

# LAKE WINNIPEG REGULATION REPORT 2015





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September 11, 2015

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Honourable Tom Nevakshonoff  
Minister of Conservation and  
Water Stewardship  
Room 330 Legislative Building  
450 Broadway  
Winnipeg, Manitoba R3C 0V8

Re: Lake Winnipeg Regulation Hearing

Dear Minister Nevakshonoff:

The Panel is pleased to submit the Clean Environment Commission's report with respect to the Lake Winnipeg Regulation Public Hearing.

[REDACTED]  
Terry Sergeant, Chairperson

[REDACTED]  
Neil Harden

[REDACTED]  
Bev Suek

[REDACTED]  
Edwin Yee



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# Foreword

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In the summer of 2011, the Minister of Conservation asked the Clean Environment Commission to hold hearings seeking public input on Manitoba Hydro's request for a final licence for Lake Winnipeg Regulation. Given the long and, sometimes, controversial history of this project, these hearings would give the public an opportunity to express their concerns.

It would be an understatement to say that this proceeding is different from the usual hearings that the commission undertakes. First, this proceeding was not conducted under *The Environment Act*, under which the Clean Environment Commission is established and given its authority. It is also under this act that the commission is asked to review certain applications for an environmental licence to develop a project, or to review broad issues of environmental concern. The Lake Winnipeg Regulation licence, under consideration in this review, is issued under *The Water Power Act*, which, while it allows for the minister to call for a hearing, has no requirement for a public review.

Second, there was no environmental assessment to be assessed. This is not a requirement of *The Water Power Act*. Furthermore, at the time of construction of the facilities for Lake Winnipeg Regulation, environmental assessment was not a legal requirement.

Finally, this project is not one awaiting an environmental licence to proceed. It was constructed four decades ago; and has been in full operation since 1976. As such, there was no looming deadline for issuance of a licence so that development could proceed. This explains why this report is only going to the minister now, four years after being referred to the commission for a public review. Subsequent to receiving this referral, the commission was asked to conduct reviews of licence applications for the Bipole III Transmission Project, as well as the Keeyask Generation Project, both of which took precedence over the Lake Winnipeg Regulation review.

Under *The Water Power Act* and *Regulation*, Manitoba Hydro is entitled to a final licence upon fulfillment and compliance with the terms and conditions of its Interim Licence. This would seem to indicate that Hydro would have a fairly easy test to meet, one that would not be subject to much scrutiny. However, given that there is a large and diverse amount of public interest in matters related to Lake Winnipeg, in general, and to its regulation, in particular, the minister asked the commission to conduct this review.

As we conducted this review, two truths became very obvious. One is that Lake Winnipeg is in serious trouble. This is not a

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surprise to Manitobans who have followed the problems of the lake in recent years. It was already well known to the commission from experience in previous reviews. The second truth is that Manitoba Hydro and, to a lesser extent, the Province of Manitoba have a communication problem when it comes to matters relating to the lake. We found much misunderstanding about the state of the lake.

While we were not asked to look at the state of Lake Winnipeg, we did hear much – in all communities – which we cannot ignore, about which we cannot help but have some opinions, and which we will share in this report. Although much of this is outside of our mandate, expectations may have been raised that the many and varied concerns we heard will be addressed.

There is, in particular, a widespread lack of understanding as to what Lake Winnipeg Regulation is, what its purpose is, and how it operates. The belief that Manitoba Hydro controls the levels of the lake and keeps the lake at higher than normal levels is so pervasive, it will be extremely difficult to change views.

Prior to embarking on our work in this review, the commission asked Manitoba Hydro to prepare documentation to assist us and the other parties engaged in these proceedings. To the extent possible, we asked that this be done in a manner not unlike an environmental impact assessment. Given that the project is four decades old and that no baseline information would be available, we did not expect a traditional impact assessment. In the end, Manitoba Hydro generated new documentation, as well as a long and comprehensive list of historical documents relevant to the project. In spite of the recognized limitations, Manitoba Hydro did produce a comprehensive report on Lake Winnipeg Regulation.

Not only did the documentation, especially the historical information, provide for interesting reading, it contributed significantly to the overall review process.

As I have written in past reports, the Clean Environment Commission takes very seriously the important role in environmental protection given it by *The Environment Act* of Manitoba. The commission seeks to fulfill this mandate, in part, by offering advice that we believe will contribute to improving the art and science of environmental assessment, which, in turn, will better protect the environment.

In recent reports, the commission was critical of both the Manitoba government and Manitoba Hydro for what we perceived to be a lack of attention to this goal. In the last year or two and, in particular, during the Lake Winnipeg Regulation hearings, the commission began to see that both the government and Hydro have turned an important corner. Through policy and legislative initiatives, the province is addressing many of the elements the commission believes to be critical to improved environmental assessment. We are of the view that “TomorrowNow – Manitoba’s Green Plan” will prove to be an important step in this. We are further of the view that many of the recommendations we make in this report can be incorporated into the management strategies that flow from this plan.

Manitoba Hydro, in the course of these hearings, went so far as to ask the commission to give advice to the minister that would lead to new approaches in environmental assessment. Hydro asked that the commission set out a “road map” to guide future environmental assessment and environmental licensing. The commission welcomes this new, open approach of Manitoba Hydro.

In this report, we will offer advice in this

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regard. This advice will not result in the “last word” in the licensing process. But we believe it will be one more positive step towards the goal.

In the coming years, a number of existing Manitoba Hydro facilities will come due for relicensing. These will include all but one of its 15 generating stations, as well as Lake Winnipeg Regulation and Churchill River Diversion, which will need to be relicensed in the next decade. While there is no legal requirement that these relicensing applications be subject to a full environmental assessment, the commission would strongly encourage the Manitoba government to do so and to hold public hearings to review these assessments.

A well-defined, more open and comprehensive review process will significantly smooth the path for these reviews. It will also benefit any reviews of other applications for environment licences.

The recommendations made in this report will not be easy to implement, in particular to do so in a timely manner. The commission believes that much work needs to be done in a relatively short time – by both Manitoba Hydro and the Government of Manitoba.

If the recommendations and advice given are implemented quickly, the commission will take some pride in having made another important contribution towards ensuring a better environment in our province.

## Acknowledgements

As with any hearing process conducted by the Clean Environment Commission, many people made significant contributions. I would like to acknowledge the great work done by these folks. My co-panelists included Neil Harden, Beverly Suek and Edwin Yee. Special thanks are due to the very skilled and dedicated commission staff: Cathy Johnson, Joyce Mueller and Amy Kagaon. We received great assistance from Melissa Hotain in liaising with the many Aboriginal communities where we held meetings. Our legal advice came from Michael Green, William Bowles and Kelly Dixon. Our report writer was Bob Armstrong. Finally, we were ably supported by a team of consultants and service providers, without whom we would have had great difficulty navigating this process. In particular, I would like to acknowledge Phil Shantz and George McMahon.

Finally, I would like to acknowledge the many people – members of the public – who took part in our proceedings, attending the meetings to share their stories and concerns. Their knowledge and personal experience added much insight into the issues before us.

**Terry Sargeant**  
**Chair, The Clean Environment Commission**  
**September 2015**



# Executive Summary

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In July 2011, the Minister of Conservation asked the Clean Environment Commission to conduct hearings into the application by Manitoba Hydro for a final licence for Lake Winnipeg Regulation (LWR). The LWR project, which went into operation in 1976, regulates the level of Lake Winnipeg to provide a reliable supply of water for Manitoba Hydro's Nelson River generating stations and to reduce the extent of flooding in communities around the lake. Manitoba Hydro was issued an Interim Licence in 1972 and the project was completed and put into operation in 1976. After approximately 40 years of operation, Manitoba Hydro applied for a final licence. This licence will be for 50 years from the time the project was put into operation. The final licence for LWR will, therefore, expire in 2026, at which time Manitoba Hydro will require a new licence.

In conducting these hearings, the commission was asked to review the public policy rationale for LWR, hear evidence on its effects, consider successes and failures of these policy goals, and comment on the concerns raised regarding Manitoba Hydro's application for a final licence. After a delay caused by the need to conduct hearings on Manitoba Hydro's Bipole III Transmission Project and Keeyask Generation Project, the commission began hearings in January of 2015. A series of hearings was held until early May, in which the commission heard from approximately

300 individuals in 20 communities and received a number of written submissions. Many Manitobans spoke about personal experiences with Lake Winnipeg, the Nelson River, and other water bodies. Technical analysis was provided by experts on behalf of Manitoba Hydro, several of the participating organizations and the commission itself, which retained several specialists to provide insights into important matters related to LWR.

This process has underlined, for the commission, the need for Manitoba to address a wide range of watershed management issues affecting Lake Winnipeg and the Nelson River. It has also prompted the commission to recommend a roadmap for future relicensing reviews of other Manitoba Hydro projects. The intent of this roadmap is to help to assess the past and current impacts of these projects and develop operational rules for them that could mitigate or reduce future impacts and balance economic, social and environmental concerns.

Ultimately, the commission believes that, based on evidence it has seen and heard, Lake Winnipeg Regulation has reduced the extent of flooding that would have been experienced on Lake Winnipeg during the heavy precipitation years of the last two decades. On the other hand, LWR has caused a variety of environmental and socio-economic

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concerns downstream of Lake Winnipeg along the Nelson River, many of which have been the subject of years of negotiation and compensation under the Northern Flood Agreement, and other agreements. The commission hopes that the roadmap for the relicensing of LWR and for other Manitoba Hydro projects that will require relicensing in the years ahead will create opportunities to identify ways of reducing or mitigating some of these impacts. In the report that follows, we will describe the evidence we have heard and seen that leads us to make a series of recommendations, many of which are focused on research, monitoring and public policy. It is our hope that continuous improvement of policy on environmental matters will lead to a healthy natural and social environment for all Manitobans.

# Chapter One

## Introduction

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### 1.1 The Manitoba Clean Environment Commission

The Manitoba Clean Environment Commission is an arms-length, provincial agency established under the authority of *The Environment Act* (1988). Under the act, the commission is mandated to provide advice and recommendations to the Minister of Conservation and Water Stewardship, and to develop and maintain public participation in environmental matters. Typically, the commission conducts reviews on projects requiring an environmental licence under *The Environment Act*. However, from time to time, the commission may also be mandated to gather information and public views on other matters of environmental concern. In the context of the review of Manitoba Hydro's application for a final licence for Lake Winnipeg Regulation (LWR or the project) under *The Water Power Act*, this meant holding open hearings to allow members of the public to provide their perspective on and experience with LWR or to challenge the information prepared by Manitoba Hydro in its application for a final licence.

**Note:** *The name of the department responsible for administering water and/or environmental management has changed a number of times in the period covered by this report. Currently, the Minister of Conservation and Water Stewardship*

*oversees these activities. For the sake of clarity, this report will refer to "the minister" responsible for these activities at a given time, rather than employ the various titles that have been used in the past.*

### 1.2 The Project

Lake Winnipeg Regulation is a series of excavated channels between Lake Winnipeg and the Nelson River and a control structure on the Nelson River, designed to control the flow of water from Lake Winnipeg for generation of electricity and to reduce flooding on Lake Winnipeg. The project, operated by Manitoba Hydro, went into operation in 1976. It includes additional works designed to keep the project from affecting a nearby body of water, Kiskitto Lake.

### 1.3 The Proponent

Manitoba Hydro is a Crown corporation established in 1961, mandated to provide for the power needs of Manitobans. The utility is overseen by the Manitoba Hydro-Electric Board, which is appointed by the Government of Manitoba and reports to the minister responsible for *The Manitoba Hydro Act*.

## 1.4 Terms of Reference

On July 5, 2011, the minister wrote to the commission requesting that the commission hold public hearings on Manitoba Hydro's application for a final licence for Lake Winnipeg Regulation.

In August 2011, the terms of reference specified the commission's mandate for the hearings and the scope of the review, as follows:

### Mandate of the Hearings

The Commission shall conduct public hearings, in appropriate locations around the north and south basins of Lake Winnipeg, in the City of Winnipeg and northern Manitoba as determined by the Commission, to hear evidence about the impacts of the regulation of Lake Winnipeg since the project was authorized under an Interim *Water Power Act* Licence issued on November 18th, 1970.

The Commission shall conduct the hearing in general accordance with its *Process Guidelines Respecting Public Hearings* which include procedures for Pre-Hearing Meetings or Conferences and Proprietary Information.

Following the public hearings the Commission shall provide a report to the Minister of Conservation summarizing the public comments received during the hearing.

The Commission may, at any time, request that the Minister of Conservation review or clarify these Terms of Reference.

### Scope of the Review

The Commission is asked to review Manitoba Hydro's request for a final licence under *The Water Power Act*. Pursuant to the *Water Power Regulation*, Manitoba Hydro is entitled to a final licence upon fulfillment and compliance with the terms and conditions of its Interim Licence. The scope of this review is to provide a public forum to consult with stakeholders regarding the performance of Hydro under their Interim Licence. *The Environment Act* does not apply to the Lake Winnipeg Regulation project as it was completed before this legislation came into force. Specifically, the commission may solicit comments on the following topics:

- Review the broader public policy rationale regarding the regulation of lake levels on Lake Winnipeg in effect at the time leading up to the issuance of the Interim Licence in 1970.
- Hear evidence from Manitobans regarding the effects and impacts of Lake Winnipeg regulation since the project was put into commercial use by Manitoba Hydro on August 1, 1976.
- Review the successes and failures of the implementation of those broader public policy goals that led up to the issuance of the Interim Licence and the construction and subsequent operation of the project.
- Summarize and make comment on the concerns raised pertaining to the issuance of a final licence to Manitoba Hydro under *The Water Power Act* including but not limited to future monitoring and research that may be beneficial to the project and Lake Winnipeg.

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The Clean Environment Commission's report shall incorporate, consider and directly reflect, where appropriate, the Principles of Sustainable Development and Guidelines for Sustainable Development as contained in the *Sustainable Development Strategy for Manitoba*. (Appendix I).

## 1.5 The Hearings

Public hearings were held from January 12 to May 1, 2015, at 20 communities near Lake Winnipeg or downstream along the Nelson River, as well as in Winnipeg. Hearings were held in Thompson, Wabowden, York Factory First Nation, Misipawistik Cree Nation, Fisher River Cree Nation, Pine Dock, Peguis First Nation, Ashern, Grand Marais, Brokenhead Ojibway Nation, Selkirk, Gimli, Manigotagan, Black River First Nation, Berens River First Nation, Sagkeeng First Nation, Pimicikamak Okimawin, Cross Lake, Norway House Cree Nation and Norway House. Written submissions were welcomed and the hearing record closed on May 8, 2015.

During these hearings, testimony was given by representatives of Manitoba Hydro and participant groups and organizations and by the public at large. Approximately 300 individuals, including those who made written submissions, actively participated in the hearings. As a result of this information gathering, the commission has gained sufficient understanding of uncertainties and concerns regarding the process of *Water Power Act* licensing to offer analysis and non-licensing recommendations regarding future management, monitoring and research.

## 1.6 Section 35 of Canada's Constitution

Section 35 of the *Constitution Act* (1982) stipulates that “[t]he existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.” While Section 35 is not an “environmental” statute, it does require consultation with Aboriginal peoples whose rights may be impacted in some fashion by a project. The process of consulting with Aboriginal peoples in accordance with Section 35 is not a “regulatory process.” The obligation to initiate and carry out consultations with respect to Section 35 is that of the province and/or of Canada, depending upon the nature of the project under consideration, its location and its ownership.

In the case of the final licence for LWR, the Government of Manitoba is conducting Section 35 consultations. The commission hearings played no role in these consultations.

## 1.7 The Report

This report to the minister presents an overview of LWR and a summary of the hearings. The commission provides comments on environmental, process and policy issues as identified by the public, participating groups and the commission. All testimony made during hearings has been transcribed and is available on the commission’s website, as are written presentations and presentation materials, such as PowerPoint presentations. A list of all hearing participants is included in Appendix III to this report.

This report is divided into 11 chapters, covering the licensing and hearing process, the history of LWR, its context within the Lake Winnipeg-Nelson River watershed, topics raised in hearings and community

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visits, issues raised by experts contracted by the commission, and the commission's recommendations to the minister.

## **Metric and Imperial Measurements**

A word about units of measurement: the metric system is the standard for use in modern government publications. However, many of the licence conditions for LWR employ Imperial measurements, such as feet above sea level (asl) or cubic feet per second (cfs). When discussing these licence conditions, this report will use these Imperial measurements, which have become familiar to many Manitobans over the past 40 years. For many other measurements, such as discussions of the area of a water body, for example, this report will use metric measurements.

# Chapter Two

## The Lake Winnipeg-Nelson River Watershed

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### 2.1 Overview

Early in the hearing process, the commission hearing panel recognized that Lake Winnipeg Regulation cannot be treated in isolation. The Lake Winnipeg/Nelson River watershed upstream affects how LWR is operated, and the operation of LWR affects the Nelson River downstream. The importance of considering the entire watershed was stressed by presenters in communities around Lake Winnipeg and along the Nelson River, as well as in Winnipeg. Many presenters raised concerns about activities throughout the Lake Winnipeg watershed and about effects on water quality and water quantity that have their origin far upstream of the lake.

In the Aboriginal communities the commission visited, we heard many times that “water is life” and that individuals and communities have a profound connection to both the land and water. The commission was told that women, as “water keepers,” have a special connection to Lake Winnipeg and the Nelson River. This was stressed to the commission during hearings in First Nations and by First Nations presenters, as well as through ceremonies and songs.

*“As an Anishinabe person, water is very central to our belief system. In our culture it is the responsibility of the kwe, which is the women, to take care of the*

*water. As life givers, we must protect the water for future generations. We must keep it clean and pure so that it can continue to offer us, offer gifts of life to everyone on Mother Earth.”*

For these reasons, this report will begin with a description of the Lake Winnipeg/Nelson River watershed, touching on major alterations to it and to its current state. This description of the “big picture” will serve to connect our comments and recommendations regarding LWR to actions within the watershed, both inside and outside of Manitoba. The chapters that follow will include specific commentary that is focused on LWR.

### 2.2 The Lake Winnipeg Watershed at a Glance

The Nelson River watershed, which includes Lake Winnipeg, is one of the largest in Canada, draining portions of four provinces and four U.S. states. The total drainage area of the Nelson River is approximately 1.07 million square kilometres and the distance from the farthest headwaters of the system, at Bow Glacier in Alberta, to the mouth of the Nelson River on Hudson Bay is 2,575 km. If it were a separate nation, the Nelson River watershed would be the 30th largest in the world, larger than France

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and Germany combined. The Lake Winnipeg watershed, nearly 1 million square kilometres, makes up most of the area of the Nelson River watershed. The Nelson River is the outlet for water from the lake. The river drops 217 metres as it runs 644 km from Lake Winnipeg to Hudson Bay. On its run to Hudson Bay, the Nelson River is joined by two rivers that drain portions of northern Manitoba: the Grass River, which runs approximately 500 km from its headwaters near the Saskatchewan border, and the Burntwood, which runs approximately 200 km from the northwest at Burntwood Lake. Since the completion of the Churchill River Diversion (CRD) project, the Burntwood River also carries water from the Churchill River. The Churchill River basin covers 280,000 square km, encompassing parts of northern Saskatchewan, northern Alberta and northern Manitoba.

Lake Winnipeg, the 11th largest lake in the world, receives water from rivers draining a vast area of forest, grassland, agricultural land, wetlands, and built-up areas. In addition to stretching west to the Rocky Mountains, Lake Winnipeg's watershed extends east almost to Lake Superior and south to the northern tip of South Dakota.

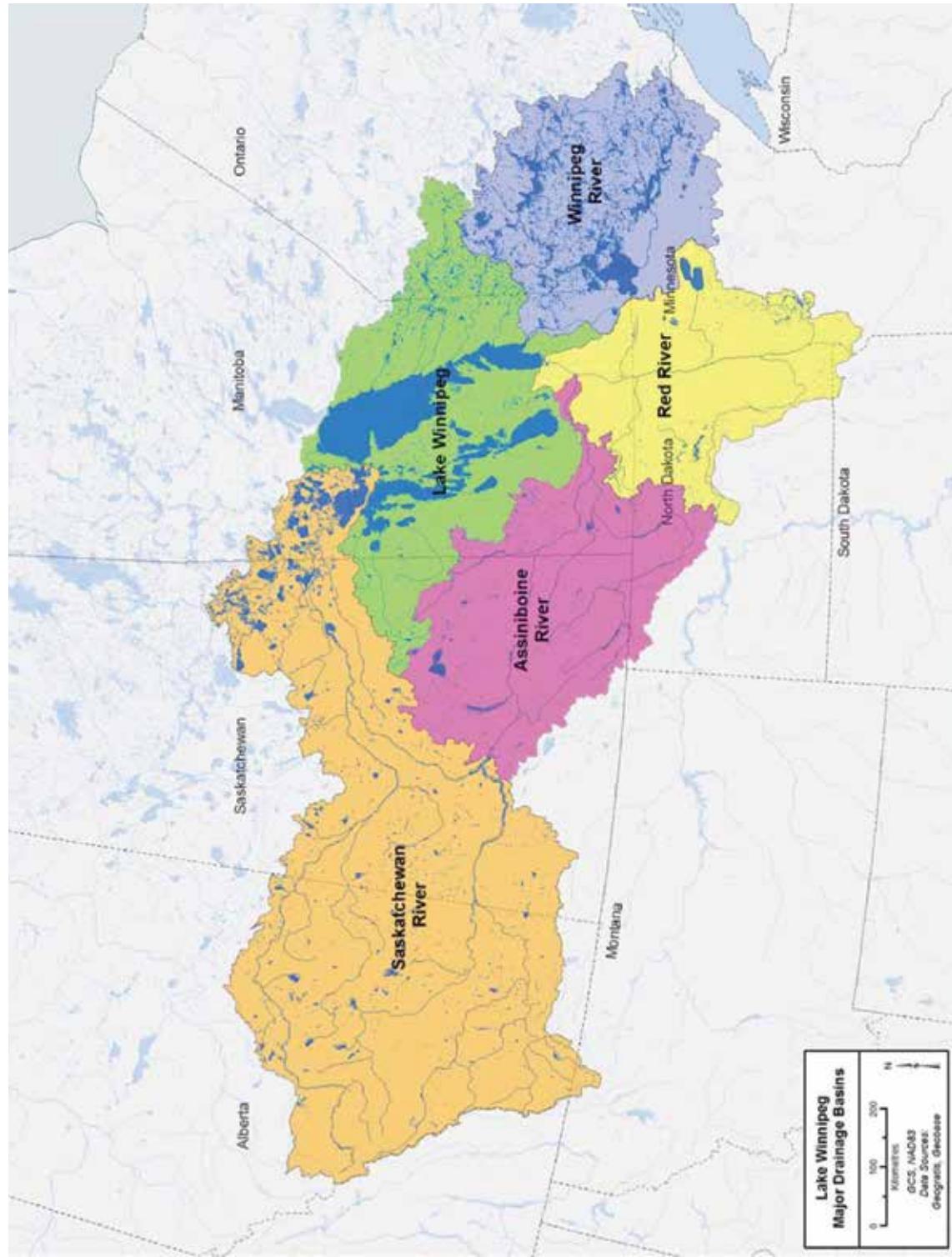
Water flows into Lake Winnipeg from four main sub-watersheds. Based on averages from 1999-2007, the four main tributaries to the lake are the Winnipeg River, which contributes roughly 49 per cent of the lake's water; the Saskatchewan River (25 per cent); the Red River (16 per cent) and the Dauphin River (4 per cent). All other rivers (Brokenhead, Berens, Bloodvein, Poplar, Fisher, Icelandic, etc) add up to 6 per cent of the total input into the lake. It is worth noting that the relative contributions of the rivers have changed over time. The portion of water contributed by the Red River is substantially higher today than during the early and mid-20th century. The Saskatchewan River's

share has declined over this same period, in part as a result of more water being used for irrigation in the drier prairies in Alberta and Saskatchewan. The amount of water in the tributaries is not simply a reflection of the size of their watershed. Although it contributes substantially more water than the Saskatchewan River, the Winnipeg River has a smaller watershed.

The majority of the population in the Lake Winnipeg watershed lives outside of Manitoba, which means they are upstream of this province. The watershed is home to well over seven million people, including approximately 95 per cent of the residents of the three prairie provinces. Major metropolitan areas in the watershed include Winnipeg, Calgary, Edmonton, Saskatoon, Regina, Fargo and Grand Forks. More than one million people live in the American portions of the Lake Winnipeg watershed. Several of the cities within the watershed have been growing rapidly in recent decades. The metropolitan areas of Calgary and Edmonton, which have well over one million residents each, had fewer than one half million residents as recently as the 1970s.

The watershed contains 55 million hectares of farmland. Of this total, 45 million hectares – approximately two-thirds of Canada's farmland – are in the Canadian portion of the watershed. Numbers of farm animals in the watershed vary with fluctuations in the agricultural sector, but as of 2006, there were more than 10 million cattle and more than 14 million pigs within the watershed, producing approximately 97 million tonnes of manure per year. Approximately 37 per cent of the watershed is classified as cropland, 16 per cent is classified as cropland/woodland mosaic and 3 per cent is cropland/grassland mosaic. Evergreen, mixed and deciduous forest makes up more than 17 per cent of the area, water and

Figure 2.1: The Lake Winnipeg watershed.



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wetlands make up 9 per cent, and grassland and shrubland make up approximately 6 per cent. Built-up areas occupy only about 0.2 per cent of the total area (Environment Canada and Manitoba Water Stewardship 2011).

## 2.3 Water Management in the Lake Winnipeg Watershed

All of the four main tributaries to Lake Winnipeg are managed by control structures of various kinds for hydroelectric production, flood control, or water supply management. Management of these rivers, some of which cross provincial borders and the Canada-U.S. border, requires co-operation across jurisdictions. The Souris River provides an example of the complexity of managing the Lake Winnipeg watershed. The river originates in marshes southeast of Regina, and winds past the small cities of Weyburn and Estevan, Saskatchewan, before descending into North Dakota and passing through Minot. After re-entering Canada and passing through Souris, it joins the Assiniboine River near Wawanesa. The complexity of management increases when more jurisdictions are involved. As a result of the boundary-spanning nature of these rivers, a large number of governmental and non-profit organizations are involved in water-management decisions and planning.

### 2.3.1 The Saskatchewan River

The Saskatchewan River has the largest watershed of the Lake Winnipeg tributaries, at 435,000 square km. It also has the largest number and most varied assortment of control structures and dams. The Saskatchewan and its tributaries have 19 hydroelectric dams, including the Grand Rapids Generating Station in Manitoba, three generating stations in Saskatchewan and 15

in Alberta. Many of these, especially those in and near the Rocky Mountains, generate fairly small amounts of power, but those further downstream create large reservoirs and generate relatively larger amounts of power. In southwestern Saskatchewan, the Gardiner Dam on the South Saskatchewan River generates 186 megawatts (MW) of power, creating the 225-km long Lake Diefenbaker. The Gardiner Dam also diverts water into the Qu'Appelle River. Two large dams on the Saskatchewan River in northeastern Saskatchewan, the E.B. Campbell and Nipawin Hydroelectric Stations, form reservoirs known respectively as Tobin Lake and Codette Lake. These two dams have a total generating capacity of nearly 550 MW. In Manitoba, the Grand Rapids dam creates a large reservoir at Cedar Lake and generates approximately 480 MW of power.

Other impoundments within the Saskatchewan River watershed are used to manage water supply for domestic consumption, cooling of thermal generating stations, and irrigation.

For the portion of the Saskatchewan River within Manitoba, the Kelsey Conservation District addresses watershed issues. There is no official inter-jurisdictional management group addressing the entire Saskatchewan River watershed. However, there are non-profit organizations in Alberta and Saskatchewan that function to support and address management and research of the North and South Saskatchewan Rivers and of the watershed as a whole.

As well, water management decisions regarding the North and South Saskatchewan Rivers are made in the context of agreements between the three prairie provinces and the federal government to share prairie river water equitably. This is established by the Master Agreement on Apportionment, administered by the Prairie Provinces Water

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Board, which specifies how much water a province may use from a river that crosses provincial borders. In the case of prairie rivers such as the North and South Saskatchewan, Alberta is allowed to manage one half of the natural flow of the river that originates in that province; the other half must flow into Saskatchewan. Saskatchewan is then allowed to manage one half of the flow that comes into the province from Alberta, plus one half of the flow originating in Saskatchewan. The other half must flow into Manitoba. This applies both to the Saskatchewan River system and to the Assiniboine River. The Prairie Provinces Water Board has representatives from the federal government, Alberta, Saskatchewan and Manitoba. The board also addresses concerns regarding water quality. Measures of water quality and quantity are made at strategically placed stations, mostly along provincial boundaries. Subcommittees have been formed to address specific topics of interest or concern (Prairie Provinces Water Board, 1969).

### 2.3.2 The Winnipeg River

The Winnipeg River watershed, covering 150,000 square km, is also highly controlled. The largest lake in this watershed, Lake of the Woods, has been regulated since the 1880s. The lake's drainage was enhanced in the late 1800s and early 1900s by increasing the number of outlets from two to six, including the City of Winnipeg aqueduct taking Shoal Lake water to Winnipeg. Control works at the Winnipeg River outlet near Kenora manage flooding on the Lake of the Woods and feed Ontario Power Generation's Whitedog Falls Generating Station north of Kenora. Once the Winnipeg River enters Manitoba, it powers six Manitoba Hydro generating stations on this province's portion of the Winnipeg River (from east to west, Pointe du Bois, Slave Falls, Seven Sisters Falls, McArthur Falls, Great Falls and Pine Falls generating stations). Flows

of water into Lake of the Woods are also regulated further upstream by hydroelectric generating stations on the Rainy River and its tributary, the Seine River. The English River, which flows into the Winnipeg River downstream of Kenora, has four generating stations operated by Ontario Power Generation: Caribou Falls, Ear Falls, Lac Seul, and Manitou.

Lake of the Woods is both an interprovincial and international water body, sharing shoreline with Manitoba, Ontario and Minnesota, and several interprovincial and international management bodies are involved in its control. The (Canadian) Lake of the Woods Control Board is mandated to control the outflow from the Lake of the Woods, Lac Seul and both the English and Winnipeg Rivers, as well as a diversion upstream. Membership on this board includes one representative from Canada, two from Ontario and one from Manitoba, each of whom is a professional engineer. The board includes additional representation from cottage owners, hydropower utilities (including Manitoba Hydro), a local municipality, Aboriginal communities, a paper company and the tourism industry. The strategy for regulation of outflow is based on assessment of current and projected hydrological conditions, coupled with knowledge of water level and flow objectives and information provided by specific interest groups and resource users (Lake of the Woods Control Board 2002).

Two international boards, created under the International Joint Commission (IJC), are also involved in management of the Winnipeg River watershed. (The International Joint Commission was established through a 1909 treaty to prevent and resolve disputes over waters shared by Canada and the United States.) The International Lake of the Woods Control Board is responsible

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for approval of outflow from Lake of the Woods when the lake level is below or above normal levels. Under most conditions, the Canadian control board manages the flow, but when the level is extremely low or extremely high, the international board takes responsibility. The International Rainy-Lake of the Woods Watershed Board co-ordinates the management of water levels and flows on Rainy Lake and the Rainy River on the Ontario-Minnesota border and assists in co-ordination of water quality efforts for the watershed. This board has recently sponsored studies examining ecological parameters to take into consideration in managing the river system for all uses (International Rainy-Lake of the Woods Control Board nd).

### **2.3.3 The Red and Assiniboine Rivers**

The Red River watershed includes both the 130,000 square km Red River basin, extending into North Dakota, Minnesota and South Dakota, and the 162,000 square km Assiniboine River watershed, which extends west of Moose Jaw in southwestern Saskatchewan and south to Minot in North Dakota.

The Assiniboine River portion of the watershed is highly controlled. Water from the South Saskatchewan River is diverted into this watershed at the Qu'Appelle Dam. The Qu'Appelle River is then managed by the Buffalo Pound Dam as a water supply for Regina, Moose Jaw and industrial and agricultural users, before it flows into the Assiniboine River just east of the Manitoba-Saskatchewan border. The Rafferty-Alameda Project in southern Saskatchewan manages flows on the Souris River (another major contributor to the Assiniboine) for flood control and residential, industrial and agricultural water supply. The Assiniboine River itself is managed for flood control

and water supply by the Shellmouth Dam in western Manitoba. During flood years, a portion of its flow is directed to Lake Manitoba via the Assiniboine River Diversion at Portage La Prairie to prevent flooding in Winnipeg.

Several of the tributaries to the Red River in the United States have controls, including the Baldhill Dam on the Sheyenne River in North Dakota, which creates a reservoir for irrigation. Flowing through one of the flattest landscapes in the world, the Red River itself is not amenable to control structures, as there are no places where the river has high banks that could contain a storage reservoir. Upstream cities such as Grand Forks employ levees to prevent flooding when the Red River rises, while the Winnipeg Floodway diverts flood water around the city of Winnipeg.

Because the Red River watershed encompasses portions of Manitoba, Saskatchewan and three states, there are several interprovincial and international bodies involved in water management and environmental issues. Included in these is a committee of the IJC, called the International Red River Board (International Red River Board nd). The two main issues for the Red River itself are flooding and water quality. The Red River Basin Commission (RRBC) is a co-operative, non-profit organization with a 25-member board representing basin cities, counties, municipalities, watershed boards, water resource districts, power boards, First Nations and other local interests. The federal (Canadian and American), provincial and state governments also have representatives on the board. The RRBC's first priority is to evaluate projects addressing human health and safety. The commission has nine inventory teams that collect information in the basin on water law, water institutions, hydrology, water supply, water quality, drainage, flood damage reduction,

conservation, fish and wildlife, and outdoor recreation. It facilitates co-operative solutions to water-related issues within the basin (Red River Basin Commission nd).

The International Souris River Board monitors the sharing of water between the U.S. and Canada and helps implement and review the Joint Water Quality Monitoring Program (International Souris River Board nd). There is currently no designated entity that addresses water management issues for the entire basin. However, since the flood of 2011, the Saskatchewan, Manitoba and North Dakota governments have made a commitment to form a coalition, the Assiniboine River Basin Commission, similar to that for the Red River Basin (Manitoba 2014a).

#### **2.3.4 The Dauphin River**

The fourth-largest contributor to Lake Winnipeg, the Dauphin River, flows a relatively short distance from Lake St. Martin to Lake Winnipeg. It carries water from a basin that includes both Lake Manitoba and Lake Winnipegosis, and is fed by a large number of smaller rivers and creeks flowing from Riding Mountain and the Duck and Porcupine Mountains in western Manitoba. Flows on the Dauphin River are influenced by the Fairford River Control Structure, which controls the flow out of Lake Manitoba and into Lake St. Martin. The Fairford Control Structure was completed in 1961 to regulate the level of Lake Manitoba between 811.0 feet asl and 813.0 feet asl. Flows on the Dauphin River are further influenced by use of the Assiniboine River Diversion at Portage La Prairie, which diverts flood water from the Assiniboine River to Lake Manitoba (Lake Manitoba Regulation Review Advisory Committee 2003).

#### **2.3.5 Other Rivers**

Only on the east side of Lake Winnipeg, to the north of the Winnipeg River, do the lake's tributaries flow in a natural state, neither regulated for water storage, flood control or electrical generation nor highly affected by constructed drainage. Many of these rivers, such as the Bloodvein, Poplar, Pigeon and Berens, flow through the area that is currently being proposed for World Heritage Site status on the basis of its outstanding natural and cultural value. The Bloodvein River is designated as a Canadian Heritage River for its nationally significant natural, cultural and recreational values.

### **2.4 Nutrient Inputs to Lake Winnipeg**

A growing population and a large agricultural sector combine to increase the flow of nutrients, specifically nitrogen and phosphorus, which make their way down the watershed to Lake Winnipeg. Sources of these nutrients include sewage treatment plants, chemical fertilizers and livestock manure, as well as natural processes. These nutrients allow for increased growth of algae and cyanobacteria (bacteria capable of obtaining energy through photosynthesis, often referred to as blue-green algae) in bodies of water, which have the potential to affect the ability of the water body to support many kinds of aquatic life. Microbes feed on organic matter, such as algae, in a process that removes dissolved oxygen from the water. High density of algae, therefore, can lead to depletion of oxygen, reducing the ability of a water body to support fish populations and other aquatic organisms. Algae blooms can also be unsightly and some types of blue-green algae can be toxic.

Nutrient inputs to Lake Winnipeg originate in several different jurisdictions.

Based on 1994-2001 data, approximately 53 per cent of the phosphorus inputs to Lake Winnipeg originated upstream (outside) of Manitoba, and 47 per cent within Manitoba. Upstream sources included the American portions of the Red River (32 per cent of total phosphorus), the Winnipeg River in Ontario (10 per cent) and the Saskatchewan River system in Saskatchewan and Alberta (5 per cent). Manitoba sources are broken down in greater detail. Natural background and undefined sources of phosphorus in the Manitoba portion of the watershed contribute 17 per cent of the total and agriculture within Manitoba contributes 15 per cent. Point sources in Manitoba, such as sewage treatment plants, contribute 9 per cent of the total, with the City of Winnipeg amounting to a little more than half of that. For nitrogen, 51 per cent came from upstream of Manitoba and 49 per cent from within Manitoba (Environment Canada and Manitoba Water Stewardship 2011).

Because water and nutrients originate from several different jurisdictions, interprovincial and international co-ordination is required to address the issue.

## Nitrogen and Phosphorus: Two Essential Nutrients

Nitrogen and phosphorus are elements essential to all plant and animal life. Nitrogen is a basic element of plant and animal proteins, including the genetic material DNA and RNA. It is also an element of chlorophyll and is necessary for photosynthesis. Phosphorus is essential to animal and plant processes, such as the growth and division of cells, storage of energy and photosynthesis. In animals, it is a building block of bones and teeth. Nitrogen is the most common element in the Earth's atmosphere, but most plants lack the ability to access nitrogen in this form. Phosphorus is much less common and is mostly stored in rock deposits and oceanic sediments. Plants draw nitrogen and phosphorus from the soil they grow in, and these nutrients then are available to the animals that eat plants.

Both elements are added to crops in the form of chemical fertilizers and in manure that is spread as a fertilizer. Lakes that have higher levels of these nutrients are known as "eutrophic" lakes. Lake Winnipeg is a eutrophic lake.

When plants and animals die, the nitrogen and phosphorus in them is returned to the soil or, in the event of water plants and animals, to the sediments below the water. When sediments are disturbed, such as by storms, this nitrogen and phosphorus can be returned to circulation and be used by other plants and animals (Manitoba Clean Environment Commission, 2009).

## 2.5 Drainage

The Lake Winnipeg watershed contains a large amount of land that has been modified by human development. One of the most significant of these modifications is the drainage of wetlands and large areas of wet prairie and the forest-prairie margin land known as aspen parkland. This has been done through the construction of drainage channels, ditches and diversions, and the straightening of natural streams.

Especially in low-lying areas of the Red River valley, the creation of a system of drains has transformed wet prairie or marsh into cropland. Historical maps of the prairies indicate that extensive wetlands once covered many places that are now farmland or residential developments. The pattern of

settlement since the late 1870s has been based on drainage. Earlier in Manitoba's history, there was little regulation of draining land, and, in fact, it was encouraged. Regulation has evolved over time. In Manitoba, drainage districts were established to manage drainage, based on the boundaries of rural municipalities. These boundaries have since been altered to reflect watershed boundaries and the drainage districts have been given a new name and mandate as Conservation Districts. Drainage continues to be in demand, as farmers seek to maximize crop production or reduce operating costs. In many areas, tile drainage has been added to cropland to allow rain and snow melt to drain more quickly.

Cities and towns, with expanses of impermeable surfaces, such as roadways,

**Figure 2.2: Historical distribution of land class types in southern Manitoba in the 1870s. (Hanuta 2006)**

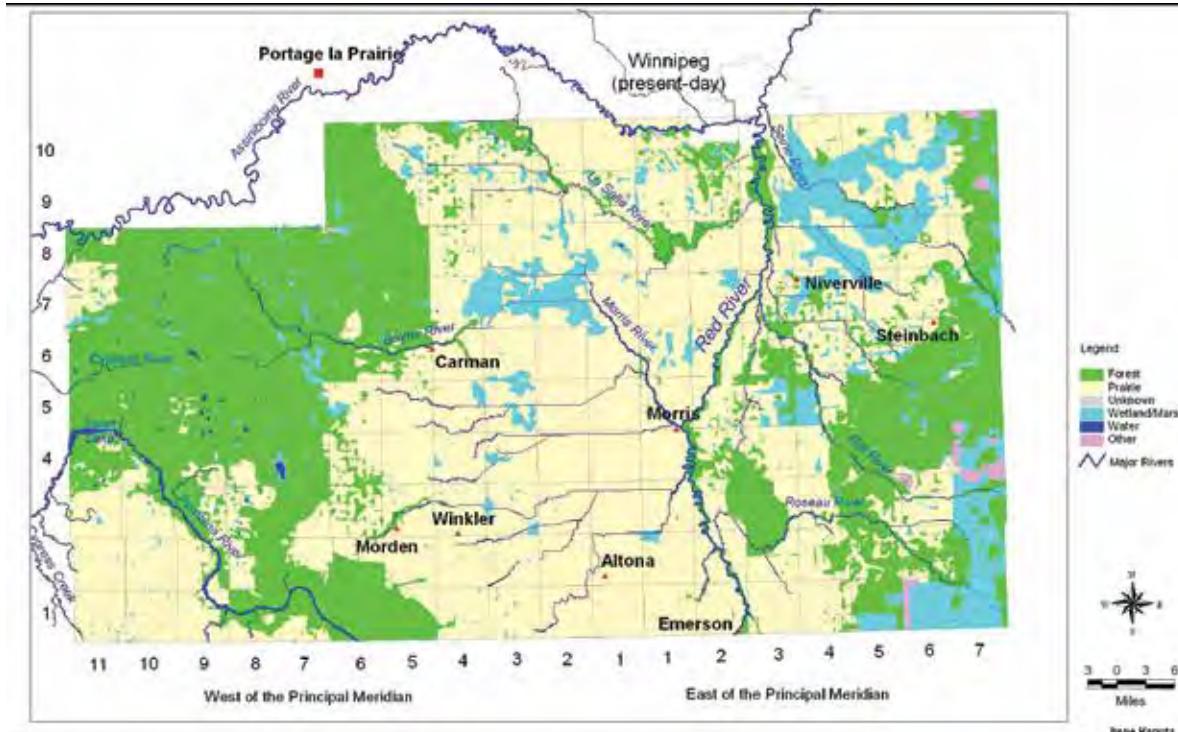
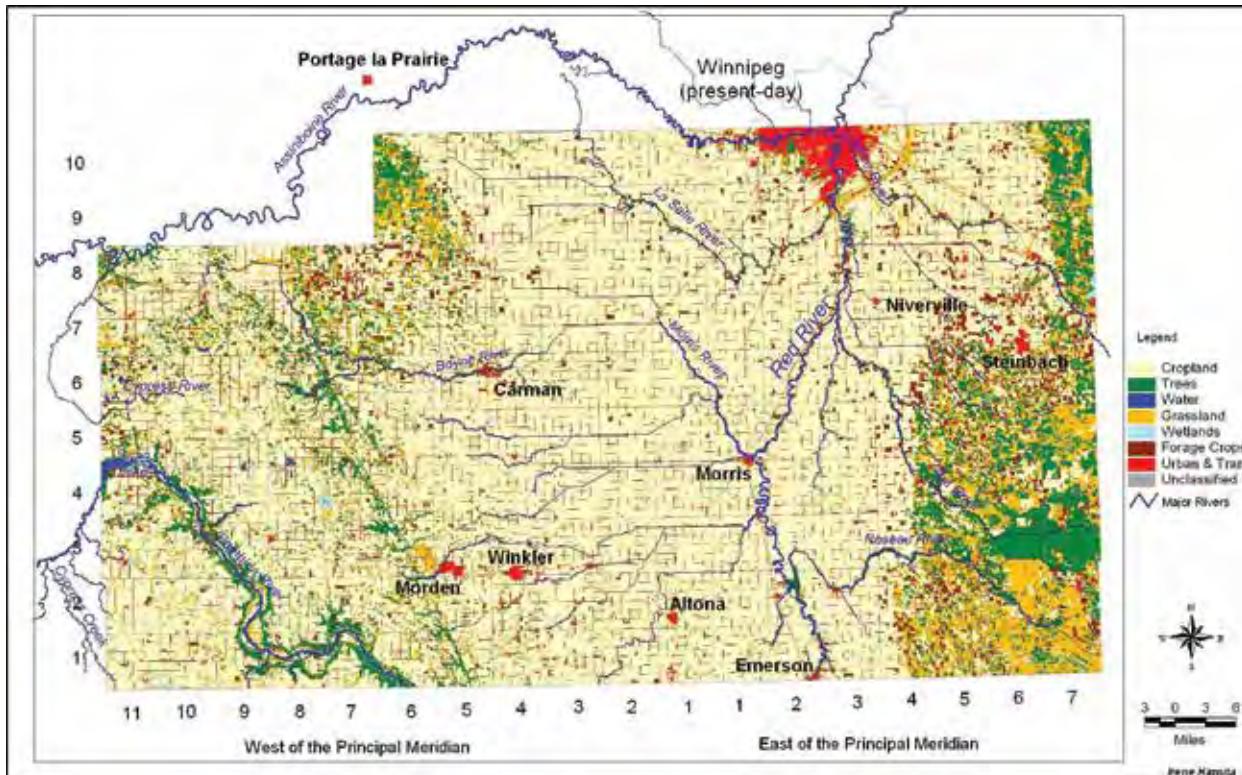


Figure 2.3: Recent distribution of land class types in southern Manitoba, in 1995. (Hanuta 2006)



parking lots and rooftops, where water runs off instead of sinking into the ground, include their own drainage networks that contribute to the flow of streams and rivers.

The effect of this has been to reduce the amount of water stored in ponds, sloughs, marshes, bogs and other wetlands and on fields. It has also resulted in more rapid travel time for water in streams and rivers, increasing and compressing the flood peak on the rivers that drain the prairie provinces following rain or snow melt. Since this water ends up in Lake Winnipeg before passing down the Nelson River, high-flow events occurring far upstream in different parts of the watershed can make the level of the lake rise. Lack of control and co-ordination of drainage in Saskatchewan contributed to the 2011 flood on the Souris and Assiniboine rivers, when heavy snow and rain resulted in record high water. Run-off from land also

contributes about two-thirds of the Manitoba portion of the nutrients that flow into Lake Winnipeg, so more rapid drainage of land contributes to higher inputs of nutrients into the lake.

## 2.6 Major Flood Controls

Since the 1950 Red River flood, which inundated large parts of Winnipeg, the Manitoba government has developed an extensive flood protection system in the Lake Winnipeg watershed. In addition to the Red River Floodway, this infrastructure includes the Assiniboine River Diversion at Portage La Prairie, which diverts floodwaters to Lake Manitoba, and the Shellmouth Reservoir on the Assiniboine River, which provides storage for flood control and other uses. A number of other control structures have been built on the Souris, Pembina, Little Saskatchewan

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and other rivers, and protective dikes have been built near many communities near rivers and lakes. Among those protective dikes are ring dikes that protect 18 Red River valley communities.

The Manitoba government is currently evaluating designs for a permanent outlet to drain Lake St. Martin, which receives water from Lake Manitoba and was flooded during the major Assiniboine River flood of 2011 and again after heavy rains in 2014. The Manitoba government built an emergency channel in 2011 to lower the level of Lake St. Martin and Lake Manitoba and was required under federal regulatory authorization to close the emergency outlet in November, 2012. The emergency channel was reopened in July 2014 after heavy rains.

Six design options have been prepared and a further public and Aboriginal consultation and environmental review is expected prior to construction.

## **2.7 Basin Management Actions and Initiatives**

Management of water flowing through the Lake Winnipeg-Nelson River watershed is a complicated matter. Control, use, diversion and drainage of water create many potential impacts downstream. Many projects and programs are undertaken in watersheds – large or small – within the larger Lake Winnipeg watershed. Several government and multi-party initiatives have been undertaken to co-ordinate research, education, policy and action over issues affecting Lake Winnipeg. These actions have been prompted by growing concern regarding the health of the lake, especially the presence of large algae blooms, some of which contain potentially toxic blue-green algae. Other actions have been prompted by flooding in Lake Winnipeg's tributaries, including the 1997 Red River flood. Highlighted below are a few of the

current activities that are significant to Lake Winnipeg and the Nelson River. Links to these information sources are provided in Appendix V.

The Lake Winnipeg Research Consortium was established in 1998, as a not-for-profit organization, to co-ordinate scientific research on the lake following the 1997 flood. The consortium is funded by a combination of donations and government grants. It acquired the former Canadian Coast Guard vessel Namao as a floating laboratory to conduct research on the lake.

The Lake Winnipeg Action Plan was instituted by the Province of Manitoba in 2003, with a goal of reducing nitrogen and phosphorus in the lake to pre-1970s levels. It was developed out of Manitoba's Nutrient Management Strategy. The plan included establishment of the Lake Winnipeg Stewardship Board, measures to prevent erosion and reduce nutrient run-off along the Red and Assiniboine rivers, expanding soil testing to ensure appropriate application of fertilizer, introduction of new sewage and septic field regulation, development of a shoreline protection project with assistance from Manitoba Hydro, commencing cross-border nutrient management discussion, licensing City of Winnipeg wastewater treatment centres and other facilities to address nutrients, and introduction of *The Water Protection Act*.

The Lake Winnipeg Stewardship Board was established in 2003 and released a report to government in December 2006 with 135 recommendations in 38 different topic areas, followed by a 2010 progress report. Drawing on input from a workshop attended by approximately 50 scientists from across Canada and the northern United States, the board's recommendations are largely focused on reducing nutrient inputs to Lake Winnipeg. The board is now disbanded.

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The Lake Winnipeg Foundation is a not-for-profit, non-governmental, largely volunteer organization, founded in 2005, that has played a role in heightening public awareness about the plight of Lake Winnipeg. Its mandate is to promote the health of Lake Winnipeg through support for research, public education, advocacy and management.

The Lake Winnipeg Basin Initiative is a federal program that provides funding for a variety of research and development and public education projects carried out around the lake.

The Lake Friendly campaign, established by south basin mayors and reeves and partially funded by the Lake Winnipeg Basin Initiative, is a non-governmental public education campaign focused on nutrient reduction. This campaign has grown into an international program seeking commitment from individuals, organizations and government at all levels to reduce nutrient inputs and help in restoring the health of Lake Winnipeg.

Manitoba's Surface Water Management Strategy was launched in the spring of 2014 by the Manitoba government following a series of workshops and face-to-face meetings. The strategy identifies 50 specific actions grouped around three central "pillars" – improving and protecting water quality, preparing for extreme events, and co-ordination and awareness. Key aspects of the strategy include a renewed focus on water retention, identification and protection of wetlands, a "no net loss of wetland benefits" approach and initiatives to support planning and governance on a watershed basis. Part of this strategy is to overhaul the drainage licensing program to focus it on a watershed basis, with no increase in water releases from present quantities (Manitoba 2014b).

At the local level, Manitoba has a series of Integrated Watershed Management Plans, which are developed in co-operation with local Conservation Districts, community members, stakeholders and the provincial government. These plans are developed under *The Water Protection Act* to identify priority land and water-related issues in a local watershed, determine projects or policies to address these issues, and identify how water-management programming will be carried out. Development of these plans involves a partnership with Manitoba's 18 Conservation Districts, covering most of the agricultural portion of Manitoba. These districts are a partnership between the provincial government and local municipalities to protect, restore and manage land and water resources on a watershed basis. They are all responsible to develop plans for improving watershed health.

Manitoba's Conservation Districts are primarily in the agricultural regions of the province. Those that are entirely or partially within the Assiniboine-Red watershed are the Whitemud Watershed, Little Saskatchewan, Assiniboine Hills, West Souris, Upper Assiniboine, Lake of the Prairies, Pembina Valley, Turtle Mountain, Seine-Rat River, LaSalle Redboine, Cooks Creek and East Interlake Conservation Districts. Conservation Districts that are entirely or partially within the watershed of the Dauphin River are Swan Lake Watershed, Intermountain, Turtle River Watershed, Alonsa and West Interlake. The Kelsey Conservation District is the only one in Manitoba's portion of the Saskatchewan River watershed.

In Saskatchewan, the Water Security Agency (WSA) is currently working to develop a 25-year Saskatchewan Water Security Plan. A key element of this plan relates to drainage of agricultural land. The

minister responsible for the WSA announced in 2012 that tighter regulation and increased enforcement would be part of the plan to prevent damage caused by unregulated farm drainage. As part of this process, the agency released a research report in November 2014 compiling attitudes of Saskatchewan residents toward drainage. Stakeholders surveyed in the process agreed that drainage should not be allowed unless specific impacts of a drainage project can be mitigated.

