LAKE MANITOBA
LAKE ST. MARTIN

OUTLET CHANNELS PROJECT

MANITOBA TRANSPORTATION AND INFRASTRUCTURE

Ice Management Plan

June 30, 2022

Manitoba
Transportation and Infrastructure

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DISCLAIMER

This document was developed to support the Channel Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project). It has been prepared by Manitoba Transportation and Infrastructure as a way to share information and facilitate discussions with Indigenous rights-holders, stakeholders, and the public. It has been prepared using existing environmental and engineering information and professional judgement, as well as information from previous and ongoing public and Indigenous engagement and consultation. The contents of this document are based on conditions and information existing at the time the document was prepared and do not take into account any subsequent changes. The information, data, recommendations, and conclusions in this report are subject to change as the information has been presented as draft. This draft plan should be read as a whole, in consideration of the entire EMP, and sections or parts should not be read out of context.

Revisions to draft plans have been informed by and will be based on information received from engagement and consultation, the Environmental Assessment process, Project planning activities and on conditions of provincial and federal environmental regulatory approvals received for the Project. As these will be living documents, any changes to the plans leading up to and after the start of construction will be shared with regulators, Indigenous rights-holders and stakeholders prior to implementation of the change. Either a revision number or subsequent amendment would be added to the specific environmental management plan to communicate the revision or change.

PREFACE

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the Project) is proposed as a permanent flood control mitigation for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction and operation of two new diversion channels: the Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba to Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Associated with these outlet channels are the development of bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure.

Manitoba Transportation and Infrastructure is the proponent for the proposed Project. After receipt of the required regulatory approvals, Manitoba Transportation and Infrastructure will develop, manage and operate the Project. This Ice Management Plan (IMP) is one component of the overall Environmental Management Program (EMP) framework which describes the environmental management processes that will be followed during the construction and operation phases of the Project. The intent of the EMP is to facilitate the timely and effective implementation of the environmental protection measures committed to in the Environmental Impact Statement (EIS), the requirements and conditions of *The Environment Act* provincial licence and *The Canadian Environmental Act 2012* Decision Statement, and other approvals received for the Project. This includes the verification that environmental commitments are implemented, monitored, evaluated for effectiveness, and adjustments made if/as required. It includes a commitment that information is reported back in a timely manner for adjustment, if required.

A key component for the success of the EMP is environmental monitoring, such that environmental management measures are inspected and modified for compliance with environmental and regulatory requirements, including those set out in provincial and federal approvals received for the Project. As indicated, monitoring results will be reviewed and used to verify predicted environmental assessment conclusions and effectiveness of mitigation measures. If unanticipated effects occur, or if mitigation measures are inadequate, adaptive management measures and subsequent monitoring will be applied, as described further in individual environmental management and monitoring plans. Monitoring results and application of adaptive management measures will inform follow-up reporting to regulators and any required revisions to environmental management plans. Manitoba Transportation and Infrastructure has initiated discussions with rights-holders and the Rural Municipality (RM) of Grahamdale in the Project area on the establishment of an Environmental Advisory Committee (EAC). The EAC would be a platform for sharing monitoring results and discussing issues of concern. In addition, Manitoba Transportation and Infrastructure anticipates that the Committee will coordinate Environmental Monitors and communications during the construction period and will be working with rights-holders and stakeholders on the structure and purpose.

Manitoba Transportation and Infrastructure remains committed to consultation and ongoing engagement with Indigenous rights-holders and stakeholders that are potentially impacted by the Project. Detailed EMP review discussions were incorporated into Indigenous group-specific consultation work plans. Engagement opportunities included virtual open house events, sharing draft environmental management and monitoring plans, sharing plan specific questionnaires, and meetings to discuss related questions and recommendations. The intent has been to offer multiple avenues to share information about the Project so that rights-holders

and stakeholders would be informed and could provide meaningful input into Project planning. The draft EMP plans and questionnaires are also posted on the Project website for public review and comment at: https://www.gov.mb.ca/mit/wms/lmblsmoutlets/environmental/index.html. Feedback and recommendations received were used to update the plans.

Figure A displays a summary of the EMP process. The EMP provides the overarching framework for the Project Construction Environmental Management Program (CEMP) and the Operation Environmental Management Program (OEMP). These will be updated prior to Project construction and operation, respectively, and will consider applicable conditions of *The Environmental Act* licence, *The Canadian Environmental Assessment Act 2012* Decision Statement Conditions and other approvals, any other pertinent findings through the design and regulatory review processes, and key relevant outcomes of the ongoing Indigenous consultation and public engagement processes.

