Presentation to the Lake Manitoba/Lake St. Martin Regulatory Review Commission

Association of Lake Manitoba Stakeholders

Agenda

- Introductions
- Looking Back : Understanding Lake Manitoba and its History
- Understanding the Flood of 2011
- Looking forward: Protecting our Future
- Conclusion and Recommendations

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Presenters

- Scott Greenlay
  - Family at Lake since 1904.
  - Former Director of Technology for Manitoba Natural Resources which included technology for water modeling at Resources Branch(Now Water Stewardship)
  - Organized websites, social media during flood response
  - Currently Co-National Leader of MNP's Technology Consulting group and Leader of Geomatics which works with Government of Canada, Various US Govmt organizations on similar projects
- Scott Forbes
  - Professor of Biology, University of Winnipeg
  - Expertise in fish & wildlife, wetland ecology, quantitative biology
  - Lake Manitoba cottage owner
- Don Clarkson
  - Manitoba businessman
  - Long-time Lake Manitoba resident and home owner
  - Family Involved in Natural Resources

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Looking Back

Understanding Lake Manitoba and its History

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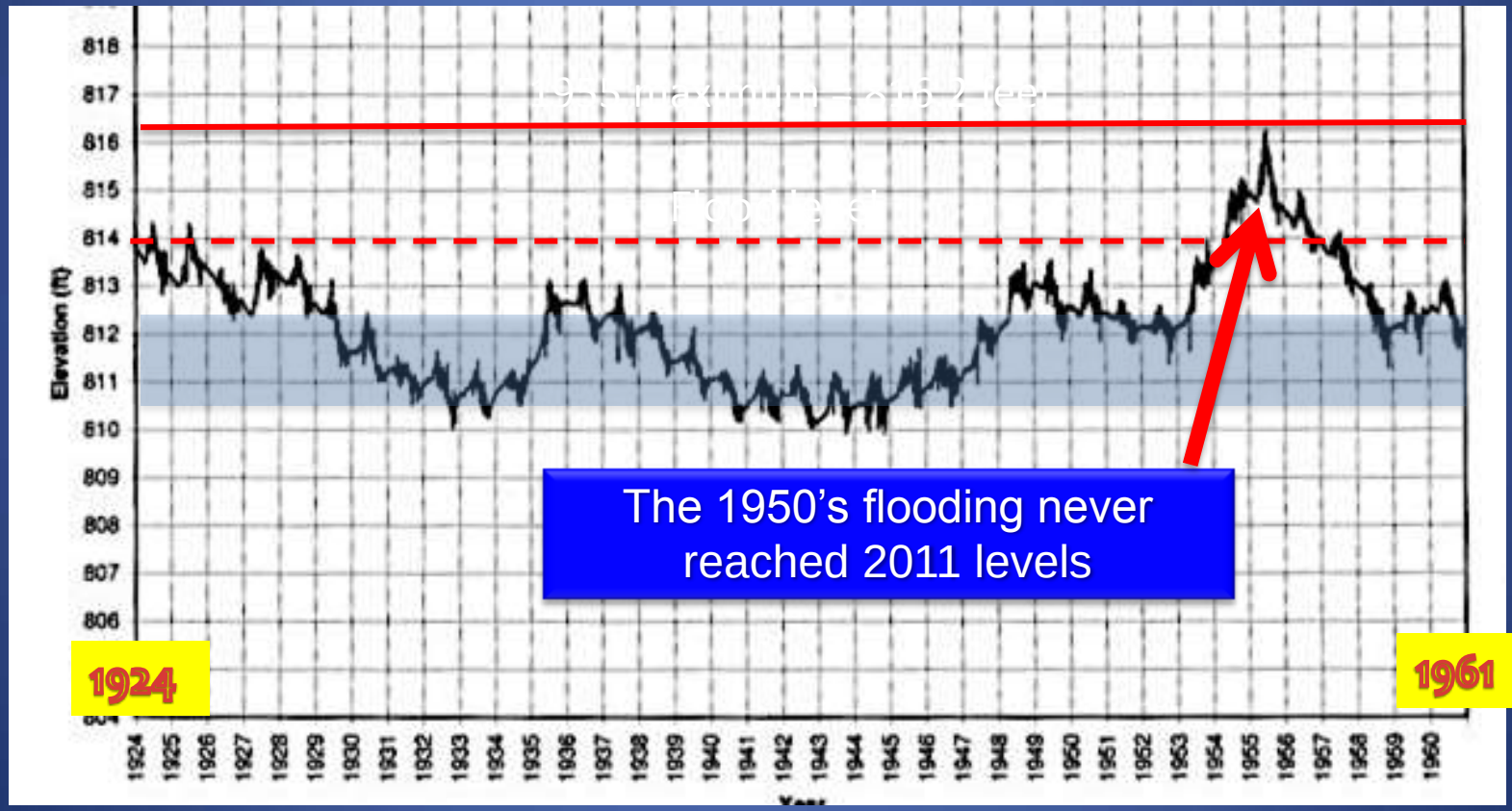
Pre-Fairford Water Levels on Lake Manitoba

Fairford Water Control Structure was completed in 1961: it allows for greater outflow from Lake Manitoba, ~17,500 cfs design capacity



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A Brief History of Water Management of Lake Manitoba

- Flooding in the mid-1950's prompted re-construction of the Fairford Water Control Structure in July 1961 that increased outflow capacity of Lake Manitoba
- In 1970 the Portage Diversion was completed with a design capacity of 25,000 cubic feet per second, 30% greater than the outflow capacity of the Fairford Water Control Structure

Conclusion: We have been playing Russian Roulette with water levels on Lake Manitoba for the last four decades

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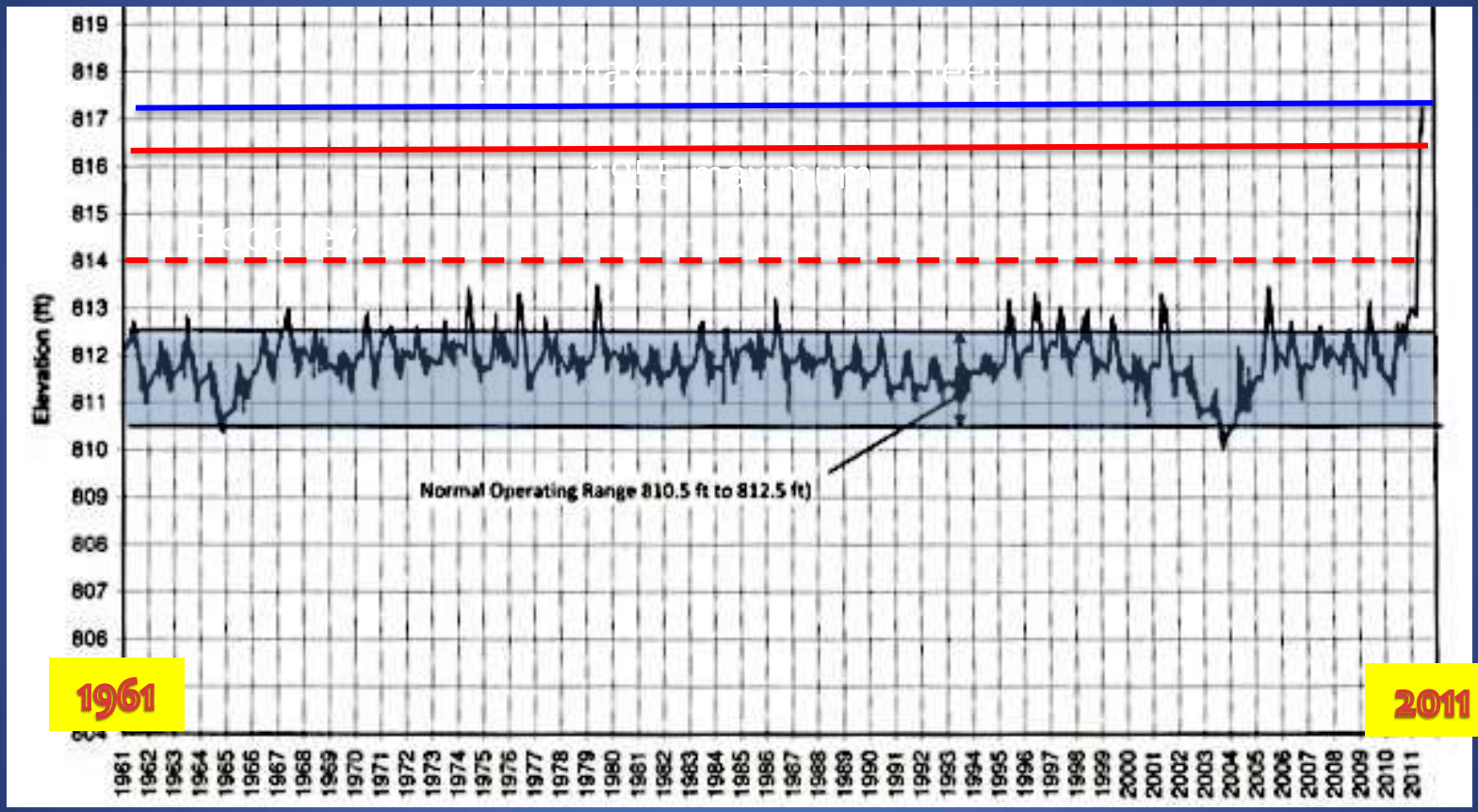
Post Fairford Water Levels on Lake Manitoba



