LAKE MANITOBA
LAKE ST. MARTIN

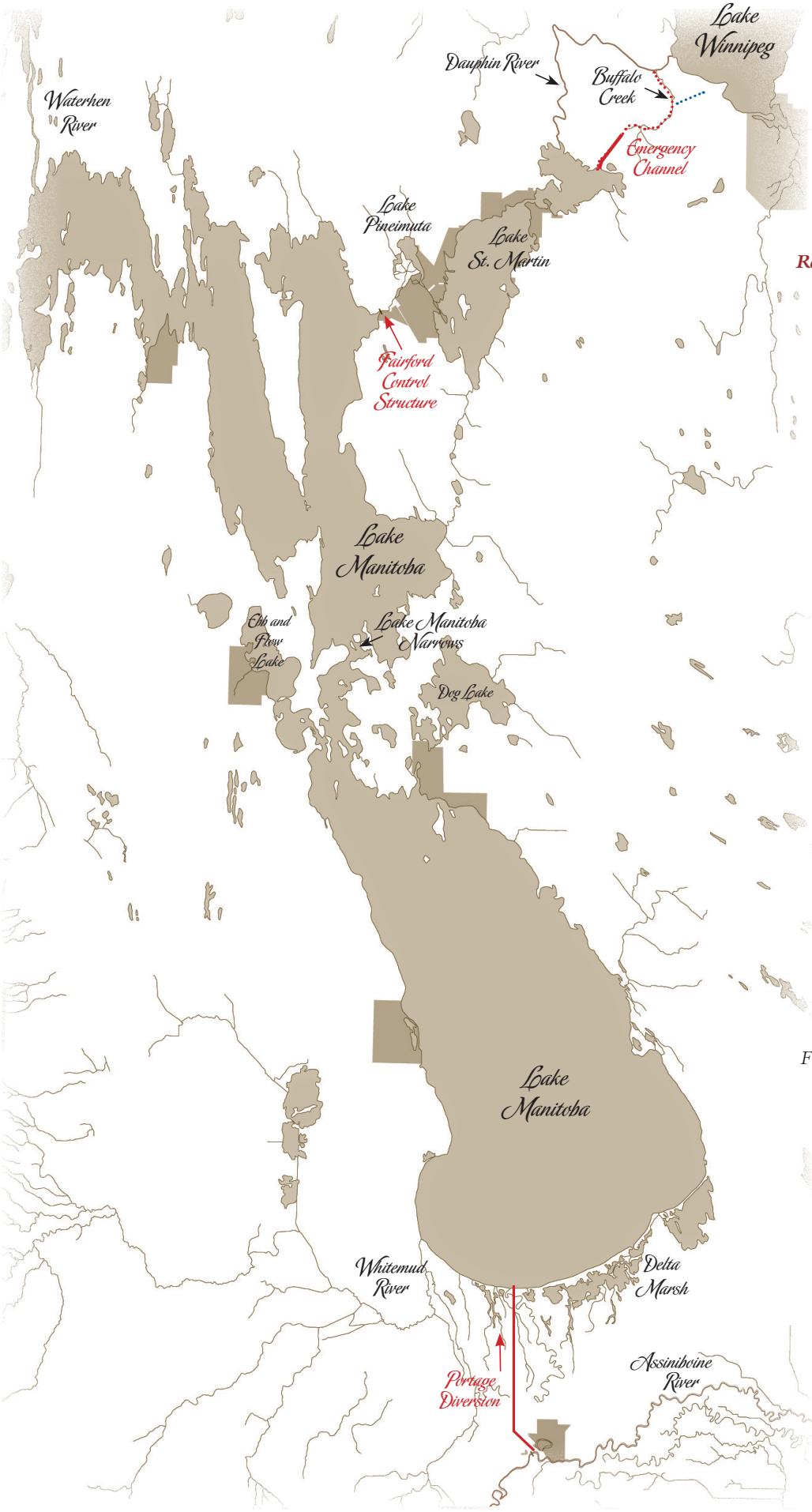
REGULATION REVIEW

Finding the Right Balance:

A Report to the Minister of Infrastructure and Transportation

Volume 1: Main Report

February 2013



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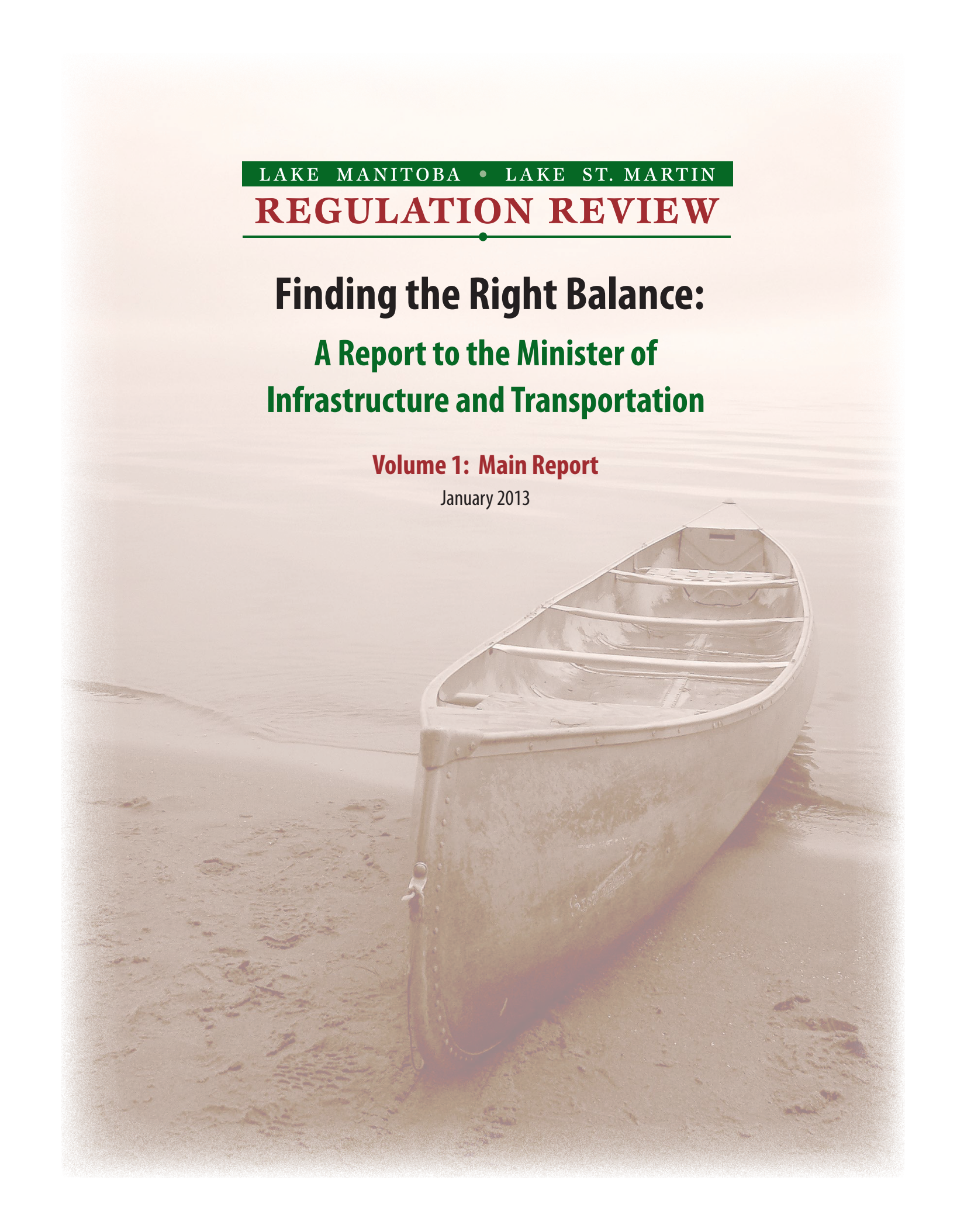


Table of Contents

Appendices

List of Figures

1 • Introduction

2011 saw a flood without precedent. In the fall of 2010, forecasters were concerned about the potential for flooding. The fall was wet and western Manitoba went into freeze-up with high levels of soil moisture. A record storm in October added to wet conditions. A heavy snowpack, twice the average, covered the upper reaches of the Assiniboine River watershed. This was followed by spring precipitation two to three times the norm. Every watershed in southern Manitoba was at flood stage. The resulting crisis mobilized a huge workforce of volunteers, contractors and the army.

Thousands of acres of farmland went underwater and went unseeded throughout the southern part of the province. The most significant flood damage, however, was in the vicinity of Lake Manitoba and Lake St. Martin. While a few homes in western Manitoba were lost to the rising water, in the vicinity of Lake Manitoba and Lake St. Martin, hundreds of people lost their homes and cottages, lost their business, lost income, suffered long-term damage to their farms, and were, or continue to be, displaced. It was rather remarkable that, given all these adverse and dangerous conditions, there was not a single loss of life and not one person went overnight without food or shelter.

The post flood response of the Province to the 2011 flood has been a number of initiatives:

- The 2011 Flood Review Task Force, which is evaluating flood management on a province-wide basis;
- development of a surface water management strategy;
- a number of technical studies; and
- this work, the Lake Manitoba/ Lake St. Martin Regulation Review, which is considering issues with respect to Lake Manitoba and Lake St. Martin.

While the people on the shores of Lake Manitoba, Lake St. Martin and Dauphin River were all subject to the same flood waters, there are divergent experiences and interests in this region defined in part by the hydraulic relationship between these bodies of water. Lake Manitoba is a large lake compared with Lake St. Martin. Small changes to water levels on Lake Manitoba can result in much larger changes downstream on Lake St. Martin and the Dauphin River. Finding a water management approach acceptable to all locations and interests will involve concessions by most parties and likely deference to downstream locations.

People who reside around Lake Manitoba have a very clear idea of what they would like to see in terms of lake levels and control structures. In particular, there is a strong demand for an additional outlet to deal with inflows from the Portage Diversion. The people on Lake St. Martin, however, have had an unfortunate and much longer history of flooding, being on the receiving end of altered flows from Lake Manitoba since the Fairford River Water Control Structure began operating in 1961. The flood of 2011 compounded an already bad situation.

The Fairford River Water Control Structure, which regulates outflows from Lake Manitoba, was built principally for the benefit of Lake Manitoba. Over the last few years, excluding the flood of 2011, Lake Manitoba would have been 1.5 to 2 feet higher on several occasions and would have flooded extensive areas were it not for the control structure. The structure, however, has often resulted in adverse conditions on Lake St. Martin, alternately causing flooding and occasionally very trying low water conditions.

The futures of the people of Lake Manitoba and Lake St. Martin are now tied more closely together. Not just by their common interest in water but by the current reality that any solution for Lake Manitoba effectively and practically requires the agreement of people downstream.

The 2011 flood also raises the issue as to whether it is practical to try to protect everyone from all flooding at any time. Is there common ground between the potential for another major flood on the scale of 2011 and economic and environmental constraints? It is a challenge for all Manitobans to consider and of particular relevance for those who live and make a living near Lake Manitoba and Lake St. Martin.

One early response specific to the Lake Manitoba flood has been revised (interim) development guidelines from the Province that recommend higher minimum building elevations. The implications of the interim new development guidelines on land use have concerned municipal governments who see new land use policies as potential constraints on development and involving an uncomfortable and uncertain period of adjustment. Land use policies themselves, however, are tied to what the water regime might be in the future.

To achieve practical solutions for Lake Manitoba, the Committee is of the opinion that it is first necessary to address and resolve issues on Lake St. Martin. Only when satisfactory solutions are found for Lake St. Martin will it be possible to consider additional works for Lake Manitoba.

In this report, the Committee makes recommendations on the range of regulation for each of the lakes, the need for a new outlet from Lake Manitoba and Lake St. Martin, and recommendations with respect to land use planning and zoning. While there are many divergent interests, we conclude that there is, in fact, a common interest to finding practical solutions and are optimistic that agreement can be reached among all of the parties.

2 • Terms of Reference

The Government of Manitoba appointed each of the members of the 2012 Lake Manitoba/Lake St. Martin Regulation Review and prepared Terms of Reference. A copy of the Terms of Reference is provided in Appendix A.

While there are five items listed in the Terms of Reference, the core aspects of the work of the Committee are to consider and provide recommendations on:

1. The need for additional water control works;
2. The most acceptable and practicable range of regulation within which the levels of Lake Manitoba and Lake St. Martin might be controlled; and
3. Land use policies and zoning criteria relative to areas around the water bodies that are vulnerable to flooding.

2.1 Approach

Figure 2.1 sets out the approach to the tasks of the Lake Manitoba/Lake St. Martin Regulation Review. There were three broad streams of work:

- Hydrology information, reports and studies;
- Public engagement; and
- Other studies and research.

These were brought together to address the Terms of Reference.

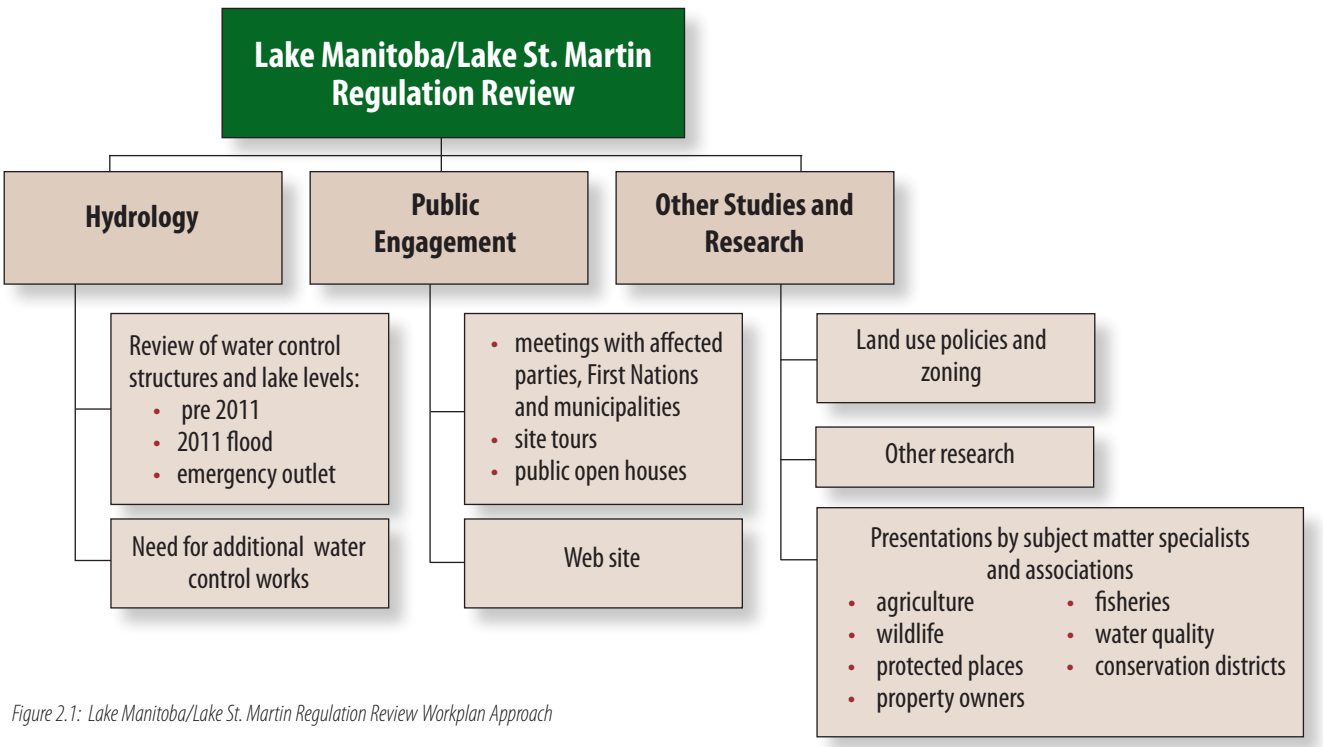


Figure 2.1: Lake Manitoba/Lake St. Martin Regulation Review Workplan Approach

A review of the need for additional water control works was undertaken without the benefit of conceptual designs for new works or detailed cost estimates. The Committee's recommendations are based on opinions and comments made at public meetings, comments made via the web site and open houses, and hydrologic analysis of the circumstances required to achieve conditions acceptable to people in the vicinity of each lake.

Expertise and experience of committee members, hydraulic information, technical reports, presentations, and studies were brought together with public opinion to frame the Committee's recommendations.

2.2 Public Engagement

The Terms of Reference require "significant engagement and dialogue with the public." Engaging the public and "client" groups in a meaningful way was essential to the fulfilling of the Committee's obligations. A comprehensive summary of activities is found in Appendix E.

The following components outline the approach to public engagement:

Meetings with Interested Parties

The Committee held multi-purpose meetings: regular committee meetings plus specialist presentations combined, where possible, with meetings with "client" groups and site visits. For example, a Manitoba Conservation presentation on fisheries was combined with meeting fishers and an appropriate site visit.

Attendees at a committee meeting

Site Visits

Committee members toured most areas around Lake Manitoba and Lake St. Martin affected by flood damage. These tours included agricultural lands, residential and cottage developments, tourist facilities, and First Nations. The site visits were combined as much as possible with committee meetings and other actions.

Public Open Houses

The Committee held seven open houses in various venues around the lakes.

Survey

An online survey was developed to obtain opinion from municipal governments and First Nations.

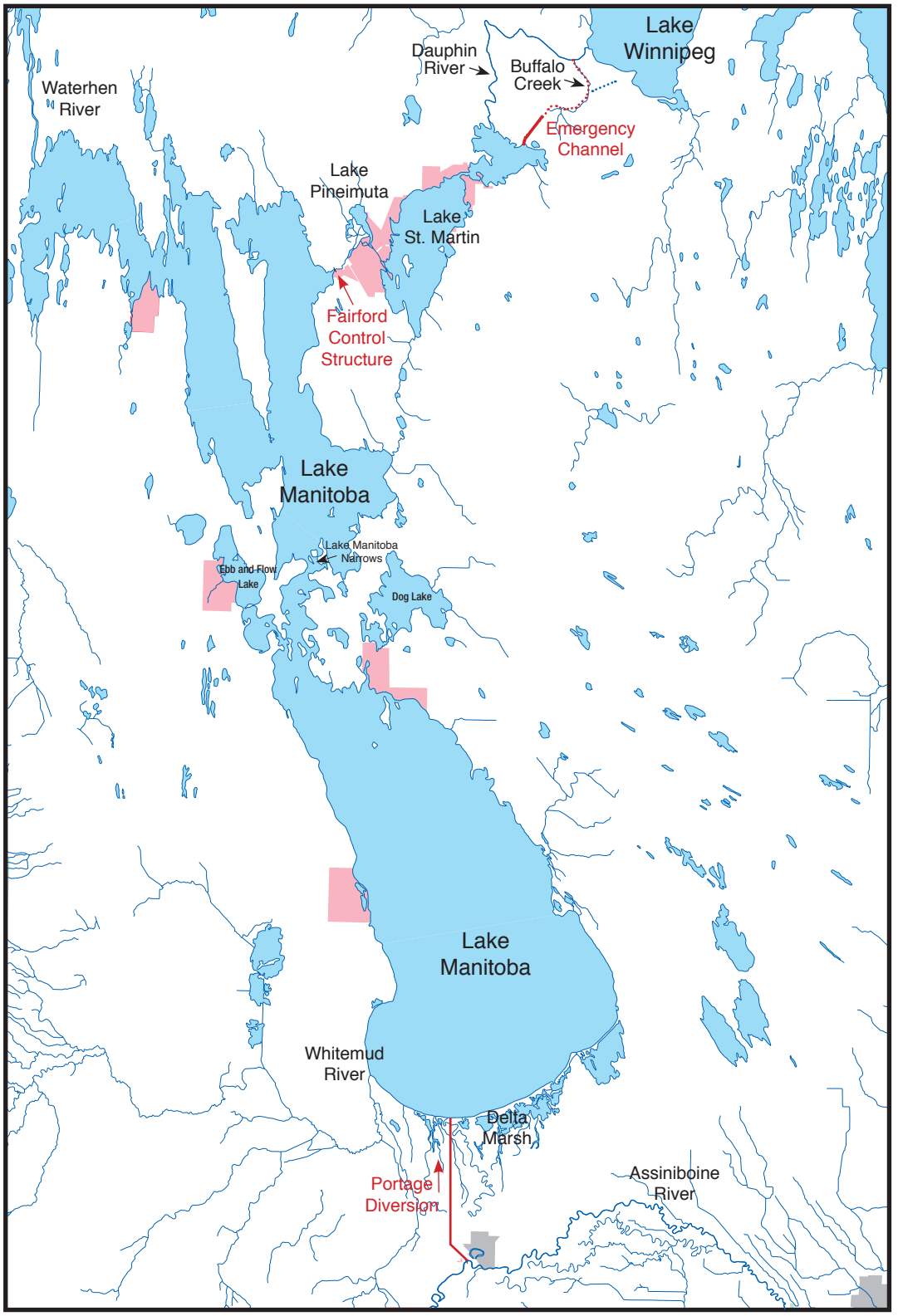
Web Site

A web site (http://www.lakemanitobalakestmartinregulationreview.ca/) was developed as a place for the public to obtain copies of each presentation made to the Committee and to find details about public open houses and other events. Another primary purpose was to facilitate and encourage public input by way of a feedback form, essentially an online survey that allowed for wide ranging comments.

2.3 Presentation of this Report

The intended audience for this report is the general public, and more particularly, those who reside around each of the lakes. Wherever possible, descriptions of land and resource uses around the lakes have been broadened to put a human face to activities. This includes historical references to give some depth to the analysis and to provide insight to sometimes competing uses.

Scattered throughout the report are “Perspectives”. These are observations made by the Committee about the issues and complexities related to trying to manage natural systems in a way that both protects natural values and serves divergent interests.



Lake Manitoba - Lake St. Martin and the Dauphin River

3 • Control Structures History and Operations

3.1 Control Structures

An overview of relevant water control structures and their operations is presented here to provide context to the report. Water control structures include the:

- Portage Diversion
- Fairford River Water Control Structure
- Emergency Channel
- Shellmouth Dam

Over the years, structures have been built in Manitoba to reduce the impact of flooding. After the 1950 Red River flood, the Red River Floodway, Portage Diversion and Shellmouth Dam were constructed, primarily to reduce flooding in Winnipeg. However, the Portage Diversion and the Shellmouth Dam also provide flood control benefits along the Assiniboine River. After the high levels on Lake Manitoba in the mid-1950s, the Fairford River Water Control Structure was built to control flooding on Lake Manitoba. Each of these structures has been effective in meeting their original objectives. However, their operation has not been without controversy. During the 2011 flood, an emergency channel was constructed to convey additional waters from Lake St. Martin.

3.1.1 The Portage Diversion

The Portage Diversion is a water control structure on the Assiniboine River immediately upstream of Portage la Prairie. The project, completed in 1970, was part of a larger attempt to prevent flooding in the Red River Valley. The Portage Diversion consists of two separate control structures that divert some of the flow of water in the Assiniboine River to a 29 kilometre long diversion channel that empties into Lake Manitoba near Delta Beach. The Diversion was originally designed to carry a maximum volume of 25,000 cubic feet per second (cfs).

During the spring of 2011, water flows in the Assiniboine River above Portage la Prairie were measured at over 53,400 cfs. The Assiniboine River downstream, however, had an estimated capacity of only some 19,000 cfs. To prevent the Assiniboine River dikes from breaching, the flows in the Diversion were increased to a peak of 34,700 cfs. This is similar to typical summer flows on the Winnipeg River. The flows in the Diversion averaged about 25,000 cfs over 15 weeks. While peak flows on the Diversion have received a lot of attention, the real impact was caused by the unprecedented length of time the Diversion continued in operation.

History of the Portage Diversion

Construction of the Portage Diversion was one of the flood control projects recommended in the 1958 report of the Royal Commission on Flood Cost Benefit. Its primary purpose was to control flooding in Winnipeg by reducing the inflows from the Assiniboine River when Red River levels are high in the city. It also was designed to reduce overbank flooding along the Assiniboine River between Portage la Prairie and Winnipeg. The Diversion cost $20.5 million dollars to construct when it was completed in 1970.

The Portage Diversion consists of two control structures: a 29 kilometre diversion channel from the Assiniboine River to Lake Manitoba, and a 1600 acre reservoir on the Assiniboine River just west of Portage la Prairie.

The channel's capacity is 25,000 cfs for most of the channel length. However, there is a failsafe section on the west side of the channel at the northern end that will breach at 15,000 cfs. Although the operating rules, discussed below, state that the flow in the Diversion shall not be allowed to exceed 25,000 cfs, during the 2011 flood, the channel was surcharged to a maximum of 34,700 cfs or almost 40 percent beyond its design capacity.

The dam on the Assiniboine River is 35 feet high and 1,400 feet long. The structure has two bascule gates that control the amount of water flowing eastward towards Winnipeg. The control structure at the entrance to the diversion channel controls the amount of flow diverted northward to Lake Manitoba.

The Diversion has been operated in 36 of the 43 years between 1970 and 2012 (see Figure 3.1). In nine of those years only small volumes were diverted to support irrigation along the diversion route, but in the other 27 years the Diversion was operated for flood control purposes. Operation has proved very beneficial for reducing flooding in Winnipeg and along the Assiniboine River east of Portage la Prairie. However, the operation has had a negative impact on Lake Manitoba, both in terms of lake regulation and water quality.

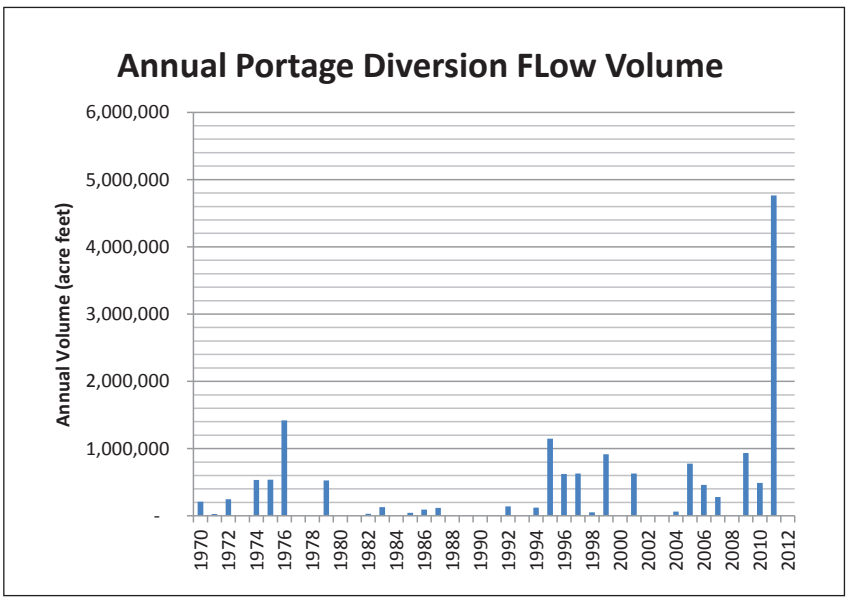


Figure 3.1: Annual Portage Diversion Flows

Figure 3.2 shows the impact that diversion of flows from the Assiniboine River has had on annual peak levels on Lake Manitoba. These peak lake level changes are computed by subtracting the Portage Diversion flows from the total inflows to Lake Manitoba and routing the daily inflows through the Fairford River Water Control Structure. The computed peak level is then compared to the recorded peak level for each year of operation. This lake level difference is not the same as simply dividing the annual volume by the surface area of the lake. That calculation ignores the fact that outflows through the Fairford River Water Control Structure increase as lake levels increase, so some of the diverted volume would continue down the Fairford River.

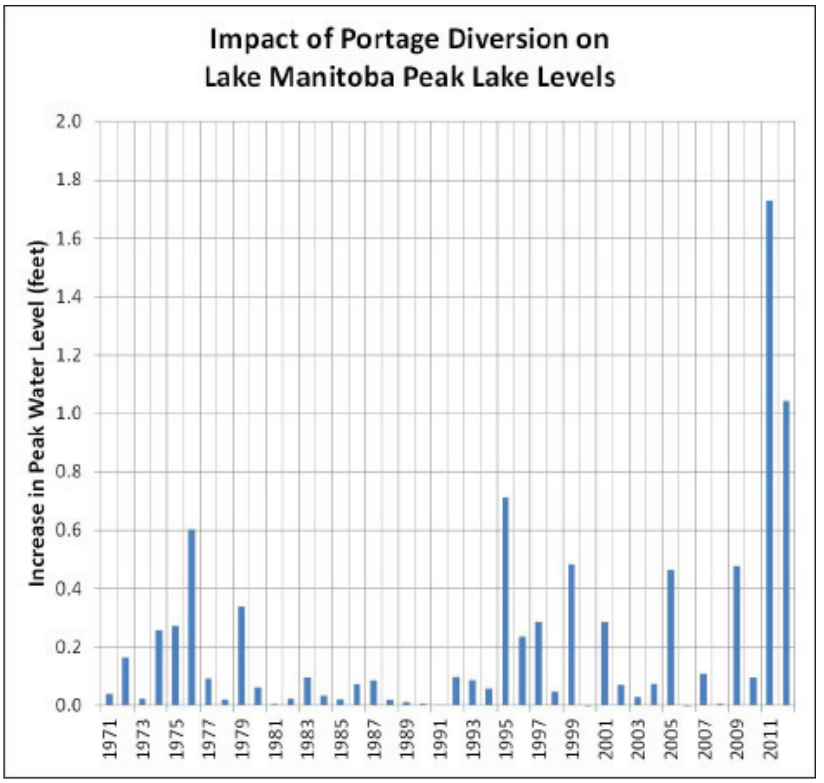


Figure 3.2: Impact of Portage Diversion on Lake Manitoba Levels

The highest impact was 1.7 feet in 2011. It is interesting to note that the second highest impact was 1.0 feet in 2012, a year when the Portage Diversion was not used. This is because the lake levels in 2012 are still being impacted by the 2011 flood.

Operating rules

The operating rules for the Portage Diversion were contained in the *1994 Red River Floodway Program of Operation* (see Appendix F). The rules set out the following operating objectives:

1. To provide maximum benefits to the City of Winnipeg and areas along the Assiniboine River downstream of Portage la Prairie.
2. To minimize ice jams forming along the Assiniboine River.
3. Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible.
4. Prevent overtopping of the failsafe section in the Portage Diversion if possible.

The eight rules contained in the Program of Operation are:

1. Except as provided for under Rule 8, the Portage Diversion shall be utilized to its maximum capability to keep water levels in Winnipeg below 17.0 feet, City Datum.
2. The flow in the Diversion shall not be allowed to exceed 25,000 cfs.
3. If flow forecasts indicate that the peak inflow into the reservoir to be 20,000 cfs or more, the Diversion will be put into use as soon as possible to flush out snow blockages and in situ ice.
4. During the period that there is ice on the reservoir, the water level of the reservoir will not be allowed to exceed 865.0 feet to provide room for releases from breaching of upstream ice jams.
5. The conduits of the Spillway Structure shall be closed while there is water going over the bascule gates.
6. While there is ice on the Assiniboine River downstream of Portage la Prairie it is desirable to limit flows to approximately 5,000 cfs in the River if possible. Flows of this magnitude appear to be optimum flows required to assist in flushing the ice down river without causing major ice jams or flooding to adjacent farm lands through local drainage inlets. This procedure provides additional capacity, if required, on the River downstream of Portage la Prairie when the second peak arrives. The level of Lake Manitoba should not be taken into account while there is ice on the Assiniboine River, as the period during which there is ice on the River during the spring runoff is only a few days, and diverted flows for this short a period of time have a negligible effect on the level of Lake Manitoba.
7. After the ice has gone from the Assiniboine River downstream of Portage 1a Prairie, it is desirable to maintain flows less than 10,000 cfs in the River if possible. Flows greater than 10,000 cfs are above the natural bank stage of the River, and backup of local streams which outlet into the Assiniboine may occur at this level. There also may be seepage problems through the dyke, leakage under the dyke through gated culverts and flooding of cultivated land between the dykes.
8. For flows of up to 30,000 cfs under open water conditions, the failsafe section of the west dyke of the Portage Diversion should not be breached if the peak stage in Winnipeg will not exceed 18.0 feet.

3.1.2 The Fairford River Water Control Structure

The Fairford River flows out of Lake Manitoba at the northeast corner of the lake. It flows through Pineimuta Lake and into Lake St. Martin. The Fairford River Water Control Structure was built for two primary purposes:

1. To reduce flooding on Lake Manitoba by allowing additional water to flow down the Fairford River into Lake Pinemuta and Lake St. Martin and eventually into Lake Winnipeg via the Dauphin River; and
2. To maintain lake levels during periods of low inflow by reducing outflow into the Fairford River.

Since it began operation in 1961, the Fairford River Water Control Structure has had adverse effects on Lake St. Martin, which the Province has been working to resolve over an extended period of time. Since the mid-1970s, the structure has been operated to consider the effects of operation on both Lake Manitoba and Lake St. Martin.

History of the Fairford River Water Control Structure

For over 100 years, attempts have been made both to reduce flooding on Lake Manitoba and alternatively to maintain water levels by controlling outflow into the Fairford River. Early attempts were failures and had unintended consequences on Lake St. Martin and the surrounding communities.

Between 1899 and 1901, severe flooding around Lake Manitoba led to the excavation of an improved outlet channel. In 1933, following dry years in the late 1920s and early 1930s, the Province constructed a concrete control dam across the Fairford River immediately downstream of the channel. The current structure was completed and put into operation in 1961.

An historical account of water levels noted that in 1901:

> *All the lakes were flooded at that time and settlements along Lake Manitoba and Lake Winnipegosis almost devastated... I had to row in among the trees and land at his door. … All the low lying land was flooded.*
>
> *In 1901 the lake was exceptionally high. The entire countryside was under water and there were muskrats [houses] everywhere.*[1]

Operating Rules

The control structure is composed of 11 bays. Each bay has stop logs that can be used to control outflows from Lake Manitoba into the Fairford River. One bay contains a fishway. A highway bridge is incorporated into the top of the structure.

Figure 3.3 shows the rating curve for the Fairford River Water Control Structure, which is the rate of flow that can be passed by the structure at various Lake Manitoba levels when all of the stop logs are removed.

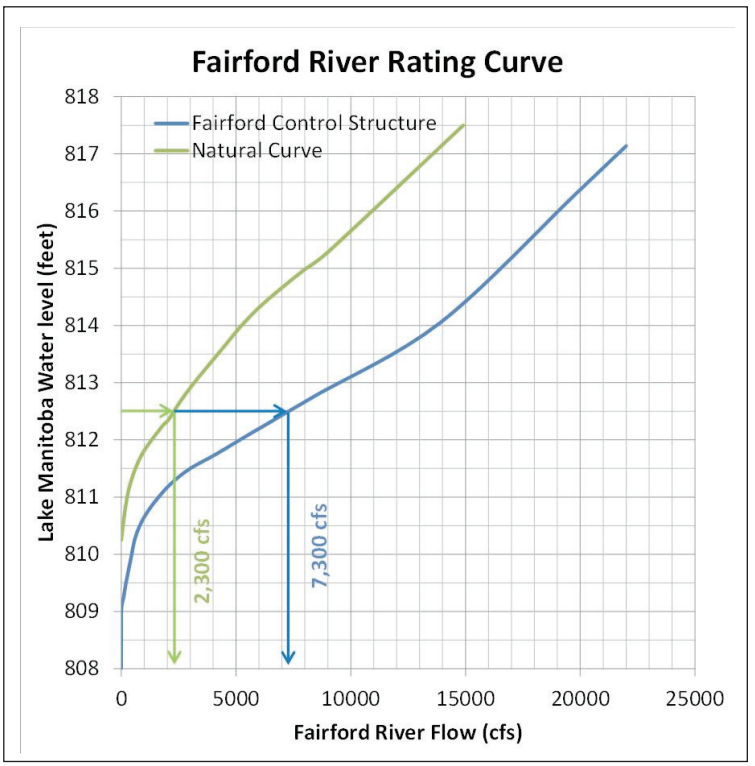


Figure 3.3: Fairford River Rating Curve

[1] Einarsson, Helgi. *Helgi Einarsson: A Manitoba Fisherman*. (G. Hauser, Trans.). Queenston House: Winnipeg, 1982. Print.

In practise, during periods of high flow, a couple of logs are left in each bay because they are difficult to remove and experience has shown that at high lake levels they have no effect on the flow capacity of the structure.

Also shown on Figure 3.3 is the rating curve for the natural channel. This curve gives the flow capacity of the unimproved channel for a variety of Lake Manitoba levels.

As an example of how to read these curves, the horizontal arrows denote a lake level of 812.5 feet. With the natural channel, the Fairford River would have conveyed 2,300 cfs with the lake at this level. With the expanded channel that was constructed in 1961, the structure could pass up to 7,300 cfs or more than triple the natural capacity.

The operators of the Fairford River Water Control Structure use the Fairford rating curve to determine how to set the logs in the control structure. As a practical example, assume the current level of Lake Manitoba is 812.5 feet and forecasters predict that inflows plus precipitation minus evaporation will average 2,000 cfs over the coming month. To maintain a lake level of 812.5 feet, the outflow would have to equal the inflow. Therefore, to maintain an outflow of 2,000 cfs the logs would have to be set to (2,000/7,300) = 27 percent of full capacity.

As another example, over the period 2007 to 2010, Lake Manitoba averaged 812.05 feet and the recorded Fairford River flows averaged 5,500 cfs. The rating curve for the current structure shows that the structure would have had to remain wide open during this period to pass that much flow. The natural curve shows that the lake would have had to be 814 feet or two feet higher to pass that much flow.

The initial operating rules for the structure were focused on maintaining a stable lake level of 812.17 feet. The minimum outflow was 50 cfs. Operation of the Fairford River Water Control Structure according to these rules was very effective in stabilizing the lake levels on Lake Manitoba. However, after a few years of operation it became clear that the operation was having a negative impact on Lake St. Martin.

The current operating rules for the Fairford River Water Control Structure were recommended by the Lake Manitoba Regulation Review Advisory Committee in their 2003 report (see Appendix C) to the Province, which adopted these rules. In summary the rules are:

Lake Manitoba should be operated in a more natural fashion based on the Minimum Log Change Model developed for the Committee. The Committee recommended:

a) When water levels on Lake Manitoba are between 810.5 feet and 812.5 feet and levels on Lake St. Martin are between 797 feet and 800 feet permit the lakes to fluctuate naturally without stop log changes.
b) Any variances in the lake levels outside of the range shall be shared between Lake Manitoba and Lake St. Martin insofar as this may be reasonably possible.
c) The minimum flow on the Fairford River should be 800 cfs with a desirable flow of 1,000 cfs as often as possible.

Figure 3.4 shows recorded lake levels from 1924 to the summer of 2012.

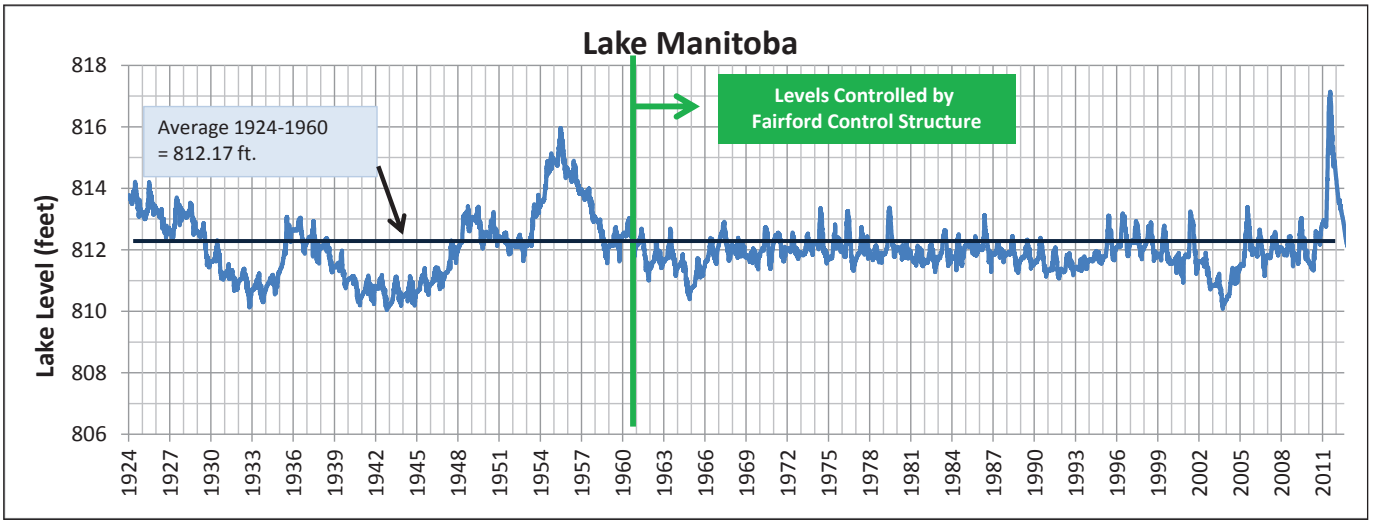


Figure 3.4: Recorded Lake Levels on Lake Manitoba

The plot shows the dramatic change in lake level patterns associated with the operation of the Fairford River Water Control Structure. Before 1961, the lake fluctuated through a range of four feet over multi-year cycles. After, regulation fluctuations were small, usually less than one foot. The plot shows that the structure was successful in preventing the occurrence of flood levels on Lake Manitoba – until 2011.

3.1.3 The Emergency Channel

By mid-summer 2011, Lake Manitoba and Lake St. Martin were at record high levels. It was recognized that if no action was taken, the level of Lake Manitoba was expected to remain well above the upper range of regulation throughout 2012 leaving communities, homes, cottages and farms at high risk of further damage from flooding, wind and waves. Lake St. Martin was

PERSPECTIVE

The operation of the Fairford River Water Control Structure follows the recommendations of the Lake Manitoba Regulation Review Advisory Committee as made in 2003. Those recommendations provide for a water level management regime that would:

> *Permit Lake Manitoba to fluctuate between 810.5 and 812.5 feet above sea level (ft. asl), insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 ft. asl in some years and drop to 810 ft. asl in others.*

To achieve this guideline, active intervention in lake levels happens at 812.5 to stem further increases and at 810.5 to stem further reductions, with the expectation that lake levels would either rise above or fall below the reference points, as the case may be, creating an effective normal range of 810 to 813 feet. What the public has seen, however, are charts that refer to the "normal range," "top of operating range," and "regulation range" all within the context of 810.5 to 812.5 feet. In the public's mind, this is a two-foot range of regulation. Many people believe that the lake is regulated to prevent it from exceeding 812.5, whereas in actuality it is regulated with an expectation that it may rise to 813 feet under normal conditions. This has complicated the discussion as to a preferred range.

expected to be above flood stage into the fall of 2012, with a summer peak 2.5 feet higher than the historic peak of 1955. Additionally, winter flows into Lake St. Martin could be as high as 15,000 cfs, far above the 5,000 cfs limit required to prevent frazil ice development on the Dauphin River.

The Province commissioned an urgent study to explore options to bring the levels of Lake St. Martin and Lake Manitoba down to the desirable range on an emergency basis as soon as possible. The Province requested a broad review of any potential options to achieve this objective in a timely and cost-effective manner while also minimizing potential impacts on other areas of the province.

The recommended option was construction of an emergency channel from Lake St. Martin to Lake Winnipeg. It was estimated that the channel would lower Lake Manitoba and Lake St. Martin by 2 to 3 feet. This channel would provide direct benefit to Lake St. Martin through accelerated drawdown of the flood levels. It would also benefit Lake Manitoba in that it would avoid the need to reduce winter outflows to 5,000 cfs.