The purpose of the CEMP and OEMP is to guide how environmental issues will be addressed during construction and operation, respectively, and how adverse effects of activities will be mitigated. The CEMP is supported by several specific or targeted management plans that will guide Manitoba Transportation and Infrastructure's development of the Project's contract documents and subsequently, the Contractor(s) activities, in an environmentally responsible manner and to meet regulatory compliance and in constructing the Project. The OEMP will include some of the same targeted plans developed to manage issues during construction, but prior to construction completion, they would be revised and adapted to suit the specific needs during the operation phase.

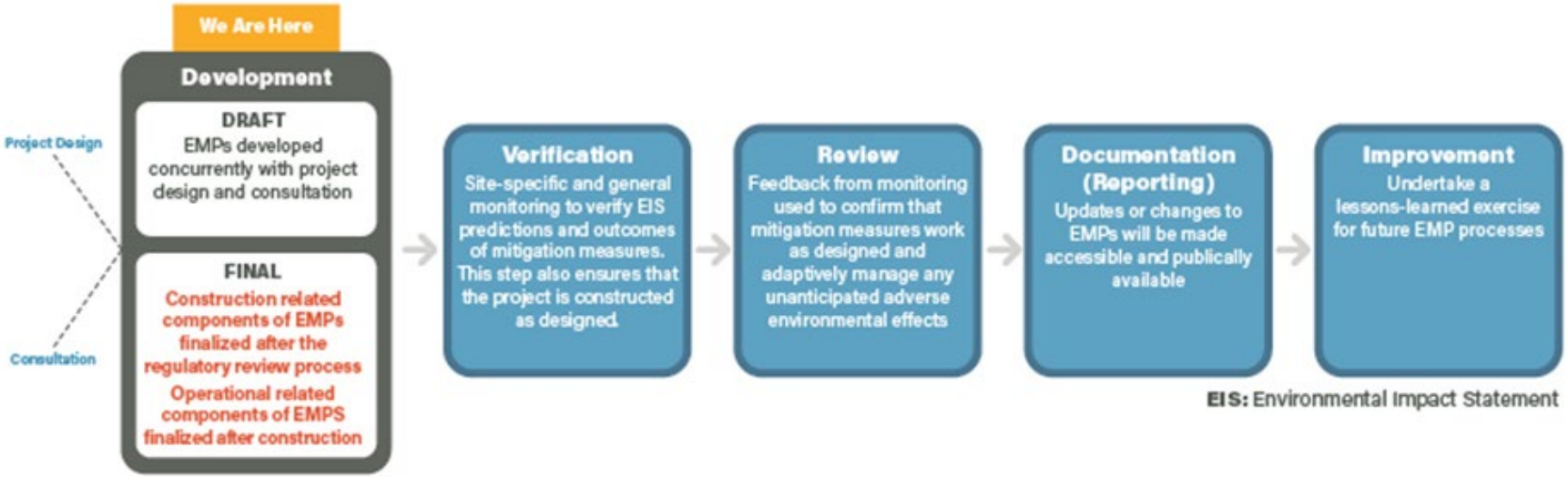

Figure A: EMP Process

LIST OF ACRONYMS AND GLOSSARY OF TERMS

Acronyms

%	percent
AMP	Access Management Plan
CEMP	Construction Environmental Management Program
CRP	Complaint Resolution Process
EIS	Environmental Impact Statement
EMP	Environmental Management Program
FRWCS	Fairford River Water Control Structure
IMP	Ice Management Plan
km	kilometre
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
m	metre
mm	millimetre
OEMP	Operation Environmental Management Program
PR	Provincial Road
the Project	The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project
RM	Rural Municipality
TC	Transport Canada
WCS	water control structure

Glossary of Terms

Contractor: refers to the individuals, entities or groups contracted by Manitoba Transportation and Infrastructure to undertake specific Project construction, operation, or maintenance activities, and includes all subcontractors and affiliates.

Detailed Design: The project phase where structural engineering design principles and applicable design codes are utilized to produce a structural design complete with drawings and tender documents in sufficient detail to construct the specific structure/rehabilitation identified as the preferred alternative from the preliminary design phase. While detailed design is primarily structural in nature, it may also include the development of the hydraulic, hydrotechnical, geotechnical, environmental, and traffic control aspects of the project to support the structural design of the bridge or structure.

Environmental Monitor: refers to the individuals, groups or designated representatives engaged by Manitoba Transportation and Infrastructure to monitor, inspect, and document compliance with contractual and regulatory requirements associated with the construction activities and associated works for the Project. The monitor may also be an active member (or representative) of the Project's Environmental Advisory Committee.

Frazil Ice: Small discs of ice ranging in size from less than 0.1 mm to a few mm, formed in turbulent water.

Hanging Ice Dam: Ice accumulation created by the deposition of entrained ice on the underside of an ice cover.

Ice Jam: Generic term referring to the accumulation of ice fragments in a watercourse that restricts flow and causes staging of water levels upstream.

