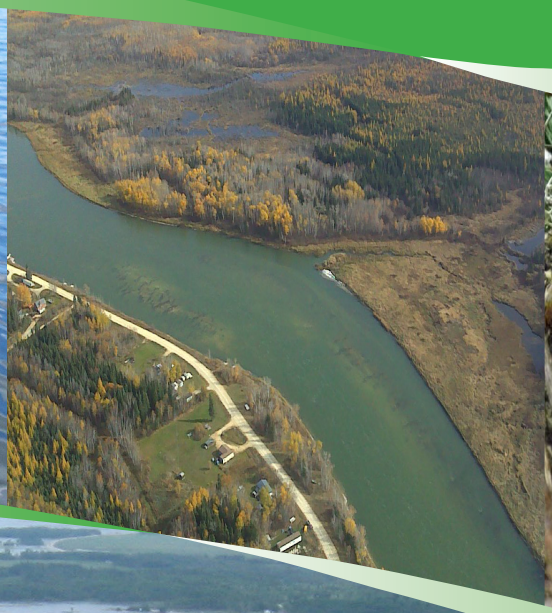
LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT EIS

Manitoba



SUMMARY

March 2020

Manitoba

LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT
Environmental Impact Statement

EIS SUMMARY

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Manitoba

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1.1 INTRODUCTION

Widespread flooding across much of southern Manitoba in 2011 resulted in unprecedented inflows into Lake Manitoba and Lake St. Martin, overwhelming the capacity of existing waterways in the region and resulting in overland flooding that affected local Indigenous communities, landowners, cottagers and many other communities in the region. Effects included damaged property, and in some cases displacement and evacuation from communities around Lake St. Martin for several years (some persisting to the present day). The economic effects of the 2011 flood event exceeded $1.2 billion, including infrastructure repair and disaster payments as well as flood response costs.

The Lake Manitoba and Lake St. Martin Permanent Outlet Channels Project (the "Project") is proposed as a permanent flood control management system for Lake Manitoba and Lake St. Martin (Figure 1-1) to alleviate flooding in the Lake St. Martin region of Manitoba. It will involve the construction 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. The presence of the new channels will facilitate better management and control of the water levels on these lakes by working concurrently with the existing Fairford River Water Control Structure in conveying water from Lake Manitoba, through Lake St. Martin to Lake Winnipeg in a manner that reduces or completely avoids overland inundation during high water events such as the 2011 and 2014 floods.

The 2011 flood event led to the emergency construction of the Lake St. Martin Emergency Outlet Channel (EOC), Reach 1, which was operated immediately following its construction from 2011 to 2012. Operation of Reach 1 was required again during a 2014 flood event, further illustrating the need for long-term flood control measures in the region. After the 2011 and 2014 flood events, the Government of Manitoba commissioned several reviews, studies, and public and Indigenous engagement sessions on the issue of flooding in the region. This process identified future flooding vulnerabilities, prioritized opportunities to improve or construct new flood protection infrastructure throughout the province and identified several potential flood protection projects. The proposed Project was selected as the preferred option.

This document is a summary of the Environmental Impact Statement (EIS) being submitted to the Canadian Environmental Assessment Agency (Agency) pursuant to the *Canadian Environmental Assessment Act, 2012* and to Manitoba Sustainable Development (MSD) as an Environment Act Proposal (EAP) pursuant to requirements of *The Environment Act* (Manitoba). Subject to regulatory approvals in 2020, the Project is scheduled to be functionally operational in the spring/summer of 2023. References for technical information summarized in this document is provided in the EIS.

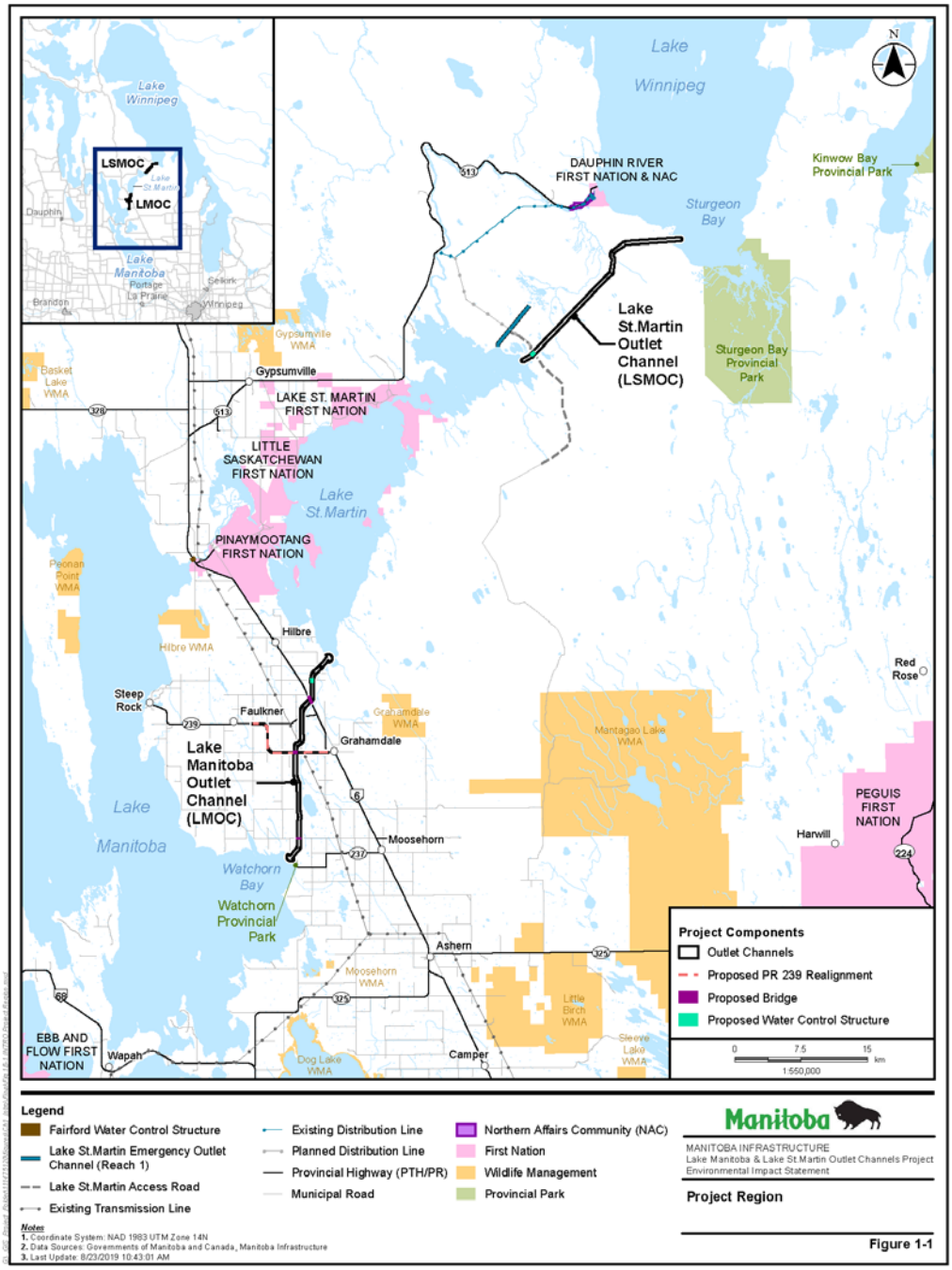

Figure 1-1 Project Region

1.2 REGULATORY SETTING

1.2.1 Federal Regulatory Requirements

This submission is a designated project under the *Canadian Environmental Assessment Act, 2012*, and therefore requires an Environmental Assessment (EA). Pursuant to Section 15(d) of the CEAA, 2012, the Agency is the authority responsible for federal review of the proposed Project. The Agency issued Guidelines for the Preparation of an EIS for the Project to Manitoba Infrastructure on May 15, 2018 with additions on August 16, 2018 and December 21, 2018. The proposed Project is in an area that has never been subject to a relevant regional environmental study pursuant to CEAA 2012. Other key federal legislation includes the *Federal Fisheries Act*, *Navigation Protection Act*, *Migratory Birds Convention Act, 1994* and *Species at Risk Act*. Furthermore, the Agency's Operational Policy Statements (OPS), technical guidance and reference documents under CEAA, 2012 also guided the environmental assessment for the proposed Project.

1.2.2 Provincial Regulatory Requirements

The proposed Project is a 'Class 3' development under the Classes of Development Regulation (164/88) of *The Environment Act* (Manitoba) and therefore requires an Environment Act Licence. Manitoba Sustainable Development's Environmental Approvals Branch (EAB) provided Environmental Impact Statement Guidelines for the Project on March 7, 2019. In these guidelines, EAB stated their agreement of one EIS for review by both Manitoba under *The Environment Act*, and the Agency under the *Canadian Environmental Assessment Act, 2012*. EAB noted that the CEAA Guidelines address almost all the required content except for some additional items specific to the provincial process. The EAB Guidelines therefore focus on the additional items not covered in the CEAA Guidelines. In addition to addressing the EIS Guidelines, provincial permits will be required under several acts to address various Project activities, such as *The Crown Lands Act* (camp development on provincial Crown lands), *The Mines and Minerals Act* (quarry development), *The Wildfires Act* (burning) and *The Dangerous Goods Handling and Transportation Act* (petroleum storage tanks). Specific standards and guidelines applicable to the various valued components are identified in the applicable assessment chapters of the Environmental Impact Statement (EIS).

1.2.3 Indigenous Peoples

The Indigenous communities of Dauphin River First Nation (FN), Dauphin River Northern Affairs Community (NAC), Lake St. Martin FN, Pinaymootang FN and Little Saskatchewan FN are located in the Project Region and are directly affected by the proposed Project. In addition, Peguis FN uses lands in proximity to the Project and has a Community Interest Zone (CIZ) just outside of the Region. Peguis FN is a signatory to Treaty No. 1 and has an outstanding Treaty Land Entitlement; the other FNs in the Project Region are signatories to Treaty No. 2. Indigenous residents of the Dauphin River NAC also use the area for traditional purposes. In 2012, the Government of Manitoba and the Manitoba Metis Federation (MMF) signed a Métis Harvesting Agreement, which designated a Métis Natural Resource Harvesting Zone that included Game Hunting Areas 16, 20 and 25 in the Project Region. Other Indigenous groups potentially affected by the proposed Project are identified and discussed in Section 5.

2.0 PROJECT OVERVIEW

2.1 PROJECT LOCATION

The Project is located in Manitoba's Interlake Region and within Treaty No. 2 lands. The LMOC would extend from Watchorn Bay on Lake Manitoba northeast to Lake St. Martin (Figure 1-1); this area is generally located north of the community of Ashern and south of Pinaymootang First Nation. The LSMOC would be located between the northeastern-most extent of Lake St. Martin and Sturgeon Bay on Lake Winnipeg (Figure 1-1).

The township and ranges for major Project components are identified in Table 2.1-1. Coordinates, for the main Project components are listed in Table 2.1-2.

Table 2.1-1 Township and Ranges Intersected by LMOC and LSMOC

Project Feature	Township			
Lake Manitoba Outlet Channel	26-8-W1	27-8-W1	28-8-W1	29-8-W1
Lake St. Martin Outlet Channel	32-5-W1	32-6-W1	33-5-W1	34-4-W1

Table 2.1-2 Proposed Project Component Coordinates (NAD 83, UTM)

Project Component			Zone	Easting	Northing
LMOC	Inlet		14 U	529841	5681518
	Outlet		14 U	534074	5704032
	Water Control Structure		14 U	532294	5701501
	Municipal Bridges	Iverson Road	14 U	532294	5701501
		Township Line Road	14 U	530796	5683620
		PTH 6	14 U	532037	5699259
		PR 239	14 U	530392	5693387
LSMOC	Inlet		14 U	557122	5738284
	Outlet		14 U	572725	5751400
	Water Control Structure		14 U	557122	5738284

The Interlake region acts as a key transportation corridor between the capital region of Manitoba and northern communities such as Thompson. Provincial Trunk Highway (PTH) 6 is a major road in the region and one of the main traffic arteries used to transport people and goods between northern and southern Manitoba (Figure 1-1).

The LMOC portion of the Project is primarily located on private agricultural lands that will be purchased for the Project. Most agricultural activities are related to cattle production, with some areas used for pasture and forage crops where the land is suitable for these practices.

There are two rural municipalities in the Project Region (West Interlake and Grahamdale), as well as several Indigenous communities, and unorganized Crown land. Moosehorn and Gypsumville are the largest communities within the RM of Grahamdale, while Ashern and Eriksdale are the largest communities within the RM of West Interlake. These communities, a number of smaller hamlets, and Indigenous communities serve as local centres of commerce. The nearest large commercial centre to the Project is the City of Winnipeg, located approximately 143 km southeast of Eriksdale. There are more than 60 residences within 3.0 km of the LMOC, the nearest of which is approximately 0.5 km from the proposed channel. The communities of Moosehorn and Pinaymootang FN are located approximately 10.9 km and 9.3 km respectively, from the LMOC.

The LSMOC is located entirely on Provincial Crown land; this area is currently considered semi-remote as road access is seasonal, with the nearest permanent residence located approximately 6.1 km from the LSMOC in Dauphin River FN. Dauphin River FN and Lake St. Martin FN reserve boundaries are located approximately 4.6 km and 12.0 km respectively, from the LSMOC.

The only federal lands in the Project Region potentially affected by the Project (see Figure 1-1) are First Nation Reserve Lands as follows:

- Pinaymootang (Fairford 50), located approximately 8.2 km northwest of the nearest point of the LMOC
- Dauphin River (Dauphin River 48A), located approximately 4.4 km west of the nearest point of the LSMOC
- Lake St. Martin First Nation (Narrows 49A), located approximately 11.4 km west of the nearest point of the LSMOC, and the closest to the proposed transmission line
- Pinaymootang FN (Fairford 50), located approximately 13.7 km northwest of the nearest point of the proposed PR 239 realignment

There are two Provincial Parks located within the region, the Sturgeon Bay Provincial Park and the Watchorn Bay Provincial Park. The region also has six Areas of Special Interest and nine Wildlife Management Areas. The Reindeer Island Ecological Reserve is located north of Sturgeon Bay Provincial Park, and the Reykjavik Game Bird Refuge is located across from Watchorn Bay along the shores of Lake Manitoba.

Agriculture, aggregate and limestone mining, commercial fishing, forestry, and tourism are the predominant land and resource-based industries in the Project Region. Resource use in the Project Region also consists mainly of hunting, trapping, fishing, camping, and recreation activities such as boating and kayaking, and snowmobiling in the winter. The nearest cottage developments are located in Steeprock, to the north of Portage Bay, as well as two developments on the north shore of Watchorn Bay

on either side of the inlet of Rendall's Creek. There are at least eight resource tourism operators in the Project Region. The region lies within the Interlake Registered Trapline (RTL) district and intersects a small portion of the Waterhen RTL sections on the west side of the region and a portion of the Gypsumville RTL section in the northwest area of the region. Commercial, subsistence and recreational fishing occurs on Lake Manitoba, Lake Winnipeg, Lake St. Martin, Dauphin River, Mantagao River, Sturgeon Bay and some tributaries. Other important economic sectors include construction, public services (e.g., health care and education), retail trade, and transportation.

2.2 PROJECT COMPONENTS

The Project components are organized around the two channels, the LMOC and LSMOC (Figure 1-1). Main Works are as follows:

- LMOC:
  - a diversion channel, approximately 24.1 km long
  - a channel inlet positioned at Watchorn Bay on Lake Manitoba and outlet at Birch Bay on Lake St. Martin
  - a water control structure (combined with a road bridge)
  - three road bridges, one of which is combined with the water control structure
  - realignment and/or new construction of PR 239 and affected municipal roads

LSMOC:

  - a diversion channel, approximately 23.8 km long
  - a channel inlet positioned at the east end of Lake St. Martin and outlet near Willow Point in Sturgeon Bay of Lake Winnipeg
  - a combined bridge and water control structure
  - several drop structures

- Associated Works and Activities (both channels)
  - power supply (distribution line to the Lake St. Martin water control structure)
  - temporary construction camps and staging areas (within the channel right-of-way, where feasible)
  - temporary access routes (via existing roads)
  - realignment of existing drainage infrastructure (diversion of surface water and groundwater)

- measures to divert surface water and groundwater during construction and operation
- erosion and sediment control
- fuel and waste storage
- facilities for storage of explosives, if required

The various phases of the Project will include supporting activities that will be wholly undertaken by others (i.e., contractors) for the provision of construction materials, power, fuel, waste management and disposal and other project needs. Such items would include the following:

- Rock and borrow materials will be provided from licensed and approved sources. The selection and use of specific sources are not defined and will be determined by the successful Contractor(s) providing the construction support on the Project.
- Power lines to the water control structures will be provided by Manitoba Hydro. If applicable, temporary camps may also be powered by existing local Manitoba Hydro services as determined by the contractor.
- Waste disposal grounds, solid wastes generated as a result of Project-related construction, and operation and maintenance phases will be transferred to appropriately permitted/licensed facilities for recycling and/or disposal.
- Wastewater generated as a result of the Project construction and operation will be stored and transferred for disposal at existing licensed facilities by qualified carriers.

2.2.1 Lake Manitoba Outlet Channel

2.2.1.1 Outlet Channel

The LMOC will run northwards from Watchorn Bay in Lake Manitoba to Birch Bay in Lake St. Martin (Figure 1-1). The preliminary channel design is approximately 24 km long, with a base width varying between 8 m and 13 m and side slopes between 5H:1V and 6H:1V, depending on bank slope stability requirements. The channel is proposed to have an invert elevation of approximately 242 m above sea level (masl) at Lake Manitoba and about 239 masl at Lake St. Martin. The depth of the earthen channel will vary between 6 m and 12 m below grade, and since the invert of the channel will be lower than water levels in the lakes, there will be water in the channel on both sides of the Water Control Structure (WCS) during operations, both with the gates open and closed. The channel structure will be excavated below grade with spoil piles placed along both sides of the channel. Average water velocities in the LMOC are expected to range between 0.9 m/s and 1.3 m/s, with locally higher velocities occurring in the vicinity of the bridges and the WCS when the WCS is open and operated at a Lake Manitoba level of 248.1 m (814 ft) and a Lake St. Martin level of 244.2 m (801 ft). Expected flow sources include local surface water runoff, supplemented by a limited discharge (base flow) from Lake Manitoba through the WCS to preserve water quality in the channel when the gates are closed, and to sustain fish habitat.

2.2.1.2 Channel Inlet and Outlet

The hydraulic profile of the channel will require lakebed excavation at the channel inlets and outlets to match proposed channel invert elevations. The excavations will be tapered over a distance of approximately 500 m or less from shoreline to transition from channel bottom to existing lakebed elevations.

2.2.1.3 Water Control Structure

A WCS is required to control flows through the LMOC, designed as part of a bridge structure at the Iverson Road channel crossing location (Figure 1-1; described in Section 2.2.1.4). The WCS conceptual design includes three 9 m wide sluice bays, guides and sill beams for upstream stoplogs, vertical lift gates and downstream stoplogs. An ancillary building will be constructed near, or attached to, the WCS to house mechanical and electrical service. Permanent electrical power will be used to raise and lower the gates.

2.2.1.4 Permanent Bridge Structures

The LMOC will intersect municipal roads and provincial highways, which will require new bridges to maintain connectivity and access. A total of four new bridges are planned to span the LMOC, one of which will be combined with the WCS described in Section 2.2.1.3 (Figure 1-1). The other three will be dedicated bridges constructed to maintain connectivity along the Township Line Road, realigned PR 239, and PTH 6 (Figure 1-1). The LMOC will not be deemed navigable and will not be designed to meet clearance requirements for passage of motorboats, sailboats and other powered vessels.

2.2.1.5 PR 239 and Municipal Road Realignments

Realignment of PR 239 and municipal roads is required in order to accommodate the LMOC, while still allowing for safe, economically feasible, and hydraulically efficient structures across the channel (Figure 1-1). Realignment of PR 239 will reduce the number of bridge crossings over the channel. Similarly, sections of municipal road will be reconstructed, realigned or extended for purposes of agricultural activities and rural residential access.

2.2.1.6 Associated Works and Activities

Rock Quarries and Borrow Material Areas

High quality limestone rock will be required for the purposes of riprap to control erosion at several points along the channel. Aggregate produced from quarries will also be used in realigning PR 239. Several potential rock and borrow sources exist in the general Project Region, which may be used by Project contractors.

Temporary Construction Camps and Staging Areas

It is expected that a portion of the LMOC construction workforce may be housed within existing accommodations in the region; however, contractors will use construction camps to supplement accommodations when the LMOC project workforce exceeds available capacity. Contractor staging areas will be used to store materials, maintain and assemble equipment and administer work on the proposed Project. Staging areas will be located on the right-of-way (ROW) wherever feasible and the exact location, number, size and details of the contractors' work areas will be verified during detailed design.

Power Supply

Permanent electrical service is required for power at the WCS to electrically raise and lower the gates, as well as to heat an appropriate number of gates to maintain winter operation capability. Manitoba Hydro will install a 24 kV overhead distribution line from nearby service to a pad-mount transformer that will be installed at the WCS location. A stand-by diesel fueled generator will be installed (including fuel tanks) as part of the Project to provide back-up power for the WCS, should there be a power failure at the site. During construction, primary power is likely to be handled with temporary on-site diesel-fueled generators and/or with potential use of overhead electrical power where available in sufficient capacity.

Temporary Access and Crossings

Temporary access routes may be required for access to the channel location, laydown areas and any other areas required for the LMOC. These may range from rough trails where vegetation may be removed or snow compacted, to service roads that are cleared, grubbed, graded, compacted and graveled to support heavy construction vehicle movement. Existing trails and other travel routes will not be altered adjacent to the Project development area other than as required for Project construction, operation and maintenance purposes. Where temporary access routes are accessible by the public, access will be blocked when not in use. After Project construction, access routes not required for on-going maintenance of the LMOC will be decommissioned and rehabilitated. Temporary detours will be used to maintain access through the area where the LMOC intersects existing provincial and municipal roads. Detours will be established prior, or simultaneous, to channel excavation and bridge construction, so as not to interrupt vehicle traffic.

Drainage Realignment

The alignment of the LMOC bisects several sub-drainage basins that feed several wetlands and small lakes, resulting in the need to address surface water drainage on the west side of the outlet channel. An outside drain will be constructed along the west side of the LMOC, likely along its entire length to capture the drainage from the west that flows across the LMOC location. The majority of the flow is expected to be re-directed into the LMOC upstream of PTH 6. Outside drains are not anticipated to be required along the east side of the outlet channel since surface runoff slopes away from the channel on that side. However, mitigation measures may be required to address the reduction in contributing area to the wetlands and Birch Creek. Surface water management is discussed in Section 2.3.11.

Facilities for the Storage of Explosives

Based on conceptual design information, blasting is not is anticipated for the construction of the LMOC; therefore, no explosive storage facilities are planned. However, if conditions encountered on the site warrant blasting, explosives and initiation systems to be used for blasting activities during the construction phase will be stored in temporary, independent magazines. The contractor will be responsible for obtaining any required permits/licensing. Magazines used for the storage of explosives will meet the federal standards and licensing requirements as specified in the *Explosives Regulation* of the federal *Explosives Act*. Siting of magazines will meet the provincial standards and licensing requirements as specified in the Operation of Mines Regulation of *The Workplace Safety and Health Act* of Manitoba.

2.2.2 Lake St. Martin Outlet Channel

2.2.2.1 Outlet Channel

The LSMOC will run northeast from the east end of Lake St. Martin towards Sturgeon Bay on Lake Winnipeg. It will pass through a wetland area, eventually connecting to an existing partially completed, but non-functioning portion of the EOC (Reach 3). The outlet channel will discharge to Sturgeon Bay in Lake Winnipeg (Figure 1-1). The functioning EOC, Reach 1 (connected to Lake St. Martin) will not be incorporated as part of the LSMOC, nor are there plans to decommission the functioning (Reach 1) portion of the EOC as part of the Project. The length of the LSMOC will be approximately 24 km with a base width of about 44 m. The earthen channel will be excavated and augmented with above-grade earthen containment dikes to achieve a capacity of 326 m^3/s (11,500 cfs) at a Lake St. Martin water elevation of 244.15 masl (801 ft) and a Lake Winnipeg water elevation of 217.6 masl (713.9 ft) when the WCS gates are open. When the WCS gates are closed (70% to 87% of the time depending on the month), the LSMOC will have approximately 1 m to 2.5 m depth of water, as a minimum, with average velocities typically less than 0.1 m/s depending on base flow. Expected flow sources include groundwater discharge and local surface water runoff, supplemented by limited discharge from Lake St. Martin through the WCS to maintain adequate water quality in the channel when it is not in operation and to sustain fish habitat.

2.2.2.2 Channel Inlet and Outlet

The inlet will include excavation into Lake St. Martin starting approximately 800 m from shore to allow a smooth transition from the lakebed to the start of the channel. Rock-filled jetties will likely be required for a short distance from the shoreline to protect the channel entrance from erosion. Based on the current design concept, the outlet will include an approximate 400 m excavation from the shoreline into Sturgeon Bay on Lake Winnipeg. Rock-filled jetties will extend into the lake parallel to most of the excavation area to prevent excessive sediment deposition in the outlet and protect the channel outlet from erosion.

2.2.2.3 Water Control Structure

A WCS is required to control flows through the LSMOC while facilitating the maintenance of Lake St. Martin water levels within the desired range. The WCS will also act as a bridge to provide access between both sides of the channel. Based on conceptual design information, the WCS will be constructed near the inlet of the LSMOC. The WCS will have two 9 m wide sluice bays, guides and sill beams for upstream stoplogs, vertical lift gates and downstream stoplogs while also serving as a bridge to provide access between both sides of the channel. Permanent electrical power from Manitoba Hydro to heat, raise and lower the gates will be backed-up by a diesel fueled generator.

2.2.2.4 Permanent Bridge Structures

Through the Indigenous engagement process with Dauphin River First Nation, Peguis First Nation, Pinaymootang First Nation, and other indigenous groups as well as local landowners there was interest expressed in developing a means to cross the LSMOC (in addition to the WCS/bridge) after construction to maintain access to harvesting areas. Mitigation measures are subject to discussion but may include a path or bridge, that can be traversed by foot, snowmobile or ATV. If, through further engagement, it is confirmed that the existing proposed bridge is not sufficient to provide this access then this concept will be advanced to final design.

2.2.2.5 Drop Structures

The LSMOC will require drop structures to minimize channel velocity in areas of steep sloping terrain. The drop structures are proposed to be constructed of rockfill, with a sheet pile cutoff at the upstream crest. The proposed design currently includes eight riprap drop structures, typically with a 76 m wide with a 2.7 m high crest. The channel elevation drop at each structure ranges between 2.1 m to 3.8 m. A sheet pile wall would be incorporated across the full width of the structure at the crest and would include a notch at the centre to concentrate base flows. The chute length would extend approximately 100 m. A level of base flow and inclusion of a notch at the top of each drop structure will provide downstream passage for fish when the WCS gates are closed to reduce the risk of fish stranding within the channels. Provision of adequate base flow and a deep pool upstream of the drop structures also reduces the potential risk of mortality for fish that may overwinter in the channel.

2.2.2.6 Associated Works and Activities

Rock Quarries and Material Borrow Areas

Quarried rock will be required for drop structures and riprap for the purpose of erosion protection at various points along the channel. Potential sources exist in the region and contractors will be required to use existing permitted sources or obtain proper permits prior to development of new sources of rock for the Project**.**

Temporary Construction Camps and Staging Areas

Temporary construction camps and staging areas will be located in existing disturbed areas and existing facilities wherever possible. Construction camps are expected to be required to accommodate in the order of 250 workers at the site. It is envisioned that a primary camp will be established for the WCS works and that the workforce related to earthworks will be divided into smaller camps associated with multiple contracts. Numerous potential camp locations are possible; however, final locations and sizes will be verified during detailed design. Contractor staging areas will be used to store materials, maintain and assemble equipment and administer work on the Project.

Power Supply

Permanent electrical service is required at the WCS to electrically raise and lower the gates, as well as to heat an appropriate number of gates to maintain winter operation capability. Manitoba Hydro will design, permit, and install a 24 kV overhead distribution line to the WCS location. The distribution line is expected to extend approximately 15 km from an existing line along PR 513 northwest of the outlet channel (Figure 1-1). The distribution line alignment will likely require a 30 m wide ROW to accommodate conductors strung on wooden poles that would typically be 12 m high. A stand-by diesel generator (including fuel tanks) will be required for emergency back-up power for the WCSs. During construction, primary power is likely to be handled with temporary on-site diesel-fueled generators and/or with potential use of overhead electrical power where available in sufficient capacity including at the WCS and along the channel length to support construction demands such as channel dewatering.

Temporary Access and Crossings

Construction-related traffic will be restricted to the Project ROW, with access via the Lake St. Martin Access Road (formerly a 19.5 km winter road) that extends northward from the existing forestry road (Idylwild Road) to the LSMOC channel inlet and the EOC (Reach 1, Figure 1-1). The LSM Access Road is a separate project being reviewed by the Province of Manitoba as a Class 2 development under Manitoba's *the Environment Act*. Access will be restricted to project and MI staff with access blocked when not in use. The only channel crossing currently planned for the Lake St. Martin Access Road is the WCS.

Drainage Realignment

A drainage ditch will be constructed on the east side of the channel to collect existing drainage. A drainage ditch is not likely required on the west side due to topography and existing drainage being away from the channel to the west. The ditch is anticipated to have a minimum 4 m wide base with 4:1 side slope. The design flow depth in the ditch is anticipated to be in the range of 1 m to 1.5 m. The velocities at the design flow are anticipated to be less than 1 m/s and concentrated in the channel centre during low flows due to channel design. Drainage control structures will be required along the channel in locations where the channel alignment intersects runoff from local drainage. The structures will likely consist of culverts and a gate system that will allow the discharge of surface runoff from the southeast side of the

LSMOC into the channel through the earthen dike while minimizing backwater from the channel into the adjacent land during periods of operation.

Facilities for the Storage of Explosives

If blasting is deemed necessary for LSMOC facilities for storage of explosives will be as described in Section 2.2.1.6 for LMOC.

2.3 PROJECT CONSTRUCTION

The construction stage for all Project components includes general preparation such as equipment marshalling, construction camps and staging areas, and rock and quarry area clearing. Requirements for specific construction activities and/or Project components are described in more detail below. Project components will be surveyed and flagged to mark the extent of required clearing after the locations are confirmed during detailed design. As construction details for the LMOC are still being developed and design of LSMOC is, in some respects, further advanced, information is provided for both channels where possible. Otherwise it is anticipated that there will likely be similarities in methods between the two channels and details are therefore provided based on the LSMOC.

2.3.1 Clearing

Construction will require vegetation clearing and grubbing of the final alignment ROW and excavating the channel to designed depths along the proposed channel alignments. ROW clearing will generally be 400 m wide and will consist of the removal and disposal of trees, shrubs, fallen timber and surface litter from the ROW and temporary access roads, prior to grading. Once cleared, excavation of the permanent outlet channels within the ROW may proceed year-round and will primarily be excavated in the dry.

2.3.2 Excavation

The inlet and outlet excavations may proceed in the wet depending on the selected construction methods. Based on the current design concept, the outlet will include excavation from the shoreline to a distance up to approximately 500 m into each lake. Rock-filled jetties will likely be required and will extend into the lake parallel to most of the excavation area. Construction will require cofferdams or temporary access groins to facilitate excavation, consisting of a combination of backhoes and dragline excavators, with the work area isolated with turbidity curtains and warning buoys installed for navigation. Excavated material will either be placed adjacent to the channel as spoil banks and/or containment dikes or transported to a pre-defined inland location away from shore.

LMOC excavation is planned to start at both lakes and work inwards, isolating the channel excavation into sections to mitigate groundwater effects and provide better control of dewatering efforts. Controlled removal of the various earth plugs separating each excavation section will be undertaken upon completion, to allow flooding of the areas and reducing the amount of pumping/groundwater

depressurization. The final sequencing of material removal and inundation will be further developed in detailed design.

For the LSMOC, construction will likely consist of clearing the ROW and installing drainage works, then advancing progressively from Lake Winnipeg towards to Lake St. Martin. Construction staging and sequencing will be coordinated to maximize excavation while minimizing the time of exposure of newly excavated slopes. Final material at the inlets and outlets (or the cofferdams if selected as the preferred construction methodology) will only be removed once channel works are complete, with the final material being released in a controlled fashion to prevent excess sedimentation or scour. This release will also be scheduled with consideration of fish spawning windows for in-water works.

2.3.3 Blasting

Based on conceptual design information, blasting is not anticipated to be required for the LMOC. For the LSMOC, bedrock excavation will occur as required, near the downstream end of the channel alignment in the vicinity of the existing Reach 3 of the Emergency Outlet Channel, where the bedrock surface is at or above the design channel invert. The existing Reach 3 Emergency Outlet Channel invert was previously excavated using D8 dozers equipped with ripping teeth. A similar approach is envisioned for widening of the existing channel as part of the LSMOC and therefore it is not anticipated that blasting will be required. However, should deepening of the channel prove to be cost-effective during channel optimization, limited blasting may be required as bedrock is anticipated to become more competent with depth.

As a conservative assumption, blasting is assumed to be used in all instances where bedrock is encountered. Should blasting be required, Contractors will be required to store, handle and transport explosives in compliance with relevant provincial and federal legislation, best practices and guidelines for safety and environmental protection. The timing of blasting activities will consider area-specific environmental sensitivities, such as minimizing disturbance to stakeholders, avoiding disturbance to rare species and sensitive time periods, and to minimize potential effects on populations used by First Nations for hunting.

2.3.4 Access Roads and Detours

The LSMOC does not interfere with any existing roads and, although the LMOC intersects existing provincial and municipal roads, construction will not interrupt vehicle traffic. Temporary detours will be used to maintain road access through the area and will be established prior, or simultaneous to, channel excavation and bridge construction. Detours are being incorporated into the design primarily to reduce/avoid potential effects on access interruption and maintain access to emergency medical services.

2.3.5 Bridges

Bridges will follow MI's design and construction standards and be composed of steel or concrete girders, concrete decking, and concrete abutments. Piers are likely to be required due to the length of span and will be armored with riprap. As with channel and water control structures (WCSs), bridges will be built in

the dry, with the exception of instream work for pier construction which will require coffer dams. Since bridges are to be built in the dry, scheduling of work relative to fish spawning windows will not be required. It is anticipated that construction will take place year-round.

2.3.6 Water Control Structures

WCS will be concrete structures spanning the full width of the outlet channels with gates that can be operated to control the flow of water as required. Based on conceptual design information, WCS locations will be excavated into and founded on the underlying till to provide a secure footing. WCSs will be constructed in the dry and will only be exposed to water once the control gates are in place and the structure can be safely exposed to flows. Since WCSs are to be built in the dry, scheduling of work relative to fish spawning windows will not be required. It is anticipated that construction will take place year-round once clearing is completed. The exception would be in-water works such as coffer dam and jetty installation and shoreline excavation related to the inlet and outlets of each channel.

2.3.7 Road Realignment

The realignment of PR 239, to occur across the LMOC, will follow MI standard performance-based construction specifications. Site preparation may include addition of sub-grade material, contouring, levelling, and compaction. Materials, including rock fill aggregate and composite material, will be loaded, hauled, dumped, spread, graded and compacted, and trimmed and shaped before the surface asphalt layer is applied. Other activities will include placement of geotextile fabric, riprap, roadway signs, erosion and sedimentation control and seeding of ditches. Intersections will be designed to adhere to MI standards. Any new municipal roads to be constructed to access any residences cut off from channel construction will conform to appropriate MI construction specifications and will include vegetation clearing and stripping of surface organic materials to be stockpiled for later use on road shoulders or for site reclamation. These roadbed surfaces are expected to be gravel.

2.3.8 Drop Structures

Drop structures are not required as part of the LMOC due to the low slope of the existing topography. For the LSMOC, drop structure construction includes installation of the sheet pile cutoff wall and building a sloped rock bed by backfilling the area immediately upstream and downstream of the sheet pile crest with rock. Drop structures will be constructed within the dry channel reach once the channel has been excavated. Alternative drop structure configurations (such as concrete structures) may be evaluated depending on preliminary design information.

