Natural Resources and Forestry (MNRF), 1996c. Technical Guide for Large Inland Lakes.

Ontario Ministry of Natural Resources and Forestry (MNRF). 1997. Policies and Procedures for the Charging of Conservation Authority Fees.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2001. *Understanding Natural Hazards*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2002c. *Adaptive Management of Stream Corridors in Ontario*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2005. *Conservation Authorities Act Hearing Guidelines*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2010. *Policies and Procedures for Conservation Authority Plan Review and Permitting Activities*

Ontario Ministry of Natural Resources and Forestry (MNRF). 2012. *Timelines for Processing S.28 Permit Applications under the Policies and Procedures for Conservation Authority Plan Review and Permitting Activities*. Policy Backgrounder S.28 Confidential.

Ontario Ministry of Natural Resources and Forestry and Conservation Ontario. 2005. *Guidelines for Developing Schedules of Regulated Areas*.

Ontario Ministry of Natural Resources and Forestry and Conservation Ontario. 2005. *Guidelines for Developing Schedules of Regulated Areas*.

Ontario Ministry of Natural Resources and Forestry and Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). 2012. *Drainage Act and Conservation Authorities Act Protocol*.

Ontario Ministry of Transportation (MTO), 1997. *MTO Drainage Management Manual*.

Parish Geomorphic. 2004. *Belt Width Delineation Procedures*. Toronto and Region Conservation Authority.

Terraprobe Limited and Aqua Solutions (for Ministry of Natural Resources and Forestry). 1998. *Geotechnical Principles for Stable Slope, Great Lakes – St. Lawrence River System: Physical Features and Processes*.

5. Conservation Ontario Guidance

Conservation Ontario has developed several guidance documents to inform and provide consistency in the application of Conservation Authority programs and services. The following is a list of Conservation Ontario Guidelines used to support the delivery of the Section 28 permitting and Plan Review programs:

Conservation Authorities Liaison Committee. 2012. Review of the Conservation Authority Fees for Planning and Permitting Activities by the Conservation Authorities Liaison Committee.

Conservation Ontario. 2004. Generic Regulation – Approval Process Document.

Conservation Ontario. 2010. Recommendations for Conducting Wetland Environmental Impact Studies (EIS) for Section 28 Regulations Permissions.

Conservation Ontario. 2011. Conservation Authority Regulatory Compliance Guidelines: Sample Policies and Procedures.

Conservation Ontario. 2013. Hydrogeological Assessment Submissions: Conservation Authority Guidelines for Development Applications.

Conservation Ontario. 2015. Guideline for Development of a Guide to Conservation Authority Permits on Agricultural Land.

Conservation Ontario. 2018. Protocol for Updates to Section 28 Mapping.

Conservation Ontario Peer Review Implementation Committee. 2008. Draft – Guidelines to Support Conservation Authority Administration of the "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation".

6. Other

North Bay-Mattawa Conservation Authority's ***Geographical Information System (GIS)*** plays a significant supporting role for Section 28 Permitting and Plan Review programs and services.

MANDATORY PROGRAM AREA

C. Water Resources Management

The Water Resources Management program involves several roles and responsibilities that take an integrated approach to studying and managing the quality and quantity of water in the watershed. A summary of existing technical studies, monitoring programs and other information on the natural resources the authority relies on within its area of jurisdiction or in specific watersheds that directly informs and supports the delivery of the Conservation Authority's mandatory programs and services (s.12(4) paragraph 2).

The summary should include the nature of the studies, programs and information relied upon that directly informs delivery of the Planning and Regulations programs.

C (1) Flood Forecasting and Warning (Current)

Guidance documents and response plans to inform the monitoring of potential flood conditions and protocols for communicating flood messages to appropriate agencies and the public.

North Bay-Mattawa Conservation Authority. March 2023. *Flood Forecasting and Warning Plan.*

Ontario Ministry of Natural Resources and Forestry (MNRF). 2021. *Emergency Response Plan, 2021*.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Provincial Flood Forecasting and Warning Program: Implementation Guidelines for Conservation Authorities and the Ministry of Natural Resources and Forestry*.

Water's Edge Environmental Solutions Team Ltd, W.F. Baird & Associates Coastal Engineers Ltd. and Planning Solutions Inc. May 2007. *Flood Damage Estimation Guide 2007: Update And Software Guide*. Ontario Ministry of Natural Resources.

C (2) Technical Studies and Policy Review (Current)

Hutchinson Environmental Sciences Ltd. (2021). *Trout Lake Watershed Study and Management Plan – Background Report.* Draft Report.

Hutchinson Environmental Sciences Ltd. (2023). *Trout Lake Watershed Study and Management Plan – Existing Conditions, Issues, Opportunities and Constraints.* Final Report.

C (3) Flood and Erosion Control Infrastructure

Totten Sims Hubicki Associates (1999) Parks Creek Backflood Control Structure Operational Manual.

C (4) Low Water Response

Guidance documents and response plans to inform the monitoring of low water conditions and protocols for communicating low water messages to appropriate agencies and the public.

Ontario Ministry of Natural Resources and Forestry (MNRF), Ontario Ministry of Environment Conservation and Parks (MECP), Ontario Ministry of Municipal Affairs and Housing (MMAH), Ontario Ministry of Research and Innovation, Association of Municipalities of Ontario (AMO), Conservation Ontario (CO). 2010. *Ontario Low Water Response.*

Ontario Ministry of Natural Resources and Forestry (MNRF). 2016. *2016 Ontario Low Water Response – Key Messages Memorandum*

C (5) Watershed Monitoring

1. **Provincial Acts & Regulations**
    - Conservation Authorities Act, R.S.O. 1990, c. C.27
        i. O. Reg. 686/21: MANDATORY PROGRAMS AND SERVICES
        ii. Ontario Regulation 177/06: NORTH BAY-MATTAWA CONSERVATION AUTHORITY: REGULATION OF DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES
        iii. O. Reg. 97/04: CONTENT OF CONSERVATION AUTHORITY REGULATIONS UNDER SUBSECTION 28 (1) OF THE ACT: DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

2. Provincial Policies, Guidelines

Guidance documents for program partners where NBMCA collects samples that contribute to Provincial monitoring programs, including Lake Partner Program (LPP), Ontario Benthos Biomonitoring Network (OBBN), Provincial Groundwater Monitoring Network (PGMN), and Provincial Water Quality Monitoring Network (PWQMN).

Jones, C., Sommers, K. M., Craig, B., and Reynoldson, T. B. 2007. *Ontario Benthos Biomonitoring Network: Protocol Manual*

Ontario Ministry of Environment, Conservation and Parks (MECP). 2011. *User Guide: For the Collection and Submission of Water Samples.* Dorset Environmental Science Centre.

Ontario Ministry of Environment, Conservation and Parks (MECP). 2021. *PGMN Sampling Field Instructions Routine 2021 Draft*

Ontario Ministry of Environment, Conservation and Parks (MECP). 2022. *Provincial Stream Monitoring Program Purpose, Functions and Responsibilities*

Ontario Ministry of Environment, Conservation and Parks (MECP). 2022. *Provincial Groundwater Monitoring Program Purpose, Functions and Responsibilities*

Ontario Ministry of Environment, Conservation and Parks (MECP). 2023. *LabOnline Guide for Routine Groundwater Sampling.* Version 6.0

Ontario Ministry of Environment, Conservation and Parks (MECP). 2024. *Ontario Provincial Stream Water Monitoring Program Protocols.* Version 2024.1.0

Ontario Ministry of Environment, Conservation and Parks (MECP). 2024. *Provincial Groundwater Monitoring Program (PGMN) Exceedance Protocol-For-Actions*

Stanfield, L (Ed.) 2017. *Onterio Stream Assessment Protocol*. Version 10.

