KASHWAKAMAK LAKE DAM
CLASS ENVIRONMENTAL ASSESSMENT - PROJECT PLAN REPORT

Prepared for: Mississippi Valley Conservation Authority
Prepared by: Egis Canada Ltd.
November 12, 2024

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Mississippi Valley Conservation Authority

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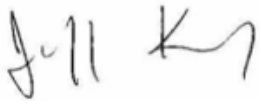

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EXECUTIVE SUMMARY

The Mississippi Valley Conservation Authority (MVCA) initiated a Conservation Ontario Class Environmental Assessment (Class EA) for the Kashwakamak Lake Dam, which is located on the main channel of the Mississippi River, about 8 km east of Fernleigh. The dam is situated on Lot 21, Concession 9, Clarendon Ward, within North Frontenac Township. Access to the site is via Road 506, turning onto Gutheinz Road, and proceeding along a private access road.

This project described herein has been undertaken in accordance with the process for Conservation Ontario's Class EA for Remedial Flood and Erosion Control Projects under the Environmental Assessment Act. The Class EA is an 'approved' Class EA under the Environmental Assessment Act (EAA), allowing Conservation Authorities (CAs) to undertake remedial flood and erosion control projects without requiring formal approval under the EAA.

The Kashwakamak Lake Dam, constructed in 1910, includes an overflow weir spillway, sluices, and a small concrete saddle dam. A 2020 Risk Assessment Study identified the need for structural interventions within five years to manage flooding and drought effectively. A 2022 Dam Safety Review (DSR) by Hatch found the overflow weir deteriorating, requiring significant concrete repairs to prevent further degradation. The dam has exceeded its design life and shows signs of deterioration. This assessment aims to determine whether the dam should be decommissioned, repaired, or replaced, balancing public safety with environmental, socio-economic, and cultural considerations.

A comprehensive consultation program was developed at the onset of the project, involving public notices, a project website, and meetings with the key stakeholders, Community Liaison Committee (CLC), First Nations and the public. Key concerns included maintaining water levels, construction timelines, and potential impacts on local natural heritage features and recreational activities were identified and discussed throughout consultation.

To add in the development and evaluation of alternative solutions for the Kashwakamak Lake Dam and the identification of potential impacts and mitigating measures, several studies and assessment were undertaken to inventory the existing natural, socio-economic, and cultural environments of the Kashwakamak Lake Dam. An Environmental Assessment revealed the presence of diverse wildlife, including fish spawning habitats and species at risk (SAR) such as bats and turtles. Based on background review, it was identified that the Kashwakamak Lake features over 577 cottages and residences, along with resorts and marinas, supporting a vibrant local community. The lake is upstream of culturally significant wild rice crops for the Ardoch Algonquin First Nation and other First Nations. The surrounding landscape is predominantly undeveloped, characterized by forests, lakes, and wetlands. The Kashwakamak Lake Dam plays a crucial role in maintaining water levels, providing flood and drought control, and supporting local recreational and tourism activities. The lake's open water

season runs from May to October, attracting high public activity with boating, fishing, hiking, hunting, resorting, and camping. During the off-season from November to April, the area supports ice fishing, snowmobiling, and other outdoor activities. A Geotechnical Investigation highlighted the existing subsurface conditions and the need for the foundation of the dam to be placed on sound bedrock.

Past Recovery Archaeological Services Inc. conducted Stage 1 & 2 and Stage 3 Archaeological Assessments for the proposed replacement of the Kashwakamak Lake Dam, covering 1.49 hectares. The Stage 1 assessment (July 25, 2023) identified potential archaeological resources, leading to a Stage 2 assessment (May 2, 2024). The Stage 2 assessment revealed a potential archaeological site, suggesting a short-term campsite for lithic reduction practices, necessitating a Stage 3 assessment. The Stage 3 assessment confirmed high cultural heritage value, warranting Stage 4 mitigation. The MVCA recommends "avoidance and protection of the site" as the Stage 4 strategy, ensuring the archaeological site is preserved during the dam replacement.

A comprehensive hydraulic analysis of the Kashwakamak Lake Dam was conducted, considering various scenarios including normal conditions, probable maximum flood events, and projections for climate change. This analysis aimed to evaluate the potential impacts on life safety, property, environmental factors, and cultural heritage assets, as well as to assess the extent of potential impacts on the surrounding area in the event of a dam failure.

The findings of this assessment confirmed the Hazard Potential Classification (HPC) of the Kashwakamak Lake Dam. According to the Ministry of Natural Resources (MNR) Technical Bulletin for Classification and Inflow Design Flood Criteria (2011), the minimum Inflow Design Floods (IDF) based on the dam's HPC to inform the dam's design. The HPC for the Kashwakamak Lake Dam was determined to be moderate, while the saddle dam was classified as low. Consequently, the IDF for the main dam is set to range from the 100-year flood to the 1000-year flood, or regulatory flood events, whichever is greater. As a conservative measure, the most severe scenario of the 1000-year flood was selected as the IDF for the main dam, while the 100-year flood was chosen for the saddle dam.

Five alternative solutions were evaluated based on criteria such as hydraulic function, geomorphology, dam safety, environmental impact, socio-economic factors, and implementation feasibility:

1. Do Nothing
2. Decommission Dam and Construct Passive Control System
3. Rehabilitation of Existing Dam
4. Replace Existing Dam in Same Location
5. Construct New Dam Downstream

Following a comprehensive evaluation process that incorporated expertise and input from various disciplines, agencies, stakeholders, First Nations, the CLC, and the public, the Technically Preferred

Alternative is Alternative 4. This involves replacing the existing Kashwakamak Lake Dam at the same location with a new dam aligned similarly to the existing structure. The Saddle Dam will also be replaced within a similar alignment to that of the existing dam. The type of structure and function is dependent on the Kashwakamak Lake Dam replacement design and will be further assessed during detailed design.

Alternative 4 effectively addresses the Problem Statement outlined in this study while preserving the integrity of the Mississippi River Watershed Plan. The new dam will be engineered to handle larger flood events, be resilient to climate change, and comply with current dam safety standards. Constructing the new dam at the existing site will avoid additional areas of disturbance, have no permanent impacts on property, and minimize socio-economic disruptions, including no long-term effects on First Nation Lands (Manòmin).

On September 9th, 2024, the MVCA Board of Directors endorsed Alternative 4 as the selected Technically Preferred Alternative.

The project will proceed with preliminary and detailed design, tendering, and construction, subject to regulatory approvals and stakeholder feedback. The implementation phase will include rigorous monitoring to ensure compliance with environmental standards and effective mitigation of potential impacts.

Table of Content

List of Figures

List of Tables

List of Appendices

1.0 INTRODUCTION

The Mississippi Valley Conservation Authority (MVCA) has initiated a Conservation Ontario Class Environmental Assessment for the Kashwakamak Lake Dam on the main channel of the Mississippi River. The existing Kashwakamak Lake Dam, constructed over 100 years ago (in 1910), has surpassed its design life. According to the 2022 Dam Safety Review, the dam is showing signs of deterioration, particularly in the overflow weir. A decision must be made regarding whether to decommission, repair, or replace the dam.

This project is being carried out in accordance with the process for Conservation Ontario's Class EA for Remedial Flood and Erosion Control Projects under the Environmental Assessment Act. The Class EA is an 'approved' Class EA under the Environmental Assessment Act (EAA), allowing Conservation Authorities (CAs) to undertake remedial flood and erosion control projects without requiring formal approval under the EAA.

1.1 Project Purpose

In 2020, MVCA conducted a Risk Assessment, followed by a Dam Safety Review (DSR) in 2022, which concluded that structural issues at the dam needed to be addressed within 5 years. MVCA incorporated this work into its 10-year capital plan and secured grants from both the Federal Government (Infrastructure Canada's Disaster Mitigation and Adaptation Fund (DMAF)) and the Provincial Government (Water and Erosion Control Infrastructure (WECI)) to support planning, design, and construction activities. In March 2023, MVCA initiated the Class EA process to determine the best approach to address the dam deficiencies.

This Project Plan has been prepared in accordance with the Conservation Ontario Class Environmental Assessment for Remedial Flood and Erosion Control Projects (Class EA), January 2002, as amended in February 2024. The Class EA involves characterizing the study area, identifying alternative solutions, assessing the potential impacts of each alternative on physical, biological/natural, cultural, socio-economic, and engineering/technical aspects, and outlining measures to mitigate any adverse effects. The Class EA process ensures that agencies, stakeholders, First Nations, community members, and the public are consulted at critical stages of the study and are given the opportunity to share comments and concerns.

This Draft Project Plan Report summarizes the Class EA process and provides a record of stakeholder consultation. The Project Plan Report is available for agency, stakeholder, and public review during a 30-day review period. Subject to the comments received on this Project Plan and the receipt of necessary approvals and funding, MVCA is expected to proceed with the implementation of the project. The implementation phase will involve preparing detailed design, tendering, and construction.

1.2 Project Background

The Kashwakamak Lake Dam is owned and operated by the MVCA. The dam is one of six (6) major dams in the Mississippi River that is used to alleviate flooding and drought. The dam structure consists of an overflow weir, two sluices that each contains 10 timber stop logs (0.3 m high x 0.3 m wide x 3.43 m long) and a small concrete saddle dam.

The Kashwakamak Lake Dam was designed and constructed initially as a lumber dam in the 1860s; however, in 1910 the dam was reconstructed and is now over 100 years old with a deteriorating concrete structure in several areas. The dam was originally owned and operated by the Mississippi River Improvement Company. Ownership and operation of the dam were transferred to the MVCA in 1991. Throughout the lifespan of the dam, several maintenance programs have been undertaken to reduce seepage and improve dam safety, including:

- 1986-1987: Concrete repairs to the weir, last documented maintenance before the transfer of ownership to MVCA.
- 1995-1996: A grouting program was undertaken along the northern embankment to inhibit seepage through the embankment. It was noted to be effective at lower water levels, however, was not effective at preventing seepage at normal operating levels.
- 2000: A grouting program for the weir and abutments was undertaken and was noted to be successful at temporarily reducing seepage. Subsequent inspections have noted further seepage through the structure.
- 2001-2003: A new wooden deck was installed at the structure.
- 2005: An overhead gantry system was installed.

Based on the findings of the 2022 Dam Safety Review, the dam was identified as showing signs of deterioration, especially the overflow weir and was stated to be in poor to fair condition. Following the outcome of the safety review, MVCA proactively updated the 10-year Capital Plan to include provisions for the environmental assessment and subsequent renewal or replacement of the dam.

1.3 Project Study Area

The Kashwakamak Lake Dam is located on the main channel of the Mississippi River, about 8 km east of Fernleigh. It is located on Lot 21, Concession 9, Clarendon Ward, within North Frontenac Township. Access to the site is via Road 506, turning onto Gutheinz Road, and proceeding along a private access road (see Figure 1-1).

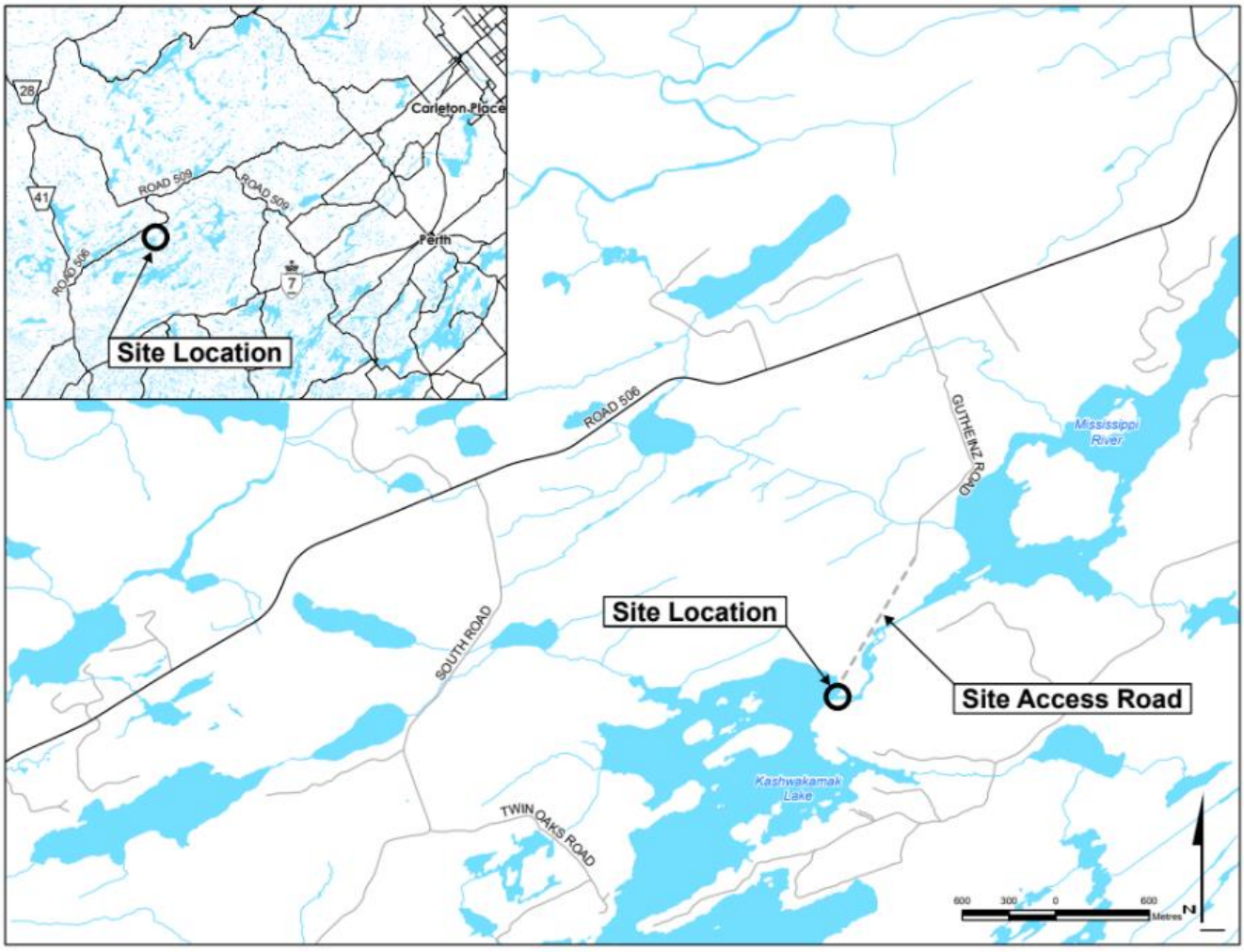

Figure 1-1: Key Plan

1.4 Project Problem Statement

The existing Kashwakamak Lake Dam was built more than 100 years ago (built in 1910) and is well beyond its design life. Based on the findings of the 2022 Dam Safety Review, the dam is showing signs of deterioration, especially the overflow weir. A decision needs to be made on whether to decommission, repair, or replace the dam. Given the age and condition of the structure, its natural heritage features, and its function as one of the six major dams managed to alleviate flooding and drought along the Mississippi River, the future of the dam must consider several constraints and opportunities such as public safety, riverine processes, flooding, climate change, cultural heritage, Indigenous rights, natural habitat, public uses and aesthetics. The Preferred Alternative must address the problem while balancing study area constraints and opportunities, in order to best meet the needs of the various stakeholder groups and interested parties.

2.0 ENVIRONMENTAL ASSESSMENT PROCESS

2.1 Ontario Environmental Assessment Act

Ontario's Environmental Assessment Act (EAA) was passed in 1975 and was proclaimed in 1976. The EAA requires proponents to examine and document the environmental effects that could result from major projects or activities and their alternatives. The EAA's comprehensive definition of the environment is:

- Air, land or water;
- Plant and animal life, including human life;
- The social, economic and cultural conditions that influence the life of humans or community;
- Any building, structure, machine or other device or thing made by humans;
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities, and
- Any part of a combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

The purpose of the EAA is the betterment of the people as a whole, or any part of Ontario, by providing for the protection, conservation and wise management of the environment (RSO 1990, c.18, s.2). It is the objective of the EAA proponents to ensure that decisions result from a rational, objective, transparent, replicable, and impartial planning process.

To meet the requirements of Ontario's EAA, class environmental assessments were approved by the Minister of the Environment in 1987 as a means of obtaining project-specific approval under the Ontario EAA. The Class EA approach streamlines the planning and approvals process for projects that are:

- Recurring;
- Similar in nature;
- Usually limited in scale;
- Predictable in the range of environmental impacts, and
- Responsive to mitigation.

2.2 Conservation Authority Class Environmental Assessment Process

The Conservation Ontario Class Environmental Assessment for Remedial Flood and Erosion Control Projects (Class EA), originally issued in January 2002 and amended in February 2024, outlines a structured process for evaluating and managing the environmental impacts of flood and erosion control projects. This Class EA provides a streamlined, standardized framework for addressing

environmental concerns associated with such projects while ensuring compliance with regulatory requirements. This Study has been completed in accordance with the planning and design process as outlined in Figure 2-1. Key aspects of the Class EA Process:

1. Pre-Planning and Screening:
    - Initial Screening: Projects are initially screened to determine if they fall within the scope of the Class EA. This involves assessing whether the project has potential environmental impacts that need to be addressed.
    - Preliminary Assessment: A preliminary assessment is conducted to identify the potential environmental effects and the level of assessment required.
2. Public and Agency Consultation:
    - Engagement: The process includes a consultation phase where input is sought from the public and relevant agencies. This helps in identifying concerns and incorporating stakeholder feedback into the planning process.
    - Review Period: A specified review period allows stakeholders to provide comments on the proposed project and its potential impacts.
3. Detailed Assessment:
    - Environmental Impact Assessment (EIA): If required, a detailed environmental impact assessment is carried out. This involves a thorough analysis of potential environmental effects, including impacts on natural resources, habitats, and communities.
    - Mitigation Measures: The assessment identifies mitigation measures to address and minimize adverse environmental impacts.
4. Decision-Making and Approval:
    - Final Review: Based on the assessment and stakeholder feedback, a final review is conducted to ensure all environmental concerns have been addressed.
    - Approval: The project proceeds to the approval stage, where necessary permits and authorizations are obtained before implementation.
5. Implementation and Monitoring:
    - Project Implementation: Once approved, the project moves to the implementation phase, which includes detailed planning, contractor selection, and construction.

- Monitoring: Post-implementation monitoring ensures that the project meets environmental standards and that any unforeseen impacts are managed effectively.

The Class EA process ensures that flood and erosion control projects are developed with a clear understanding of their environmental implications, incorporating public input and regulatory compliance throughout the project lifecycle.

2.3 Section 16 Orders

Upon completion of the Project Plan, the report is placed on public record for a minimum of 30 calendar days to allow for reviewing. A Notice of Study Completion is circulated and advertised to inform agencies, stakeholders, First Nations, interested parties, and the public that the report has been finalized and is available for viewing and providing final comments. The Notice also informs the public and other stakeholders of their right to request a Section 16 Order, including details on how and when such a request should be submitted.

Section 16 order request can be submitted to the "Minister of Environment, Conservation and Parks on the grounds that the order may prevent, mitigate or remedy adverse impacts on the existing Aboriginal and treaty rights". The Minister will not consider any requests that are not based on these grounds. The Section 16 Order process has been replaced with an additional 30-day window for the Ministry to decide if the Minister should take any action. During the additional 30 days the Minister will decide if the project will be elevated (Section 16 Order granted) or if it will be approved with conditions. If the Minister advises the proponent that the project will be approved but with conditions, the Minister has more time to draft these conditions. If there is no response from the Minister within the additional 30-days, the proponent may proceed with the project.

