Water Management

Mississippi River Watershed Plan
Discussion Paper Series

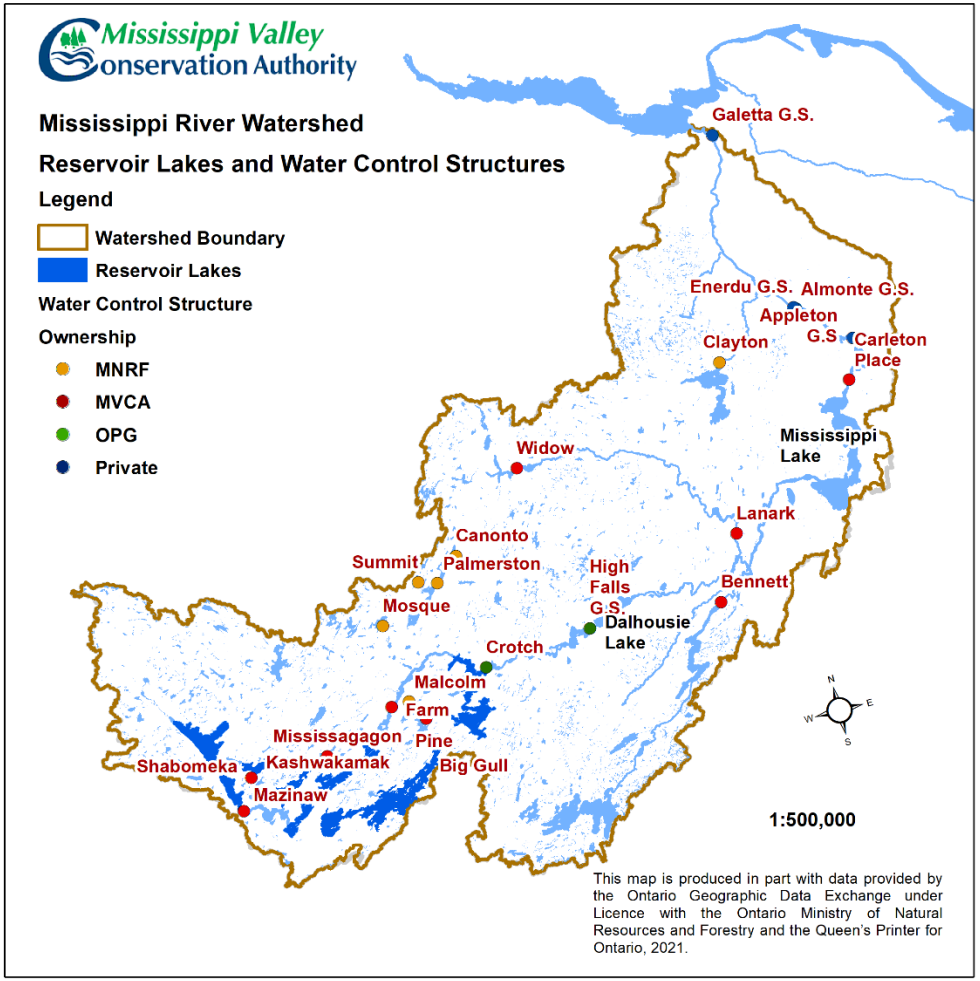
Water Management in the Mississippi Watershed

The Mississippi River is a "managed system", with a series of water control structures (dams and weirs) that are used to manipulated water flows and levels for a variety of purposes. Dams are operated for several purposes: flood protection, low flow augmentation, recreation and tourism, fisheries, power generation, and erosion control.

In 2006, the *Mississippi River Water Management Plan* (MRWMP) was developed by the Ministry of Natural Resources (MNRF), hydro power producers, and Mississippi Valley Conservation Authority (MVCA) in accordance with the *Lakes and Rivers Improvement Act*. The plan sets operational targets for the 12 largest dams on the system – the desired upper and lower limits for water level/flows to achieve operational goals and objectives. The operational targets also consider protection of ecological features and species, giving particular consideration to wild rice beds, and lake trout and walleye spawning habitats, as all three are highly sensitive to water level fluctuations.