2.3.9 Temporary Construction Camps and Staging Areas

Construction activities will require temporary staging areas and construction camps throughout the construction period. Construction staging areas will likely include mobile construction trailer facilities for use as administration buildings and equipment maintenance. Depending on the final size and occupancy of the camps and staging areas, trailers will be equipped with self-contained holding tanks for potable

water and septic waste. Drinking water could potentially be sourced from existing wells or otherwise be from wells permitted and licensed by contractors or delivered by truck from the nearest licensed/permitted water treatment facility. Sewage holding tanks will be used to temporarily hold generated wastewater; these would be pumped out at regular intervals and disposed of at permitted/licensed facilities. The remote camps will be equipped with diesel fueled generators to power the facilities. However, if located near an existing distribution line, electricity may be supplied from the existing distribution system.

2.3.10 Water Management

The appropriate management of surface and groundwater is a critical element of the design, construction and operation of the Project. As described below, detailed plans will be developed to address how surface water and groundwater will be managed during construction and over the life of the Project. These plans will be developed to address potential impacts related to surface water movement, to manage the risk of erosion, and will consider reduction of inflows into Birch Creek and Buffalo Creek as a result of the LMOC and LSMOC construction. Key items to be addressed in managing surface water include the following:

- control of surface water sources within or near the Project area that may be impacted during construction, including surface water in adjacent water courses and water bodies, surface water from construction dewatering activities due to seepage, depressurizing systems, and surface water from rainfall and/or snow melt runoff
- management and accommodation for surface water during construction staging and sequencing with consideration for ditching requirements, alignments and risks associated with runoff and flooding
- management and accommodation of surface water runoff during long-term operation with consideration given to ditching requirements, preliminary sizing of the drains and required structures
- sediment and erosion control

Temporary interim drainage measures will be implemented during construction as an interim step towards the final drainage design that will incorporate outside drains and drainage outlet structures. Site specific treatments (i.e., engineered temporary sediment basins, dikes, etc.) will be identified on an as needed basis during detailed design.

Key items to be addressed in managing groundwater related to construction include the following:

- confined aquifer artesian pressures (to flowing artesian conditions)
- groundwater seepage into and/or out of the channel
- impact of channel construction on groundwater wells
- impact of groundwater on the channel design, construction and operation

- potential effect of channel construction on wetlands

2.3.11 Revegetation

Revegetation is required to mitigate the potential for surface water erosion and the potential colonization of the channel by weeds. Revegetation will be among the final phases of site-specific construction activities for all Project components but will require planning and site preparation for successful re-establishment of vegetation. A revegetation plan (part of the project Environmental Management Program summarized in Section 2.5) will include selection of species likely to be tolerant of site-specific conditions. Temporary and permanent re-vegetation activities will begin as soon as possible after finished grades are established. Additional mitigation measures may also be required to address the risk of poor vegetation growth on portions of the channel side slopes that will experience alternating periods of submergence and exposure as a result of long-term operation and closure of the WCSs.

2.3.12 Fuel and Waste Management

There will likely be multiple fuel storage areas either near construction camps or within staging areas with the volume of fuel storage determined by the contractor. The contractor(s) will also be responsible for managing wastes associated with construction and/or maintenance contracts and will be required to provide a waste management plan at the beginning of the contract. Small quantities of domestic solid waste will be collected in appropriate on-site containment for transport to appropriately permitted/licensed waste disposal grounds. Wastewater (sewage and grey water) from work camps and construction sites will be collected in approved holding tanks and hauled to an appropriately licensed/permitted facility for disposal and treatment. Solid, liquid and hazardous wastes from the Project will be collected, stored, transported, disposed of and/or treated in accordance with relevant legislation such as Manitoba's *The Environment Act* (Waste Disposal Grounds Regulation) and *The Dangerous Goods Handling and Transportation Act*. During construction, fuel handling and storage areas will be located a minimum of 100 m from a waterbody. Fuel storage areas will incorporate secondary containment to reduce or avoid the potential for contamination in the event of an unexpected spill or container leak. Materials and equipment for the containment and recovery of accidental hazardous material spills will be available at all construction sites. During operation, fuel handling and storage will be in accordance with appropriate provincial and federal regulations and guidelines.

2.3.13 Power Supply

Overhead distribution lines will be constructed to provide service to each of the WCSs. The lines will be designed, constructed, and operated by Manitoba Hydro; the Crown Corporation responsible for electrical utilities in the province of Manitoba, in accordance to Manitoba Hydro's environmental management practices.

2.3.14 Workforce

Detailed construction phase workforce requirements (including number of employees, characterization and management of workforce, transportation of employees, associated traffic on municipal and/or provincial roads, work schedules, and lodging) will be estimated following completion of detailed design. The LSMOC construction camps are expected to be required to accommodate in the order of 250 workers at the site. This estimate consists of approximately 100 for construction of the WCS and 150 for major earthworks and drop structures along the channel length. Although existing accommodations do exist in the vicinity of the LMOC, provision of additional accommodations may be required of contractors in the form of work camps depending on timing and demand. A preliminary estimate of the number of workers employed on the LMOC portion of the project includes a peak workforce of approximately 325 workers.

2.4 PROJECT OPERATION AND MAINTENANCE

2.4.1 Operation Guidelines

The development of operating guidelines is based on the work of several Manitoba Infrastructure technical committees established to develop guidelines and desired levels for Lake Manitoba and Lake St. Martin. The work involved technical studies and engagement with the general public and Indigenous groups in the region. Operation of the LMOC and LSMOC WCSs will be tied to water levels and projected near-term water flows in the local area and region.

Regional floodwater is currently managed by use of the existing Fairford River Water Control Structure (FRWCS), currently the only WCS used to regulate outflows from Lake Manitoba. The LMOC will provide a second mechanism by which outflows from Lake Manitoba into Lake St. Martin can be regulated. The Dauphin River is currently the only natural outflow from Lake St. Martin. The EOC exists as an outlet from Lake St. Martin to the Dauphin River via Reach 1 and Big Buffalo Creek; however, it is not licenced for operation outside of declared emergency conditions. The LSMOC will provide a licenced mechanism for regulating outflows from Lake St. Martin to Lake Winnipeg additional to the natural Dauphin River flows.

During the operations and maintenance phase of the Project, MI will operate the LMOC and LSMOC by adjusting the gates on the respective WCSs in response to monitoring and flood forecasting according to the operating guidelines. This is expected to result in essentially two modes of WCS gate operation: open gates, to reduce levels on Lake Manitoba by increasing outflows from Lake Manitoba and Lake St. Martin during flood conditions; and closed gates, where only base flows are conveyed through the gates and lake levels and river flows are maintained or marginally decreased during non-flood conditions.

2.4.2 Vegetation Management

Established vegetation assists in minimizing erosion but has the potential to interfere with channel hydraulics if not properly maintained. Appropriate and realistic performance measures for the establishment of permanent vegetative cover will be developed as the naturalization and revegetation

design advances through to detailed design. During the initial maintenance (post-construction) of the Project, services will be provided to track revegetation progress, monitor for environmental compliance and to identify deficiencies and requirements for remedial planting work.

Long-term vegetation monitoring and management requirements will be developed as part of an operations and maintenance plan that will be developed. Maintaining vegetative cover on the base, slopes, embankments and adjacent perimeter drainage ditches will mitigate against erosion damages from flooding and heavy precipitation as well as prevent growth of invasive weedy species. A management procedure will be developed to describe the implementation schedule of inspections and vegetation management potentially including re-seeding, mowing and weed control, as required.

2.4.3 Water Management

Plans will be developed to address surface water and groundwater management. Key items to be addressed during the operation and maintenance phase of the Project include the following:

- management and accommodation of surface water runoff during long-term operation with consideration given to ditching requirements, preliminary sizing of the drains and required structures (Water Management Plan)
- sediment and erosion monitoring and control, to address the potential for sediments to mobilize into the Lake, or erosion around structures such as the outlets (Sediment Management Plan)
- debris management, particularly for the LSMOC, to address potential accumulations of debris floating along the shoreline of Lake Winnipeg at the outlet, which could wash away when the channel goes into operation (Debris Management Plan)

Key items to be addressed regarding groundwater management include the following:

- confined aquifer artesian pressures (to flowing artesian conditions) and groundwater seepage into and/or out of the channel
- impact of the channel on groundwater wells, and impact of groundwater on the channel operation
- potential impact of the channel on wetlands

2.4.4 Ice Management

Based on channel design, it is anticipated that a solid cover of ice will form within the channels during winter periods when no diversion is occurring. Seepage from the surrounding groundwater system may result in additional thickening of ice within the channels. The WCS gates will not be opened during the period in which there is solid ice cover in the channel (typically from December 1 – April 30); however, active diversion of water during the winter may be considered if severe flooding is forecasted for the following spring (expected to occur approximately 20% of the time).

2.4.5 Fuel and Waste Storage

The WCSs for both the LMOC and LSMOC will require standby diesel-fueled generators to provide back-up power in the case of power outages. The related fuel storage tanks will incorporate secondary containment to minimize the potential for contamination in the event of an unexpected spill or leak. Materials and equipment for the containment and recovery of accidental hazardous material spills will be available on site. Suitable protection, such as bollards, will be placed around fuel tanks to minimize potential for vehicle collision with tanks. Waste generation is anticipated to be negligible post-construction of the Project.

2.4.1 Maintenance Requirements

An operations and maintenance manual will be developed for Project components (inlets, outlets, channels, and the WCSs) describing maintenance needs during operational and non-operation periods. The WCSs include operable gates and hoists for which maintenance will be required. The manual will include roles and responsibilities, records and logs, coordination with agencies, emergency operations, operating guidelines, operating procedures, maintenance manuals, and maintenance procedures.

2.4.2 Workforce

The number and transportation of employees required during the operation and maintenance stage of the Project is anticipated to be minimal (e.g., one to two employees and one truck/vehicle) for routine inspections during closed gate conditions and associated with maintenance and inspection of channels and WCSs. Additional employees/labor may be required seasonally to assist in management of vegetation growth on channel side slopes or for additional monitoring/maintenance during open gate conditions, with staffing and equipment provided commensurate with the work to be undertaken.

2.5 ENVIRONMENTAL MANAGEMENT PROGRAM

A Project-specific Environmental Management Program (EMP) is being developed to address the environmental management processes that will be followed during the construction, and operation and maintenance phases of the Project. One of the primary functions of the EMP is to demonstrate compliance with the various federal and provincial environmental regulatory requirements, including the verification that all environmental commitments are executed, monitored, evaluated for effectiveness, and that information is reported back in a timely manner to the Project management team for adjustment if required. The EMP describes the roles and responsibilities of the parties involved in implementing the Project. It is a “living document” that will be reviewed and updated by on a regular basis, with continuous improvement being made so that the Project is constructed, operated and maintained in an environmentally responsible manner.

The EMP includes various environmental protection measures derived from Manitoba Infrastructure’s environmental and safety policies, which will be incorporated into relevant contract documents and inspection processes. The plans comprising the EMP will be finalized after the regulatory review process

is complete and the necessary approvals and associated conditions are received. Their finalization will benefit from the regulatory review process, as well as the ongoing Indigenous and public engagement process. Other environmental management plans will be developed to address various issues, including: Environmental Protection Plans, Project Environmental Requirements, Access Management Plan, Sediment Management Plan, Water Management Plan, Revegetation Plan, Dust Control Plan, Waste Management Plan, Hazardous Materials Management Plan, Emergency Response Plan and a Construction Decommissioning Plan.

3.0 PROJECT JUSTIFICATION AND ALTERNATIVES CONSIDERED

3.1 PROJECT JUSTIFICATION

Most of the southern portion of Manitoba is relatively flat, and the natural landscape contains several large river basins and sub-basins that move water over large areas through the province's many rivers and large lakes before ultimately emptying into Hudson Bay. Given the flat topography in much of Manitoba, the province is susceptible to flooding; especially in the spring, when surface water flows are typically at their peak.

Land development in the prairie provinces has increased over the past century, including clearing and draining lands to make way for urban areas and agricultural development. These practices have generally resulted in quicker drainage and increased flows to receiving water bodies, creating conditions where flooding events have resulted in increasing impacts to people, the economy, and infrastructure. As the financial consequences of significant flood events increased, impacting people's ability to use the land, their livelihoods, their properties and private or public infrastructure, Manitoba has responded by increasing its flood protection infrastructure. Flood mitigation works have been developed over time, incrementally protecting areas of vulnerability in a systematic fashion.

The economic effects of the 2011 flood event described in Section 1.1 exceeded $1.2 billion, including infrastructure repair and disaster payments as well as flood response costs. The need for the Project was further underscored in 2014, when a summer flood in southern Manitoba increased inflows to Lake Manitoba and raised levels by two feet over its normal operating range, resulting in increased flows to Lake St. Martin through the FRCS. This necessitated use of the EOC, Reach 1 for the second time since its initial operation in November 2011.

To address escalating risks associated with flooding in Manitoba, the Province carried out several studies and discussions with affected people to examine ways to address this issue for parts of the province that remained vulnerable. The result of this process was a decision to construct new flood protection infrastructure to mitigate remaining flooding vulnerabilities around Lake Manitoba and Lake St. Martin, namely the subject Lake Manitoba and Lake St. Martin Outlet Channels Project.

3.2 ALTERNATIVE FLOOD PROTECTION INFRASTRUCTURE CONSIDERED

As indicated, after the 2011 flood, Manitoba commissioned a study of options to reduce water levels on Lake Manitoba and Lake St. Martin on an emergency basis. Options ranged from the construction of various Lake Manitoba and Lake St. Martin channels in various lengths, locations, and sizes, to dams on the Assiniboine River and increasing the capacity of the Assiniboine River channel, to a diversion from the Assiniboine River to the La Salle River. Of the options evaluated, the construction of an additional

Lake St. Martin channel (to become the EOC) and full use of the FRWCS was assessed as the most timely, effective, and economical option for lowering flood levels in Lake Manitoba and Lake St. Martin under the emergency conditions.

Several committees were established to review the way the lakes were regulated, and to make recommendations on permanent outlet channels for Lake Manitoba and Lake St. Martin. The process involved an investigation of the various social, political and technical issues that arose from the many components of the flood, and reviewed flood forecasting and preparedness, public communication, and flooding on First Nations land. Recommendations were made on the range of regulations for the lakes and the need for a new outlet from Lake Manitoba to Lake St. Martin. Based on public input there was also considerable interest for an additional outlet from Lake Manitoba, and the recommendation was modified to include a second channel between Lake Manitoba and Lake St. Martin to provide the total required outlet capacity.

Further study evaluated a wide variety of potential flood protection measures for the basins with more than 70 mitigation options being evaluated based on benefit/cost ratios and environmental considerations, including dikes, reservoirs, diversion channels, channel improvements, modifications to land use, as well as the purchase of vulnerable properties where protection measures were not practical across the basins. The result was that an increase in the discharge capacity from Lake Manitoba and Lake St. Martin would be a viable and direct means to limit rises in flood conditions on both lakes. Based on this, the Province decided to proceed with plans to design and construct Lake Manitoba and Lake St. Martin Outlet Channels because they would provide large scale positive effects to alleviate flooding in the region.

3.3 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

Work to advance the Lake Manitoba and Lake St. Martin Outlet Channels design involved a two-stage process. Stage 1 examined alternative outlet options for the Lake Manitoba Outlet Channel (LMOC) and the Lake St. Martin Outlet Channel (LSMOC) and involved technical analyses and Indigenous and public engagement to reduce the number of preferred alternatives for more detailed study in Stage 2 and identify the preferred alternatives for the Project.

3.3.1 Lake Manitoba Outlet Channel Routing

Stage 1 for the LMOC involved examining six alternative routes. Options were evaluated in terms of hydraulics, water levels, and cost. General environmental issues were described for each option in terms of relative effects on surface water quality, groundwater, terrestrial environment, fish habitat, fish resources, and social environment. A relative ranking of each option was generated and based on screening criteria and economic analyses. Three options were recommended for further evaluation in Stage 2, with one subsequently dropped due to limited hydraulic capacity.

In Stage 2, an assessment was conducted to identify the engineering and environmental risks associated with the remaining two options. The assessment focused on potential groundwater, surface water and geotechnical concerns and impacts, and identified technically and economically feasible measures to

mitigate the associated risks. Through meetings with landowners, an additional alternative option was nominated, but was not selected after analysis due to risks to aquifer water quality including concerns for local well users and higher excavation quantities and costs. Based on this process, the most southerly alternative along Birch Creek (Option D) was identified as the preferred option.

3.3.2 Lake St. Martin Outlet Channel Routing

Stage 1 for the LSMOC began by examining the feasibility of using the one or all of the three reaches of the existing EOC. One of the issues was the existing bog and need for channel improvements in Reach 2, and the potential for flooding Dauphin River communities with use of Reach 1. Route options were examined for two outlet locations to Lake Winnipeg based on cost, biophysical environment, social environment, and hydraulic capacity, resulting in a preferred option (Willow Point) moving to Stage 2 for further evaluation.

The Stage 2 study considered four options for the LSMOC consisting of various combinations of existing EOC reaches, and one new channel inlet, to convey water from Lake St. Martin to Willow Point on Lake Winnipeg. A set of evaluation criteria was developed for comparing the options by rating their performance and suitability. Based on the analysis, the preferred option was identified, involving a new channel inlet east of Reach 1 following a northerly direction to EOC Reach 3 and then to Willow Point.

3.3.3 Water Control Structures

Several options were considered to control flows in the outlet channels. Gated control structures were selected as the best option. Overflow weirs were also considered for the Lake Manitoba and Lake St. Martin Outlet Channels but were not selected due to factors such as less ability to control flows during lake fluctuations and the need to be substantially wider than the outlet channels to achieve the required discharge capacity. Gated control structures allow for greater flexibility than overflow weirs in operating the outlet channels in response to flood events. The location of the Lake Manitoba Outlet Channel control structure was selected near the downstream end to minimize the required size of the control structure, eliminate the need for a secondary drop or outlet structure, and to reduce impacts on groundwater and adjacent wetlands. In comparison, the location of the Lake St. Martin Outlet Channel control structure was selected at the inlet on Lake St. Martin to limit outflow at times of low lake levels.

3.3.4 Bridges

The Lake Manitoba Outlet Channel intersects PR 239, PTH 6 and several municipal roads (Iverson Road, Carne Ridge Road, and Township Line Road) that will require bridge crossings to maintain connectivity. Several alternative locations were examined to address traffic flow and safety issues. To minimize construction cost and improve channel hydraulic efficiency the number of crossing structures along the Lake Manitoba Outlet Channel was minimized and locations selected that best allow right angle crossings. The Iverson Road LMOC crossing was selected to be a combination bridge/WCS. Likewise, a bridge will be required in combination with the WCS for the Lake St. Martin Outlet Channel to provide access to and across the channel for maintenance of the LSMOC as well as the existing EOC. As

indicated, an additional non-vehicular bridge or other method of crossing the LSMOC to provide trail access is the subject of additional discussion with First Nations as potential mitigation for traditional land use and access.

3.3.5 Provincial Road 239 Realignment

Maintaining the existing alignment of PR 239 would require construction of an additional bridge. To achieve cost savings and reduce the number of crossings alternative designs for the intersection of PR239 and the Project were considered. More than 10 realignment design options for PR 239 were assessed and the preferred alignment selected based on a number of characteristics such as construction and user costs, hydraulic efficiency, reducing environmental effects, and avoidance of residences and livestock operations.

3.3.6 Power Distribution Line

Electrical power will be required for construction activities and operation of the WCSs. Options considered for power supply included use of portable diesel generators or accessing grid electrical power, with grid electrical power preferred.

As the LMOC will be located in a developed rural area and electrical distribution lines are already present nearby, power is expected to be sourced from the nearest viable distribution line. On-site diesel generation during construction may be implemented in addition to grid power on a case-by-case basis depending on contractor needs.

By comparison, the LSMOC is located in a semi-remote area, with the nearest electrical power source being a distribution line 15 km to the northwest. Manitoba Hydro has indicated that a tap into the existing distribution line via an existing winter road corridor is the likely route to provide power to the LSMOC WCS.

4.0 PUBLIC ENGAGEMENT PROGRAM SUMMARY

Public engagement to address the flooding in the Project Region began formally in 2011, with meetings and discussions with landowners, Indigenous communities and groups, and the public, focussed on the studies and committees described in Section 3. The outcome of these discussions included the confirmation that new flood protection infrastructure was required. As the process to address flooding impacts evolved into examining measures to address future flooding and the design and alignment of the Project, a wider area was examined to include other stakeholders who might be affected. Public information sessions and/or public open houses were timed to correlate with planning and design milestones. Follow up sessions and other mechanisms, such as one-on-one meetings, were organized based on the needs and interests of stakeholder groups.

Stakeholder sessions were held 2013 in Dauphin, Brandon, and Portage La Prairie to explain the studies and obtain input from targeted audiences and the public on flood mitigation options to consider. Invitations were sent to individuals and organizations in the study region including Reeves, Chief Administrative Officers, Mayors, Councillors, leadership and representatives of First Nation and Metis communities, local businesses, local landowners, interested groups and other interested individuals. A 2014 open house held in Ashern provided information on the preliminary outlet options and provided an opportunity for stakeholders to examine proposals, express their opinions, and influence the design. Approximately 250 people attended, representing homeowners, farmers/ranchers, and cottage owners, elected officials, business owners, and Indigenous community members.

The engagement process incorporated multiple methods to provide or request feedback, including: a Project website (https://www.gov.mb.ca/mit/wms/lmblsmoutlets/description/index.html), Project email account, questionnaires, comment sheets, presentations with opportunities to ask questions, “table talk” storyboards and a “graffiti wall” to write comments at public meetings. At each public meeting, handouts were available including maps showing the location and alignment of the proposed outlet channels and the federal government’s environmental assessment process. An online survey was initiated for the public engagement process, in recognition that busy schedules can interfere with participation at scheduled events. The survey also allowed interested parties to absorb information and provide feedback on their own time.

Between June 2017 and June 2019, an additional four rounds of public open houses in Moosehorn and Winnipeg between were held to communicate and discuss various aspects of the Preferred Project. Feedback from the engagement process has provided input to the assessment of the Project and is explicitly referenced in the EIS, as summarized in Attachment A. Engagement will continue throughout the development of the proposed Project and receipt of necessary regulatory approvals. Future engagement will provide updated information and opportunities for interested and affected parties to continue commenting on the Project throughout detailed design, construction, operation, non-operation and maintenance. Comments and input received will be reviewed to assess whether the information alters the effects assessment and/or warrants modifications to mitigation measures proposed as part of this EIS and/or licence conditions.

5.0 INDIGENOUS ENGAGEMENT PLAN SUMMARY

In addition to summarizing the engagement with Indigenous groups, the EIS Guidelines require an overview of potential impacts to Aboriginal or Treaty rights. The Manitoba Government recognizes that the Crown has a legal duty to consult in a meaningful way with First Nations, Metis and other Aboriginal communities when any proposed provincial law, regulation, decision or action may infringe upon or adversely affect the exercise of a treaty or Aboriginal right. Subsection 35(1) of the Constitution Act, 1982, provides that the existing Aboriginal and Treaty rights of the Aboriginal peoples of Canada are hereby recognized and affirmed. Subsection 35 (2) defines the Aboriginal peoples of Canada as including First Nation, Inuit and Métis peoples of Canada. Government must also reasonably accommodate concerns about the effects of the decision or action raised in the consultation process, by attempting to address those concerns. Manitoba Infrastructure and Manitoba Indigenous and Northern Relations (INRM) are engaging Indigenous peoples to better understand the Project's potential impacts on Treaty or Indigenous rights. Manitoba recognizes that assistance may be required for a community to be able to meaningfully participate in the consultation process and has established a Crown-Aboriginal Consultation Participation Fund to assist communities with the cost of consultation, based on a funding agreement.

The engagement and consultation plan involved an initial phase of determining communities that may be interested and or affected by the Project and making initial contact through letters to determine the community's interest in engagement. The next phase involved the development of consultation plans and budgets to accommodate community participation, and meetings and information exchanges to discuss issues relevant to the assessment of the potential impacts of the Project. This information will be reviewed and analyzed prior to reporting the consultation results internally to Crown decision makers. In the final phase, community concerns will be addressed and/or accommodated. Explanations will be provided to each community to explain how their input was incorporated into any decision-making.

Indigenous engagement to address flooding in the Project Region began formally in 2011, with several First Nations and other Indigenous communities that were displaced due to the flooding. Discussions focussed on input to the studies and committees described in Section 3, with the outcome confirming that new flood protection infrastructure was required and that some communities remained displaced from the 2011 floods and continue to face challenges from the displacements.

As the process began to include the design and alignment of the Project, Manitoba Infrastructure and INRM determined the initial communities to engage with based on geographic area, proximity to the Project, traditional territory, rights-based activities, previous consultations, community protocols and other knowledge of community land use. From 2015 to 2018, engagement methods included letters, emails, discussions with community elected officials, meetings with community members, participation at Open Houses and community reports. Members of the communities involved in discussions included Elders, youth, resource users, Chiefs and Councils, Northern Affairs Councils, and Metis Government. The output was organized into a list of issues and concerns by Indigenous community and Indigenous group and has been an important input explicitly referenced throughout the EIS, as summarized in Attachment B.

Based on Manitoba's identification process, twelve Indigenous communities located on Lake Manitoba, Lake St. Martin and Lake Winnipeg have used, or are currently using, land within and adjacent to the Project area to exercise Indigenous and Treaty Rights (in alphabetical order):

- Dauphin River First Nation
- Dauphin River Northern Affairs Community
- Ebb and Flow First Nation
- Fisher River Cree Nation
- Kinonjeoshtegon First Nation
- Lake Manitoba First Nation
- Lake St. Martin First Nation
- Little Saskatchewan First Nation
- Manitoba Metis Federation
- O-Chi-Chak-Ko-Sipi First Nation
- Peguis First Nation
- Pinaymootang First Nation

The Agency's 2018 EIS Guidelines provided a list of the groups deemed to be most affected by the Project, which are those First Nation communities listed above, plus the following:

- Skownan First Nation
- Sandy Bay First Nation
- Bloodvein First Nation
- Norway House Cree Nation
- Berens River First Nation
- Hollow Water First Nation
- Brokenhead Ojibway Nation
- Sagkeeng First Nation
- Black River First Nation
- Poplar River First Nation

- Misipawistik Cree Nation

The Agency's EIS Guidelines noted that the last five First Nations on the list above were those that may also be affected by the Project, but to a lesser degree than others on the list. Later in 2018 The Agency added Keeseekoowenin Ojibway First Nation to the list of potential most affected First Nations, and in June 2019 the list was expanded further to include Fox Lake Cree Nation, Pimicikamak Okimawin (Cross Lake Band of Indians), York Factory Cree Nation, Tataskweyak Cree Nation, and the Council of Chiefs of Anishinaabe Agowidiiwinan.

In addition to the First Nation communities, Manitoba Infrastructure has met with and/or corresponded with the following Northern Affairs Communities (NAC) about the Project:

- Aghaming NAC
- Berens River NAC
- Dauphin River NAC
- Fisher Bay NAC
- Loon Straits NAC
- Manigotagan NAC
- Matheson Island NAC
- Norway House NAC
- Pine Dock NAC
- Princess Harbour NAC
- Seymourville NAC

Manitoba Infrastructure has corresponded with the communities identified in the EIS Guidelines. Meetings and email exchanges continue with First Nations in 2019 to answer questions, and exchange information on potential environmental effects and develop workplans and budgets to facilitate ongoing engagement and consultation. Manitoba Infrastructure will continue to engage with Indigenous peoples and communities on this Project regarding development of engagement plans and TK studies. Notices have been sent out to Indigenous communities and groups advising them of the recently launched Project website and inviting them to provide comment through the Project email. The intent is to further develop an understanding of the interests and concerns of people and communities potentially affected by the proposed Project. These processes will provide ways to minimize potential adverse effects and enhance positive effects where possible. Accommodation for potential adverse Project effects may be addressed in operating guidelines for the channel and detailed design.

Once MI has made the determination that the communities have provided all the information they intend to share, or that communities have chosen not to engage, an internal report on what was heard and nominated accommodation measures will be completed. MI will undertake external communications with each First Nation, Metis or other Indigenous communities who participated in the engagement and consultation processes. MI will address the government decisions and any measures to be undertaken to mitigate potential adverse effects on the exercise of Aboriginal and Treaty rights. The communication will convey all the concerns heard from the communities and groups, how they were incorporated into the decision and how concerns were or will be addressed or accommodated.

6.0 SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT

The environmental assessment addressed both Project-related and cumulative environmental effects using a standardized framework. Valued components (VCs) on which to base the assessment of environmental effects of the Project were selected with consideration of EIS Guidelines, likelihood of occurring in the area and interacting with the Project, issues identified through public and Indigenous consultation and the professional experience of the assessment team. The following is the list of VCs assessed:

- atmospheric environment
- geology and soils
- groundwater and surface water
- fish and fish habitat
- vegetation
- wildlife
- land and resource use
- infrastructure and services
- economy
- human health
- heritage resources
- traditional land and resource use
- Indigenous health and socioeconomic conditions
- Aboriginal and Treaty rights

The assessment describes existing conditions for each VC, determines how the Project interacts with each VC, presents mitigation and environmental protection measures for each VC so as to reduce or eliminate adverse effects, and characterizes the residual environmental effects that remain after mitigation has been applied, in terms of significance. As a general explanation on details common to all VCs, Section 4.4.4 of the EIS (Characterization of Residual Environmental Effects and Defining Thresholds for Significance) describes the approach and criteria (i.e., direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context. Significance of effects is not determined

for the physical environment VCs (atmospheric environment, geology and soils, groundwater and surface water). Significance is determined for those VCs that are receptors to any change in the physical environment VCs: the aquatic environment, terrestrial environment VCs, human environment VCs and Indigenous peoples. Sections 6.1 through 6.13 summarize the environmental effects on the VCs.

The assessment examined effects using three spatial boundaries that are applied to each VC in accordance to its key characteristics: a Project development area (PDA), local assessment area (LAA), and regional assessment area (RAA), of which the latter two can vary depending on the VC. Figures 6-1, 6-2, and 6-3 show the spatial boundaries for the VCs. The PDA is the physical space or directly affected area within which Project components and activities are located and the immediately adjacent area. The LAA includes the PDA and adjacent areas where environmental effects may reasonably be expected to occur. The RAA is the area that provides context to the changes occurring in the LAA for each VC, and it is the area within which the Project's environmental effects may interact or accumulate with the environmental effects of other projects or activities that have been or will be carried out such that cumulative environmental effects may potentially occur.

Effects are assessed in relation to the specific Project phases and activities, including the construction phase (estimated as five years) and the operations and maintenance phase, which has no duration to it because the Project is expected to operate in perpetuity and is not expected to be decommissioned.