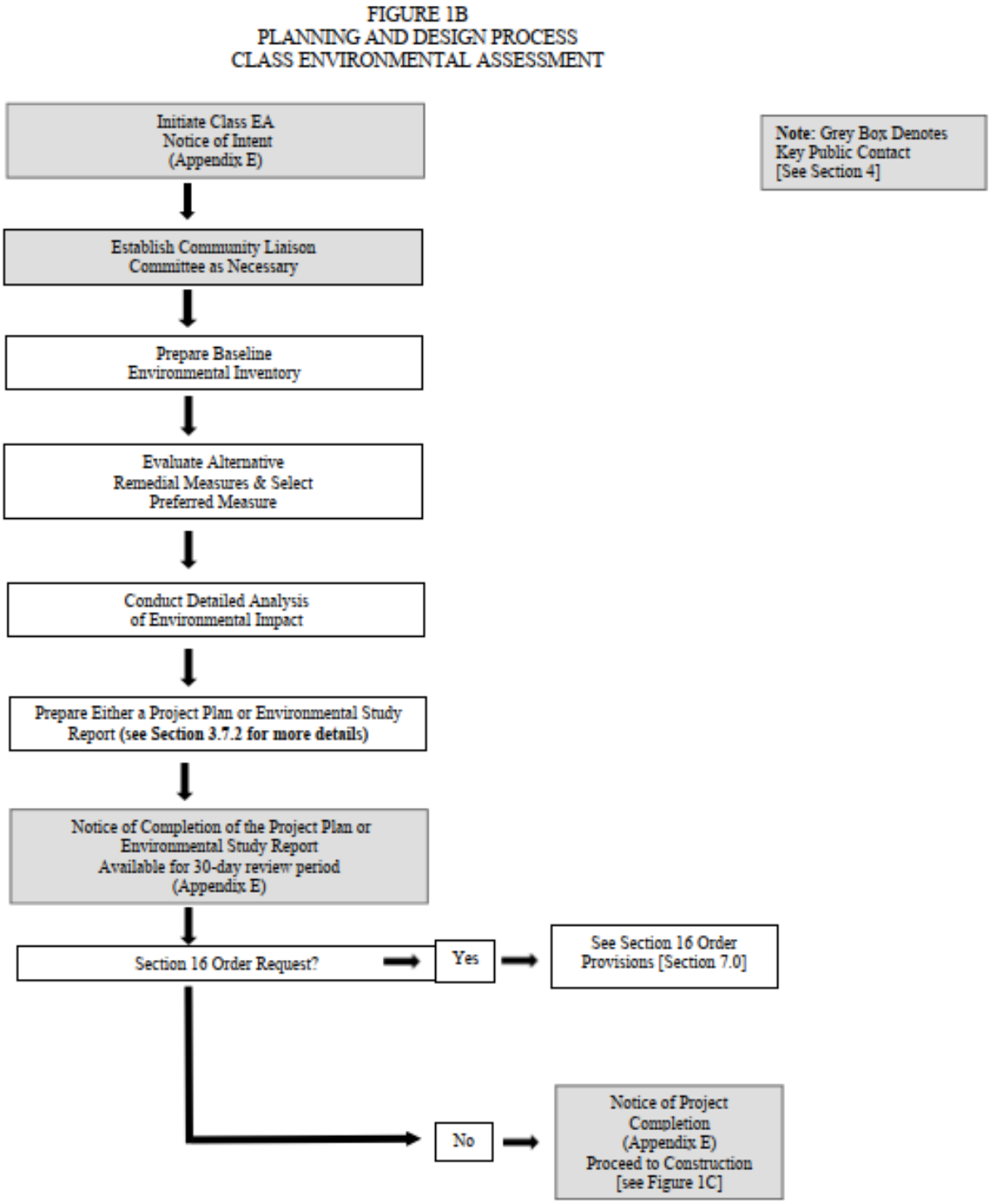

Figure 2-1: Planning and Design Process for Class Environmental Assessments

3.0 PUBLIC CONSULTATION

3.1 Public Consultation Approach

Consultation is a key component of the Class EA process. It is important for members of the community and stakeholders to provide balanced and objective information and consulting them to obtain feedback on the study process, alternatives, and recommended technically preferred alternative.

A consultation program was developed specifically for this study under the following basis:

- Present clear and concise information at key stages of the study process;
- Solicit community, regulatory and municipal staff input;
- Identify concerns related to the undertaking;
- Consider stakeholder comments when developing the technically preferred alternative; and
- Meet Class EA consultation requirements.

Consultation early and throughout the Class EA process attempts to meet the growing expectation on the part of the public that they will be consulted regarding decisions made by public decision-making bodies.

A Project Contact List was developed at the initiation of this study and was updated regularly throughout the project to add, remove or revise information as necessary. The Project Contact list includes government ministries/agencies, municipal staff, municipal elected officials, emergency services, businesses, potentially affected pubic, members of provincial parliament, First Nations and key interest groups. The Project Contact List can be found in ***Appendix A***.

Throughout the Class EA study, all notices were sent out via email and/or mailout through Canada Post, as required. Notices were also posted on the MVCA website and other social media platforms, as well as advertised in the North Frontenac News.

3.1.1 Project Website

A project website (Kashwakamak Lake Dam Class EA – MVCA) was created for the study and launched in March 2023, coinciding with the issuance of the Notice of Intent. The website was updated throughout the course of the study and provided information on the study background, notifications, links to related studies, Public Information Centre (PIC) presentations, and contact details for those interested in reaching out to the project team.

3.1.2 First Nations Consultation

Engaging with First Nations is a crucial aspect of acknowledging their stewardship of heritage. MVCA and Egis worked collaboratively with First Nations throughout this study to provide information and

seek their input and perspectives on the evaluation of alternatives and the development of environmental mitigation measures.

First Nations with potential interest in the study area were identified by MVCA and confirmed through correspondence from the Ministry of the Environment, Conservation and Parks (MECP) response letter to the Notice of Intent. This project falls within the Traditional and/or Treaty Territories of the Algonquin of Ontario, Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, Algonquins of Pikwàkanagàn First Nation, Huron-Wendat, Ardoch Algonquin First Nation, Kawartha Nishnawbe, Mohawks of the Bay of Quinte, Chippewas of Georgina Island First Nation, Chippewas of Rama First Nation, and Beausoleil First Nation. The Métis Nation of Ontario was also included on the project notification list.

Consultation with First Nations was carried out at key milestones throughout the Class EA process directly by MVCA. First Nations were included on the contact list and received notifications of the study intent, invitations to join the Community Liaison Committee (CLC), and information about the PIC via email and mail. They were encouraged to participate in the study by providing input through direct correspondence with the project team and by participating in the online PIC

Additionally, MVCA extended invitations to First Nations to participate in the Stage 2 and 3 Archaeological Assessments and marine archaeological field investigations.

3.2 Notifications and Consultation

Key consultations undertaken throughout the study with key agencies, stakeholders, and the public are listed in Table 3-1 and Table 3-2 for First Nations. All notifications have been appended to ***Appendix B***, and all consultation responses, including emails received and sent by the project team, along with a summary table, are enclosed in ***Appendix C*** for Agencies and Stakeholders and ***Appendix D*** for First Nations.

Table 3-1: Agencies, Stakeholders and Public Consultation Events

Consultation Event	Date
Notice of Intent	May 25, 2023
North Frontenac News – Notice of Intent	May 25 and June 1, 2023
CLC Expression of Interest	August 25, 2023
CLC Expression of Interest Response	September 29, 2023
Selection of CLC Members	October 6, 2023

Consultation Event	Date
CLC Meeting # 1	February 26, 2024
Notice of PIC	May 2, 2024
North Frontenac News – PIC Notification	May 2 and 9, 2024
Virtual PIC	May 23, 2024
Community Liaison Meeting # 2	August 13, 2024
Notice of Completion	November 14, 2024
North Frontenac News – Notice of Completion	November 14, 2024

Table 3-2: First Nations Consultation Events

Consultation Event	Date
Notice of Intent	May 25, 2023
CLC Expression of Interest	August 25, 2023
CLC Expression of Interest Response	September 29, 2023
Selection of CLC Members	October 6, 2023
CLC Meeting # 1	February 26, 2024
Project Notification – Stage 2 Archaeological Assessment	April 18, 2024
Stage 2 Archaeological Assessment Field Visit (First Nation attendees: Alderville First Nation and Algonquins of Pikwàkanagàn)	May 2, 2024
Notice of PIC	May 2, 2024
North Frontenac News – PIC Notification	May 2 and 9, 2024
Virtual PIC	May 23, 2024
Project Notification – Stage 3 Archaeological Assessment	August 12, 2024

Consultation Event	Date
CLC Meeting # 2	August 13, 2024
Stage 3 Archaeological Assessment Field Visit (First Nation attendees: Algonquins of Pikwàkanagàn)	August 20-22, 2024
Notice of Completion	November 14, 2024
North Frontenac News – Notice of Completion	November 14, 2024

3.2.1 Notice of Intent

The Notice of Intent was distributed by Egis on May 25th, 2023, to the project Contact List. The Notice of Intent was posted to MVCA's website. The Notice of Intent materials can be found in ***Appendix B***.

Responses received from various stakeholders as a result of the Notice of Intent, including emails received and sent by the project team and comment summary table, are included in ***Appendix C*** and ***Appendix D***.

3.2.2 Community Liaison Committee

3.2.2.1 Expression of Interest

On August 25th, 2023, MVCA and Egis contacted various organizations and advertised an opportunity for individuals to join a CLC. The CLC was established to engage interested members, gather diverse perspectives, and obtain early input at key points in the study process before reaching out to the broader public through more traditional consultation methods. The members of the CLC consisted of:

- Three (3) members of the public who expressed an interest in the project and that own or lease property abutting or within 20 km of the Kashwakamak Lake Dam;
- One (1) member representing the Township of North Frontenac;
- One (1) member representing the Kashwakamak Lake Association (KLA), and
- One (1) member representing each of the identified Indigenous Communities.

Two (2) meetings occurred during the EA process:

- To provide an overview of the project, objectives and process, and
- To consider proposed alternative solutions and provide feedback into the evaluation and selection of the Technically Preferred Alternative.

3.2.2.2 CLC Meeting #1

MVCA and Egis hosted the first virtual CLC meeting on February 26th, 2024 from 2:00 to 4:00 p.m. All six members, including the representative from Hiawatha First Nation, were in attendance. During the meeting, Egis presented an overview of the project, which included details on the study area, project understanding, and scope, the Class EA process, and the team's engagement and consultation activities undertaken to date. Additionally, Egis presented the current findings from the natural heritage, archaeology, and cultural heritage investigations, as well as the proposed alternative solutions, evaluation criteria and matrix, and the recommended technically preferred alternative.

Key feedback from CLC Meeting #1 is summarized in the table below (Table 3-3). For complete meeting minutes from CLC Meeting #1, please refer to ***Appendix E***.

Table 3-3: Summary of Key Comments from CLC Meeting #1

Comment Received	MVCA/Egis Response
Will the water levels be maintained at the same level?	The new dam will ensure that water levels and the water management plans be maintained and even improve as a result of the new structure functioning and operating more efficiently.
When will construction start on the dam?	Construction on the dam will likely start in 2-3 years (fall 2026 or 2027) after the completion of the EA, the design, the tendering process, and obtaining permits.
What are the potential impacts of the dam on Manòmin?	MVCA responded that the data collected cannot be correlated since they do not typically survey the downstream area and they do not have data from before the dams were built to establish a baseline condition. However, there is another dam located between Kashwakamak Lake Dam and the Ardoch community to allow for buffering and additional protection of the Manòmin. MVCA also noted that in the structure operating plan, there are certain times of year when there needs to be stable flow and water levels to maintain the rice crop populations, and the dam is operated accordingly.
How the water level will be controlled during the replacement of the dam?	MVCA noted that the installation of temporary coffer dams with a staged construction plan to maintain water levels during replacement or other construction works would mitigate impacts.

3.2.2.3 CLC Meeting #2

MVCA and Egis hosted the second virtual CLC meeting on August 13th, 2024, from 1:00 to 3:00 p.m. Four of the six members attended, but unfortunately, the Mayor of the Township of North Frontenac and the representative from Hiawatha First Nation were unable to attend. During the meeting, Egis provided an update on the Class EA process, presented the findings from the Stage 2 Archaeological Assessment (Stage 2 AA), and outlined the requirements for a Stage 3 AA. Additionally, an overview of the comments received during the PIC was provided, along with a summary of the responses from MVCA and Egis. The presentation also identified the recommended technically preferred alternative, which will be presented to the MVCA Board of Directors for approval.

Key feedback from CLC Meeting #2 is summarized in the table below (Table 3-4). For complete meeting minutes from CLC Meeting #2, please refer to ***Appendix E***.

Table 3-4: Summary of Key Comments from CLC Meeting #2

Comment Received	MVCA/Egis Response
Will the water levels be maintained at the same level?	The new dam will ensure that water levels and the water management plans be maintained and even improved as a result of the new structure functioning and operating more efficiently.
Cottagers have expressed concerns about lowering the lake's water level too much, as it could cause the pumps that draw water from the lake to freeze. Some cottages rely on this water source.	MVCA noted that they will follow up with the lake association to get further information to determine a feasible plan to address the impacts.
Is there a contingency plan in place if the dam is not completed on schedule or if the water levels rise earlier than expected?	Egis PM confirmed that there will be a contingency plan, however it will be developed during detailed design. MVCA also confirmed that it is too early in the project to provide details on construction planning, but a contingency plan will be developed in the coming stages of the project.
Is there an immediate risk of the dam failing and which downstream communities could be impacted?	The dam is continuously observed and monitored by the MVCA as part of a monthly monitoring program. MVCA noted that the community of Ardoch is the closest downstream and that any breach wave impact would be mitigated by the Farm Lake dam. Dam failure during construction is not anticipated, and the construction process,

Comment Received	MVCA/Egis Response
	which will be carried out in stages, is not expected to increase the risk of failure.

3.2.3 Public Information Centre

MVCA and Egis hosted a virtual PIC via Zoom on May 23rd, 2024, from 4:00 to 6:00 p.m. The event featured a formal presentation by Egis, followed by an open question-and-answer period.

The Notice of PIC was distributed via email and Canada Post on May 2nd, 2024 to agencies, stakeholders, First Nations, interest groups, and the public. It was also posted on the MVCA website and advertised in the North Frontenac News on May 2nd and 9th, 2024.

Fourteen attendees participated in the PIC, including the Mayor of the Township of North Frontenac and one representative from Hiawatha First Nation. A total of 15 comments were received during the PIC, with three additional email responses received afterward.

The purpose of the PIC was to share information related to the study background, the Class EA process, existing study area conditions, project overview and understanding, evaluation of alternative solutions, identification of the recommended alternative, and next steps in the Class EA process, as well as to provide an opportunity for attendees to share comments and concerns pertaining to the study.

The Notice of PIC requested that all comments be submitted by June 20th, 2024. Following the PIC, the presentation and recording were made available on the MVCA's website (Kashwakamak Lake Dam Class EA – MVCA) to provide information and allow further opportunity for the public to review and comment.

The Notice of PIC and presentation materials are available in ***Appendix F***. Formal written comments and responses are included in ***Appendix C***.

Key feedback received during the PIC is summarized in the table below (Table 3-5).

Table 3-5: Summary of Key Comments and Responses from PIC

Comment Received	MVCA/Egis Response
Will the water levels be maintained at the same level?	The new dam will ensure that water levels and the water management plans be maintained and even improved as a result of the new structure functioning and operating more efficiently.

Comment Received	MVCA/Egis Response
What mitigation measures will be implemented during construction?	The mitigation measures will be further outlined and assessed during the design stage. However, it is anticipated that it will include the implementation of a temporary bypass system to dewater and reroute the water prior to construction, and a sediment and erosion plan to mitigate erosion impacts during construction. From a Natural Heritage perspective, timing windows and a few other mitigation measures will be implemented to protect fish, bats, turtles, vegetation and other species.
What are "temporary impacts"?	Temporary impacts could be during construction an earlier drawdown of the lake may be required around September-October.
Will notification be given prior to change in water levels?	It was acknowledged that the lake is widely used for many recreational and tourist activities. MVCA will try to choose the timing that will have the least impact and accommodate the users of the lake. MVCA will have a plan in place to inform everyone affected by the earlier changes in water level. Adequate notification will also be provided to local marinas prior to reducing water levels, so they are prepared for the surge of boats at that time.
Is there an immediate risk of the dam failing?	There is no immediate risk of dam failure. The existing dam has significant deficiencies due to its age, which, if not addressed, would pose a greater risk of dam failure. The dam is continuously observed and monitored by the MVCA as part of a monthly monitoring program.
What is the timeline for the whole project getting underway, including the demolition and lowering of lake levels?	The next phase of the project will be preliminary and detailed design, which MVCA will be initiating in 2025-2026. Following the design phase, permits will need to be acquired. Therefore, construction is currently expected to occur in the Fall of 2026 at the earliest.
How will this project be funded, and will there be additional impact on the municipality in terms of	MVCA noted that they were successful in securing both federal and provincial funding for the project: • Granted federal funding through the Disaster, Mitigation, and Adaptation Fund program, which is run

Comment Received	MVCA/Egis Response
additional pressure on their budgets?	by Infrastructure Canada. Federal funding is provided for up to 40% of eligible project costs. • Granted provincial funding through the Water, Erosion, and Control Infrastructure program, which is delivered through a municipal-provincial-conservation authority partnership. Provincial funding is provided for up to 50% of the remaining project balance. The remainder of the project costs are assumed by the MVCA. The project is eligible for Category 1 funding, meaning that all of the member municipalities within the jurisdiction contribute towards the reconstruction of the dam to some level.

Full meeting minutes were prepared for the PIC, and can be found in ***Appendix E***.

3.2.4 Notice of Completion

A Notice of Completion was distributed on November 14, 2024, to the project contact list (***Appendix A***). The Notice of Completion was posted on the MVCA's website and advertised in the North Frontenac News on November 14, 2024. The Notice of Completion can be found in ***Appendix E***.

The Notice of Completion was issued to announce the start of the 30-day public review period for the Project Plan Report prepared as part of this Class EA. It informed interested parties that they could submit comments to the project team within 30 calendar days from the beginning of the review period. The notice also indicated that a Section 16 Request could be made to the MECP to seek an order for a more detailed study (i.e., an individual or comprehensive EA approval) or to impose conditions (e.g., requiring additional studies). Such requests would only be considered on the grounds that it may prevent, mitigate or remedy adverse impacts to constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered.

Responses received during the 30-day public review period will be summarized in the Project File Report following the review period.

4.0 INVENTORY OF EXISTING CONDITIONS

This section provides an overview of the background information (secondary sources) and the results of the field investigations conducted specifically for this study. The following sections summarize the existing natural, socio-economic, and cultural environments of the Kashwakamak Lake Dam. This information will support the development and evaluation of alternative solutions and the identification of potential impacts and mitigating measures.

4.1 Existing Kashwakamak Lake Dam

4.1.1 Watershed Management

In 2006, the Ministry of Natural Resources (MNR), along with hydro power producers and the MVCA, developed the Mississippi River Water Management Plan (MRWMP) in line with the Lakes and Rivers Improvement Act. This plan outlines the operating ranges (upper and lower water level/flow targets) and management strategies for the primary water control structures throughout the river system. Under the Conservation Authorities Act, the MVCA is responsible for flood and erosion control, flood forecasting and warnings, and providing expertise on land use planning issues related to flood risks and other hazards.

The Mississippi River Watershed Plan (MRWP), developed by MVCA in 2021, provides a strategic framework for the management and conservation of the Mississippi River watershed in eastern Ontario. This plan addresses key issues such as water quality, flood and drought control, power generation, natural habitat protection and supports recreational/tourism, with a focus on maintaining ecological health and enhancing community resilience. It integrates scientific data, stakeholder engagement, and policy guidance to tackle challenges related to land use, climate change, and resource management. By fostering collaborative efforts among local governments, conservation groups, and residents, the plan aims to ensure the sustainable use and preservation of the watershed's resources, promoting a balanced approach that supports both environmental sustainability and regional development.

The Kashwakamak Lake Dam study area lies within Kashwakamak Lake which is located in the upper reaches of the Mississippi River, within the Township of North Frontenac. The Mississippi River Watershed is composed of a complex network of rivers, streams, rapids and over 250 lakes located in Eastern Ontario and has an overall watershed catchment area of 3,765 km^2 (Figure 4-1).