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Use of Lake as Reservoir

"When the artificial inflow exceeds the Fairford outflow capacity, by definition, there is a conscious decision to use the lake as a reservoir"

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But graph doesn't tell the whole story

- Large natural lake level fluctuations allowed Lake Manitoba to have natural defenses against flood years:
  - Shoreline protection from trees/bush
  - Marshes/Wetlands absorbed some of the excess
  - Constant water levels cause shoreline erosion
  - Lake fluctuations allow creation of sand berms, etc.
  - Numerous accounts by long-terms residents
  - Work of Jay Doering at University of Manitoba
    - Lowering of Lake level allows for shoreline rebuilding
- Opening of Diversion also introduces phosphorus, silt, and foreign biota
  - Work of Goldsborough et al, re: Impact of phosphorus
  - Foreign Biota and credibility re: Garrison

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Summary: Understanding the Past and it's impact on 2011

- Assiniboine Diversion in 1970 created substantially more inflow without offsetting outflow capacity
- Regulation of Lake in recent years within small operating range destroyed natural land defenses which were paramount to the 1950's flood protection
- Continual maintenance at high level with no draw down over last few years destroyed both natural and artificial shoreline protection
- Operation of the diversion of the years has a negative impact on water quality and the ecosystem

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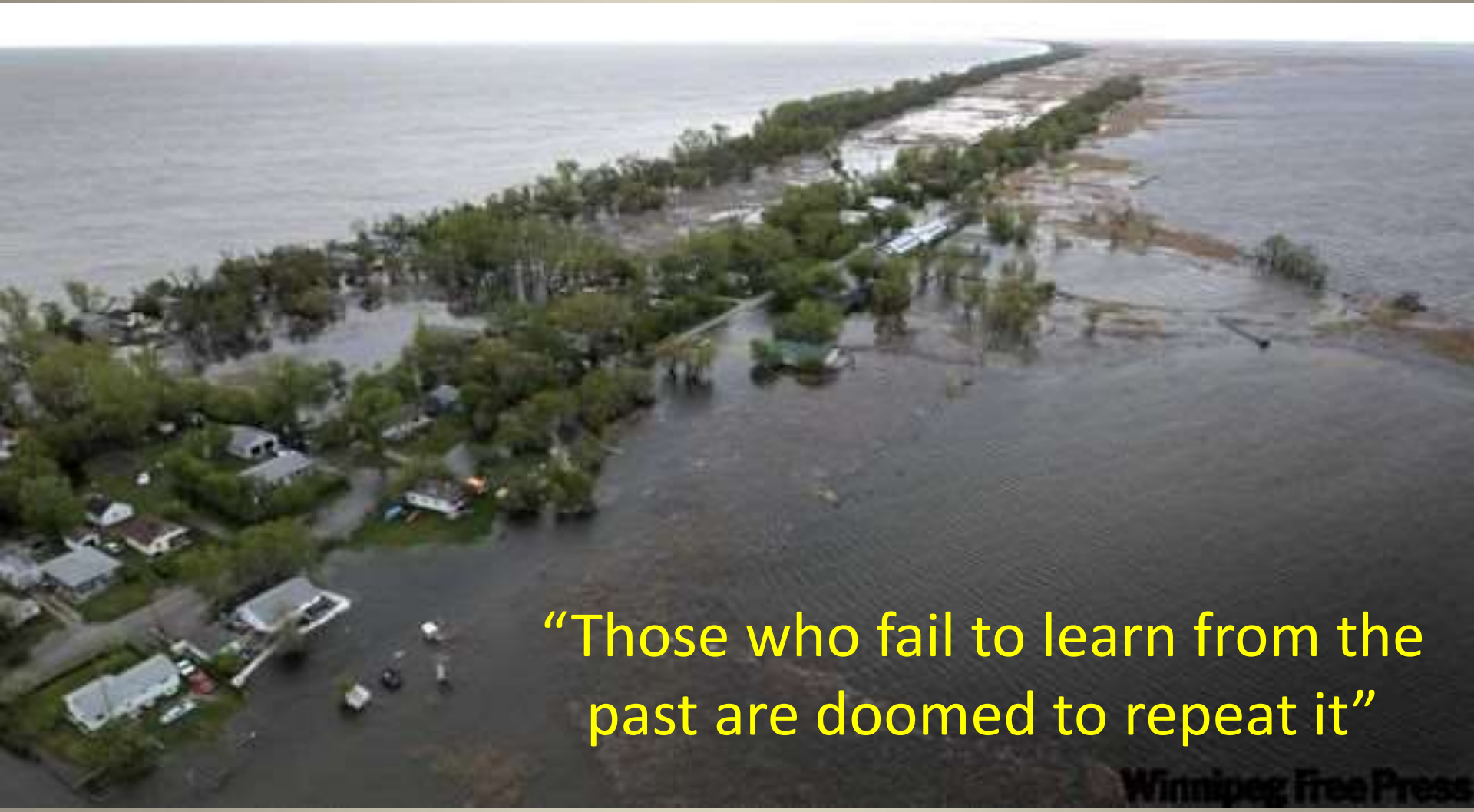
Understanding the Flood of 2011



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Analysis: Understanding the flood of 2011

- Fall of 2010, Lake level was already high
- Drawdown did not occur over winter to provide buffer for Spring Melt
- No concept of buffer for Spring Melt was in place
- The Lake entered the Spring of 2011 with little or no capacity to handle a Spring Melt of any size let alone a Flood
- *A Very Dangerous Situation…*

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Analysis: Dispelling the myth that the 2011 Flood of Lake Manitoba was an unavoidable Natural Disaster

- No Model in place at Water Stewardship prior to 2011 to predict Large Body of Water behaviour or impact
- Dr. Scott Forbes developed a water model to determine the impact of the water inputs into Lake Manitoba during 2011
- Based on science and math models
- Full copy of model and science available from Dr. Forbes for review

