Water Security Agency

SASKATCHEWAN

August 2015

Quill Lakes Project

Consultation

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Purpose of Meetings

- In response to flooding at Quill Lakes WSA is examining a possible project to divert water away from Big Quill Lake and is undertaking survey and design, environmental studies and consultations to determine cost and feasibility.
- This series of meetings is a intended to explain the proposed project to local stakeholders, answer questions and obtaining stakeholder response.
- WSA will bring this issue to Cabinet for consideration. The report on these consultations, which will be prepared by HJ Linnen, will be part of the material prepared for Cabinet.

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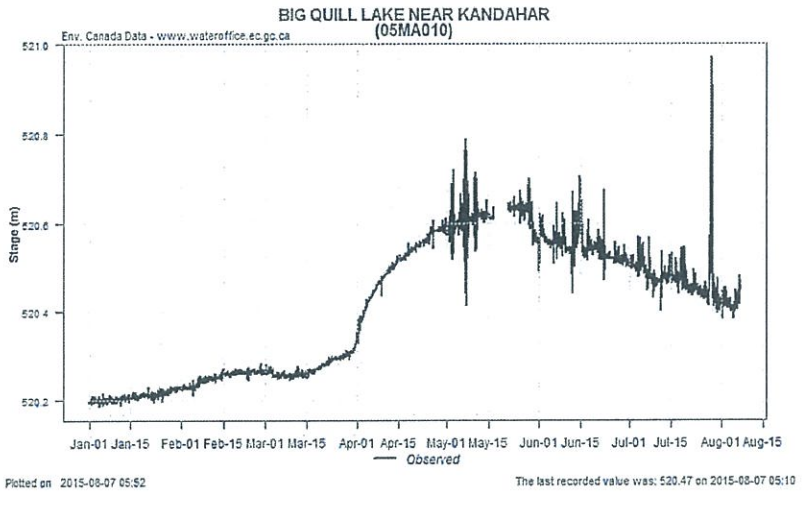
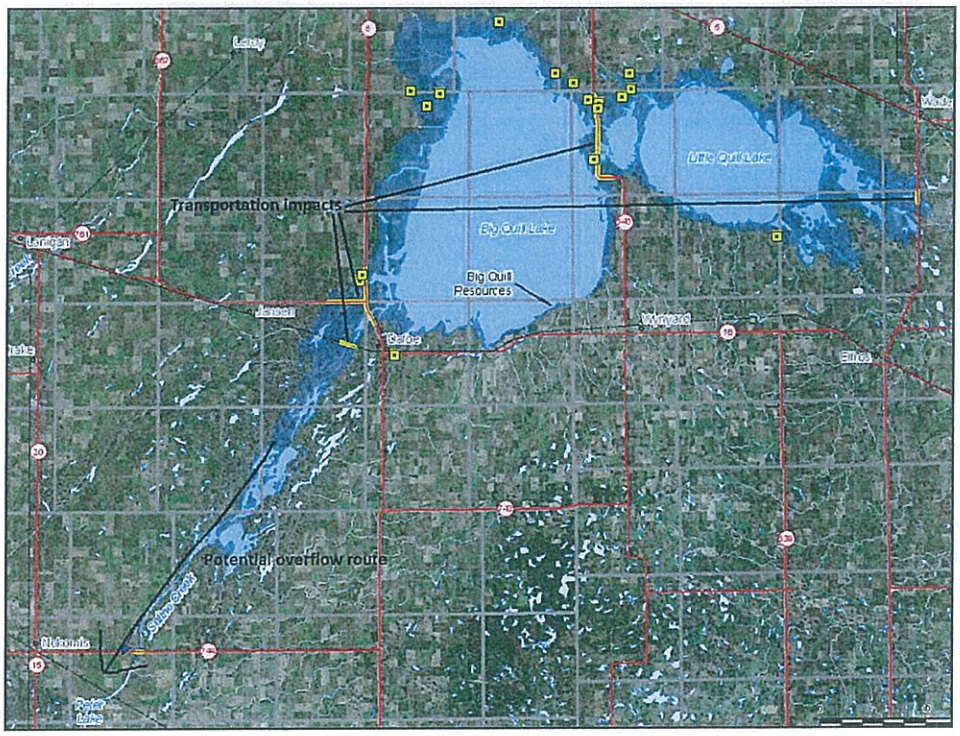
Challenges at the Quill Lakes