The Water Innovation Centre, a project within the International Institute for Sustainable Development (IISD), focuses on water management policy and practice, particularly in reference to the Lake Winnipeg watershed. One of its projects examines ways to remove nutrients from the watershed – by harvesting cattails in wetlands – to reduce the problem of excess nutrients (particularly phosphorus) downstream.

The recent creation of the Lake Winnipeg Indigenous Collective, formally established in March 2015, provides a voice for First Nations from around Lake Winnipeg. The collective's mission is "to seek healthy and equitable solutions for our waters and our people from the diverse communities who have a relationship with Manitoba's great sacred lake." The organization plans to address issues related to past effects of LWR, future decisions about LWR, impacts of algae blooms due to nutrient loading, lack of representation of Indigenous voices in decision making, and the connection between the health of the lake and social and economic health of communities. Initially established with representation from Brokenhead Ojibway Nation, Sagkeeng First Nation, Misipawistik Cree Nation, Norway House Cree Nation, Pinaymootang First Nation and Black River First Nation, the collective plans to engage other First Nations to join. It is initially being supported by Brokenhead Ojibway Nation, the Lake

Winnipeg Foundation and the Centre for Indigenous Environmental Resources.

## What We Heard: Watershed Issues

Watershed issues were frequently discussed during the LWR hearings. In many communities, presenters expressed concerns that activities upstream had an impact on the quality, quantity and timing of water entering Lake Winnipeg and the Nelson River.

*"If we don't try and find a solution, we're not going to have a healthy Lake Winnipeg, we're not going to have a place to swim, we're not going to have a place to do recreational fishing, commercial fishing. It's just going to be one big green algae lake. And if any one of you has ever had the experience of driving out on Lake Winnipeg, going on a fishing or hunting trip, and if you ever come across hitting that sludge, you know, that's a scary feeling. That's just like green soup or something. I don't know how to explain it, but it just stinks."*

The commission heard concerns about the Lake St. Martin emergency outlet during some of the hearings, especially those held in the northern Interlake. Some presenters were concerned that the diversion of Assiniboine River water to Lake Manitoba, and from there to Lake Winnipeg via the Dauphin River and the planned diversion, could raise the level of Lake Winnipeg. Several presenters from Dauphin River and other north basin communities said that creation of the emergency channel caused additional debris and silt to enter Lake Winnipeg, affecting the distribution of fish and causing additional damage to fishing nets. The commission also heard from presenters whose homes were damaged by flood waters at the community of Dauphin River.

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Presenters at Peguis First Nation spoke about industrial development throughout the Lake Winnipeg watershed, and were concerned about effects on water quality from resource industries upstream. They also raised concerns that agricultural drainage in the Interlake increased flooding risks at Peguis and peat mining reduced the amount of natural filtration of water flowing into the lake. Peguis presenters spoke of the toll that overland flooding and flooding of the Fisher River have taken on the physical and psychological health of individuals who have been displaced from their homes or had their homes damaged by flooding. Flooding along the Fisher River was also a concern at Fisher River Cree Nation, located where the river flows into Fisher Bay.

Presenters at Sagkeeng and Black River First Nations, and those from Hollow Water First Nation who presented on video, spoke about the effects of development of the Winnipeg River on traditional resource harvesting. Some presenters also spoke about impacts of the forest industry in Ontario, further upstream in the Winnipeg River watershed. A group of owners of property along the Winnipeg River spoke about their concerns that the Pine Falls dam, located just upstream of their properties, had caused problems with erosion on their property.

At communities around both the north and south basins and downstream along the Nelson River, the commission heard frequent concerns about algae blooms and water quality. Presenters spoke about the impact of algae blooms on fishing, concerns over skin irritation caused by swimming in Lake Winnipeg or downstream water bodies, and the potential impact of declining water quality on health. Many presenters stated that they are at the receiving end of everything that is done to water in the Lake Winnipeg watershed.

During Winnipeg hearings, the commission heard from advocates for upstream water storage, including representatives of the IISD, who spoke about the nutrient management benefits of storing and gradually releasing flood water. One such project, the South Tobacco Creek project in the Manitoba Escarpment area, uses a series of small dams to retain water in ponds. Another project, in Minnesota, creates a nearly 800-hectare impoundment to store flood waters from a drainage area of 186 square kilometres. Harvesting the cattails that grow in this impoundment could prevent thousands of kilograms of phosphorus each year from flowing into the river. Such approaches, it was argued, offer an excellent opportunity to address water quality problems on Lake Winnipeg. The importance of nutrient management and upstream water management were emphasised by some statistical comparisons made by the IISD. With a watershed 40 times larger than its surface area, Lake Winnipeg has the largest proportion of watershed area to lake area of any of the world's largest lakes (Great Slave Lake has the next largest ratio, with a watershed almost 35 times larger than the lake's surface). Comparing the volume of lake water to the size of the watershed, Lake Winnipeg is even more of a statistical outlier. Lake Winnipeg's ratio of basin size to lake volume is 7.5 times greater than that of Great Slave Lake. This emphasizes the potential of Lake Winnipeg to be affected by changes in land use, drainage and population within its watershed.

Another presenter advocated storage of excess water on farmland through a system called "waffle storage", in which some upstream fields are deliberately allowed to flood and the water on them is released only after the peak flood has passed. Such systems would require a greater degree of watershed planning, but would have the potential to

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support better management of water in high-flow years.

### **Commission Comment: Watershed Issues**

Much of what the commission heard went beyond the discussion of the effects of LWR. Many of the concerns the commission heard about the effects of high water or increased levels of nutrients in the lake are reflections of the pressures felt by the entire watershed.

The commission is aware that there are many projects and programs dealing with management, planning and protection of water in the Lake Winnipeg-Nelson River watershed. However, there is no specific set of management goals or policy objectives uniting all of these programs and planning and advisory bodies, with the exception of unspecified nutrient reduction targets. Many of these programs and bodies are local in nature, without a great deal of consideration of long-range results downstream. Furthermore, although there are many programs and bodies focusing on Lake Winnipeg, they pay little consideration to water issues further downstream along the Nelson River. The commission believes that the Manitoba government, in consultation and co-operation with jurisdictions within the Lake Winnipeg watershed, should set specific and practical goals for Lake Winnipeg and the Nelson River that all programs can be measured against. The federal government should take a greater role in cross-border co-ordination to assist in establishing and reaching these goals.

The commission considers that all activities affecting the Lake Winnipeg-Nelson River watershed should be assessed in light of all impacts, taking into account the three pillars of sustainable development: social, economic and environmental

sustainability. Manitoba needs to manage water on a watershed basis and, indeed, many programs are doing that. However, a number of significant water management projects, such as the operation of major flood control structures, have not been adequately assessed and licensed in this context.

When considering the impacts of LWR, it is important to remember that Manitoba is at the mercy of other jurisdictions for the water that ends up in this province. Manitoba Hydro needs to assess and plan for the decisions on water management, use and drainage taken upstream of this province, but cannot be held responsible for major rains or snowfalls, nor for upstream decisions that direct water more rapidly to Lake Winnipeg.

The commission believes that upstream storage of water should be supported to slow down the flow of water to the lake and reduce the magnitude of floods. Combined with ideas for harvesting cattails, upstream storage may also offer a promising way of reducing inputs of nitrogen and phosphorus to the lake. However, it is important to remember that such developments are unlikely to be able to prevent all floods. Even in a fully natural state in the early 19th century, the Red River valley experienced floods as large as or larger than the 1997 flood.

However, all such ideas, promising as they are, require a degree of basin-wide co-operation and planning. The commission believes that the Manitoba government must continue with a basin-wide approach and work with other upstream jurisdictions to manage water in this way. The actions in Manitoba's Surface Water Management Strategy offer many practical ways to have an impact on the timing and amount of water entering Lake Winnipeg as well as on the quality of that water.

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Regarding concerns about the diversion of water to Lake Manitoba and the planned drain from Lake St. Martin to Lake Winnipeg, it must be kept in mind that this is not water transferred to Lake Winnipeg from an entirely separate watershed. The diversion to Lake Manitoba probably changes the timing of the water's arrival in Lake Winnipeg, but not the quantity of water. It could, however, lead to a slight difference in quality. Environmental study and consultation regarding the planning of a new diversion will need to explore and address a variety of issues and concerns, including the operation and contributions from the Shellmouth Dam and the Assiniboine River Diversion, the specific goals upstream and downstream of the diversion, alternatives that may also accomplish the stated goals, and specific environmental effects on the Dauphin River and Lake Winnipeg.

## Recommendations

The Commission recommends that:

- 2.1 *The Government of Manitoba, in co-operation with other jurisdictions in the watershed, set specific management goals and policy objectives for Lake Winnipeg, against which projects within the watershed can be assessed.*
- 2.2 *The Government of Manitoba undertake an environmental assessment of key operations within the Manitoba portion of the Lake Winnipeg watershed, such as the Shellmouth Dam and the Assiniboine River Diversion at Portage La Prairie, to better understand their impact on the watershed and ensure that ecological as well as social and economic impacts are fully considered.*

# Chapter Three

## Understanding Lake Winnipeg Regulation

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### 3.1 Brief History of Lake Winnipeg Regulation

Lake Winnipeg Regulation was developed to meet growing demand for electricity in Manitoba in the decades following the Second World War and in response to the desire to reduce the damage caused by flooding along Lake Winnipeg.

As use of electricity grew in Manitoba in the 20th century, the Winnipeg River's generating potential was developed, with a series of six hydroelectric generating stations built between 1920 and 1955. By the time the last Winnipeg River station was built, Manitoba had an electricity transmission system that extended throughout the province, and 75 per cent of farms had joined the grid through the post-war rural electrification initiative. Meanwhile, the growth of the post-war consumer society had brought electrical appliances into homes throughout Manitoba. Once the Winnipeg River was fully developed, new sources of electricity were needed. The Nelson River had been surveyed as early as 1913 as a source for hydroelectric power, and in 1960, the Kelsey Generating Station was built to supply power to the city of Thompson and the adjacent nickel-mining operation.

Beginning in the 1950s, regulation of Lake Winnipeg was examined both as a means of

reducing flooding in lakeshore communities and as a way of ensuring a dependable supply of water on the Nelson River to generate electricity. Following major flooding in 1950, Interlake residents urged the Manitoba and Canadian governments to address flooding on the lake by opening up a new outlet. This led to the first engineering studies of the technical feasibility of LWR, which preceded studies of the environmental and social effects of the project.

The Manitoba government initiated the Lakes Winnipeg and Manitoba Board in 1956 to explore options to mitigate damage caused by seasonal flooding along the shores of the lakes. The board examined regulating the level of Lake Winnipeg as a means of reducing property damage caused by flooding. It concluded, in its 1958 report, that LWR would be viable, but that it would only be cost-effective if undertaken as part of a plan to generate power on the Nelson River. By the 1960s, developments in the field of high-voltage, long-distance transmission of electricity made it technologically feasible to transmit electricity from northern Manitoba to consumers in the more heavily populated south.

The next major studies were carried out in 1963 and 1964 by the engineering firm G.E. Crippen and Associates for the newly formed Nelson River Programming Board, which

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was established through a federal-provincial cost-sharing agreement. The engineering firm was hired to study the economic feasibility of developing the hydroelectric resources of the lower Nelson River. Because hydroelectric generating stations require a dependable flow of water – especially during the winter, when electrical consumption is highest – the firm examined the economic feasibility of regulating Lake Winnipeg to provide this dependable flow. It also examined the economic feasibility of diverting water from the Churchill River into the Nelson River, via the Rat and Burntwood Rivers. The study asserted that carrying out both LWR and CRD would produce an 80 per cent increase in dependable flow on the Nelson River for generation of electricity, which would be enough to support the operation of at least six generating stations. As a result of this study, Manitoba Hydro commenced work on the first phase of its Nelson River development in 1966, with the beginning of work on the Kettle Generating Station, near the town of Gillam. Work on Manitoba Hydro's first high-voltage Bipole transmission line began at this same time. Kettle was the first of three dams built on the Nelson from the late 1960s to 1990.

Following the Crippen Report in 1964, a report commissioned by the Manitoba Water Commission in 1968 called for creation of a large storage reservoir at Southern Indian Lake by raising levels of the lake by approximately 35 feet (10.6 metres). It was expected that creation of such a large reservoir, through what was known as “high-level diversion” of the Churchill River, would provide enough water for the generating stations on the lower Nelson River that LWR would not be needed for a number of years. High-level diversion of the Churchill, however, would come at a cost of substantial environmental damage and the relocation of the residents in the community of South

Indian Lake (now O Pipon Na Piwin Cree Nation). This became a highly controversial issue in the lead-up to the 1969 provincial election and galvanized the growing environmental awareness of many people in Manitoba.

At the same time, additional research into LWR was conducted on behalf of the Manitoba Water Commission, leading to the identification of an operating range of 711.0 to 715.0 feet asl as one that fell within Lake Winnipeg's historical water level range of 709.0 to 717.5 feet asl. This research also examined how LWR would be accomplished, with several options considered for location of control structures and channels. Options that were ultimately rejected included building a control structure at Warren Landing and a pumping station to transfer water from Lake Winnipeg to Playgreen Lake, building a second control structure on the east channel of the Nelson River, and even a proposal to divide Lake Winnipeg into two pools, with a control structure built across the narrows of Lake Winnipeg, which would allow the north and south basins to be at different elevations.

After the 1969 provincial election, Manitoba Hydro was denied a licence to proceed with high-level diversion of the Churchill River. Instead, it was directed to investigate options for proceeding with LWR. Ultimately, Manitoba Hydro applied for a licence in 1970 for LWR, to be followed by a low-level diversion of the Churchill River, flooding Southern Indian Lake by approximately 10 feet (3 metres) instead of the originally proposed 35 feet (10.6 metres). In the public announcement by the Manitoba government that September, LWR was described as intended both for flood control on Lake Winnipeg and regulation of the Nelson River for power production.

In 1971, recognizing that LWR and CRD were major undertakings with considerable

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environmental and social impact, the governments of Manitoba and Canada jointly initiated the Lake Winnipeg, Churchill and Nelson Rivers Study Board (the Study Board). The Study Board's report, published in 1975, was intended to determine the potential effects of the regulation and diversion projects and to recommend modification in design and operation of the project, as well as remediation measures to lessen its undesirable effects. At the time, this was one of the most comprehensive studies of a major project, although it is worth remembering that many environmental sciences were then in their infancy. Environmental impact assessments were only formally introduced in Canada in 1973 in the federal Environmental Assessment and Review Process. As well, prior to the 1982 *Constitution Act* and the subsequent court rulings on matters of Aboriginal and treaty rights, the legal environment governing relations between governments and Aboriginal people was substantially different in the 1970s. The Study Board report included 47 recommendations for implementation by Manitoba, Canada or Manitoba Hydro, many of which were focused on environmental monitoring and management, mitigation of impacts, community capacity building, and protection of community infrastructure.

LWR was largely complete when the Study Board released its report. This is the opposite of the order that would be followed today. Today, an Environmental Impact Statement (EIS), using a substantial amount of baseline research into environmental conditions and identification of potential effects on the biophysical and socio-economic environments, would precede the beginning of construction.

### **3.1.1 The Northern Flood Agreement**

In 1974, while Manitoba Hydro was constructing LWR and CRD and the Study

Board was examining the potential impacts of the projects, First Nations in the surrounding area formed the Northern Flood Committee (NFC). The NFC, representing the First Nations of Norway House, Cross Lake (now Pimicikamak Okimawin), Split Lake (now Tataskweyak Cree Nation), Nelson House (now Nisichawayasihk Cree Nation), and York Factory, plus Fox Lake, South Indian Lake and Ilford, sought to protect the environment and Aboriginal rights through lengthy negotiations with the Manitoba and Canadian governments and Manitoba Hydro. The communities were prompted to take action in part by the experience of the community of Chemawawin, which had been inundated in the early 1960s after the construction of the Grand Rapids Generating Station on the Saskatchewan River. Initially, the NFC sought a court injunction to halt work on LWR, but, in 1975, proposed conditions for a negotiated settlement. The NFC's work led to the signing of the Northern Flood Agreement (NFA) in December 1977, which was subsequently ratified by referendums in the member First Nations in 1978. The five signatory First Nations were Norway House, Cross Lake, Split Lake, Nelson House and York Factory (Canada 1977).

Among the issues covered in the NFA's 25 articles are exchange of land for land lost to flooding, maintenance of water levels, land use, navigation, debris management, water quality, cemeteries affected by flooding, the need for consultations before future developments, minimizing damage to wildlife, community infrastructure, clearing of land, awarding of damages, formalizing resource use areas, development of community plans, implementation of Study Board recommendations, employment and training, trapping and fishing, remedial works, arbitration, communication and community liaison.

Again, it is worth noting that, just as a modern EIS precedes construction on a project, today consultations with affected Aboriginal communities are legally required before construction. In the case of the NFA, the ratification in 1978 was followed by many years of negotiations of claims resulting from impacts of both LWR and CRD. Eventually, between 1992 and 1997, all of the signatory First Nations, except for Pimicikamak Okimawin, signed implementation agreements to streamline implementation of the NFA. As well, other First Nations and northern communities have signed Implementation agreements in this regard. implementation agreements were signed with Fox Lake Cree Nation in 2004, War Lake First Nation in 2005, and the community of Cross Lake (the small community adjacent to the reserve at Pimicikamak Okimawin) in 1990 and 2010 and Wabowden in 1992. An agreement in principle has been signed with the Norway House community (the community adjacent to Norway House Cree Nation) and work continues with the communities of Thicket Portage and Pikwitonei to resolve outstanding issues.

Several follow-up environmental studies have been carried out since completion of LWR and CRD, many of them mandated by the NFA. From 1982 to 1986, the Cross Lake Environmental Impact Assessment Study was carried out, leading to recommendations that included building of the Cross Lake Weir to reduce water level extremes on Cross Lake. From 1983 to 1986, the Canada-Manitoba Mercury Monitoring Agreement Study Board carried out studies on mercury levels in fish, water, soils and people along the CRD and LWR routes. Between 1985 and 1992, the Manitoba Ecological Monitoring Program and the Federal Ecological Monitoring Program carried out studies of subjects such as water quality, fish and fish habitat, waterfowl and resource harvesting, largely focused on the

same area. In 2008, the Coordinated Aquatic Monitoring Program (CAMP) began carrying out studies of water quality, aquatic life, fisheries and other topics in lakes and rivers affected by LWR and CRD and in nearby, unaffected (off-system) water bodies (Know History 2015).

### **3.1.2 Recent Studies and Agreements Involving LWR**

More recently, four First Nations negotiated an agreement with Manitoba Hydro known as the Joint Keeyask Development Agreement (JKDA), which sets out the terms for them to become equity partners in the Keeyask Generation Project. One of the terms of the JKDA, which was signed in 2009 by Manitoba Hydro, York Factory First Nation, Fox Lake Cree Nation, and Cree Nation Partners (a partnership of Tataskweyak Cree Nation and War Lake First Nation), was that development of the Keeyask Project would not require any change to the existing licences for LWR or CRD. The regulatory process for the Keeyask Project involved completion of an EIS focusing largely on the reach of the Nelson River from Split Lake to Stephens Lake.

As of summer 2015, Manitoba Hydro is compiling an assessment of the effects of multiple hydroelectric projects in the Nelson and Churchill river sub-watersheds in northern Manitoba. The Clean Environment Commission, in its 2013 report on Manitoba Hydro's application for an *Environment Act* licence for the Bipole III Transmission Project, had recommended that such a study take place before additional development on the Nelson River. The purpose of the study, known as a Regional Cumulative Effects Assessment (RCEA), is to examine how impacts of various projects may work in combination or how a series of smaller impacts may add up to a large

impact. Manitoba Hydro and the Manitoba government are currently working on the RCEA, which will include a consideration of LWR in this regional context. (Manitoba Clean Environment Commission 2013, 2014).

## 3.2 Manitoba's Hydroelectric System

To understand the role of LWR, it is helpful to view Manitoba's hydroelectric system as a whole. Electricity in Manitoba is generated and transmitted by Manitoba Hydro, which operates a total of 17 generating stations, 15 of which are hydroelectric, and also buys electricity from two wind farms. Most of Manitoba Hydro's generating capacity is supplied by generating stations on the Nelson River. Three large generating stations on the Nelson River – Kettle, Long Spruce, and Limestone – have a combined capacity of more than 3,500 megawatts (MW) and represent approximately 70 per cent of Manitoba Hydro's generating capacity. (One MW is enough to light more than 16,000 60-watt light bulbs.) They went into operation in 1974 (Kettle), 1979 (Long Spruce) and 1990 (Limestone). The Jenpeg Control Structure, though built primarily for regulating outflow from Lake Winnipeg, contains a relatively small generating station, capable of producing 125 MW of electricity. The Kelsey Generating Station, the oldest on the Nelson River, generates 220 MW of electricity. Kelsey was completed in 1960 to provide power for the city of Thompson and adjacent mining operations. Another Nelson River generating station, Keeyask, is currently under construction upstream of the Kettle station, and will add nearly 700 MW of generating capacity to the total.

The generating stations downstream on the Nelson require about 160,000 cfs to produce electricity at maximum capacity. In the summer, when Lake Winnipeg is at

715.0 feet asl, Manitoba Hydro can discharge 150,000 cfs from the lake. In the winter, though, ice cover reduces discharge capacity to about 75,000 cfs. Under those conditions, water from CRD is required to allow the lower Nelson River stations to operate at their full capacity. CRD consists of two control structures and one excavated channel. The Missi Falls structure raises the level of Southern Indian Lake by three metres so that water will flow via an excavated channel into the Rat and Burntwood River system. The Notigi structure on the Rat River regulates the flow into the Burntwood River, which flows into the Nelson River at Split Lake. Manitoba Hydro is licensed to divert 30,000 cfs (850 cubic metres per second) from the Churchill to the Nelson system. While CRD has an impact on the environment at Southern Indian Lake, along the Churchill, Rat and Burntwood Rivers, and on the Nelson River from Split Lake to Hudson Bay, it is not a part of this review.

In addition to the Nelson River generating stations, Manitoba Hydro operates the Grand Rapids Generating Station on the Saskatchewan River, which has a capacity of 480 MW, the Wuskwatim Generating Station on the Burntwood River, which has a capacity of 200 MW, and a series of six generating stations along the Winnipeg River, with a total capacity of approximately 580 MW. These Winnipeg River stations include the oldest in Manitoba: the Pointe de Bois station, which went into service in 1911. In addition to the hydroelectric generating stations, Manitoba Hydro operates thermal generating stations in Brandon and East Selkirk, which burn natural gas and have a generation capacity of 458 MW of electricity. The Brandon station also has one coal-fired unit. Manitoba Hydro purchases electricity from two independently owned wind farms at St. Leon and St. Joseph, providing a maximum of nearly 240 MW of electricity.

Figure 3.1: Manitoba's hydroelectric system. (Manitoba Hydro)

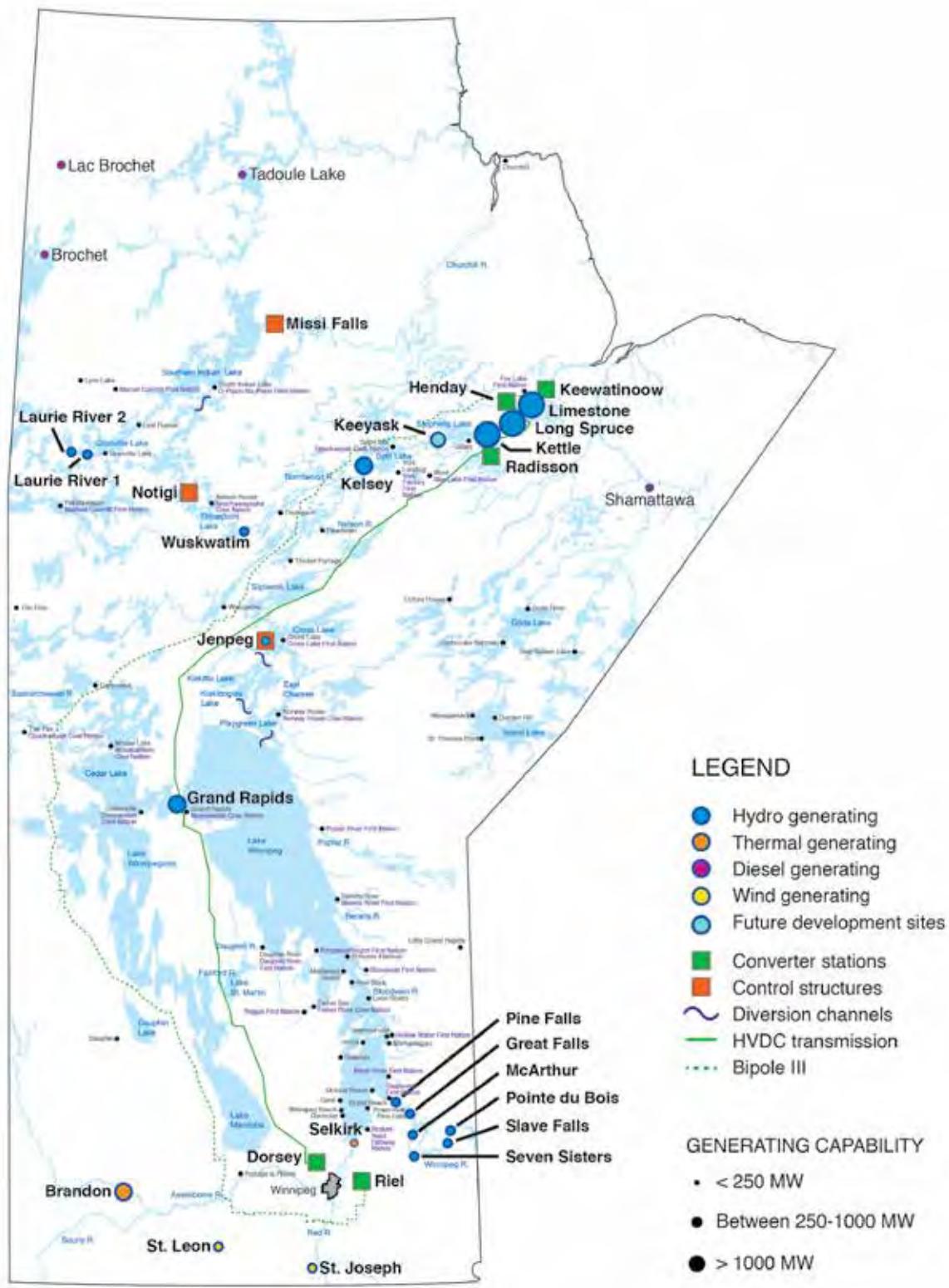


Figure 3.2: Manitoba Hydro's northern hydroelectric generating stations. (Manitoba Hydro)

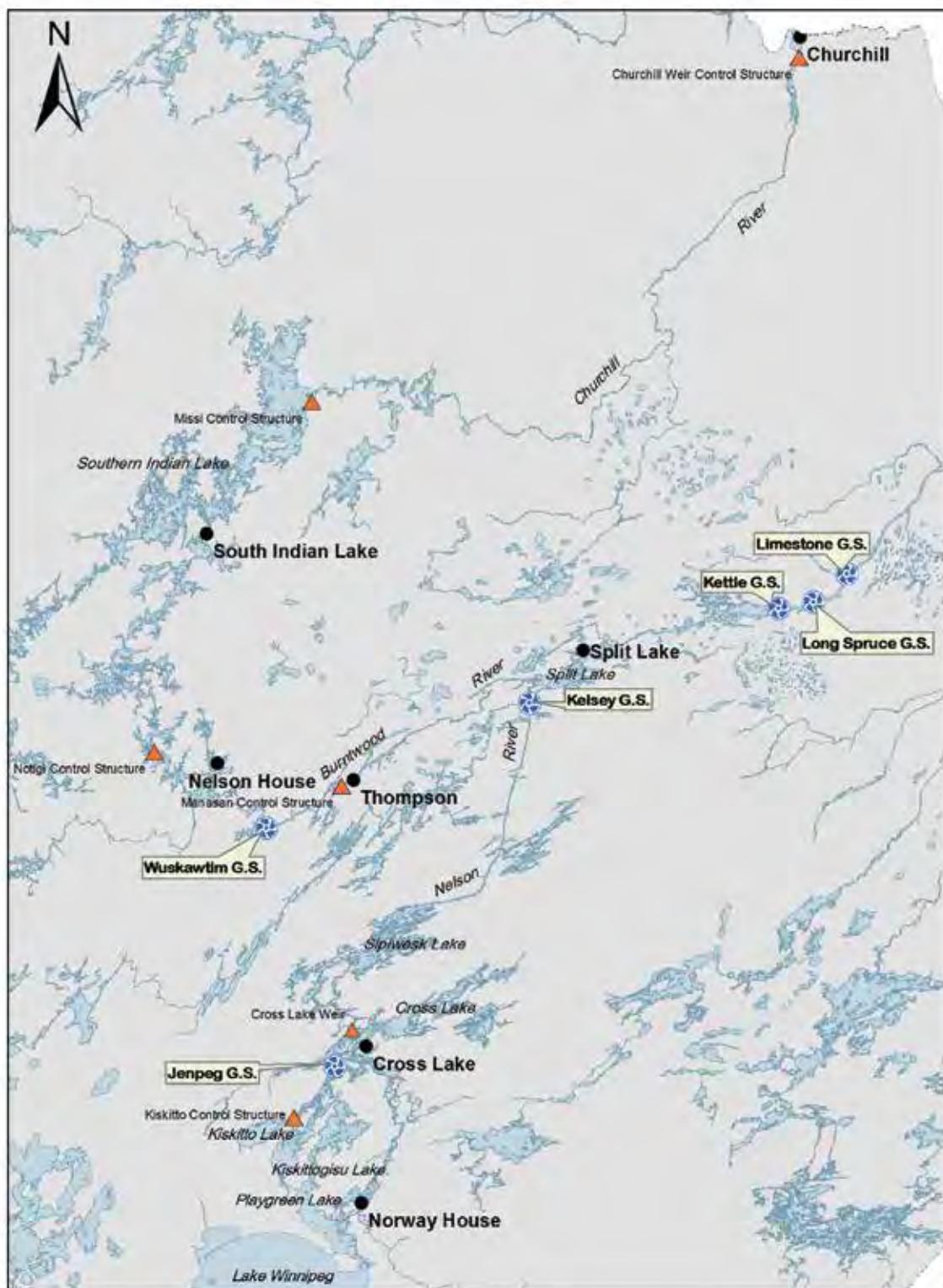
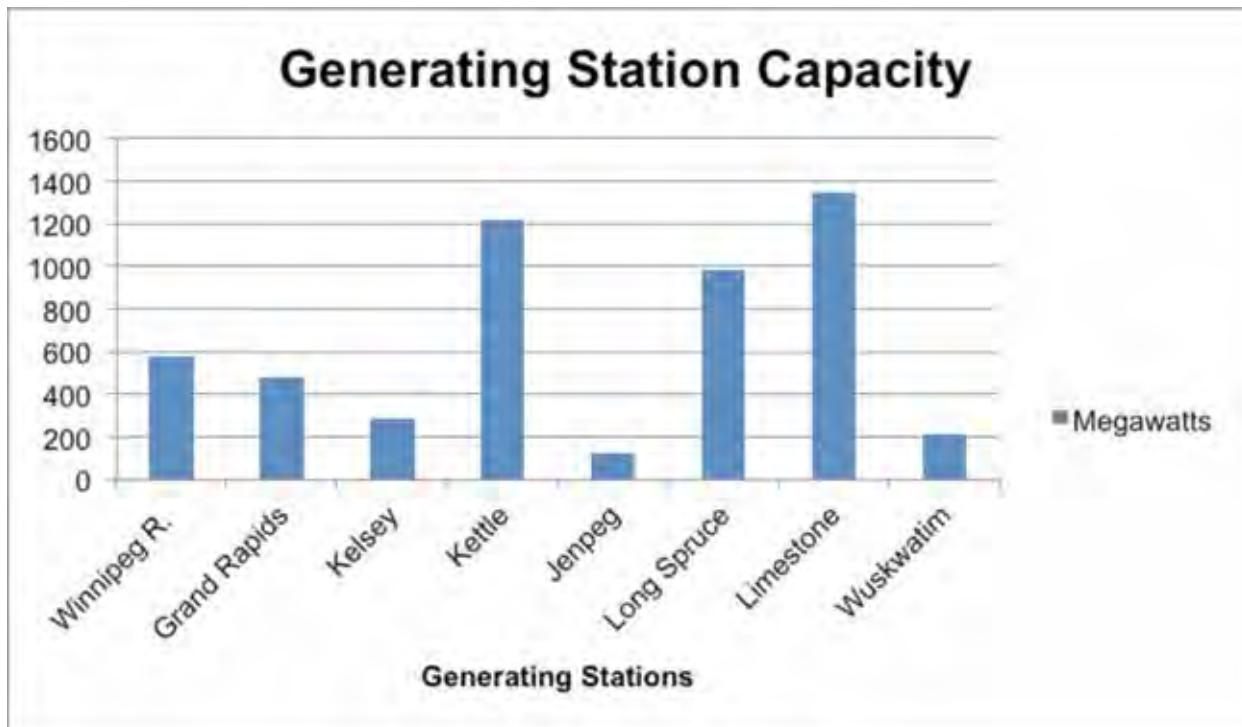


Figure 3.3: Major hydro generating stations by generation capacity. (Manitoba Hydro)



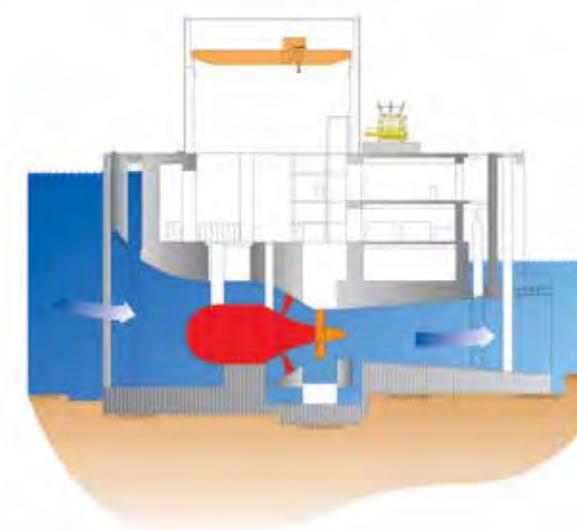
Manitoba Hydro's system of transmission lines includes connections to Saskatchewan, Ontario, North Dakota and Minnesota, which allow for surplus electricity to be sold when it is not needed in Manitoba and for electricity to be purchased from other jurisdictions in the event of a shortfall in Manitoba. Manitoba's period of peak demand for electricity is winter, as a result of the use of electricity for heating. In Minnesota, Wisconsin and other American states, peak demand is in summer, as a result of the widespread use of air conditioning.

The Nelson River's prominence in Manitoba Hydro's generating system reflects its status as the largest river in Manitoba, with the most electrical generating capacity. The electrical generating capacity of a river is a result of the amount of water in the river and the height it drops, referred to as the hydraulic head. Increasing either the amount of water or

the amount of hydraulic head provides greater power to turn the turbines that generate electricity. Therefore, the greatest potential to generate electricity is on a large river, such as the Nelson, at a place such as set of rapids where it drops a relatively large amount in a relatively short distance. Water stored in a reservoir upstream of a generating station therefore represents stored energy, like a giant battery. By controlling the release of the water through the turbines of a generating station, this potential energy can be turned into electricity when it is needed. It's necessary to be able to store potential energy in this manner because once electricity is generated, it cannot be stored.

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**Figure 3.4: Bulb type turbine at Jenpeg.  
(Manitoba Hydro)**



(Note: this cross-section depicts the Jenpeg Generating Station, which has unique bulb-style turbines to generate electricity at a site with relatively little hydraulic head, where the water is essentially running horizontally. Manitoba Hydro's other generating stations employ a style of turbine in which the water runs past them vertically and drops a greater distance.)

LWR therefore allows Lake Winnipeg to be used as a storage reservoir so that water can be released as needed to generate power at the downstream generating stations on the Nelson River. LWR is also designed to allow Manitoba Hydro to discharge more water from Lake Winnipeg in winter, resulting in more power, than would be possible under natural conditions. The four feet of storage allowed under Manitoba Hydro's licence for LWR ensures enough water to provide the corporation with almost one quarter of its dependable energy.

Water released at the Jenpeg Control Structure takes weeks to reach the three large generating stations on the lower Nelson River,

so releases at Jenpeg are not based on hour-by-hour power demands, but on forecasts of expected demand several weeks in the future.

### 3.3 What is Lake Winnipeg Regulation?

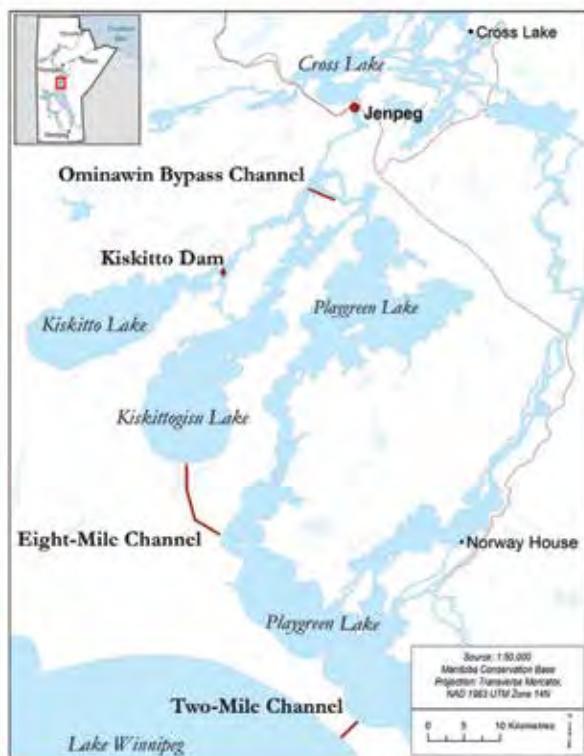
LWR consists of a series of excavated channels to allow for increased drainage of Lake Winnipeg, combined with the Jenpeg Control Structure on the west channel of the Nelson River, just upstream of Cross Lake. The channels allow for water to flow more freely into the Nelson River, while the Jenpeg Control Structure allows for regulation of the discharge of water down the Nelson River. The channels and channel improvements allow up to 50 per cent more water to flow out of Lake Winnipeg than was possible in the past with only the natural channel at Warren Landing. All of the components of LWR are on the west channel. The east channel is not directly regulated by LWR, but is affected by altered water levels on Playgreen Lake.

To understand what LWR is, it helps first to understand the geography of the affected area. The natural drainage outlet from Lake Winnipeg, at the north end of the lake near Warren Landing, is a relatively shallow channel leading to Playgreen Lake, the first of a series of lakes known as the Outlet Lakes. Because this channel is only two to three metres deep, natural water flow is restricted, especially when the lake surface is covered by ice approximately one metre thick. Outflow from Lake Winnipeg through the Warren Landing channel is thus reduced in the winter, when demand for electricity in Manitoba is about 1,000 MW higher. In Playgreen Lake, the Nelson River is split into west and east channels. The west channel, which flows from Playgreen to Kiskittogisu Lake via a complex network of shallow channels, and into the western end of Cross Lake, carries approximately 85 per cent of the water flowing

out of Lake Winnipeg. The east channel carries the remaining 15 per cent and flows past Norway House Cree Nation, through Pipestone Lake and into Cross Lake.

Most of the water flowing out of Lake Winnipeg, therefore, either passes through the turbines or the spillway of the Jenpeg Generating Station. Raising or lowering the spillway or turbine gates allows Manitoba Hydro to control the amount of water continuing downstream.

**Figure 3.5: Lake Winnipeg Regulation project area. (Manitoba Hydro)**



From south to north, the elements of LWR are:

- Two-Mile Channel, excavated to provide an additional outlet from Lake Winnipeg to Playgreen Lake through the narrow peninsula west of the natural outlet at Warren Landing. As the name suggests, Two-Mile Channel was nearly two miles (3.2 km) long

when it was excavated. It is 30 feet (9 metres) deep and approximately 600-700 feet (180-210 metres) wide. As will be discussed in Section 7.3, Shoreline Erosion, the dimensions of Two-Mile Channel have changed somewhat since the construction of LWR.

- Eight-Mile Channel, which connects the southern end of Playgreen Lake with the southern end of Kiskittogisu Lake. This channel is wider than Two-Mile Channel (ranging from 700 to 1,200 feet or 213 to 366 metres) and approximately 20 feet (6 metres) deep. It allows water leaving Playgreen Lake to flow more readily into Kiskittogisu Lake instead of being constricted by narrow passages in the natural channel between the lakes further to the north.
- Kisipachewuk Channel Improvement, a relatively short excavation of a channel that leads from Kiskittogisu Lake to the Nelson River. This excavation deepens the river bed to increase flow over a length of about 260 feet (80 metres) and a width of 200 feet (60 metres).
- The Ominawin Bypass Channel, a channel at the north end of Kiskittogisu Lake that allows water to bypass the natural constrictions of the previously existing Ominawin Channel. This Bypass Channel is 2.1 miles (3.4 km) long, 1,400 feet wide (425 metres), and 20 feet (6 metres) deep. It also has a centre division, made of rock, which allows the channel to freeze with a more even covering of ice in the winter, reducing the risk of ice impeding the flow of water.
- The Jenpeg Control Structure, a dam across the west channel of the Nelson River about 100 km north of Lake

Winnipeg. This structure includes six turbines through which water passes, generating a maximum of 125 MW of electricity. When the flow in the river is greater than the capacity of the turbines, the excess is discharged over the spillway.

Other components of LWR include the Kiskitto Control Structure, which prevents water on Kiskittogisu Lake from flowing back into Kiskitto Lake, and the Black Duck Control Structure and Diversion Channel, which regulate Kiskitto Lake within its natural range. These components of LWR were constructed to prevent the project from affecting Kiskitto Lake.

In 1970, the Manitoba government issued an Interim licence to Manitoba Hydro under *The Water Power Act* to develop LWR. A supplementary Interim licence, reflecting modifications in the design of the project, was granted in 1972. In the years since the project went into operation in 1976, Manitoba Hydro has been engaged in a series of studies, negotiations and agreements with First Nations and other communities in the region, leading to a variety of compensation and mitigation programs. In response to questioning during the hearings, Manitoba Hydro stated that the long lapse in time between the completion of the project and the application for a final licence was a result of this long process. Manitoba Hydro also acknowledged that, by law in the state of Wisconsin, a utility can only count a purchase of power from Manitoba Hydro as renewable energy if Manitoba Hydro has a final licence for LWR. A final licence for LWR is, therefore, necessary for the corporation's export plans. Manitoba Hydro is also developing a new high-voltage transmission line to Minnesota, which can be used for exporting surplus power or importing power.

Under *The Water Power Act*, a proponent is entitled to a final licence upon

demonstrating that it has carried out the terms of the Interim licence. The Manitoba government has determined that this final licence is valid for a period of 50 years. Manitoba Hydro's current application is for a 50-year licence running from 1976, the year the project went into operation, to 2026, at which point it will require a new final licence. A copy of the licences is included in Appendix II of this report.

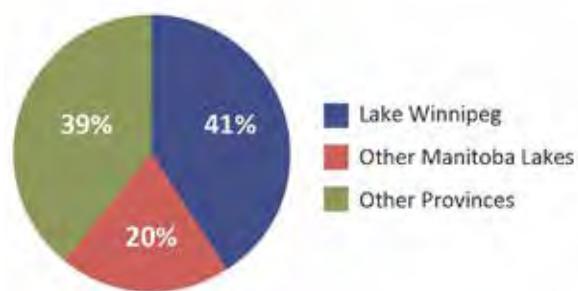
## 3.4 Operation of LWR

### Manitoba Hydro's Information: Operation of LWR

The Jenpeg Control Structure manages approximately 85 per cent of the flow out of Lake Winnipeg, the remainder of the flow going through the unregulated Nelson River east channel. Jenpeg functions primarily as a water control facility, though it also has a generating capability.

Lake Winnipeg serves as an important reservoir for the storage of water within Manitoba Hydro's system. Manitoba Hydro has calculated that Lake Winnipeg contributes approximately 40 per cent of total system storage, with 20 per cent provided by other Manitoba lakes and 39 per cent by other provinces.

**Figure 3.6: Relative system storage contributions. (Manitoba Hydro)**



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By raising or lowering the five gates on the Jenpeg Control Structure spillway or by opening or closing the gates on each of the six water passages that direct water to the turbines, Manitoba Hydro is able to determine how much water passes through the structure. Staff based at Jenpeg operate the facility from a control room on-site. Manitoba Hydro has stated that LWR cannot be operated to meet short-term power demands because several weeks are required for releases from the lake to arrive at the large downstream generating stations. Therefore, Manitoba Hydro regulates Jenpeg releases based on current Lake Winnipeg level, forecasts of near-term inflows to the lake, and typical seasonal load patterns.

On average, Jenpeg flows from late fall through the winter and in the mid-summer are the greatest, with the lowest flows in spring and late summer/early fall. Following freeze-up, flows are normally increased, when demand for electricity in Manitoba is at its highest. In all but one of the years since 1977, flows have been maximized during the winter, with generally limited variability. Winter flows can vary, depending on Lake Winnipeg water levels and ice constrictions, but the range of winter flows is narrower than any other time of the year.

The spring thaw, or freshet, normally produces higher inflows. Spring flows, in combination with seasonally reduced power demand and the need to limit releases to avoid flooding of the lower Nelson River, afford some opportunity to re-fill Lake Winnipeg. Releases through Jenpeg and the spillway are most variable during the summer, sometime falling to the minimum licence requirement, depending on Lake Winnipeg's level and inflow. Under wet conditions, maximum releases can continue into the spring and summer to avoid Lake Winnipeg rising to the upper end of the operating range. Inflow and electricity demand typically decline and

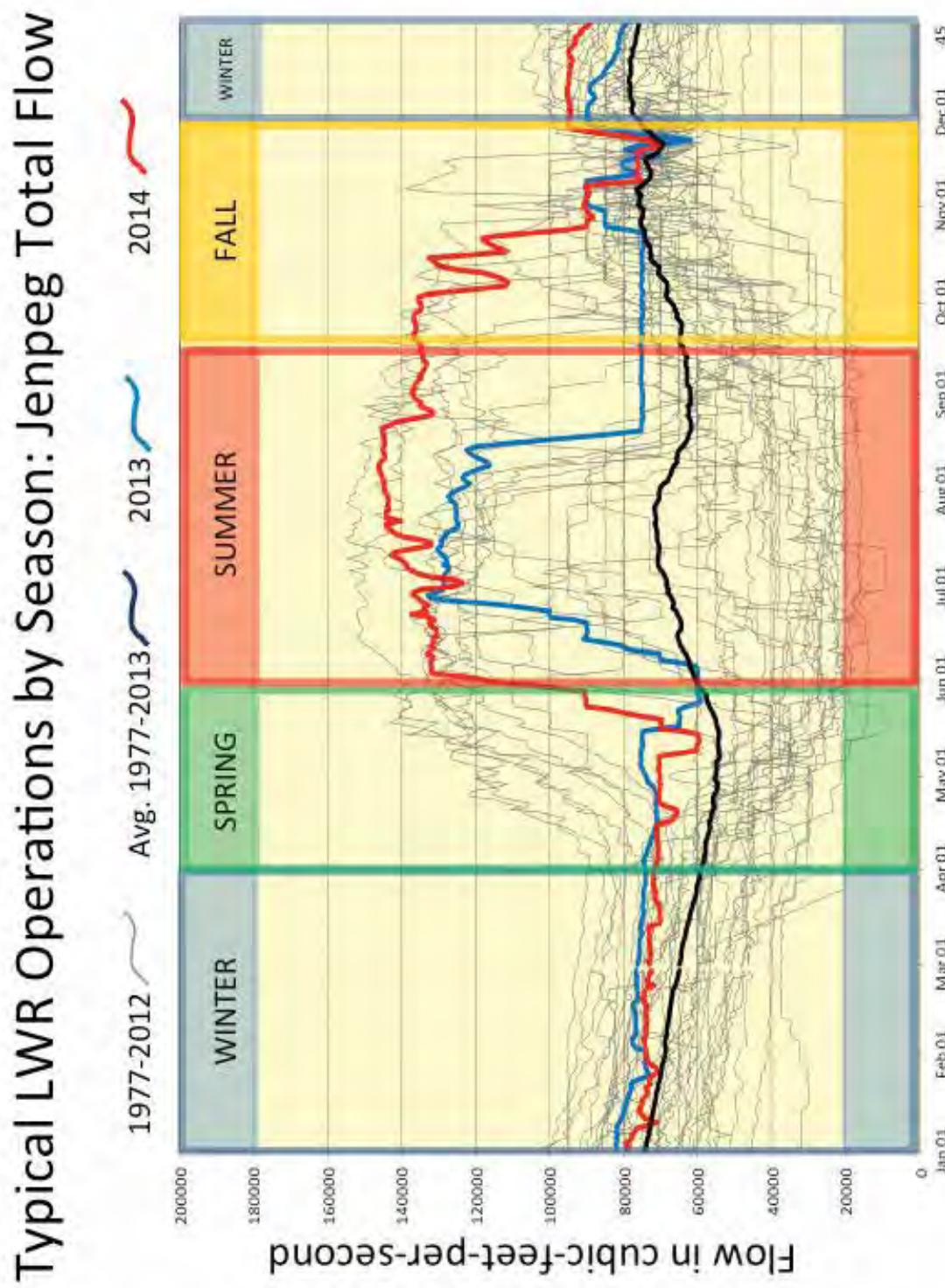
losses of water to evaporation increase in the late summer and early fall. At this time of year, releases also decline, conserving water in storage for the winter high-demand period and for future drought protection.

There are, of course, exceptions to this general operating pattern, particularly with the wet conditions and high water levels of the last few years. These high-precipitation conditions typically result in Jenpeg being operated at maximum discharge for an extended period of time. In such protracted wet conditions, Manitoba Hydro has limited options for managing levels and flows. In 2014, Jenpeg was under maximum discharge from June through October. That entire period was required to bring Lake Winnipeg water levels below 715.0 feet asl, from a peak of slightly above 716.0 feet asl in late July/early August. It should also be noted that maximum discharge in winter is significantly lower than in other times of year as ice constrictions limit water flow.

Manitoba Hydro has in place a decision support system to assist with short-term energy operations planning and impact assessment of various and sometimes competing system demands on power generation. A number of computer models are used to support Manitoba Hydro's energy operations and long-term system development planning.

Using its short-term energy operations planning models, Manitoba Hydro staff members incorporate information about precipitation, runoff into Lake Winnipeg, the current level of the lake, current outflow from the Jenpeg spillway and powerhouse, electricity provided to the grid, system demands, export obligations and the wholesale electricity market. Manitoba Hydro has stated that, while day-to-day decisions at Jenpeg are generally economic in nature, they are made with consideration of both

Figure 3.7: Typical Lake Winnipeg Regulation operations by season: Jenpeg total flow. (Manitoba Hydro)



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upstream and downstream stakeholders, as well as within the constraints of the operating licence. Manitoba Hydro has stated that operations at Jenpeg have been modified to reduce the creation of slush ice downstream of the generating station (see Section 8.4, Navigation, Transportation and Public Safety) and to limit the rate of change of the flow during the open-water season to reduce the impact on waterway users. Manitoba Hydro has stated that operators also sometimes increase outflow at Jenpeg before the level of Lake Winnipeg reaches 715.0 feet asl, in an effort to reduce the magnitude and duration of maximum discharge.

### **Commission Comment: Operation of LWR**

Managing a large, integrated hydroelectric system with various generating stations, control structures and reservoirs requires a balancing act among supply (including supply of water and supply of imported and non-hydro forms of energy), demand, and regulatory, environmental and socio-economic factors. The latter considerations include the LWR licence conditions, but also involve issues such as public safety and community concerns and interests related to flows and levels on waterways. The commission considers that the record demonstrates that Manitoba Hydro has improved in its efforts to balance these factors.

The commission heard during the hearings of how other jurisdictions have managed their surface water systems, many of which face far greater competing needs. In contrast to many other jurisdictions and other systems, LWR is subject to only a few formal licence conditions (see Sections 4.2, Terms of Licence and 4.3, Licence Compliance) and rules that directly address how LWR is operated. Over time, Manitoba Hydro

has modified its operations and developed informal ways, such as its Best Management Practices, to address some of the specific environmental, socio-economic, safety and other considerations.