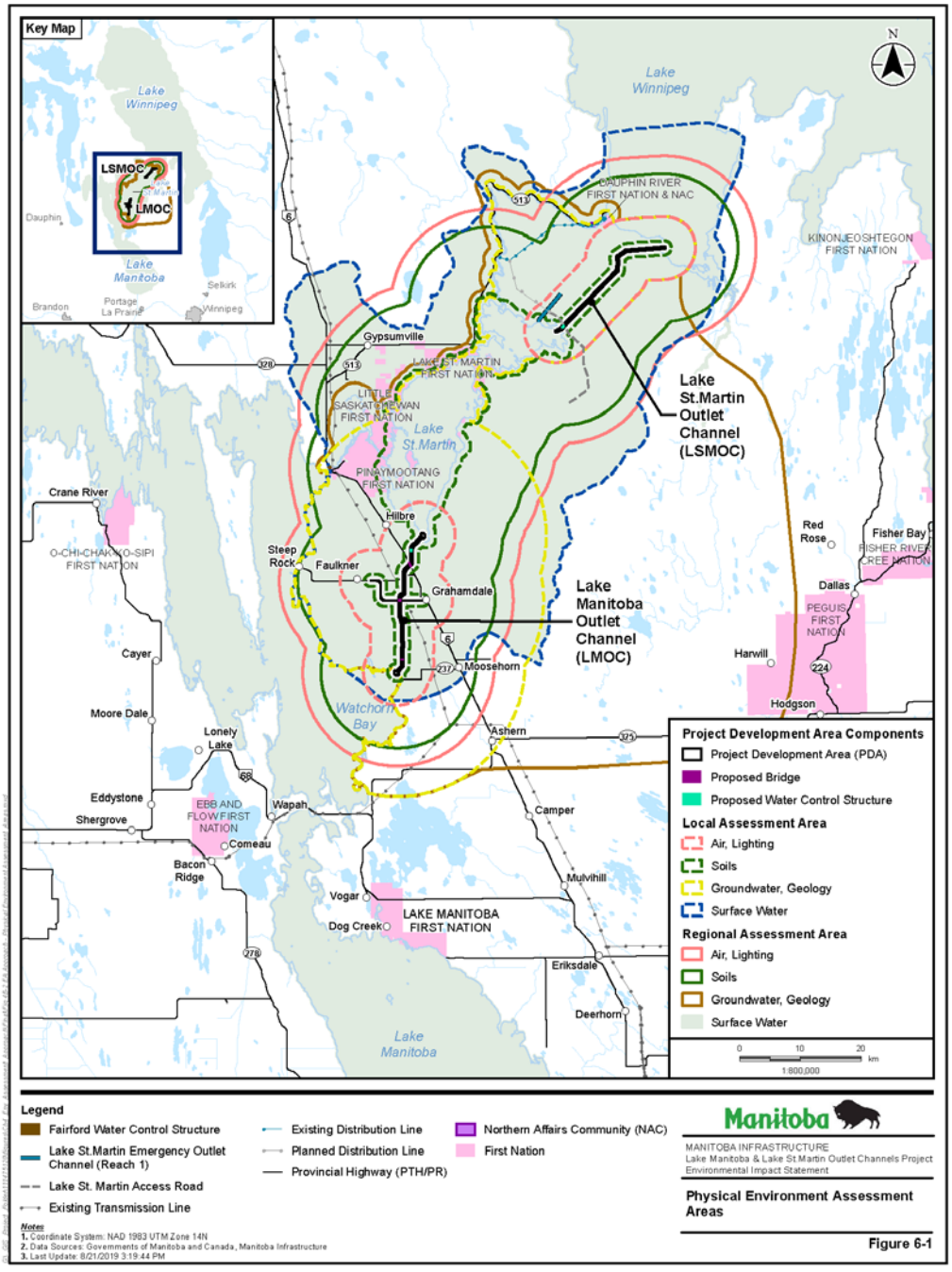

Figure 6-1 Physical Environment Assessment Areas

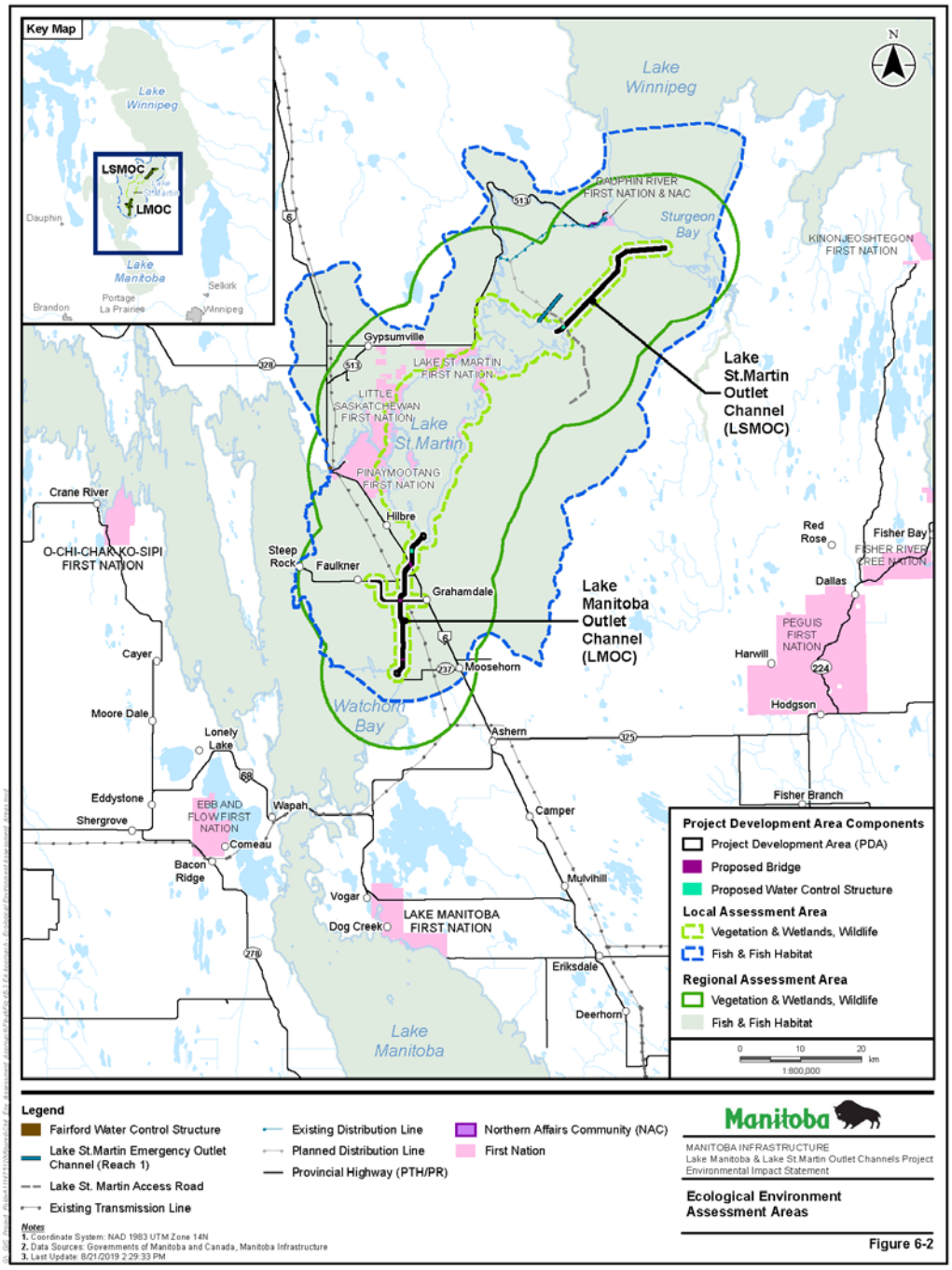

Figure 6-2 Ecological Environment Assessment Areas

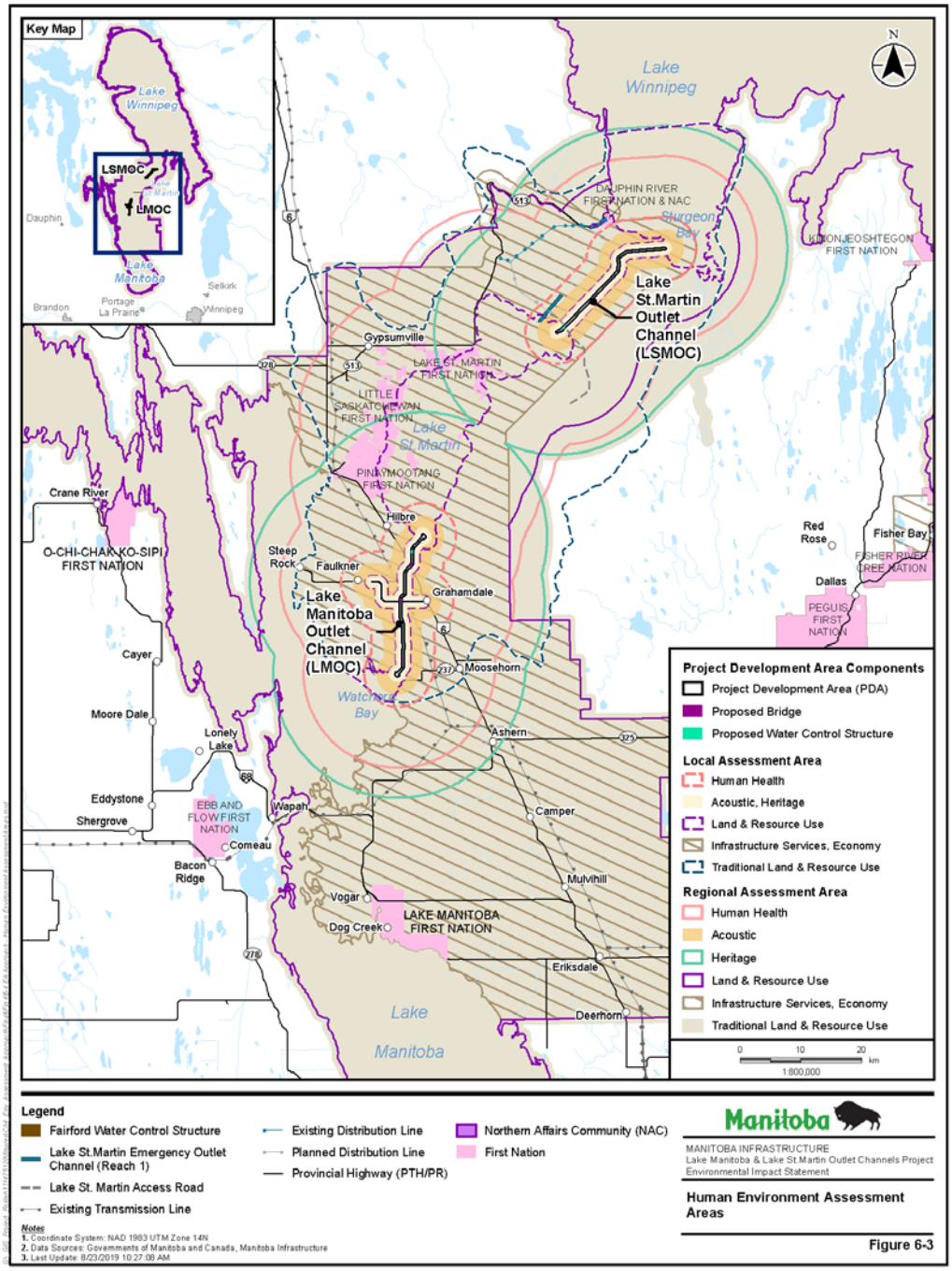

Figure 6-3 Human Environment Assessment Areas

6.1 ATMOSPHERIC ENVIRONMENT

6.1.1 Description of the Baseline Conditions

6.1.1.1 Air Quality and Climate

Based on measurements at the Dauphin station for the 30-year period 1981 to 2010, the coldest months of the year are in the December to February period, and the warmest months of the year are in the June to August period. The greatest precipitation occurs in the June to September period. Average winds are in the 13.0 km/h to 16.6 km/h (3.6 m/s to 4.6 m/s) range. The most frequent wind direction is from the west. The highest wind speeds are associated with west winds. The relative humidity tends to be higher in the morning; this is likely due to the closer proximity to Lake Manitoba. In the afternoon, the relative humidity is lower due to warmer temperatures. Visibilities less than 1 km occur less than 1% of the time. Visibilities between 1 km and 9 km occur less than 7% of the year, with most of the year yielding visibility ranges greater than 9 km.

Air quality contaminants of concern assessed in the baseline study included criteria air contaminants (CACs), which are common air pollutants with known human health and environmental effects, including nitrogen oxides (NO_x), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particulate matter (PM). Available long-term ambient air quality data of CACs: NO_X, SO_2, PM_{10}, $PM_{2.5}$, O_3 and, CO were assessed. There are no local greenhouse gas (GHG) emission inventories for the Project area because of less industrial activity within the LAA; therefore, the Project GHG emissions cannot be compared to local emissions. Manitoba GHG emissions accounted for 3.0% of the national GHG emissions and Manitoba is the sixth largest provincial emitter of GHGs in Canada.

6.1.1.2 Acoustic Environment

No urban/suburban areas exist within the LAA. All areas within the LAA are considered quiet rural locations, and the existing sound levels are conservatively assumed to be 35 dBA, as recommended in Health Canada Guidance. There are no communities or residential receptors located within LAA for the LSMOC. Some residential receptors were identified within the LAAs of the LMOC and PR 239 realignment route. At present, the specific locations of disposal haul roads and aggregate quarries are not known; they will be determined by the contractor. Any residential receptors found within these Project elements will be assessed using the assumed existing baseline sound levels of 35 dBA.

6.1.1.3 Ambient Light

The LSMOC and LMOC PDAs are located approximately 180 to 220 km north of the City of Winnipeg. There are no communities, residential receptors or major roadways located within 5 km (i.e., within the LAA) of the LSMOC PDA and there are three small communities (Grahamdale, Steep Rock Junction and Birch Bay), numerous residential receptors, and PTH 6 located within 5 km of the LMOC PDA. Communities of the size of Grahamdale, Steep Rock Junction and Birch Bay typically have localized light pollution, such that only in the immediate vicinity of a streetlight is the night sky masked by light, and

backyards, parks and other areas afford ready views of the major constellations. There are no existing sources of artificial light contributing to the existing ambient light environment within the LSMOC PDA and LAA.

6.1.2 Effects on the Environment

6.1.2.1 Change to the Environment

Air Quality and Climate

During construction, there are two types of air emissions: exhaust emissions from construction equipment, and fugitive dust emissions from surface disturbance activities. Gases and particles are common by-products of fossil fuel combustion. Fugitive dust emissions from surface disturbance activities result in particle emissions of various size ranges. The larger dust particles are removed near the disturbance area by gravitational settling and are the main contributor to dustfall. Air emissions are carried off-site by the wind. Construction vehicle exhaust is a source of GHG emissions (measured as carbon dioxide equivalent [CO_2e]). Upstream GHG emissions can originate from construction material extraction, processing, fabrication, and shipping to the Project site; and electricity use in construction offices and lighting. Approximately 417,397 t CO_2e are estimated to be released over the construction period, and the maximum annual Project emission from the construction period is 127,774.7 t CO_2e (year 3). About 78% of the construction GHG emissions are estimated to be to be released between construction years 2 to 4. LMOC and LSMOC construction emissions contribute 58% and 42% of overall Project construction emissions, respectively.

Acoustic Environment

Noise propagation from the Project construction activities was considered to potentially affect nearby receptors within the acoustic LAA. The Project noise emission levels during construction are predicted for the identified receptors within the LAA and compared to the established thresholds. Noise effects at most receptors were expected to be of low magnitude to moderate magnitude, but several were predicted to exceed the 50 dBA threshold. The receptors were preliminarily identified within the LMOC and PR 239 realignment LAA and considered as habitable dwellings, and those with high expected noise impact will be reassessed once the construction schedule and the equipment usage are known. Additionally, the extents of noise buffers were established for various Project components. These were defined by the distances at which the Project noise levels would be estimated to fall below the 50 dBA threshold. Noise emissions during operations are not considered continuous as the operation of Water Control Structure(s) (WCS) will be limited to potential flooding periods and regular maintenance. Therefore, noise emissions from operations are not assessed quantitatively.

Ambient Light

The majority of the site preparation and construction activities will likely occur during daytime hours; however, there is the potential for such activities to occur during the nighttime depending on the

construction schedule and the time of year (i.e., during the fall and winter when days are shorter). During this time, it is likely that portable lighting units would be used to meet visibility and worker safety needs. There would also be light associated with the use of vehicles to support the Project related transportation.

The operation and maintenance phase of the Project includes the outlet channels once construction is completed under both open and closed aspects of the WCS. During the operation and maintenance phase of the Project, there will be minimum interactions with the light environment as there will be minimum sources of permanent lighting. If required, permanent lighting structures would use directed lighting (when and where required) and would likely be installed around the control structures only.

6.1.2.2 Mitigation Measures

Air Quality

The following mitigation options would be implemented for the management of combustion emissions (i.e., construction vehicles) during the construction phase:

- Project off-road construction equipment will comply with emission standards in the Canadian Off-Road Compression-Ignition Engine Emission Regulations (GOC 2019a).
- Engines and exhaust systems will be properly maintained. Equipment will not be operated, including construction equipment, that shows excessive emissions of exhaust gases until corrective repairs or adjustments are made.
- Construction vehicle idling times will be reduced to the extent possible in order to reduce emissions, as a best management practice.
- Cold starts will be limited to the extent possible to reduce emissions, as a best management practice.
- Use of a work camp will reduce emissions associated with transportation of staff to and from site during construction.

The following mitigation measures are planned for the management of fugitive dust emissions during all Project phases:

- All work will be conducted in a manner that minimizes the raising of dust from construction or maintenance operations.
- Only water or approved dust suppressants will be used for dust control. The use of waste petroleum or petroleum by-products as dust suppressants is not allowed.
- All vehicles used to haul soils or aggregates to or from the work site will have the load covered with a tarpaulin cover during transport to minimize dust and prevent material from falling out.

- All material stockpiles or spoil piles prone to wind erosion will be maintained so as to minimize release of particulate matter or dust. This may include, but is not limited to, covering or stabilization of material stockpiled at the work site as required.

Considerations for the application of dust suppressant include:

- The application of dust suppressants will be limited to the roadway, driveway or designated area.
- The application rates of all dust suppressants will be monitored to ensure adequate coverage without pooling or runoff of products.
- The amount of dust suppressant applied will not exceed the minimum amount required to effectively suppress dust.
- The material must not migrate or run off the traveled portion of the roadway or designated area.
- Dust suppressants must conform to the manufacturer's specifications and must not contain concentrations of contaminants that would not normally be found in the suppressant.
- Dust suppressants will not enter and contaminate waterbodies, including surface and groundwater. Do not allow the product to leave the roadway.
- Products will not be applied to areas of roads that are subject to flooding.
- Products will not be applied if precipitation is occurring or forecast to occur before the product sets or cures.
- Over-application or application beyond the road shoulder will be avoided.

Greenhouse Gases

The mitigation measures associated with ambient air quality to reduce combustion emissions are also applicable to the mitigation of GHG emissions because combustion sources account for all the GHG emissions associated with the construction phase.

Acoustic Environment

The following best management practices will be implemented to help mitigate noise effects at receptors with moderate to high potential noise impacts:

- Residents near construction noise-generating activities where noise impacts are expected to be moderate or high will be notified.
- Temporary noise abatement barriers may be used to reduce noise levels. If noise abatement barriers are ineffective, a temporary reduction in the intensity of construction activities may be considered.

- Machinery and factory supplied noise-abatement equipment (e.g., mufflers) will be maintained in good working order.
- Machinery idling will be minimized.
- A noise complaint response procedure will be implemented to address noise complaints should they arise.

Ambient Light

To limit potential effects from the use of the mobile lighting and/or permanent lighting structures on light trespass, glare, and sky glow, the following mitigation measures will be employed:

- Full cut-off luminaire will be used wherever possible to reduce glare, light trespass, and sky glow from the Project lighting.
- As much as is possible, lighting will be located such that unavoidable light spill off the working area is not directed toward receptors outside of the PDAs.
- Lighting will be located so that the lights are not directed toward oncoming traffic on nearby roads on or off-site because of the nuisance and safety hazard this may present.
- Lights will be designed to avoid excessive use of the mobile flood lighting units and reduce potential effects by turning off lighting when they are not required.
- Contractor(s) will adhere to lighting design guidelines, and the lighting requirements for workspaces as enforced by Labour Canada.
- The Project will comply with applicable federal and provincial health and safety guidelines.

6.1.3 Residual Effects

As indicated previously, significance of effects is not determined for the atmospheric environment. Significance is determined for those VCs that are receptors to any change in the physical environment VCs: the aquatic environment, terrestrial environment VCs, human environment VCs and Indigenous peoples. Section 6.2.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

Air Quality

Project construction, operation and maintenance activities will create dust and combustion emissions. Residual effects on air quality during the Project operation and maintenance activities are expected to be lower in magnitude, duration and extent than during the construction phase due to the completion of excavation work, reduced use of vehicles and equipment, limited areal extent, and infrequent nature of

the operation and maintenance activities. Residual effects during the operation and maintenance phases are expected to be minor and limited mainly to the PDAs, with some use of the Project area roadways.

Greenhouse Gases

The GHG emissions associated with construction of the Project are offset by reducing or eliminating future GHG emissions that would have occurred as a result of flood associated activities such as flood emergency management, flood debris cleanup, and during reconstruction of damaged areas. The Project represents less than 0.02% and 0.6% of 2017 national and provincial annual GHG emissions respectively. Therefore, the project GHG emissions have negligible contribution to the national and provincial GHG emissions.

Acoustic Environment

During the construction phase of the Project, the potential noise effects of the Project activities are expected to occur primarily within the PDA and extend to the LAA. Increased noise emissions may also occur along the provincial and municipal roads used for access and transport of materials, equipment and crews in the Project area during construction activities. Duration of noise emissions from construction activities will be limited to the construction phase. Residual effects on acoustic environment during the Project operation and maintenance activities are expected to be lower in magnitude, duration and extent than during the construction phase due to the reduced use of vehicles and equipment and infrequent nature of activities. Effects during the operation and maintenance phase are expected to be negligible and limited mainly to the PDAs, with some use of Project area roadways.

Ambient Light

As the majority of the Project construction will occur during daytime hours, Project-related lighting during night-time will be limited. The use of mobile artificial lighting may occur for short periods of time during the fall and winter seasons when the working day extends into the dark or during times when nighttime construction is required to meet schedule demands. In consideration of the potential levels of light trespass and glare from the operation of mobile lighting units and the proposed mitigation, it is unlikely that sky glow levels would increase to such a level that would be representative of an urban environment.

During the Project operation and maintenance, some night-time safety lighting may be required for the POCs, channel inlets and outlets, drop structures, WCSs, bridges, quarries, and road works. The final lighting design has not yet been selected. Light trespass and glare from the permanent structures will be reduced where possible using full cut-off luminaires to focus light on the work area. Full cut-off lighting is also expected to reduce sky glow contributions to light reflected off nearby surfaces, which will be minimal.

6.2 GEOLOGY AND SOILS

6.2.1 Description of the Baseline Conditions

6.2.1.1 Geology

The regional and local bedrock geology is composed of layers of Devonian, Silurian and Ordovician carbonates and sandstone formed during the Paleozoic era that overlay or onlap with Precambrian granites or gneisses. The carbonate bedrock in the area is overlain by layers of till, intertills, post-glacial sediments and peat or organic deposits of varying thicknesses, with most areas having less than 10 m of overburden materials, but greater depth are possible in isolated locations. The PDA will be located in areas mainly within till, as well as some areas of organic deposits, glaciolacustrine sediments, rock, and near-surface bedrock. Other Project components will be located within similar lithologies, namely PR 239 will be located in areas within organic deposits. In addition, borrow pits will be aiming at sands from beaches of glaciolacustrine origins, and the Manitoba Hydro distribution line will be located in areas within sediments of glaciolacustrine origin and till. The Project is located in an area of low seismic activity.

6.2.1.2 Soils and Terrain

The majority of the RAA and entire LAA are located within the Ashern, Gypsumville and Sturgeon Bay ecodistricts. All are characterized as having drumlinoid or ridge and swale topography oriented in a northwest to southeast direction, with slope gradients generally less than 5%.

The soil materials occurring in the southern portion of the RAA, from Lake Manitoba to the south end of Lake St. Martin (including the west and east side) consist of extremely calcareous, very stony water-worked loamy textured glacial till. Ridges are comprised of relatively coarse textured, cobbly and gravelly deposits, while depressions contain the finer deposits. Discontinuous veneers of level to very gentling undulating glaciolacustrine clay sediments also occur on the west side of Lake St. Martin. The changing topography in this portion of the RAA has resulted in imperfectly, both very poorly and well drained soils.

Organic soils are predominant in the northern portion of the RAA, extending from Lake St. Martin to Lake Winnipeg. The organic soils are found in lower lying and depressional areas and are very poorly to poorly drained. The organic materials are not deep, and generally mineral soil (glaciolacustrine or till) contact occurs within the top 1 m of the soil surface. The organic material is comprised of sphagnum peat, forest peat or fen peat and ranges from being nutrient poor to nutrient rich.

Minor inclusions of carbonate bedrock occur in the RAA and are comprised of unconsolidated bedrock on nearly level to gently sloping topography. Vegetation on the carbonate bedrock is stunted and sparse as a result of little to no soil profile development. With respect to permafrost, the RAA is located south of the localized permafrost zone. The RAA is approximately 150 km south of any isolated areas of permafrost and approximately 630 km south of continuous permafrost.

Within the LAA, four dominant soil orders are found – Chernozems, Organics, Gleysols and Brunisols. Surface soil textures are predominantly medium (loams) within the soil areas of the LAA, followed by organic textures, then coarse (sand) to coarse skeletal (gravelly sand) textures.

Wind erosion risk is predominantly negligible, while a minor portion of the LAA has a low to severe wind erosion risk. Water erosion risk is predominantly very low, while a smaller portion has a moderate risk and a minor component has a low risk. Most soils in the LAA have a high compaction risk, while a substantive portion have a moderate and low risk.

Soils in the southern portion of the LAA, including the LMOC and along the southern and western shoreline of Lake St. Martin, are rated to have agricultural capability. Most soils are generally considered marginal for cropping agriculture and have severe to very severe limitations, with only a minor portion of the LAA generally considered prime agricultural land, with moderate limitations. Limitations to agricultural capability affecting a large portion of the LAA include structure and permeability, stoniness and excess water. A minor portion of the LAA is affected by moisture limitations, slope and consolidated bedrock. Soils within the LAA predominantly rated as poor suitability for reclamation purposes, with limitations due to high carbonate content and high stoniness content in the tills in the southern portion of the LAA and due to pH, texture and calcium carbonate content in the northern portion of the LAA.

Sensitive soil and terrain sites identified in the LAA include soils highly prone to erosion, sandy soils, saline soils, shallow soils and exposed bedrock, and known and potential impacted sites. Known and potential impacted sites include those identified by Federal and Provincial agencies, located within reserve lands associated with Indigenous communities along the western shoreline of Lake St. Martin, and potential manure-impacted sites in areas of cattle feedlots and manure stockpiles. No sites of unique terrain features or steep slopes were identified in the LAA.

6.2.2 Effects on the Environment

There are no potential effects to geology; consequently, no mitigation measures and residual effects are described.

6.2.2.1 Change to the Environment

Terrain Conditions

The primary pathway for Project effects to terrain conditions is through alterations to natural drainage paths and shallow groundwater flow. Hydrologic processes of seepage and inundation are important within the LAA, and the presence of the LMOC and LSMOC will alter these processes locally, in the vicinity of these components. The presence of the channels is anticipated to affect the movement of surface and shallow groundwater flow. Without the mitigation outlined in the Project EIS, this is anticipated to result in wetting-up on upslope of the channels and drying-down downslope of the channels. This would be expected to result in inundation and flooding on the upgradient sides of the channels, the west side of the LSMOC and east side of the LMOC, adversely affecting soil capability and productivity for current land uses, including natural vegetation and agricultural crop production, haylands

and pasture. Conversely, this could result in increased dryness in soils on the downgradient side of the channels and affect soil capability and productivity for natural vegetation and agriculture.

The assessment of slope stability of Project structures such as soil stockpiles and channel slopes will be made by the engineering service providers during the Project design phase.

Soil Quantity and Quality

While only a minor portion of the LAA is generally considered prime agricultural land, the predominant land uses around the LMOC is agricultural. Some natural vegetation also occurs, predominantly on the east side of the channel. Around the LSMOC portion of the LAA, natural vegetation predominates and there is no agricultural land use. Around Lake St. Martin, land use is mixed, with natural vegetation predominating on the eastern and northern shorelines, and agricultural land use occurring on the western and southern shorelines. As such, different parameters are used to assess changes to soil quantity and quality across the LAA. For the LMOC portion of the LAA and associated Lake Manitoba Project components, where agricultural land use predominates, soil capability for agriculture is of primary concern and the suitability of soils for reclamation of disturbed areas and Project structures such as stockpiles and channel slopes is also assessed. For the LSMOC portion of LAA and associated Lake St. Martin Project components, where natural vegetation predominates, the primary concern is the salvage and use of soils for reclamation purposes, therefore, reclamation suitability of soils is of primary concern.

Conversion of areas of soils supporting agricultural and natural vegetation land uses to industrial land use is an expected outcome of constructing the Project components. This conversion will affect these areas through Project operation. Construction and presence of Project components and infrastructure will affect soils and, in turn, the agricultural capability and reclamation suitability of these soils. There are multiple pathways for Project effects through the construction and operations phases of the Project.

During the construction phase, site preparation and construction of Project components will require clearing, topsoil stripping, soil excavation, and soil handling and stockpiling. These activities will affect soil capability of the land through changes in organic and mineral topsoil and upper subsoil thickness. Loss of soil quantity (thickness/depth/volume) and/or loss of soil quality can result from various mechanisms, including improper soil stripping, excavation and handling, admixing, compaction of topsoil and upper subsoil, and wind and/or water erosion of disturbed, exposed and stockpiled soils. Changes to soil properties including texture, organic matter content and structure can affect wind erosion risk. Similarly, water erosion risk may be affected by changes to topsoil texture, organic matter content, slope, structure and related infiltration characteristics. The loss of vegetative cover, particularly in areas of permanent, natural vegetation, will result in soils being more susceptible to erosion losses via wind and water.

Under permanent, physical Project footprints, soil areas will be lost for agricultural or natural vegetation land uses through the Project operation phase. Loss of these pre-Project land uses will occur at rock quarry and borrow material sites, as well as at temporary construction camps and staging areas. These losses will be temporary, and areas will be reclaimed and returned to pre-Project land uses following the construction phase, or during the operation phase, when they are no longer required to support the Project.

The Project is anticipated to lower water levels in Lake St. Martin. The reduction of lake levels in Lake Manitoba, in a manner that reduces inundation of lands surrounding Lake St. Martin due to the operation of the LMOC and LSMOC, is a desired positive outcome and objective of the Project. These reductions in lake levels will affect soils within the LSMOC portion of the LAA. A reduction in flood levels is anticipated to have a positive effect associated with the return of soil capability and productivity for natural vegetation and agricultural land uses adversely affected during pre-Project conditions.

Shoreline erosion is a process that will continue following construction of the Project. However, a reduction in lake levels and reduction in the frequency and level of flood events due to the Project are anticipated. This is expected to have a neutral effect on shoreline erosion.

6.2.2.2 Mitigation Measures

Terrain Conditions

Environmental protection measures incorporated into Project design and specific construction mitigation that lessen residual effects on terrain stability include the following:

- Engineering design of Project infrastructure including berms, dikes, ditches and channels will be completed to reduce the potential for soil stability issues.
- Channel banks, berms, dikes and ditches will be seeded and revegetated with an appropriate native seed or erosion control mix to improve stability of these features, unless these features are being stabilized by rip-rap.
- Drainage channels and re-alignments on upgradient sides of LMOC and LSMOC will channel water downslope and into the channels to minimize the risk of inundation and flooding as a result of channel presence.
- Surface drainage patterns for other Project components will be re-established where possible.

Soil Quantity and Quality

Mitigation measures to address potential effects to soil quality are summarized as follows:

- Topsoil in designated areas will be stripped and stockpiled for later reuse in site restoration. Granular material or other surface preparation, as approved by the Engineer, will be placed to ensure all weather accessibility.
- Locations within Designated Areas where equipment, hazardous material and/or wastes will be stored or maintained will be underlain with at least 30 cm of impermeable soil or approved equal and lined with an impermeable groundsheet to contain spills and minimize cleanup costs.
- Immediately following construction, all salvaged and stockpiled organics and soils which were set aside during site development will be spread back over the area from which they originated and shall

be seeded. If local soils are not available, other organic-based covers may be used to allow seed germination.

- All grubbed organic and topsoil layers with leaf litter and root mass will be stockpiled in appropriate locations and retained for reclamation efforts.
- Slash will be piled in a manner that allows for clean, efficient burning of all material. Avoid mixing soil into the slash.
- Erosion and sediment control measures include maintenance of vegetation cover, where possible, long-term, temporary or emergency stabilization of soil, other erosion and sediment controls (e.g., erosion control blankets), setback of soil stockpiles from waterbodies, revegetation of disturbed areas, and runoff diversion to prevent undesirable soil movement or soil releases and discharges to a waterbody.
- Stripped topsoil will be stored and used in the reclamation of the site.
- Spills, leaks or releases will be reported within 24 hours and contaminated soil will be appropriately disposed of at a licensed facility or stored in a designated storage area to prevent secondary contamination.
- All designated areas will be leveled to natural or pre-existing grade and slope as part of decommissioning. Stockpiled topsoil and other organic matter that had been removed from the site shall be spread to promote natural re-establishment of vegetation.
- Immediately following construction, all salvaged and stockpiled organics and soils which were set aside during site development will be spread back over the area from which they originated and shall be seeded. If local soils are not available, other organic-based covers may be used to allow seed germination.

6.2.2.3 Residual Effects

As indicated previously, significance of effects is not determined for geology and soils. Significance is determined for those VCs that are receptors to any change in the physical environment VCs: the aquatic environment, terrestrial environment VCs, human environment VCs and Indigenous peoples. Section 6.3.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

Terrain Conditions

Residual effects to terrain conditions are anticipated to be limited to alterations to drainage through the operation phase in relation to the presence of the LMOC and the LSMOC. These residual effects are considered adverse and will persist over through Project operation and are irreversible; in other words,

soil capability and productivity is not expected to return to baseline conditions. The effects are not sensitive to timing and are expected to occur continuously throughout the operation phase.

The drainage alterations are anticipated to affect soil capability and productivity for natural vegetation and agricultural crop production. The effects are anticipated to comprise an estimated area of up to 2,400 ha around the LSMOC. An undetermined but limited area around the LMOC is anticipated to be affected. As the effects resulting from alterations in drainage are anticipated to extend into the LAA they are considered to be of high magnitude. The effects will occur in both disturbed, agricultural landscapes, and undisturbed areas of natural vegetation and wetlands.

Soil Quantity and Quality

Residual effects to soil quantity and quality will be both adverse, as a result of Project presence and soil disturbance during construction, and positive, as a result of changes to lake levels and flood levels on Lake St. Martin. Construction will necessitate soil disturbance consisting of soil stripping, excavation, handling and stockpiling, and, in the cases of temporary components, replacement for site rehabilitation. For the permanent channel components, soils supporting agricultural crop production and natural vegetation will be affected through Project operations. This soil disturbance will result in adverse effects including disturbance a loss of soils with agricultural capability around the LMOC, and soils supporting natural vegetation around the LSMOC. These soils will be stockpiled adjacent to the channel.

Salvage of mineral topsoil and organic materials, and better-quality upper subsoils, if required, will be conducted to provide for reclamation and rehabilitation needs. This will include areas of temporary components that will be returned to equivalent land use following the construction period, and for stabilization and revegetation of Project structures, including soil stockpiles and channel slopes. Effects to soil quality and quantity is not anticipated to limit the ability to reclaim and rehabilitate areas disturbed by the Project.

Positive effects will occur due to the return of soil capability and productivity for agricultural cropping and natural vegetation along the Lake St. Martin shoreline. This will be the result of reduced lake levels and flooding levels on Lake St. Martin and will affect between approximately 2,140 and 2,750 ha.

In summary, the residual effects to soil quantity and quality are considered adverse to positive in direction and are anticipated to persist over the short-term to the long-term (i.e., through Project operation). The effects are generally considered irreversible for the permanent Project components; in other words, soil capability and productivity are not expected to return to baseline conditions. The effects are not sensitive to timing and are expected to occur infrequently during the construction phase (i.e., soil excavation and handling) to sporadically/intermittently throughout the operation phase (i.e., changes to flooding levels). The effects will occur in both disturbed, agricultural landscapes, and undisturbed areas of natural vegetation and wetlands. Effects to soil quality and quantity, in turn, affect soil capability and productivity for natural vegetation and agricultural cropping in areas of respective land uses – effects to these VCs area summarized in Section 6.6 (vegetation) and Section 6.8 (land and resource use [agriculture]).

6.3 GROUNDWATER

6.3.1 Description of the Baseline Conditions

Within the PDA and LAA, a carbonate aquifer is overlain with an aquiclude (i.e., does not transmit water) of till. The morphology of the till surface has created low-lying organic deposits within till troughs, within which wetlands have formed, likely fed with water from precipitation trapped within those low-lying depressions, and by slow-leaking groundwater under continuous artesian pressures.

The regional carbonate bedrock aquifer is confined and underlies the RAA. The carbonate aquifer recharge occurs in the uplands area under unconfined conditions where bedrock elevations are relatively high, and sediment cover is thin to non-existent. The groundwater flow radiates out from the uplands in all directions towards the major lakes (i.e., St. Martin, Manitoba and Winnipeg). The aquifer discharges into bogs, streams, and the major lakes. Discharge to lakes could be widely distributed but is most likely near where bedrock outcrops. Flowing artesian conditions are present in places forming springs.

The carbonate aquifer in the area of the LMOC is overlain by 5 to 18 m of till. The LMOC is located in the Birch Creek valley. The piezometric head in this area is higher than ground surface; because the bedrock aquifer is confined, it is entirely saturated. Typical seasonal piezometric head varies 2.5 to 3 m per year in the aquifer in the area of the LMOC. The elevation of Lake Manitoba and Lake St. Martin is lower than the groundwater in the area, indicating groundwater flow in the carbonate aquifer would be from the LMOC area towards the lakes. The carbonate aquifer is the main source of water for domestic use within the LMOC area.

At slightly greater depths, within the till horizon, sparse lenses of coarser sediments exist along the LMOC section. Depending on continuity and interconnectivity to the overall groundwater flow system, intertill zones may slowly discharge groundwater to the surface for extended periods of time, if the water saturated coarse sediment unit intersects the surface.

The till layer is overlain by a discontinuous horizon composed of localized, discontinuous areas of glaciolacustrine silts and clays, or relict shoreline sands, gravels, and silty littoral sands scattered in the region and overlying the till surface. Groundwater flow is limited within the coarser sediments due to the discontinuous nature of these layers. The surficial aquifer is not suitable for drinking water purposes because it is too shallow, but the overall quantity is enough to provide to wetlands in the LSMOC area.

Groundwater samples were collected from wells completed along LMOC and LSMOC and analyzed for water quality. All groundwater quality components were below their corresponding guideline except total dissolved solids (TDS), total coliforms and manganese. Positive results for total coliforms are very likely due to sampling wells not being disinfected prior to sampling. Hardness is not subject to a maximum acceptable concentration: there is no health effect due to hardness. The manganese concentration is high in till groundwater compared to the carbonate aquifer groundwater; the guidelines for manganese and TDS are based on aesthetics (staining and taste) and are not based on the protection of human health.

6.3.2 Effects on the Environment

6.3.2.1 Change to the Environment

Local Groundwater Flows, Levels and Quality

LMOC

The LMOC will be excavated in the till overlaying the carbonate aquifer that is under artesian pressure. Because the carbonate aquifer piezometric head is above ground level, there is a risk of till blowout. Groundwater dewatering will be necessary to lower the pressure in the aquifer. This reduction in head in the aquifer will occur away from the PDA in the carbonate aquifer used by domestic wells. While the effect will not be noticeable at most domestic wells, some wells may have the piezometric head impacted to a large enough degree to affect water supply. Livestock watering wells using only the natural artesian pressure might be impacted depending on their location.

There are 273 water wells within 5 km from the PDA. It is likely that many of the wells are not currently active.

Groundwater flows at Lake Manitoba and Lake St. Martin inlet or outlet (in Birch Bay or Watchorn Bay) might decrease due to hydrostatic pressure reduction caused by dewatering, but the dewatering groundwater will be discharged to the surface and will ultimately discharge to Birch Bay in Lake St. Martin or Watchorn Bay in Lake Manitoba. If quarry operations require dewatering, because the zone of influence due to dewatering will extend at distance from the given quarry, water availability can be affected at domestic wells located nearby.

Pressure relief wells along the channel might be necessary to maintain hydrostatic pressure at a safe ground pressure level during operations. The most likely area for this type of passive long-term depressurization is in the north section, downstream of the proposed control structure. The hydrostratic pressure drop will extend at a shorter distance from the channel and will be localized (compared to effects during construction phase), affecting fewer domestic wells. Water from depressurization will be discharged to the channel or to an outside drain constructed parallel to the channel and eventually reach Birch Creek or Watchorn Creek systems.

The surficial overburden is generally comprised of till and organic soils. The distance that changes in water level are transferred through the groundwater are limited. Changes in groundwater around the channel excavations will be small (less than 1 m), and the effects will transfer only 10 to 200 m at most from the LMOC. The channel construction and operation will improve drainage in the PDA lowering the saturation level in the surficial overburden and soils.

LSMOC

The effects of the Project on the groundwater are described in the local groundwater/surface water Interactions section below.