- Big Quill has risen more than 6.5 m since 2005 and has reached record levels:
- If Big Quill rises a further 1.00 m it will begin to overflow to Last Mountain with potential ecological impacts and significant concern from property owners
- High water is threatening highways 6,16 and 35
- Threat to CPR line
- Flooding farm land - long term damage due to salinity
- 4 farmyards currently impacted, potential for more
- One section of highway 6/16 had to be raised this year
- 27,000 acres private land and 58,000 acres crown land already impacted
- Could increase to 83,000 acres of private land if lakes spill

Big Quill Lake 2015 Hydrograph





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Project Alternatives

WSA has examined a number of options to deal with rising water at Quill Lakes

- Construction of dam to prevent flow out of Big Quills
  - Flooding of 83,000 acres of private farmland, perhaps more
  - Major costs to keep highways and railway open,
- Close off Drainage Works
  - Minimum impact – 0.01 m/yr in wet years
  - Substantial cost
  - Several years to implement
- Channels to divert water to Red Deer River
  - Cost of $22 - $30 M

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Project Alternatives - Continued

- Divert inflow water to Last Mountain Lake – Ironspring Creek
  - Conceptual construction cost of ~$106 M
- Divert inflow water to Last Mountain Lake – Wimmer Brook
  - Requires Ironspring Creek diversion to be built
  - Cost of ~$10 M plus $106 million for Ironspring
- Construction of outlet channel to allow Quills to drain into Last Mountain Lake
  - Ecological damage in lake and downstream
  - Not viable due to ecological impact

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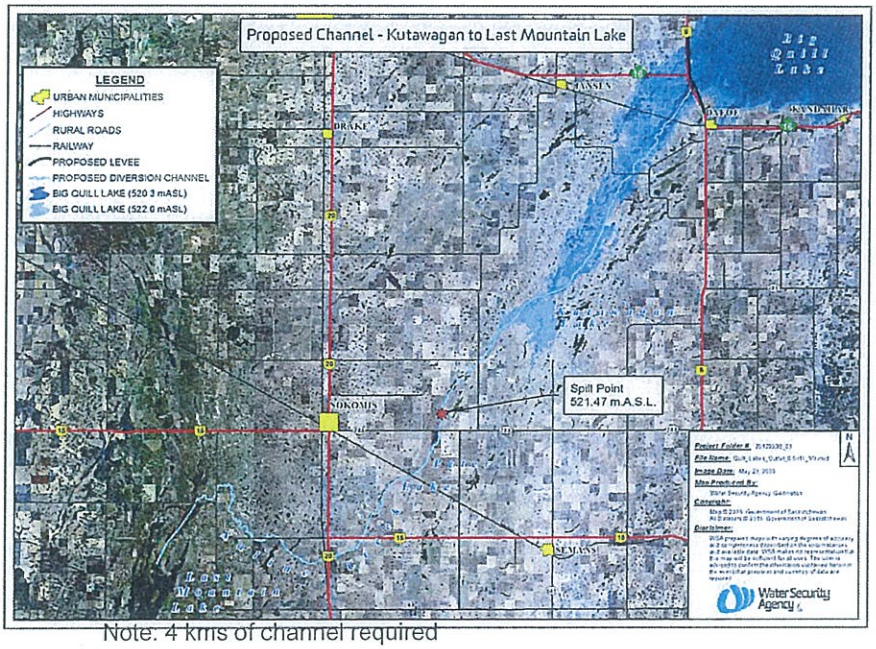
Project Alternatives - Continued

- Do nothing – let nature take its course
  - High costs for infrastructure
  - Flooded farmland, potentially 83,000 acres
  - Potential ecological impacts to LML
- Kutawagan Diversion (Current Proposal)
  - Reduced impacts to LML
  - Protects Highways 6/16
  - Reduced agricultural flooding
  - Most cost effective option
  - Conceptual cost $19 million for construction