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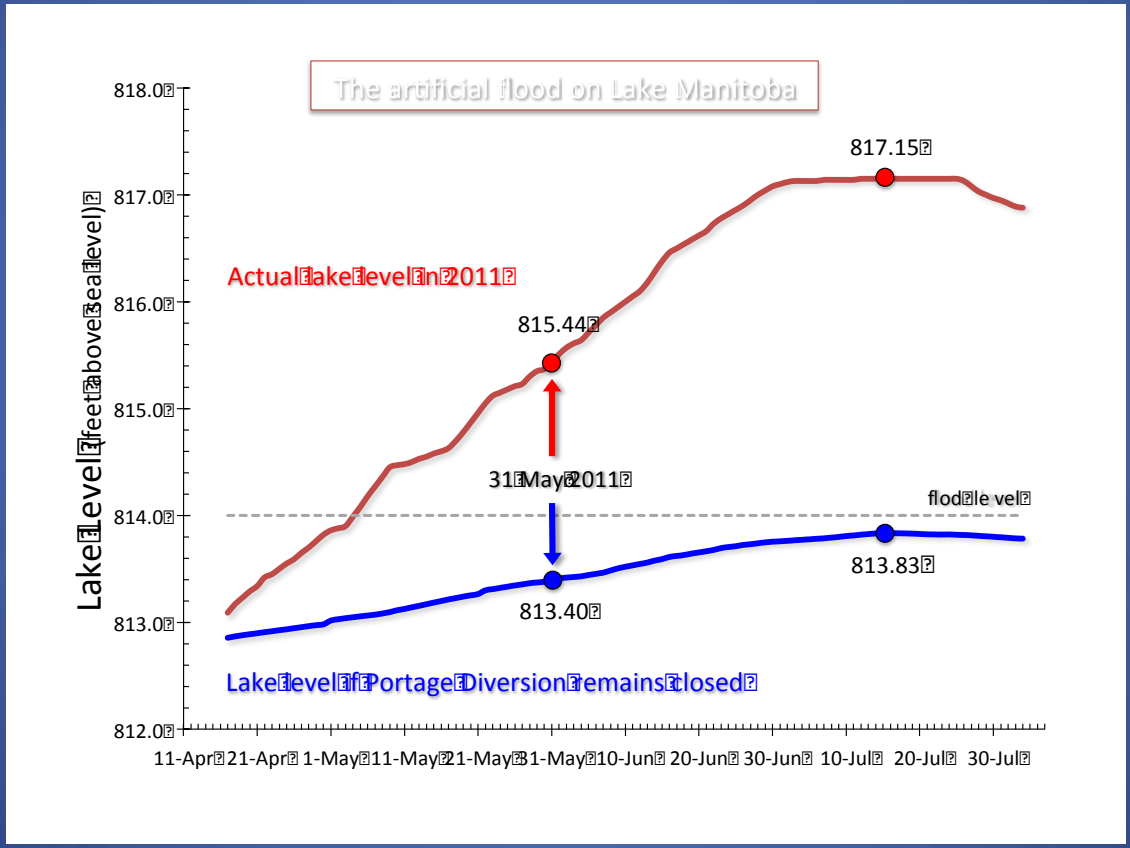
Result: Analysis of Flood of 2011 with and Without Assiniboine Diversion



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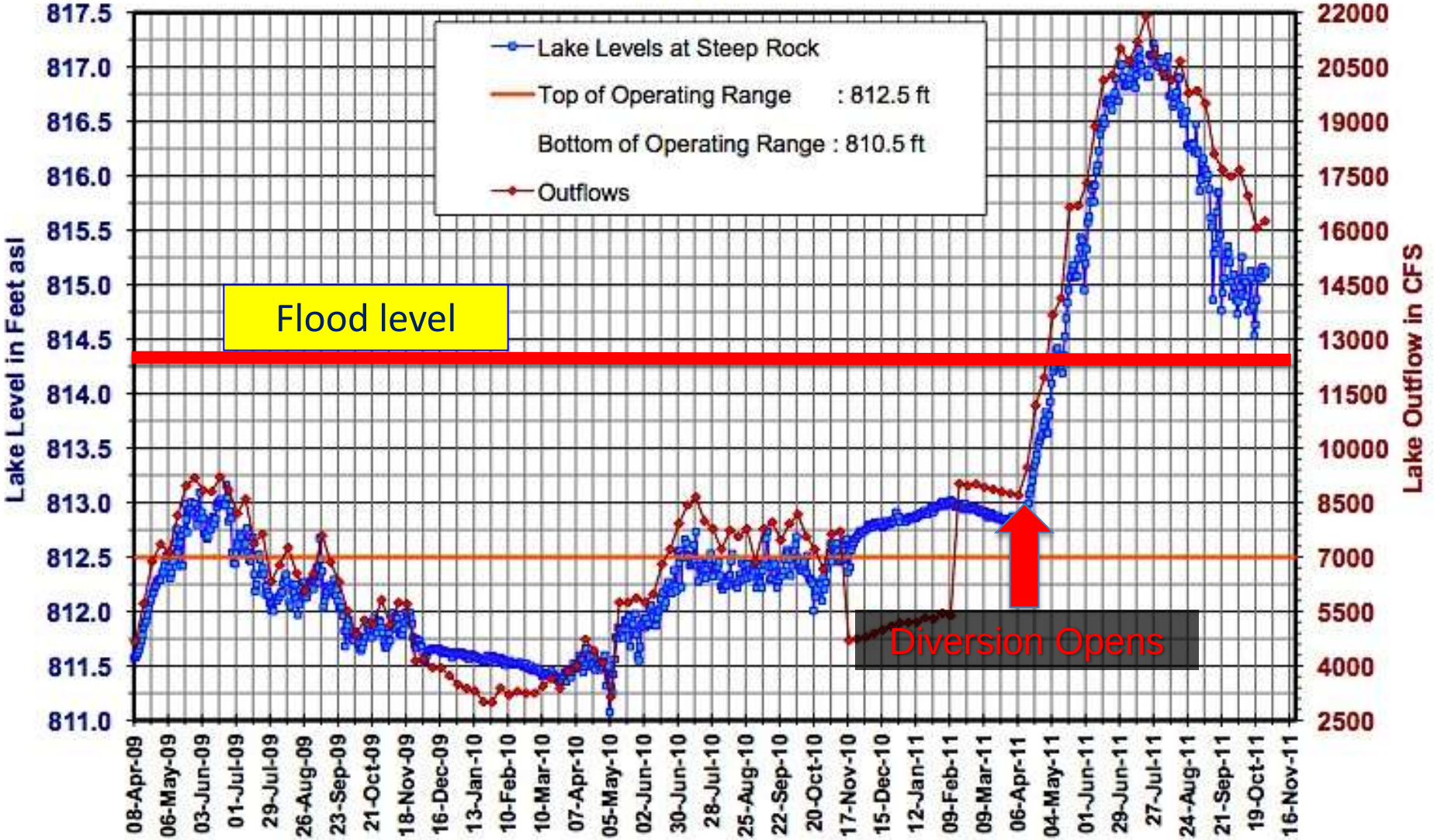
Manitoba
Water Stewardship

Lake Manitoba Observed Levels and Outflows
2009-2011



Analysis

- Conclusion:
  - Lake likely would not have flooded without the operation of the Diversion
  - Flood was a direct result of the increase water level of the operation of the Portage Diversion
  - Damage on May 31st would have been similar to October 2010 Weather event without operation of Diversion.

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Learning from the past

- In the 1950's it took 3 years for the Lake to rise 4 feet
  - This provided valuable time to prepare
  - Raising homes, preparing shorelines, etc.
- Due to diversion in 2011, it rose 4 feet in 3 months
  - This left people no time to prepare
  - No time to evacuate or shore up defenses

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Wind : Understanding the Science

- Many believe “The Wind Storm of May 31st was a freak occurrence”
- This is untrue
- NOAA shows statistical certainty of this type of event:

Delta Beach/Lake Manitoba (DELTABCH)
Statistics based on observations taken between 10/2008 - 5/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	18	16	22	16	34	14	18	17	27	22	25	9	**19**

- 4 Beaufort = 3.5 to 6 foot wave height
- Conclusion: Wind storms occur with sufficient frequency at Lake Manitoba, they should be expected.

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There are differences between a river flood and lake flood…

- Pre-2011, Manitoba Govm't flood fighting focused on River Flooding. Large Lakes are VERY different.
  - River flood is a ephemeral event, takes days and weeks to ebb and flow
  - Large lake floods take months and years to subside
- Large Lakes also have
  - Issues of Wind Tide add to Lake height
  - Issues of Shoreline erosion due to long periods of high water and wave action
  - Sandbag dikes (and likely clay dikes) can not withstand continual height and wave action
- YouTube Video showing ineffectiveness of Govm't of Manitoba Recommended Diking at Pioneer Resort