As was evident during the hearings, there are only a few conditions on the LWR licence and some of those that do exist, such as the minimum flow requirement or maximum rate of change, not only lack scientific rationale, but have never been rigorously assessed in any public planning process to see if they are appropriate to address environmental or socio-economic conditions.

Beyond the licence conditions themselves, Manitoba Hydro has operated LWR and other waterway systems in Manitoba in the absence of (or based on very limited) externally reviewed and approved rules governing operating conditions, such as levels and flows on various water bodies and at various structures. This informal way of operating means Manitoba Hydro can address the particular needs of certain stakeholders, but it also means the priorities, conditions and trade-offs are very much determined by Manitoba Hydro, without public scrutiny or a consideration of a broader public interest. At times, it may actually put Manitoba Hydro in an awkward position having to make certain decisions which really should be aired through a more public planning process with government oversight and involvement.

The above should not be interpreted as a criticism of Manitoba Hydro. Up until this point, the corporation has not been asked to undertake a public water management planning exercise. During the hearing, Manitoba Hydro acknowledged the deficiencies in the current LWR licence and indicated that they are open to a more modern approach and to examining practices in other jurisdictions. The current informal way of managing LWR and other river

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systems in Manitoba stands in stark contrast to other jurisdictions that have engaged in multi-stakeholder water management planning processes under government oversight for major water management projects. During the hearings, Manitoba Hydro, some of the participating groups and organizations and some of the independent experts identified other jurisdictions from which lessons could be drawn.

Taking a more rigorous and public approach to planning future LWR operations would most likely lead to some environmental enhancements, as well as addressing certain socio-economic concerns more directly. Moreover, it might help the public to better understand the multiple and often competing environmental, social and economic demands in water management planning.

The commission heard discussions of the computer models Manitoba Hydro uses in energy operations and long-term system development planning. It is not clear that these models support both long-term planning of the hydroelectric system and real-time decision-making about operations in a way that incorporates environmental and social needs in addition to reliability and economic needs.

In Chapter 10 of this Report, “Going Forward” the commission will provide a more detailed discussion and recommendations on reviewing the operating regime for LWR with more formal, transparent, scientifically and publicly established rules, along with models and other decision-support tools that can help the public to better understand trade-offs in water management decisions.



# Chapter Four

## Licence Process, Terms and Compliance

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### 4.1 The Licensing Process

The process of working toward a final licence for Lake Winnipeg Regulation began in December 2010, when Manitoba Hydro requested a final *Water Power Act* licence from the Manitoba government. In July, 2011, the minister announced that the Clean Environment Commission would hold public hearings on Manitoba Hydro's request for a final licence. In August 2011, the minister provided the commission with the terms of reference for hearings regarding the licence.

The commission was asked to review the public policy surrounding regulation of Lake Winnipeg and to hear evidence from Manitobans regarding the effects and impacts of LWR. The commission was asked to review the successes and failures of the implementation of the public policy goals of LWR. Although the commission may make comments on concerns raised regarding the issuance of a final licence, including future monitoring and research, the commission was not asked to provide an opinion on whether or not a final licence should be issued, nor on whether or not LWR should have been developed in the first place. Nor was the commission asked to review other aspects of the Manitoba Hydro system.

After receiving its terms of reference, the commission requested that Manitoba

Hydro prepare a document in plain language describing LWR and its effects. The process of reviewing the application for a final licence was delayed, however, by two new developments proposed by Manitoba Hydro, both of which required public hearings held by the Clean Environment Commission. In December 2011, the Environmental Impact Statement for the Bipole III Transmission Project was released, leading to a review and public hearings, which concluded in the winter of 2013. Shortly after the commission completed its review of the Bipole III Project, it began hearings on the Keeyask Generation Project, which concluded in the winter of 2014.

In July 2014, Manitoba Hydro published “A Document in Support of Manitoba Hydro’s Request for a Final Licence Under *The Manitoba Water Power Act*,” which was intended to provide the commission and the public with information about the history, operations and effects of LWR. This document was based on information from many of the follow-up research programs described in Section 3.1, A Brief History of Lake Winnipeg Regulation. This document included information on the potential effects of revisions to the LWR licence, which the commission had posed to Manitoba Hydro. Publication of this report set in motion the hearings that began in January 2015. The document was not an environmental impact

statement, as it did not contain baseline environmental data on the pre-project environment, as such baseline data were not available, nor did it contain new research.

## 4.2 Terms of Licence

Manitoba Hydro is licensed under *The Water Power Act* to regulate Lake Winnipeg between the elevations of 711.0 and 715.0 feet asl for the purposes of generation of electricity. Under the licence, if the level of the lake reaches 715.0 feet asl, Manitoba Hydro is required to operate the Jenpeg Control Structure at maximum discharge to lessen flooding impacts on Lake Winnipeg. If the level of the lake falls below 711.0 feet asl, Manitoba Hydro is required to operate Jenpeg in accordance with instructions from the minister. Lake levels referred to in the licence are for the wind-eliminated level of the lake. Wind-eliminated levels of Lake Winnipeg are calculated using eight Water Survey of Canada stations (four in the north basin and two each in the south basin and the narrows area), using a formula established in 1982 by the Ad Hoc Committee on Lake Winnipeg Datum, chaired by the Manitoba Water Resources Branch, with representation from Manitoba Hydro and the Water Survey of Canada. Because strong winds can move water to the north or south in Lake Winnipeg and cause variations, it is necessary to calculate what the level would be without the effect of wind. This process was independently reviewed by W.F. Baird and Associates Coastal Engineers in 2000 in a report prepared for the Lake Winnipeg Shoreline Erosion Advisory Group (2000) and was considered appropriate.

Under another condition of the licence, the combined flow from all natural and artificial channels from Lake Winnipeg must not be less than 25,000 cfs. The licence also sets a maximum rate of change for flows from

**Figure 4.1: Water Survey of Canada gauges on Lake Winnipeg. (Manitoba Hydro)**

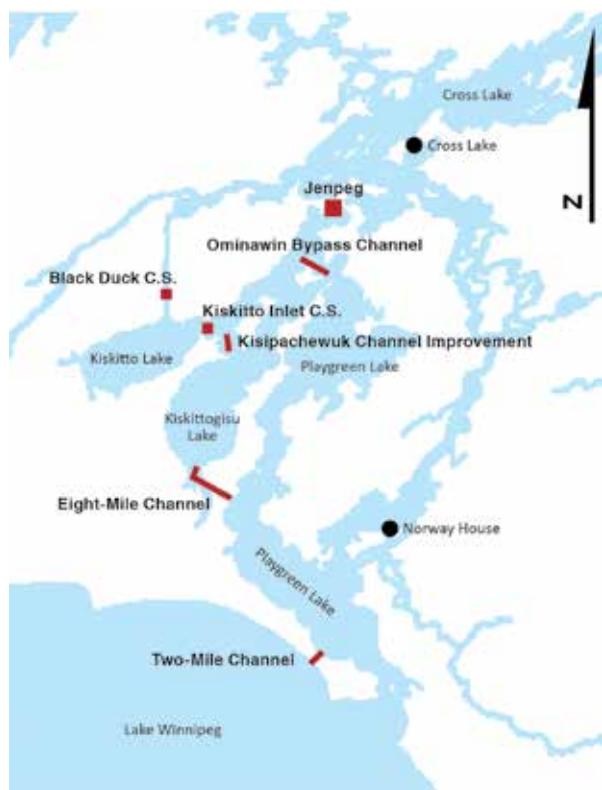


Jenpeg. In a 24-hour period, the flow rate at Jenpeg is not permitted to change by more than 15,000 cfs. The licence for LWR also sets ranges for the elevations of the Outlet Lakes, with Playgreen set at 707.0 to 714.9 feet asl and Kiskittogisu set at 706.0 to 714.8 feet asl.

The original 1970 licence authorized Manitoba Hydro to build two control structures on the west channel of the Nelson River: one at Ominawin Rapids and one at Metchanais Rapids. The 1972 supplementary licence was modified to reflect the final design of LWR. It authorized Manitoba Hydro to build one control structure at the Jenpeg site on the west channel and to create the Ominawin Bypass Channel at Ominawin Rapids, as well as the Kisipachewuk Rapids channel improvements, in addition to the Two-Mile and Eight-Mile Channels and the Kiskitto Lake works. Conditions regarding

lake water levels, minimum outflows on the Nelson River and the maximum rate of change to outflows were the same for both the 1970 licence and the 1972 supplementary licence.

**Figure 4.2: The Outlet Lakes and Jenpeg. (Manitoba Hydro)**



It is important to remember that when the licence refers to a maximum level for Lake Winnipeg or the Outlet Lakes, it does not mean that Manitoba Hydro is required to ensure that the lakes in question never rise above those levels. Since the maximum inflow capacity into Lake Winnipeg, via the Winnipeg, Saskatchewan, Red, Dauphin and other rivers, is greater even than the expanded outflow created through LWR, it is still possible for the levels of the lakes to rise above these specified elevations. The licence stipulates that when these levels are exceeded, water must be discharged at the maximum

rate possible at Jenpeg to return the lakes to their licensed range.

Both the 1970 licence and the 1972 supplementary licence state that upon satisfactory completion of the project and fulfillment of all terms and conditions required in the Interim Licence, the minister will issue a final licence. The Interim Licence states that the final licence will be issued "subject to the regulations then in force."

## 4.3 Licence Compliance

Manitoba Hydro reported that it has met some licence conditions 100 per cent of the time since the beginning of the project, while other conditions have not always been met. Wind-effects, ice jams, emergencies and errors in operation of the Jenpeg Control Structure were listed as causes of occasions when licence conditions were not met.

Manitoba Hydro instituted a combined reporting program for all operations in 2005, in co-operation with the Manitoba government, to monitor compliance with all of its *Water Power Act* licences. Any deviation from a licence condition is reported to Manitoba Conservation and Water Stewardship.

### 4.3.1 Licence Condition: Playgreen and Kiskittogisu Lakes

Water levels on Playgreen and Kiskittogisu Lakes have been within their mandated levels 99.9 per cent of the time. Typically, when water levels have been outside of their mandated range, it has been the result of wind set-up, which occurs when prolonged strong winds force large amounts of water on Lake Winnipeg in one direction. A strong wind from the south can cause wind set-up by forcing more water than usual through Two-Mile Channel and the Warren Landing outlet into Playgreen Lake.

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### **4.3.2 Licence Condition: Maximum Discharge**

The licence states that Manitoba Hydro must operate the Jenpeg Control Structure to maximize discharge when the wind-eliminated water level on Lake Winnipeg exceeds 715.0 feet asl. Since the project went into operation, Manitoba Hydro has operated at maximum discharge 100 per cent of the time when Lake Winnipeg has reached 715.0 feet asl. Between 1977 and 2013, there were nine periods during which Jenpeg was operated at maximum discharge because of levels over 715.0 feet asl on Lake Winnipeg. As of the end of the hearings, these periods were:

- May-August 1979
- May-June 1986
- May-July 1997
- May-October 2005
- July-August 2008
- May-September 2009
- July-December 2010
- April-October 2011
- July 2013
- June-October 2014

### **4.3.3 Licence Condition: Minimum Outflow**

The licence states that the combined outflow from the east channel of the Nelson River and the Jenpeg Control Structure must not be less than 25,000 cfs. Manitoba Hydro states that it has met this condition 99.9 per cent of the time. This condition is based on

the lowest flow recorded pre-LWR at Bladder Rapids, 30 km downstream of Jenpeg, which was 24,600 cfs. Those occasions when it has not met this condition have been the result of wind effects reducing the flow into the east channel.

### **4.3.4 Licence Condition: Forecasting Levels and Flows**

The licence requires Manitoba Hydro to provide a 90-day forecast of water levels and flows for LWR each month to the minister, including forecasts of daily inflows to Lake Winnipeg, flows for the Nelson River east and west channel, and levels for Lake Winnipeg, Playgreen and Kiskittogisu Lakes. These forecasts are also posted on Manitoba Hydro's website.

### **4.3.5 Licence Condition: Outflow Rate of Change**

The licence states that Manitoba Hydro must operate the Jenpeg Control Structure so the amount of water discharged does not change by more than 15,000 cfs in a 24-hour period. This condition has been met 94.8 per cent of the time. Manitoba Hydro states that this condition was exceeded more frequently during the first decades of operation of LWR. From 1976 to 1999, this condition was exceeded seven to eight per cent of the time, but from 2000 to 2012 it was exceeded less than two per cent of the time. Approximately half of the occasions when this condition was exceeded involved changes in flow rate of less than 2,000 cfs in excess of the maximum change. Reasons for exceeding this condition include unexpected outages of powerhouse units or power lines, operator error during adjustments to flow or power generation, wind effects, ice jams and emergencies. One of the periods when Manitoba Hydro deviated from this condition was authorized in advance by the Manitoba government. This occurred

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in 2010, when the corporation installed an ice boom upstream of Jenpeg to allow ice cover upstream of the control structure to form more smoothly. An ice boom is a floating structure designed to prevent ice from flowing down the river.

#### **4.3.6 Licence Condition: Kiskitto Lake**

The licence states that water levels on Kiskitto Lake must remain within their natural range. This condition has been met 100 per cent of the time.



# Chapter Five

## The Public Hearing Process

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### 5.1 Clean Environment Commission

The panel assigned to conduct the public hearings consisted of Terry Sargeant (Chairperson of the panel and of the Clean Environment Commission), Neil Harden, Beverly Suek and Edwin Yee. Panel members for any given set of hearings are selected from among the members of the Clean Environment Commission based on expertise and availability. Members of the commission are appointed by the minister.

### 5.2 Public Participation

All groups and members of the public were able to ask questions of Manitoba Hydro and provide their own perspective on LWR. A number of groups and organizations were substantially involved in the hearing process. Many of these groups and organizations took part in the pre-hearing process, during which they reviewed Manitoba Hydro's "Document in Support of Manitoba Hydro's Request for a Final Licence under *The Manitoba Water Power Act*" and sought further information before the beginning of hearings. Many of the participating groups were represented by counsel and brought their own expert witnesses to the hearings. Many of them also received funding through the Participant Assistance Program to help them analyze

and assess impacts, gather community views on LWR and prepare for the hearings. Those participating were:

- Black River First Nation
- Consumers' Association of Canada (Manitoba Branch)
- Interlake Reserves Tribal Council
- Keewatinook Fishers of Lake Winnipeg
- Manitoba Métis Federation
- Manitoba Wildlands
- Norway House Fishermen's Co-operative
- Peguis First Nation
- Pimicikamak Okimawin
- Tataskweyak Cree Nation
- York Factory First Nation

#### 5.2.1 Community Hearings

Given the size of Lake Winnipeg and the downstream area affected by LWR, community hearings were held over a large part of Manitoba. In early September 2014,

the commission invited First Nations or other communities with an interest in LWR to host meetings. Commission staff also began scheduling community hearings in other cities and towns in the region to allow community members to provide the commission with their first-hand experiences with LWR.

Hearings were held in 10 First Nations, 11 cities, towns and villages, and in the Winnipeg head office of the Manitoba Métis Federation. Hearings were held in Thompson, Wabowden, York Factory First Nation, Misipawistik Cree Nation, Fisher River Cree Nation, Pine Dock, Peguis First Nation, Ashern, Grand Marais, Brokenhead Ojibway Nation, Selkirk, Gimli, Manigotagan, Black River First Nation, Berens River First Nation, Sagkeeng First Nation, Pimicikamak Okimawin, Cross Lake, Norway House Cree Nation and Norway House.

### **5.2.2 Participant Assistance Program**

Typically, when the commission conducts hearings into a project requiring a licence under *The Environment Act*, funding is available for Participants as governed by *The Environment Act* Participant Assistance Regulation. This creates a Proponent-funded program that ensures the qualifying public organizations have access to resources to participate effectively in hearings of this nature. Participants usually use these funds to hire legal counsel and/or specialists on environmental assessment and to pay travel and accommodation expenses for representatives to make presentations. For these hearings, funds were also made available for communities to prepare for and host a community meeting with the commission. Although these hearings were carried out under *The Water Power Act*, a pool of Participant Assistance funding was available for this purpose.

## **5.3 Presenters**

Presenters are individuals or representatives of organizations who attended and spoke only at the hearings. They were allowed 15 minutes per person in which to present their views or information and, in some cases, were asked questions of clarification by the panel. Special times, such as evening sessions, were set aside to enable members of the public to make presentations at the hearings.

## **5.4 Written Submissions**

As an alternative to appearing at the hearings, members of the public and interested organizations are invited to submit written presentations. The commission received 15 written submissions, covering a variety of topics. These are taken into consideration along with in-person presentations.

## **5.5 Access to Information**

All the information presented to the commission during the hearings is available on the commission's website ([www.cecmanitoba.ca](http://www.cecmanitoba.ca)). This includes background documents, presentations, verbatim transcripts of in-person submissions and written submissions. A list of those who presented information to the commission is available in Appendix III of this report.

### **Commission Comment: The Public Hearing Process**

The hearing process for this report was one of the most extensive ever conducted by the commission, in terms of the number of individuals who spoke or made written submissions and the number of communities visited. The degree of passion and interest

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demonstrated is an indicator of the importance of water, in general, and Lake Winnipeg and the Nelson River, in particular, to the people of Manitoba.

As a result of this information gathering, the commission has gained sufficient understanding of uncertainties and concerns regarding the process of *Water Power Act* licensing to offer analysis and non-licensing recommendations regarding future management, monitoring and research.



# **Chapter Six**

## **Reports of Clean Environment Commission Experts**

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### **6.1 Overview**

In order to provide analysis of a variety of factors affecting Lake Winnipeg Regulation or the Lake Winnipeg/Nelson River area, the commission contracted with several specialists to write and present independent reports on subjects relevant to the hearings. These reports broadened the commission's understanding of several technical and scientific issues relevant to a discussion of LWR and informed the thinking of commission members as they considered the wide range of views presented during the hearings. These reports were made available to the public and to all the participating parties, including participating organizations, government representatives and Manitoba Hydro. (These reports are available in full on the Clean Environment Commission website at [www.cecmanitoba.ca](http://www.cecmanitoba.ca)). With few exceptions, the specialists who presented them were available for questioning during the hearings.

The specialists and the reports they presented, were:

- Harvey Thorleifson, The University of Minnesota, Department of Earth Sciences, "Influence of Isostatic Rebound on Lake Winnipeg," an examination of the influence of the earth's crust rebounding after having been depressed by the weight of ice sheets during the last Ice Age.
- Peter J. Zuzek, W.F. Baird and Associates Coastal Engineers, "Lake Winnipeg Erosion and Accretion Processes: A Compendium to the Lake Winnipeg Shoreline Management Handbook."
- Raymond Hesslein, "Water Level Regulation in the Lake Winnipeg Basin and its Effects on Nutrient Status of the Lake."
- Gregory K. McCullough, The University of Manitoba, Centre for Earth Observation Studies, "Climate in the Lake Winnipeg Watershed and the Level of Lake Winnipeg."
- Gordon Goldsborough, The University of Manitoba Department of Biological Sciences, "Coastal Wetlands of Lake Winnipeg and the Netley-Libau Marsh," a summary of studies on the state of the marsh at the mouth of the Red River, where it empties into Lake Winnipeg.
- George F. McMahon, SENES Consultants, An Arcadis Company, "Review of Hydrologic and Operation Models Presented to the Manitoba Clean Environment Commission," a technical analysis of the models used by Manitoba Hydro to assess

theoretical changes to the terms of the licence for LWR.

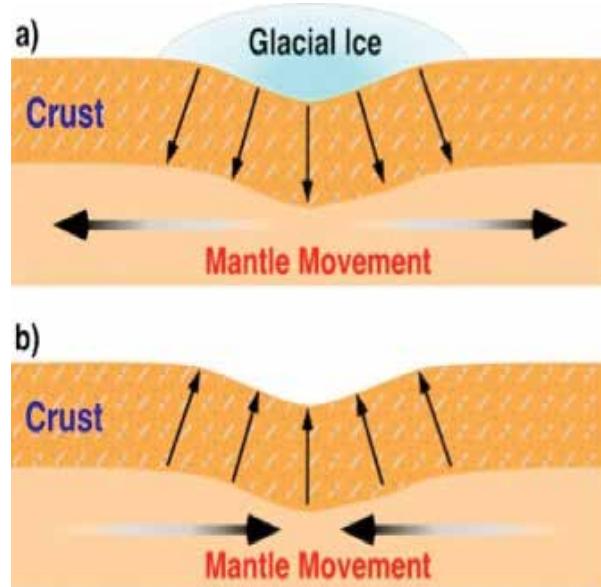
## 6.2 Influence of Isostatic Rebound on Lake Winnipeg

Isostatic rebound is a geological process that has been changing the shape of Lake Winnipeg for thousands of years and that continues to make Lake Winnipeg expand and grow toward the south.

Isostatic rebound is the very gradual upward movement of the earth's crust in areas where it had been depressed by the weight of the massive ice sheets of the Ice Age. Between 10,000 and 20,000 years ago, all of Manitoba was covered by thick sheets of ice, like those that currently cover Antarctica. They were thickest – about four kilometres – over Hudson Bay. The pressure of this immense depth of ice pushed down on the earth's crust, which floats on top of the earth's interior. In effect, this great weight caused the crust underneath the ice to sink further into the earth, just as a heavy weight on a boat will cause the boat to ride lower in the water. The weight of the ice sheets pushed the earth's surface as much as one kilometre lower in the region where the sheets were thickest. As the ice melted, the earth's crust began to rise, just as a boat will rise when a load is taken out of it. This rebound is a slow and gradual process, taking thousands of years, and is occurring over a widespread area of Canada that was covered during the Ice Age.

Because the crust was depressed the most below what is now Hudson Bay, isostatic rebound is occurring most rapidly in that area. The earth's crust is rising by about one metre per century around Hudson Bay, with the rate of rebound diminishing farther from Hudson Bay. The effect of isostatic rebound on Lake Winnipeg is intensified because the lake runs some 400 km from south to north

**Figure 6.1: Depression of earth's surface under the ice sheet (a) and rebounding (b). (<https://oncirculation.files.wordpress.com/2012/11/rebound.png>)**



and the surface of the earth at the north basin is rising more rapidly than at the south basin. As a result, the outlet of the lake at Warren Landing is rising more rapidly than the south basin inlets of the Winnipeg and Red Rivers, causing the lake to expand to the south. Essentially, this can be visualized by taking a basin partially filled with water and raising one end; water will run into the end that isn't raised.

This process was already occurring at the time when Lake Agassiz, a huge lake of glacial melt water, covered much of Manitoba and produced the lake-bottom sediments that resulted in the wide, flat Red River valley. Lake Agassiz's ancient shoreline beaches still remain in many places on the landscape. At the time they were formed, these shorelines would have been at the same elevation, but today shorelines to the northeast (closest to Hudson Bay) are at a higher elevation than other shorelines from the same period,

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because they have risen more rapidly than the shorelines farther from Hudson Bay.

Isostatic rebound has changed the shapes of lakes and the flows of rivers over the last several thousand years. After Lake Agassiz drained, for some time what is now Lake Winnipeg's north basin was entirely separate from the south basin. A small lake in the south basin flowed through a river where the narrows of Lake Winnipeg is today and emptied into the north basin lake. The north basin lake then flowed into a river, which flowed into an entirely separate Playgreen Lake. For some time after the melting of the ice sheets and the draining of Lake Agassiz, the Saskatchewan River flowed into the Nelson River downstream of Lake Winnipeg. As a result of isostatic rebound, the Saskatchewan River was forced into a new channel, flowing into Lake Winnipeg, leading to an increase in the amount of water flowing into the lake.

As early as the late 1800s, evidence for isostatic rebound began to be recognized when scientists mapped Lake Agassiz's ancient shorelines. The development of radiocarbon dating provided further evidence beginning in the 1950s. Evidence for isostatic rebound can be seen around Hudson Bay, where there are shorelines high above the surface of the Bay that are dated to about 8,000 years ago and others much closer to the Bay dated to 1,000 years or less. The tide gauge at Churchill continues to provide data (since 1940) that indicate that sea level has been retreating at a rate of about 70 cm per century. In thousands of years, as isostatic rebound continues, Hudson Bay itself will gradually become dry land.

A variety of scientific studies, involving radiocarbon dating of marine shorelines, tide gauges, lake gauges and measurements of gravity, have indicated that, at the north end of the lake, the rate of rebound amounts to approximately 40 cm per century, while

at the south end, it is approximately 20 cm per century. This means that, as the lake essentially pivots, the water level in the south basin rises by approximately 20 cm per century. The rate of rebound is gradually slowing down. Research shows that several thousand years ago, the surface was rising at a faster rate than today. A variety of studies in the south basin confirm the rate and the long-term nature of rebound. For example, radiocarbon dating indicates that the south basin was dry land until about 4,000 years ago. At a site offshore from Gimli, scientists examining the layers of sediment and clay underneath the water have found evidence of what was once dry land beneath 10 metres of lake water and four meters of sediment deposited after the flooding of the land.

This gradual rise in the lake level means that the natural state of Lake Winnipeg is to expand through shoreline erosion. This allows for shorelines to recede by observed rates of 0.5 to 5 metres per year in the south basin. The author notes that it may seem like a paradox that a small, gradual rise in lake level can cause shorelines to recede, given the much larger fluctuations produced by flooding and wind setup. This is explained by looking at the angle of the shoreline itself. The drop-off between the high and low water lines along the shore is typically 10 per cent, or a 1 metre drop over 10 metres of horizontal distance. That means the lake level can rise and fall by much more than 20 cm as a result of wind effects and seasonal variations and still be contained by the relatively steep bank. However, a permanent rise in lake levels, even a small one, exposes the base of the slope to a sustained increase in the power of waves, with the result that the lakeshore is continually weakened and the shoreline is gradually pushed back.

Several geographic features along Lake Winnipeg are the result of isostatic rebound –

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and are also known to be signs of rising water levels in other places. On Lake Winnipeg, the sandy beach that separates the south end of the lake from Netley-Libau Marsh is a barrier island. So too is Willow Island, near Gimli. The sandy barrier separating Delta Marsh from Lake Manitoba is also a sign that that lake is expanding to the south as a result of isostatic rebound. Other barrier islands are found in the Great Lakes at Hamilton and Duluth, and along the east coast of the U.S. Barrier islands are a sign of rising water levels. They erode through wave action on the side facing the lake or ocean, and are built up on the side facing the lagoon or marsh. Over time, barrier islands move toward the land, even as the land recedes farther inland as a result of rising water. Another feature of Lake Winnipeg that indicates rising water levels is the existence of drowned valleys, also known as estuaries, such as those of the Icelandic River and Netley Creek. A drowned valley is one that has become an inlet of the ocean or lake into which a river empties, as a result of the ocean or lake rising.

Isostatic rebound is occurring on other large lakes in Manitoba, but its effects vary depending on the placement of the inlet and outlet of a lake. Lake Winnipegosis, for example, is actually contracting as a result of isostatic rebound, because its outlet, the Waterhen River, is at the south end of the lake. That means the north end of the lake is rising relative to the lake's outlet, so that gradually the water is moving toward the outlet. Ancient shorelines inland from the current shoreline of Lake Winnipegosis demonstrate this process. A similar process is occurring at Lake Nipigon, in Ontario, because its outlet is also at the lake's south end.

The author concludes that isostatic rebound is inevitable and is the main driver of shoreline erosion on Lake Winnipeg, particularly on the south basin. If not for

isostatic rebound, shoreline erosion would occur sporadically and in places, but because of the unstoppable rise of the earth's crust, Lake Winnipeg is expanding southward and will continue to do so. The current Netley-Libau Marsh will in time become part of Lake Winnipeg as a result of isostatic rebound, and, in fact, research shows that as recently as 1,500 years ago, the marsh was dry ground. As this happens, the marsh will gradually move further south.

One implication of isostatic rebound for LWR is that gradually it becomes more of a challenge to use the project to control flooding on the lake. Because the outlet is steadily rising relative to the rest of the lake, a commitment to reduce flood levels will require a more aggressive promotion of outflow. However, even if it were possible to use LWR to maintain a constant lake level, the landscape will still take decades or centuries to respond to uplift that has already occurred. Therefore, greater co-operation will be required in the future involving communities on the lake, on the Nelson River, Manitoba Hydro and the Manitoba government as they attempt to respond to these changes.

As for the recorded rise in average lake levels since LWR went into operation in 1976, the author of the paper said isostatic rebound likely played some role, but a greater role in this short-term (by geological time scales) change has been a pattern of greater precipitation for most of the years since 1976.

### **6.3 Lake Winnipeg Erosion and Accretion Processes**

This report was a compendium of technical studies completed by the engineering consulting firms Baird and Stantec for the Lake Winnipeg Shoreline Management Handbook (Manitoba

Conservation, 2001), as well as other recent observations.

A starting point for the discussion of erosion on Lake Winnipeg is that it is a natural process that occurred before LWR, as well as after, and occurs on almost all lakes in Canada and around the world. Erosion creates many of the ecosystems that exist around the lake, including beaches and mudflats.

Erosion is caused when the force of waves or currents is greater than the ability of the shoreline to resist. Larger storms, with more powerful waves, exert greater forces on the shore than calm conditions.

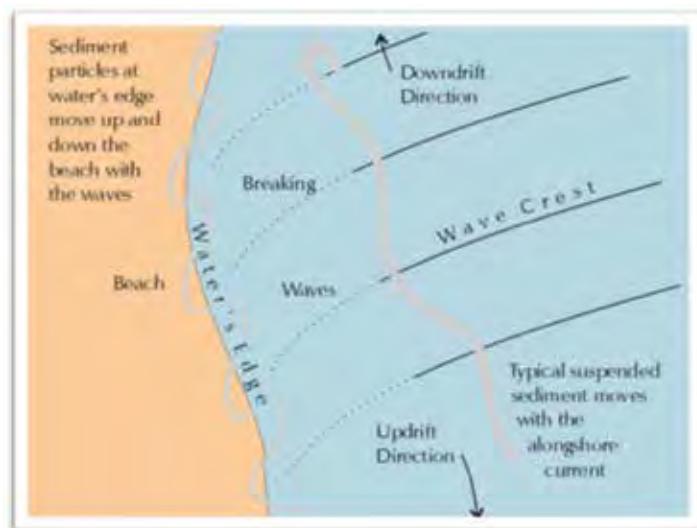
The geology of a lake largely determines how shoreline erosion occurs. In the case of Lake Winnipeg, bedrock is covered by complex layers of glacial sediment left behind after the melting of continental ice sheets that once covered Manitoba. During the melting of the ice sheets, which caused the ancient Lake Agassiz to form, large amounts of loose sand and gravel were also washed into the Lake Winnipeg area by melt water rivers. When the last of the glaciers retreated 10,000 years ago, the bedrock under and around most of Lake Winnipeg was covered by sediments, including glacial till, lacustrine (lake bottom) clays, and sandy outwash deposits where ancient glacial rivers had dropped their loads of sediment.

Wind, wave and ice actions working on the bedrock and surface deposits have given Lake Winnipeg a number of different kinds of shorelines, some of which erode much more quickly than others. Bedrock shorelines are not common on Lake Winnipeg, but where they do occur, as on the southwestern tip of Elk Island, they are very resistant

to erosion. Shorelines comprised of glacial sediments such as glacial till and clay, on the other hand, are very prone to erosion when exposed to waves. Eroding sand deposits are those shorelines where large deposits of sand, often mixed with rounded pebbles or larger rocks, form bluffs along the edge of the lake. When wave action weakens these bluffs, the sediment will slump into the lake and be transported by currents along the shore until some natural barrier causes the sediment to accumulate on the shore of the lake. Where this occurs, depositional beaches are created. An example of this phenomenon can be seen at Grand Beach, where sand that eroded into the lake from sand bluffs to the north is transported by wind and wave action along the shore until the headland at Grand Beach disrupts this flow and causes the sand to be deposited. Another area where sand is deposited by moving currents is the sand bar between Elk Island and Victoria Beach, which has grown substantially over the last 60 years.

Shoreline erosion, therefore, continually changes the shoreline of Lake Winnipeg, with some areas eroding more rapidly than others and some areas gaining new material.

**Figure 6.2: Along-shore transport of sediment.**



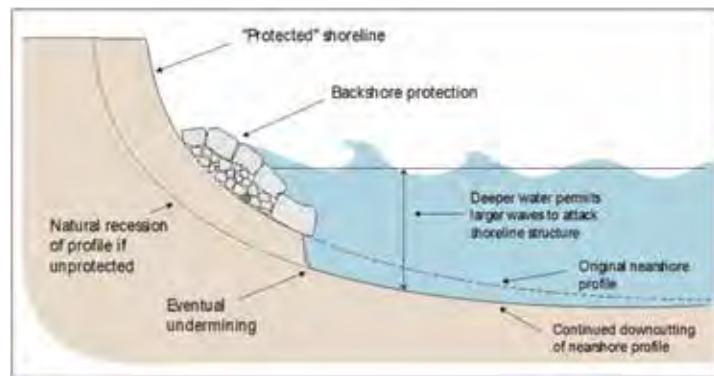
The level of the lake does not determine whether or not there will be erosion. Rather, the lake's level determines where erosion will take place. Therefore, if the lake is at 711.0 feet asl, waves will still cause erosion, but the erosion will occur at a lower point on the shoreline. A computer simulation carried out by Baird and Stantec for the Lake Winnipeg Shoreline Erosion Study in 2000 supports this conclusion. The simulation showed that if the level of Lake Winnipeg had been one or two feet lower from 1971 to 1994, a particular stretch of south basin shoreline would have receded less, but the amount of downcutting (erosion) of the nearshore area (the lake bottom up to one km out from the shore) would have been greater. Lakebed downcutting is an important driver of erosion because, as the nearshore area is further eroded, more wave energy is able to reach the shore.

Shoreline erosion is therefore a natural process that will occur at faster or slower rates for different parts of the lake shore, depending on the force of waves and currents affecting a portion of shoreline and on the ability of the shoreline material to resist these forces. When the shoreline consists of cohesive sediments (clays and glacial tills), erosion occurs both at the shore and further from shore on the lake bottom. Lakebed downcutting is irreversible. Downcutting is greater closer to shore and decreases further offshore. At the shore, waves remove consolidated material from the bank or bluff, and keep the bluff in a near vertical condition as it migrates inland. The rate at which bluffs along Lake Winnipeg retreat varies depending on the exposure to waves and the materials of the shoreline, but averaged out over many years is typically between 0.3 and 0.6 metres per year. This rate is not constant and often the majority of shoreline erosion

in a given decade will occur in one or two major storms. This rate of erosion is generally consistent with findings on other lakes with similar conditions and shorelines. The average rate of retreat on Lake Michigan is 0.3 metres per year and on Lake Ontario it is slightly less than 0.3 metres per year. On the north shore of Lake Erie at an area called Long Point, bluffs are retreating by 4 metres per year (120 metres recorded in the last 30 years).

An important point in understanding shoreline erosion is that shorelines maintain a consistent profile over time even as erosion causes them to recede. As the illustration of lake bed downcutting and failure of shoreline protection shows, the natural tendency of any area of shoreline is to maintain the same angle or curve from the lake bed to the beach or bluff. Placing rip rap or concrete along the shore temporarily changes that profile as the lake bed erodes below the protected area. Because downcutting off shore occurs regardless of what protection is placed on the shore, in time, the deepening of the lake bed off shore allows more wave energy to reach the shore. As a result, the force of these waves will erode the lakebed at the toe of the shoreline protection, undercutting it and causing it to collapse. In time, the shoreline protection will either fail or require costly maintenance, making shoreline protection ultimately a temporary measure.

Figure 6.3: Shoreline profile.



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Shoreline protection also cuts off the supply of new sand and gravel from existing beaches. The author described the process known as “accretion” in which new material is deposited in some areas of a lake shore. When sand and gravel are eroded away from one portion of shoreline, they are transported by wave currents along the shoreline until they come to some kind of obstruction, such as a point of land, where they are deposited. As a result, armouring a large area of shoreline prevents new sand and gravel from being eroded into the lake (for as long as the protection continues to work) and cuts off this supply of sand and gravel from beaches. This effect has been well documented in studies on the Great Lakes. One portion of Lake Erie, where 90 per cent of the shoreline is armoured, has had dramatic changes in its beaches as a result.

This report was not an investigation into the effects of LWR on shoreline erosion, which would have required considerable additional study. The author did, however, summarize applications of an erosion-modelling program called COSMOS on erosion at sites on Lake Diefenbaker, in Saskatchewan, and on Lake Ontario. At Lake Diefenbaker, a reservoir on the South Saskatchewan River, the greatest shoreline recession was seen to occur in years when the reservoir was at or near its full supply level. At Lake Ontario, application of the model to one area of eroding bluffs showed that rates of bluff recession were reduced by 50 per cent by reducing the range of Lake Ontario water levels from the natural range of 2.0 metres to the post-regulation range of 1.2 metres. Given that estimates based on historical inflows to Lake Winnipeg and outflows through the Nelson River indicate that the lake would have had a greater range of levels without LWR, shorelines might have receded more rapidly along the lake without LWR.

It is possible to predict where erosion will occur by using computer models that consider water levels and the varying characteristics of the existing shorelines. Collecting data to use in such a model can be expensive and time-consuming. However, future planning decisions regarding development around Lake Winnipeg would benefit greatly from such a data-gathering and forecasting exercise. This would allow for the creation of maps showing where the greatest erosion hazards exist. Such a process occurs in many other jurisdictions. In Ontario, shoreline development policies require that erosion hazards are mapped with a 100-year prediction, so that new construction is not allowed unless hazard-mapping shows that it's safe from erosion threats for at least 100 years. A similar rule in the state of Michigan uses a 50-year erosion-hazard prediction. By comparison, Manitoba has limited policies and regulations to manage shoreline hazards and guide new development. Manitoba would benefit from provincial government policies requiring such forecasting and mapping and from strong lakeshore development policies reflecting the ongoing and inevitable reality of erosion. The author recommended development of policies that would encourage the resilience of shoreline communities so that they were less vulnerable to erosion hazards. Such policies would include enhancing development setbacks along shores, artificially nourishing shorelines to address shoreline erosion and protecting shoreline habitat and function.

Regarding the impact of LWR on erosion, the author concluded that a detailed investigation would be needed to determine whether LWR has increased or decreased erosion. This would require mapping shoreline change since 1976 and creating computer modeling tools to simulate pre-LWR erosion rates based on known water-level data. It would then require simulating what erosion would have occurred since 1976

without LWR, based on known inflows from that period. Predicting future erosion, given estimates about climate change, would require studies both of possible changes in inflows to the lake (such as the forecasts of increases in precipitation for portions of the Lake Winnipeg watershed) and possible changes to winds which could increase the amount of wave energy affecting the lake's shorelines.

## 6.4 Climate in the Lake Winnipeg Watershed and the Level of Lake Winnipeg

This report summarized information on historical temperature, precipitation and river discharge in the Lake Winnipeg watershed, predictions of future climate and runoff and their effects on lake levels.

Weather data show increased precipitation over the last 100 years in all parts of the Lake Winnipeg watershed: 14 per cent in southwest Alberta, 12 per cent along the North Saskatchewan, 7 per cent along the South Saskatchewan, 13 per cent in southern Manitoba and northern North Dakota, 9 per cent in northwest Minnesota, and 8 per cent in northwest Ontario. Looking at more recent changes, a comparison of average precipitation and runoff for 1996-2005 to average precipitation and runoff for 1946-1995 indicates significant spring precipitation increases in various parts of the Red, Winnipeg and Saskatchewan River watersheds, with the largest percentage increases in runoff in the Red River basin. A gradual, long-term temperature increase has also occurred over the last century of about one degree Celsius in July/August temperatures, with a corresponding one degree Celsius rise in summer water temperatures.

Translating precipitation and runoff into river discharge reveals that the discharge of

three of the four largest tributaries to Lake Winnipeg has increased over time. From 1910 to 2010, the annual discharge of the Red River increased by 160 per cent, while the discharge of the Dauphin River increased by 95 per cent and the Winnipeg River by 53 per cent. Only the Saskatchewan River's discharge declined over that time – attributed to causes such as water loss from irrigation and the creation of Lake Diefenbaker, as well as increased evaporation – by 19 per cent. Comparing the relative contributions of the four rivers to Lake Winnipeg, the Winnipeg River contributes roughly half of the total water in the lake, followed by the Saskatchewan (25 per cent), the Red (16 per cent) and the Dauphin (4 per cent) (Environment Canada and Manitoba Water Stewardship 2011). In the first half of the twentieth century, the Winnipeg and Saskatchewan Rivers contributed roughly equal amounts of water.

Increases in precipitation can cause dramatic increases in runoff, depending on how the additional precipitation falls. If additional precipitation comes in the form of more frequent or severe storms, the additional moisture can't be absorbed into the ground and will run off into creeks and rivers. As a result, while precipitation in the eastern Red River watershed was 20 per cent higher (increasing from 550 mm/year to 660 mm/year) in the decade 1996-2005 than the average for most of the 20th century, the amount of run-off from that watershed more than doubled (from 50 mm to 110 mm).

Long-term study of precipitation and runoff shows that the Lake Winnipeg watershed has had a series of high-flow periods separated by drier periods over the last century. However, each period of high flows has exceeded the one before. Comparing the average of annual peak flows for two wet periods (the current decade and a wet period at the beginning of the 20th century) shows

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that the high flows in the current decade have been almost 50 per cent higher than the high flows in the earlier decade.

Another factor that increases the damage caused by high water on Lake Winnipeg is the effect of wind setup. The author examined wind setup events going back to 1914, identified as occasions when the daily mean water level at Gimli or Winnipeg Beach rose above its median level for the previous week. The study showed that high wind setup levels and years of frequent wind set up occurred both before and after LWR went into operation.

As a result of increased precipitation and runoff, Lake Winnipeg is now, on average, 1 foot (0.3 metres) higher than in the early 20th century. However, without LWR, the combined effect of increased flow and isostatic rebound (see Section 6.1, above) would have increased Lake Winnipeg levels by 2 feet (0.6 metres) over early 20th century levels. Modelling shows that without LWR, the extreme high water levels in flood years would have been even higher. For example, in the 1997 and 2011 flood years, modelling shows that Lake Winnipeg would have reached 718.0 feet asl, 2 feet higher than the 1997 peak.

Regulation has affected Lake Winnipeg's level differently in dry periods and wet periods. In the drier 1980s and early '90s, the annual mean lake level tended to be increased by regulation and the seasonal peak was shifted from May or June to late summer or fall. In the wetter years since 1996, the annual mean level has been reduced by LWR, and the timing of the spring peak has not been shifted by regulation.

Examining forecasts of future precipitation, the author noted that various climate change models offer a range of scenarios, depending on the success of

the world community at limiting future greenhouse gas emissions. However, for the most part, the climate change models predict moderate increases in precipitation in the Red and Winnipeg watersheds, which will be magnified into larger increases in runoff and, in the Saskatchewan watershed, either no change or a drying trend. Ultimately, the author concluded that if increases in precipitation and runoff in the Winnipeg and Red watersheds occur as predicted, it will be very difficult to manage Lake Winnipeg below 715.0 feet asl in the future.

## **6.5 Water Level Regulation in the Lake Winnipeg Basin and its Effect on Nutrient Status of the Lake**

This report assessed the possible impact of LWR on the level of nutrients (primarily phosphorus) in Lake Winnipeg that result in algae growth. Plants use phosphorus in processes such as photosynthesis, storing energy, cell division and growth. Therefore, phosphorus is the primary driver for algae growth. Lake Winnipeg has always been a nutrient-rich lake, with large quantities of nutrients delivered by the inflowing rivers, especially the Red River, which delivers 60-80 per cent of the lake's phosphorus. Population growth in the Lake Winnipeg watershed, greater use of fertilizer and increased intensity and extent of drainage have all resulted in increased amounts of phosphorus reaching Lake Winnipeg in the last two decades. This result has been intensified by higher precipitation during the last two decades, causing more phosphorus to run off into creeks and rivers that feed the lake.

The concentration of any nutrient in a lake will depend both on how much of the nutrient is flowing into it and how much is flowing out of it. Manitoba Hydro uses the

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Jenpeg Control Structure to manage outflow from Lake Winnipeg, but averaged out over the year, Manitoba Hydro cannot significantly change outflow from what it would be naturally. In other words, if Manitoba Hydro maintained outflows higher or lower than inflows for long, the lake would in time either be emptied or overfilled. The limited capacity of LWR to significantly change the residency time of water can be illustrated by considering the terms of the licence for LWR. Manitoba Hydro is licensed to regulate Lake Winnipeg for power production when the level of the lake is between 711.0 and 715.0 feet asl. Four feet of Lake Winnipeg is equivalent to about one third of the lake's annual inflow. In theory, if the lake level were at 711.0 feet asl and outflows were stopped, it would take one third of a year to bring the lake to 715.0 feet asl, the point at which Manitoba Hydro is obligated to operate the Jenpeg Control Structure at maximum discharge. This means that the residence time for water in the lake cannot for long be greater than it would be naturally. Over the past two decades, the residence time of water in the lake has been three to four years. Each year during this time the amount of water flowing out of the lake has been about one-quarter to one-third of the lake's total volume.

If the concentration of nutrients flowing into the lake varies from season to season, it would be possible for regulation of outflows to cause short-term increases in nutrients. For example, under LWR, Manitoba Hydro increases outflows above their natural level in winter in order to generate power. If Manitoba Hydro limits outflows in summer to maintain enough water for winter power production, the result could be a seasonal increase in nutrient concentrations in the lake if water flowing into the lake in summer carries a higher concentration of nutrients. While further study would be needed to verify seasonal variations in nutrient concentrations,

it was estimated that seasonal variations in nutrient concentrations caused by LWR would be low, at 2.5 per cent or lower. This variation is much lower than the dramatic increase (as much as 100 per cent) in nutrient concentrations in Lake Winnipeg over the last 20 years, during which time inflows from rivers have also dramatically increased. As a result, the author concludes that effects on nutrient concentrations resulting from LWR would be insignificant in comparison to the changes resulting from increased nutrient inflow in the Red and other rivers. Management of inflows in the watershed and changes in land use will continue to influence both the magnitude and timing of phosphorus inputs into the lake. Regulation of inflows into the lake will have as great an effect on water levels and timing of those levels as regulation of outflows. Regulation of outflows and levels on the lake to achieve multiple objectives of hydroelectric power, shoreline stability, flood control, the fishery, recreational use and ecosystem health will require integrated management of flows and land use across the entire basin.

## **6.6 Coastal Wetlands and Lake Winnipeg and the Netley-Libau Marsh**

This report presented information on coastal wetlands in general and the environmental benefits they provide and the threats they face, as well as the specific issues facing Netley-Libau Marsh, the wetland at the south end of Lake Winnipeg around the mouth of the Red River. Defining criteria of a wetland are that water is less than two metres deep, soil is saturated and low in oxygen and vegetation is adapted to wet, low-oxygen conditions. Coastal wetlands are next to a large body of water and can be of several types. Lacustrine wetlands are within a lake; riverine wetlands are located around

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the mouths of rivers or creeks, and barrier-protected wetlands are located behind barrier islands or beaches.

Lake Winnipeg has an abundance of coastal wetlands. A preliminary estimate of the lake's coastal wetlands, based on Forest Resource Inventory classifications using aerial photographs and satellite images, indicates approximately 140,000 hectares of coastal wetlands along the lake. This total is only 20,000 hectares less than the total amount of coastal wetland of the five Laurentian Great Lakes combined (Michigan, Huron, Erie, Superior and Ontario). Together, Lakes Winnipeg, Winnipegosis and Manitoba are estimated to have some 271,000 hectares of coastal wetland, which is substantially more than the total of 160,000 hectares in the Laurentian Great Lakes. Manitoba's great lakes (Winnipeg, Manitoba and Winnipegosis) have a large amount of wetland habitat because Manitoba's flat topography provides a shallow relief profile where wetland plants can develop. Flat shorelines and slow-moving rivers allow for large transitional areas between lake environments and dry upland environments. The majority of Lake Winnipeg's wetlands (76 per cent by this estimate) are of the riverine type. These totals do not include the even larger amounts of treed muskeg along the shore of Lake Winnipeg. North of Hecla Island on both the east and west shores, much of the land surrounding Lake Winnipeg is treed muskeg. For the purposes of this paper, these areas were identified, but not included in the analysis or the totals.

Wetlands are environmentally, economically, socially and culturally important in many ways, providing control of erosion and floods, storage of carbon, assimilation and metabolism of wastes, habitat for fish and wildlife and protected species, sources of domestically and culturally important plants, and locations for recreation, education and

research. Across Canada, they are threatened by agricultural activity, including construction of drains and dikes, urban and residential encroachment, peat removal, grazing by livestock, resource extraction and surface flow or aerial drift of pesticides, fertilizers and manure. Coastal wetlands are threatened by shoreline development, altered lake hydrology and invasive species. Shoreline development of coastal wetlands or near coastal wetlands exposes them to increased possibility of chemical contamination, increased destruction of native vegetation, increased risk of exotic plants, altered hydrology when roads and other construction interrupt the flow of water in and out of the wetland, and obstacles to the movement of fish and other animals caused by construction of dikes and roads.

One essential need for a marsh is a period of low water levels. Low water levels expose mudflats and thereby provide an opportunity for wetland plants to germinate and reproduce. Emergent vegetation – plants like cattails and bulrushes that rise out of the water – is an essential characteristic of a wetland. If water levels remain high without ever exposing the mudflats, the area of emergent vegetation may decrease and a wetland may become simply a shallow lake. This has been the trend at the Netley-Libau Marsh, which is the largest coastal wetland in Manitoba and believed to be one of the largest in North America. From 1979 to 2001, the open-water portion of this marsh increased from approximately 8,900 hectares (about 35 per cent of the total area) to more than 13,000 hectares (about 51 per cent), while the area covered by cattails and bulrushes declined steeply from 3,200 hectares to a little more than 300 hectares. Aerial photos of the marsh in 1979 and 2001 show the substantial decline in emergent vegetation over these decades.

Four causes of the decline in the Netley-Libau Marsh were examined, in chronological

order. The first factor considered was the dredging of a channel connecting the Red River directly with the marsh in 1913, known as the Netley Cut. Originally carried out to allow the marsh to drain so that farmers could cut wild hay and to provide boat access to Netley Lake, the Netley Cut allowed water from the Red River to flow into the marsh, substantially increasing the size of Netley Lake. The Netley Cut rapidly grew wider, with the result that more Red River water flowed into the marsh. The cut has continued to widen and today appears to be widening even faster, approaching 0.5 km in width. The Netley Cut now carries a greater share of the Red River than any of the three channels (east, west and centre) that flow into Lake Winnipeg. By allowing more water into the marsh, the Netley Cut contributes to the drowning of marsh vegetation and erosion of upland areas in the marsh, as well as to increases in algae growth in the marsh.

The lack of periodic low water periods since the beginning of LWR in 1976 was also cited as a contributing factor. Long-term data on lake levels show that LWR has limited the range of water levels on Lake Winnipeg, so that high water periods are lower than they were in the past and low water period are not as low as previously. For example, during the dry decades in the 1930s and 1940s, Lake Winnipeg's level dropped at one point to just over 709.0 feet asl and there were several years when the level was below 711.0 feet asl. Since the beginning of LWR, Lake Winnipeg has never gone as low as 711.0 feet asl. (Given the high precipitation of recent years, even without LWR, the lake would only have reached 711.0 once since 1976, as mentioned in Section 7.6.1, Lake Winnipeg Wetlands.) The beneficial effect of periodic low-water years on marsh health is indicated by the way the marsh responded to the 2003 drought. Low water levels in the marsh that year exposed mud flats where

the seeds of marsh plants could germinate. During a one-year drought occurring in what was otherwise a long cycle of wet years, the open-water portion of Netley-Libau Marsh declined by some 2,500 hectares as cattails and bulrushes grew in newly exposed ground. Even after the drought ended, some of the regained vegetation cover (mostly cattails) has remained in place. Although the author states the opinion that the lack of low-water periods has contributed to the decline of Netley-Libau Marsh, he concludes that LWR alone would not have resulted in the magnitude of change recorded at the marsh.

A third cause of the decline in Netley-Libau Marsh is the cessation of dredging on the Red River in 1999. This dredging had been carried out by the federal government to keep a channel open for boating to Lake Winnipeg. Since the end of dredging, the main channel has become more constricted with silt, which results in more water going through the Netley Cut instead of continuing down the former channels of the river.

A fourth and more recent factor is the breaking of ice on the Red River to prevent flooding upstream on the Red River. Cutting ice on the Red River prior to spring break-up may facilitate the movement of water into the marsh. The Red River and Netley Lake become ice-free weeks before Lake Winnipeg, so water flowing to the lake may hit an ice blockage and flow through the Netley Cut into Netley-Libau Marsh.