MANDATORY PROGRAM AREA
D. Conservation Areas and Lands

D (1) Section 29 Enforcement and Compliance (Current)

1. Provincial Acts & Regulations

- Conservation Authorities Act, R.S.O. 1990, c. C.27
    i. O. Reg. 686/21 MANDATORY PROGRAMS AND SERVICES
    ii. O. Reg. 688/21: RULES OF CONDUCT IN CONSERVATION AREAS
    iii. R.R.O. 1990, Reg. 125: CONSERVATION AREAS – NORTH BAY-MATTAWA

D (2) Planning Act Comments (Current)

See list of documents under B(1) above related to Planning Act applications, specifically those which may affect lands owned or managed by NBMCA.

D (3) Conservation Areas Management

Technical studies, monitoring programs and other information that directly informs and supports the delivery of the Conservation Areas Management program……..

1. **Provincial Acts & Regulations**
    - Conservation Authorities Act, R.S.O. 1990, c. C.27
        i. O. Reg. 686/21: MANDATORY PROGRAMS AND SERVICES
        ii. O. Reg. 688/21: RULES OF CONDUCT IN CONSERVATION AREAS
        iii. R.R.O. 1990, Reg. 125: CONSERVATION AREAS – NORTH BAY-MATTAWA
        iv. O. Reg 177/06: NORTH BAY-MATTAWA CONSERVATION AUTHORITY: REGULATION OF DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES
        v. O. Reg. 97/04: CONTENT OF CONSERVATION AUTHORITY REGULATIONS UNDER SUBSECTION 28 (1) OF THE ACT: DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

2. **Technical Studies**

G. K. Strachan Engineering Inc. 2022. *Environmental Impact Assessment of the Proposed Multi-Use Trail System Along the North Bay Escarpment.*

Managed Forest Tax Incentive Program (MFTIP) - Managed Forest Plans

A key tool in caring for Conservation Authority lands which helps ensure that good forestry practices and stewardship principles will be followed on CA lands.

Managed Forest Plan 2009-2018 Shields-McLaren Conservation Area

Managed Forest Plan 2009-2018 J.P. Webster Conservation Area

Managed Forest Plan 2009-2018 La Vase Portage Conservation Area

Managed Forest Plan 2009-2018 Jack Pine Hill Conservation Area

Managed Forest Plan 2009-2018 Shirley Skinner Memorial Conservation Area

Managed Forest Plan 2009-2018 Eau Claire Gorge Conservation Area

Managed Forest Plan 2009-2018 Corbeil Conservation Area

Master Plans

Master Plans were developed for Conservation Areas which describe the area's resource inventory and capabilities, provide management options and cost estimates to develop and manage these areas as natural environment day-use areas.

North Bay-Mattawa Conservation Authority. 1977. *The Eau Clair Gorge Master Plan.*

North Bay-Mattawa Conservation Authority. 1979. *La Vase Park Draft Master Plan.*

North Bay-Mattawa Conservation Authority. 1979. *Papineau Lake Master Plan.*

North Bay-Mattawa Conservation Authority. 1980. *Mattawa Island Conservation Area Master Plan.*

North Bay-Mattawa Conservation Authority. 1981. *Corbeil Conservation Area Master Plan.*

North Bay-Mattawa Conservation Authority. 1981. *J.P. Webster Nature Preserve Master Plan.*

North Bay-Mattawa Conservation Authority. 1997. *La Vase Portage Conservation Area Master Plan, Final Report.*

North Bay-Mattawa Conservation Authority. 1998. *North Bay Elks' Lodge Family Park Master Plan.*

North Bay-Mattawa Conservation Authority. 1999. *Shirley Skinner Memorial Nature Preserve Master Plan.*

North Bay-Mattawa Conservation Authority. 2000. *Shield's-McLaren Conservation Area Master Plan – Final Report.*

MANDATORY PROGRAM AREA
E. Source Protection Authority

A summary of existing technical studies, monitoring programs and other information on the natural resources the authority relies on within its area of jurisdiction or in specific watersheds that directly informs and supports the delivery of the Conservation Authority's mandatory programs and services (s.12(4) paragraph 2).

The summary should include the nature of the studies, programs and information relied upon that directly informs delivery of the Planning and Regulations programs.

E (1) Governance (Current)

1. **Provincial Acts & Regulations**
    - Clean Water Act, 2006, S.O. 2006, c. 22
        i. O. Reg. 284/07: SOURCE PROTECTION AREAS AND REGIONS
        ii. O. Reg. 287/07: GENERAL
        iii. O. Reg. 288/07: SOURCE PROTECTION COMMITTEES
    - Conservation Authorities Act, R.S.O. 1990, c. C.27
        i. O. Reg. 686/21 MANDATORY PROGRAMS AND SERVICES
        ii. Ontario Regulation 177/06, North Bay-Mattawa Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses
        iii. O. Reg. 97/04 CONTENT OF CONSERVATION AUTHORITY REGULATIONS UNDER SUBSECTION 28 (1) OF THE ACT: DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

E (2) Technical Studies (Current)

AECOM. 2009. *Paleolimnology of Callander Bay, Lake Nipissing*. Report prepared for the North Bay-Mattawa Conservation Authority, March 2009.

AECOM. 2010. *Surface Water Vulnerability and Threats Assessment for Drinking Water Source Protection for the City of North Bay*. January 6, 2010.

AECOM. 2010. *Surface Water Vulnerability Study for the Village of South River Drinking Water Intake*, Final report prepared for the North Bay-Mattawa Conservation Authority, Project No. 113616, January 6, 2010

AquaResource Ltd. 2010. *Trout/Turtle Lake Tier Two Subwatershed Stress Assessment and Tier Three Local Area Risk Assessment*. February, 2010.

Gartner Lee Ltd. 2007. *Source Protection Planning Conceptual Water Budget*. Draft version 4.1. Prepared for NBMCA. January 2007.

Gartner Lee Ltd. 2007. *Trout Lake Surface Water Vulnerability Study for Source Water Protection*. February 2007.

Gartner Lee Ltd. 2008. *North Bay – Mattawa Source Protection Area Conceptual Water Budget*. Prepared for North Bay – Mattawa Conservation Authority.

Gartner Lee Ltd. 2008. *Tier One Water Budget and Water Quantity Stress Assessment for Trout Lake Sub-watershed*. Prepared for North Bay – Mattawa Conservation Authority. Source Water Protection Area. April 26: North Bay.

Hutchinson Environmental Sciences Ltd. 2010. *Callander Drinking Water Source Protection Technical Studies Update*. Project J100011, March 22.

Trailhead Consulting & P. Quinby Consulting. 2010. *A Preliminary Assessment of Climate Change Implications for the North Bay-Mattawa*

Water and Earth Science Associates Ltd (WESA). 2009: *Drinking Water Source Protection Studies for the Village of South River: Surface Water Vulnerability Study, Threats Inventory and Issues Evaluation, Water Quality Risk Assessment*. Draft final report prepared for the North Bay-Mattawa Conservation Authority, Project No. SB5904, March 2009

Water and Earth Science Associates Ltd (WESA). 2010. *North Bay – Mattawa Source Protection Area Tier One Water Budget and Stress Assessment for the South River, Powassan and Mattawa Municipal Supplies*. Revised June, 2010.