http://www.youtube.com/watch?v=9ESKp83sscQ&feature=fvwrel

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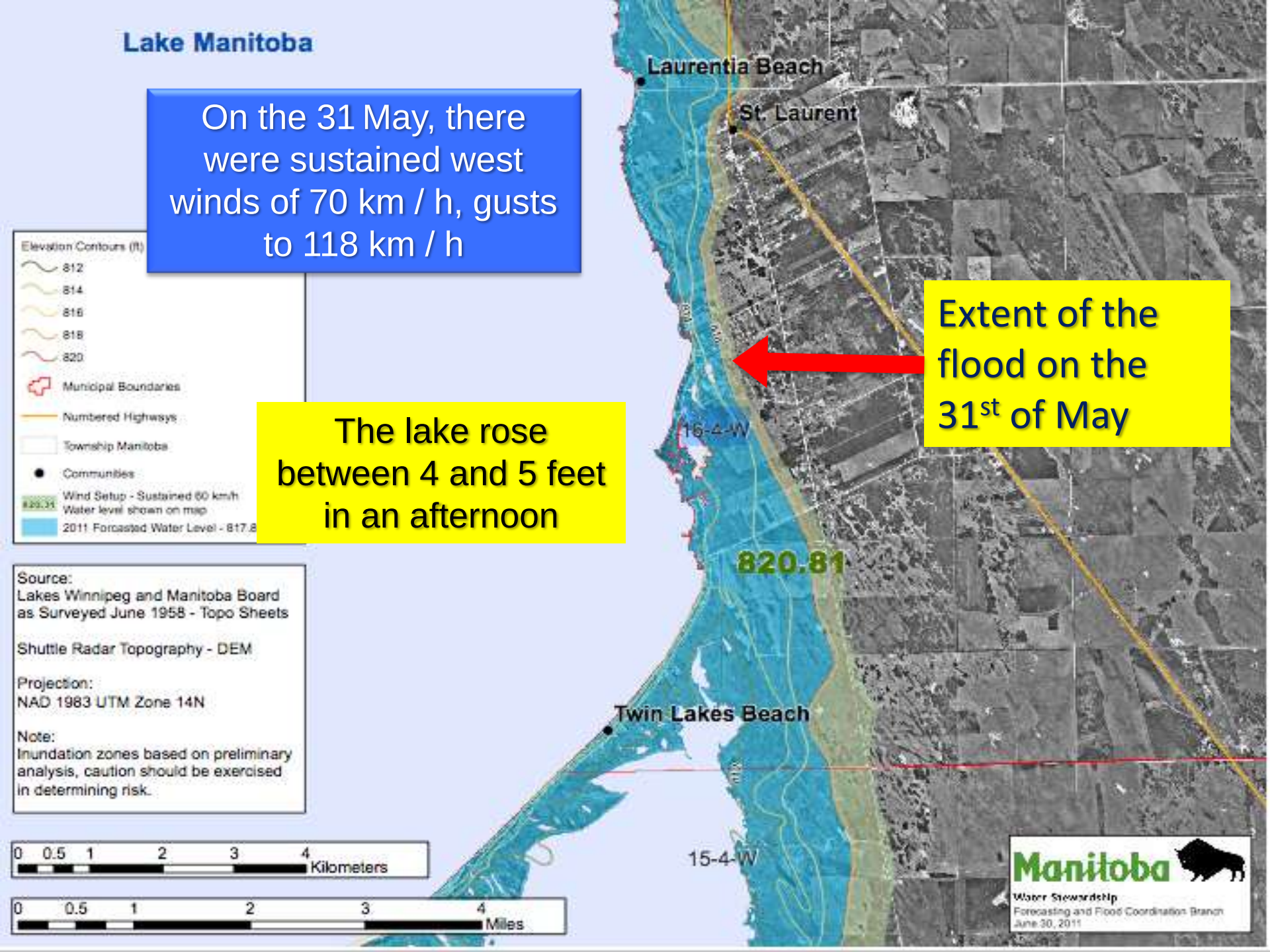
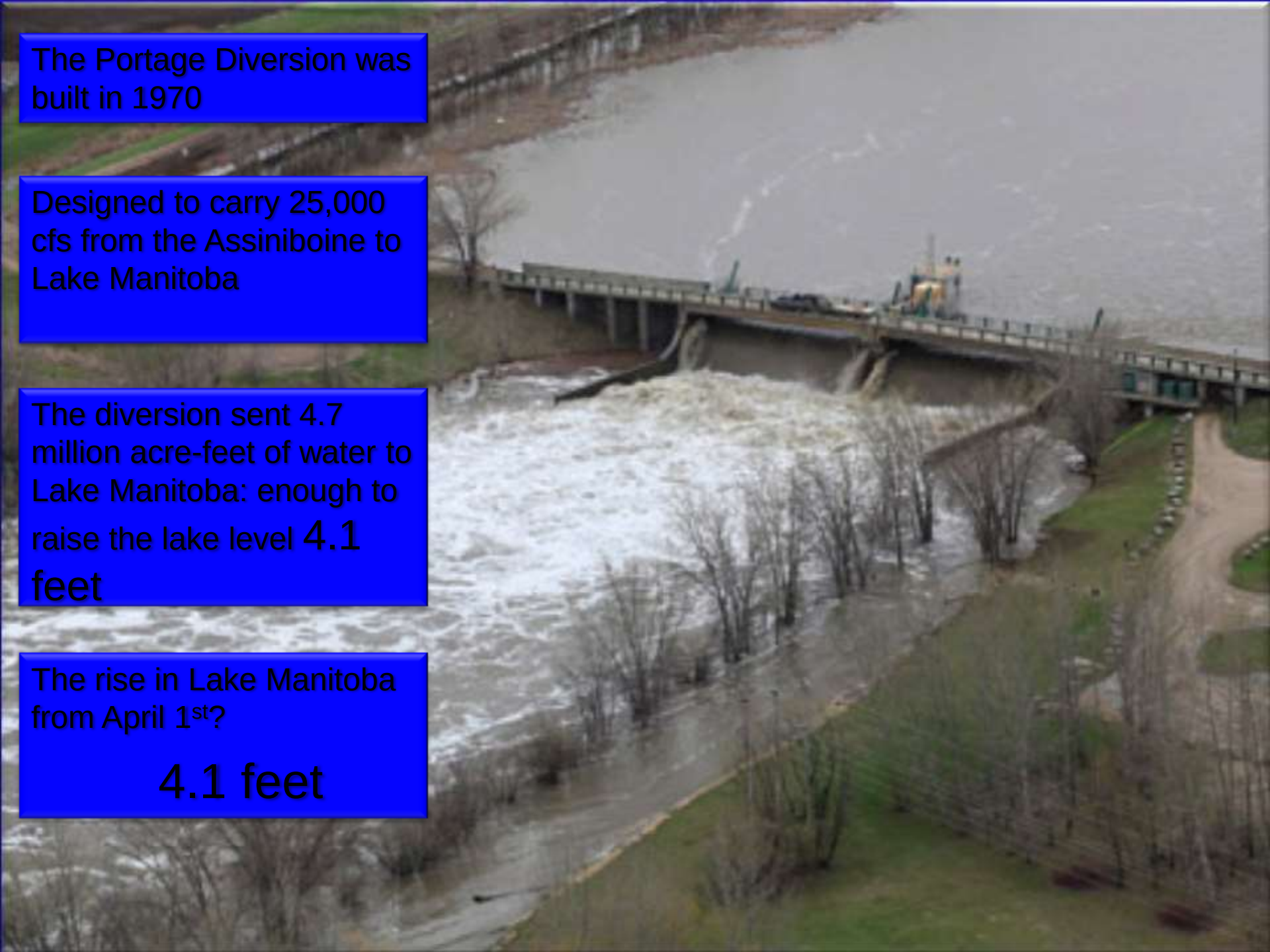

Lake Manitoba
On the 31 May, there were sustained west winds of 70 km / h, gusts to 118 km / h
Laurentia Beach
St. Laurent
Extent of the flood on the 31st of May
The lake rose between 4 and 5 feet in an afternoon
16-4-W
820.81
Twin Lakes Beach
15-4-W
Elevation Contours (ft)
812
814
816
818
820
Municipal Boundaries
Numbered Highways
Township Manitoba
Communities
Wind Setup - Sustained 60 km/h
Water level shown on map
2011 Forcasted Water Level - 817.8
Source:
Lakes Winnipeg and Manitoba Board as Surveyed June 1958 - Topo Sheets
Shuttle Radar Topography - DEM
Projection:
NAD 1983 UTM Zone 14N
Note:
Inundation zones based on preliminary analysis, caution should be exercised in determining risk.
0 0.5 1 2 3 4 Kilometers
0 0.5 1 2 3 4 Miles
Manitoba
Water Stewardship
Forecasting and Flood Coordination Branch
June 30, 2011