2011 Operation

The initial target was to construct a 5,000 cfs capacity channel by November 1, 2011. However, because of the remoteness of the project site and the difficulties associated with doing major earthwork in a marsh environment, it became clear that the full project could not be completed by November 1. Therefore, the channel, designed as three reaches, was scaled back to 3,500 cfs capacity.

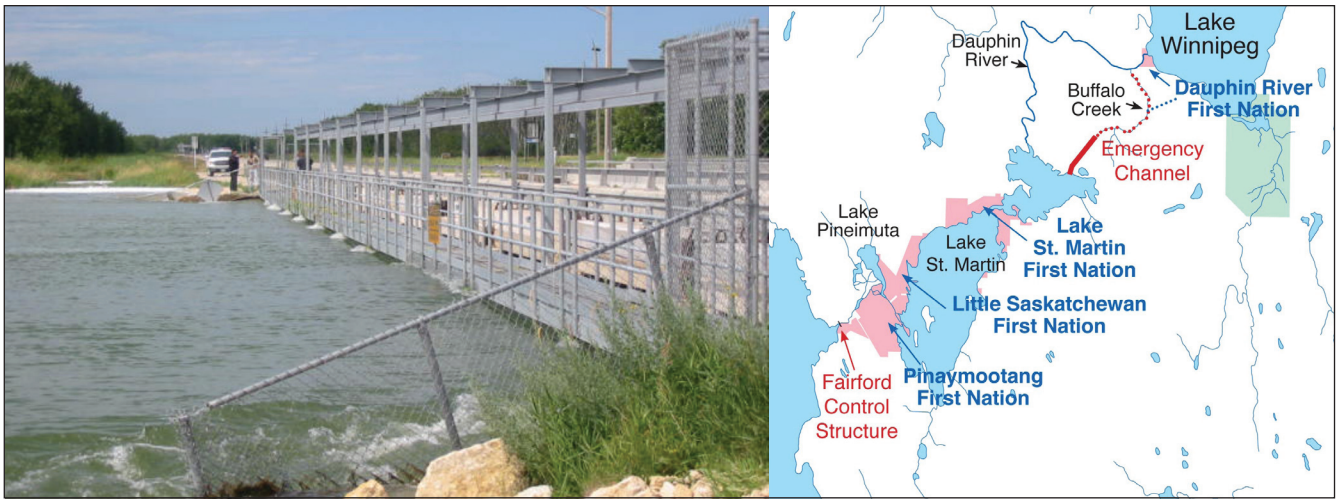
Reach 1 extends eight kilometres from the northeast corner of Lake St. Martin to Big Buffalo Lake. This section was operational by November 1, 2011. Reach 2 follows Buffalo Creek for a further nine kilometres and did not require any construction. Reach 3 would divert the flow from Buffalo Creek in a north-easterly direction to Lake Winnipeg and would eliminate additional flow from entering the Dauphin River. In the absence of Reach 3, the flows continue down Buffalo Creek re-entering the Dauphin River 3.5 km above the mouth. However, a major concern with allowing the diverted flows to re-enter the Dauphin River was the possibility that frazil ice on the river would become trapped under the ice sheet on Lake Winnipeg and create a large accumulation called a “hanging dam”. A fully developed hanging dam would block the river’s flow causing extensive flooding of Dauphin River First Nation. Blockage of the river would eventually have an impact on Lake St. Martin levels as well.

PERSPECTIVE

Was the Fairford Control Structure designed to handle Portage Diversion flows?

The Fairford Control Structure was put into operation on June 1, 1960. The Portage Diversion was not completed until 1970. There is an assumption, therefore, that the Fairford structure was not designed to convey the additional inflows from the Portage Diversion.

In fact, the Fairford Control Structure was designed to control Lake Manitoba between 811 and 813 feet, including the simulated inflows from the Portage Diversion based on the recorded Assiniboine flows over the period from 1914 to 1955. However as discussed in Section 8.2.2 the flows in the Assiniboine River have been higher since 1970 than they were during the period used in the Fairford design. Therefore, although the Fairford Control Structure was designed to handle anticipated Portage Diversion flows, the actual operation since 1970 has resulted in larger and more frequent Portage Diversion operation than had been anticipated.



Fairford River Control Structure

Reach 3 was designed to divert the emergency flows from Buffalo Creek to Lake Winnipeg so there would be less chance of frazil ice problems developing. However, the warm winter of 2011/12 – the warmest in many years – slowed frazil ice development such that when Reach 3 was completed in late winter it was no longer required and never put into operation. Since the Emergency Channel was constructed on an emergency basis without any environmental reviews it was closed once the emergency is over. It was closed in the fall of 2012.

The benefit to Lake Manitoba of keeping the Fairford River Water Control Structure wide open all winter was to lower the lake levels by an additional foot over the 2011/12 winter. The benefit to Lake St. Martin was to lower spring 2012 levels by more than three feet.

The ability to lower Lake Manitoba through the winter is restricted by the high potential of the risk of frazil ice jamming and associated flooding at freeze-up downstream of Lake St. Martin. This is a particular problem for Dauphin River First Nation and concern about this led to creation of substantial dikes in the community in 2011. Frazil ice formation turned out not to be a problem due to the warm winter of 2011/12 and the dikes have proven to be a major problem for the community. During late summer 2012 the dikes were in the process of being removed or lowered.

3.1.4 Shellmouth Dam

Although the Shellmouth Dam is an important component of flood control for the Assiniboine River and for Winnipeg, its operation had limited impact on Lake Manitoba in 2011. Shellmouth operation began to reduce Assiniboine River flows at Portage la Prairie in mid-April and by early May the reduction was 10,000 cfs. Without Shellmouth operation the peak flow west of Portage la Prairie would have been over 60,000 cfs but with almost 35,000 cfs already in the Portage Diversion, the additional flows would have overflowed at the Hoop and Holler breach adding to overland flooding east of Portage la Prairie rather than flowing down the Portage Diversion to Lake Manitoba.

3.2 Comparing 2011 to Previous Floods

To put the flood of 2011 into context it is necessary to compare it to past floods, both on the Assiniboine River and on Lake Manitoba. Lake levels and outflows have been recorded on Lake Manitoba since the 1920s. Figure 3.5 shows the recorded levels on Lake Manitoba from 1924 to 2011. The blue line shows recorded lake levels.

Since 1961, the Fairford River Water Control Structure has been used to control the levels on Lake Manitoba. Also, since 1970, the Portage Diversion has been used to reduce flooding on the lower Assiniboine River and in Winnipeg by diverting excess flows from the Assiniboine River to Lake Manitoba. These two structures have changed the lake level patterns.

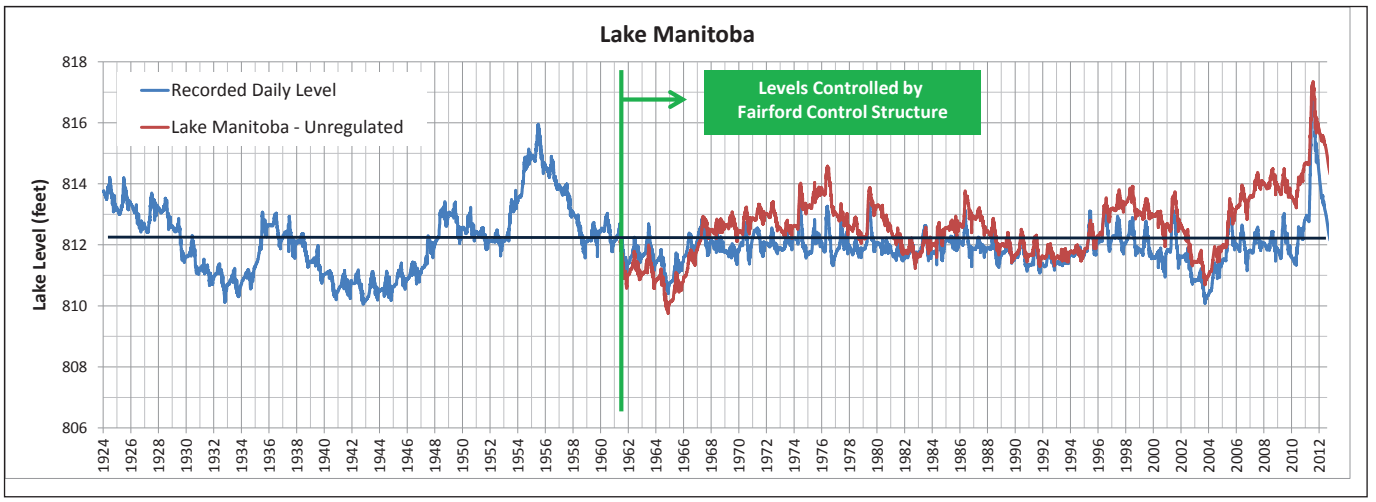


Figure 3.5: Lake Manitoba Recorded and Unregulated Levels

A simulation model was developed to estimate the levels that would have occurred if these two structures were not in place. The simulated unregulated lake levels are shown in red. They reflect the pattern of extended dry and wet periods that were evident in the pre-regulation period before 1961. They also show that, in the absence of the Portage Diversion and the Fairford River Water Control Structure, the 2011 flood on Lake Manitoba would still have been the worst flood since water levels were recorded.

Record High Inflows from Lake Winnipegosis

Over the long term, the major source of river inflow to Lake Manitoba has been the Waterhen River. It drains an area of western Manitoba and eastern Saskatchewan from the north slopes of the Riding Mountain to just south of The Pas. The Waterhen River flows from Lake Winnipegosis to Lake Manitoba. Lake Winnipegosis has a relatively small outlet relative to its drainage area. Therefore, the lake responds slowly to changing inflows. This is one reason for the long lake level fluctuation cycles on Lake Manitoba evident in Figure 3.5. When the levels of Lake Winnipegosis are high as a result of prolonged heavy runoff, it takes months and even years for the lake to recede to its normal level. During this period, the outflows through the Waterhen River remain high, resulting in prolonged above normal inflows to Lake Manitoba.

Figure 3.6 shows the annual inflows to Lake Winnipegosis from 1951 to the present.

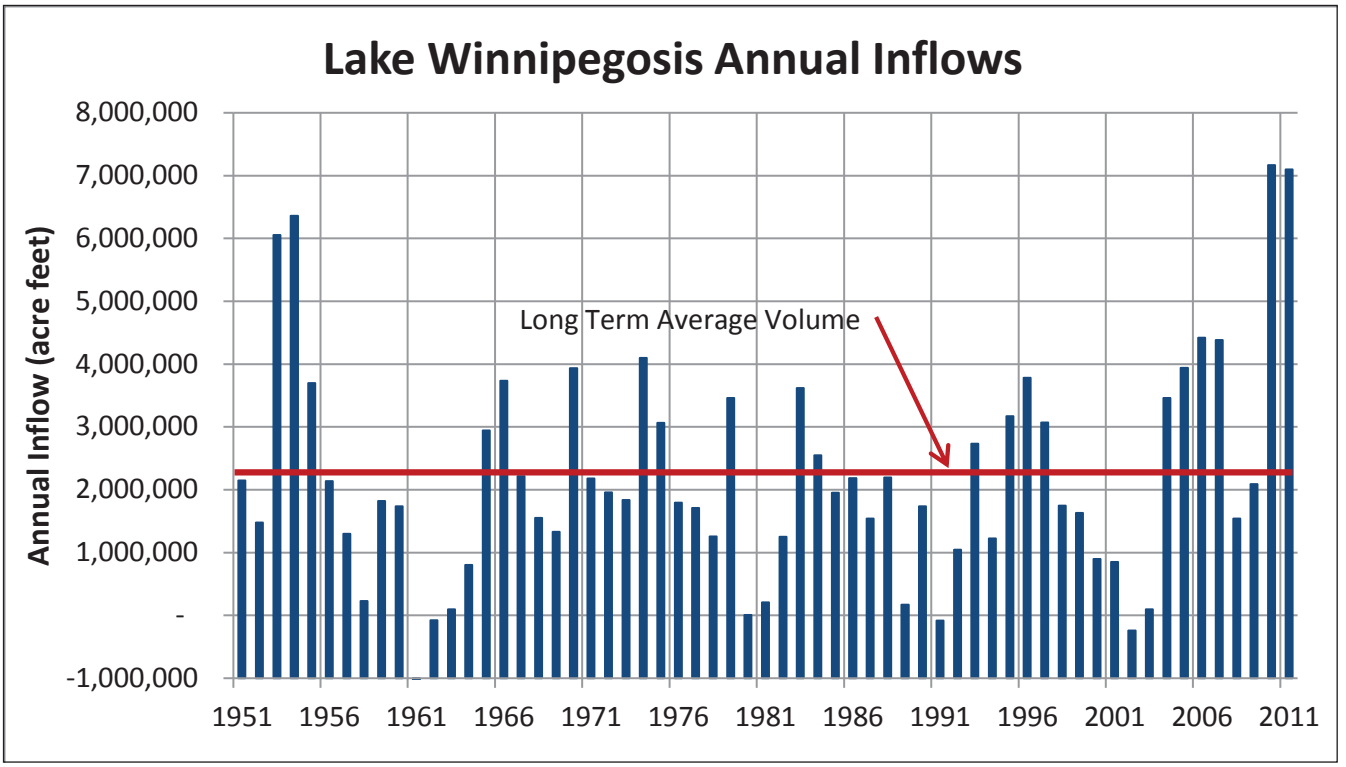


Figure 3.6: Lake Winnipegosis Annual Inflows

It is interesting to note that in 1961 and 1962 the total inflow for the year was negative. In these years, evaporation from the lake surface exceeded the total inflow from the surrounding watershed plus precipitation.

The average inflow over the period from 1950 to the present was just over two million acre-feet per year. The two highest years on record were 2010 followed by 2011. The inflow volumes in both 2010 and 2011 were more than three times the average inflow. Furthermore, in six of the last eight years, inflows to Lake Winnipegosis were above average. As a result, by the summer of 2011, levels on Lake Winnipegosis were the highest recorded since records began in 1913. In turn, this resulted in the highest sustained inflows to Lake Manitoba via the Waterhen River in a century.

Record Flow Volumes on the Assiniboine River

The Assiniboine River rises in eastern Saskatchewan north of Yorkton. It is joined by the Qu'Appelle River at St. Lazare and the Souris River east of Brandon. The Assiniboine River and each of these tributaries experienced record flooding in 2011. The result was record peak flows at Portage la Prairie and a flood volume that far surpassed any previously recorded flood.

Figure 3.7 shows the annual peak flows recorded on the Assiniboine River since 1913.

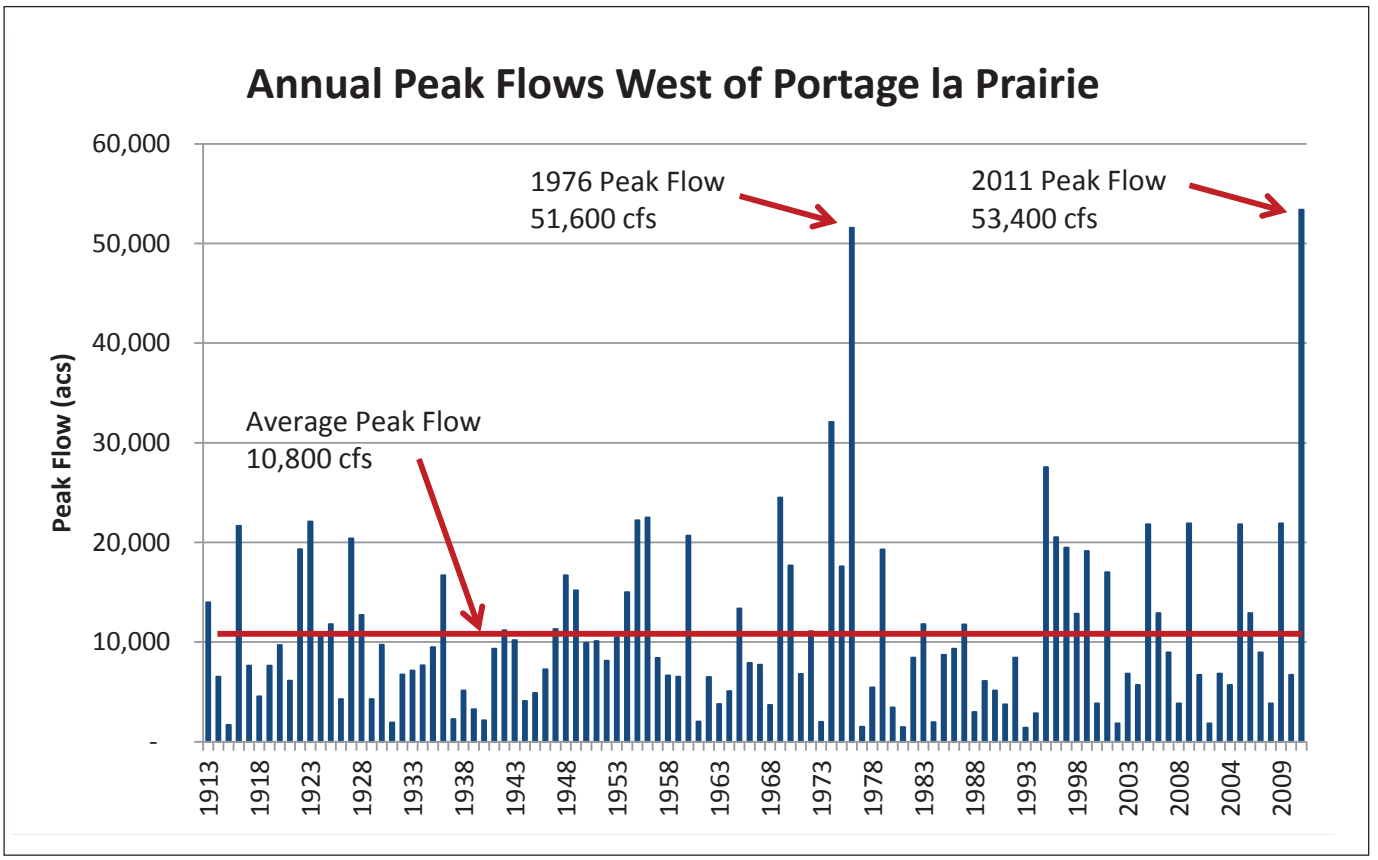


Figure 3.7: Annual Peak Flows on the Assiniboine River

The peak flow of 53,400 cfs in 2011 surpassed the previous peak flow recorded in 1976. Yet the 2011 flood had a much larger impact on Lake Manitoba than 1976 due to the duration of the flood.

Figure 3.8 shows the daily recorded flows on the Assiniboine River at Holland for 1976 and 2011. The peak flows are similar, but the 1976 flood only exceeded 20,000 cfs for 36 days. The 2011 flood exceeded 20,000 cfs for 106 days or for more than three months.

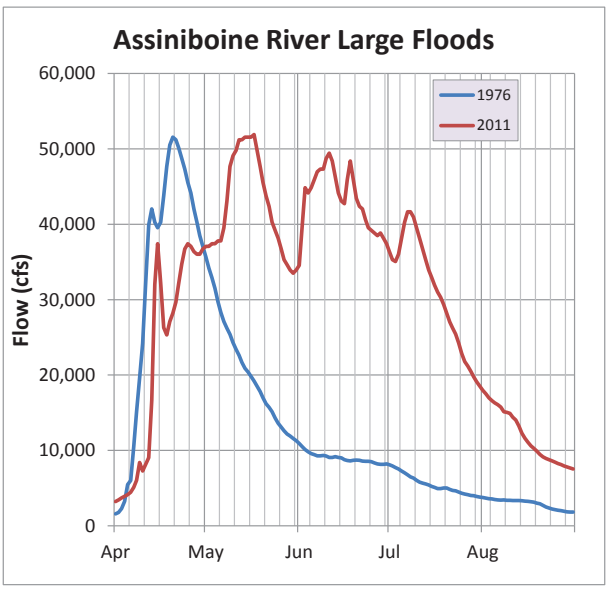


Figure 3.8: Flood Comparison 1976 vs. 2011

Figure 3.9 shows the annual spring flow volumes on the Assiniboine River at Portage la Prairie. The plot shows the annual volume of water in the river for each year for the period of April to July. In terms of volume, 2011 was not only the largest flood on record, but the volume more than doubled the previous record volume observed in 1976.

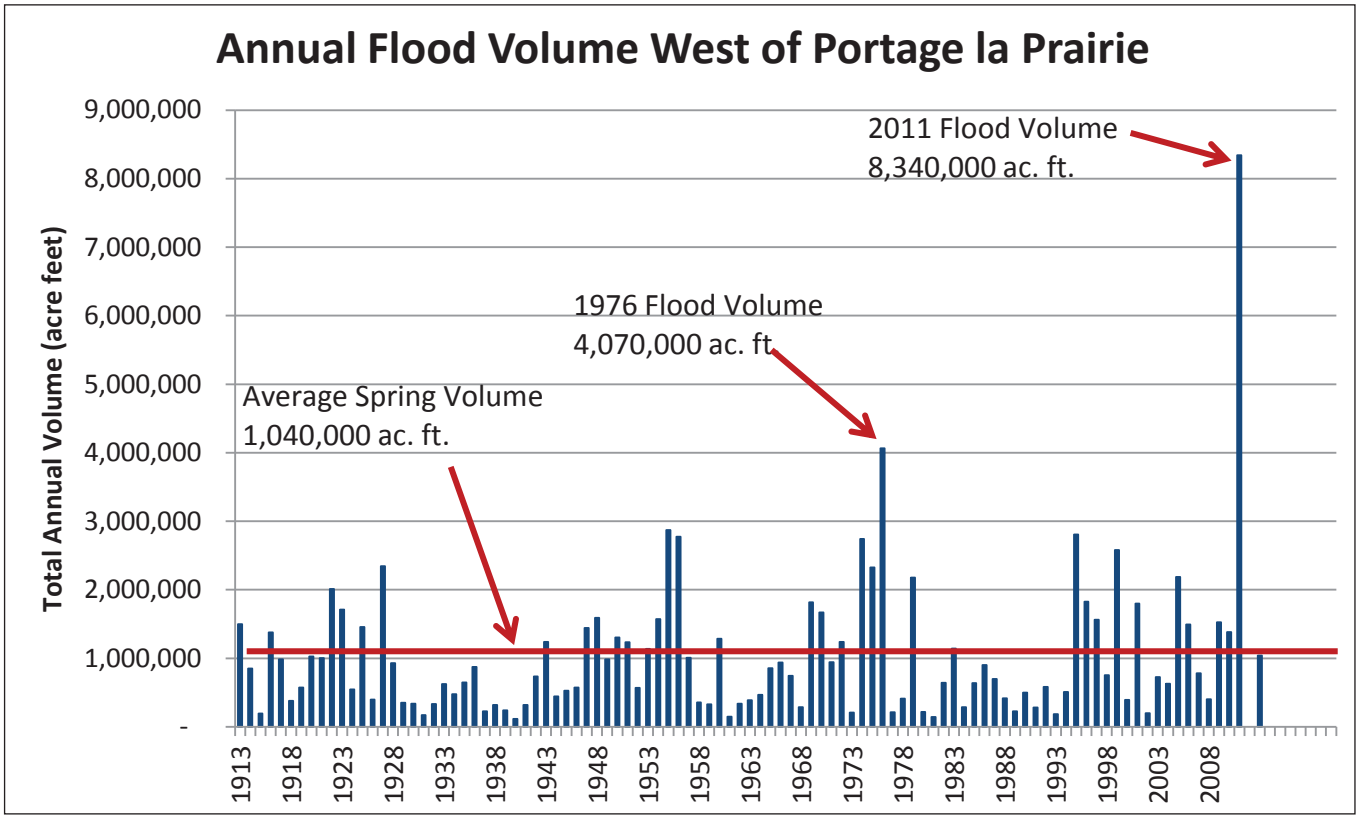


Figure 3.9: Assiniboine River April to July Flow Volumes

3.2.1 Conditions Leading Up to 2011 Flood

In the Canadian prairies, spring flooding is dependent on four primary factors:

1. Fall soil moisture – with high fall soil moisture, less of the melting snow will soak into the ground. This will increase runoff into the rivers and streams.
2. Snowfall – the more snow that falls over the winter increases the volume of water held in the snowpack. This water will be released once the melt begins.
3. Spring temperatures – a slow thaw followed by a period of low temperatures releases the snow water slowly, providing time for infiltration into the soil. A rapid melt releases all of the water stored in the snowpack at once, reducing the time for infiltration.
4. Rain on snow – rain during snowmelt not only increases the volume of runoff, but the latent heat in the raindrops also increases the rate of snowmelt.

In the spring of 2011, all of these factors combined to cause exceptionally high runoff both in the Lake Manitoba watershed and the Assiniboine River watershed.

Precipitation during the fall of 2010 was heavy and well above normal in most of Manitoba, central and southern Saskatchewan, and North Dakota. Cold temperatures in November resulted in significant soil-frost penetration in most areas and widespread heavy snow occurred from late

November through early February over the entire basin. In addition, spring storms exacerbated the flooding conditions along the Assiniboine River.

As a consequence, the Assiniboine River at Russell experienced a 1-in-67 year flood; the Qu'Appelle River at Welby a 1-in-140 year flood; the Assiniboine River at Brandon a 1-in-250 year flood; and the Assiniboine River at Portage la Prairie a 1-in-220 year flood.

The spring peak flow on the Waterhen River was the highest ever recorded. This was a result of high spring inflows and compounded by a series of consecutive high flow years leading up to 2011, which resulted in record high late winter levels on Lake Winnipegosis before the spring runoff began.

3.3 Flooding in Western Manitoba in 2011

In 2011, the Assiniboine River experienced unprecedented flooding at all locations downstream of the Shellmouth Reservoir for most of April, May, June, July and August. The first major settlement to experience the floodwater was St. Lazare, near the confluence of the Assiniboine River and Qu'Appelle River. Dikes were built up to protect against the rising floodwater, but unfortunately some residences were not spared as their protective dikes were overwhelmed. The flood continued downstream, spilling over its banks. Brandon, Manitoba's second largest city, prepared well in advance of the anticipated flood, building up both earthen dikes and sandbag dikes. After a heavy snowfall on April 29 and 30 over much of the Assiniboine River watershed, the crest forecast for Brandon was revised upward, well above the flood of 1976. The river peaked around 37,100 cfs – 60 percent higher than the previous highest recorded peak of 23,000 cfs in 1923.

Shortly thereafter, a state of emergency was declared in Brandon as well as other municipalities across Manitoba. Premier Greg Selinger requested from Prime Minister Stephen Harper troops from the Canadian military to help with the flood fighting efforts. The last time the military was called in to help fight a flood in Manitoba was the Red River flood in 1997.

On the Souris River, most of the early spring runoff came from the United States portion of the watershed. Consequently, Melita was the most affected, with a peak level only one foot lower than the 1976 peak. Later, in mid-June, rainstorms over the Manitoba portion of the watershed (up to 35 mm) caused peak stages higher than those recorded in both Souris and Wawanesa earlier that spring. Pipestone Creek flows were already very high during May and contributed to record levels for Oak Lake and Plum Lake, and induced unprecedented flows in Plum Creek downstream towards the town of Souris.

Between May 27 and June 1, an unstable weather system moved across Manitoba bringing significant rain to southwestern portions of the province. Cumulative rainfall from this storm was highest in Souris (110 mm), Hamiota (100 mm) and Brandon (92 mm), with most rain occurring on May 31. Local estimates for the Souris area reported 63 mm of rainfall on May 31 alone.

In addition to this significant rainfall, on May 31, gale force winds caused extensive damage to cottages and homes on Lake Manitoba. Waves as high as 7 feet were reported against dikes and buildings. Areas around the lake that were hardest hit include the rural municipalities of St. Laurent, Woodlands, Alonsa, Portage La Prairie, and the First Nation communities of Lake Manitoba and Sandy Bay.

The storm of June 22, 2011, over the upper Saskatchewan portion of the Souris River watershed, which saw rains of up to 150 mm, caused an incredible flood impact. The extensive runoff and river flow were devastating to Minot, North Dakota. When the surge crest reached the towns of Melita and Souris on July 4 and 5 respectively, it broke the existing 1976 peak flood levels by 1.64 ft. and 0.38 ft.

3.4 Lake Manitoba – Water Levels and Flows

3.4.1 Water Levels and Flows Prior to 2011

Levels on Lake Manitoba were close to average through most of the decade leading up to 2011.

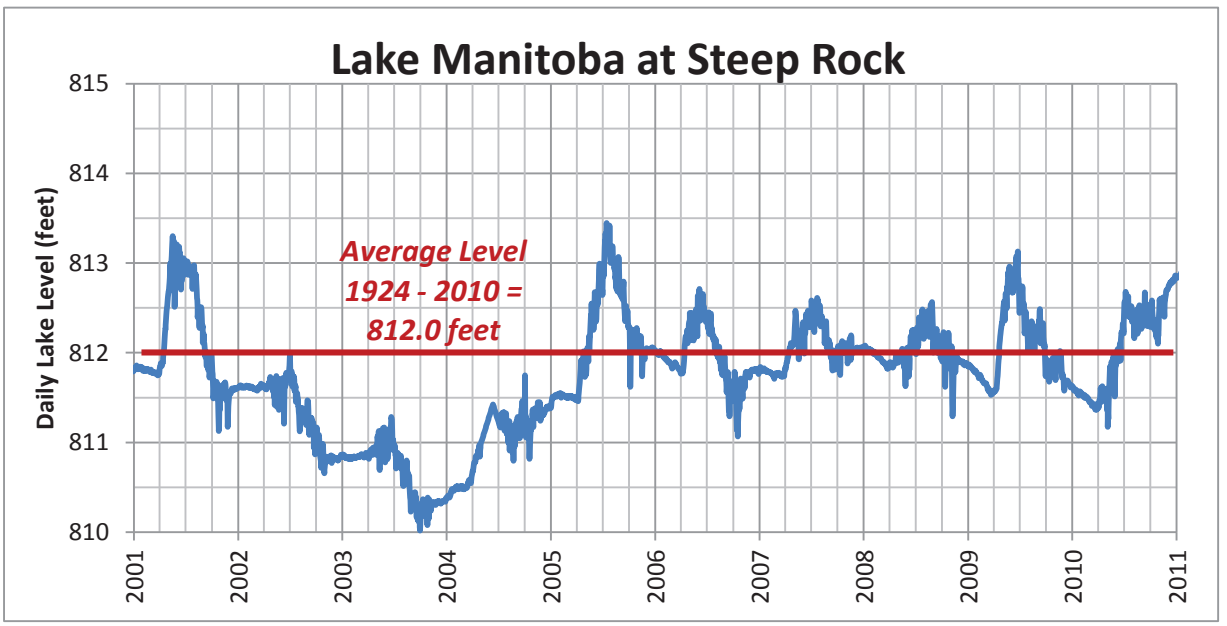


Figure 3.10: Lake Manitoba Levels

However, outflows (see Figure 3.11) were well above average, particularly in 2001 and from 2005 to 2010, indicating that the first decade of the 21st century was considerably wetter than normal in the Lake Manitoba basin.

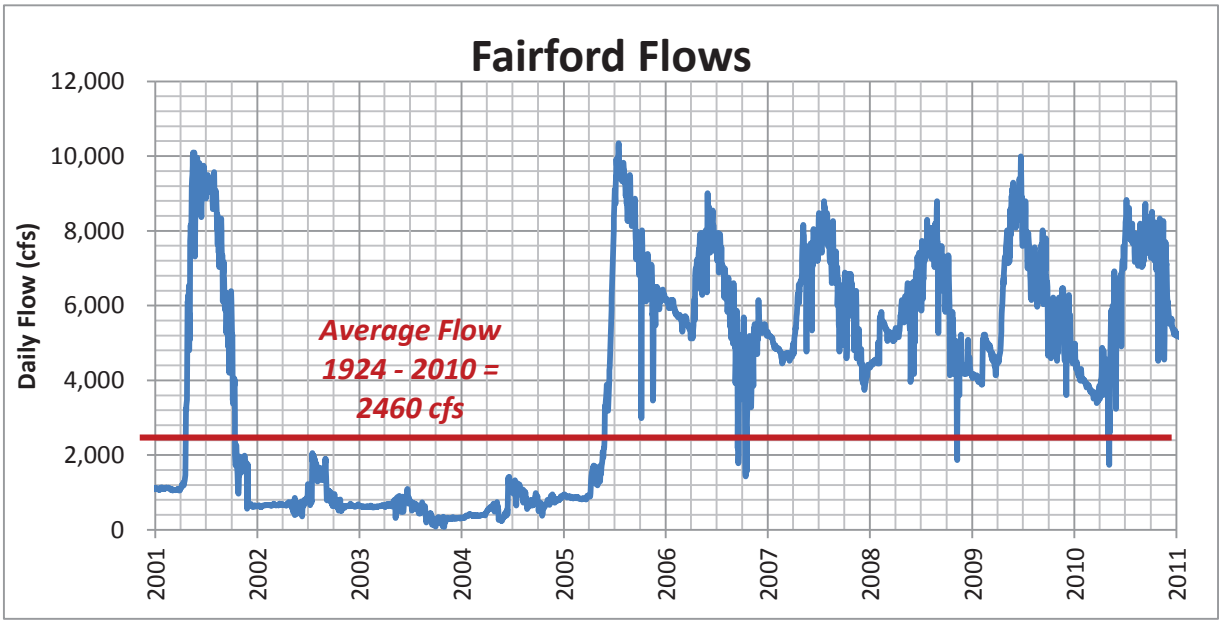


Figure 3.11: Fairford River Recorded Flows

3.4.2 History of Flooding

Levels have been recorded systematically on Lake Manitoba since 1924. As discussed previously, levels on Lake Manitoba fluctuated on a multi-year cycle before 1961 when the Fairford River Water Control Structure was put into operation. The only major flood recorded prior to 2011 took place in the 1950s. Figure 3.12 shows the levels on Lake Manitoba during this decade. Figure 3.13 shows the flows on the Fairford River.

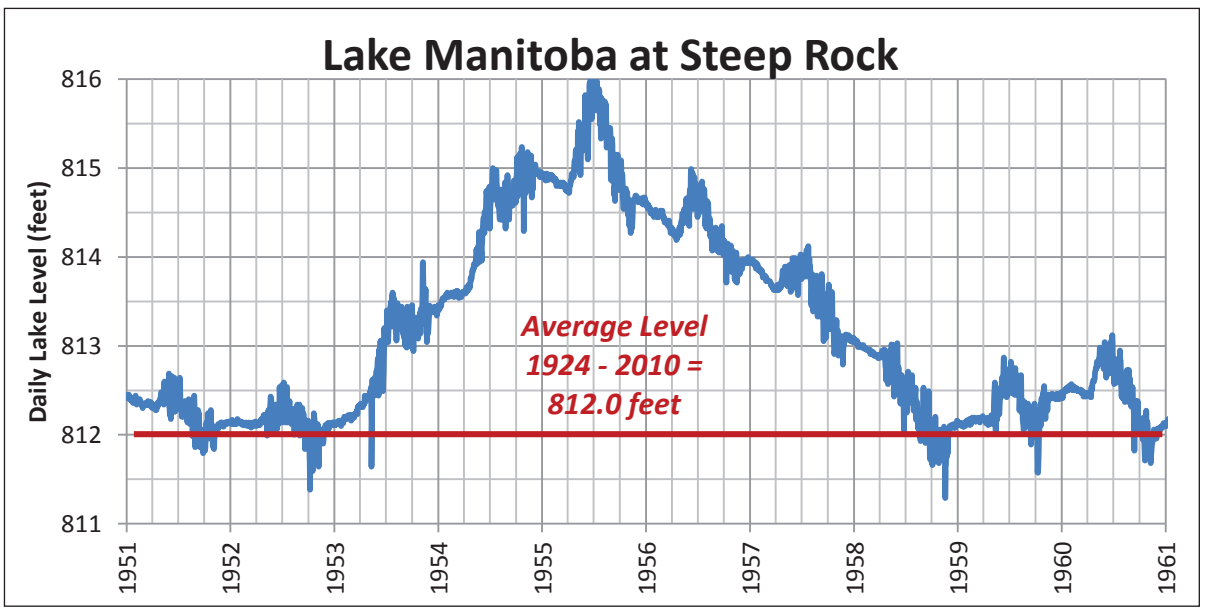


Figure 3.12: Lake Manitoba Levels 1951-1960

In 1955, Lake Manitoba levels peaked at 816.2 feet. It took three years for the level to recede to the long term average level of 812.2 feet. During the five years from 1953 to 1957, the Fairford River flows averaged 5,600 cfs. It is interesting to note that from 2005 to 2010 the average Fairford River flow was 5,700 cfs, but flooding on Lake Manitoba was minor.

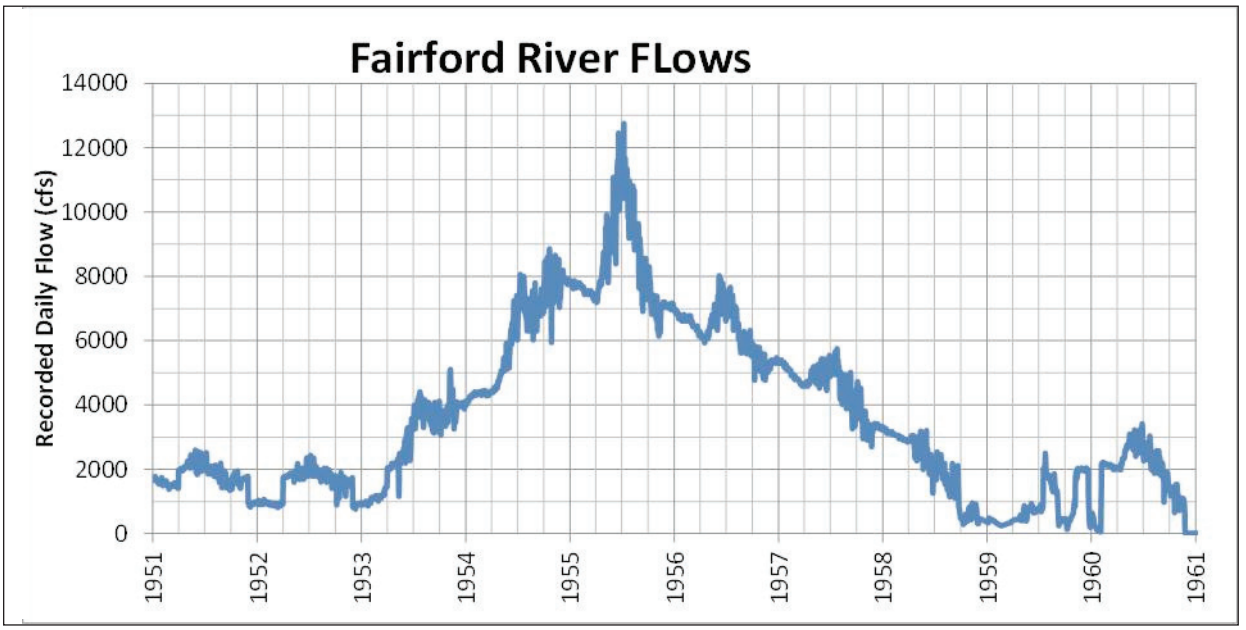


Figure 3.13: Fairford River Flows 1951-1960

3.4.3 The 2011 Flood Event

Lake Manitoba levels were at 812.8 feet at the beginning of January 2011 (see Figure 3.14). This was the highest January level since 1958, before the Fairford River Water Control Structure was in place. This level is an undesirably high mid-winter level for any year, but was of particular concern in light of the large flood that was being forecast for 2011. The situation was aggravated by the need to reduce winter flows at Fairford to 5,000 cfs to prevent frazil ice development on the Dauphin River downstream from Lake St. Martin.

PERSPECTIVE

Were Lake Manitoba levels held high from 2006 to 2010?

From 2006 to 2010 the average level of Lake Manitoba was 812.0 feet (see Figure 3.10). The Committee has heard that the lake had been held too high during this period. In fact, Fairford was at least 98 percent wide open during this full period, with the exception of the winter flow reductions in 2007/08, 2008/09, and 2010/11. These flow reductions were required to prevent frazil ice development as discussed in Section 3.1.3. The levels were not high because of an operational decision. Rather, the inflows to the lake over that period were unusually high.

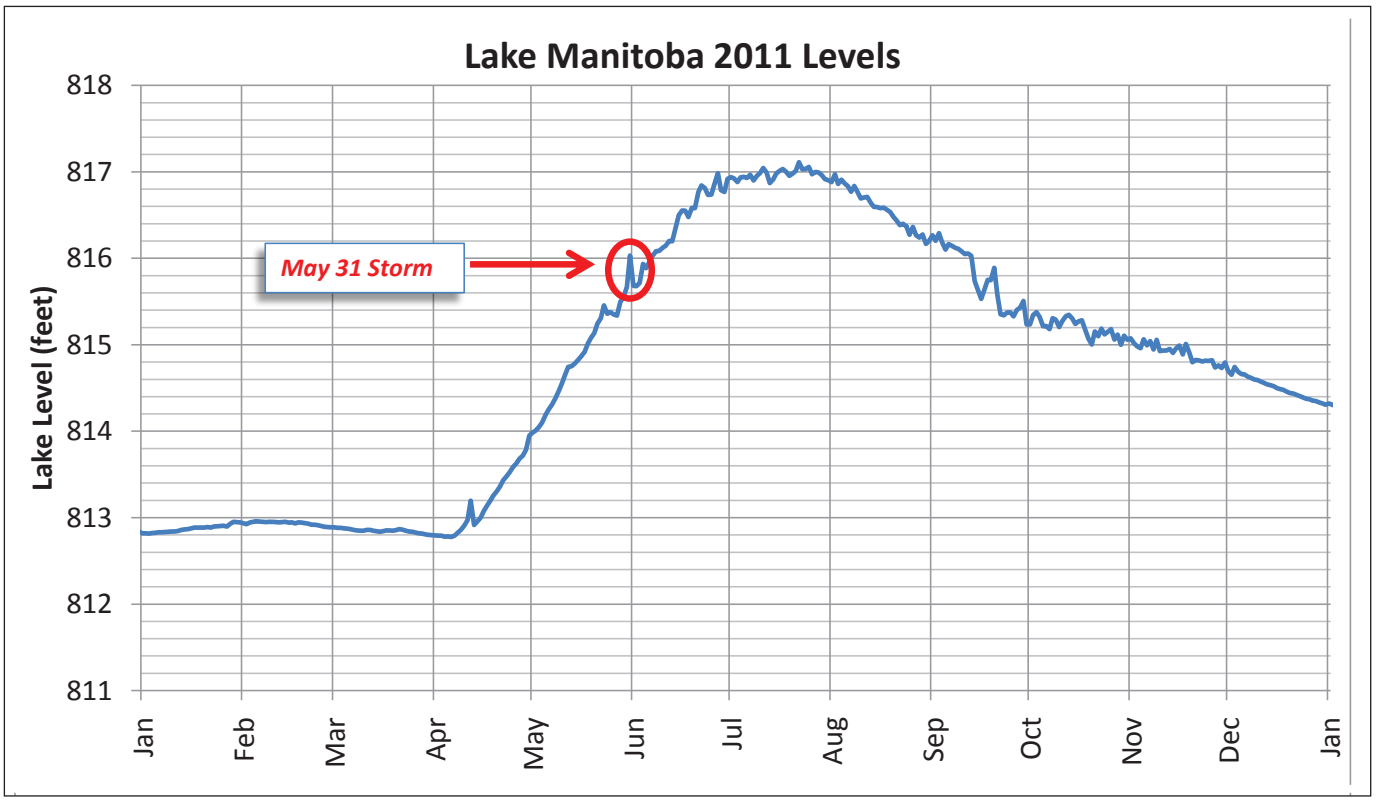


Figure 3.14: Lake Manitoba 2011 Levels

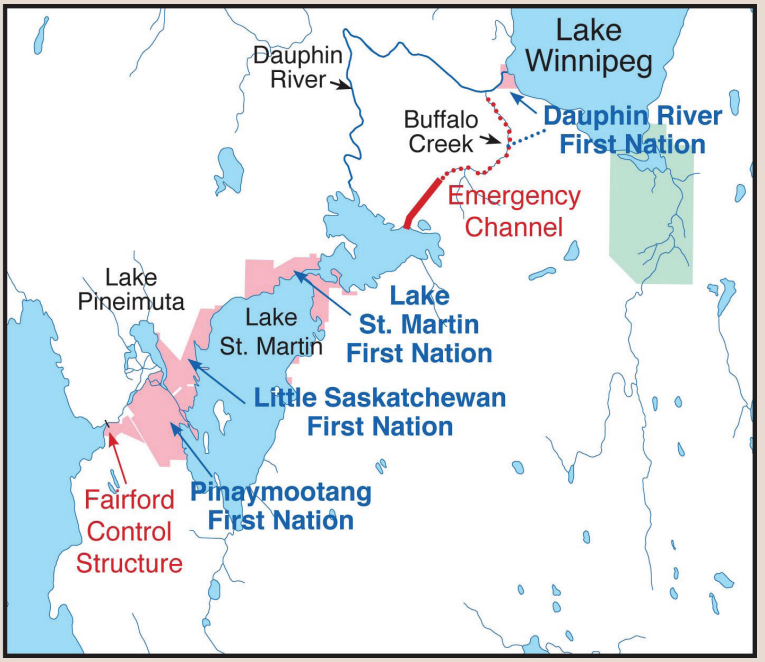
In early April, levels began to rise quickly as flows on the Waterhen River increased and the Portage Diversion was put into operation. By the end of May, the lake level was approaching 816 feet, almost as high as the record peak level in June 1955. On May 31, gale force winds on Lake Manitoba caused the lake levels in the south basin to rise even further. Waves as high as 7 feet caused extensive damage to cottages and homes.