Waterloo Hydrogeologic, Inc. 2006. *NBMCA Groundwater Study Report*. In association with Tunnock Consulting Ltd. January 2006. (includes *Technical Memorandum: North Bay – Mattawa Conservation Authority Study Results*. August 2006 update)

Waters Environmental Geosciences Ltd. 2009. *Groundwater Risk Assessment for the Municipality of Powassan.*

Waters Environmental Geosciences Ltd. 2009. *Groundwater Risk Assessment for the Town of Mattawa.*

Waters Environmental Geosciences Ltd. 2009. *Groundwater Vulnerability Analysis for the Municipality of Powassan.*

Waters Environmental Geosciences Ltd. 2009. *Groundwater Vulnerability Analysis for the Town of Mattawa.*

E (3) Policy Development

North Bay-Mattawa Source Protection Committee. 2015. *North Bay-Mattawa Source Protection Area: Assessment Report.*

North Bay-Mattawa Source Protection Committee. 2015. *North Bay-Mattawa Source Protection Area: Source Protection Plan.*

E (4) Significant Threat Policy Implementation

Ontario Ministry of Environment, Conservation and Parks (MECP). 2021. *2021 technical rules under the Clean Water Act*

MANDATORY PROGRAM AREA
F. On-site Sewage System Program

A summary of existing technical studies, monitoring programs and other information on the natural resources the authority relies on within its area of jurisdiction or in specific watersheds that directly informs and supports the delivery of the Conservation Authority's mandatory programs and services (s.12(4) paragraph 2).

The summary should include the nature of the studies, programs and information relied upon that directly informs delivery of the OSS program.

F (1) OSS Permitting and Compliance

1. **Provincial Acts & Regulations**
    - Conservation Authorities Act, R.S.O. 1990, c. C.27
        i. O. Reg. 686/21 MANDATORY PROGRAMS AND SERVICES, S.14
    - Ontario Building Code Act, 1992, S.O. 1992, c. 23
        i. O. Reg. 332/12: BUILDING CODE

2. **NBMCA Policies, Guidelines**

NBMCA has developed policies to provide guidance, consistency, accountability, efficiency, and transparency for internal staff and external customers on how the OSS On-site Sewage System program operates in relation to Ontario Regulation 332/12.

North Bay-Mattawa Conservation Authority (NBMCA). 2005. *Code of Conduct for Building Officials*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2005. *Sewage Disposal System File Review Policy*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2009. *NBMCA Regulation 1-2009.* North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2012. *NBMCA On-site Sewage System Maintenance Inspection/Re-inspection Policy*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2015. *Concern Procedure 2015*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2020. *Planning & Development Administrative Procedural Manual*. North Bay, Ontario

3. Provincial Policies, Guidelines

4. Other

F (2) Mandatory Maintenance Inspections (Current)

1. Provincial Acts & Regulations

- Conservation Authorities Act, R.S.O. 1990, c. C.27
    i. O. Reg. 686/21 MANDATORY PROGRAMS AND SERVICES, S.13
    ii. Section 21.1 (1)
- Ontario Building Code Act, 1992, S.O. 1992, c. 23
    i. O. Reg. 332/12: BUILDING CODE
    ii. Section 1.10.2 of Division C of the Ontario Building Code (OBC)
- Clean Water Act, 2006, S.O. 2006, c. 22
    i. Section 38: Obligation to implement policies

2. NBMCA Policies, Guidelines

North Bay-Mattawa Conservation Authority (NBMCA). 2011. *Mandatory Maintenance Inspection Program Guideline*. North Bay, Ontario.

North Bay-Mattawa Conservation Authority (NBMCA). 2016. *North Bay-Mattawa Conservation Authority Septic System Re-Inspection Program Hazard Ratings*. North Bay, Ontario.

North Bay-Mattawa Source Protection Authority (NBSPA). 2015. *North Bay-Mattawa Source Protection Authority Approved Assessment Report.* North Bay, Ontario.

North Bay-Mattawa Source Protection Authority (NBSPA). 2015. *North Bay-Mattawa Source Protection Plan.* North Bay, Ontario.

3. Provincial Policies, Guidelines

Ministry of Municipal Affairs and Housing (MMAH). 2011. *On-site Sewage System Maintenance Inspections*.

4. Conservation Ontario Guidelines, Resources

Conservation Ontario. 2014. Implementation Resource Guide, Module 8: Other Obligations (Septic System Inspections).

Appendix B – Overview of NBMCA monitoring programs

The North Bay-Mattawa Conservation Authority (NBMCA) has a wide variety of monitoring programs ranging from meteorology, surface water quantity, quality, and aquatic biology and groundwater quantity and quality. Most of these monitoring programs are in partnership with federal and provincial agencies. NBMCA partners with the Ministry of Environment, Conservation and Parks (MECP) monitoring networks including the Provincial Water Quality Monitoring Network (PWQMN), Provincial Groundwater Monitoring Network (PGMN), Lake Partner Program (LPP), and the Ontario Benthos Biomonitoring Network (OBBN). Water quality data from these programs feed into the Watershed Report Cards, produced in partnership with Conservation Ontario and the other Conservation Authorities. NBMCA participates in the Ministry of Natural Resources and Forestry's (MNRF's) snow survey program, Flood Forecast and Warning, and Ontario Low Water Response programs that are coordinated by the Surface Water Monitoring Centre (SWMC). NBMCA relies on streamflow and lake level data that are obtained from Water Survey of Canada (WSC) and MNRF hydrometric gauges situated within its area for its Flood Forecasting and Warning (FFW) and Ontario Low Water Response (OLWR) programs. In addition to these partnerships, NBMCA in collaboration with the City of North Bay monitors the water quality of Trout Lake and works in partnership with Nipissing University for the continuous turbidity monitoring of the Wasi River.

Meteorology

Precipitation

NBMCA has one precipitation gauge in field use. This tipping bucket rain gauge is located at PGMN groundwater well W392-1 in Feronia, Ontario. It records rainfall from April to November (i.e., is covered each winter), and the data are stored in a logger which must be manually downloaded. NBMCA has been provided telemetry for this site which was installed in 2024 to allow for near real-time data availability. This will inform the NBMCA Flood Forecast and Warning program. Additionally, NBMCA is in progress of installing an Ott Pluvio all-season precipitation gauge at the Corbeil Conservation Area, to be paired with the existing snow survey location (see Snow section, below). NBMCA also relies on the Environment and Climate Change Canada (ECCC) meteorological stations at the Jack Garland Airport in North Bay operated by Nav Canada (NAVCAN) and Meteorological Service of Canada (MSC) for historic climate data. There is a tipping bucket rain gauge at the Wasi River WSC gauge location, but its installation and proximity to trees and other obstacles likely reduce the quality of data.

Precipitation data feed into the Flood Forecast and Warning and Ontario Low Water Response programs as well as determine whether water quality samples reflect event flow or baseflow conditions.

Table 15: Precipitation gauge locations and data periods

Site	Operator	Data period	Subwatershed
North Bay A	ECCC – Historic	1939-2013	Chippewa Creek
North Bay A	ECCC – Historic	2013-2014	Chippewa Creek
North Bay A	NAVCAN	2014-present	Chippewa Creek
North Bay North Bay Airport	ECCC - MSC	2017-present	Chippewa Creek
PGMN Well 392-1 (April-Nov only)	NBMCA	2007-present	Trout Lake
Wasi River at Astorville	ECCC - WSC	2007-present	Wasi River

Snow

NBMCA collects biweekly data on snow depth and water content from November 15 to May 15 as a partner in the MNRF's snow survey program (coordinated by SWMC). Surveys increase frequency to a weekly basis from March onwards, when flooding from snowmelt is a concern. Snow depth and water content is measured and averaged from 10 sites at each of 3 snow courses, shown in Table 16 and Figure 10. Sampling in North Bay moved from the North Bay Psychiatric Hospital to the North Bay Golf and Country Club between the 2011-2012 and 2012-2013 sample seasons, after the hospital closed. The data collected through these snow surveys contribute to the Flood Forecast and Warning program.