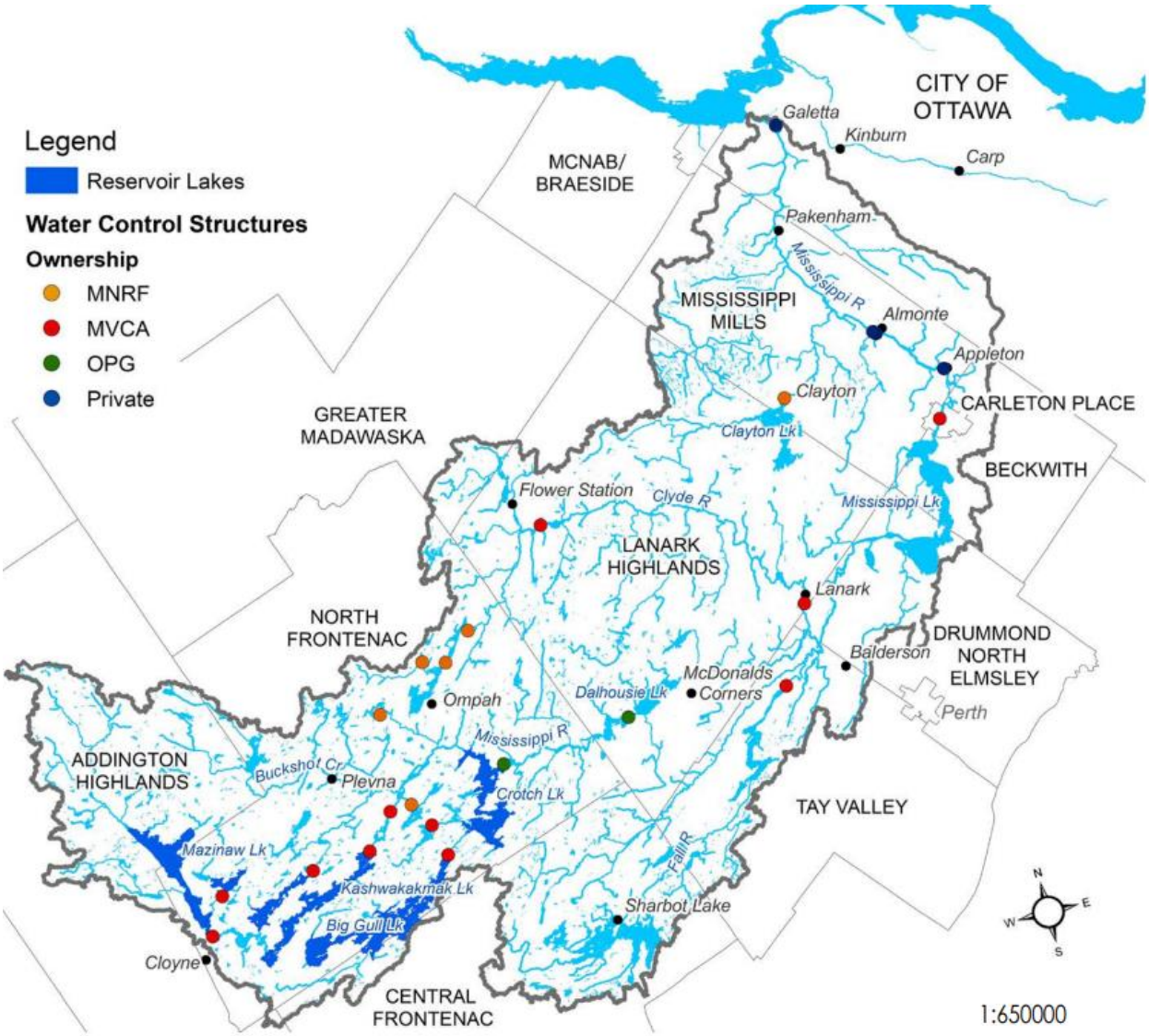

Figure 4-1: Water Control Structures and Reservoir Lakes (source: MRWP, 2021)

The key function of the Kashwakamak Lake Dam within the Mississippi River Watershed Plan, managed by the MVCA, is to regulate water levels and manage flow within the Mississippi River watershed. This dam plays a crucial role in controlling water storage and release to mitigate flood risks, ensure stable water levels for ecological health, and provide reliable water resources for local communities. Additionally, it helps to maintain water quality and supports recreational activities by balancing the water flow throughout the watershed, which is vital for sustaining both the environmental and socio-economic aspects of the region.

For comprehensive details regarding the Mississippi River Watershed Plan (MRWP, 2021) and the Mississippi River Water Management Plan (MRWMP, 2006, and as amended), please refer to the MVCA website where reports can be viewed separately.

4.1.2 Dam Configuration and Operation

The Kashwakamak Lake Dam is a concrete structure consisting of two sluices with each containing 10 timber stop logs (0.30 m x 0.30 m x 3.43 m) and an overflow weir with a crest elevation of 261.06 m, as well as a small concrete saddle dam that is located approximately 60 m to the north of the main dam and runs adjacent to the access road. The main dam controls a drainage area of 415 sq. km with a total storage volume of 3,822 ha. m (38,220 m^3). Immediately upstream of the dam there is a safety boom, and downstream there are existing rock embankments and outcrops.

The dam is one of the major dams along the Mississippi River that is used to alleviate flooding and drought. The dam has manually operated gates with elevations ranging between 258.22 m to 261.22 m. The dam is operated throughout the year. During the spring freshet, the dam is operated to gradually increase lake levels to meet summer requirements while minimizing shoreline damage caused by ice movement. The objective is to raise the reservoir to summer levels before the walleye spawning period. Throughout the summer, lake levels are maintained between 261.00 m and 261.22 m, with a minimum baseline flow ensured at all times. In the fall, drawdown begins after the Thanksgiving weekend and continues until 14 of the 20 stoplogs are removed. Winter lake levels are typically achieved by December (range from 259.55 m to 259.70 m), with a gradual decline following until the spring freshet.

Photos: Overflow weir of main dam (left), Kashwakamak Lake Dam (overflow weir and two sluices gates, middle), and saddle dam (right).

4.1.3 Dam Condition

In 2022, Hatch conducted a Dam Safety Review (DSR) of the Kashwakamak Lake Dam, encompassing an assessment of the geotechnical, hydrotechnical, and structural components of the water-retaining structures. This review represented the second DSR performed by Hatch on the dam; the initial review was completed by Trow in 2006, followed by a Conditions Assessment of Concrete Structure by Cleland Jardine Engineering Limited in 2016 and a Dam Safety Risk Assessment by Hatch in 2020 to evaluate the dam and its associated structures.

The results of the 2022 site inspection indicated that the Kashwakamak Lake overflow weir is deteriorating and in poor condition. While there were no indications that the structural integrity of the weir or adjacent sluiceway has been compromised, repairs should be made to correct the concrete deterioration evident at the overflow weir to prevent further deterioration and loss of sections within the planned five-year time period. In particular, substantial concrete repairs are necessary for the overflow structure, which has long displayed significant spalling on the upstream face and a heavily deteriorated horizontal joint at the toe, where previous repairs have been ineffective.

Photos: South abutment wall (left), overflow weir (middle), and saddle dam (right).

Based on previous dam inspection (2016) and the Dam Safety Inspection Report (2022), a few key deficiencies were noted:

- The dam abutments have insufficient freeboard. Freeboard acts as a safety margin to accommodate fluctuations in water levels caused by wind and wave action without risking overtopping of the structure;
- The overflow weir and abutments do not meet current standards for ice loading from the lake;
- The dam was originally constructed using outdated methods and materials, which may present significant challenges for rehabilitation;
- All concrete structures are observed to be deteriorating, with conditions rated as poor to fair; and
- Given the dam's age (over 100 years), it was designed according to outdated Hazard Potential Classification and Inflow Design Flood criteria.

For further details pertaining to the condition of the existing dams, refer to the Dam Safety Assessment (Trow, 2006), Dam Safety Risks Assessment (Hatch, May 2020), Dam Safety Review (Hatch, March 2022), and MVCA's annual Dam Safety Inspections prepared under separate cover.

4.1.4 Hydrologic and Hydraulic Assessment

4.1.4.1 Hydrology Review

Hydrologic data for this study was acquired through a review of the reports and models provided by the MVCA at the onset of this assignment:

- Pre-Engineering Study, Kashwakamak Lake Dam (Terraprobe, January 1997);
- Kashwakamak Lake Dam Study (Terraprobe, July 1998);
- Kashwakamak Lake Dam Feasibility Study (EGA, August 1998);
- Kashwakamak Lake Dam Operation, Maintenance & Surveillance Manual (MVCA, October 2013);
- Dam Safety Assessment, Kashwakamak Lake Dam (Trow, November 2006);
- Kashwakamak Lake Dam Condition Assessment of Concrete Structure (Cleland Jardine, February 2016);
- Kashwakamak Lake Dam Structural Assessment (Hatch, May 2020);
- Kashwakamak Lake Dam Safety Review (Hatch, March 2022);
- HEC-HMS Model for the Mississippi River (J. Perdikaris, May 2023), and
- Hydrology Memorandum (Innovative Defensive Options, September 2023).

A comprehensive hydrologic study for the Mississippi River was completed using HEC-HMS software by J. Perdikaris in May 2023. Various combinations of input for the modelling approaches were developed in the hydrologic model (event-based or continuous storms, Green-Ampt or soil moisture accounting soil infiltration, and outflow curve or specified release method for downstream conditions). After a review of hydrology data, it was noted that additional scenarios would be required to complete the hydraulic analyses for the Kashwakamak Lake Dam EA study.

Additional scenarios for input to the hydraulic models were provided, and hydrographs for storm events with 2- to 1000-year return periods and the probable maximum flood (PMF) were developed and validated in the Hydrology Memorandum by Innovative Defense Options (September 2023). Simulations accounting for the climate change impact were also completed and provided. Hydrographs for the storm events referred to as 1/3 PMF and 2/3 PMF (the 1000-year storm plus 1/3 of the difference between the 1000-year event and the PMF, and the 1000-year storm plus 2/3 of the difference between the 1000-year event and the PMF) were derived from the 1000-year and PMF hydrographs.

The MVCA hourly lake level data ranging from December 1993 to October 2023 was obtained to perform a statistical analysis. As a result, the mode of the lake level data was calculated to be 261.15 m. Additionally, it was noted from the data that the lake level is maintained between 261.10 m to

261.20 m approximately 39% of time. Therefore, the initial lake level was taken to be 261.15 m, as this can be considered the most representative operational water level for Kashwakamak Lake.

4.1.4.2 Hydraulic Analysis

Egis undertook a hydraulic analysis of the Kashwakamak Lake Dam using HEC-RAS software. MVCA provided a hydraulic model developed by Hatch for the Kashwakamak Lake Dam Safety Review (March, 2022). A LIDAR survey and a bathymetric survey (2023) was conducted by MVCA. The elevation data was then incorporated into the hydraulic model. The model extends from the Kashwakamak Lake Dam to 12.5 km downstream. There are two sharp elevation changes along the river course with a drop of approximately 17 m over the model extent. The dam was modelled as an inline structure with gated sections. The crest elevation of the saddle dam was indicated by previous reports and design drawings to be 261.66 m. Therefore, the saddle dam will be overtopped during any scenario where the Kashwakamak Lake water surface elevation exceeds the crest.

The hydraulic analysis of the Kashwakamak Lake Dam was conducted for several scenarios, including normal conditions, the probable maximum flood, and climate change projections. This analysis aimed to evaluate potential impacts on life safety, property, environmental factors, and cultural heritage assets. Furthermore, the extent of potential impacts on the surrounding area in the event of a failure was evaluated. This assessment helped confirm the Hazard Potential Classification (HPC) of the Kashwakamak Lake Dam.

HEC-RAS base condition plans were initially created for 100-year, 1000-year, 1/3 PMF, 2/3 PMF, and PMF scenarios. These plans were then expanded with the climate change scenario, dam break scenario (DBS), and a combination of climate change plus dam break. The lake level, inflow, and outflow data for Kashwakamak Lake and Kashwakamak Lake Dam were taken directly from the HEC-RAS model results from the above noted scenarios.

For the analyses of the impacted properties, in addition to the scenarios described above, the 'normal' event was modelled to represent the lake and dam on a day with no flooding events. A peak inflow of 10 m^3/s for Kashwakamak Lake was assumed to model the normal event. This value was taken as it is large enough to stabilize the model while still representing a scenario without other flood events.

The floodplains for these events (normal, 100-year, 1000-year, 1/3 PMF, 2/3 PMF, and PMF) without climate change were created to evaluate the impacts. No permanent residences were identified to intersect the floodplain limits. Although other structures such as boathouses and sheds were found to be impacted, only the seasonal residences impacted were considered in the hazard potential classification evaluations.

As described in the MNR Technical Bulletin for Classification and Inflow Design Flood Criteria (2011), the range of minimum Inflow Design Floods (IDF) based on the dam HPC are summarized in the table below (Table 4-1) and are used in the design of the dam. The HPC for Kashwakamak Lake Dam and saddle dam were determined to be moderate and low, as described in the following Section 4.1.5, and thus the IDF for the dam should range from the 100-year flood to the 1000-year flood or regulatory flood events, whichever is greater. Therefore, as a conservative approach, the worst case of the 1000-year and 100-year flood event was selected as the IDF for the main dam and the saddle dam, respectively.

Table 4-1: Range of Minimum Inflow Design Floods (Adapted from MNR, 2011)

<table>
<tr><th rowspan="2">Hazard Potential Classification</th><th colspan="4">Range of Minimum Inflow Design Floods</th></tr>
<tr><th colspan="2">Life Safety</th><th>Property and Environment</th><th>Cultural – Built Heritage</th></tr>
<tr><td>Low</td><td colspan="4">25-year Flood to 100-year Flood</td></tr>
<tr><td>Moderate</td><td colspan="4">100-year Flood to 1000-year Flood or Regulatory Flood whichever is greater</td></tr>
<tr><td>High</td><td>Potential loss of life of 1-10</td><td>1/3 between the 1000-year Flood and PMF</td><td>1000-year Flood or Regulatory Flood which ever is greater to 1/3 between the 1000-year Flood and PMF</td><td rowspan="3">1000-year Flood or Regulatory Flood whichever is greater</td></tr>
<tr><td rowspan="2">Very High</td><td>Potential loss of life of 11-100</td><td>2/3 between the 1000-year Flood and PMF</td><td rowspan="2">1/3 between the 1000-year Flood and PMF to PMF</td></tr>
<tr><td>Potential loss of life of 100 or more persons</td><td>PMF</td></tr>
</table>

Freeboard calculations were completed considering wind and wave impacts, as is generally done for dams and per MNR requirements. Wind setup and wave runup for the site are calculated separately and combined to compare the existing crest elevation of the structures. A minimum freeboard of 0.60 m was adopted based on the fetch distance of 780 m, as per the MNR Technical Bulletin for Spillways and Flood Control Structures (August, 2011) and the provincial guidelines applicable to this site. The freeboard calculations, water surface elevations (WSE), and flow information for the climate change scenarios are presented in the table below (Table 4-2).

Based on the calculations, the minimum freeboard requirements for the abutments and saddle dam are not met. The south abutment, north abutment, and saddle dam are required to be raised by 0.36 m (to an elevation of 261.99 m), 0.32 m (to an elevation of 261.99 m) and 0.19 m (to an elevation of

261.85 m), respectively. However, it is recommended to adjust the saddle dam crest elevation to 261.99 m (or approximately 262.0 m) to be consistent with the abutment walls.

An existing natural channel east of the saddle dam and access roadway would function as an overflow channel when the saddle dam is overtopped. Under the proposed conditions, converting the saddle dam to an emergency spillway could be considered to maintain the existing conditions. The future access roadway should be designed to allow the overflow and convey it towards the downstream channel during flood events.

Table 4-2: Summary of Freeboard Calculations

Features	Weir	Stop Logged Gates	South Abutment	North Abutment	Saddle Dam
Dam Hazard Potential Classification[1]	F: Moderate, NF: Moderate				F: Low, NF: Low
Inflow Design Flood (IDF) Selection Criteria (MNR 2011)	100-year to the 1000-year or Regulatory Flood whichever is greater				25-year to the 100-year
IDF Selected	1000-year				100-year
IDF (1000-year) (m^3/s) (With Climate Change)	99 (123)				73 (91)
Maximum Design Earthquake (MDE) AEP	1000-year				500-year
Structure Crest Elevation (m)	261.06	262.62	261.63	261.67	261.66
Winter Drawdown Level (m)	259.59				
Maximum Normal Lake Operating Level (m)	261.20				
IDF Level (m) (With Climate Change)	261.39 (261.47)				261.25 (261.33)
Stop Log Status	n/a	All Removed	n/a	n/a	n/a
Peak Inflow (m^3/s)	99		n/a	n/a	n/a
Peak Inflow Volume (1000 m^3)	17.9		n/a	n/a	n/a
Peak Outflow (m^3/s)	48		n/a	n/a	n/a
Peak Outflow Volume (1000 m^3)	15.2		n/a	n/a	n/a
Fetch (m)	780				
Minimum Freeboard Criteria (m) (MNR 2011)	0.60				
Wind Set-up IDF (Normal) (m)	0.01 (0.02)				
Wave Run-up IDF (Normal) (m)	0.34 (0.59)				

Features	Weir	Stop Logged Gates	South Abutment	North Abutment	Saddle Dam
Total Wind Setup & Wave Runup IDF (Normal) (m)	0.35 (0.61)				
Freeboard Normal Conditions (m)	n/a	n/a	-0.17	-0.13	-0.14
Freeboard IDF Conditions (m) As per MNR 0.60 m minimum [2] criterion	n/a	n/a	*-0.36*	*-0.32*	*-0.19*
Assessment of Freeboard (Normal)	n/a	n/a	Inadequate	Inadequate	Inadequate
Assessment of Freeboard (IDF)	n/a	n/a	Inadequate	Inadequate	Inadequate

Notes:
1. F refers to "Flooding" in a dam-break scenario, whereas NF is "non-Flooding" in the same context.
2. Due to the calculated freeboard (0.36 m) is smaller than the MNR minimum requirement, the minimum is applied in the calculations.

For further details pertaining to the hydraulic analysis, refer to the Hydraulic Analysis Memorandum (Egis, May 8, 2024, Rev.2) appended in ***Appendix G***.

4.1.5 Dam Classification

The Ontario MNR has developed the Hazard Potential Classification (HPC) system to evaluate the potential hazards caused by the uncontrolled release of a reservoir, due to failure of the dam structure or appurtenances, such as gates or stoplogs. Additionally, the MVCA prepared a Methodology for Determining Environmental Losses & Classification memorandum in March 2024, which provided further details to supplement the MNR criteria.

The HPC is determined by assessing the greatest incremental losses that could occur in the event of a dam failure and is split into four categories: (1) life safety, (2) property losses, (3) environmental losses, and (4) cultural / built heritage losses. An incremental loss is defined as losses from dam failure in excess of losses from a similar event (flood, earthquake, etc.) but without failure of the dam.

The final Hazard Potential Classifications for the given categories are summarized in the below table (Table 4-3).

Table 4-3: Hazard Potential Classification Assessment

Hazard Potential	Life Safety	Property Losses	Environmental Losses	Cultural and Built Heritage Losses
Class	Moderate	Moderate	Moderate (Fish and Fish Habitat)	Low
			Low (SAR, Wildlife, and Manòmin)	

The overall hazard potential class for the existing Kashwakamak Lake Dam structure, including the overflow weir, sluiceway (gated section), and the north and south abutments is concluded to be moderate, as per the MNR Technical Bulletin (2011). The proposed design options for replacing or rehabilitating the Kashwakamak Lake Dam will be consistent with the current conditions. Therefore, the HPC will be maintained, and the future structure will also have a moderate hazard potential.

The hazard potential class for the saddle dam is assessed to be low due to its location, height, length, and functionality. The saddle dam is not used for any operational purposes and is located immediately west of the access road. Any incremental impact due to the saddle dam failure would be none to low.

For further details pertaining to the HPC, refer to the Hydraulic Analysis Memorandum (Egis, May 8, 2024, Rev.2) and the Methodology for Determining Environmental Losses & Classification Memorandum (MVCA, March 2024) appended in ***Appendix G***.

4.2 Natural Heritage Environment

Egis staff conducted a field investigation on June 6th, 2023, to inspect the study area for any natural environmental features (e.g., fish habitat, ecological land classification, SAR bat habitat, etc.). Conditions were warm (20 °C) and cloudy with 100% smog/cloud cover. The field investigations included a walkthrough of the study area to document existing conditions (i.e., Ecological Land Classification (ELC)) and document SAR and their habitat. Areas within the study area, where access was not permitted, or inaccessible, were observed using binoculars. The study area was inspected for hollow and snag trees that may be suitable for bat maternity roosting habitat, as well as Butternut and Black Ash within 25 m of the Kashwakamak Lake Dam.

The vegetation communities observed within the study area were characterized using the ELC protocol (Lee et al., 1998) and delineated on an aerial photograph. During the field investigations, observations of wildlife species were made through sight, sound, and physical evidence.

For full details pertaining the findings of the natural heritage investigation, refer to the Kashwakamak Lake Dam Natural Heritage Existing Conditions Memorandum prepared by Egis (February 20, 2024) enclosed in ***Appendix H***.