The lake peaked at just over 817 feet in late July and started a slow decline. Because of the operation of the Emergency Channel, the winter flow reduction at Fairford to 5,000 cfs was not required. By the end of December 2011, the lake had receded to 814.3 feet and flows through the Fairford River Water Control Structure were at 14,000 cfs. These were by far the highest winter flows ever recorded in the Fairford River.

3.5 Lake St. Martin/Dauphin River - Water Levels and Flows

PERSPECTIVE

The perspective of First Nations bordering Lake St. Martin cannot be appreciated without a careful review of the history of flooding since the construction of the Fairford River Water Control Structure in 1961.



The Fairford River Water Control Structure was built for the benefit of Lake Manitoba without much analysis of downstream effects. There was no intent to cause damage; it was simply a lack of consideration. And in that period there was no defined duty to consult First Nations about potential effects. As it turned out, the downstream effects were significant, adverse and long-lived. It displaced people from their homes, destroyed native pastures that First Nations had enjoyed for generations, placed large demands on First Nation administrative resources, created a deep seated mistrust of government intentions, and spawned lawsuits that have yet to be resolved. There are people living in Winnipeg today who still consider themselves as being displaced by the flood events of the 1960s and 1970s. While a growing recognition of this problem has led to a much more balanced use of the control structure and attempts to resolve outstanding claims, there is a pervasive memory of past injustice.

3.5.1 Water Levels and Flows Prior to 2011

Flows on the Fairford River were generally above average from 2001 to 2010, resulting in above average levels on Lake St. Martin (see Figure 3.16). Between the summer of 2006 and the end of 2011, the lake was above 800 feet most of the time. Lake levels above 800 feet start to flood hay lands along the edge of the lake.

Figure 3.15 shows the area on reserve lands on Lake St. Martin that is flooded at 801 feet.

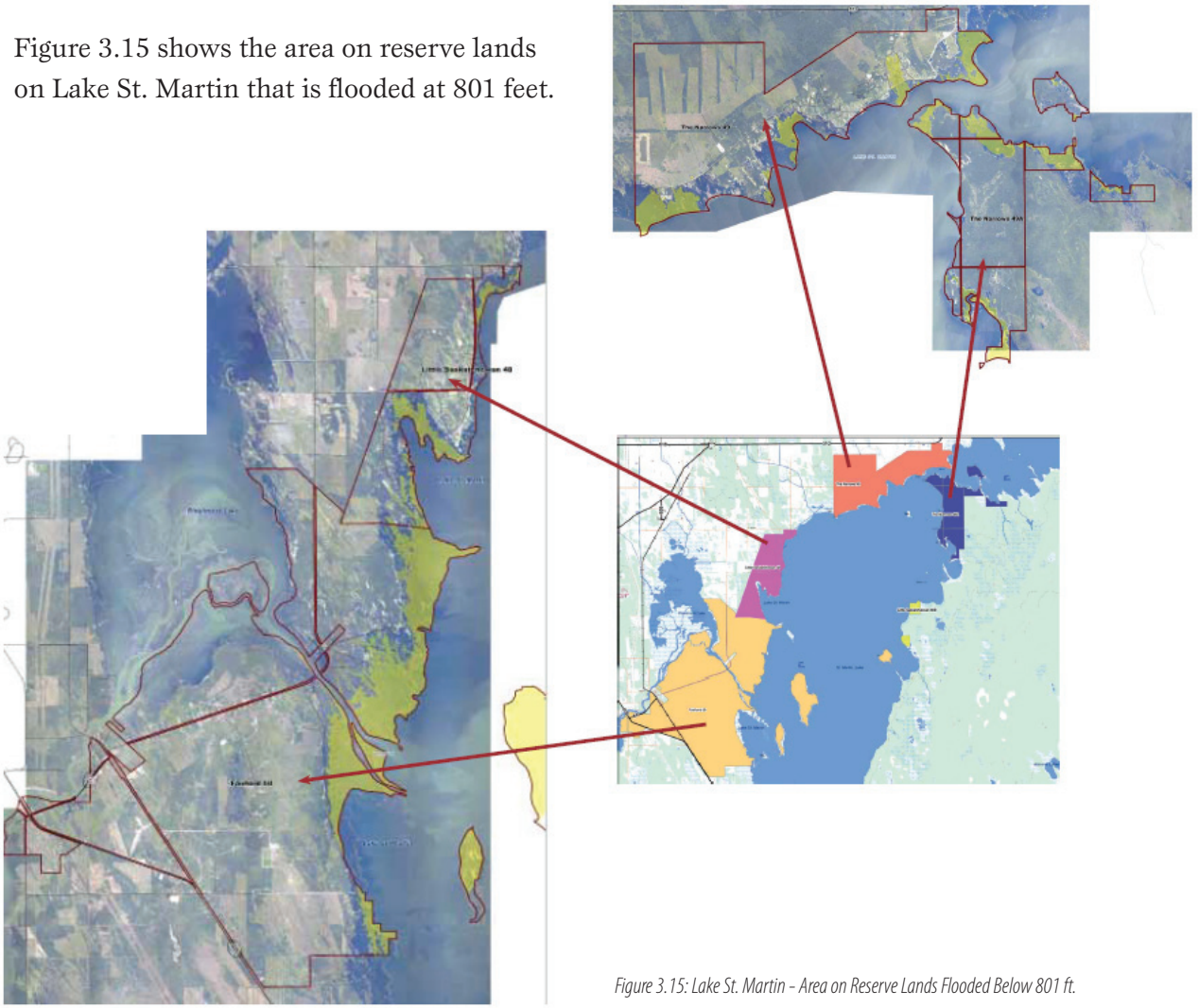


Figure 3.15: Lake St. Martin - Area on Reserve Lands Flooded Below 801 ft.

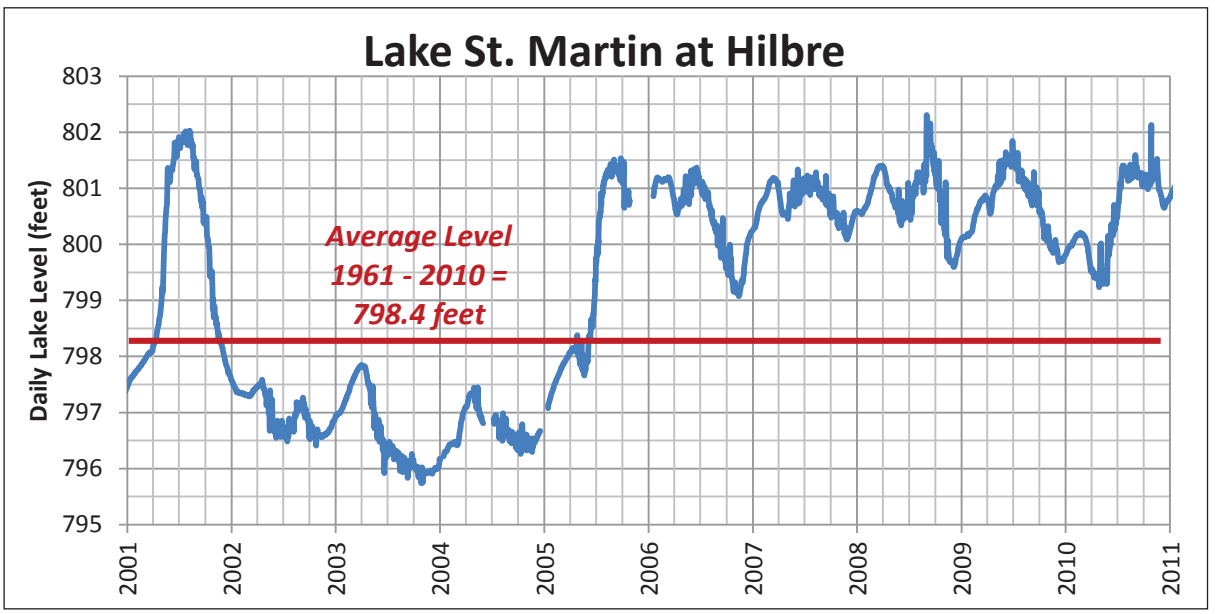


Figure 3.16: Lake St Martin Recorded Levels

3.5.2 History of Flooding

Lake St. Martin has a long history of flooding. Much of the land around the lake is flat and prone to flooding. In addition, the groundwater in this portion of the Interlake is very close to the surface and the pressure in the confined aquifer – underground water that is contained above and below by layers of rock or soil – is artesian when released, meaning the pressure could naturally push the water to the surface. When conditions around Lake St. Martin are wet, it can be difficult to distinguish between wetness caused by high lake levels and wetness caused by the high water table and poor drainage.

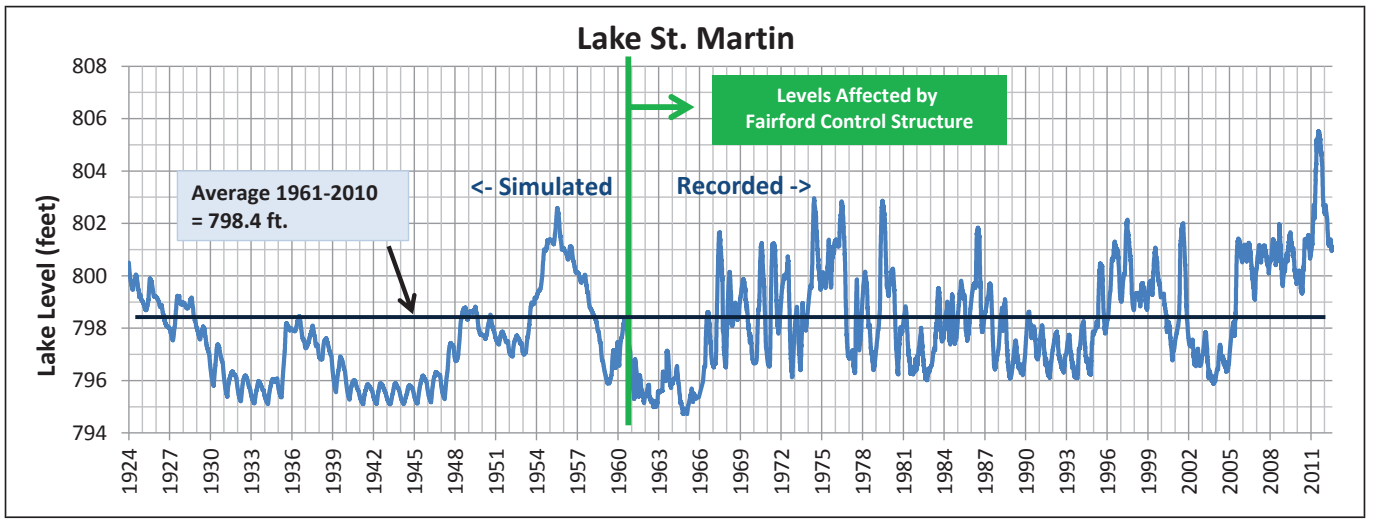


Figure 3.17: Lake St. Martin Lake Levels

Figure 3.17 shows recorded levels on Lake St. Martin. Levels have been recorded since 1961. Levels back to 1924 were simulated based on Fairford River flows through the lake during those years. Levels, before and after regulation, are generally within the same range although the low levels during the 1960s and the high levels during the 1970s were more extreme. The most obvious difference is the rapid fluctuations in lake levels since the Fairford River Water Control Structure was put into operation. Some of the fluctuations are wind effects but others are a direct result of sudden changes in inflow to Lake St. Martin when the log settings in the Fairford structure are changed.

As a result of the flood experience following completion of the Fairford River Water Control Structure, the Province purchased most or all of the privately held land around Lake St Martin and Pineimuta Lake in the mid-1970s. As a result of these purchases, most of the land in the vicinity of the lakes, with the exception of First Nation lands, is now Crown land.

While there are other interests in the lakes, such as sports fishing and tourism, First Nations hold the core interest in the levels of Lake St. Martin and Pineimuta Lake and flows on the Dauphin River.

There are four First Nations bordering Lake St Martin and Dauphin River: [2]

- Pinaymootang First Nation with a registered on-reserve population of 1,320
- Little Saskatchewan First Nation, with a registered on-reserve population of 642
- Lake St. Martin First Nation with a registered on-reserve population of 1,417
- Dauphin River First Nation with a registered on-reserve population of 209

Dauphin River First Nation is in a different hydrological regime than the other three communities. While it receives all the water coming into Lake St. Martin, it does not border Lake St. Martin. It lies in a river environment on the shores of Lake Winnipeg. While flooding of the river and debris washing into Lake Winnipeg is an issue, the greatest effect on Dauphin River is the propensity for the formation of frazil ice at the mouth of the river (where the ice sheet forms on Lake Winnipeg) and at the "big bend" on the river. Frazil ice forms at night with a drop in temperature. Historically, it has caused the river to back up and resulted in flooding PTH 513 near the big bend and in the community.

The potential for a flood of this kind was perceived to be such a threat in the fall of 2011 that extensive dikes were built on both banks of the community. Due to an unseasonably warm 2011/12 winter, however, the frazil ice did not materialize. Meanwhile, the dikes have seriously disrupted the community, including closing the commercial fishery. As of the summer of 2012, a solution to the dike problem was being developed jointly by Dauphin River First Nation and the Province.

" The construction of the Fairford Dam has had a negative impact downstream. The First Nation communities have been affected along with recreation, wildlife, fisheries, and agriculture. The Government of Manitoba has taken steps in compensating for the loss of hay land, but this is not comparable to the destruction the dam has caused from increased fluctuations of water levels."

- Myrle Traverse, *Analyzing the Effects of the Fairford Dam on Lake St. Martin First Nation, 1999.*

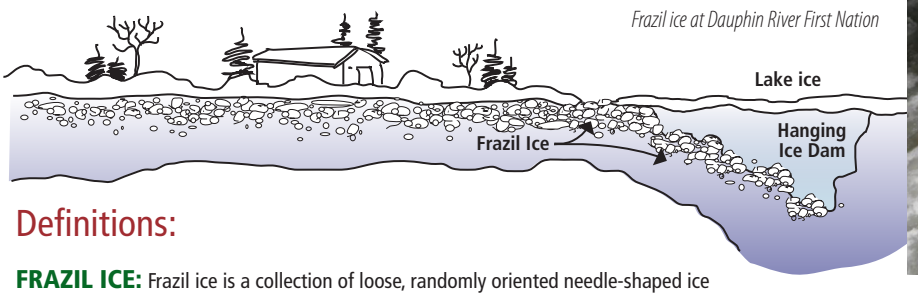
[2] Aboriginal Affairs and Northern Development Canada, First Nation Profiles, Registered Population, June 2012.

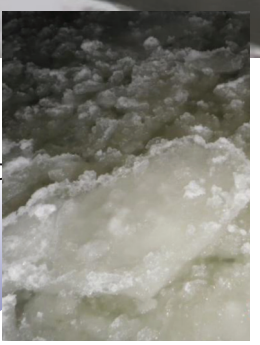
Prior Reports and Recommendations

Lawsuits and concerns about the operation of the Fairford River Water Control Structure led to a number of technical studies starting in the early 1970s.

The Manitoba Water Commission (1978) noted that the regulation of Lake Manitoba reduced the frequency of higher water levels but the effect was to increase the frequency of higher levels on downstream lakes – Lake St. Martin and Pineimuta Lake. The effect downstream was such that when Lake Manitoba is at a low level, the outflow from Lake Manitoba decreases and Lake St. Martin and Pineimuta Lake have lower levels with greater frequency.

Frazil ice at Dauphin River First Nation





Definitions:

FRAZIL ICE: Frazil ice is a collection of loose, randomly oriented needle-shaped ice crystals in water. It resembles slush and has the appearance of being slightly oily when seen on the surface of water. It sporadically forms in open, turbulent, supercooled water, which means that it usually forms in rivers, lakes and oceans, on clear nights when the weather is colder, and air temperature reaches –6°C or lower.

HANGING DAMS: At high velocities, the frazil is transported downstream under the ice cover where it adheres to the undersurface in a low velocity area. As the supply of frazil continues, the ice accumulation under the cover grows in size forming a "hanging dam". A hanging dam can cause extensive blockage of the flow area resulting in increased upstreamwater levels and potential flooding. Frazil ice jams also occur at upstream locations on the Dauphin River frequently flooding Highway 513.

The 2003 report of the Lake Manitoba Regulation Review Advisory Committee noted that:

> *Since 1960, there have been numerous annual peak flows on Lake St. Martin that exceeded elevation 800.0 ft. asl, the* ***approximate level when flooding occurs*** *(emphasis added). Many of these events exceeded this level by more than one foot and a few by approximately three feet. Under calculated natural conditions, only a few events would have exceeded 800.0 ft. asl.* [3]

The Committee recommended that:

> *The level of Lake St. Martin should be maintained within a more natural range of 797.0 ft. to 800 ft. asl insofar as this may be reasonably possible, in order to reduce flooding, to provide better access for commercial fishing and recreational interests, to enhance the commercial and sports fisheries, to maintain marshlands in a natural state, to restore the natural aesthetics of the region and to provide hayland for local ranchers.* [4]

Figure 3.17 shows that water levels on Lake St. Martin have exceeded the 800 ft flood level every year since 2005. In fact, since the recommendation of 2003, the recommended levels for Lake St. Martin have been achieved infrequently.

Legal Actions

Agreements were negotiated in the 1970s with each of the three affected First Nations (Pinaymootang, Little Saskatchewan and Lake St. Martin) on the basis that the Fairford River Water Control Structure had caused artificial flooding. The agreements provided for the transfer of land from Manitoba to Canada to be set apart as reserve lands in compensation for those lands now subject to more frequent flooding. Affected non-First Nation land owners were compensated in the form of cash settlements.

Under the terms of these agreements, Manitoba was to be indemnified for flood damage resulting from the operation of the Fairford River Water Control Structure. However, the agreement with Pinaymootang was not finalized because Canada did not approve the agreement. The land transfer part of the agreement was fulfilled to the extent that lands have either been available for the benefit of the First Nations or transferred to Canada and set aside as reserve lands. In total, some 9,100 acres have been either transferred or made available to First Nations as compensation.

The lingering problem is that the operation of the Fairford River Water Control Structure continues to flood First Nation lands without any agreement with the affected First Nations. Manitoba is presently engaged in tri-partite talks with Canada and each of the affected First Nations, working towards full and fair settlement agreements that would include flood easements and compensation for past flood damages.

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[3] The Lake Manitoba Regulation Review Advisory Committee, *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues: A report to the Manitoba Minister of Conservation*, July 2003. Web. 5 Oct. 2012.

[4] Ibid.

When and if the flood easements are in place, the levels of Lake St. Martin and Pineimuta Lake can rise to the levels specified in the agreements without any future legal action. However, the Committee's task to identify preferred lake levels is not necessarily satisfied by these arrangements. Preferred lake levels may be quite different to lake levels that may be contained in the easements. The signatory First Nations may agree to easement levels, but it does not mean they are the preferred levels.

3.6 The 2011 Flood Event

As shown in Figure 3.18, Lake St. Martin levels were at 800.8 feet at the start of 2011. Levels dropped off a little in early April as the Dauphin River cleared of ice, but with increasing Fairford River flows the levels started to rise rapidly. Levels peaked at 805.6 feet in late July, more than two feet higher than the previous recorded maximum level. The high levels flooded shoreline and backshore areas around the lake and forced the evacuation of community residents.

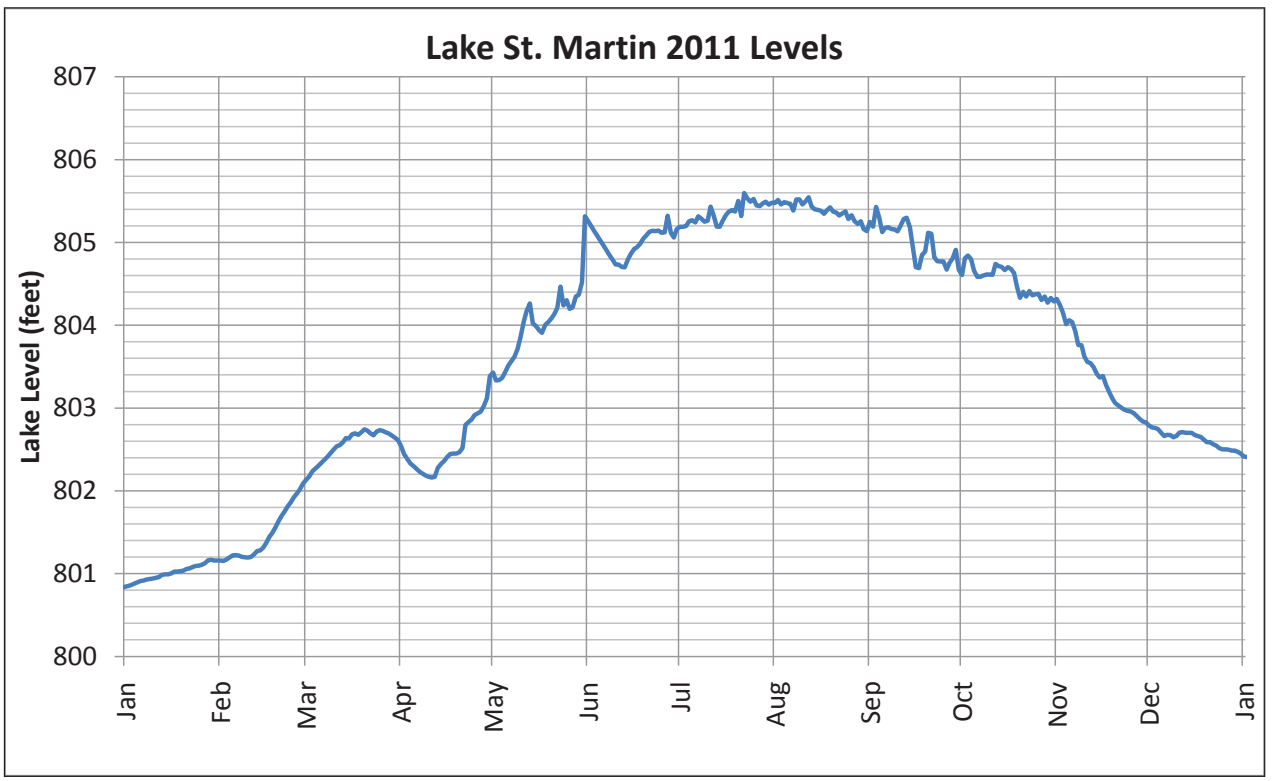


Figure 3.18: Lake St. Martin 2011 Levels

The flood of 2011 prompted a hurried but significant program of dike construction on each of the First Nations bordering Lake Manitoba and Lake St. Martin. The dikes met with varying success. On at least one of the First Nations, the program left a legacy of well-constructed infrastructure that serves as a high quality road within the reserve and more or less permanent protection for a majority of homes. For Lake St. Martin First Nation, however, the dikes failed to protect the community resulting in extensive damage to some 180 homes and leaving over 1,100 people living in temporary accommodation.

Discussions are continuing with each First Nation that received clay dikes (all but one) about making them permanent and upgrades to make them more useful to each community. This could include increasing the width to local road standards, sloping the sides, placing culverts, and grading driveways.

When and if these dikes become permanent features, the housing portions of most reserve lands on Lake St. Martin will be protected to about 805 feet asl. This does not solve the issue of artificial flooding of reserve lands, but does lessen the potential impact of future damage to housing and other infrastructure. The lack of internal drainage on many First Nations is an additional concern that requires the same degree of attention as the permanent dikes.

PERSPECTIVE

People naturally focus on their own concerns. It is hard for people to have empathy for others who they don't know and who are dealing with issues that they have not experienced themselves. For people living in Winnipeg, the flood of 2011 was experienced largely through the media. Lake Manitoba people feel their problems were not fully appreciated by the broader public. People bordering Lake St. Martin feel that not even those on Lake Manitoba fully appreciate their problems.

As described in more detail in Section 3.1.3, an emergency channel was constructed from Lake St. Martin in the summer and fall of 2011. Without the channel, the level of Lake Manitoba was expected to remain well above the upper range of regulation throughout 2012. Lake St. Martin was expected to be above flood stage into the fall of 2012, with a summer peak 2.5 feet higher than the historic peak of 1955.

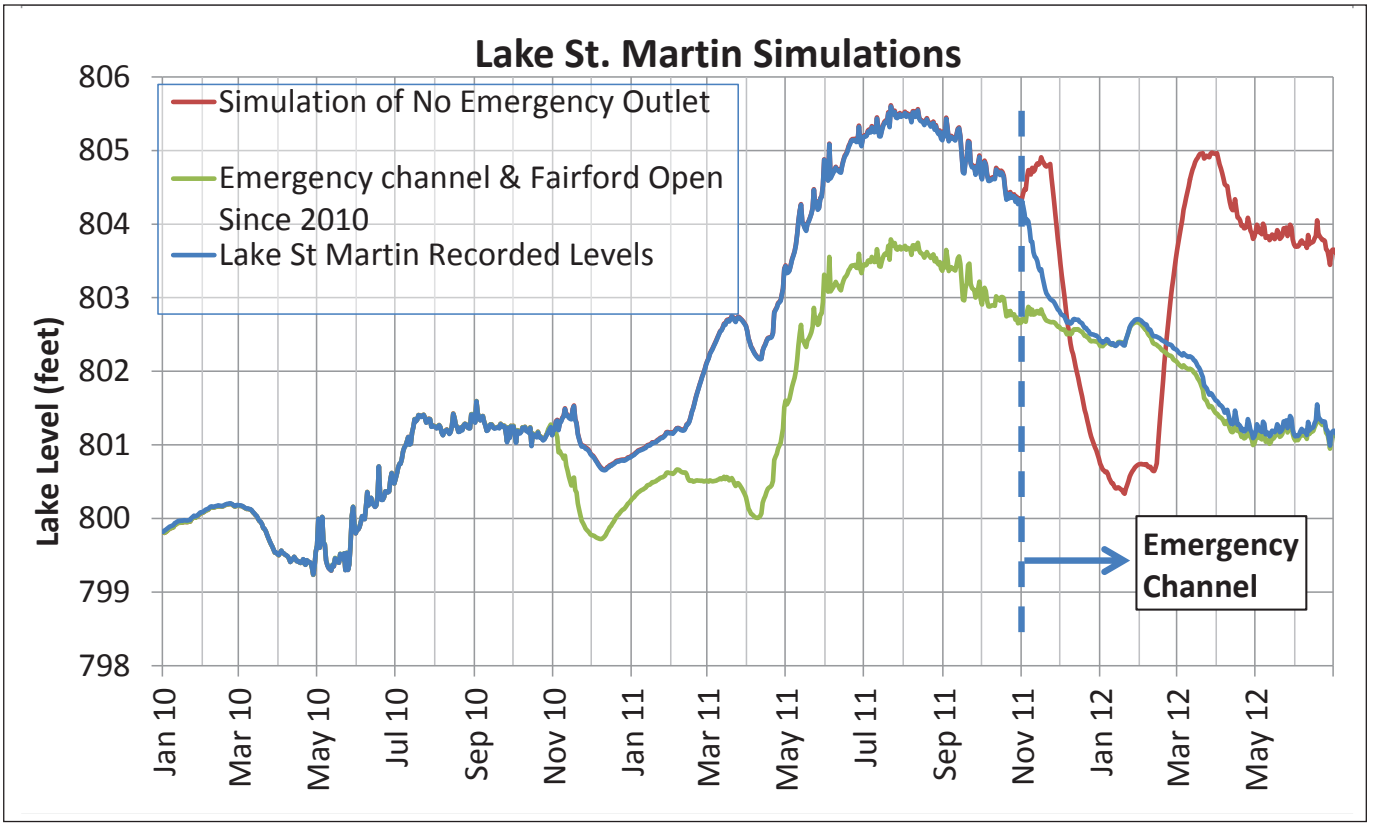


Figure 3.19: Effectiveness of Emergency Channel

Figure 3.19 shows simulations of Lake St. Martin levels with and without the Emergency Channel. The blue line shows that Lake St. Martin recorded levels continued to drop over the fall and winter of 2011/12. The light green line shows the lake levels that would have occurred if the Emergency Channel had been in place a year earlier. The peak 2011 level would have been almost two feet lower than what actually occurred.

The red line shows the levels that would have occurred if the Emergency Channel had not been constructed. The Fairford flows would have been reduced to 5,000 cfs over the winter period, as they had been in 2010/11 to prevent frazil ice development on the Dauphin River. This would have resulted in a drop in Lake St. Martin levels. However, the reduced winter flow volumes would have remained in Lake Manitoba, resulting in higher than recorded spring flows in 2012 once the control structure was reopened. This would have brought Lake St. Martin levels back up to the levels experienced in the fall of 2011.

3.6.1 Addressing Lake Levels – Lake St. Martin

The Lake Manitoba Regulation Review Advisory Committee, in their report of 2003, recommended that:

> *The level of Lake St. Martin should be maintained within a more natural range of 797.0 ft. to 800 ft. asl insofar as this may be reasonably possible.* [5]

As noted, this recommended range has been achieved less than 40 percent of the time over the last 20 years. In addition to this apparent historic inability to obtain an operating range acceptable to First Nations downstream of the Fairford Control Structure, the flood of 2011 has given new impetus to resolving long standing legal actions and substantial discussions about ongoing clean up and remediation of flood damage. In this environment, discussions with First Nations about "the most acceptable and practicable range of regulation within which the levels ……of Lake St. Martin might be controlled" has proven to be problematic for all parties.

To deal with this set of circumstances, the Committee has taken the approach to consider what works and measures would be necessary to achieve the levels recommended in 2003, in most circumstances. That is, to consider what works would have to be in place (and how they would have to be operated) to give all the parties reasonable assurances that 797 to 800 ft. asl (or an alternative range developed in discussions with First Nations) could be achieved.

[5] The Lake Manitoba Regulation Review Advisory Committee, *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues: A report to the Manitoba Minister of Conservation*, July 2003. Web. 5 Oct. 2012.

4 • Treaties and Water Management in Manitoba

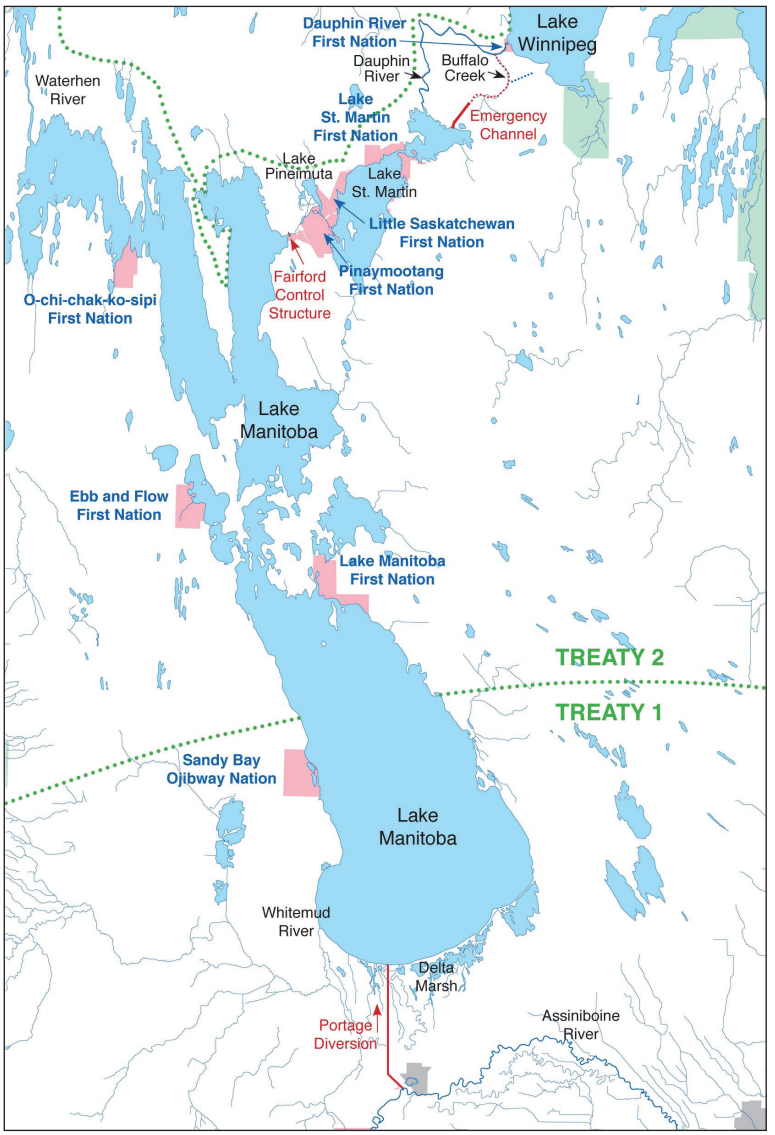
A review of treaties is essential to provide some context to water management in Manitoba. Treaties are a central part of this province's history that have growing relevance today with respect to management of natural resources, including water management strategies.

The population bordering Lake Manitoba and Lake St. Martin includes seven reserves with an on-reserve population of about 10,500 people.

4.1 History of Treaties

The history of treaties very much follows settlement and resource exploitation across Canada. The Crown's motivation in signing treaties was to facilitate non-Aboriginal access to resources. The government of the day and the English Crown recognised that Aboriginal title had value. Land might be forcibly occupied by outsiders but under British Common Law the government could not readily issue title. As real property was the foundation of English society, title was essential. The government had little interest in northern treaties until Aboriginal title looked like it might stand in the way of Canadian interests. Treaties in the northern part of Manitoba, therefore, occurred at a later date than treaties across the southern prairies.

For Aboriginal people, the economic situation shaped the outcome of the treaties. The First Nations viewed treaties as a means to improve their economic condition. From the



First Nations of Lake Manitoba and Lake St. Martin

perspective at the time, First Nations were to be the recipients of government largess. They were to receive benefits and be guaranteed the right to continue historic pursuits throughout the resource area. They were also to receive the protection of the Crown in disputes with the settlers.

The balance of power and authority, however, worsened for Aboriginal people after the treaty. Benefits proved to be fleeting and they lost their leverage. The value of annual provisioning soon had little value and the anticipated improvement in economic conditions did not materialize.

The numbered treaties are a series of 11 treaties signed between Aboriginal people in Canada and the reigning Monarch of Canada from 1871 to 1921. These treaties are essentially agreements with the Government of Canada and overseen by Aboriginal Affairs and Northern Development Canada.

The lands bordering Lake Manitoba and Lake St. Martin are within two of the numbered treaties. Sandy Bay First Nation falls within Treaty 1. The other First Nations around the lakes fall within Treaty 2.

Treaty 1

Treaty 1 was the first treaty signed since the 1867 formation of the modern Canadian government and one year after the Province of Manitoba was formed as a part of the Canadian Confederation. It was also known as the Stone Fort Treaty, based on the nickname of Lower Fort Garry, where the treaty was signed. The treaty was made August 3, 1871.

Treaty 2

Treaty 2 was signed August 21, 1871. It was also known as the "Manitoba Post Treaty", named after the fur trading post of the Hudson's Bay Company where the treaty was signed. Manitoba Post was located on the northwest shore of Lake Manitoba. The terms of this treaty were similar to that of Treaty 1.

Treaty 1 and Treaty 2 were amended by an Order in Council on April 30, 1875, to add provisions that were originally promised verbally by the government. Similar "outside promises" were included in the text of 1873's Treaty 3, adding further pressure on the government to include such provisions in the earlier treaties. [6]

At the making of Treaty 1, Lieutenant-Governor Archibald, speaking on behalf of Canada stated:

> *Your Great Mother, therefore, will lay aside for you 'lots' of land to be used by you and your children forever. She will not allow the white man to intrude upon these lots. She will make rules to keep them for you, so that as long as the sun shall shine, there shall be no Indian who has not a place that he can call his home, where he can go and pitch his camp, or if he chooses, build his house and till his land.*

[6] "Treaty 1." *Wikipedia, The Free Encyclopedia*. Wikimedia Foundation, Inc. 21 July 2012. Web. 5 Aug. 2012.

When you have made your treaty you will still be free to hunt over much of the land included in this treaty. Much of it is rocky and unfit for cultivation. Much of that is wooded is beyond the places where the white man will require to go, at all events, for some time to come. Till these lands are needed for use you will be free to hunt over them, and make all the use of them which you have in the past. [7]

The region of interest for the Committee cuts across treaty lines. The Committee has focused its attention on First Nations who border directly on either Lake Manitoba or Lake St. Martin.

4.2 Métis Influence

The **Métis** are constitutionally recognized as one of the Aboriginal peoples in Canada. They trace their ancestry to a mixed First Nations and European heritage that developed into a distinct Aboriginal group with formal recognition equal to that of the Inuit and First Nations.

The Métis were central figures in the fur trade, led the commercial aspects of the buffalo hunt, and occupied farm lands along the major river systems. Today, there are significant populations of Métis people in communities bordering Lake Manitoba.

The actions of the Métis community to protect their rights and interests brought Manitoba into Confederation with the *Manitoba Act of 1870*, later given constitutional status by the British Parliament in the *Constitution Act, 1871*.

Negotiations forced by Louis Riel resulted in concessions from Canada for Manitoba and the Métis including:

- Full provincial status for Manitoba (rather than territorial status);
- Guarantees for the French language and for Roman Catholic schools;
- Protection for settled and related common lands;
- Distribution of 1.4 million acres of land to Métis children, "towards the extinguishment of the Indian title to the lands in the province" and to ensure the perpetuation of Métis communities in Manitoba; and
- Amnesty for those who had participated in the resistance and formed the provisional government.

The provisions for the French language and Roman Catholic schools proved to be fleeting with subsequent provincial legislation withdrawing funding from denominational schools. (The "Manitoba Schools Question" became a national political crisis.) The promised distribution of land to the Métis community proved to be less than satisfactory and is the subject of court cases to this day.

[7] Morris, Alexander. *The Treaties of Canada with the Indians*. Toronto: Prospero Books, 2000. Print.

From the 2006 census, there were 71,805 residents of Manitoba who self-identified as Métis. In addition to more contemporary occupations, many Métis continue with traditional lifestyles and are active in commercial fishing and trapping. They remain interested in maintaining a diverse and healthy wildlife population. Waterways are important to the Métis.

5 • The Impact of Water Level Regulation

The Terms of Reference required the Committee to review and consider the impact of water level regulation on the lake and surrounding land, including people and communities, wildlife and wetlands, agriculture, fisheries, water quality, and recreation.

To address this task, the Committee received presentations by subject matter specialists from government departments and the University of Manitoba among others; undertook literature reviews; made site visits; received at meetings comments from people engaged in related occupations; and received comments from the public at large through open house venues and through the Committee's web site and surveys.

Presented below is a high level summary of what the Committee heard on these topics followed by a more detailed consideration of each topic.

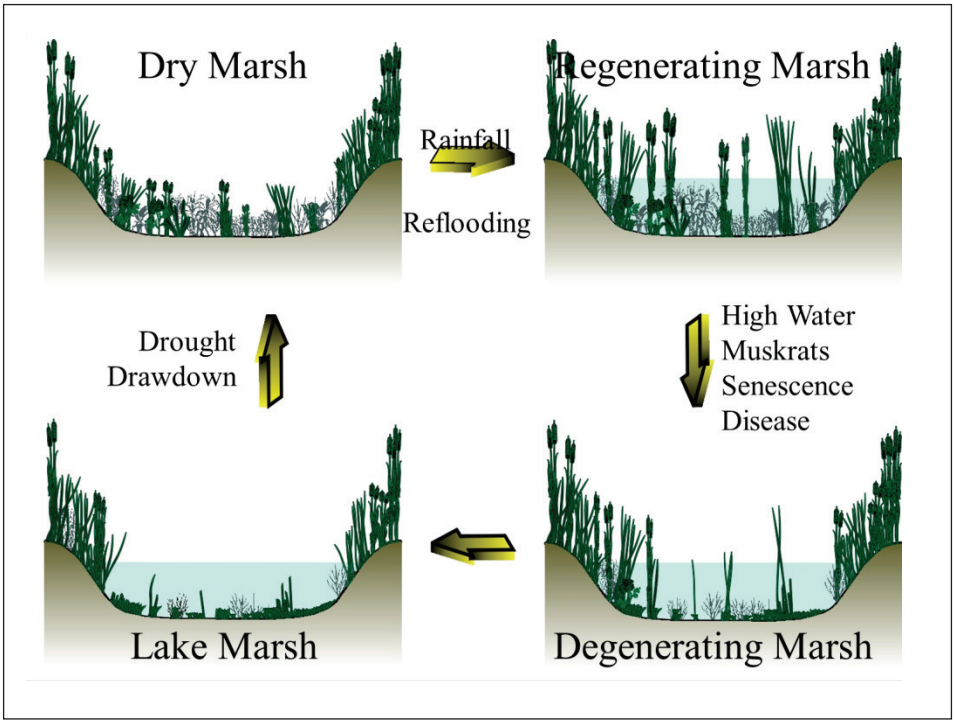


Figure 5.1 Marsh renewal cycle

The Committee received presentations to the effect that there is no evidence of a direct correlation between fish populations and any particular water level, and no evidence of a direct correlation between wildlife and one water level. In each case, the Committee's understanding of the science is that both fish populations and wildlife would benefit from a more diverse and abundant riparian and aquatic vegetation. This vegetation comes naturally from water levels that remain at a low level for at least one growing season. Low lake levels that are sustained over a growing season allow for re-vegetation and a diversity of riparian vegetation. The ideal depiction of marsh renewal is shown in Figure 5.1, courtesy of Ducks Unlimited.