Table 16: Snow Course locations and data periods

Site	Data period	Subwatershed
Corbeil Conservation Area (6005)	1987-present	La Vase River
North Bay Psychiatric Hospital (6006)	1988-2012	Duchesnay Creek
North Bay Golf and Country Club (6006)	2012-present	Chippewa Creek
Shirley Skinner Conservation Area (6009)	2006-present	Kaibuskong River

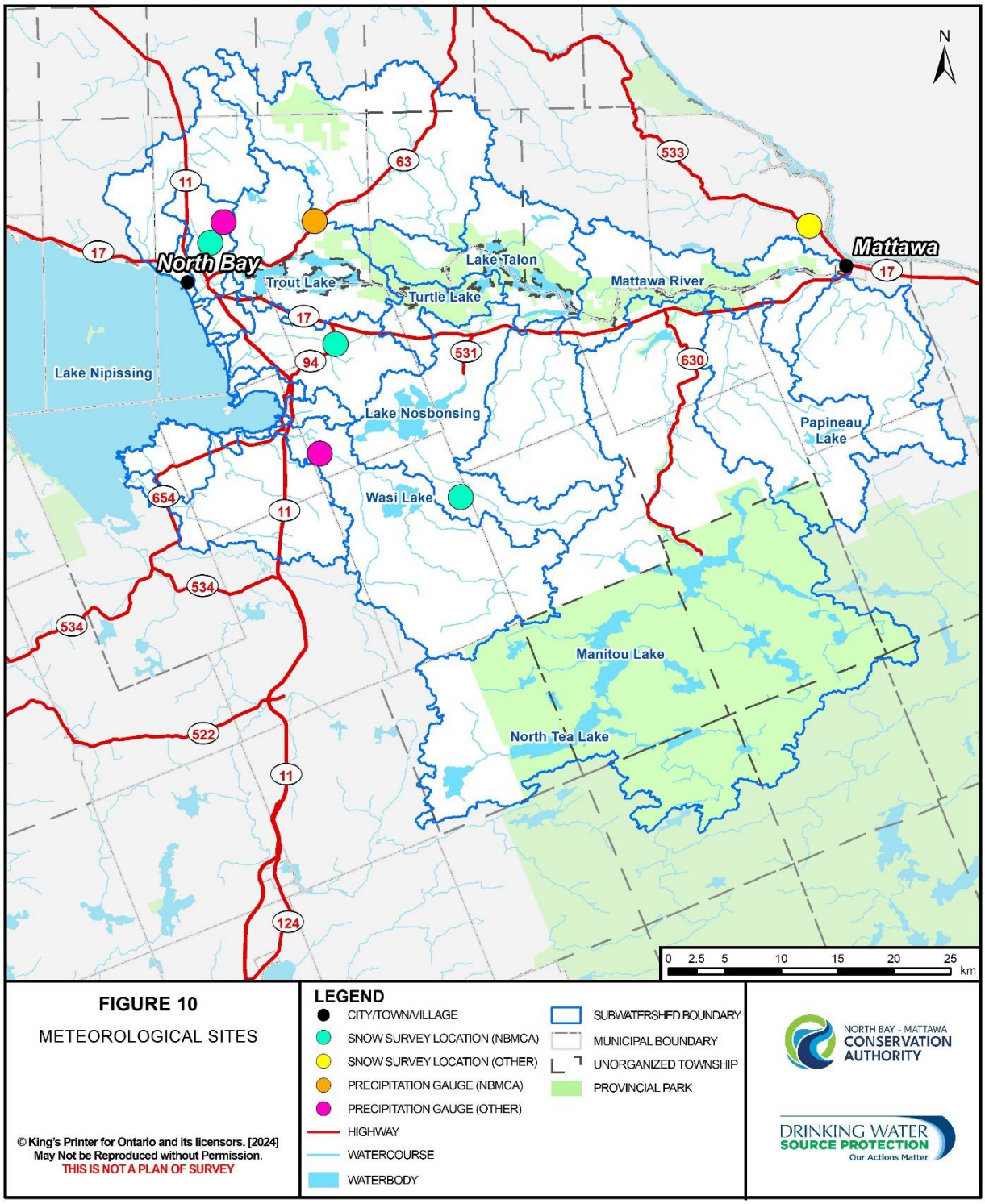

Figure 10 NBMCA's meteorological (snow and rain) monitoring sites.

Surface Water Quantity

The hydrometric data that NBMCA relies on is collected by WSC (five gauges) and MNRF (three gauges), and Ontario Power Generation (OPG; two gauges). WSC maintains another six stations in the area surrounding NBMCA (Table 3, Figure 3) that help inform broader landscape conditions. The WSC and MNRF gauges transmit data hourly. The Chippewa Creek gauge transmits data every 15-minutes with a 15-20 minute upload delay and can be called to obtain instantaneous (5-minute) readings. Water level and flow data is publicly available from the WSC website. Data from the MNRF and OPG at Hurdman Dam is available through the Surface Water Monitoring Centre/MNRF WISKI Web Portal. Data from OPG at the Otto Holden Dam (reservoir water level and discharge) on the Ottawa River upstream of Mattawa are available from the Ottawa River Regulation Planning Board (ORRPB) website. Data from the stations which transmit via GOES are automatically integrated into NBMCA's WISKI database.

All hydrometric stations report water level data which are used primarily for NBMCA's Flood Forecasting and Warning program and reviewed regularly as part of NBMCA's Daily Planning Cycle. The three WSC gauges on Lake Nipissing tributaries have established discharge relationships, and one is being developed for the newly reinstalled station on the Mattawa River. Discharge data is analyzed for the Ontario Low Water Response program. The hydrometric data are also used when analyzing water quality data (e.g., calculating nutrient loadings) and as baseline data for floodplain mapping updates. Manual staff gauges have also been installed at select other locations but are not actively monitored. Additionally, NBMCA has collected a limited amount of manual stream flow data using a handheld velocity meter from some smaller watercourses primarily in the Wasi River and Trout Lake subwatersheds.

Table 17 - Hydrometric stations within and close to NBMCA's area of jurisdiction.

Description	Variables	Data Period	Operator	Subwatershed
Sturgeon River near Glen Afton (02DC004)	water level, discharge	1941-1962; 1979-present	WSC	Sturgeon River
Lake Nipissing at North Bay (02DD006)	water level	1933-present	WSC	Lake Nipissing
La Vase River in North Bay (02DD013)	water level, discharge	1974-present	WSC	La Vase River
Chippewa Creek in North Bay (02DD014)	water level, discharge, air & water temperature	1974-present	WSC	Chippewa Creek
Lake Nipissing at French River Outlet (02DD021)	Water level, water temperature	1951-1998; 2010-present	WSC	Lake Nipissing

Description	Variables	Data Period	Operator	Subwatershed
Forest Lake at South River (02DD023)	water level	2005-present	WSC	South River
Wasi River near Astorville (02DD024)	water level, discharge, rain, turbidity	2007-present	WSC	Wasi River
Lake Nipissing at West Bay (02DD032)	water level, air & water temperature	2023-present	WSC	Lake Nipissing
Ottawa River at Mattawa (02JE013)	water level	1906; 1908-present	WSC	Ottawa River
Mattawa River below Bouillon Lake (02JE020)	Water level, discharge (future)	1971-1998; 2023-present	WSC	Mattawa River
Ottawa River at Thorne (02JE032)	water level	2017-present	WSC	Ottawa River
Aumond Creek Near Mattawa (02KA015)	water level, discharge	2008-present	WSC	Aumond Creek
Turtle Lake Dam	water level, water temperature	2018-present	MNRF	Turtle Lake
Lake Nosbonsing Dam	water level, water temperature	2018-present	MNRF	Kaibuskong River
Lake Talon at Blanchard's Landing	water level, water temperature	2017-present	MNRF	Lake Talon
Mattawa River at Hurdman Dam	water level	2000-present	OPG[1]	Lower Mattawa River
Otto Holden Dam	water level, discharge	1990-present	OPG	Ottawa River

[1] OPG operates gauge; privately operated dam.