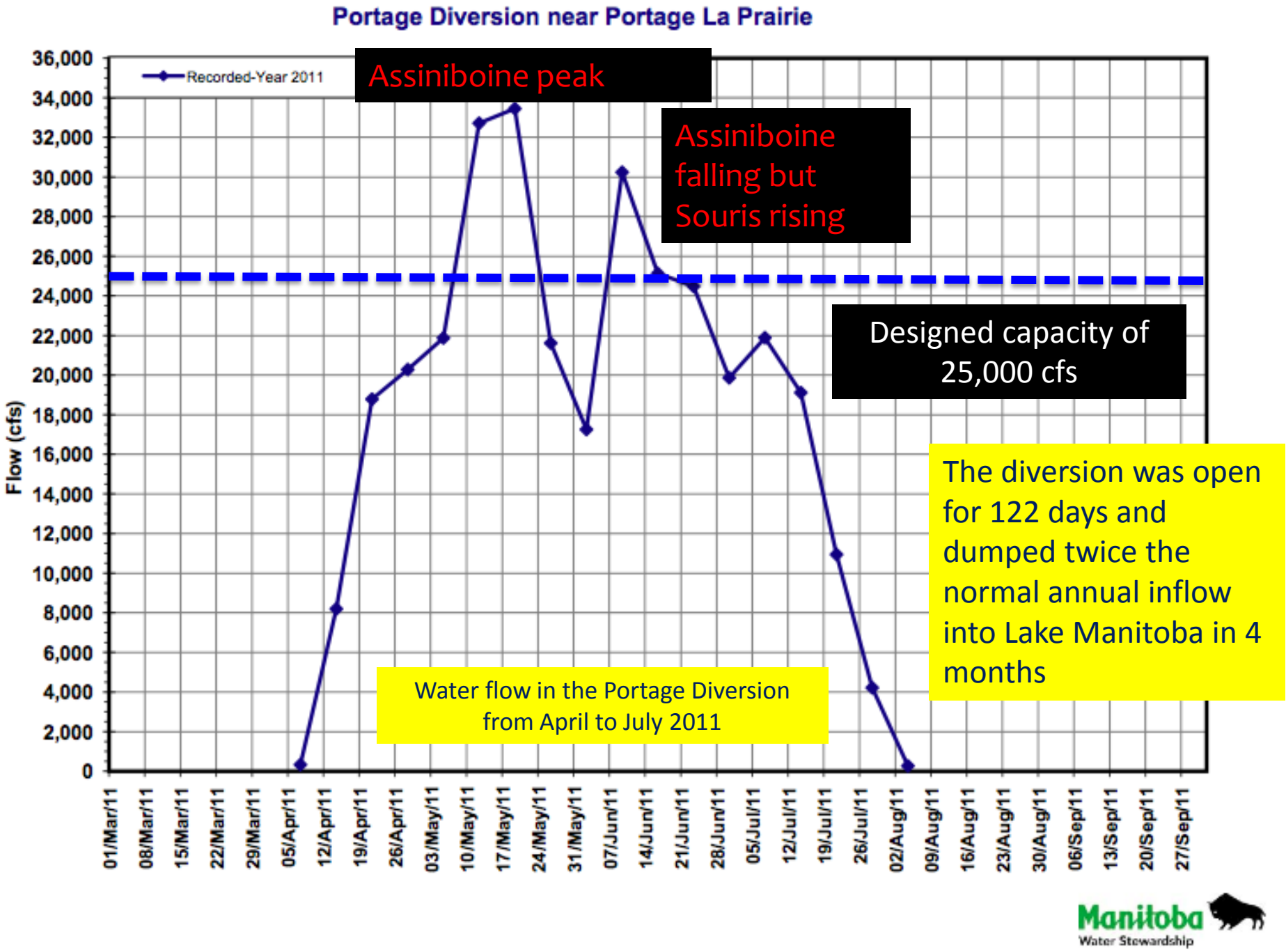
The Portage Diversion was built in 1970

Designed to carry 25,000 cfs from the Assiniboine to Lake Manitoba

The diversion sent 4.7 million acre-feet of water to Lake Manitoba: enough to raise the lake level 4.1 feet

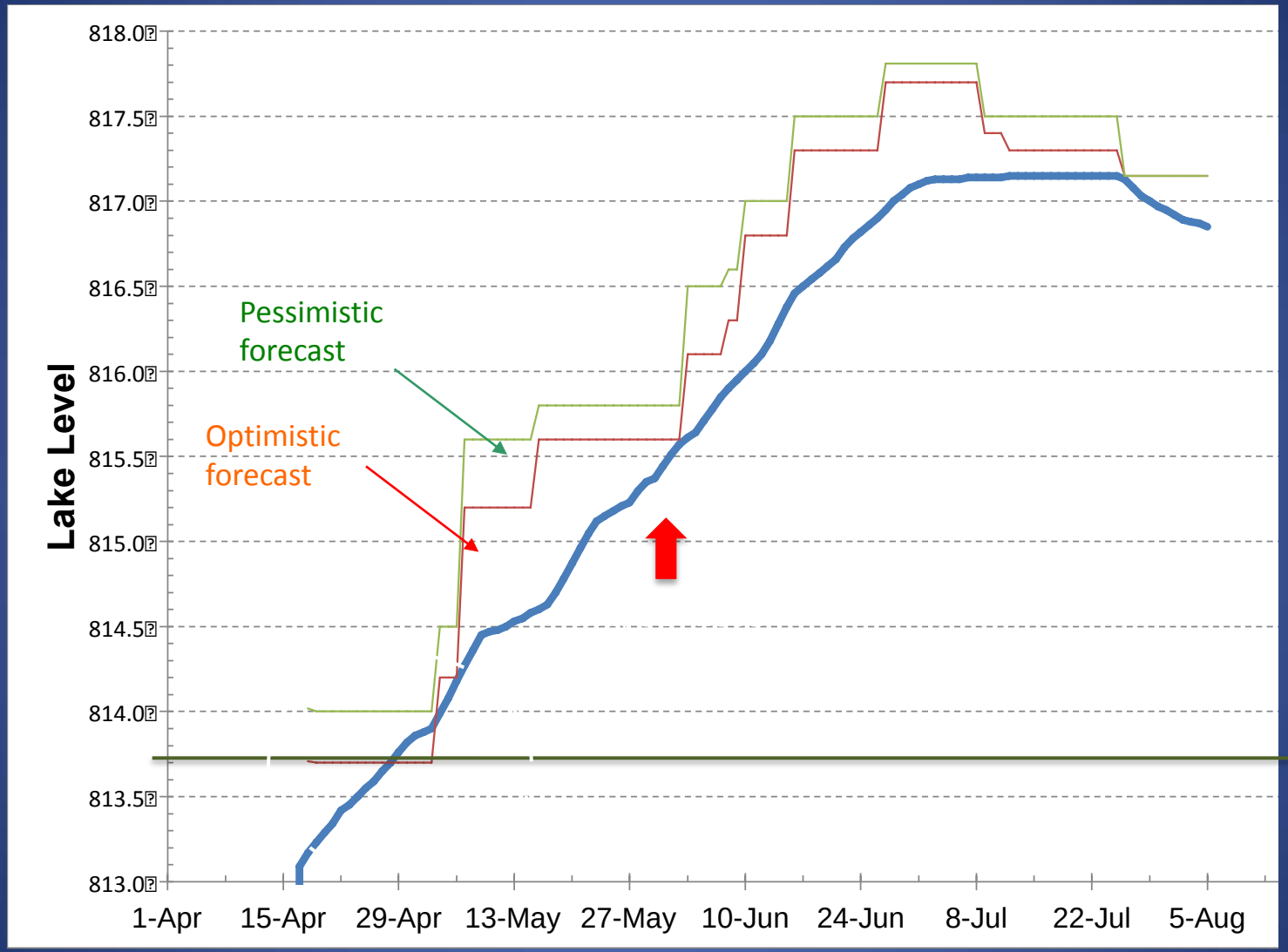
The rise in Lake Manitoba from April 1st?

4.1 feet



Manitoba
Water Stewardship

Looking at the data: Forecasting Models were not in place
Actual and forecast water levels on Lake Manitoba in 2011



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This was a preventable disaster.

The damage from the Lake Manitoba / Lake St. Martin flood will likely exceed $2 billion before it is all over.

With proper flood mitigation the 2011 Flood would have cost less than 1/10th or around $100 to $200 Million.

The disaster occurred because no outlet to Lake Manitoba was created when the Portage Diversion was built 4 decades ago.

And We still don't have one…

Misinformation didn't help

Important Information for Lake Manitoba Property Owners

High Water Advisory on Lake Manitoba

High water on almost all rivers and streams in southern Manitoba is causing increased levels on Manitoba lakes. On Lake Manitoba, the peak level is forecasted to be 815.79 feet around the middle of June. Between now and the date of the peak, the lake will continue to slowly rise.