4.2.1 Fish and Aquatic Systems

Land Information Ontario (MNR 2023b) identifies Kashwakamak Lake as having a cool - warmwater thermal regime with fish present. The lake, and the Mississippi River downstream of the dam, provides permanent fish habitat where potentially suitable spawning habitat may be present both upstream and downstream of the study area. Spawning habitat is potentially present for Walleye, White Sucker, and bait fish (i.e., minnow sp.) downstream within the Mississippi River, with spawning habitat potentially present for Largemouth Bass, Smallmouth Bass, Sunfish species (Lepomis sp.), and bait fish species upstream (Figure 4-2).

There is a large population of Walleye that are known to occur at Kashwakamak Lake, where spawning takes place at the main inlet at Whitefish Rapids (flowing from Marble Lake) and several other locations along the north shore of the lake (MRWMP, amended 2020). Whitefish Rapids is approximately 14 km upstream of the Kashwakamak Dam structure. Additional species that are known to spawn in the lake include Bass and Northern Pike. Bass have been observed to spawn throughout the lake in shallow bays, while Northern Pike are known to spawn at two locations in the extreme eastern end of the lake (MRWMP, amended 2020). As such, water levels must be maintained high enough in the early spring for successful Walleye spawning (260.5 m) and Bass spawning (261.1 m) in June. Northern Pike do not require operational constraints (MRWMP, amended 2020).

The Department of Fisheries and Oceans (DFO) does not identify any aquatic SAR or SAR habitat within the study area.

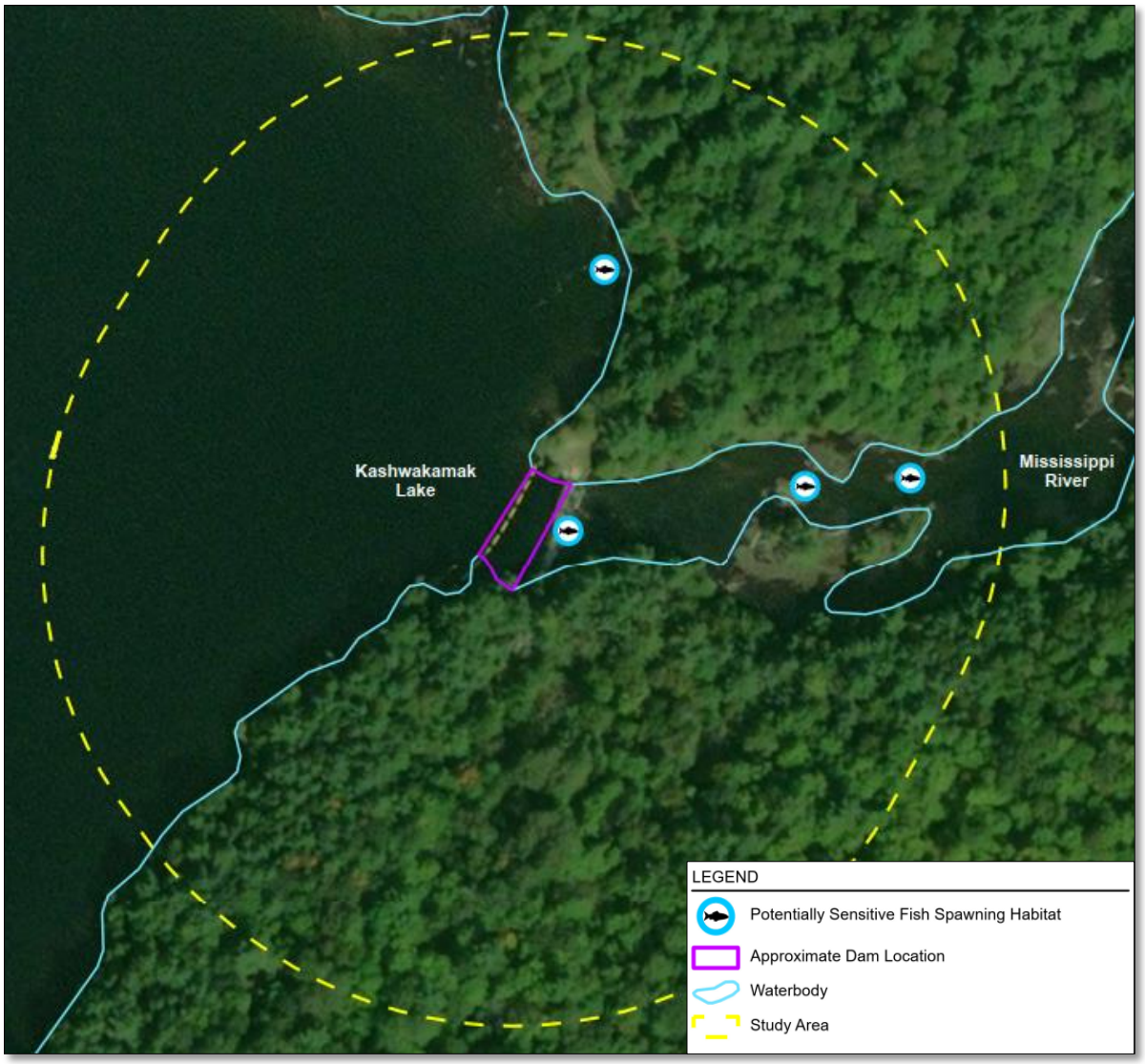

Figure 4-2: Fish Spawning Habitat

4.2.2 Terrestrial Ecosystems

Terrestrial ecosystems involve the interaction of land, air, water, and biotic components (e.g., vegetation, wildlife) functioning as an ecological unit over space and time (MTO, 2013a). Existing vegetation and wildlife within the study area was observed to be characteristic of the Eastern Ontario landscape.

4.2.3 Vegetation

The vegetation cover within the study area consisted of one vegetation community surrounding the dam, which was a Mixed Forest (FOM) that is characteristic of Ecodistrict 5E-11. The dominant tree

species that were observed were Eastern hemlock (*Tsuga canadensis*) and Eastern white cedar (*Thuja occidentalis*) with American elm (*Ulmus americana*), American beech (*Fagus grandifolia*), white pine (*Pinus strobus*), red oak (*Quercus rubrum*), and paper birch (Betula papyrifera) occurring occasionally.

The area immediately surrounding the dam has been cleared for the access road and has a trail that runs along it for portaging, where herbaceous species such as common dandelion (*Taraxacum officinale*), Canada columbine (*Aquilegia canadensis*), cow vetch (*Vicia cracca*), Philadelphia fleabane (*Erigeron philadelphicus*), red clover (*Trifolium pratense*), Mayflower (*Maianthemum canadense*), grass species (Poa sp.) and royal fern (*Osmunda regalis*) were commonly encountered. Occasionally occurring herbaceous species were blue cohosh (*Caulophyllum thalictroides*), wild strawberry (*Fragaria vesca*), common milkweed (*Asclepias syriaca*), indian tobacco (*Lobelia inflata*), and northern bugleweed (*Lycopus uniflorus*).

4.2.3.1 Invasive and Noxious Plant Species

There were no plant species listed as Restricted under the Invasive Species Act (2015) observed to be present within the study area during the 2023 field investigation.

4.2.3.2 Significant Woodlands

There are no significant woodlands present within the study area. Though the provincial NHIC (2023a) database, as well as the Townships' Official Plan (2017), the identifies woodlands as being present within the study area, this layer, however, does not identify the woodlands as being significant.

4.2.3.3 Significant Wetlands

There are no significant wetlands present within the study area based on background review and field truthing. However, there are several small wetlands around the perimeter of the lake and downstream of the dam (i.e., Mud Lake Provincially Significant Wetland, Figure 4-3).

4.2.3.4 Culturally Significant Plant Species

Manòmin, or wild rice, is an aquatic annual species of grass of cultural significance to the Algonquin First Nations. The species grows in brackish marshes, lacustrine, riverine, or along shored habitats where the water depth ideally ranges from 15 – 90 cm with a soft soil layer on the bottom (OMAFRA, 2012). The species is sensitive to changes in temperature and water levels, with an ideal temperate range of between 17 – 21 °C. Wild rice is also important for several different species, as it provides food for waterfowl and habitat for furbearing mammals, snails and insects (MRWMP, amended 2020).

Manòmin, although not present in Kashwakamak Lake, is found growing in Mud Lake which is approximately 7 km downstream from Kashwakamak Lake and subsequently affected by alterations to

water levels (MRWMP, amended 2020). Manòmin is sensitive to changes in water levels, as low levels can cause them to dry out and destroy seed beds, with high water levels causing them to drown.

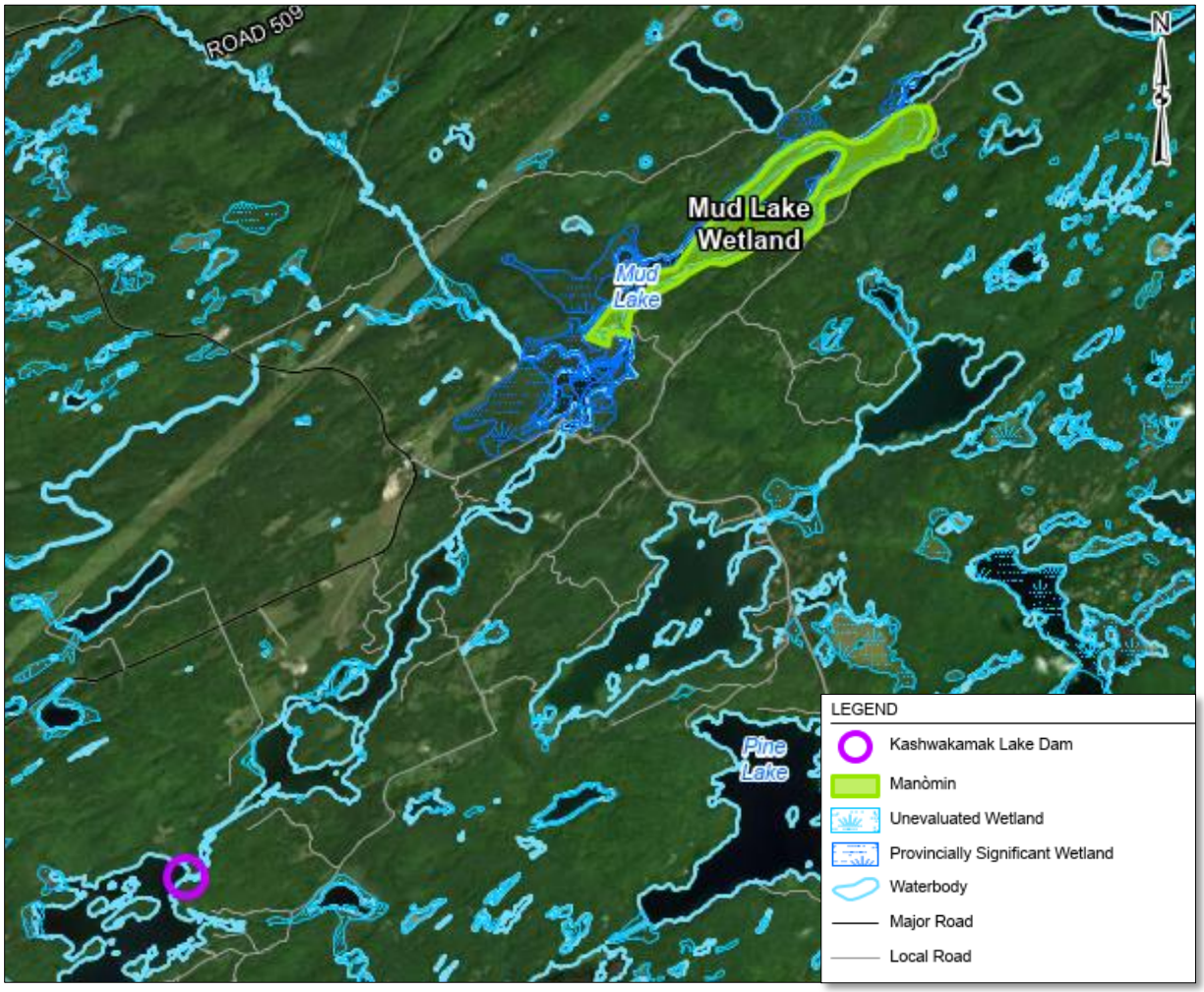

Figure 4-3: Location of Manòmin

4.2.4 Wildlife and Migratory Birds

The Significant Wildlife Habitat Criteria Schedules for Ecoregion 5E (MNR 2015) provide descriptions of wildlife habitats and guidance on criteria for determining the presence of candidate and confirmed wildlife habitats. Candidate significant wildlife habitat identified as being potentially present within the study area consisted of Bat Maternity Colonies, Turtle Wintering Area, Turtle and Lizard Nesting Area, and Special Concern and Rare Wildlife Species.

4.2.4.1 Bat Maternity Colonies

Candidate Bat Maternity Colonies are present within the study area. SAR bat species utilize large diameter breast height (DBH) snag and dead trees that have potential cavities in which to roost and

breed (i.e., maternity colonies). These trees can be found in forested habitat adjacent to suitable foraging areas such as open wetlands and waterbodies. The FOM community had several potentially suitable SAR bat maternity roosting trees. These species are not heavily dependent on large cavity or snag trees as they often roost singly or in small groups during the maternity period. In addition, they are generally considered to utilize forested habitats at the landscape scale and often move maternity roosts between years.

4.2.4.2 Turtle Wintering Area

Candidate turtle wintering areas are present within the study area. Kashwakamak Lake likely provides overwintering habitat, as the lake is deep enough to not freeze completely overwinter. Background review identified that there were many observations of Snapping Turtle, Blanding's Turtle, and Midland Painted Turtle within and near the study area. It is not anticipated that overwintering would occur immediately upstream of the dam due to flows and the habitat downstream is not considered to be conducive.

4.2.4.3 Turtle and Lizard Nesting Area

Candidate Turtle and Lizard (i.e., Five-lined skink) Nesting Areas were observed to be present in the study area. During the 2023 site visit, a hatched/predated turtle nest was also observed to present immediately adjacent to the Kashwakamak Dam structure. Additionally, several rocky outcroppings, rock features and open deciduous-mixed forests were observed to be present.

4.2.4.4 Special Concern and Rare Wildlife Species

Candidate Special Concern and Rare Wildlife Species are present within the study area. During the 2023 site visit, a Snapping Turtle and nesting feature (Figure 4-4) were observed to be present. Additionally, during the background review it was found that the following species were observed to potentially occur within a 2 km radius of the study area: Eastern Whip-poor-will, Blanding's Turtle, Butternut, Eastern Ribbonsnake and a restricted species.

4.2.5 Species at Risk

Background information obtained from sources indicate that SAR and their habitat are potentially present within the study area.

4.2.5.1 Vascular Plants

No tree or herbaceous SAR were observed within the study area.

4.2.5.2 Herptiles

The study area is located on Kashwakamak Lake where there are many observations from Ontario Nature, NHIC and iNaturalist for several SAR herptiles.

Figure 4-4: Location of Turtle Observations and Nests

Blanding's Turtles are largely aquatic and inhabit shallow lakes, ponds, slow moving creeks, and wetlands with soft organic substrates with abundant submergent vegetation. Upland habitats are used as migratory corridors between summer, winter, breeding, and nesting habitats. Adults regularly travel several kilometers between habitats. Blanding's Turtles nest in open habitat with low vegetation cover and loose, sandy and/or gravelly soil above the waterline in natural and developed habitats (COSEWIC 2016a). No Blanding's turtles were observed during the 2023 site visit, however, there were several verified observations on iNaturalist from as recent as June 2023, and Kashwakamak Lake provides suitable nesting and overwintering habitat. Immediately adjacent habitat is not as conducive for their

summer habitat needs as there was not an abundance of aquatic vegetation. They may use the Mississippi River as a migration corridor.

Midland Painted Turtles inhabit slow moving, relatively shallow and well-vegetated wetlands including swamps, marshes, ponds, fens, bogs, lakes, rivers, and creeks with abundant basking sites and organic substrate. Nesting habitat is usually within 1,200 m of aquatic habitat and in an open, south-facing area with sandy-loamy and/or gravely substrate (COSEWIC 2018a). No Midland painted turtles were observed during the 2023 site visit, however, there were several verified observations on iNaturalist from as recent as 2021. Kashwakamak Lake provides suitable nesting and overwintering habitat.

Snapping Turtles inhabit a wide range of wetland habitats including ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, soft bottoms, and dense aquatic vegetation. Adults will use streams to move between waterbodies especially during the mating season. Nesting sites are in open habitat with sandy or gravelly substrate and are often found in road shoulders (COSEWIC 2008). During the 2023 site visit, a Snapping Turtle was observed to be present within the northern log catchment bay near the dam's structure. Additionally, a previous turtle nest was observed to be present with 5 m of the dam's structure in sandy loose soil at the lake's edge. Turtle eggs can be challenging to identify once they have hatched, but it is believed to have been a Snapping Turtle nest.

Overall, there is potential suitable nesting and overwintering habitat for Blanding's Turtle, Midland Painted Turtle and Snapping Turtle to occur within the study area (Open Aquatic/ Kashwakamak Lake). Any work done on the construction and replacement of the existing Kashwakamak Dam should occur outside of the active turtle nesting season for Central & Northern Ontario of April 15 – October 15 or protection measures be put in place to reduce the risk of harm.

4.2.5.3 Reptiles and Amphibians

Eastern Milksnakes are habitat generalists, but prefer open areas such as pastures, meadows, prairies, rock outcrops, rights-of-way, and agricultural land near forest habitat. They commonly feed around old buildings and barns, where rodent populations are high. Milksnakes hibernate in mammal burrows, old building foundations, old wells, hollow logs, and rock crevices (COSEWIC 2014). No Milksnakes were observed during the 2023 site visit. However, there are reports from iNaturalist of Milksnakes within ~1 km of the site as recent as 2022. No suitable habitat for hibernation was observed within the study area.

The *Five-lined Skink* (Great Lakes/ St. Lawrence Population) is the most widely distributed lizard species in North America, where the species prefers rocky outcroppings, sand dunes, and open deciduous – mixed forest types (COSEWIC 2007). Individuals are known to spend most of their time under rocks, woody debris and other forms of cover/ Individuals of the Great Lakes/ St. Lawrence Population are known to occur in the Canadian Shield where they hide under rocks from the open bedrock. No Five-

lined skinks were observed during the 2023 site visit, however, there are many observations on iNaturalist from as recent as 2022.

Given the location of the study area (i.e., within Frotenac Arch) and the presence of rock features on the edge of Kashwakamak Lake, the presence of Milksnakes and Five-lined skink cannot be eliminated as suitable habitat is present. However, dam replacement activities are not anticipated to impact Milksnakes or Five-lined skink.

4.2.5.4 Birds

Eastern Wood-pewee are found in the mid-canopy layer of deciduous and mixedwood forests with open understories and is commonly associated with edges and clearings. Forest size does not seem to be a critical factor in habitat selection; however, breeding numbers decrease with increasing development in surrounding habitat. Eastern Wood-pewee hunts aerial insects from a perch in the subcanopy (COSEWIC 2012a). No Eastern Wood-pewee individuals were observed during the 2023 site visit, however, they may be present with the FOM community.

Eastern Whip-poor-will are nocturnal aerial insectivores in the nightjar family that nests in most early successional forest types, where the species prefers semi-open/ patchy forests such as rock barrens or regenerating forests (COSEWIC 2009). Common tree associations for Eastern Whip-poor-will nesting habitat include pine, oak, aspen and birch, all of which were observed to be present within the FOM community. No Eastern Whip-poor-will individuals were observed during the 2023 site visit, however, species-specific surveys were not completed. The access road and lake provide openings in the canopy that Eastern Whip-poor-will are known to utilize.

The *Red-headed Woodpecker* is considered a habitat generalist, but prefers open woodlands and forest edges, often found in disturbed areas such as cemeteries, parks, golf courses, sparsely treed pastures, and agricultural areas. Preferred nesting habitat typically requires dead limbs or snags with an open canopy (COSEWIC 2018b). No Red-headed Woodpecker were observed to be present during the 2023 site visit, however, may use the FOM community for breeding habitat.

Wood Thrush breeds in deciduous or mixed upland forest habitat with a moderate subcanopy and open forest floor. Wood Thrush are sensitive to habitat fragmentation but will nest in forest patches as small as 3 ha. Nests are constructed in young trees or shrubs and adults primarily forage for invertebrates on the ground (COSEWIC 2012b). No Wood Thrush were observed to be present during the 2023 site visit, however, may use the FOM community for breeding habitat.

Overall, no SAR birds were observed during the 2023 site visit. The forested area within the study area could provide potentially suitable breeding habitat (i.e., nesting) for both Red-headed Woodpecker and Wood Thrush.