Shorelines

Around Lake St. Martin, the Fairford River and the Dauphin River, water levels will decrease during high dewatering conditions for construction. There will be a decrease in groundwater discharge in the saturated soils along the shoreline due to the hydrostatic pressure reduction caused by the dewatering. The effects will be negligible within 100 m of the shoreline.

Local Groundwater/Surface Water Interactions

LMOC

During discussions with landowners, concerns were often expressed that surface water may be transferred to groundwater creating a risk that pathogens may contaminate the domestic water supply. This area is under high artesian pressure (the carbonate aquifer is under pressure at higher head than ground surface, lake levels and water level in wetlands), meaning that the water will flow from the aquifer to the surface if there is a pathway. Currently, there is a thick till aquiclude (i.e., does not transmit water) protecting the underlying carbonate aquifer. If the till is breached during construction, then the surface water will not flow into the aquifer. The risk of groundwater under the direct influence of surface water at the proposed LMOC is very low due to high artesian pressure maintaining any flow in the direction from groundwater to surface water.

Domestic well water quality is generally an issue in flooded areas as flooding surface water has the potential to flow overland into domestic wells. The Project will reduce the frequency and extent of flooding along the Fairford River, Lake St. Martin and the Dauphin River, therefore protecting wells located in these current flood zones and reducing the risk of domestic well bacteriological contamination.

Wetlands and small wetland lakes and ponds located along the east side of the LMOC alignment are potentially affected during construction. Unconfirmed groundwater seepage at the bottom of wetlands, originating from the carbonate aquifer under artesian pressure, could decrease due to hydrostatic pressure relief operations during construction and operation. Dewatering associated with depressurization will create a lost in source water for these wetlands. Lateral shallow unconfirmed connection between the channel and the wetlands will be cut by the Project within the PDA, decreasing water availability to close by wetlands. The volume of dewatering water during construction, being ultimately discharged to Birch Bay in Lake St. Martin or Watchorn Bay in Lake Manitoba, has the potential to surcharge drainage capacity of downstream ditches and creeks.

LSMOC

The LSMOC route will pass through wetland areas. The wetland water levels can be disturbed by channel construction. The effect caused by disturbed shallow groundwater levels can occur up to 1,600 m perpendicular to the channel based on preliminary assessment but could be less than 500 m based on acquired experience from the past EOC project.

It is anticipated that natural surface and shallow subsurface drainage flow may be affected along the approximately 24 km length of the LSMOC, affecting drainage over an area of up to approximately 1,200 ha on either side of the channel. Consequently, there is an increased potential for inundation and flooding on the east side of the channel, while the west side of the channel would be expected to dry down and experience reduced surface and near-surface moisture conditions.

Artesian pressure will be relieved at the proposed location of the most upstream drop structure, locally depressurizing the carbonate aquifer. The depressurization zone of influence will expand over a limited distance. Provided that depressurization is expanded to the point of reaching local springs originating from the carbonate aquifer, the flow of those springs could decrease; the closer the spring, the greater the flow could decrease.

6.3.2.2 Mitigation Measures

Local Groundwater Flows, Levels and Quality

Mitigation will consist of the following:

- A Groundwater Management Plan will be developed to refine the analyses of effects of dewatering and provide a current enumeration of wells.
- Further aquifer investigation and modelling will be carried out to determine the effect of construction dewatering on specific domestic wells. Additional observation wells will be installed prior to construction dewatering to monitor the effects during dewatering of each section. Mitigation plans will be modified as required during the dewatering as specific information is received from monitoring.
- Mitigation for domestic wells could include lowering existing pump, supplying new pumps, or drilling new wells.
- Water from construction dewatering will be diverted to dugouts for livestock watering. Dugouts will be supplied by pressure relief artesian wells during operation.
- The drainage along LSMOC will be maintained to reduce the potential effects of water backing up in the wetlands upstream, south and east of the LSMOC.

Local Groundwater / Surface Water Interactions

LMOC

Mitigation will consist of the following:

- Dewatering water can be conveyed to wetlands if further water supply is needed.
- Clay cut-off walls (or other measures) can be built during construction to stop leakage affecting water balance of wetlands.

LSMOC

As indicated, Groundwater and Surface Water Management Plans are being developed as part of the engineering design. Mitigation will consist of the following:

- The drainage along LSMOC will be maintained to reduce the potential effects of water backing up in the wetlands upstream (south and east) of the LSMOC.
- Grout injection of the pervious top horizon of carbonate aquifer in areas of potential exposure prior to excavation is considered to cut-off possible artificial groundwater discharge and maintain artesian pressure within the carbonate aquifer.

6.3.2.3 Residual Effects

As indicated previously, the significance of residual effects is not determined for groundwater. Significance is determined for those VCs that are receptors to any change in the physical environment VCs: the aquatic environment, terrestrial environment VCs, human environment VCs and Indigenous peoples. Section 6.4.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

The Project may affect pressure in domestic or livestock wells within 3 to 5 km of the LMOC; however, the effect is mitigable by a Groundwater Management Plan that will further study effects, consult with local landowners and develop specific mitigation plans for each well user. Groundwater flows at Lake Manitoba and Lake St. Martin inlet or outlet (in Birch Bay or Watchorn Bay) might decrease due to hydrostatic pressure reduction caused by dewatering, but the dewatering groundwater will be discharged to the surface and will ultimately discharge to Birch Bay in Lake St. Martin or Watchorn Bay in Lake Manitoba.

Changes in groundwater level and flow around the LMOC 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. The location of the proposed LMOC was selected to reduce the risk of drinking water bacterial contamination. By maintaining artesian pressure within the carbonate aquifer in the area, the residual effect is the decrease of risk of domestic use aquifer to be contaminated by surface water.

It is anticipated that natural surface and shallow subsurface drainage flow may be affected along the LSMOC. Residual effects to drainage are expected to occur within a distance of 500 m or less of the channel, affecting 1,250 ha on either side of the channel.

6.4 SURFACE WATER

6.4.1 Description of the Baseline Conditions

6.4.1.1 Surface Water Quality

The water quality in the Lake Manitoba, Fairford River, Lake St. Martin, Dauphin River, and Sturgeon Bay in Lake Winnipeg (Figure 1-1) is moderately nutrient rich, low to moderately turbid, slightly alkaline, very hard, and well-oxygenated. There are existing contributions of nutrients, wastewater effluents, fertilizers, pesticides, animal waste and other contaminants associated with human residential, industrial and recreational activities that enter the area waterways through runoff or as direct discharges. In land areas that were previously inundated during high flow events, overland flooding may have released or transported compounds that can affect water quality in the area.

6.4.1.2 Hydrology

Lake Manitoba has a drainage area of approximately 79,800 km^2, a surface area of approximately 4,500 km^2 and approximately 915 km of shoreline. Lake St. Martin has a total surface area of approximately 345 km^2 with about 260 km of shoreline. The Fairford River is the only outlet for Lake Manitoba and is located at the northeast corner of the lake. Flows on the Fairford River are regulated via the Fairford River Water Control Structure (FRWCS), which allows higher and lower outflows from Lake Manitoba than under natural conditions. The Dauphin River has a gross total drainage area of about 82,300 km^2 and a length of about 50 km from its inlet on Lake St. Martin to its outlet into Sturgeon Bay on Lake Winnipeg. Winter ice forms on the Fairford River upstream and downstream of the FRWCS and along the Dauphin River. The outflow from Lake St. Martin is controlled by the Dauphin River, which is the only natural outlet from Lake St. Martin. A solid ice cover typically forms on Lake St. Martin in November and remains until the following spring break-up in April or May.

The LMOC will cross the Birch Creek and Watchorn Creek systems and the LSMOC will cross the upper reaches of the Buffalo Creek system. Birch Creek flows from the wetlands, ponds and small wetland lakes located adjacent to the proposed LMOC route north to Birch Bay in Lake St. Martin. Watchorn Creek originates near Reed Lake and flows south to Watchorn Bay in Lake Manitoba. The Buffalo Creek watershed consists of Big Buffalo Lake, Little Buffalo Lake, Buffalo Creek and several small unnamed lakes, ponds and creeks.

6.4.2 Effects on the Environment

6.4.2.1 Change to the Environment

Regional Flow and Water Levels

Changes in regional flow and water levels will occur as a result of the operation of the LMOC and LSMOC, which is a desired positive outcome and objective of the Project. The LMOC and LSMOC will provide a secondary mechanism for managing the outflows from Lake Manitoba and Lake St. Martin. Water flowing from Lake Manitoba that previously was routed to Lake St. Martin via the primary pathway of the Fairford River will be routed through the Fairford River and the LMOC to Lake St. Martin, and water from Lake St. Martin that previously was routed to Sturgeon Bay through the primary pathway of the Dauphin River will be routed through the Dauphin River and the LSMOC to Sturgeon Bay. The additional hydraulic conveyance provided by the LMOC and LSMOC will increase the amount of time that Lake Manitoba and Lake St. Martin can be maintained within the desired lake levels, reduce peak flood levels, and decrease inundation of low-lying areas around the lakes.

The operation of the LMOC and LSMOC will increase the outflows from Lake Manitoba and Lake St. Martin during flood conditions. This increased outflow capacity will allow water levels to be maintained at lower levels, thus decreasing flood risks around the two lakes. Less flow will also pass though the Fairford River and the Dauphin River during flood conditions. This decreased flow will reduce flooding along these rivers and in Lake Pineimuta. No discernable effect is expected on Lake Winnipeg or further downstream. The LMOC and LSMOCs will be operated such that, during low flow conditions, lake levels and river flows will be maintained and only marginally decreased.

Regional and/or Local Fluvial and Shoreline Geomorphology

Changes in regional fluvial geomorphology may occur in the Fairford River system or Dauphin River system as a result of the operation of the LMOC and LSMOC. Changes in flow amounts can affect erosional and depositional patterns in rivers and alter the processes of aggradation and degradation in the channel, which can result in changes to river bedload, channel bed elevations and/or channel morphology. Changes in local shoreline geomorphology will occur in Watchorn Bay in Lake Manitoba, Lake St. Martin and Sturgeon Bay in Lake Winnipeg due to construction of the Lake Manitoba and Lake St. Martin inlet and outlet areas, and operation of the LMOC and LSMOC. The construction of the inlet and outlets for the channels will require excavation of the lake bottom in these areas, and operation of the outlet channels will require that these areas be maintained at the constructed elevations to provide conveyance of flows as designed for each channel. These local shoreline changes could alter existing wind, wave and ice action, sediment transport, or beach forming processes in these areas.

A reduction in lake levels in Lake Manitoba and Lake St. Martin due to the operation of the outlet channels will reduce the amount of shoreline area inundated during high flows, which may alter the amount of exposed shoreline in the area. This change could alter existing wind, wave and ice action in some localized shoreline areas, but is not expected to change shoreline geomorphology. Discharge into

Lake St. Martin near Birch Bay from the LMOC and discharge into Sturgeon Bay near Willow Point from the LSMOC may alter the lake bed in these outlet areas during periods when outflows are high enough to cause scouring and movement of lake bed sediments or other substrates (e.g., sand, gravel, rock).

Local Drainage Areas and Local Drainage Patterns

Changes to local drainage areas and local drainage patterns will occur due to the construction and operation of the LMOC and LSMOC. The PDA required for the LMOC will alter drainage patterns in the Birch Creek and Watchorn Creek drainage basins as it cuts across some of the drainage areas for these basins. This alteration of drainage patterns will occur only along the west side of the LMOC. Drainage along the east side of the LMOC will not be altered. The small wetland lakes and ponds located along the east side of the LMOC alignment are outside of the PDA and will not be directly altered by the Project construction or operation activities but there are areas of wetland vegetation associated with these small lakes and ponds that will be affected by the Project. The small lakes, ponds and wetlands along the LMOC are dependent on surface water sources to maintain flows and water levels, and do not appear to be hydraulically connected to groundwater sources in the area. The construction and operation of the LMOC will result in a low to moderate magnitude reduction in flows in the Birch Creek system and a negligible change in flows in the Watchorn Creek system.

The PDA for the LSMOC will intercept surface water drainage from the upper reaches of the Buffalo Creek system, as well as some areas of ephemeral streams and wetlands. The construction and operation of the LSMOC does not physically alter the drainage areas, but the location of the LSMOC intercepts drainage from the south and east of the channel to the Buffalo Creek system. 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. In addition, Big Buffalo Lake may be supplied by groundwater upwelling from the carbonate aquifer, thereby supplying Buffalo Creek with additional water, although the construction and operation of the LSMOC will likely cause a reduction in flows to the Buffalo Creek system.

Regional and/or Local Sediment and Debris Transport

Changes in regional and/or local sediment and debris transport may occur due to the construction and operation of the Project. Clearing, excavation and other Project construction activities in the LMOC and LSMOC PDA could result in the release and transport of sediment and/or debris to waterways within or adjacent to the PDA. Operation of the LMOC and LSMOC will reduce flows and lake levels in Lake Manitoba, the Fairford River, Lake St. Martin and the Dauphin River, which is expected to alter sediment and debris transport at a local scale. The changes that will occur within each system are not expected to be of a magnitude that would result in a change in regional erosional or sedimentation processes.

Land-based construction activities in the PDA such as clearing, excavation and vehicle and equipment movements can result in the release and transport of sediment from work sites to area waterways. In-water excavation and slope contouring required to construct the LMOC and LSMOC inlet and outlet areas may cause a temporary increase in suspended sediments in these areas during these activities.

The reduction in lake levels and flows that will occur due to the operation of the Project is expected to reduce the amount of sediment and debris (floating or submerged) transport in the Fairford River, Lake St. Martin, Dauphin River and Sturgeon Bay as there will be less erosion at high flows or high lake levels occurring in these systems. Sediment deposition in Sturgeon Bay was found to vary among open water and ice-covered periods, with higher sedimentation rates in the fall than spring and summer. Wind is a more significant factor in suspended sediment dynamics than inputs from rivers that discharge into the lake.

The Project will serve to mitigate erosion and sedimentation effects from operation of the EOC, as flows will be routed through the LMOC and LSMOC, and no high flows will be passed through the Buffalo Lakes and Buffalo Creek system as part of the operation of the LMOC and LSMOC. The operation of the EOC did not reduce flow volumes or lake levels in the Fairford River, Lake St. Martin or Dauphin River

out when channel operation is required, which could temporarily increase sediment and/or debris transport.

The overall changes in sediment erosion, transport and deposition due to the Project are expected to be localized in nature, minor and not measurable. The overall amount of sediment and debris in the system is not expected to be altered, but it is expected to be distributed differently.

Regional and/or Local Ice Processes

The changes to regional flows and lake levels due to operation of the Project, and the changes in local drainage areas and local drainage patterns due to construction and operation of the Project, may affect ice processes in these waterways, as freeze and thaw cycles in lakes and rivers are related to flow and lake levels. The ice processes in the area waterways were examined under both open and closed gate operation during operation and non-operation of the EOC, and consideration of ice issues in the constructed channels and channel infrastructure is included in the conceptual and preliminary design of the outlet channels. It is expected that the reduced flows and lake levels will reduce the risk of ice jamming and flooding in the Fairford and Dauphin rivers. The addition of the inlet and outlet areas will likely alter ice forming processes in these areas, as there will be changes in flows and, in some areas, changes in local shoreline geomorphology. If the channels are in operation during early winter periods, the changes in flows could slow the formation of ice at the inlet and outlet areas, and it would require longer periods of time to achieve a solid ice cover in these areas. This localized effect on ice formation could affect transportation across these areas in winter periods.

Most of the changes to flows and lake levels due to operation of the Project will occur during peak flow periods in the open water season after ice-out, and operation of the FRWCS, LMOC and LSMOC will be managed in accordance with the revised operating guidelines. As such, the magnitude of the potential change to ice processes in regional waterways is predicted to be low to negligible.

The changes in flows in the Watchorn Creek system were considered to be negligible, and as such any changes in ice processes in this system are expected to be negligible. The changes to flows in the Birch Creek system could affect the timing and amount of freeze up in this system, although it is expected that the shallow wetland lakes and some if not all channel sections of the Birch Creek system would freeze to the bottom in most Manitoba winters, with or without the Project. As such, the magnitude of the potential change to ice processes in the Birch Creek system is predicted to be low to negligible.

The surface water areas that will be affected by the LSMOC are small intermittent stream sections in the headwaters of the Buffalo Lake and Buffalo Creek system. It is expected that these areas would freeze to the bottom in most Manitoba winters, with or without the Project. As such, the magnitude of the potential change to ice processes in the surface water areas that will be affected by the LSMOC is predicted to be negligible.

Regional and/or Local Surface Water Quality

There were no pathways of effects for regional changes to surface water quality identified for the construction phase of the Project. During construction, there will be the need to discharge groundwater from active aquifer depressurization activities. The areas along the LMOC where aquifer depressurization will be required are in areas where local residents currently draw groundwater for drinking water supplies, and the groundwater system currently naturally discharges to Lake Manitoba and Lake St. Martin. Based on the existing use of groundwater in the area and existing groundwater quality, it is expected that the groundwater that will be released to surface water areas will be within recommended guidelines. As such, the magnitude of potential adverse changes to surface water quality during construction of the LMOC is predicted to be low to negligible.

For the LSMOC, groundwater will be discharged to the outside drain constructed parallel to the channel. The groundwater system currently naturally discharges to Lake Winnipeg. Based on existing groundwater quality, it is expected that the groundwater that will be released to surface water areas will be within recommended guidelines. As such, the magnitude of potential adverse changes to surface water quality during construction of the LSMOC is predicted to be low to negligible.

The changes in regional flows due to the operation of the Project will alter the timing of how water passes through the existing system and diverts high flows from the Fairford and Dauphin rivers to the LMOC and LSMOC. The addition of the outlet channels alters the route for the passage of high flows from Lake Manitoba to Sturgeon Bay but does not change the overall composition or volume of water entering or leaving the system. That is, all flows from the Lake Manitoba basin will enter Sturgeon Bay, with or without the Project. There is the potential for low dissolved oxygen conditions to occur in the LMOC when the WCS is not in operation for an extended period.

The majority of the surface water quality parameters previously monitored show some natural variability and fluctuate seasonally and among years. There was no linkage between operation of the EOC and surface water quality in the sampled waterways with some exceptions, such as temporary increases in total suspended solids, temporary increases in phosphorus concentrations, and methylmercury being detected more often and at higher concentrations, but with concentrations consistently well below the relevant guidelines.

The transport of peat and other organic materials from the Buffalo Lakes or Buffalo Creek system is not expected to occur during open gate periods of the LMOC and LSMOC, as flows will be routed through the LMOC and LSMOC, and no high flows will be passed through the Buffalo Lakes and Buffalo Creek system as part of the operation of the LMOC and LSMOC. The LMOC and LSMOC will be designed to be non-erodible for normal operating conditions and are not expected to contribute additional sediment or debris to Lake St. Martin, the Dauphin River or Sturgeon Bay.

Based on historical and existing surface water quality data for the region, and information on the potential effects of high flows on surface water quality obtained from the EOC studies, it is not expected that the operation of the LMOC and LSMOC will alter the surface water quality in the regional or local waterways beyond the range of variability already observed in these waterways. The operation of the LMOC and

LSMOC diverts high flows from the Fairford and Dauphin rivers and avoids passing high flows through the Buffalo Lake or Buffalo Creek system. As such, the changes in surface water quality that occurred in relation to very high flows and the operation of the EOC are not expected to occur with the operation of the Project.

6.4.2.2 Mitigation Measures

The Project is designed as a mitigation project to modify regional flows and water levels in order to reduce flooding on Lake Manitoba, Lake St. Martin and the Fairford and Dauphin Rivers. No additional mitigation to effects on regional flows and water levels is required.

A primary form of mitigation that could be used to offset changes to flows in the Buffalo Creek system and wetlands associated with the construction and operation of the LSMOC is the repurposing of the EOC. Repurposing of the EOC to allow additional flows to the Buffalo Lakes and Buffalo Creek from Lake St. Martin would potentially replace any flows lost from interception of wetland flows to the creek due to the Project. The amount of flows would need to be adjusted based on concurrent studies of flows, wetland hydrology and fish habitat to optimize the mitigation, but would be within the range of flows that occur naturally in the system.

MI is developing a comprehensive Environmental Management Program (EMP) that incorporates several plans that will outline mitigation methods and measures to reduce or prevent potential effects to surface water during Project construction and operation, including ice processes (see Section 2.5). In addition to plans such as the Surface Water Management Plan (SWMP), the Debris Management Program (DMP) and the Sediment Management Program (SMP), specific mitigation includes the following:

- The LMOC and LSMOC will be operated in accordance with the Operating Rules developed for the Project (Section 2.4.1), which includes considerations for ice management.
- Signs indicating potential areas of thin ice will be used at LMOC and LSMOC inlet and outlet areas in accordance with Transport Canada requirements.
- The SWMP will outline the methods and approach to document surface water quality in the Project area during construction, operation and maintenance activities, including comparison of collected samples to recommended guidelines.

6.4.2.3 Residual Effects

As indicated previously, significance of residual effects is not determined for surface water or hydrology. Significance is determined for those VCs that are receptors to any change in the physical environment VCs: the aquatic environment, terrestrial environment VCs, human environment VCs and Indigenous peoples. Section 6.4.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

The potential effects of the operation of the proposed LMOC and LSMOC on regional flows and lake levels include a reduction in peak flood levels, reduced flood inundation areas, and an increase in the amount of time that Lake Manitoba and Lake St. Martin are within the desired regulated range. These effects are a desired positive outcome and objective of the Project. Local drainage areas and drainage patterns will be unavoidably altered in the areas where the LMOC and LSMOC will be located, but considerations for drainage in detailed design and application of mitigation measures will limit the magnitude and extent of these changes.

Minor, localized changes may occur in regards to changes in fluvial or shoreline geomorphology, and sediment and debris transport, but the changes in flows and lake levels that will occur in the regional and local waterways are within the range of high and low flows that have previously occurred in the Project area, and the magnitude of these potential effects were considered to be negligible to low. Monitoring and implementation of the SMP and DMP will address issues that may arise.

The potential changes to ice processes in the regional and local waterways were considered to be neutral in direction and of negligible to low magnitude after mitigation, as the potential for adverse effects is minor and localized in nature and can be mitigated by navigational signage.

No adverse changes are expected to overall surface water quality in the regional or local area waterways, as the composition and volume of water being transported from Lake Manitoba to Sturgeon Bay is not altered by the Project construction or operation. That is, all flows from the Lake Manitoba basin will enter Sturgeon Bay, with or without the Project. Temporary increases in suspended sediments may occur in local waterways due to construction activities, or at the channel inlet and outlet areas during initial WCS gate open conditions. There may be a localized effect (within the PDA) of low dissolved oxygen in the LMOC during extended periods of no operation.

The potential effects on surface water resources in the regional or local waterways were determined to be limited to the LAA. There were no pathways of effects or residual effects to the RAA.

6.5 FISH AND FISH HABITAT

6.5.1 Description of the Baseline Conditions

6.5.1.1 Lake Manitoba, Lake St. Martin, and Lake Winnipeg

Lake Manitoba and Lake Winnipeg are highly productive lakes due to their shallow depths relative to their large surface areas, warm summer water temperatures, and well mixed water columns. This natural productivity has increased substantially due to eutrophication caused primarily by agricultural run-off, which has degraded water quality of both lakes and has resulted in increases in cyanobacteria and green algae concentrations.

Nearshore habitat in Watchorn Bay of Lake Manitoba within the LAA is characterized by gravel and cobble substrate along the shoreline, with sand dominating substrates at depths >0.5 m. At depths >1.5 m, substrates consist of gravel, sand, and silt. Aquatic vegetation in Watchorn Bay is sparse. Habitat

in Sturgeon Bay in Lake Winnipeg is shallow and turbid due primarily to wind-driven currents that re-suspend the fine bottom substrates. Shoreline substrates are generally comprised of gravel and cobble while offshore substrates are clay, silt, and sand.

Habitat in Lake St. Martin is shallow (mean depth of 3.8 m; maximum depth of 6.4 m) with silt, sand, and clay substrates in the north basin and sand, gravel and boulders more prevalent in the southern end near the mouth of the Fairford River. Due to its large surface area to volume ratio and its exposure to prevailing winds, Lake St. Martin does not thermally stratify in summer.

The shallow, warm, and turbid habitat conditions in Lake Manitoba, Lake St. Martin, and the north basin of Lake Winnipeg provide near ideal habitat for open-water fish species such as cisco, lake whitefish, walleye, sauger, and suckers. A total of 37 species are known to occur in Lake Manitoba and there is potential for an approximately 10 species that may gain access to the lake from the Assiniboine River via the Portage Diversion. The most common large-bodied fish species in Lake Manitoba are white sucker, shorthead redhorse, common carp, freshwater drum, walleye, northern pike, and yellow perch.

More than 65 species are known to occur in or have been introduced to Lake Winnipeg. Many fish species in the lake, such as shorthead redhorse, bullheads, northern pike, sculpin, and freshwater drum, prefer nearshore habitat. Species preferring offshore areas include lake whitefish, goldeye, mooneye, emerald shiner, rainbow smelt and cisco. The most abundant species in the lake (i.e., walleye, sauger, yellow perch, white sucker, and burbot) are found in both nearshore and offshore habitats as adults. Non-native rainbow smelt first appeared in Lake Winnipeg in 1990 and are now an important part of the offshore prey fish community in the north basin. Walleye abundance in Lake Winnipeg has increased in concert with rainbow smelt, which have become one of the principal prey items for walleye in the lake.

Twenty different fish species are known to inhabit Lake St. Martin. White sucker, yellow perch, northern pike, and spottail shiner are the most abundant species year-round while lake whitefish and cisco are abundant in fall. During spring, sexually mature white sucker, northern pike, shorthead redhorse and yellow perch have been captured throughout the lake and white sucker, walleye, and yellow perch are known to spawn in the lake or its tributaries. Lake whitefish are known to spawn on gravel bars in the northeast basin of Lake St. Martin and in the narrows between basins in fall. However, lake whitefish likely spawn throughout Lake St. Martin. Tributaries to Lake Manitoba, Lake St. Martin, and the north basin of Lake Winnipeg are important spawning areas for walleye, suckers and northern pike. Nearshore wetlands are important spawning and rearing areas for northern pike, carp, walleye and yellow perch.

6.5.1.2 Fairford and Dauphin Rivers

The Fairford River drains Lake Manitoba to Lake St. Martin. Habitat upstream of the Fairford River Water Control Structure (FRWCS) is 330 m wide at the mouth tapering to 150 m wide at the control structure with maximum depth of 3.5 m. Habitat downstream of the FRWCS is up to 5 m deep with limestone cobbles present in high velocity areas and organic material and fine sediments in depositional areas. A fishway was installed in the FRWCS in 1984 to pass fish migrating upstream from Lake St. Martin to Lake Manitoba. White suckers, walleye, and sauger are known to successfully use this fishway in spring.

The Dauphin River is the natural outflow from Lake St. Martin. Most of the river is relatively shallow and swiftly flowing. Substrates in the lower river are characterized by hard compacted gravels and cobbles. Sand is rare except in the final kilometer where water velocities are lower as the river enters Sturgeon Bay. Sand, silt, and smaller gravels are transported by the river into Sturgeon Bay as suspended material while gravels and cobbles are transported as bed load.

White sucker and shorthead redhorse are the most abundant species in the Dauphin River in spring, and they use the Dauphin River for spawning. Carp, freshwater drum, northern pike, sauger, yellow perch, and white bass are also relatively abundant in the river in spring and they spawn in the Dauphin River or in Lake St. Martin. Species such as white bass, carp and freshwater drum become more prevalent in the river as water temperatures warm and suckers and northern pike move back downstream to Sturgeon Bay after spawning. Historically, a large spawning run of walleye occurred in the Dauphin River at spring break-up. However, the size of this run has diminished substantially and there is currently no significant walleye spawning run in the Dauphin River. Large numbers of lake whitefish from Lake Winnipeg migrate up the Dauphin River each fall to spawn in Lake St. Martin and in the river itself.

6.5.1.3 Lakes and Tributaries Near the Proposed Channel Routes

There is a series of fish-bearing small lakes (25 ha to 260 ha) and wetlands adjacent to the proposed LMOC. Most of these lakes drain to Birch Bay in Lake St. Martin through constructed channels connected to Birch Creek; others drain to Watchorn Bay in Lake Manitoba via Watchorn Creek. The size and depth of these lakes varies annually and seasonally depending on local precipitation. The lakes likely become anoxic during winter due to their shallow depth and abundance of aquatic vegetation. Northern pike, white sucker, and walleye are known to spawn in Birch Creek in spring. However, the ability of fish to access habitat in the upstream lakes depends yearly on the magnitude of the spring freshet.

Big Buffalo Lake and Little Buffalo Lake are part of a large bog complex located between Lake St. Martin and Sturgeon Bay that was used as the outlet of the emergency outlet channel constructed in 2011 and whose headwater tributaries would be intersected by the proposed LSMOC. Habitat in Big Buffalo Lake is shallow (1.0 m to 2.0 m) with organic substrates and abundant aquatic vegetation in the water and sedges, cattails, and bulrushes around the shoreline. Natural inflow to Big Buffalo Lake consists of local run off from surrounding wetlands and possibly groundwater. However, the lake becomes anoxic in winter. Access to the lake by large bodied fish from the Dauphin River is periodic and dependent on flows and beaver activity in Buffalo Creek.

Habitat in the headwaters of Buffalo Creek is a peat bog and with poorly defined channels. Downstream of Big Buffalo Lake, gradient, flow, and habitat diversity in Buffalo Creek increases and is comprised of runs, pools, and riffles. Beaver dams and impoundments are the dominant habitat forming process in the Buffalo Creek watershed. The beaver dams create pools with soft substrates and impede fish passage at low flows. Instream vegetation is dense throughout Buffalo Creek and riparian vegetation is comprised of grasses and willows. Fish species in Big Buffalo Lake include yellow perch, northern pike, and white sucker. Based on sampling results yellow perch were by far the most abundant species present prior to operation of the emergency channel. Perch, pike, and sucker spawning occur in the lake. Concentrations

of minnows are found in areas with abundant aquatic vegetation. Yellow perch numbers were substantially reduced following operation of the emergency channel in 2011 and catches in Big Buffalo Lake in the years following its use were dominated by white sucker and northern pike. The most abundant fish species in Buffalo Creek are central mudminnow, longnose dace, northern pearl dace, and juvenile white sucker. Similar species diversity was observed after operation of the emergency channel, but fish densities were lower than prior to its use, primarily due to a reduction in the number of central mudminnow and northern pearl dace.

6.5.1.4 Aquatic Species at Risk and Aquatic Invasive Species

There are seven aquatic species at risk that have a potential to occur within the LAA or RAA: mapleleaf mussel, lake sturgeon, bigmouth buffalo, silver chub, bigmouth shiner, chestnut lamprey, and shortjaw cisco. Mapleleaf mussel is the only species in the RAA listed on Schedule 1 of SARA. While there are historical records of mapleleaf mussel occurring as far north as the mouth of the Dauphin River, there are no records of mapleleaf mussel occurring within the LAA or the west side of Lake Winnipeg since 1992. This includes an absence of mapleleaf mussel from samples collected in Sturgeon Bay and Lake St. Martin during monitoring of the emergency channel conducted since 2011. However, mapleleaf mussel have been recorded from most major tributaries on the east side of Lake Winnipeg.

Lake sturgeon were historically abundant in Lake Winnipeg; however, the species was severely reduced by the commercial fishery in the late 1800s and have not recovered. Lake sturgeon are still captured occasionally within Sturgeon Bay, although rarely. Historically, lake sturgeon did not occur within the Lake Manitoba system; however, a recent capture of a juvenile sturgeon in Lake Manitoba in 2015 likely gained access via the Portage Diversion and originated from fish stocked into the Assiniboine River. There have been anecdotal reports of lake sturgeon captured in Lake St. Martin but there are no official records of the species occurring within the Dauphin River/Lake St. Martin system. No other aquatic species at risk have been found to occur within the LAA to date.

There are 15 aquatic invasive species (AIS) with direct routes of dispersal to potentially colonize the LAA and RAA. These include eight species of plants (curly leaf pondweed, Eurasian water milfoil, salt cedar, yellow flag iris, flowering rush, Himalayan balsam, invasive phragmites, and purple loosestrife), three species of invertebrates (spiny water flea, zebra mussel, rusty crayfish), and four species of fish (common carp, rainbow smelt, mosquito fish, round goby).

6.5.2 Effects on the Environment

The Project has the potential to result in the permanent alteration or destruction of fish habitat, alter fish passage, and/or affect fish health and mortality. Each of these potential pathways of effect are described below.

6.5.2.1 Permanent Alteration or Destruction of Fish Habitat

Fish habitat may be permanently altered or destroyed during construction and operation of the LMOC and LSMOC. During construction, fish habitat may be altered or destroyed due to: excavation of lake bottom habitat at the inlets and outlets of the LMOC and LSMOC; realigning, isolating, or dewatering small lakes and streams along or adjacent to the channels; changing groundwater inflows to lakes and stream adjacent to the channels; increasing sediment transport and deposition; changing flow patterns in the Fairford and Dauphin rivers and at the areas near the channel inlets and outlets; and reducing the duration that riparian vegetation is inundated during extreme floods.

6.5.2.2 Change in Fish Passage

During construction, changes in fish passage could occur during replacement or installation of new stream crossings along the realigned PR 239, any necessary road realignments, and along the LSMOC access road and distribution line. During operations, changes in the upstream and downstream movement of adult, juvenile, and larval fish between Lake Manitoba, Lake St. Martin, and Lake Winnipeg may occur due to the use of the LMOC and LSMOC when the control structures are open, and water is moving between the lakes. Use of the channels could also affect fish passage by affecting the attraction flows in the Fairford and Dauphin rivers, particularly during the spring and fall spawning periods.

6.5.2.3 Change in Fish Health and Mortality

Fish health and mortality have the potential to be affected by activities required for construction and operation of the channels. This is primarily because most construction activities will occur in or near water and could potentially release deleterious substances to streams and lakes adjacent to or downstream of the LMOC and LSMOC. Such releases may directly affect respiration of fish and gas exchange of fish eggs or indirectly affect plankton or benthic invertebrates which are food for many fish species. Specific pathways of potential effects on fish health and mortality during construction and operations are: accidental release of grease, fuel, oil, and/or hydraulic fluids from heavy machinery and concrete washout from the water control structures; increased overpressures from blasting in borrow-pits and quarries; introduction of sediment; stranding of fish and fish eggs in the channels after their use; and increased harvest pressure due to the presence of the work-force and improved access.

6.5.3 Mitigation Measures

6.5.3.1 Permanent Alteration or Destruction of Fish Habitat

The Project will mitigate any permanent alteration or destruction of fish habitat caused by building the channels through creating new fish habitat in the LMOC and LSMOC. When completed, the LMOC and LSMOC will provide at least 172 ha of new fish habitat; 72 ha in the LMOC and 100 ha in the LSMOC. Baseflow in the LSMOC will be provided year-round to maintain water temperatures and dissolved oxygen concentrations within the ranges required to sustain large-bodied and forage fish species. Water levels upstream and downstream of the WCS when the gates are closed will allow fish to enter and leave

the LMOC to Lake St. Martin or Lake Manitoba at all times. When the WCS gates are open, habitat areas in the channels will increase and flow conditions will be much more riverine compared to when the WCSs are closed.

A variety of fish species are expected to use the habitat provided by the channels year-round. This may include spawning, rearing, and overwintering for forage fish and for large-bodied fish such as walleye, suckers, northern pike, and lake whitefish. During operation, flow conditions below the WCS in the LMOC and below the downstream-most drop structure in the LSMOC are expected to be fast (>1 m/sec) and turbulent and this may provide conditions suitable for spawning, particularly for walleye. During periods of non-use, both channels are likely to support large numbers of forage fish as well as young-of-the-year and juveniles of many large-bodied fish species in the LAA. Adult northern pike are also likely to reside in the channels year-round.