Preliminary Design: An engineering process undertaken at the pre-structural design phase. For structures, preliminary design includes some or all of the following: collection of survey information, preliminary foundation report (including soils investigation), hydrological analysis, hydraulic analysis and design, hydrogeological investigation, historical ice thickness and ice levels, condition assessment, geometric design, traffic forecasting, hazard protection, site location, environmental determinations, consideration of traffic accommodation, identification of constructability issues and possible construction staging, development of alternatives for advancement to structural design, life cycle cost analysis of alternatives, evaluation and selection of the preferred replacement structure/rehabilitation work. This phase in the design process typically supports the pre-construction engagement and consultation process with the public and rights-holders, as well as the environmental submissions that satisfy environmental and/or regulatory requirements.

Rights-holders: include First Nations, Metis communities and other Indigenous groups who hold Aboriginal or Treaty rights that are protected under section 35 of *The Constitution Act* 1982. Commonly, these include hunting, trapping, fishing, or gathering rights.

1.0 INTRODUCTION

1.1 Purpose and Scope

The Ice Management Plan (IMP) is a component of Manitoba Transportation and Infrastructure's overall Environmental Management Program (EMP) for the Lake Manitoba and Lake St. Martin Outlet Channels Project ("the Project"). The EMP consists of a series of monitoring and management plans being developed to provide mitigation measures and Best Management Practices for Project construction, operation and maintenance activities to reduce or avoid potential adverse effects. The plans outline monitoring activities that will be undertaken to document environmental conditions, guide mitigation and adaptive management measures, and undertake Project activities such that they are carried out in compliance with applicable environmental legislation and licensing requirements. They have considered and incorporated input received from rights-holders and other Project stakeholders.

The Project will involve the construction and operation of the Lake Manitoba Outlet Channel (LMOC), the Lake St. Martin Outlet Channel (LSMOC) and associated components such as bridges, control structures with power connections, a new realignment of Provincial Road (PR) 239, and other ancillary infrastructure, as described in the EMP Framework. The construction methodology for the LMOC and LSMOC is described in the Construction Environmental Management Program (CEMP).

The Project will provide additional outlets to release water from Lake Manitoba and Lake St. Martin. Operation of the outlet channels will result in changes to the regional flow system, including changes to lake water levels and changes to flows in the connecting rivers. The location of the proposed outlet channels in relation to the regional flow system is shown in Figure 1.

Although the outlet channels will be used primarily during the spring and summer to reduce damage caused by open water flooding, the channels are designed to permit operation in the winter months as well. Winter operation of the outlet channels will be considered to reduce water levels in the lakes following a large flood in the previous spring/summer, or to pre-emptively lower lake levels to prepare for a large flood in the subsequent spring as stipulated in the Operating Guidelines for the Project. Based on a simulation of historic (1915-2017) conditions from, it is estimated that for the 103-year period of record the LMOC and LSMOC would be operated in 33 years (32.0%), with winter operation occurring in 12 of those years (11.7 % of record, or 36.4% of operating years). It is recognized that this percentage would be increased based on climate change predictions since there is more volume of water in the system and therefore it takes longer to lower the lake level. Management of ice processes, both in the channels and in the connected flow system, will be considered during winter operation of the outlet channels.