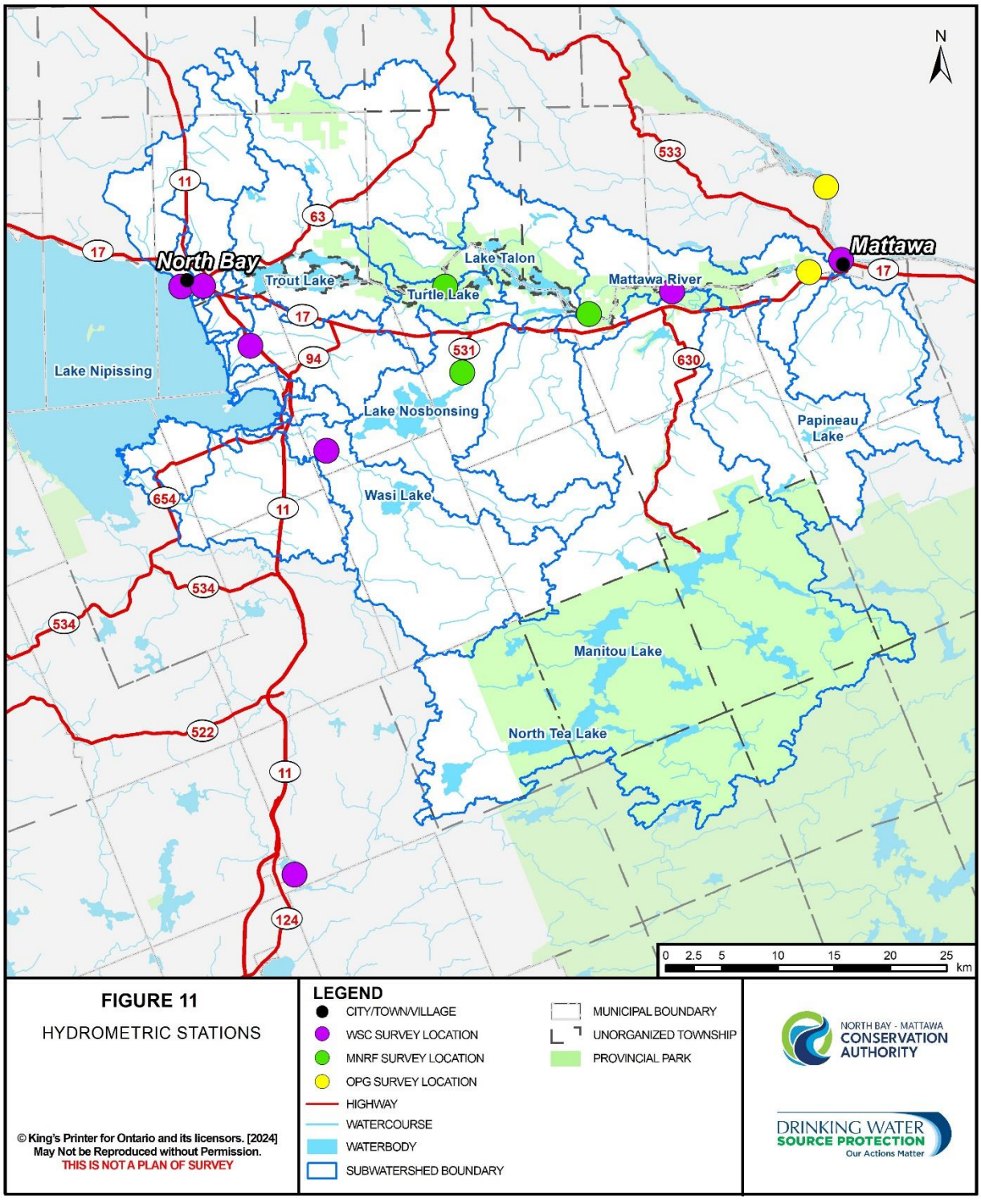

Figure 11 - Hydrometric stations within and close to NBMCA's area of jurisdiction.

Surface Water Quality

NBMCA monitors surface water quality of lakes, rivers, and streams. Lake monitoring programs are partnered with the City of North Bay for Trout Lake and with MECP's Lakes Partner Program (LPP) for all lakes. River and stream water quality sampled through the MECP's Provincial Water Quality Monitoring Network (PWQMN) is supplemented by additional NBMCA sites. NBMCA also conducts benthic macroinvertebrate sampling as a biologic indicator of stream water quality. Historic sampling efforts have focused on the Wasi River, Callander Bay/South Shore, and Trout Lake subwatersheds but have since expanded throughout the watershed.

Lake Water Quality

Area lakes are sampled for Secchi depth (a measure of clarity) and total phosphorus (TP) as part of the LPP. NBMCA additionally has a sonde that is lowered from the water surface to lakebed to collect vertical profiles of water quality at each sample location. This sonde collects the following data:

- Temperature
- Dissolved oxygen
- Specific Conductance
- Turbidity
- pH
- Chlorophyll-A
- Phycocyanin (a pigment for blue-green algae)

The sonde has a depth sensor and is set up to collect a data point every one second as it is slowly lowered to the lakebed so that temperature and temperature-dependent sensors return accurate readings in the vertical profile. Historic datasets were collected using a manual dissolved oxygen and temperature sensor with measurements taken at discrete depths.

There are four core lakes that are sampled annually, with additional lakes sampled on a rotational basis. Trout Lake is sampled monthly for Total Phosphorus (TP), May through October. Other lakes are visited monthly between May and August, with TP sampled only in May and August. Site visits during June and July visits collect only Secchi depth and sonde data for these other lakes. The frequency of sampling on Trout Lake, Callander Bay, and Wasi Lake has varied and historically has been weekly and bi-weekly in the past to support the Drinking Water Source Protection program. Callander Bay and Wasi Lake historically had additional sample sites. The number of established sites on a lake is dependent on its size and shape complexity. Details about lakes being sampled are included in Figure 12 and Table 11. Some lakes are also sampled by other LPP participants. This TP data is incorporated in NBMCA analyses since all data is from the same program methodology and laboratory.

Table 18 - Active Lake sampling sites. Some sites are visited more frequently for Secchi depth and sonde measurements than TP sampling.

Lake	No. sites	Frequency (TP sampling)	Schedule (last sampled)	Subwatershed
Trout Lake	8	Monthly (May-Oct)	Annually (2024)	Trout Lake
Callander Bay	1	Monthly (May & Aug)	Annually (2024)	Callander Bay/ South Shore
Lake Nosbonsing	7	Monthly (May & Aug)	Annually (2024)	Kaibuskong River
Wasi Lake	1	Monthly (May & Aug)	Annually (2024)	Wasi River
Earl's Lake	1	Monthly (May & Aug)	Rotational (2022)	Lower Mattawa River
Four Mile Lake	2	Monthly (May & Aug)	Rotational (2021)	Trout Lake
Lake Chant Plein	1	Monthly (May & Aug)	Rotational (2022)	Lower Mattawa River
Lake Talon	3	Monthly (May & Aug)	Rotational (2022)	Lake Talon
Papineau Lake	2	Monthly (May & Aug)	Rotational (2024)	Pautois Creek
Pine Lake	1	Monthly (May & Aug)	Rotational (2019)	Turtle Lake
Smith Lake	3	Monthly (May & Aug)	Rotational (2021)	Amable du Fond River
Taggart Lake	1	Monthly (May & Aug)	Rotational (2022)	Lower Mattawa River
Turtle Lake	1	Monthly (May & Aug)	Rotational (2019)	Turtle Lake