4.2.5.5 Bats

There were several high-quality potentially suitable bat maternity roosting habitat trees (i.e., cavities, large DBH, peeling bark, etc.) observed within or adjacent to the study area suitable for *Little Brown Myotis, Northern Myotis & Tri-colored Bat*. This was observed to be present within the FOM community within the study area. During the removal and replacement of the Kashwakamak Lake dam structure, there is potential for SAR bats and their habitat to be impacted should the removal of trees be required to accommodate better accessibility for construction vehicles and laydowns for vehicle parking and material storage.

Little Brown Myotis, Northern Myotis & Tri-colored Bat are SAR bat species that share similar habitat preferences during their active season and are described together. They have been observed using trees as small as 10 cm DBH, but typically exhibiting early stages of decay, with cavities (usually >10 m high), loose bark, and/or leaves within forested habitats for maternity roosting purposes. Additionally, these species are known to use anthropogenic structures (e.g., houses, barns) for roosting as well (COSEWIC 2013, ECCC 2018).

4.3 Geotechnical

Egis conducted a geotechnical investigation to support the Class EA for the Kashwakamak Lake Dam. The purpose of the investigation was to explore the subsurface conditions at the site and to provide borehole location plans, records of borehole logs, and laboratory test results. This report outlines the anticipated geotechnical conditions that will influence the design and construction of the proposed replacement and rehabilitation of the dam structure, along with recommendations for foundation design.

The fieldwork was conducted between September 18 and 25, 2023 and involved four (4) boreholes advanced into the bedrock to a maximum depth of 9 m below the existing ground surface (mbgs) (El. 253.1 m), drilled at the north (left) dam abutment. Three additional boreholes were drilled downstream to a maximum depth of 6.3 mbgs (El. 252.9 m). The site stratigraphy at the drilled borehole locations consisted of a thin layer of topsoil, encountered only in BH23-4, underlain by bedrock. In all other boreholes, bedrock was observed at the ground surface and was cored and sampled to the bottom of the boreholes.

Based on the retrieved rock cores from the boreholes, the bedrock was identified as Carbonate Metasedimentary bedrock, with diagonal veins of marble. It was observed to be slightly weathered and slightly fractured, with moderately close, horizontal to diagonal joints. The Carbonate Metasedimentary bedrock was noted to be strong, grey to dark grey, with white bands of marble, and medium to thinly bedded.

Groundwater was not observed during the site investigation in three of the open boreholes. However, minor artesian pressure was observed in BH23-1, which dissipated shortly after drilling was completed. Groundwater was measured at an elevation of 260.6 meters in the installed monitoring well at the northern (left) abutment, which approximately corresponds to the water level in the upstream lake. The groundwater level was recorded in the well on September 26, 2023. Groundwater levels are expected to fluctuate due to extreme weather events and seasonal changes.

Should the existing dam be replaced in its current location, the existing structure will need to be demolished to allow for the construction of the new proposed dam. The demolition of the existing structure and the construction of the new dam shall be conducted within the confines of a temporary cofferdam or a secant pile wall, designed and installed in accordance with OHSA. The excavations for the proposed dam replacement should extend down to sound bedrock. Based on the borehole results, sound bedrock is expected to be encountered at a shallow depth near the ground surface.

For detailed information on the geotechnical investigation conducted for this study, please refer to the Geotechnical Investigation and Design Report for the Kashwakamak Lake Dam Replacement (Egis/McIntosh Perry, June 2024, Rev.2), which is included in ***Appendix M***.

4.4 Socio-Economic Environment

A socio-economic review was conducted to analyze the Kashwakamak Lake Dam, surrounding land uses, and possible staging areas. The study area is situated within the Township of North Frontenac, with the site located along Kashwakamak Lake on Lot 21, Concession 9.

4.4.1 Land Use/Composition

According to the Township of North Frontenac's Official Plan (2017), the shores of the lake are zoned as Waterfront Area, Crown Land, and Rural. The lands immediately surrounding the work area consist of private property, the Township shoreline allowance, and Crown Land.

The shores of Kashwakamak Lake also accommodate over 577 cottages and residences, as well as resorts and marinas. Additionally, Kashwakamak Lake is upstream of Manòmin (Zizania palustris), wild rice crops, which hold cultural significance for the Ardoch Algonquin First Nation and other First Nations. The landscape is characterized by forests, lakes, and wetlands (both evaluated and unevaluated) and remains largely undeveloped.

4.4.2 Recreation and Tourism

The Kashwakamak Lake Dam is essential for maintaining water levels, providing not only flood and drought control but also supporting local recreational and tourism activities in the surrounding area. The open water season for Kashwakamak Lake is from May to October which experiences the highest

public activity around the lake and dam, with activities such as recreational boating, fishing, hiking, hunting, resorting and camping. In the off-season (November to April), activities include ice fishing, snowmobiling and other outdoor pursuits.

A portage trail is situated on the north side of the dam, which is a popular canoe route frequented by large groups.

4.5 Cultural Heritage – Built Heritage & Archaeology

4.5.1 Archaeological

Past Recovery Archaeological Services Inc. (Past Recovery) conducted a Stage 1 assessment in support of the Class EA for the proposed replacement of the Kashwakamak Lake Dam. The study area for the proposed replacement was approximately 1.49 hectares (3.69 acres) in size.

The purpose of the Stage 1 investigation was to evaluate the archaeological potential of the study area and present recommendations for the mitigation of any significant known or potential archaeological resources. To this end, historical, environmental, and archaeological research was conducted to assess archaeological potential. A property inspection was completed on July 25, 2023, to determine current conditions and record factors that could affect the assessment of archaeological potential within the study area. The results indicated that the subject property retains potential for pre-Contact and post-Contact archaeological resources.

The results of the Stage 1 AA documented the following:

1. Portions of the study area have been determined to exhibit archaeological potential should be subject to Stage 2 AA prior to the initiation of below-grade soil disturbances or other alterations, and

2. Future Stage 2 AA should be undertaken by a licensed consultant archaeologist, in compliance with Standards and Guidelines for Consultant Archaeologists (MCM 2011). As the study area is non-agricultural land, all portions.

A Stage 2 AA was completed on May 2nd, 2024. Fieldwork was conducted according to the archaeological fieldwork standards outlined in the Standards and Guidelines for Consultant Archaeologists (MCM 2011). The purpose of the Stage 2 assessment was to determine whether the property contained archaeological resources requiring further assessment, and if so, to recommend an appropriate Stage 3 assessment strategy. The assessment involved the use of shovel test pits across all parts of the study area determined to retain archaeological potential.

The results of the Stage 2 AA documented the following:

1. The property survey resulted in the identification of one previously unrecorded potential archaeological site. The artifacts recovered suggested that the site was the location of a short-term campsite where the inhabitants engaged in late-stage lithic reduction practices, using both locally available and imported lithic raw materials.

2. A Stage 3 site-specific AA should be undertaken for the small potential archaeological site. The assessment should be undertaken by a licensed consultant archaeologist in compliance with Standards and Guidelines for Consultant Archaeologists (MCM 2011).

A Stage 3 AA was completed over three days, from August 20th to August 22nd, 2024. The findings indicate that the site possesses a high level of cultural heritage value or interest, which warrants Stage 4 mitigation of development impacts. During the assessment, Past Recovery identified a cluster of lithic detritus centrally located within the site limits established during the Stage 2 assessment. The artifact assemblage consists of 44 pieces of lithic material and three fragments of small mammal bone.

For Stage 4 mitigation of development impacts, there are two potential approaches: "avoidance and protection of the site" or "excavation and recording." To support the "avoidance and protection of the site" approach, a strategy will be developed that considers both short- and long-term measures to ensure the site's protection, including a required 10-meter protective buffer (see Map 5 from the Stage 3 report). If avoidance and protection of the Kashwakamak Lake Dam site is not feasible, the second approach, "excavation and recording", would involve the excavation of archaeological artifacts and documentation of the areas of the site that will be impacted.

Given the location of the archaeological findings in relation to the recommended preferred alternative for the replacement of the Kashwakamak Lake Dam at the same location, the MVCA is recommending that "avoidance and protection of the site" be adopted as the appropriate Stage 4 mitigation of development impacts. Through careful design of the new dam and strategic placement of staging areas, we are confident that the archaeological site will be fully preserved and will not be impacted by the proposed replacement. MVCA has developed a proposed protection strategy for the archaeological site, which is included as an appendix to the Stage 3 Archaeological Assessment Report.

For detailed information on the archaeological assessments conducted for this study, please refer to the Stage 1 & 2 Archaeological Assessment and Stage 3 Archaeological Assessment Reports for the Kashwakamak Lake Dam Replacement (Past Recovery, May 11, 2024, and October 3, 2024), which is included in ***Appendix I & J***, respectively.

4.5.2 Marine Archaeological

Archaeological Research Associates (ARA) conducted a Marine Archaeological Assessment (Marine AA) for the Kashwakamak Lake Dam Class EA. This assessment comprised background research, similar to a land-based Stage 1 AA, and an in-water marine evaluation, equivalent to a land-based Stage 2 AA

The marine archaeological assessment was conducted on September 11th, 2023 under ideal conditions, with visibility extending to the bottom in both upstream and downstream areas. A snorkel survey was performed despite the sluice gates being closed, as the water depth in the study area required this method. The riverbed, both upstream and downstream, consisted of bedrock scattered with unmodified trees and loose rock. The snorkel survey was carried out in intervals of two to three meters, while extremely shallow areas were assessed by personnel along the shoreline.

Wooden notched logs from a previous log boom were discovered along both edges of the upstream study area but were located outside the primary study area. These logs, replaced by the current safety boom in 2006, are believed to date from 20 to 40 years ago and are not considered to have heritage significance or value. No other artifacts, aside from modern refuse such as broken glass, were found in the study area, which was thus deemed free of archaeological concerns.

For detailed information on the marine archaeological assessment conducted for this study, please refer to the Marin AA Report prepared for the Kashwakamak Lake Dam Replacement (ARA, May 13, 2024), which is included in ***Appendix K.***

4.5.3 Built Heritage Resources and Cultural Heritage Landscape

Egis conducted a Cultural Heritage Evaluation Report (CHER) to support the Class EA for the Kashwakamak Lake Dam. The purpose of the CHER was to assess whether the Kashwakamak Lake Dam holds any cultural heritage value or interest (CHVI) under the Ontario Heritage Act. This evaluation followed the methodology recommended in the Ontario Heritage Toolkit, which involved background research, a site visit to document current conditions, and an assessment of the property's cultural heritage value based on the criteria specified in Ontario Regulation 9/06: Criteria for Determining Cultural Heritage Value or Interest under the Ontario Heritage Act.

The Kashwakamak Lake Dam, constructed in 1910, features a simple concrete sluice dam with two sluiceways, each equipped with ten stoplogs, and an earthen embankment. The main structure includes two bulkhead walls, three concrete piers forming the sluiceways, and a broad-crested concrete weir. After conducting background research, a site investigation, and applying the criteria from O. Reg. 9/06, it was concluded that the Kashwakamak Lake Dam does not possess CHVI. Therefore, no further cultural heritage reporting is required.

Refer to the Cultural Heritage Assessment Report, Kashwakamak Lake Dam Replacement (Egis/Mcintosh Perry, November 16th, 2023) for greater detail on the cultural heritage findings within the study area, which is included in ***Appendix L***.

4.6 Climate Change

MECP finalized a 'guide,' *Consideration of Climate Change in Environmental Assessment In Ontario* (updated August 11, 2021), which, together with their code of practices, sets out the MECP's expectations for considering climate change in the preparation, execution, and documentation of environmental assessment studies and processes. The guide defines "climate consideration" in a project as incorporating methods to reduce greenhouse gas emissions, develop a resilient design, and preserve local ecological integrity amidst changing climates.

As per Section 4.1.4, a hydraulic analysis of the Kashwakamak Lake Dam and Saddle Dam was conducted for various scenarios during the environmental assessment process, including the determination of climate change impacts on life safety, properties, the environment, and cultural-built heritage features. Recommendations have been made for the detailed design to ensure that the preferred alternative effectively accounts for climate change adaptation.

5.0 ALTERNATIVE SOLUTIONS AND EVALUATION

The main objective of the Class EA process is to identify and evaluate possible alternative solutions to address the Problem Statement identified in Section 1.4. The following sections describe the evaluation methodology for identifying and reviewing alternative solutions, as well as the identification of the recommended Technically Preferred Alternative.

5.1 Identification of Alternative Solutions

The following alternative solutions have been developed for the Kashwakamak Lake Dam and Saddle Dam (Table 5-1). These solutions were evaluated based on the results of various studies and consultations completed during this Class EA process.

Table 5-1: Proposed Alternative Solutions for Kashwakamak Lake Dam and Saddle Dam

Alternative Solution No.	Alternative Solution	Alternative Solution Description	
		Kashwakamak Lake Dam	Saddle Dam
1	Do Nothing	No change made within the Study Area (status quo). No improvements are made, and no measures are proposed to address the deteriorated structural condition of the dam.	
2a	Decommission the Existing Dam and Construct Passive Control System	This alternative involves decommissioning of the dam and creating a passive water control system (such as an overflow weir).	Saddle Dam would need to be repaired or replaced under this scenario to aid in flood and drought control. Failure of the Saddle Dam would result in overtopping of the access road which limits access to the main dam to perform emergency maintenance or operations during a significant storm event.
2b	Decommission the Existing Dam and Reinstate Natural Watercourse	This alternative involves decommissioning/full removal of the existing dam and reinstating a natural watercourse/channel.	Saddle Dam would be decommissioned as access to the Kashwakamak Lake Dam would no longer be required.
3	Rehabilitation of the Existing Dam	Rehabilitation of the Dam would consist of salvaging elements of the existing dam and preserving the structure in a stable state similar to the existing condition.	Rehabilitation of the Saddle Dam would consist of salvaging elements of the existing dam and preserving the structure in a stable state similar to the existing condition.
4	Replace the Existing Dams at the Same Location	Construction of a new dam within a similar alignment to that of the existing dam. For the purpose of this evaluation, the removal of the existing dams in its entirety was considered, with new footings and anchors installed at bedrock.	Replacement of the Saddle Dam within a similar alignment to that of the existing dam. The type of structure and function is dependent on the Kashwakamak Lake Dam replacement design.
5	Construct New Dam Downstream	Construct a new dam immediately downstream of the existing dam. This alternative will allow the existing Kashwakamak Lake dam to remain in place during construction to aid in the management of flow.	Replacement of the Saddle Dam within a similar alignment to that of the existing dam. The type of structure and function is dependent on the Kashwakamak Lake Dam replacement design.

5.2 Evaluation Methodology

The evaluation of alternative solutions was undertaken to address the Problem Statement identified for this project (Section 1.4) and to consider all aspects of the Class EA study. The overall assessment and evaluation process followed two basic concepts:

1. Assessment of Alternatives: the potential benefits of each alternative are assessed against a comprehensive set of criteria for Function, Biological/Natural Environment, Socio-Economic and Cultural Environment and Implementation.

2. Evaluation of Alternatives: A comparative evaluation of alternatives to identify a recommended technically preferred alternative.

An evaluation framework was developed by the Project Team, including technical considerations and environmental components that address the broad definition of the environment as described in the Class EA and Environmental Assessment Act (EAA), as well as based on comments received from relevant agencies, stakeholders, First Nations, CLC, interested parties (Kashwakamak Lake Association), and the public. Five categories were established to aid in the evaluation of Alternative Solutions: Physical, Natural, Social, First Nations and Cultural Heritage Environment, and Economic (Table 5-2). The criteria for each category were established based on the key objectives outlined in the MRWP, which serve to support planning and decision-making processes for sustainable watershed management. The key objectives of the MRWP are as follows:

1. **Water Management:** Implementing strategies to mitigate flood and drought, stormwater management, and ice conditions, as well as enable sustainable power generation.

2. **Climate Change Adaptation:** Implements strategies to enhance local resilience and adapt to shifting climate patterns and extreme weather events.

3. **Natural Hazards:** To reduce risks to human life and property from flooding, erosion, and unstable slopes and soils.

4. **Natural Systems and Land Conservation:** Focusing on the overall protection, enhancement of natural features and the management of flood and drought within the systems to protect aquatic and terrestrial ecosystems, including the Manòmin (rice crops).

5. **Water Quality:** To maintain or enhance current water quality for all users.

6. **Growth and Development:** Considering the social and economic factors that shape the community's relationship with the watershed and its resources. This includes enhancing

opportunities for recreational and tourist activities (such as fishing, boating, and camping) while preserving the aesthetic beauty of the watershed.

Table 5-2 identifies the evaluation criteria and rationale, as well as the criteria measures and corresponding descriptions. The evaluation of the alternative solutions (Table 5-3) was carried out using the Reasoned Argument method of comparing differences in impacts and provides a clear rationale for the selection of the technically preferred alternative. The evaluation of alternative solutions considers the positive and negative potential impacts associated with each of the alternative solutions in consideration of the criteria listed in Table 5-2. This evaluation is a relative comparison to be used to determine which alternative is technically preferred.

Each criterion evaluated was summarized using the following rankings from Not Preferred to Preferred:

Not Preferred – Fails to address the Problem Statement; consequently, it does not achieve the MVCA's objectives for this assignment.

Less Preferred – Partially addresses the Problem Statement; ultimately falls short of meeting the MVCA's objectives for this assignment.

Preferred – Addresses the Problem Statement and aligns with the MVCA's objectives for this assignment.

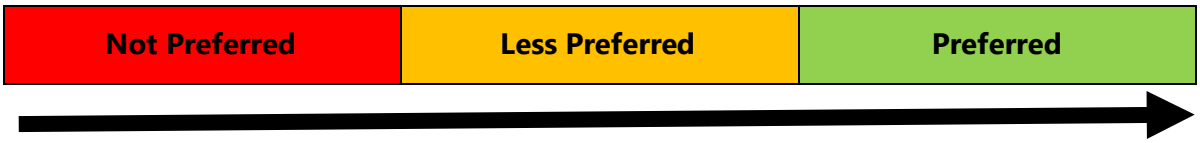

Table 5-2: Proposed Evaluation Criteria

Criterion/ Weighted	Criteria Measure	Description of Criteria Measures
Functional/ Physical	Hydraulic Function/ Flooding and Drought	Effectiveness of the alternative in achieving the target levels outlined in the current MRWMP for mitigating flood and drought, managing stormwater, and addressing ice conditions.
	Geomorphology/ Sediment Transport	Effectiveness of the alternative to promote dynamic stability of channel processes and mitigate sediment impacts.

Criterion/ Weighted	Criteria Measure	Description of Criteria Measures
	Dam Safety	Effectiveness of the alternative to meet Dam Safety Guidelines, reduce risk of failure, and avoid any damage to property and loss of life.
	Service Life	Anticipated length of service life.
	Climate Change Adaptation	The ability of the structure and/or design to effectively adapt to shifting climate patterns, extreme weather events including ice conditions, and environmental changes.
	Implementation/ Constructability	Potential to implement the alternative, based on site conditions and common accepted construction practise.
Natural Environment	Fisheries/Aquatic Habitat	Potential temporary and long-term impacts to fish communities and aquatic habitats. Effectiveness of the alternative to enhance fisheries resources; fish diversity, food source, and fish passage.
	Terrestrial Habitat (Wildlife and Vegetation)	Potential temporary and long-term impact to wildlife habitats and movement corridors and vegetation communities (i.e., vegetation and tree removal).
	Species-at-Risk Impacts	Potential temporary and long-term impact and/or enhancement to existing SAR and their habitat in the project area.
	Existing Watercourses Quality	Potential temporary and long-term impact to existing watercourses or waterbodies including Kashwakamak Lake and its tributaries from a water and habitat quality perspective.
Social Environment	Private Property Impacts	Measure of the impact to adjacent private property during construction/ commissioning.
	Temporary/ Permanent Property Agreements/ Acquisitions	Anticipated requirements for temporary and/or permanent property agreements/acquisitions with adjacent privately owned properties.