While the operating guidelines for the Fairford River Water Control Structure are intended to allow for this cycle of natural rejuvenation, the lake has been in a wet cycle almost throughout the entire period since the guidelines have been introduced. The control structure has been more or less wide open (with the exception of late fall reductions to mitigate frazil ice formation on the Dauphin River), but inflows have kept Lake Manitoba at the high end of its desirable operating range and the cycle depicted in the chart has not happened.

Commonly, the Committee heard from the public that a healthy aquatic and riparian ecosystem is desired, but with the added proviso that lake levels should not exceed or fall below certain levels that were perceived to be best for their own specific interests. While these concepts are not necessarily compatible, there was broad acceptance that natural fluctuations in water levels result in an abundance and diversity of aquatic and riparian vegetation that are beneficial to essentially all aspects of the lake, from water quality through to fisheries and wildlife.

> *" To maintain species diversity, maintain habitat diversity."*
>
> - comment at Public Meeting

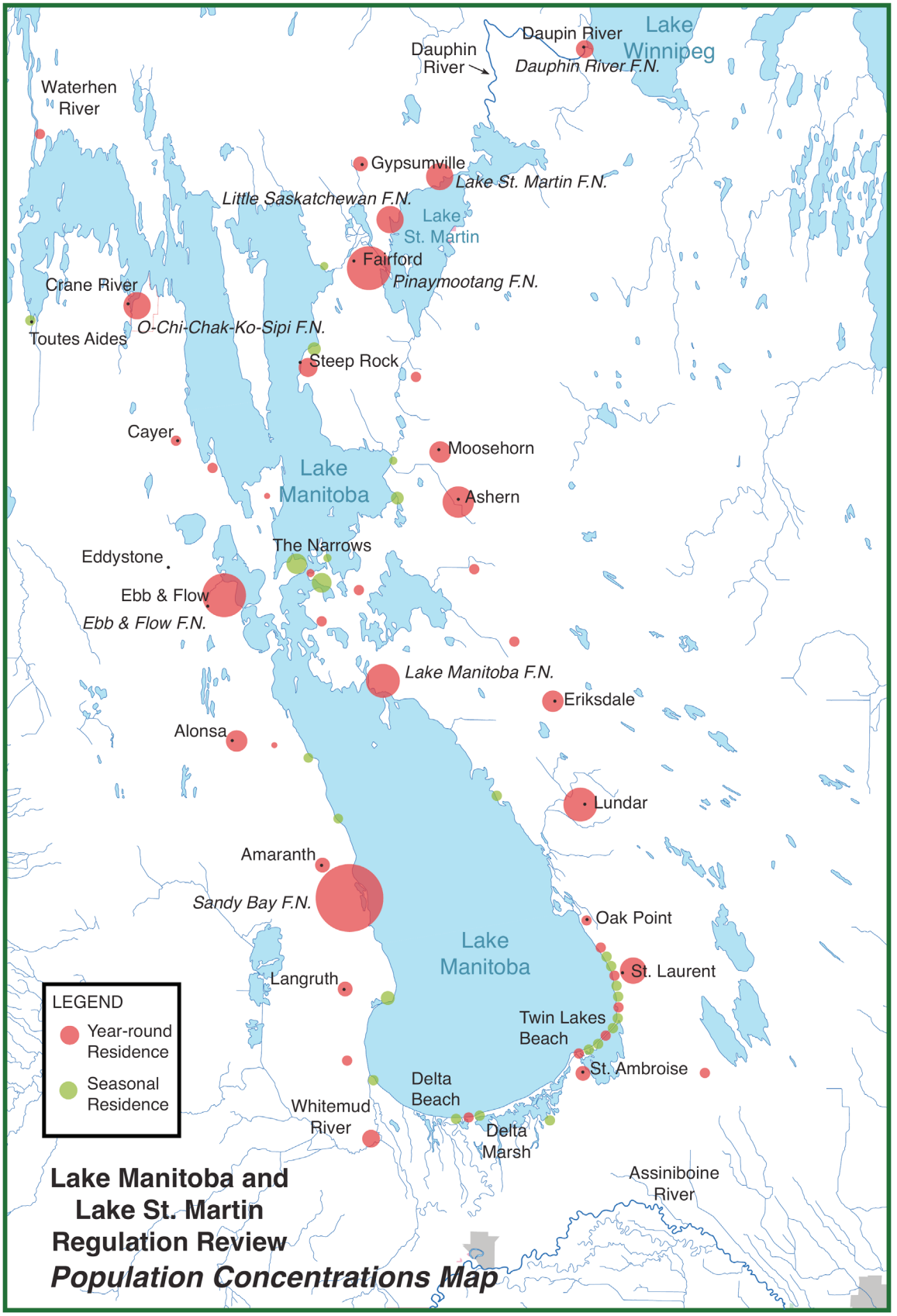
The Committee also heard that the Portage Diversion has an adverse effect on water quality through increased nutrients, decreased salinity and increase of suspended solids. There is a deep concern by the agricultural community over the loss of agricultural lands due to high lake levels. Some highly productive farm and ranch lands may have been lost permanently due to the creation of saline soil conditions resulting from standing water.

The shoreline/vegetation conditions that are beneficial to wildlife and fisheries, however, may also support a native hay crop valuable to the ranching community although native hay is susceptible to standing water that lasts over 60 days. There is a complex relationship between healthy marshes and productive native hay/pasture, but they are not incompatible with a management regime that accounts for both.

Presented below are sections dealing with each topic within this part of the mandate. These topic areas are described in some detail to provide context and, where appropriate, background on related industries.

5.1 Permanent and Seasonal Residents

There are four First Nations bordering Lake Manitoba with an on-reserve population of about 7,000 people, and approximately 2,000 cottage properties and other permanent residents along the shores. Typically, seasonal recreation properties have been developed close to the shoreline while First Nations have taken advantage of other parts of their reserve lands and located further from the shore. Nonetheless, Lake Manitoba First Nations still had a significant number of homes and infrastructure impacted by the floods of 2011.


Daupin River
Lake Winnipeg
Dauphin River
Dauphin River F.N.
Waterhen River
Gypsumville
Lake St. Martin F.N.
Little Saskatchewan F.N.
Lake St. Martin
Fairford
Pinaymootang F.N.
Crane River
O-Chi-Chak-Ko-Sipi F.N.
Toutes Aides
Steep Rock
Cayer
Moosehorn
Lake Manitoba
Ashern
The Narrows
Eddystone
Ebb & Flow
Ebb & Flow F.N.
Lake Manitoba F.N.
Eriksdale
Alonsa
Lundar
Amaranth
Sandy Bay F.N.
Oak Point
Lake Manitoba
St. Laurent
Langruth
Twin Lakes Beach
St. Ambroise
Delta Beach
Whitemud River
Delta Marsh
Assiniboine River
LEGEND
Year-round Residence
Seasonal Residence
Lake Manitoba and Lake St. Martin Regulation Review
Population Concentrations Map

There is a common interest of all people along Lake Manitoba regarding both lake levels and water quality. Water levels and flows and the biology of the lake have an impact on its use and enjoyment by residents. Conversely, shoreline and recreational development can have an impact on water quality and vegetation along the lake's edge.

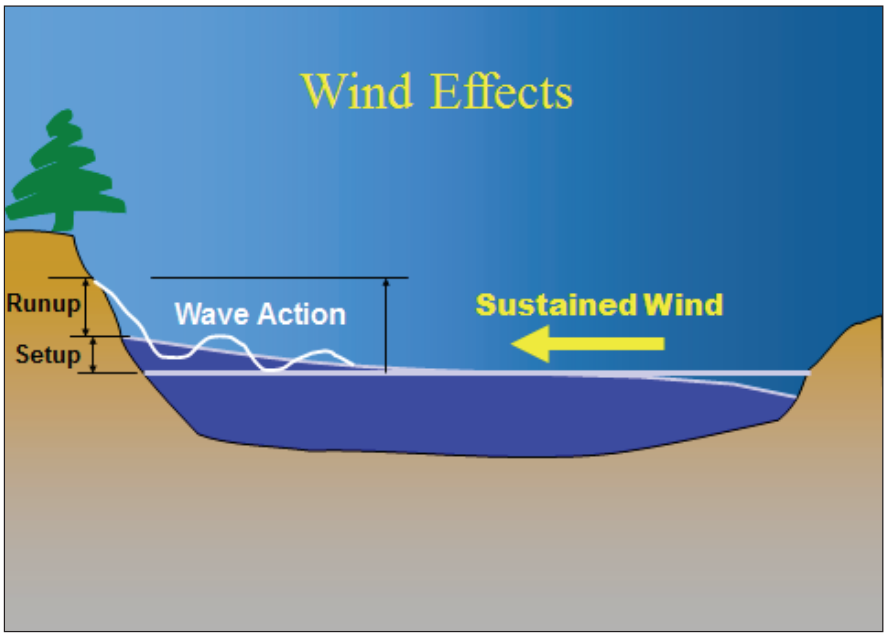


Figure 5.2: Wind effects and wave action

High lake levels, even below flood stage, can cause stress and anxiety, as lake residents are fully aware of the dangers posed by wind and wave action (see Figure 5.2).

Conversely, low lake levels affect the use and enjoyment of boaters and sport fishers. Low levels are reported as more of an issue in the north basin than the south basin of Lake Manitoba.

Concerns about poor water quality, algae blooms and high coliform counts are an issue throughout the lake. There is a common interest in the abundance and diversity of fish and wildlife, although what people want to see in lake levels for swimming and boating are at times incompatible with achieving vibrant habitats along and on the shore.

In general, the area of wet meadows along lakes increases with natural water level fluctuations. A large and productive shore region is an important characteristic of a healthy lake. This zone is at particular risk from control structures that reduce the natural fluctuation of water levels upon which many wetland plants and animals depend. Stable water levels, over time, can reduce the area of wetland from a broad zone along the shore to a narrow band of vegetation. Marshes and wet meadows of Lake Manitoba are at particular risk.

PERSPECTIVE

While damage to property on the shores of Lake Manitoba has mostly been to seasonal residences, the notion that these are simply recreational properties tends to trivialize the damage. There are some elaborate and expensive cottages along the lake, but many cottage owners are not wealthy; their cottages are relatively modest. Some are used as a permanent summer residence and have often been in the family for two or more generations. The loss and damage has been felt deeply and the notion that these are just cottages fails to capture the real sense of loss.

Property owners that want lake levels more or less constant throughout the summer season are asking for a regulatory regime that will diminish the quality of the lake over an extended period of time. Stable levels also eventually reduce the extent of beaches along the shoreline. If a beach is not flooded from time to time, sandy beaches become transformed into grasslands. Presentations to the Committee included recognition that lake level fluctuations were a positive factor in recommending an operating regime.

Big Point

As another aspect of accommodating growing populations around Lake Manitoba, property development has become part of the fabric of the municipal economy. For example, cottages and permanent residents make up a significant part of municipal budgets; cottage owners are the backbone of the local service industry; and property development provides an important opportunity for local landowners, developers and contractors.

In the 2003 report of the Lake Manitoba Regulatory Review Advisory Committee, the Twin Lakes Beach Association indicated that:

> *"...the current target level of 812.17 ft. asl, which is the approximate long-term average level of the lake, was unacceptable to them as a target. They claim at this elevation, lake levels could quickly increase to 812.5ft asl or higher, the elevation where their properties are severely endangered by strong northerly winds and the resulting setup and wave action."*

While the Committee in 2003 ultimately recommended a range higher than that sought by the Twin Lakes Beach Association, it is useful to note that the level the Association wanted could not have been achieved given the current control structures and the wet conditions experienced over the last few years.

PERSPECTIVE

It is easy to be critical of the decision to build cottages and permanent homes along the low-lying shorelines of Lake Manitoba. After the flood of 2011, it was obvious to critics and local residents alike that structures should have been built at higher elevations. However, in living memory there had not been conditions like 2011. For the better part of 90 years, the lake has rarely exceeded 814 ft. asl, and those elevations have not been seen once since 1961 when the new Fairford River Water Control Structure gave everyone comfort that all would be fine.

Many critics of the Lake Manitoba situation live in Winnipeg where a good part of the city would have been flooded several times during the last 60 years. Save for elaborate and expensive flood control measures, it is likely that a substantial part of Winnipeg and elsewhere in the Red River Valley may now have been abandoned. We are almost all of us in southern Manitoba guilty of defying Mother Nature and paying the price for it.

Do we need better land use policies and zoning? Yes! Has the Lake Manitoba area particularly failed in this respect? No.

5.2 Wildlife & Wetlands

Background

Fluctuating water levels that occur as a result of natural wet and dry cycles are necessary to maintain quality wildlife habitat and biodiversity in the coastal wetlands of Lake Manitoba and Lake St. Martin. Much of these coastal wetlands contain important wildlife habitat (see Figure 5.3).

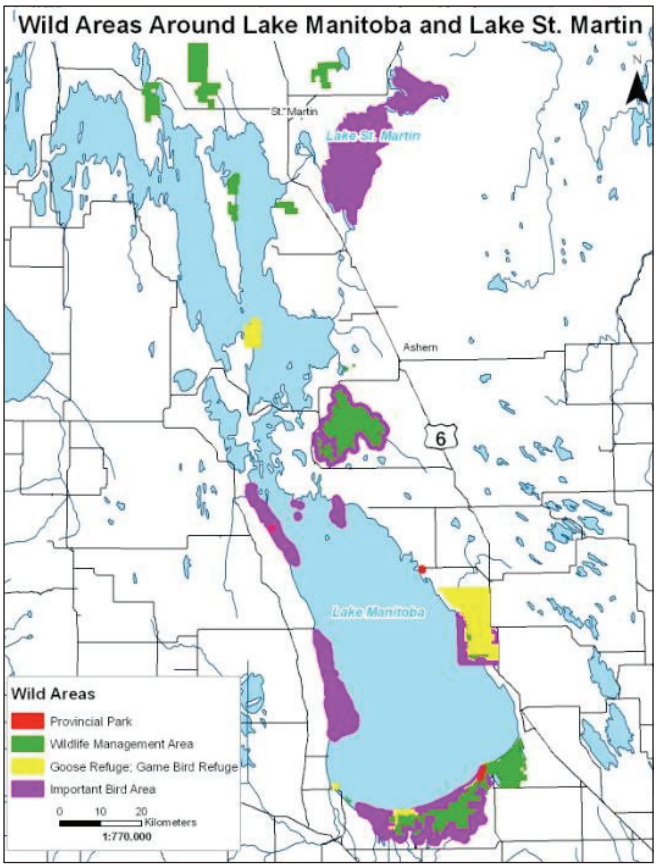


Figure 5.3: Wildlife Areas around Lake Manitoba and Lake St. Martin (Source: Manitoba Conservation and Water Stewardship)

Lake Manitoba and Lake St. Martin beaches contain critical habit for threatened and endangered species such as the piping plover, which nests on the beach adjacent to the Clandeboye Channel. In high water years, this beach ridge habitat is not available to the extent that, "...long term regulation at 812 levels [has] excluded plovers from most of Lake Manitoba." [8]

Caspian terns, pelicans, grebes and other colonial water bird species require island habitats for nesting, such as that found on the Sand Reef Islands. Similarly, a variety of wading birds, passerines, mammals and amphibians require habitat found in wet meadows, beach ridges and upland areas.

Piping plovers (Source: Manitoba Conservation and Water Stewardship)

[8] Manitoba Conservation and Water Stewardship, Wildlife Branch, in its presentation to the Committee, April 2012.

Delta Marsh
(Source: Manitoba Conservation and Water Stewardship)

Delta Marsh
(Source: Manitoba Conservation and Water Stewardship)

Delta Marsh (Source: Manitoba Conservation and Water Stewardship)

Delta Marsh

By examining sediment layers in Lake Manitoba, studies conducted in the 1970s showed that the Assiniboine River once flowed into the south end of the lake. Sediments were gradually moved eastwards by currents, resulting in the formation of a "barrier beach", which separates coastal wetlands from the lake. The portion of the lake basin that was isolated by this beach became Delta Marsh. Today, the beaches along the lake's south shore continue to be supplied by the sand that was deposited in the lake.

From the late 1800s to the 1960s, Delta Marsh was an international attraction, particularly as a hunting destination.

In more recent years, Delta Marsh has received international recognition as a wetland. It has been designated as a:

- Globally Significant Important Bird Area
- RAMSAR wetland of International Significance
- Manitoba Heritage Marsh
- Manitoba Wildlife Management Area
- Game Bird Refuge.

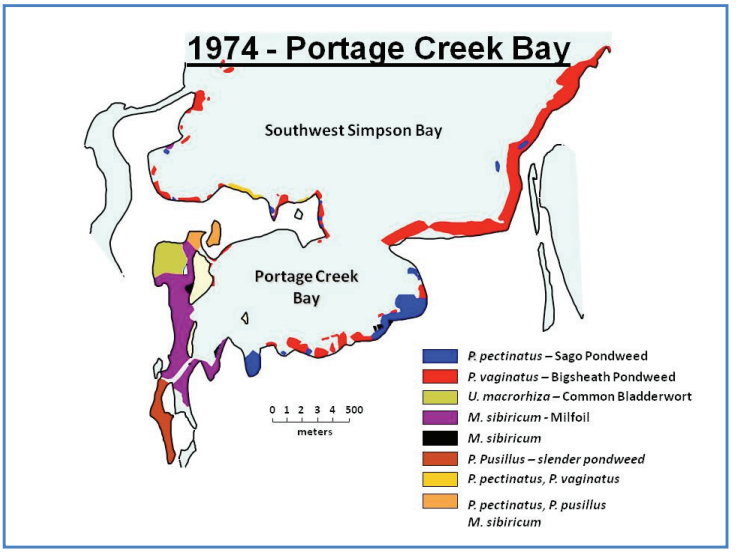
Delta Marsh was once an internationally significant staging area for waterfowl. However, today:

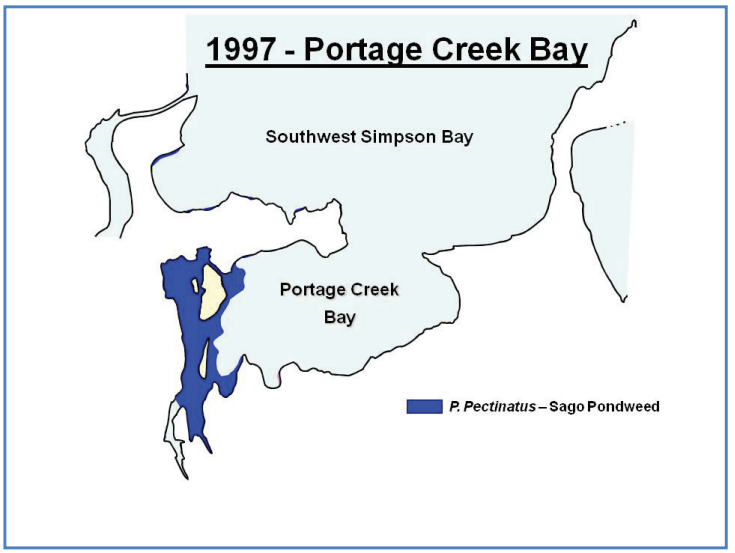
> *The abundance of waterfowl that once attracted hunters and later researchers to the marsh is largely gone. Only a few small areas of attractive habitat now exist, such as the Lynch's Point Ducks Unlimited Project Area, the Center Marsh/School Bay, and the Sioux pass Marsh DU project.* [9]

[9] Ibid.

Impacts and Implications

The reduction in waterfowl and quality wildlife habitat near Delta Marsh can be traced to human manipulation of water levels in the marsh. This began in the 1940s when dams were constructed between the marsh and the lake in order to retain water in the marsh for hunting purposes and improve muskrat production. By maintaining water levels at an average elevation, the natural wet and dry cycle of Lake Manitoba and the surrounding area was eliminated, causing serious problems for the health of the marshes in the Lake Manitoba basin.





Figures 5.4 & 5.5: Portage Creek Bay 1974 and 1997 (Source: Manitoba Conservation and Water Stewardship)

The effects of stable water levels on the lake's wildlife are complex, but effectively all adverse from the perspective of wildlife. Hardstem bulrush, the emergent vegetation plant species preferred by diving ducks, is disappearing as a result of the combination of stable water levels and disturbance to the poorly consolidated sediments on the marsh bottom. Also disappearing is the submerged vegetation (pondweeds) that waterfowl require for food. Furthermore, without this vegetation, the erosion of islands and shorelines has accelerated.

Specific areas within Delta Marsh show a significant decline in vegetation and diversity (see Figures 5.4 and 5.5). Over all of Delta Marsh, Manitoba Conservation and Water Stewardship estimate that "the area occupied by submersed vegetation has declined by about 50 percent from 1970 levels."[10] Species diversity has also declined. However, when the water levels drop, the vegetation and beach ridges can recover and become re-established.

[10] Ibid.

5.3 Agriculture

There is a rich diversity of agriculture in the vicinity of Lake Manitoba and Lake St. Martin, including production of cereal grains, oil seeds, speciality crops and mixed farming. The focus of this section, however, is ranching. The lands bordering Lake Manitoba/Lake St. Martin are one of the important beef producing areas of Manitoba. Ranchers in the vicinity of the two lakes note that this is "marginal farm land but incredible ranch land." These productive ranch lands are also the most susceptible to flooding, making ranchers particularly interested in the regulation levels chosen.

Background

The first European settlers arrived in the late 1800s. The early days of farming were an exercise in subsistence. Milk cows, beef cattle, forage and grain production, sheep for wool, chickens, and large vegetable gardens all supplemented by fishing and hunting were the life of first settlers.

Today, ranching is a specialization and an important component of the Manitoba economy.

Typical of the area around the lakes, ranchers are predominantly cow-calf operations. Beef calves are usually born in the spring, almost all outdoors. The fall roundup is a tradition on many ranches and still may be done on horseback. Cows and calves are brought in from their summer pastures, separated and weaned. After weaning in the fall, there are alternative strategies. Calves may be backgrounded to reach a weight of 800-900 pounds, at about a year old, and then sold to a feedlot for finishing. Or calves are backgrounded on a lower energy diet of mostly forages and put back on grass the following summer. At 18 months and at some 900 to 1000 pounds, they are sold to feedlots as shortkeeps for finishing.

> *" Haying with a scythe and rake couldn't have been easy especially on the island. But the really amazing thing was that the two men swam out in the morning and back in the evening after a long day's work."*
>
> - Ashern Historical Society, *Taming a Wilderness: A History of Ashern and District,* 1976

This is specialised work and like most commodities is tied into the world markets. While many of the practices look unchanged from 100 years ago, it is a very different type of enterprise. Successful ranchers employ sophisticated management techniques. They are still subject to the vagaries of the market, however, and losses of forage and pasture to flooding can be catastrophic.

Log barn with hay roof at Robb's

Compared to most locations throughout North America, the ranch lands in the vicinity of Lake Manitoba and Lake St. Martin are highly productive and associated with other attributes that make them an important component of Manitoba's agricultural economy.

Stocking Rates: Stocking rates near and around Lake Manitoba are 35 animal units/160acres/year (1animal unit or 1AMU = 1000lbs). By way of comparison, Brooks, Alberta, has a stocking rate of 4-10 AMU/160acres/yr, meaning a rancher in Brooks requires as much as eight times the land base to maintain a similar size herd.

Water: Most Lake Manitoba areas have unlimited water supply in every quarter whether it's surface water or well water, even in extended dryer periods. In many parts of western Canada, cattle have to walk up to two miles for water on a daily basis.

Dry Land Forage Production for Winter Feed: Lake Manitoba tame and native forage production ranges are typically two to three times that in areas like Medicine Hat, Alberta. While Lake Manitoba ranchers expect to be self-sustaining, many other ranching areas of North America need to source additional winter feed supplies, especially in dryer periods. There have been years where Lake Manitoba ranchers have required assistance with freight assistance for forage, but it is not the norm.

Natural Shelter: Lake Manitoba provides virtually unlimited natural shelter for all types of extreme weather conditions. As a result, cattle live in their natural environment almost year-round, with natural and even manure distribution. Many other parts of Canada and the U.S. have open prairies and need windbreak infrastructure for housing cattle in cold climate conditions, which restricts those operations to specific sites on an ongoing basis. It also means there is a constant need for infrastructure repair and manure removal, which adds cost.

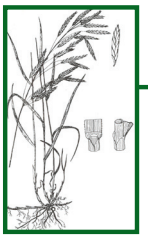
Land Prices: Lake Manitoba pasture land prices range from $200-$600/acre. In other locations, land prices are much higher. Prices in southern Alberta are commonly $1,000-$5,000/acre due to other demands on agricultural lands. This speaks to the viability of a ranching industry, making Manitoba a desirable location for investing in ranching.

Destocking and/or Sourcing Alternative Pasture Land: This is very common in many parts of the Prairie Provinces. The Lake Manitoba area is usually reliable for pasture production even in times of drought. Ranching in this area is generally self-sustaining, with ability to have enough pasture and enough forage production to maintain an economic herd within a single ranching operation.

It is not all rosy, however. There are some comparative disadvantages as well, including:

- A relatively long winter and extended dormant season;
- Spring calving challenges due to health issues and potential for restricted access due to spring runoff when conditions are wet and muddy; and
- Predator issues.

Overall, the advantages far outweigh the disadvantages, and ranching in the vicinity of Lake Manitoba and Lake St. Martin is a valuable land use that deserves consideration in the development of a management strategy for the two lakes.



Bromus inermis
(Smooth brome)

Medicago sativa
(Alfalfa)

Bromus biebersteinii
(Meadow brome)

Phleum pratense
(Timothy)

Definitions:

TAME HAY: A term given to hay fields that are on arable land and are occasionally rejuvenated. They may also receive herbicide and fertilizer treatments.

Agrpyron smithii
(Wheatgrass)

Festuca elatior
(Tall Fescue)

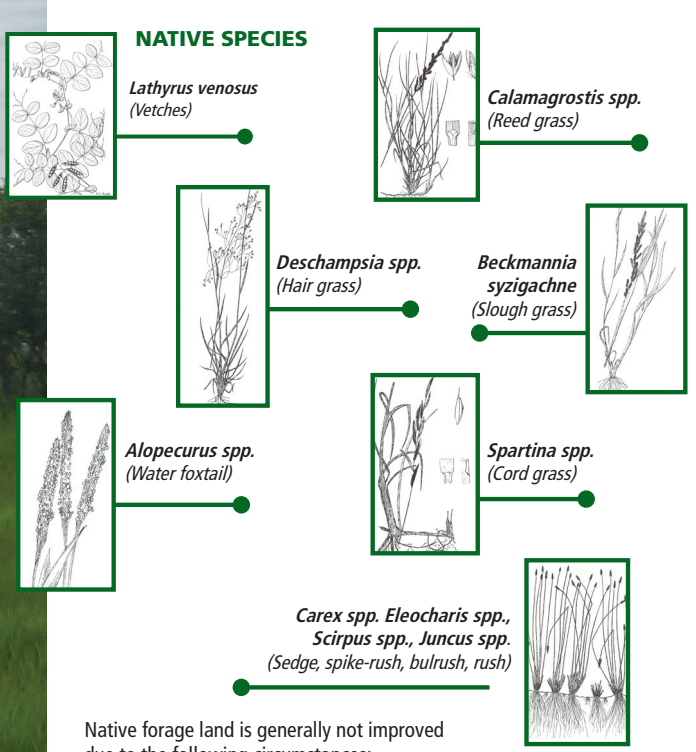
Lotus corniculatus
(Trefoil)

Definitions:

NATIVE HAY: A general term given to forage stands that are not likely to have ever been seeded but are used for forage production. These lands may be comprised of only indigenous (native) plants, tame forages or a combination of both tame and native plants. Other terms that are sometimes used for this type of land are "wild hay" or "meadow hay".

The underlying factor is that these lands do not undergo occasional rejuvenation (spraying out the old stand and reseeding to tame forages) and/or inputs such as herbicides or fertilizer. For this r eason they are also known as "unimproved" forage lands. They are generally treated as rangelands. Native hay is frequently available from the edge of sloughs and lakes and is known as "slough hay" or "marsh hay".

Tame species that may be found with native hay include: Timothy, Brome Grass, Reed Canary Grass, Fescues and Clovers.



Native forage land is generally not improved due to the following circumstances:

- Soil is not suitable for cultivation.
  - This may range from poor soils such as sandy soil, wet soil, or saline soil or to other physical factors that make it unsuitable for cultivation such as stoniness (ranging from small rocks to large boulders) or steep slopes.
- The area is heavily wooded, limiting use of seeding, spraying or fertilizing equipment.
- The area is commonly flooded, discouraging a producer to invest in land improvements.

Impacts and Implications

Pasture and Forage

The core issue with flooding in the vicinity of the two lakes is damage to pasture and forage. These effects are both immediate and long-term. There are issues with immediate loss of income and loss of opportunity, which brings into question the viability of ranching in the area and the motivation to plan for the future and make investments.

The length of time that plants are under water is the determining factor in damage to both native hay/pasture and to tame hay. Fluctuating water levels are a natural cycle beneficial to native hay/pastures. Periodic seasonal flooding with native hay under water for up to 60 days is actually beneficial for a productive native hay stand.

Once drowned out, however, native hay takes a long time to re-establish. The timelines for native hay are uncertain but could be in the order of five to seven years to re-establish a diverse and productive forage stand. Invasive species and less productive plants will establish within a year, but lack the nutrient value of a mature field of native hay.

Native hay is impractical to re-establish using conventional farming methods and has to rejuvenate naturally. This poses the risk that invasive and noxious species may replace the preferred species of native hay on a long-term basis.

Effects of flooding

Tame hay is more vulnerable to flooding than native hay. A shorter time under water can result in complete loss of tame hay vegetation. Tame hay can be re-established by conventional farming methods but the cost is substantial ($150-$200/acre) and requires certainty before farmers are willing to make this type of investment.

Lake Manitoba ranchers make the point that the impact of flooding in a lake environment is very different from that associated with the Red or Assiniboine Rivers. In those environments, floods typically last a few weeks at most, allowing cereal grain farmers to still get a crop. Flooding in a lake environment lasts months at best and has effects that can last over years.

For example, native hay production in the area has been severely affected. There has been reduced production over the past 5 to 10 years due to high water, ground conditions that have been too wet to access for harvest, and yield potential reduced due to an infestation of bulrushes.

Alfalfa and other tame species have been negatively impacted as well. Ranchers have experienced reduced yields, a complete loss of many of the tame species, and invasion of less desirable species.

Native and tame pasture have, in many areas, been reduced to monocultures, populated with undesirable invasive species, and productive riparian (shoreline) areas have been both flooded and overwhelmed with bulrushes.

Soil salinity

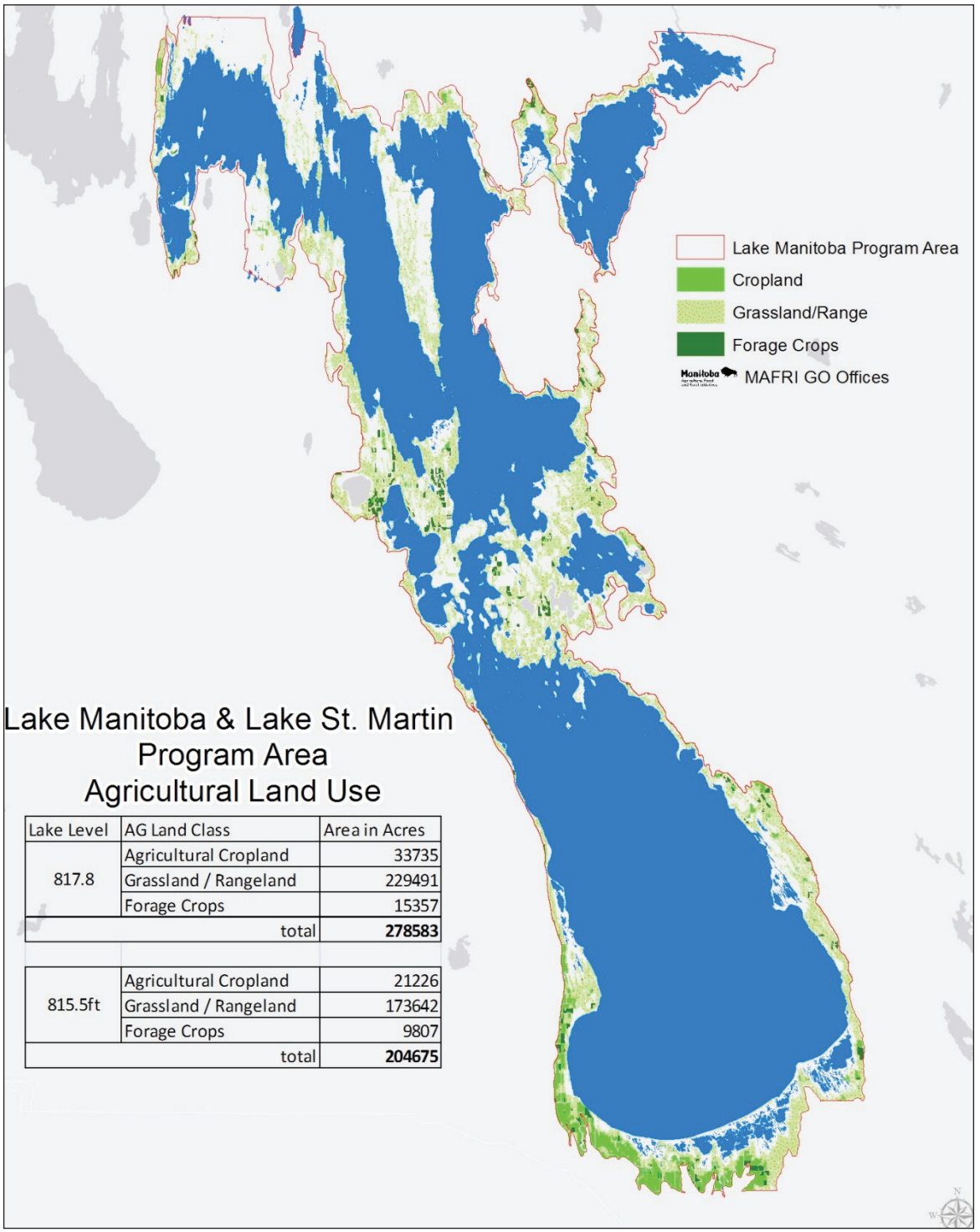
Soil salinity occurs where there is both a presence of salts (in the soil, groundwater or both) and a high water table. "Wicking" of moisture to the soil surface draws up salts from below. Salts can be transported to the soil surface from the water table and then accumulate on the soil surface due to evaporation. While the effect of salinity is not typically seen in wet years, it is driven by excess moisture, which can include periods of excessive precipitation or flooding.

The consequences of salinity include:

- Inability to establish forages;
- Detrimental effects on plant growth and yield; and
- Soil erosion, which may ultimately occur when salinity levels are so high that crop growth cannot be supported and soil is left bare.

Salinity is an important land degradation problem that may require a long recovery time. If the water table is able to recede and consistent rains help to leach the salts back down through the soil profile, then the salinity problem may be short-lived. However, this can take many years and is fully dependent on climatic conditions.

Some of the most productive forage crops have a low to medium tolerance to saline conditions. Ranchers are now testing their soils to determine if the flood of 2011 caused not only a loss of native and tame hay, but also long-term problems with soil salinity. Foxtail barley is one indicator species for saline conditions and there are troubling signs of infestation, which suggests that soil salinity may have increased due to the flood and/or excessive precipitation



Lake Manitoba & Lake St. Martin
Program Area
Agricultural Land Use

Lake Level	AG Land Class	Area in Acres
817.8	Agricultural Cropland	33735
	Grassland / Rangeland	229491
	Forage Crops	15357
	total	**278583**
815.5ft	Agricultural Cropland	21226
	Grassland / Rangeland	173642
	Forage Crops	9807
	total	**204675**

5.4 Fisheries

Background

Commercial fishing has been practiced on Lake Manitoba and Lake St. Martin since the late 1800s. Early commercial fishing on these lakes was so successful that a fear of over-fishing and the rapid collapse of the industry led to limits being set. In 1905, the federal government decided that only winter fishing would be permitted on Lake Manitoba, Lake St. Martin, and Waterhen, Dog and Shoal Lakes.[11] This was not only because of concerns about over-fishing, but also in part because the government wanted to encourage farming.[12] Many years later, in the 1960s, areas of Lake Manitoba and Lake St. Martin were re-opened for summer commercial fishing of coarse fish (carp and mullet) only.

Although in different quantities, the species caught today on Lake Manitoba are generally the same as those in the 1920s – pickerel, tullibee, whitefish, northern pike, yellow perch, and mullet. Lake St. Martin was at one time considered to be, for its size, one of the best whitefish lakes in Manitoba. Today, whitefish continues to be the primary species caught on that lake.

While there were many people fishing and production was good, making a living in the industry in the late 1800s and early 1900s was a struggle. In his biography, *A Manitoba Fisherman* (1982), Helgi Einarsson states:

> *...times were hard here in the west that winter [1894-95]. . . I sold from one to twelve dollars worth of fish per day, generally at five cents a pound for whitefish, one cent for pike and two and a half cents for pickerel, but if anyone came with 25 cents or more and wanted fish, he got just about as much fish as he wanted.*

Einarsson goes on to provide additional perspective of the situation at that time:

> *I then [December, 1897] had 12 carloads or about thirty thousand pounds of fish and had filled all the storage space available [in Westbourne]. Among them were two carloads of pike, so large it was impossible to pack them in crates on account of their length. Each fish weighted between 16 and 30 pounds. [Armstrong] offered me three cents a pound for the whitefish and half a cent for the pike.*

Since the 1970s, the commercial harvest of species from Lake Manitoba, including walleye, sauger and perch – today's most economically important species – has fluctuated but at reduced levels (see Figure 5.6). While less data is available for the commercial harvest from Lake St. Martin, harvest levels have remained relatively stable in recent years (see Figure 5.7).

On Lake Manitoba, the species that have generated the greatest portion of production by weight in recent years are yellow perch, pickerel (walleye) and mullet. Other species fished today include northern pike, whitefish, sauger, carp and tullibee. From the 1990/91 fishing season through to the 2011/12 season, the average total weight harvested was 1.1 million kilograms, which resulted in an average total payment of 1.9 million dollars (Manitoba Conservation and Water Stewardship, Fisheries Branch data).

[11] The Lake Manitoba Regulation Review Advisory Committee, *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues: A report to the Manitoba Minister of Conservation*, July 2003. Web. 5 Oct. 2012.

[12] Ibid

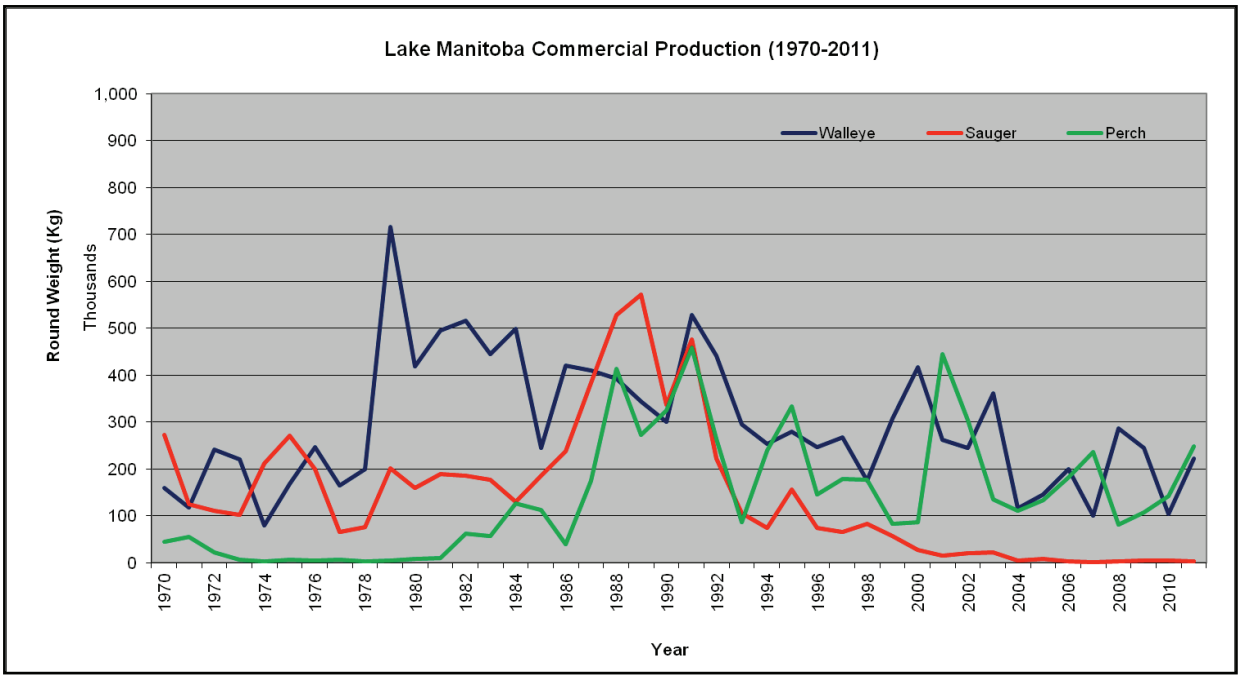


Figure 5.6: Lake Manitoba Commercial Production from 1970-2011 (Source: Manitoba Conservation and Water Stewardship)

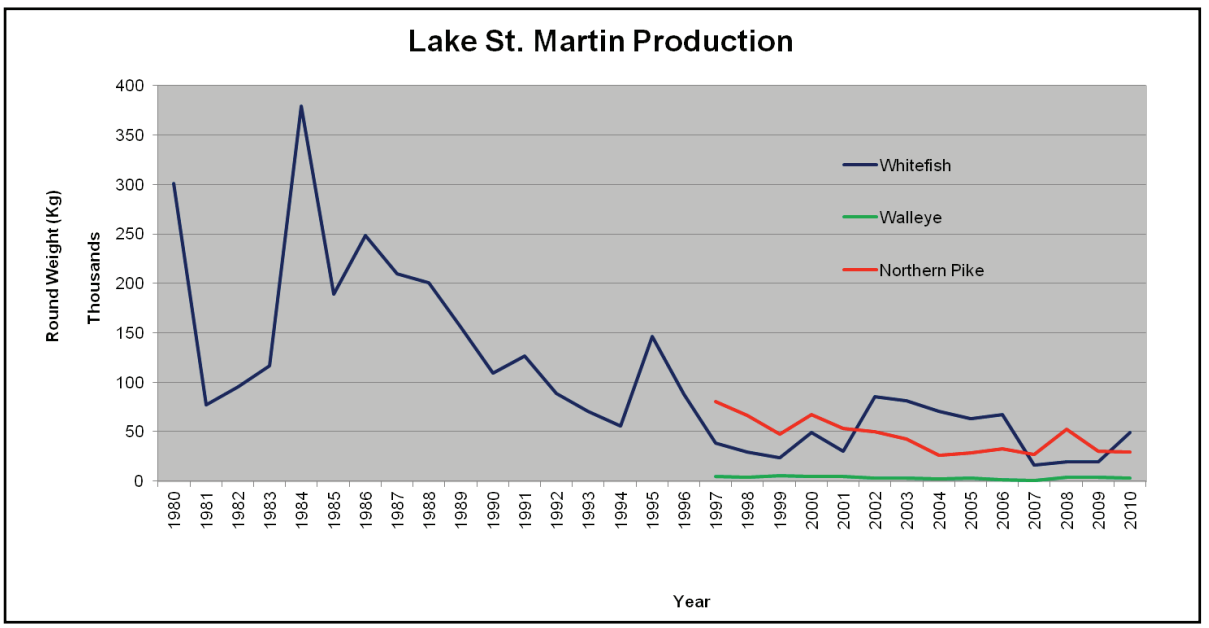


Figure 5.7: Lake St. Martin Commercial Production from 1980-2010 (Source: Manitoba Conservation and Water Stewardship)

The same species of fish are caught on Lake St. Martin as on Lake Manitoba, although at a lesser volume. The species that generate the greatest portion of production by weight on Lake St. Martin are northern pike, whitefish, mullet and carp. From 1990/91 through 2011/12, the average total weight harvested from the lake was 118,459 kilograms, resulting in an average payment of $123,738.