Based on the effects of the 2003 drought in stimulating regeneration in the Netley-Libau Marsh, the author said management strategies to address the decline in the marsh may include: periodic reductions in Lake Winnipeg water levels for up to two years, on a 10- to 20-year cycle; developing a way to regulate the flow through the Netley Cut; and resuming dredging at the mouth of the Red River. The author also described a

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recent restoration of the Metzger Marsh on Lake Erie. Like Netley-Libau, this marsh had lost much of its emergent vegetation, in this case because of the loss of a barrier ridge that separated it from the lake. Since the U.S. Army of Corps of Engineers rebuilt the barrier ridge in the early 1990s, new plant growth has been “remarkable.” The author also discussed research on the use of emergent plants such as cattails and reed grasses to absorb nitrogen and phosphorus in the water and keep these nutrients out of the lake. Developing a system to harvest this vegetation from the marsh – possibly for use as a biomass energy source – could remove large amounts of nutrients from the water. One approach currently being studied is the development of “bioplatforms” planted with cattails to allow cattails to grow in parts of the marsh where the water is too deep for them to grow rooted in the ground. These platforms may help to dissipate waves and promote sediment accretion and the biomass from the cattails can be harvested, removing nutrients from the water.

A more thorough inventory of Lake Winnipeg’s coastal wetlands was also recommended, as well as a historical review of changes to coastal wetlands. This could help distinguish the relative contribution of the Red River to changes in Netley-Libau Marsh, versus the hydrological influence on Lake Winnipeg’s coastal marsh ecology.

## **6.7 Review of Hydrologic and Operational Models Presented to the Manitoba Clean Environment Commission**

This report examined the models and data used in Manitoba Hydro’s documentation in support of its application for a final licence. It described the operating rules

for LWR as “simple, generalized and only minimally prescriptive. Rules for maximum and minimum releases are neither adjusted seasonally nor in response to hydrological priorities or conditions within the basin. The most significant gap, however, is the fact that no targets, priorities or conditions govern Jenpeg release decisions relative to system power, in-stream flows, or distribution of storage within the MH [Manitoba Hydro] system. Consequently, when Lake Winnipeg is within its normal power range, which is most of the time, Jenpeg release decisions are largely based on operator discretion, informed by past practice and judgement. While these are legitimate and essential elements of reservoir system operation, they are not easily reduced to a set of logical operating rules that can be replicated in a true operational model.” The author therefore recommended development of a “rule-based system operational simulation model.”

The lack of rule-based operation simulation capabilities limits the ability of Manitoba Hydro to factor in needs other than power generation, such as environmental, flood or drought risks, and limits public understanding of the rationale for decisions about release of water at Jenpeg. Without such a model, Manitoba Hydro’s forecasts regarding what would happen if the LWR licence terms were changed (either to a lower or higher maximum level) are less certain. The author also states that Manitoba Hydro’s existing modeling system is ill-equipped to forecast responses to, and effects of, drought and climate change.

While the limitations in modelling do not call into question the conclusions in Manitoba Hydro’s documents about the environmental effects of LWR, the author states that limitations in the model make those conclusions less certain than they otherwise would be.



# **Chapter Seven**

# **Physical/Environmental Effects of Lake Winnipeg Regulation**

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## **7.1 Overview**

Lake Winnipeg Regulation has a direct effect on Lake Winnipeg and the Nelson River by changing water levels and the flow regime of water. The changes have the potential to create physical and environmental impacts on the water bodies that affect other aspects of the environment. This chapter will examine potential effects on the water regime, shoreline erosion, water quality, fish populations, wetlands and ungulates. For each of these subjects, potential effects on the environment of Lake Winnipeg will be discussed first, followed by potential effects on the downstream environment. The downstream environment includes the entire length of the Nelson River starting from Warren Landing, including the Outlet Lakes, Cross Lake, Sipiesk Lake and Split Lake. Potential impacts on people and communities resulting from these changes will be discussed in Chapter Eight: Socio-Economic Effects.

## **7.2 Water Regime**

Water regime is a term that refers to the levels and flow of water and its seasonal timing. On Lake Winnipeg, the concern regarding water regime focuses on Manitoba Hydro's operating range (711.0 to 715.0 feet asl) for the lake and whether or not Manitoba Hydro uses the Jenpeg Control Structure to raise the level above what it would be without

LWR. In the downstream area, concerns focus on the quantity of water released through Jenpeg and changes to the seasonal nature of flows. Because of the constructed and expanded outlet channels, LWR allows greater flow in winter than would naturally be the case, allowing more water to flow to lower Nelson River generating stations at the time of year when electricity use is highest. In many years, this results in higher flows in winter than in summer, a reversal of the natural seasonal pattern, and in greater fluctuations, both day to day and year to year, than would naturally be the case.

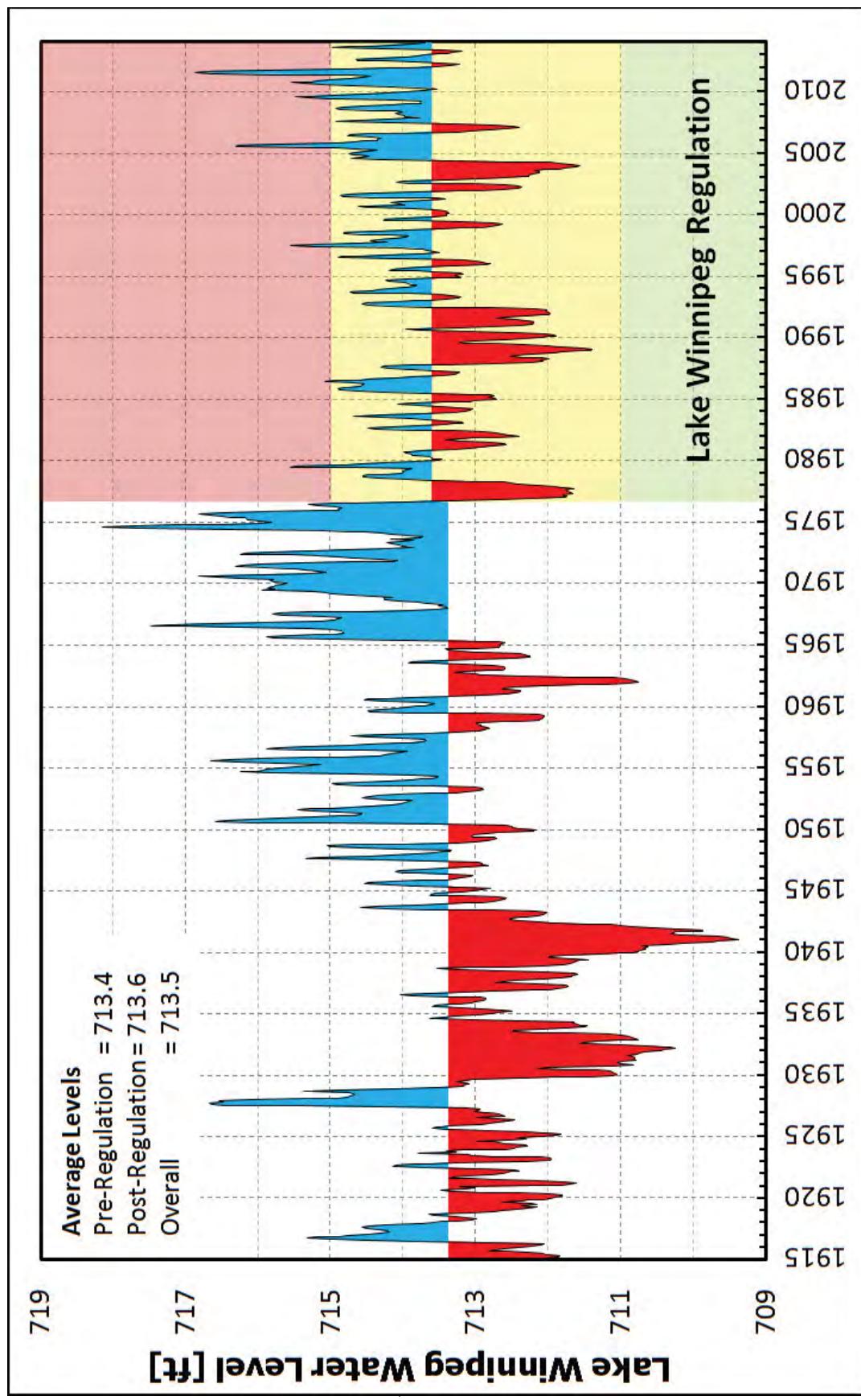
### **7.2.1 Water Regime – Lake Winnipeg**

#### **Manitoba Hydro's Information: Water Regime – Lake Winnipeg**

A comparison of Lake Winnipeg's levels over time shows that the average level of the lake has been 0.2 feet (6 centimeters) higher since the completion of LWR in 1976. Manitoba Hydro made this calculation based on data from eight gauges operated by the Water Survey of Canada, providing a record of the lake's levels since 1913. The process for calculating the level of the lake is described in Section 4.2, Terms of Licence.

Manitoba Hydro calculated the long-term average level of Lake Winnipeg at 713.4 feet

Figure 7.1: Lake Winnipeg water levels, before and after Lake Winnipeg Regulation. (Manitoba Hydro)



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asl for the years before LWR and 713.6 feet asl since LWR. The record shows that the range of water levels has been reduced since LWR. Prior to LWR, water levels (based on average monthly levels) on Lake Winnipeg ranged from a low of 709.4 feet asl, during an extended dry period in the 1930s and '40s, to 718.1 feet asl during an extended high-water period from the mid-1960s to mid-1970s. Since LWR came into operation, water levels have ranged between 711.4 feet asl and 716.9 feet asl. These changes in water levels have occurred as climate-caused stream flows into Lake Winnipeg have been higher on average in the post-LWR years. As an indicator of the higher flows, measured outflows from Lake Winnipeg have averaged 76,400 cfs since LWR, compared to an average of 73,200 cfs in the pre-LWR period.

Manitoba Hydro used two techniques to estimate what the level of Lake Winnipeg would have been over the last 40 years if LWR had not been built. One process involved using Water Survey of Canada gauges on rivers flowing into Lake Winnipeg (Winnipeg, Saskatchewan, Red, Fairford, Bloodvein, Pigeon, Manigotagan, Poplar and Gunisao) to calculate inflows to the lake. The other involved using outflow data from Bladder Rapids on the Nelson River to estimate inflow. In both approaches a “water balance model” compared the calculated inflows to the natural outflow capacity that existed before the excavation of the additional and expanded outflow channels. Determining if inflows exceed outflows (and by how much) at any given time will allow for an estimate of how much the level of the lake would rise as a result.

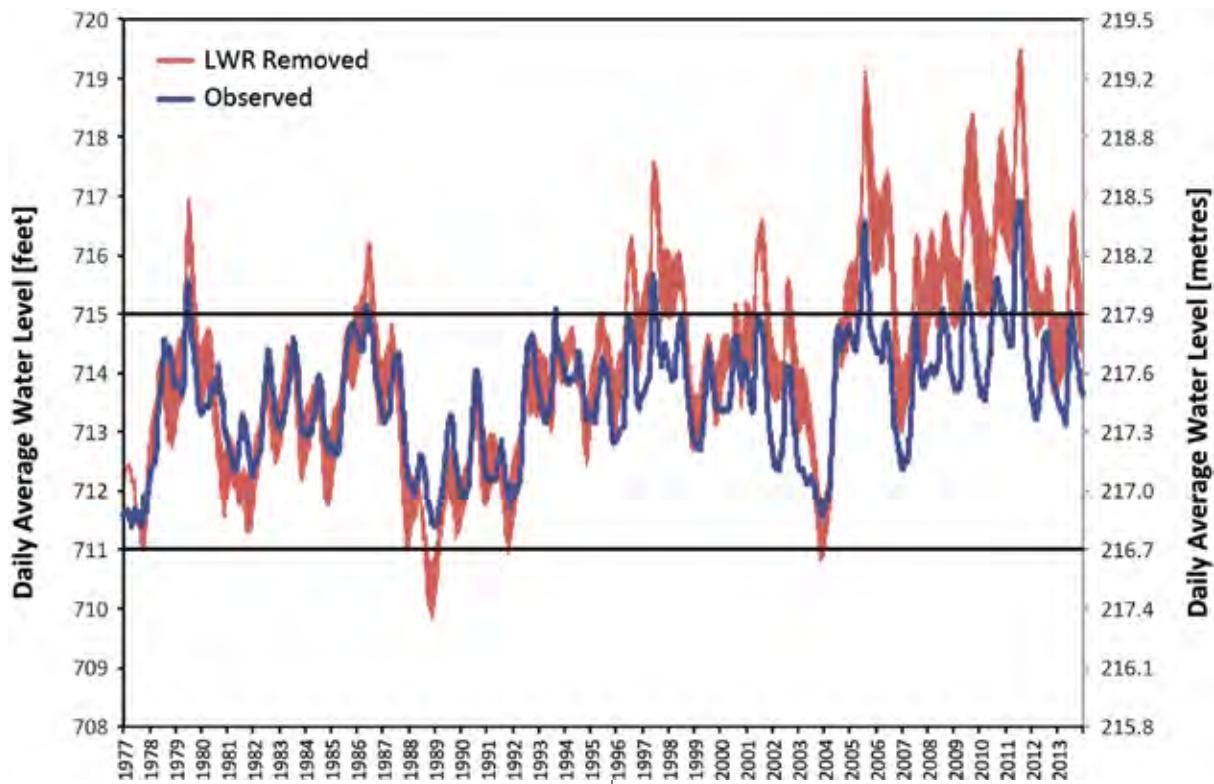
Manitoba Hydro’s calculations indicate that without LWR, peak levels would have been higher during the last 40 years and high water levels would have occurred more often. The highest recorded wind-eliminated water

level since 1976 was 716.9 feet asl. Manitoba Hydro estimates that without the increased outflow capacity created by LWR, the peak would have been 718.6 to 719.5 feet asl. Since 1976, water levels over 715.0 feet asl have occurred approximately five per cent of the time. Manitoba Hydro’s calculations indicate that such water levels would have occurred five to seven times as often if LWR had not been constructed. During the high-inflow year 2011, according to Manitoba Hydro’s calculations, average monthly levels on Lake Winnipeg would have been 1.7 to 2.5 feet (0.52 to 0.76 metres) higher without LWR.

The corporation’s calculations also indicate that without LWR, the lowest levels since 1976 would have been 709.8-710.7 feet asl, compared to the actual lowest recorded level post-LWR of 711.4 feet. Lake levels below 711.0 feet asl would only have occurred in 1988, at a time of a multi-year drought. Manitoba Hydro states that, although LWR has reduced the extreme highs and lows from Lake Winnipeg levels since 1976, it has not necessarily resulted in a “narrow” range of levels. Levels have varied by 5.5 feet since LWR.

The seasonal pattern of lake levels on Lake Winnipeg – higher in summer and lower in winter – is similar with LWR to what would occur in a natural state. However, the increased outflow in winter and spring, made possible by the constructed and expanded outlet channels, allows Lake Winnipeg’s level to rise more slowly in the spring than would occur naturally. Although LWR creates greater capacity for outflow during the winter, when power demand is highest, Manitoba Hydro states that the winter draw-down on Lake Winnipeg has changed only slightly from the pre-LWR average. Since the project went into operation, winter drawdown has averaged 0.16 feet (4.9 cm), compared to 0.15 feet (4.6 cm) before LWR.

Figure 7.2 Lake Winnipeg water levels and predicted levels without LWR. (Manitoba Hydro)



In anticipation of public calls for a lower maximum for Manitoba Hydro's licence for LWR, the commission asked Manitoba Hydro prior to the hearings to assess the potential effect of reducing the upper end of the operating range to 714.0 feet asl. Manitoba Hydro responded that such a change would have little effect on high water levels and would cause greater environmental impacts downstream. A maximum operating range of 714.0 feet asl would reduce the lake's average level by 0.4 feet (12 cm). During peak floods, such as those of 2005 and 2011, the lake's level would be 0.2 feet (6 cm) lower. Because such a change would require operating Jenpeg at maximum discharge whenever the level of Lake Winnipeg reached 714.0 feet asl, Jenpeg would operate at maximum discharge more frequently. If the upper limit of the LWR licence had been 714.0 feet asl, Jenpeg would have operated at maximum discharge 24 times since 1976, instead of the nine times it has been at maximum discharge. A result of such

an operating rule would be more frequent events downstream of Jenpeg in which the rate of flow changed rapidly. Lowering the upper end of the LWR operating range would also result in a loss of revenues for Manitoba Hydro estimated at \$27 million per year through to the year 2047-2048. As a result of the corporation having less water to generate dependable energy, Manitoba Hydro would either need to import more electricity or have less ability to make long-term export sales.

### What We Heard: Water Regime – Lake Winnipeg

The commission heard concerns about high water levels from many Manitobans who live or own property near Lake Winnipeg.

At Fisher River Cree Nation, a portion of the reserve being developed for cottages was flooded in 2011. The planned cottage development has since been stalled because

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of persistent high water. The same high water event also damaged a large amount of existing housing. High water in recent years has cut off access to hay land and areas for harvesting traditional medicinal plants.

Representatives of Peguis First Nation presented a theory that high levels on Lake Winnipeg prevent water from draining off the land on the First Nation. The chief said increased drainage upstream of the First Nation allows more water to flow into the community, but the high level of Lake Winnipeg prevents it from draining rapidly. Peguis presented satellite images showing large areas of the First Nation's land covered with water at various times in the last several years. Although Peguis has long had flooding problems and representatives personally recalled floods that occurred in 1972 and 1974, the problem of rapid overland flooding was described as a recent development that has become a major issue since the middle of the last decade. Because of chronic flooding, the number of farmers at Peguis has declined from approximately 75 to only three today. In 2011, Peguis had 60 per cent of its farmland unavailable because of flooding.

At Pine Dock, several fishers reported that their docks have been underwater for the last few years and either they have no access to a dock now or need to buy a floating dock. One fisher spoke of fluctuating water levels, describing a dock that was 5 feet above water in the 1980s and is now 2 feet below water.

Fishers in several north basin communities, including Fisher River First Nation and Pine Dock, spoke of changes in the currents on the lake that they believed were a result of the high water levels. These currents were said to make fishing and navigation more difficult, as well as dispersing fish from their usual locations. Fishers near the Lake Winnipeg narrows explained that they require a current from the north for fish

to come south to where their nets are. But now, they said, even when there is a strong north wind, the current still flows from the south.

High water levels have also affected fishers in the south basin. One fisher at Grand Marais spoke of high water levels affecting the Balsam Bay Harbour, where the permanent dock was said to be below water level. During high water in 2010, several boats in the harbour were lost as a result of waves overtopping the harbour's protective structure and the floating docks were blown away from the harbour. This phenomenon was described as recent.

At Black River First Nation, presenters spoke about high water inundating the former site of the community and the community's traditional hay lands. At Sagkeeng First Nation, concerns were raised that high water on Lake Winnipeg backs up the Winnipeg River to the Pine Falls dam, affecting their community. The written and video submission from Hollow Water First Nation referred to high and fluctuating water levels on Lake Winnipeg that were impacting housing, fishing, wildlife habitat, and resource harvesting.

Presenters in many communities expressed the concern that eight gauges on Lake Winnipeg may not be enough to provide accurate measurements of water levels.

In several communities, including Black River, Grand Marais and Gimli, the commission heard presenters argue for a reduced upper limit in the LWR licence, from the current 715.0 feet asl to 714.0 feet asl or lower. A number of presenters stated that basing the regulated levels on the wind-eliminated level of the lake is a problem, given that sustained high winds can raise water levels by a metre to a metre and a half in a few hours.

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## Commission Comment: Water Regime – Lake Winnipeg

There is no doubt that high levels on Lake Winnipeg are a serious issue for residents, property owners and the province as a whole. However, the fact of high water levels does not prove that LWR is a cause of this problem. Evidence from a variety of historical and technical sources indicates that Lake Winnipeg reached high flood levels on many occasions before LWR was built. As well, the commission is aware that the high-water problems on the lake in recent years have occurred in a period marked by several historic floods within the Lake Winnipeg watershed, such as the record flooding on the Assiniboine River in 2011, the record flooding in the Calgary region in 2013 and the record high levels on Lake of the Woods in 2014. Independent analysis conducted for the commission confirms that if LWR had not been built, peak levels in the last 40 years would have been even higher. This analysis agrees with Manitoba Hydro's assessment of the effect of LWR on peak levels.

Some of the specific concerns, such as the frequent flooding problems at Peguis, are more likely connected to watershed issues than to LWR. Peguis's serious flooding concerns are made worse by an extended wet period and may also be affected by upstream drainage. Satellite maps of flooded ground at Peguis that were presented as evidence of a connection to LWR, however, do not establish such a connection. The commission notes that the level of flooding on the First Nation, as indicated by the images, did not appear to be connected to the level of Lake Winnipeg at the time the image was made. There is little, if any, evidence to suggest that a high level on Lake Winnipeg causes flooding on Peguis. Rather, it is much more likely that both factors are caused by the same combination of high precipitation and reduced upstream water retention.

The commission heard from several presenters who were concerned about the number or location of gauges used to measure the level of Lake Winnipeg. However, it has been confirmed by independent analysis that the number of gauges and the method used to measure the wind-eliminated level of the lake are appropriate.

Some of the tendency to blame Manitoba Hydro for high water on Lake Winnipeg – expressed at many locations around the lake – may be based on a misunderstanding of the conditions of the licence for LWR. On several occasions during hearings, the commission heard members of the public suggest that Lake Winnipeg levels of greater than 715.0 feet asl constitute a “violation” of the licence. This, however, is not the case, as the expanded drainage capacity created by LWR cannot prevent Lake Winnipeg from rising above this level during high-precipitation years. The licence condition referred to above requires Manitoba Hydro to operate the Jenpeg Control Structure at maximum discharge when lake levels reach 715.0 feet asl, and the evidence presented was that Manitoba Hydro has done that.

There is also a strong sense in lakeside communities that Manitoba Hydro deliberately holds water back during the summer, using the Jenpeg Control Structure, in order to have enough water to generate power during the peak demand season in winter. This, it is believed, means that the lake level is high in the fall when the most powerful windstorms, such as the “weather bomb” of 2010, tend to strike. This perception may have been prompted by the Study Board report in the 1970s, which predicted that LWR would result in an increase in the average level of the lake of 0.7 feet. In fact, water gauge data show that the increase has been 0.2 feet. At the time of the Study Board prediction, Manitoba lacked the interprovincial and

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international transmission connections that allow Manitoba Hydro to export excess power in summer and import power in winter during high demand periods. The ability to import electricity in winter when demand is highest in Manitoba has reduced the need to maintain higher water levels in winter. While it is true that Jenpeg is used to hold back water in low-precipitation years in order to ensure adequate flow in the winter, Manitoba has not had a low-precipitation year in more than a decade. In six of the last seven years, Manitoba Hydro has operated Jenpeg at maximum discharge for all or a substantial part of the summer because of high levels of inflow. Lake Winnipeg would have been at a higher level during the season of autumn windstorms without LWR during the last several years.

Several lakeside residents or property owners suggested that to reduce flooding on Lake Winnipeg, the licence for LWR should be altered to require maximum discharge at 714.0 feet asl. However, this suggestion does not take into consideration the impact of increased discharge on the downstream environment and communities. Manitoba Hydro's modelling predicted that, under such a licence condition, the Jenpeg Control Structure would have been operated at maximum discharge 24 times from 1977 to 2013, instead of the nine times it has operated in that manner. Because the inflow capacity to Lake Winnipeg is greater than the outflow capacity, the lake would still have flooded in heavy precipitation years. Manitoba Hydro's models predict that, had the 714.0 feet asl condition been in place during flood years in 2005 and 2011, Lake Winnipeg's level would have been only 0.2 feet (6 centimetres) lower. Therefore, imposing such a condition would, in all probability, result in harmful downstream effects with virtually no flood-reduction benefits for Lake Winnipeg properties.

The commission notes that Manitoba Hydro conducted modelling to show what Lake Winnipeg levels would have been since 1976 had the project not been built. It would provide a more complete picture of the impact of the project if Manitoba Hydro extended the modelling back to the beginning of the period in which there are known recorded levels for Lake Winnipeg and provided estimates of what Lake Winnipeg's levels would have been from early in the 20th century if the project had been in place. This would help to confirm the understanding of the contribution LWR has made to the management of water levels on Lake Winnipeg under a wide range of weather conditions.

## Recommendation

The Commission recommends that:

- 7.1 *Manitoba Hydro extend its modelling of Lake Winnipeg levels back to 1913 to indicate how Lake Winnipeg Regulation would have influenced lake levels throughout the entire period of record.*

### 7.2.2 Water Regime – Downstream

#### Manitoba Hydro's Information: Water Regime – Downstream

Manitoba Hydro's figures on downstream water levels show the varied impacts of the project. Upstream of the Jenpeg Control Structure, it has resulted in generally higher water levels. Downstream of Jenpeg, LWR has changed the seasonal pattern of water levels, with many lakes experiencing higher water levels in winter.

Mean monthly water levels on Playgreen Lake are 0.5 feet (0.15 metres) higher since LWR, although given the generally greater outflows from Lake Winnipeg since LWR, it is not clear how much of this increase is

a result of LWR and how much is a result of recent wetter conditions in the Lake Winnipeg watershed. On Kiskittogisu Lake, LWR appears to have increased minimum and mean water levels by 1 to 2 feet (0.3 to 0.6 metres) and increased the range of water levels, with higher levels in summer and lower levels in winter. Kiskitto Lake has remained within its natural historic range.

The Jenpeg forebay is the portion of the Nelson River immediately upstream of the Jenpeg Control Structure. It extends from the Kisipachewuk Channel to Jenpeg and includes the Ominawin Bypass Channel. In this area, LWR has increased the average water level and the range of water levels (from 681.0 to 688.0 asl feet pre-LWR to 702.0 to 714.0 feet asl post-LWR). This increase in water levels resulted in flooding of 65 square kilometres.

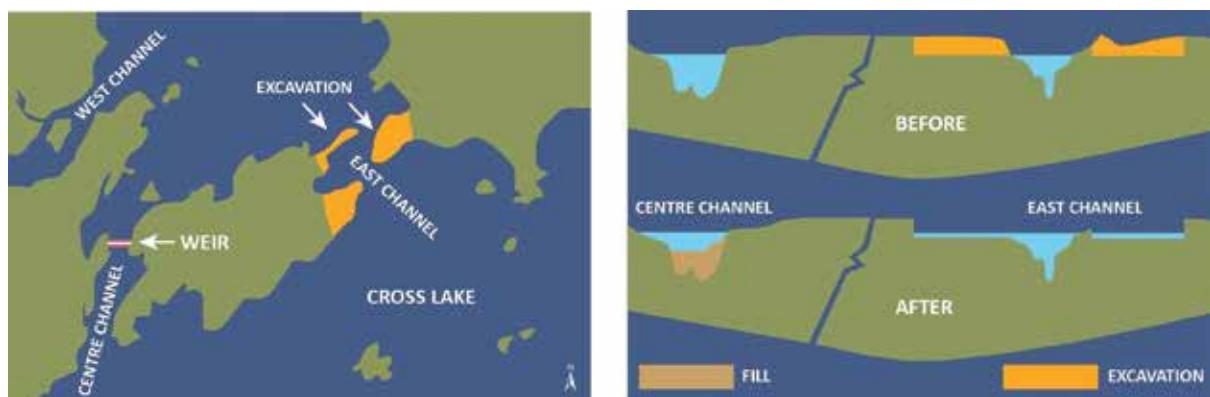
Cross Lake has experienced a reversal of natural seasonal patterns in water level since LWR went into operation, with higher average flows in winter and lower average flows in summer. From the beginning of LWR until 1991, monthly average water levels in Cross Lake were as much as 1.5 feet (46 cm) higher in winter and 4 feet (1.2 metres) lower in summer than during the pre-LWR period. Since the construction of the Cross Lake Weir in 1991, water levels have been higher throughout the year, with less variation, than

compared to the pre-LWR period. Average mid-winter levels since 1991 are 682.0 feet asl (compared to 679.0 asl pre-LWR), with a drop of about 1 foot in spring, followed by a rise to about 682.0 feet asl in mid-summer (compared to a mid-summer level of 681.0 feet asl pre-LWR). While the Cross Lake Weir contributes to keeping water levels higher since 1991, the high outflows from Lake Winnipeg during the recent prolonged wet period in the Lake Winnipeg watershed also play a role.

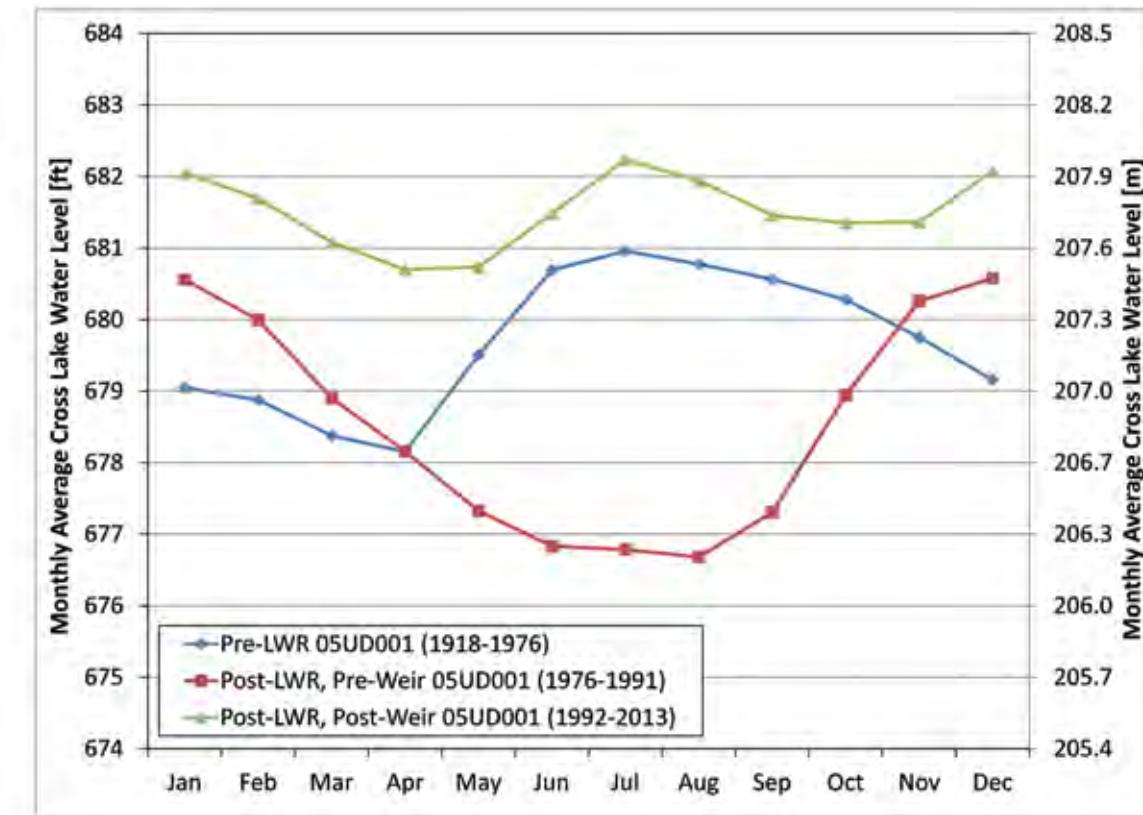
Pipestone, Walker and Duck Lakes are all influenced by water levels on Cross Lake. Walker Lake is approximately 40 km east of Cross Lake, connected by the Walker River. When Cross Lake's elevation is above 681.0 feet asl, it will influence the level of water on Walker Lake. As a result, all three of these lakes are affected by LWR because it directly influences the level of water on Cross Lake.

Sipiweesk Lake is affected both by LWR and the Kelsey Dam, completed in 1960. LWR has increased average monthly water level variation on Sipiweesk Lake, from 0.7 feet (20 cm) to 1.1 feet (34 cm), adding to the effects of the operation of Kelsey. Sipiweesk Lake has experienced a reversal of natural seasonal flows, with the lowest monthly averages in May and June and the highest in mid-winter.

Figure 7.3: The Cross Lake Weir. (Manitoba Hydro)



**Figure 7.4: Pre and post-Lake Winnipeg Regulation water levels on Cross Lake. (Manitoba Hydro)**



Split Lake is affected by both CRD and LWR and now has average water levels 1.2 feet (37 cm) higher than in the pre-CRD/LWR period. The seasonal pattern of water levels in Split Lake was also altered, with higher levels in winter than in summer since 1976. Average January levels post-LWR are nearly 550.0 feet asl, compared to just over 546.0 feet asl pre-LWR. Average June levels post-LWR, at approximately 548.0 feet asl, are slightly lower than pre-LWR June levels on Split Lake.

Reserve land lost to flooding and future land lost to erosion are identified and compensated through a process described in the NFA and the implementation agreements. Under this process, Manitoba Hydro is granted an easement on land below a certain elevation known as a “severance line.” The severance line is defined as the boundary of

a 100-year flood, including wind and wave events. This process also factors in shoreline composition and susceptibility to future erosion. Under the NFA, lands granted to Manitoba Hydro are to be compensated on a four-to-one basis, so that the First Nation receives four acres of land for every one that is flooded. The implementation agreements allow for replacement for easement land based on a substantially higher ratio.

Figure 7.5: Downstream area affected by Lake Winnipeg Regulation. (Manitoba Hydro)



## Comparing highs and lows, not just average water levels

Comparing average water levels before and after LWR does not provide a complete picture of the change in the water regime caused by the project. A more complete picture emerges by comparing times of high and low water and comparing ranges between the highest and lowest levels before and after LWR.

A series of graphs provided by Manitoba Hydro in response to a question by the commission showed the periods with the highest and lowest water levels on a seasonal basis, before and after LWR. The results for different parts of the system are summarized below.

On South Playgreen Lake and the east channel of the Nelson River at Norway House, the average water level has been about 1 foot higher since the project went into operation, with a variation between recorded highs and lows of a little less than 2 feet. This compares to a maximum variation of about 4.5 feet before LWR.

On Kiskittogisu Lake, the variation has remained about the same, between 1 and 2 feet. The average lake level is approximately 1 foot higher in summer and 1 foot lower in winter, than pre-LWR. The seasonal peaks (summer and winter) are 1 foot higher than the recorded highest levels pre-LWR.

Cross Lake experiences greater seasonal variations, with the greatest differences recorded between the start of the project and the completion of the Cross Lake Weir in 1991. During these years, up to 11 feet of variation between the recorded high and low points was experienced. Since the construction of the weir, this variation has been reduced to 6 feet, which is similar to a pre-LWR level of 4 to 5 feet.

Post-weir, in years of average to above-average flows, the seasonal pattern is for higher water levels in summer than in winter. But in low-flow years, the seasonal pattern is reversed, with lower flows in summer than in winter.

The greatest variation is experienced on Sipiwek Lake, with an 11-foot difference between the highs and the lows. In comparison, a 5-foot difference was recorded between 1965 and 1976, pre-LWR. Seasonal reversal is also experienced. Overall levels on Sipiwek are higher post-LWR, with the maximums and averages up to 2 feet higher than under pre-LWR conditions.

The level of Sipiwek was raised 15 to 17 feet when Kelsey Dam was constructed. The effects of LWR are in addition to those from Kelsey.

### What We Heard: Water Regime – Downstream

Representatives of the Norway House Fishermen's Co-op reported that high water levels on Playgreen Lake have resulted in their docks no longer being available for use. One

representative of the Co-op reported that he has had to replace his dock four times since the 1980s because of fluctuating water levels.

For Pimicikamak Okimawin, fluctuating water levels and a reversal of the natural seasonal pattern since LWR have been a major

source of problems. Using Water Survey of Canada data, the First Nation's representatives demonstrated that the pattern of water levels on Cross Lake remained largely the same during the decades before LWR, although the water levels themselves had ups and downs depending on climate trends. In all decades, the lowest water levels of the year would be reached in late April when the ice began to melt, followed by a surge in water levels in May/June and a gradual drop in late summer/fall. This seasonal pattern held true both during dry periods, as in the 1930s, and wet periods, as in the 1960s. In the 1930s, levels on Cross Lake reached as low as 674.0 feet asl (205.5 metres) in the spring and rose to a little over 676.0 feet asl (206 metres) in the summer. In the 1960s, the spring levels in many years were between 677.5 and 679.0 feet asl (206.5 to 207 metres) and the summer high levels were typically between 679.0 and 682.0 feet asl (207 to 208 metres). During the wet years in the 1960s, summer levels could be 3 to 5 feet (1 to 1.5 metres) higher than the spring low point. After LWR began operating, a greater range of fluctuation began, both within a given year and year to year. At the same time, the seasonal pattern changed, with high levels in the early winter and the lowest levels, in most years, in the summer. In the 1980s, before the construction of the Cross Lake Weir, summer levels on Cross Lake were below 676.0 feet asl (206 metres) several times, and in one year reached a record low of 672.5 feet asl (205 metres), exposing 300 square kilometres of the bottom of the lake. Since the construction of the Cross Lake Weir in 1991, summer water levels on the lake have remained above 677.5 feet asl (206.5 metres), except for the drought year of 2003. More recently, the wet years of the last decade have seen Cross Lake levels as high as 685.5 feet asl (209 metres). Pimicikamak's presentation stressed that, although the Cross Lake Weir has eliminated the lowest summer levels on Cross Lake, it has not returned the lake to a natural water regime.

Pimicikamak noted in their submission that Article 10.2 of the NFA in 1977 anticipated the construction, in 1991-1992, of the Cross Lake Weir. "Without limitation, for the purpose of avoiding many adverse effects on the community of Cross Lake, it is contemplated that it may be appropriate for Hydro to construct a control structure at or near the outlet of Cross Lake and to operate this structure so as to prevent the occurrence of low water levels which adversely affect the community and to restore, to the extent practical, the natural pattern of seasonal fluctuation in lake levels." Nearly a decade later, in 1986, the Cross Lake Environmental Impact Assessment Study Report proposed a "water control scheme" to mitigate the negative effects of LWR on fish and wildlife habitat and human uses of Cross Lake. This led to the construction of the Cross Lake Weir, which includes both a weir to prevent water levels on the lake from getting too low and excavation and channel widening to allow the lake to drain when water levels get too high.

Although Manitoba Hydro asserts that the weir has improved riparian and aquatic habitat and returned Cross Lake to a more natural seasonal pattern, Pimicikamak argues that the data do not show a return to "near normal" water regimes on the lake. Cross Lake has continued to experience relatively rapid increases and decreases in water level, as well as erratic patterns in summer and autumn, the latter sometimes the result of the "November cutback" when flow through Jenpeg is reduced just prior to freeze-up to allow a smooth ice cover to form in the Jenpeg forebay. As well, in some years since the completion of the weir (typically during dry years), there have still been seasonal reversals of the water regime (i.e: lower water levels in summer than in winter).

Pimicikamak stresses that Manitoba Hydro makes positive assumptions about

the likely impact of the Cross Lake Weir on whitefish, aquatic furbearers, and waterfowl, but has not done research on the weir's effects. Pimicikamak argues that when the Cross Lake Environmental Impact Assessment Study recommended construction of a weir to improve habitat on Cross Lake, it recommended that it be built in conjunction with changes to operating procedures for LWR. These operating recommendations were:

- That the licence provision for a minimum allowable outflow of 25,000 cfs be replaced by a requirement that Manitoba Hydro not permit Cross Lake to fall below an elevation of 679.0 feet asl as a result of actions within Hydro's control;
- That the licence condition requiring maximum outflow at Jenpeg when Lake Winnipeg reaches 715.0 asl feet be replaced by a provision requiring that regulation of Jenpeg at its upper limit come under the direction of the minister;
- That the November cutback be prohibited; and
- That Manitoba Hydro establish a management objective to minimize negative impacts on fish and furbearers in Cross Lake.

Pimicikamak notes that these changes have not been implemented. However, it acknowledges that hydrological data suggest that Manitoba Hydro has attempted to follow some of these recommendations in the way it operates Jenpeg.

Although the recommended licence condition of a minimum water level on Cross Lake of 679.0 feet asl was not added to the licence, since the installation of the Cross

Lake Weir, the level has been above that level 92 per cent of the time. From 1976 to 1993, Cross Lake's minimum level was below this point, while it has only gone below 679.0 feet asl in seven years since 1993. Historically, prior to LWR, there were 15 years in which Cross Lake levels were recorded below 679.0 feet asl.

Graphs of Cross Lake water levels also reveal the impact of Manitoba Hydro's fall ice management activities, when the Jenpeg discharges are slowed down to allow a smooth layer of ice to form upstream of the control structure in the forebay. Once this smooth ice cover is formed, water discharge from Jenpeg is typically increased, which causes a short, sharp rise in the level of Cross Lake in late November or early December. It is this process that causes much of the slush ice problem discussed in Chapter Eight: Socio-economic Effects in the section on Navigation, Transportation and Public Safety.

Members of the Manitoba Métis Federation who hunt, fish or trap in the downstream area discussed a number of effects of fluctuating water levels along the Nelson River and, especially, on Sipiweesk Lake, including erosion and making access to resource harvesting areas more difficult. Similar concerns were expressed by residents of communities in the area during the hearings.

A representative of Tataskweyak Cree Nation stated that, until about 2005, the normal state of affairs since LWR was for lower water levels on Split Lake in the summer. Since then, though, water levels on the lake have been high year round. For the first 20 years after LWR, Tataskweyak experienced flooding three times, but in the last 20 years the community has experienced flooding every two or three years. Representatives from Tataskweyak and York Factory First Nation noted that the

terms of their Joint Keeyask Development Agreement with Manitoba Hydro included that development of the Keeyask Generating Station would not require a change to the operating conditions of LWR and CRD. It was argued that changes would add a new element of uncertainty to life for the communities.

### **Commission Comment: Water Regime – Downstream**

Changes to the water regime have had a variety of impacts on the natural environment and on social, cultural and economic life for the communities downstream of Lake Winnipeg. LWR has changed the seasonal pattern of flows on the Nelson River and resulted in higher levels downstream of Jenpeg. Operations have resulted in greater variation, both year-to-year and, sometimes, day-to-day. The specific kinds of impacts will be discussed later in this chapter and in Chapter Eight: Socio Economic Effects.

The construction of the Cross Lake Weir appears to have partially mitigated the effect on the water regime, by reducing the extreme high and low water levels on Cross Lake. However, it has not returned conditions to a natural water regime.

One of the concerns the commission heard – which the commission shares – is that the system for making decisions about operation of LWR has no explicit set of rules that allow environmental and social needs to be incorporated. Although Manitoba Hydro representatives said such considerations do come into play, there is no set of rules mandating such consideration. Beyond the fairly simple licence conditions mandating a minimum flow and a maximum daily rate of change in flow, it is up to Manitoba Hydro's discretion to make decisions affecting the water regime of the Nelson River. Furthermore, these two licence conditions

appear to have been developed with little or no scientific basis. The minimum-flow condition of 25,000 cfs appears to reflect the record low flow for the Nelson River, while the condition referring to the maximum rate of change does not appear to have been based on any evidence. The commission believes that a system should be developed that allows other interests in addition to hydroelectric generation and reduction of flooding on Lake Winnipeg to come into play. Chapter 10 of this report contains a discussion of ideas for developing operating rules for LWR that could formally take into account these other values.

## **7.3 Shoreline Erosion**

Shoreline erosion concerns on Lake Winnipeg are focused largely on the effect of high water levels, combined with strong winds, which cause banks to collapse and land to be lost around the lake. As lake communities are home to more than 20,000 permanent residents and many seasonal residents, this has an effect on property values and use and enjoyment of the lake.

In the downstream area, erosion concerns are focused on the impact of the altered water regime, which has accelerated erosion at many places through increased flows. Erosion can result in an increased amount of debris entering the water, as a result of forested shorelines collapsing, with a variety of impacts on resource use and travel. It can also result in an increase in suspended solids in the water.

### **7.3.1 Shoreline Erosion – Lake Winnipeg**

#### **Manitoba Hydro's Information: Shoreline Erosion – Lake Winnipeg**

The shoreline of Lake Winnipeg consists largely of easily erodible materials, such as

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clay, sand and deposits left behind by Ice Age glaciers. As a result, erosion has been recorded along the shoreline for as long as mapping has been conducted. This has become an ongoing issue for residents, especially in the south basin, where many homes, businesses and cottages are built along the shore.

Manitoba Hydro maintains that shoreline erosion on Lake Winnipeg is driven by natural processes unrelated to LWR. Since LWR has caused lake levels to be lower than they otherwise would have been, given the high precipitation of recent years, the corporation concludes that the project has not increased erosion rates.

Manitoba Hydro cited information gathered prior to the construction of the project, such as the Study Board report, which plotted historic shorelines on Lake Winnipeg since 1876. This study showed that typical south basin shores were eroding at 1 to 2 feet (0.3-0.6 metres) per year, with extremes of up to 25 feet/year (7.6 metres). Furthermore, erosion was found not to be a steady process. Rather, one extreme storm could cause more shoreline erosion in one area than had been experienced in several preceding years. As one example, in 1974, the Study Board report pointed out a section of shoreline about five kilometres north of Gimli, which had eroded by 700 feet (213 metres) from 1876 to 1971. Additional erosion at this site, according to the 2000 Lake Winnipeg Shoreline Erosion Study, amounted to 108 feet (33 metres) between 1971 and 1994.

The Study Board predicted that LWR would increase shoreline erosion on the lake, based on the assumption that the project would increase average lake levels by 0.7 feet (20 cm). In fact, since LWR went into operation, average lake levels have been 0.2 feet (6 cm) higher than the pre-LWR average, despite the higher precipitation levels of the past 15 or more years.

## What We Heard: Shoreline Erosion – Lake Winnipeg

The Keewatinook Fishers of Lake Winnipeg, an organization representing north basin fishers from many communities, provided photographic evidence of shoreline erosion on Long Point. Photos indicated that, in the last 10 years, erosion has resulted in the tip of the point becoming an island. Other photos indicated that, in the last five years, fishing cabins have been flooded as a result of advancing shorelines. Many other fishing camps were reported to be underwater as a result of shoreline erosion, affecting the ability of families to travel to the fishing camp to work together as in the past. The commission was also shown photos of shoreline erosion near Misipawistik Cree Nation and heard about shoreline erosion at Gull Bay, near Grand Rapids, which had affected a fishing camp used by members.

Shoreline erosion was a major issue during hearings in the south basin. One landowner at Grand Marais spoke of losing more than half of his shoreline property as a result of erosion. The commission also heard about the efforts of communities to protect shorelines from erosion, including an engineering study commissioned by the Rural Municipality of Victoria Beach. Similar experiences were described by property owners near Gimli, especially those on Willow Island, who reported losing a large amount of lakefront land. South end property owners, including those on Chalet Beach, also described the large amount of beachfront that has been lost over the decades. The commission heard many examples of specific beaches that had been eroded. In Gimli, the commission heard that the Rural Municipality of Gimli at one time had approximately 35 km of beaches and now the amount of beach has been reduced by half. At Manigotagan, shoreline erosion was said to have taken away a beach as well as 30 campsites in a privately operated

campground. At Brokenhead Ojibway Nation, one speaker referred to Stony Point at Patricia Beach, which was formerly a wide area of firm sand and is now described as mud and silt. Brokenhead residents also discussed the loss of land, including cottages and a lodge, at the mouth of the Brokenhead River.

Loss of property value was discussed in relation to shoreline erosion during commission hearings at Gimli, Grand

**Figure 7.6: Willow Island on Lake Winnipeg. ([www.gimlicommunityweb.com](http://www.gimlicommunityweb.com))**



Marais and Selkirk. In beach communities, the commission heard from presenters who suggested that periodic low water levels allow beaches to regenerate, and that LWR, by regulating water levels, has prevented this regeneration. Several property owners, particularly at locations on the south basin, spoke of spending tens of thousands of dollars in the attempt to protect their property from erosion. At Gimli, we heard of the unsightly effect of boulders and other shoreline protection placed along the lake shore to prevent erosion damage.

At Sagkeeng First Nation and Black River First Nation, photos and maps illustrated long-term shoreline erosion. Hollow Water First Nation's written submission described erosion on Black Island and other islands

and portions of the Lake Winnipeg shoreline. Sagkeeng presented a map showing successive shorelines at and around the mouth of the Winnipeg River from the years 1874, 1948, 1970 and 1983. A councillor for Sagkeeng said the First Nation required \$1.4 million several years ago to move 10 houses that were threatened by shoreline erosion and will soon need to move another 15 houses along the Winnipeg River. At Black River, historic maps and air photos showed that the former location of the community, closer to the mouth of the Black River, has been partially submerged. Other photos indicated the amount of lost shoreline near the community's beach area. A group of Winnipeg River property owners discussed erosion along the Winnipeg River downstream of the Pine Falls Generating Station.

Discussions of shoreline erosion often made reference to autumn windstorms, in which strong north winds blow large amounts of water south and raise the water level rapidly in the south basin. The major storm, known as the weather bomb of October 2010, was frequently mentioned. Concern was raised in several lake communities that Manitoba Hydro is keeping the level at the 715.0 feet asl operating limit maximum in order to produce energy during the peak winter season, and in the process exposing lake communities to greater risk from autumn storms.

### **Commission Comment: Shoreline Erosion – Lake Winnipeg**

Shoreline erosion, like high water, is undoubtedly a serious issue for residents, property owners and all users of Lake Winnipeg. Erosion takes a financial and emotional toll on many families and communities. High water levels in recent years have accelerated shoreline erosion, especially during episodes of high wind-driven waves, such as the 2010 weather bomb.

Both the independent experts retained by the commission and those retained by Manitoba Hydro have characterized shoreline erosion as a natural phenomenon that would occur on Lake Winnipeg with or without LWR. In some cases, even those arguing that LWR had accelerated shoreline erosion presented evidence that erosion is a natural process. In one community, the commission heard testimony and saw maps showing locations of historic shorelines dating back to the late 1800s. According to these maps – which had been submitted by presenters who believe Manitoba Hydro has caused Lake Winnipeg's shoreline erosion – most of the shoreline erosion in this area occurred decades before the construction of LWR.

One of the reasons shoreline erosion has had an impact on Lake Winnipeg communities and property owners may be that many shoreline developments were built without a full understanding or consideration of shoreline erosion. The commission is aware of cottages that were developed on areas of shoreline that could be classified as barrier islands. Barrier islands, as described by our independent experts, are a feature of eroding shorelines and naturally tend to erode and migrate in toward the main shore. Other developments, such as the Gimli Harbour, may be preventing the natural process by which sand is added to existing beaches further along the shore. (Sand naturally is moved along the shoreline until an obstruction causes it to settle, so such a structure may prevent sand from settling on the down-current side.) In such places, it may be necessary to artificially nourish existing beaches by adding sand.

Experts point to several natural factors that make Lake Winnipeg susceptible to shoreline erosion. One factor, as described in Section 6.3, Lake Winnipeg Erosion and Accretion Processes, is that much of the

lakeshore consists of highly erodible clay, sand and glacial deposits. Unlike a lake where the shoreline is defined by bedrock – such as those in the Canadian Shield – Lake Winnipeg has a shoreline that offers relatively little resistance to prolonged wave energy. The east shore of the north basin is considerably less erodible than the west shore, but most of the population living along the lake is found in the areas with greater susceptibility to erosion.

Another factor is the natural phenomenon of isostatic rebound, described in Section 6.2, Influence of Isostatic Rebound on Lake Winnipeg. This irreversible process causes the north basin of Lake Winnipeg to rise more rapidly than the south basin, raising the level of the lake in the south basin by approximately 0.7 feet (20 cm) per century.

That said, the idea has been raised that by keeping Lake Winnipeg within a narrower band of elevations, LWR has resulted in wave energy being concentrated on a smaller portion of the shoreline than would naturally be the case. Additional research on the causes of erosion on Lake Winnipeg would be needed to determine if LWR has contributed to some portion of shoreline erosion in the last 40 years, although it would be prohibitively expensive and time-consuming to carry out such research on a scale necessary to reach a definitive conclusion. As erosion would be on-going whether LWR is in operation or not, a more beneficial approach may be to do additional targeted research that would lead to better planning and development decisions regarding where buildings and other structures can safely be placed for long-term stability.

Experts with considerable experience in other jurisdictions highlighted the fact that Manitoba has lacked appropriate regulations on development. There are many examples

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of these types of restrictions from other jurisdictions in Canada and the United States, particularly around the Great Lakes.