Kutawagan



Note: 4 kms of channel required

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Benefits of Proposed Works

- Should eliminate need to raise highways 6 and 16
  - Savings of $40 to $140 million
- CPR line protected
- Reduces flooding of agricultural land
  - Potentially by 30,000 acres
- Prevents a direct overflow of saline water from Big Quill to Last Mountain Lake
- Benefits greater the sooner works are constructed

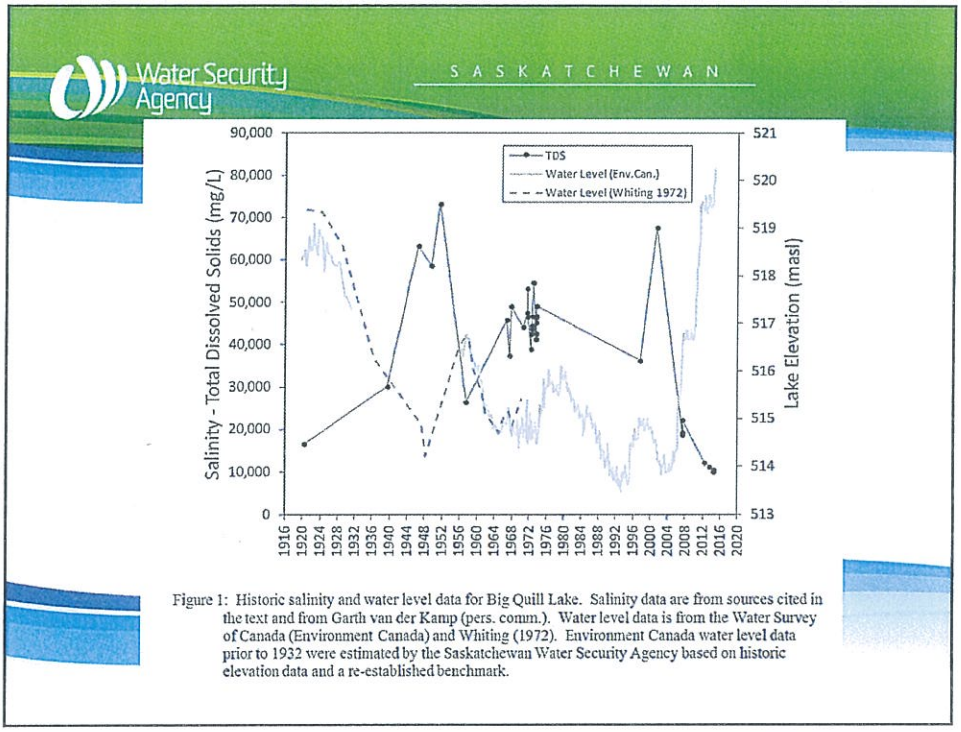

Figure 1: Historic salinity and water level data for Big Quill Lake. Salinity data are from sources cited in the text and from Garth van der Kamp (pers. comm.). Water level data is from the Water Survey of Canada (Environment Canada) and Whiting (1972). Environment Canada water level data prior to 1932 were estimated by the Saskatchewan Water Security Agency based on historic elevation data and a re-established benchmark.