Strong winds can cause increased lake levels and high waves. Property owners should be aware that weather and wind direction can impact water levels, the height of waves and how high waves run up the shoreline.

The high water advisory for Lake Manitoba will be in place for some time and high levels are expected for most of the year.

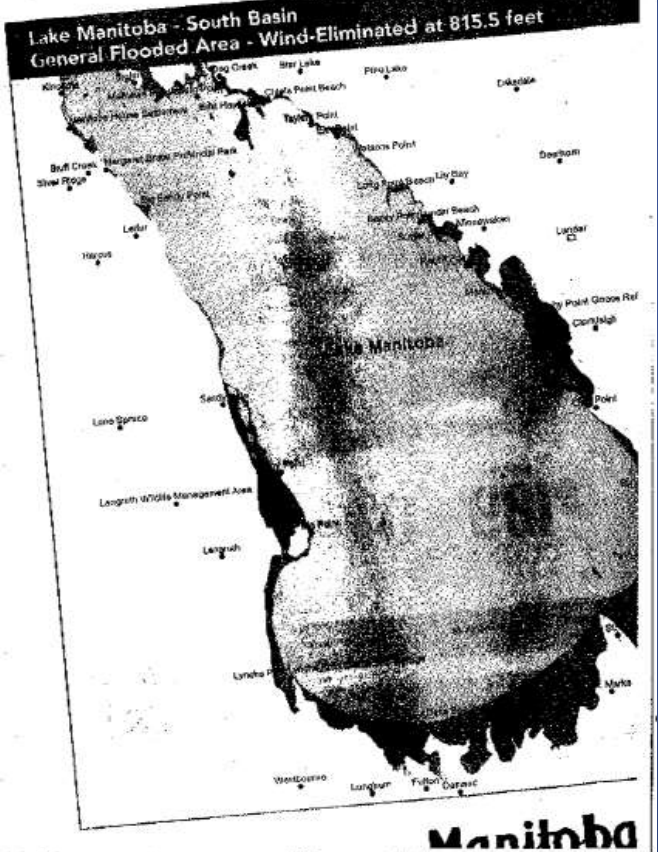
Historic Water Levels

With unprecedented high water levels in southern Manitoba this year, Lake Manitoba is at its highest level in 50 years. Before the Fairford Dam was built and the Fairford River channel was increased to regulate lake levels, Lake Manitoba was often above 814 feet and had levels similar to what they are today. In 1955, Lake Manitoba was above 815 feet for a long period of time.

The historic flood of 2011 has put not only Lake Manitoba, but almost every other major lake in the province, at flood stage.

More Information

Property owners along Lake Manitoba are encouraged to find out more information about lake levels and flood protection by calling **1-855-679-3802 or 204-945-7200, or by visiting the flood website at manitoba.ca** where detailed maps, including maps for flood zones and wind setup, are available.



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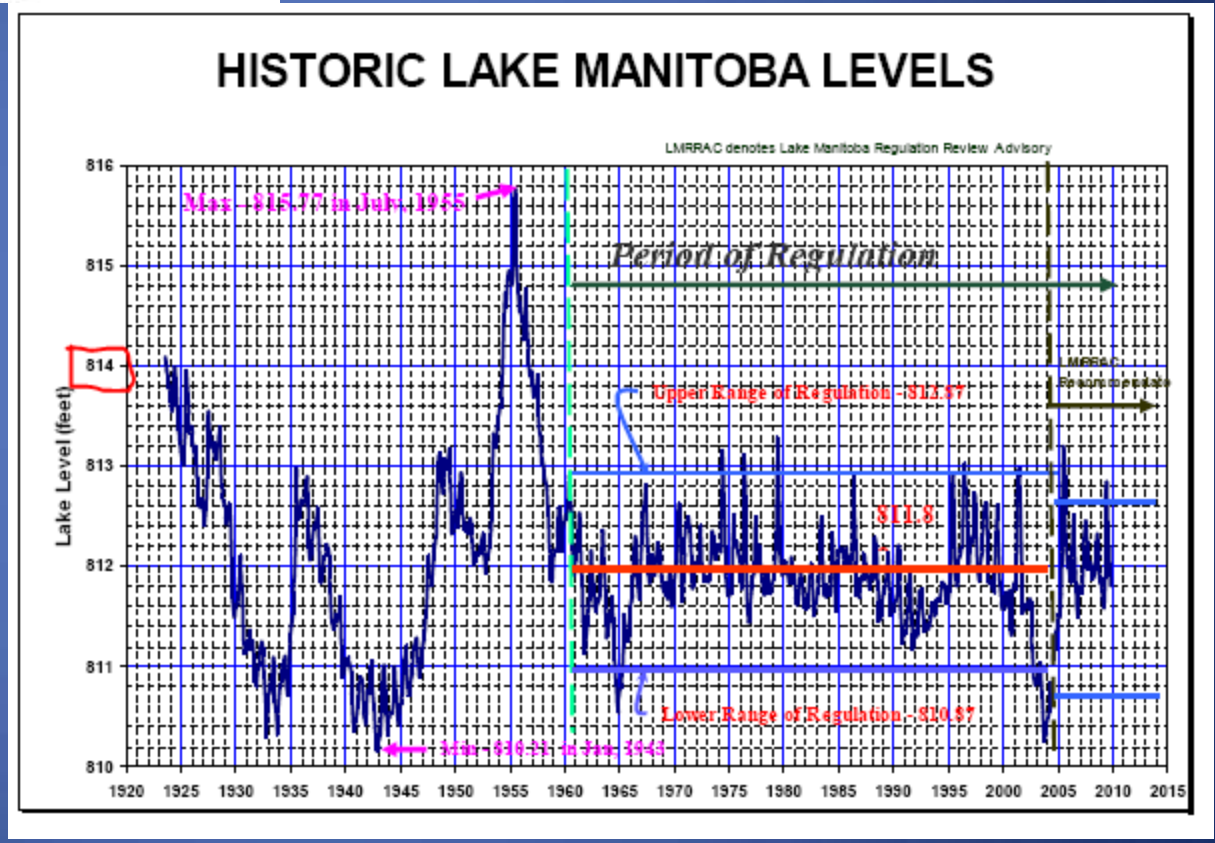
Manitoba is at its highest ... built and the Fairford River channel was increased to regulate ... Lake Manitoba was often above 814 feet and had levels similar to what they are today. In 1955, Lake Manitoba was above 815 feet for a long period of time.

... but not only Lake Manitoba, but almost



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Analysis: Summary of Findings

- Lake was not “drawn down” to prepare for a Spring Flood
- Lake would likely not have flooded without operation of Diversion
- Wind Storms occur regularly on Lake Manitoba, and regardless of May 31st occurrence, wind events would have occurred throughout the flood period.
- Misinformation has been damaging to general public understanding of the situation and has exasperated the people impacted.

Conclusion: The flooding of Lake Manitoba and resulting damage to property was a result of a deliberate series of decisions by the Government of Manitoba. It was not a natural event.

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Looking Forward: Protecting the Future

It is incumbent on each generation to build the best possible road for the next

- John F. Kennedy

Background: Why must the Lake be regulated?