Manitoba's Provincial Planning Land Use Policies recognize watershed connections and protection of shorelines, riparian areas and their ecology. These policies include recommendations for setbacks from water bodies and areas of erodible soils and for retention of vegetation in riparian areas. These policies, however, are planning guidelines that relate only to new developments. As suggested by the independent expert who reported on erosion for the commission, studies are needed to project the future impact of erosion and determine where appropriate development limits are. New configurations for future developments should be explored in response to predictable impacts from future erosion. This may mean that new developments cannot continue to line a shore with waterfront properties, because such an approach is more likely to put structures at risk from future erosion.

While a new approach for the future is needed, dealing with existing developments is also a challenge. Many current structures around Lake Winnipeg, particularly in the south basin, are much closer to the shoreline than they were in the past and are closer to the water than would currently be recommended. Given that erosion is expected to continue at similar rates, this creates a challenge for the future. Adaptation and mitigation measures will be needed for current structures, properties and communities that are likely to be affected by projected future erosion. Municipalities and the provincial government need to take action and establish definitive limits in erosion-prone areas and ensure they are enforced. Adaptation plans are required for existing developments.

The Manitoba government, under *The Water Power Act*, has set out a hydro reserve around Lake Winnipeg, at 722.0 feet asl, which applies only to Crown lands. This elevation was arrived at by taking into consideration the upper operating limit of LWR, with an allowance for wave action and wind set-up, plus two feet for flood reserve. Development below this line is not allowed without special permission and then must follow strict guidelines. This elevation is still above much of the development that has taken place on private, municipal and other lands around the lakeshore. There are, for example, several cottage areas along the shore of the south basin that are below this hydro reserve level. For example, Chalet Beach and Willow Island are below this elevation, as is most of Long Point in the north basin, where a number of fishing camps have been damaged by erosion. Given that isostatic rebound and climate change ensure more erosion in the future, it will be necessary for provincial and municipal governments to work together, using the results of erosion studies and current knowledge, to take definitive actions to determine the limits of waterside developments, include them in development plans and strictly enforce these limits.

## Recommendations

The Commission recommends that:

- 7.2 *The Government of Manitoba, in co-operation with Manitoba Hydro, as a basis for development and planning decisions, undertake erosion studies in highly vulnerable and developed areas in the south basin to determine the rate of erosion, the cause of erosion, and mitigation measures.*
- 7.3 *The Government of Manitoba re-examine the 722.0 feet asl limit on the Lake Winnipeg hydro reserve to determine if*

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*it is still effective in protecting property and activities on Crown land around Lake Winnipeg or if and where a new line should be implemented.*

### **7.3.2 Shoreline Erosion – Downstream**

#### **Manitoba Hydro's Information: Shoreline Erosion – Downstream**

Shoreline erosion and the generation of debris (including tree trunks and roots that are washed into the water) have been accelerated by LWR in several downstream areas, through the flooding of the Jenpeg forebay, increased water levels on Cross Lake and, at times, increased flows in the Nelson River. This has resulted in the loss of beaches and islands and difficulty accessing the shoreline, as well as hazards for navigation. Erosion within Two-Mile and Eight-Mile Channels has also occurred since the development of LWR.

Both Two-Mile and Eight-Mile Channels have been deepened (scoured) by erosion since 1976 by approximately 5 feet (1.5 metres) and 6.5 feet (two metres), respectively. The bank of Two-Mile Channel near its inlet has eroded more than 150 feet (46 metres) since 1978 as a result of wave action on Lake Winnipeg. Near its outlet into Playgreen Lake, the bank has eroded approximately 25 feet (7.6 metres). A smaller amount of bank erosion has been observed on the banks of Eight-Mile Channel. Along the shore of Playgreen Lake, Manitoba Hydro's studies indicate shoreline erosion in some places, while others have minor or no evidence of shoreline erosion. Manitoba Hydro cited the 1985 study by the firm MacLaren Plansearch Inc., which concluded that a highly erodible southwest shore of Playgreen Lake had eroded at virtually the same rate before and after LWR. A 2004 report by Manitoba Hydro

indicated that most of the shoreline along Kiskittogisu Lake showed signs of ongoing erosion. In the Jenpeg forebay, bank recession rates from 2003 to 2012 were found to vary depending on the shoreline type, with the greatest recession rates averaging 0.7 feet (0.2 metres) per year. Some 65-70 per cent of the shorelines in the forebay are vulnerable to erosion from wave action.

Higher water levels on Cross Lake, resulting both from LWR and from the construction of the Cross Lake Weir as a mitigation measure, have increased erosion on Cross Lake. Under the NFA, Manitoba Hydro began a shoreline protection program in the community of Cross Lake that resulted in placement of rock to protect approximately 14,400 feet (4.3 km) of shoreline in 2011-2012. In 2011, during a time of record high water levels, a new channel was created by erosion altering flows in the area of Duck Rapids. This new channel will result in significant debris and sediment entering Sipiwesk Lake. Greater erosion on Sipiwesk Lake has necessitated shoreline protection measures, undertaken by Manitoba Hydro under the NFA, to protect burial sites so that they will not be disturbed during times of high water. Sipiwesk Lake has been affected by erosion caused by impoundment of the Kelsey Generating Station forebay, which raised levels on the lake in the 1960s, as well as by LWR. Reports on Sipiwesk Lake erosion, issued in 1974 and 1992, stated that 50 per cent of the lake's shoreline had experienced severe erosion, with greater erosion occurring after LWR.

On Split Lake, which is affected by LWR and CRD, high water has caused slumping of the shoreline and erosion. High water levels in 2005 necessitated emergency shoreline protection work by Manitoba Hydro and again in 2008. In total 19,000 feet (5.8 km) of shoreline protection projects have been

completed at Tataskwewak Cree Nation and another 7,900 feet (2.4 km) at York Factory First Nation.

Under the NFA, Manitoba Hydro is responsible to monitor shoreline erosion and install shoreline protection along affected reserve lands, cemeteries and burial sites.

### **What We Heard: Shoreline Erosion – Downstream**

The commission heard and saw considerable evidence of extensive erosion occurring from Two-Mile Channel to Split Lake. This erosion has an impact on resource use and navigation, which will be discussed in greater detail in Chapter 8: Socio-Economic Effects, and has a visual impact on the appearance of the Nelson River and lakes in the downstream area.

The commission heard a presentation by a mapping expert retained by Peguis First Nation, who compared pre-LWR and post-LWR maps to provide an estimate of the amount of land lost to erosion as well as the amount of new shoreline created through deposition. This study looked at a small portion of the north basin of Lake Winnipeg and at Playgreen Lake. The map comparison indicated a loss of approximately 477 hectares from an area that included Two-Mile Channel and the southwest shore of Playgreen Lake. This includes 145 hectares of land lost due to the excavation of Two-Mile Channel and a strip of 169 hectares along the shore of Playgreen Lake. Near this latter stretch of shoreline, an additional 62 hectares of land was lost from a point that appears to have been eroded. Material from this lost point appears to have been deposited nearby to form a new, smaller point and some small islands.

Members of Norway House Cree Nation, Manitoba Métis Federation members and

residents of Norway House expressed concerns about erosion at Two-Mile Channel. The channel is being both widened and shortened by erosion and large amounts of sediment are flowing into Playgreen Lake as a result. Erosion at the channel was said to have been so great that the navigation light at the south end of the channel has had to be moved. Manitoba Hydro's figures indicated the length of the channel had been reduced by approximately 370 feet (112 metres) since the completion of LWR. In places, as a result of sediment deposition, new sandbars appear to have been formed in Playgreen Lake. Concerns were expressed about the effect of this deposition on spawning areas in the lake. The west shore of Playgreen Lake near Eight-Mile Channel and islands in Playgreen Lake have also experienced substantial amounts of erosion. This erosion has exposed one former dump site containing construction debris from the building of LWR. Loss of islands in Playgreen Lake may make navigation more difficult by removing route-finding landmarks.

*“Today, I don’t even take my grandkids out in the lake where we used to spend many summers as well, called Sandy Island. Sandy Island was called exactly what it was, it had sand, it had a beach almost all the way around the island. Now we will be lucky if we can find a quarter mile of a beach on that island. And our kids can’t, my grandkids can’t even swim in the water because the water is so dirty.”*

Representatives of the Norway House Fishermen's Co-op presented video showing the effects of shoreline erosion on Playgreen Lake, which depicted lake ice extending into the forest on the lakeshore and a large number of dead or dying trees. The Co-op has participated in five shoreline stabilization projects, funded by Manitoba Hydro, since

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2012 along the west shore of Playgreen Lake. The most recent, in 2014, involved removing 8,000 dead trees along an 8,500-foot (2.6 km) stretch of shoreline, preventing the trees from becoming floating debris. As on Lake Winnipeg, shoreline erosion has had an effect on beaches in the Playgreen Lake area.

Erosion of the Nelson River shoreline downstream of Jenpeg is exposing gravesites and artifacts. Pimicikamak members spoke of grave sites along the Nelson River, on Sipiweesk Lake and on the Walker River that are threatened by erosion and presented a photo of a human skull that had been exposed. Shoreline erosion was also described as resulting in rivers and lakeshores lined with dead trees and “spiders” – the local term for a tree stump and roots that have been exposed and made mobile in the water as a result of erosion. Pimicikamak members also expressed concern about the new channel that was eroded in 2014 between Duck Lake and Sipiweesk Lake through a marsh described as formerly a good hunting area for moose and waterfowl.

Members of the Manitoba Métis Federation, who fish on Sipiweesk Lake or further downstream, noted that Sipiweesk is particularly prone to erosion. Erosion along Sipiweesk has continued to result in large amounts of debris entering the Nelson River.

At both Tataskweyak and York Factory First Nation, shoreline protection projects have been carried out within the communities. At Tataskweyak, these projects were prompted by a flood in 2005 that threatened community infrastructure, including the cemetery. A representative of Tataskweyak reported that continued high water on Split Lake has caused islands to disappear in the last 10 years. As well, Tataskweyak’s representatives noted that the Study Board had predicted that it would take 50 years for shorelines along Split Lake to stabilize after the creation of LWR and CRD.

## **Commission Comment: Shoreline Erosion – Downstream**

The commission was concerned to learn of the amount and rate of shoreline erosion occurring at Two-Mile Channel. This channel – which remains open long after the rest of Lake Winnipeg and Playgreen Lake are iced over because of the amount of current passing through it – has eroded by approximately 370 feet (112 metres) in length since construction of LWR. Given that this channel is not a natural feature, clearly this is not erosion that can be attributed simply to natural processes. The effects of this erosion on water quality (through increased turbidity – cloudiness of the water caused by suspended solids) and fish habitat (through damage to spawning sites) are not fully understood because of a lack of focused research. Likewise, more investigation of the other constructed or expanded channels is needed to determine their erosion rates and the possible effects of erosion. The reports we heard of exposed dumpsites at the locations of former work sites or camps for Two-Mile and Eight-Mile Channels are an immediate concern. The possibility of erosion exposing former construction materials and other matter should be addressed immediately.

We were also concerned to learn about the new channel that had eroded at Duck Lake. While high flows down the Nelson River resulting from years of heavy precipitation naturally would cause erosion along the river, the effect of fluctuations caused by releases from Jenpeg, plus the reversal of the natural seasonal pattern of flows, may also have played a significant role in this dramatic change to the landscape. As Sipiweesk Lake is affected by fluctuations in water level caused by the Kelsey forebay, Kelsey may also have played a role in the erosion of the new channel. Evaluation of the Jenpeg operating regime, as will be discussed in Chapter 10, must consider these effects.

Erosion has also exposed cultural and heritage sites, including burial sites, and has forced several downstream communities, including Pimicikamak Okimawin, Tataskweyak Cree Nation, Norway House First Nation and York Factory First Nation, to protect shorelines with rip rap within their built-up areas. These protected shorelines are neither natural nor visually attractive environments. As was pointed out during the hearings, a shoreline covered with rip rap lacks the diversity of species and natural habitats found in natural shorelines. In addition, armouring a shoreline is ultimately a temporary solution, as erosion continues offshore from the protective works. Additional study is needed to determine causes of downstream erosion, as well as methods of reducing or mitigating erosion damage that are effective, practical and ecologically sound.

All parties agree that there has been erosion downstream of Jenpeg since the construction of LWR and all agree that LWR has played a role. What proportion of shoreline erosion is a result of LWR, compared to natural processes and the high precipitation cycle of the last 15 to 20 years, is less clear. The Study Board predicted that it would take 50 years for new shorelines to stabilize following LWR and CRD, but it appears that little stabilization has occurred after 40 years. It may be that the Study Board's forecast was based on the environmental conditions at the time and does not take into account the increased precipitation in recent years. Additional research is needed to determine if there has been any downstream shoreline stabilization, if and how the rate of erosion has changed and where the most vulnerable areas will be in the near future. Methods to assist in this analysis include, but are not limited to, aerial photography and in-stream measurements comparing conditions before and after LWR construction, as well as local knowledge.

Efforts must be made to stabilize the shoreline along the upper Nelson River. Methods employed must be ecologically, socially, culturally and economically suitable and offer long-term protection. It is likely that it will be necessary to employ a variety of methods to find the right fit for the differing situations along the river.

## Recommendations

The Commission recommends that:

- 7.4 *Manitoba Hydro undertake a study to determine where erosion is occurring along the upper Nelson River and at what rate since implementation of Lake Winnipeg Regulation. Through the use of aerial photographs and in-stream measurements of the shoreline made before and after construction, Manitoba Hydro prepare a map identifying eroded sections and vulnerable areas.*
- 7.5 *Manitoba Hydro closely examine erosion in the constructed channels and determine the overall change that is occurring. If this erosion is found to be causing negative effects, Manitoba Hydro should undertake erosion-control measures.*
- 7.6 *Manitoba Hydro determine if the current methods of erosion control are effective and acceptable to local residents and resource users in the long term and if these methods are working, delaying shoreline losses or deflecting them to another area of shoreline.*
- 7.7 *Manitoba Hydro research and implement more ecologically friendly methods of erosion control wherever feasible.*
- 7.8 *Manitoba Hydro examine all former construction areas, locate any former dump sites, determine their contents and take appropriate action to prevent*

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*contamination of water and soil and visual impact on the landscape.*

## 7.4 Water Quality

Many concerns about water quality have their origin in nutrient run-off occurring upstream in the Lake Winnipeg watershed. On Lake Winnipeg, the concern is largely focused on whether or not LWR allows nutrients to become more concentrated by preventing them from being flushed down the Nelson River. In the downstream area, in particular, the concern is often that erosion caused by LWR reduces water quality by raising the level of suspended solids in the water.

### 7.4.1 Water Quality – Lake Winnipeg

#### Manitoba Hydro's Information: Water Quality – Lake Winnipeg

Lake Winnipeg has experienced increased loading of the nutrients nitrogen and phosphorous in recent decades. These nutrients are essential to plant growth and have allowed for growth in algae and cyanobacteria (bacteria capable of obtaining energy through photosynthesis, often referred to as blue-green algae). Lakes with large amounts of nutrients, known as eutrophic lakes, can be highly productive for fish. However, over time, they can also become inhospitable to fish and other organisms that require high concentrations of dissolved oxygen. This can happen because the microbes that cause algae to decay consume dissolved oxygen during that process. Lower dissolved oxygen levels have been recorded in the central part of the north basin in some recent studies, while the south basin has maintained dissolved oxygen levels that are adequate for the protection of aquatic life.

Manitoba Hydro notes that the recent increases in nutrients in Lake Winnipeg have come at a time (since the 1990s) when high inflows, especially from the Red River, have contributed to increased nutrient loading in the lake.

Although Lake Winnipeg is one of the world's largest in terms of area it covers, it is a very shallow lake and has a much smaller volume of water than other lakes of comparable area, such as Lake Ontario. One consequence of this is that Lake Winnipeg has a very short water residency time, described as the amount of time water spends in the lake before flowing out to the Nelson River. Lake Winnipeg's water residency time is approximately 3.8 years, which compares to 6.0 years for Lake Ontario. LWR does not appear to have caused significant changes in the residency time of water in Lake Winnipeg. In the driest years – the multi-year drought of the 1980s and the 2003 drought – LWR increased water residency time because water was held back in summer to keep the level of the lake from falling below 711.0 feet asl. During times of high inflows, Lake Winnipeg has had a hydrological cycle more like that of a natural lake (ex: rising in spring with the snow melt and declining over the winter), so any effects of LWR would be reduced at the same time as the lake has had increased nutrient levels.

A recent study indicated that the ratio of total phosphorous flowing out of Lake Winnipeg compared to total phosphorous flowing into Lake Winnipeg did not change between the period 1971-1980 and 1996-2005 (McCullough et. al. 2012). This would suggest that increases in phosphorous in the lake are a result of increased inflows and not a result of LWR reducing the outflow of phosphorous. The report notes that the Red River is the major source of nutrients flowing into Lake Winnipeg. Although the Red River only

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supplied an average of 16 per cent of the water to the lake between 1999 and 2007, the river provided 68 per cent of total phosphorus and 34 per cent of total nitrogen during the years 1994-2007. In addition to external loading of nutrients (ex: nutrients flowing into the lake from rivers), Lake Winnipeg is affected by “internal nutrient loading” in which nutrients such as phosphorus, located in the sediments on the floor of the lake, are re-suspended in the lake’s water column, as a result of wind and wave action. This then makes these nutrients available to feed algae.

### **What We Heard: Water Quality – Lake Winnipeg**

Increased siltation was a water quality concern for many north basin fishers. In Pine Dock, fishers spoke of a “silt blanket” – a layer of silt-laden water which they believed to be spreading out from the Dauphin River. As this “silt blanket” reaches further into the lake, it pushes the fish away. Nets in the water are fouled with mud and algae when the silt reaches them. In communities throughout the north basin, this was attributed to erosion caused by the Lake Manitoba emergency drainage channel.

At several Lake Winnipeg communities, including Black River, Sagkeeng, and Berens River First Nations, presenters spoke of children acquiring rashes, as a result of swimming in Lake Winnipeg.

Effects on potable water were discussed frequently at First Nations. A common experience mentioned during hearings at many First Nations was the memory of drinking water directly from Lake Winnipeg. This memory was contrasted with the lake’s current murky condition. Some communities have specific problems with potable water that they consider connected to the state of Lake Winnipeg water quality. At Berens River

First Nation, it was stated that when the level of Lake Winnipeg is high, and especially when there is a wind from the northwest, lake water is forced up the river to the intake for the community’s potable water system, creating water treatment problems. At Peguis First Nation, presenters were concerned that the high level of Lake Winnipeg forces the water table higher and allows groundwater that is used for drinking to be contaminated. Frequent flooding of the community, combined with a high water table, was said to result in contaminated well water and wells that need to be treated regularly.

Lake Winnipeg’s growing problem with algae blooms was also discussed in many communities. Fishers from Dauphin River reported that the algae bloom in the north basin has been located near Reindeer Island in recent years, but since the opening of the emergency channel from Lake St. Martin, another bloom has formed closer to their community in Sturgeon Bay.

### **Commission Comment: Water Quality – Lake Winnipeg**

As with high lake levels and shoreline erosion in the previous chapter, the commission heard from many residents of Lake Winnipeg communities who are deeply concerned about water quality on the lake. Their concerns were heartfelt and legitimate and point to a continuing need to address problems, such as nutrient inputs into the Lake Winnipeg watershed, and the need to develop watershed plans to manage surface water.

It is unclear, however, how LWR might have an impact on water quality of Lake Winnipeg. On several occasions, we heard presenters suggest that the Jenpeg Control Structure blocks the outflow of nutrients from the lake and causes them to increase in

concentration. However, it appears that LWR has not increased the residence time of water in the lake and has increased the outflow capacity of the lake through constructed and expanded outflow channels. One theory suggested was that LWR reduces outflow in summer in order to ensure that there is enough water in winter to generate electricity during the high-demand season. This would then mean that nutrient-rich water was retained in the lake during the growing season, encouraging algae blooms. However, given the high precipitation of recent years, Manitoba Hydro has been operating Jenpeg at maximum discharge for all or part of six of the last seven summers.

An expert retained by the commission estimated that a small (less than 2.5 per cent) increase in concentration of phosphorous in the lake could happen in years when LWR reduces outflow in summer, but research would be needed to confirm this. This would be due to the fact that phosphorous concentrations in the lake are higher in summer than in winter. However, the expert concluded that this would amount to a relatively insignificant portion of the increase in phosphorous concentration in the lake in the last 20 years (as much as 100 per cent increase). For more information, see Section 6.5, Water Level Regulation in the Lake Winnipeg Basin and its Effect on Nutrient Status of the Lake.

Ultimately, it appears likely that any impact of LWR on Lake Winnipeg's water quality problems is far less significant than the impact caused by nutrient inputs, loss of wetlands and other issues upstream.

## 7.4.2 Water Quality – Downstream

### Manitoba Hydro's Information: Water Quality – Downstream

Manitoba Hydro reported that water quality in the Outlet Lakes is generally within the levels set by the Manitoba Water Quality Standards, Objective and Guidelines, although some parameters are in excess. Total phosphorus exceeds the Manitoba guidelines for nutrients. As well, aluminium and iron exceed guidelines, but such excessive levels are fairly common on rivers and lakes not affected by Manitoba Hydro's operations. Phosphorus and nitrogen are key nutrients in the production of algae and have been identified as causing abundant algae growth on Lake Winnipeg. However, studies of the Outlet Lakes in comparison to Setting Lake, which is not connected to the Manitoba Hydro system, indicate that algae production is not notably higher in the Outlet Lakes than in Setting Lake.

In measurements of the water quality parameter known as total suspended solids (TSS), Playgreen Lake has a higher concentration than Little Playgreen Lake or Cross Lake, but all are within the guidelines. The lower Nelson River has a higher concentration than the upper Nelson. Lakes on the Nelson River have a higher TSS than off-system lakes, a result of higher levels of erosion along the Nelson River.

Downstream of the Jenpeg Control Structure, similar water quality conditions are found on Cross Lake. Samples of water from Cross Lake exceed guidelines for total phosphorus and aluminum and some samples exceed guidelines for iron. As well, in some winters, dissolved oxygen at deep levels of Cross Lake fell below the guidelines. Low dissolved oxygen levels are not uncommon in late winter in water bodies covered by ice.

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Some of the studies made over time indicate that phosphorus in Cross Lake has increased in the years since LWR went into operation, while nitrogen levels in the lake are indicated in some studies to have decreased. Several studies have stated that turbidity (cloudiness of the water caused by suspended solids) increased on Cross Lake after LWR. Overall, Manitoba Hydro's compilation of information states that changes to water quality are uncertain, with some studies reporting declines in dissolved oxygen and increases in turbidity and others reporting no significant change.

Further downstream, in Sipiesk Lake, studies reported a decrease in nitrogen, an increase in fecal coliform and in several ions (chloride, sodium, potassium) and no change to phosphorus since LWR.

For water quality, as for other parameters, Manitoba Hydro notes that, downstream of the Kelsey Generating Station, it is difficult to separate the effects of LWR from those of CRD. Water samples from Split Lake exceed Manitoba guidelines for total phosphorus, iron and aluminum. Studies cited by Manitoba Hydro indicate that phosphorous in Split Lake either decreased or remained the same after LWR, with the exception of one study, which indicated a temporary increase. Concentrations of aluminum in Split Lake are likely influenced by the higher concentrations of this element in the water of the Burntwood River, which flows into Split Lake. CRD is thought to be the most likely source of suspended solids in Split Lake, as the Burntwood River brings a large sediment load into the lake.

## **What We Heard: Water Quality – Downstream**

As on Lake Winnipeg, declining water quality on Playgreen Lake was said to have

affected swimming, to the point where children at Norway House don't want to swim in the lake anymore or parents don't allow children to swim in the lake. Similar concerns about swimming and water quality were expressed at communities further downstream. Several presenters at Norway House also spoke about landfill sites that were buried and left behind following construction of Two-Mile and Eight-Mile Channels. The sites were said to contain old fuel containers and other kinds of waste with the potential to affect nearby waters.

Representatives of the Cross Lake Community Council told the commission that because of high turbidity, water treatment costs twice as much as it should for a community of its size. This is because the suspended solids in highly turbid water reduce the effectiveness of the treatment process.

Representatives of Norway House Cree Nation, Pimicikamak Okimawin and other individuals expressed the concern that the increased outflow from Lake Winnipeg at Two-Mile Channel has allowed more sediment and algae to flow downriver. The previous shallow channel at Warren Landing, it was argued, would have constricted flow of sediment out of the lake.

At York Factory First Nation, high levels on Split Lake were said to have an effect on drinking water. The community's water intake is on the Aiken River, but when levels are high on Split Lake, lake water can back up to the intake, making water treatment more difficult.

## **Commission Comment: Water Quality – Downstream**

While some of the water-quality problems downstream of Lake Winnipeg are caused by nutrient run-off or land-use changes upstream

of Lake Winnipeg, LWR plays a role as well. Erosion resulting from the current in Two-Mile Channel, the flooding of the Jenpeg forebay and increases in current downstream of Jenpeg cause sediment to enter the water. The higher level of suspended solids in Playgreen Lake may be a result of the large amount of erosion along Two-Mile Channel and the adjoining lake shores. This erosion must be assessed and addressed, as does the possibility of contamination from former dump sites at the camp and work sites for the project.

Increases in algae in the Nelson River and lakes such as Cross Lake and Split Lake are partly related to increased nutrient levels on Lake Winnipeg, but likely also to climate change (longer or warmer summers and shorter winters). Rashes reported in many communities are likely swimmer's itch, an annoying but not dangerous condition caused by a parasitic worm carried in the intestines of waterfowl and aquatic mammals. Additional monitoring could help to confirm this and perhaps could lead to improved public education to prevent swimmer's itch (towelling off immediately after swimming helps to prevent swimmer's itch, as does showering right away).

Actions the commission is recommending to address nutrient retention upstream in the watershed and erosion studies in the area affected by LWR may help to address some of the water quality issues identified by downstream communities.

## 7.5 Fish Populations and Fisheries

Changes to the water regime, erosion, and physical disruption of specific fish habitats are among the impacts hydroelectric projects can have on fish populations. In many communities around Lake Winnipeg and

along the Nelson River, fishing is an important cultural tradition. Commercial fishing is also a major local industry throughout the area.

### 7.5.1 Fish Populations and Fisheries – Lake Winnipeg

#### Manitoba Hydro's Information: Fish Populations and Fisheries – Lake Winnipeg

Manitoba Hydro discussed concerns about Lake Winnipeg fish populations by focusing on the commercial fishery. The Lake Winnipeg commercial fishery is the largest in Manitoba, and, in 2008-2009, had more than 800 licensed fishers and produced more than 73 per cent of the total value of fish in Manitoba, with a total value, that year, of more than \$19 million. Because of the importance of the commercial fishery to many communities around Lake Winnipeg, the possible effects of LWR have long been a matter of concern.

Manitoba Hydro cited a 2011 study of commercial harvest, by decade, going back to the 1940s. The harvest numbers show that in the 2000s, approximately 3.9 million kilograms of walleye were harvested each year on the lake, nearly double the annual harvest in the 1940s, the decade with the next highest walleye harvest. The same study shows a decline in sauger catch, to 450,000 kg/year in the 2000s, compared to 2.7 million kg/year in the 1940s and 1.8 million kg/year in the 1980s. The whitefish harvest in the 2000s, 1.4 million kg/year, was second to the harvest in the 1980s, almost 1.6 million kg/year. Manitoba Hydro cautions, though, that the available fisheries information is not adequate to determine past or present biological productivity of the lake.

Manitoba Hydro cited a review that was conducted by independent fisheries experts in 1992, after a period of declining whitefish

catches. It concluded there was no evidence that LWR had any impact on the whitefish fishery. In the meantime, data on the annual harvest of fish from Lake Winnipeg show that whitefish catches have had ups and downs, while catches of walleye (the highest-priced fish) have steadily risen and have been at record levels. Total commercial catch in the decade of the 2000s was substantially higher than the 1950s or the 1960s. A more recent (2011) task force on the Lake Winnipeg fishery, established by the minister, reported that the lake's fisheries were in a generally healthy state. The task force reported that the main environmental stressors for the fishery were eutrophication, invasive species and climate change.

### **What We Heard: Fish Populations and Fisheries – Lake Winnipeg**

In several communities around Lake Winnipeg, we heard that fishers now need to travel farther to catch fish. The Keewatinook Fishers of Lake Winnipeg presented a map indicating current and former locations for summer and winter fishing, identified by their members. Several locations near Berens River and Grand Rapids were identified as former fishing locations.

We heard in several communities that former spawning locations had changed as a result of changes in currents or declines in water quality. Formerly productive areas, especially on the west side of the north basin, were said to no longer have fish. Whitefish were said to be particularly affected. We heard from Dauphin River fishers that whitefish were scarce in that area and were now found mostly in the south basin. We also heard, at Brokenhead Ojibway Nation in the south basin, that fewer fish were being caught in local nets.

Descriptions of a “silt blanket” in which fish could not be caught, or of rust-coloured

water that would not support fish, were also heard from a number of presenters, especially in north basin communities that were visited.

In several communities, presenters discussed fish being caught with abnormalities, sores, cysts or tumours. The Keewatinook Fishers of Lake Winnipeg presented a photo of one such fish and said that such fish have become more common on Lake Winnipeg in recent years.

Although the commission heard from many fishers who had concerns about fishing on the lake, it is worth noting that such concerns did not emerge everywhere on Lake Winnipeg. At our meeting in Gimli, despite the presence of a large fishing industry, the discussion was focused on erosion and high water levels, rather than fishing. At Pine Dock, the comments of the commercial fishers were largely focused on high water levels and their effects on docks and on lake currents.

### **Commission Comment: Fish Populations and Fisheries – Lake Winnipeg**

As with water quality, it is difficult to see a connection between LWR and reports of concerns about fish populations on Lake Winnipeg. Many of the presenters concerned about fish populations referred to sediment, algae blooms and the eutrophication of Lake Winnipeg. These concerns are more likely linked to the large inflows of nutrients resulting from land-use changes, high precipitation and population growth within the Lake Winnipeg watershed.

The commission understands that Lake Winnipeg continues to be a productive fishery and, in fact, total catch has been at or near record levels for many years. A long-term historical study of the Lake Winnipeg fishery

has indicated that fishing on the lake has long been cyclical, with several periods of high catches in the first half of the 20th century alternating with periods of much lower catches (Franzin, et. al. 2003).

One of the challenges in considering fish populations on Lake Winnipeg, relative to LWR, is that fisheries information is not adequate for assessing the biological productivity of the lake. Changes in catch may reflect changes in price and market for different species. Harvest numbers do not provide a snapshot of the overall health of all fish populations, including those not commercially harvested.

### **7.5.2 Fish Populations and Fisheries – Downstream**

#### **Manitoba Hydro's Information: Fish Populations and Fisheries – Downstream**

Manitoba Hydro cited a variety of studies in the Outlet Lakes, conducted since completion of LWR, that indicate healthy fish populations. From 2008-2009 to 2010-2011, Playgreen, Kiskittogisu and Kiskitto Lakes produced an average of more than 150,000 kg of quota species. The Study Board in 1975, had predicted a reduction in productivity in Playgreen Lake lasting for 50 years (referred to in Manitoba Hydro's LWR document as five years) as a result of sedimentation.

In Cross Lake, whitefish populations were negatively affected by the changes to the water regime caused by LWR. Declines in whitefish populations in Cross Lake have been attributed to drawdown of water levels that reduced habitat and the spawning success of fish and to at least one major winter fish kill resulting from a rapid drawdown. The location of the Jenpeg Control Structure, built on the site of a stretch of rapids (a common

location for a hydroelectric project), may have affected a former spawning location for sturgeon although the decline in sturgeon, was a result of overfishing that preceded development of LWR. Commercial fishing in Cross Lake was closed in 1983 and reopened in 1995. Since then, it has produced just over one quarter of the annual catch of quota species prior to LWR. Moreover, the composition of fish species in the lake has changed since LWR, with whitefish greatly reduced. Stocking of whitefish fry and eggs since 1992 has not resulted in a substantial improvement in the number of whitefish. Possible factors for the decline of whitefish and the failure of mitigation efforts to restore whitefish numbers include the effect of water levels and flows on spawning and spawning habitat, the placement of Jenpeg on a site that may have been spawning habitat, changes in predator-prey dynamics resulting from a larger proportion of pike and walleye in Cross Lake, and the recent presence of rainbow smelt consuming small fish such as young whitefish.

Walker Lake, located to the east of Cross Lake and affected by LWR when water levels are high on Cross Lake, has maintained a commercial fishery. Prior to 1992, the quota species on Walker Lake were whitefish and walleye, but since then, the quota species have been walleye and northern pike.

Problems related to low water levels in Cross Lake led to the building of the Cross Lake Weir, completed in 1991. The construction of LWR resulted in very unnatural monthly average water levels on Cross Lake, which likely had a very negative effect on the fishery. The construction of the weir resulted in more natural monthly water elevations. Post-weir monitoring, however, has indicated no sustained increase in catch per unit of effort (CPUE), a measurement of fisheries productivity.

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Sipiwesk Lake was affected both by LWR and the construction of the Kelsey Generating Station. Sipiwesk Lake appears to have initially suffered some decline in fish populations, followed more recently by an increase to levels at or higher than pre-LWR levels, as indicated by CPUE. Recent studies on Sipiwesk also indicate a decline in whitefish. Effects on fish populations on Sipiwesk Lake that may have been caused by LWR are difficult to distinguish from effects that may have been caused by the Kelsey Generating Station.

Monitoring of fish populations on Split Lake via CPUE indicates that fish numbers appear to have increased in the lake during the 1980s, followed by a decline in the 1990s. Recent studies on Split Lake, since the late 1990s, show a decline in the proportion of cisco and whitefish, and an increase in the proportion of walleye and northern pike. Split Lake is the only water body along the lower Nelson River that currently supports a commercial fishery. Overall, the lower Nelson River has the lowest CPUE of any of the currently monitored water bodies, although it is difficult to discern if these are effects from LWR and/or CRD. Studies show that CPUE on Split Lake increased substantially in the 1980s and has since declined, but is still higher than in the two years studied prior to LWR and CRD.

### **What We Heard: Fish Populations and Fisheries – Downstream**

Representatives of the Norway House Fishermen's Co-op, representing about 50 licensed commercial fishers at Norway House, plus helpers, said fishing has declined in recent years on Playgreen Lake. The Co-op has a total quota of 115,000 kg of fish from Playgreen Lake, but, in recent years, members have caught about 80,000 kg on Playgreen and have had to have some of their Playgreen quota transferred to Lake Winnipeg. The Co-

op also has a larger quota on Lake Winnipeg. Travelling the greater distance to fish on Lake Winnipeg has increased the cost of fishing for Co-op members, which one presenter reported as \$180 per day for a boat. Figures presented by the Co-op indicated peak fishing years between 2000 and 2006, with a drop occurring around 2007-2008.

One representative of the Co-op reported that an elder had told him the area around Two-Mile Channel was a particularly important fishing location prior to LWR. The area was said to have been a spawning site and to have had a combination of currents and a weedy area that made it ideal for fish. Because of sediment from Lake Winnipeg, the south end of Playgreen Lake was described as less productive than in the past.

We also heard that the composition of the fish community has changed along the Nelson River, with a growing number of northern pike and declining number of whitefish in many areas. As the price paid for northern pike is relatively low, this change in community composition is a concern for commercial fishers. As well, the decline in whitefish populations that has been part of this shift in the fish community has reduced access to an important food for domestic consumption in many communities.

*"I went and set a net in there last fall, just to see if the whitefish were still there. I got whitefish, not as many, I got more jackfish than normally, didn't get any carp, didn't get any perch ... no red suckers, no goldeye. And these were all the fish that were there when I was younger. So I noticed a difference."*

Members of the Manitoba Métis Federation spoke about the effect of LWR – and also the Kelsey Generating Station – on Sipiwesk Lake. We were told that a

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formerly productive area for whitefish near Duck Rapids became much less productive following LWR.

### **Commission Comment: Fish Populations and Fisheries – Downstream**

One of the challenges of understanding the effect of LWR on fish populations is that systematic monitoring of the effects has been lacking throughout much of the post-LWR period. A long-term co-ordinated monitoring program was recommended in 1975 by the Study Board, leading, in 1981, to a claim under the NFA that Manitoba Hydro had not carried out this recommendation. In response to this, the Manitoba Ecological Monitoring Program (1985-1989) and Federal Ecological Monitoring Program (1986-1992) were carried out. Eventually, in 2004, the environmental review process for the Wuskwatim Generating Station identified the need for a systematic monitoring program (Manitoba Clean Environment Commission 2004), leading to the establishment of the Coordinated Aquatic Monitoring Program (CAMP), in 2006.

The commission notes that life history data on fish, answering questions such as where they travel and where they spawn, were generally lacking prior to LWR. Therefore, a full understanding of the project's effects on fish populations is not possible. Knowledge of habitat use under current conditions would be useful in order to identify opportunities to improve conditions for the fishery and to evaluate the effect on the fishery of potential changes to the operating regime. Such knowledge could help to determine if changes to the operating regime could have some beneficial effect on the fishery.

The commission is not aware of any attempts to determine if the health of any

given year's production of whitefish is related to water levels or flows since an analysis was carried out in 1982 and 1984, before the construction of the Cross Lake Weir. Some annual reports since then suggest possible reasons why the whitefish population has not rebounded, but these are speculative. It should also be noted that sampling done more recently, under the CAMP, uses nets with different mesh sizes and different configurations of nets than previous sampling, making systematic comparisons and analysis difficult. The commission also has questions regarding the interpretations of such data as do exist. Manitoba Hydro states that "although overall whitefish numbers do not appear to be increasing, the numbers caught in the Middle Basin [of Cross Lake] have generally increased since 1995." However, the commission's review of annual reports indicated higher catches and CPUE in the years 1995-98, followed by a decline, with no whitefish caught in 2002 and 2007. As well, no whitefish were caught during the 2009 and 2010 CAMP gill net sampling. This uncertainty about whitefish populations points to a great need to determine what has caused this decline and to determine if changes to the water regime have affected habitat needed for the whitefish population in Cross Lake.

The impact of LWR on fish populations and fisheries is one of several areas in which an assessment of LWR would have benefitted from greater inclusion of Aboriginal Technical Knowledge (ATK). People who have fished these waters all their lives, and who learned to fish from parents, grandparents and elders who fished there before them, are likely to have an understanding of historical and current fish habitats, spawning, movements and populations. This knowledge could help to fill some of the knowledge gaps regarding the effects of LWR, as well as identify possible mitigation measures to address some of those effects.

## Aboriginal Traditional Knowledge

Aboriginal Traditional Knowledge (ATK) is knowledge that is held by and unique to Aboriginal people. It is a living body of knowledge that is cumulative, dynamic and adapted over time to reflect changes in the social, economic, environmental, spiritual and political spheres of Aboriginal knowledge holders.

## Recommendations

The Commission recommends that:

- 7.9 *Manitoba Hydro, in co-operation with resource users, seek out and collect ATK, local knowledge and documented information on pre-Lake Winnipeg Regulation distribution of fish species, their spawning areas and movement patterns in Cross Lake, the Outlet Lakes, Sipiwesk Lake and in the adjacent connected lakes.*
- 7.10 *Manitoba Hydro, in co-operation with resource users, evaluate the current status of the identified sites, determine their capabilities to support fish populations and identify and implement alternative methods to rehabilitate or replace these sites.*

## 7.6 Wetlands

Changes to the water regime on Lake Winnipeg and downstream can affect wetlands, which are important for nesting, spawning, feeding and other habitat needs of many animals, as well as playing an important role in influencing water quality. There are three main kinds of wetlands in the project area: marshes, bogs and fens. Marshes have standing or slowly moving water seasonally or for long periods, are rich in nutrients, and are characterized by reeds, rushes and sedges. Fens and bogs are both low in nutrients and have a high water table. Bogs are dominated by sphagnum mosses, low shrubs and often black spruce. Fens are dominated by black spruce, tamarack, sedges, grasses and mosses and have very slow internal drainage, rather than draining directly into a water body. Because of the importance of wetlands to many species of fish and wildlife that are harvested for food or furs, impacts on wetlands can affect the ability of people to take part in traditional resource-use activities, such as trapping, fishing, hunting and collecting traditional medicines. Issues regarding wetlands on Lake Winnipeg include the declining health of the Netley-Libau Marsh. In downstream communities, flooding of wetlands and the seasonal reversal of the water regime are major issues.

### 7.6.1 Wetlands – Lake Winnipeg

#### Manitoba Hydro's Information: Wetlands – Lake Winnipeg

Wetlands were not specifically addressed by Manitoba Hydro, except for a discussion of the Netley-Libau Marsh at the south end of Lake Winnipeg. Manitoba Hydro attributes the decline of the marsh largely to the Netley Cut, an excavation made in the bank of the Red River in 1913 to help drain the marsh, which had the opposite effect by allowing

Figure 7.7 Netley-Libau Marsh. (Manitoba Hydro)



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Red River water to enter the marsh. Manitoba Hydro notes that high water levels on Lake Winnipeg can cause high water in the Netley-Libau Marsh, which in turn can kill the marsh vegetation. Even with normal water levels, strong winds from the north can inundate the marsh in this manner.

The Netley-Libau Marsh is a large complex of wetland, channels and shallow lakes at the south end of Lake Winnipeg near the mouth of the Red River. The marsh is one of the largest in Canada and contains important habitat for fish and waterfowl, as well as serving to filter water entering into Lake Winnipeg. However, the Netley-Libau Marsh has been losing marsh habitat for many years and is becoming less environmentally productive. LWR has been examined as one of the potential factors causing this decline.

Manitoba Hydro provided some history on the Netley Cut, which was carried out to allow high water on the marsh to drain into the river so that farmers could cut wild hay. Prior to the Netley Cut, most water from the Red River flowed directly into Lake Winnipeg, except in times of extreme flooding. Over the years, through erosion, the Netley Cut has increased from about 40 feet (12 metres) in width to more than 1,400 feet (425 metres), and an ever-increasing share of Red River water has flowed directly into the marsh. A marsh requires periodic low-water periods when seeds of plants such as cattails and bulrushes can germinate on exposed mudflats. With much of the Red River flowing into Netley-Libau Marsh, these low-water periods seldom occur. As a result, a large part of what was once a marsh is now the large, shallow Netley Lake.

Manitoba Hydro examined several other, more recent, factors that have contributed to the loss of marsh vegetation. Dredging of the Red River, which had been carried out by the federal government to aid navigation, was

discontinued in 1999, which allowed siltation to restrict flow through the main channels of the river. As a result, even more water is thought to have gone through the Netley Cut into the marsh. More recently, the Manitoba government's flood-fighting efforts have involved cutting ice on the Red River late each winter to prevent ice jams and improve water flow to Lake Winnipeg. However, it is possible that this may lead to ice jams near where the Red River flows into Lake Winnipeg, which again could result in more water going through the Netley Cut.

The introduction of the common carp into the Lake Winnipeg watershed has also had an impact on the marsh. Carp feeding behaviour dislodges vegetation in the marsh, which results in greater turbidity, resulting in further loss of vegetation.

Manitoba Hydro noted that the Study Board predicted that higher water levels on Lake Winnipeg and the elimination of extreme highs and lows would have a negative effect on the Netley-Libau Marsh. Hydro notes that this prediction was based on the assumption that LWR would raise the lake's average level by 0.7 feet (20 cm), while instead it has raised the lake's average by 0.2 feet (6 cm). Manitoba Hydro notes as well that research has shown that the decline of the marsh was already occurring before LWR. Mapping of the marsh has shown that, since the 1920s, it has been losing islands, upland habitats and emergent vegetation, such as cattails and rushes. The decline of marsh vegetation is often attributed to season-long periods of high water that inundate the marsh enough to cause plants to die. Manitoba Hydro states that even when the level of Lake Winnipeg is not high enough to cause water to back up into the marsh, the effect of strong north winds is enough to cause an increase of more than one metre in the water level, pushing water into the marsh.

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Manitoba Hydro is a member of the Netley-Libau Marsh Working Group, which is supporting research into the health of the marsh.

## What We Heard: Wetlands – Lake Winnipeg

Presenters in several communities around Lake Winnipeg noted that consistent high water levels have flooded many of the lake's coastal marshes. In Selkirk, the commission heard from several presenters who were concerned about the health of the Netley-Libau Marsh, including people who formerly hunted or fished in the marsh. Pruden Bay was also mentioned as a location that used to be a productive marsh, with a hunting lodge, but is now a lake. At Grand Marais, the commission heard that Beaconia Marsh has also declined in health in recent years.

Several presenters said Manitoba Hydro should control lake levels to provide periodic low-water years, which would help to regenerate vegetation in Netley-Libau Marsh.

Declining health of marshes has an impact on several activities of importance in Aboriginal communities. Presenters at several First Nations spoke about the flooding of wetlands where medicinal plants had previously been picked. Loss of wetlands caused by high water therefore limits access to traditional medicines. In several communities along Lake Winnipeg, the commission heard of a decline in the population of muskrats, which was frequently linked to a decline in the health of wetlands. In First Nations, including Brokenhead Ojibway Nation, Sagkeeng First Nation and Peguis First Nation, muskrats were mentioned as formerly being of particular importance, both for income and for food. Hollow Water First Nation's written and video presentations referred to effects on muskrat populations

and on medicinal plants as a result of high water in wetlands. Presenters in several communities said not only are fewer muskrats caught today, but signs of muskrat activity, such as push-ups (holes in the ice where winter feeding takes place and vegetation accumulates) are much less common today. The commission heard from individuals who in the past hunted waterfowl in Netley-Libau March, before the current flooding of large portions of the marsh made it much less productive for waterfowl. At Grand Marais, we heard of a marsh that now "stinks" and no longer supports bird populations.

*"Netley Marsh, as it is now, is hardly there anymore. The centre channel is probably four times as wide as it once was. The west channel and the Salamonia channel are basically non-existent..."*

## Commission Comment: Wetlands – Lake Winnipeg

The commission is concerned about the state of Lake Winnipeg's wetlands and the level of study they have received. The commission heard, from the wetland expert it commissioned, that much more needs to be known about Manitoba's wetlands. The commission would agree, especially given the area that wetlands cover adjacent to the lake and our very limited knowledge about them. A comprehensive inventory of Lake Winnipeg wetlands and a calculation of their ecological and economic value to the province are necessary. Many methods to conduct such evaluations have been developed for the Laurentian Great Lakes that could be applied to Lake Winnipeg.

As with many of the other challenges facing Lake Winnipeg, the impacts observed in the surrounding wetlands are likely the result of very high flows into the watershed as well as from development and land-use practices.

Modeling of Lake Winnipeg's water levels suggests that even without LWR, levels below 711.0 feet asl might only have been reached once in the last 40 years. LWR likely, therefore, played only a very small role in the decline of some marshes, such as Netley-Libau, by preventing the very low water levels that are caused by extended dry periods. In the case of Netley-Libau, the consensus of experts appears to be that the Netley Cut began the deterioration of the marsh long before LWR was put into operation. Deliberately creating low water levels to stimulate regrowth of marsh vegetation would be impossible during a time of high inflows such as over the last decade. To intentionally lower Lake Winnipeg during a time of low inflows would create great impacts on the power generation system that could put Manitobans at risk, personally and economically.

The commission understands that Lake Winnipeg's wetlands are of vital importance to breeding, migrating or staging waterfowl, aquatic furbearers, fish and other wetland-dependent species. Populations of both waterfowl and aquatic furbearers are closely linked to wetlands, particularly marshes, so declining health of wetlands, such as Netley-Libau Marsh, has affected trapping and hunting opportunities for people who previously used Lake Winnipeg's marshes. Because of their importance to the environment and the local culture and economy, steps need to be taken to permanently protect wetlands, whether they are held by the Crown, the local government or private land owners.

## Recommendations

The Commission recommends that:

- 7.11 *The Government of Manitoba, in co-operation with other parties, conduct a comprehensive wetland inventory around Lake Winnipeg.*
- 7.12 *The Government of Manitoba take steps to permanently protect marshes and wetlands around Lake Winnipeg.*

### 7.6.2 Wetlands – Downstream

#### Manitoba Hydro's Information: Wetlands – Downstream

In Manitoba Hydro's compilation of information prepared for the LWR hearings, downstream wetlands were not a separate category for the consideration of environmental effects. They were discussed in the context of waterfowl and aquatic furbearers. Manitoba Hydro noted that flooding of the Jenpeg forebay resulted in the loss of some marsh habitat. A 1990 study concluded that high water levels in the fall and reduced water levels in the spring had a negative effect on productive marsh habitat on Duck Lake, with some converted to mud flats.

Manitoba Hydro presented no new research on aquatic furbearers, but acknowledged that the Study Board predicted that changes to water levels related to LWR would have a negative impact on the population of aquatic furbearers (especially muskrat and beaver) in both the Outlet Lakes area and downstream of Jenpeg. Manitoba Hydro noted that in both Norway House Cree Nation and Pimicikamak Okimawin, community members reported furbearers being killed by fluctuating water levels, such as when rising water levels in winter flood them in their dens. Manitoba Hydro stated that the Cross Lake Weir likely improved

conditions for aquatic furbearers on Cross Lake, but had no studies to verify that hypothesis. On Sipiwesk Lake, furbearer populations were previously affected by the construction of the Kelsey Generating Station, making it difficult to isolate the effects of LWR from those of Kelsey. Manitoba Hydro acknowledges that fluctuations in water levels have negatively affected aquatic furbearers in Split Lake and further downriver.

Habitat changes caused by LWR appear to have reduced duck populations in the Outlet Lakes. Studies conducted in 1986-1987 showed a substantial decline in the density of diving ducks in the area. Later studies showed that the population of ducks on Playgreen Lake remained substantially below the pre-LWR level, but the population on Kiskitto and Kiskittogisu Lakes had increased substantially. Another study indicated that the area around Warren Landing had been particularly negatively affected following LWR. Research was conducted to test the hypothesis that increased water levels resulting from LWR had affected waterfowl populations by reducing the number of benthic invertebrates (organisms that live on the bottom of lakes or rivers, which are an important food source for some waterfowl), but no definitive reason for the decline in numbers could be demonstrated.

On Cross Lake, changes in flows and flow patterns may have reduced the amount or suitability of habitat for geese and diving ducks. On Duck Lake, high water levels in the fall and reduced water levels in the spring have had a severe impact on a previously productive marsh habitat. Impacts of LWR on Sipiwesk Lake are difficult to determine because of the combination of effects from Kelsey Generating Station.

Manitoba Hydro stated that impacts on waterfowl on Split Lake and further down the river are difficult to separate from those of

CRD, but notes that erosion and fluctuating shorelines are thought to have damaged waterfowl habitat.

Overall, Manitoba Hydro stated that natural variability in waterfowl populations and alterations in flyways make quantifying local impacts difficult.

## **What We Heard: Downstream Wetlands – Downstream**

The commission heard from an expert retained by Pimicikamak Okimawin of the loss of species and habitat diversity resulting from changes to shorelines downstream of Jenpeg. It was stated that up to 90 per cent of the living things found in lakes are in the shallow water at the edge and in the periodically flooded land along the shore. These riparian zones and wetlands have the greatest biodiversity. However, Pimicikamak's representatives stated, there is no long-term study of riparian and wetland zones along the Nelson River. Natural shorelines in this area would have a variety of vegetation zones, from submerged aquatic plants in the shallow areas closest to shore, to emergent wetland vegetation (sedges and rushes) on shore closest to the water's edge, to herbaceous plants and small shrubs further from the shore and then larger deciduous shrubs (such as willows) farther still from shore. This range of vegetation zones was described as typical of a sheltered reach of a boreal river. The commission was shown photos of shoreline marshes in the Cross Lake area that have been flooded throughout the summer and of shoreline debris that prevents the growth of other vegetation. The commission also saw photos of a controlled embayment created near Cross Lake in an attempt to re-establish a cattail marsh.

Resource users at Norway House Cree Nation and Norway House community

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spoke about the effect of high water levels on Playgreen Lake on wetlands and wildlife. Trappers said formerly productive marsh and shoreline areas no longer produce muskrats and other aquatic furbearers and report that they seldom see signs of muskrats, such as push-ups.

Resource users at Pimicikamak Okimawin spoke extensively about the effects of LWR on wetland wildlife. Muskrat and beaver populations declined significantly in the affected areas because of flooding. In some cases, beavers or muskrats are drowned within their winter lodges downstream of Jenpeg by a winter release of water. The commission was shown photographs of furbearers killed by winter flooding and of beaver lodges left high and dry as a result of low water levels. One trapper said that muskrats are seldom seen in areas near Cross Lake that formerly produced 700 to 800 muskrats per year. A presenter for Pimicikamak noted that in the 1980s, the Cross Lake Environmental Impact Assessment report called for the creation of muskrat marshes. It was also stated that the most productive muskrat marshes require about two feet (0.6 metres) of annual water level fluctuation, as well as lower levels about once every five years to allow for germination of cattails and rushes on an exposed seedbed.