Criterion/ Weighted	Criteria Measure	Description of Criteria Measures
	Recreational Impacts	Ability to achieve target water levels set in MRWMP to minimize impacts to existing recreation activities.
	Tourism Impacts	Potential financial impacts to local tourism attractions (i.e., camping, resorts, fishing, boating, etc.).
First Nations/ Cultural Environment	Lands and Harvesting Rights	Potential impacts to Indigenous Communities lands and harvesting rights (i.e., Manòmin, walleye, and other fish harvesting uses or potential for use, and portage routes).
	Built Heritage and Cultural Heritage Features	Potential impact to cultural and/or heritage features in the project area.
	Marine Archaeological Features	Potential impact to marine archaeological features in the project area.
	Archaeological Features	Potential impact to land archaeological features in the project area.
Economic	Capital Costs	Relative measure of the initial costs to install/construct the proposed works, including environmental mitigation, sediment management, etc.
	Operational and Maintenance Costs	Relative measure of the ongoing maintenance and operational costs following implementation.

At the onset of the Class EA, each alternative was assessed and assigned a preliminary ranking under each criterion. The evaluation was then updated and finalized (Table 5-3) following consultation with various project members (i.e., MVCA, Township, Community Liaison Committee, First Nations) based on their knowledge of their study area, as well as governing agencies and public input received through the PIC.

Alternative 2b, Decommission the Existing Dam and Reinstate Natural Watercourse, involves the complete decommissioning of the existing dam structure and the reinstatement of a natural, unrestricted watercourse. The full removal of the existing dam without installing a weir system would make it extremely difficult to achieve the objectives of the MRWMP. This alternative would have

significant implications for flood and drought control, recreational access, erosion control, as well as notable impacts on the natural and social environment, as well as First Nations lands and harvesting rights. Therefore, Alternative 2b, Decommission the Existing Dam and Reinstate Natural Watercourse, was not carried forward into the detailed evaluation.

Table 5-3: Proposal Alternative Solution Evaluation

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
FUNCTIONAL/PHYSICAL						
Hydraulic Function/ Flooding and Drought	Effectiveness of the alternative in achieving the target levels outlined in the current MRWMP for mitigating flood and drought, managing stormwater, and addressing ice conditions.	- Seepage issue through the north embankment wall and overflow weir of the main dam will continue. Seepage and settlement will also continue along the Saddle Dam and the access road. - No changes to structural elements and dimensions of dams and therefore it will not meet current guidelines. - Will not meet climate change adaptation requirements and will likely be susceptible to overtopping during larger storm events.	- Significant impact upstream and downstream. - Downstream will experience higher water levels/flooding during the storms/wet season and lower water levels during the dry season. - Storage loss in the overall Mississippi River system, which will impact the downstream dams/structures and flood control. - Considering the function of Kashwakamak Lake and the overall watershed, implementing this alternative would be challenging, ultimately hindering efforts to achieve MRWMP objectives related to flood and drought mitigation, erosion control, ice management, and other initiatives.	- No changes to the size of the spillway means less resiliency to larger storm events (climate change). - Rehabilitation of structure will also not address freeboard deficiencies and may not provide sufficient capacity to safely pass the updated IDF (inflow design flood). - Seepage issue through the north embankment will continue.	- Water levels and the MRWMP will be maintained and enhanced due to the structure's ability to provide more efficient service. - Seepage issues will be addressed. - No change in floodplain extent. - A larger overflow structure can be installed to accommodate larger storm events (climate change). - Decommissioning or converting the saddle dam into an emergency spillway can be considered.	- Seepage issues will be addressed. - A larger overflow structure can be installed to accommodate larger storm events (climate change). - Minor changes anticipated to the lake extent between the existing dam and downstream dam. - The area between the existing dam and the proposed dam will experience increased water levels. - Will require larger structure. - Decommissioning or converting the saddle dam into an emergency spillway can be considered.
Geomorphology/ Sediment Transport	Effectiveness of the alternative to promote dynamic stability of channel processes and mitigate sediment impacts.	- Downstream geomorphology will be maintained. - In the event of dam failure, it is anticipated that the downstream geomorphology would be altered, as well as a large quantity of material and sediment would be transported downstream.	- A passive control system can foster a more dynamic and resilient geomorphological environment, enhancing sediment transport, habitat diversity, and ecosystem stability. - However, a passive system would not fulfill the requirements of the	- Downstream geomorphology will be maintained. - Minor impacts to soil and sediment quality may result from construction activities; these impacts are temporary and can be mitigated.	- Downstream geomorphology will be maintained. - Minor impacts to soil and sediment quality may result from construction activities; these impacts are temporary and can be mitigated.	- Downstream geomorphology will be slightly impacted immediately downstream with the construction of a wider and larger dam; however, the remainder of channel's geomorphology will be maintained.

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
			MRWMP, including flood and drought mitigation, as well as ice control.	- The new dam can incorporate sediment management strategies that help maintain sediment transport, which is crucial for habitat maintenance both upstream and downstream. This ensures that spawning grounds and other essential habitats remain intact.	- A new dam can incorporate sediment management strategies that help maintain sediment transport, which is crucial for habitat maintenance both upstream and downstream. This ensures that spawning grounds and other essential habitats remain intact.	- Minor impacts to soils and sediment quality may result due to construction; these impacts are temporary and can be mitigated.
Dam Safety	Effectiveness of the alternative to meet Dam Safety Guidelines, reduce risk of failure and avoid any damage to property and loss of life.	- Both structures have insufficient freeboard. - The overflow weir structure and abutments will continue to not meet requirements for ice loading. - Concrete structures are in a deteriorated state and in poor to fair condition. Structures will continue to deteriorate and will be at risk of failure. - Risk of dam failure will increase. - A failure of the Saddle Dam would hinder access to the dam, particularly for emergency maintenance or operations during a major storm event. - This alternative poses a severe safety risk to local residents/cottagers and downstream communities.	- There is no way to control flows during a significant storm event. - Low head dams can pose a danger to the public during high tailwater conditions due to submerged hydraulic jump. - New passive water control structure would be designed to current dam safety guidelines.	- Both structures would continue to have insufficient freeboard. - Temporarily lowers the risk of failure but necessitates additional inspections and surveillance. - This alternative still poses a potential risk to public safety as the dam will continue to deteriorate.	- It will meet the dam safety guidelines including minimum freeboard. - Risk of dam failure significantly decreased.	- It will meet the dam safety guidelines including minimum freeboard. - Risk of dam failure significantly decreased.

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
Service Life	Anticipated length of service life.	- The existing dam was built in 1910 and has a limited remaining service life.	- Full service life.	- The service life of the existing dam will be extended; however, is dependent on the rehabilitation work undertaken.	- Full service life.	- Full service life.
Climate Change Adaptation	The ability of the structure and/or design to effectively adapt to shifting climate patterns, extreme weather events including ice conditions, and environmental changes.	- No structural changes will occur, limiting climate change adaptation efforts. - The dam will struggle to effectively respond to changing flow patterns associated with climate change, hindering its ability to adjust the timing and extent of freshets or droughts. This may negatively impact aquatic habitats by altering water quality, temperatures, and sediment deposition.	- Limited ability to control flows especially in response to changing weather patterns, such as increased flooding or prolonged droughts. - Without active flow control, managing water levels to respond to extreme weather events becomes challenging, potentially leading to habitat degradation upstream or downstream. - Passive systems may lack mechanisms to regulate water temperatures, which can negatively affect sensitive aquatic species during periods of warming. - These systems can support natural sediment transport and deposition processes, which are vital for maintaining healthy aquatic habitats., as well as improving water quality through natural filtration processes.	- No major structural changes will take place, which will restrict climate change adaptation efforts. The dam will not be able to effectively respond to changing flow patterns associated with climate change which will hinder the ability to adjust the timing and extent of freshets or droughts. - Rehabilitated dam may struggle to control water temperatures, putting aquatic and sensitive species at risk during warm periods.	- A modern dam can be equipped with advanced control systems that adjust flow rates based on real-time environmental conditions. This adaptability allows for better management of freshet timing and extent, ensuring that high flows are released in a controlled manner to reduce erosion, and habitat disruption upstream and downstream of the dam. - During a drought, a new dam can be designed to store water more efficiently, allowing for controlled releases to maintain downstream flow levels which will help sustain aquatic habitats and preserve water quality by minimizing concentration of pollutants being released. - By controlling water releases from various depths, a new dam can help regulate water temperature which means during warmer months, cooler water from the lower layers can be released, offering protection to sensitive	- A modern dam can be equipped with advanced control systems that adjust flow rates based on real-time environmental conditions. This adaptability allows for better management of freshet timing and extent, ensuring that high flows are released in a controlled manner to reduce erosion, and habitat disruption upstream and downstream of the dam. - During a drought, a new dam can be designed to store water more efficiently, allowing for controlled releases to maintain downstream flow levels which will help sustain aquatic habitats and preserve water quality by minimizing concentration of pollutants being released. - By controlling water releases from various depths, a new dam can help regulate water temperature which means during warmer months, cooler water from the lower layers can be released, offering protection to sensitive

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
					aquatic species from thermal stress.	aquatic species from thermal stress.
Implementation/ Constructability	Potential to implement the alternative, based on site conditions and common accepted construction practise.	- No construction work undertaken.	- It can be implemented in stages. - A portion of the existing dam can be utilized as a bypass during decommissioning. - Cofferdam required.	- The effectiveness of concrete repairs may be limited, as noted by Cleland Jardine Engineering in the 2016 Structural Assessment, due to outdated methods. - The materials originally used to construct the dam may pose significant challenges because of a lack of cohesion and differences in material properties at the interfaces of new and existing concrete. - Ongoing seepage at the north abutment is unlikely to be resolved without substantial work, such as installing a new concrete abutment and grouting, as the effectiveness of previous grout treatments has been limited. - Cofferdam will be required to undertake construction.	- Feasible for construction. Needs diversion, possibly using the saddle dam. - Cofferdam will be required to undertake construction.	- Cofferdam required to remove existing dam, however during construction the existing dam can remain in place to help manage flows. - Using the existing dam as a cofferdam would be ideal; however, from a hydraulic perspective, it could result in additional properties flooding due to elevation differences and topography at other possible dam locations downstream. - Additional property requirements such as; tree removal and access road construction required.
Functional/Physical Evaluation		**Not Preferred**	**Less Preferred**	**Less Preferred**	**Preferred**	**Preferred**

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
NATURAL ENVIRONMENT						
Fisheries/Aquatic Habitat	Potential temporary and long-term impacts to fish communities and aquatic habitats. Effectiveness of the alternative to enhance fisheries resources; fish diversity, food source, and fish passage.	- Leaving a deteriorating dam in place can lead to both immediate and lasting negative effects on fish communities and aquatic habitats, ultimately hindering efforts to meet MRWP objectives for enhancing fisheries resources. - In the event of a dam failure, fish habitat located immediately downstream has the potential of being destroyed whether it is through transportation of the larger materials downstream, vegetation removal, or sedimentation. However, it is anticipated that fish habitat could be restored and that the fish habitat function and populations affected by the dam breach would recover with time. - The timing of the dam failure could have a greater impact on fish populations and spawning, as spring and summer months are critical for spawning, feeding, and rearing activities. - Fish habitat upstream of the dam is expected to be restored within one year of a dam failure and would reestablish itself almost immediately once the water levels are restored.	- By promoting natural flow conditions and habitat variety, a passive system can enhance fish diversity, helping to create resilient populations and foster the growth of vegetation and invertebrates, which provide vital food sources for fish and can improve population dynamics. - With a passive control system, aquatic species such as turtles would be able to move freely upstream and downstream providing long term benefits for fish and aquatic habitat.	- During rehabilitation activities, sediment disturbance can temporarily disrupt local habitats, potentially displacing fish populations and affecting spawning areas. - In addition, changes to the dam's operations during rehabilitation may lead to temporary shifts in flow patterns, affecting how water moves through the ecosystem and impacting fish behavior. - While this alternative will maintain the MRWMP, it doesn't provide opportunities to incorporate strategies that improve fish passage.	- During the construction phase, activities may temporarily disrupt local fish and fish habitat. Construction activities can lead to temporary alteration to fish habitat upstream from measures put in place (i.e. cofferdam) to construct the new structure while maintaining flow. However, long term impacts are not anticipated, and fish habitat would return to natural functions shortly after construction is completed. Mitigation measures will be implemented in the design and during construction. - The new dam will help maintain/create a stable reservoir that will continue to support aquatic vegetation and invertebrate populations, which serve as critical food sources for fish. - The new dam presents potential temporary challenges during construction; however, its long-term impacts can be positive if properly designed and managed to enhance fish communities and aquatic habitats, ultimately supporting the objectives of the MRWMP.	- During the construction phase activities may temporarily disrupt local habitats. Construction activities can lead to temporary changes in water quality, such as increased turbidity or fluctuations in temperature and oxygen levels, which may stress fish populations. Mitigation measures will be implemented in the design and during construction. - Permanent displacement and destruction of significant fish habitat in the form of sport fish and baitfish spawning immediately downstream of existing the Dam may occur pending the placement of the new dam. - As per the objectives of the MRWMP, the new dam will help maintain/create a stable reservoir that will continue to support aquatic vegetation and invertebrate populations, which serve as critical food sources for fish, positively influencing population dynamics.

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		Rationale				
Terrestrial Habitat (Wildlife and Vegetation)	Potential temporary and long-term impact to wildlife habitats, wildlife movement corridors and vegetation communities (i.e., vegetation and tree removal).	- No impacts anticipated as a result of this alternative. - In the event of a failure, the sudden release of water can lead to both immediate and long-term negative impacts on wildlife habitats, movement corridors, and vegetation communities, ultimately affecting ecosystem health and resilience. - Water can flood nearby habitats, displacing wildlife and disrupting movement corridors, making it challenging for animals to reach food, breeding, and migration areas. - Changes in vegetation communities, including potential loss of tree cover and shifts in plant diversity, can impact local species that rely on specific habitats.	- Moderate impacts to the surrounding woodlands, riparian vegetation, local habitat, displacing wildlife and altering ecosystem dynamics are anticipated during the construction of the new passive system, resulting in loss of wildlife habitat. - No long-term impacts are anticipated as a result of this alternative on wildlife and vegetation. Site restoration will be required prior to completing construction.	- The presence of construction equipment and personnel can disrupt local habitats, temporarily displacing wildlife and affecting their nesting and foraging areas. - Short term impacts to the surrounding woodlands and riparian vegetation are anticipated. - No long-term impacts are anticipated as a result of this alternative on wildlife and vegetation. Site conditions will be restored prior to completing construction.	- Minor/moderate impacts anticipated on local habitat during construction that may lead to the displacement of wildlife and removal of vegetation to complete the dam replacement work. - No long-term impacts on wildlife and vegetation are expected from this alternative, as there is an abundance of similar habitat adjacent to the study area. Site conditions will be restored before construction is completed. - The design of the new dam could potentially incorporate enhancements to improve ecosystem services, such as better water quality, flood control, and habitat connectivity, ultimately benefiting wildlife communities. To be considered during detailed design.	- Higher potential impacts anticipated on local habitat during construction that may lead to the displacement of wildlife and removal of vegetation to construct the new dam and access road. - No long-term impacts on wildlife and vegetation are expected from this alternative, as there is abundant similar habitat adjacent to the study area. Site conditions will be restored before construction is completed. - The design of the new dam could potentially incorporate enhancements to improve ecosystem services, such as better water quality, flood control, and habitat connectivity, ultimately benefiting wildlife communities. To be considered during detailed design.
Species-at-Risk (SAR) Impacts	Potential temporary and long-term impact and/or enhancement to existing SAR and their habitat in the project area.	- No impacts anticipated as a result of this alternative. - In the event of dam failure, potential impacts are anticipated to surrounding SAR and their habitat present within and around the shores of Kashwakamak Lake, as well as downstream terrestrial and aquatic habitats.	- Construction may have some short-term effects on species at risk (SAR) or their habitats. However, in the long run, the passive system would enable SAR turtles, like the Blanding's Turtle and Snapping Turtle, to use the watercourse as a migration corridor between the lake and downstream wetland habitats, allowing for unobstructed travel.	- Minor vegetation removal will be necessary during construction to access the dam and establish staging areas, which could potentially affect SAR or their habitats (e.g., birds, bats) during this period. - Potential to impact SAR turtles or their habitat during construction of the dam along shoreline and within the watercourse.	- Minor to moderate vegetation removal will be needed during construction to access the dam and set up staging areas, which could potentially impact SAR or their habitats (e.g., birds, bats) during construction. - Potential to impact SAR turtles or their habitat during construction of the dam along shoreline and within the watercourse.	- Additional vegetation removal will be necessary in comparison to other alternatives during construction to access the new dam location and establish staging areas, which could potentially affect SAR or their habitats (e.g., birds, bats). - Potential to impact SAR turtles or their habitat during construction

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		- SAR turtles within the lake will be able to move/relocate. If the dam were to breach during their more vulnerable period of hibernation there could be impacts to species such as the Map Turtle which hibernates in lakes.		- Mitigation measures (i.e., time windows, avoidance, etc.) should be implemented during construction to reduce potential impacts.	- Mitigation measures (i.e., time windows, avoidance, etc.) should be implemented during construction to reduce potential impacts.	of the dam along shoreline and within the watercourse. - Mitigation measures (i.e., time windows, avoidance, limit areas of disturbance, etc.) should be implemented during construction to reduce potential impacts.
Existing Watercourses Quality	Potential temporary and long-term impact to existing watercourses or waterbodies including the Kashwakamak Lake and its tributaries from a water and habitat quality perspective.	- No changes anticipated to water and habitat quality. - In the event of dam failure, a sudden influx of sediment, debris, and pollutants into the water, resulting in increased turbidity and decreased oxygen levels, which can harm aquatic life. - Although immediate water quality may suffer from the dam failure, natural processes can help restore water quality over time. However, the recovery period can be prolonged, depending on the extent of the damage.	- Over time, a passive control system can enhance water quality by promoting natural flow regimes and reducing pollutant accumulation. - A well-designed passive control system can enhance habitat connectivity, facilitating the movement of aquatic organisms between Kashwakamak Lake and the Mississippi River. This is essential for maintaining healthy aquatic habitats and improving conditions for fish and other wildlife. - However, a passive system ultimately hindering efforts to achieve MRWP objectives related to flood and drought mitigation, ice management, and other initiatives.	- During rehabilitation, construction activities may increase sedimentation and turbidity in the water, leading to short-term declines in water quality, which can negatively affect aquatic organisms. - In addition, rehabilitation work may necessitate changes in water management, potentially leading to temporary fluctuations in flow levels that can disrupt habitats and aquatic life. - In the long term, the rehabilitation of the dam will have limited potential to enhance water and habitat quality and quantity.	- During construction, sediment disturbance and runoff can temporarily degrade water quality by increasing turbidity and introducing pollutants, which can harm aquatic habitat. - The process of replacing the dam may also lead to temporary changes in flow regimes, impacting water levels in adjacent watercourses and potentially disrupting habitats for fish and other aquatic organisms. - However, long-term enhancements in water quality and flow can result in healthier aquatic ecosystems, fostering biodiversity and resilience to environmental changes.	- During construction, sediment disturbance and runoff can temporarily degrade water quality by increasing turbidity and introducing pollutants, which can harm aquatic habitat. - The process of replacing the dam may also lead to temporary changes in flow regimes, impacting water levels in adjacent watercourses and potentially disrupting habitats for fish and other aquatic organisms. - However, long-term enhancements in water quality and flow can result in healthier aquatic ecosystems, fostering biodiversity and resilience to environmental changes.
Natural Environment Evaluation		**Not Preferred**	**Preferred**	**Less Preferred**	**Less Preferred**	**Not Preferred**
SOCIAL ENVIRONMENT						