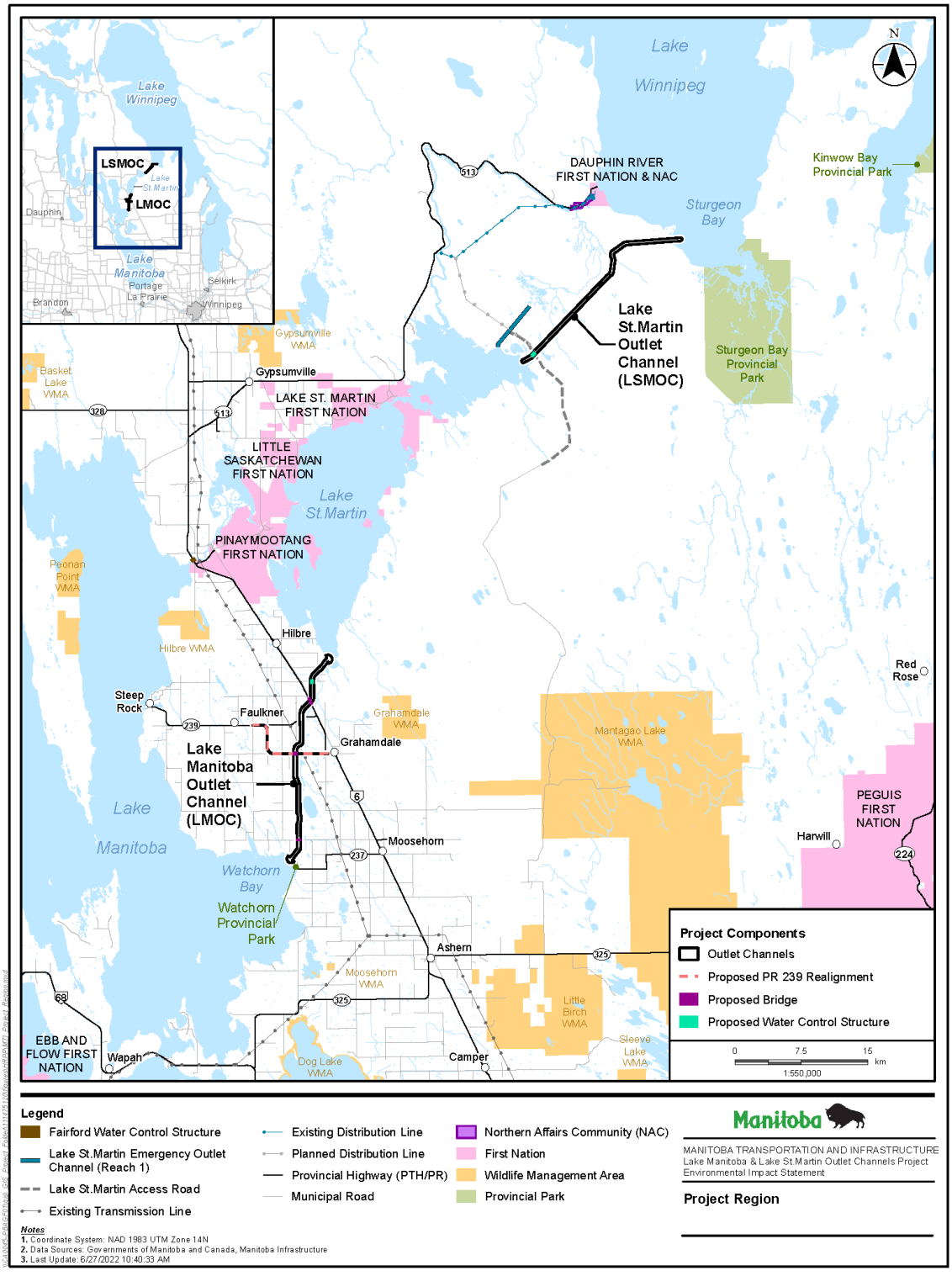

Figure 1: Project Area

1.2 Objective

The objective of the IMP is to manage hazards related to ice during operation of the outlet channels in consideration of public and worker safety and environmental impacts. Potential ice hazards include river ice jams (within the outlet channels and in Project-affected rivers) and variations in lake ice thicknesses. The IMP is a component of the Operation Environmental Management Program (OEMP).

2.0 ICE MANAGEMENT WITHIN OUTLET CHANNELS

Ice management within the outlet channels is important to minimize the risk of adverse ice conditions within the channels (e.g., ice jams), which could potentially lead to reduced freeboard on the channel dikes and a reduction in winter discharge capacity. Unpredictable ice processes could also cause damage to channel components such as drop structures and the water control structure (WCS). The following sections describe how ice will be managed in the LSMOC and LMOC.

2.1 Operation of Outlet Channels Following Winter Non-Operation

In years when the LMOC and LSMOC are not operated in the winter (i.e., WCS gates are closed), thermal ice covers will form in the channels. Depending on winter air temperatures, the ice thickness will range from approximately 0.6-1.2 metres (m). In accordance with the Operating Guidelines developed for the Project, the WCS gates will not typically be initially opened during the period where there is a solid ice cover in the channels (approximately December 1 to April 30).

Prior to normal spring operation, an observational survey of the outlet channels will be conducted to assess ice conditions. The survey may involve an initial monitoring phase where satellite-telemetered cameras mounted on the WCS would provide daily images of ice conditions to assess pre-breakup. Manitoba Transportation and Infrastructure Regional Operations staff would drive the dikes to assess ice conditions along the channels to carry out an ice condition assessment once degradation is observed. If conditions necessitate, a drone would be deployed to provide coverage of inaccessible areas. If required, Manitoba Transportation and Infrastructure can task RADARSAT satellite imagery to provide images of ice conditions. The ice condition assessment would only be carried out in years where operation in early spring is considered. It is anticipated that in most years that the cameras would confirm ice degradation prior to operation. Once the channels are observed to be free of ice (or substantial deterioration of the ice cover has occurred), spring operation of the outlet channels will commence.