Sipiwesk Lake was described as a formerly productive water body where the populations of beaver and muskrat were affected both by fluctuations caused by LWR and flooding caused by the Kelsey Generating Station. One resource user said muskrat were plentiful on Sipiwesk Lake in the 1980s, but have since declined in number. An expert witness retained by Pimicikamak Okimawin said the health of muskrat populations is symptomatic of the health of riparian (shoreline) ecosystems along the Nelson River. Nelson River riparian ecosystems downstream of Jenpeg have become less diverse and

productive as a result of the seasonally altered and extreme variation in water levels.

We also heard at York Factory First Nation that muskrats and beaver have become less common along the Aiken River and elsewhere in the Split Lake area.

*“Our trappers will tell you how the changes in water levels have changed the abundance of furbearers. You now rarely see muskrat and beaver...where they used to be common.”*

Resource users at both Pimicikamak Okimawin and Norway House Cree Nation spoke of a decline in the numbers of waterfowl and specifically referred to a decline in the population of coots, which are small, dark-coloured water birds also known as mud hens. Pimicikamak presented several photos of flooded waterfowl nests, which were described as a common sight on Cross and Pipestone Lakes. Pimicikamak residents have noted a decline in population of geese, scaup, grebes, scoters, mallards, black ducks, buffleheads and goldeneye, as well as declines in the populations of invertebrates and aquatic plants that waterfowl eat.

### **Commission Comment: Wetlands – Downstream**

The commission notes that wetlands were not an environmental component considered separately by Manitoba Hydro and considers that the impact of the project on wetlands would have been worthy of much more consideration. Wetlands should be considered as the backbone of a healthy ecosystem that can support aquatic furbearers, waterfowl and water birds and all of the other life forms that depend on them. Ecosystems such as wetlands should be understood as a source of important ecosystem services – a term that refers to the benefits provided by an

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ecosystem, including, in the case of wetlands, removing toxins and nutrients from the water, stabilizing shorelines, and providing habitat for culturally and economically important fish, mammals and birds.

During the recent hearings on the Keeyask Generating Station on the lower Nelson River, Manitoba Hydro's assessment of that project noted that Nelson River wetlands were "already highly disrupted by water level regulation" including CRD and LWR, due to fluctuation in water level, ice scouring, erosion and the seasonal reversal of flows. The EIS for Keeyask characterized Nelson River wetlands in that area as "low quality, disturbed, non-native wetland types." It seems likely, therefore, that the same characterization would apply to wetlands in the areas immediately downstream of Jenpeg as well, which are affected by all of those same factors.

Although Manitoba Hydro examined both waterfowl and aquatic furbearers in its preparation for the LWR hearings, those examinations were missing important information. Given that LWR was predicted to negatively affect downstream waterfowl populations, Manitoba Hydro failed, in the years after the project was developed, to collect sufficient data to determine the project's impact. The material compiled by Manitoba Hydro for the hearings acknowledged that, between 1972 and 1992, only 13 days of aerial surveys of waterfowl were carried out, despite the fact that both Environment Canada and the Department of Fisheries and Oceans had recommended surveys of ducks and geese in the study area to be of sufficient intensity and duration to enable assessment of waterfowl trends. Furthermore, Manitoba Hydro assumes that the Cross Lake Weir has had a positive effect on waterfowl, despite having conducted no waterfowl monitoring on Cross Lake since the construction of the weir in 1991. Another statement by Manitoba Hydro

– that broader regional habitat alterations and flyway pattern changes may have been a factor in changes in the abundance of waterfowl along the Nelson River – was also made without supporting evidence.

The commission is also concerned by a gap in knowledge regarding the effects of the project – and especially the effects of the Cross Lake Weir – on aquatic furbearers. Manitoba Hydro states that the Cross Lake Weir, by preventing the occasional extreme low water levels that were experienced in the 1980s, has probably helped to mitigate effects of the project on the habitat of aquatic furbearers. However, no focused monitoring has been conducted to determine the impact of the weir on these populations and no repopulation of muskrats has been observed in this area. From an analysis of the hydrographic data presented in the Manitoba Hydro document on LWR, it appears that the Cross Lake Weir has reduced the amount that water levels on Cross Lake decrease in late fall or early winter, which may be a benefit for muskrats. However, the average amount that water levels increase later in winter after freeze-up has not changed with construction of the weir, and it is this mid-winter increase in water levels that can cause drowning of muskrats. As for beaver populations, it appears that no beaver house surveys have been conducted since 1986 along the upper Nelson River to monitor long-term trends. As well, no telemetry studies involving captured and marked furbearers appear to have been carried out along the Nelson River. Aerial surveys have been conducted more recently along the lower Nelson River as part of the environmental assessment of the Keeyask Generation Project. Aerial surveys for muskrat push-ups were also conducted along the lower Nelson for the Keeyask Project.

Additional monitoring is needed to better understand the effect of LWR on wetlands,

waterfowl and aquatic furbearers. This should include mapping of historical habitat using ATK and air photos, as well as assessing current availability of habitat, to assess changes in the abundance of habitat. ATK, air photos and satellite images would also help in determining the current functional quality of wetland habitat. Once habitat is mapped, it would be possible to identify areas that can be rehabilitated or re-established. Re-establishing muskrat or beaver populations could require identifying areas where control structures could be put in place to manage water levels. Telemetry studies of aquatic furbearers have not been carried out to assess the impact of LWR or the Cross Lake Weir, but they would be useful to determine the success or failure of any efforts to restore furbearer populations.

The commission understands that aerial photos and other information exist for the LWR area, which could allow for an assessment of the amount of affected wetland. A better understanding of the loss of wetlands could lead to proposals for establishment or restoration of them. Monitoring of wetlands, and selected species that depend upon them, should become part of the regular monitoring cycle under CAMP.

Assessment of the impact of the project on wetlands could lead to a better understanding of the environmental needs of wetlands and the species that depend on them (such as amount and timing of water flow). Incorporation of these environmental needs into operational models for Jenpeg could allow for mitigation or reduction of LWR's effects. These models could be used to explore possibilities for mitigation of impacts on wetlands and the species that depend upon them without seriously impacting power generation. The development of such models is described in Section 10.2, Operating Rules and Models.

## Recommendations

The Commission recommends that:

- 7.13 *Manitoba Hydro, in co-operation with resource users, evaluate the success and/or failure of the Cross Lake Weir in improving water levels and re-establishment of ecological components, particularly whitefish and aquatic furbearers, and reducing impacts on travel.*
- 7.14 *Manitoba Hydro, working with resource users, determine the pre-Lake Winnipeg Regulation distribution of wetlands, using aerial photos, satellite images and other methods to reconstruct their distribution and compare this to the current distribution.*
- 7.15 *Manitoba Hydro seek out possible areas for wetland enhancement, rehabilitation and re-establishment to support ecosystem services and populations of aquatic furbearers, waterfowl and waterbirds.*
- 7.16 *Manitoba Hydro include wetland and wetland species monitoring in the CAMP program.*

## 7.7 Ungulates (Moose and Caribou)

Loss of habitat and increased access resulting from LWR had some affect on local populations of ungulates – moose and boreal woodland caribou – in the downstream area, though this was not a topic of major concern raised in the hearings.

## 7.7.1 Ungulates

### Manitoba Hydro's Information: Ungulates

Flooding in the Jenpeg forebay was predicted by the Study Board to lead to the loss of 20 to 48 moose from the total population, through the loss of nearly 100 square km of moose habitat. No current estimates are presented for local populations. Downstream of Jenpeg, the effects of LWR are combined with the effects of the Kelsey Generating Station, and these were predicted by the Study Board to affect 140 square kilometres of moose habitat, with most of that impact from Kelsey. The region had relatively low population densities of moose both before and after LWR (ex: 5 to 10 animals per 100 square km). Manitoba Hydro concludes that increased road access since the creation of LWR is likely to have played a larger role in observations of a decline in numbers of ungulates, by allowing for increased hunting pressure in some portions of the region. The corporation cites a 1985 Manitoba Department of Natural Resources study that found good quality moose habitat that was underutilized by moose. This was interpreted as a sign that hunting is affecting populations rather than loss of habitat. For the area further downriver, at Split Lake and beyond to Gull Rapids, effects on ungulate populations have been caused by some localized loss of shoreline habitat. However, ungulate populations and distribution are related to forest age and forest fire history, which has a greater effect on available habitat. However, Manitoba Hydro states that the moose population in the Split Lake Resource Management Area is thought to have remained stable since 1994.

Regarding caribou populations, changes in the water regime, shoreline hanging ice (ice that freezes at a higher level before the water

level drops later in winter) and shoreline debris may have made it more difficult for caribou to use islands in the Nelson River and lakes for calving or as a refuge from wolves. The project area borders on two identified boreal woodland caribou ranges: the Norway House range to the east of the Nelson River west channel and the Wabowden range to the west of the west channel. The Wabowden herd is the only one intersected by the LWR area. The Norway House range is considered by the Manitoba Boreal Woodland Caribou Management Committee to have an “acceptable” population of more than 100 and a low level of human-caused disturbance. The Wabowden range is considered to have a high level of human-caused disturbance (including Highway 6 and Bipoles 1 and 2) and a high priority conservation status although its population is also identified as “acceptable.”

### Commission Comment: Ungulates

The commission agrees that LWR has likely had only a small direct impact on ungulate populations, primarily through the loss of a small amount of habitat in the Jenpeg forebay. Increased human populations in the neighbouring communities, increased road access since the creation of LWR and an aging forest have likely had a greater impact.



# **Chapter Eight**

## **Socio-economic Effects**

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### **8.1 Overview**

Flooding, shoreline erosion and changes to the water regime have had an impact on many aspects of social, community and economic life around Lake Winnipeg and along the Nelson River. Manitoba Hydro did not conduct a detailed assessment of socio-economic effects of LWR as part of its application for a final licence. Many socio-economic effects in the downstream area are addressed in some way through mitigation or compensation programs – in most cases, they were agreed to under the NFA or the various implementation agreements.

### **8.2 Culture, Way of Life and Heritage Resources**

This category of effects includes impacts on tangible cultural and heritage resources, such as buildings or places of cultural and spiritual significance, and impacts on less tangible aspects of culture, such as way of life, customs, practices and traditions. Many cultural concerns about the impact of LWR are related to changes affecting resource use, such as fishing, hunting, trapping and gathering, that may have resulted from changes to the water regime or shoreline erosion. Since resource use is such an important part of Aboriginal societies, impacts on it have wide-ranging effects on culture and way of life. Other cultural and

way-of-life impacts include loss of recreation opportunities or places for community or family gatherings caused by changes to water quality or shorelines. In some places, erosion and flooding have caused a direct loss of heritage resources.

#### **8.2.1 Culture, Way of Life and Heritage Resources – Lake Winnipeg**

##### **Manitoba Hydro's Information: Culture, Way of Life and Heritage Resources – Lake Winnipeg**

As Manitoba Hydro concludes that LWR has not had an impact on Lake Winnipeg, it did not describe cultural or heritage impacts on lakeside communities.

##### **What We Heard: Culture, Way of Life and Heritage Resources – Lake Winnipeg**

In several First Nations communities around Lake Winnipeg, the cultural effect of lost resource-harvesting and recreation opportunities was discussed.

In Black River First Nation, presenters showed a documentary film about traditional skills such as snowshoe-making, which was shot in the community decades ago. This was an illustration of a way of life that has largely

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been lost over time. In Brokenhead Ojibway Nation, presenters spoke of the decline of fishing and trapping as activities passed on from generation to generation. Changes in the organization and structure of commercial fishing have also had an impact on the culture and way of life of many communities. Hollow Water First Nation's written submission discussed the social, spiritual and cultural importance of the harvest of wild rice, which was said to be affected by flooding on Lake Winnipeg and on neighbouring rivers and lakes. The commission heard from several presenters who described how families or communities would spend the summer together at fishing camps that no longer exist. In their presentation to the commission, the Keewatinook Fishers of Lake Winnipeg called for language renewal, to be funded by Manitoba Hydro, for Aboriginal fishers on the lake.

Many presenters spoke of the great importance of Lake Winnipeg in the culture, history and spiritual beliefs of Aboriginal peoples. It was explained on several occasions that, in First Nations cultures, women are considered the carriers or protectors of water. This is related to the fact that women carry water within them to give birth to children. As a result, the declining condition of Lake Winnipeg is felt especially powerfully by women.

Many presenters spoke about the loss of recreational opportunities resulting from the disappearance of beaches along Lake Winnipeg. The loss of beaches has taken away places for family and community gatherings in many areas on both basins of the lake. The loss of beach recreation was an important point both in Aboriginal communities and in Gimli, Selkirk and Grand Marais. At hearings in First Nations around the lake, concerns about skin rashes were said to have led parents to direct their children away from

swimming in the lake.

At Sagkeeng First Nation, we heard that high lake levels have exposed burial sites along the shore of Lake Winnipeg.

### **Commission Comment: Culture, Way of Life and Heritage Resources – Lake Winnipeg**

Lake Winnipeg is without a doubt of great importance to the culture, way of life and heritage of all Manitobans. Changes to the resource economy of the lake have an impact on the way of life of lakeside communities. Changes to the lake's recreational character – such as the loss of beaches – have an impact on the way of life of tens of thousands of Manitobans for whom a summer or a day at the lake is an important part of life. While it appears likely that high precipitation in recent decades has been the major cause of high water levels, which, along with high winds, have been the reason for high erosion rates along the lake, additional research on lake erosion is required. Such research could help to determine places most at risk from erosion and inform policy regarding development near the lake. It could also lead to recognition of locations where measures may be taken, such as artificial nourishment of beaches, to maintain recreational areas.

The commission acknowledges there have been great changes to the way of life and impacts on culture in communities around Lake Winnipeg, but there is no evidence that this is directly related to LWR.

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## 8.2.2 Culture, Way of Life and Heritage Resources – Downstream

### Manitoba Hydro's Information: Culture, Way of Life and Heritage Resources – Downstream

Manitoba Hydro acknowledged that LWR has affected culture, way of life and heritage resources in the downstream area, both by physical impacts on tangible heritage and cultural resources and by changes to the way of life caused by flooding, erosion and other impacts.

Regarding tangible heritage and cultural resources, LWR and other hydroelectric developments have flooded or caused erosion at archaeological, cultural and burial sites along affected waterways. Attempts to mitigate these impacts include work at the Hunting River Burial Site, in collaboration with the Province of Manitoba, Cross Lake First Nation (now Pimicikamak) and Pikwitonei Community Council; the Sipiweesk Lake Archaeological Program, funded by Manitoba Hydro and carried out by the Heritage Resources Branch; a 10-year System-Wide Archaeological Program, encompassing not just the Nelson, but the Winnipeg and other rivers; shoreline protection measures at a number of at-risk sites along LWR waterways; and erosion-protection measures near the Anglican Church, cemetery and a cultural site in Tataskweyak Cree Nation.

Some areas of significant cultural and heritage resources at risk of erosion along the Nelson River have been protected with the construction of gabion baskets – wire baskets filled with rock – to prevent erosion caused by high water levels.

Intangible cultural impacts include effects on resource use, travel and recreation. To the extent that LWR prevents people from engaging in these traditional pursuits –

through its effects on travel or through its effects on populations of fish and wildlife species – it has a cultural impact. Some of these impacts are discussed in Section 8.3, Resource Use and Section 8.4, Navigation, Transportation and Public Safety. Provisions in the NFA and settlement agreements are intended to address these impacts.

### What We Heard: Culture, Way of Life and Heritage Resources – Downstream

Many presenters of Aboriginal background spoke eloquently on the importance of the land and how their lives are intertwined with it. The land, the trees, the waterways, the animals, the fish – all are connected in a long history of living in harmony with the environment. For them, these forests and waterways are not just a place to live, but part of who they are as people and as communities. They expressed their desire to live in harmony with the land and uphold a duty to protect it.

Presenters talked about growing up on traplines and in fishing camps and learning history, traditions and spiritual ways from their grandmothers and grandfathers. This was an important way of passing on their language and culture to the next generation.

*“I wanted to answer your question about what fishing does to a family. First of all, it brings them together, it brings them growth, and everybody there has a role, a responsibility. And it builds character in the kids, it builds a family unit, it builds love. All of that stuff, hunting, fishing, gathering of herbs, medicines, all of that stuff families do together. And if one fishing family can act – if the whole world can act – like a family that has gone fishing together, our world is a lot better place.”*

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They spoke of learning to navigate on water and ice and knowing every turn based on the trees, rocks and shorelines. Now all that has changed, they said. Banks have eroded along the shores, trees have fallen into the water, and the fish and other animals that once sustained them are no longer in abundance. Not only is much of that lost, but they also described how their joy in travelling the waterways had turned to fear – fear of hitting a log or a “spider” floating in the water (discussed in Section 8.4, Navigation, Transportation and Public Safety). They had stories of people being injured or having boats and motors damaged by these collisions, and said the dangers were too common to ignore. They talked about their reluctance to bring their children onto the water as a result of debris, changing and unpredictable water levels, and damaged shorelines that make access difficult. In winter, hanging ice makes travel more difficult and dangerous and slush ice makes traditional routes to traplines or hunting places very uncertain. What used to be a positive experience is now fraught with unpredictable conditions that are often dangerous.

At Norway House Cree Nation, we heard about the loss of gathering places for families and communities caused by erosion within Playgreen Lake. In some of these lost places, including islands and beaches, extended families would spend the summer together fishing. Others were described as places for recreation and visiting.

*“We have also lost many beaches, landing sites, camp sites that allowed us to come together as families. These places were key to our community recreation and health.”*

We heard that changes to the environment mean that fewer people, and fewer in the younger generation, take up traditional activities such as trapping, hunting and

fishing. One presenter noted that, in the past, these activities were possible within a few minutes of the community. Now, because they require a long boat or snowmobile trip, both the time and the travel cost are barriers for many in the community.

At Pimicikamak Okimawin, presenters referred to the experience of the community as a trauma that has affected generations. The loss of connection to the land and opportunities to engage in traditional activities has led to depression, substance abuse and suicide, some presenters said.

Presenters at a number of northern communities, including Pimicikamak and Norway House, referred to compensation programs that paid resource users (trappers or fishers) for the loss of resources. Compensation, even if it made up the economic losses, does not replace the loss of way of life and self-worth that comes from carrying out traditional work in nature.

Impacts on recreation have also affected the way of life of communities. Several presenters said a swimming pool is now needed in their community because of the state of the water. At Pimicikamak and Norway House we heard that fluctuating winter water levels make it difficult to impossible to create and maintain a skating surface on the lake in winter.

### **Commission Comment: Culture, Way of Life and Heritage Resources – Downstream**

In our visits to communities along the Nelson River, the commission heard many heartfelt discussions of the loss of culture. We heard of efforts in many communities to pass on cultural teachings to young generations by, for example, taking students camping, fishing, hunting or trapping. And although many students are introduced to these experiences

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through such programs, we heard as well that comparatively few young people take up these traditional pursuits. The result is not just a loss of that traditional activity, but of the storytelling, cultural teaching and language learning that are traditionally carried on through these activities.

The commission notes that the NFA contained a provision to create alternative opportunities for recreation in the affected communities. Cross Lake, Norway House and Tataskweyak Cree Nation have recreation centres that include skating rinks and community halls, built as a result of the NFA. Such institutional gathering places may become an important part of community life, but they do reflect a change from traditional, spontaneous forms of recreation.

Cultural impacts are inherently difficult to quantify and difficult to mitigate. It is difficult to measure the magnitude of the loss when a community loses the ability to practice an important tradition. Can a compensation payment truly make up for the loss? At the same time, it is inherently difficult to trace a direct cause-and-effect line between cultural changes and any specific cause. In other words, LWR likely caused some of the loss of cultural traditions and way of life that were discussed in communities we visited, but did it have a larger or smaller impact than the arrival of television and the internet, other modern conveniences, or the creation of an all-weather road? At the time of the Study Board report in the 1970s, it was noted that northern communities were undergoing a steady transition from traditional or hunter-gatherer societies to wage economies. Hydro development, the Study Board predicted, would lead to an accelerated rate of change exceeding the capacity of the community to adjust. Much of what we heard in the downstream communities focused on the cultural consequences of such rapid

adjustment. Arising out of the NFA were a large number of measures intended to address some of the impacts of this rapid change, including programs to encourage fishing and trapping or to reduce the effects of the project on access to fishing and trapping areas. It was clear to the commission from the words of many presenters that impacts on culture and way of life have been profound and are still being felt.

Actions the commission is recommending to address erosion and restoration of aquatic and wetland habitats in the area affected by LWR, may make available some additional opportunities to practise cultural traditions.

## 8.3 Resource Use

Effects on resource use – a category that includes commercial and domestic harvest activities such as fishing, hunting, trapping and gathering – are typically easier to confirm and measure than effects on culture or way of life. Effects on resource use may have been caused by direct loss of fish and mammals or changes to aquatic or terrestrial habitat. These kinds of impacts were discussed previously in Section 7.5, Fish Populations and Fisheries and Section 7.6, Wetlands. Other project effects on resource use may be a result of changes to waterways, shorelines or ice surfaces that make it more difficult to access harvest areas and damage equipment.

### 8.3.1 Resource Use – Lake Winnipeg

#### Manitoba Hydro's Information: Resource Use – Lake Winnipeg

Manitoba Hydro discussed three key environmental issues of concern regarding Lake Winnipeg, one of which is the Lake Winnipeg fishery. As discussed in Section 7.5, Fish Populations and Fisheries, Manitoba

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Hydro stated that there is no evidence to suggest LWR has had an impact on the fishery.

## **What We Heard: Resource Use – Lake Winnipeg**

In communities around the lake, the commission heard that fishing has been difficult at least since the beginning of this current period of extreme high precipitation years. Fishers in the north basin spoke of a “silt blanket” emanating from the Dauphin River since the construction of the emergency drain from Lake Manitoba. They said fish cannot be caught within the area of the silt blanket. They also said that nets are consistently being fouled by algae or destroyed by large floating debris. Members of the Keewatinook Fishers of Lake Winnipeg said that since the implementation of LWR, fishers go through 30-40 nets per season, whereas fishers would lose about 15 nets per season before LWR. We heard that nets cost \$120-\$150 each, so this adds up to a significant expense. The Keewatinook Fishers also showed photos of fishing camps on Long Point that have been damaged or destroyed by erosion. We also saw photos of erosion impacts on fishing at Misipawistik Cree Nation. Impacts on fishing nets were cited by fishers at many other First Nations.

We heard of currents that have changed and fish no longer being found in the former locations. In some cases, fish that were once found in the north basin are now in the south, we were told. At Pine Dock, we heard that the strength of the current flowing north in Lake Winnipeg can prevent fish from coming south through the narrows. Because of fish movements, fishers in several locations said they need to travel farther, spending more money on fuel as a result.

At Peguis, Brokenhead, Sagkeeng and

Black River, and in the Hollow Water First Nation written submission, we heard of effects on trapping, with once-plentiful marshes no longer producing muskrat. The loss of muskrat results in both a loss of a traditional income stream but also the loss of a traditional food source.

## **Commission Comment: Resource Use – Lake Winnipeg**

The commission was concerned by references made by resource users in a number of communities to unusual currents in Lake Winnipeg and growing amounts of debris and silt affecting fishing. It seems most likely that these are related to the high levels of precipitation in recent years, which have caused lake levels to rise and increased erosion. The concern that larger amounts of sediment have entered the lake as a result of the Assiniboine River water diverted into Lake Winnipeg, via Lake Manitoba and Lake St. Martin, needs to be further explored. Additional research on flows of water within Lake Winnipeg would also be helpful to better understand if the existence of two outlets (Two-Mile Channel and Warren Landing) has affected local currents.

The commission agrees that LWR has not affected fish populations in Lake Winnipeg. Muskrat populations may have been affected by the loss of coastal wetlands, but there is no evidence that this is directly related to LWR.

### **8.3.2 Resource Use – Downstream**

#### **Manitoba Hydro's Information: Resource Use – Downstream**

Manitoba Hydro describes a number of programs negotiated as part of the NFA or the implementation agreements that relate to impacts of the project on resource use. Many of the programs are for compensation for

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effects on fishing, which are highly varied in the downstream areas.

One program that is ongoing is the domestic fishing program at Pimicikamak, which pays fishers to fish on Cross Lake or some off-system lakes and bring the fish back to the community, where it is made available to community members. This program also includes a hot lunch program for the schools and a gardening program.

Concerns about the impact of hydroelectric projects on sturgeon have resulted in a variety of initiatives, including the Lake Sturgeon Stewardship and Enhancement Program (which rears and stocks sturgeon and conducts research and public education programs), the Nelson River Sturgeon Board (a stakeholders' group that focuses on protecting and enhancing sturgeon stocks between Cross Lake and Kelsey Generating Station), and Kischi Sipi Namao (a stakeholders' group focusing on sturgeon in the lower Nelson, Hayes, Gods and Echoing Rivers). These are all focused on developing and implementing measures to protect and enhance sturgeon populations, which were reduced primarily through over-exploitation in the first half of the 20th century.

Manitoba Hydro acknowledged that in communities affected by LWR there is a perception that the project has affected the taste or texture of fish. In response, Manitoba Hydro engaged the assistance of Fisheries and Oceans Canada and the University of Manitoba to conduct several taste tests. In one study, all fish passed all the taste tests. In the other study, participants from lower Nelson River communities expressed a slight (described as not statistically significant) preference for fish caught from water bodies not affected by hydroelectric development. However, Manitoba Hydro notes that in at least one of the communities, participants believed the study was flawed because there

were no fish caught when the water was warmer, which participants believed would cause a greater difference in the taste of the fish.

Regarding trapping, Manitoba Hydro acknowledges that the project has impacted the population of furbearers through direct mortality (as a result of fluctuating water levels) and habitat loss and has affected the ability of trappers to access traplines by making travel more difficult. The NFA contains several provisions to relocate or compensate trappers affected by the project. It also includes support for improvements to portages and access routes for trappers. One specific claim by Pimicikamak led to specific trapping programs in the Cross Lake Registered Trapline Area, including a subsidy program, a loan program, trapline improvement, habitat enhancement, trapping training and annual review and consultation.

Other provisions in the NFA, addressing loss of resource use opportunities, included an article giving First Nations priority for resource harvesting in the areas they most commonly used. These are identified as Resource Management Areas. Resource Management Boards were established under the implementation agreements to consider broader resource management issues in each First Nation's Resource Management Area.

## **What We Heard: Resource Use – Downstream**

**Members of the Norway House Commercial Fishermen's Co-op** told us that they are now unable to obtain their quota of fish from Playgreen Lake and must fish increasingly in the north basin of Lake Winnipeg, increasing their fuel expenses. Like fishers on Lake Winnipeg, Norway House fishers said they have more nets destroyed by debris now than in the past. We also heard

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of the cost and labour involved in building a dock. One fisher said the summer season typically begins with repairing the dock, and if it needs to be rebuilt it can require a week's worth of time and can cost anywhere from \$1,000 to \$5,000. As a result, when high water levels make a dock unusable, it creates a substantial cost, in time and money, for the owner.

At Pimicikamak, we heard that few members of the community engage in commercial fishing now. We also heard from resource users who fish, trap or hunt in locations very far from Cross Lake, which makes it more of a challenge to take part in these activities.

*“Used to be in the fall, we would catch the whitefish coming in, we would catch them in our rivers. We would – our elders, our people, our fishermen would be smoking whitefish, and they would be hanging them up for the winter. Those days are gone. They are not there anymore the way they used to be.”*

At Norway House and Pimicikamak, we heard of some of the difficulties faced by trappers as a result of changes to winter ice conditions. Fluctuating water levels in winter can freeze traps in place. Hanging ice creates a barrier preventing shoreline access for trappers in winter. These problems, which result in loss of equipment or difficult access, are in addition to the many reports of reduced numbers of aquatic furbearers, discussed in Section 7.6, Wetlands.

*“Growing up, too, I trapped muskrats in the bay with my brother. My grandfather taught us how to trap muskrats. And there was always push-ups, all the way along that bay, and we would have plenty of traps on this side of RCMP Point. We always, as young kids, we made a bit of*

*a living with muskrats. We did okay. We got to save some money. Nowadays, I’m lucky if I see one push-up in that bay.”*

Members of the Manitoba Métis Federation told us that the creation of resource management areas, as a result of the NFA and implementation agreements, cut them off from lakes where they previously fished. We also heard from another member who said the decline of the whitefish fishery on Sipiwek Lake forced him to travel farther to catch fish.

### **Commission Comment: Resource Use – Downstream**

Changes to the water regime, including the seasonal reversal of flows, winter-time fluctuations, flooding and dewatering (especially during the periods of low water on Cross Lake before construction of the Weir) have had a variety of impacts on resource use in the downstream area. These impacts on resource use – particularly trapping of muskrat and beaver – were anticipated in the Study Board report in 1975. It is therefore surprising that, in some cases, there was little follow-up monitoring of impacts and of the major mitigation measure intended to address these impacts – the Cross Lake Weir. Impacts on fisheries were predicted by the Study Board to be minor, though it was anticipated that the project could be harmful to whitefish by reducing the success of spawning. Both the experience of community members and the results of fisheries monitoring indicate that the project has been especially harmful to whitefish populations. It is, therefore, also surprising that no detailed research has been conducted to assess the impact of the Cross Lake Weir on whitefish or to identify the possibility of modifications in operations that could reduce the effect on whitefish. The commission notes that the effect on whitefish has an impact on domestic

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consumption, because these fish were in the past a particularly important part of the diet of many Aboriginal people.

The commission is aware that many initiatives have arisen from the NFA and implementation agreement processes to address impacts on resource use. However, it seems the focus of efforts has been on compensation for negative effects, rather than on mitigation, such as restoration of wetlands that could support furbearer populations or spawning habitat for fish.

Actions the commission is recommending to address erosion and restoration of aquatic and wetland habitats in the area affected by LWR may mitigate some of the past impacts and provide for some expanded opportunity for resource harvesting.

## 8.4 Navigation, Transportation and Public Safety

Flooding, erosion and changes to the water regime have had an impact on water and ice travel in the downstream area and, to a lesser extent, on Lake Winnipeg. Shoreline erosion causes debris to enter the water, which creates a hazard for navigation. Debris on the shore – including large, tangled masses of dead trees – can also make access to the water or ice more difficult. Changes to the water regime in the downstream area have a variety of impacts on ice travel, resulting in unpredictable or uneven ice surfaces, water flowing on top of the ice and other challenges. Rapid currents and high water on the Nelson River affect both boat travel and the ability to construct winter ice roads.

**Figure 8.1: Shoreline debris at Sipiwek Lake. (Darrell Settee)**



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### **8.4.1 Navigation, Transportation and Public Safety – Lake Winnipeg**

#### **Manitoba Hydro's Information: Navigation, Transportation and Public Safety – Lake Winnipeg**

Concerns about navigation, transportation and public safety on Lake Winnipeg relevant to LWR, primarily focus on debris entering the lake as a result of erosion. Manitoba Hydro has concluded, based on a variety of studies, including those of the Lake Winnipeg Shoreline Erosion Advisory Group and the corporation's own analysis, that LWR has not increased shoreline erosion on the lake. Manitoba Hydro cited data to show that LWR has reduced the level of flooding that would have been experienced on the lake as a result of high inflows.

#### **What We Heard: Navigation, Transportation and Public Safety – Lake Winnipeg**

The commission heard a variety of concerns about debris entering Lake Winnipeg as a result of erosion. While this was often discussed in relation to fishing, with references to nets destroyed by debris, there were comments about the safety concerns regarding floating debris in the water. In several lakeside communities, we also heard of docks being flooded by high lake levels. This was a major concern in Pine Dock and Matheson Island, for example, where several fishers said they could not gain access to their docks. It was also discussed by presenters in Selkirk and Grand Marais and in the Hollow Water First Nation written submission.

We also heard discussion of the last low-water year on Lake Winnipeg. The Keewatinook Fishers of Lake Winnipeg showed photos of a fishing boat that had been damaged when it ran aground in low water.

Several other boats were damaged during the low-water period in 2003.

#### **Commission Comment: Navigation, Transportation and Public Safety – Lake Winnipeg**

As with the sections on water regime and erosion, the commission believes that the challenges to navigation, transportation and safety on Lake Winnipeg are primarily a result of high precipitation in recent years, which has caused the level of Lake Winnipeg to rise. As in some earlier sections, the commission believes that the very real challenges of flooded docks and dangerous floating debris provide another incentive for watershed management actions, such as wetland protection and upstream water storage that could hold back flood waters from Lake Winnipeg. Concerns about debris entering as a result of the emergency drain from Lake Manitoba are worthy of follow-up and any work on a permanent drain from Lake St. Martin to Lake Winnipeg will require study to ensure that it does not cause more debris to be introduced in the lake.

### **8.4.2 Navigation, Transportation and Public Safety – Downstream**

#### **Manitoba Hydro's Information: Navigation, Transportation and Public Safety – Downstream**

Manitoba Hydro acknowledges that changes to water flows have had a direct impact on navigation, transportation and public safety in downstream communities. These impacts have occurred both in the open water season, as a result of floating debris, and during the winter, as a result of slush ice and hanging ice caused by changes in flow under the ice. These impacts can also affect travel by damaging equipment, such as boats, motors and snowmobiles. In addition to

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making travel more difficult or dangerous on the ice or water, the project has made it more difficult to get access to the ice or water as a result of shoreline erosion and accumulations of dead trees along stretches of shoreline. These accumulations of debris have blocked access to some portages, gathering areas and shorelines.

A number of programs, negotiated through the NFA and the various implementation agreements, are intended to address these challenges. The Waterways Management Program is intended to support safe travel through three main activities: the Boat Patrol Program, the Debris Management Program and the Safe Ice Travel Program.

The Boat Patrol Program is a seasonal program (usually June to October) in which two-person crews gather floating debris, place hazard markers, record and map travel routes, identify safe travel routes for resource users and provide emergency assistance to waterway users. Workers in the program are hired from downstream Aboriginal communities as seasonal Manitoba Hydro employees or contract workers. In 2012, 35 Manitoba Hydro employees and five contract workers made up 19 boat patrols.

The Debris Management Program, established in 1998, formalized Manitoba Hydro's response to concerns about debris. Under the program, priorities are established for clearing debris along shorelines and work areas are established. Seasonal workers in the program gather shoreline debris in piles above the high-water line. Floating debris gathered by boat patrol workers is also added to these piles. Debris piles, built up in the summer, are typically burned in the fall, after the first snow, to minimize the risk of forest fire.

The Safe Ice Travel Program is developed by Manitoba Hydro in conjunction with

northern communities to reduce the danger of ice travel on affected waterways. Seasonal contract employees, typically Aboriginal resource users, are hired to prepare the safe ice routes. These trails are mapped, tested for ice thickness, cleared of obstructions and routinely monitored (generally twice a week) and patrolled. Safe cabins that can be used in emergencies have been built into the ice travel system. Ice routes may vary from year to year because of water levels, weather and the quality of ice.

In addition to the three components of the Waterways Management Program, Manitoba Hydro has a Water Level Forecast Notice Program intended to ensure that people living near affected waterways are informed about water level and flow conditions. As a result of the NFA, Manitoba Hydro has been providing the five NFA First Nations with water level forecasts since the 1970s. Notices are made in Cree and English and are sent to a growing number of recipients. Notices are posted more frequently during times of rapidly changing conditions. Since the 1990s, they have also been posted on Manitoba Hydro's website.

Debris, slush ice and other effects of the project have also caused damage to a number of boats, motors and snowmobiles in the downstream area. Under the NFA, members of the five signatory First Nations are eligible to make claims for loss. In the case of a claim, the agreement put the onus on Manitoba Hydro to prove it did not cause the damage. With the exception of Pimicikamak Okimawin, the other NFA First Nations have signed implementation agreements that result in the claims process being managed by the First Nation and funded by Manitoba Hydro. At Pimicikamak, claimants work directly with Manitoba Hydro. The principle of compensating for property loss, with the onus on Manitoba Hydro to prove that it did not cause the loss, is also included in other

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settlement agreements with communities and resource user groups in the downstream area.

## **What We Heard: Navigation, Transportation and Public Safety – Downstream**

The commission heard many detailed descriptions and first-hand experiences of the effects LWR has had on navigation, transportation and public safety. We heard stories of dangerous encounters with floating debris and of winter journeys rendered extremely difficult and sometimes dangerous, as a result of the condition known as slush ice. We were shown photos and videos that illustrated the magnitude of the challenge posed by debris along shorelines where erosion is causing thousands of trees to fall into the water only to wash up on shore downstream. During an autumn visit to the Jenpeg Control Structure, we saw crews from the Debris Management Program working to clear debris along one stretch of the Jenpeg forebay shoreline.

As described in Section 7.3.2, Shoreline Erosion – Downstream, the Norway House Fishermen's Co-op spoke of the effects of shoreline erosion on Playgreen Lake, noting in particular, the impacts dead trees floating in the river have on travel.

The commission heard of drownings that Pimicikamak residents believe were connected to changes in water regime caused by LWR and of dangerous encounters with floating debris. Collisions with debris have damaged equipment and have led to fear of travelling on the water, cutting off some community members from traditional activities.

*"I go hunting up in the Nelson River and it is crazy. If you don't hit a log, you are going to hit willows. If you don't hit willows, you hit something else."*

Regarding ice travel, we heard of several different kinds of problems. One set of problems is created when the ice forms in early winter at a high level, but then the water underneath the ice drops as water is released at Jenpeg to generate electricity. This can lead to air pockets underneath the ice. We heard from one resource user at Norway House who lost a snowmobile and nearly lost his life when his snowmobile crashed through one of these air pockets. A related problem is hanging ice. When the water level under the ice drops over the winter, for the most part, the level of the ice drops with it. But at the shore, there will still be a shelf of ice at the higher, early-winter level. This hanging ice acts as a barrier to prevent access to the shoreline and can be hazardous to travel on, as it can collapse.

Another major challenge in winter travel is caused by slush ice, which forms when water is released in winter and is able to get above the level of the ice. Areas affected by slush ice may look like any other snow-covered lake or river, but will have a layer of wet slush hidden below the surface snow. Snowmobiles travelling over slush ice may get bogged down in this slush.

The commission heard several personal experiences of slush ice and saw several photographs of snowmobiles stuck in slush. At Pimicikamak, we heard stories of individuals whose expected hour or two-hour snowmobile trips turned into day-long struggles with slush and even unexpected nights in emergency cabins. The combination of a long day on the trail and the wet slush brought on a danger of hypothermia in some of these cases. The commission also heard of snowmobile drivers striking ice ridges, damaging their machines and suffering injuries.

While a program exists to compensate people for damage to equipment (including

snowmobiles and outboard engines) resulting from LWR, even when property owners are compensated, they still have the inconvenience of being unable to travel until repairs can be carried out. One presenter from the Manitoba Métis Federation said he damaged a motor by striking floating debris while fishing on the Nelson River but his repairs weren't covered.

At York Factory First Nation, we heard that high water levels and strong flows are affecting the community's winter ice road. The road is becoming harder to maintain and a new location may be needed in the future because of the faster currents on the northeast end of Split Lake. Because of the greater costs to maintain the road, the First Nation is concerned that it may not be able to keep the

## Slush Ice, Hanging Ice, and the November Cutback

Slush ice is a natural phenomenon that occurs any time currents create cracks in the ice that allow water to rise to the surface. However, it becomes a much more intense and widespread problem when winter releases of water at Jenpeg flood the ice. The commission understands that one of the causes of slush ice is the operation known as the November cutback, when flows of water through Jenpeg are reduced for a time just before freeze-up. The purpose of the November cutback is to slow the flow of water through the Jenpeg forebay, which then allows ice to form a more even, smooth surface. A smooth ice surface then allows water to flow more freely under the ice in winter.

Upstream of Jenpeg, the November cutback causes ice to form at a higher level than it will be at later in the winter. Downstream of Jenpeg, the November cutback causes ice to form at a lower level than will be experienced later in the winter. During the winter, when there is greater demand for electricity and more water is released through Jenpeg, areas downstream of the control structure will experience slush ice as this additional water is released onto an already-existing ice surface. Upstream of Jenpeg, however, hanging ice and air pockets are more likely a concern as the water level decreases below the already-existing ice surface.

After the 1985 November cutback, in which a nearly two-foot drop in the Cross Lake water level over two weeks was followed by a three-foot rise by the end of December, the 1986 Cross Lake Environmental Impact Study recommended discontinuing the practice. While Manitoba Hydro continues to carry out a November cutback, typically the drop in Cross Lake levels is not more than one foot, followed by a two-foot rise during winter. It is this rise in Cross Lake levels after the November cutback period that causes slush ice.

The installation of an ice boom, just upstream from the Jenpeg Control Structure, in 2010, was intended to help create an even, smooth ice surface in the forebay. In response to questions in the hearings, Manitoba Hydro said the ice boom has allowed for the November cutback to be less abrupt, which should reduce some of the problems of slush and hanging ice. The commission heard that Manitoba Hydro employs an ice specialist during this period to monitor ice formation through daily flights in order to advise on Jenpeg operations at this time of year.

contract to build and maintain it, thus losing a contract that creates some employment for its members. York Factory First Nation's ferry service has also been affected by fluctuating water levels in the open water season. During a low-water year, the ferry was unable to reach the community's ferry landing. More recently, during a high-water year, the ferry landing was under water. Presenters also said that many islands in Split Lake have eroded away as LWR and CRD have raised water levels. In many cases, what were once islands are now reefs and pose a hazard to navigation.

### **Commission Comment: Navigation, Transportation and Public Safety – Downstream**

Through changes to the water regime, LWR has made it more difficult for residents of downstream communities to travel to their traditional resource use areas to follow their culture and way of life through living on the land. That this was identified as a concern early in the history of LWR is made clear by the presence in the NFA of Article 5 dealing with navigation, and specifically mentioning debris.

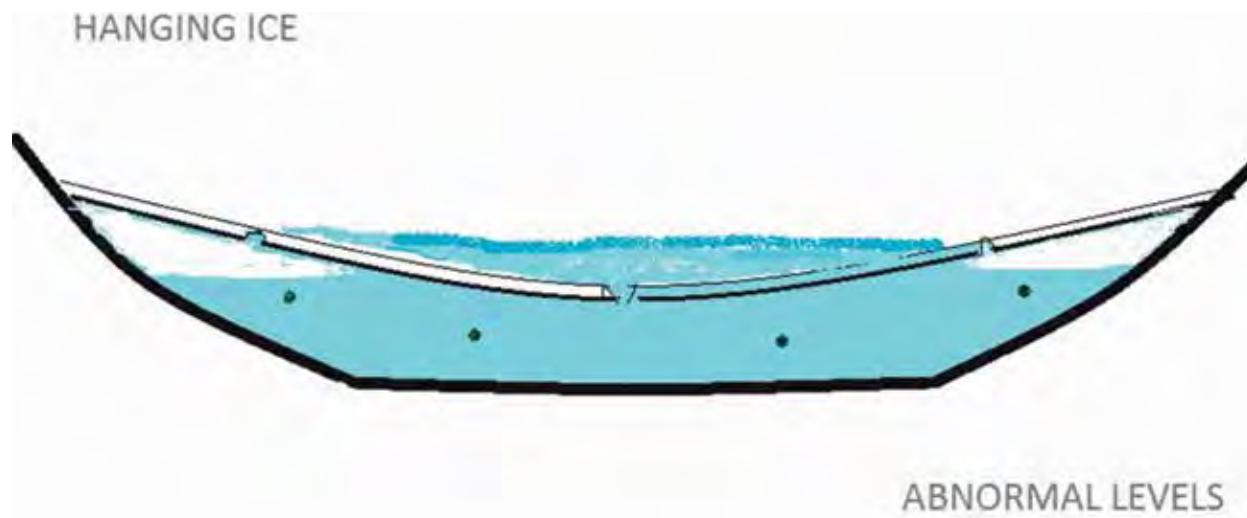
It appears that a substantial, ongoing commitment of resources is made through the Waterways Management Program, including boat patrols, debris management and safe ice travel. It is clear, however, that these will remain challenges for as long as LWR exists.

In the development of models for the operation of LWR, discussed in Section 10.2, Operating Rules and Models, one goal should be to determine if there are ways to operate Jenpeg that will reduce ecological and socio-economic effects, such as slush ice, without significantly impacting electrical generation. Additional measures to control erosion may also help to reduce some transportation concerns caused by floating debris. It is likely that the current high water level, resulting from a sustained wet period across much of the Lake Winnipeg watershed, has caused additional challenges both for reducing slush ice and debris.

## **8.5 Health Issues and Concerns**

Health concerns surrounding LWR include the effects of changes to diet and

**Figure 8.2: Hanging ice. (Pimicikamak)**



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lifestyle that may be connected to flooding, erosion and changes in the water regime, and the effect of increased nutrients or suspended solids in the water. One concern specifically focused on the downstream area is the potential for flooding caused by hydroelectric developments to lead to an increase in methyl mercury in fish.

### **8.5.1 Health Issues and Concerns – Lake Winnipeg**

#### **Manitoba Hydro's Information: Health Issues and Concerns – Lake Winnipeg**

As with several other subjects, Manitoba Hydro did not discuss this category of socio-economic impacts in relation to Lake Winnipeg communities, because Manitoba Hydro maintains that LWR has not caused flooding or increased erosion on the lake.

#### **What We Heard: Health Issues and Concerns – Lake Winnipeg**

At several First Nations around Lake Winnipeg, we heard of health concerns related to lifestyle changes, including the switch from country food to store-bought food. Diabetes rates were discussed, as were the health effects of no longer working outside at traditional physical activities such as fishing, hunting and trapping. At Peguis First Nation, we heard of health concerns related to mould in flooded houses. Hollow Water First Nation raised a similar concern in its written submission.

In many communities, people spoke about the decline in water quality on Lake Winnipeg. Many presenters said that in the past, especially while fishing, it was common to drink water directly from Lake Winnipeg. This was particularly the case for presenters from north basin communities such as Berens River First Nation and Misipawistik Cree Nation. At Berens River, we heard that silt

and debris had an effect on the community's water treatment plant, and when water levels are high on Lake Winnipeg, lake water backs up into the river where the treatment plant's intake is located. At Misipawistik, we heard a number of concerns about the Grand Rapids Generating Station, including community concerns about contamination from oils and fluids originating in the generating station. We also heard of anxiety in the community over fears of a dam breach.

#### **Commission Comment: Health Issues and Concerns – Lake Winnipeg**

The commission recognizes that many of the communities around the lake have serious health-related issues, but believes that there is little evidence to link these to LWR. In many cases, these are systemic problems that must be addressed by the federal and provincial governments in co-operation with the First Nations.

### **8.5.2 Health Issues and Concerns – Downstream**

#### **Manitoba Hydro's Information: Health Issues and Concerns – Downstream**

Manitoba Hydro acknowledges concerns from the downstream communities, especially those on Cross Lake, of increased turbidity and algae. Research in Cross Lake, before and after LWR, indicated no increase in total suspended solids and in several other measured water quality parameters, including coliform bacteria. Parameters that changed were increases in total organic and inorganic carbon and chloride and decreases in colour and nitrogen.

Concerns about potential effects of the project on drinking water led to Article 6 of the NFA, which states that potable (ex:

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drinking/cooking) water in the affected First Nations is the responsibility of the Government of Canada, but that Manitoba Hydro will reimburse the government for 50 per cent of any increased cost resulting from the project. This was related to the concern that the project would result in an increase in suspended solids in the water that would make water treatment more expensive.

Another potential effect on health identified during the development of the project was an increase in mercury levels in fish consumed by local residents. Mercury is naturally present in the environment as a result of its presence in the underlying geology, and mercury levels in aquatic life vary depending on the concentration of this naturally occurring mercury. Hydroelectric development can result in elevated mercury levels when additional land and vegetation is flooded. When vegetation from flooded land breaks down in the water, bacteria absorb the naturally occurring mercury and convert it to methyl mercury, which is a form of mercury that is readily absorbed in the flesh of the organisms that consume the bacteria. It then becomes concentrated higher up the food chain so that those organisms at the top of the food chain, such as walleye and pike, have the highest concentrations of methyl mercury in their flesh. Elevated mercury levels in fish can pose a health hazard to humans, based on the level of methyl mercury in the fish, the amount of fish consumed, and the sensitivity of the person consuming the fish (ex: restrictions on consumption of fish are more stringent for children and pregnant women).

Because LWR flooded a relatively small amount of land in the Jenpeg forebay (in comparison with CRD or the Kelsey and Kettle Generating Stations), it would be expected to result in a smaller increase in mercury levels in fish than would other hydro developments. Testing of fish in the Outlet Lakes, since LWR came into operation, does

not indicate any increase in mercury after the project was completed. In Cross Lake, small increases in mercury in walleye and pike were detected in the years after LWR was completed, though in both cases average concentrations remained below the limit for commercial sale. Mercury concentrations have since declined. In both Cross Lake and the Outlet Lakes, mercury content in walleye and pike is lower than it is on Setting Lake, which is not connected to any hydro developments. This is an indication of the natural variability related to the mercury that is naturally present in the underlying geology of a water body. The fishery on Sipiesk Lake was closed from 1970 to 1977, and again in 1979 and 1985, as a result of elevated mercury levels, but it is believed that this was a result of the flooding caused by the Kelsey Generating Station. Current mercury levels in fish in the area are similar to pre-LWR levels.

In response to a claim under the NFA, testing of hair and umbilical-cord blood samples from residents of Cross Lake and Norway House was conducted from 1977 to 1990. It indicated the two communities had the lowest mercury levels of the six northern communities sampled (the other communities were South Indian Lake, Split Lake, Nelson House and York Landing). From 1977 to 1985, 92 per cent of the samples indicated mercury levels in the acceptable range (20 parts per billion) and no samples in the “at risk” range (100 parts per billion or higher). Testing in 1989 and 1990 indicated 98 per cent of samples in the acceptable range and again none in the “at risk” range.

Average mercury levels in walleye and pike in Split Lake currently are well below the standard for commercial sale, while those in whitefish are substantially lower. The Split Lake fishery was closed for five years prior to the completion of LWR (from 1971 to 1976) due to high mercury levels. Levels in pike and walleye remained high through the 1980s and

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began to decline late in that decade.

Manitoba Hydro acknowledges that the mercury program itself caused anxiety in the downstream communities. As there was no Cree word for “mercury,” some of the information provided by government sources shortly after construction of LWR used the Cree word for “poison.” Anxiety surrounding the use of this wording could cause some residents of the area to stop eating fish.

### **What We Heard: Health Issues and Concerns – Downstream**

As in Lake Winnipeg communities, the commission heard many concerns about water quality. A representative of the Cross Lake Community Council said the community’s drinking water treatment plant costs more to operate than it should, and attributed that to sediment in the water.

Many presenters spoke about the health impact of lifestyle changes. The commission was told about high rates of diabetes in the communities and heard from one presenter who said that many of the older people in his family have had amputations as a result of the disease. Growth in diabetes was attributed to a number of factors, including people not wanting to eat fish from the Nelson River anymore, the great distance involved in getting to resource harvesting areas, and the change away from an active lifestyle of fishing, hunting, trapping and gathering. Changes in taste and texture of fish were reported by presenters at Norway House Cree Nation, Pimicikamak and York Factory First Nation. The commission heard that many people prefer to eat fish that were caught at off-system lakes. The change away from a traditional, active, self-sufficient lifestyle was also said to be a factor in mental health problems, including suicide and addictions, in

the community.

*“They cannot do what their parents could do, and what their parents did was live off the land. The land was their economic base. The land was their hospital. The land was their psychiatric help. The land was everything to them. But you take away a part of that land, you take away from their spirit. You take away from their pride, their self-esteem.”*

In several downstream communities, including Pimicikamak and York Factory First Nation, presenters expressed concern about flooding of harvesting areas for traditional Aboriginal medicines.

Several presenters in Pimicikamak said their community needs to have a hospital, not just a nursing station, because of its population and the number of health issues faced by residents.

### **Commission Comment: Health Issues and Concerns – Downstream**

The commission acknowledges that there are many health concerns faced by the downstream communities. Many of these, such as high rates of diabetes, are shared by Aboriginal communities across Canada where modern conveniences, fast food, high prices for fruits and vegetables and reduced dependence on country foods have made more people susceptible to illness.

To the extent that LWR may have reduced the availability of country foods – such as its effects on the populations of whitefish – it is a contributing factor. To the extent that perceptions of contamination related to LWR, such as fears of mercury, discourage people from consuming country foods, that also contributes to health effects in downstream communities. As well, to the extent that LWR

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has encouraged people to stop pursuing traditional active lifestyles (by creating challenges for people travelling on the ice or water), it may also have contributed to some health effects.