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
Private Property Impacts	Measure of the impact to adjacent private property during construction/ commissioning.	- No direct impacts to private property. - In the event of dam failure, there is a risk of permanently impacting both upstream and downstream shoreline residents (full time and seasonal cottagers), as well as the potential loss or damage to property.	- With the removal of the dam, the shoreline will be affected permanently by the loss of the ability to control water levels. - This alternative has the potential to cause shoreline erosion and permanent loss of private property. - There will be impacts due to construction and commissioning related activities. These impacts are temporary and unavoidable.	- There will be impacts due to construction and commissioning related activities. These impacts are temporary and unavoidable.	- There will be impacts due to construction and commissioning related activities. These impacts are temporary and unavoidable.	- There will be impacts due to construction and commissioning related activities. These impacts are temporary and unavoidable.
Temporary/ Permanent Property Agreements/ Acquisitions	Anticipated requirements for temporary and/or permanent property agreements/ acquisitions with adjacent privately owned properties.	- None required.	- None deemed required at this time, however, further assessment of the proposed design would be required to fully assess property impacts.	- Temporary access/use of property may be required for staging areas. - No permanent property impacts anticipated.	- No permanent property impacts anticipated. - Temporary access/use of property may be required for staging areas.	- Permanent property agreements/acquisition will be required to construct the new dam and access road downstream. - Temporary access/use of property will also be required for staging areas.
Recreational Impacts	Ability to achieve target levels set in MRWP to minimize impacts to existing recreation activities.	- No changes are anticipated as a result of this alternative. - In the event of dam failure, there will be significant impacts on the recreational use of the lake and shoreline residents and cottagers, including alterations in dock access.	- A passive system would greatly affect recreational use such as shoreline properties and boating due to significant fluctuations in water levels. - Reduction/limited ability to mitigate floods/droughts and maintain current WMP. - Depending on the design, there may be considerable impacts on the recreational use of the lake	- No direct or indirect impacts to the recreational use of the lake. - There may be some impacts to recreational use during construction such as rerouting a temporary portage route. These impacts are temporary and unavoidable.	- No long-term impacts are anticipated to occur on the recreational use of the lake. - There may be some impacts to recreational use during construction such as requiring an earlier drawdown of the lake, these impacts are temporary and may be unavoidable. - Depending on staging requirements and natural heritage timing windows, the	- No long-term impacts are anticipated to occur on the recreational use of the lake. - There may be some impacts to recreational use during construction such as requiring an earlier drawdown of the lake, these impacts are temporary and may be unavoidable. - Depending on staging requirements and natural heritage timing windows, the construction of the new dam and

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
			during the construction of the new passive system.		dam replacement may need to be stagged over several seasons.	the decommissioning of the existing dam may need to be stagged over multiple seasons. - Using the existing dam as a cofferdam would aid in maintaining lake levels for recreational purposes during construction.
Tourism Impacts	Potential financial impacts to local tourism attractions (i.e., camping, resorts, fishing, boating, etc.).	- No changes are anticipated as a result of this alternative. - In the event of dam failure, significant impacts on the recreational use of the lake are anticipated, which may adversely affect local tourism and revenues (i.e., reduction in visitors to resorts, campsites, marina, etc.).	- The reduction or limited capacity to mitigate significant fluctuations in water levels will impact the recreational use of the lake, potentially adversely affecting local tourism and revenue, such as a decrease in visitors to resorts, campsites, and marinas.	- This alternative will have shorter construction timelines than alternative 4 & 5; however, construction may still discourage tourists from visiting Kashwakamak Lake due to concerns related to construction noise, visual impacts, and the temporary loss of amenities. - Local businesses (e.g., resorts, campsites, marinas) that rely on tourism may experience fluctuations in revenue during the construction period.	- Longer construction timelines may discourage tourists from visiting Kashwakamak Lake due to concerns related to construction noise, visual impacts, and the temporary loss of amenities. - Local businesses (e.g., resorts, campsites, marinas) that rely on tourism may experience fluctuations in revenue during the construction period.	- Longer construction timelines may discourage tourists from visiting Kashwakamak Lake due to concerns related to construction noise, visual impacts, and the temporary loss of amenities. - Local businesses (e.g., resorts, campsites, marinas) that rely on tourism may experience fluctuations in revenue during the construction period.
Social Environment Evaluation		**Less Preferred**	**Not Preferred**	**Preferred**	**Preferred**	**Less Preferred**
FIRST NATIONS/ CULTURAL ENVIRONMENT						

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
Lands and Harvesting Rights	Potential impacts to Indigenous Communities lands and harvesting rights (i.e., Manòmin, walleye, and other fish harvesting uses or potential for use, and portage routes).	- In the event of dam failure, there is a risk that higher water levels could flood the wild rice fields, potentially damaging the annual crops. Additionally, changes in water levels could affect the temperatures of the watercourse and rice fields. - Temporary impacts are expected on upstream fish habitat due to dam failure, along with more significant effects on downstream sport fish habitat, particularly for walleye.	Untouched lands, including the removal of vegetation and habitat, as well as the upstream and downstream watercourse, would need to be modified or destroyed to construct the new passive system. Mitigation would need to be implemented within detailed design to minimize impacts. - Potential impacts to the Manòmin may occur if there is a reduction in water levels/water flow downstream. - Changes in flow regime may also adversely affect walleye spawning and harvesting success. - Mitigation measures will be implemented during construction, including temporary closures or rerouting of portage routes, temporary fishing restrictions, the implementation of bypass measures to maintain the flow regime for fish habitat and Manòmin, and implementation of timing windows, among other actions.	- No impacts anticipated on the Manòmin as water levels and temperatures will be maintained with the rehabilitation of the structure. - Mitigation measures will be implemented during construction, including temporary closures or rerouting of portage routes, temporary fishing restrictions, the implementation of bypass measures to maintain the flow regime for fish habitat and Manòmin, and implementation of timing windows, among other actions.	- No impacts anticipated on the Manòmin and fish habitat/harvesting as flow regime will be maintained. - Mitigation measures will be implemented during construction, including temporary closures or rerouting of portage routes, temporary fishing restrictions, the implementation of bypass measures to maintain the flow regime for fish habitat and Manòmin, and implementation of timing windows, among other actions.	- Untouched lands, including the removal of vegetation and habitat, as well as the upstream and downstream watercourse (sensitive fish habitat (Walleye)), would need to be modified or destroyed to construct the new dam downstream. Mitigation would need to be implemented within detailed design to minimize impacts. - No impacts anticipated on the Manòmin as flow regime will be maintained.

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
Built Heritage and Cultural Heritage Features	Potential impact to cultural and/or heritage features in the project area.	- No impacts.	- CHER confirmed that the Dam **does not** retain cultural heritage value or interest (CHVI) under the Ontario Heritage Act. No impacts to cultural heritage resources anticipated.	- CHER confirmed that the Dam **does not** retain cultural heritage value or interest (CHVI) under the Ontario Heritage Act. No impacts to cultural heritage resources anticipated.	- CHER confirmed that the Dam **does not** retain cultural heritage value or interest (CHVI) under the Ontario Heritage Act. No impacts to cultural heritage resources anticipated.	- CHER confirmed that the Dam **does not** retain cultural heritage value or interest (CHVI) under the Ontario Heritage Act. No impacts to cultural heritage resources anticipated.
Marine Archaeological Features	Potential impact to marine archaeological features in the project area.	- No impacts.	- No impacts anticipated as Marine AA did not find any archaeological resources.	- No impacts anticipated as Marine AA did not find any archaeological resources.	- No impacts anticipated as Marine AA did not find any archaeological resources.	- No impacts anticipated as Marine AA did not find any archaeological resources.
Archaeological Features	Potential impact to land archaeological features in the project area.	- No impacts.	- Based on the findings from the Stage 1 and 2 AA, no archaeological impacts are expected for this alternative. The majority of the study area, including the existing dam locations, access road, and potential staging areas, has been cleared of archaeological resources. - A small Indigenous site was identified along the water's edge in the eastern portion of the study area, leading to a Stage 3 assessment. A restricted area, along with a 10-meter buffer zone, was established. This alternative is not expected to impact the archaeological site.	- Based on the findings from the Stage 1 and 2 AA, no archaeological impacts are expected for this alternative. The majority of the study area, including the existing dam locations, access road, and potential staging areas, has been cleared of archaeological resources. - A small Indigenous site was identified along the water's edge in the eastern portion of the study area, leading to a Stage 3 assessment. A restricted area, along with a 10-meter buffer zone, was established. This alternative is not expected to impact the archaeological site.	- Based on the findings from the Stage 1 and 2 AA, no archaeological impacts are expected for this alternative. The majority of the study area, including the existing dam locations, access road, and potential staging areas, have been cleared of archaeological resources. - A small Indigenous site was identified along the water's edge in the eastern portion of the study area, leading to a Stage 3 assessment. A restricted area, along with a 10-meter buffer zone, was established. This alternative is not expected to impact the archaeological site.	- A small Indigenous site was identified along the water's edge in the eastern portion of the study area, leading to a Stage 3 assessment. A restricted area, along with a 10-meter buffer zone, was established. - The archaeological site could influence the design and construction of this alternative, as it will need to be avoided.
First Nations/ Cultural Environment Evaluation		**Preferred**	**Less Preferred**	**Preferred**	**Preferred**	**Less Preferred**

Criteria Measure	Description of Criteria Measures	Alternative 1 Do Nothing	Alternative 2 Decommission Dam and Construct Passive Control System	Alternative 3 Rehabilitation of the Existing Dam	Alternative 4 Replace Existing Dam in Same Location	Alternative 5 Construct New Dam Downstream
		Rationale				
ECONOMIC ENVIRONMENT						
Capital Costs	Relative measure of the initial costs to install/construct the proposed works, including environmental mitigation, sediment management, etc.	- No/low cost.	- Relatively moderate cost pending the proposed design. - Approximate estimate of $1.0 – 1.5 Million; however, is heavily dependent on the design and therefore a more refined cost estimate can't be provided at this time.	- Moderate cost pending the proposed rehabilitation design. - The 2022 Dam Safety Review (Hatch) estimated the value to be approximately $1.5 million.	- This alternative has the second highest cost, estimated at approximately $4.1 million. - Additional costs due to shoring to complete work.	- This alternative has the highest anticipated cost as the banks are farther apart at this location. It will require a longer dam elevating the cost of the dam significantly. - Estimated cost dependent on the placement of the dam downstream and proposed design. Estimated cost would be significantly higher than Alternative 4. - Reduced cost of shoring by utilizing the existing dam during construction.
Operational and Maintenance Costs	Relative measure of the ongoing maintenance and operational costs following implementation.	- Ongoing and enhanced monitoring required to identify risk of failure and provide for early warning of downstream residents/communities.	- Low operational and maintenance costs.	- If repairs could even be completed, constant inspections/monitoring and ongoing maintenance would be required. Dam will eventually need to be replaced at the end of design life (approx. 20 years).	- Standard monitoring and maintenance costs for a new dam. - Some additional maintenance training may be required pending the design.	- Standard monitoring and maintenance costs for a new dam. - Some additional maintenance training may be required pending the design.
Economic Environment Evaluation		**Less Preferred**	**Preferred**	**Not Preferred**	**Less Preferred**	**Not Preferred**

5.3 Selection of the Preferred Alternative

Following a comprehensive evaluation process, incorporating the diverse expertise, knowledge, and input from various disciplines, agencies, stakeholders, First Nations, CLC and the public, the Technically Preferred Alternative is Alternative 4, replace the existing Kashwakamak Lake Dam at the same location with a similar alignment to that of the existing dam. Alternative 4 addresses the Problem Statement outlined in this study while preserving the integrity of the Watershed Management Plan. The new dam will be engineered to handle larger storm events, be resilient to climate change, and comply with current safety standards. Moreover, constructing the new dam at the existing site will not introduce additional areas of disturbance, is expected to have no permanent impacts on property, and will minimize socio-economic disruptions, including no long-term effects on First Nation Lands (Manòmin).

On September 9th, 2024, MVCA Board of Directors endorsed Alternative 4, replace the existing Kashwakamak Lake Dam at the same location, to be the selected Technically Preferred Alternative.

5.4 Detailed Environmental Analysis/Impact Assessment

To complete the detailed environmental analysis/impact assessment of the Technically Preferred Alternative, the information collected for the baseline environmental inventory, as well as the alternatives evaluation, was examined in greater detail to confirm potential impacts, refine mitigation and/or compensation measures, and identify any unforeseen impacts.

The screening criteria used were consistent with the criteria provided in the Conservation Ontario Class Environmental Assessment (amended February, 2024) guidelines. These criteria represented impacts on physical, biological, cultural, socio-economic, and engineering/technical considerations.

The environmental components where potential positive, negative, or neutral effects are likely were identified. The detailed consideration included potential effect ranking as Negative High (-H), Negative Medium (-M), Negative Low (-L), Neutral or None (N), Positive Low (+L), Positive Medium (+M), or Positive High (+H), based on the magnitude, geographic extent, duration, frequency, permanence or reversibility, and ecological context of the effect in question. Proposed mitigation and/or compensation measures, along with any residual effects, were also documented.

The results of the detailed environmental impact analysis of the Preferred Alternative are presented in ***Appendix N***. The criteria determined as "Not Applicable (NA)" and environmental components where no impacts are likely were omitted from further discussion. The proposed mitigation measures are further discussed and outlined in Section 6.0.

6.0 ENVIRONMENTAL MITIGATION MEASURES

To address potential impacts on the physical, biological, cultural, socio-economic, and engineering/technical environments identified in the Detailed Environmental Analysis (Section 5.4, ***Appendix N***), it is recommended that the following mitigation measures be integrated into the detailed design and executed during construction. These measures aim to minimize impacts and safeguard the Natural, Social, and First Nations Cultural Heritage Environment. In addition, it is recommended during construction that the regulation of water levels/dam activities follow restrictions and guidelines outlined in MRWMP (amended 2020) and MRWP (2021).

6.1 Physical

6.1.1 Air Quality

Generation of fumes and odours may be created during construction by machinery working within the study area. Odour and fume impacts will be minimized by ensuring that all equipment is properly maintained and that all pollution control devices on the equipment are functional and well-maintained.

6.1.2 Noise and Vibration

The potential negative effects on noise levels and vibration are expected to be minimal and confined to areas in close proximity to the construction site within the local study area. These impacts are attributed to the operation of construction equipment and a possible increase in truck traffic during peak hours. Mitigation measures may include:

- Conduct construction Monday to Friday during normal working hours;
- Enforcing the North Frontenac Noise By-Law;
- Performing regular equipment inspections and operations (e.g., restricting the swinging of truck tailgates to dislodge material during filling operations) to ensure noise levels are kept to a minimum, and
- Notifying the public in advance of works that may cause excessive vibration.

6.1.3 Water Flow Regime

Effective water management and control will be essential before and during the dam replacement project. Water levels will vary based on excavation depths and the duration of open excavations. Additionally, lake water levels will change in response to extreme weather and seasonal variations. It will be the responsibility of the contractors to develop a dewatering plan that accounts for expected lake water levels and surficial and bedrock conditions. A specialized dewatering contractor will provide recommendations for suitable dewatering methods to effectively manage water levels.

To the greatest degree possible, all in-water works and associated dewatering activities should be scheduled and completed outside of the recreational tourism season (May long-weekend to September long-weekend.) Where it is necessary to drawdown water levels and conduct dewatering during the recreational tourism season, the duration should be limited and a minimum of 2-weeks notice should be given to waterfront property owners.

Groundwater disposal must be carried out in compliance with applicable regulations. A Dewatering Control Plan shall be prepared by the Contractor and submitted to MVCA for approval prior to commencing construction. Flows will be maintained at all times. Dewatering shall be carried out as per OPSS 517 – *Construction Specifications for Dewatering*.

Assessment of the dewatering requirements and the need for registration on the Environmental Activity and Sector Registry (EASR) or a Permit to take Water (PTTW) should be carried out by specialists experienced in this field.

6.1.4 Existing Surface Drainage and Groundwater Seepage

Potential negative affects on existing surface drainage are expected to be minor and confined to the construction access and staging areas within the local study area. Where existing drainage paths cannot be maintained, mitigation may include the following:

- Minimizing vegetation removal and soil exposure during site preparation;
- Implementing sediment and erosion control measures (e.g., installing and maintaining a sediment fence along the boundaries of the construction access and/or staging areas) in accordance with the MVCA's erosion and sediment control requirements during construction, and
- Ensuring the Contractor takes appropriate measures for the collection and disposal of surface and groundwater runoff, including the use of an adequate pumping system.
- Restoring the site to a condition that provides for equivalent or improved pre and post-construction drainage and groundwater infiltration.

6.1.5 Water Quality

Mitigation measures will be implemented by the contractors to prevent adverse impacts from contaminants, foreign objects, or sediment movement into surface waters and groundwater within the study area. The following actions will be taken to mitigate the affect of construction activities near watercourses associated with the study area:

- Appropriate erosion and sediment control measures will be installed prior to construction to prevent siltation of watercourses.

- The construction site and staging area will be monitored, and waste materials collected on a regular basis to prevent the accumulation of litter and construction debris in nearby woods, fields, watercourses, wetlands, and water bodies;
- Mobile equipment refueling will take place no closer than 30 m from any watercourse to prevent water contamination due to accidental fuel spills. For non-mobile equipment, refueling will be carried out in a controlled manner to prevent fuel spillage, and drip pans will be placed under parked equipment at all times;
- Equipment shall not be parked or operated within any drainage course. Equipment operating near any watercourse must be in good working condition, properly maintained, and free of excess oil and grease to reduce the risk of contaminant leakage, and
- Should a spill occur, proper containment, cleanup, and reporting in accordance with provincial and federal requirements must be completed to protect surface water resources. The Contractor is required to have a spill kit available on-site in the event of a spill. All spills that may have an adverse effect should be reported to the MECP) Spills Action Centre (1-800-268-6060) in accordance with provincial and federal legislation.

During detailed design, it will be determined whether a Permit to Take Water (for greater than 400,000 L/day) or an Environmental Activity Sector Registry (for 50,000 L/day to 400,000 L/day) will be required during construction.

6.1.6 Management of Excess Materials

The proposed project is expected to generate excess soil. As a result, O.Reg. 406/19: On-Site and Excess Soil Management (as amended) regulations will be followed for all soil taken off site, which provides for the transportation and processing of hazardous and non-hazardous waste.

6.2 Biological

6.2.1 Wildlife and Migratory Birds

Due to the sighting of migratory birds and their habitat within the study area. no tree or other habitat vegetation removal should occur during the core migratory bird breeding and nesting window of April 1 to August 31 of any year. A screening of the study area for the presence of migratory birds or their nests should be conducted by an avian specialist prior to any disturbance or removal of vegetation during this period. If migratory birds or their nests are encountered at any time of the year, work should not continue in the area of the nest until:

- It has been determined by an avian specialist that the young have fledged and vacated the nest and work area; or
- An avian specialist has established a suitable buffer distance to prevent disturbance to the birds; and

- If a buffer distance has been implemented, an avian specialist must monitor the construction to ensure that migratory birds and their eggs are not disturbed, destroyed, or taken.

The removal of vegetation during the proposed replacement of the dams may temporarily disturb wildlife habitat; however, this type of habitat is well represented outside the study area. Impacts to at-risk wildlife species listed on the Species at Risk in Ontario List (Ontario Regulation 230/08) (e.g., turtles, birds, etc.) are discussed below in Section 6.2.5.

6.2.2 Vegetation

To mitigate vegetation disturbance and prevent erosion and sediment transport, the following principles should be implemented during project design:

- Disturbance of riparian vegetation should be minimized where possible;
- Implement tree protection measures such as installing fencing around the root zones and to delineate construction zone;
- Embankments disturbed as a result of construction shall be restored to their pre-construction condition or improved (i.e., enhanced), and
- Disturbed vegetative cover should be replaced with native species appropriate to the Kashwakamak Lake study area. Areas of exposed soil shall be revegetated as soon as possible following disturbance. If there is insufficient time in the growing season for seeds to sprout, the site shall be stabilized with temporary erosion and sediment control measures and seeded in the following spring.

Field surveys did not document any provincially, federally, or regionally significant plant species. In addition, no SAR plants or rare plants were identified. Adverse impacts to SAR or rare plant/vegetation communities therefore are not anticipated to result from the project works.

6.2.2.1 Invasive and Noxious Plant Species

During the 2023 field investigation, no plant species classified under the Weed Control Act (1990) or as an 'Invasive Species' under the Invasive Species Act (2015) were observed within the study area. However, the contractors should take the following measures during project implementation:

- Debris, including earth clods and invasive species material attached to the equipment's exterior, is prohibited from entering the working area. Equipment arriving on-site should be inspected near the entrance for debris, which must be completely removed and managed according to specified procedures before the equipment proceeds to the working area, ad
- Equipment must also be inspected for debris before leaving the working area. Any debris should be removed and managed according to specified guidelines to prevent further contact with standing, sprayed, or cut invasive species.

6.2.2.2 Culturally Significant Plant Species

Manòmin, although not present in Kashwakamak Lake, is found growing in Mud Lake which is approximately 7 km downstream from Kashwakamak Lake and subsequently affected by alterations to water levels (MRWMP).

During construction, guidelines and restrictions as outlined in the MRWMP should be implemented. This includes having outflow being controlled from June 1st – September 30th to maintain the growth of Manòmin crops and allow for harvest.

6.2.3 Fish and Fish Habitat

Under Section 35 of the Fisheries Act, 2019, a key habitat protection provision prohibits any work, undertaking or activity that would result in the "harmful alteration, disruption or destruction of fish habitat" (HADD), unless authorized by DFO or through regulations outlined in the Fisheries Act. The activities outlined in this section, as they relate to the planned construction works, are not anticipated to result in HADD, provided the design considerations and mitigation measures are employed as recommended.