In extreme cases where there is a risk of severe flooding the following spring, operation (opening) of the WCS gates will be considered even if a solid ice cover still exists within the outlet channels. Such operations will require careful adjustments of the gates and continuous monitoring; flow in the outlet channels would be gradually increased and ice conditions in the channels would be monitored concurrently for signs of undesirable changes in ice conditions. If the ice cover is observed to be breaking up uncontrollably and/or if ice jams form in the channel, the WCS gates would be lowered to reduce flow into the channels and prevent potential overtopping of the channel dikes or banks from the flow constriction caused by the ice jam. The broken ice pieces could also cause damage to bridge piers or drop structures as they are transported downstream.

2.2 Winter Operation of Outlet Channels

In years with significant spring/summer floods, the outlet channels may continue to be operated through the winter, in accordance with the Operating Guidelines, to continue reducing water levels in Lake Manitoba and Lake St. Martin. As mentioned previously, in years where the outlet channels operate, it is estimated that the LMOC and LSMOC would continue to be operated in approximately 12 % of the winter periods. During operation of the channels, communication processes will be managed by the Manitoba Transportation and Infrastructure according to existing protocols for other flood control infrastructure (e.g., Fairford River Water Control Structure [FRWCS], Shellmouth Dam, Portage Diversion, and Red River Floodway). This involves a combination of press releases, forecasts and reports by the Hydrologic Forecasting Center, and real time operation/monitoring data on Manitoba Transportation and Infrastructure's website.

In general, lake inflows and water levels are lower during the winter season and thus potential maximum flows in the outlet channels are less during this time than during an open water flood. In addition to lake level considerations in controlling the flows in each of the outlet channels, ice processes within the channels must be considered. The WCS will have heated vertical gates that can be operated throughout the winter.

2.2.1 Ice Conditions in LMOC

The WCS of the LMOC is located near the downstream end of the channel, approximately 3 kilometres (km) upstream of the outlet to Lake St. Martin. In winters when the WCS gates remain closed and only the riparian flow is released, the LMOC will form a uniform thermal ice cover. Should winter operation be required (as dictated by the threshold lake levels defined in the Operating Guidelines), the LMOC will be operated to mitigate potential negative impacts of ice formation in the channel. Based on the assessment monitoring described previously, at the onset of freeze-up the WCS gates will be operated to temporarily reduce or stop flow in the LMOC. The reduction in water velocity afforded by this will promote the rapid formation of a stable ice cover in the channel. Once formed, the ice cover will insulate the water surface, and reduce the volume of frazil ice produced (frazil ice refers to small discs of ice ranging in size from less than 0.1 millimetres (mm) to a few mm, formed in turbulent water). This will limit the severity of ice accumulation in the channel and avoid the formation of a hanging ice dam at the outlet in Lake St. Martin. Depending on the hydraulic and meteorological conditions, the stable ice cover may form thermally or through the accumulation of ice pans at the surface. Once a stable ice cover has formed, the WCS gates would be fully opened to allow the channel to operate at maximum capacity in accordance with the Operating Guidelines. The flow will be increased gradually, and in steps to limit the risk of mechanical breakup of the ice cover. Ice conditions in the LMOC will be monitored to minimize the chance of ice cover instabilities.

In the event of unforeseen ice conditions in the LMOC during winter operation (e.g., development of an ice jam), the WCS gates will be lowered to reduce the flow in the channel. If required, equipment such as tracked excavators with extended reach will be mobilized to help remove ice jam blockages if forecasted flood conditions necessitate the continued operation of the LMOC.

2.2.2 Ice Conditions in LSMOC

The WCS of the LSMOC is located at the upstream end, near the inlet in Lake St. Martin. In winters when the WCS gates remain closed and only the riparian flow is released, the LSMOC will form a uniform thermal ice cover.

Similar to the LMOC, in years when gated operations are required, the LSMOC WCS will be operated to limit winter flows to promote the formation of a stable ice cover in the channel, thereby reducing the volume of frazil ice produced. This will limit the severity of ice accumulations on the drop structures and will inhibit the formation of a hanging dam at the outlet in Lake Winnipeg.

During operation, depending on the hydraulic and meteorological conditions, the stable ice cover may form thermally or through the accumulation of ice pans at the surface. As indicated, observational monitoring of ice conditions and dike freeboard will be conducted regularly during winter operation of the LSMOC. It is anticipated that monitoring of ice conditions will occur more frequently during the first few winter operations of the LSMOC (i.e., daily to weekly) to document and understand the ice conditions. Monitoring frequency may be adjusted in subsequent years to be commensurate with patterns in the observed ice conditions. If unforeseen ice conditions develop in the outlet channel (i.e., ice jams or excessive accumulation of ice on the drop structure crests) causing reduced freeboard on channel dikes, the WCS gates will be lowered to reduce flow in the LSMOC and maintain safe freeboard. Equipment such as long-reach excavators will be used, if necessary, to assist in clearing ice jams if forecasted flood conditions necessitate the continued operation of the LSMOC at higher flows.

