

**LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT
RESPONSE TO IAAC TECHNICAL INFORMATION REQUESTS**

Question IAAC-21

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Abbreviations and Acronyms

EIS	environmental impact statement
EMP	Environmental Management Program
EOC	emergency outlet channel
GWMP	Groundwater Management Plan
LMOC	Lake Manitoba outlet channel
LSMOC	Lake St. Martin outlet channel
VCs	valued components

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EIS Guideline Reference: 7.2.2. Changes to Groundwater, Surface Water and Fluvial Morphology

EIS Reference: 11.4.1 Groundwater; 12.4.1 Purpose and Objectives; 16.2 Summary of Environmental Effects

Context and Rationale

The EIS Guidelines require the proponent to assess the effects of the Project on groundwater and surface water, including groundwater and surface water interactions, and to present evidence to support conclusions drawn about these effects.

In Section 16.2 of the EIS, under potential effects to groundwater, it is stated that water levels will decrease in the area of the Dauphin River during the construction phase of the LSMOC. This river is a significant distance north of the LSMOC (greater than the 500 m distance where effects are stated to occur). No analytical assessment was presented to demonstrate the potential for decreases in groundwater levels at this distance from the LSMOC.

This information is required to understand the extent of changes from the Project to groundwater and surface water and associated environmental effects.

Information Requests

- a) Present an assessment of the reduction in groundwater elevations associated with the construction and operation of the LSMOC. The assessment should include a discussion of potential changes in the quantity of groundwater discharging to surface water. The assessment should include:
 - i. A cross-section showing bedrock topography, overburden stratigraphy, channel inverts, channel operation levels, and groundwater elevations required for construction and operation.
 - ii. An assessment of the hydraulic conductivity of the bedrock aquifer.
 - iii. An assessment of the groundwater elevations within the bedrock aquifer.
 - iv. An assessment of changes in bedrock and overburden groundwater levels associated with the construction and operation of the LSMOC.

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Prior to the response to (a), the following is provided as clarification.

The environmental impact statement (EIS) states what could be construed as a misleading term in the use of the word “dewatering” in Volume 2, Section 6.4.4.2 Changes in Local Groundwater Flows, Levels

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and Quality in the discussion of the effects of operation of the surficial aquifer. The term “dewatering” should be replaced with the term “flooding”. This indicates that the effects of groundwater control measures during construction are to be constrained to the proximity of the channels.

The original text in Volume 5, Section 6.4.4.2, pg. 6.160, para. 4 read as follows (bold emphasis added):

“Around Lake St. Martin, the Fairford River and Dauphin River, water levels will decrease during high **dewatering** conditions due to the Project. There will be a decrease in groundwater discharge in the saturated soils along the shoreline due to the pressure reduction. The effects will not be noticeable within a short distance of the shoreline.”

The text should read (revised text is underlined):

“Around Lake St. Martin, the Fairford River and the Dauphin River, water levels will be decreased during high flooding conditions due to Project operation. There will be a decrease in groundwater discharge into the saturated soils along the shoreline due to the pressure reduction. The effects will not be noticeable within a short distance of the shoreline.”

Also, in EIS Volume 5, Section 16.2, Table 16.2-1 (pg. 6.8), the original text read as follows (bold emphasis added):

“Changes in groundwater level and flow around the channel excavations is expected to be less than 1 m, and the effects will transfer over 10 to 200 m perpendicular to the channels at most. Around Lake St. Martin, the Fairford River and the Dauphin River, water levels will decrease during high **dewatering** conditions due to the Project.”

The text should read (revised text is underlined):

“Changes in groundwater level and flow around the channel excavations are expected to be less than 1 m, and the effects will transfer over 10 to 200 m perpendicular to the channels at most. Around Lake St. Martin, the Fairford River and Dauphin River, water levels will be decreased during high flooding conditions due to Project operation. There will be a decrease in groundwater discharge into the saturated soils along the shoreline due to the pressure reduction. The effects will not be noticeable within a short distance of the shoreline.”

a) An assessment of the potential effects of the LSMOC on groundwater was conducted.

The following provides responses to (i) to (iv), and, notwithstanding the responses to (i) to (iii) above, the response for (iv) provides additional information regarding what information and analysis was done.

- i. A cross-section showing bedrock topography, overburden stratigraphy, channel inverts, channel operation levels, and groundwater elevations is not available at this time and is being developed as part of the Preliminary Engineering for the Lake St. Martin Outlet Channel (LSMOC).

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- ii. Hydraulic conductivity of the bedrock aquifer is not available at this time and is being determined as part of the Preliminary Engineering for the LSMOC.
- iii. Changes in groundwater elevations within the bedrock aquifer are not available at this time and is being determined as part of the Preliminary Engineering for the LSMOC.
- iv. In order to complete the assessment of groundwater at the LSMOC, different information is used than itemized in (i) through (iii) above to assess how potential changes in groundwater elevation and flow patterns from the Project would affect other valued components (VCs) directly. The integrated effects of changes in groundwater levels and flows were assessed for both construction and operation as discussed below.

The EIS presents the effects of changes in groundwater and surface water from the LSMOC construction and operation in Volume 2, Section 6.4.4.3 Changes in Local Groundwater/Surface Water interactions and Volume 2, Sections 6.4.7.4 Changes in Local Drainage Areas and Local Drainage Patterns.

Developing a further understanding of groundwater conditions for pre-construction conditions, during construction, and post-construction is also important in protecting the aquifer. This information can inform the development of a Groundwater Management Plan (GWMP) and may identify key locations where mitigation is required. This will be accomplished through ongoing pre-construction groundwater drilling and testing of the aquifer properties, and from construction and post-construction monitoring plans to be developed as part of the Preliminary Design phase of the LSMOC and included in the GWMP.