KEY FACTS:

- It is illegal to dam or otherwise alter a waterway without a permit.
- There are 23 documented authorized dams and weirs in the watershed. MVCA owns 11 and operates 4 on behalf of MNRF. The remaining are owned and operated by private hydro power producers.
- Six lakes in the upper watershed are used as water reservoirs to mitigate flooding. Crotch Lake is the largest "reservoir lake" and provides as much water storage capacity as the other five lakes combined.



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- Generating stations owned by Ontario Power Generation (OPG), Enerdu Power Systems, Mississippi River Power, and TransAlta are all "run-of-river" facilities that rely on natural river flows. These flows are augmented during dry months by drawing down Crotch Lake in accordance with the MRWMP.
- A network of gauges located across the watershed measures water levels and flows. Data is used to inform dam operations, flood forecasting and warning, conduct trend analysis, and carryout system planning and dam design.
- Dalhousie Lake and Mississippi Lake are surrounded by relatively flat land that has been heavily developed. These "flood prone areas" pose a safety risk to residents and flood damage risk to property. Both are also affected by natural constrictions that constrain water from exiting the lakes.

Water Management - Challenges and Opportunities

Key challenges for water management centre on balancing competing and increasing demand for water, with changes in water supply, and the impending effects of climate change. Continued growth and development within the watershed bring increases in residential and commercial demand for water, and economic sectors such as agriculture and tourism also depend on water. The management and human use of water must also be balanced with environmental needs to ensure there is enough available for fish, amphibians, and other aquatic and terrestrial organisms.

Climate change projections predict more frequent and extreme rainfall events and flooding, an earlier spring freshet, prolonged periods of low summer flow, and more frequent drought-like conditions. Some of these changes are already being observed in the watershed (ex. since 2012, MVCA has experienced four droughts).

A ***Mississippi River Water Budget*** *(Tier 1)* was prepared in 2009 to support the development of the *Mississippi-Rideau Source Protection Plan* to assessed and quantify water use (demand) and supply for the Mississippi Watershed. It identified gaps in data and also did not consider the potential impacts of climate change. There is opportunity to build upon this work by completing the recommendations of the study and also incorporating climate change considerations.

When developed in 2006, the scope of the ***Mississippi River Water Management Plan*** (MRWMP) was restricted to addressing water levels and flows associated with the hydro facilities and the main storage reservoirs. It did not address issues of water quality, or the projected impacts of changes in climate or land use. These factors are expected to have significant implications for how water levels are managed to balance competing needs with changes in water availability.

In 2018, MNRF amended the MRWMP to address a number of administrative requirements, but there have been no changes to the operating ranges since 2006. An Implementation Review of the Plan was completed in 2020. Further update is needed to address predicted changes in water flows and levels at different times of year arising from the impacts of climate change. Any changes to the operating plan must be approved by the province.

The MRWMP requires a minimum target flow of 1 cubic meter per second (m^3/s) at the High Falls Generating Station, however the plan recognizes 5 m^3/s as the preferred minimum year-round target. Mississippi River water users are accustomed water levels associated with 5 m^3/s, however, this is becoming increasingly difficult to achieve due to more frequent and longer periods of drought.

Climate studies[1] specific to the Mississippi River watershed predict potentially significant decreases in soil moisture and water availability during the summer months. In addition to placing stress on the natural environment, this has considerable implications for agriculture, forestry, hydro power generation, municipal services, water recreation and tourism. A climate change assessment for the period from 2011 to 2100, also predicts that under low flow conditions, hydro energy production could decrease by 9% to 23%.

The Mississippi River **Low Water Response** Team is made up of local municipalities, key provincial ministries[2], county-level Emergency Management offices, the Ontario Clean Water Agency (OCWA), Ontario Power Generation (OPG) and Mississippi River Power. Its mandate is to use a combination of water data, provincial and local legislation, communication techniques and local tools to advocate for water conservation during low water conditions. There is an opportunity for this same group to collaborate on pursuit of resiliency projects and to agree on how the system will be managed under extreme conditions.