2.2.3 Ice Conditions at Channel Inlets

Operation of the outlet channels during the winter will alter the local flow patterns in the lakes near the inlets. Higher water velocities through the inlets will result in sustained open water and/or thinner ice covers compared to when the channels are not operated.

2.2.4 Ice Conditions at Channel Outlets

Winter operation of the outlet channels will alter local flow patterns at the channel outlets in Lake St. Martin and Lake Winnipeg.

As described in Section 2.2.1, when winter operation is required, the LMOC WCS will be operated to promote the development of a stable ice cover over its full length, which will limit the volume of frazil ice produced and transported into Lake St. Martin. The channel immediately downstream of the WCS will remain open for a short distance due to local high velocities and turbulence leaving the WCS. The remainder of the downstream channel is expected to develop a stable ice cover that will transition to a lake ice cover near the channel outlet in Lake St. Martin. The lake ice cover in the vicinity of the outlet will be thinner due to the local changes to water velocities resulting from operation of the LMOC.

When operated at higher flows, the LSMOC may not form a stable ice cover over its entire length (some reaches between drop structures may have a stable ice cover while others may not). Frazil ice will continue to be produced in the open water areas, and the ice will be transported downstream to Lake Winnipeg. The entrained frazil slush and ice pans will deposit under the thermal lake ice cover on Lake Winnipeg, creating a hanging dam. This type of ice formation occurs naturally each year at the outlet of the Dauphin River to Lake Winnipeg. As the hanging dam grows, the water level in the outlet and in the channel immediately upstream will rise. Water levels upstream of the final drop structure will not be directly affected by the hanging dam. Monitoring of ice processes in the LSMOC during winter operation will therefore also include observations of the hanging dam formation at the outlet. In the event that the hanging dam conditions become severe, and the channel dikes are at risk of overtopping, flow in the LSMOC will be reduced to form a stable ice cover in the LSMOC and cut off the supply of ice to the hanging dam. The flow would not be reduced below the riparian flow required to maintain adequate dissolved oxygen concentrations for aquatic organisms (as discussed in Section 2.2.2). If a hanging dam does not form, the lake ice cover in the vicinity of the outlet will be thinner due to the local changes to water velocities resulting from operation of the LSMOC.

Signage indicating potential areas of thin ice will be displayed at the LMOC and LSMOC outlet areas in accordance with TC requirements. Figure 2 shows the approximate extents of the areas of thin lake ice cover resulting from outlet channel operation. Figure 2 also indicates an area in the Lake St. Martin Narrows that could experience changes in freeze-up patterns (discussed later in Section 3.2).