In order to complete the assessment of groundwater at the LSMOC, different information was used than itemized in (i) through (iii) above to assess how potential changes in groundwater elevation and flow patterns from the Project would affect other VCs directly. The integrated effects of changes in groundwater levels and flows were assessed for both construction and operation, as outlined below.

1. Expected effects of changes in groundwater levels and flows on wetlands
2. Expected effects of changes in groundwater levels and flows on Buffalo Creek
3. Expected effects of changes in groundwater levels on domestic wells

The following provides details of how effects on VCs from changes in groundwater were determined for the assessment for each of the above three effects.

1) Expected effects of changes in groundwater levels and flows on wetlands

In the EIS Volume 2, Section 6.4.4.3 Changes in Local Groundwater/Surface Water interactions, there is discussion on how effects on groundwater may affect wetlands. In order to determine the effects of construction and operation of the LSMOC on the surrounding wetlands, an analysis of the effects on the surrounding wetlands from development of the emergency outlet channel (EOC) built in 2011 was performed. The EOC was built in the same wetlands complex located between Lake St.

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Martin and Lake Winnipeg. This analysis recognizes that groundwater and surface water are both affected with the construction and operation of the channel and both surface water and groundwater changes are affecting wetlands hydrology and the wetland vegetation. The analysis integrates effects of both construction and operation over a period of seven years (2011 to 2018). It should be noted that the EOC was built under emergency conditions and did not include components of the design that will be incorporated in the LSMOC (such as an outside drain) that will mitigate effects on the wetlands. The assessment was done by integrating knowledge and experience from multiple disciplines such as surface water, groundwater, soils and wetlands function.

For a full description of the how the effects of the LSMOC on the adjacent wetlands were assessed, see response to IAAC-23.

During operation, overland and shallow subsurface drainage flow may be affected along the approximately 24 km length of the LSMOC. Based on examination of the effects of the EOC, effects would be reduced to 500 m on upgradient with mitigation, and 500 m on downgradient sides for reasons discussed in IAAC 23. Unmitigated, this effect would be expected to affect drainage over an area of up to approximately 1,200 ha on either side of the channel (EIS Volume 2, page 6.165).

2) Expected effects of changes in groundwater levels and flows to flows on Buffalo Creek

It is recognized in the EIS Volume 2, Section 6.4.7.4 Changes in Local Drainage Areas and Local Drainage Patterns that the construction and operation of the LSMOC may affect flows in Buffalo Creek due to changes in surface water and groundwater (EIS Volume 2, page 6.199). The Buffalo Creek system is complex as it includes wetlands and groundwater discharge areas. Surface water runoff in a wetland does not flow uniformly; therefore, effects cannot be predicted using typical approaches of measurement of drainage area and flow analysis, as was done with the Birch Creek and Watchorn Creek drainage areas, to examine effects of the Lake Manitoba Outlet Channel (LMOC). In addition, Big Buffalo Lake may be supplied by groundwater upwelling from the carbonate aquifer, thereby supplying Buffalo Creek with additional water, which is difficult to measure and quantify.

Although construction and operation the LSMOC will likely cause a reduction in flows; quantification of effects to flows in the Buffalo Creek system (from both changes in groundwater discharge to the surface and flow through the wetlands) cannot be predicted with a high degree of confidence before construction is complete. As discussed in IAAC-15, MI will be implementing a series of environmental management plans and monitoring plans as part of the Project Environmental Management Program (EMP) to address potential residual effects.

MI does not intend to operate the EOC for flood control after the construction of the LSMOC. Repurposing of the EOC (if needed) to allow additional flows to the Buffalo Lakes and Buffalo Creek from Lake St. Martin could potentially replace any flows lost from interception of wetland flows to the creek. The amount of flows would need to be adjusted based on concurrent studies of flows, wetland hydrology and fish habitat to optimize the mitigation. Repurposing the EOC is not being considered as an option at this time.

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3) *Expected effects of changes in groundwater levels on domestic wells*

Unlike at the LMOC, there are no domestic wells located near the LSMOC and the EIS did not comment on groundwater effects on wells in the LSMOC area. The nearest groundwater well users are at Dauphin River First Nation, 5 km to 6 km north and northeast of the channel (see EIS Volume 2, Figure 6.4B-1). The majority of the community wells are on the north side of the Dauphin River, which serves as a groundwater discharge, hydraulically isolating domestic wells on the north side. A few wells are located on the south side (i.e. project side) of the Dauphin River. Sentinel wells will monitor groundwater quality within the Dauphin River First Nation community located approximately 6 km northeast of the LSMOC.

If it is assumed that the hydrogeology parameters (i.e., hydraulic conductivity, storativity) of the bedrock aquifer beneath the proposed LSMOC is within the same range as characterized within the LMOC assessment (see IAAC 27), then an assessment of the potential effect on the wells can be developed. The LMOC groundwater assessment used an analytical model (discussed in response to IAAC-27) under a wide range of potential hydraulic conductivities in the bedrock aquifer. The dewatering depths required at LSMOC are not as deep as the LMOC dewatering depth; therefore, dewatering impacts will be much less than the 3 km to 5 km away from the channel discussed in the LMOC assessment. This assessment confirms that no domestic wells are expected to be impacted during construction. However, groundwater monitoring wells will be placed near the Dauphin River community to monitor potential effects near the closest domestic wells. Operation impacts will be much less than construction impacts (500 m or less as discussed above and in response to IAAC -23) and will not be expected to impact domestic wells 5 km away.