In the early days of commercial fishing on Lake Manitoba and Lake St. Martin, the fishery was a key part of their way of life and an important source of income. Since that time, the number of people involved in fishing on the lakes has dropped, along with the associated income. In 2010, 362 commercial fishing licences were granted for Lake Manitoba, and the average income produced was just $4,114.

Despite these limited returns, commercial fishing remains significant as a supplementary source of income for Lake Manitoba and Lake St. Martin fishers, as well as those who find employment as helpers. In addition, the fishery provides residents around the lakes with an important connection to their ancestors' way of life and their history, and people retain a strong sense of pride in their fishing heritage.

Ice fishing

Core aspects of commercial fishing have changed little since the first commercial operations started on Lake Manitoba. Transportation and access has improved dramatically, but it still involves setting nets, picking fish and field dressing in much the way it was done 100 years ago.

Impacts and Implications

While the relationship between water levels and fish production is not fully understood, there are several ways in which changes in Lake Manitoba and Lake St. Martin water levels may have an impact on fish and, in turn, affect the people who rely on the fisheries as a source of income.

Possible impacts of lake level regulation on fish include alterations to passages or channels that fish rely on to move from one lake or tributary to another. There is also the potential for high or low water levels to impact the nutrient load in a water body. Species have specific requirements that they need to have met in order to maintain populations and diversity. For example, pike and perch eggs attach to a surface to grow (substrate) and juveniles require a plentiful amount of food after they have hatched. This habitat and food source is provided by plants. In turn, the plants require fluctuation in water levels in order to thrive and be available to the pike and perch. Similarly, many fish species are dependent on the diverse habitat, warm temperatures and nutrient-rich environment found in the wetlands, marshes and beaches located along lake edges.

Winter fishing operations

While it is recognized that natural fluctuations in water levels are best for the diversity and long-term health of fish communities and by association the health of the commercial fisheries dependent on them, water level and fish productivity cannot be directly related. Figure 5.8 demonstrates the results of one study that investigated this subject. More data collected over the long term is required in order to properly understand this relationship.

As a result, there is no specific high or low water level and no particular range of regulation that would better sustain the fishery. However, the key for a productive environment for the fishery means avoiding a stabilised water level that negatively impacts coastal wetlands.

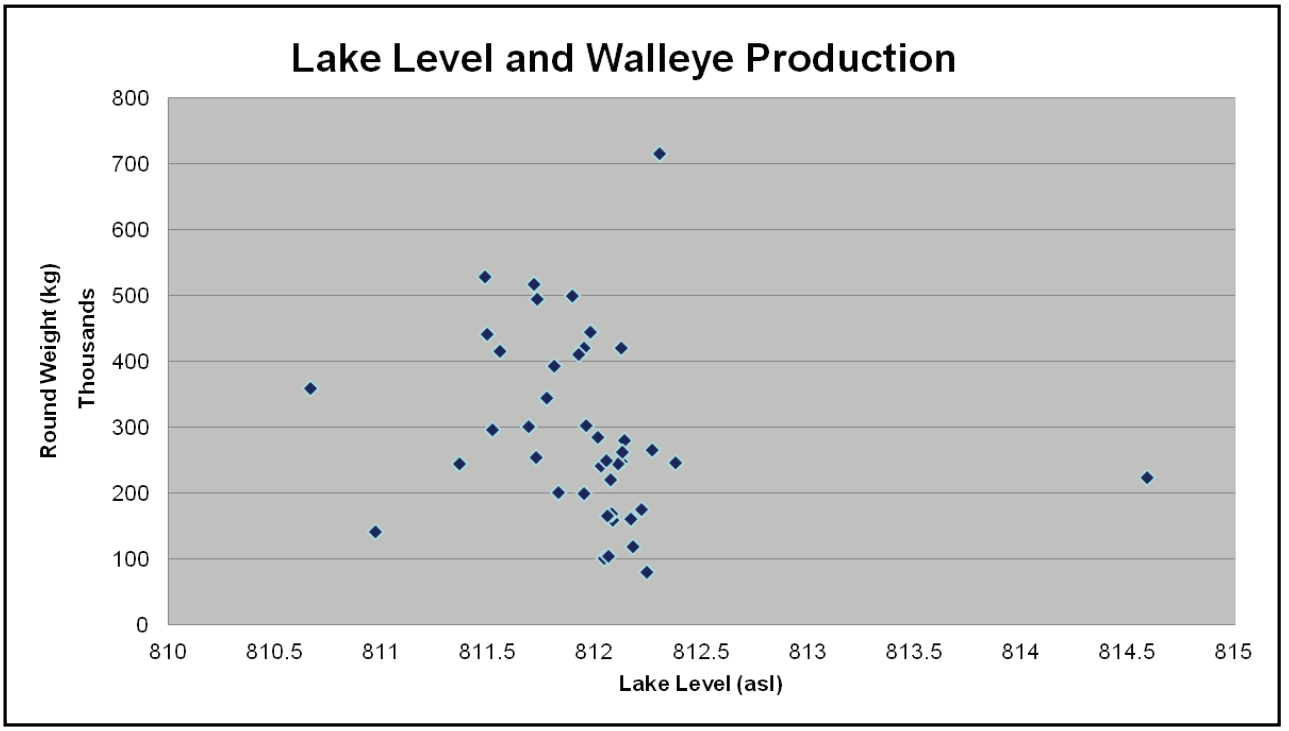


Figure 5.8: The Correlation between Lake Level and Walleye Production (Source: Manitoba Conservation and Water Stewardship)

5.5 Water Quality

Background

Water quality can impact the overall health of an aquatic ecosystem as well as the suitability of a lake as a public resource. Manitoba Conservation and Water Stewardship conduct water quality monitoring at several stations in the Lake Manitoba and Lake St. Martin area.

Algal bloom (Source: Manitoba Conservation and Water Stewardship)

Water quality is affected by the presence of algal blooms, which are caused by an excess of nitrogen and phosphorus in the water. Algal blooms can have a number of negative impacts on people and the environment. These include reducing recreational opportunities and appeal, causing low levels of dissolved oxygen in the water, affecting drinking water, clogging fishing nets, and producing toxic algae.

There are three long-term lake monitoring stations, with two located on Lake Manitoba, at Delta Marsh and at the Narrows, and a third on the Fairford River at PTH 6. In addition, two other lake monitoring stations were added at Lundar and St. Ambroise in 2011. The frequency of sampling was also increased during the 2011 flood.

River monitoring is conducted at three long-term stations on Lake Manitoba tributaries – the Waterhen River at PR 328, the Whitemud River at Highway 16, and the Assiniboine River. Sampling frequency at the river monitoring stations also increased during the 2011 flood.

In 2011, Lake St. Martin water quality was sampled at three locations – the North Basin, the Narrows and the South Basin.

Impacts and Implications

Manitoba Conservation and Water Stewardship have investigated whether water quality in Lake Manitoba is related to water level, and examined the relationship between water level and total phosphorus and total nitrogen (Figures 5.9 and 5.10).

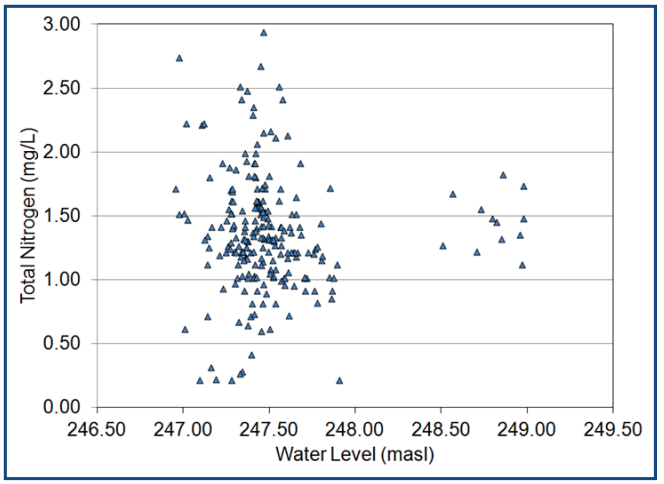


Figure 5.9: Total Nitrogen and Water Level
(Source: Manitoba Conservation and Water Stewardship)

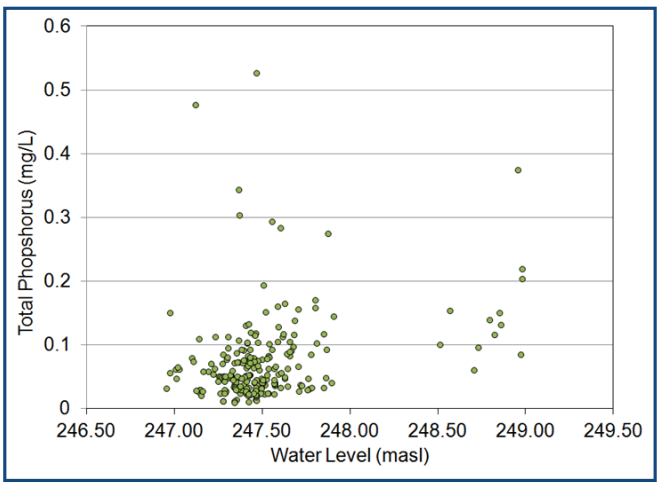


Figure 5.10: Total Phosphorus and Water Level
(Source: Manitoba Conservation and Water Stewardship)

When it is flowing, the Portage Diversion is the largest source of phosphorus to Lake Manitoba. In 2011, more than 60 percent of the lake's total phosphorus load was transported by the Portage Diversion. Phosphorus concentrations were shown to be elevated at Delta Marsh in 2011, as well as in other wet years (see Figure 5.11). However, an increase in phosphorus was not shown at the Narrows. The largest source of nitrogen to Lake Manitoba is the Waterhen River. In 2011, nearly 60 percent of the lake's total nitrogen load was transported by the Waterhen River. This percentage is greater in years when the Portage Diversion does not flow. In contrast with phosphorus, nitrogen concentrations were not affected by the 2011 flood, and no significant increases were observed (see Figure 5.12).

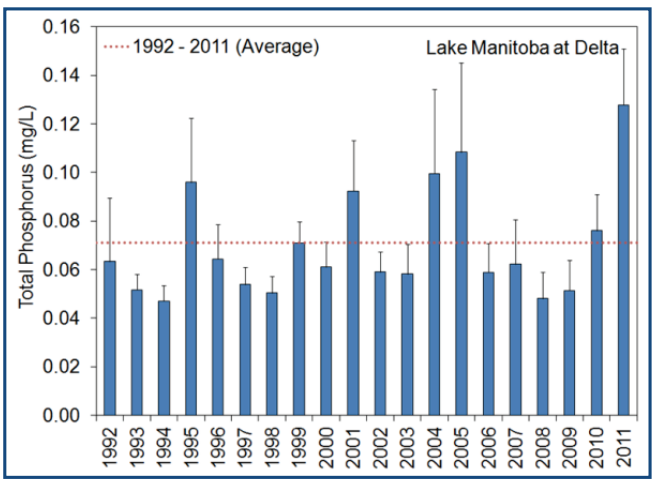


Figure 5.11: Lake Manitoba Total Phosphorus Levels
(Source: Manitoba Conservation and Water Stewardship)

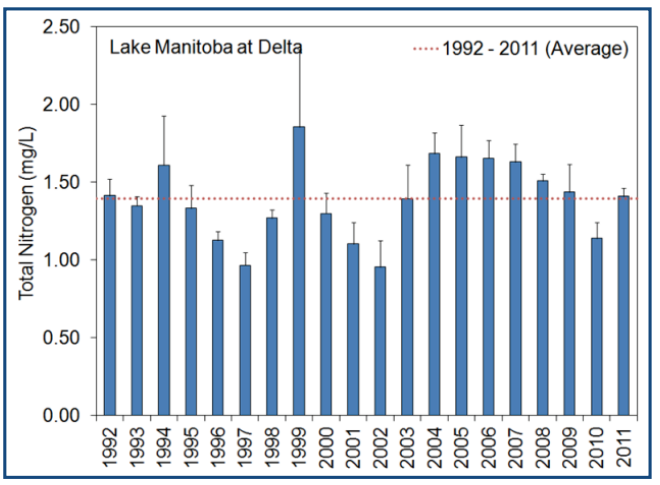


Figure 5.12: Lake Manitoba Total Nitrogen Levels
(Source: Manitoba Conservation and Water Stewardship)

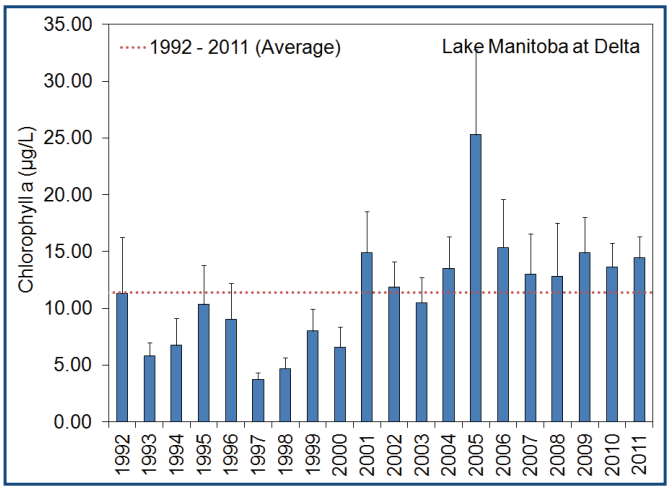


Figure 5.13: Lake Manitoba Levels of Chlorophyll a: (Source: Manitoba Conservation and Water Stewardship)

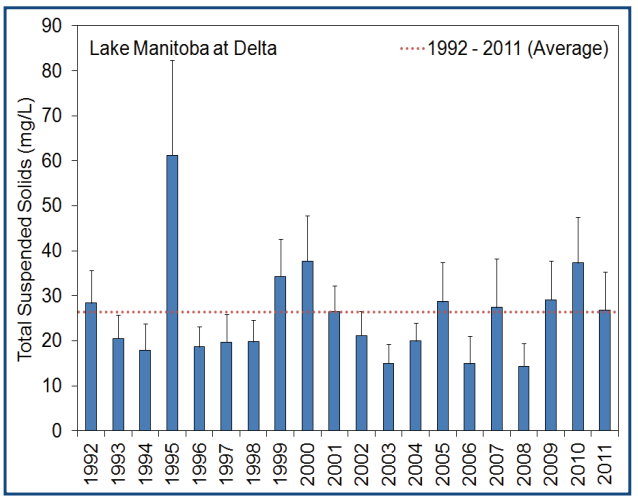


Figure 5.14: Lake Manitoba Total Suspended Solids (Source: Manitoba Conservation and Water Stewardship)

Other indicators of water quality include chlorophyll a, total suspended solids, conductivity, dissolved oxygen, and metals and pesticides. The average chlorophyll a concentration in Lake Manitoba was slightly higher in 2011 than the long-term average, but within the range of historical concentrations (see Figure 5.13). When it flows, the Portage Diversion is the largest source of total suspended solids to Lake Manitoba, and in 2011 contributed more than 85 percent of the lake's load. However, the concentration of total suspended solids in Lake Manitoba in 2011 was similar to the long-term average and as with chlorophyll a, was within the range of historical concentrations (see Figure 5.14).

Conductivity, an indirect measurement of the salinity of water, has been declining in Lake Manitoba in recent years, and appeared to be affected by the 2011 flood (see Figure 5.15). This reduction in conductivity can be linked to the inflow from the Portage Diversion.

At most times, the amount of dissolved oxygen in Lake Manitoba is sufficient for aquatic life. However, this amount has occasionally been below the guideline for supporting aquatic life, including twice in 2011, in May and August (see Figure 5.16).

Due to the extent of flooding in 2011, occasional instances of metal and pesticide concentrations exceeding Manitoba's objectives and guidelines were not unexpected. Despite this, the majority of such concentrations did not exceed those objectives and guidelines.

In the fall of 2011, water quality monitoring was conducted at five stations – Waterhen River, Lake Manitoba Narrows, Fairford River, Dauphin River, and Sturgeon Bay – for the purposes of preparing an Environmental Impact Statement on the emergency outlet. This monitoring continued through to summer 2012. Measurements taken are being used to examine the regional water quality prior to and during the operation of the outlet.

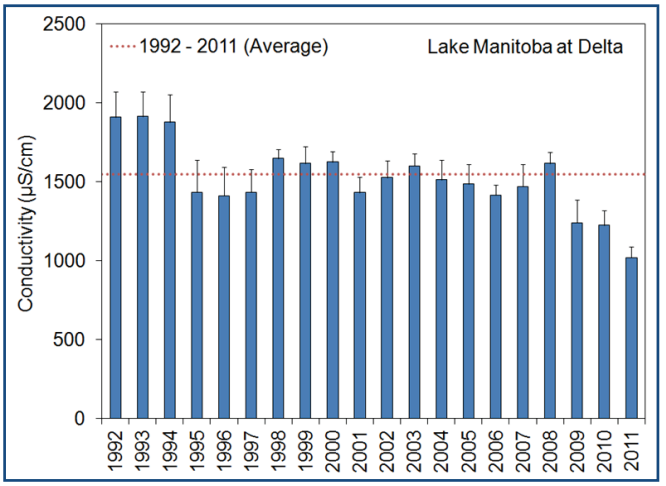


Figure 5.15: Lake Manitoba Conductivity
(Source: Manitoba Conservation and Water Stewardship)

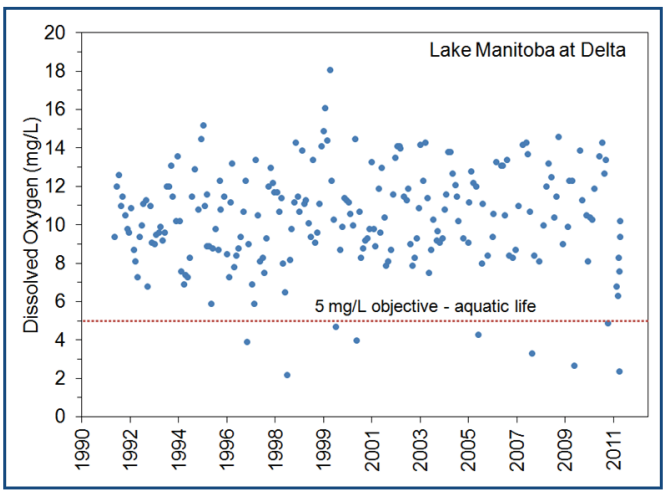


Figure 5.16: Lake Manitoba Dissolved Oxygen
(Source: Manitoba Conservation and Water Stewardship)

Monitoring showed that the Lake St. Martin water quality "met the majority of water quality objectives and guidelines."[13] It also demonstrated that the amount of phosphorus in Lake St. Martin was similar to that at other sites, other than the south end of Lake Manitoba where it was approximately five times higher (see Figure 5.17). Lake St. Martin had the greatest water clarity (least turbidity). As with the phosphorus concentration, turbidity was greatest at the south end of Lake Manitoba (see Figure 5.18). Chlorophyll a was highest at the south end of Lake Manitoba and lowest at Lake St. Martin (see Figure 5.19).

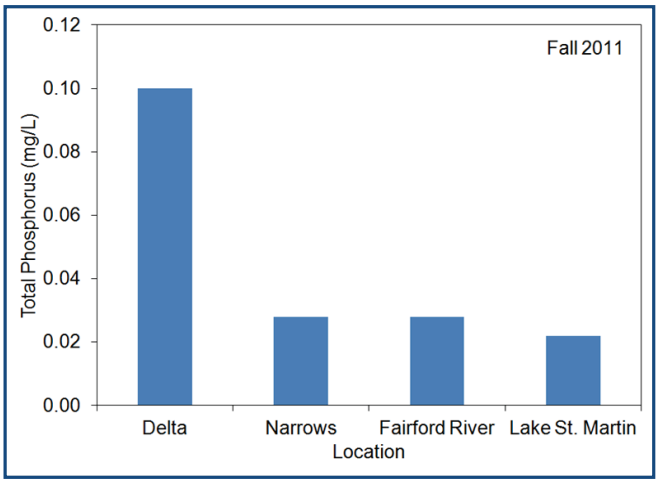


Figure 5.17: 2011 Total Phosphorus Levels, various locations
(Source: Manitoba Conservation and Water Stewardship)

Manitoba Conservation and Water Stewardship also collected fish (northern pike, whitefish, white sucker and yellow perch) from Lake St. Martin for mercury analysis in the fall of 2011. Mercury concentrations in all fish collected were found to be generally low and within the safe limits for human consumption and unrestricted commercial sale.

[13] Manitoba Conservation and Water Stewardship, Water Quality Management Section, Presentation to the Committee, May 2012.

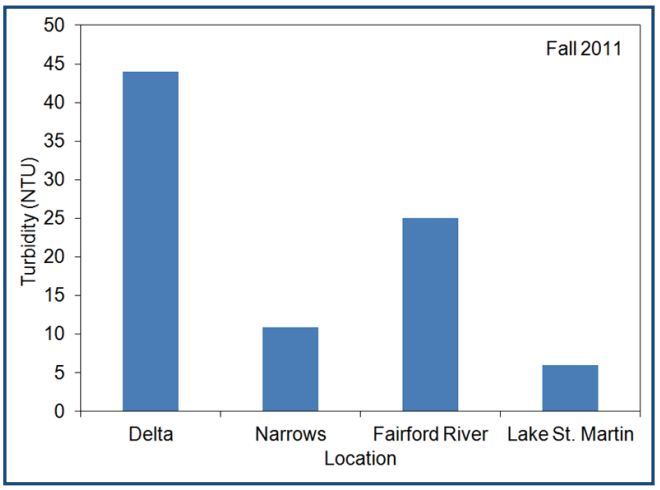


Figure 5.18: 2011 Turbidity, various locations
(Source: Manitoba Conservation and Water Stewardship)

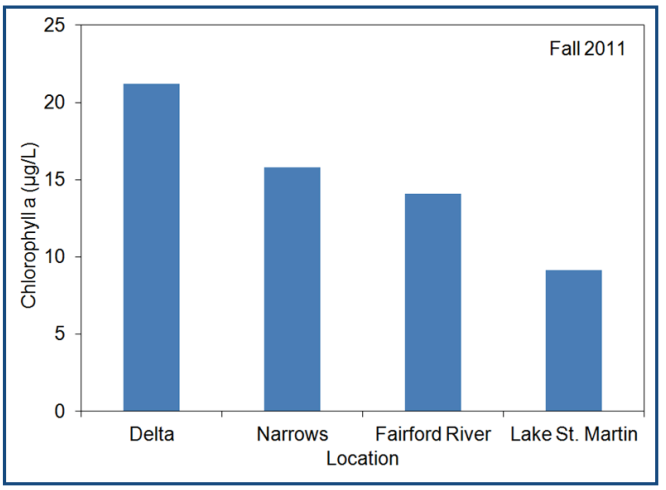


Figure 5.19: 2011 Chlorophyll a, various locations
(Source: Manitoba Conservation and Water Stewardship)

In addition to lake and river monitoring, Manitoba Conservation and Water Stewardship conduct ongoing beach monitoring. In the past, this has occurred at four beaches – Lynch's Point, Delta, St. Ambroise, and Twin Lakes. However, due to the flood, these beaches were closed in 2011 and no samples were collected. In past years, recreational water quality has typically been good. From 2006 through 2010, E. coli (*Escherichia coli*) was below the recreational guideline at Delta and St. Ambroise Beaches, but there were four occasions when it exceeded the guideline at either Lynch's Point Beach or Twin Lakes Beach.

In conclusion, while water quality monitoring over time has shown increases in phosphorus and chlorophyll and decreases in conductivity in Lake Manitoba, "water levels do not appear to be a major driver of water quality."[14] However, water quality in the lake's south basin, in terms of total phosphorus and conductivity, does appear to have been significantly affected by the Portage Diversion.

Fish sampling (Source: Manitoba Conservation and Water Stewardship)

Flooded recreational area (Source: Manitoba Conservation and Water Stewardship)

[14] Ibid

6 • Future Impact of Climate Change

Climate change is a critical challenge facing humanity today. The process of change unleashed by the rapid rise of atmospheric greenhouse gas emissions, historically and today, has the capacity to alter our economic systems, ecological networks and social relationships. Globally, 2010 was the hottest year ever recorded, and nine of the 10 hottest years occurred in the first decade of the 21st century. And Canada is warming much faster than the world as a whole.

The issue of climate change must be considered in the design of future water control structures. Standard engineering practise is to design water control structures based on a statistical analysis of past streamflows and water levels. In other words, the design assumes that the future water regime will be similar to the past regime. But if river flow patterns change with a changing climate, an appropriate design needs to take those changes into account. Designing a structure to manage historic flow patterns is not helpful if future flows will be different. For example, will future flows into Lake Manitoba increase or decrease? Will there be more floods on the Assiniboine River resulting in more frequent use of the Portage Diversion?

PERSPECTIVE

Is this climate change?

Climate variability has always been a fact on the Canadian Prairies. People living through the drought of the 1930s likely thought that the climate had changed for good.

Captain John Palliser in 1859 concluded that the prairies west of Regina (Palliser's Triangle) were too dry for farming. In the 1930s people concluded he was right.

When high levels persisted on Lake Manitoba in the 1950s, again residents thought that the climate had gotten wetter and pressed the government to respond by constructing the Fairford River Water Control Structure. This type of variability experienced in the 1930s and 1950s, however, does not constitute climate change.

Global climate circulation models have been developed by various agencies around the world. These models show variances in predicted precipitation amounts but agree that for the Canadian prairies, temperatures will be rising over the coming decades.

The climate models predict that:

- In southern Manitoba, temperatures will increase across all months over the next century. The average number of days per year with temperatures exceeding 30° C will increase from 16 days in the last half of the 20th century to 70 days by 2100.
- For most of Canada, winters will warm more than summers, a trend that is already occurring.
- In summer, reductions in average precipitation are expected in Southwestern Canada and Eastern Canada.

- In winter, average precipitation will increase nation-wide, but will fall more as rain than snow.
- Snow cover will be reduced, such that much of Canada will see March snow cover decrease by 50 percent.
- More frost-free days, as winter shortens and summer lengthens.

Considerable research has been done on the effect of increasing greenhouse gasses on future climates. However, it is difficult to infer from these data what the impact will be on water resources. The climate models suggest that precipitation will be higher in the future in Manitoba, but so will temperature. Will the effects of increased precipitation be offset by the effects of evaporation and evapotranspiration (see Figure 6.1) on soil moisture? Also, if the winters are shorter, will less snowfall accumulate resulting in lower spring floods or will the increase in spring rains speed the melting of the snow and aggravate flooding?

In early 2012, Stantec Engineering completed a hydrologic study of the impact of climate change on flows on the Assiniboine River. A computer model of the Assiniboine River basin was constructed to assess potential effects of climate change on surface water flow and soil moisture. This was accomplished through comparison of modeled historical data based on historical meteorological inputs to modeled climate-change scenarios data using meteorological inputs generated by the Canadian Regional Climate Model [AET].

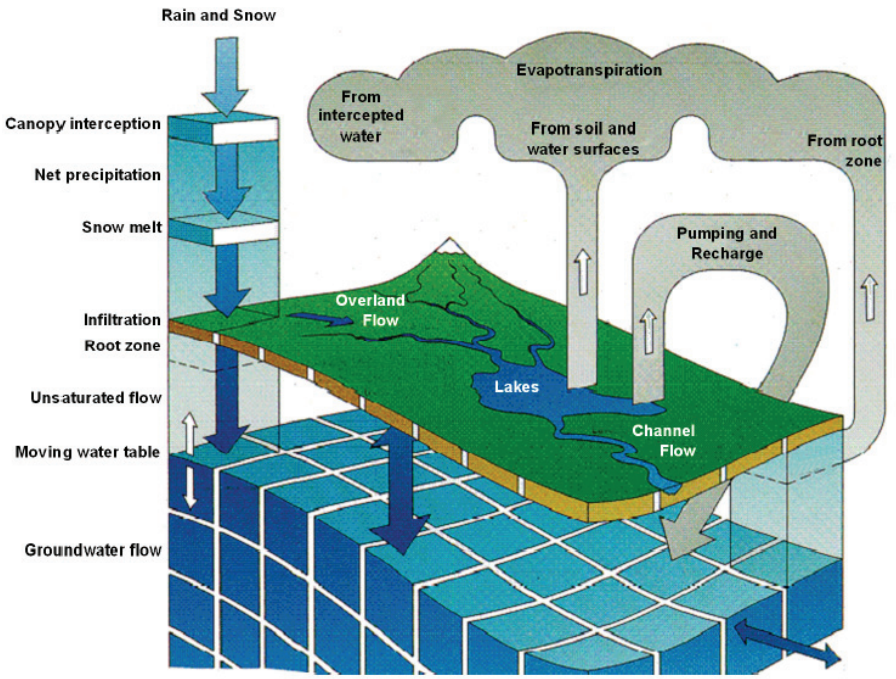


Figure 6.1: Hydrological Processes in MIKE-SHE (DHI 1998)

For soil moisture, the study found that by mid-century warmer weather will lead to higher evapotranspiration throughout the summer and fall. This higher evapotranspiration will force down soil moisture through the summer into the fall. Higher precipitation in winter and spring (through June) will replenish soil moisture in the spring so that spring soil moisture remains similar to current spring conditions.

Summer precipitation is expected to remain roughly the same for the next 60 years and then decline in the later part of the 21st century, from 2070 to 2100. If this lower precipitation occurs later in the 21st century, soil moisture will drop significantly in the summer and fall towards the later part of the 21st century.

The study concluded:

- Average annual streamflows are predicted to be somewhat lower in future.
- Extreme streamflow years have occurred in the past and will occur in the future. Study results suggest that future extreme events may be slightly more frequent than in the past due to a higher likelihood of the combination of higher winter and spring precipitation occurring after a wet fall.
- Low flows (one in 10 years or 10 percent) will be about the same in the future as they have been in the past. This should not have an impact on water supply or wastewater assimilation.
- Streamflow variation is expected to continue to be large in the future, but not much different than in the past. Predicted future streamflow fluctuations are within historical natural variation and no significant trend is apparent.
- Temperature changes show a consistent increase across all months over the next century, leading to higher evapotranspiration throughout the summer and fall, which would force down soil moisture through the summer into the fall.

Based on the findings of the Stantec study, it can be inferred that average flows for the Assiniboine River will be a little lower in the future, but extreme floods could occur a little more frequently. This suggests that in future the Portage Diversion might be used a little less often, but an extreme flood like 2011 could still occur. Based on an analysis of past floods, the return period for the 2011 peak flow on the Assiniboine River is 1-in-220 years. With climate change, the frequency might increase to 1-in-150 years. However, a flood of this magnitude will still be very rare.

Integrated Watershed Management Planning

The province has taken steps to develop an integrated water planning and management system based on watersheds, as set out in the Manitoba Water Strategy.

The International Institute for Sustainable Development noted in a report to the province that:

> *A climate change adaptation strategy based on ecological watershed management is therefore needed for three key reasons:*
>
> - *From a provincial perspective, it's the most effective mechanism for regulating water supply.*
> - *The strong consensus from scientific assessments is that integrated management of water and land is crucial for managing climate impacts.*
> - *Ecological watershed management has the significant co-benefit of reducing nutrient loads in Lake Winnipeg.*

Adapting to climate change through ecological watershed management poses an institutional challenge. Climate change impacts, specifically more frequent extreme precipitation events and shifting seasonal rainfall patterns, will exacerbate longstanding tensions over agricultural land drainage. [15]

PERSPECTIVE

Adapting to climate change

Water is becoming an increasingly important consideration in the lives of Manitobans. Organizing our water and land use decisions on a watershed basis would provide an improved framework to deal with short-term conflicts over drainage and land use decisions, and a long-term ability to better adapt to increased climate variability. Additional layers of bureaucracy to deal with the future are not required. What is required is a proper alignment of our existing institutions to reflect changing responsibilities and challenges.

[15] The International Institute for Sustainable Development. *The Manitoba Challenge, Linking Water and Land Management for Climate Adaptation,* Jan. 2010. Web. 5 Oct. 2012.

7 • Public Engagement

The terms of reference required "significant engagement and dialogue with the public." The expertise and experience of committee members, hydraulic information, technical reports, presentations, and studies came together with public opinion to frame the Committee's recommendations. Engaging the public in a meaningful way was essential to the completion of our task.

It was humbling to experience the knowledge, passion and effort that went into the presentations and comments received by the Committee.

The Committee's approach to public engagement included the following:

Focused Meetings

These meetings addressed specific topics from the Terms of Reference. Members of the public with a specific interest and/or knowledge of the subject areas were invited to attend a technical presentation and participate in discussions. For example, topics included planning, fishery, wildlife and agriculture. These meetings were held at various locations around Lake Manitoba.

Site Visits

The Committee undertook site visits in association with each of the focused meetings, typically with local people knowledgeable about the area.

Public Open Houses

The Committee held seven open houses at locations convenient to people around Lake Manitoba and Lake St. Martin. All but one of the open houses were hosted jointly by the Committee and the 2011 Manitoba Flood Review Task Force, as the two groups co-ordinated their investigations and activities where possible. These events were typically held between 4:00 and 8:00 pm. They were advertised on the Committee's web site, in local newspapers, on local web sites, and on the radio.

Dauphin River First Nation

Web Site

A web site for the Regulation Review was up and running by June 2012. The web site (http://www.lakemanitobalakestmartinregulationreview.ca/) included: copies of all presentations made to the Committee, information about upcoming events and open houses, and a feedback form to allow the public to make direct comments.

Other Public Engagement

Other forms of public engagement included meetings with individuals and an internet-based survey of municipalities and First Nations.

A detailed description of the public engagement actions and a complete "What We Heard" report are presented in Appendix E. A summary of "What We Heard" is presented below.

7.1 What We Heard – Summary

The Committee received a great deal of information from the public and stakeholders related to its terms of reference. The following is a summary of this input. Note that in most cases direct quotes taken from either feedback forms or submissions made to the Committee during meetings have not been attributed for privacy reasons.

The Committee used several methods to solicit public and stakeholder comments. These methods included feedback forms available on the Committee's web site as well as in person at public open houses; an e-mail sign-up list that was used to send out updates and notices as well as request feedback; and seven public open houses, which were advertised through a variety of print, radio and online sources.

In addition, a survey was distributed to municipalities and First Nations around Lake Manitoba and Lake St. Martin. In total, 121 feedback forms were received online plus another 91 were completed at open houses. The municipal government survey was completed by all 10 communities that received it.

Open house attendees

Input on a range of topics was also provided to the Committee by many technical experts and stakeholders through presentations and meetings. Some of the people or groups represented through presentations to the Committee included ranchers, farmers, fishers, property owners, municipalities, and First Nations. A final source of input was obtained via a survey conducted by the Lake Manitoba Flood Rehabilitation Committee, which was completed by 495 people.

All of the comments received have been categorized and summarized below under the following four headings: Lake Levels, The Need for Additional Water Control Works, Environmental and Social Impacts of Water Level Regulation, and Land Use Policies and Zoning.

7.1.1 Lake Levels

Lake Manitoba

Online Feedback Forms, Open Houses and Municipal Government Survey Results

The majority of the 121 respondents to the online feedback form indicated that the lake should be regulated at pre-flood levels, which were described as either 810-812 or 810.5-812.5 ft. asl. Several respondents felt this range was only appropriate provided that the levels were at 811 feet by September 30, so that marshlands have a chance to be flushed out and emergency spring runoff can be accommodated. Other respondents felt that greater variation, such as 808–812 ft. asl, was necessary to accommodate marsh health, but also to protect property around the lake. Still others suggested that levels should be just slightly lower than before the flood, with an upper limit of 811 ft. asl. A few respondents suggested the lower limit should be 807 feet, with only one in support of a very low range of 805-807 ft. asl. In contrast, a handful of people were in support of a higher upper limit, at 813 or 814 ft. asl.

Discussions and presentations about lake levels typically use language that suggests that the "range of regulation" for Lake Manitoba is 810.5 to 812.5 ft. asl. In fact, the guidelines for the operation of the Fairford Control Structure do not use the term range of regulation; they state that water levels should be permitted to fluctuate between 810.5 and 812.5 ft. asl "with the expectation that water levels on the lake may rise to 813.0 ft. asl in some years." These complete guidelines have not often been fully communicated to the public. There is a concern that people commenting on the guidelines are not aware that the guidelines contemplate the lake rising above 812.5 ft. asl.

Responses were split in terms of whether people were satisfied with the range of regulation for Lake Manitoba prior to the spring of 2011. Many respondents who indicated they were not satisfied felt that the lake had been kept at too high levels for many years. Several noted that it was important for potential outputs from the lake to be able to equal potential inputs; otherwise it was suggested that it is not possible to actually maintain levels within the regulated range.

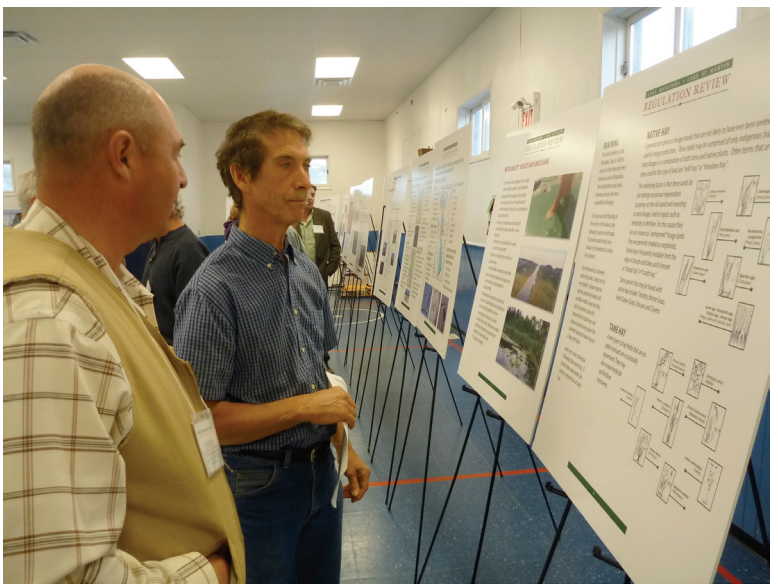
"The range of the lake must be lowered, primarily because the current infrastructure in place to reduce lake levels is not capable of keeping levels below the upper maximum level."

From the 91 open house feedback forms, approximately 10 people commented on what they believe are the proper levels for Lake Manitoba. The vast majority of those people suggested the maximum level for the lake should be 812 feet or lower, and the minimum level should be about 810 ft. asl. Several people noted their concern that the lake was (in September 2012) still too high.

The results of the Committee's municipal government survey indicated that, for most communities around Lake Manitoba, regulation of the lake's levels was generally acceptable up until 2011. However, survey results suggest that problems occur when the lake levels are at the high end of the range and that this was the situation for several years leading up to 2011. Overall, the majority of survey respondents felt that Lake Manitoba's levels should stay within the range of 810.5-812.5 ft. asl.

Technical and Stakeholder Presentations

Many of the technical presentations provided to the Committee emphasized the need for fluctuating water levels. It was explained that this is key for maintaining quality wildlife habitat and biodiversity, and most accurately reflects the natural wet and dry cycles of the area. It was also noted that flooding and associated flood damage in the area is made worse as a result of wetland drainage from surrounding lands.



The Reeve of the R.M. of Lakeview attends an open house

A variety of comments were presented to the Committee from individual stakeholders or groups concerned with the regulation of Lake Manitoba. It was frequently noted that the communities located downstream of Lake Manitoba must be consulted on any matters related to regulation of the lake. Comments received from ranching interests noted the importance of predictable lake levels to beef producers. Many stakeholders also expressed concerns regarding the operation of the Portage Diversion, indicating this has a significant impact on the people living around Lake Manitoba and suggesting that the amount of water entering Lake Manitoba via the Diversion should be reduced. Several voiced the opinion that the 2011 flood was a preventable disaster that occurred as a result of the combination of artificial inflow to Lake Manitoba exceeding the lake's capacity for outflow, and the recent continual

maintenance of the lake at a high level leading to the destruction of natural and artificial shoreline protection. During a speech given at a committee meeting in St. Laurent, Reeve Philip Thordarson of the R.M. of Lakeview commented:

> *"The people living around Lake Manitoba are now unable to plan for the future because the Portage Diversion can and will be operated any time that weather events and water levels threaten others. We are beginning to feel like second class citizens in our own province."*

Numerous presenters stressed the need for a period of recovery after flooding. Rather than reducing Fairford outflows once the lake recedes to 812.5 ft. asl, as recommended by the 2003 study, they recommend holding Fairford wide open until the lake recedes to 811.5 ft. asl to allow marsh vegetation and beach ridges to re-establish.

The Association of Lake Manitoba Stakeholders (ALMS) is composed of representatives from cottage and property owner associations around Lake Manitoba with a membership of approximately 1,500 property owners. When asked for clarity on their recommendations for lake levels, ALMS passed the following motion:

> *"BE IT RESOLVED THAT the ALMS recommends and urges the Lake Manitoba/Lake St. Martin Regulatory Review Commission to advise the Province of Manitoba as follows:*
>
> *AS the present "Guide lines" have resulted in Lake Manitoba being at or above the top of its operating range (812.5 asl) since at least October of 2010.*
>
> *FURTHERMORE as Lake Manitoba has been at or above 812 ASL for most of the last 6 years, and this continuous high level has caused destruction of both the shoreline, as well as natural and human-made defences,*
>
> *AS SUCH it is ALMS' position that:*
>
> 1) *Additional Outflow capacity must be created to allow the Lake to handle both the natural inflows as well as the additional 32,000 cfs the Portage Diversion can add to the Lake. The current Fairford dam is insufficient. Current downstream capacity beyond Fairford is also insufficient.*
>
> 2) *Operating Range - Lake Manitoba must be maintained between 810.5 and 812 feet above sea level. Such range must fluctuate within a 12 month period (see below, "Prescribed Fluctuations")*
>
> 3) *Prescribed Fluctuations - The Lake must not be permitted to sit at or above the MAXIMUM range (812 feet ASL) for a period EXCEEDING 4 MONTHS within a 12 month period. Further the Lake must be regulated to vary 1.5 feet within the operating range within a 12 month period.*

4) Legislation and supporting regulations are required to:

4a) Keep the Lake within its operating range and required fluctuation. Such legislation must enforce the requirement to maintain sufficient downstream capacity to maintain the prescribed Lake Manitoba levels (i.e. Fairford and beyond);

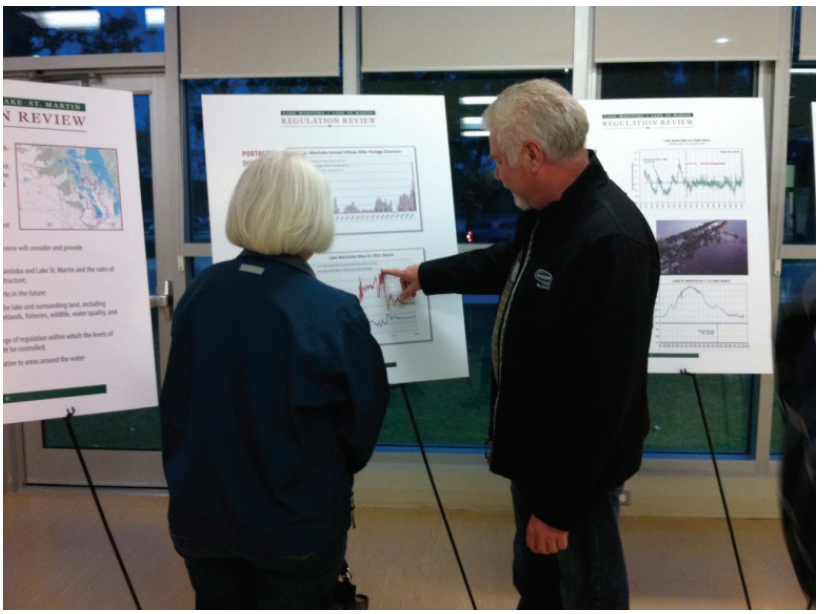
4b) Set rules for operation of both the Outlet(s) (Fairford and whatever else is built) and Inflow(s) (the Portage Diversion); including the proactive risk sensitive management model developed by Dr. Scott Forbes.