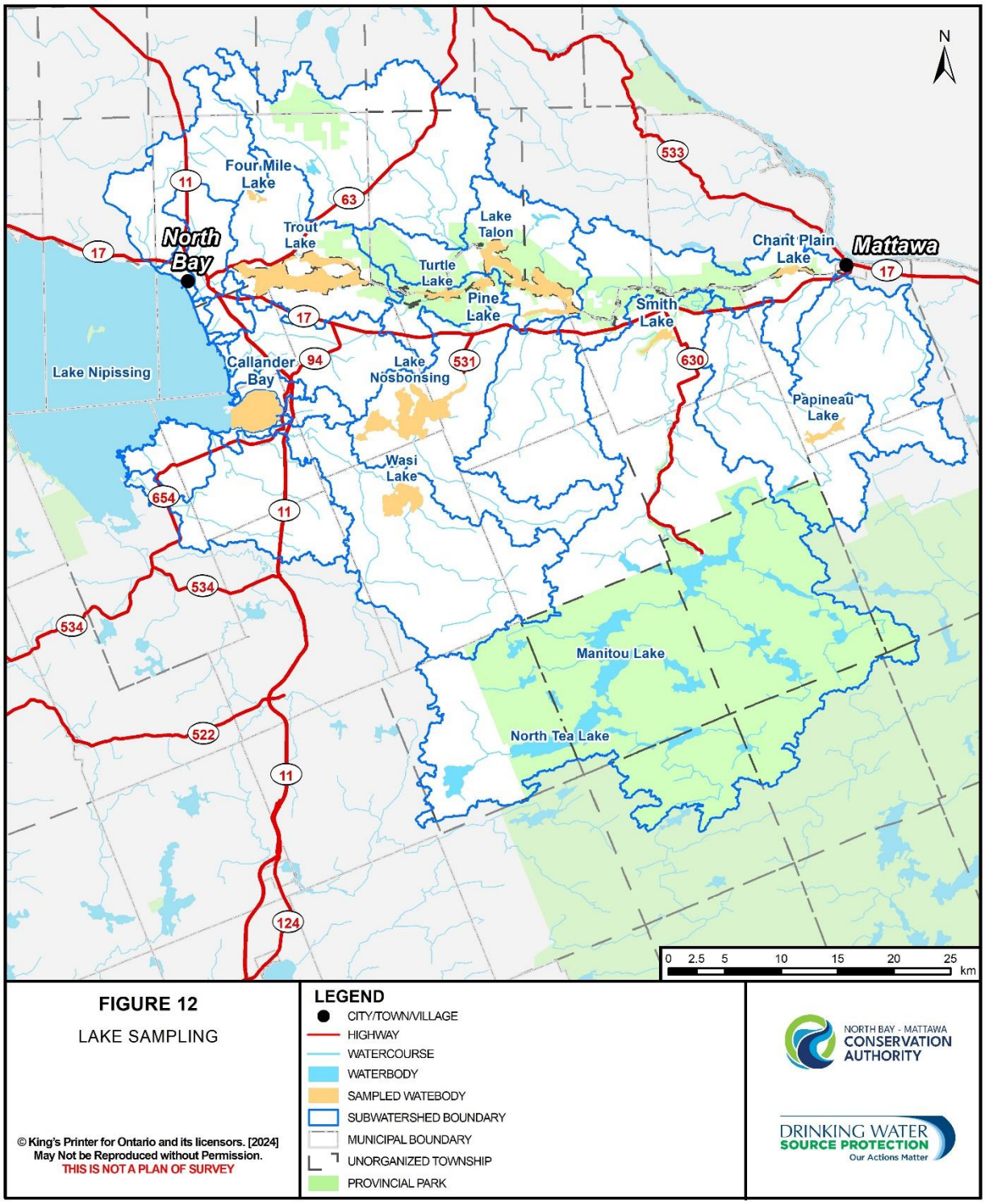

Figure 12 - Lake water quality monitoring

River and Stream Water Quality

NBMCA samples nine watercourses as a partner in MECP's PWQMN for a variety of (approximately 40) water quality parameters (general chemistry including ions, nutrients, metals, turbidity, conductivity, pH, etc.) on a monthly basis from April to November. Two of these sites (Ottawa River, South River) are outside of NBMCA's area of jurisdiction. Four sites (Chippewa Creek, Wasi River, Duchesnay Creek, and Amable du Fond River) have been sampled monthly for winter sampling (December to March) in recent years. Winter sampling does not include metals analysis. Additional sites have been sampled internally for total phosphorus, with tributaries to Trout Lake and Callander Bay historically being sampled weekly and bi-weekly, respectively. Historic sampling in the Wasi River subwatershed and along Four Mile Creek had a higher density of sample sites. The internal sampling network expanded across the watershed in 2018, retaining only one site per stream or river, and adjusted sample frequency to monthly, aligning with PWQMN samples. Two sites were added in 2024. In-situ field measurements of turbidity (available 2016 onward), temperature, specific conductance, pH, and dissolved oxygen are collected at all sites when water samples are collected. See Table 19 and Figure 13 for an overview of stream and river sample sites.

In addition to water samples, there are sensors that record time-series water quality data. There is a sensor for temperature and specific conductance (SPC) that had been installed in Chippewa Creek in partnership with the MECP for the PWQMN in 2019, 2021, and 2022. The sensor was stolen from Chippewa Creek in 2022 and has been installed in Wasi River since 2023. A turbidity sensor is installed at the Wasi River WSC gauge in partnership with Nipissing University and is connected to the telemetry. There are also small sensors that record only water temperature. These have historically been installed in multiple locations in Chippewa Creek, and more recently on a rotational basis in other streams that have limited background datasets. The SPC and temperature sensors are removed for the winter.

Table 19 - Stream and River Sample sites. Subwatershed is listed if not the same as watercourse name. Data periods on IWM samples marked with an asterix (*) were sampled historically as part of the PWQMN.

Site ID	Watercourse (subwatershed)	Program	Data Period
03013301302	Duchesnay Creek	PWQMN	1968-1994, 2007-present
03013301502	La Vase River	PWQMN	1968-1985, 1992, 2024-present
03013301902	Chippewa Creek	PWQMN	1968-1994, 2003-present
03013302402	La Vase River	PWQMN	1973-1994, 2016-2023
03013303002	Wasi River	PWQMN	1984-1994, 2003-present
03013304002	South River	PWQMN	2017-present
18000036002	Ottawa River	PWQMN	1968-1990, 1992-1994, 2007-present

Site ID	Watercourse (subwatershed)	Program	Data Period
18607002002	Mattawa River	PWQMN	1968-1990, 1992-1994, 2007-present
18607006002	Kaibuskong River	PWQMN	1972-1975, 2007-present
18607008002	Amable Du Fond River	PWQMN	1972-1975, 2007-present
CA-LWC-02	Lansdowne Creek (Callander Bay/South Shore)	IWM	2024-present
BM-BMC-01	Boom Creek	IWM	2018-present
BU-BUC-01	Burford Creek	IWM	2010-present
JP-JPC-01	Jessups Creek	IWM	2018-present
LV-CKC-01	Cook Creek (La Vase River)	IWM	2024-present
NO-BAC-01	Balsam Creek (North River)	IWM	2018-present
NO-NOR-01	North River	IWM	2018-present
PK-PKC-01	Parks Creek	IWM	1973-1976*, 1981-1988*, 2018-present
PT-PTC-01	Pautois Creek	IWM	2018-present
SH-SHC-01	Sharpes Creek	IWM	2018-present
TR-FMC-12	Four Mile Creek (Trout Lake)	IWM	1982-1989*, 1991*, 1993-1994*, 2003-2005*, 2005, 2008-present
TR-LEC-02	Lees Creek (Trout Lake)	IWM	1988-1990*; 2024-present
WB-BDC-01	Boulder Creek (Windsor/ Boulder/Bear Creeks)	IWM	2018-present
WB-BEC-01	Bear Creek (Windsor/ Boulder/Bear Creeks)	IWM	2018-present
WB-WDC-01	Windsor Creek (Windsor/ Boulder/Bear Creeks)	IWM	2010-present