- to prevent what happened in 2011 from happening again
- Prevent a reoccurrence of the Largest Disaster in Manitoba history
- Recent evidence suggests current regulatory framework is insufficient
- A strong set of regulation will restore resident's confidence and resulting economic health

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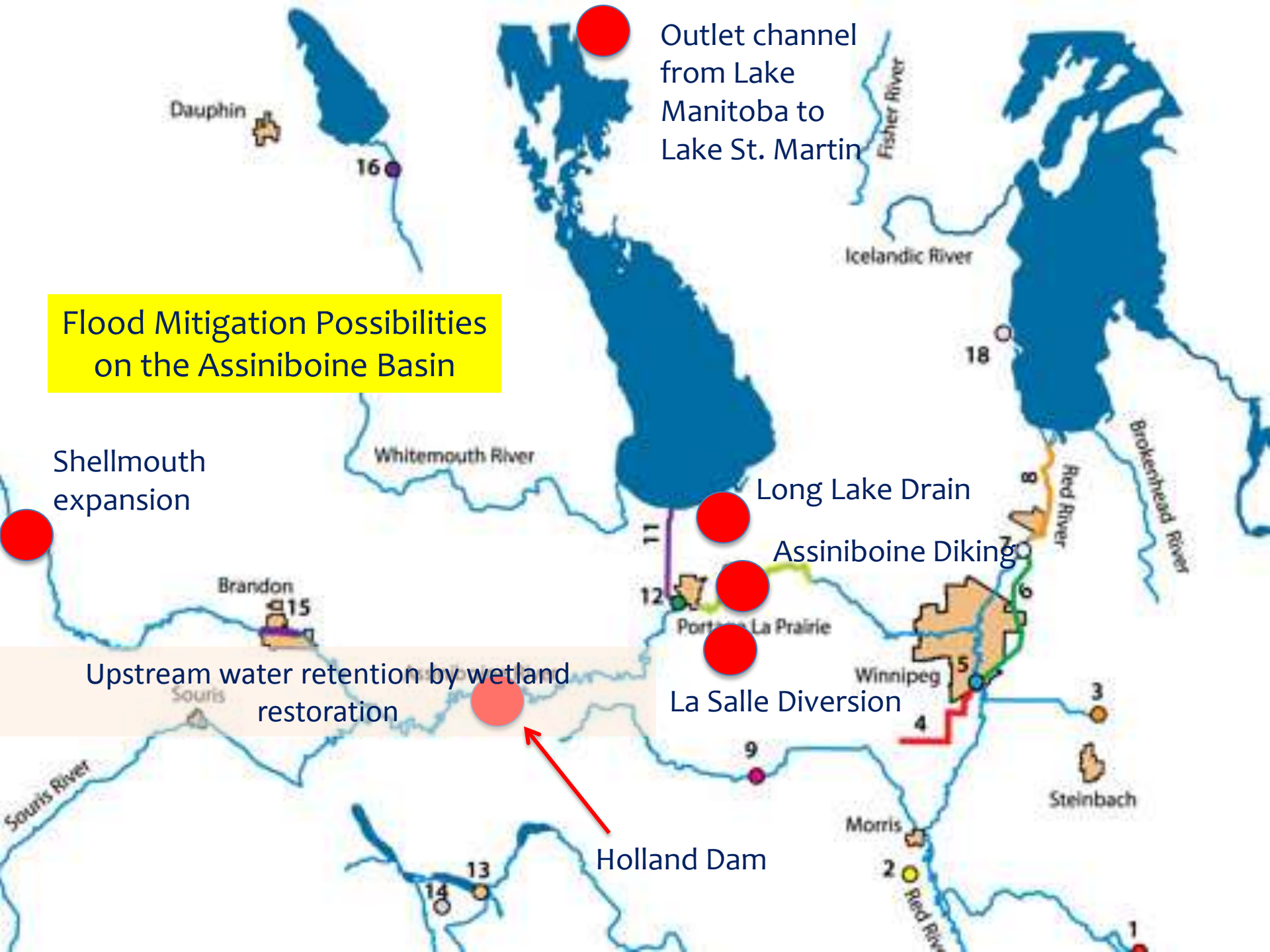
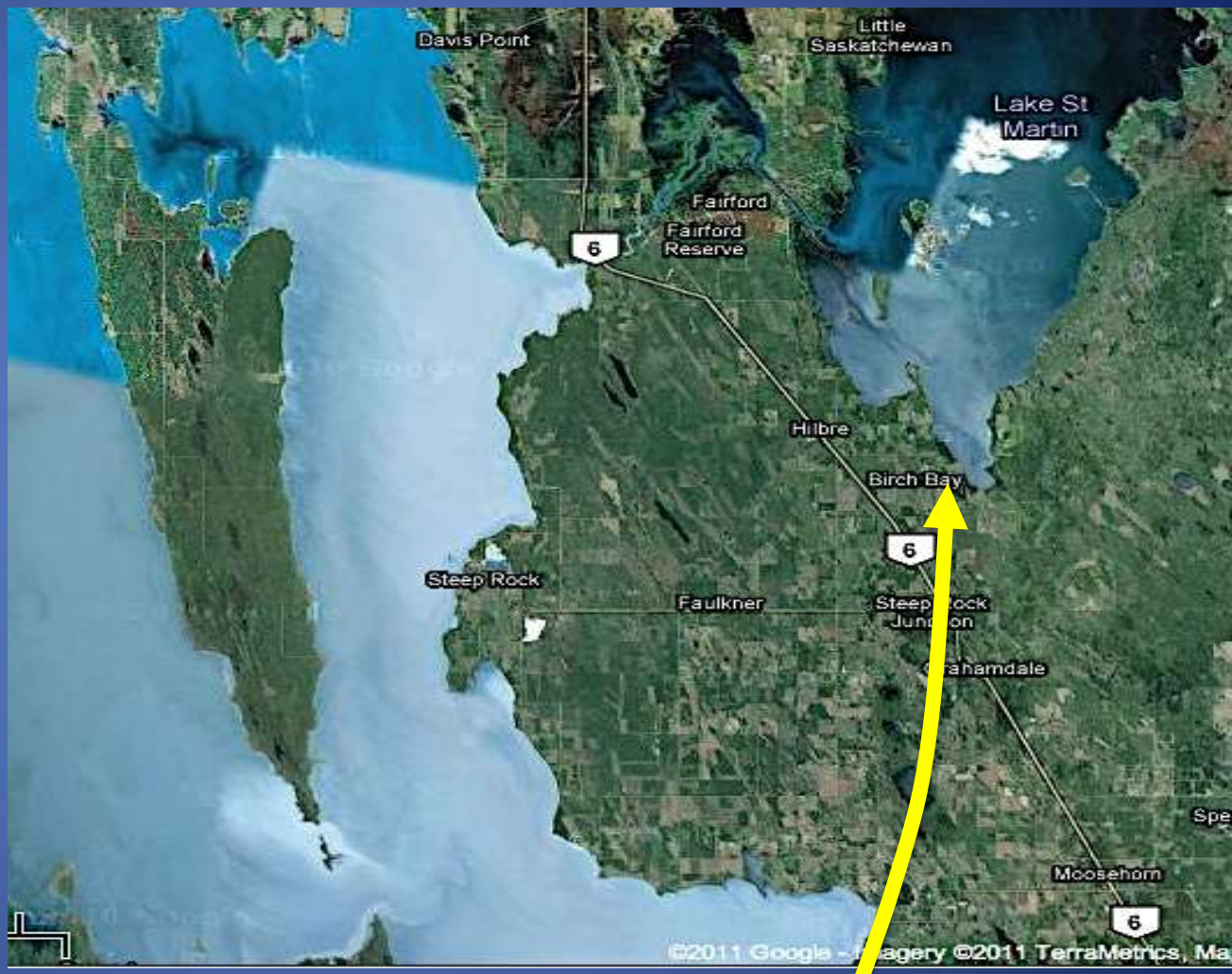

Flood Mitigation Possibilities on the Assiniboine Basin
Outlet channel from Lake Manitoba to Lake St. Martin
Shellmouth expansion
Long Lake Drain
Assiniboine Diking
La Salle Diversion
Upstream water retention by wetland restoration
Holland Dam
Dauphin
Whitemouth River
Fisher River
Icelandic River
Brokenhead River
Red River
Brandon
Souris
Souris River
Winnipeg
Steinbach
Morris
16
18
11
12
15
8
7
6
5
4
3
9
13
14
2
1

The problem on Lake Manitoba will not be solved until a new outlet is created

Natural overland flow of water out of Lake Manitoba at >817 feet through Steep Rock Junction



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Regulation: A traffic light model of water level management on Lake Manitoba

- A risk-sensitive water management strategy designed to accommodate a normal 6 to 18 inch rise in lake level between ice out and mid-summer and allow surplus capacity to adapt to adverse events
- More aggressive water management strategies are implemented based upon a combination of current water level and projected lake inputs in a Bayesian framework that can be updated in real time (e.g., to incorporate adverse precipitation events)

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A Water Management Model for Lake Manitoba

- Dr. Forbes has developed a simple model which could be used to help make on-going regulation of Lake Manitoba easy to administer
- Developed around the principal of traffic light

Background

- The lake operating range is held between 810 and 812 feet
- The lake fluctuates between these limits on an annual basis, approaching the upper limit during the midsummer, and reaching the lower limit over winter