4c) Such rules should prohibit the use of the Portage Diversion for use beyond that of Lake Manitoba regulation or flooding of the Assiniboine watershed;

4d) Clear rules for prescribed clean-up and repair of shoreline and properties around Lake Manitoba as a result of operation of the Portage Diversion and the debris and/or pollution it introduces;

4e) Clear requirements for future governments to uphold the legislation and regulations, including a requirement to maintain the Lake levels and the Lake's control structures, as well as legislated action or consequences for failure to comply with the legislation."

Lake Manitoba Flood Rehabilitation Committee Survey



Open House arttendees

A total of 495 people commented on the operating range of Lake Manitoba through the survey conducted by the Lake Manitoba Flood Rehabilitation Committee. Of those respondents, 324 out of 468 people (69 percent) indicated their preferred lake level minimum for Lake Manitoba was 810 ft. asl. A total of 314 out of 476 people (66 percent) indicated their preferred maximum level was 812 ft. asl or lower, with 812.5 feet being the second most frequently suggested maximum, by 130 people (see Figure 7.1).

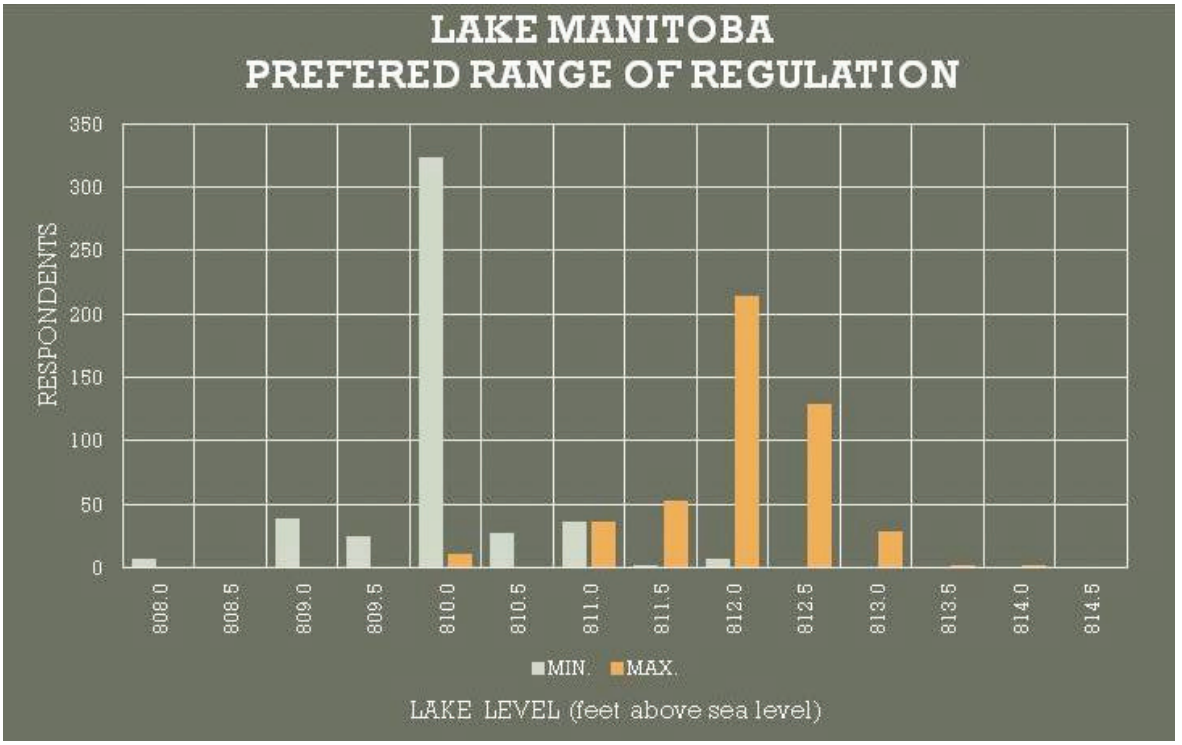


Figure 7.1: Lake Manitoba Preferred Range of Regulation
(SOURCE: Lake Manitoba Flood Rehabilitation Committee, July 2012)

Table 7.1: Summary of Comments – Lake Manitoba Levels

What We Heard		Feet above sea level (ft. asl)
Committee Sources	Online Feedback Forms (Committee website): 121 total responses	Majority of respondents: pre-2011 levels, described as either 810-812 or 810.5-812.5
	Municipal Government Survey: 10 total responses	Majority of respondents: 810.5-812.5
Technical Presentations	Manitoba Conservation and Water Stewardship	Fluctuating levels – range not specified
	Ducks Unlimited Canada	810-813
Stakeholder Presentations	R.M. of Lakeview	810.5-812.5
	R.M. of Woodlands	810.5-812.5
	Manitoba Beef Producers	Spring maximum: 812 Summer maximum: 811-811.5
	Westlake Grazing Club & other ranchers	809.5-812
	Association of Lake Manitoba Stakeholders	810.5-812
	Lake Manitoba Flood Rehabilitation Committee Survey: 495 total responses	Minimum level: 810 (324/468 respondents = 69%) Maximum level: 812 or lower (314/476 respondents = 66%)

Lake St. Martin

Many people who responded to the online feedback form did not comment on Lake St. Martin levels. Those who did comment did not specify their preferred lake level range, but made general comments related to regulating development around the lake so that past flooding problems are not repeated and/or so that the lake level can be raised, and maintaining a range that works with and enables effective drainage from Lake Manitoba. Somewhat in contrast, it was also suggested that outflow improvements made to Lake Manitoba should not adversely impact Lake St. Martin residents.

No one who filled out open house feedback forms commented on recommended levels for Lake St. Martin.

Open house attendees

In general, respondents to the Committee's municipal government survey were less knowledgeable or had less information to provide regarding the regulation of Lake St. Martin. Responses were mixed as to whether the regulation of the lake was acceptable prior to 2011. Two respondents indicated that Lake St. Martin should be maintained at the current range of 797-800 ft. asl, but the rest did not indicate whether they were in favour or against this range and did not specify any other recommended range.

The technical and stakeholder presentations received by the Committee did not identify specified recommended lake levels for Lake St. Martin. Those who did refer to Lake St. Martin lake levels primarily spoke of the need to consider and study the effects of the Fairford Control Structure on the water bodies and communities downstream, and the need to consult with those communities as well.

7.1.2 The Need for Additional Water Control Works or Outlets

A large majority of respondents to the online feedback form on the Committee's website felt that the Emergency Channel from Lake St. Martin to Lake Winnipeg should be made permanent. The majority of respondents were also in favour of the construction of a new channel from Lake Manitoba to Lake St. Martin. The most important consideration for many people was improvement

of drainage from Lake Manitoba. It was also noted that water retention upstream of the Portage Diversion should be increased through the use of dams, reservoirs and/or incentive programs to encourage landowners to store water on their property.

Approximately 30 people who filled out an open house feedback form indicated in some way that the existing control structures for Lake Manitoba are inadequate. Of these, roughly half specifically noted that outflows from the lake must be able to match inflows. Half also suggested that a new channel or outlet is needed. A variety of additional comments were received on this topic, including some related to opening the Fairford Control Structure to its full capacity, keeping the Emergency Channel open, the need for better water management upstream, and over-use of the Portage Diversion. A few people noted they understand there is a need to use the Portage Diversion to prevent damage to urban centres, but felt that as a result the Province needs to accept an associated responsibility to develop a larger outlet for Lake Manitoba regardless of cost.

All 10 respondents to the Committee's municipal government survey felt that the Emergency Channel from Lake St. Martin to Lake Winnipeg should be made a permanent control structure, and most also felt there is a need for a new channel between Lake Manitoba and Lake St. Martin.

Many stakeholders who provided presentations or attended Committee meetings were in favour of developing a new outlet from Lake Manitoba. It was frequently suggested that existing infrastructure and control works are insufficient for managing the lake's levels and that a new outlet or channel is necessary in order to increase outflow from the lake. It is believed that such an outlet was recommended for construction at the time the Portage Diversion was built, and that the operation of the Fairford Control Structure and any other such structures should be linked to the operation of the Diversion. Some stakeholders specifically recommended that a new channel be constructed from Watchorn Bay on Lake Manitoba to Birch Creek on Lake St. Martin. In addition, multiple stakeholders noted the importance of considering any potential impacts or consequences that might occur as a result of the construction or operation of a new control structure. Other recommendations regarding water control infrastructure and management included developing a comprehensive water management plan, improving communications regarding the operational timing of control structures, conducting flood mitigation on the Assiniboine River, and restoring the channel capacity of the Assiniboine River.

> *"It is imperative that governments make a budgetary commitment to responsible drainage and water management, such as the creation of new drains, maintenance of existing drains, and new long-term flood mitigation efforts."*

The vast majority (97 percent) of the 495 total respondents to the Lake Manitoba Flood Rehabilitation Committee (LMFRC) survey indicated they were in favour of additional water control structures on Lake Manitoba. However, of the respondents from the Lake St. Martin area, 23 percent were not in favour. It is possible that the percentage of total respondents not in favour may have been greater had more people from the Lake St. Martin area responded to the survey (see Figure 7.2). The LMFRC is continuing to seek additional respondents from the Lake St. Martin area in order to obtain more conclusive information on this subject.

"I am in favour of additional control structures but not the proposed channels near the Fairford Dam. There would be a great impact on the fish habitat."

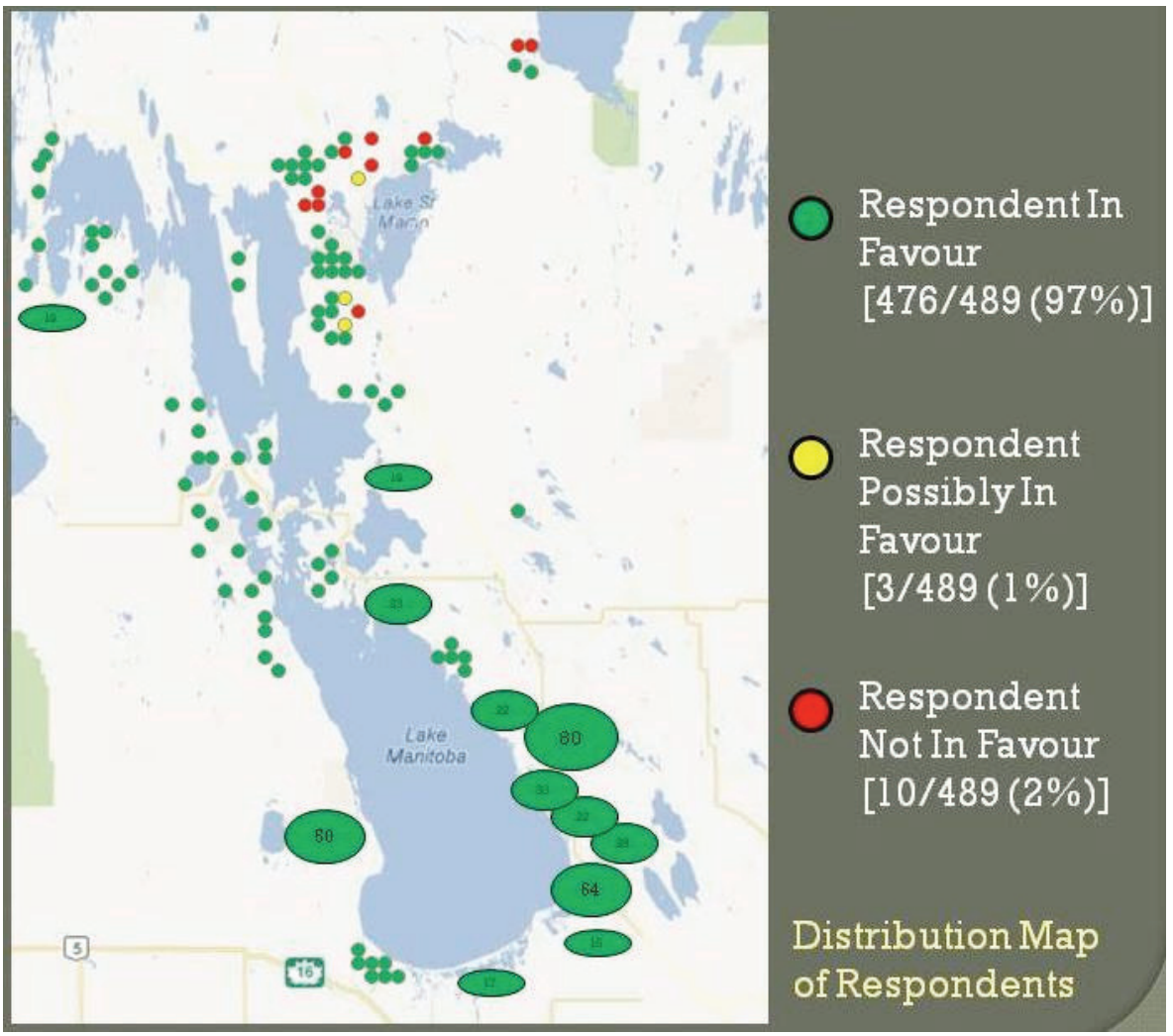


Figure 7.2: Distribution of LMFRC Survey Respondents In Favour or Against Additional Water Control Structures for Lake Manitoba (SOURCE: Lake Manitoba Flood Rehabilitation Committee, July 2012)

Table 7.2: Summary of Comments - The Need for a New Outlet/Channel

What We Heard		In favour or against
Committee Sources	Online Feedback Forms: 121 total responses	Majority of respondents: In favour
	Survey: 10 total responses	All respondents: In favour
Stakeholder Presentations	R.M. of Lakeview	In favour
	Lake Manitoba Flood Rehabilitation Committee	In favour – Watchorn Bay to Birch Creek
	R.M. of Woodlands	In favour – Watchorn Bay to Birch Creek
	MB Beef Producers	In favour
	Westlake Grazing Club & other ranchers	In favour – Watchorn Bay to Birch Creek
	Association of Lake Manitoba Stakeholders	In favour
	Lake Manitoba Flood Rehabilitation Committee Survey: 495 Responses	Lake Manitoba area residents: In favour - 446/446 respondents (100%) Lake St. Martin area residents: In favour - 33/43 respondents (77%) Not in Favour - 10/43 respondents (23%)

7.1.3 Environmental and Social Impacts of Water Level Regulation

Many people who completed the online feedback form described the financial and emotional hardship they continue to experience as a result of the flood. People noted lost livelihoods from farms and businesses, the deterioration of land values, the loss of dream homes that they had waited years to obtain or build, and the loss of recreation opportunities. In some cases, respondents indicated that they were able to accept the sacrifice of their property for the good of the communities downstream, but wished that the Province would accept some of the responsibility for the flood, particularly in terms of the use of the Portage Diversion. In addition, many people described their frustration with the pace of the compensation process and the amount of compensation provided, as well as with the officials administering related programs. To a lesser degree, some respondents also noted their concerns with the environmental impacts associated with the flood and with lake level regulation.

> *"My wife and I have been working since the second week in February (on the weekends) to cut trees falling on the cottage, remove sand bags, clean debris, raise work sheds, dispose of damaged property, aid in raising the cottage, redo plumbing, electrical, rebuild deck stairs and landings. We are far from finished."*

Open house attendees

Through the open house feedback form, many people described the degree to which they were impacted by the 2011 flood. It was made clear that the flood caused devastation for many of those who filled out the form and various hardships for others. Ranchers and farmers noted a number of issues related to the flood, including lost production, insufficient compensation, high salinity levels in fields, and years of recovery ahead for hay and forage lands. Approximately 30 people indicated that they had, and continue to have, a variety of significant difficulties with the provincial compensation program. Several people also noted their concerns with the environmental impacts of the 2011 flood, with a range of comments made regarding such issues as the potentially improper disposal of mouldy furniture and appliances, pollution and siltation problems resulting from the use of the Portage Diversion, and the loss of countless numbers of trees and a world-class marshland.

Regarding the issue of the environmental impacts of water level regulation, the Committee's municipal government survey included a question about the effectiveness of shoreline reserves in protecting shorelines from erosion, maintaining public access to the lake, and protecting water quality. Responses regarding this effectiveness were mixed, but several options were suggested as methods for protecting shorelines. These included maintaining a fluctuating lake level, with a target of 811 ft. asl for a few years to allow for deposits, updating assessments of riparian zones and erosion protection, maintaining lower lake levels, and providing funding for municipalities to protect their shorelines.

> *"Additional control structures are an immediate option to prevent flooding but [do] nothing to prevent long-term pollution of Lake Manitoba via the Portage Diversion."*

Through technical presentations, the Committee received a vast amount of information concerning the environmental, economic and social impacts of water level regulation. One of the key points made by Manitoba Conservation and Water Stewardship was that water level management plans should reflect the natural wet and dry cycles of the Lake Manitoba area, which result in the fluctuating water levels that are best for maintaining quality wildlife habitat and biodiversity. It was also recommended that Lake Manitoba be allowed to rest at low levels for one or more growing seasons in order to promote the growth of riparian and aquatic vegetation. Fisheries and ranching

interests in attendance for a presentation on this subject generally agreed that maintaining a sustained lower level for a minimum of one growing season would be needed to ensure that fields and marshes in the area can drain and be rejuvenated. In addition, recommendations were made to restore wetlands in the Assiniboine watershed in order to reduce use of the Portage Diversion, and also to restore wetlands around Lake Manitoba in order to filter nutrients and contaminants from non-point sources.

> *"Producers recognize that occasional spring loss of pasture and hayland will occur around the lakes. This is expected and is in fact healthy for some areas producing native hay / grass. The problem facing producers today is that high water levels are no longer only occasional; this has become a chronic condition faced by many producers."*

Presentations from Manitoba Agriculture, Food and Rural Initiatives demonstrated the degree to which flooding impacted producers, as well as soil and forages. It was suggested that it may take up to five to seven years for forages around Lake Manitoba to return to normal production, but that halting all flooding would be detrimental to riparian areas that are valuable to the livestock industry, as some native hay species are more productive with short intervals of spring flooding.

Many stakeholders who presented to the Committee were very concerned about the potential and actual impacts of water level regulation. Significant impacts on the communities downstream of Lake Manitoba, including Pinaymootang First Nation, Dauphin River First Nation and others, were noted. These included severe impacts to fishing grounds and the fisheries in general, loss of access to and damage in communities, lost livelihoods, destruction of hunting and trapping areas, and negative impacts on wildlife habitat.

> *"Buffalo Creek went from being 30 feet wide to a roaring 300 foot wide waterway spewing huge amounts of debris, trees and silt into the Dauphin River and the Sturgeon Bay fishing grounds."*

The R.M.s of Lakeview and Grahamdale also noted their concerns regarding the many impacts of the 2011 flood. The R.M. of Grahamdale suggested that an assessment of the shoreline and riparian zone damage caused by the flood should be conducted, with any resulting information considered in conjunction with flood mitigation studies for the area.

The presentation from the Manitoba Beef Producers and other presentations representative of ranching interests illustrated the significant degree to which ranchers were impacted by the 2011 flood. It was indicated that producers and their operations have been impacted by chronically high lake levels and lake level uncertainty, as well as by the damage caused to shoreline and riparian areas. The commercial value of many beef production operations and their land base has been reduced, and many ranchers have had to sell off or significantly reduce the size of their cattle herds. The recommendations suggested by the Manitoba Beef Producers to address these issues were generally focused on expediting compensation for producers and providing related programs to assist with flood recovery and forage restoration.

The Association of Lake Manitoba Stakeholders (ALMS) presented the Committee with information that was gathered during an ALMS open house held in March 2012. The results of that open house, attended by over 400 Lake Manitoba residents, indicated that the primary concerns of those in attendance affected by the 2011 flood involve the social, economic and environmental impacts of the flood. A variety of environmental concerns were also raised by some of the respondents to the Lake Manitoba Flood Rehabilitation Committee survey. Concerns included the potential impacts of water control structures and/or flooding on fish and fish habitat, trapping, water wells, and water quality.

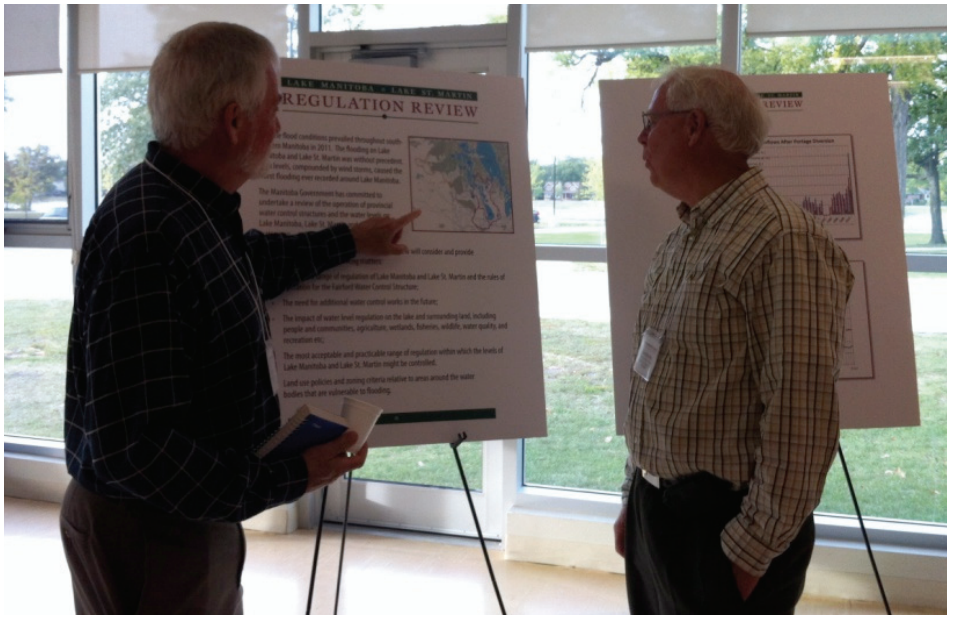
> *"The damage to our property and our livelihoods has been horrendous and the stress and heartbreak have been almost unbearable."*

7.1.4 Land Use Policies and Zoning

Respondents to the online feedback form provided mixed responses regarding the adequacy of existing land use policies and zoning regulations. Those who felt policies were inadequate commented on factors such as confusing processes, a lack of guidance from government, poor training of officials, ongoing illegal drainage, outdated regulations, and the need for required elevations of roads and buildings to be higher in low lying areas. A variety of suggestions were offered in response to a question that asked what new zoning or land development guidelines should be like. Comments made by those in support of existing policies indicated that policies are adequate as long as water levels are managed within the proper range, and that it is important that policies such as those regarding drainage are used and enforced. Several people indicated the issue is not land use policies; rather, it is water management.

> *"I lived in my dream home that I worked hard for 32 years to get for seven months before someone's decision impacted my life forever. Financially, I cannot afford the 16 percent they are expecting me to pay to lift a home that I am not convinced is liftable nor required if they were to manage the lake levels."*

The responses received indicated that many people will be significantly impacted by the policy requiring new construction to be based on the "flood of record" plus wind effects. Many respondents indicated that following this policy has or will come at a great personal financial cost. This was difficult for many to accept, considering factors such as significant declines in the resale values of properties, the fact that this policy protects infrastructure but not pasture or farm land, the requirement of people to adhere to this policy even in areas that were not affected by the flood (or were adequately protected by dikes), and the belief that future flooding can be avoided if Lake Manitoba outputs are able to equal inputs. Respondents noted that the funding offered by the Province is insufficient to cover all costs associated with complying with this policy and many, particularly seniors, were concerned with their ability to access their homes and garages once raised. People were also concerned that this policy creates the impression that the Province may



be willing to allow a repeat occurrence of the 2011 flood.

"A land use policy change would also significantly reduce the value of our land, reducing [the] financial strength of our operation. Personally, land use policy changes would deter me from moving back to the farm, since it would be obvious that flooding will be a normal occurrence in the area."

Few comments were made in the open house feedback forms related to land use planning and zoning policies. However, several people raised issues with the government policy requiring them to raise their home or cottage. Problems included not knowing how they are to go about doing this, not having the necessary information, not being able to afford the upfront costs needed to comply with the requirement, and having difficulty finding contractors to do the work.

The majority of respondents to the Committee's municipal government survey indicated that existing planning and regulatory tools for managing shoreline development were good. Multiple respondents indicated the issue is not with planning and regulation standards, acts or policies, but with water management policies. It was suggested that planning tools have been effective and can continue to be so if lake levels are properly maintained and can be anticipated.

The Committee received presentations from Manitoba's Department of Local Government on topics including strategies for managing growth and development in flood-prone areas and from Manitoba Infrastructure and Transportation (MIT) on flood protection levels. MIT recommended that the Committee adopt Manitoba's current interim flood protection levels as permanent and that the Committee recommend the "designated flood area" policy as part of its final report. During the discussions following these presentations, several points were raised by some of the stakeholders in attendance. It was suggested there has been confusion regarding the requirement for homes and cottages to be raised and that communication with stakeholders regarding the calculations of flood protection levels and the "flood of record" level could be improved. In general, conflicting viewpoints were presented regarding land use and planning policies, with some feeling there is a need for policies that are adapted to the impacts on agriculture and communities that resulted from the 2011 flood and others suggesting there is no need for policy revisions, as the source of high water was the human-controlled Portage Diversion.

During Committee meetings, many municipalities expressed their concerns with the Province's new flood levels and related policies and regulations. It was suggested that communication has been lacking and as a result understanding was also lacking. It was also felt that the Province's requirement to build all new structures to the elevation set by the "flood of record" has imposed unacceptable costs on the residents and municipalities bordering the lakes. The issue of many First Nation communities lacking adequate planning tools was also noted. In general, many stakeholders were of the opinion that land use policies around Lake Manitoba should not be changed solely because of the 2011 flood, as flooding in the area is seen as unlikely provided that water levels are properly managed and outputs from the lake can equal inputs.

Surrounded by floodwaters

8 • Interim and Potential Long-term Actions

8.1 Land Use Policies and Zoning

One of the core aspects of the work of the Committee was to consider and provide recommendations on land use policies and zoning criteria relative to areas vulnerable to flooding around Lake Manitoba and Lake St. Martin. To investigate this issue, the Committee commissioned a Land Use Planning study in cooperation with the 2011 Flood Task Force. The following summary of the findings of that study has been substantively taken from the Executive Summary of the study prepared by McKay Finnigan and Associates.

Although it was anticipated that the study would be focused on Lake Manitoba and Lake St. Martin, the conclusions and recommendations emanating from it were intended to have broader application throughout the province. The study was structured to provide a high level understanding of approaches to land use policies/regulations and to develop general principles and arrive at conclusions that would assist the Committee in developing related recommendations.

Work on the study took place from early June through to the end of August 2012. It involved meetings with community leaders, research into land use planning policies/regulations "best practices" elsewhere, a half-day workshop that looked at experience in this area across Canada and the United States, and structured interviews in each community to seek more detailed information directly from individual First Nations, the Planning Districts, and municipalities around Lake Manitoba and Lake St. Martin.

Land use planning when done properly can make life for future generations that much better. It can result in what most people really want – a sustainable community that meets the needs of the present without compromising the ability of future generations to meet their needs. To be effective, planning must be done through a process that balances ecological, cultural, historic, and aesthetic values with economic development.

Communities use planning to direct development and public projects, and ensure their land use regulations (zoning) meet the community's needs. Land use planning can prevent many hazard-related problems by directing poorly conceived new developments and post-disaster rebuilding away from dangerous locations. When it comes to what individuals and families will experience in the future related to floods, planning can have a huge impact through directing where new development should or should not go.

8.1.1 Population

Census data for 2011 shows that 27,380 people lived in communities bordering Lake Manitoba and Lake St. Martin. Of this number, 20,177 resided within the 11 rural municipalities bordering Lake Manitoba and 7,203 lived on the six reserves located around Lake Manitoba and Lake St. Martin. While the population of the First Nation communities has been increasing steadily over the years, with more than half their residents being under the age of 29, those living within the rural municipalities on average are much older in age. Notably, the total population of the 11 rural municipalities decreased by 4.6 percent from 2006 to 2011.

8.1.2 Land Use Planning and Floods in Manitoba

When planning, communities generally employ five strategies for managing growth and development in flood prone areas:

- Designating hazard lands;
- Dedicating shoreline reserves;
- Maintaining/enhancing shoreline vegetation;
- Defining flood protection levels; and
- Establishing setbacks from water bodies.

The study found that all municipalities in the Red River Valley/Lake Winnipeg area and Lake Manitoba/Lake St. Martin area address each of these five strategies, to varying degrees, in their respective development plans and zoning by-laws. In fact, with sound policies in place, planning per se seems to be relatively well organized and managed at the provincial and municipal levels. The limited data made available through the study suggests that, for a variety of reasons, such is not the case on First Nation communities in Manitoba, at least not those within the study area.

A key issue identified through the study is the apparently insufficient initiatives or planning structures to better ensure an effective coordination of efforts between municipalities and First Nation communities. For instance, other than a recent initiative between the Province with the Fisher River and Peguis First Nations and neighbouring municipalities around livestock/hog barn operations, and the reciprocal arrangements regarding land use that the R.M. of Headingly has with the Swan Lake First Nation, it seems there have been few past initiatives taken to co-ordinate land use planning between municipalities and adjacent First Nation communities in Manitoba. Similarly, there seems to be little effective coordination taking place between neighbouring municipalities when it comes to drainage. For example, it is not uncommon for large drains to terminate at one municipality's boundary with the additional water simply spilling onto the neighbouring jurisdiction's lands.

The need for better, more effective coordination of efforts between jurisdictions can also be found when one compares the results of decisions that have been made in Manitoba with those in neighbouring Saskatchewan.

Saskatchewan is the most relevant case in point as it is most similar to Manitoba in many respects, and much of the water flowing into Lake Manitoba and Lake St. Martin originates in Saskatchewan.

To assist in ensuring the safety and security of individuals, communities and property from natural and human-induced threats, among other things, the Government of Saskatchewan currently requires that all planning documents and decisions, insofar as is practical:

- Identify potential hazard lands and address their management;
- Limit development on hazard lands to minimize the risk to public or private infrastructure;
- Prohibit the development of new buildings and additions to buildings in the flood way of the 1-in-500 year flood elevation of any watercourse or water body; and
- Require flood proofing of new buildings and additions to buildings to an elevation of 0.5 m above the 1-in-500 year flood elevation of any watercourse or water in the flood fringe.

In comparison, the *Provincial Land Use Policy* in Manitoba states that Land Subject to Flooding is land that:

- Is inundated by floods up to and including the design flood (ie. 1 in a 100 year flood);
- Has a known history of flooding; or
- Experiences flooding during a flood event of a magnitude specified by the Province in areas protected by flood control works; or
- Is identified under the Designated Flood Area Regulation

And, Land Subject to Flooding must be identified.

Development of this land may be permitted only if the risks are eliminated or ways are identified to ensure that:

- No additional risk to life, health or safety is created as a result of the development;
- Buildings and other things constructed, such as septic fields, are protected from the risks related to flooding, erosion and bank instability, and
- Water flow, velocities and flood levels will not be adversely altered, obstructed or increased as a result of the development.

To implement provincial land use policies municipalities rely on the province to determine what the Land Subject to Flooding (noted above) means in practical terms. That means identification of the Flood Protection Level (FPL) expressed as minimum building elevations in feet/meters above sea level; elevations that can be used by homeowners and contractors. Flood Protection Levels, expressed in elevations, of course, vary from location to location.

The provincial interpretation of the provincial land use policy is that the Flood Protection Level is the higher of the:

- 100-year flood or
- Flood of record.

There is a slight discrepancy in wording between the policy and the practice/ implementation, but the above interpretation has been consistently applied since at least 1980.

Given their past experience in dealing with floods and surface water issues such as drainage, all municipal and First Nation leaders who engaged through this study recognized the need for an initiative or structure that would encourage collaborative planning between all jurisdictions. As one leader commented, "water knows no boundaries" and natural boundaries (watersheds) are in the end more relevant than political jurisdictions when dealing with land use planning and floods.

Planning Along Watersheds

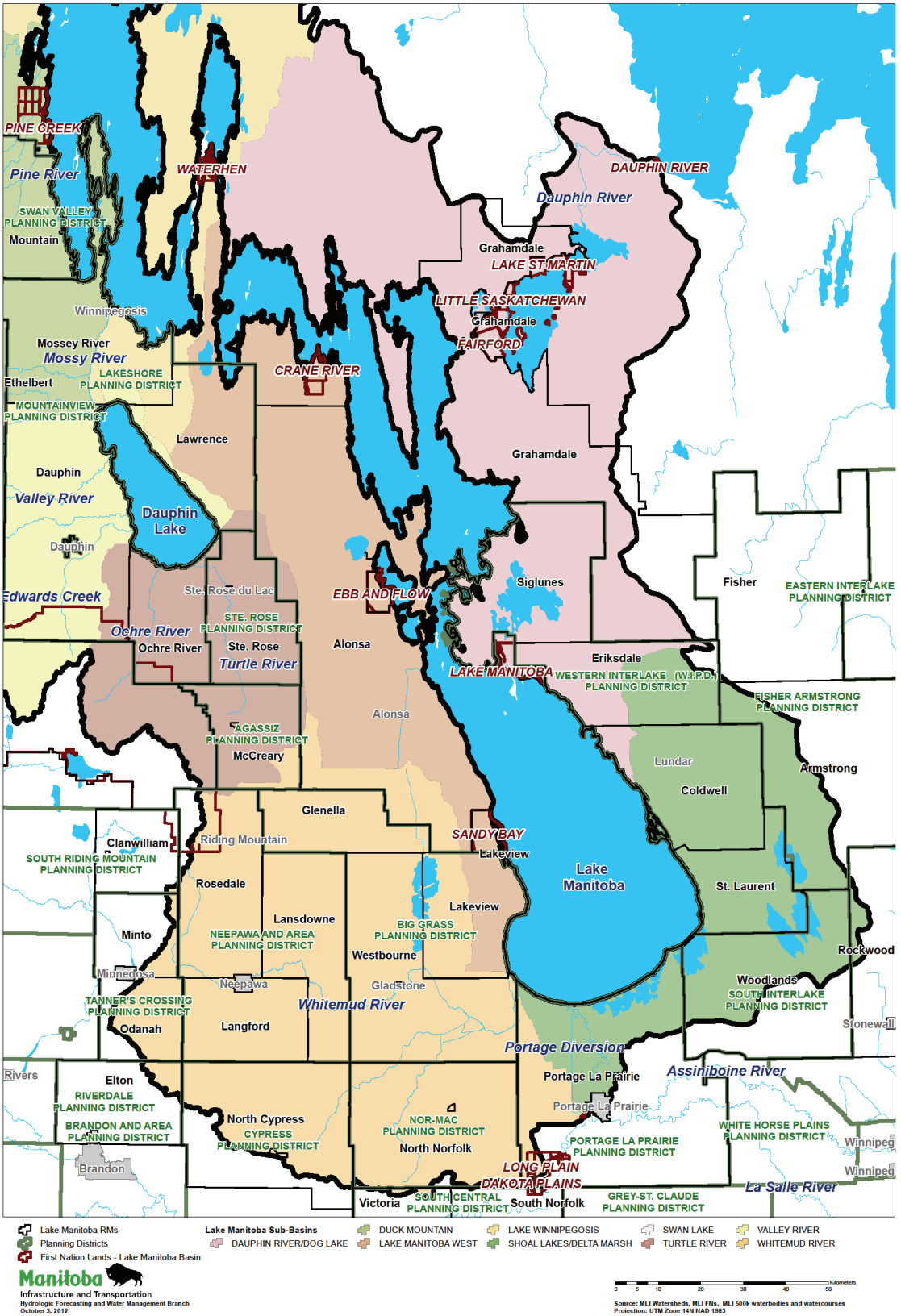
The real problem is that when it comes to planning to mitigate damage due to floods, indeed "water knows no boundaries." In fact, water could care less about political boundaries and local jurisdictions – the geographic boundaries for which development plans and zoning regulations are drawn up and enforced by municipalities. The map that follows indicates how watershed boundaries within the Lake Manitoba basin and those of the various political/administrative jurisdictions differ.

The legacy effects of geographic areas created by treaties also need to be taken into account, as the Province has no authority to enforce land use planning policies and regulations on reserve lands, while at the same time First Nations have an interest in resolving issues such as road access and drainage with neighbouring municipalities. In spite of these realities and challenges, this study found that significant progress has been made in Manitoba in terms of planning and the regulation of development along watersheds.

Red River Valley

Manitobans have learned from experience dealing with floods. Following the 1997 "flood of the century" in the Red River Valley, exceptional actions were taken that were felt to be in keeping with the exceptional nature of the devastation experienced during the flood. Perhaps most importantly, the Province introduced regulations under the Water Resources Administration Act that designated specific areas around the Red River, both south and north of Winnipeg, to be "designated flood areas". Through these regulations, the Province assumed the responsibility and authority for determining building elevations and/or other flood proofing requirements to be taken by an individual developer or land owner who may wish to build within these designated areas. All structures (besides fences) now require permits from the Province, whose staff administer and enforce the flood proofing requirements. Should a development be found to be in contravention of these requirements, the owner could be ordered to remove the structure and/or a caveat may be registered on the title to the property (which, among other things, would advise any future owner that the property will not be eligible for disaster assistance funding in the event of a flood). This relatively new regulatory system apparently has resulted in a compliance rate in excess of 90 percent; a significant improvement over past experience along the Red River.

Lake Manitoba Basin, Watersheds and Administrative Boundaries



Municipal leaders within the Red River Valley who were consulted through the Land Use Planning study offered the following viewpoints given their experience to date with this new modus operandi within the Designated Flood Areas:

Pros:

- The Province has the resources and clout to make decisions and require compliance (order demolitions, caveats, etc).
- Since our municipality is not the one setting down these rules, we are not the bad guys.
- There seems to be a tendency for members of the public to be more accepting of the requirements when they understand they are a directive of the Province.

Cons:

- Manitoba Water Stewardship's regional offices are spread too thin; they cover a lot of territory and at times the turnaround time for input on a particular application seems unreasonably long. There is a need for more provincial staff on the ground.
- Municipalities relinquish some of their control over future development.

Red River Basin Commission

Many of those interviewed also mentioned the work of the Red River Basin Commission (RRBC). The RRBC was established in 2002 following the merger of three regional watershed management bodies. Its mandate is to initiate a grass roots effort that addresses land and water issues in a basin-wide context transcending the borders of North Dakota, South Dakota, Minnesota, and Manitoba. It is a not-for-profit corporation made up of a 41-member Board of Directors comprised mainly of representatives from local government, as well as representatives of First Nations, a water supply co-operative, a lake improvement association, environmental groups, and four members at-large. The RRBC has been successful in establishing a set of goals and objectives for water management in the Red River Basin. It has also commissioned a number of research initiatives that have helped inform locally-based policy.

Conservation Districts

In 2006, the Manitoba Conservation District Program was expanded to better "create healthy and sustainable watersheds through focused, priority-based programs that provide definite improvements to watershed health." Through this program some 18 Conservation Districts have been established to foster watershed co-operation and communication between upstream and downstream municipalities to address local land and water management issues. To date, 14 have been involved as water planning authorities (under The Water Protection Act) and have successfully completed an integrated watershed management plan (IWMP) for their respective areas. When it comes to land use planning and flooding, these plans are a step in the right direction, as they take more of a land- and watershed-based (or regional) approach to planning. Some have been cited as having had good success in engaging representatives of First Nations within their watershed areas in the planning process.

While Manitoba has experienced significant progress over the past decade in establishing Conservation Districts and developing integrated watershed management plans, the reality is that serious problems continue to persist when it comes to putting these plans into action. Conservation Districts have no regulatory authority and some have consciously decided to avoid dealing with surface water management issues. These issues around drainage can, if not addressed, exacerbate problems during floods.

8.1.3 Planning Districts and Municipalities: Viewpoints

The overarching view offered by municipal leaders through the Land Use Planning study was that the root cause of the flooding problems faced by everyone in 2011 was the result of poor water management and not planning and land use policies/regulations. Generally, it was felt that before any planning recommendations can be formulated, clear decisions need to be made by the Province about both the level at which water in the lake will be managed and the new flood building standard to regulate future development.

Serious concerns were raised about the impact that water control structures (particularly the Portage Diversion) have had, and will continue to have, on flooding in the Lake Manitoba area. Given the role that past government decisions have played in exacerbating the 2011 flood, it is difficult for many to understand why the decision has not already been made to proceed with facilitating the flow of this extra water from Lake Manitoba into Lake Winnipeg through both the construction of a channel(s) and dredging operations. The latter were "top of mind" issues with respect to Lake Manitoba and flooding together with concerns about water quality, the level at which the government deems acceptable at which to regulate the lake in future, and the potential ongoing loss of riparian zones.

> *" We will never forget the water flowing from the Assiniboine River, almost touching the bottom of the bridges on #1 Hwy. We will also never forget how quickly the lake rose and the terrible damage it did. The damage to our property and our livelihoods has been horrendous and the stress and heartbreak have been almost unbearable."*
>
> - Reeve Philip Thordarson, RM of Lakeview

Most felt that the flood was caused by artificial interventions and comparisons cannot be made with the flood of 1997 in the Red River Valley. They pointed out that river flood waters naturally recede within a reasonable amount of time, whereas flooding from lakes lingers on and on. Essentially, given the degree to which the Province seems able to control the amount of water that gets diverted to Lake Manitoba, municipal leaders generally expect the Province to do whatever it will take to have this water continue its journey to Lake Winnipeg at a faster rate, and to guarantee that Lake Manitoba will be regulated to keep the maximum elevation somewhere in the range of 812 ft. asl. Besides limiting the maximum amount of water in the lake

at any one time, most would also like to see it regulated in a manner to simulate the natural rise and fall of the water to help rejuvenate the vegetation along the shoreline.

At the same time, most municipal leaders recognize that what happened in 2011 cannot be ignored, and that in many ways what happened was a "game changer" when considering land use planning and regulations for the future.

Land Use Planning Policies, Regulations and Enforcement

Municipal leaders interviewed through the study generally felt that, given the exceptional nature of the devastation that was experienced on the ground during the 2011 flood, all involved need to take a step back and consider what might be done differently in the future.