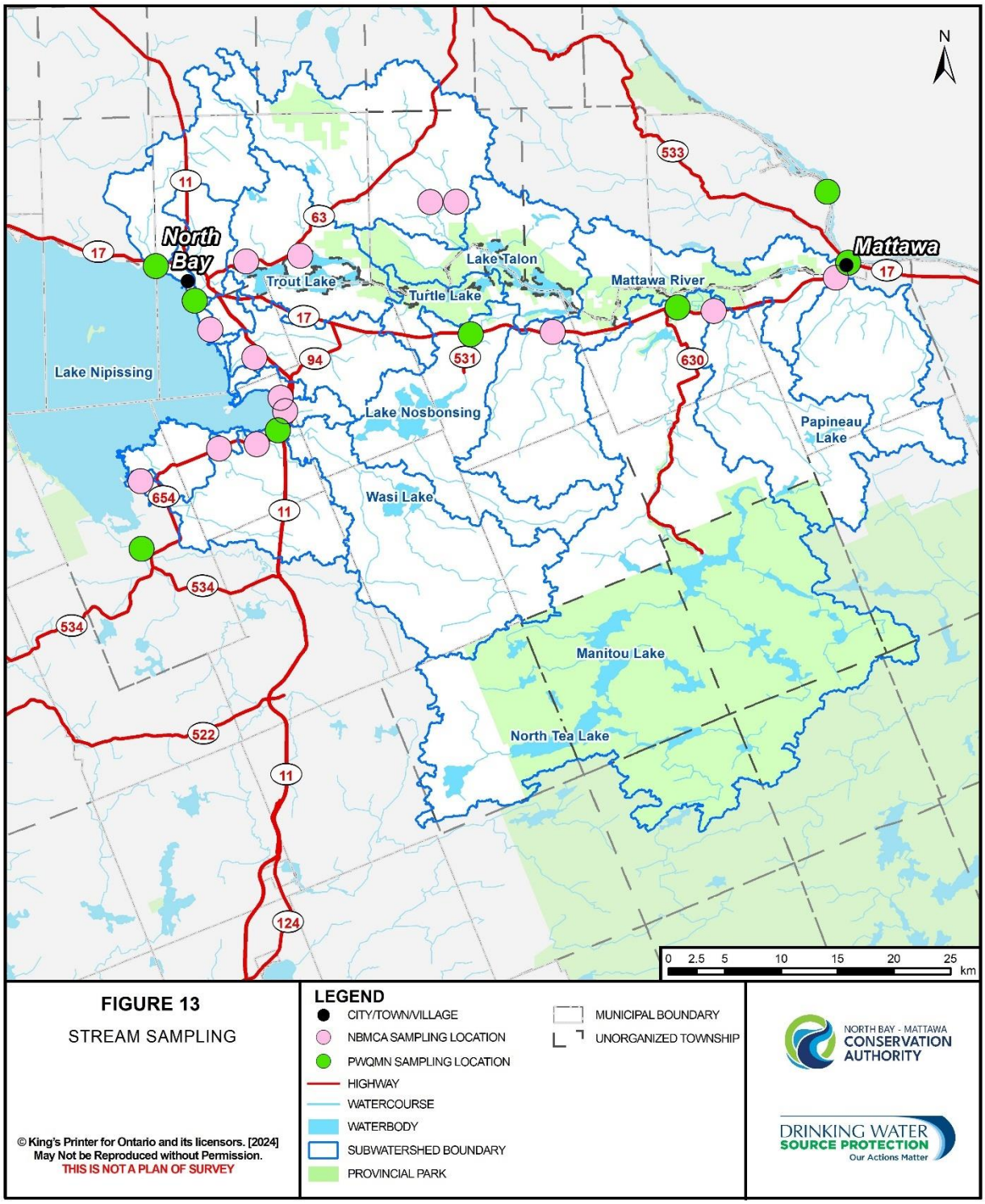

Figure 13 - Stream water quality sampling locations

Aquatic Biology

NBMCA monitors benthic macroinvertebrate community composition (taxonomy) and habitat characteristics as a participant in the Ontario Benthos Biomonitoring Network (OBBN) program. Sampling is conducted in the spring (ideally in May). Much of the historic sampling has focused on Chippewa Creek, Lees Creek, and Four Mile Creek, and in recent years, sites in the Chippewa Creek subwatershed have been sampled annually, with a selection of rotational sites being added throughout the rest of the subwatershed (Figure 14, Table 20). Additional or alternate sites have been sampled in Chippewa Creek historically. Until 2016, samples were identified only to the OBBN's minimum 27-group standard (a mixture of taxonomic levels, mostly Orders); samples collected in 2017 onwards are identified to the more specific Family level taxonomy.

Table 20 – Active sample sites for benthic invertebrate sampling. Subwatershed listed where not the same as creek name.

Site	Sampled since	Years	Creek (Subwatershed)
BM-BMC-01	2021	1	Boom Creek
BU-BUC-01	2018	1	Burford Creek
CA-LWC-01	2013	2	Lansdowne Creek (Callander Bay/South Shore)
CP-CPC-04	2009	13	Chippewa Creek
CP-CPC-09; CP-CPC-10	2009	11	Chippewa Creek
CP-CPC-17	2014	6	Chippewa Creek
CP-JNC-01	2017	5	Johnson Creek (Chippewa Creek)
DU-DUC-02; DU-DUC-04	2022	1	Duchesnay Creek
KA-KAR-02	2021	1	Kaibuskong River
NO-NOR-01	2019	1	North River
PK-PKC-01	2018	1	Parks Creek
PT-PTC-02	2018	1	Pautois Creek
SH-SHC-01	2019	1	Sharpes Creek
TR-FMC-12; TR-FMC-14	2009	7	Four Mile Creek (Trout Lake)
TR-LEC-01	2010	4	Lees Creek (Trout Lake)
WA-WAR-11	2021	1	Wasi River
WB-WDC-01	2013	3	Windsor Creek (Windsor/Boulder/Bear Creeks)