Although the commission heard members of downstream communities express concerns that changes to water quality in the Nelson River have affected health, it is unclear what impact LWR has had on this. Two studies cited by Manitoba Hydro compared water quality data near Norway House before and after construction of LWR and found no change to turbidity or total suspended solids. Increases were recorded in total phosphorous near Norway House, but this would likely be a result of the increase in phosphorous entering Lake Winnipeg during this period. The same water quality studies at Cross Lake also indicated no change for total suspended solids, though one indicated a possible short-term increase in turbidity. Several other studies have stated that LWR caused an increase in turbidity on Cross Lake. Overall, it is not clear what the effect has been because of the relatively small amount of pre-LWR data.

The commission understands that the issue of mercury and hydroelectric development is primarily a concern in areas where there has been a large amount of flooded land, relative to the overall size of the reservoir. Further, the commission understands that elevated mercury levels in a body of water are a temporary phenomenon. Following impoundment of a reservoir, mercury levels in fish increase initially and gradually decline to natural levels after approximately 20-30 years. Accordingly, then, the flooding of the Jenpeg forebay might have caused a small increase in mercury levels in fish in the 1970s, but this effect would have decreased some time ago. The more significant effect of mercury, as a result of LWR, is likely that the awareness of mercury

created uneasiness about the safety of eating fish and may have led to dietary changes in communities along the Nelson River, with individuals switching from consumption of fish to less healthy processed foods.

The commission saw signs in several communities of determined efforts to improve health, especially for the next generation. We heard from teachers in outdoor education programs who take young people out to learn to fish, hunt and trap. We saw the ropes course built in Norway House Cree Nation to encourage healthy, active living. We heard from presenters in Pimicikamak who coach youth hockey teams. The commission is recommending actions to address erosion, fish habitat and restoration of wetlands that could support efforts by communities to encourage traditional activities and food consumption.

## **8.6 Employment, Training and Business Opportunities**

Flooding, erosion and changes to the water regime can affect resource use and tourism industries on Lake Winnipeg or in the downstream area and, as a result, may reduce employment, training and business opportunities. Conversely, construction, operation, monitoring and mitigation of a hydroelectric project can create both temporary and continuing employment, training and business opportunities. Making sure that their residents have an opportunity to benefit through employment and training from hydroelectric development is an important concern for many communities.

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### **8.6.1 Employment, Training and Business Opportunities – Lake Winnipeg**

#### **Manitoba Hydro's Information: Employment, Training and Business Opportunities – Lake Winnipeg**

As with many of the other categories of potential impacts of the project, Manitoba Hydro did not discuss impacts on employment, training and business opportunities on Lake Winnipeg. Manitoba Hydro presented employment figures for the corporation as a whole and for two current construction projects that illustrated its efforts to recruit Aboriginal employees, including members of First Nations in the Lake Winnipeg area.

#### **What We Heard: Employment, Training and Business Opportunities – Lake Winnipeg**

The commission heard many presentations that underlined how important Lake Winnipeg is to the economy of Manitoba. We heard presentations from numerous fishers, including members and representatives of the Keewatinook Fishers of Lake Winnipeg. In communities, such as Misipawistik Cree Nation and Berens River First Nation, commercial fishing is the most important industry. One presenter at Misipawistik said that without commercial fishing there would be no employment in the community. A presenter in Berens River expressed concern for the future of the industry, stating that it will be difficult to find a young person to buy the fishing quota and take over the operation. The employment impact of commercial fishing is much greater than just the number of licensed fishers, as there are also many helpers in the industry. Presenters in several communities described increased expenses related to commercial

fishing, as described in Section 8.3, Resource Use. Hollow Water First Nation's submission stated that in the past wild rice harvesting was the largest income source for many people in the community. Buyers would come to the community from the United States and the community had a large processing plant for the crop. However, high water and turbidity are harmful to wild rice and the community has lost a great deal of revenue as a result.

We also heard presenters discuss the employment and business impact of high water on other industries, such as agriculture. Presenters from Peguis First Nation and from the Interlake Reserves Tribal Council said agriculture once played an important role in their communities. The representative from the Tribal Council said his home community once had 40 farmers, raising wheat and cattle, but has only two today because of high water. At Peguis, there are only a few farm families left because of overland flooding.

Economic impacts on the tourism industry were discussed in many communities. As described in Section 7.2, Water Regime, and Section 7.3, Shoreline Erosion, cottage developments and property values in many south basin communities have been affected by high water and erosion. Several presenters mentioned former hunting or fishing lodges that no longer function. A former lodge at Brokenhead Ojibway Nation no longer exists. Netley-Libau Marsh was once a world-renowned destination for waterfowl hunters.

#### **Commission Comment: Employment, Training and Business Opportunities – Lake Winnipeg**

The commission understands that some businesses on and around Lake Winnipeg have been affected by high water levels, erosion and debris. However, we found no

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evidence to link this to LWR, given that high water in recent decades has been a result of high precipitation in the Lake Winnipeg watershed.

### **8.6.2 Employment, Training and Business Opportunities – Downstream**

#### **Manitoba Hydro's Information: Employment, Training and Business Opportunities – Downstream**

Employment on LWR peaked during construction in 1974 when the project employed 1,385 people, including 360 northern residents. Since then, LWR has produced employment in the operation of the Jenpeg Control Structure, temporary work on mitigation projects such as the building of the Cross Lake Weir, and seasonal work, such as the jobs in the Waterways Management Program (boat patrol, debris management, safe ice travel). The corporation has policies to enhance Aboriginal representation in its workforce, including the Manitoba Hydro Pre-Placement Training Initiative, which provides training to help Aboriginal candidates enter into the corporation's electrical, mechanical, station operator and power line training programs.

Manitoba Hydro presented figures on Aboriginal employment in the corporation as a whole, in northern Manitoba, and on the construction of its Bipole III Transmission Project and Keeyask Generation Project. In the corporation as a whole, 17 per cent of employees self-identify as Aboriginal (1,120 out of 6,247), which Manitoba Hydro representatives said is a higher proportion than the total proportion of Aboriginal people in Manitoba's population. As well, more than 25 per cent of the approximately 250 summer students hired each year are Aboriginal. In

northern Manitoba, the corporation has slightly exceeded its target of 45 per cent for the proportion of employees who identify as Aboriginal. On the Bipole III project, 1,170 out of 2,270 hires as of March 15, 2015, were Aboriginal, while on the Keeyask project 2,183 out of 3,897 hires were Aboriginal. One hire is not the same as one employee. One individual hired for one period of temporary work, and again for a second period of temporary work, would count as two hires. Of all the First Nations in Manitoba, Pimicikamak has the largest number of members with "active employment status" with Manitoba Hydro as of April, 2015.

#### **What We Heard: Employment, Training and Business Opportunities – Downstream**

Several presenters referred to high unemployment in the downstream communities as a sign that aspects of the NFA have not been fulfilled. The agreement calls for employment "to the maximum possible extent" of residents in "all works and operations related to the project" and creates an Employment Task Force to maximize opportunities at each of the signatory communities. One presenter at Pimicikamak advocated for more focus on environmental study and monitoring in the community's schools, leading to more employment of community members in environmental mitigation and monitoring.

Several presenters said employment opportunities in hydroelectric projects are limited to temporary work during construction and a very small number of operational jobs afterwards. One presenter at Norway House pointed out that, after large numbers of people worked on the construction of Jenpeg, it only takes 20 people to operate it.

The commission also heard about efforts by the neighbouring communities to create their own employment not related to Manitoba Hydro, including the newly-opened Salisbury House restaurant at Norway House Cree Nation. Local job creation is important, a representative of Norway House Cree Nation said, because First Nations people are tied to their home community, unlike workers in Alberta's oilpatch, who leave homes thousands of kilometres behind to work.

One presenter from the Manitoba Métis Federation said he has worked on recent Manitoba Hydro projects where, during site clearing and preparation, there were a large number of Aboriginal workers. However, once the contractors begin working on the actual construction, most of the workers are flown in from outside of the region or outside of Manitoba. At York Factory First Nation, we heard that only one or two members of the community have continuing work with Manitoba Hydro.

At several downstream communities, we heard a reference to the intent of the NFA to "eradicate mass poverty." Presenters said hydro development has failed to create economic opportunities that would eradicate mass poverty. The phrase in question is used in Schedule E of the NFA regarding creation of community development plans: "The Community Development Plan shall serve as a policy co-ordinating instrument, setting forth the best-case community development scenario and joint action program for the eradication of mass poverty and mass unemployment and the improvement of the physical, social and economic conditions and transportation."

### **Commission Comment: Employment, Training and Business Opportunities – Downstream**

The commission has heard the criticism that Aboriginal employment in many resource projects, including hydroelectric development, tends to focus on temporary or lower-paid employment. However, the commission also knows of Aboriginal people learning skilled trades through Manitoba Hydro programs or studying fields such as engineering through the University of Manitoba's Engineering Access Program, to which Manitoba Hydro is a donor. We encourage all parties to continue in efforts not only to create employment but to enhance educational and training opportunities for Aboriginal people in northern Manitoba. The commission believes that additional monitoring and follow-up research that we are recommending, as well as monitoring and research elsewhere in the hydroelectric system – have the potential to create employment, training and business opportunities in the downstream communities.



# Chapter Nine

## Public Policy Issues

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### 9.1 Overview

The unique nature of this public review of Manitoba Hydro's application for a final licence for Lake Winnipeg Regulation raised a large number of public policy questions. Because LWR is the first Manitoba Hydro project to face hearings for a final licence, this process raised questions relevant to the entire Manitoba Hydro system. The length of time that has passed between the issuance of the interim LWR licence and these hearings – and the new developments in public policy regarding environmental matters in the intervening years – prompted many participating groups to look at the legislative and public policy background to hydroelectric project licensing. This chapter will describe the legislation under which LWR is currently licensed, as well as a number of other pieces of legislation relevant to environmental protection and water management.

### 9.2 The Water Power Act

In Manitoba, all projects that use water to produce power – including LWR – are licensed under *The Water Power Act*. The act initially authorizes a new development under an interim licence, which allows the proponent to build the project and, after a suitable period of operation, confirm that the interim licence conditions are suitable and apply for a final licence. If the minister is

satisfied that the licence holder has met the terms and conditions of the interim licence, a final licence is granted. A final licence is not permanent, but can be granted for a period of up to 50 years. When that period comes to an end, the licensee may apply for a renewal licence, also for a maximum of 50 years.

The act and its regulations contain provisions to allow for the management and oversight of water power projects, including planning and charging water rental fees. It also contains provisions allowing the government to investigate water power operations. The licence holder is required to prepare records to which the minister's staff can have free access to verify the amount of water stored, diverted, used or capable of being used; the amount of power generated or capable of being generated; the condition of the works; and that the licence conditions have been followed. The act does not contain a requirement for an environmental assessment or public consultation.

### 9.3 Other Legislation Relevant to Water and Environment

#### 9.3.1 The Manitoba Hydro Act

*The Manitoba Hydro Act* sets out Manitoba Hydro as a Crown corporation

and establishes the board and its powers and operations. The purpose of the act is to provide for a supply of power adequate to the needs of the province and to promote economy and efficiency in the development, generation, transmission, distribution, supply and use of power. Notable powers granted to Manitoba Hydro, under the act, include the power to enter on any property, without permission, for Hydro purposes and the power to expropriate. Manitoba Hydro must pay compensation for damages occurred through access to property. Under the act, the Lieutenant Governor in Council (Cabinet) can prescribe how power is to be generated, transmitted or distributed and can control any lake, river, or other water body in Manitoba. Under the act, Manitoba Hydro is allowed to enter into agreements with Canada, any province or the United States and may supply power to other provinces or states.

### **9.3.2 The Water Rights Act**

*The Water Rights Act* addresses withdrawals and diversions of water, primarily for purposes other than generation of electricity. It allows for permits to be issued for preliminary work, followed by a final application. The focus of the act is on licensing the use of water for domestic, municipal, agricultural, industrial and irrigation purposes. The act requires the minister to consider scientific and other information relating to the levels of groundwater and surface water bodies and the in-stream flows that are necessary to protect and maintain aquatic ecosystems. It allows for the minister to suspend or restrict the right to withdraw or divert water if it affects aquatic ecosystem health. As with many other pieces of environmental legislation, the act explicitly requires a public announcement and the opportunity for the public to comment on licence applications.

### **9.3.3 The Water Resources Administration Act**

The purpose of *The Water Resources Administration Act* is to allow for the management of the construction and operation of water control works, particularly those under *The Water Power Act*, *The Water Rights Act*, *The Dyking Act*, *The Groundwater and Water Well Act*, and *The Water Supply Commissions Act*. *The Water Resources Administration Act* lists a number of matters the minister must consider in approving operating guidelines for water control works, including:

- the purpose of the water control works;
- the effect operation has on other water control works;
- competing needs of people affected by the water control works;
- an approved watershed management plan, as defined by *The Water Protection Act*;
- flood control;
- water storage and supply needs;
- drainage;
- means of minimizing artificial flooding;
- protection and maintenance of fish and wildlife habitat and aquatic ecosystems;
- recreation uses;
- effects of different climatological and hydrological conditions in the watershed; and
- uncertainty in forecasting.

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The minister may establish advisory committees for water control works and, except in cases of emergency, there must be an opportunity for public consultation. The act contains provisions for claims regarding artificial flooding and for prohibitions on building in reservoir areas and designated flood areas.

### **9.3.4 The Environment Act**

Manitoba's *Environment Act*, enacted in 1988, sets out three classes of developments and requirements for public consultation and assessment of environmental impacts. Under *The Environment Act*, a proponent may be required to submit an environmental assessment for a Class 1, 2 or 3 development, but the current practice is to require an environmental assessment report for a Class 3 development. The act requires that there be an opportunity for public comment on licence applications. *The Environment Act* also established the Clean Environment Commission to provide advice and recommendations to the minister and develop and maintain public participation in environmental matters.

### **9.3.5 The Water Protection Act**

The purpose of *The Water Protection Act*, a more recent piece of legislation, is to provide for the protection and stewardship of Manitoba's water resources and aquatic ecosystems. This act recognizes that social and economic well-being is dependent on a sufficient supply of high-quality water; the importance of comprehensive watershed planning; the interdependence of water, land and ecosystems; the need to protect water and ecosystems; the importance of scientific information in decision making; the need to protect riparian areas and wetlands; and the benefit of providing financial incentives. *The Water Protection Act* acknowledges the

importance of planning on a watershed basis and empowers the minister to designate watershed planning authorities that must hold public meetings in preparing watershed plans. The act also describes issues that must be considered in preparation of a watershed plan. The act institutes water quality standards as law and requires that activities licensed under *The Environment Act* adhere to them. Various other water matters are included in the act, including setting out conditions of Winnipeg's North End Pollution Control Centre upgrade, prohibiting phosphorus in cleaning products, allowing for regulations on invasive species and facilitating Water Quality Management Zones.

The act also establishes the Water Council, to advise the minister on matters relating to water, monitor watershed plans, review water quality regulations, co-ordinate advisory boards and similar bodies, and assist in reporting sustainability indicators related to water. It also establishes a Stewardship Fund to support research and activities in support of water and watershed management.

## **What We Heard: Public Policy**

The commission heard several critiques of the public policy and legislative environment surrounding LWR. Several participating groups expressed concern that the project was being relicensed under *The Water Power Act* and that no environmental assessment was required in the relicensing. The lack of provision within the act for public consultation, the lack of emphasis on the environment, and lack of a broad, watershed-scale vision were frequently expressed concerns. Participant groups proposed new approaches for licensing and described legislation from other jurisdictions that they believe better addresses environmental concerns and diverse social interests. Several groups proposed ideas for greater oversight of

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LWR and of projects affecting Lake Winnipeg and other waters, including proposals for multi-party task forces or governance boards.

### **Consumers' Association of Canada**

The Consumers' Association of Canada (CAC) argued that the concerns raised during the hearings illustrate the need for a new approach for licensing and monitoring of LWR. The CAC cited numerous perceptions revealed by presenters in hearings to argue that opportunities to rehabilitate and protect the environment have been missed, that the current system is biased or opaque, that the current legislation is inadequate to address all the environmental issues of Lake Winnipeg and the Nelson and Churchill Rivers, and that Manitoba Hydro's tools for analyzing water resources are unproven. The CAC presented information on a variety of regulatory and management approaches being undertaken in other jurisdictions that, it was argued, provide for greater incorporation of environmental values, broader public input, and more open decision-making processes regarding the management of water resources.

The CAC presented an argument for a complete review of *The Water Power Act* to ensure that reviews of projects such as LWR are more in tune with modern values and scientific understanding. Excluding older projects, such as LWR, from review under *The Environment Act* creates a "grandfather clause" that deprives people affected by these projects from the full protection of current laws and regulations.

The CAC's presentation cited concerns raised in the hearings, as well as legislative and regulatory developments elsewhere, to support eight key themes:

- acknowledging that alterations to flow and reductions in the range of lake levels are environmental risk factors;

- developing a holistic and inclusive approach to regulation;
- enabling early, meaningful participation by communities with an interest;
- carefully considering how value is measured (ex: consideration of more than just economic value);
- addressing gaps in knowledge;
- presenting a variety of alternatives in water resource management;
- taking an open, adaptive approach to risks; and
- promoting diligence.

Examples of legislation and public policy cited by the CAC included British Columbia's *Water Sustainability Act*, the Lake Ontario-St. Lawrence River Plan 2014 developed by the International Joint Commission and the Federal Energy Regulatory Commission in the United States. The CAC detailed aspects of these and other pieces of legislation that require consideration of environmental needs in water management decisions, incorporation of stakeholder and community views, and regular, science-based and even peer-reviewed monitoring.

The CAC recommended that LWR be regulated under *The Environment Act*, with Manitoba Hydro required to file an Environmental Impact Statement within three to five years. Other recommendations included in the submission were: determining within one year whether or not Manitoba Hydro has complied with the terms of its interim licence for LWR; setting expectations for the future licensing process; clarifying roles and responsibilities for water management in Manitoba; instructing

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Manitoba Hydro to develop a transparent and accessible model for water flows that it can share with experts and communities; and clarifying the role of Aboriginal consultation regarding LWR.

As part of its proposal for reform of water governance, the CAC recommended that the minister establish a multi-party task force on water governance.

### **Manitoba Wildlands**

Manitoba Wildlands argued that the Manitoba government and Manitoba Hydro need to move to a “whole-system, whole-basin, whole-lake” approach to monitoring, protecting, managing and regulating Lake Winnipeg. Manitoba Wildlands briefly described the development of public policy regarding Lake Winnipeg, dating back to the publication of a study on water power in the prairie provinces in 1916 and continuing through the development of LWR and CRD. Public policy, programs, studies and reports on Lake Winnipeg were described as “a hodge podge of single-issue, single-location, single-species, or single-environmental-element statements.”

The organization concluded that Lake Winnipeg requires a comprehensive system for governance, regulation, management, monitoring and protection. As part of this system, Manitoba Wildlands advocated that ATK needs to be included.

Specific concerns about policy and governance listed in Manitoba Wildlands’ submission were:

- Manitobans know little about Lake Winnipeg’s use as a reservoir for hydroelectric generation.
- Not enough scientific monitoring and

assessment has been carried out on Lake Winnipeg since 1970.

- Traditional knowledge has not been included in making decisions about regulation, governance, management, monitoring and protection of Lake Winnipeg.
- Process and results of Aboriginal consultations regarding LWR aren’t yet known.
- Government staff, consultants and scientists may not have sufficient information to support public policy regarding Lake Winnipeg.
- Existing boards, committees and reports do not assist in developing “whole-lake” or “whole-system” policy.
- There are many existing laws and regulations affecting Lake Winnipeg and LWR.
- Lake communities obtain information and participate in lake governance through the Manitoba government website.
- It’s unclear how various levels of government work together with respect to Lake Winnipeg.
- Reporting channels, access to information and funding regarding Lake Winnipeg are unclear.
- Many kinds of licences are involved in LWR.
- Manitoba Hydro does not seem to understand what it takes to maintain a “social licence” to continue to operate LWR.

## Pimicikamak Okimawin

Representatives of Pimicikamak Okimawin raised a number of concerns about the process of the licence review for LWR. Interpretations of *The Water Power Act*, considerations of the scope of the project and the review, the project's history and the lack of an assessment of some project effects were among the process issues raised. The First Nation's representatives stressed that the project was developed without First Nations input and against their wishes. They noted that they cannot change the fact that the project was developed without their input, but stressed that the licence for the project could be changed to provide for their input.

From Pimicikamak's perspective, the current licensing process is inadequate because it fails to consider the interconnected nature of the entire Manitoba Hydro system. In the 1992 report of the Federal Ecological Monitoring Program, LWR and CRD were referred to as a single unit. While the interim licence for CRD is undergoing a review, Pimicikamak's representatives argued that both CRD and the Kelsey Generating Station should be the subject of a public hearing process.

Pimicikamak's representatives raised concerns about a lack of monitoring and research on the effects of LWR and the lack of research-based rationales for the original licensing conditions. The licence, it was argued, is "very bare-bones" in that it sets operating rules regarding minimum flow, maximum fluctuations and the point at which Jenpeg must be operated at maximum outflow. It does not, however, state objectives in terms of ecosystem health.

Pimicikamak, like the CAC, argued that the minister has the authority under *The Water Power Act* to impose additional licence conditions. Pimicikamak's representatives

cited the objectives of the act, noting that one objective is "To ensure that the potential for negative impacts of water power development projects are minimized." Given that the full extent of damage caused by LWR was not known when the interim licence was issued, it was argued that damage caused by LWR should now be addressed in full in the final licence. Pimicikamak also argued that wording in the interim licence allows for additional conditions to be imposed. A representative quoted a passage from *The Water Power Act* Regulations, reproduced in Clause 6 of the interim licence, as follows:

*"Every licence shall be deemed to have been executed on the express condition that the licensee shall:*

*"(a) divert, use, or store the water authorized to be diverted, used or stored by him in such a manner as not to interfere, in the opinion of the minister, with the maximum advantageous development of the power **and other resources** of the river or stream upon which the works are located; [emphasis in Pimicikamak submission]*

*"(b) conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the minister or any person authorized by the minister in that behalf." [emphasis in Pimicikamak submission]*

The submission argued that "and other resources" can refer to fish and wildlife, which means that the ecological considerations are a factor in licences issued under *The Water Power Act*. If the interim licence operating parameters harm these other resources, the minister then has the authority, as the underlined portion of (b) above shows, to consider additional conditions in an attempt to balance water power uses with

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environmental, social and cultural needs.

Pimicikamak recommended that Manitoba Hydro's licence for LWR require establishment of a water governance board for the Lake Winnipeg basin, which would both look at how to improve conditions, such as excess nutrient run-off, and focus on operations of LWR.

### **Manitoba Hydro**

Manitoba Hydro, in its closing argument during the hearings, noted that there was no precedent, under *The Water Power Act*, for hearings such as those held for LWR. The licence for LWR was the first licence review ever held under the act. The corporation stated that it believes Manitobans' expectations have changed and that, in order for Manitoba Hydro to have a social licence for its project, it is willing to participate in development of a modern process for the review of LWR prior to the application for its renewal licence. Such a new process may have greater room for public consultation and a greater attempt to balance different needs and values. The corporation stated that it believes such a process should also be developed for licence renewals for CRD, the Kelsey, Kettle, Long Spruce and Limestone generating stations on the Nelson River, Grand Rapids generating station on the Saskatchewan River, and the six Winnipeg River generating stations. The corporation stated that it would prefer a long lead time for any new process in order to prepare the appropriate information, as it would hope to apply for a renewal five years before the end of a licence period.

Regarding governance issues, Manitoba Hydro noted that *The Water Power Act* regulations were updated as recently as 2010 and *The Environment Act* is currently undergoing two reviews: one by the Law Reform Commission and another by the

Province of Manitoba. Cautioning that any "simple legislative fixes" might address specific concerns over LWR but not be suitable for other water-related matters, Manitoba Hydro argued that adequate authority exists within existing federal and provincial legislation to address the concerns raised in the LWR hearings.

Regarding large-basin planning, Hydro stated that it shares the belief in the need to think of the "big picture," but much of this lies outside the mandate of the corporation and the expertise of its staff. The corporation urged the province to consider, in applying legislation to large-basin planning, that:

- Water management planning in Manitoba must include all major water management projects in the province, not just Manitoba Hydro's projects.
- Hydro electricity is the foundation of Manitoba's clean energy strategy.
- Affected interests must be involved early and throughout the process.
- Ecosystem health is one of many components to be considered.
- Proper scoping and cost considerations are essential in directing what kinds of studies are needed.
- Other agreements between Manitoba Hydro and various First Nations are based on the existing operating rules for LWR.

Addressing proposals made at the hearings to create a multi-party decision-making board to oversee the Lake Winnipeg basin and LWR, Hydro argued that:

- Removing operational control from

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Manitoba Hydro could jeopardize the security of Manitoba's electricity supply and have an economic impact on electricity customers.

- Placing decision-making authority in the hands of a board would also make the board liable for compensation, mitigation and remediation.

## Commission Comment: Public Policy

A comparison of the provisions of *The Water Power Act* with other, more recent, legislation affecting water resources confirms that *The Water Power Act* contains little consideration of environmental protection. Rather, the act is focused on ensuring that hydroelectric resources are technically efficient and reliable. Aside from a provision for regulations regarding construction of fish passages, the act is silent on the environment. It does not require any form of public consultation in the development of a project or its operation.

Contrasting this older legislation with more modern legislation, we see significant differences. Interim licences are not issued under more recent legislation, such as *The Environment Act*, and there are no specific time constraints on the length of time a licence is valid. Public consultation is a requirement in the planning and, often, in the operational stages. Under *The Water Resources Administration Act*, for example, the minister is required to consider fish and wildlife and aquatic habitat when approving operating guidelines for a water control structure. The act also includes a provision for public consultation on operating rules. *The Water Rights Act* requires the minister to consider the health of aquatic ecosystems and allows for suspending or restricting water licences in order to protect the environment. It also requires a public

announcement and the opportunity for the public to comment. *The Water Protection Act* acknowledges the importance of planning on a watershed basis and contains a requirement for public meetings, as watershed planning is inherently a public process. *The Environment Act* contains a requirement to provide an opportunity for public comment and a provision so that the minister may call for public hearings. *The Environment Act* regulations call for an environmental assessment for major projects (Class 3 developments). In *Towards Sustainable Drainage, A Proposed Regulatory Approach*, one of the strategies under "Manitoba's Green Plan" it was noted that, when projects require duplicate authorizations under *The Water Rights Act* and *The Environment Act*, consideration has been given for the harmonization of authorization under *The Environment Act*. Similar consideration should be given in licensing and relicensing hydroelectric generation projects. Most *Environment Act* licences are also reviewed when an alteration is requested, when a problem arises, and on an ongoing basis and as new technologies and information become available. There is no set time for renewal and new licensing conditions evolve with the situation.

Most of Manitoba Hydro's developments in northern Manitoba predate *The Environment Act* and most of these other, more recent, pieces of legislation. They were planned and built at a time when the law did not require the same degree of public consultation and consideration of environmental matters as is required today. The first Manitoba Hydro developments to have environmental impact assessments (EIA) were the Wuskwatim Generation and Transmission Projects, the subject of hearings by the Clean Environment Commission in 2004, followed by the Bipole III Transmission Project in 2013 and Keeyask Generation

Project in 2014. These projects all were made better as a result of the extensive process of research and consultation that went into preparing an EIA and submitting it to public scrutiny.

Although *The Water Power Act* does not require an EIA in a relicensing process, prior to the hearings for the final licence for LWR, Manitoba Hydro prepared a binder of information about the project. This information was made available to participants and others interested in the LWR and its potential effects. The Manitoba Hydro document contained a short summary of LWR, detailed hydrological records for water levels on Lake Winnipeg and downstream, summaries of research and monitoring that has occurred before and after LWR and a variety of other information. However, it was not an EIA report. It lacked the baseline information that an EIA on a new project would have. It was not created through a lengthy and comprehensive period of consultation. Most significantly, it did not contain new research. Manitoba Hydro assembled information from the many monitoring and research programs over the last four decades, but did not conduct new studies to fill in gaps. As we saw in discussions of the Cross Lake Weir, the results of which were never comprehensively studied, some of these gaps were significant. One of the challenges in assessing the information in this document is that many of these research and monitoring programs have been driven by specific claims under the Northern Flood Agreement. A complaint-driven research and monitoring program is unlikely to be thorough and comprehensive. In the next chapter of this report, the commission will offer advice for improving the process for future relicensing decisions of Manitoba Hydro projects.

## Recommendations

The Commission recommends that:

- 9.1 *The Government of Manitoba evaluate the current licensing regime for hydro projects and ensure that legislation and regulation is consistent with modern legislative, consultation and environmental standards.*
- 9.2 *The Government of Manitoba require relicensing of hydro projects to be done under *The Environment Act*, in addition to or in lieu of any other water management legislation.*
- 9.3 *The Government of Manitoba undertake a review of any licence issued for hydro projects, on specified anniversary dates, to assess the level of compliance and adjust licensing conditions as required.*
- 9.4 *The Government of Manitoba ensure that incident reporting, compliance reporting and annual reporting schedules are incorporated into any licence and that such reports be made available in a timely manner.*



# Chapter Ten

## Going Forward

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### 10.1 Overview

Lake Winnipeg Regulation was the first Manitoba Hydro project to come up for a final licence under *The Water Power Act* that was subject to public review. The ideas and issues raised in these hearings provide insights that can guide future actions. Participating groups and organizations – and Manitoba Hydro – learned lessons from this process that can be applied in the relatively near future when LWR comes up for a licence renewal. These lessons will also be of use in preparing for the relicensing applications of other Manitoba Hydro facilities. Given that LWR, and other Manitoba Hydro facilities, are long-term fixtures in the environment, it is important to consider their effects and operation in light of forecast changes to the environment resulting from global climate change. It is also important, given changes in the social and legal environment and public expectations since LWR was built, to revisit how this project and others are operated, how communities are involved in these projects and how communication is carried out regarding these major developments.

### 10.2 Operating Rules and Models

As was discussed in Section 3.4, Operation of LWR, the operating conditions attached to Manitoba Hydro's licence for LWR

are minimal. There are few rules to direct Manitoba Hydro on when to release or hold back water, and these rules are, to a large extent, not supported by a strong scientific rationale. The Jenpeg maximum daily rate-of-change licence condition appears to have been arbitrarily selected, given the lack of documentation to support it. The minimum-flow condition appears to have been based on a limited historical record but without supporting evidence. Neither condition appears to relate to environmental studies conducted by the Study Board, as they were adopted before the studies were completed.

Throughout the hearings, the commission heard comments and recommendations from various participants that Manitoba should examine water management planning practices from other jurisdictions to assess their utility for addressing, in a participatory planning environment, a broader array of modern-day operating rules and management objectives than has been addressed to date. Many of these other jurisdictions have a greater number and diversity of operating rules in place than currently exist for LWR. In many of these jurisdictions, operating rules and management objectives are collaboratively developed through public planning processes that are transparent and provided with adequate resources to ensure effective involvement of multiple stakeholders and scientific peer review.

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Operating rules for waterway systems or individual control structures and/or generating stations may stipulate minimum, maximum and/or ecological flows at the facility or at locations downstream. Rules may also specify releases conditioned on the need to control downstream flooding, re-distribute storage within the system, fill downstream reservoirs or contribute to meeting system power demands. Minimum flows are simply a recommended minimum volume of water that is required to flow through or past a facility continuously and/or at certain times. The intention of the minimum flow is normally to protect a particular ecological function or functions in the downstream aquatic environment, such as a fish spawning habitat and/or the maintenance of riverine wetland habitat for aquatic life. Not having a sufficient minimum flow can render critical habitat functions useless. For example, it is highly possible that the whitefish decline in Cross Lake was caused by the lack of sufficient water flow from Jenpeg during the spawning period. Minimum flows normally vary by season or month and, to a large extent, are designed to resemble the flows on a natural (ex: unaltered) river system. Maximum flows are often stipulated because of the capacity constraints at a specific facility.

A wide assortment of approaches, models and techniques are available to assist in the design of ecological minimum flows. The expert retained by the commission testified that operating rules can be tested in simulation models to identify flow regimes designed to enhance quantity, timing and quality of flows affecting aquatic systems. In these types of models, rules can be formulated that prescribe releases from system storage in proportion to system inflows and available water in storage, thereby mimicking natural wet and dry periods. This can be offered as an alternative to fixed minimum flows that may not be suitable under all conditions. In

addition to minimum flows and other low-flow protocols, environmental flow regimes may also prescribe pulsed, triggered or periodic high-flow releases for a variety of purposes, including fish spawning, fisheries protection, periodic draining or flooding of wetlands. The commission notes that it is not possible for LWR to be operated in a way that completely resembles natural flows, given that Manitoba's electric system is almost completely based on hydroelectricity and requires winter-time flow to generate power. However, operational models of flow regimes can assess ways of meeting both power generation and environmental flow needs to the greatest extent possible.

The difference between minimum and maximum levels is often described as the operating range and can be intended to provide an acceptable range to water body users and stakeholders. In some cases, operating ranges or limits can be described in "normal" or "out of normal" conditions, where flood or drought events are treated as "out of normal." This allows for a degree of regulatory flexibility to deal with more extreme events. More importantly, operational models permit investigation of adaptive operational responses to progressively worsening flood or drought conditions.

Rates of flow change are often set out in licence terms and conditions. Two major drivers to put limits on the rates of change are public safety and fisheries. With respect to safety, a gradual transition to higher or lower flows gives people on the water or at the shoreline the opportunity to move or adjust their activities to stay safe. Rates of flow change have also been established to protect fisheries and more specifically habitat use, where a sudden shift in water flows may result in undesirable outcomes, such as stranding fish.

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The commission believes LWR requires new, formalized operating rules. At this point, the commission is not in a position to recommend any specific new licensing conditions or operating rules. It would be preferable, as part of a future environmental assessment, for key stakeholders to assess the existing environment and look for opportunities for mitigation or operational improvements by examining alternative management strategies using the above-described rule-based system operational model.

Carrying out a full environmental assessment of LWR in advance of relicensing would provide an opportunity to gather the information needed to assess operating rules for the project. An environmental assessment for LWR is an ideal planning tool to address flows, levels and rates of change, because it will provide the mechanism to identify the current state of the environment under existing licence conditions. The environmental assessment can identify areas of study that would need to be addressed and then identify desired objectives or targets to meet environmental and socio-economic objectives. All proposed operating terms would need to be scrutinized with respect to their environmental, economic and social impacts. Some suggested operating rules may be beneficial for a particular environmental component, but may result in negative socio-economic impacts (such as reducing the amount of electricity that can be produced) or may result in negative impacts on other components. In essence, different alternatives should be developed and then examined with respect to their benefits, impacts and trade-offs. Integrated river basin planning processes typically involve stakeholders in collaborative development of performance measures for comparison of operational alternatives.

During protracted wet periods of the kind recently experienced in Manitoba, high

water levels on Lake Winnipeg are normally accompanied by maximum and long running releases from Jenpeg. Restrictions on lake level and rate of drawdown or filling can significantly affect availability of water and storage throughout the system. Changes to the existing licence conditions, imposition of new LWR operating rules or addition of new projects to the Manitoba Hydro system will likely result in changes to flow regimes throughout the system, the determination of which will require application of a rule-based operational model.

The commission is of the opinion that, in the future, more prescriptive and complex operating rules will be needed to address a growing variety of modern-day social preferences, demands on water and storage, and environmental requirements. Implementation of these rules in day-to-day system operation will also be more complex than historical operations have been. They may also require real-time water control decision support tools developed from the operational planning models used to derive them.

The commission's expert put forth a compelling case that a new generation of decision-support tools, including rule-based operational models, would be needed to better understand and assess the implications and trade-offs of (1) new fixed and conditional operating rules, such as environmental flow regimes or drought operation protocols; (2) effects of seasonally or conditionally varying operating levels; and (3) anticipatory/adaptive flood management and drought response strategies. The tools should be capable of examining hypothetical historical and climate-adjusted hydrologic conditions, in addition to the partial historical analysis presented in evidence at the hearings. The spreadsheet models developed and applied by Manitoba Hydro, while minimally supportive

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of its licence application, are not capable of multipurpose operational analysis of the kind needed to address problems and issues likely to arise in future integrated river basin planning, relicensing or environmental impact assessment efforts.

While Manitoba Hydro was of the opinion that the commission's expert, Dr. McMahon, was not fully aware of all the models and tools it utilizes, the corporation did acknowledge Dr. McMahon's assertion that the HERMES and SPLASH models (currently used by Manitoba Hydro) were not appropriate for consideration of operational alternatives, even limited to the relatively simple comparison of impacts of increasing or decreasing the Lake Winnipeg operating range by a foot.

The commission believes that models and data employed in the future should be accessible to the public and non-proprietary, although the commission acknowledges that there will be information about prices and contracts that Manitoba Hydro needs to keep confidential. Stakeholders are more likely to understand, appreciate and build consensus on management strategies formulated using transparent processes, models and data. A collaborative environment, in which stakeholders are able to understand Manitoba Hydro's operational needs as well as the environmental implications of LWR operations, may be most effective in ensuring that environmental, social and economic needs are addressed. Software adopted for river basin planning and analysis of future LWR operating regimes should allow for assessment of Manitoba-wide implications of alternative operational strategies on social, economic and environmental objectives. It should be applicable under constant and climate-adjusted hydrologic conditions and should be capable of being used in a planning environment that is accessible to stakeholders.

## Recommendation

The Commission recommends that:

- 10.1 *Manitoba Hydro develop and make available for public review operational model(s) for alternative approaches to system management. The models should allow for evaluation of the effects of these strategies on objectives, including, but not limited to, ecological health, social impacts and economic impacts on both Manitoba Hydro and local communities.*

## 10.3 Climate Change

### Manitoba Hydro's Information: Climate Change

Manitoba Hydro calculated estimates for future climate change within the Lake Winnipeg watershed by averaging 147 global climate model simulations. The average of all the predictions is for an increase in mean annual temperature in the watershed of 2.5 C by the 2050s and 3.6 C by the 2080s. The average of these models also predicts an increase in runoff for all the basins within the Lake Winnipeg watershed, with the largest increase occurring in the Winnipeg River basin, and only modest increases in the Saskatchewan and Assiniboine basins.

### What We Heard: Climate Change

An expert witness for Manitoba Wildlands presented information to indicate that the global climate is reaching a point of abrupt climate change that will make extremes of heat, cold, precipitation and drought more pronounced. This is particularly the case closer to the Arctic, where enough sea ice and snow cover has melted to significantly decrease the albedo effect (albedo is a measurement of the reflectivity of the earth's surface; snow and ice have a high albedo effect because they are able to reflect the

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sun's rays, preventing warming). With the decreased albedo effect, warming accelerates. Warming in the Arctic releases methane from permafrost, which, as a greenhouse gas, further accelerates climate change. Warming of the polar regions in turn has decreased the difference in temperatures between the equator and the polar regions, which affects global atmospheric and ocean currents. One result of this is an Arctic jet stream that may extend much farther south than normal in some places or retreat much farther north. Another result may be extreme weather events, such as the torrential downpour that caused a major flood in southern Alberta in June 2013, and droughts, such as the extreme drought currently affecting California. That "wavy" jet stream may account for unusual phenomena, such as unusually warm weather in Canada's northern territories, while locations in the U.S. are struck with unusually cold temperatures.

As a result of climate change, models for Lake Winnipeg's future climate and hydrology are less reliable. Planning based on a one-in-a-hundred or one-in-a-thousand year events becomes less certain, as such events may happen much more frequently under a more extreme climate. With a warmer climate, evaporation in Lake Winnipeg will increase during hot, dry years. As well, with higher water temperatures, there will be greater risk of blue-green algae blooms. The melting of glaciers in the Alberta Rockies may lead to decreasing flows in the Saskatchewan River system.

### **Commission Comment: Climate Change**

The commission was not reassured, from Manitoba Hydro's responses, that there is a comprehensive drought plan that takes into account the current climate change predictions and environmental effects. The

commission is also not re-assured that the full suite of possibilities for climate change within the Nelson River-Lake Winnipeg watershed has been thoroughly explored. The global models need to be brought down to the regional level to consider such things as a wetter Red River valley, with more extreme events, and the effect of warmer and shorter winters on ice cover, especially along the Nelson River. This may affect how LWR is operated in the future. Erratic weather and warmer temperatures will likely increase winter travel woes for residents and resource users along the river.

A model of the full Manitoba Hydro system may help to explore possible scenarios and needed adjustments within the system as different weather patterns affect different parts of the contributing watersheds. As well, such a model of the hydroelectric system and climate change effects may help in communicating the far-reaching effects of local decisions in the Lake Winnipeg watershed. Planning for climate change needs to consider the possibility that increased precipitation, combined with the effect of isostatic rebound, may mean that, in the future, it may become necessary to operate LWR at maximum discharge nearly continuously to remain at or below the current 715.0 feet asl maximum operating level. Therefore, long-term planning on Lake Winnipeg may need to consider how climate change will affect lake levels and the operating range in the future.

The recent period of heavy precipitation affects all waterways, not just Lake Winnipeg. The potential for even greater precipitation as a result of climate change means that all Manitobans must prepare for the possibility of higher water levels and greater flooding. All governments, including the provincial government, municipalities and First Nations, need to conduct assessments of future flood and drought risks and make contingency,

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adaptation and mitigation plans to deal with these risks.

## Recommendations

The Commission recommends that:

- 10.2 *The Government of Manitoba develop a climate change risk and adaptation planning framework for individuals and communities in the Lake Winnipeg watershed*
- 10.3 *Manitoba Hydro develop a climate change risk and adaptation planning framework for its system*

## 10.4 Planning for a Future Environmental Assessment for LWR

All parties at the LWR hearing acknowledge the need for a more comprehensive examination of LWR as part of Manitoba Hydro's application for a renewal licence. To consider what should guide development of an Environmental Impact Assessment for the renewal licence, it would be useful to look at some of the shortcomings of the existing information on the impact of LWR and how an EIA for the renewal could address these.

- 1) Participants acknowledged that LWR was originally implemented without the benefit of a modern-day environmental assessment. Authors of the 1975 Study Board report even noted, at the time, that they did not have the ability to assess and understand the full impact of the project and were facing time and budget constraints to complete their entire study in four years. Manitoba Hydro has a number of years in which to prepare an EIA prior to the

next licensing period. Planning an EIA, getting guidance from external bodies, consulting with communities and stakeholders, and conducting research over multiple seasons takes considerable amounts of time, so work needs to begin soon.

- 2) The Study Board explicitly eliminated some water bodies from its study, such as Sipiesk Lake, on the grounds that it had already been affected by the Kelsey Generating Station. As a result, Sipiesk Lake has never been fully assessed for environmental effects. It would be important to ensure that the scoping for a new LWR EIA does not "scope out" impacts of the project.
- 3) The Study Board report appears not to have had any bearing on the operation of the Jenpeg Control Structure. Most modern-day EIAs of hydroelectric projects will examine alternative operating regimes in order to accommodate needs beyond hydroelectric generation. Such work will examine the minimum flows needed at certain times of year to protect ecological functions, such as fish spawning, or socio-economic needs, such as safe boating or ice travel. The two operating conditions for Jenpeg that are related to downstream conditions (the minimum flow requirement of 25,000 cfs and the maximum rate-of-change limit of 15,000 cfs in 24 hours) were established prior to the work of the Study Board or without reference to any Study Board research.
- 4) The Study Board's original assessment of LWR was not carried out co-operatively with Aboriginal peoples. The idea that project proponents should listen and be responsive to

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ATK was essentially unheard of at the time of the Study Board. There is now wide agreement that ATK provides a valuable understanding of project impacts and helps to reveal opportunities to reduce or mitigate impacts.

In light of this opportunity to make up for some of the shortcomings in the original assessment of the project, the commission would like to offer some suggestions for development of the EIA for Manitoba Hydro's renewal licence.

### **Purpose and Objectives**

Key participants must be involved in defining the purpose and objectives of this EIA. Given that LWR is already 40 years old and that it is an essential part of Manitoba's hydroelectric system, it would be most effective if participants commit to looking forward toward improving conditions, rather than focusing on a past environment that cannot be recovered. The commission suggests that the purpose of this EIA could be to improve upon the existing natural, social and economic conditions that have been affected by LWR. Acknowledging Manitoba Hydro's mission to generate a secure supply of electricity for Manitoba is also an important consideration. Objectives of the EIA could be to:

- develop a better understanding of the environment before and after LWR;
- evaluate the operating regime for LWR;
- identify possible mitigation measures, including engineering works and operations;
- identify long-term monitoring measures; and
- commit to long-term adaptive management.

### **Study Area**

The commission suggests that the study area for an LWR EIA extend from Warren Landing and Two-Mile Channel in the south to the Kelsey Generating Station and Split Lake Inlet in the north. It would then take into consideration all of the areas where channels, channel improvements, dikes and control structures have been built and the water bodies most affected by these developments. Water bodies to be studied would include Playgreen, Little Playgreen, Cross, Kiskitto, Kiskittogisu, Walker, Drunken, Pipestone, Black Duck, Duck and Sipiwesk Lakes, as well as the Nelson River and both its east and west channels. Water bodies that flow into the Nelson River between Sipiwesk Lake and Kelsey may also need to be included. Regarding the area downstream from Kelsey Generating Station, the commission recommends that the impact of LWR on this area be subject to environmental review, either as a part of the LWR EIA, in a combined review of LWR and CRD, or in a separate review of the CRD. The commission does not believe that there is sufficient evidence of an impact on Lake Winnipeg caused by LWR, to warrant including the lake in the EIA for LWR.

### **Steering Committee**

The commission suggests establishment of a steering committee or advisory body that would have overall responsibility for the environmental assessment, including the assessment of the operating regime for LWR. This steering committee should have an independent chair. It is important that such a committee be able to represent the interests of the participants experiencing the greatest impact in the core study area (Warren Landing to Kelsey GS). The central participants would be Manitoba Hydro, the Manitoba government, Pimicikamak Okimawin and Norway House Cree Nation. This steering committee should determine what studies are required as part of the EIA.

Direction should be sought from the Power Licensing Section and the Environmental Approvals Branch of Conservation and Water Stewardship in scoping the EIA. Other organizations and communities should be consulted when draft guidelines for the EIA are developed and again when the draft EIA is available. This would include the Norway House, Cross Lake, Wabowden and Thicket Portage communities, the Manitoba Métis Federation and perhaps local resource user groups representing fishers and trappers in this area. If suggestions are being made for operating regime changes at either Jenpeg or Kelsey – which could have an impact downstream of Kelsey – Tataskweyak Cree Nation, War Lake First Nation and York Factory First Nation, Ilford and Pikwitonei communities and local resource user groups must also be consulted.

### **Studies and Topics**

While the steering committee will make its recommendations on study topics, the commission believes that the LWR hearings have highlighted some existing gaps that need to be filled with research. These include impacts on waterfowl, aquatic furbearers, wetlands and riparian areas, critical fish habitat and erosion in the artificial channels and the river channel. A priority should be to study environmental indicators that are influenced by changes in water management operations. It will also be possible for the LWR EIA to build on the Regional Cumulative Effects Assessment (RCEA) of Manitoba Hydro's Nelson and Churchill River projects, which is currently being prepared.

### **Operating Regime**

Since LWR already exists, the main focus of the EIA for the licence renewal will be assessment of the operating regime for the Jenpeg Control Structure. An operating regime should identify minimum flows required at various seasons or dates to

support certain ecological functions, such as spawning and maximum rates of flow change. An operating regime may also specify minimum and maximum water levels at certain locations. As there may be cases where, as a result of weather extremes or unforeseen circumstances, it would not be possible to adhere to these conditions, it would also be important to anticipate this in the operating regime and develop rules regarding operating outside of the compliance conditions.

### **Monitoring and Mitigation**

The EIA should also seek to identify possible mitigation measures and develop a monitoring program to test the effectiveness of mitigation measures. A commitment to adaptive management would allow for mitigation measures to be altered and improved based on the results of monitoring. To ensure that there is committed long-term monitoring in a consistent manner, the Coordinated Aquatic Monitoring Program (CAMP) should be formalized and made a permanent program.

### **Aboriginal Traditional Knowledge**

Development of the EIA must include gathering and applying ATK at the beginning of the process to identify studies that may be required, better understand the impacts of LWR, and identify the flow conditions or water levels required to support healthy ecological functions, habitats and cultural pursuits in the study area.

### **Gap Analysis**

In its final argument in the hearings, Manitoba Hydro noted that the current RCEA being undertaken of its projects in the Churchill and Nelson River sub-watersheds may help to identify information gaps that can be addressed in the assessment of the renewal licence for LWR.

### **Communication**

The steering committee must also

establish and implement a communication plan that will ensure that community members from all communities downstream of LWR and the general public are aware of their activities and outcomes.

## Recommendations

The Commission recommends that:

- 10.4 *The Government of Manitoba require an environmental assessment of Lake Winnipeg Regulation prior to relicensing*
- 10.5 *The Government of Manitoba facilitate the establishment of a Steering Committee, with an independent chair, to undertake an environmental assessment of Lake Winnipeg Regulation effects downstream as described in Section 10.4, Planning for a Future Environmental Assessment for LWR, of this report*
- 10.6 *Manitoba Hydro make the Coordinated Aquatic Monitoring Program permanent, with appropriate funding*

## 10.5 Legacy Project Licensing

In the previous section, the commission discussed a process for planning the environmental assessment of LWR as part of the relicensing of that project. In this section, we will address some matters relating to the relicensing of most of Manitoba Hydro's generation facilities, as well as LWR and CRD.

Manitoba Hydro operates 15 hydroelectric generation stations throughout the province, almost all of which will be subject to licensing processes, under *The Water Power Act*, over the next few years. Manitoba Hydro has applied for final licenses for Limestone Generating Station and Jenpeg. It has applied for a renewal of a final licence for Grand Rapids, which expired in January 2015. Kelsey is currently operating under a Short-Term

Amending Licence. Six generating stations are operating under Short-Term Extension Licences, five of which expire on September 30, 2015, and one on January 1, 2017. The remaining four are operating under Final Licences, with the following expiry dates: Slave Falls, January 1, 2022; Kettle, November 1, 2022; Long Spruce, April 28, 2028; and Great Falls, January 1, 2032. In addition, Lake Winnipeg Regulation, including the Jenpeg, and Churchill River Diversion, both of which are currently seeking a final licence, will be due for relicensing in the next decade. The 15th generating station is Wuskwatim, licensed in the past decade. This will result in an incredible amount of work for Manitoba Hydro officials and provincial regulators. To that end, the commission was asked to consider a proposal to conduct these renewal application reviews in geographical groupings.

The groupings suggested are as follows:

1. The six Winnipeg River generating stations
2. Lake Winnipeg Regulation, Churchill River Diversion and Kelsey
3. Kettle, Long Spruce and Limestone

Grand Rapids, as the only generating station on the Saskatchewan River and the two small stations on the Laurie River would be considered on their own.

Grouping of the projects in this way will result in all the projects in a given group being considered for relicensing at the same time, regardless of when their licences expire. As well, this would reset the clock for the licences, giving each facility within a group a common licensing date. In addition to allowing for licensing efficiency, this process would assist in assessment of effects, especially the cumulative effects of hydro development in a particular area. This

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proposal originated with Manitoba Hydro, whose representatives acknowledged the value in such an approach. During the hearings, the commission heard no strong objections from any of the other parties. We are of the view that this proposal makes very good sense and recommend that the Manitoba government adopt this suggestion.

While the commission is prepared to support a more manageable licensing process, we continue to stress the need for environmental assessment and an open and transparent review process. The commission is of the view that Manitoba Hydro's existing projects, licensed under *The Water Power Act*, must be subject to a public review when they are relicensed. This review must include development of an EIA, overseen by a steering committee similar to the one recommended for the relicensing of LWR.

The commission is fully aware that environment assessment of long-existing projects cannot meet the standard required for a proposed project. This is due, in large part, to the lack of baseline information. But, we are also aware that the science of environmental assessment has advanced to the point where it is possible to conduct a very good evaluation of past, current and future impacts. It is also possible to identify needs and methods for mitigation, enhancement and evaluation incorporating adaptive management. This is especially true when the assessment is done in concert with ATK and local knowledge.

The commission is further of the view that these projects should be relicensed under *The Environment Act*, in tandem with, or in lieu of, other water management acts. *The Environment Act*, in its current form, did not exist at the time of construction of any of these projects. If it had, or if these projects were to be built today, licensing under this act would be required.