In terms of the biggest challenges faced by municipalities in being able to administer and enforce adequate land use policies and zoning regulations when it comes to trying to limit potential damage due to floods, the municipalities in the Lake Manitoba and Lake St. Martin area mentioned the following most frequently:

- Limited budgets/resources available to either hire qualified in-house staff or outside experts to do the work;
- Lack of good data, particularly up-to-date maps;
- Lack of coordination of surface water management between jurisdictions (drainage); and
- Difficulty saying "no" to development that would expand a municipality's tax base or to proposals being presented by friends and neighbours.

Regarding the last point, one Reeve explained it can be particularly challenging to say "no" if one realizes that a consequence might be not getting elected next time around. Another noted that budget constraints make it challenging for municipalities to designate public reserves for which they would then need to set aside adequate funds for proper maintenance of the lands. While one of the Planning Districts in the Red River Valley expressed a desire for the Province to pass legislation that would enable it to impose fines on violators, representatives of municipalities around Lake Manitoba generally indicated they could not see themselves enforcing regulations on their ratepayers in this way.

Only one of the municipalities around Lake Manitoba indicated that when processing applications for new buildings, as a rule they required lot grading and building grade elevations as recommended by Water Stewardship, together with a survey grade level. None indicated that they undertook inspections to ensure proposed buildings/developments were built according to plans as approved, although one noted they did ensure that building code requirements had been met. Generally speaking, the underlying reasons for this situation relate to a municipality not having adequate staff to administer the approval process and to perform inspections, and/or wanting to avoid being perceived as putting too many roadblocks in the way of new development.

One community leader interviewed through this study noted that even when a municipality in

Manitoba feels compelled to go after a violator, it is relatively expensive and time consuming to do, as the only recourse available at present is to take that violator to court. He referred to the contrasting situation in British Columbia where municipalities have the power to levy fines that can be registered on the title to the property, which has proven very effective in achieving compliance.

Most municipal leaders recognized the need to develop more restrictive guidelines or regulations for development in flood prone areas, including (some reluctantly) the establishment of "designated flood areas". However, all generally want to be part of a process that would enable them to have input into developing these more restrictive regulations, including input into where the boundaries for any "designated flood areas" would be drawn.

Manitoba's Development Standards and Interim Guidelines

Policy

As noted previously, the Provincial Land Use Policy states that any developments in flood prone areas may be permitted only if the risks are eliminated or ways are identified to ensure that:

- No additional risk to life, health or safety is created as a result of the development;
- Buildings and other things constructed, such as septic fields, are protected from the risks related to flooding, erosion and bank instability, and
- Water flow, velocities and flood levels will not be adversely altered, obstructed or increased as a result of the development.

The majority of municipal leaders interviewed through the study stated they felt that on a "go forward basis' "the worst flood on record" should serve as the standard for Manitoba explaining that:

- Given the magnitude of compensation costs following a flood, how could the Province do anything but design regulations to accommodate the worst flood; and
- The reality is that governments cannot knowingly put people at risk – people need to understand they cannot build in a flood zone.

" The new 'normal' is what we experienced last year. We can't erase people's memories and need to consider this when we talk about building standards."

- Reeve Don Walsh, RM of Woodlands

Interim Guidelines

Following the 2011 flood, the Province introduced "interim" Flood Protection Levels to be used in assessing flood hazards such that permanent structures constructed upon lands around Lake Manitoba would be protected from flooding up to and including that which was experienced in 2011. Detailed calculations were produced to establish Flood Protection Levels, which are defined as the corresponding flood of record plus freeboard to allow for wind setup and wave effects. It should be noted that flood protection requirements for permanent

structures near or adjacent to major lakes, such as Lake Manitoba, are determined on a site-specific basis.

Those interviewed for the study were asked to describe, with specific examples where possible, what adhering to these interim levels has meant (or will mean) to their respective municipalities or planning districts.

Raising permanent dwelling to higher elevation

Most respondents expressed frustration with the guidelines and commented on how their very "interim" nature is problematic, as they leave everyone in a state of limbo. Some noted problems or challenges encountered in trying to interpret and enforce the guidelines. Examples of comments made include:

- Interim guidelines seem to have been put in place overnight through somewhat of a rash decision. When the lake goes back to 810.5 feet, people will complain about having had to build their properties too high.
- We have no option but to treat these "interim" guidelines as permanent. Once we tell homeowners to say build/rebuild their properties to a higher level, once the work has been done, it's "permanent" not interim.
- Because the province looks at each property and determines the building height for that property, the resulting numbers for a community can have quite a range. It is confusing and results in some neighbouring properties having different requirements that are not easily understood. For example, "Why should I have to build higher than my neighbour?" It would be better to keep it simple and require all properties in a particular area to be built to the same elevation.
- Some lots simply are not large enough to enable their owners to have their properties/ buildings raised to meet the guidelines (due to insufficient distance from neighbouring lots).
- Having to raise municipal roads to accommodate and service building lots with these new elevation levels will be extremely costly.
- Some development unfortunately has proceeded without permits, as it has been difficult for the applicant to get clear answers and approval from the government.

> *" We've already lost one third of our land in St. Laurent. If the water levels go any higher we'll be toast. Around 75 percent of our income comes from cottage development."*
>
> - Reeve Earl Zotter, RM of St. Laurent

- Some R.M.s are reluctant to give out permits based on the "interim" guidelines – a final decision is required as all involved need something more concrete to work with.
- What will happen to existing properties, as some owners have decided to raise theirs while others have decided not to?
- Some individuals simply do not have the resources to raise their properties to meet the guidelines. As a result, while neighbouring lots are raised, those that aren't will become more susceptible to flooding/runoff water.
- Most R.M.s have firefighting equipment that may not be able to handle two story buildings that have been forced to be elevated to a higher level as a result of these guidelines. If we now have to turn down approval for the construction of new two story buildings, we'll essentially be losing much-needed tax revenue.
- After all this time, much of our agricultural land is still flooded. The guidelines are generally irrelevant to our municipality, which relies mostly on monies from agriculture as its source of revenue. The Manitoba government seems only concerned with cottages, with little or no consideration for the farm land and the future of agriculture in the area.
- Given the guidelines, much of the land around the lakes will no longer be developable.
- Municipalities need more development and growth to be sustainable. We need to know what the level of the lake is going to be and what factors are being considered in setting elevations. If municipalities knew for sure what they had to do, we could then start to work on it and develop a plan to encourage development in more appropriate areas.
- People are no longer interested in buying lakefront properties. Property values are down considerably as a result of the flood and its impact on land (including farm land) and buildings.

8.1.4 First Nations: Viewpoints

The timing of the Land Use Planning study unfortunately took place while many of the residents of the reserves around Lake Manitoba and Lake St. Martin were displaced as a result of the 2011 flooding and still living outside of their communities. As such, active participation by First Nation representatives was relatively limited. Timing also coincided with summer vacations, such that meetings with officials from Aboriginal Affairs and Northern Development Canada (AANDC) proved not to be possible.

All of the First Nation leaders who participated in the study indicated the need for a collaborative approach to better co-ordinate land use planning between reserves and neighbouring municipalities. They also indicated the need for a better communications system to be set up during floods, so that everyone affected can receive the same information in a timely manner. Finally, all expressed concerns about the quality of the water on the lakes, impact on the fishery, and erosion of the lake shore.

> *" Some of our sacred lands have been lost in the flood. We use to have our pow wow and other ceremonies by the lake but haven't been able to do this since the flooding."*
>
> - Chief Eugene Eastman, O-Chi-Chak-Ko-Sipi First Nation

Representatives of Sandy Bay First Nation explained that water from the land due to drainage issues is their biggest source of flooding rather than water from Lake Manitoba. Similarly, they see a need to develop a better system to co-ordinate the maintenance and joint use of local roads with residents of neighbouring municipalities.

Generally speaking, First Nations face the same challenges, such as limited budgets/resources available to hire qualified staff, as those faced by municipalities trying to administer and enforce adequate land use policies and/or regulations to limit potential damage due to floods. None of the First Nations that participated in this study had any land use policies or plans in place. At present, there are no legal or institutional tools in place to encourage co-operation and co-ordination of land use plans and policies between reserves and their neighbouring municipalities. First Nations also have a unique direct relationship with the federal government through Aboriginal Affairs and Northern Development Canada (AANDC).

The Administration Building in Sandy Bay First Nation

8.1.5 Role of the Federal Government

Geotube

United States of America

While the study learned that the land use planning and flood management systems in the U.S.A. are far from perfect and in fact, over the years, have resulted in increased flood losses, created a false sense of security that building in a flood plain is okay, and disconnected citizens and local governments from the financial consequences of developing in hazard areas, the lessons learned from these outcomes have led to significant changes in the approach taken. Of note is the Disaster Mitigation Act of 2000, which requires more intergovernmental cooperation and the development of detailed local land use and flood mitigation plans. Perhaps more importantly, this Act makes federal funding available for pre-disaster mitigation planning as well as post-disaster mitigation works.

State flood plain managers in the U.S.A. have also learned from past mistakes and are pushing a new approach – "No Adverse Impact" – which calls for the actions of one property owner to have no adverse effect on the rights of other property owners, either upstream or downstream. Under this concept, the adverse effects or impacts can be measured in terms of increased flood peaks, increased flood stages, higher flood velocities, increased erosion and sedimentation, or other impacts the community considers important.

Canada

Since the early 1990s, the Government of Canada, through disaster assistance funding, has been willing to pay hundreds of millions of dollars "picking up the pieces" after a flood but unlike its American counterpart, has not been engaged at the front end working toward mitigating potential damage due to floods.

However, the current government has concluded that "an ounce of prevention is worth a pound of cure" with its recent announcement of the Financial Support to Provinces and Territories for 2011 Flood Mitigation Investments, through which it is anticipated that Manitoba alone will receive federal funds in the range of $300-$400 million to help offset the roughly $1 billion cost to the province of fighting the 2011 flood. Consideration is being given to making this initiative a permanent national program. While eligible costs to date have been limited to approved permanent

Flood Mitigation

flood protection measures, such as permanent dikes, a case should be made for federal contributions to go toward assisting provincial and local authorities (including First Nations) to undertake land use planning along watersheds in a more effective and co-ordinated manner and to hire staff with the requisite expertise to ensure that regulations are enforced.

8.1.6 Existing Provincial Policy

While the provincial flood protection policy requires flood protection to the higher of the 1-in-100 year flood level or the flood of record, flood damages continue to occur in Manitoba. The standard response of water managers has been to re-compute the 1-in-100 year flood level based on the latest flood or to raise the flood protection level to the flood of record, as was done for Lake Manitoba after the 2011 flood. This has resulted in considerable confusion.

The interim Flood Protection Level (FPL) for Lake Manitoba was computed based on the May 31, 2011, wind event (815.3 feet wind-eliminated water level) plus wind setup (2 to 5 feet) plus wave uprush (1 to 2 feet), resulting in flood protection levels that could potentially be as high as 822.3 feet. Such lake levels on Lake Manitoba have uncertain probabilities of recurring but would be very rare, and communities around Lake Manitoba would have the highest standard of flood protection in the province based on this single event. On the other hand, if structures are constructed based on this FPL, there would be little structural flood damage in future.

The problem with the provincial standard is that the 1-in-100 year flood is likely too low. With a 1-in-100 year flood, there is a one percent chance that it will reoccur in any given year. But if a person lives there for 10 years, the chance that the one percent flood will be exceeded sometime in that 10-year period is 9.6 percent. And the chance that he or she will be flooded sometime in the next 50 year period is 40 percent. This is too risky and is likely the reason that damages continue to occur in flood prone regions of Manitoba.

Risk-Based Approach

Flood damages such as those that occurred in 2011 could have been minimized through delineation of flood prone areas and the prior control of development within these areas. A risk-based flood protection approach would involve mapping flood prone areas for various probabilities of flood events, and could form the basis for responsible land use planning and zoning for urban, lakeside or rural areas. Such information is available for some communities in Manitoba, but many officials do not seem to be aware it exists or choose not to use it.

The approach can be extended to objectively identify existing flood prone properties, and to determine the damages associated with flooding and the benefits and associated costs of various flood mitigation measures. Examples of non-structural measures include doing nothing, land acquisition and zoning. Examples of structural measures include raising buildings, building dikes, constructing diversion works, and developing upstream storage.

A risk-based approach would involve:

1. Assessing the hydrologic risk by determining the flood flows for the 1:2 (50 percent probability of exceedance), 1:5, 1:10, etc., flood events under existing conditions;
2. Mapping the extent and depth of flooding for each flood event; and
3. Determining the damages (agricultural, urban, etc.) for each flood event.

These steps would be repeated for each mitigation alternative and the reduction in damages/ benefits determined and compared with cost.

In fact, it would be preferable to have a minimum standard applied throughout the province based on a common return period, augmented by risk assessment for critical care facilities, emergency response equipment, important infrastructure, and any large capital investment. The minimum standard would be enacted via regulation; the augmented risk assessment would be at the discretion of the authority investing in the new capital works.

8.2 The Need for Additional Water Control Works

8.2.1 Establishing the Need

In the private sector, analytical tools (net present value, internal rate of return, payback period, and benefit-cost analysis) moderated with a strategic outlook make capital decisions appear relatively easy. Capital decision making in the public sector is a greater blend of qualitative and quantitative analysis. Benefits are difficult to quantify and there is a greater emphasis on justification – how to select among many worthy projects.

It is clear from the presentations made to the Committee there is an overwhelming interest and demand for an additional outlet to Lake Manitoba (undertaken in a manner that meets the needs of people resident on Lake St. Martin and Dauphin River). Demands for an additional outlet have been made by the public at every single Committee meeting. Rural municipalities bordering Lake Manitoba have been unanimous in their demand for an additional outlet and have passed resolutions calling for action on this issue. Survey results from the Committee's web site likewise effectively show unanimous support and demand for an additional outlet.

PERSPECTIVE

Protecting everybody and everything from flood damage.

Flood protection is a mix of private and public measures. The broad assumption in western jurisdictions is that the individual is responsible to know and understand risks to his person and property and to take appropriate measures. The government has a role only when the circumstances are beyond the capability of any one individual. Private responsibilities include building higher than flood levels. Public measures include determining what those flood levels might be, designing and building control structures and dikes, and/or restricting development in flood prone areas. It is neither practical nor possible, however, to protect all of Manitoba from every flood event nor is it an environmentally sound construct. There are choices to be made.

This demand is made on the basis that the Portage Diversion now seems to have an effective capacity of 35,000 cfs while the Fairford Control Structure has a capacity of 20,000 cfs (at high lake levels). Many residents perceive this as a formula guaranteed to create another flood. Further, the interim development guidelines requiring people to build permanent and seasonal residences to higher elevations seems like a transfer of costs from the Province to local residents. The people bordering Lake Manitoba feel they have been sacrificed and will continue to be sacrificed to save people and property on the lower Assiniboine. The Province has undertaken assessments that show that this is not necessarily the case, but there is a firmly held conviction by Lake Manitoba residents that something needs to be done to deal with the effects of the Diversion. To them, it's a matter of natural justice; correcting an obvious wrong.

PERSPECTIVE

Recent experience is interpreted as the new reality.

A common perception is that "things are not as they used to be." After a series of wet years, residents tend to assume the climate has changed and conditions will never go back to "normal". This impression is augmented by news reports and documentaries discussing the impact of climate change. Will flooding be more common in the future or will weather patterns cycle back to dry periods as it has in the past? If in fact the climate of southern Manitoba is changing then flood control works should not be designed based on past recorded data.

While decisions on most public projects are not based solely on benefit-cost analysis, there is a need to know, however, where a project stands using analytical techniques. Otherwise, the result is poor public decision making resulting in less than optimum capital investment, aka "white elephants".

The Committee is not mandated to design or cost capital works. However, the Committee has looked at recent engineering studies, and considered what would be needed to achieve results that might be acceptable to both the residents of Lake St. Martin and Lake Manitoba.

Discussion

The flood of 2011 was caused by record high natural inflows on the Waterhen River augmented by high and prolonged diverted flows from the Assiniboine River via the Portage Diversion. Hydrologists have stated that this is a very rare event, with an estimated return period of 1-in-400 years. If that is correct, it may be difficult to economically justify the cost of constructing an additional outlet using conventional benefit-cost analysis. It would likely be less expensive to flood proof properties and pay for future damages when they occur rather than to build a new channel and control structure. However, two arguments have been presented to the Committee for justifying construction of a second outlet channel:

1. **2011 was a "man-made flood."**
   Because so much water was diverted from the Assiniboine River to Lake Manitoba, flooding on the lake was not a natural event; it was caused by government policy. The residents generally understand why the decisions were made, but believe the government must take responsibility for the damages arising from those policy decisions. That would include full restitution for 2011 damages and structural works to ensure that the damage never happens again. By this argument, economics plays a lesser part in decisions respecting a second outlet.

2. **With climate change, flooding will be more common.**
   Flooding associated with high river flows and lake levels will be more common in the future because of climate change. If the increasing CO2 levels in the atmosphere change the climate of the Canadian prairies then economic studies of structural options cannot be based solely on historic data, as climate factors will render future flows and lake levels different from past levels.

Whatever the technical and economic analysis might be, this is an emotionally charged issue. For many people on both Lake Manitoba and Lake St. Martin, the Portage Diversion is now a top of mind, ever present danger. It has become synonymous with disaster.

PERSPECTIVE

Was the 2011 flood on Lake Manitoba a "man-made flood"?

The argument about whether the flood on Lake Manitoba was a "man-made flood" is partially technical (hydrologic analysis), partially semantics and partially perspective. A technical approach looking for "state of nature" would compare what did happen to what would have happened if none of the works were in place. That is, not only no Portage Diversion but also no Fairford Control Structure. And maybe no railway tracks, roads and drainage ditches. Under those conditions, it is probable that the flood of 2011 would have been similar to what was actually experienced. The water from the Assiniboine River would have found its way into Lake Manitoba naturally and with no Fairford Control Structure, the lake would have nowhere to go but up and out. A premise of this argument is that all works must be taken into consideration. In particular, if you want to consider the adverse effect of the Portage Diversion on Lake Manitoba you should also take into account the benefit of the Fairford Control Structure.

That is one perspective.

An alternative perspective is that one should look at decisions in light of conditions then prevailing. The major flood control works in southern Manitoba have been in place for a generation and people have generally found ways to live with them. Over the past four decades, flood damages have been reduced in Winnipeg, and the Fairford Control Structure had proved to be effective in controlling high and low levels on Lake Manitoba. There have been a few years with lake levels higher than normal, but these have not caused any significant damage.

But then came the spring of 2011 with a forecast of record flows both on the Waterhen River and on the Assiniboine River. The rules of operation for the Portage Diversion clearly state that the flow on the Diversion should not exceed 25,000 cfs. Also, the Diversion should not be used to raise Lake Manitoba levels above 812.87 feet if possible. Lake Manitoba was at 812.8 feet at the start of April, so according to this objective the Diversion should not have been used at all in 2011, and according to rule 2 it should not have been permitted to divert more than 25,000 cfs.

But the operating rules also state that it is desirable to maintain flows less than 10,000 cfs in the Assiniboine River if possible. So in 2011 it was not possible to meet all of the objectives and rules for the Portage Diversion. With a peak flow of over 50,000 cfs arriving at Portage la Prairie from the west and a river capacity of 18,000 cfs east of Portage la Prairie, the only choices were to divert as much as possible to Lake Manitoba and aggravate flooding there, or to let the Assiniboine River overflow its banks east of Portage la Prairie and let more than 30,000 cfs overflow the banks of the Assiniboine, flooding all of the valley between there and Winnipeg as well as the towns along the La Salle River. There was no solution that would save everyone harmless. It was simply a question of what alternative would do less damage –flood the lower reaches of the Assiniboine River or flood Lake Manitoba/Lake St. Martin. The decision was taken by the Province to do the latter.

The argument about what is the "right" perspective does not lend itself to resolution. There is a body of technical data to bolster the first perspective. There is also a very strong public opinion that this is a question of values and standards; that Lake Manitoba and Lake St. Martin deserve the same level of flood protection as others.

8.2.2 Design of Fairford Control Structure

The control of Lake Manitoba levels was recommended by the Lakes Winnipeg and Manitoba Board (1958). The report recommended that the levels of Lake Manitoba be controlled by means of a new control dam and channel enlargement in the upper Fairford River. The 1958 report "Benefit Cost Analysis Lake Manitoba Regulation" by Professor E. Kuiper reported that "… the channel enlargement was designed so that the recorded natural Lake Manitoba range of 810.3-815.8 would have been reduced to an artificial range of 811 to 813 had the control works been in existence during the period of record, 1914 to 1958."[16] In sizing the Fairford Channel, the designers took into account the additional water that would be diverted from the Assiniboine River once the Portage Diversion was constructed. However, they computed those annual volumes based on recorded flows in the Assiniboine River during the first half of the 20th century. An analysis of the Assiniboine River recorded flows from 1924 to 1969 indicated that the Portage Diversion would have been operated in 18 of the 46 years (39 percent of the years), and the average annual volume diverted would have been 76,000 acre feet per year. However, since the Diversion was put into operation in 1971, it has been operated in 36 of the 43 years, or in 84 percent of the years. The average annual volume diverted was 364,000 acre feet. Even excluding the 2011 volume, the average annual volume diverted from 1970 to 2010 was 266,000 acre feet, or 3.5 times the volume the designers of the Fairford Control Structure had assumed.

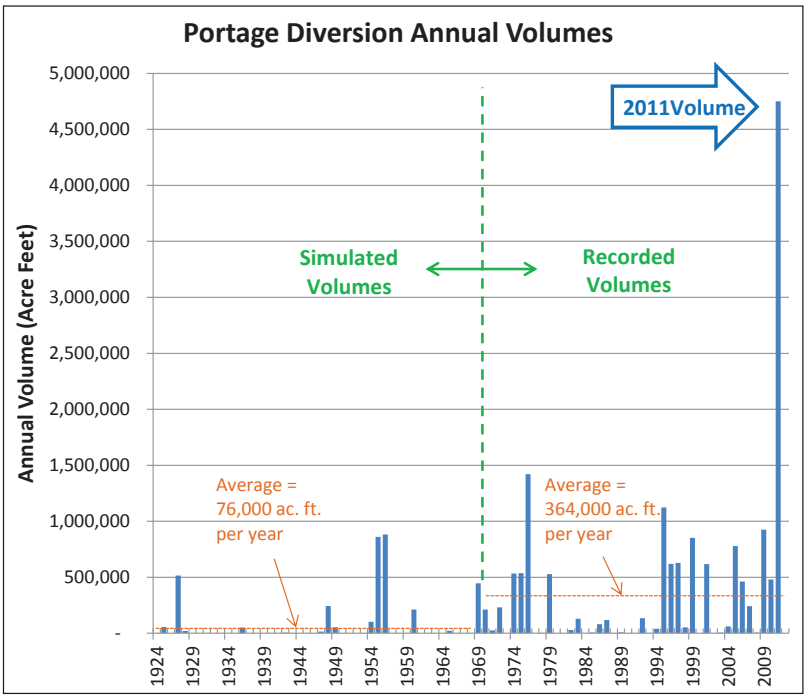


Figure 8.1: Portage Diversion - Volume Diverted 2011

Figure 8.1 also shows that the volume diverted in 2011 was far beyond any previous year. The geodetic datum for Lake Manitoba has been adjusted by .013 feet since the Kuiper report was written. Using the current datum, the Fairford Structure was designed to maintain Lake Manitoba within the range of 810.87 to 812.87 feet.

[16] Kuiper, E. Benefit-Cost Analysis: *Lake Manitoba Regulation,* University of Manitoba: Winnipeg, 1958

Figure 8.2 shows the lake level range that the Fairford Control Structure was designed to maintain.

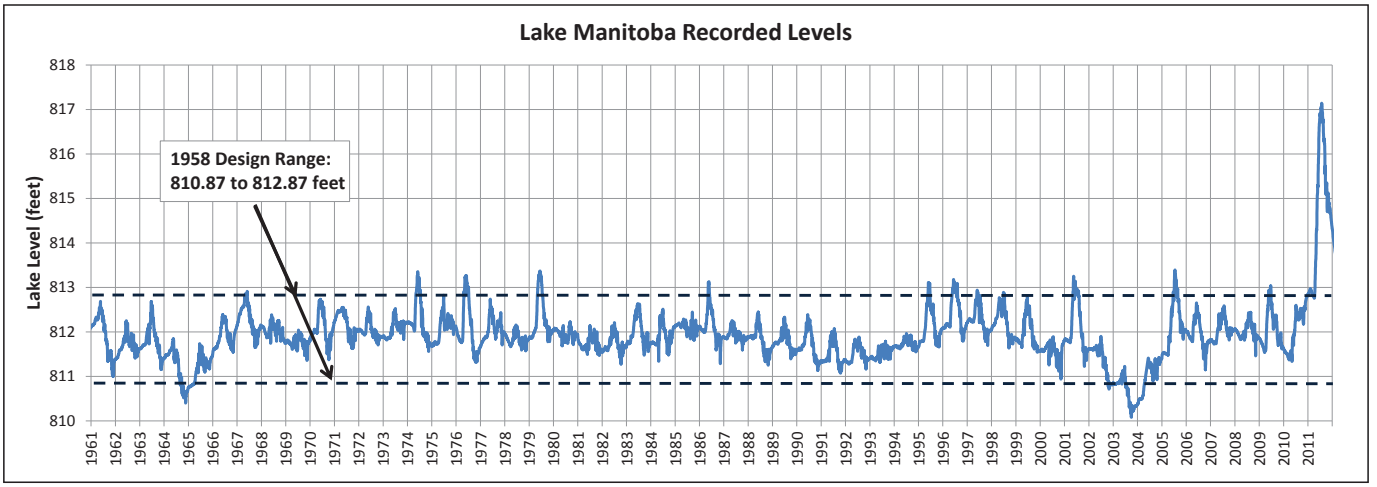


Figure 8.2: Fairford Control Structure Target Range

A review of the recorded lake levels since 1961 shows that the control structure has been quite successful in maintaining Lake Manitoba levels within the target range in all years except 2011. However, there were a few years when lake levels exceeded the design maximum level of 812.87 feet. Table 8.1 shows the years when lake levels exceeded 812.87 feet, along with the volume diverted during that year from the Assiniboine River via the Portage Diversion.

Table 8.1: Portage Diversion Operation during High Years

Year	Peak Lake Manitoba Level (feet)	Number of Days Above 812.87 feet	Volume Diverted (acre feet)
1974	813.43	58	533,000
1976	813.30	61	1,420,000
1979	813.49	70	529,000
1986	813.19	22	80,900
1995	813.18	28	1,123,000
1996	813.31	67	619,000
1997	813.02	11	629,000
2001	813.30	69	618,000
2005	813.45	50	778,000
2009	813.13	24	924,000
2011	817.27	310	4,751,000
2012	814.32	197	0

There is suspicion that the increased usage of the Portage Diversion is due to non-critical operations such as keeping river levels at The Forks in Winnipeg below the river walkway level. A review of the data suggests this is seldom the case. The more likely reason is the impact of ongoing land drainage and land use changes. A recent study from the University of Saskatchewan[17] found that for Smith Creek, a tributary to the Assiniboine River in Saskatchewan, complete restoration of wetlands would reduce spring streamflow volumes by an average of 79 percent. However, additional sensitivity analysis showed that the effects of land use change and wetland drainage alteration on cumulative basin spring discharge volume and peak daily spring discharge were highly variable from year to year and depended on the flow condition.

Therefore, in 12 of the 43 years between 1970 and 2012, the Portage Diversion was operated even though Lake Manitoba was above 812.87 feet. As noted in a previous chapter, one of the four operating objectives for the Portage Diversion is: "Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible." It is obvious that the Portage Diversion is having more impact on Lake Manitoba than the designers had anticipated.

The preceding analysis is based on an exceedance of 812.87 feet. However, the intent of the minimum log change recommendation in the 2003 report was to prevent Lake Manitoba from exceeding 813 feet. A preliminary analysis of the data between 1971 when the Portage Diversion was put into operation and 2010 suggests that a 35 percent increase in the capacity of the Lake Manitoba outlet would be required to meet the objective of keeping Lake Manitoba from exceeding 813 feet in all years except 2011.

Analysis

As this is not a technical report, a full engineering analysis of the need for an additional outlet is beyond the scope of the report. As noted in the previous section, the Fairford Control Structure has been largely successful in maintaining Lake Manitoba between elevations 810.87 and 812.87 feet. Yet operation of the Portage Diversion has forced levels above 812.87 feet in 12 out of 43 years. Also, the Committee has heard from many lake residents that 812.87 feet is too high for a top of range.

However, it was the flood of 2011 that forced Lake Manitoba to unprecedented high levels causing extensive damage to structures and farmland around the lake. It was the flood of 2011 that led to the call for an additional outlet from Lake Manitoba. But the flood of 2011 was an extremely rare event. As discussed in Section 3.2, the combination of record inflows from Lake Winnipegosis via the Waterhen River and the volumes diverted from the Assiniboine River via the Portage Diversion resulted in unprecedented flooding on Lake Manitoba and Lake St. Martin.

[17] Pomeroy, John, et al. "Prairie Hydrological Model Study Final Report." *Centre for Hydrology Report No. 7* (2010). Centre for Hydrology, University of Saskatchewan. Web. 5 Oct. 2012.

Flows have been recorded on the Assiniboine River for a century. An analysis by Manitoba Water Stewardship computed that the return period for the 2011 peak flow of the Assiniboine River at Portage la Prairie was 1-in-220 years. But as noted in Section 3.1.1, the large impact on Lake Manitoba was not due to peak flow on the Assiniboine River, but rather the duration of the flood and the large number of days the Portage Diversion was used. Figure 8.3 is a frequency curve of the April to July flow volumes west of Portage la Prairie. According to this curve, the 2011 spring flood volume on the Assiniboine River was between a 1-in-500 and 1-in-1,000 year event. Even if the effects of climate change render a flood of this magnitude a little more common, it will still be an extremely rare event. It would be difficult to justify the addition of a second outlet to Lake Manitoba based on such a rare event.

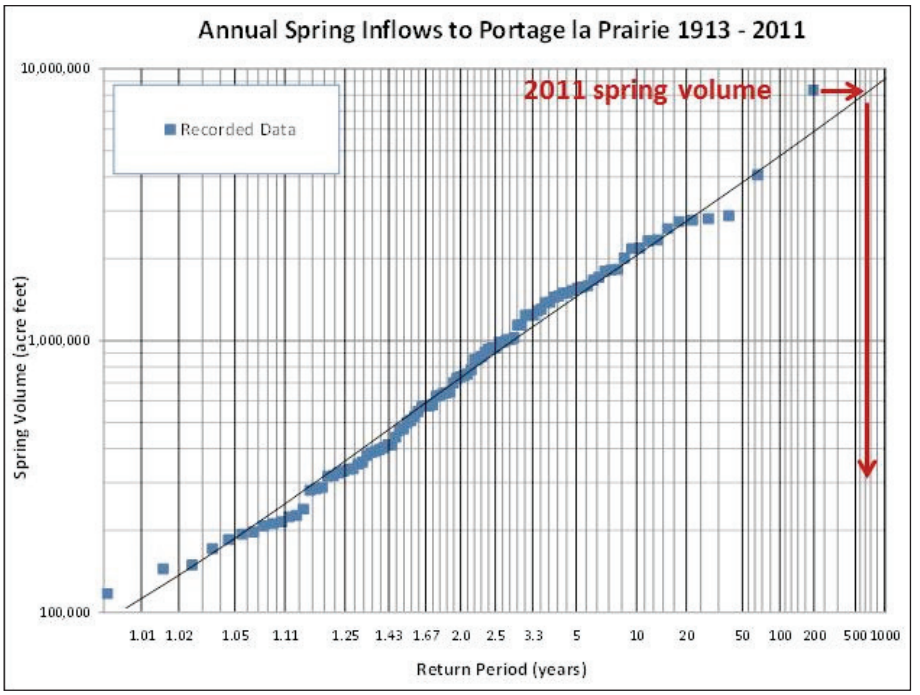


Figure 8.3: Frequency Curve

However, given that operation of the Portage Diversion has sent considerably more inflows to Lake Manitoba than had been expected by the designers, and recognizing that the operation of the Diversion has caused Lake Manitoba to exceed the maximum design level of 812.87 feet in 12 of the 43 years between 1970 and 2012, additional outlet capacity for Lake Manitoba should be given serious consideration.

8.2.3 Options for Additional Outlets

When the Fairford Control Structure was built in 1961, there was also discussion about an equivalent increase in outlet capacity for Lake St. Martin. This work was never done. As a result, operation of the Fairford Control Structure has been beneficial to Lake Manitoba, but has aggravated flooding and lake level fluctuations on Lake St. Martin.

During the 2011 flood, the Province requested that KGS Group and AECOM Engineering explore options for an additional outlet for Lake Manitoba as well as Lake St. Martin. Because of the ongoing emergency, one major requirement was that the outlet could be constructed quickly. Based

on these studies, the Province constructed an emergency outlet for Lake St. Martin in the fall of 2011. This channel has been effective in providing flood relief on Lake St. Martin and has benefitted Lake Manitoba in that it allowed Fairford to remain open over the winter of 2011/12. However, the channel was only constructed to deal with the emergency and was closed in the fall of 2012. The Committee recognizes the importance of the additional outlet capacity for Lake St. Martin. Furthermore, the Committee has come to understand that the flooding issues on Lake St. Martin must be addressed before an additional outlet from Lake Manitoba can be considered.

Figure 8.4 shows the alternative outlet options that were reviewed in the study.

Route D from Watchorn Bay on Lake Manitoba to Birch Creek is the route recommended by Lake Manitoba residents. During the 2011 flood, water was observed along most of this route and the expectation is that water would flow from Lake Manitoba to Lake St. Martin with a relatively small amount of excavation. However, this route is the longest route studied and passes through a number of sensitive marshes. Also, for sufficient flows to pass through the second channel, it would have to be considerably wider than the other shorter channel routes.

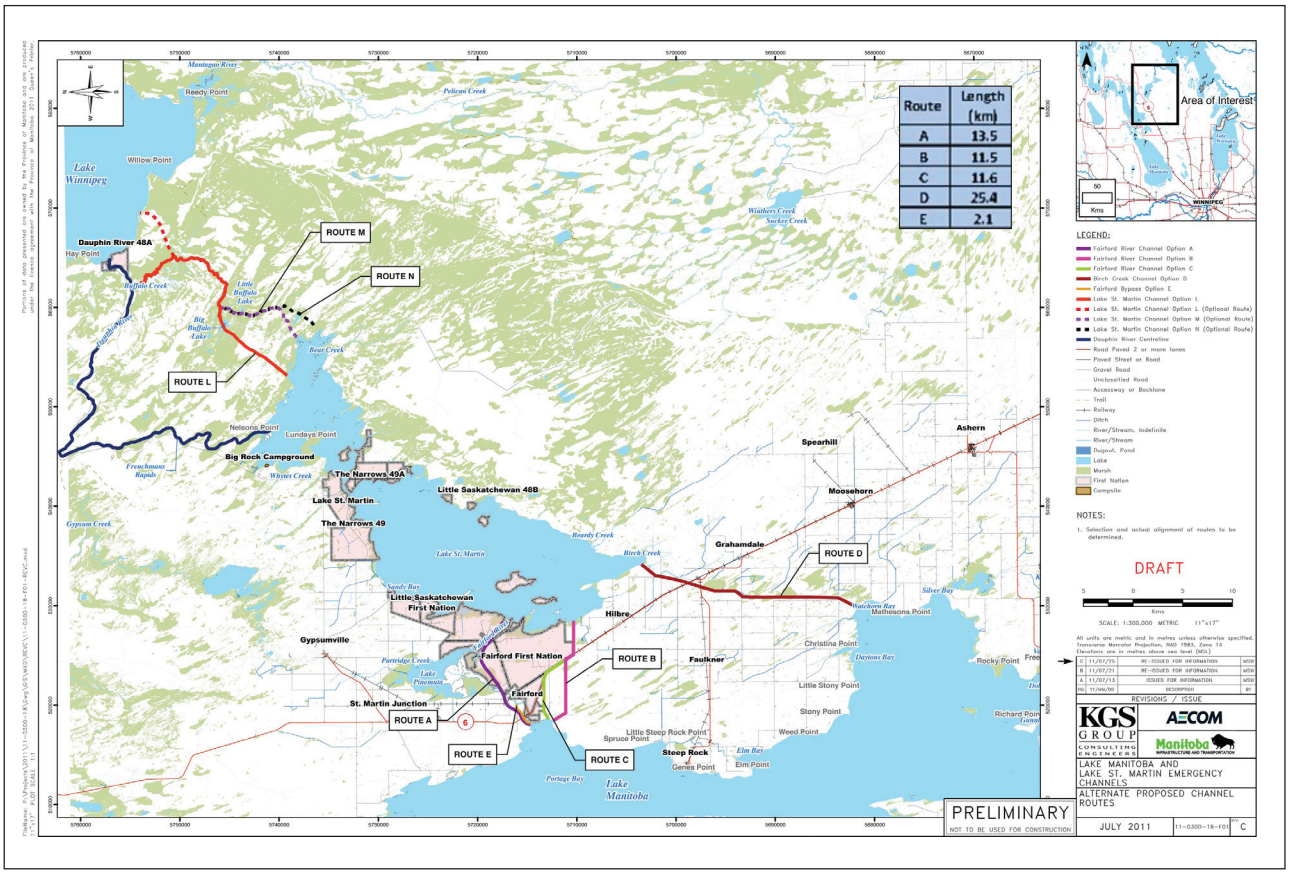


Figure 8.4: Outlet Options for Lake Manitoba

The shortest route is Route E around the north side of the Fairford Control Structure. It would likely be the least expensive to construct, but would only be effective for relatively small increases in outflow capacity. For larger increases, the bridge across the Fairford River just upstream from Lake St. Martin would become a significant restriction.

Route C just south of the Fairford River channel would avoid the bridge restriction and would still be half the length of Route D.

Based on some preliminary analysis by KGS Group and AECOM, a 10,000 cfs capacity channel at Route C would cost a little over $200 million. A 10,000 cfs channel would increase the total outflow capacity by 75 percent.

Any decision about an outlet for Lake Manitoba has to consider a number of factors including cost, efficacy, environment, and perhaps most importantly, the effect on Lake St. Martin. Lake Manitoba is about 14 times the size of Lake St. Martin. Reducing lake levels on Lake Manitoba by any appreciable amount has a significant downstream effect on this much smaller body of water. As noted earlier, the history of the 1961 Fairford Control Structure has been one of adverse effects on Lake St. Martin, on the people living along the lake, and their use and enjoyment of their lakeshore. Any new outlet for Lake Manitoba would have to demonstrate, at a minimum, that it would cause no additional adverse effects.

While the Committee received comments that a new outlet from Lake Manitoba should be equal in capacity to the Portage Diversion, the effect of such a structure on Lake St. Martin and the technical feasibility of increasing the size of the Emergency Channel to accommodate a flow of this magnitude would make a new outlet of this size most improbable. It would be technically difficult to achieve, the two additional channels would be prohibitively expensive, and the result would be two immense channels that would only be used to capacity on average once in 400 years.

Table 8.2: Issues related to a New Outlet from Lake Manitoba

Issue	Pro	Con
Public opinion	– Lake Manitoba interests are overwhelmingly in favour of an additional outlet. – An additional outlet is viewed as essential and a necessary remedy to deal with the effects of the Portage Diversion.	– First Nations land and property have been negatively impacted by operation of the Fairford Control Structure. People resident around Lake St. Martin have concerns about more water.
Good governance	– Portage Diversion operation since 1971 has had more impact on Lake Manitoba than the designers of the Fairford Control Structure had intended. – Operation of water control works should not aggravate flooding without full mitigation and/or compensation.	– Must address flooding issues on Lake St. Martin before considering an additional outlet from Lake Manitoba. – Any additional capacity between Lake Manitoba and Lake St. Martin must be matched by additional outlet capacity for Lake St. Martin. – First Nation communities on Lake St. Martin must be generally supportive of any proposed additional outlets.
Technical considerations	– The distance between Lake Manitoba and Lake St. Martin is about 10 kilometres just south of Pinaymootang First Nation. A relatively small capacity channel could be readily constructed.	– A large capacity channel would be very difficult to achieve. Because there is only about 3 m difference between the two lakes, a large capacity channel would have a low slope and be shallow and very wide, resulting in a huge structure.
Economic Considerations	– The threat of additional floods has eroded public confidence in the lands surrounding Lake Manitoba and Lake St. Martin, compromising future investment and development.	– Conventional benefit-cost analysis would likely conclude that any major/high capacity channel would have a low benefit-cost ratio.
Environment	– New water control works require substantive environmental assessments	

9 • Recommendations

The expertise and experience of committee members, hydraulic information, technical reports, presentations, and studies were brought together with input from public consultation to frame the recommendations for this report.

Recommendations are made in three general areas:

1. The need for additional water control works;
2. The most acceptable and practicable range of regulation within which the levels of Lake Manitoba and Lake St. Martin might be controlled; and
3. Land use policies and zoning criteria relative to areas around the water bodies that are vulnerable to flooding.

Additional observations by the Committee on topics important to the community around Lake Manitoba and Lake St. Martin, but not directly related to our Terms of Reference are presented in a section entitled Out of Scope Considerations.

The Committee is aware that these recommendations do not necessarily match the scope demanded by some members of the public. The Committee, however, considers the recommendations to be pragmatic, defensible and achievable. The recommendations encompass works and measures that can be accomplished in the near term. Where the Committee has recommended new capital works, those recommendations are scaled to meet tests normally applied to public expenditure.

In several cases, the Committee has made recommendations about a specific result to be achieved, but has left implementation details and/or design as a following step. This is particularly the case where engineering design and costing will be required to identify and select cost-effective options.

And lastly, the Committee sees these recommendations as a package. They are a suite of recommendations, a mix of measures that in their totality reasonably address concerns of people and communities around the lakes and the broader public interest.

9.1 Need for Additional Water Control Works

9.1.1 Lake St. Martin

Although most of the comments received by the Committee related to an outlet for Lake Manitoba, the Committee recognizes that control of Lake St. Martin levels must be attained before additional capacity is added to the outlet of Lake Manitoba.

In making recommendations, the Committee recognises that any new works affecting Lake St. Martin will require substantive discussion with the First Nations bordering Lake St. Martin and the Dauphin River. The recommendations here are not intended to be a substitute for those discussions, but solely a solution to achieve a water regime that deals with a history of adverse high lake levels on Lake St. Martin and that accommodates interests on Lake Manitoba.

Recommendations respecting Reach 3 (the third and last leg of the Emergency Channel) are the result of discussions with affected First Nations who are concerned that the current alignment will have an adverse effect on an important Lake Winnipeg fishery.

Therefore, the Committee recommends that the Emergency Channel be made permanent.

- **The capacity should be sufficient such that Lake St. Martin can be maintained within the desirable range of 797 to 800 feet at least 90 percent of the time;**
- **Consideration should be given to the inclusion of a control structure at the mouth of the permanent outlet channel to limit outflow at times of low lake levels; and**
- **The current Reach 3 should be redirected so that the channel outlets south of Willow Point on Lake Winnipeg.**

It is recognised that under unusually wet or dry conditions it would be impractical to hold Lake St. Martin within the desirable range.

9.1.2 Lake Manitoba

It is clear from presentations made to the Committee, comments from the public, and survey responses that there is an overwhelming interest and demand for an additional outlet to Lake Manitoba. Many have suggested that additional outlet capacity must be sufficient to avoid the flooding that would be experienced in a repeat of a 2011-sized flood. However, it would be difficult to justify the addition of a second outlet to Lake Manitoba based on such a rare event. This would require construction of an immense channel that would pass very little flow in all but the most extreme flood events. And to ensure that flooding would not be aggravated on Lake St. Martin, a similarly-sized channel would be required from Lake St. Martin to Lake Winnipeg. The cost of these two channels would almost certainly be more than could be justified on a benefit-cost basis given the low probability of a recurrence of the flood of 2011. While the scale of such works would be

unlikely to pass the test for public capital investment, given the large public interest in this concept, the Committee encourages the Province to undertake the necessary engineering studies and to develop cost estimates to provide the information necessary to satisfy public concerns.