Restricted activity timing windows are applied to protect fish from impacts of works or undertakings in and around water during spawning migrations and other critical life history stages. These guidelines are set by the MNR based on location; the study area is in the MNR Southern Region. Given the known presence of the fish species, in-water work may only be permitted from July 16 – March 14.

Erosion and sediment control (ESC) measures shall be implemented to prevent sedimentation in the watercourses, as sediment can cause respiratory distress, reduced feeding efficiency and impairment to growth and reproduction in fish species. The following will be included in the Contract Documents to protect fish and fish habitat:

- OPSS 804 - Construction Specification for Temporary Erosion Control
- OPSS 805 - Construction Specification for Temporary Sediment Control, and
- OPSS 182 - General Specification for Environmental Protection for Construction in Waterbodies and Waterbody Banks

6.2.4 Species at Risk

The following mitigation measures should be employed to protect SAR and their habitat during project work in order to maintain compliance with the ESA:

- SAR Awareness Training: This training shall be provided by the Contractor to all staff working on site. All employees involved in construction activities should be trained in the identification

and life cycles of the SAR that may be encountered during construction. The training should focus on identification of SAR that may be observed within the study area (i.e. bats, turtles);

- Daily Site Inspections for SAR: For the duration of the project works, the Contractor shall perform a thorough sweep of the construction zone before works are to begin to encourage any SAR on-site to move away. Site inspections shall be undertaken throughout the workday to determine if SAR have entered the work area. The following mitigation measures are required if SAR enter the site and to prevent adverse impacts to the SAR:
    - Temporary Work Stoppage during SAR Encounter: If any SAR or their nest is observed during the site inspection or at any other time, the Contractor shall immediately halt construction within 10 m of the species. SAR that are encountered within the work zone should be allowed a reasonable amount of time to leave the work area. If a turtle is encountered appears to be moving through the area, the species shall be allowed to move out of the work area on their own, and,
    - Report SAR Observations within the Work Area to the MECP: The Contractor will contact MVCA's Contract Administration to notify them of SAR observations within the work area. Contract Administrator shall report the SAR observation to the MVCA in writing within 24 hours of the observation to seek advise on how to proceed if a SAR is encountered within or adjacent to the work area if required (i.e., need to consult MECP etc.). All SAR observations and any relocation shall be documented and reported to MECP/NHIC. SAR should only be handled by a qualified professional who have knowledge of the species and the correct approvals to undertake SAR handling.

6.2.4.1 SAR Turtles

There is potentially suitable nesting and overwintering habitat for Blanding's Turtle, Midland Painted Turtle, Map Turtle, and Snapping Turtle within the study area (OAO/Kashwakamak Lake). Any work related to the construction and replacement of the existing Kashwakamak Dam should take place outside the active turtle nesting season for Central and Northern Ontario, which is from April 15 to October 15, or protective measures, such as exclusion fencing, should be implemented to reduce the risk of harm.

6.2.4.2 SAR Bats

Given the presence of forests (i.e., FOM) and high-quality maternity roosting trees in the study area, little brown myotis, northern myotis, and tri-colored bat, have a moderate potential of occurring during their active season (April 1 – September 30). Bat presence surveys may be required during detailed design to determine use by SAR bats depending on vegetation removals.

6.2.4.3 Birds

No species-at-risk (SAR) birds were observed during the 2023 site visit. The forested area within the study site may offer potentially suitable breeding habitat for both the Red-headed Woodpecker and the Wood Thrush. Furthermore, any activities that could harm or kill SAR birds should be scheduled outside their active season. Therefore, it is recommended that tree removals be avoided from April 15 to August 31. If tree removal is required during this time period the area should be screened and cleared by an Avian Biologist. It is not expected that vegetation removed for these works will impact SAR birds, provided mitigation measures/timing windows are followed.

6.3 Cultural

The impacts of the project on land uses in the study area were assessed in accordance with the scope of the assignment. In general, it is not anticipated that the construction activities will have any long-term negative effects on adjacent land uses.

6.3.1 Recreational or Tourist Uses of a Water Body and/or Adjacent Lands

Kashwakamak Lake is popular for recreational and tourist activities like boating, swimming, fishing, camping, resorts and cottage stays. The construction is anticipated to cause short-term effects on these activities, which may include an earlier drawdown of the lake and temporary closures or relocations of portage routes. Communications will be critical and a Communication Plan including communication protocols shall be developed to ensure timely and appropriate distribution of information to waterfront property owners. A minimum 2-weeks notice shall be given prior to any early drawdown of the lake.

6.3.2 Cultural Heritage – Archaeology

Given the location of the archaeological findings in relation to the recommended preferred alternative for the replacement of the Kashwakamak Lake Dam at the same location, the MVCA is recommending that "avoidance and protection of the site" be adopted as the appropriate Stage 4 mitigation of development impacts. Through careful design of the new dam and strategic placement of staging areas, we are confident that the archaeological site will be fully preserved and will not be impacted by the proposed replacement. MVCA has developed a proposed protection strategy for the archaeological site, which is included as an appendix to the Stage 3 Archaeological Assessment Report.

Short-Term Protection:

- A temporary barrier, such as snow fencing, to be erected during construction immediately adjacent to the construction area to delineate the site limits. This will aid in the protection of the archaeological site, as well as maintaining the natural vegetated buffer of approximately 50 m from the site;

- Install clear and visible signs around the site and buffer zone that notify all personnel of the archaeological importance of the area and the prohibition of unauthorized entry;
- Delineate a "No Go Zone" area and issue instructions to all on-site construction personnel to avoid accidental damage to the site:
    - The "No Go Zone" shall not undergo any site alternations, either temporarily or permanently. This includes, but is not limited to, minor forms of soil disturbance such as tree removal, landscaping and regrading.
    - No construction equipment, personnel, or machinery may enter the "No Go Zone".
    - The location of the "No Go Zone" will be clearly identified on the construction drawings, contract documents and reference will be made to avoid this area;
    - Temporary closure or relocation of the portage route on the north shore, and
    - Only trained archaeologists or designated personnel should be allowed access to the archaeological site, and only under appropriate conditions.
- Following construction, retain a licensed consultant archaeologist to complete a Stage 4 avoidance and protection report documenting the success of site avoidance after the completion of the work.

Long-Term Protection:

To ensure the long-term protection of the archaeological site, MVCA proposes the following mitigation measures:

- Establishment of a Permanent "No Go Zone" for Development: A permanent "No Go Zone" will be established for development of lands through the creation of a natural vegetation buffer, with a minimum offset of 10 meters from the archaeological site. No future development or alteration of natural features (i.e., minor forms of soil disturbance such as tree removal, landscaping, and regrading) will be permitted on MVCA lands, with the exception of the dam replacement. As a result, the existing heavily vegetated buffer around the archaeological site will be preserved to protect the archaeological site. This buffer zone will be clearly delineated on the design plans for the Kashwakamak Lake Dam and will be incorporated into MVCA's legal documents for the site.
- On-Site Signage: MVCA will install permanent signage at the entrance to the dam site and along the shoreline portage route to clearly communicate the following:
    - The location of the archaeological site and the prohibition of access beyond this point ("No Go Zone"), except for authorized personnel.

- A warning that any unauthorized alteration within the "No Go Zone" including soil disturbance, vegetation removal, or landscaping, may result in penalties under Section 69 of the Ontario Heritage Act or its associated regulations.

- Prohibition of Alterations without Authorization: No alterations to the archaeological site, whether temporary or permanent, including even minor soil disturbances (e.g., tree removal, landscaping, or excavation), will be permitted without prior approval from MVCA to access land and additional archaeological fieldwork by a licensed consultant archaeologist may be required before any such activities can take place. Any future archaeological assessment of the Kashwakamak Lake Dam site (BfGf-3) should involve continued engagement with First Nation communities/ organizations.
- Record-Keeping and Documentation: MVCA will maintain comprehensive records of any site assessments, discoveries, or protective measures undertaken to safeguard the archaeological site. These records will be kept up to date and accessible for future reference and compliance purposes.

During construction, there is always the chance of encountering buried archaeological material. If this occurs, the Contractor shall immediately stop all construction activities in the area and contact the Contract Administrator who will contact the Ministry of Citizenship and Multiculturalism (MCM) (416-314-7159). If unmarked human remains are uncovered, the provisions of the Ontario Cemeteries Act apply. The Contractor shall immediately stop all construction activities in the area and contact the Contract Administrator who will contact the office of the Heritage Operations Unit, MCM, the Registrar of Cemeteries (416-326-8394), the local Ontario Provincial Police (OPP), and the local Coroner.

6.3.3 Built and Cultural Heritage

A marker recognizing the workers who built the dam is carved into the bedrock near the weir. The Contractor should provide and install suitable cover to protect the marker from construction impacts for the duration of the project. The remainder of the study area has been assessed and cleared of any built heritage or cultural heritage landscape resources.

6.4 Socio-Economic

6.4.1 Surrounding Neighbourhood or Community

The Kashwakamak Lake Dam is accessed via private property and the lake is widely used by local residents/cottagers for recreational purposes. Regular communication with the landowner will be required throughout the duration of the project to confirm matters related to access, materials storage, and other planned and unplanned activities and their impacts on the landowner and tenants. Protocols shall be developed to ensure timely and appropriate communications with the landowner and other landowners in the immediate vicinity of the construction site.

6.4.2 Property Access & Traffic Management

The dam is accessed by a private road off of Gutheinz Road, with several privately owned properties adjacent to the site. In the lands surrounding the study area, there is a potential for increase in truck traffic and noise levels during construction. Mitigation measures may include:

- A Communication Plan shall be developed and implemented during detailed design and construction to ensure timely and appropriate communications with property owners regarding construction schedules, potential disruptions, and other matters;
- Coordinate and develop locking protocol for gate shared with Hydro One and local landowner.
- Implement a traffic management plan to ensure safe and efficient access around the construction area and that access to private properties is maintained throughout construction phase;
- Install appropriate measures (i.e., fencing, signage, etc.) that minimize traffic disruption;
- Provide adequate notification of potential disruptions to access, and
- Limit construction to Monday to Friday during normal working hours, if feasible.

6.5 Engineering/Technical

6.5.1 Erosion and Sediment Control

Project works can lead to the suspension of sediment in the watercourse. Also, exposed or stockpiled soils adjacent to the watercourse can lead to sedimentation during rain events. In order to prevent the entrainment of sediment in the watercourses, the detailed design and tender package shall include the following mitigation measures:

- An Erosion and Sediment (ESC) Control Plan shall be prepared by the Contractor and submitted to MVCA for approval;
- ESC measures shall be installed prior to starting work to prevent sediment from entering the watercourse and will be removed at the completion of construction;
- ESC measures shall be inspected for effectiveness regularly throughout construction and deficiencies corrected, and
- The installation, monitoring, maintenance, and removal of temporary ESC measures shall be according to OPSS 804 - Timing Constraints for Temporary Erosion Control Measures and OPSS 805 - Timing Constraints for Temporary Sediment Control Measures.

6.5.2 Geotechnical

The recommendations presented in this report assume that an adequate level of construction monitoring by qualified geotechnical personnel will be provided during construction. The bedrock

quality should be confirmed by extending 1.5 m probe holes into the bedrock within the footing footprints. These holes will need to be reviewed by the geotechnical engineer to ensure that no significant mud seams or voids exist. The holes must be filled with grout after the inspection is completed. All bearing surfaces should be inspected and approved by experienced geotechnical personnel prior to placing the footings or lean mix concrete slabs.

Additionally, adequate construction monitoring should include laboratory and field testing during construction. This includes full-time compaction testing of backfill behind retaining walls and part-time compaction testing of general backfill, along with laboratory testing for the proposed fill soils for this site. Periodic testing of concrete is also required.

All backfilling shall comply with OPSS 501 for compaction requirements, unless the design recommendations included in this report exceed the provisions of OPSS 501.

7.0 PROJECT IMPLEMENTATION

This section provides an overview of the principal actives associated with implementing the Project, including general guidance for permitting and approvals, monitoring and commitments during detailed design.

7.1 Permitting and Approvals

The execution of all project activities is contingent upon securing all required federal, provincial, and municipal permits and approvals before commencing project work. The following permits and approvals will be required during the detailed design phase:

MNR - Approval to construct, alter, improve or repair dam infrastructure in Ontario is subject to Lakes and Rivers Improvement Act Authorization (LRIA). MNR is responsible for administering the LRIA and its associated regulations and processing applications under LRIA section 14 or 16. MNR's role is to review applications and provide an authorization on an application but the MNR does not provide design recommendations.

Crown land and shore lands are also regulated under the *Public Lands Act, Section 14*. Therefore, a Crown Land Work Permit will also be required to construct a structure and working within the water body.

DFO – The Fish and Fish Habitat Protection Program ensures compliance with relevant provisions under the *Fisheries Act* and the *Species at Risk Act*. The program reviews proposed scope of works, undertakings and activities that may impact fish and fish habitat. The program will review the proposed project to identify the potential risks to the conservation and protection of fish and fish habitat. The Fish and Fish Habitat Protection Program ensures that impacts are managed in the best way possible. During the review, DFO will determine if the project will need an authorization under the Fisheries Act. If it is determined that the project will cause the death of fish, and/or harmful alteration, disruption or destruction of fish habitat, an authorization is required. The authorization will include terms and conditions you must follow to avoid, mitigate, offset and monitor the impacts to fish and fish habitat resulting from the project. Based on the proposed scope of work, the proposed dam replacement does not follow a Code of Practice and therefore a Request for Review will need to be prepared and submitted to the DFO.

Transport Canada (TC) – Under the *Canadian Navigable Waters Act* (CNWA), owners of works who propose to construct, place, alter, rebuild, remove, or decommission works that are in, on, over, under, through or across any navigable water, may be required to apply for an approval from Transport Canada, or seek authorization through the public resolution process. The Navigation Protection

Program (NPP) is responsible for administering and processing applications for approval. The Minister of Transport has the authority to issues terms and conditions with an approval.

Kashwakamak Lake is not listed on the Scheduled Waterways list under the Canadian Navigable Waters Act (CNWA). It appears the watercourse is navigable based on the size of the watercourse, flow, and connectivity to Mississippi River. Kashwakamak Lake is popular for many activities including fishing, hiking, canoeing and other water sport activities.

Based on the size of the dam, the watercourse, and the fact that the watercourse is connected to the Kashwakamak Lake and Mississippi River which is used for recreational boating, a full application process will need to be completed in accordance with NPP. Permitting requirements to be confirmed during the detailed design.

MECP - A Permit to Take Water (PTTW) or Environmental Activity Sector Registry (EASR) will be required if dewatering activities will be greater than 50,000 + litres of water a day from the environment. During the detailed design, a review of water-taking activities will need to be completed to determine if there are any significant concerns with respect to short-term pumping of shallow groundwater.

The EASR regulation prescribes the takings of ground water and stormwater for the purpose of dewatering construction projects that require dewatering between 50,000 and 400,000 L/day. Activities required to be registered in the EASR do not require a PTTW for the water taking. An environmental compliance approval (ECA) under section 53 of the *Ontario Water Resources Act* (OWRA) is also not required for the discharge of stormwater.

A Permit-to-Take-Water regulation prescribes the takings of ground water and stormwater for the purpose of dewatering construction projects that require dewatering greater than 400,000 L/day. Applying for the permit involves the submission of an application and appropriate scientific evaluation/studies. MECP will review the permit application, measuring it against a number of requirements. Designated PTTW applications will be posted on the Environmental Registry in accordance with the Environmental Bill of Rights and consider public comments in its decision. The permit authorizes you to withdraw water from a water source(s) according to the terms and conditions on the permit.

For the Kashwakamak Lake Dam project, compliance with the Endangered Species Act (2007) may be necessary, particularly regarding the potential removal of forested areas. Depending on the extent of forest removal, SAR bat surveys during detailed design may need to be conducted, and an Information Gathering Form (IGF) submitted for review to MECP.

7.2 Monitoring Requirements

Environmental monitoring is essential to characterize and monitor the quality of the surrounding environment, identify potential negative effects and refine mitigation measures, ensure compliance with environmental regulations, and prevent long-term adverse impacts on the environment.

A comprehensive monitoring program will be developed in the detailed design phase for the replacement of the Kashwakamak Lake Dam. This program will be designed to monitor impacts to the environment during the various stages of construction and following construction completion. This will allow for an inclusive assessment of cumulative impacts. The key elements of the comprehensive monitoring program will include, but are not limited to, the following, described below:

- Construction work monitoring, and
- Environmental compliance monitoring.

The objective of the construction works monitoring program will be to assess the structural integrity of the construction and their effectiveness with respect to controlling environmental impacts during construction (i.e., erosion and sediment control, water management, etc.).

Construction-phase and post-construction monitoring may include recording of water levels, photographic record of the constructed works, and a review of constructed works by a qualified engineer. Post-construction monitoring may also be undertaken to monitor and maintain the dam replacement including site investigations to confirm no negative impacts are occurring upstream and downstream of the dam.

7.3 Detailed Design Commitments

During this study, the following items were noted for consideration in the Detailed Design phase:

- Fish Passage - During the detailed design of the Kashwakamak Lake Dam, further consideration should be given for improvements to fish passage. Enhancing fish passage will help ensure the continued movement of aquatic species between upstream and downstream habitats, promoting biodiversity and ecosystem health. This may involve the incorporation of fish ladders, bypass channels, or other innovative solutions to facilitate safe and effective passage for various fish species, thereby mitigating the potential impacts of the dam on aquatic life. However, there are currently no other dams within the watershed that fish passage capabilities either for upstream or downstream passage, within the MRW. With the exception of the American Eel, who has potential to occur in the lower reaches of the Mississippi River below Dalhousie Lake, none of the fish species in the Mississippi River (and specifically in proximity to the Kashwakamak Lake Dam) are large distance migrators and are usually not the intended target species of fish passage systems installed in other locations. While the feasibility of adding fish

passage to the new dam may be considered as part of detailed design, it is anticipated it will be screened out based on the above noted.

- Permitting/Approvals - The execution of all project activities is contingent upon securing all required federal, provincial, and municipal permits and approvals (DFO, TC, MECP, MNR, etc.) before starting the project.
- Mitigation Measures – Detailed mitigation measures will be outlined and assessed during the design and tendering phases. Pending the detailed design, mitigation measures must be established to prevent potential impacts from water level fluctuations, sedimentation, and spills of harmful substances during construction activities. Protection of fish and fish habitat, species at risk, significant aquatic and terrestrial wildlife habitats, and downstream Manómin beds is essential during these activities.
- Dewatering Control Plan - A dewatering plan should be prepared during the detailed design phase to effectively manage surface/groundwater and ensure the stability of the construction site.
- Contingency Plan - A plan will be developed during the detailed design phase to address potential unforeseen circumstances (e.g., construction delays) and ensure the project remains adaptable.
- Tree Removal and Restoration Plan - A Tree Removal and Restoration Plan to be prepared during the detailed design phase. Impacts to trees as a result of construction will be minimized wherever possible. Environmental mitigation measures such as tree protection, proposed landscaping, plantings, restoration work, and mitigation measures during construction will be included in the plan and tender package.
- Erosion and Sediment Control (ESC) Plan - Temporary and permanent ESC measures are essential during construction and for the long-term. Site-specific temporary ESC measures to be determined during detailed design and included within Contract Drawings, following current Best Management Practices, Standard Drawings and Special Provisions, as well as conform to MVCA standards. Preventing erosion will be the preferred mitigation measure in efforts to eliminate and/or reduce sedimentation.
- Notification Protocol - The MVCA recognizes that the lake is heavily utilized for various recreational and tourism activities. Therefore, a plan will be established to inform stakeholders of any changes (e.g., early lake drawdown) and impacts related to construction, minimizing disruption to these activities.
    - The MVCA will aim to select timings that minimize impacts and accommodates lake users.
    - Adequate notification will be provided to the local marinas prior to lowering water levels, ensuring they are prepared for an influx of boats during that time.

- Stage 4 Mitigation of Development Impacts – Finalize the "avoidance and protection" strategy for the Stage 4 AA mitigation of development impacts. Ensure that the protection measures outlined in the Stage 3 AA are integrated into the detailed design, reflected in the tender documents, and implemented throughout construction and post-construction phases.
- Monitoring Program - A comprehensive monitoring program needs to be developed in the detailed design phase for the replacement of the Kashwakamak Lake Dam. The program should be designed to monitor impacts to the environment during the various stages: construction and post-construction.

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