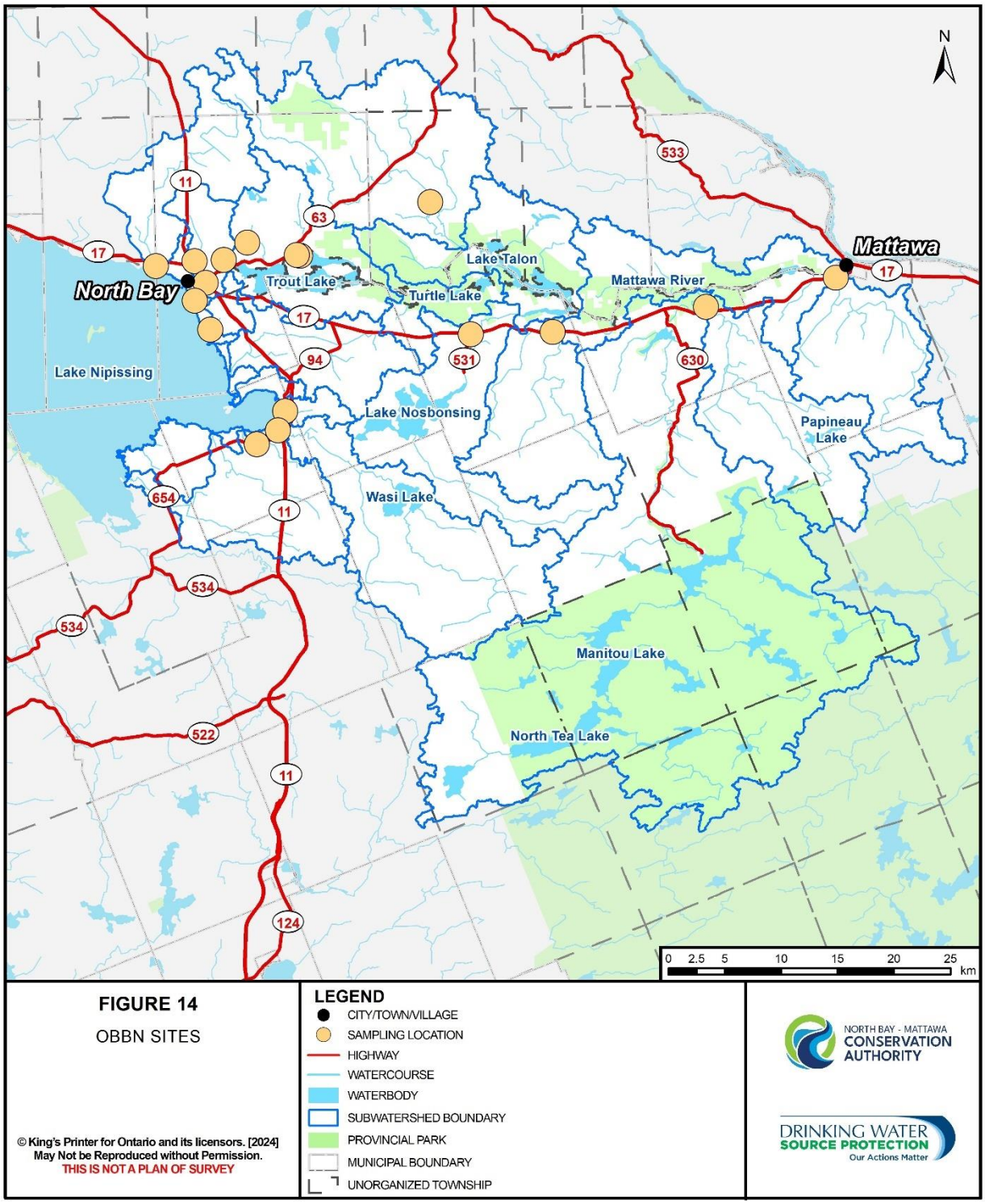

Figure 14 – OBBN sample sites

Groundwater

NBMCA maintains and monitors groundwater level at six wells as a partner in MECP's PGMN program, with each well located in a different subwatershed (Table 21 and Figure 15). The

wells have been equipped with Leveloggers that record pressure (from which water level is calculated) and temperature hourly. There are Barologgers in three wells that are used for barometric pressure compensation of the pressure data from all six groundwater wells. Site visits are conducted approximately four times per year to download sensor data and manually measure water levels to calibrate hourly datasets. The MECP provided NBMCA with GOES telemetry installed at W392-1 in 2024 to allow near real-time data access for this site's water level, barometric pressure, and rain gauge data.

Water quality is sampled once per year, usually in the fall. Sampling guidelines indicate a minimum of three times the standing volume of water in a well should be purged prior to sample collection. W272-1 is below a warehouse floor and is not practical to sample for water quality. The volume of water in W390-1 is too great to be able to efficiently sample. W391-1 and W392-1 are also high-volume wells but have been sampled every second year.

Table 21 - NBMCA's groundwater monitoring sites.

Site	Water Level	Barometric Pressure	Rain Gauge	Water Quality	Subwatershed
W272-1	Yes	Yes	No	No	La Vase River
W274-1	Yes	No	No	Annually	Park's Creek
W277-1	Yes	No	No	Annually	Chippewa Creek
W390-1	Yes	No	No	No	Wasi River
W391-1	Yes	Yes	No	Bi-annually	Sharpes Creek
W392-1	Yes	Yes	Yes	Bi-annually	Trout Lake

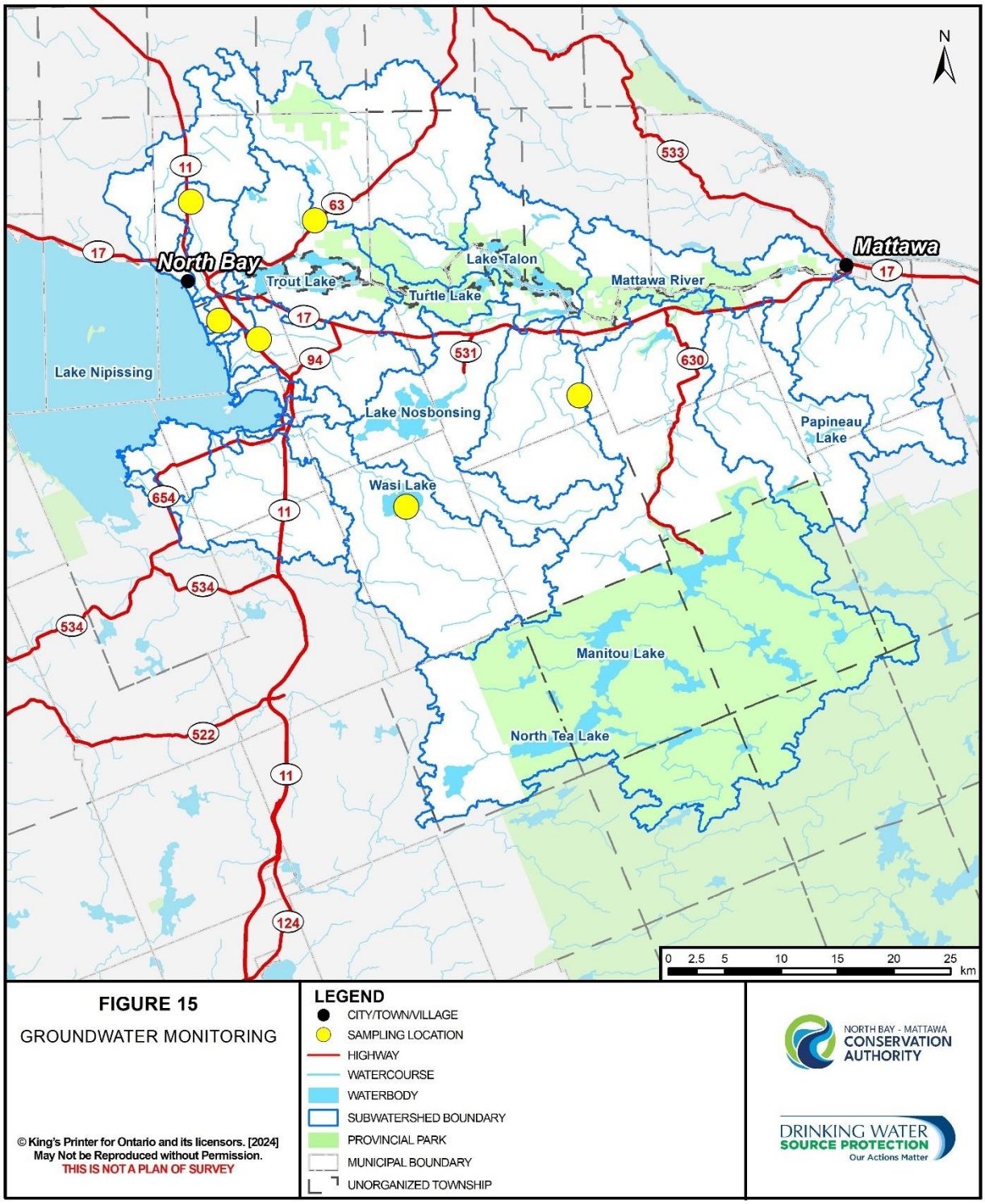

Figure 15 - NBMCA's groundwater monitoring sites.