Other mitigation measures to address potential alteration or destruction of fish habitat during construction and operation of the channels are:

- Follow DFO timing windows for instream work, as practical, particularly for any instream work required “in-the-wet”.
- Grout injection of the carbonate aquifer near the LSMOC to maintain artesian groundwater pressures in the carbonate aquifer if warranted during detailed design.
- Discharge groundwater from aquifer depressurization during construction of the LMOC to Birch Creek, Watchorn Creek, or to the lakes, wetlands, and drains to the east of the LMOC if required.
- Comply with provincial AIS regulations.
- Implement the Access Management Plan to reduce the risk of increasing dispersal of AIS including requiring all heavy machinery to be cleaned and disinfected prior to arriving on site and before moving between work areas at different lakes and drainages.
- Design any temporary diversions to provide fish passage, even during low flow conditions, and construct any temporary diversions “in-the-dry” or outside the fish spawning window.
- Incorporate habitat enhancements, where possible, including potential repurposing of the emergency outlet channel to convey additional flow to the Big Buffalo Lake bog area.
- Implement the Sediment Management Plan which will stipulate that contractor(s) provide 100 m set-backs from work areas and waterbodies or a buffer zone of undisturbed vegetation between the work area and waterbody of at least 10 m plus 1.5 times the slope gradient or 30 m, whichever is greater. The Sediment Management Plan will also limit machine fording to one-time events and limit any instream work to low flow periods when waterbodies or watercourses are dry or frozen. It will also identify several other measures that will reduce potential aquatic effects:
  - silt curtains around excavation areas where practical;

  - conducting excavations within dewatered cofferdams “in-the-dry”;
  - transferring excavation spoil to upland areas away from streams and waterbodies; rip-rapping sides of the channels and compacting bottom sediments to the maximum extent possible; and
  - vegetating channel slopes with native vegetation.

- Use LMOC and LSMOC only during high flood events and maintain lake levels within the operating rules to minimize changes in riparian vegetation inundation.
- Design and operate LMOC and LSMOC such that hydraulic conditions in the Fairford River and Dauphin River during spring and fall spawning periods are suitable for upstream fish passage and walleye and lake whitefish spawning and egg incubation.
- Design the channel inlets and outlets to limit sediment scour and entrainment of fish and fish eggs in the outflow.

6.5.3.2 Change in Fish Passage

Mitigation measures to eliminate or reduce potential changes in fish passage during construction and operation of the LMOC and LSMOC are:

- Design LSMOC to allow fish to exit during the entire open-water season
- Develop and implement ramping rates for implementation during start-up and shut-down of the channels to provide fish with cues that flow velocities in the channels are changing
- Design lower-most drop structure in the LSMOC to prevent upstream fish passage so that fish continue to use the Dauphin River

6.5.3.3 Change in Fish Health and Mortality

Mitigation measures to eliminate or reduce potential changes in fish health and mortality during construction and operation of the LMOC and LSMOC are listed in the Project Environmental Requirements document and include:

- Prohibit re-fueling of machinery and storage of hydrocarbon products within 100 m from the high-water mark of waterbodies and watercourses
- Store hydrocarbon products in secondary containment and approved storage tanks
- Maintain accessible spill control and clean-up equipment and educate workforce about Spill Response and Remediation Plan
- Ensure equipment and vehicles are clean and free of leaks upon arrival to site and kept in good working order

- Locate borrow-pits and quarries at least 100 m away from watercourses and waterbodies
- Adhere to set-back and charge sizes that comply with Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters
- Prohibit use of ammonium nitrate-fuel oil (ANFO) mixtures as explosives
- Implement the sediment control measures per the Sediment Management Plan
- Isolate in-water work areas and conduct fish and mussel salvages prior to construction
- Provide year-round baseflow in the LSMOC when not in use
- Design and construct channels with minimum residual pool depths to overwinter fish
  - Design LMOC to provide fish with egress year-round.
  - Design LSMOC to provide fish with downstream egress under most conditions and depths and flows suitable to sustain fish year-round
- Design downstream-most drop structure in the LSMOC to prevent fish access from Lake Winnipeg.
- Maintain flows in the channels throughout the fish egg incubation periods of spring and fall spawning species.

6.5.4 Residual Effects and their Significance

Section 7.2.1.6 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

6.5.4.1 Permanent Alteration or Destruction of Fish Habitat

None of the potential effects to fish habitat can be eliminated by the mitigation measures that will be employed during construction and operation of the channels. However, none of the potentially altered habitat is unique or will limit fish production in Lake Manitoba, Lake St. Martin, or Lake Winnipeg or their tributaries. Effects on habitat from sediment mobilization and deposition, groundwater depressurization, and realignment of drains are expected to be small in magnitude and have little effect on fish populations in the LAA. The channels have been designed to remain permanently wetted and have permanent fish habitat. This habitat is expected to provide spawning, rearing, foraging, and overwintering habitat for large numbers of forage fish, fish that will be a food source for fish with commercial, recreational or Aboriginal (CRA) value, such as walleye and northern pike. It is expected that the Project will result in a net gain in fish habitat as a result of the 172 ha of permanently wetted habitat created in the channels. Overall, effects to CRA fish productivity in the LAA and RAA due to potential changes in fish habitat are not expected to be measurable.

6.5.4.2 Change in Fish Passage

Changes in fish passage due to replacement or installation of new stream crossings are not expected to occur because there are specific guidelines for the design, sizing, and installation of stream crossings and these are well understood and will be followed during the Project.

Mitigation measures cannot eliminate the passive or active movement of fish out of the lakes through the channels. Although it is expected there will be a small net increase in downstream movement of fish between the lakes in the long-term due to operation of the channels, the magnitude of this movement is expected to be small in comparison to the size of fish populations in the lakes and such movements are not expected to affect fish population sizes or productivity in the RAA. Small, localized changes in the abundance of schooling fish species (e.g., minnows) or life stages (e.g., larvae) may occur intermittently when the channels are operating. However, any effect is expected to be short-term and low in magnitude as any fish lost to the system are expected to be replaced by recruitment the following year such that there is no measurable effect on fish population size or productivity.

Use of the channels may also affect cues that attract fish to the Fairford and Dauphin rivers, particularly by spawning fish. This is because a portion of the flow in these rivers will be carried by the channels. This is not expected to result in any change in the hydraulics or attraction flows in the Fairford or Dauphin rivers because the channels will only convey the water that would otherwise be flooding upland areas around the lakes and rivers; flows in the river themselves will remain the same as they would during flood conditions without the channels. Flow in the channels during flood events is likely to attract fish that would otherwise be attracted to the Fairford and Dauphin rivers. However, this is not expected to cause a decrease in spawning success or productivity of the fish populations in the RAA because: fish will not be able to ascend upstream beyond the lowest drop structure in the LSMOC; habitat below the WCS in the LMOC and below the lowest drop structure in the LSMOC is likely to provide some spawning habitat for some fish species; and the channels are expected to be used only every three to four years.

6.5.4.3 Change in Fish Health and Mortality

Of the potential effects on fish heath and mortality, only the potential effects of sediment, stranding of fish, and increased fishing pressure are likely to cause residual effects. Potential effects on fish health and mortality from accidental releases of deleterious substances and blasting in the borrow-pit and quarries are not assessed further because the likelihood of such releases and effects from blasting occurring is low and because the proposed mitigation measures are considered to be highly effective at reducing the risks.

Effect of sediment releases on fish health and mortality are expected to be low in magnitude and restricted to the LAA and have no measurable effect on fish populations in the LAA or RAA. This is because the mitigation measures are well understood, technically feasible, and effective for the streams and lakes near the Project. Sediment loads introduced during construction will be only a small proportion of the annual inputs to Lake St. Martin and Lake Winnipeg and will be highly localized and quickly

dispersed by waves and currents in the lakes. Fish species living in Lake Manitoba, Lake St. Martin, and Lake Winnipeg are adapted to living in the naturally turbid conditions.

Fish will not be susceptible to stranding in the LMOC. This is because water levels in the channel upstream and downstream of the WCS will always be at the same level as Lake Manitoba and Lake St. Martin, respectively, and because there will be no physical barriers in the channel, fish will always have unrestricted egress to the lakes. Stranding of fish and eggs in the main body of the LSMOC will be prevented by providing baseflow year-round, providing deep pools for fish upstream of the drop structures, and by designing the drop-structures to allow fish to leave the channel egress at any time of the year. Therefore, although stranding of individual fish or fish eggs along the margins of the channels may be unavoidable, effects of stranding to the populations of focal fish species in the LAA and RAA are expected to be low in magnitude and will only occur sporadically over the duration of channel operations. No measurable effect on the productivity of any fish populations in the LAA or RAA is expected.

Increased fish harvesting due to the presence of the workforce and improved access to fish-bearing lakes and streams is unavoidable. However, such increased harvesting is not expected to have a substantial effect on the abundance of CRA fish species in the LAA or RAA because the construction workforce will only be present for a maximum of 2.5 years, only a small proportion of this workforce is expected to be active anglers, and all anglers will need to abide by provincial fishing regulations. Importantly, none of the new roads or rights-of-way provide any new access to Lake Manitoba, Lake St. Martin, or Lake Winnipeg where most of the recreational, commercial, and Aboriginal fishing occurs.

Based on the assessment of the proposed effects of the Project on fish and fish habitat, considering the avoidance and mitigation measures available, the residual effects of the Project on fish and fish habitat are predicted to be not significant.

6.6 VEGETATION

6.6.1 Description of the Baseline Conditions

The Project is located in the Sturgeon Ecodistrict of the Mid-Boreal Lowland Ecoregion and Ashern and Gypsumville Ecodistricts of the Interlake Plain Ecoregion. A portion of the RAA is also located in the Waterhen Ecodistrict; however, it occupies a very minor portion (2.6%) of the RAA.

6.6.1.1 Landscape Diversity

Native vegetation patches in the RAA are mainly smaller than 10 ha. However, patch size is highly variable for forested, grassland and wetland areas and mean patch size is generally greater than 10 ha due to the area of a small number of large patches. Patch perimeter also varies greatly. Shrublands have the greatest average length of edge (3.9 km). Many large native forest patches have complex shapes with a high degree of edge in relation to area. Mapped wetland area is extensive around Lake St. Martin and the LSMOC and there is a greater amount of patch area to edge perimeter as a result.

6.6.1.2 Community and Species Diversity

The LAA is a diverse matrix of plant communities dominated by Lake St. Martin (water), wetlands (both shrub and herb wetlands identified from satellite imagery data and marsh wetlands identified from Project mapping), deciduous forests, hayland, and grassland. Native upland vegetation makes up 8,908.6 ha (14%) of the LAA with forested land equaling 6,303.1 ha (9.9%) of the LAA. The most common forest type in the LAA is dense deciduous forest (3,877.9 ha). Grasslands make up 2,531.1 ha (4.0%) of the LAA; however, only 7.7 ha of grassland is located within the PDA. Shrublands make up 74.4 ha (0.1%) of the LAA and wetlands make up 15,153.3 ha (23.7%). Aquatic vegetation also occurs in the LAA in Lake Manitoba, Lake Winnipeg and Lake St. Martin. A total of 8,337.5 ha of aquatic vegetation were identified based on baseline mapping.

A total of 202 vascular plant species were observed during the 2016 field surveys, including 5 ericaceous shrubs, 25 graminoids, 129 herbaceous species, 27 shrubs, and 15 trees. Based on desktop review, vascular plant species at risk that have potential to occur in the LAA include: rough agalinis, small white lady's slipper, black ash, Gastony's cliffbrake, western prairie fringed orchid, Riddell's goldenrod, Great Plains ladies'-tresses, western silvery aster, and culver's-root. Three occurrences of dragon's mouth orchid and one occurrence of yellow willow were found along the LSMOC. Four additional occurrences of yellow willow were observed along the LMOC. Common sweet-grass, saline shooting star, annual sunflower, and early yellow locoweed were all observed once along the LMOC. None of these species are listed by the federal *Species at Risk Act* (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or *Manitoba Endangered Species and Ecosystems Act* (MBESA). Additional undetected plant species of conservation concern (SOCC) could be present within the PDA as many species' numbers fluctuate from year to year in response to environmental conditions.

Ten non-native invasive species were observed during field surveys with dandelion and absinthe the most common. Most of the weed species were observed along the LSMOC near the shore of Lake Winnipeg.

6.6.1.3 Wetlands Function

Wetlands are common in the Project RAA, occupying 38.8% (131,479.7 ha). Fens and swamps are the most common class. Fens occupy 2.1% (2,807.9 ha) to 92.4% (121,536.7 ha) of the RAA and occur as large complexes associated with Buffalo Lake and smaller areas closer to Lake Winnipeg, and potentially extensive areas east of Lake St. Martin. Swamps occupy 0.4% (1,396.0 ha) to 26.6% (90,356.1 ha) of the RAA and are most common north of Lake St. Martin, including in the LSMOC intersected sub-watersheds. Marshes occupy 0.5% (1,659.8 ha) to 11.1% (37,769.0 ha) of the vegetation RAA and are most common in the Project intersected LSMOC sub-watersheds, although herb dominated wetlands identified by LCC data in this portion of the RAA are more likely fens based on LAA mapping and climatic conditions. Bogs are uncommon in the LAA 28.4 ha (<0.1%) and suspected to be uncommon in the RAA. Bogs were only mapped north of Lake St. Martin in the LAA.

The Project-intersected LMOC/PR 239 sub-watersheds have largely been converted to agricultural use. Marsh wetlands may have originally been shrubby or forested swamps, and marshes and remaining

swamps may contain non-native plant species. In addition, hydrology and biogeochemistry functions of wetlands in the Project intersected LMOC/PR 239 sub-watersheds may have been altered due to increased surface run-off and nutrient inputs from surrounding cultivation. Increased run-off may also affect wetlands near industrial developments, and road salts and oils from vehicles may discharge to some wetlands. Functions of the wetlands in the Project LSMOC intersected sub-watersheds are likely largely unaltered due to low abundance of human disturbance.

6.6.2 Effects on the Environment

6.6.2.1 Change to the Environment

Landscape Diversity

Project construction will alter mean vegetation patch size and mean patch perimeter length. Mean patch size increases for forested, grassland and wetland patches and decreases for shrub patches following site clearing for the Project. Mean patch perimeter length decreases for forested patches and shrubland patches, remains unchanged for grasslands and increases for wetlands. The changes, however, are small, <1% of the existing condition mean, and the maximum patch size is only decreased for wetlands (87,809.36 ha at existing conditions to 87,109.30 ha following site clearing, or 0.8%). No large forested patches (>200 ha with an internal 100 m buffer) are intersected by the PDA and no size class, including larger classes of shrubland, grassland or wetlands, are lost from the RAA as a result of the Project.

Landscape diversity of native vegetation will likely be altered by Project clearing. Vegetation will be removed for channel construction and realignment of PR 239. The LMOC and LSMOC ROWs will be reclaimed following construction; however, vegetation will consist of different species and may be maintained in a different state than prior to construction, with graminoid or shrub landcover instead of forested. The distribution line connection, including required connection structures and maintenance, will be located in the PDA and no additional vegetation clearing or fragmentation will occur.

The locations of quarries and borrow material sites for aggregate and limestone material have not been determined. All but the quarry location near the start of the LSMOC access road upgrade are predominately located in areas of agricultural land cover, although patches of remnant native vegetation may be cleared for expansion of existing quarries or development of new quarries.

Effects to landscape diversity are not expected during operations and maintenance as additional vegetation clearing is not planned.

Community Diversity

Vegetation clearing will remove 306.3 ha (-3.4%) of native upland vegetation within the LAA. All native upland vegetation cover classes within the LAA will be maintained; however, clearing the ROW will change forested and shrubland areas into grassland communities and these restored communities may not have the same species composition or structure as prior to construction. Vegetation clearing includes 165.7 ha of native upland vegetation in the LMOC portion of the LAA, which is predominantly dense and

open deciduous forest. Along PR 239, 12.7 ha of native upland vegetation will be removed in the LAA, including predominantly dense and open deciduous forest. Clearing along the LSMOC will entail 127.9 ha of native upland vegetation, primarily dense coniferous and mixedwood forest, being removed. No known areas of tall grass prairie communities of conservation concern will be disturbed by the Project and effects on alvars are not anticipated. Effects on communities of conservation concern will be limited to vegetation communities on seven locations of sandy soil within the PDA. Vegetation clearing will change the abundance of forest age classes in the LAA, however, no age class of any upland or wetland forest type will be lost and changes in the relative abundance of age classes are small.

Community diversity of native vegetation, including both uplands and wetlands, will likely be altered by clearing during Project construction. Vegetation will be removed for channel construction and realignment of PR 239. The loss of vegetation will have a direct effect on the area of native vegetation communities. The change in water levels associated with the diversion of water through the channel will likely have an indirect effect on community diversity.

During operation, taller shrub and tree cover will likely be cleared from parts the ROW to maintain access roads. In addition, some native upland vegetation communities may benefit from reduced flooding including forest or grassland. Indirect effects from dust and non-native invasive species is likely to spread into the LAA.

The LMOC and LSMOC ROWs will be reclaimed following construction; however, native vegetation communities may be maintained in a different state than prior to construction with graminoid or shrub land cover instead of forested. Further changes to community diversity during Project operations and maintenance include indirect edge effects from non-native invasive species introduction and spread. Areas disturbed during construction will be reclaimed using native plant species and the PDA inspected for areas of water impoundment and drying of wetlands adjacent to the ROW. Outside drainages will be constructed to help maintain surrounding drainage, one on the west side of the LMOC and one on the east side of the LSMOC. Drainage design will be altered, or other mitigation options implemented if drainage problems are identified during Project operations.

Species Diversity

The Project will result in the direct loss of four plant SOCC within the PDA: sweet grass, saline shooting star, annual sunflower and dragon's mouth orchid. The Project will also decrease the abundance of native vegetation communities and increase the fragmentation of large native vegetation patches, which may reduce the area of suitable habitat for SOCC. However, some plant SOCC (e.g., upland dependent species) that have historically been negatively affected by flooding may be positively affected by the Project because of a reduction in inundated areas when the Project is operating for flood control. Occurrences of annual sunflower, early yellow locoweed and yellow willow were also found in the LAA or RAA, and undocumented occurrences may occur in the PDA.

The abundance and spatial distribution of plant species of interest to Indigenous groups will likely be reduced due to Project clearing. The Project will alter the area of vegetation communities that support plant species of interest to Indigenous groups. The loss of area in native upland vegetation and wetland

communities that support these species in the LAA is predominantly located within the LSMOC in deciduous swamps (-50.6%), shrubland (-40.6%), shrub dominated bogs (-18.6%), forested bogs (-17.5%), shrub dominated fens (-17.5%), and mixedwood swamps (-17.5%). These changes in land cover may alter the abundance of upland dependent plant species of interest to Indigenous groups and wetland dependent plant species, particularly berries as many of those species are shrubs (e.g., cranberry and blueberry species). The loss of marsh wetland habitat could result in the loss of seneca observed along Goodison Lake and the loss of sweet grass observed near Reed Lake as they are both wetland species.

The Project will also have a positive effect on plant species of interest for Indigenous groups, including berries, due to the prevention of flooding in traditional use plant gathering areas. Portions of land cover classes that support plant species of interest to Indigenous groups will be altered in the LAA but no classes will be lost due to the Project.

Construction will cause soil disturbances (i.e., vegetation clearing, compaction) that will create opportunities for the invasive of adjacent native upland vegetation and wetlands. The seeds of these non-native invasive species would likely remain in the seedbank in stockpiled material and are anticipated to persist following construction. Operations, particularly vehicle traffic on roads and some vegetation management techniques (e.g., mowing), may also spread non-native invasive species. With the application of the mitigation measures, it is anticipated that the introduction, spread, and abundance of non-native invasive species would be managed. As the PDA and LAA of the LMOC is largely disturbed, the likelihood of introducing and spreading non-native invasive species is higher. In addition, the creation of a linear disturbance into relatively undisturbed native upland vegetation and wetlands will facilitate non-native invasive species movement.

In summary, the Project could result in direct loss of plant SOCC and plant species of interest for Indigenous groups from vegetation clearing during construction. Vehicle and heavy equipment use during construction and operation could result in the direct loss of plant SOCC and plant species of interest for Indigenous groups through removal or crushing, soil compaction, and rutting. Indirect effects during construction from dust, or introduction or spread of non-native invasive species may also effect SOCC and plant species of interest to Indigenous groups.

Additional vegetation clearing is not planned during operation and maintenance; however, SOCC and plant species of interest to Indigenous groups could be affected by dust from vehicle traffic and weed control and vegetation management (e.g., herbicide application and mowing). The Project could also spread plant diseases and pests including jack pine budworm and Eastern larch beetle, which are known to occur in the LAA.

Wetland Functions

Project clearing and channel construction is estimated to result in the loss of 290.6 ha of wetland area in the LMOC/PR 239 intersected sub-watersheds and 617.7 ha in the LSMOC intersected sub-watersheds. Direct loss of wetland area in the Project intersected LMOC/PR 239 sub-watersheds is restricted to shallow open water wetlands. Bogs, fens and swamps, marsh and shallow open water wetland classes, will be directly affected by the Project in the LSMOC intersected sub-watersheds, with fens the most

affected. No wetland class will be lost as a result of the Project and direct losses of individual wetland classes are expected to range from 5.7% (shallow open water) to 17.4% (marsh) in the RAA.

Reduced catchment area may permanently reduce wetland water depth, duration of flooding and flood frequency, particularly near Birch Creek. Reduced marsh and shallow open water wetland abundance and altered wetland water levels in the Project intersected LMOC/PR 239 sub-watersheds will reduce the abundance of wetland-dependent plant species and alter the distribution of these plants in the RAA. The outside drain on the west side of the LMOC should help reduce alterations to wetland levels from changes in sub-watershed water flow paths and limit ponding in existing upland areas adjacent to the channel.

The Project has the potential to alter wetland function from changes in wetland abundance, vegetation cover and structure, and altered water inputs and drainage patterns. These changes have the potential to alter nutrient cycles, decomposition and carbon accumulation rates, water filtration and storage, habitat, and related socio-economic functions such as hunting and trapping. Effects are expected to occur during construction and extend through operations.

6.6.2.2 Mitigation Measures

In addition to measures summarized in Section 2.5, key mitigation measures implemented during construction and operation to reduce potential Project effects on vegetation, include:

- Prior to clearing or grubbing, the work area will be clearly staked or marked.
- Machinery will arrive on-site in a clean condition and will be kept in good working order and free of fuel, oil or fluid leaks. Machinery that is found to be leaking any fuel, oil or other fluids will be moved off the work site immediately for repaired.
- The Access Management Plan will detail how construction-related traffic will be restricted to the Project ROW and associated access routes during Project construction and maintenance. Where access routes are accessible by the public, access will be blocked when not in use for construction.
- Wetland water levels along the LMOC and LSMOC will be monitored following construction in areas where shallow ground water is intersected and either re-directing drainage into effected wetlands or modify outside drainage ditch design to reduce changes in wetland hydrology.
- A 300 m setback will be applied to all known occurrences of federally-listed species at risk and their critical habitat following Environment Canada requirements.
- A 30 m setback will be applied to all known occurrences of provincially listed SOCC.
- Designated Area(s) will be established for fuel storage, materials handling and storage, equipment cleaning, refueling and servicing. Any Designated Area will be located at least 100 m away from any waterbody or wetland and will be kept clear of snow and/or miscellaneous materials to allow for clear access and routine inspection and leak detection.

- Where seeding is not required, temporary site locations will be left in a manner which promotes natural re-vegetation of the site. In cases where seeding is required, and when conditions permit, it will commence immediately upon completion of grading, capping and trimming operations.

Unmitigated wetland loss will be compensated following provincial wetland offsetting requirements of *The Water Rights Act*.

6.6.2.3 Project Residual Effects and Significance

Section 8.2.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. Based on the assessment of the proposed effects of the Project on vegetation and the proposed mitigation measures, the residual effects are considered not significant for landscape diversity, community diversity, species diversity and wetland functions. Following the implementation of mitigation measures described above, residual effects are expected to be low to moderate in magnitude and infrequent, but long-term, and irreversible. The geographic extent of effects on landscape diversity of the LSMOC will extend to the RAA. Effects on community diversity, species diversity and wetland function from construction of the LMOC and PR 239 re-route will be local in extent. Effects from Project operations will also be adverse and continuous, but low in magnitude. The Project occurs in both a disturbed and undisturbed ecological context for vegetation. Although the existing landscape south of Lake St. Martin is highly fragmented, the Project will not result in the loss of any remaining large forest or wetland patches and affects are mainly to smaller patches already altered by surrounding human land use. No native vegetation land cover class is lost from the LAA and reductions in area of upland land cover classes is small, maximum 10.2% of existing conditions. Loss of SOCC and species of interest to Indigenous groups should not occur with further pre-construction surveys and Indigenous engagement. Wetland compensation should off-set affects to wetlands. As indicated, based on the assessment of the proposed effects of the Project on vegetation and the proposed mitigation measures, the residual effects are considered not significant.

6.7 WILDLIFE

6.7.1 Description of the Baseline Conditions

6.7.1.1 Overview

The Project is in the Boreal Plains Ecozone in a transitional area between more open habitats in the south and more low-lying forested habitats in the north. The southern part of the wildlife RAA (Figure 6-2), including the LMOC, is characterized by trembling aspen stands interspersed with agriculture, grasslands, and wetlands while the northern part is notably low-lying and characterized by mixedwood and coniferous forests on sandy moraine ridges, graminoid dominant rich fens, and peat bogs.

The quantity and quality of natural habitats in the RAA have been reduced to varying degrees by the regulation of Lake Manitoba water levels, land conversion for agriculture (e.g., cropland, hayland, and

pastureland), draining of wetlands, and development of roads, transmission lines, quarries, communities, campgrounds, and cottages, predominantly in the south surrounding the LMOC. Areas surrounding the LSMOC in the north part of the RAA have experienced minimal land conversion and development due to presence of large bog and fen complexes. The LAA is composed of 27.3% wetland habitats (i.e., bog, fen, marsh, swamp), 14.0% natural upland habitats (i.e., grassland, shrubland, forest), 55.4% water (e.g., Lake St. Martin), and 6.0% modified wildlife habitats (i.e., developed, barren, and agricultural lands).

6.7.1.2 Migratory Birds

Migratory birds are a valued group of wildlife species, as identified by Indigenous and public engagement. The LAA has the potential to support 224 bird species, including 195 with the potential to breed within the LAA and 29 that breed in more northern habitats. Of these, 192 are migratory birds as defined by the *Migratory Birds Convention Act, 1994* while the remaining 32 species are protected under *The Wildlife Act*. Of the 195 species with potential to breed in the RAA, there are 59 waterbirds (e.g., waterfowl, shorebirds), 18 raptors (e.g., hawks, owls), 4 upland game birds (e.g., grouse), and 114 other birds (e.g., songbirds, woodpeckers, nightjars).

6.7.1.3 Species at Risk and Species of Conservation Concern

Species at Risk (SAR) is a valued group of species as identified by Indigenous and public engagement and the EIS Guidelines. Twenty-three SAR have the potential to occur in the LAA: four mammal species, 15 bird species, one amphibian species, one reptile species, and two invertebrate species. Three species of Species of Conservation Concern (SOCC) also have the potential to occur in the RAA (two bird species and one invertebrate). The PDA overlaps potential red-headed woodpecker habitat along LMOC and the PR 239 highway realignment and critical eastern whip-poor-will habitat along LSMOC.

6.7.1.4 Change to the Environment

Project-related environmental effects were identified by considering potential interactions between Project components and wildlife and include a change in habitat, a change in mortality risk, and a change in movement.

Change in Habitat

Construction

Project construction will result in the loss or alteration of 2,100.7 ha of terrestrial and aquatic habitat within the LAA, a -3.3% change from baseline conditions. Clearing and excavation of the PDA will result in a direct loss of 1,205.8 ha of wetland habitat (-2.5%), 298.7 ha of forested habitat (-4.7%), and 410.0 ha of grassland (-7.1%; 7.7 ha [-0.3%] native cover). An indirect loss or alteration of wildlife habitat is expected through sensory disturbance, edge effects, and altered wetland function that can result in habitat avoidance and reduced habitat effectiveness for wildlife, including migratory birds, SAR, moose, elk, and furbearers in areas adjacent to the PDA.

During construction, the primary pathways for a direct change in wildlife habitat (i.e., loss or alteration) are associated with PDA preparation and include vegetation clearing, ground disturbance, water development, and water control activities. Sensory disturbances (i.e., noise), edge effects resulting from habitat fragmentation, and altered wetland function are the primary pathways for an indirect change in habitat attributes. Indirect changes may result in habitat avoidance by wildlife or reduced ecological function of habitat.

Given the availability of suitable habitat and known occurrences of SAR within the LAA, the SAR most likely to be affected by the direct loss or alteration of habitat are: northern leopard frog, least bittern, and yellow rail in wetlands; short-eared owl and bobolink in grasslands; and bats, eastern whip-poor-will, common nighthawk, red-headed woodpecker, and olive-sided flycatcher in forests. The PDA overlaps one 10 x 10 km critical habitat square for eastern whip-poor-will at the LSMOC inlet (145.4 ha of the square) and two proposed critical habitat squares for red-headed woodpecker along PR 239 realignment and a portion of LMOC.

Migratory birds have the potential to breed in all habitat types within the LAA (e.g., songbirds and raptors in grasslands and forest, waterfowl in wetlands) and will be affected by the habitat loss or alteration resulting from Project construction. Known raptors nests (e.g., bald eagle) within the LAA are located along the shores of Lake St. Martin and likely to be unaffected by the Project given their distance (over 1 km) from the PDA. Similarly, due to the distance between the PDA and location of nesting colonies (i.e., several kilometres) on Lake Manitoba and Lake St. Martin, construction noise and activity is not expected to affect colonial waterbirds. Construction noise and activity may reduce the number of migratory birds such as ducks and geese, breeding or staging in the aquatic habitats located near the inlet and outlet structures and along parts of the LMOC, particularly Reed Lake, Clear Lake, and Goodison Lake.

Operation and Maintenance

Operation of the outlet channels will result in marked decreases in maximum realized water levels during major flooding events (38.7 cm in Lake Manitoba and 74.1 cm in Lake St. Martin) while resulting in a 3.1 cm increase in Lake Winnipeg water levels. Similarly, the operation of the outlet channels is expected to reduce the amount of peak flows entering Lake Pineimuta, which would result in lower lake levels and decrease the area of inundation during peak flow periods.

The WCSs are expected to remain closed 70% to 87% of the time depending on the month but the overall effect will result in reduced water levels in the LAA. Operation of the outlet channels may benefit some of the species who rely on the shallow marsh areas along the shores of Lake St. Martin (e.g., muskrat, waterfowl).

Fluctuating water levels during outlet channel operations is the primary pathway for a direct change in habitat. As the outlet channels transition between conveyance and non-conveyance, the water balance of

the outlet channels and interconnecting lakes are expected to be affected, which can directly affect the habitat available for certain wildlife species, particularly those that inhabit lake margins (e.g., muskrat) and/or islands (e.g., colonial waterbirds).

There are no pathways for adverse effects resulting from the operation of the Project on SAR as it relates to a change in habitat because overall water levels and maximum flood levels are expected to be reduced. Although the channels will retain water throughout operation, the design limits the channels' potential to support SAR. For example, the rocky channel substrates and presence of fish are not favorable for northern leopard frog.

Reclamation of the upland berms along LMOC may provide habitat for species at risk such as bobolink, red-headed woodpecker, and short-eared owl. Project infrastructure (e.g., bridges, outlet structures) may provide suitable nesting structures for barn swallow.

Potential adverse effects on migratory birds during operation are associated with vegetation management along the outlet channel ROWs as this activity has the potential to affect nesting habitat for migratory birds. Vegetation management will occur outside of the sensitive breeding period for migratory birds and will adhere to measures described in the vegetation management plans.

The LAA includes the Lake St. Martin IBA, which contains several nesting islands for colonial nesting waterbirds that have the potential to be affected by altered water regimes. Overall water levels and maximum flood levels are expected to be reduced on Lake St. Martin, which will reduce flooding of islands, shorelines, and overwater nests. Reduced water levels may improve the conditions of the shallow marsh habitats located along the shore of Lake St. Martin which would benefit breeding and staging waterfowl. Presence of Project infrastructure (e.g., bridges, outlet structures) may provide suitable structures for some species (e.g., cliff swallow).

Change in Mortality Risk

Construction

During construction, there is potential for increased mortality risk to small mammals, reptiles, and amphibians due to their limited mobility (i.e., encounters with construction equipment). Overwintering amphibians and mammals are also at greater risk as they may encounter heavy machinery during ground disturbance activities. Vehicle-related wildlife mortality has the potential to affect a wider range of species, including migratory birds, SAR and SOCC, and large mammals. Proper management of wastes, including at temporary camps, will reduce the potential for wildlife to be attracted to the construction site (e.g., black bear), thus reducing the potential for mortality risk related to human-wildlife conflict.

Vegetation clearing and ground disturbance during site preparation, and collisions associated with Project-related traffic, are the primary pathways for a direct change in mortality risk during the construction phase. Ground-nesting birds, species with decreased mobility (i.e., amphibians, small mammals), and denning or roosting species (e.g., bats) are most susceptible to direct mortality during site preparation as individuals may be unable to escape construction activities.

SAR are not uniquely susceptible to a change in mortality risk during the construction in comparison to other species. Species most likely to be affected include bobolink, northern leopard frog, and invertebrates.

Migratory birds are most susceptible to a change in mortality risk during vegetation clearing and Project-related traffic. Species most likely to be affected are ground-nesting species (e.g., clay-colored sparrow) and species that inhabit upland and wetland habitats adjacent to roadways (e.g., mallard).

Operation and Maintenance

The outlet channels are expected to contain water throughout the year, with potential marked flow increases typically limited to spring flooding events. While this has the potential to result in increased mortality risk for ground-nesting birds or species with decreased mobility (e.g., mice, voles), it is unlikely that this would be a regular occurrence or that water levels would rise suddenly enough to drown or fatally sweep away wildlife using the channels. Species that attempt to cross during periods of high flow are also at greater mortality risk.

Increased mortality risk to furbearers and ungulates is anticipated to persist as a result of hunting/trapping. Although the Lake St. Martin access road will be gated, the linear features provide an efficient mechanism to move across the landscape that also provides relatively clear, elevated sightlines that are desirable to resource users. Waterbirds, particularly juveniles, and reptiles, amphibians and small mammals that use or traverse the wetted channel have the potential to be preyed upon by fish (e.g., northern pike) inhabiting the channels. Overall, the Project will result in reduced water levels and maximum flood levels that is expected to return water levels to more beneficial conditions for terrestrial wildlife (e.g., moose) prior to flooding in 2011.

Fluctuating water levels during outlet channel operation and maintenance is the primary pathway for a direct change in wildlife mortality risk. As the outlet channels transition between conveyance and non-conveyance, the water balance of the outlet channels has the potential to result in increased mortality risk for wildlife inhabiting the channels. The channels may indirectly increase mortality risk to wildlife by enhancing predator and hunter/trapper access in remote areas and providing aquatic habitat for predatory fish (e.g., northern pike).

SAR are not uniquely susceptible to a change in mortality risk during operations in comparison to other species. Northern leopard frog is a SAR most likely to be affected through increased predation risk in the outlet channels and mortality during dispersal periods. Permanent Project infrastructure such as outlet structures and bridges have the potential to provide nesting habitat for bird SAR (e.g., barn swallow).

Migratory bird species are uniquely susceptible to a change in mortality risk during the operation phase of the Project from electrocution or collision with the 15-km long distribution line. Additionally, some species may be at greater mortality risk due to altered hunting (i.e., game birds) and/or predation dynamics (e.g., juvenile waterbird species [described above]). Permanent project infrastructure such as outlet structures and bridges have the potential to provide nesting habitat for migratory bird species (e.g., barn swallow, American robin) while pole structures along the distribution line may provide nesting platforms for raptors. The Project is not anticipated to adversely affect colonial nesting waterbirds as water levels are expected to be reduced.

Change in Movement

Construction

Site preparation activities and construction of the outlet channel ROWs are the primary pathways to affect a change in movement by creating physical and sensory barriers. During construction, noise and activity associated with heavy equipment and personnel is anticipated to deter wildlife from using or crossing the active construction portions of the PDA for the short-term. Moose, elk, and furbearers will likely avoid movements through the active construction areas. The LSMOC will bisect a potentially sensitive terrestrial corridor between large patches of contiguous habitat and may present a semi-permeable barrier for marten dispersal. The LMOC is not expected to affect elk movement as existing data and local knowledge of elk movement in the area suggests the South Interlake elk herd primarily uses areas west of the proposed channel.