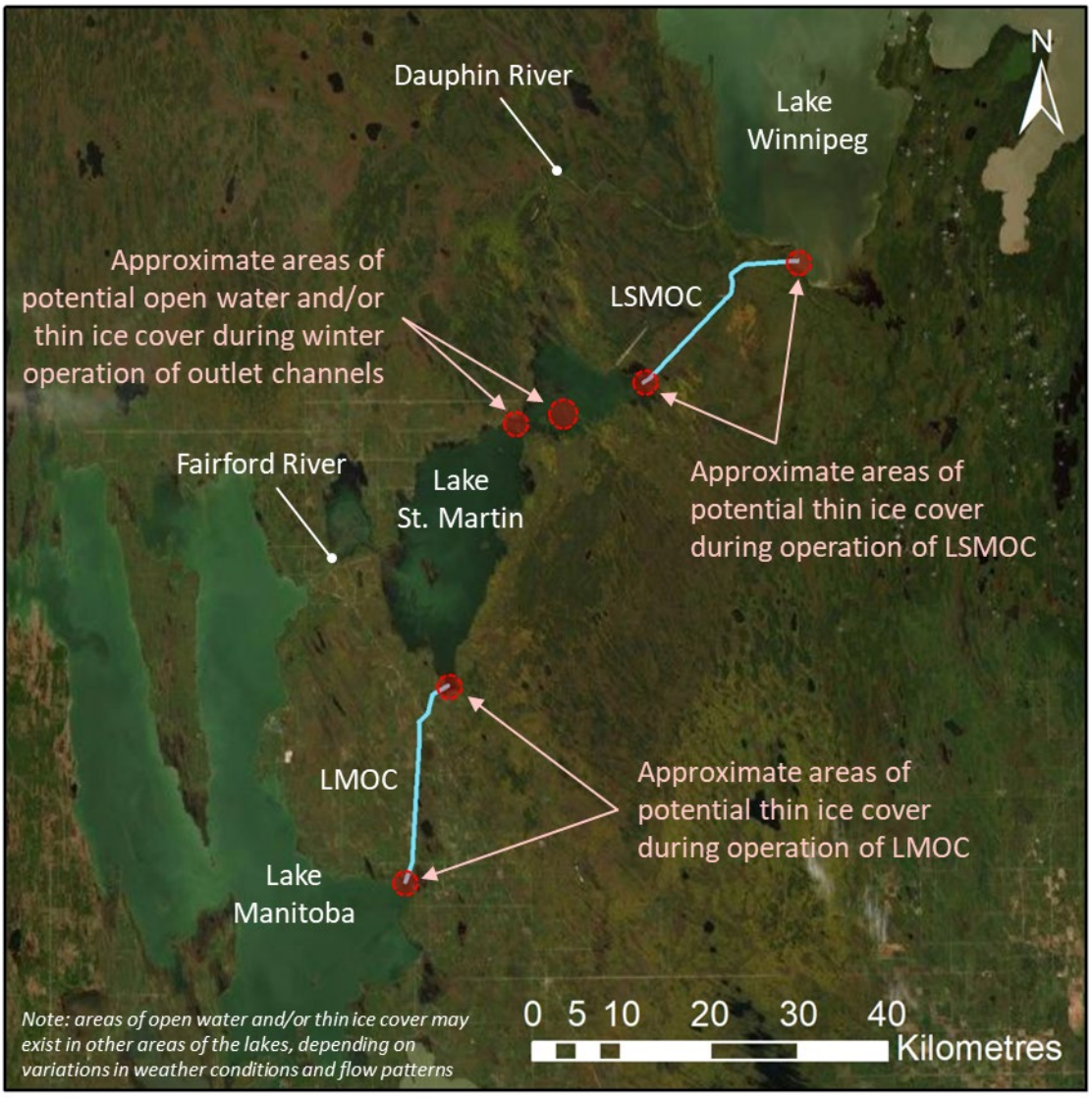

Figure 2: Locations of Potential Thin Lake Ice

3.0 ICE MANAGEMENT IN PROJECT-AFFECTED FLOW SYSTEM

Outflows from Lake Manitoba and Lake St. Martin are currently conveyed solely by the Fairford River and Dauphin River, respectively. Descriptions of the existing river ice conditions and anticipated effects of the Project are provided in the following sections.

3.1 Existing River Ice Processes

3.1.1 Fairford River

The Fairford River runs from the northeast end of Lake Manitoba, through Lake Pineimuta, to Lake St. Martin. The primary flow path is approximately 17 km long, but the river branches into multiple smaller reaches in the delta region through Lake Pineimuta. The FRWCS regulates outflow from Lake Manitoba. The outflows from the FRWCS are normally limited in magnitude in the winter to promote the formation of a stable ice cover in the Fairford River and reduce the severity of frazil ice formation in the Dauphin River downstream. Under these low flow conditions, ice formations on the river both upstream and downstream of the FRWCS do not substantially influence the outflow capacity from the lake.

Most of Lake Pineimuta typically freezes over with a thermally grown ice cover early in the winter. The two channels of the Fairford River take longer to develop an ice cover and may remain open through most of the winter in some years. Border ice may bridge across the river at certain locations, initiating ice covers at various points along the river. An ice front also progresses upstream from the thermal ice cover on Lake St. Martin. Throughout the winter, the ice coverage can change quite drastically as the various ice covers advance and retreat in response to flow conditions and air temperatures. The area upstream of the FRWCS in Lake Manitoba takes longer to freeze over due to the higher water velocities, and often does not completely freeze over throughout the entire winter.

3.1.2 Dauphin River

The Dauphin River is approximately 52 km long, running from the north basin of Lake St. Martin to Lake Winnipeg. Flow in the Dauphin River is not directly regulated but is influenced by operation of the FRWCS.

The ice processes in the Dauphin River are notably different in the upper, low gradient reach compared to the lower, high gradient reach. During winter, water flowing out of Lake St. Martin and into the Dauphin River cools and forms frazil ice. The shallow depth of Lake St. Martin reduces the residual heat capacity of the lake water, allowing ice to begin to form in the river within a few hundred metres of the lake. The frazil ice volume increases in the downstream direction, and the frazil slush forms competent ice pans which are transported downstream with the flow. Border ice forms in the lower velocity regions near the banks and in the side channels of the upper reach.

Approximately 11 km from Lake Winnipeg, the river gradient increases abruptly. The fast-moving water in this reach limits the extent of border ice growth and frazil pans are transported downstream with the flow to Lake Winnipeg. A thermal ice cover grows in Lake Winnipeg early in the winter. Incoming frazil pans and slush can be swept under the lake ice cover or may juxtapose against the lake ice cover depending on the hydraulic conditions at the outlet. During higher flows, the frazil pans are typically swept under the lake ice cover and are transported further into the lake where they are eventually deposited. This forms a hanging dam and causes the upstream water levels to gradually increase. Eventually, the staging of water allows incoming frazil pans to juxtapose against the lake ice cover and the leading edge of the cover begins to progress upstream.