Ice, both surface and frazil ice, can impact flow management, hydropower-generation operations, and municipal works, and can damage shoreline properties and structures. With climate change, hazardous and nuisance ice conditions are expected to occur more frequently. Frazil ice has also been identified as an increasing issue where management options may be available.

Water storage is a key limiting factor in mitigating both flood and drought impacts. Six reservoir lakes provide storage capacity to collect the spring freshet to alleviate flooding downstream. The reservoir lakes are all located in the upper watershed and offer relatively limited storage capacity.[3] Without any storage reservoirs in the lower two-thirds of the watershed, there is no opportunity to store water both to augment flow during low flow periods, or to mitigate flooding during high flow events.

Studies conducted elsewhere have confirmed and quantified the value of **wetlands** in providing **natural storage** to attenuate floods and droughts. MVCA regulates development in and adjacent to wetlands with a focus on protecting their hydrologic function in easing flood and drought impacts. Protection and enhancement of these assets, particularly in proximity to urban settlements, can mitigate flood and drought impacts, complimenting the function provided by the upstream reservoir lakes. ***See our Discussion Paper about Natural Systems.***

[1] Kunjikutty, S. 2015. Future Water Budget Projections in Mississippi Rideau Watershed Region', and
Lehman, P and S. Kunjikutty, J. Oblak. 2015. Climate Change Implications for Small Waterpower Facilities - A Watershed Perspective.

[2] Ministry of the Environment, Parks & Conservation, Ministry of Health, Ministry of Natural Resources & Forestry, Ministry of Agriculture, Food & Rural Affairs

[3] For example, the Madawaska River has about twice the drainage area of the Mississippi watershed but it's Bark Lake Reservoir is almost six times larger than Crotch Lake. Mazinaw, Kashwakamak and Big Gull combined provide about the same storage volume as Crotch Lake.

Most of the **dams** along the system are nearing or are at the end of their lifecycle, and will require major repair or replacement within the next 10-15 years. As of 2020, the current 10-year capital plan identifies capital works on 11 dams, valued at over $5.9 million. This poses a significant cost to member municipalities and taxpayers, but also provides an opportunity to review current system design to identify potential improvements and efficiencies. There may be an opportunity to increase storage capacity or improve operational flexibility and safety during renewal of the facilities. MVCA, with the support of its member municipalities, can adopt and implement an **Asset Management Plan** to ensure the long-term structural integrity of the dams.

Water use is regulated under the Ontario *Water Resources Act*. Water users taking more than 50,000 liters of water per day must obtain a Permit to Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP). Permit holders include: municipal water and wastewater treatment facilities, agricultural and aquaculture facilities, aggregate producers, campgrounds, construction sites, golf courses, and hydropower generators - who require the permit to divert water through the generating plant. The PTTW program provides a means to quantify and track large scale water use, but does not capture the cumulative volume of the numerous other smaller scale users, such as individual household that rely on a surface water in-take.

MVCA partners with Water Survey of Canada (WSC) and MNRF to collect **water level and flow data** from gauges across the watershed. The data supports water management operations, flood forecasting, and low flow assessments, and various modelling analyses such as floodplain mapping, nutrient modelling, climate change assessments and hydrology/hydraulic modelling. The automated information is also updated daily on the MVCA website for public use. Water level and flow monitoring technologies are continually improving, and there is ongoing opportunity to increase automated monitoring capabilities and improve overall efficiencies.