SAR are not uniquely susceptible to a change in movement during the construction phase in comparison to other species. There is no pathway for bird, bat, and reptile SAR movement to be affected. Northern leopard frog is the species most likely to be affected but they are known to disperse across expanses of open habitat and the outlet channel, where rip rap is absent, is not anticipated to create a barrier for movement or dispersal. There is no pathway for a change in movement for wolverine or American badger as they are not expected to regularly occupy the LAA.

There is no pathway for a change in movement for migratory birds and no related adverse effects are anticipated.

Operation and Maintenance

The conveyance of water, and increased volumes of floodwater at times, in the outlet channels during the Operation and Maintenance phase of the Project will alter the dynamics of the linear features as a potential barrier for wildlife movement. The operation of the outlet channels is not anticipated to create a barrier to wildlife movement that is dissimilar to those presented by the Fairford or Dauphin Rivers in the RAA. During periods when the WCS gates are closed, the LMOC and LSMOC will not markedly increase the potential for the Project to disrupt wildlife movement beyond that experienced during the construction phase. However, for most species the operational characteristics during flooding events, when the WCS gates are open, may serve to temporarily reduce the “permeability” (i.e., increase the barrier effect) of the ROWs to regular or seasonal movements by terrestrial species.

The creation of linear features on the landscape, particularly in forested habitats, is expected to result in habitat fragmentation and that may alter wildlife movement patterns, particularly for elk along the LMOC and American marten along the LSMOC. The PR 239 road realignment is not expected to result in a change in movement as the ROW crosses similar habitat types and there are no known environmentally sensitive sites, sensitive habitats, or movement corridors along the proposed realignment route. Floodwater conveyance, when the WCS gates are open, is the primary pathway for a change in movement, particularly when conveying floodwaters where potential changes are exacerbated by adding another element to the existing ROW barrier.

SAR are not uniquely susceptible to a change in movement during the operational phase in comparison to other species. There is no pathway for bird, bat, and reptile SAR movement to be affected. Potential effects to SAR described above for the construction phase are likely to persist during the operational phase and may be exacerbated during temporary periods of floodwater conveyance.

There is no pathway for a change in movement for migratory birds and no adverse effects are anticipated.

6.7.1.5 Mitigation Measures

Key mitigation measures that will be implemented during construction and operation to reduce potential Project effects on wildlife include:

- Clearing will not occur between April 1st and August 30th of any year unless otherwise authorized by the Engineer in order to avoid disturbance to nesting birds and other wildlife.

- Terrestrial buffers, as identified by the Manitoba Conservation Data Centre's Recommended Development Setback Distances from Birds and/or MSDs Forest Management Guidelines for Terrestrial Buffers will be adhered to for all applicable sites.
- If construction is scheduled to occur within the nesting period for owls and raptors (March 1 to August 31), a nest survey may be conducted by a qualified wildlife biologist if warranted. In the event an active nest is found, it will be subject to site-specific mitigation measures (i.e., clearly marked protective buffer around the nest and/or non-intrusive monitoring).
- Treed habitats will be retained where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats. If tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to determine the likelihood of occupancy before removal. This will also reduce the risk to other species that use trees for denning or shelter (e.g., marten).
- If critical habitat identified within the recovery strategy overlaps with the PDA (after final channel design), a red-headed woodpecker and/or eastern whip-poor-will mitigation and offset plan will be developed. These plans will be developed in consultation with provincial and federal regulators, stakeholders and indigenous communities.
- Snags containing nesting cavities or having potential to support nesting cavities will be removed and saved along portions of the ROW that will be cleared. Snags saved prior to land clearing will be erected post-construction along new ROW edges in areas supporting potential red-headed woodpecker habitat. Erect new nesting structures for red-headed woodpecker if suitable cavity trees can not be salvaged.
- To reduce the possibility of vehicle collisions with wildlife, vehicle speed will not exceed posted speed limits and wildlife warning signs will be installed where appropriate.
- Gates or other barriers will be installed to limit public from accessing outlet channel ROWs.
- Designs for minimizing the use of rip rap and minimizing the side slopes will be implemented to the extent feasible, to facilitate wildlife movement.
- Cover plantings (e.g., trees and/or shrubs) will be added along select upland areas of the channels to facilitate movement of wildlife.

6.7.1.6 Project Residual Effects and Significance

Section 8.3.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. A significant residual effect on wildlife is defined as one that, following the application of mitigation measures, threatens the long-term persistence or viability of a wildlife species in the RAA.

The Project is in an area that supports a diversity of SAR and SOCC, including potential critical habitat for red-headed woodpecker and eastern whip-poor-will. Change in SAR habitat is expected to be low in magnitude for eastern whip-poor-will and moderate in magnitude for red-headed woodpecker. However, with mitigation, and the commitment of the implementing the red headed woodpecker and eastern whip-poor-will mitigation and offset plans, Project effects on SAR and SOCC are expected to be not significant. Based on the assessment of the proposed effects of the Project on wildlife (including migratory birds) and the proposed mitigation measures, the residual effects are considered not significant as the Project is not expected to threaten the viability of a wildlife species.

6.8 LAND AND RESOURCE USE

6.8.1 Description of the Baseline Conditions

The PDA, LAA, and RAA are comprised of provincial Crown land, rural municipal lands (Grahamdale and West Interlake) and unorganized Crown Land in the Lake St. Martin Area. Indigenous communities located in the RAA are Lake Manitoba First Nation, Pinaymootang First Nation, Little Saskatchewan First Nation, Lake St. Martin First Nation, Dauphin River First Nation, Fisher Creek First Nation, Peguis First Nation, and Kinonjeoshtegon First Nation. Communities in the RAA consist of Moosehorn, Gypsumville, Ashern, and Eriksdale.

Most land in the LAA and RAA is a mix of private and municipal ownership with some areas of Crown land in rural municipalities, while land outside of the RMs are primarily Crown-owned or leased. Private properties dominate the PDA for the LMOC. There are no private properties within the PDA for LSMOC. The LSMOC will pass exclusively across Crown land. Rural farm dwellings occur throughout the RMs as part of agricultural development. Four rural dwellings are located within the PDA for the LMOC. There are no rural dwellings in the LSMOC PDA.

Agriculture is an important land use within the RAA. Most of the agricultural land use occurs within the RM of Grahamdale and the RM of West Interlake; however, some occurs in the Federal lands associated with the Indigenous communities of Lake St. Martin First Nation, Little Saskatchewan First Nation and Pinaymootang First Nation. A large portion of the land in the RAA is designated for agricultural use, including in the vicinity of LMOC. Within the RAA, land is rated for agricultural capability within the RMs of Grahamdale and the RM of West Interlake and along the western shoreline of Lake St. Martin, while the areas east of Lake St. Martin and between Lake St. Martin and Lake Winnipeg are not rated for agricultural capability. These unrated areas are predominantly comprised of organic soils. Most areas of the LAA rated for agricultural capability have severe limitations and are considered marginal for sustained arable agriculture, while a substantial portion of the LAA is considered only capable of producing perennial forage crops and improvement practices are not feasible. Not all lands rated for agricultural capability are developed for agriculture (i.e., some areas remain under natural vegetation). Within the RAA, the majority of agricultural operations are considered livestock operations with cropping consisting predominantly of hay production to support livestock. A minor proportion of the farms within the RAA have grain as their primary production commodity. Agricultural land within the LAA is a combination of privately-owned and Crown land being used by landowners under lease and permit.

Various recreational sites and activities occur within the LAA and RAA. No campgrounds, resort areas or cottages are intersected by the LMOC or LSMOC PDA. There are two cottage developments west of the LMOC in the LAA (Watchorn Bay) as well as cottage developments on Lake Manitoba in the RAA. Watchorn Provincial Recreation Park is located approximately 400 m from the LMOC PDA. The lakes and large rivers in the RAA are used for several water-related activities such as recreational boating, windsurfing, sailing, canoeing, kayaking, swimming and jet skis and provide access for snowmobiles and other vehicles in the winter months. There are many recreational and snowmobile trails and associated shelters located within the PDA, LAA, and RAA; none are in the vicinity of the LSMOC. There is one private land wildlife area in the PDA. There are six lodges/outfitters identified in the RAA and two resource outfitters in/immediately adjacent to the LAA.

Resource use activities occur throughout the RAA within established Game Hunting Areas (GHAs. The PDA, LAA and RAA are also located within one Game Bird hunting Zone. The LAA and RAA intersect a small portion of the Gypsumville RTL section in the Interlake RTL District. The RAA is also encompassed by an Open Trapping Area Zone. Commercial, subsistence and recreational fishing occurs in the LAA and RAA on Lake Manitoba, Lake St. Martin, Dauphin River, Mantagao River, Sturgeon Bay and some tributaries to these waterbodies. Other fish waterbodies in the RAA include Dog Lake, Swan Lake, and North Shoal Lake. A bait fishery is also prominent on Lake Winnipeg.

Mineral dispositions include quarry leases, private quarry permits, mining claims and casual quarry permits in the LAA and RAA. Quarries are located at Steep Rock and Faulkner in the RAA. All the aggregate quarries are under quarry lease, most for aggregate production. There are no metal, fossil fuel or other mining activities in the area. Aggregate resource deposits in the RAA consist of sand and gravel deposits comprising beach and offshore deposits and near surface dolomitic limestone bedrock. Numerous bedrock quarries and inactive and/or depleted Crown and private sand and gravel pits are located throughout the RAA.

The LAA and RAA is located within the Interlake Forest Section and encompass five FMUs. Productive forestland is located throughout the PDA, LAA, and RAA. There are two quota holders with operations in the RAA, three timber supply areas along with numerous past personal permit areas and several small forest regeneration areas. One provincial permanent sample plot is located within the RAA. Groundwater is an important source of fresh water for many uses. Licensed groundwater supply wells in the RAA are for municipal, industrial, and other purposes. No surface water use licences exist within the RAA. Flowing wells and high water level wells are common in the PDA, LAA and RAA. Generally, groundwater wells in the PDA and LAA are used primarily for domestic and livestock purposes.

6.8.2 Effects on the Environment

6.8.2.1 Change to the Environment

As part of construction, privately-owned property parcels will be acquired for the LMOC PDA with additional parcels to be acquired adjacent to the LMOC PDA. These adjacent parcels will become severed/isolated (i.e., road access is cut-off) due the Project alignment, so MI will also acquire them.

Crown land and Crown-leased land parcels are also similarly affected. These lands would become severed/isolated in terms of road access due to the Project. These Crown land leases will need to be closed because road access will have been removed.

Buildings located within the LMOC alignment will need to be removed. There are no planned rural residential developments or multi-lot subdivisions affected by or in close proximity to the Project. The Project will have low visual prominence, and because the landscape of the LAA has low topographical relief, the Project will likely only be visible to receptor sites in its immediate vicinity. The Project will affect a very small proportion of land within the RAA; however, it will alter land patterns along the PDA for the LMOC. The land use pattern for the LSMOC is undeveloped. Aggregate/quarry development associated with the Project is undetermined at this time although potential sites have been identified. Quarries developed by Contractors will be required to meet applicable provincial Acts and regulations regarding reclamation and rehabilitation activities.

The realignment of PR 239 is also located in proximity to residences in the LAA; seven of these are less than 100 m from the road allowance for the realignment. The PR 239 realignment will be permanent over the life of the Project as traffic volumes will shift over the long-term from north to south. The distribution line, which is also permanent, will cross provincial Crown Land in unorganized territory. Power is also expected to be provided to a LMOC WCS via a very short tap from nearby lines. Temporary construction areas for camps, staging areas, etc., will be reclaimed following construction.

Areas under current agricultural land use or with agricultural capability within the LMOC PDA will be lost from current agricultural land use or future potential agricultural land use. In addition to land within the PDA, lands outside the PDA will also be removed from agricultural production due to access being cut off by the presence of the LMOC, lack of existing road access, and the presence of wetlands and/or open water, or a combination of these factors. These lands are predominantly located on the east side of the LMOC PDA, but a few land parcels are located on the west side of the channel. The lands include privately held land planned for acquisition, as well as Crown land leases and Crown land being used under permit that will be returned to the Crown. Areas of current agricultural land use and lands with agricultural capability that are within the LMOC PDA and associated with privately held lands being acquired and Crown land transfers back to the Crown, are assumed to be permanent losses for agricultural land use.

The Project is anticipated to lower water levels in Lake St. Martin which will affect agricultural land use within the Lake St. Martin shoreline LAA. A reduction in flood levels is anticipated to have a positive effect associated with the return of agricultural capability and productivity for agricultural land uses. Lands affected are predominantly hay and pasture lands on Reserve land associated with the Indigenous communities of Lake St. Martin First Nation, Little Saskatchewan First Nation and Pinaymootang First Nation.

Temporary land loss and/or land degradation might affect current and potential agricultural land use in areas of temporary Project components, including Lake Manitoba rock quarries and borrow material areas, and temporary construction camps and staging areas. They may be located in areas of current

agricultural land use or in areas currently under other land uses but that have agricultural capability and may potentially be used for agriculture in the future.

Alterations to localized surface drainage and shallow groundwater flow as a result of the presence of LMOC and the associated Lake Manitoba drainage realignment are anticipated to affect soil wetness and drainage regimes, which in turn may affect agricultural capability and land use.

Conflict with agricultural activities will occur commencing with construction and will last through the operation and maintenance phase. Conflict during operations with agricultural activities will be primarily due to the presence of the LMOC. This will result in limitations to access for operations which have fields on both sides of the channel, loss and/or damage to facilities, increased management effort and production costs and concerns related to increased biosecurity risks.

Recreational land use occurs throughout the RAA. Existing protected areas or ecological reserves are not anticipated to be affected from construction and operation of the LMOC and LSMOC, as these were avoided through routing. Areas avoided include existing and proposed ecological reserves, legally protected WMAs, and First Nation Reserves. Outlet channel routing also considered proximity to campgrounds, picnic areas and recreational sites, lodges, resorts, cottages and recreation sites/trails. One provincial park, Watchorn Provincial Recreation Park is located near the LMOC ingress point at Watchorn Bay. The final outlet channel routes do not traverse a WMA, and none are located in proximity to the routes. No effects on WMAs are anticipated from the Project. The LMOC crosses through one conservation district (West Interlake) and does not directly affect any municipal conservation lands.

The final route for the LSMOC does not cross any designated parcels of Crown land in unorganized territory between Lake St. Martin and Lake Winnipeg. Other Crown land and Crown-leased lands are crossed by the LMOC. No existing or proposed protected areas/ASIs are traversed by the LMOC. One candidate protected area (ASI) located along Sturgeon Bay is crossed by the LSMOC, encompassing approximately 418 ha. Neither of the LMOC or LSMOC PDAs cross First Nation Reserves or within 1 km in LAA.

There are no designated lands or protected areas along the proposed realignment of PR 239 or along the proposed ROW for the new distribution line. Temporary Project components including quarries, borrow material areas, temporary construction camps and staging areas will potentially be located in areas of recreational land use.

The assessment of change in hunting, trapping and commercial fishing focused on reduction in or degradation of hunting, trapping and commercial fishing activities (e.g., area affected, commercial success) and potential damage to equipment (e.g., hunting shacks, traps) from restrictions to access, that could result from the Project. The assessment of change in mining and aggregates focused on change in mining/aggregate extraction that could result from the Project. The assessment of change in forest areas focused on commercial forests and effects on high value forest sites. The assessment of change in groundwater use focused on change in quantity and quality that may arise from interaction with the Project with respect to flowing and high-water level wells, and groundwater well and surface water areas.

Temporary construction areas and associated works and activities (e.g., temporary construction camps, staging areas, quarries) are required to facilitate the Project and have potential to affect resource use, depending on location. It is anticipated that these areas and associated works and activities will be located on disturbed land. Construction of a new distribution line as part of the LSMOC would have its own disturbance and nuisance effects associated with it. It is anticipated to cross provincial Crown Land in unorganized territory.

6.8.2.2 Mitigation Measures

Some of the following mitigation measures have been factored into the Project design and/or will be factored into future plans identified under the Project's Environmental Management Program. Key mitigation measures of potential Project effects on land and resource use during construction and operation and maintenance include the following:

- The acquisition of lands for the Project will be conducted through expropriation and governed by the Expropriation Act.
- Manitoba Infrastructure will contact stakeholders, recreational users/organizations, resource users/ harvesters to the extent feasible and practical prior to Project start-up to notify them and MSD Regional representatives of Project construction activities and schedule.
- Engagement with, and between, Crown land leaseholders and MSD will be undertaken regarding future use of Crown land and Crown-leased land along the PDA and adjacent to the channel ROW.
- Construction activities and equipment will be managed to avoid damage and disturbance to adjacent properties, structures and operations.
- Channel excavation will be limited to defined rights-of-way and access routes.
- Existing roads, road allowances, trails, portages and other travel ways will not be blocked or altered as a result of clearing and grubbing activities so as not to interfere with other users.
- There will be no entry of personnel or equipment, or work conducted on private property.
- All work will be conducted in a manner that minimizes the raising of dust; only water or approved dust suppressants shall be used for dust control.
- All construction equipment supplied will be effectively "sound-reduced" by proper means.
- Noise by-laws of the adjacent communities and municipal authorities will be complied with.
- Advanced notification will be given to affected parties prior to each blasting event.
- The Contractor will restore access roads not required for on-going maintenance to original condition.
- Manitoba Infrastructure will implement an Access Management Plan, including control measures.
- Access will be maintained into yard sites where possible for PR 239 road realignment.
- Signs directing traffic to detours will be installed during construction to address public safety.

- Construction, operation and maintenance will avoid affecting neighbouring properties or operations.
- All designated areas and temporary access roads will be leveled to natural or pre-existing grade and slope for decommissioning.
- Reclamation of temporary construction areas and aggregate/quarry sites will follow measures in place at the time of remediation in full compliance with legislation and regulatory standards.
- Soil stockpiles along the LMOC will be designed to allow for haying or harvest of vegetation and provide landowner access to conduct haying activities.
- Drainage channels and re-alignments on upgradient sides of LMOC and LSMOC will channel water downslope and into channels to minimize the risk of inundation and flooding from channel presence.
- Surface drainage patterns for other Project components will be re-established where possible.
- An access management plan will be developed in conjunction with individual landowners to reduce the effects of access limitations.
- Agricultural infrastructure, facilities and related resources will be inventoried and a plan developed in conjunction with individual landowners for moving, repairing or replacing these in appropriate areas outside of the PDA.
- Locations of manure stockpiles within the PDA will be confirmed and stockpiles will be relocated to suitable areas outside of the PDA determined in conjunction with landowners prior to construction.
- Manitoba Infrastructure will develop a biosecurity management plan to address biosecurity concerns.
- Where construction or maintenance activities have the potential to interfere with field activities, discussions with the landowner or producers will be held to move livestock/equipment.
- All equipment will arrive at the construction site clean, free of soil/vegetative debris (including weed seeds).
- Notices to boaters, involving posting of signage (i.e., danger, trespass warnings) will be implemented.
- Employees, workers and other staff will not hunt, trap or harass wildlife.
- No person will remove, disturb, spring or in any way interfere with any trap set out lawfully by any other person for the purpose of taking furbearing animals.
- Warning signage will be installed to discourage members of the public from accessing the channel ROWs.
- No in-water activities in fish bearing waters or potentially fish bearing waters will be undertaken between September 15 and June 30 of the following year, unless otherwise authorized by DFO/MSD.

- Quarry operations will not encroach within 15 metres of any property boundary adjoining, private, municipal, or Crown leased land.
- All brush and trees, except those designated to be saved will be cut level with the ground. All surface debris, excluding merchantable timber, shall be disposed of appropriately.
- Merchantable timber will be cleared of limbs and neatly stockpiled piled within the work limits.
- Loss of Crown productive forestland from channel clearing will require compensation to be paid by MI to MSD based on the Forest Damage Appraisal and Valuation (FDAV) policy.
- Construction dewatering will be limited through appropriate construction planning and will be in accordance with terms/conditions of *The Groundwater and Water Well Act* and *The Water Rights Act.*
- Drill holes will be sealed as soon as possible in the case of a groundwater level rise.
- Existing water wells within the PDA will be plugged and decommissioned to prevent contamination.
- Protection measures will be in place for sealing/grouting and pumping out drill holes in artesian well areas to prevent groundwater contamination as part of a Groundwater Management Plan. Where a decrease in water pressure occurs in domestic wells to noticeable levels (in comparison to the natural variability) or in livestock wells to unusable levels (for flowing wells) as a result of Project activities, appropriate measures to mitigate the resultant drop in water pressure will be implemented to ensure that potable water is available (i.e., providing landowners with new wells, pumps or temporary water supply for livestock during construction) as per the Groundwater Management Plan.
- Groundwater seepage will be mitigated by allowing seepage to either infiltrate back into the subsurface, or flow back into waterbodies via the surface drainage pathway (the channel).
- Manitoba Infrastructure will develop a Surface Water Management Plan and Groundwater Management Plan.

6.8.2.3 Residual Effects and their Significance

Project effects on land use have been considered and avoided or reduced through the application of mitigation measures. Land use within the PDA for the LMOC and LSMOC will change as a result of the Project. Access to areas in the PDA and LAA will be affected by construction activities temporarily and permanently with Project presence. The Project will comply with the RM of Grahamdale development plan land use policies and Provincial land use policies. Section 9.2.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. Residual adverse effects are anticipated to be low to moderate magnitude and will not substantially affect land use activities in the LAA. Manitoba Infrastructure acknowledges that the effect of the LMOC on private land and residences is considerable from the perspective of the individual landowner, but in terms of effects across the LAA, residual effects on change in land use are predicted to be not significant.

Along and adjacent to the LMOC, residual adverse effects on agricultural land use are anticipated to be moderate to high magnitude considering the context of agricultural land use areas within the LAA and are mostly due to the permanent loss of agricultural land and conflict with agricultural activities. Following the consideration of compensatory mitigation, residual effects are predicted to be not significant. Effects to agricultural land use around the Lake St. Martin portion of the LAA are expected to be positive as a result of decreased lake levels and flood levels due to the Project. Follow-up and monitoring activities will be used to confirm effects, including those from access limitations, drainage alterations resulting from the presence of the LMOC, flood level changes on Lake St. Martin, and soil disturbance at temporary Project components. Additionally, follow-up will confirm the location of manure stockpiles for relocation and confirm limitations to equipment and livestock crossings over bridge structures. Monitoring will confirm mitigation measures are effectively controlling biosecurity risk associated with construction activities.

Routing of the outlet channels included the consideration of recreation and tourism. No lodges, campgrounds, resorts or cottages are traversed by the LMOC or LSMOC alignments. Project effects on parks, recreation and tourism have been considered and avoided or reduced through the application of mitigation measures. The Project will not affect the functioning of Watchorn Provincial Recreation Park and will not affect any federal or provincial existing designated or permanently protected lands. One ASI area at Sturgeon Bay will be affected by LSMOC PDA. Residual adverse effects are anticipated to be low magnitude and will not substantially affect recreational use activities in the LAA. Residual effects on change in parks, recreation and tourism are predicted to be not significant.

Project effects on resource use (hunting, trapping, fishing, mining/aggregates, forestry, groundwater and surface water) have been considered and avoided or reduced through the application of mitigation measures. Residual adverse effects generally are low to moderate in magnitude and will not substantially affect any of the resource use activities within the LAA. Residual effects on resource use are predicted to be not significant.

6.9 INFRASTRUCTURE AND SERVICES

6.9.1 Description of the Baseline Conditions

The RAA and LAA encompass the RMs of Grahamdale and West Interlake, and include communities such as Moosehorn, Gypsumville and Ashern. It includes Dauphin River First Nation, Dauphin River Northern Affairs Community, Lake St. Martin First Nation, Pinaymootang First Nation, Little Saskatchewan First Nation, Peguis First Nation, Fisher River Cree Nation, Kinonjeoshtegon First Nation and the Lake St. Martin NAC area.

6.9.1.1 Temporary Accommodations

Temporary accommodations in the RAA include hotels, motels and campgrounds. Within the RAA, there are nine hotels and motels. The Moosehorn Motor Hotel, which has 12 rooms, is located in the community of Moosehorn. There are three motels in Ashern the Sharptail Motor Inn (eight rooms), the

Interlake Motel (18 rooms) and the Ashern Motor Hotel (12 rooms). The Pinaymootang Motel and Entertainment Centre, located in Fairford, has 20 rooms.

6.9.1.2 Community Infrastructure and Services

Emergency/Medical Services

The Royal Canadian Mounted Police (RCMP) is the primary provider of police services in the RAA. There are two RCMP detachments in the RAA in the immediate vicinity of the PDA (Ashern and Gypsumville). There are fire departments in the RAA in the immediate area of the Project, located in Ashern, Grahamdale, Gypsumville, Moosehorn, Fairford, Faulkner, Hilbre, St. Martin, Steep Rock and Eriksdale.

The Interlake-Eastern Regional Health Authority (RHA) is responsible for the administration and operation of health care in the RAA. The RHA boundaries include areas in the Interlake and eastern Manitoba which are outside of the RAA. The North Zone, District 14, includes the RM of Grahamdale, Pinaymootang First Nation, Little Saskatchewan First Nation, Lake St. Martin First Nation, Lake Manitoba First Nation, and the RMs of Eriksdale and Siglunes (now part of the RM of West Interlake). The Lakeshore General Hospital 14-bed acute care hospital is located in the community of Ashern. The hospital has an emergency room that is open 24 hours a day, 7 days a week and has ambulance services that includes transporting patients to and from Winnipeg and Dauphin. There are community health offices in Ashern and St. Laurent; the latter is approximately 95 km from Ashern. Both communities also have emergency medical service stations. A mobile clinic visits Gypsumville once a week. The E. M. Crowe Memorial Hospital, located in the community of Eriksdale, has 13 acute care beds. Shock Trauma Air Rescue Society (STARS) is contracted by the provincial government to provide rapid and emergency medical care and air transport for critically ill and injured patients. The federal government provides most services to residents living on reserve. First Nation members living on reserve also access regional hospitals and programs that are off reserve in the region.

Transportation

The road network in the RAA includes the provincial highway network and the access road to the LSMOC that are owned and maintained by MI. PTH 6, which is two-lane and paved, is a primary route that connects the City of Winnipeg to the City of Thompson in northern Manitoba. PRs 237, 239 and 513 are secondary routes. Roadway volumes on PR 237, PR 239, and PR 513 indicate low volume rural roads and, with the exception of PR 513, show a decline in usage. Summer traffic levels on all routes are higher than annual averages. Most municipal roads in the RMs are two-lane, gravel surfaced public roads with the numbering system based on the section-township and range grid system. Municipal roads in communities are often paved and named.

Traffic collision data is collected by MI for highways in the Province of Manitoba. Of the sections reviewed (i.e., PTH 6, PR 513, PR 239, PR 237, PR 235), the top three mostly involved animal-vehicle collisions and were located on PTH 6. Collisions on the municipal road network are expected to be low due to the low volume of traffic.

There is one active airport in the RAA, which is located at Ashern. There is one rail line in the RAA that parallels PTH 6. The 104 km long line segment for the Warren to Steep Rock Junction route was operated by the Canadian National Railway (CNR) but was abandoned in 1997.

Water and Waste Management

Regional and local potable water in the RAA is provided through public, semi-public and private water systems. There are public potable water systems at Ashern and at the beaches at Steep Rock. Semi-public potable water systems are located at businesses and schools in the RAA (e.g., Gypsumville School, Moosehorn Co-op, Moosehorn Motor Hotel. Roviera Resort and Campground, Sharptail Park Watchorn Provincial Park). There are water treatment plants at Dauphin River First Nation, Lake St. Martin First Nation, Lake Manitoba First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Kinonjeoshtegan First Nation, Fisher River Cree Nation, and Pequis First Nation.

There are seven wastewater treatment lagoons in operation in the RAA. They are located near the communities of Ashern, Faulkner, Moosehorn, Pineimuta, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinymootang First Nation and Dauphin River First Nation. The closest wastewater treatment lagoon to the PDA is the one for Moosehorn, located approximately 6.6 km east of the LMOC alignment.

There are six waste disposal grounds located within the RAA in the vicinity of the PDA. These waste disposal grounds are located near the communities of Ashern, Mulivihill, Faulkner, Moosehorn, Pineimuta and Eriksdale. Dauphin River First Nation has a solid waste transfer station and a waste disposal ground is under construction in Little Saskatchewan First Nation.

Utilities

Electrical services are provided to communities in the RAA by Manitoba Hydro. Transmission lines located within the RAA include portions of the Bipoles I and II high voltage direct current (HVDC) lines that pass through the RAA in a ROW adjacent to PTH 6, and sections of two 230 kV transmission lines that connect to communities in the region. There are also distribution lines in the area providing power to communities and residences in the RAA. There are no natural gas, oil or other pipelines located in the RAA.

6.9.2 Effects on the Environment

6.9.2.1 Change to the Environment

The Project construction workforce may increase demand for temporary accommodations through use of existing motels. However, these are limited in the RAA to approximately 70 rooms and so it is likely that one or more construction camps will be required. Depending on the timing and the number of workers requiring temporary accommodations, there is a potential that there will be limited accommodations available for others (e.g., tourists) during construction, particularly in the vicinity of the LMOC. Operations

and maintenance of the Project is expected to involve one or two workers in one vehicle, which will not affect temporary accommodations.

The Project's construction workforce and Project activities may increase the demand for community infrastructure and services which could result in a reduction in available capacity and/or quality of services for local residents and visitors. Project construction may result in an increased demand for health, emergency and protection services which may increase response times. Construction of the Project will generate solid waste and the construction camps will require water, wastewater and solid waste services. If these services are procured locally, they may result in demands that exceed the capacity of service providers, affecting their ability to serve local customers.

Project-generated construction road traffic will increase traffic volumes, potentially contributing to roadway congestion. In addition, realignment of PR 239 and municipal roads in the RM of Grahamdale is required in order to accommodate the LMOC. Construction of the LSMOC will use the the proposed Lake St. Martin Access Road and existing roads, which will extend the Idylwild (forestry) Road, east of Lake St. Martin, and connect via local roads to PTH 6, south of Grahamdale.

Project construction can sever or alter utility infrastructure, including drainage systems, water mains, and sewage mains, electricity and telecommunications lines, and natural gas distribution lines. This would occur if any underground utilities intersect with the LMOC alignment, or due to the re-alignment of PR 239 and local roadways.

6.9.2.2 Mitigation Measures

Accommodations

The following mitigation measures will be implemented to reduce demands on temporary accommodations:

- MI will continue to share Project information, such as construction schedules, and anticipated workforce numbers with the RMs, First Nations, local communities, service providers and businesses in the RAA during construction
- temporary construction camps will be used to house the construction workforce for the LMOC and LSMOC
- workers will be hired locally wherever possible
- transportation of workers between construction camp/accommodations and worksites will be done in groups (e.g., vans) to reduce the potential number of vehicles on the road network

Community Infrastructure and Services

The following mitigation measures will be implemented to reduce demands on community infrastructure and services:

- MI will continue to share Project information with the RMs, First Nations, local communities, service providers and businesses in the RAA about the construction workforce and timing of construction activities
- solid wastes generated as a result of Project-related construction and operation and maintenance phases will be regularly transferred to appropriately permitted/licensed facilities for recycling and/or disposal within or outside of the LAA
- wastewater generated as a result of the Project construction *(*i.e., wastewater from work camps) will be stored and transferred for disposal to existing licensed facilities by qualified carriers within or outside of the LAA
- drinking water will either be sourced from wells (existing permitted/licensed sources or otherwise be permitted/licensed by Contractors with approvals obtained in accordance with provincial acts and regulations) or delivered by truck from the nearest licensed/permitted water treatment facility
- an Emergency Response Plan will be developed for the Project and shared with Project personnel. The plan will include measures to address the disposal of waste, emergency response communications, 24-hour emergency transport to hospital for occupational and non-occupational injuries and a plan for fire response and evacuation
- an Access Management Plan, which will address access related issues expressed by directly affected landowners, First Nations and the public, will be prepared to outline specific measures to ensure proper access during the construction of the Project
- a Waste Management Plan will be prepared for the Project that will include practices for management both general and hazardous wastes

Transportation

The following mitigation measures will be implemented to reduce changes in road traffic and the road network:

- MI will continue to share Project information with the RMs, First Nations, local communities and stakeholders in the RAA during construction so that detours can be communicated to residents and mitigate travel delays
- transportation of workers between construction camp/accommodations and worksites will be done in groups (e.g., vans) to the extent feasible and often using the PDA itself for access, to reduce the potential number of vehicles on the road network

- materials transported by truck will be compliant with weight restrictions, Spring Road Restrictions and geometric constraints set out by MI and the RMs of Grahamdale and West Interlake
- a Traffic Management Plan will be prepared for the Project, which will include a traffic control plan to describe anticipated detours and schedules specific to the project design to mitigate travel delays
- an Access Management Plan, will be developed to address access related issues expressed by directly affected landowners, First Nations and the public and outline the requirements for specific measures to ensure compliant contractor access during the construction of the Project
- sections of municipal roads will be reconstructed, realigned or extended to provide access across the LMOC at the bridge crossings to be constructed. Access across the LSMOC will be limited to the bridge/control structure that will be constructed as part of the project.
- temporary detours will be used to maintain access through the LMOC PDA to reduce/avoid potential effects on access interruption and maintain access for emergency medical services
- Project construction-related traffic will be restricted to the Project PDA and associated temporary access routes to the extent practical and required
- ongoing alignment optimization planning, financial considerations, environmental considerations, and continued discussions with local landowners, stakeholders and RMs will influence how and where provincial and municipal roads are realigned
- temporary detours will be used to maintain access through the area where the LMOC intersects existing provincial and municipal roads.
- MI will repair roads if they are damaged during construction

Utility Infrastructure

MI will continue to share Project information with entities responsible for underground and aboveground utilities (e.g., the RM of Grahamdale, Manitoba Hydro), and will coordinate any utility re-routing as part of Project construction.

6.9.2.3 Residual Effects and their Significance

Section 9.3.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented.

Accommodations

Due to the limited availability of such temporary accommodations in the LAA, it is anticipated that most workers will be housed at one or more temporary construction camps. With the implementation of

mitigation measures, residual effects on accommodations are expected to be not significant. There could also be an economic benefit to the region because of spending on accommodations and related services. During the operation and maintenance phase, the Project will require the services of one or two maintenance personnel.

Community Infrastructure and Services

There are two RCMP detachments. In addition to the hospital in Ashern, the Province of Manitoba operates STARS to provide rapid emergency medical care and transport for injured persons to Winnipeg. Potential effects from the Project on health, emergency and protection services will be reduced through the implementation of the Emergency Response Plan, which will include a plan for medical incidents that includes 24-hour emergency transport to hospital and a plan for fire response and evacuation.

Safe Work Manitoba maintains data on time-off injury rates for various industries. In 2017, the time-off injury rate for the heavy construction industry was 3.6 injuries per 100 full-time equivalents (SWM 2018). Assuming that the 2017 time-off injury work is applicable to the Project, at peak project workforce there would be 20.7 injuries/year. In consideration of identified mitigation measures, the Project will have a negligible to low effect on services provided by first responders and medical facilities within the LAA.

A detailed estimate of wastewater generation has not been completed for the Project; however, as it is estimated that there are 575 workers during peak construction, compared to the LAA permanent population, the increase in solid waste in the LAA would be approximately 5%, at maximum.

Depending on the final size and occupancy of the temporary construction camps, camp trailers will most likely be equipped with self-contained holding tanks for potable water and wastewater. Otherwise separate holding tanks will be used to temporarily store these fluids which would be pumped out at regular intervals and disposed of at permitted/licensed facilities or lagoons. The final wastewater disposal sites will be confirmed by the contractor based on the capacity.

Drinking water could potentially be sourced from wells (existing permitted/licensed sources or otherwise to be permitted/licensed by contractors with approvals obtained in accordance with provincial acts and regulations). If there are potable water supply constraints within the LAA, potable water will be delivered by truck from licensed and permitted facilities located outside of the LAA.

With the implementation of mitigation measures, during construction, effects are expected to be not significant. With the limited number of workers during operations and maintenance, no effects on community infrastructure and services are anticipated during normal operations.

Transportation

PTH 6 will be the main access road for the transportation of equipment, materials, and personnel from Winnipeg, and other commercial centres into the LAA. For LMOC construction, it is anticipated that southern sections of the PDA will be accessed via PR 237, central sections via PR 239, and northern

sections via local roadways. Current traffic volumes have been assessed as being well below the traffic thresholds, so it is not anticipated that the Project will change the level of service of this road.