Due to the high gradient of the lower reach, the ice cover typically experiences several consolidation events as it advances upstream; this refers to the collapse and mechanical thickening of the ice cover in response to the external forces of gravity and water shear which grow as the cover lengthens. The thickness and roughness of the consolidated cover can raise water levels by several metres (as much as 3-5 m in some areas).

When the ice front progresses to the upper reach, it generally advances much faster via juxtaposition and surface packing of the ice pans. Some mechanical thickening of the cover in the upstream reach can occur, but not nearly to the same extent as in the lower reach. Provincial Road 513 has been flooded in the past due to ice-affected staging in the upper reach. If the flow is sufficiently low, border ice may completely bridge across sections of the upper reach early in the winter, which cuts off the ice supply to downstream and can also insulate the water flowing in the river. Consequently, ice cover in the lower reach takes longer to form.

Once an ice cover forms, open water leads typically develop as the flowing water erodes the ice along preferential flow paths. As air temperatures rise in the spring, additional open water leads form and grow in size as the ice cover decays and melts.

3.2 Potential Project Effects

As documented in Volume 2, Section 6.4.7 of the Project EIS, changes to regional flow patterns from Lake Manitoba to Lake Winnipeg in the post-Project environment were quantified using a water balance model. The general effect of the Project is a reduction in the frequency of high winter flows on the Fairford and Dauphin rivers. The Project is predicted to have a negligible effect on the frequency of low flow events.

The Lake St. Martin Narrows typically does not freeze over completely in the winter in the existing environment; open water leads remain in the constriction where water velocities are highest. Winter operation of the outlet channels would increase flow through the system and could cause some increase in the size of the open water leads that remain through the Lake St. Martin Narrows over the winter (see Figure 2).

In general, the magnitude of the potential changes to ice processes in regional waterways (i.e., Dauphin River and Fairford River) is predicted to be low to negligible. Therefore, no specific ice management practices are anticipated to be required outside of the LMOC and LSMOC. As noted in Section 2.2, operation of the outlet channels could be communicated to nearby communities via press releases, forecasts, and reports by the Hydrologic Forecasting Center, and or real time operation/monitoring data on Manitoba Transportation and

Infrastructure's website. Manitoba Transportation and Infrastructure has developed a draft Complaint Resolution Process intended to collect, respond to, and resolve any Project-related complaints. Complaints regarding ice will be addressed through this process and may include specific monitoring activities such as visual observations, drone flights, surveys, etc., as required on a case-by-case basis.

4.0 ADAPTIVE MANAGEMENT AND MONITORING

4.1 General

A follow up process is a form of adaptive management to improve practices by learning about their effects and then making changes in those practices as new information is available. The federal *Impact Assessment Act* defines a follow up program as "a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures." An associated Operational Policy Statement (https://www.canada.ca/content/dam/iaac-acei/documents/ops/ops-follow-up-programs-2011.pdf) indicated that "a follow-up program is used to:

- verify predictions of environmental effects identified in the environmental assessment,
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required,
- support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects,
- provide information on environmental effects and mitigation that can be used to improve and/or support future environmental assessments including cumulative environmental effects assessments, and
- support environmental management systems used to manage the environmental effects of projects."

In summary, operation of the LMOC and LSMOC in the winter will be performed in a manner to reduce the severity of ice formations in the outlet channels. Warning signage indicating potential areas of thin lake ice will be displayed at the channel inlets and outlets in accordance with TC requirements. Other waterway access restrictions related to hazardous ice conditions in the channels will be identified as provided in the AMP. Conditions in the channels will be monitored during winter operation, which will include water levels, ice processes, ice thicknesses, and water temperature. Monitoring techniques will include deployment of water level and temperature sensors, conducting reconnaissance surveys, or use of time-lapse cameras. Although operation of the outlet channels is not anticipated to have any negative impacts on ice processes in the Project-affected flow system, incident-based ice monitoring may also be conducted to respond to ice-related complaints in accordance with Manitoba Transportation and Infrastructure's Complaint Resolution Process (CRP).

4.2 Follow up Response

As indicated, in the event of adverse ice conditions in the channels or connected flow system, mitigation measures may include operational adjustments (e.g., flow reductions) in the outlet channels, or deployment of equipment such as long-reach excavators to help clear ice jams. The latter is not expected to be a regular occurrence as operational measures are intended to prevent the formation of ice jams in the outlet channels and connected waterways. Adaptive management options to be considered, if required, include expanding/ adjusting ice monitoring protocols (e.g., increasing frequency of monitoring), modifying winter operation of the outlet channels in accordance with the Operating Guidelines, and installation of additional ice management works such as ice booms.