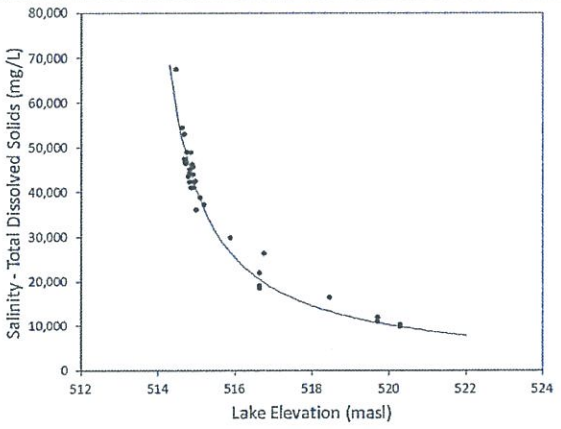

Figure 2: Relationship between salinity and lake elevation for Big Quill Lake. Water level data on water quality sampling dates were interpolated between adjacent dates. Salinity data sources are the same as Figure 1, except winter and spring values (from Hammer 1973) were removed from the dataset as were those between 1931 and 1956 because of the paucity of water level data. Winter and spring data were removed because the principal interest was to establish a relationship between typical salinity and lake level, which can be biased during winter because of brine rejection during surface ice formation and biased during spring if the separation of inflowing water and/or vertical differences in lake salinity still persists from winter. Curve Expert (version 1.38) was used to find the line of best fit, which was a saturation growth-rate model (salinity = (131.96 x lake elevation)/(-513.30968 + lake elevation); r^2=0.96). This line is extrapolated beyond the high elevation data to provide a rough initial estimate of salinity if Big Quill Lake continues to increase in elevation.

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- At high flows Qu'Appelle naturally flows into LML at Valeport
- After peak flows, LML drains into Qu'Appelle
- Small outlet to size of lake, long period of decline
- Craven Control Structure can be used to maintain elevation of LML by reducing flow down the Qu'Appelle
- Craven structure fully open since 2013 due to high water levels
- Outflow related to level of the lake, currently 26.6 m^3/s

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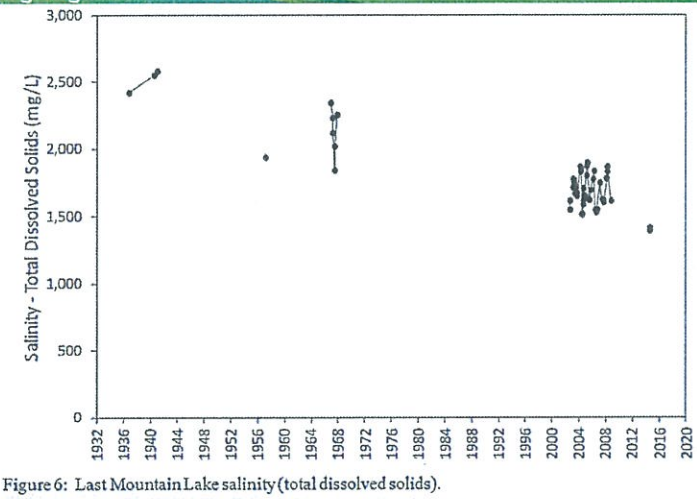

Figure 6: Last Mountain Lake salinity (total dissolved solids).

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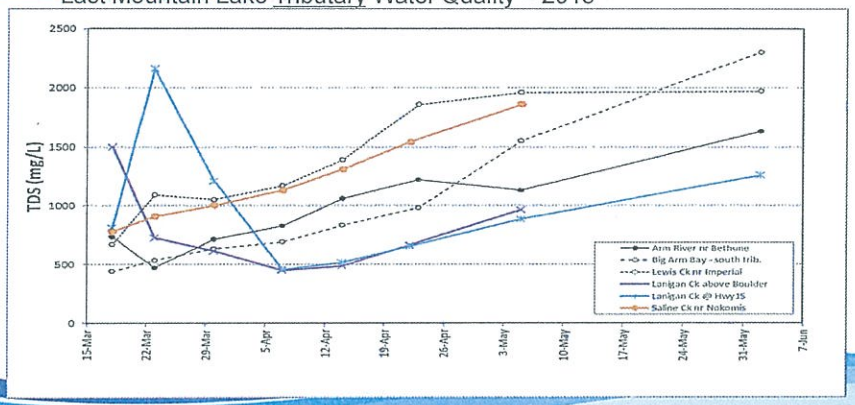
Last Mountain Lake Tributary Water Quality – 2015



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Implications for LML of Natural Overflow - do nothing scenario

- TDS of about 8,000 mg/l in inflow
- TDS loading over 10 years of 421,000 Tonnes
- Implications would be greater at north end as it would take time for inflow to mix evenly through the lake
- May be implications to fish habitat in Lanigan Creek and at the north end of the lake, especially in the inlet Bay
- Additional modelling underway