LSMOC construction sites will be accessed via the Lake St. Martin (LSM) Access Road. Because most of the LSMOC construction traffic will use the LSM road, it is anticipated that Project-related traffic along PTH 6, north of Grahamdale, as well as on connecting roads, such as PR 513 will be minimal, and will not affect the level of services on those roads. There will be increases in roadway volumes along local roads that connect to the EOC.

Traffic flow along roadways during construction periods will be managed via a traffic management plan, which may involve re-routing traffic along alternative routes. The maximum likely re-routing during construction would add approximately 10 km to local trips, resulting in increased travel times (assuming 60 km/h) of ten minutes per trip.

With the implementation of mitigation measures, during construction, effects are expected to be not significant. Because of limited workers during operations and maintenance, the Project will have negligible effects on traffic volumes post-construction. The operation of the LMOC and LSMOC will alleviate flooding in low-lying areas within the LAA which will mean that roadways that may be flooded will remain operational.

Utility Infrastructure

There is limited potential for construction related impacts to utility infrastructure in the LAA. There are no identified potable water or sewer mains that would be affected. Overhead electricity and telecommunication utilities that could be affected by roadway re-alignment would be relocated with minimal service interruption. In consideration of the above, there are anticipated to be no residual effects on utility infrastructure during construction. The operation of the LMOC and LSMOC will alleviate flooding in low-lying areas within the LAA. A potential concern of flooding is contamination of potable water wells from flooded septic fields or wastewater lagoons.

Conclusion

Based on the assessment of the proposed effects of the Project on infrastructure and services and the proposed mitigation measures, the residual effects are considered not significant.

6.10 ECONOMY

6.10.1 Description of the Baseline Conditions

6.10.1.1 Provincial Economy

Manitoba has a diversified economy, which includes a substantial natural resource base, including agriculture, forestry, mining, and hydroelectric development; well-developed construction, transportation, wholesale and retail trade, hospitality, and services sectors; and extensive employment in health,

education, and other public-sector services. Manitoba's GDP grew 1% from 2017 to 2018 to approximately $67.2 billion. As of May 2019, Manitoba had an employed workforce of 654,800 persons, out of a population of 1,360,396, and an unemployment rate of 5%.

6.10.1.2 Local Businesses and Labour Force

The economy LAA (Figure 6-3) is composed of two rural municipalities, several Indigenous communities, and unorganized Crown Land. The LAA is relatively lightly populated, with most of the population living in settlements to the south of Lake St. Martin. Moosehorn and Gypsumville are the largest communities within the RM of Grahamdale, while Ashern and Eriksdale are the largest communities within the RM of West Interlake. These communities, several smaller hamlets, and Indigenous communities serve as local centres of commerce. The nearest large commercial centre to the LAA is the City of Winnipeg, located approximately 143 km SE of Eriksdale.

The LAA for the Project supports agriculture, fishing, mineral extraction, recreation and tourism, as well as traditional use activities by Indigenous People. Traditional use activities in the economy RAA occur primarily along the LSMOC. The major economic sector in the LAA continues to be agriculture, which is focused mainly on ranching and feedlots for cattle. Other resource industries within the RAA include forest products, aggregate mining, and commercial fishing.

In 2016, the labour force of the LAA consisted of 3,725 persons over the age of 15 years. Of these individuals, there were 635 unemployed workers, of which 125 lived in the RM of Grahamdale and West Interlake, with the balance living in an Indigenous community.

In 2016, approximately 58% of the LAA labour force was employed in basic industries (e.g., health care, social assistance, education, agriculture, forestry, fishing and hunting), 36% in non-basic industries (e.g., public administration, retail trade, accommodations and food services), and the balance not identified.

In 2016, employment in occupations related to sales and service accounted for the largest proportion of employed persons within the LAA (19.5%), followed by construction related occupations (trades, transport and equipment operators and related occupations) at 19.2%. Occupations related to manufacturing and utilities; and to art, culture, recreation, and sport accounted for the lowest proportion of the workforce at 1.5% and 0.5% respectively.

6.10.2 Effects on the Environment

6.10.2.1 Change to the Environment

Provincial Economy

Project spending can affect the provincial economy through the generation of GDP, employment, labour income, and government revenue. Dollars spent on labour, equipment, and materials will be recycled resulting in spin-off benefits (i.e. indirect and induced economic impacts) back into the economy of Manitoba and Canada.

Project capital expenditures, exclusive of land and contingency, are estimated at $456 million, of which 12% ($55 million) is expected to occur in the LAA. An estimated $371 million of capital expenditures are expected to occur in other parts of Manitoba, and $28 million in other parts of Canada. Of the total capital expenditures, an estimated 29% ($131 million) will be spent on direct labour. Project construction would generate an estimated $675 million in economic output in Manitoba, inclusive of direct, indirect, and induced effects, and $291 million in economic output in other parts of Canada. Project construction is predicted to contribute an estimated $335 million to Manitoba's GDP, with an additional $165 million in GDP accruing to other parts of Canada.

Regional Economy

Businesses located within the LAA and other areas of the Interlake region provide goods and services that could be used in Project construction, including civil construction, heavy equipment repair and maintenance, aggregate, transportation/logistics, fuel, and hospitality. Due to their proximity, these businesses are well-positioned to benefit from Project spending. Capital expenditures within the LAA, net of contingency, escalation, and land cost, are estimated at $83 million or 18% of total capital expenditures. In addition, indirect and induced economic activity would result in increased spending in the LAA.

Project spending can positively and adversely affect regional businesses. Benefits typically relate to increased revenue from Project-associated spending, which could support capital investment, hiring, and other business initiatives. Other local businesses could be expected to benefit from spending by the Project's labour force residing temporarily in the LAA.

Potential adverse effects relate to increased demand for labour, goods, and services, which can increase operational costs of local businesses through wage inflation and employee turnover. Project spending can also adversely affect the affordability of accommodations due to increased demand by visitors to the LAA in search of Project employment.

Adverse effects of Project spending relate to increased operational costs due to wage inflation and employee turnover. During construction, the average annual wage of direct full-time workers is estimated at $70,186. This is substantially higher than the median employment wage in the LAA, which is $35,289. Considering the size of the Project relative to the economy within the LAA, there is potential that Project-related employment could result in some wage inflation, particularly in construction-related industries. It could also cause higher rates of turnover, as some employees seek Project related employment.

Land and resource-based businesses could also be beneficially and/or adversely affected by the Project. The procurement of resource products, such as aggregate, from local suppliers will result in revenue inflows into the RAA. Land and resource-based industries can also be adversely affected due to land take up by the Project, property fragmentation, changes to access, and nuisance effects.

During operations, local businesses will benefit from direct spending by the Project, as well as spending by the Project's operations and maintenance personnel. However, there will be less expenditure related effects during operations because of the limited Project spending during this phase.

The RM of Grahamdale could experience changes in local tax revenue to the extent that tax assessable properties will be acquired by MI to provide lands for the PDA and other uses.

Labour Availability

The Project's workforce is estimated to peak at 575 persons during construction. Manitoba Infrastructure estimates that approximately 19% of direct construction labour needed for the Project (105 persons, 313 PYs) could be satisfied by current LAA residents with the remaining hired from elsewhere in Manitoba. Based on the Project's design, demand for skilled labour would be greatest among occupations in trades, transport and equipment operators. In addition to direct employment, it is estimated that 83 PYs of indirect employment and 59 PYs of induced employment would be created in the LAA during Project construction.

During construction, Project contractors and sub-contractors will hire workers from within the LAA and also bring in workers from outside the LAA. Local suppliers to the Project will create additional indirect jobs, and spending by the direct and indirect workforce will result in induced employment. Project labour demands may cause shortages of skilled workers and competition with current employers in other sectors such as resource industries, service providers, and local government.

During operations, the Project will require a workforce of one to two persons for ongoing maintenance. During ramp-up, Project demand for qualified labour from the LAA could decrease the number of unemployed persons in the LAA, but could also contribute to labour shortages, potentially resulting in increased costs for some local businesses.

Goods and Services

The Project will increase economic activity in the LAA due to Project-associated spending, with Project-related demand for goods and services within the LAA potentially resulting in reduced availability of goods and services and increased costs to LAA residents.

The Project could also cause adverse effects on other economic sectors as a result of its demand for goods and services. Project-related hiring could increase competition for the available labour force, reducing the ability of local businesses in other sectors to recruit and retain employees, thus affecting their ability to provide services to LAA resident and visitors.

6.10.2.2 Mitigation Measures

Provincial Economy

Project effects on the provincial economy are expected to be positive in direction with the addition of direct, indirect, and induced employment income and GDP. As such, no mitigation measures are proposed to address adverse effects. Manitoba Infrastructure will adhere to government procurement policies and procedure with respect to labour, and goods and services.

Regional Economy

Project specific mitigation measures to manage effects to the regional economy include:

- adhere to government procurement policies and procedures
- post Project purchasing needs in advance
- develop work packages consistent with the capabilities of local and regional businesses
- work with Indigenous groups to increase opportunities for their meaningful participation
- develop a labour and training strategic action plan
- compensate RMs for decreased tax revenue

Labour Availability

Project-specific mitigation measures to manage effects on labour availability include:

- encourage a hire-local-first approach for both the construction and operations phases
- follow industry standard wage rates to limit potential wage inflation
- post job qualifications in advance and identify available training programs and providers
- work with local communities to develop training programs
- implement the Project's labour and training strategic action plan

Goods and Services

Mitigations measures are as follows:

- develop work packages that would be consistent with the capabilities of local and regional businesses
- follow industry standard wage rates to limit potential wage inflation
- construct and operate work camps for non-resident construction workforce to reduce demand on accommodations within LAA
- develop a database of local and Indigenous suppliers of goods and services and ensure that such firms are made aware of opportunities

6.10.2.3 Residual Effects and their Significance

Section 9.4.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. A significant effect on the economy is defined as one that is distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to program, policies, plans, or through other mitigation measures.

Provincial Economy

The Project will have a positive effect on the provincial economy; particularly during construction. The Project would have a negligible effect on the provincial economy during the operations and maintenance phase given the relatively small annual expenditure (less than $500,000) and workforce involved (one or two persons). Manitoba Infrastructure will be responsible for the cost of operations and maintenance of Project infrastructure.

Regional Economy

The Project is predicted to have both positive and adverse effects on the regional economy. Project spending will give a financial boost to the regional economy during construction. The Project would have a negligible effect on the regional economy related to expenditures given the relatively small annual expenditure (less than $500,000) and workforce involved (one or two persons). The Project will not adversely affect the taxation base of the RM of Grahamdale, because MI will pay a grant in lieu of property taxes. Some businesses may be adversely affected due to the competition for available labour. However, mitigation measures will help offset this and the relatively high unemployment rate within the LAA indicates that the labour market has some capacity to absorb additional demand. The Project will affect some individual agricultural operations, and other land and resource users. However, with the application of mitigation measures, such effects are not anticipated to degrade or disrupt activities such that they cannot continue near the baseline level within the LAA overall. Finally, the Project has potential to affect the cost and availability of some services within the LAA. However, community residents will have alternatives with shortages most pronounced during the relatively short peak employment period. As well, such adverse effects will be balanced by the benefits that will be enjoyed by the communities, as summarized above.

During operations, the Project will employ one or two individuals, who will undertake ongoing maintenance, such as vegetation clearing. Additional individuals may be hired on a periodic basis to provide more substantive maintenance. It is assumed that the Project's operational workforce will reside within the LAA, and household spending by these individuals will contribute to induced employment within the LAA. The Project will have a negligible effect on the labour force within the LAA during operations because of the low number of workers that will be directly or indirectly employed during this phase

The Project's economic effects on Indigenous communities may differ qualitatively from communities within the LAA overall. Indigenous community members have a higher likelihood of being engaged in land

and resource based economic activities, for which it has been concluded that the Project will have low to moderate adverse effects. Indigenous communities tend to have higher rates of unemployment than does the LAA overall so these communities may experience higher rates of Project employment compared to communities in the LAA overall. Identified Indigenous operating businesses within the LAA shows somewhat less diversity than for the LAA overall. This could result in more limited opportunities for economic participation. Mitigation measures to facilitate local economic participation in the Project may help offset this limitation.

Goods and Services

It is not expected that the Project will affect cost and availability of consumer and other goods to residents or visitors within the LAA because such items can easily be transported from major commercial centres. The use of construction camps will limit Project-related demands on accommodations within the LAA and effects on tourism-related businesses. Project-related hiring of skilled and unskilled workers may contribute to labour shortages in some economic sectors, including trades and service employees. This is predicted to have a moderately adverse economic effect, which will persist over the course of the construction period and be reversed upon completion of construction.

Due to the relatively small amount of Project spending during the operations and maintenance phase, effects on goods and services during this phase are predicted to be negligible.

Conclusion

Based on the assessment of the proposed effects of the Project on economy and the proposed mitigation measures, the residual effects are considered not significant.

6.11 HUMAN HEALTH

6.11.1 Description of the Baseline Conditions

This section describes the existing air quality, water quality, soil quality and noise level conditions that are relevant to assessing the existing potential human health risks associated with current environmental conditions within the Project study area.

6.11.1.1 Air Quality

Information about existing air quality within the LAA and RAA for the human health VC is described in the Atmospheric Environment section (Section 6.2). Baseline air quality generally meets appropriate ambient air quality guidelines.

6.11.1.2 Water Quality

Information about existing water quality within the LAA and RAA for the human health VC was taken from the groundwater and surface water VC (Section 6.3 and 6.4, respectively). Surface water and

groundwater data relevant to the assessment of potential human health risks relates to the suitability of their use as sources of potable water. In each water body for which data was available, concentrations of metals were below their respective drinking water quality guidelines or standards. It should be noted that there is no indication that surface water is used as a daily source of domestic potable water. The consumption of surface water may occur on an occasional basis. However, given that surface water either meets, or is expected to meet, drinking water quality standards for metals, the occasional use of surface water for drinking would not be expected to represent a potential human health risk. Information on groundwater quality provided suggests that groundwater is generally of good quality. Measured components are below their corresponding guideline except total dissolved solids (TDS), total coliforms and manganese. As indicated in Section 6.3, the guidelines for manganese and TDS are based on aesthetics (staining and taste) and are not based on the protection of human health. The assessment noted that groundwater is typically free of total coliforms and recommended additional testing to confirm the results.

6.11.1.3 Soil Quality

The geology and soils VC (Section 6.2) provides information on agricultural capability, compaction risk, wind and water erosion risks, and reclamation suitability. Information regarding the concentrations of metals or other chemicals in the soils in the region are not available. In the absence of this information, the assessment of potential health risks associated with exposures to chemicals in the soils must be limited to a qualitative evaluation.

6.11.1.4 Noise Levels

A review of the RAA was carried out as a part of the desktop studies to estimate the existing sound levels as well as identify potential receptor locations (Section 6.1). No urban/suburban areas were identified within RAA. The areas within the RAA of LSMOC, LMOC and the PR 239 realignment route are considered rural and the existing sound levels are assumed to be below the 35 dBA threshold as suggested in Health Canada Guidance. There are no communities or residential receptors located within 5 km (i.e., within the LAA) of the LSMOC PDA and there are three communities (Grahamdale, Faulkner, and Birch Bay) with numerous residential receptors within 5 km of the LMOC PDA and PR239 realignment route.

6.11.2 Effects on the Environment

6.11.2.1 Change to the Environment

Air Quality

As indicated in Section 6.1, Project-related emissions of chemicals to the air from construction and operations activities may expose human receptors to these chemicals via inhalation. The assessment of Project effects on air quality determined that changes in air quality are expected to be consistent with those of a typical construction project. The air quality assessment concluded that the primary effects on

air quality are related to dust concentrations, and Project effects on ambient air quality are greatest near the PDA and decrease substantially with increasing distance from the PDA.

Regulatory agencies such as Health Canada, consider air pollutants such as nitrogen oxides (NO_x), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particulate matter (PM) to be non-threshold contaminants and that even small amounts of exposure can be associated with potential human health risks. At very low concentrations, the potential health risks are low and as the concentrations increase, the potential health risk increases. The human health-based ambient air quality standards for chemicals such as those listed are defined as representing concentrations in ambient air (over the specified averaging period) with negligible risk to human health, including sensitive members of the population. Thus, Project-related changes in air quality that do not exceed the established Health Canada thresholds would be considered to represent a negligible human health risk and a negligible change in human health risk from existing baseline conditions. Based on anticipated concentrations outside the PDA, the predicted Project-related concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$, O_3, and CO would remain well below their respective thresholds. Therefore, as the residual effects of the Project on air quality would be not significant, no further assessment of potential human health risks related to changes in air quality would be required.

Soil Quality

As indicated in Section 6.2, changes in soil quality resulting from the deposition of Project-related dust to soil could alter the concentrations of chemicals in surface soils within the LAA. Changes in soil quality could, in turn, result in changes in the quality of terrestrial country foods (both plants and animals) if the chemicals are taken up into these country foods. Changes in the concentrations of Project-related chemicals in soil would only occur if chemical concentrations in Project-related dust were different from the chemical concentrations found in surface soils within the LAA. Information presented in the Geology and Soils assessment (Section 6.2) and the Atmospheric Environment assessment (Section 6.1), indicates that dust generated during Project construction and operations activities will be derived from the surface soils within the PDA and the chemical concentrations in these dusts would not be expected to differ from the concentrations in the surrounding surface soils within the LAA. Thus, deposition of Project-related dust onto vegetation would not alter chemical concentrations in vegetation beyond what would be associated with dust deposition in the absence of the Project.

The Human Health assessment follows Health Canada guidance for the evaluation of human health related to country food to determine whether the predicted changes in soil quality and country food quality were of sufficient magnitude to warrant further assessment in a detailed human health risk assessment. The findings show that Project-related construction and operations activities that release fugitive dusts will not increase concentrations in surface soil, or in terrestrial country food that may be consumed by an individual currently or in the future. Based on these findings, a detailed risk assessment to assess potential Project effects on country foods is not necessary. These results further indicate that the Project will have no residual effects on soil or terrestrial country food quality and consequently there are no pathways of effect from the Project to human health risk associated with exposures to chemicals in soil or terrestrial country foods.

Water Quality

As indicated in Section 6.4, Project-related changes in chemical concentrations in surface water may alter the potential human health risks for people who use surface water as a potable water source. Changes in chemical concentrations in surface water may also result in changes in the concentrations of these chemicals in fish and other aquatic biota that are used as country foods. Changes in the quality of surface water and/or aquatic country foods may result in changes in human health risks for people who consume surface water and/or aquatic country foods.

Information presented regarding the groundwater and surface water VC (Section 6.4) indicates that Project activities related to construction and operation are not anticipated to result in changes in surface water quality or groundwater quality. Therefore, the Project will not affect aquatic country food quality. As a result, the human health risks associated with the consumption of groundwater, surface water and/or aquatic country foods will not be affected by Project activities.

The findings show that groundwater and surface water meet the Canadian Drinking Water Quality Guidelines. Based on these findings, a detailed risk assessment to evaluate potential Project effects on groundwater or surface water is not necessary. These results further indicate that the Project will have no residual effects on groundwater or surface water quality and consequently the Project will have no pathways of effect to human health risk associated with exposures to chemicals in groundwater, surface water or aquatic country foods.

Noise

The assessment of the acoustic environment (atmospheric environment VC Section 6.1) considered potential increases in ambient noise levels at 44 residential receptor locations within the LAA (see atmospheric environment VC, Section 6.1). The results of the acoustic assessment determined that residual noise effects are expected to be low (peak noise levels would not exceed 50 dBA) at 24 of the receptor locations. At 12 receptor locations, residual noise effects could be moderate (peak noise level would exceed 50 dBA but would not exceed 57 dBA). At 6 of the 44 receptor locations, residual noise effects could be high (peak noise levels exceed 57 dBA). These predictions do not include the application of receptor-specific noise mitigation measures. Based on these results, the assessment of Project-related changes in noise levels concluded that:

- during construction, the potential noise effects of the Project construction activities are expected to occur within the PDA and extend to the LAA
- increased noise emissions may also occur along the provincial and municipal roads used for access and transport of materials, equipment and crews in PDA during construction activities. The duration of noise emissions from construction activities will be limited to the construction phase.
- following construction, the sound levels within the LAA are expected to decrease to pre-construction levels.

- effects on acoustic environment during the Project operation and maintenance activities are expected to be lower in magnitude, duration and extent than during the construction phase due to the reduced use of vehicles and equipment and infrequent nature of the activities.
- effects during the operation and maintenance phase are expected to be negligible and limited mainly to the PDAs, with some use of Project area roadways.

6.11.2.2 Mitigation Measures

Air Quality

Based on the information contained in the Atmospheric Environment assessment, increases in the concentrations of air contaminants are predicted to be small and would result in final concentrations that remain below the appropriate thresholds. The air quality assessment assumed that standard dust mitigation measures would be applied during the construction phase to limit the release of fugitive dusts during construction and operations. Further mitigation includes the following:

- Project off-road construction equipment will comply with emission standards in the Canadian Off-Road Compression-Ignition Engine Emission Regulations.
- Engines and exhaust systems will be properly maintained. Equipment will not be operated, including construction equipment, that shows excessive emissions of exhaust gases until corrective repairs or adjustments are made.
- The concentration of sulphur in diesel fuel shall not exceed 15 mg/kg to comply with Sulphur in Diesel Fuel Regulations.
- Construction vehicle idling times will be reduced to the extent possible in order to reduce emissions, as a best management practice.
- Cold starts will be limited to the extent possible to reduce emissions, as a best management practice.
- Use of a work camp will reduce emissions associated with transportation of staff to and from site during construction.

Soil Quality

The Project will have no effect on the chemical quality of soil. Therefore, no additional mitigation measures to address potential changes in human health risks related to changes in soil chemistry are required

Water Quality

Manitoba Infrastructure is developing a Surface Water Quality Monitoring Program for the Project. The Surface Water Quality Monitoring Program being developed for the PDA waterways will include the

continued collection of surface water samples from regional and local waterways and analyses of a suite of parameters that will provide information on surface water quality in the Project area during Project construction, operation and maintenance activities. The information from this monitoring program can be used to determine whether surface water quality continues to meet the drinking water quality standards. If results indicate that drinking water quality standards are exceeded, a human health risk assessment may be necessary to determine whether the noted changes represent a potential human health risk.

Noise

MI's Environmental Management Program and associated Project Environmental Requirements are summarized Section 2.5. The need for mitigation depends on the type of activity and the proximity of receptors to Project activities. Mitigation measures were not incorporated in the acoustic models for the assessment of effects since the construction equipment list and schedule are preliminary.

At present, potential acoustic mitigation measures comprise applying best practices in construction noise management and reducing or restricting equipment activities in specific areas or during specific time periods. The following best management practices for noise would be implemented to help mitigate noise effects at receptors with moderate to high noise impacts:

- Residents near to construction noise-generating activities will be notified. Temporary noise abatement barriers may be used to reduce noise levels. If noise abatement barriers are ineffective, a temporary reduction in the intensity of construction activities may be considered.
- Machinery and factory-supplied noise-abatement equipment (e.g., mufflers) will be maintained in good working order.
- Loud construction activities (e.g., pile driving) will be restricted to daytime periods.
- Machinery idling will be minimized.
- A complaint response procedure will be implemented to address noise complaints should they arise.

6.11.2.3 Residual Effects and their Significance

Section 9.5.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. The Project is anticipated to have a residual effect on air quality; however, the concentrations of air contaminants are predicted to remain below the applicable thresholds and thus, the changes are not significant and further assessment is not required. There are no expected changes to surface water quality, groundwater quality, soil quality or country food quality in the LAA or RAA as a result of the Project. Therefore, there are no residual effects to be characterized. While the Project effects on noise levels in the absence of mitigation are expected to result in an increase to levels that would exceed the 57dBA upper noise threshold at a limited number of (6 of 44) residential receptor locations (assuming a conservative baseline of 35 dBA), mitigation

measures will address residual effects. In addition, effects would not last beyond construction of the Project and are not expected to extend beyond the LAA. Indigenous and non-Indigenous receptors in the area are expected to be able to continue pre-Project activities in the area.

A significant effect on Human Health is one that results in exposures that exceed objectives established by relevant regulatory organization(s) and are likely to result in a long-term change in the health of an identified receptor(s). This definition is based on a consideration of the magnitude of exposure and relevant contextual effects attributes such as the spatial and temporal distribution of effects and an understanding of the confidence in the estimated potential changes in human health. The Project will have no significant residual effects on air quality, surface water quality, groundwater quality, soil quality, terrestrial country food quality or aquatic country food quality. As a result, the Project will have no significant residual effects on human health.

A significant effect on Noise Levels is one that results in changes in audible noise levels that exceed provincial guidelines, and where there is a reasonable expectation that the predicted changes in noise levels could result in an increase in public annoyance and could affect human health and welfare. Residual effects on changes in noise levels are limited to the construction phase and do not extended beyond the LAA. Construction related changes in noise levels are sporadic and/or intermittent and will only persist at a given receptor location while construction activities are occurring in the vicinity of the receptor location. As construction moves away from a given receptor location, noise levels are expected to return to pre-Project levels.

Based on the assessment of the proposed effects of the Project on Human Health and changes in noise levels, and the proposed mitigation measures, the residual effects are considered not significant.

6.12 HERITAGE RESOURCES

6.12.1 Description of the Baseline Conditions

6.12.1.1 Archaeology and History of the RAA

Indigenous peoples likely began to occupy the RAA 7,000 to 8,000 years ago, soon after Glacial Lake Agassiz drained, but there is little evidence of their presence here, likely due to a limited number of archaeological surveys. There is potential for evidence of Precontact Period activity in the RAA to be discovered in future studies and, based on a conservative approach, it is assumed that an archaeological survey of the PDA and LAA could reveal such evidence. It is further assumed that there was a presence in the area, at least periodically, of Indigenous peoples throughout the Precontact Period. A 2019 review of heritage resources in the RAA revealed 15 archaeological sites (all but one in a disturbed context) and three palaeontological sites. There are no recorded sites in the PDA and one in the LAA. This site was related to the discovery of a hollow cannon ball collected on the surface.

Contact with Europeans in Manitoba may have begun with Henry Kelsey in 1691. The Interlake was well known to European traders by the early 18th century because of the explorations of Joseph Smith and La

Vérendrye. North West Co. and independent fur trade posts were established in the Fairford area by the late 18th century and the Hudson Bay Co. by the early 19th century. Traders used the Fairford Trail to travel to and from these posts south through the Interlake. A 465 m segment of this trail interacts with the PDA at the shore of Lake Manitoba. Dominion Land surveyors began laying out river lots in the 1870s at Fairford and in 1871, the Indigenous peoples of the Interlake signed Treaty 2. Though earlier European traders and explorers described the Indigenous peoples of the area as Swampy Cree, by the time of treaty, they identified as Ojibwa or Anishinaabeg.

Homestead settlement began in the early 1900s with a wave of Swedish immigrants whose names influenced place names in the region. Fairford Post closed in 1912. Local Indigenous peoples' economy began to rely on a combination of agriculture including potatoes and root crops, cattle and haying with continued traditional subsistence from hunting, fishing, gather plants, and fur trapping. With the homestead came the conversion to agricultural lands that cover a large portion of the LMOC RAA. The LSMOC RAA has no agricultural conversion.

Bayton St. Thomas Lutheran Cemetery is in SW 20-27-8-W1 in the LAA and is within 25 m of the west boundary of the PDA. The earliest known interment in the cemetery is 1921 and the most recent reported is December 31, 2016 indicating that this is an active cemetery. According to the Interlake Reserves Tribal Council October Phase 1 Traditional Land Use and Traditional Knowledge Report there is a cemetery in or near the north side of the LAA on Sturgeon Bay. Bissell Memorial United Church is within the LAA in Grahamdale, SE 15-28-8-W1M, and is 660 m from the PDA. There is no cemetery on the church property. There are no centennial farms located in the PDA or the LAA. There is one centennial farm in SE 6-26-7-W1M in the RAA.

The potential for heritage resources to be present is based on the relationship of the Project to major landscapes and waterbodies and watercourses in the RAA, including Sturgeon Bay on Lake Winnipeg, Lake St. Martin, and Watchorn Bay on Lake Manitoba (Figure 1-1). Water courses include the Fairford and Dauphin Rivers as well as Watchorn Creek. The LSMOC crosses primarily low peat lands while the LMOC crosses drumlinoid topography characterized by ridges and swales. Heritage resources in the RAA have been affected by past activities, especially conversion of land to agriculture and residential development as well as resource extraction and infrastructure and utilities rights-of-way covering a large portion of the LMOC RAA. The LSMOC RAA has no agricultural lands and limited residential conversion, resource extraction, and infrastructure.

6.12.2 Effects on the Environment

6.12.2.1 Change to the Environment

Heritage Resources

Construction

Ground-disturbing Project activities, such as vegetation clearing and initial earthworks, development of temporary construction camps and staging areas, have the potential to interact with heritage resources by

subsurface disturbance and alteration of the horizontal and vertical locations of any intact archaeological features or objects contained therein. Furthermore, removal of vegetation may create unstable soil conditions that could result in displacement of exposed heritage objects.

Physical construction of utilities, infrastructure and other facilities, quarry development, and realignment of existing water works also have the potential to interact with heritage resources by subsurface disturbance and alteration of the horizontal and vertical locations of any intact archaeological features or objects contained therein.

Operation

Effects beyond the PDA are not anticipated during the operation phase of the Project. An approved preconstruction HRIA will mitigate any effects to heritage resources during the operation and maintenance phase. There are no recorded heritage resource sites within the PDA and one in the LAA.

Based on the desktop review, a historical feature, the Fairford Trail, crosses the PDA within 380 m of the confluence of Watchorn Creek and Watchorn Bay on Lake Manitoba. Construction of the Project will remove a 465 m long segment of this feature. A section of the trail is within 130 m of the lake and therefore, as a historic travel route near a major waterbody, there is the potential for heritage resources related to the use of the trail to be present. This will be mitigated by a preconstruction HRIA, which will also innumerate how many heritage resources will interact with the Project.

Cemeteries

Construction

Physical construction of utilities, infrastructure, and other facilities, quarry development, and realignment of existing water works, has the potential to interact with cemeteries by creating noise and dust that interfere with funeral ceremonies and visits to pay respects at existing graves. If there are unmarked graves outside the known cemetery boundaries, a common historical occurrence, ground disturbing activities could expose burials.

Operation

Project-related transportation within the LAA for all phases including movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA has the potential to interact with cemeteries by creating noise and dust that interfere with funeral ceremonies and visits to pay respects at existing graves. For all phases, emissions, discharges and wastes also have the potential to interact with cemeteries by creating noise and dust that interfere with funeral ceremonies and visits to pay respects at existing graves.

Water development and control dewatering and realignment of existing water works have the potential to interact with cemeteries by changing the typical groundwater regime. Dewatering can cause collapse of grave shafts creating depressions, causing headstones to tip and grave covers to tilt or crack. Increases in the water table or flooding can cause recent burials to float, pushing up on the grave shaft and

potentially tipping headstones and cracking and tilting grave covers. Through flood control facilitated by the Project, it is anticipated that the likelihood of this effect will be reduced.

The Bayton St. Thomas Lutheran Cemetery is in the LAA and the east cemetery boundary is within 25 m of the west edge of the PDA. The ROW was altered to avoid the known boundaries of this cemetery; however, it is not currently known whether there are unmarked graves outside the cemetery boundaries. An issue that may be of relevance to this cemetery is that the presence of the channel will alter local surface and subsurface flow paths. This could result in wetting up of soils upgradient side (west) of the channel and drying down of soils on the downgradient side (east). The effects to drainage on the upgradient side are not expected to extend beyond the PDA.

According to the Interlake Reserves Tribal Council October Phase 1 Traditional Land Use and Traditional Knowledge Report, there is a cemetery in or near the north side of the LAA on Sturgeon Bay.

6.12.2.2 Mitigation Measures

Heritage Resources

MI is developing an Environmental Management Program to address mitigation and monitoring requirements. The program will include a Cultural and Heritage Resources Protection Plan to specifically deal with potential effects to heritage resources. It will include the following measures:

- The Historic Resources Branch (of the Manitoba Sport, Culture and Heritage Department) will be informed immediately if any heritage resources, or objects thought to be heritage resources, are discovered during site preparation and construction.
- Protective barriers will be placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds.
- All heritage resources discovered during site preparation and construction will be left in their original position until the Project Archaeologist is contacted and provides instruction.
- Orientation for Project staff working in construction areas will include heritage resource awareness and training, including the nature of heritage resources and the management of any resources encountered.
- Orientation information will include typical heritage resource materials and reporting procedures.
- The Contractor will report heritage resource materials immediately to the Construction Supervisor and will cease construction activities in the immediate vicinity until the Project Archaeologist is contacted and prescribes instruction.
- The Culture and Heritage Resource Protection Plan will be adhered to during construction and operations phases of the project.

In addition, mitigation for change to heritage resources will be the completion and approval by the HRB of a preconstruction HRIA.

Cemeteries

A preconstruction geophysical survey will be completed, and the results and recommendations approved by the HRB to confirm there is no potential for unmarked graves 25 m outside the boundary of the Bayton St. Thomas Lutheran Cemetery. To avoid interrupting funerals or other ceremonies in Bayton St. Thomas Lutheran Cemetery, attempts will be made to notify the St. Thomas Lutheran Church of construction and maintenance schedules to facilitate avoiding noise and dust causing activities. Contact information will be posted at the cemetery, at least during construction, so individuals planning funerals or other ceremonies can contact the appropriate construction contractors to advise them when an event is being held to avoid interruptions by noise and dust. To mitigate any residual effects of changes to the Bayton St. Thomas Lutheran Cemetery because of altered surface or groundwater flow, the water table will be monitored and the extant burials be periodically checked for evidence of tilting headstones, cracked grave covers or new depressions with freshly faulted edges. This could be accomplished by a baseline photographic survey that is used as a comparative model to periodically check the cemetery as part of a follow up and monitoring program. Though it is not anticipated that the Project will interact with this site, to mitigate any residual effects of changes to the cemetery reported on Sturgeon Bay by Dauphin River First Nation, a preconstruction visit to the site with Knowledge Holders from the First Nation is warranted to facilitate avoidance by an appropriate distance.

6.12.2.3 Residual Effects and their Significance

Except for the effect on the Fairford Trail, potential effects on heritage resources will be confirmed after a preconstruction HRIA of the PDA is conducted under a valid permit. An HRIA will use predictive modelling to indicate locations of high heritage potential and examine and test those locations for heritage resources. If heritage resources are discovered at any of those locations, assessment by systematic testing will determine whether the resources are intact or disturbed. Intact resources, if required by HRB, will be mitigated through scientific salvage excavation.

Section 9.6.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. Residual effects are reduced through mitigation measures and the Cultural and Heritage Resources Protection Plan. Any inadvertent discoveries of heritage resources will be reported to provincial authorities, as required under provincial heritage legislation. If a cultural or heritage resource is inadvertently discovered, the protection measures for the resource(s) will be determined through processes outlined in the Cultural and Heritage Resources Protection Plan. Recorded cultural and heritage resources and their protection measures have been incorporated into the applicable environmental protection plan. The Environmental Protection Plans will also include the site and protection measures to be used for the ongoing protection of cultural and heritage resources during operations.

With the mitigations described above in place, no adverse residual effects regarding dust and noise, altered surface and ground water, or unmarked graves are anticipated.

A significant effect on heritage resources is one that results in the removal of the resource. For cemeteries, a significant effect is any disruption by ground disturbance or flooding/dewatering or disruption of use of an active cemetery. The determination of significance assumes that a preconstruction HRIA of the PDA will be completed and approved by the HRB and mitigations described above regarding the St. Thomas Lutheran Cemetery. Based on the assessment of the proposed effects of the Project on heritage resources and the proposed mitigation measures, the residual effects are considered not significant.

6.13 INDIGENOUS PEOPLES

6.13.1 Description of the Baseline Conditions

Baseline conditions for Indigenous people and communities were identified through a literature review that included community reports from Indigenous groups and Northern Affairs Communities (NAC) engaged on the Project, technical reports assembled by MI, Traditional Knowledge (TK) and technical reports for previous projects, and from open houses held for Project-related discussion. The various Indigenous peoples and communities that have participated in the engagement and consultation for this Project are described in Section 5.