Partners in Water Management

In addition to engaging the Power Producers and Ministry of Natural Resources and Forestry (MNRF), the MVCA has been working with a Watershed Public Advisory Committee (PAC) made up of representatives from key communities in the watershed including: agriculture, development, forestry, hydro producers, lake associations, tourism and the general public. Other partners may include:

- Canadian Institute for Climate Choices
- Canadian Water Resources Association
- Counties and municipalities
- Ducks Unlimited Canada
- Indigenous Communities
- Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)
- Ontario Clean Water Agency (OCWA)
- Plenty Canada
- Universities
- Water Survey of Canada (WSC)

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35 Draft Actions

MVCA has identified 35 potential actions designed to address the goals and objectives identified through the watershed planning process. A much longer list was reviewed and culled in consultation with the Watershed PAC. The following actions are relevant to hydro power production. To see all 35 draft actions visit: https://mvc.on.ca/watershedplan

Action 1. Extend the role of the MVCA Public Advisory Committee (PAC) for implementation and update of the Watershed Plan. (committee is made up of agriculture, development, forestry, hydro power, lakes, tourism)

Action 3. Undertake meaningful engagement and establish new relationships with indigenous partners through implementation of an Indigenous Engagement Plan and through ongoing engagement in watershed initiatives. *This may include:*

- *Improve MVCA's corporate understanding of indigenous rights, values and customs, and provide indigenous awareness training within the organization.*
- *Determine when and how Indigenous communities would like to be involved in watershed matters.*
- *Foster relationships and partnership with the indigenous community through continued engagement in watershed initiatives.*

Action 4. Improve the MVCA hydrometric (water level and flow monitoring) network, to increase automated monitoring capabilities and overall efficiency. *This may include:*

- *Continue to collaborate with Water Survey Canada in monitoring/maintaining water level/flow gauges.*
- *Review location of gauges to ensure there is appropriate coverage and where necessary add or reposition gauges.*

Action 5. Prepare a Mississippi River Watershed Model incorporating historical, near real-time, and projected future hydro-climatic data, based on up to date information and science.

Action 6. Update the Mississippi River Water Budget to better evaluate water needs and use by completing the recommendations of the MRSPP Tier 1 budget assessment and incorporating climate change considerations. *This may include:*

- *Improve understanding of local wetland, surface and groundwater interactions. (collaboration with the academic community?)*
- *Assess past drought occurrences to determine impacts on river flow, and the conditions under which the target flows could not be achieved.*
- *Survey (voluntary) partners from all sectors on a regular basis to maintain up to date information on water use, water needs, and water availability.*
- *Work with the Town of Carleton Place to ensure both the projected growth and proposed expansions of its water and wastewater facilities can address water supply/demand, and quality requirements.*

Action 7. Update Mississippi River Water Management Plan to address modeling and water budget work completed under Actions 5 and 6, and to assist in rebalancing the competing interests for the watershed's water resources where needed.

Action 8. Improve the groundwater monitoring program to meet MVCA and municipal source water protection requirements. *This may include:*

- *Assess groundwater information to determine information needs and gaps, and work with MECP to address.*
- *Establish a centralized system of collecting and consolidating groundwater data collected through the subdivision review process (already in early development with RVCA)*

Action 9. Develop and implement an Asset Management Plan for water control structures.

Action 10. Undertake a Water Storage Capacity and Management Study of both man-made (dams and reservoirs) and natural storage (wetlands) options and capacity.

Action 11. Undertake an Ice Risk Assessment in partnership with hydro power producers and municipalities. *This may include:*

- *Collaborate with hydro power producers in determining solutions for frazil ice issues.*

Action 12. Work with municipalities, landowners and other partners to quantify, value and protect wetlands as hydrologic and natural assets.

Action 13. Enhance response planning and readiness through the Low Water Response Team to address low water response and to ensure it includes representation from all key water use sectors. *This may include:*

- *Further implementation of water conservation measures, such as municipal water conservation by-laws, where needed.*
- *Encourage municipalities that haven't already done so, to adopt and implement Water Conservation By-laws.*

Action 14. Work with municipalities, landowners and other partners to enhance on-site retention and infiltration of water.

Action 15. Support waterfront property owners in implementing adaptive management measures to address potential impacts of variable water levels.

Action 29. Value the ecosystem services and climate resiliency provided by natural asset features and functions (wetlands, woodlands, etc.).

Action 30. Work with municipalities and public agencies to improve the application and coordination of regulatory tools for the protection of wetlands, riparian areas, woodlands and natural systems.