Assumptions

- An expanded outflow capacity from Lake Manitoba increasing summer and winter outflow capacity by 6000 to 8000 cfs
- An expanded outflow capacity from Lake St. Martin to match the increased outflow capacity from Lake Manitoba

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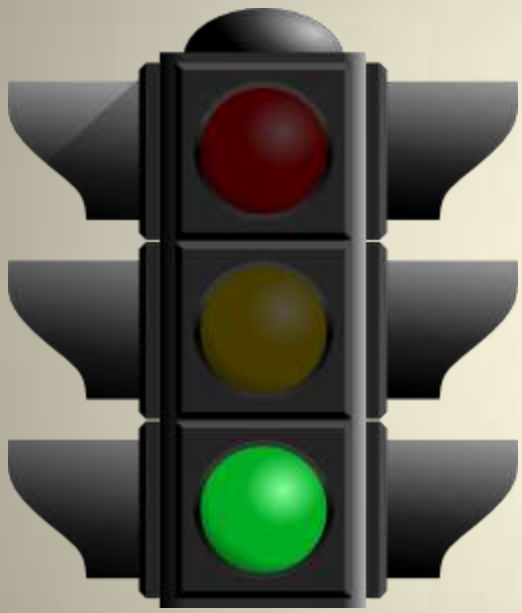

Green light

Fall-early winter conditions:

- Lake level below 811 feet (midpoint of operating range)
- Upstream Assiniboine water levels below average
- Over winter precipitation below average
- Low soil moisture

Management actions:

Normal outflow from Lake Manitoba (less than 6000 cfs) until lake below 810.5

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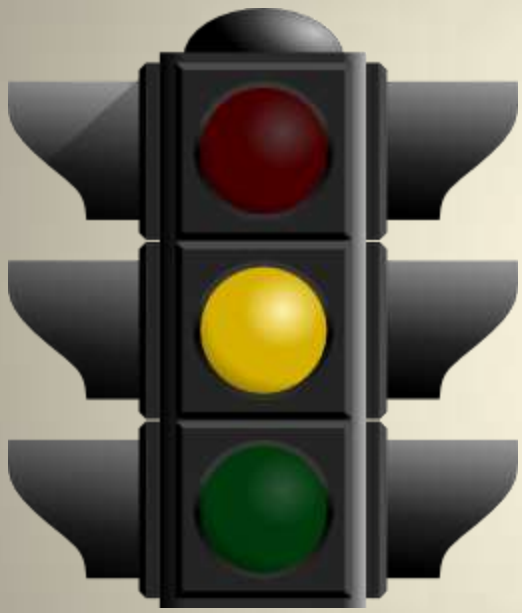
Yellow light



Fall-early winter conditions:

- Lake level below 811.5 feet
- Upstream Assiniboine water levels average
- Over winter precipitation average
- Average soil moisture

Management actions:

Intermediate outflow from Lake Manitoba (6,000 to 12,000 cfs) until lake below 810.5 feet

Channel from Lake St. Martin open

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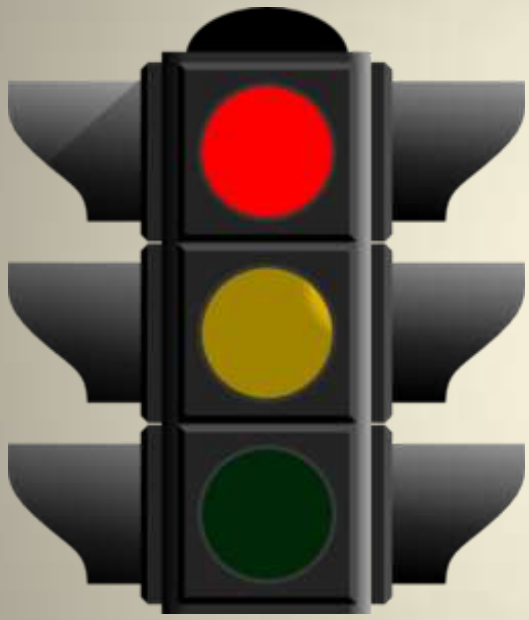

Red light

Fall-early winter conditions:

- Lake level above 811.5 feet
- Upstream Assiniboine water levels above average
- Over winter precipitation above average
- High soil moisture

Management actions:

Maximum winter outflow from Lake Manitoba (20,000 cfs)

Matching maximum outflow from Lake St. Martin

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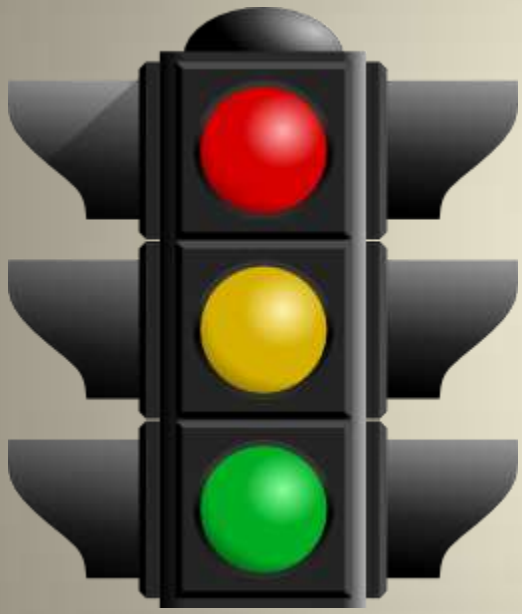
A traffic light model of water level management on Lake Manitoba



Advantages:

- Higher summer water level allows for recreational opportunities on lake
- Annual water level fluctuation is appropriate for habitat management for wildlife
- Low over winter water level provides maximum ability to respond to adverse late winter spring water conditions

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Operating Range of Lake

- Must take into account all factors impacting the Lake
  - But we must deal with outflow issue
  - But need a more conservative lake management policy
  - Lake Management should be based on Large Lake Science

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Conclusions and Recommendations

A nation's greatness is measured by how it treats its weakest members.“

- Mahatma Ghandi

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Recommendations

1. Increase Outflow capacity of Lake Manitoba
   a) By 6,000 to 12,000 cfs depending on regulatory framework
   b) But we do not want to ignore impact on neighbours at Lake St. Martin
2. "Emergency Channel"
   a) A program of Channel Maintenance
   b) Create a permanent control structure
   c) Increase channel capacity
3. Flood Mitigation on the Assiniboine
   a) Dike Restoration (to increase downstream capacity)
   b) Restore wetlands capacity
   c) Increase upstream storage capacity
4. Restore Channel capacity of Assiniboine River
   a) Easy to repair as requires brush removal
   b) If had been in place, would have been 1 foot lower
   c) Restore to 1976 capacity of 24,000 cfs

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Recommendations

5. Provide a Regulatory Framework to direct future generations on the transparent management of the Lake
    a) Provide rules to run the diversion
    b) Provide automatic clean-up / restoration of Lakeshore after operation of Diversion
    c) Provide rules for how to handle Spring Melt buffer
    d) Provide rules for handle multiple high water years and low water years
    e) A communication framework for transparency
6. Allow a yearly fluctuation of the Lake
    a) Would be 2 feet if allowed natural process to occur
    b) Would vary 2 feet between Spring and Fall

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What should be considered the baseline level?

- Use Historical Reference: Crown Land Surveys which show historical lake shorelines
- Simple Lake Level model is insufficient.
- There needs to be seasonality to Lake Levels
- Concept that lake level should be maintained at different levels based on time of year. Examples:
  - Winter: Drain down to provide buffer for Spring melt
  - Summer: Top up to maintain recreational/commercial needs

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ALMS Motions

- Motion: Be it resolved that the lake level be regulated and not be allowed to fall below 810.5 and not rise above 812 ASL for a period of time not greater than four months.

- Motion: Be it resolved that the lake level be lowered to the low end of the operating range beginning in 2012 and continuing until man-influenced and natural shore-line restoration and clean-up is complete.

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Top 3 Concerns of those Impacted

1. Equitable and timely treatment, compensation and or assistance of all affected property and business owners and farmers.

2. Regulation and legislation of lake levels of Lake Manitoba.

3. Water quality and affected marshland, shores/beaches, recreational and industries and long-term environmental impact.

Source: Open House, ALMS, March 2012, attended by over 400 Lake Manitoba Citizens.

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A closing thought

In 2011, hundreds of lives were impacted by a Flood. Livelihoods lost, lives changed forever.

Soon, Billions of dollars will have been spent.

Without decisive action, it will happen again.

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Thank You

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