A total of 39 Indigenous groups have been engaged on the Project, and several of these groups have identified traditional use resources, sites or areas, and cultural features within the LAA. The following Indigenous groups have reserves or community locations within the LAA and RAA: Pinaymootang First Nation, Little Saskatchewan First Nation, Lake St. Martin First Nation, Dauphin River First Nation, Dauphin River NAC, Peguis First Nation, Fisher River Cree Nation, Fisher River NAC, Lake Manitoba First Nation, and Kinonjeoshtegon First Nation. Members of the other 29 Indigenous groups engaged on the Project may choose to live and work within the LAA and RAA or travel to areas within the LAA or RAA to access services, temporary employment, or to harvest country food.

While many of the communities described in Section 5 have received some level of engagement with MI, several are still in the preliminary phases of engagement. Information in the EIS includes a community overview for each Indigenous group, where available, with information on Traditional Land and Resource Use (TLRU), including hunting, trapping, fishing, plant gathering, cultural and spiritual sites, habitation areas, and trails and travelways, that summarizes publicly available information.

6.13.2 Traditional Land and Resource Use

6.13.2.1 Changes to the Environment

Change in Availability of Traditional Resources for Current Use

Project pathways that could affect the availability of traditional resources include change in fish and wildlife habitat, change in wildlife movement, change in wildlife health or mortality, change in plant communities and diversity, and change in wetland functions.

Change in Habitat

Concerns about wildlife and wildlife habitat were raised by communities and Indigenous groups, including Dauphin River NAC, Dauphin River First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First Nation, Fisher River Cree Nation, Ebb and Flow First Nation, O-Chi-Chak-Ko-Sipi First Nation, Norway House Cree Nation, Kinonjeoshtegon First Nation, and Lake Manitoba First Nation.

Indigenous groups indicated existing effects to important spawning habitat such as Bear Creek, Dauphin River, Johnson Beach and Buffalo Creek. Additional changes would affect fishing resources, reducing preferred species such as walleye (pickerel), carp, and whitefish. Indigenous groups also made note of potential effects to fish spawning areas at the mouth of the Dauphin River and on Lake St. Martin.

Change in Fish and Wildlife Movement

The Project could also lead to changes in the distribution and abundance of fish in Lake St. Martin and Dauphin River through changes in fish access resulting from dewatering or water diversion. Fish movement and passage could also change due the realignment of PR 239, juvenile fish entrainment, or attracting adult fish to move downstream from Lake Manitoba and Lake St. Martin to Lake Winnipeg.

Concerns were noted by Dauphin River First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First Nation, Fisher River Cree Nation, Kinonjeoshtegon First Nation, and Lake Manitoba First Nation regarding the movement of fish between Lake Manitoba and the Dauphin River, an important migratory route used by whitefish moving to upstream spawning areas.

The linear channels bisect areas of wildlife habitat. Change in wildlife movement through fragmentation was identified as a potential pathway by Indigenous groups on other development projects. For the Bipole III Transmission Project, which involved linear corridors, Fox Lake Cree Nation was concerned with habitat fragmentation. Regarding the proposed Project, the addition of the outlet channels may alter wildlife movement through the LAA, affecting Indigenous use of traditional resources.

Change in Fish Health or Mortality

Concerns regarding fish stranding were raised by Dauphin River NAC, Dauphin River First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First Nation, Fisher River Cree Nation, Ebb and Flow First Nation, O-Chi-Chak-Ko-Sipi First Nation, Norway House Cree Nation, Kinonjeoshtegon First Nation, and Lake Manitoba First Nation. Further concern related to effects on the quality of fish as a result of the Project were noted by Dauphin River NAC, Dauphin River First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First Nation, Fisher River Cree Nation, Ebb and Flow First Nation, O-Chi-Chak-Ko-Sipi First Nation, Norway House Cree Nation, Kinonjeoshtegon First Nation, and Lake Manitoba First Nation.

Change in Plant Communities and Diversity

Dauphin River First Nation and Ebb and Flow First Nation indicated their concern for the historical loss of traditional use plant species, including berries and other edible plant species due to flooding or other unidentified factors. Lake St. Martin First Nation indicated that the flooding of Lake St. Martin has resulted in adverse effects to the harvesting of medicinal plants and herbs.

Change in Wetland Functions

During the Indigenous engagement program for the Project, potential effects on wetland function were identified by Dauphin River NAC, Dauphin River First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Pinaymootang First Nation, Peguis First Nation, Fisher River Cree Nation, Ebb and Flow First Nation, O-Chi-Chak-Ko-Sipi First Nation, Norway House Cree Nation, Kinonjeoshtegon First Nation, and Lake Manitoba First Nation.

Change in Access to Traditional Resources and Areas for Current Use

The Project has the potential to affect access to traditional resources or areas during construction and operation. Kinonjeoshtegon First Nation, Lake St. Martin First Nation, Little Saskatchewan First Nation, Peguis First Nation, Pinaymootang First Nation, and Dauphin River First Nation expressed concerns that increased uncontrolled access during construction will have effects on their hunting activities and success. Lake St. Martin First Nation and Peguis First Nation expressed concerns regarding hunting access issues arising from road construction. Manitoba Métis Federation citizens noted that they are restricted to practicing traditional activities on unoccupied Crown land, so projects that result in any change of access for Métis people are concerning. Black River First Nation indicated that previous projects led to concerns regarding increased access to traditional hunting areas for non-Indigenous hunters. Fisher River Cree Nation indicated concerns regarding reduction in access to hunting areas. Fox Lake Cree Nation expressed concern regarding changes in access due to development.

Dauphin River First Nation, Peguis First Nation, Kinonjeoshtegon First Nation, and Pinaymootang First Nation reported the use of important trails and routes, including snowmobile trails, to access fishing, hunting, and gathering areas. These snowmobile trails are intersected by the north end of the LSMOC,

and the Project will bisect these trails and prevent or alter access to hunting, trapping, and plant harvesting areas immediately southwest of Lake Winnipeg and in fishing areas in Sturgeon Bay.

Change to Cultural and Spiritual Sites or Areas

The Project has the potential to affect or disturb current use sites or areas during construction and operation, including sites and areas for cultural or spiritual practices, or archaeological and palaeontological sites and areas.

Tataskweyak Cree Nation voiced concerns with ongoing development in general and potential damage to sacred and burial sites. Fox Lake Cree Nation reported concerns over development impeding the ability to engage in traditional culture, practices, and beliefs, as well as permanently altering the landscape. Tataskweyak Cree Nation indicated their concerns regarding impacts to the cultural landscape and heritage resources, and the relationships that they have with them. Kinonjeoshtegon First Nation, Little Saskatchewan First Nation, Dauphin River First Nation, Lake Manitoba First Nation, Pinaymootang First Nation, and Peguis First Nation identified TLRU sites within the RAA, including gravesites and spiritual areas and features. The Provincial Archaeological Site Inventory identified six registered archaeological sites in the Interlake Region, with one of the sites located on Dauphin River First Nation lands and the remaining five sites located within or adjacent to Pinaymootang First Nation traditional lands.

Change to the Cultural Value or Importance Associated with Current Use

The Project has the potential to affect the cultural value or the importance associated with current use. As noted in the EIS Guidelines, this could include changes that affect the spiritual and cultural experiences of the activity or practice, as well as a sense of place and well-being, and the applicability and transmission of Indigenous knowledge, laws, customs, and traditions.

For Sagkeeng First Nation, ways of life, land, water, and animals are tied to Indigenous culture, making it impossible to divide each of these into discrete categories. Fisher River Cree Nation expressed concerns related to the potential effects of the Project on cultural experience including increased noise, dust, and light pollution. Manitoba Métis Federation indicated that community harvesters are likely to avoid areas where industrial development is obvious, as animals and plants in these areas are thought to have been disturbed. For Fox Lake Cree Nation, cultural identity is connected to ‘Aski’ - the land, water, resources, animals, and their interrelationships – and these things are integral to cultural identity. Tataskweyak Cree Nation noted, “Our culture, built around hunting, fishing and gathering, possesses knowledge accumulated over generations about how the non-human beings of Mother Earth interrelate with each other”.

6.13.2.2 Mitigation Measures

Mitigation measures provided for fish and fish habitat (Section 6.5), vegetation (Section 6.6), heritage resources (Section 6.12), wildlife (Section 6.7), and land and resource use (Section 6.8) are applicable for mitigating effects on traditional land and resource use. Additionally, the following mitigation measures will be implemented:

- Project-specific environmental management plans and monitoring programs will be developed and implemented to mitigate potential effects to fish and wildlife.
- a schedule of construction and Project activities will be made available to all Indigenous groups and NAC engaged on the Project, so that areas and time periods of activity can be avoided.
- MI will engage with Dauphin River First Nation, Peguis First Nation, Pinaymootang First Nation, and other Indigenous groups in order to better understand the use and importance of the snowmobile trails which are intersected by the LSMOC and to develop suitable means of crossing the LSMOC following construction.
- an appropriate ceremony will be held prior to commencement of construction under the direction of local Indigenous knowledge holders.

Manitoba Infrastructure has included all available (to date) traditional land use and land use needs as currently provided by Indigenous Groups in the Environmental Impact Statement (EIS). Manitoba Infrastructure is supporting additional traditional knowledge studies through Consultation agreements with Indigenous Communities.

The manner to which traditional land use information will be collected is outlined in the document entitled “Indigenous Consultation Approach and Current Status” (ICACS) in Appendix C of the EIS This report further describes information provided in the EIS and will be provided separately and is intended to be incorporated into the EIS.

6.13.2.3 Residual Effects and their Significance

The Project is anticipated to result in changes to the availability of traditional resources for current use through alteration, reduction, or loss of habitat. Although the specific degree to which the PDA is being accessed for traditional purposes is not known, it is conservatively assumed that the Project will restrict access to traditional resources, current use sites, or locations.

Section 10.2.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. The residual environmental effects from the Project on TLRU are predicted to not be significant. The Project will not result in the long-term loss of availability of traditional use resources or access to lands currently relied on for traditional use practices, or the permanent loss of traditional use sites and areas in the LAA and RAA. It is also anticipated that changes in value or importance associated with current use will be largely limited to the PDA and direct disturbance areas, and with mitigation and continued engagement with Indigenous groups, that effects can be mitigated.

6.13.3 Indigenous Health and Socio-economic Conditions

6.13.3.1 Changes to the Environment

The Project has the potential to affect Indigenous health conditions through changes in air quality, water quality, soil quality and noise levels. Reductions in the quantity and availability of country foods and the perceived value or quality of country food may also occur.

The Project has the potential to affect Indigenous socio-economic conditions by altering land and resource activities that Indigenous people are engaged in, such as commercial fishing, trapping and forestry. Changes may also take place through changes to farming and agricultural activities or recreation and tourism. The Project's construction workforce may increase demand for the temporary accommodations and place demanded on community infrastructure and services which are used by Indigenous people. Project related traffic may result in congestion on roads used by Indigenous people. Project employment, expenditures and population growth related to development can result in positive and adverse effects which will extend to Indigenous people because they account for a large proportion of the population near the Project Development Area. Local, regional, and provincial businesses, including Indigenous-owned businesses, could benefit from Project and consumer-related spending. Adverse economic effects might occur when the labour, goods and services required for the Project exceed the existing capacity, potentially leading to supply issues and cost increases and subsequently effect Indigenous people living in the immediate Project region

6.13.3.2 Mitigation Measures

Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous health conditions include those identified in the land and resource use (Section 9.2), infrastructure and services (Section 9.3), economy (Section 9.4), health (Section 9.5), and TLRU (Section10.1) assessments. No additional mitigation measures have been identified to address effects on Indigenous health and socio-economic conditions. MI will continue to engage with Indigenous groups regarding the proposed mitigation measures.

6.13.3.3 Residual Effects and their Significance

Section 10.3.1.5 of the EIS further describes the various criteria (direction, duration, magnitude, timing, geographic extent, frequency, reversibility, and context) that characterize the potential residual effects that remain after mitigation measures have been implemented. No changes are expected to surface water quality, groundwater quality, soil quality, or chemical quality of country food as a result of the Project. Although some alteration of behavior will be required to continue harvesting country foods, changes to current use practices will not be critically reduced. Noise levels are not anticipated to affect public health and welfare. Overall, residual effects on Indigenous health conditions are anticipated to be not significant.

The reductions in lake levels and flood levels in Lake St. Martin as a result of the Project will provide positive effects to agricultural land use within Lake St. Martin First Nation, Little Saskatchewan First

Nation and Pinaymootang First Nation. Residual effects on commercial fishing, trapping, forestry, and recreation and tourism are expected particularly during construction; however, it is anticipated that the activities will be able to continue at similar levels as under baseline conditions. Changes to accommodation will take place during Project construction but are not anticipated to persistent and ongoing. MI's Environmental Management Program (Section 2.5) will include a traffic management plan and emergency response plan to mitigate residual effects on community infrastructure and services. Positive effects on infrastructure and services are anticipated during operations when the Project will alleviate flooding in low-lying areas and roadways and other infrastructure that may otherwise be flooded may remain operational. Changes in labour force and regional economy are unlikely to pose a substantial risk or benefit to the economy. It is expected that residual effects can be managed through the Project's labour and training strategic action plan and mitigation which increase Indigenous participation. Overall, residual effects on Indigenous socio-economic conditions are anticipated to be not significant.

6.13.4 Aboriginal and Treaty Rights

All the First Nations engaged by the Project are signatory to Treaties 1, 2 or 5, which provided historically defined treaty rights. Indigenous groups without historic treaty consist of the Manitoba Métis Federation and the residents of the identified NACs, and the Supreme Court of Canada has determined that non-status Indians (and Métis) have the same Aboriginal rights as status people.

Section 10.4.1.5 of the EIS further describes the various criteria that characterize the potential residual effects that remain after mitigation measures have been implemented. Residual effects on Aboriginal and Treaty rights are anticipated as a result of the disposition or conversion of Crown Land and changes to TLRU (changes in the sites, resources, and access relied upon to practice activities such as hunting and fishing). Minimal disruption to the ability to exercise rights is anticipated and the seriousness of effects is minor. This categorization considers that: the persistence and viability of species relied upon to exercise Aboriginal and Treaty rights within the RAA are not anticipated to change as a result of the Project, it is anticipated that activities related to the exercise of Aboriginal and Treaty rights will be able to continue with some restrictions and alteration of behaviour by members of Indigenous groups, and that the Crown land within the TLRU LAA will remain available for the exercise of Aboriginal and Treaty rights.

6.14 CUMULATIVE EFFECTS

The assessment of cumulative effects followed the same procedure used in the Project Effects Assessment sections presented in Sections 6.1 through 6.13. The approach used an evaluation of Project construction and operations that includes consideration of overlapping infrastructure and the effects from reasonably foreseeable projects. The approach included; the selection of appropriate VCs (those that have residual effects based on the Project-specific assessment); development of a Project Inclusion List (other past, present or future projects or physical activities that may interact cumulatively with the Project); describing the context (in terms of the regional landscape of southern Manitoba); examining effects for construction and operations; and developing mitigation measures and determining residual effects. The cumulative effects assessment found that in all cases, the Project effects are the dominant contributor to the future cumulative effects. As a result, mitigations proposed for the Project effects was considered

adequate to address cumulative effects and the Project contribution to cumulative effects is not significant for all VCs. The overall purpose of the Project is to result in a positive effect by reducing the outcomes of a major natural flood on some of the human and natural values in that region.

6.15 ACCIDENTS AND MALFUNCTIONS

The following four accident and malfunction scenarios were determined based on professional judgment, experience with similar projects, and, in consideration of comments provided by agencies, Indigenous groups and the public:

- breach or overtopping of channel dikes, and/or failure of control structures
- spill of hazardous materials
- fire
- collisions of vehicles, with other vehicles, people or wildlife

The assessment examined potential interactions among VCs and addressed site-specific sensitivities and potential pathways of effects. It also described the safeguards established to prevent such occurrences and the contingency and emergency response procedures that will be put in place if such events were to occur. Project and cumulative effects of each accident or malfunction on each VC are described and the significance of the effect is determined using the same thresholds as those for the Project environmental effects. Any event that results in human mortality was considered significant. The potential for, and consequence of, accidents and malfunctions were assessed considering information from Manitoba Infrastructure's experience and for other similar projects, as it has been successfully constructing and operating flood control projects for several decades.

The Project Environmental Management Program and the various health and safety programs include specific protection, management and monitoring plans that include measures to prevent accidents and malfunctions. The assessment of accidents and malfunctions concluded that the mitigation measures for such occurrences would result in effects that are not significant, with the following exceptions:

- any event that results in a human fatality
- spills that destroy habitat for vegetation, wildlife or fish species of conservation concern
- fires that destroy critical habitat or affect agricultural land so that current operations cannot continue, or land use and traditional land and resource use cannot continue as presently carried out

With the environmental protection plans, mitigation measures and emergency response plans in place, the likelihood of significant environmental or socio-economic effects occurring is low.

7.0 FOLLOW-UP AND MONITORING PROGRAMS

7.1 APPROACH

The proposed preliminary environmental follow-up and monitoring programs for the Project are outlined below for each VC. Final follow-up and monitoring plans will rely on approval conditions (both provincial and federal), future refinement of Project planning, and the results of ongoing consultation with Indigenous groups and stakeholders; and include guidelines for preparing monitoring reports (e.g., number, content, frequency and format). After the Project is approved, MI will follow government procurement policies and procedure with respect to labour, and goods and services, in terms of carrying out the programs. Manitoba Infrastructure is willing to discuss possible monitoring opportunities with Indigenous groups.

7.2 ATMOSPHERIC ENVIRONMENT

Follow-up and monitoring are not proposed for atmospheric environment. However, in terms of acoustic environment, while not anticipated, monitoring may be required in the event of residential complaints related to construction noise.

7.3 GEOLOGY AND SOILS

Most follow-up and monitoring recommendations for geology are described under the groundwater topic because effects are more closely related to those on groundwater. Since there are no residual effects to geology, no follow-up is required. Monitoring for soils to confirm the effectiveness of mitigations applied will include monitoring soil salvage during construction, including soil excavation, handling and stockpiling to confirm appropriate soil salvage and maintenance of soil quantity; and, periodic monitoring through construction of soil stockpiles to confirm adequate stabilization and erosion control.

7.4 GROUNDWATER

The objective of the hydrogeology follow-up and monitoring program is to determine whether there are changes to the volume/accessibility or quality of the groundwater in the LAA as a result of construction or operations, and to update and implement mitigation measures and response plans accordingly. The effects of the Project on groundwater and domestic water wells have been noted as a concern by landowners in the area and by local Indigenous groups. A follow-up and monitoring program will improve and validate hydrogeological interpretations and monitor the effects of dewatering operations on groundwater in the LAA. Monitoring will be carried out to further investigate groundwater in the LSMOC area; and, further aquifer investigation and modelling will be done to determine the effect of construction dewatering on specific domestic water wells in the potentially affected LMOC area. The analyses of effects of dewatering will be communicated to local well users that may be affected; developing mitigation plans will involve working with those users. Additional observation wells will be installed prior to

construction dewatering to monitor the effects in the area during dewatering of each section during construction. Mitigation plans will be modified if/as required during dewatering as specific information is received from observation wells and local well users.

7.5 SURFACE WATER

Water levels and flows, as well as ice forming processes, will be managed and monitored by Manitoba Infrastructure in accordance with the Operating Guidelines developed for the Project. The changes in flows and water levels caused by the Project may have minor effects on fluvial geomorphology, sediment and debris transport, and ice processes in the LAA, but primarily during and immediately after construction. As such, the purpose and objectives of follow-up activities will be to monitor and further understand the residual effects on surface water hydrology due to the Project.

Once the Project is constructed and in operation, water levels and flows in Lake Manitoba, Lake St. Martin and the Fairford and Dauphin Rivers will be managed in accordance with the Operating Guidelines developed for the Project. The residual effects of the operation of the Project on regional flows and lake levels includes a reduction in peak flood levels, reduced flood inundation areas, and an increase in the amount of time that Lake Manitoba and Lake St. Martin are within the regulated range. These effects are a desired positive outcome and objective of the Project, and, as such, there are no mitigation or follow-up activities required.

There are no predicted adverse changes to overall surface water quality in the regional or local area waterways because the composition and volume of water being transported from Lake Manitoba to Sturgeon Bay is not altered by the Project.

An Aquatic Effects Monitoring Plan (AEMP) is being developed for Project regional waterways and will include the continued collection of surface water samples from regional and local waterways, and analyses of a suite of parameters that will provide information on surface water quality in the Project area during Project construction, operation and maintenance activities. The purpose and objective of surface water quality monitoring will be to document existing surface water quality conditions prior to the commencement of clearing or construction of the proposed outlet channels and provide ongoing monitoring of watercourses and waterbodies in the Project region during construction, operation or maintenance activities. The data and analyses generated by monitoring will be used to provide information on the effectiveness of mitigation measures, aid in the validation of predicted residual effects, and provide data and results required for environmental regulatory approvals requirements.

7.6 FISH AND FISH HABITAT

An AEMP will be developed to monitor the measurable parameters for each potential pathway of effect with the greatest likelihood of occurrence and/or greatest potential consequence to fish and fish habitat. Monitoring conducted under the AEMP will focus on the primary effects on key components of fish and fish habitat, rather than addressing all potential changes. Components monitored as part of the AEMP will include water quality, particularly TSS concentrations; the quality and quantity of fish habitat; lower trophic

communities; and focal fish populations abundance and distribution. Monitoring results will be used on an ongoing basis to assess the need for modifications to prescribed mitigation measures and monitoring, and to confirm compliance with the regulatory requirements of the Project. Monitoring results will be reported on a timely basis in compliance with provincial and federal legislation and any Environment Certificate or permit conditions issued to the Project.

7.7 VEGETATION

Follow-up and monitoring of Project effects on vegetation will be implemented to determine the effectiveness of mitigation measures to address changes to the vegetation and define additional actions that may be needed if mitigation measures are not effective. As such, the follow-up and monitoring program will assess the success of reclamation measures and obtain additional pre-construction data to information mitigation and determine whether unexpected effects are occurring. Additional pre-construction surveys for species of conservation concern (SOCC) will be conducted to further evaluate occurrences in the PDA and identify areas requiring mitigation. Surveys will focus on areas of low sampling density including patches of remnant native vegetation along the LMOC and PR 239 re-route, and areas of higher rare plant potential along the LSMOC PDA (e.g., transition areas from wetland to upland and areas of shallow bedrock). Shortly after construction, monitoring will be focused on assessing the rate of establishment of a healthy vegetation cover, and the quick recognition and mitigation of soil erosion. Soil monitoring will focus on compaction, erosion and areas of poor vegetation growth. Changes to wetland vegetation adjacent to the PDA will also be monitored following Project construction.

7.8 WILDLIFE

The Environmental Management Program (see Section 2.5) will include a Wildlife Monitoring Plan (WMP), developed to provide detailed methods on how predicted changes to wildlife habitat availability and wildlife movement will be verified and how the effectiveness of mitigation strategies will be evaluated. The WMP will provide details on the design, methods, and schedule for all mammal, bird, and amphibian survey and monitoring programs.

Species at risk (SAR) monitoring will focus primarily on ground-based point count surveys for species most likely to be affected by the Project, such as red-headed woodpecker, and eastern whip-poorwill. Pre-construction surveys will focus on identifying occupied habitats within the PDA and LAA to aid in species-specific mitigation efforts during construction. Surveys during the construction and post-construction phases will focus on previously occupied habitats (i.e., from pre-construction surveys) to assess the effectiveness of mitigation measures and reclamation and/or restoration efforts.

For mammals, monitoring may involve a remote camera study along LMOC and LSMOC in order to capture presence/absence or occupancy data for wide-ranging large bodied species and/or predators. Additional monitoring for birds may also include surveys to assess potential Project effects to other sensitive habitats within the LAA. The WMP will include, in consultation with federal regulators, the development of a red-headed woodpecker and/or eastern whip-poor-will mitigation and offset plan to further mitigate a change in habitat for SAR whose critical habitat may be affected by the Project.

Components of the plan include commitments to gather additional field information on SAR and SOCC occurrence prior to construction; measures to manage effects on SAR and SOCC; measures to restore SAR and SOCC habitat, including within the ROWs; and the implementation to include monitoring the effectiveness of offsets, restoration efforts, and/or land parcels set aside for SAR. General compliance monitoring during Project construction for sensitive wildlife features and habitats will also be undertaken.

7.9 LAND AND RESOURCE USE

Land and resource use activities within the RAA are the subject of ongoing planning, management, regulatory enforcement and monitoring by the federal, provincial and municipal governments. This includes monitoring and the collection of information on, for example, municipal land use, hunting and angling activity and development for the purpose of licensing, enforcement and resource management.

MI has provided and will continue to provide Project information to relevant agencies and organizations as required and requested. Monitoring would include identifying the locations of manure stockpiles so they can be relocated to appropriate areas outside the LMOC PDA in cooperation with landowners. In addition, the Biosecurity Management Plan to identify biosecurity issues and risk sites and risk types will include landowner communication and monitoring to confirm that mitigation measures such as equipment cleaning and disinfection are being carried out.

7.10 INFRASTRUCTURE AND SERVICES

No follow-up monitoring plans for the effects on infrastructure and services have been identified.

7.11 ECONOMY

No follow-up monitoring plans for the economic effects have been identified.

7.12 HUMAN HEALTH

Follow-up and monitoring for human health is typically based on the outputs of physical environment monitoring, such as air and water quality. No air quality monitoring is currently envisioned, so examination of results from a health perspective will be based on groundwater monitoring (Section 7.4) and surface water monitoring (Section 7.5). If results indicate that applicable quality standards are exceeded, a human health risk assessment may be necessary to determine whether the noted changes represent a potential human health risk.

7.13 HERITAGE RESOURCES

Monitoring heritage resources is important prior to and during construction to identify and recover any artifacts unearthed, record the site context, and make decisions as to how to manage them if they are at risk. Manitoba Infrastructure and its construction contractors will abide by requirements issued by the regulator for site avoidance, excavation or heritage resource monitoring.

Follow-up and monitoring for heritage resources will include a pre-construction heritage resources impact assessment (HRIA) and construction monitoring of areas of high heritage resource potential based on the results of the HRIA. Confidential HRIA reports will be filed with the Province, as required under archaeological investigation permits. During construction, any inadvertent discoveries of heritage resources will be reported to provincial authorities, as required under provincial heritage legislation.

7.14 INDIGENOUS PEOPLES

Follow-up and monitoring requirements specific to traditional land and resource use, Indigenous health and socio-economic conditions, and Aboriginal and Treaty rights have not been identified. The current planned approach will be to share the results of other relevant monitoring (fisheries, wildlife, etc.) with communities as part of the ongoing engagement process (see Section 5). This will also be used to share and discuss the anticipated effects of the Project and efficacy of proposed mitigation. If any need for follow-up and monitoring is identified through ongoing engagement, MI will discuss this with Indigenous groups.

8.0 CONCLUSION

The purpose of the Project is to develop a permanent flood control management system for Lake Manitoba and Lake St. Martin to alleviate flooding in the Lake St. Martin region, which, in the past, has resulted in unprecedented inflows into Lake Manitoba and Lake St. Martin, overwhelming the capacity of existing waterways in the region and resulting in overland flooding that affected local Indigenous communities, landowners, cottagers and many other communities in the region. The EIS documents an assessment of the potential changes to the environment as a result of the Project, which determined that, with the implementation of the proposed commitments and mitigation measures, adverse residual environmental effects of Project-related construction and operation are predicted to be not significant for all aquatic, terrestrial and human VCs. Subject to regulatory approvals in 2020, the Project is scheduled to be functionally operational in the spring/summer of 2023.

Attachment A SUMMARY OF PUBLIC ISSUES AND CONCERNS

Summary of Public Issues and Concerns

Land and Resource Use	Concerns regarding land restrictions in the channel right of way and in the remnant parcels being designated for wildlife instead of haying, causing illegal hunting and wildfire concerns
	Loss of agriculture, agricultural land, and economic benefits from agriculture in the area
	Impacts to local commercial fisheries
	Concern that the project is not moving forward quickly enough, and the risks of flooding to the area in the meantime
	Impacts to First Nations and loss of beaches, traditional medicines, fish, and moose, powwow and teaching areas
	Concern regarding unwanted trespassing, cottage development, and illegal hunting from the access to the Project area (vehicular access and ATVs)
	Inconvenience of travelling further to access lands
	Impacts to Watchorn Park and Watchorn beach, including dredging silt
	Land expropriation concerns, including timelines, unknowns, and compensation
	Safety concerns for children in vicinity of the channel
	Concerns about the ability for the channel to mitigate flooding
	Concerns regarding the operation of the Portage Diversion, including the salinization of soils in flooded areas
Infrastructure and Services	Concerns regarding traffic interruptions and re-routing traffic during construction
	Impacts to groundwater sources, including loss of water supply for cattle near the channels
Economy	Loss of taxable land and tax revenue for the RM
	Impacts to tourism and associated economy, including recreational fishery
	Impacts to commercial fishing and trapping
	Concern that haying will not be allowed in the channel right of ways
	Costs of maintenance of the outlets, including deposition and dredging of silt
	Concern that the project will Impact agriculture for the sake of preserving wetlands and wildlife
Health	*E.coli* contamination from agricultural drainage to the area
	Impacts to source water (surface and groundwater) for drinking
	Issues associated with the introduction and spread of water hemlock, causing rashes
Heritage	Impacts to archaeological resources, including artifacts near Watchorn park
Air Quality, Acoustics, Lighting	Impacts to air quality need to be considered in the EIS
Geology and soils	Concern about sediment transport and sediment deposition downstream
	Potential for vast impacts to shorelines if another flood is to occur in the area with the project being delayed

Summary of Public Issues and Concerns

Surface water	Impacts to shoreline damage/erosion especially given the wind effects and associated sediment and debris transportation
	Contaminant movement from one waterbody to another
	Formation of frazzle ice at the mouth of the Dauphin River
	Potential for groundwater and surface water interactions causing water contamination issues
	Concern regarding regulated water levels, including potential that water will back up and affect Pinemuta Lake and cause flooding in constricted areas (e.g. the narrows)
	Water quality impacts including increased algae, pesticides, and nutrients downstream
	Impacts to the larger watershed, including issues with the continued operation of the Portage Diversion (contaminant transport, soil salinity, and impacts further downstream than the identified assessment area
Groundwater	Impacts to local groundwater volume and quality during construction and associated impacts to cattle operations that rely on groundwater availability
	Impacts to well and septic systems
	Potential for Project to cause groundwater/surface water interactions and contamination to source water
Aquatics	Concern that the spatial boundaries identified are inadequate to study the far-reaching downstream impacts
	Impacts to wetlands and wetland drainage associated with the project
	Concern that the channels will provide optimal habitat for breeding of invasive species (e.g. carp, zebra mussels)
	Concern that the channels will transport micro-organisms (e.g. E.coli) and change the shorelines and local ecosystems
Fish and Fish Habitat	Impacts to fish movement, including fish passage and fish migration in smaller drains and spawning habitats
	Impacts to fish and fish habitat, including locating the channel inlets and outlets in spawning bays for important fish species (including whitefish)
	Impacts to fish habitat from sediment transport and deposition through the channels
	Project having cumulative impacts to fish populations that are already being felt (e.g. loss of perch in the area)
Vegetation	Potential for weeds and invasive species in the channel right of ways and the need for weed control
	Potential for impacts to vegetation in the riparian zone, shorelines need to be protected from erosion
	Concern for impacts to wetlands and reeds in Delta Marsh and that water levels will not be allowed to fluctuate like they would naturally, letting vegetation re-establish

Summary of Public Issues and Concerns

Wildlife	Impacts and disturbance to small animals, birds, waterfowl, and migratory birds that nest in the Project area and fox dens that exist near the planned channel control structures
	Issues with beavers and beaver dams from the vegetation near the channel and the need for beaver control
	Concern on the disturbance to animals during construction and the ability of animals to evacuate the area once constructed
	Cumulative impacts to the loss of moose and elk that is currently felt in the area
	Increase of ravens to the area and the associated impacts to calves and smaller birds/eggs
	Impacts to species at risk and migratory birds, including flooding of shoreline nests and impacts to woodpecker habitat
	Concern that the project was selected to be located on high ground given that waterfowl could adapt
	Potential for the standing water in the channels to create mosquito habitat and cause a nuisance
	Impacts to wolves, moose, deer, and grouse in the area
	Loss of frogs, snakes, and pelicans on Lake Manitoba due to flooding and introduction of coyotes.

Attachment B SUMMARY OF INDIGENOUS ISSUES AND CONCERNS

Summary of Indigenous Issues and Concerns

Land and Resource Use	navigation
	Change in water level regulation impacting governance and decision-making with land and water
	Loss of farmland, namely hay land, due to flooding on Lake St. Martin
	Loss of hay land due to fluctuations in water levels on Lake Pineimuta as an issue that needs to be addressed by the Province
	Benefits of the Project are primarily to address agricultural interests on Lake Manitoba
	Impacts to recreation and tourism in the area (e.g. boating, recreation access, camping, and potential for increased recreation)
	Wider effects of the Project on commercial fisheries and need for compensation for adverse effects
	Damage to equipment from debris moving to Lake Winnipeg affecting traditional fishing grounds
	Increased access to the area benefitting potential for further development of peat mining industries
Infrastructure and Services	Number and control of access roads connected with the Project
	Increase in vehicle traffic and potential for vehicle-wildlife collisions
	Impact of road works including traffic diversions
Economy	Potential impacts to commercial fishing and forestry in the area impacting local economies
	Need for compensation for adverse effects on resource-based industries, including commercial fisheries and
	Need for opportunities for economic participation in the Project, including training and mentoring
	Concerns regarding lack of local spending by Project-related contractors (gas/hotels) for Indigenous owned businesses
Health	Impacts to domestic drinking water supply, including source water contamination and expenses to water treatment systems from new or increased levels of contaminants
	Health of fish for consumption, including potential for mercury contamination from the Project
Heritage	Loss, damage, or disturbance of areas of cultural, historical, archaeological, paleontological, or architectural significance through Project related disturbance
Traditional land and resource use	Impact on fishing grounds (e.g. depleting fish stocks, project debris, contamination of fish)
	Damage to equipment from debris in Lake Winnipeg affecting traditional fishing activities
	Impacts on hunting and trapping (e.g. reduction in vegetation, moose populations and animal movement, land access)
	Impacts on gathering and access to traditional areas (e.g plants for medicine, berries, eagle feathers, and traditional foods (including fish).
Air Quality, Acoustics, Lighting	Altered cultural experience due to light, dust, and noise effects and the presence of permanent structures.

Summary of Indigenous Issues and Concerns

Geology and soils	Concerns related to channels ability to reduce flooding and the safety and stability of the channels
	Concerns related to increased erosion and the potential to increase sediment and debris in surface water and from runoff from farmland
Surface water	Concerns about the channels affecting surface water regimes and flood waters moving towards communities and back down the channel instead of following natural drainage patterns
	Concerns that the channel will increase water levels and increase shoreline erosion and downstream debris and sedimentation
	Changes in flow, including increased water levels during peak flow events and potential for flooding
	Water quality effects including contamination of water bodies from transport of farmland runoff (pesticides/nutrients), and mercury
Groundwater	Concerns that components of the Project including, excavation during the construction and operational phases could impact groundwater, aquifers and residential drinking wells. Potential for contaminants entering water during construction, including spills from construction practices and machinery
Aquatics	Change in mercury accumulation in aquatic biota
	Effects on headwater lakes and streams
	Change in groundwater/surface water interactions important to fish
Fish and Fish Habitat	Introduction of invasive species (e.g., zebra mussels) resulting from the Project
	Fish mortality due to stranding in the channels
	Impacts to spawning areas, including loss of habitat/change in shoreline morphology
	Changes in fish migration patterns
	Change in water quality
	Changes in fish health and quality from surface water contaminants (e.g. mercury)
	Need for monitoring of fish population and hatcheries/stocking fish ladders
Vegetation	Reduction in vegetation (including vegetation for harvesting) and access to vegetation
	Requirement for ongoing monitoring of vegetation
	Protection of existing wetlands from drainage
Wildlife	Flooding and debris have impacted the numbers of moose, deer, grouse and rabbits in the area
	Disturbance of wildlife and wildlife habitat due to Project construction and operation
	Increase in wildlife mortality due to potential vehicle-wildlife collisions from increase vehicle traffic associated with project construction/operation
	Potential impact on wildlife from increased hunting to the area with increased access