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Proposed Project – Implications for Quill Lakes

- Reduce total inflow to Quill Lakes and reduce rate of rise or accelerate decline
- Modelling last 10 years shows mean inflow no longer reaching Big Quill of 14,170 acre feet
- Model shows level lowered by 0.3 m over last 10 years
- Modelling shows could reduce flooding by 30,000 acres if wet years continue

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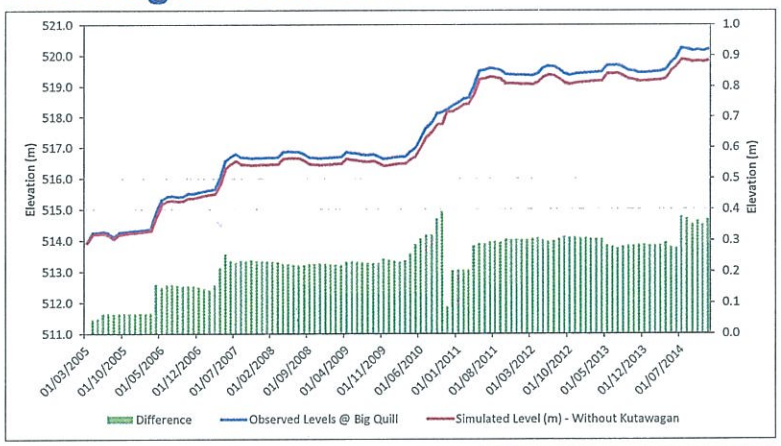
Observed Water Level for Big Quill Compared to simulation with Kutawagan Diversion



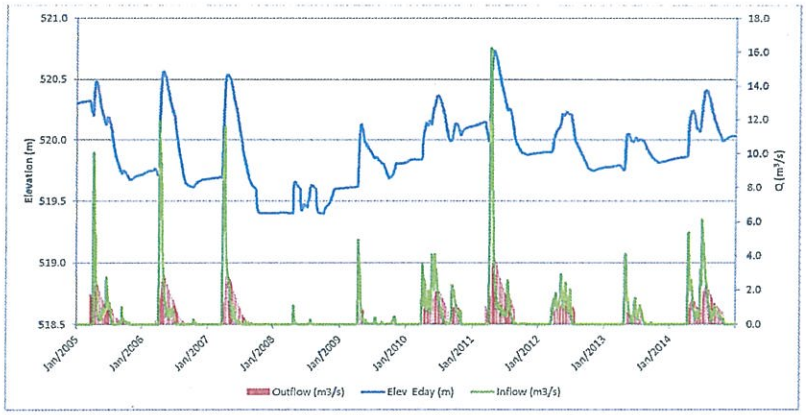


Figure 4: Results of the water level simulation for the Kutawagan Pond.

August 10, 2015

Proposed Project – Implications for LML and Qu'Appelle

- Maximum diversion rate of 4.1 m^3/s
- Mean flow would be 1.1 m^3/s over ice free months
- Mean diversion of 15,229 cubic decametres
- Last Mountain Lake would see a small increase in water levels
- Maximum impact would have occurred in 2011 of 0.07m due to very high outflows that year
- Less in other years
- Outflow from LML would increase by an average of 0.5m^3/s and a peak of 1.7 m^3/s
- Total loading of TDS over 10 years is less than with natural spill (363,000 Tonnes versus 421,000)
- Average TDS is much lower (2400 mg/L) versus natural overflow (8,000 mg/L)

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Current Status and Plans

- WSA doing survey and design to determine cost and feasibility
- WSA developing operating plan
- WSA doing environmental work
  - Water quality
  - Fish habitat
  - Wildlife habitat, especially migratory birds at Kutawagan and LML
- WSA consulting
- The project would trigger both federal and provincial environmental reviews
- WSA is in discussions with CEA and Ministry of Environment about review and emergency exemption
- Emergency exemption requires that all environmental issues be addressed, but work can be completed and mitigated after
- WSA will bring issue to government in the fall with a possible decision to construct works in preparation for 2016 runoff

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Current Status and Plans

- Thank you.
- Comments and questions.