While the Committee is not recommending a large-scale outlet, it is recommending, however, an additional outlet. The Portage Diversion has sent considerably more inflows to Lake Manitoba than had been expected by the designers and recognizing that the operation of the Diversion has caused Lake Manitoba to exceed the maximum design level of 812.87 feet in 12 of the 43 years between 1970 and 2012, additional outlet capacity for Lake Manitoba should be given serious consideration. A preliminary analysis suggests that an increase of about 35 percent in Fairford capacity would have maintained Lake Manitoba levels within the target range set by the designers of the Fairford Control Structure in all years except 2011.

Therefore, the Committee recommends that a second channel be constructed between Lake Manitoba and Lake St. Martin that would provide the total outlet capacity to meet the original design criteria for the Fairford Control Structure.

9.2 Range of Regulation

9.2.1 Range of Regulation – Lake Manitoba

Comments received from residents around Lake Manitoba were quite consistent in suggesting that Lake Manitoba has been kept too high over the past few years, but that "natural variability" is necessary for the health of the lake. Many also suggested that after the recent high water period levels need to be held in the lower part of the range, so that marshes and shoreline vegetation can be re-established and natural beach ridges can re-develop. The most common recommended top of range was 812.0 feet.

It should be noted that the long-term, average level of Lake Manitoba is 812.2 feet. A top of range of 812.0 feet would be lower than the long-term average. Some proponents suggest that an upper limit of 812.0 feet to allow for natural variability would provide more opportunity to respond when a wet period occurs. Others simply want to take any steps necessary to reduce the chances of the recurrence of a flood like the 2011 flood.

The current range of natural variation is two feet, from 810.5 to 812.5 feet. If the top of range is reduced to 812.0 feet, the range of natural variability would be reduced to 1.5 feet. This narrower range would have a negative impact on the health of the lake and the surrounding marshes. Also, to achieve the reduced range, the Fairford Control Structure would have to be operated more aggressively thereby increasing the fluctuations on Lake St. Martin.

The Committee is of the opinion that the current range of operation for Lake Manitoba is the preferable range for the long-term health of the lake. However, the Committee recognizes the need for a period of low levels to allow marshes and beach ridges to re-establish.

Therefore, the Committee recommends that the range be lowered from the current range of 810.5 to 812.5 feet by half a foot to 810.0 to 812.0 for a period of five years.

While the proposed high end of regulated lake levels is reduced for five years the recommendation would maintain natural lake level fluctuations while also keeping levels lower.

Many commented that after a flood event the levels should be permitted to recede to a level that will permit restoration of the lake. According to the current operating rules, once high levels recede to the top of range (812.5 feet), the Fairford Control Structure should be reset to the "normal log setting" and permitted to fluctuate normally until the lake levels are outside of the range of 810.5 to 812.5 feet. This action would reduce the outflows and slow the rate of lake level drop. A minor change to the operating rules is suggested whereby outflows would not be restored to normal until the lake level reaches the middle of the operating range. After a flood event, the control structure would remain fully open until the level reaches 811.5 feet under the current operating range, or 811.0 feet under the recommended lower range during the five-year period. This change would have the desired effect on Lake Manitoba, but would permit high inflows to Lake St. Martin to persist.

A comparison of Lake St. Martin levels before and after the Fairford Control Structure was constructed shows that the range of levels has increased on Lake St. Martin. It also shows that the lake experienced frequent rapid fluctuations in lake levels (see Figure 3.17). These are caused by the rapid changes in Fairford River flows associated with stop log changes at the Fairford Structure. Under natural conditions, Fairford flows slowly fluctuated with changing Lake Manitoba levels. With Fairford operation, the flows change rapidly when the stop logs are adjusted. These rapid flow changes result in increased fluctuations in Lake St. Martin levels.

Under the current operating rules, the Fairford structure would remain wide open when the lake is above the top of the desirable range, but would be cut back to a normal setting (60 percent capacity) once levels recede to the top of the normal range.

At 812.5 feet, the Fairford Control Structure can pass 7,300 cfs. If the outflow is cut to 60 percent capacity at that lake level, the Fairford River flow would be reduced by 3,000 cfs. This would result in a rapid drop in the Lake St. Martin level.

However, at a lake level of 811 feet (middle of the recommended range), the Fairford Control Structure can pass 1,620 cfs. A reduction to 60 percent capacity at that lake level would cut the Fairford flow from 1,620 cfs to 1,000 cfs. This smaller change in Fairford flows would result in a smaller drop in Lake St. Martin levels. Therefore, although the proposed modification in the operating rules would result in extended flows in the 7,000 cfs range, these flows are seldom associated with flooding on Lake St. Martin. Delaying the flow decrease until the level of Lake Manitoba receded to 811 feet would smooth out the fluctuation associated with log changes at the Fairford structure.

Therefore, the Committee recommends that the current operating rules for the Fairford Control Structure be modified such that:

- **During recovery from flood conditions on Lake Manitoba, the Fairford Control Structure is kept wide open until Lake Manitoba recedes to the middle of the range;**
- **For recovery from drought, the Fairford Control Structure is kept at 800 cfs until Lake Manitoba levels increase to middle of the range; and**
- **Under normal operating conditions, once outflow reaches normal, there are no further stop-log adjustments, as long as Lake Manitoba remains within the range.**

9.2.2 Range of Regulation – Lake St. Martin

For the Committee to meet its terms of reference, it must recommend "the most acceptable and practicable range of regulation within which the levels… of Lake St. Martin might be controlled."

As noted in Section 3.6.1, the existing recommended range of 797 ft. to 800 ft. asl has been achieved less than 40 percent of the time over the last 20 years. In these circumstances, asking First Nations to select a range or to confirm the existing range is not a useful exercise. We would effectively be asking them to agree to a range that has proved to be unachievable under prevailing conditions.

To deal with this set of circumstances, the Committee has taken the approach of considering what works and measures would be necessary to achieve the levels recommended in 2003. That is, to consider what works would have to be in place (and how they would have to be operated) to give all parties reasonable assurances that 797 to 800 ft. asl could be achieved. This analysis is made more complex by also trying to achieve results of sometimes competing interests to the people on Lake Manitoba.

Therefore, the Committee recommends that in designing the permanent outlet from Lake St Martin as recommended above, consideration must be given to both the desirable lake level

Recommendations as a suite

Recommendations in this report regarding regulation of Lakes Manitoba and St. Martin need to be seen as a complete package. There are recommendations for an additional outlet to Lake Manitoba, a recommendation to make the Emergency Channel permanent and a recommendation to lower Lake Manitoba. While the recommended new outlet is of moderate size, a permanent channel from Lake St. Martin reduces the operational constraints on both the Fairford Control Structure and the proposed additional outlet so that increased flows can pass through the Fairford Control Structure 12 months of the year and still achieve desired lake levels on Lake St. Martin. The proposed lower lake level means that flood mitigation measures potentially start from a lower level.

There is also a secondary recommendation (a Consideration in this report) to increase the capacity of the lower Assiniboine River. The potential for increased flows in the Assiniboine is significant as the high water levels on Lake Manitoba were not caused by a spike in the volume on the Portage Diversion but by the unprecedented long duration of the flows in the Diversion. The potential relief provided by the increased capacity on the Assiniboine provides one more option to mitigate flooding on Lake Manitoba and downstream on Lake St. Martin.

range for Lake St. Martin (797 to 800 ft. asl) and to the effects of an additional outlet from Lake Manitoba to Lake St. Martin.

In all of this, the Committee is of the opinion that no new works will be undertaken for either Lake Manitoba or Lake St. Martin without the effective approval of the First Nations below the Fairford River Water Control Structure. Finding a solution that works for the downstream First Nations, therefore, is a necessary first step to arriving at an overall solution.

9.3 Land Use Policies and Zoning Revisions

9.3.1 Designated Flood Areas

Just as those living in the Red River Valley have come to recognize over time that certain areas are more prone to flooding than others, so too residents around Lake Manitoba and Lake St. Martin have come to appreciate, particularly given what was experienced in 2011, that certain lands should be avoided when it comes to new development and/or guidelines should be enforced that would see new structures built above flood levels.

Most Manitobans, including those living around the lakes, recognize that the flooding that occurred in 2011 cannot be ignored, and actions are now required to better ensure that the kind of devastation experienced on the ground in 2011 is not repeated for future generations. In this regard, the Committee is recommending "Designated Flood Areas" to be established in the Lake Manitoba/Lake St. Martin area in a similar fashion to those in the Red River Valley. Designated Flood Areas are enacted via regulations under the Water Resources Administration Act.

In delineating these areas, it is important that the Province consult with representatives of local authorities. Our recommendations include a proposal for a pilot project that would involve Planning Districts and Municipalities. If this recommendation were adopted, the pilot would be a vehicle for having community discussions about Designated Flood Areas.

9.3.2 Policy: Development Guidelines/Standards

While provincial flood protection policy requires flood protection to the higher of the 1-in-100 year flood level or the flood of record, flood damages continue to occur in Manitoba. The standard response of water managers has been to re-compute the 1-in-100 year flood level based on the latest flood or to raise the flood protection level to the flood of record, as was done for Lake Manitoba after the 2011 flood. These new levels determine the province's flood protection requirements that municipalities are to include in their planning documents. This has resulted in some confusion.

The interim flood protection level (FPL) for Lake Manitoba was computed based on the May 31, 2011, wind event (815.3 feet wind eliminated water level) plus wind setup (2 to 5 feet) plus wave uprush (1 to 2 feet), resulting in flood protection levels that could potentially be as high as 822.3

feet. Such lake levels on Lake Manitoba have rare probabilities of recurring and communities around Lake Manitoba would have the highest standard of flood protection in the province based on this single event. On the other hand, if structures are built based on this FPL, there would be very little structural flood damage in future.

It is the Committee's opinion that the 1-in-100 year flood standard is too low. With a 100 year flood, there is a one percent chance that it will reoccur in any one year, but if a person lives there for 10 years, the chance that the one percent flood will be exceeded sometime in that 10-year period is 9.6 percent. And the chance the property will be flooded sometime in the next 50 year period is 40 percent. This is too risky and likely the reason that damages continue to occur in flood prone regions of Manitoba.

The policy of basing the FPL on the flood of record when it exceeds the 1:100 year flood level is designed to address this issue, and it usually works fairly well. However when the flood of record is so extreme that it has a minimal chance of recurrence the Committee is of the opinion that it results in an unbalanced policy. In most regions of the province the FPL is based on a 1 in 100 year frequency, but at Twin Lakes Beach the interim FPL might have a chance of recurrence as high as 1 in 1,000 years.

The Committee recognizes the benefits of restricting development close to the shoreline, not only because of flooding due to high levels but also because erodible shorelines by their very nature move over time. However a more balanced approach would be to set the FPL based on a somewhat more cautious return period, and address the future shoreline erosion issue by means of development set-backs.

It is recommended that a uniform FPL be developed and applied throughout the province. Such a standard should strike a balance between the public safety interests, the impact on individuals (including their personal security and peace of mind), and economic development.

Whatever guidelines or standards the Province adopts for new construction in flood prone areas, they should be transparent, clearly communicated, equitable, consistent in their application, enforceable, and developed such that outcomes flowing from them generally are predictable. The existing provincial flood protection policy does not provide adequate protection across Manitoba.

Therefore, the Committee recommends that the Province:

- **Increase the standard for the Flood Protection Level to one based on a 1-in-200 year flood event.**
- **Assist local developers and institutions in the application of a risk-based approach for developing a higher standard of flood protection, which would be implemented locally on an economic basis or where facilities are of a critical nature, involving emergency response, important infrastructure or large public investment. The minimum standard would be enacted via regulation and the augmented risk**

assessment would be at the discretion of the authority investing in the new capital works.

One remaining issue is the problem of determining the 1:200 year level on Lake Manitoba. Frequency analysis is based on the assumption that each point in the analysis is completely independent from the other points. For Lake Manitoba this assumption is not correct. As can be seen in figure 3.5 Lake Manitoba levels have fluctuated over multi-year cycles. The result of this clustering is that standard frequency analysis will over-estimate the return period for a given lake level. However adjusting for this clustering effect is a complex process. Therefore it is recommended that a factor of safety be added to the computed 1:200 year level when computing the Flood Protection Levels on Lake Manitoba.

9.3.3 Planning Tools

Information that is available on the location and extent of flood prone areas is not being effectively used by local communities for planning and development purposes. On the other hand, digital elevation maps suitable for planning are not widely available and not contiguous.

The Province should explore and implement clear policy measures to ensure future development does not knowingly occur within flood prone areas and provide communities with the appropriate maps.

Therefore, the Committee recommends that the Province develop maps delineating flood prone areas for various probabilities of flood, which could be used by the public and by local administrations for zoning purposes and for developing flood mitigation projects. These should be made available through the internet.

9.3.4 Pilot Project

The natural boundaries of watersheds are more relevant than political or jurisdictional boundaries when dealing with land use planning and floods. At present, there is a disconnect between how water impacts the land and human settlements and how planning and the enforcement of policies and regulations are undertaken.

In undertaking the land use study interviews were held with rural municipalities and First Nations. It is noteworthy that all rural municipalities and First Nations consulted around Lake Manitoba said “yes” to the following question:

> *Assuming that adequate resources would be made available to do it properly, would your community be open to participating in a Pilot Project/planning process involving neighbouring municipalities and others to establish a “Special Planning Area” or authority to develop and enforce an Integrated Watershed Management Plan?*

Recognizing the challenges inherent in establishing new institutions, the Committee concluded that consideration be given to expanding the mandate of an existing institution(s) to undertake the pilot.

Therefore, the Committee recommends that the Government of Canada and the Government of Manitoba establish a five-year pilot project that would include planning districts, municipalities, conservation districts, and First Nations. The pilot would be based on a watershed and would include all municipalities, planning districts and First Nations that are wholly or partially located within the watershed. Through this pilot, the conservation district would be mandated to lead the preparation of a Plan that would define Designated Flood Areas within the watershed, develop appropriate land use policies and regulations relating to flood control/mitigation including land drainage, and incorporate the principles associated with "No Adverse Impact". The Plan should be subject to a consultation process consistent with the requirements under The Planning Act and ultimately approved and adopted by the Province. The Province should then require that planning districts and municipalities incorporate the geographically relevant flood specific planning elements into their development plans and encourage the First Nations communities to do likewise. The Province, through Water Stewardship, could be responsible for implementing and enforcing the drainage provisions.

Among other things, this Pilot Project would need to:

- **Hire qualified staff to prepare the plan for the area, and assist planning districts, municipalities and First Nations to incorporate the flood related land use policies into their development plans;**
- **Acquire contour maps (e.g. LIDAR and other data needed for planning);**
- **Engage with the local community and the Province to define Designated Flood Areas around the lakes and rivers; and**
- **Develop incentives to encourage landowners to take positive action to protect shorelines and re-introduce wetlands.**

9.3.5 Municipal Planning

Although most property owners and developers comply with the planning policies and regulations that restrict development in flood prone areas, there needs to be a means for dealing with violators. Since municipalities do not wish to be put in a position of imposing fines on residents within their municipality, it is recommended that provisions be put in place rspecting future development only that would allow caveats to be registered noting that structure do not conform to Flood Protection Levels and may be ineligible for Disaster Financial Assistance. The registration of such a caveat would forewarn subsequent owners of the non-compliance.

9.3.6 Planning with First Nations

With respect to First Nations, the Committee notes that:

- First Nations need the resources to undertake planning for their communities; and
- There is a need to facilitate the development of a collaborative approach to planning between First Nations and municipalities.

First Nation residents complain that when neighboring R.M.s improve their drains, they can aggravate flooding on the reserves. A mechanism is needed to ensure drainage systems are designed on a watershed basis, without consideration of administrative boundaries. If an upstream R.M. is planning to improve a drain, regulations should be in place to ensure that the downstream R.M. or First Nation has adequate capacity to receive the additional flows.

Therefore, the Committee recommends that the Province engage the Government of Canada and First Nations in a process that will lead to improved planning and coordination of plans between municipalities and First Nations.

9.3.7 Interprovincial and Cross-Border Co-operation

Lake Manitoba/Lake St. Martin flooding in 2011 included substantial inflows derived from the west and south of provincial borders. Finding an accommodation with our neighbours is an important part of the solution in dealing with flooding in the Lake Manitoba/Lake St. Martin basin. Recommendations in this area will be considered by the 2011 Flood Task Force, as they have a province-wide mandate to deal with the scope of this issue.

9.4 Out of Scope Considerations

Out of scope considerations include issues of concern to the Committee that do not fall within our Terms of Reference. They are cast as 'considerations' simply to distinguish them from the core responsibilities of the Committee.

9.4.1 On-Reserve Drainage

The Committee heard that water damage to property on First Nations is often associated with poor on-reserve drainage. Given the long and unfortunate history of water damage to homes on First Nations there is a clear failure of parties to take appropriate action. First Nations require the resources to plan, design and manage on-reserve drainage.

9.4.2 Improved Capacity of the Assiniboine River below Portage la Prairie

The integrity of the dykes along the Assiniboine River east of Portage la Prairie has deteriorated over time. In the previous large flood on the lower Assiniboine River, which occurred in 1976, the

peak flow at the gauge near Portage la Prairie was 23,600 cfs. In fact, since flow recording began at this station in 1923, the peak has exceeded 20,000 cfs in seven years. The peak flow recorded in 2011 was just 19,400 cfs and there was considerable concern that the dykes could not contain that flow. The result was that more water had to be diverted to Lake Manitoba in 2011 than would have been required if the dykes had been maintained.

As one component of flood management for the Assiniboine River, the dykes should be raised and strengthened so that they can convey at least 22,000 cfs. This work should be done on both sides of the River from Portage la Prairie to Headingley.

9.4.3 Unrestricted Fish Passage Between Lake Manitoba and Lake St. Martin

Lake Manitoba and Lake St. Martin fishers have long noted that the Fairford Control Structure has impeded the natural migration of fish into Lake Manitoba and resulted in a significant reduction in fish stocks. The fish ladder in the control structure is seen to be ineffective. If the Province builds a new outlet to Lake Manitoba as recommended, it should take that opportunity to design the new outlet in such a way as to provide unrestricted fish passage between Lake Manitoba and Lake St. Martin.

9.4.4 Planning for the Aftermath

The aftermath of any disaster is more complex and longer lasting than the event itself. Floods happen over days or weeks. The aftermath lasts months and years. While the province has put emphasis on flood/disaster preparation, more consideration must be given to planning for the aftermath. A period where people and communities need the most help has been seen by those affected by the flood as wanting. It has been the subject of the most troubling discussions the Committee has had at open houses and other public venues. The Committee is of the opinion that consideration be given to study of long-term effects of natural disasters and our common response to them.

9.4.5 Stakeholder Input into Operation of the Portage Diversion and the Fairford Control Structure

Many complaints were heard around Lake Manitoba that operating decisions for both the Portage Diversion and the Fairford Control Structure were made

Portage Diversion

without adequate consideration of the impact on Lake Manitoba stakeholders. For example, many complaints were heard about Portage Diversion operation for "cosmetic reasons". They suggest the Diversion has been operated beyond the period required for flood control for reasons like keeping the walkways at the Forks clear of water or enabling the market gardeners along the Assiniboine River east of Portage la Prairie to get their crops in a few days earlier. With respect to the Fairford Control Structure, it is widely believed that the Province restricted outflows over the period from 2006 to 2010, thereby holding Lake Manitoba too high.

Whether these allegations are true or not, the Province would benefit from having a systematic process for local review of operating decisions, similar to the Shellmouth Operation Review Committee. It would provide a forum for receiving local input to operating decisions and help stakeholders understand why the structures are operated as they are.

Further, recommendation made by the Committee suggests a number of areas where research and/or other work is indicated. This work could be undertaken under the auspices of the proposed Operation Review Committee and includes:

- Research on native hay and forage production. The flood of 2011 had a significant impact on native hay and forage production. These effects may last over an extended period of time. There is value in understanding the recovery process and immediate steps should be taken to conduct a longitudinal study of native hay along the shores of both Lake Manitoba and Lake St. Martin.
- The effect of the proposed reduction in the level of Lake Manitoba needs to be monitored and evaluated. A program to undertake this monitoring and evaluation needs to be developed and in place soon after the recommendation is adopted.
- Additionally, it is suggested that a biennial forum be held to facilitate discussion of issues related to the management of Lake Manitoba and Lake St. Martin, and as an opportunity to present research and other findings.

Fairford Control Structure

Appendix A: Terms of Reference

TERMS OF REFERENCE
2012 LAKE MANITOBA/LAKE ST. MARTIN REGULATION REVIEW

The flooding on Lake Manitoba and Lake St. Martin was unprecedented in 2011. The peak level on Lake Manitoba of 249.1 m (817.2 ft) at the end of July was more than 1.2 m (4 ft) higher than the desirable top of range on Lake Manitoba and in late fall water levels were still approximately 0.6 m (2 ft) above the top of the desirable range. The unprecedented high levels were a result of numerous factors combined to cause the worst flooding ever recorded on Lake Manitoba.

The ability to lower Lake Manitoba through the winter is restricted by the high potential of the risk of frazil ice jamming and associated flooding at freeze-up downstream of Lake St. Martin along the Dauphin River. Due to the current high water levels on Lake Manitoba and the need to lower Lake Manitoba and Lake St. Martin over the winter, an emergency outlet was constructed from Lake St. Martin. The ongoing operation of the emergency outlet in future high water years will require an Environment Act license including operating rules and/or a range of regulation for Lake Manitoba.

Following the unprecedented water levels experienced in 2011, the Manitoba Government has committed to undertake a review of the operation of provincial water control structures and the water levels on Lake Manitoba, Lake St. Martin and other associated waterways. The Lake Manitoba/Lake St. Martin Regulation Review will be undertaken by an appointed Committee, to be chaired by an expert who is familiar with the review of flood events. The Lake Manitoba/Lake St. Martin Regulation Review Committee will be provided with resources sufficient to undertake the review, which is expected to include: significant engagement and dialogue with the public and with stakeholders; hiring of independent experts to provide technical advice or research on discrete issues of interest; collection of data and site visits, as required; and production of a final report, including recommendations to government.

The Lake Manitoba/Lake St. Martin Regulation Review will consider and provide recommendations on the following matters:

- The current range of regulation of Lake Manitoba and Lake St. Martin and the rules of operation for the Fairford Water Control Structure;
- The need for additional water control works in the future;
- The impact of water level regulation on the lake and surrounding land, including people and communities, agriculture, wetlands, fisheries, wildlife, water quality, and recreation etc;
- The most acceptable and practicable range of regulation within which the levels of Lake Manitoba and Lake St. Martin might be controlled; and
- Land use policies and zoning criteria relative to areas around the water bodies that are vulnerable to flooding.

The Lake Manitoba/Lake St. Martin Regulation Review will require significant engagement with the public and key stakeholders in a transparent and meaningful manner. The Lake Manitoba/Lake St. Martin Regulation Review Committee may choose the format and extent of public engagement and it is expected that feedback, along with the Committee's findings, conclusions and recommendations are to be made available to the public; a 'What We Heard" type of document is encouraged. While engagement with the public is critical in this process, it must also be made clear that the scope is limited to a public review; the process is not to be construed or communicated as a hearing.

The Committee's work will rely on expertise and information resident within government departments. Provincial government officials will cooperate with the Committee to provide information to ensure that work is completed on a timely basis. In some cases, this may extend to departments completing discrete pieces of research and/or planning, providing mapping support, or providing administrative support. Requirements for expertise may also include requirements for legal opinions. All requests from the Committee for support from provincial officials must be approved at senior levels. The Committee is encouraged to utilize their budget to engage independent service providers when required.

The Lake Manitoba/Lake St. Martin Regulation Review will be conducted concurrently with the 2011 Flood Review. It is expected that where there are items of mutual interest to both reviews, that the Flood Review Task Force and Regulation Review Committee will coordinate their investigation, activities and so much as possible, their recommendations.

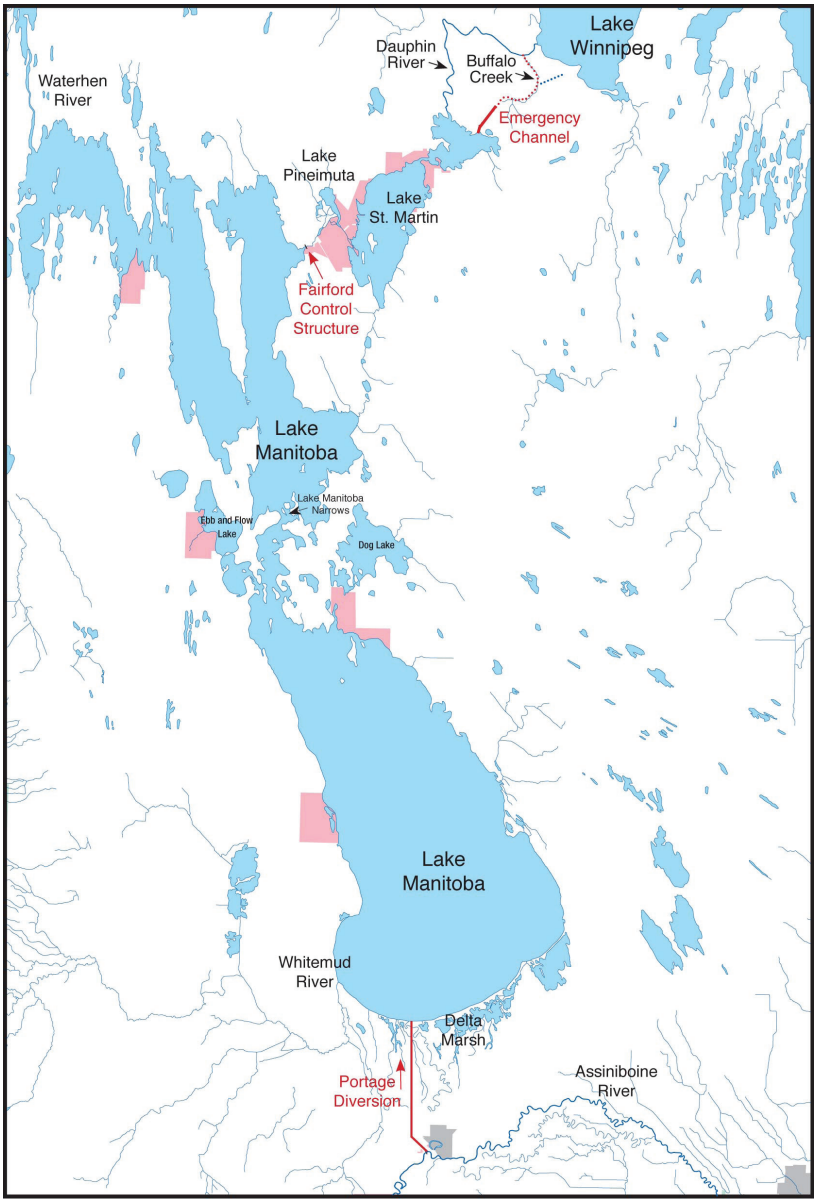
Appendix B: Lake Manitoba and Lake St. Martin

Lake Manitoba is Canada's thirteenth largest lake (4,700 km2) and the world's 33rd largest freshwater lake.[18]

Lake Manitoba is about 200 km long, up to 40 km wide and effectively divided into two basins by The Narrows, an 800 m channel in the centre of the lake. This natural channel at The Narrows is substantially constrained by bridge works that include embankments extending from each side of the lake.

The south basin with a maximum depth of 7 m is somewhat shallower than the north basin. The lake drains via the Fairford River east into Lake St. Martin and from there via the Dauphin River into Lake Winnipeg at Sturgeon Bay.

The lake was known to French explorers as Lac des Prairies.



Lake Manitoba is primarily fed by Lake Winnipegosis via the Waterhen River. With the commissioning of the Portage Diversion in 1970 there have been flows diverted from the Assiniboine River but not every year and with significant variation.

On average, most of the water inflow is from the Waterhen River (42 % of the inflow) and from precipitation directly on the lake's surface (40 %), while nearly 50 % of the outflow is by evaporation. The high rate of evaporation relative to total outflow partially explains why it is difficult to maintain lake levels in periods of drought.

[18] By way of comparison, Lake Winnipeg is about 24,500 km2 and some 415 km long.

Lake St. Martin is also comprised of two basins, a larger western basin connected by a narrow channel to a smaller basin to the northeast. The total surface area is 345 km2. The overall length the two basins is about 38 km with the widest distance at about 10 kilometres. Lake St. Martin is shallow; the main basin has a maximum depth of 4.1 m and the smaller basin 1.5 m.

Pineimuta Lake is a shallow, 39 km2 wetland complex situated between Lake Manitoba and Lake St. Martin.

Dog Lake on the east side of the lake and **Ebb and Flow Lake** on the west side are both connected to Lake Manitoba by short channels and generally fluctuate with changing Lake Manitoba levels. Although they normally flow into Lake Manitoba, when lake levels are high the channels reverse and backflows from Lake Manitoba cause the smaller lakes to rise.

Appendix C: Previous Reviews, Recommendations and Outcomes

C1. The Lake Manitoba Regulation Review Advisory Committee (2003)

The Lake Manitoba Regulation Review Advisory Committee was appointed in 2001, following complaints to the Minister of Conservation with respect to relatively high water levels on Lake Manitoba.

The Terms of Reference developed to guide the Lake Manitoba Regulation Review Advisory Committee were as follows:

1. Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled;
2. Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year, and if so recommend specific levels or range of levels;
3. Determine the best course of action for water levels along the Fairford River, Pineimuta Lake, Lake St. Martin and the Dauphin River, including the best course of action with respect to the operation of the Fairford Dam; and
4. Examine existing data with respect to the present water quality of Lake Manitoba and compare to historical water quality.

During the course of is two year tenure, the Committee held more than 20 regular meetings at which it reviewed and discussed the concerns and issues placed before it, heard presentations from a variety of agencies and organizations, and evaluated the findings of studies and reports prepared on its behalf. The Committee also conducted a number of inspection tours. The Committee also held public meetings and received more than 25 presentations in these public forums. The work of the Committee was presented to the government in its report, *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues, July 2003.*

One of the committee and one of the technical advisors from the 2003 report sit on the Lake Manitoba/Lake St. Martin Regulation Review Committee. There are issues in common to the work of both committees and common technical resources. The work of the 2003 Committee has been carefully considered in development of our findings and recommendations.

C2. Lake Manitoba Stewardship Board

The Lake Manitoba Stewardship Board was formed by the Minister of Water Stewardship, on February 27, 2007, with a mission to: "Maintain and enhance the long term health of the Lake Manitoba watershed along with Lake St. Martin, Lake Pineimuta, Fairford River, and Dauphin River to Lake Winnipeg."

TERMS OF REFERENCE

1. To establish and maintain an ongoing dialogue with local interests, municipalities and the Province regarding the management of Lake Manitoba, Lake Pineimuta, Lake St. Martin, and the Fairford and Dauphin rivers, to solicit, as required, public input related to these concerns, and to communicate with the public on a regular basis.
2. To communicate with the Minister on an ongoing basis with regard to water levels on Lake Manitoba, Lake Pineimuta, and Lake St. Martin, including the operation and maintenance of the Fairford River Water Control Structure and the associated fish ladder, and to recommend appropriate seasonal flows to be maintained in the Fairford and Dauphin rivers insofar as this is reasonably possible.
3. To advocate long-term monitoring and research on water levels and the health of Lake Manitoba, Lake Pineimuta, and Lake St. Martin, including coastal marshlands along these water bodies, to be carried out by the appropriate agencies and report on the results to the Minister. This should include all aspects of water quality, fisheries, wildlife, agriculture, recreation, shoreline erosion, marshland rejuvenation, impacts on First Nations and other communities, and such other matters as deemed advisable by the Committee or by the Minister.
4. To investigate, and if considered advisable, recommend remedial projects to enhance all aspects of the general health of the lakes, associated marshlands and associated resources and resource uses, as outlined above. In this regard, the Committee shall actively encourage jointly funded private sector/government projects.
5. To provide advice to Manitoba Water Stewardship on the operation of the Portage Diversion to ensure that Lake Manitoba interests are taken into consideration.
6. Review fishery management plans according to the following criteria in order of importance: a) biological sustainability, b) economic viability, and c) social fairness and community benefits. In doing so a more reasoned and fair approach can be developed (i.e. with supporting data / information and fair public values incorporated).

The Board held four types of meetings: regular meetings, subcommittee meetings, special meetings, and public consultations; received presentations, undertook consultations and produced a series of reports.

In the year ending December 2009, the Board produced reports on its Science Workshop, Public Consultation, Residents Report and a Census Report. The work of the Lake Manitoba Stewardship Board formally came to a conclusion in mid-2012. The chair of the Stewardship Board, Dr. Gordon Goldsborough, sits as a member of the Lake Manitoba/Lake St. Martin Regulation Review.

Appendix D: Concurrent Studies and Reviews

D1. The 2011 Manitoba Flood Review Task Force

The 2011 Manitoba Flood Review Task Force (The Task Force) was commissioned at the same time as the Lake Manitoba/ Lake St. Martin Regulation Review. The Task Force has a province wide mandate and is to review and consider:

- The operation of provincial flood control infrastructure and ancillary works;
- Suggested procedures for undertaking flood mitigation measures;
- The accuracy and timeliness of the Province's flood forecasting efforts;
- The level of flood preparedness;
- The adequacy of existing flood protection infrastructure, and the need for additional works;
- The environmental, social, water quality and human health impacts related to flooding of environmentally sensitive developments;
- Land use policies and zoning criteria relative to areas of the basin that are vulnerable to flooding;
- Adequacy of communications to the public; and
- Impacts on the road networks and bridges to businesses and public access.

The two reviews have one task in common, which is to consider and make recommendations respecting land use policies and zoning criteria. While this task is being led by the Regulation Review Committee, there were general principles developed that have province-wide application.

The work of the Task Force has a slightly longer schedule than that of the Committee and its report, therefore, will be forthcoming slightly later than this report. Its findings and recommendations, however, will have direct application to flood issues relative to Lake Manitoba and Lake St. Martin.

D2. Surface Water Management Strategy

Manitoba Conservation and Water Stewardship is developing a province-wide surface water management strategy to be complete by mid-2013. The strategy will address the management of water in a holistic and integrated way that will consider the diversity of human needs and the importance of water to sustain our natural environment.

Extensive consultations with stakeholders will be essential in finding a balanced approach to surface water management in Manitoba.

The strategy will guide future planning and issue management for water. It will also reduce the tendency for escalation of water issues by providing local authorities and provincial officials with a consistent rationale for decision making on water management for all scales of watersheds. The strategy will be grounded in principles of shared governance, with clearly articulated roles for all who have authority and responsibility for water and individual Manitobans.

D3. The Assiniboine Basin and Lake Manitoba Flood Mitigation Study

Manitoba Infrastructure and Transportation has commissioned a conceptual level study for the Assiniboine River and Lake Manitoba watersheds and to make recommendations on how future flood events can be mitigated on the main stems of the Assiniboine River and Souris River, and around Lake Manitoba, Lake St. Martin, Dauphin Lake and Shoal Lakes.

The study will include examination of a wide range of possible measures including non-structural measures, such as land use changes as well as structural measures, such as large dams.

The results of this study will be the foundation for flood mitigation programs for the next few decades. Reviews being conducted by the 2011 Flood Review Task Force and the Lake Manitoba/ Lake St. Martin Regulation Review Committee will be used as inputs to this study.

D4. Lake St. Martin Flood Mitigation Alternatives Study

The Flood Mitigation Study for First Nations along Fairford River, Lake St. Martin, and Lake Pineimuta is being conducted by the engineering firm AECOM concurrently with this work. It is an economic analysis which would assess the feasibility of flood mitigation alternatives for each of the four First Nations impacted by operation of Fairford River Control Structure. This study is to evaluate the cost-effectiveness of upgrading and/or rebuilding the existing on-reserve flood protection measures and evaluate alternative improvements to the capacity of the Dauphin River and flood mitigation alternatives for Lake Pineimuta. The purpose of this analysis is to:

- Determine effectiveness of Lake St. Martin Emergency Outlet Channel at reducing flood levels;
- Determine dike elevations and other measures required to protect the First Nations from flooding;
- Estimate the costs for flood protection

D5. Land Use Planning Report

See Volume II: Appendices.

Appendix E: Public Engagement

E1. Meetings and Presentations

Meetings and Site Visits

Date	Description and/or Presenters	Location
Feb. 23	• Presentation by Director of Manitoba Infrastructure and Transportation	Canad Inns Polo Park, Winnipeg
Apr. 4	• Tour of affected properties	Twin Beaches
Apr. 4	• Land Use Planning Presentation by Manitoba Department of Local Government • Chief of Pinaymootang First Nation • Dauphin River Commercial Fisheries Federation	St. Laurent Legion, St. Laurent
Apr. 27	• Tour of affected properties in Langruth area, including Sandy Bay First Nation	Langruth area
Apr. 27	• Fisheries Presentation by Manitoba Conservation and Water Stewardship • Reeve of R.M. of Lakeview • Little Saskatchewan First Nation	Langruth Community Hall, Langruth
May 17	• Tour of affected properties and meetings with representatives of Dauphin River First Nation, Chief and Councillors for • Little Saskatchewan First Nation, Councillor for Pinaymootang First Nation • Presentation by Rick Bowering at Dauphin River First Nation	Dauphin River First Nation, Little Saskatchewan First Nation, and Pinaymootang First Nation
May 18	• Tour of affected properties and meeting with Chief and Councillors for Lake Manitoba First Nation	The Narrows area and Lake Manitoba First Nation
June 7	• Tour of affected properties	Eddystone area
June 7	• Agriculture Presentations by Manitoba Agriculture, Food and Rural Initiatives, Manitoba Beef Producers, Westlake Grazing Club, Arnthor Jonasson and Raymond Larson	Westlake Community Centre, Eddystone
June 12	• Land Use Policies and Zoning Criteria Study: meeting with First Nations	Canad Inns McPhillips, Winnipeg
June 19	• Land Use Policies and Zoning Criteria Study: meeting with Rural Municipalities	Legion, St. Laurent
June 22	• Presentations by Director of Manitoba Infrastructure and Transportation, Rick Bowering, Gordon Goldsborough and McKay Finnigan and Associates	Langruth Community Hall, Langruth

Date	Description and/or Presenters	Location
July 21	• Presentations by Association of Lake Manitoba Stakeholders, Lake Manitoba Flood Rehabilitation Committee, Aboriginal Affairs and Northern Development Canada and Ducks Unlimited	Canad Inns Polo Park, Winnipeg
July 30	• Land Use Policies and Zoning Criteria Study Presentations by Christopher Duerksen, Michael McCandless, and Ashlyn Haglund	Canad Inns McPhillips, Winnipeg
Aug. 30	• Climate Change and Land Use Planning Presentation by Stantec Engineering, Rick Bowering, and McKay Finnigan and Associates	Canad Inns Polo Park, Winnipeg
Sept. 26	• Presentations by Don Kuryk and Manitoba Agriculture, Food and Rural Initiatives	Canad Inns Polo Park, Winnipeg
Oct. 10	• Presentation by McKay Finnigan and Associates	Canad Inns Polo Park, Winnipeg

Open Houses

Date	Location	Attendance (number of people signed in)
Sept. 11	Recreation Centre, St. Laurent	72
Sept. 12	Pinaymootang Arena, Fairford	56
Sept. 13	Centennial Hall, Ashern	38
Sept. 18	PCU Centre, Portage La Prairie	85
Sept. 19	Community Hall, Langruth	38
Sept. 20	Community Hall, Toutes Aides	15
Sept. 26	Canad Inns Polo Park, Winnipeg	72

E2. What We Heard Report

See Volume II: Appendices.

E3. Municipal Survey Report

See Volume II: Appendices.

E4. Online Feedback Form Report

See Volume II: Appendices.

Appendix F: 1994 Red River Floodway Program of Operations

Portage Diversion Operation Rules

RED RIVER FLOODWAY

PROGRAM OF OPERATION

October, 1984
Winnipeg, Manitoba

Prepared by:
Flood Damage Reduction Section
Water Management Service

PORTAGE DIVERSION OPERATION RULES

The Portage Diversion has a capacity of 25,000 cfs (708 m^3/s) at full supply level of 769.0 feet (234.39 m) However, there is a failsafe section which will breach at 15,000 cfs (425 m^3/s).

Operation Objectives

The Portage Diversion will be operated to meet these objectives:

1. To provide maximum benefits to the City of Winnipeg and areas along the Assiniboine River downstream of Portage la Prairie
2. To minimize ice jams forming along the Assiniboine River.
3. Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible.
4. Prevent overtopping of the failsafe section in the Portage Diversion, if possible.

Emergency Operation

The Assiniboine River dykes between Portage la Prairie and Headingley have a capacity of about 20,000 cfs (566 m^3/s). Therefore, an emergency situation exists when the inflow into the reservoir is 45,000 cfs (1274 m^3/s). When the inflow exceeds 45,000 cfs (1274 m^3/s), it is the policy to maintain 25,000 cfs (708 m^3/s) in the Portage Diversion with the remainder allowed into the Assiniboine River downstream. When the Assiniboine River dykes are overtopped, adjustments must be made

to the computed natural flow in Winnipeg. This is discussed under the section Assiniboine River Dykes Overtopped.

Operation Rules

1. Except as provided for under Rule 8, the Portage Diversion shall be utilized to its maximum capability to keep water levels in Winnipeg below 17.0 feet (5.2 m), City Datum.
2. The flow in the Diversion shall not be allowed to exceed 25,000 cfs (708 m^3/s).
3. If flow forecasts indicate that the peak inflow into the reservoir to be 20,000 cfs (566 m^3/s) or more, the Diversion will be put into use as soon as possible to flush out snow blockages and insitu ice.
4. During the period that there is ice on the reservoir, the water level of the reservoir will not be allowed to exceed 865.0 feet (263.65 m) to provide room for releases from breaching of upstream ice jams.
5. The conduits of the Spillway Structure shall be closed while there is water going over the bascule gates.
6. While there is ice on the Assiniboine River downstream of Portage la Prairie it is desirable to limit flows to approximately 5,000 cfs (142 m^3/s) in the River if possible. Flows of this magnitude appear to be optimum flows required to assist in flushing the ice down river without causing major ice jams or flooding to adjacent farm lands through local drainage inlets. This procedure provides additional

capacity, if required, on the River downstream of Portage la Prairie when the second peak arrives. The level of Lake Manitoba should not be taken into account while there is ice on the Assiniboine River, as the period during which there is ice on the River during the spring runoff is only a few days, and diverted flows for this short a period of time have a negligible effect on the level of Lake Manitoba.

7. After the ice has gone from the Assiniboine River downstream of Portage la Prairie, it is desirable to maintain flows less than 10,000 cfs (283 m^3/s) in the River if possible. Flows greater than 10,000 cfs (283 m^3/s) are above the natural bank stage of the River, and backup of local streams which outlet into the Assiniboine may occur at this level. There also may be seepage problems through the dyke, leakage under the dyke through gated culverts and flooding of cultivated land between the dykes.

8. For flows of up to 30,000 cfs (850 m^3/s) under open water conditions, the failsafe section of the west dyke of the Portage Diversion should not be breached if the peak stage in Winnipeg will not exceed 18.0 feet (5.5 m).