## Recommendations

The Commission recommends that:

- 10.7 *The Government of Manitoba require that the relicensing of all existing hydro projects be done under *The Environment Act*, with the further requirement for a full environmental assessment, which incorporates ATK.*
- 10.8 *The Government of Manitoba require that the relicensing of all existing hydro projects be subject to a public review.*
- 10.9 *The Government of Manitoba, in the relicensing of the existing hydro projects, do so in the geographical groupings noted in Section 10.5, Legacy Project Licensing.*

## 10.6 Supporting Watershed Thinking

In Chapter Two of this report, the commission addressed the issue of the Lake Winnipeg-Nelson River watershed. We noted that the watershed is a very large and complex system, further complicated by the fact it crosses many national and international borders. We called upon the Government of Manitoba to develop management goals that would inform development within the watershed. In this section, the commission will offer further advice regarding development of public policy that will support this objective.

Historically, there has been a tendency for legislative functions and regulations to operate in "silos" – that is, disconnected from one another – which can make effective problem solving difficult. Several participating groups, in these hearings, spoke of the need to avoid this practice and, instead, to adopt whole-ecosystem, or whole-watershed thinking. As we have seen,

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actions may often be taken to solve a local issue, without realization of the effect this action may have on other communities or on the environment. This report has outlined some examples of this phenomenon, such as limited development planning and lack of environmental consideration in past hydro development.

Other examples include flood management and surface drainage. It was as recently as 2005 that the Red River Floodway expansion became the first flood management project subject to an environmental assessment. Other major flood control works and activities, too often, operate in a realm separate from ecological considerations and only for selected socio-economic ones. Surface drainage was done, for too long, largely without consideration of what happens downstream. Also, until very recently, development of hydro generation operated in a stand-alone manner to the exclusion of ecological and social considerations.

In Manitoba, in 2015, there are very few water bodies – lakes, rivers, streams – that are not subject to some controls or regulations. This makes it impossible to operate any water management project in isolation.

The commission acknowledges that much of the current public policy development in this regard is taking “watershed” and “ecosystem” approaches. However, there is a need to ensure that “the big picture” is clear to all government agencies and the public, that efforts are co-ordinated, and that co-operation is maximized. This will require strong oversight to ensure that these various initiatives are not in conflict or duplicating efforts, that they are meeting their stated goals and that these goals are compatible with the desired result.

The commission encourages the government to consider regular and targeted

reviews of goals, objectives and outcomes of the various water-related environmental policies and strategies. In our view, this may be best accomplished by an independent agency with an objective outlook. Included in this review could be the assessment and identification of how other levels of government and non-governmental organizations are, or could be, involved to help achieve these goals.

## Recommendation

The Commission recommends that:

*10.10 The Government of Manitoba charge an independent body to review policies, statutes, goals, objectives and outcomes of the various water-related environmental policies and strategies to ensure there is consistency between them and that they meet the desired result of watershed- and/or ecosystem-wide approaches.*

## 10.7 Communication and Cooperation

Many times during the hearings, the commission was struck by the communication barriers that exist between Manitoba Hydro and Manitobans. The commission heard presenters who appeared to believe that provincial control structures, such as the Fairford Control Structure, are Manitoba Hydro operations. We heard from many people who misunderstood the meaning of the 715.0 feet asl operating range maximum, believing that Manitoba Hydro is responsible to ensure that the level of Lake Winnipeg never exceeds this elevation, or who believe that Lake Winnipeg is intentionally kept at this level. The basic function of LWR – to ensure a supply of water for the large downstream generating stations on the Nelson River – appeared not to be fully understood by some.

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For individuals who wish to learn more about LWR, and other hydro projects, finding information can be a challenge. The Manitoba Hydro website is very confusing and not particularly user-friendly. It is difficult for the casual user to pinpoint information about a particular project. Manitoba Hydro needs to work to improve communication, especially in communities around Lake Winnipeg and along the Nelson River. In communicating with stakeholders and communities, Manitoba Hydro needs to present information clearly, with minimal technical/engineering jargon, while making detailed data available for those who want it. Manitoba Hydro should seek out opportunities for face-to-face meetings with Manitobans where individuals can have their questions answered or raise their concerns. Communication is a two-way street. Good communication on the part of Manitoba Hydro requires a concerted effort to listen to concerns and work with communities.

Communication regarding provincial water management actions also appears to be a challenge. The commission heard from presenters that management decisions about the operation of the Fairford Control Structure have only recently been communicated to residents downstream. We also heard expressions of uncertainty and anxiety around the emergency drain from Lake St. Martin and the proposed permanent drain. Lack of communication about provincial water management may be one of the reasons some people associate these activities and facilities with Manitoba Hydro. Since the Crown corporation is a visible presence, it becomes associated in some minds with anything involving water. Some of this may be the result of water management responsibilities being recently divided between Manitoba Infrastructure and Transportation (ex: flood-related activities) and Manitoba Conservation and Water Stewardship (ex: power generation and water management). Provincial water management

information is available through different government websites, but navigating these websites can also be a challenge. As well, the reports and information may be too long and technical for many readers. It should be noted that access to high-speed internet is limited, making it more difficult to access information online. Face-to-face meetings must be an important part of any communication strategy. As we discussed above, in response to climate change concerns, the need to communicate water-management issues and decisions is likely to increase if climate change results in greater extremes and more precipitation.

## Recommendations

The Commission recommends that:

- 10.11 *Manitoba Hydro provide more and plain language information on their planning processes and how it is incorporated into their decision making, such as drought planning and climate change adaptation*
- 10.12 *The Government of Manitoba improve public information on water management by providing more plain language documentation, identify and facilitate the link between departments responsible for water management, explain the planning processes and how they are incorporated into decision making, such as flood and drought planning and adaptation to climate change*

## 10.8 Conclusion

The Lake Winnipeg-Nelson River watershed has not been a naturally functioning system for many years. This is not just a result of Manitoba Hydro's regulation of Lake Winnipeg for power production and flood reduction, but of the myriad control structures, generating stations, diversions and drainage channels throughout the million-

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square-kilometre watershed. All of these activities combine to make maintaining a healthy, functioning ecosystem a challenge. This challenge is likely to be made even greater by a changing climate.

It is clear that Manitoba cannot go backward and restore Lake Winnipeg and the Nelson River to their natural state. In a province that relies on water to generate more than 90 per cent of its electricity, the ability to regulate flows on the Nelson River to generate power at the time of peak demand is essential. But if we cannot return to a system that follows a fully natural water regime, we must, to the best of our ability, protect and enhance what remains, whether that means finding ways to protect spawning conditions for fish or to restore the many ecologically rich wetlands. And we must find ways to protect communities and people who live near or enjoy the use of these waterways. In responding to these challenges, Manitoba must apply the principles of sustainable development, which call for a balancing of economic, social and environmental priorities. Recent actions by the Manitoba government are encouraging in that they take a holistic approach to water and environmental management. Actions elsewhere in the Lake Winnipeg watershed – beyond Manitoba’s borders – also indicate that a positive, watershed-focused approach is being used.

In the past 40 years, LWR and the other hydroelectric developments on the Nelson River have made a great contribution to Manitoba’s economy. This contribution, however, has resulted in sacrifices by those who live downstream of Lake Winnipeg. This application for a final licence of these works marks the start of a new era in which there must be a better balance of interests. Manitoba Hydro has recognized this, in its statements during these hearings, and is a

willing partner in developing a new way of doing business that keeps the “big picture” of a healthy watershed in mind.

In the terms of reference for these hearings, the commission was asked to comment on the public policy goals of LWR. LWR was originally licensed to reduce Lake Winnipeg flooding, provide a reliable source of water to generate power and prevent the need for a high-level Churchill River Diversion. It has met those goals. The next challenge is to determine if operation of LWR – and other Manitoba Hydro facilities – can support other environmental and social needs. This report has provided a road map for relicensing – requested by Manitoba Hydro during the hearings. It is the commission’s hope that Manitoba Hydro and stakeholders can, together, use this roadmap to reach a destination that is environmentally, socially and economically healthy for all.



# Chapter Eleven

## Recommendations

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### The Commission recommends that:

<p>2.1 <i>The Government of Manitoba, in co-operation with other jurisdictions in the watershed, set specific management goals and policy objectives for Lake Winnipeg, against which projects within the watershed can be assessed.</i></p> <p>2.2 <i>The Government of Manitoba undertake an environmental assessment of key operations within the Manitoba portion of the Lake Winnipeg watershed, such as the Shellmouth Dam and the Assiniboine River Diversion at Portage La Prairie, to better understand their impact on the watershed and ensure that ecological as well as social and economic impacts are fully considered.</i></p> <p>7.1 <i>Manitoba Hydro extend its modelling of Lake Winnipeg levels back to 1914 to indicate how Lake Winnipeg Regulation would have influenced lake levels throughout the entire period of record.</i></p> <p>7.2 <i>The Government of Manitoba, in co-operation with Manitoba Hydro, as a basis for development and planning decisions, undertake erosion studies in highly vulnerable and developed areas in the south basin to determine the rate of erosion, the cause of erosion, and mitigation measures.</i></p>	<p>7.3 <i>The Government of Manitoba re-examine the 722 feet asl limit on the Lake Winnipeg hydro reserve to determine if it is still effective in protecting property and activities on Crown land around Lake Winnipeg or if and where a new line should be implemented.</i></p> <p>7.4 <i>Manitoba Hydro undertake a study to determine where erosion is occurring along the upper Nelson River and at what rate since implementation of Lake Winnipeg Regulation. Through the use of aerial photographs and in-stream measurements of the shoreline made before and after construction, Manitoba Hydro prepare a map identifying eroded sections and vulnerable areas.</i></p> <p>7.5 <i>Manitoba Hydro closely examine erosion in the constructed channels and determine the overall change that is occurring. If this erosion is found to be causing negative effects, Manitoba Hydro should undertake erosion-control measures.</i></p> <p>7.6 <i>Manitoba Hydro determine if the current methods of erosion control are effective and acceptable to local residents and resource users in the long term and if these methods are working, delaying shoreline losses or deflecting them to another area of shoreline.</i></p> <p>7.7 <i>Manitoba Hydro research and implement more ecologically friendly methods of erosion control wherever feasible.</i></p>
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<p>7.8 Manitoba Hydro examine all former construction areas, locate any former dump sites, determine their contents and take appropriate action to prevent contamination of water and soil and visual impact on the landscape.</p> <p>7.9 Manitoba Hydro, in co-operation with resource users, seek out and collect ATK, local knowledge and documented information on pre-Lake Winnipeg Regulation distribution of fish species, their spawning areas and movement patterns in Cross Lake, the Outlet Lakes, Sipiwek Lake and in the adjacent connected lakes.</p> <p>7.10 Manitoba Hydro, in co-operation with resource users, evaluate the current status of the identified sites, determine their capabilities to support fish populations and identify and implement alternative methods to rehabilitate or replace these sites.</p> <p>7.11 The Government of Manitoba, in co-operation with other parties, conduct a comprehensive wetland inventory around Lake Winnipeg.</p> <p>7.12 The Government of Manitoba take steps to permanently protect marshes and wetlands around Lake Winnipeg.</p> <p>7.13 Manitoba Hydro, in co-operation with resource users, evaluate the success and/or failure of the Cross Lake Weir in improving water levels and re-establishment of ecological components, particularly whitefish and aquatic furbearers, and reducing impacts on travel.</p> <p>7.14 Manitoba Hydro, working with resource users, determine the pre-Lake Winnipeg Regulation distribution of wetlands, using aerial photos, satellite images and other methods to reconstruct their distribution and compare this to the current distribution.</p>	<p>7.15 Manitoba Hydro seek out possible areas for wetland enhancement, rehabilitation and re-establishment to support ecosystem services and populations of aquatic furbearers, waterfowl and waterbirds.</p> <p>7.16 Manitoba Hydro include wetland and wetland species monitoring in the CAMP program.</p> <p>9.1 The Government of Manitoba evaluate the current licensing regime for hydro projects and ensure that legislation and regulation is consistent with modern legislative, consultation and environmental standards.</p> <p>9.2 The Government of Manitoba require relicensing of hydro projects to be done under The Environment Act, in addition to or in lieu of any other water management legislation.</p> <p>9.3 The Government of Manitoba undertake a review of any licence issued for hydro projects, on specified anniversary dates, to assess the level of compliance and adjust licensing conditions as required.</p> <p>9.4 The Government of Manitoba ensure that incident reporting, compliance reporting and annual reporting schedules are incorporated into any licence and that such reports be made available in a timely manner.</p> <p>10.1 Manitoba Hydro develop and make available for public review operational model(s) for alternative approaches to system management. The models should allow for evaluation of the effects of these strategies on objectives, including, but not limited to, ecological health, social impacts and economic impacts on both Manitoba Hydro and local communities.</p>
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<p>10.2 The Government of Manitoba develop a climate change risk and adaptation planning framework for individuals and communities in the Lake Winnipeg watershed.</p> <p>10.3 Manitoba Hydro develop a climate change risk and adaptation planning framework for its system.</p> <p>10.4 The Government of Manitoba require an environmental assessment of Lake Winnipeg Regulation prior to relicensing.</p> <p>10.5 The Government of Manitoba facilitate the establishment of a Steering Committee, with an independent chair, to undertake an environmental assessment of Lake Winnipeg Regulation effects downstream as described in Section 10.4, Planning for a Future Environmental Assessment for LWR, of this report.</p> <p>10.6 Manitoba Hydro fund and make the Coordinated Aquatic Monitoring Program permanent.</p> <p>10.7 The Government of Manitoba require that the relicensing of all existing hydro projects be done under The Environment Act, with the further requirement for a full environmental assessment, which incorporates ATK.</p> <p>10.8 The Government of Manitoba require that the relicensing of all existing hydro projects be subject to a public review.</p> <p>10.9 The Government of Manitoba, in the relicensing of the existing hydro projects, do so in the geographical groupings noted in Section 10.5, Legacy Project Licensing.</p>	<p>10.10 The Government of Manitoba charge an independent body to review policies, statutes, goals, objectives and outcomes of the various water-related environmental policies and strategies to ensure there is consistency between them and that they meet the desired result of watershed- and/or ecosystem-wide approaches.</p> <p>10.11 Manitoba Hydro provide more and plain language information on their planning processes and how it is incorporated into their decision making, such as drought planning and climate change adaptation.</p> <p>10.12 The Government of Manitoba improve public information on water management by providing more plain language documentation, identify and facilitate the link between departments responsible for water management, explain the planning processes and how they are incorporated into decision making, such as flood and drought planning and adaptation to climate change.</p>
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# Appendix I

## Terms of Reference

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### MINISTER OF CONSERVATION

Legislative Building  
Winnipeg, Manitoba, CANADA  
R3C 0V8

Mr. Terry Sargeant  
Chair,  
Clean Environment Commission  
Room 305 - 155 Carlton Street  
Winnipeg MB R3C 3H8

SEP 01 2011

Dear Mr. Sargeant:

Further to my letter to you dated July 5, 2011, attached are Terms of Reference to scope your review of Manitoba Hydro's request for a final licence under the Water Power Act pertaining to the regulation of Lake Winnipeg.

Pursuant to the *Water Power Regulation*, Manitoba Hydro is entitled to a final licence upon fulfillment and compliance with the terms and conditions of its Interim Licence. The purpose of this review is to provide a public forum to consult with stakeholders regarding Manitoba Hydro's performance under its Interim Licence. This information should then be reviewed by the CEC, with a report to the Ministers of Conservation and Water Stewardship summarizing public comments.

Steve Topping of Manitoba Water Stewardship will be the government technical contact for matters concerning this review. You may contact him directly at 945-7488 with any information requests you may have.

Yours sincerely,

Bill Blaikie  
Minister of Conservation

Enclosure

c. Honourable Christine Melnick  
Steve Topping, Water Stewardship

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## Terms of Reference

### Clean Environment Commission Public Hearing On Manitoba Hydro's Request for a Final Licence under *The Water Power Act*

#### BACKGROUND

Manitoba Hydro has applied to Manitoba Water Stewardship for a “final licence” for the regulation of Lake Winnipeg under *The Water Power Act*. Pursuant to the Water Power Regulation under the Act, Manitoba Hydro is entitled to a final licence upon fulfillment and compliance with the terms and conditions of the Interim Licence and any other terms and conditions that the Minister may impose. A final license would expire on or before August 1, 2026.

The Minister of Water Stewardship made a request to the Minister of Conservation that the Clean Environment Commission be asked to conduct a review of Manitoba Hydro’s application, including a public hearing to allow for the participation of the public in the review.

#### MANDATE OF THE HEARINGS

The Commission shall conduct public hearings, in appropriate locations around the north and south basins of Lake Winnipeg, in the City of Winnipeg and northern Manitoba as determined by the Commission, to hear evidence about the impacts of the regulation of Lake Winnipeg since the project was authorized under an Interim Water Power Act Licence issued on November 18<sup>th</sup>, 1970.

The Commission shall conduct the hearings in general accordance with its *Process Guidelines Respecting Public Hearings* which include procedures for Pre-Hearing Meetings or Conferences and Proprietary Information.

Following the public hearings the Commission shall provide a report to the Minister of Conservation summarizing the public comments received during the hearing.

The Commission may, at any time, request that the Minister of Conservation review or clarify these Terms of Reference.

#### SCOPE OF THE REVIEW

The Commission is asked to review Manitoba Hydro’s request for a final licence under *The Water Power Act*. Pursuant to the *Water Power Regulation*, Manitoba Hydro is entitled to a final licence upon fulfillment and compliance with the terms and conditions of its Interim Licence. The scope of this review is to provide a public forum to consult with stakeholders regarding the performance of Hydro under their Interim Licence. *The Environment Act* does not apply to the Lake Winnipeg Regulation project as it was completed before this legislation came into force. Specifically, the Commission may solicit comments on the following related topics:

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- Review the broader public policy rationale regarding the regulation of lake levels on Lake Winnipeg in effect at the time leading up to the issuance of the Interim Licence in 1970.
- Hear evidence from Manitobans regarding the effects and impacts of Lake Winnipeg regulation since the project was put into commercial use by Manitoba Hydro on August 1, 1976.
- Review the successes and failures of the implementation of those broader public policy goals that led up to the issuance of the Interim Licence and the construction and subsequent operation of the project.
- Summarize and make comment on the concerns raised pertaining to the issuance of a final licence to Manitoba Hydro under *The Water Power Act* including but not limited to future monitoring and research that may be beneficial to the project and Lake Winnipeg.

The Clean Environment Commission's report shall incorporate, consider and directly reflect, where appropriate, the Principles of Sustainable Development and Guidelines for Sustainable Development as contained in *Sustainable Development Strategy for Manitoba*.

August, 2011



# Appendix II

## Lake Winnipeg Regulation Licences

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PROVINCE OF MANITOBA

DEPARTMENT OF MINES AND NATURAL RESOURCES

WATER RESOURCES BRANCH

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### INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES

Lakes Winnipeg, Playgreen, and Kiskittogisu

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

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WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the Legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by letter dated September 22, 1970, signed by David Cass-Beggs, Chairman, and by other documents attached hereto, has filed with the Director of Water Resources at Winnipeg, (hereinafter called "the Director"), an application for a license to regulate the water levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power; and,

WHEREAS Provincial lands as defined in the Water Power Act, R.S.M. 1970, Cap. W70, (hereinafter called "the Act"), are required to be used or occupied by the Licensee in carrying out the undertaking for which this Interim License is granted, the nature of the said undertaking being the construction at or near the outlet of Lake Winnipeg of a diversion channel from Lake Winnipeg to Playgreen Lake; a diversion channel from Playgreen Lake to Kiskittogisu Lake; river channel excavations at the Metchanais Rapids and Ominawin Rapids channels; two gated control structures, across the Metchanais Rapids and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill; and all necessary machinery and equipment required for regulating water levels for the production of electric power for industrial and general purposes, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and,

WHEREAS the Licensee has fully complied with the requirements of the

amendments thereto (hereinafter called "the Regulations"), insofar as it is required for the issue to the Licensee of this Interim License; and,

WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Interim License and has undertaken to observe and fulfill all the terms and conditions which under this Interim License and under the Regulations the Licensee is required to observe or fulfil;

NOW THEREFORE, under authority of and subject to the provisions of the Act and Regulations, this Interim License is issued, granting to the Licensee:

- (a) The right to regulate the levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power, and
- (b) The right to construct, operate and maintain the undertaking, the location and description of which are shown upon the record plans numbered and filed in the office of the Director at Winnipeg, except as the said undertaking may be modified or extended with the approval of the Minister of Mines and Natural Resources (hereinafter called "the Minister"), in accordance with plans previously submitted and approved.

Subject, nevertheless, to the provisions of the Regulations and of any other regulations now or hereinafter in force governing the granting or administering of Provincial lands required in connection with the regulation of water levels for the development of water power, and to the following special terms and conditions, namely:

1. Prior to the construction of any works, plans therefor shall be submitted to the Director for approval, and the Licensee shall not commence construction of any works until the Director has approved the plans therefor.
2. For the purposes of considering plans submitted under Article 1 hereof, the Director may require the Licensee to obtain and submit to him such information, reports, and evidence as the Director deems necessary.
3. Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes and may flood such lands as are designated on a plan identified as No. 39-2-1184, or as such plan may be amended.

and limited from time to time by the Minister provided that, when so requested in writing by the Director, following completion of the works and the commencement of the regulation of water levels, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works and the lands required for flooding purposes only. Such survey shall be limited to include only such areas for the said purposes as the Director may approve and shall be prepared in accordance with Section 24 of the Regulation.

4. The Licensee shall also from time to time in accordance with Section 24 of the Regulations cause surveys to be made and plans prepared by a Manitoba Land Surveyor of all lands required as right-of-way for transmission lines, roads, railways, and other purposes of the undertaking, as the locations thereof become defined, as distinct from those purposes described in Article 3 hereof.
5. Subject to approval of plans of the works under Article 1 hereof, the Licensee may construct the following works:
  - (a) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.
  - (b) River channel excavations at the Metchanais Rapids and Ominawin Rapids channels.
  - (c) Two gated control structures, across the Metchanais and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill.
  - (d) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.
6. The Licensee may regulate water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean sea level, Canadian Geodetic Datum (with wind effect eliminated):
  - (a) Lake Winnipeg - maximum 715.0 and minimum 711.0,
  - (b) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,
  - (c) Kiskittogisu Lake - maximum 714.8 and minimum 706.0, subject, however, to the provisions of Section 72 of the Regulations, which reads as follows:

"72. Every license shall be deemed to have been executed on the express condition that the licensee shall--

(a) Divert, use or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located;

(b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;

(c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."

7. The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.
8. The Licensee shall operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.
9. Subject to Article 8 hereof, and except as may be otherwise authorized by the minister under Section 72 of the Regulation, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.
10. Notwithstanding any other terms or conditions of this Interim License, the Licensee shall, during periods when the water level in Lake

Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures as ordered by the minister under Section 72 of the Regulation.

11. On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the two said control structures for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.
12. Subject to Article 10 hereof, but notwithstanding any other terms or conditions of this Interim License, the Licensee shall operate the two said control structures in such a manner that any increase or decrease in the rate of the combined outflow from Lakes Playgreen and Kiskittogisu during any 24 hour period shall not exceed 15,000 cubic feet per second.
13. During the term of this Interim License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 hereof which are situated within the Severance Line designated on a plan identified as No. 39-2-1183, in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.
14. The plans filed by the Licensee and made a part of this Interim License are as follows:

<u>Manitoba Water Resources Branch File Number</u>	<u>Licensee's File Number</u>	<u>Description</u>
39-2-1180	05 0-D-0303 (Rev.0)	Location general arrangement and cross-sections of development
39-2-1183	--	Map showing severance line specified in license issued to Manitoba Hydro under the Water-Power Act for regulating Lakes Winnipeg, Playgreen and Kiskittogisu
39-2-1184	--	Map showing lands authorized to be flooded under license issued to Manitoba Hydro under the Water Power Act for regulating Lakes Winnipeg, Playgreen, and Kiskittogisu.

15. Upon the satisfactory completion by the Licensee of the undertaking and upon the due observance and fulfillment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the regulation of water levels, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorised. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:
  - (a) The undertaking in respect of which the Final License is to be issued is to comprise:
    - (i) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.
    - (ii) River channel excavations at the Metchanais Rapids and Ominawin Rapids channels.
    - (iii) Two gated control structures, across the Metchanais Rapids and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill.
    - (iv) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.
  - (b) The Licensee may regulate water levels in Lakes Winnipeg, Playgreen and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean seal level, Canadian Geodetic Datum (with wind effect eliminated):
    - (i) Lake Winnipeg - maximum 715.0 and minimum 711.0
    - (ii) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,
    - (iii) Kiskittogisu Lake - maximum 714.8 and minimum 706.0, subject, however, to the provisions of Section 72 of the Regulations which reads as follows:

"72. Every license shall be deemed to have been executed on the express condition that the licensee shall--

      - (a) Divert, use, or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located;
      - (b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;

(c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."

(e) The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.

(d) The Licensee shall operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.

(e) Subject to Article 8 of the Interim License, and except as may be otherwise authorized by the minister under Section 72 of the Regulations, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.

(f) Notwithstanding any other terms or conditions of this Final License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures as ordered by the minister under Section 72 of the Regulations.

(g) On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the two said control structures for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.

(h) Subject to Article 10 of the Interim License, but notwithstanding any other terms or conditions of the Interim License, the Licensee shall operate the two said control structures in such a manner that any increase or decrease in the rate of the combined outflow from Lakes Playgreen and Kiskittogisu during any 24 hour period shall not exceed 15,000 cubic feet per second.

(i) During the term of the Final License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 of the Interim License which are situated within the Severance Line designated on a plan identified as No. 39-2-1183, in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

(j) The term of the Final License shall be fifty (50) years from the date of issuance thereof and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.

(k) The Severance Line as defined in Section 1 of the Regulations shall be shown in red and marked "Severance Line" upon record plan No. 39-2-1183, on file in the office of the Director.

16. All record plans filed with the Director and referred to in this Interim License are incorporated herewith and made a part hereof.

17. This Interim License is issued upon the express condition that it shall be subject to the provisions of the Regulations and all amendments thereto

Issued at Winnipeg this 18th day of November A.D. 1970 at the direction of the Honourable Minister of Mines and Natural Resources.

Minister of Mines and Natural Resources.

PROVINCE OF MANITOBA  
DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT  
WATER RESOURCES BRANCH

SUPPLEMENTARY INTERIM LICENSE FOR THE REGULATION OF  
WATER LEVELS FOR WATER POWER PURPOSES

Lakes Winnipeg, Playgreen, and Kiskittogisu

Issued in accordance with the provisions of  
the Water Power Act, Chapter W70, Revised  
Statutes of Manitoba, 1970, and amendments,  
and of the Regulations in force thereunder  
to govern the mode of granting and adminis-  
tering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of  
the Legislature of the Province of Manitoba, and whose head office address is  
Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by Interim  
License dated November 18, 1970, issued in accordance with the provisions of  
the Water Power Act, R.S.M. 1970, Cap. W70 (hereinafter called "the Act"),  
and the Manitoba Water Power Regulations, being Manitoba Regulation 95/45  
and all amendments thereto (hereinafter called "the Regulations"), was  
granted the right to regulate the water levels of Lakes Winnipeg, Playgreen,  
and Kiskittogisu for the development of water power; to construct, operate and  
maintain the undertaking, the location and description of which are shown on  
record plans filed in the office of the Director General of Water Resources  
(Director of the Water Resources Branch, hereinafter called "the Director")  
in Winnipeg; and to occupy certain lands of the Province required for these  
purposes; and,

WHEREAS the development authorized to be maintained by the Licensee  
by the said Interim License includes the construction at or near the outlet  
of Lake Winnipeg of a diversion channel from Lake Winnipeg to Playgreen Lake;  
a diversion channel from Playgreen Lake to Kiskittogisu Lake; river channel  
excavations at the Metchanais Rapids and Ominawin Rapids channels; two gated  
control structures, across the Metchanais Rapids and Ominawin Rapids channels,  
each being of reinforced concrete with two adjacent dams of rock fill; and  
all necessary machinery and equipment required for regulating water levels for  
the production of electric power for industrial and general purposes, as shown  
or described more particularly by means of the record plans and data filed  
with the Director, as specified hereinafter; and,

WHEREAS the Licensee is desirous of relinquishing the right to construct certain of the works authorized under the said Interim License including river channel excavations and control structures at Metchanais and Ominawin Rapids, and of acquiring instead the right to construct alternative works including a control structure at a site known as Jenpeg, a river channel excavation at Kisipachewuk Rapids, a by-pass channel at Ominawin Rapids, a dam and dykes at the natural outlet of Kiskitto Lake, a diversion channel from Stan Creek to Kiskitto Lake, and a diversion channel from Kiskitto Lake to the Minago River drainage basin with control structure; and

WHEREAS Section 39 of the Regulations reads as follows:

"39. Subject to these regulations the terms of any interim license may be amended by a supplementary license entered into between the Minister and the interim licensee; and plans and specifications previously approved may be amended with the consent in writing of the Minister, but any such amendment shall affect only the portion specifically covered in such supplementary license or writing, and shall in no case operate to alter or amend or in any way whatsoever be a waiver of any other part, condition or provision of the original interim license." and,

WHEREAS the Licensee by letter dated January 20, 1972, signed by J.F. Funnell, General Counsel and Secretary, has filed with the Director an application for a supplementary interim license to amend the said Interim License; and,

WHEREAS the Licensee has fully complied with the requirements of the Regulations insofar as it is required for the issue to the Licensee of this Supplementary Interim License amending the said Interim License; and,

WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Supplementary Interim License amending the said Interim License and has undertaken to observe and fulfil all the terms and conditions which under this Supplementary Interim License and under the Regulations the Licensee is required to observe or fulfil; and,

WHEREAS it is deemed expedient and advisable to issue a Supplementary Interim License amending the Interim License dated November 18, 1970;

NOW THEREFORE, under authority of and subject to the provisions of the Act and the Regulations, this Supplementary Interim License is issued amending the said Interim License dated November 18, 1970 by deleting Articles 3, 5, 7, 8, 10, 11, 12, 13, 14, and 15 thereof, and substituting new Articles 3, 5, 7, 8, 10, 11, 12, 12A, 13, 14, and 15 therefor, as follows:

3. Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes and may flood such lands as are designated on a plan identified as No. 39-2-1184 (Rev. 1), or as such plan may be amended and limited from time to time by the Minister provided that, when so requested in writing by the Director, following completion of the works and the commencement of the regulation of water levels, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works and the lands required for flooding purposes only. Such survey shall be limited to include only such areas for the said purposes as the Director may approve and shall be prepared in accordance with Section 24 of the Regulations.
5. Subject to approval of plans of the works under Article 1 hereof, the Licensee may construct the following works:
  - (a) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskitogisu Lake.
  - (b) River channel excavation at the Kisipachewuk Rapids channel.
  - (c) A reinforced concrete control structure at a site known as Jenpeg on the west channel of the Nelson River with adjacent reinforced concrete headblock with gated openings forming part of the control works (which may be later utilized for a future generating station if so licensed under the Act), also with rockfill abutment and channel closure dams, and earthfill saddle closure dams.
  - (d) A by-pass channel at Ominawin Rapids.

- (e) Intermittent earthfill dykes along the west side of Kiskittogisu Lake and the Kisipachewuk Rapids channel, and across the Kiskitto Lake outlet.
- (f) A diversion channel from Stan Creek to Kiskitto Lake.
- (g) A diversion channel from Kiskitto Lake to a tributary of the Minago River, with a small overflow weir or stop log control structure.
- (h) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

7. The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.
8. The Licensee shall operate the said control structure at Jenpeg in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.
10. Notwithstanding any other terms or conditions of this Interim License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg as ordered by the Minister under Section 72 of the Regulations.
11. On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the said control structure at Jenpeg for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.
12. Subject to Article 10 hereof, but notwithstanding any other terms or conditions of this Interim License, the Licensee shall operate the said control structure at Jenpeg in such a manner that any increase or decrease in the rate of the discharge therefrom during any 24 hour period shall not exceed 15,000 cubic feet per second.

12A. The Licensee shall operate the said control structure on the Kiskitto-Minago diversion channel in such a manner as to regulate water levels in Kiskitto Lake within natural ranges subject to the orders of the Director.

13. During the term of this Interim License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 hereof which are situated within the Severance Line designated on a plan identified as No. 39-2-1183 (Rev. 1), in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

14. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
39-3-1018	0510-D-9172 (Rev. 1)	Location general arrangement and cross-sections of development
39-2-1183 (Rev. 1)	—	Map showing severance line specified in license issued to Manitoba Hydro under the Water-Power Act for regulating Lakes Winnipeg, Playgreen and Kiskittogisu
39-2-1184 (Rev. 1)	—	Map showing lands of the Province authorized to be flooded under license issued to Manitoba Hydro under the Water Power Act for regulating Lakes Winnipeg, Playgreen, and Kiskittogisu.

15. Upon the satisfactory completion by the Licensee of the undertaking and upon the due observance and fulfillment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the regulation of water levels, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorized. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:

(a) The undertaking in respect of which the Final License is to be issued is to comprise:

- (i) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.
- (ii) River channel excavation at the Kisipachewuk Rapids channel.
- (iii) A reinforced concrete control structure at a site known as Jenpeg on the west channel of the Nelson River with adjacent reinforced concrete headblock with gated openings forming part of the control works (which may be later utilized for a future generating station if so licensed under the Act), also with rockfill abutment and channel closure dams, and earthfill saddle closure dams.
- (iv) A by-pass channel at Ominawin Rapids.
- (v) Intermittent earthfill dykes along the west side of Kiskittogisu Lake and the Kisipachewuk Rapids channel, and across the Kiskitto Lake outlet.
- (vi) A diversion channel from Stan Creek to Kiskitto Lake.
- (vii) A diversion channel from Kiskitto Lake to a tributary of the Minago River, with a small overflow weir or stop log control structure.
- (viii) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

(b) The Licensee may regulate water levels in Lakes Winnipeg, Playgreen and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean sea level, Canadian Geodetic Datum (with wind effect eliminated):

- (i) Lake Winnipeg - maximum 715.0 and minimum 711.0,
- (ii) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,
- (iii) Kiskittogisu Lake - maximum 714.8 and minimum 706.0, subject, however, to the provisions of Section 72 of the Regulations which reads as follows:

"72. Every license shall be deemed to have been executed on the express condition that the licensee shall--

- (a) Divert, use, or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located;
- (b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;
- (c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."
- (c) The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.
- (d) The Licensee shall operate the said control structure at Jenpeg in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.
- (e) Subject to Article 8 of the Interim License, and except as may be otherwise authorized by the Minister under Section 72 of the Regulations, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.

- (f) Notwithstanding any other terms or conditions of this Final License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg as ordered by the Minister under Section 72 of the Regulations.
- (g) On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the said control structure at Jenpeg for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.
- (h) Subject to Article 10 of the Interim License, but notwithstanding any other terms or conditions of the Interim License, the Licensee shall operate the said control structure at Jenpeg in such a manner that any increase or decrease in the rate of the discharge therefrom during any 24 hour period shall not exceed 15,000 cubic feet per second.
- (i) The licensee shall operate the said control structure on the Kiskitto-Minago diversion channel in such a manner as to regulate water levels in Kiskitto Lake within natural ranges subject to the orders of the Director.
- (j) During the term of the Final License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 of the Interim License which are situated within the Severance Line designated on a plan identified as No. 39-2-1183 (Rev. 1), in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.
- (k) The term of the Final License shall be fifty (50) years from the date of issuance thereof and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.
- (l) The Severance Line as defined in Section 1 of the Regulations shall be shown in red and marked "Severance Line" upon record plan No. 39-2-1183 (Rev. 1), on file in the office of the Director.

All other terms of the said Interim License shall otherwise remain unaltered.

Issued at Winnipeg this 9th day of August A.D. 1972  
at the direction of the Honourable Minister of Mines, Resources  
and Environmental Management.

MINISTER OF MINES, RESOURCES AND ENVIRONMENTAL  
MANAGEMENT.



## Appendix III

# Hearing Participants

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Presenter	Affiliation
Abraham, Frank	Chief, Black River First Nation
Abraham, Joseph	Private, Sagkeeng First Nation
Abraham, Myrtle	Black River First Nation
Adamson, Tim	Private
Adkins, Bob	Manitoba Hydro
Anders, Reanna	Private, Berens River First Nation
Anderson, Alfred	Minister, Manitoba Métis Federation
Anderson, Roxann	Private
Apetagon, Eileen	Elder, Norway House Cree Nation
Apetagon, Leslie	Norway House Fisherman's Cooperative/Elder, Norway House Cree Nation
Arnason, Cameron	Private
Arnason, Joan	Private
Arnason, Judy	Private
Bailey, Ross	Private
Ballard, Myrle	Keewatinook Fishers of Lake Winnipeg
Baptiste, Kash	Private, Berens River First Nation
Batenchuk, Karen	Private, Berens River First Nation
Bayer, Loretta	Councillor, Norway House Cree Nation
Bear, Jim	Chief, Brokenhead Ojibway Nation
Beardy, George	York Factory First Nation
Beardy, Georgina	Private, York Factory First Nation
Beardy, Jim	Private, York Factory First Nation
Beardy, Philip	Private, Pimicikamak Okimawin
Becker, Walter	Private
Beckwith, Paul	Manitoba Wildlands
Bedford, Doug	Manitoba Hydro
Benson, Chris	Private
Bird, David	Private, Black River First Nation
Bird, Paula	Private, Black River First Nation
Bird, Warren	Private, Black River First Nation

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Bland, Ted	Chief, York Factory First Nation
Bluesky, Gord	Brokenhead Ojibway Nation
Boulange, Avery	Private, Berens River First Nation
Braun, Will	Interchurch Council on Hydropower Inc.
Bristow, Clayton	Private
Brown, Eva	Private
Brownlie, Robin Jarvis	Keewatin Public Interest Research Group
Brunen, Valeri	Private, Norway House
Bruyere, Nancy	Private, Anglican Church
Bunn, Ruben	Sagkeeng First Nation
Burch, Val	Private
Campbell, Norman	Private, Manitoba Métis Federation
Campbell, Norman Sr.	Private
Captain, Brian Jr.	Private, Norway House Cree Nation
Cariou, Warren	Keewatin Public Interest Research Group
Chartrand, David	President, Manitoba Métis Federation
Chief, Paul	Brokenhead Ojibway Nation
Chief-Abigosis, Delores	Brokenhead Ojibway Nation
Chornoboy, Jim	Private, Manitoba Métis Federation
Cizek, Petr	Peguis First Nation
Clark, Chris	Private, Norway House Cree Nation
Clarke, Shandy	Black River First Nation
Cochrane, Carl	Private, Fisher River First Nation
Cochrane, Jess	Private, Peguis First Nation
Constant, Leroy	York Factory First Nation
Cook, Alfie	Keewatinook Fishers of Lake Winnipeg
Cook, Alice	Private, Misipawistik Cree Nation
Cook, Dwayne	Private, Misipawistik Cree Nation
Cook, Heidi	Misipawistik Cree Nation
Cook, Jason	Private
Cook, Ted	Private, Misipawistik Cree Nation
Cormie, David	Manitoba Hydro
Courchene, Allen	Private, Sagkeeng First Nation
Courchene, Genaile	Private, Sagkeeng First Nation
Courchene, Karen	Private, Peguis First Nation
Courchene, Mark	Private, Sagkeeng First Nation
Crate, Dorothy	Private, Fisher River First Nation
Daniels, Joe	Sagkeeng First Nation
Daniels, Joseph	Sagkeeng First Nation
Denecheze, Ovide	Private, Berens River First Nation
Desautels, Maurice	Winnipeg River Property Owners Group
Desrosiers, Jean	Minister, Manitoba Métis Federation
Disbrowe, Gerald	Private
Disbrowe, Valerie	Keewatinook Fishers of Lake Winnipeg/Berens River First Nation
Dixon, James	Private, Norway House Cree Nation

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Dorie, Kaylene	Private, Sagkeeng First Nation Duffney, Sherry
Duplassie, Ryan	Black River First Nation
Einarsson, Dale	Private/Black River First Nation
	President, Dauphin River Commercial Fishers Association
Einarsson, Helgi	Mayor, Dauphin River
Ellis, Brian	Winnipeg Condo Corporation No. 323
Enright, Angela	Winnipeg River Property Owners Group
Ettawacappo, Charles	Private, Norway House Cree Nation
Evans, Ron	Chief, Norway House Cree Nation
Everett, Jackie	Chief, Berens River First Nation
Everett, Mika	Private, Berens River First Nation
Everett, Nicholas	Private, Berens River First Nation
Farrell, Tom	Private
Ferland, William	Private, Misipawistik Cree Nation
Flett, Isaiah	Private, Berens River First Nation
Flett, Olga	Private, Berens River First Nation
Flett, Lloyd	Private, Manitoba Métis Federation
Fleury, Annette	Private, Misipawistik Cree Nation
Folster, Samantha	Councillor, Norway House Cree Nation
Fredette, Gilbert	Deputy Chief, Norway House Cree Nation
Fyke, Garry	Private, Manitoba Métis Federation
Garrett, Mervin	Pimicikamak Okimawin
Gawne, Kevin	Manitoba Hydro
Gerrard, Jon	MLA River Heights
Gerrard, Nelson	Private
Goldsborough, Gordon	Clean Environment Commission
Goodon, Will	Minister, Manitoba Métis Federation
Gorchynski, Julian	Board of Directors, Grand Beach and Area Development Corporation; Private
Gould, Derrick	Interlake Reserves Tribal Council/Keewatinook Fishers of Lake Winnipeg
Grant, David	Private
Greenwood, Ron	Private
Grieve, Linda	Grand Beach and Area Development Corporation; Private
Halcrow, Daniel	Private, Pimicikamak Okimawin
Halcrow, Dion	Private, Pimicikamak Okimawin
Halcrow, Nick	Elder, Pimicikamak Okimawin
Halcrow, Rosalie	Cross Lake Community Council
Hall, Marilyn	Private, Misipawistik Cree Nation
Hamilton, George	Private, Pimicikamak Okimawin
Hamilton, Helga	Pimicikamak Okimawin

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Hapel, Joanne	Private
Henderson, Derek	Chief, Sagkeeng First Nation
Hocakuk, Allen	Private, Brokenhead Ojibway Nation
Hodgson, Brian	RM of Victoria Beach
Hood, Jasmine	Private, Berens River First Nation
Hope, Devorie	Private, Sagkeeng First Nation
Hudson, Glenn	Chief, Peguis First Nation
Hunt, Laurie	R.M. of St. Andrews
Hutchison, Dale	Manitoba Hydro
Jacobson, Patsy	Private, Misipawistik Cree Nation
Jones Scott, Roy	Pimicikamak Okimawin
Keating, Sean	Tataskweyak Cree Nation
Keeper, Brian	Tataskweyak Cree Nation
Kennedy Courcelles, Cheryl	Private
Kent, April	Black River First Nation
Kent, Ralph	Brokenhead Ojibway Nation
Kent, Sage	Private, Sagkeeng First Nation
Kristinansson, Karen	Private
Kulchyski, Peter	Black River First Nation
Lagimodiere, Julyda	Vice President, Manitoba Métis Federation
Langhan, Jasmine	Manitoba Métis Federation
Lee, Alfred	Private
Legitt, Linda	Berens River Fishing Association
Lenton, Keith	Norway House Fisherman's Cooperative
Levin, Harvey	Private
Lowry, Gordon	Private
Luttermann, Annette	Pimicikamak Okimawin
MacFadgen, Roseann	Cross Lake Community Council
Mannigway, Anna	Private, Peguis First Nation
Mason, Mike	Victoria Beach Cottage Owners Association
Mason, Ray	Private, Peguis First Nation
Matechuk, Brent	Private
Mattern, David	Private
Mayor, Janet	Manitoba Hydro
McCullough, Gregory	Clean Environment Commission
McKay, Dalton	Private, Pimicikamak Okimawin
McKay, Dion	Councillor, Fisher River First Nation
McKay, Don	Pimicikamak Okimawin
McKay, George	Private, Pimicikamak Okimawin
McKay, Leslie	Private, Fisher River First Nation
McKay, Malcolm	Private, Pimicikamak Okimawin
McKay, Morris	Private, Pimicikamak Okimawin
McKay, Norman	Councillor, Berens River First Nation
McKay, Steve	Private, Fisher River First Nation
McKay, Tyrone	Private, Berens River First Nation
McLeod, Cameron	Cross Lake Community Council

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McLeod, Charlie	Private
McMahon, George	Clean Environment Commission
McMillan, Linda	R.M. Of Victoria Beach
McMorris, Penny	Private
McPherson, Ernest	Black River First Nation
Meade, Reg	Mayor, Wabowden/President, Northern Association of Community Councils
Meagher, Jerry	Private
Meikle, Gertrude	Norway House Community Council
Merrick, Cathy	Chief, Pimicikamak Okimawin
Mitchell, Patricia	Black River First Nation
Monias, Tommy	Private, Pimicikamak Okimawin
Monkman, Bob	Private
Monkman, David	Private
Monkman, Gordon	Private
Monkman, Michael	Private
Monkman, William	Private
Moore, George	Private, Pimicikamak Okimawin
Morriseau, Brenda	Private, Sagkeeng First Nation
Morriseau, Lyle	Councillor, Sagkeeng First Nation
Morrison, Bruce	Private
Morrison, Winona	Private, Peguis First Nation
Mowatt, Danny	Private, Norway House
Mowatt, Kenny	Private
Mowatt, Laura	Private, Norway House
Mowatt, Loretta	Norway House Cree Nation
Muswaggon, David	Councillor, Pimicikamak Okimawin
Muswaggon, Mike	Private, Norway House Cree Nation
Muswagon, Allan	Private, Pimicikamak Okimawin
Muswagon, Kerry	Mikisew School, Cross Lake
Muswagon, William	Private, Pimicikamak Okimawin
Nasecapow, Barbara	Private, Misipawistik Cree Nation
Nelson, Baldur	Private
Nicole	Private, Sagkeeng First Nation
Olson, Eric	Private
O'Neil, Maureen	Private
Osborne, Jackson	Private, Pimicikamak Okimawin
Osborne, William	Elder, Pimicikamak Okimawin
Ouskin, Roddy	Private, York Factory First Nation
Pakneciniw, Kukitew	Private, Peguis First Nation
Palson, Thora	Councillor, R.M. Of Gimli
Parenteau, Mark	Minister, Manitoba Métis Federation
Parisian, Cheyenne	Private, Peguis First Nation
Parisian, Mekhi	Private, Peguis First Nation
Parisian, Peter	Private, Peguis First Nation
Park, Jack	Minister, Manitoba Métis Federation

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Pastora Sala, Jöelle	Consumers' Association of Canada
Paul, Sasha	Manitoba Hydro
Paupanakis, Darwin	Private, Pimicikamak Okimawin
Porteous, Ken	Private
Raining Bird, Jeremiah	Pimicikamak Okimawin
Rait, Eugene	Private, Peguis First Nation
Redhead, Nellie	Private, York Factory First Nation
Redhead, Wayne	Private, York Factory First Nation
Riel, Marci	Manitoba Métis Federation
Robinson, Bernalda	Private, Sagkeeng First Nation
Robinson, Margaret	Pimicikamak Okimawin
Ross, Albert	Keewatinook Fishers of Lake Winnipeg
Ross, Daniel	Pimicikamak Okimawin
Ross, Flora	Cross Lake Women's Council
Ross, Happy Jack	Private, Pimicikamak Okimawin
Ross, Roger	Private, Pimicikamak Okimawin
Saunders, Donna	Private, York Factory First Nation
Saunders, Doreen	Private, York Factory First Nation
Saunders, Langford	President, Norway House Fisherman's Cooperative
Selkirk, Bernard	Private
Settee, Connie	Cross Lake Community Council
Settee, Darel	Pimicikamak Okimawin
Settee, Keith	Cross Lake Community Council
Shefman, Corey	Interlake Reserves Tribal Council
Shepard, Neil	Private
Sinclair, Nigaan	Peguis First Nation
Sinclair, Walter Jr.	Private, Fisher River First Nation
Sinclair, Walter Sr.	Private, Fisher River First Nation
Smith, Bev	Private, Brokenhead Ojibway Nation
Smith, Carl	Private, Brokenhead Ojibway Nation
Smith, Happy	Private, Brokenhead Ojibway Nation
Smith, Marlene	Private, Brokenhead Ojibway Nation
Speiss, Cristo	Mayor, Norway House Community Council
Spence, Albertine	Private
Spence, Gary	Private, Peguis First Nation
Spence, Gary	Private, Peguis First Nation
Spence, John	Private, Pimicikamak Okimawin
Spence, Martha	Elder, Tataskweyak Cree Nation
Spence, Victor	Tataskweyak Cree Nation
Spence, Virginia	Private, Sagkeeng First Nation
Starr, Mabel	Black River First Nation
Starr, Sweetpea	Private, Brokenhead Ojibway Nation
Stevenson, Earl	Private, Peguis First Nation
Stevenson, Lloyd	Peguis First Nation
Stewart, Cam	Private, Manitoba Métis Federation

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Stewart, Christine	Private
Stinson, Jim	Private
Sutherland, Kiefer	Private, Peguis First Nation
Sutherland, Maurice	Private, Peguis First Nation
Sutherland, Mike	Councillor, Peguis First Nation
Swampy, Sara	Elder, Sagkeeng First Nation
Swanson, Danny	Norway House Community Council
Swanson, Gary	Manitoba Hydro
Sweeney, Mark	Manitoba Hydro
Thaddeus, Darrell	Private, Fisher River First Nation
Thomas, Glen	Private
Thompson, Cheryl	Peguis First Nation
Thompson, Roy	Private, Peguis First Nation
Thompson, Ryan	Private
Thorleifson, Harvey	Clean Environment Commission
Traverse, Henry	Interlake Reserves Tribal Council/Keewatinook Fishers of Lake Winnipeg
Valentine, David	Private, Misipawistik Cree Nation
Vandal, Valerie	Private, Black River First Nation
Venema, Henry	International Institute for Sustainable Development
Walker, Dennis	Private
Walker, Gertrude	Private, Peguis First Nation
Walker, Maureen	Private
Warms, Jamon	Private, Berens River First Nation
Weremy, Andy	Private
Whelan Enns, Gaile	Manitoba Wildlands
Whelan, Jared	Sagkeeng First Nation
Whiteway, Roland	Councillor, Berens River First Nation
Williams, Byron	Consumers' Association of Canada
Williams, Nancy	Private, York Factory First Nation
Young, Donald	Private
Young, Margaret	Private
Zuzek, Peter	Clean Environment Commission

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## Written Submissions

Willow Island Property Owners Association  
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Frederik Veldink, Silver Harbour Property Owners Association  
Jennifer Enghrecht  
Ray Bodnaruk  
Treaty 2 Territorial Alliance  
Winnipeg River Property Owners  
Hollow Water First Nation

## Appendix IV

# Acronyms

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asl	above sea level
ATK	Aboriginal Traditional Knowledge
CAC	Consumers' Association of Canada (Manitoba Inc.)
CAMP	Coordinated Ecological Monitoring Program
cfs	cubic feet per second
CRD	Churchill River Diversion
CPUE	catch per unit effort
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
IISD	International Institute for Sustainable Development
IJC	International Joint Commission
IRTC	Interlake Reserves Tribal Council
JKDA	Joint Keeyask Development Agreement
km	kilometers
LWR	Lake Winnipeg Regulation
MW	Megawatt
NFA	Northern Flood Agreement
NFC	Northern Flood Committee
RCEA	Regional Cumulative Effects Assessment
RRBC	Red River Basin Commission
TSS	Total Suspended Solids
WSA	Water Security Agency (Saskatchewan)



# **Appendix V**

## **Sources of Information Regarding the Lake Winnipeg Watershed**

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Centre for Indigenous Environmental Resources. <http://www.yourcier.org/first-nations-gathering-for-lake-winnipeg.html>

Lake Friendly. <http://www.lakefriendly.ca/>

Lake Winnipeg Action Plan. [https://www.gov.mb.ca/waterstewardship/water\\_quality/lake\\_winnipeg/action\\_plan.html](https://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/action_plan.html)

Lake Winnipeg Basin Initiative. <https://www.ec.gc.ca/eau-water/default.asp?lang=En&n=4E8DF48A-1>

Lake Winnipeg Foundation. <http://www.lakewinnipegfoundation.org/>

Lake Winnipeg Indigenous Collective. <http://www.yourcier.org/first-nations-gathering-for-lake-winnipeg.html>

Lake Winnipeg Research Consortium. <http://www.lakewinnipegresearch.org/>

Lake Winnipeg Stewardship Board. [https://www.gov.mb.ca/waterstewardship/water\\_quality/lake\\_winnipeg/interim\\_rpt.html](https://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/interim_rpt.html)

Manitoba Conservation Districts Association. <http://www.mcda.ca/>

Saskatchewan Water Security Agency. <https://www.wsask.ca/>

Water Innovation Centre (International Institute for Sustainable Development). <http://www.iisd.org/wic/>