# SUMMARY OF COMMENTS/RECOMMENDATIONS

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| **PROPONENT:** | **Rural Municipality of Killarney – Turtle Mountain** |
| **PROPOSAL NAME:** | **Killarney – Turtle Mountain Water Supply System** |
| **CLASS OF DEVELOPMENT:** | **Two** |
| **TYPE OF DEVELOPMENT:** | **Transportation/Transmission - Pipelines** |
| **CLIENT FILE NO.:** | **5396.00** |

## OVERVIEW:

The Proposal was received on March 5, 2009. It was dated March, 2009. The advertisement of the proposal was as follows:

"A Proposal has been filed by W. L. Gibbons and Associates Inc. on behalf of the Rural Municipality of Killarney -Turtle Mountain for the construction and operation of a new groundwater water supply system to provide water for municipal purposes to the Town of Killarney, including fire protection. The new system would consist of a well field in SW 21-3-16W that would supply up to 925 cubic decameters of water per year, a pipeline from the well field to the town, and a water treatment plant on Lakeshore Drive in the town, near the existing water treatment plant, with a reservoir capacity of 2.2 megalitres. The water treatment plant would use manganese greensand filtration and reverse osmosis to treat the water to Drinking Water Guidelines, including the removal of iron, manganese and hardness from the raw water. Treated water would also be chlorinated. Membrane concentrate from the reverse osmosis process would be discharged to Killarney Lake via the existing intake line. This process wastewater would contain elevated levels of calcium, magnesium, and sodium. Filter backwash from the manganese greensand filters would be discharged to Killarney's wastewater treatment lagoon, as occurs with the existing water treatment plant. The existing water tower and water plant equipment would be decommissioned when the new system is operational. The new reservoir would be connected to the existing 1.8 megalitre reservoir for a total of 4.0 megalitres of storage. Once the proposed system was completed, the Town of Killarney would no longer use Lake Killarney as a water source. Construction of the system is proposed to occur in 2010."

The Proposal was advertised in The Killarney Guide on March, 27, 2009. It was placed in the Main, Millenium Public Library, Eco-Network and Lakehead Regional Library (Killarney) public registries. The Proposal was distributed to TAC members on March 20, 2009. The closing date for comments from members of the public and TAC members was April 20, 2009.

**COMMENTS FROM THE PUBLIC:**

**Ben Neufeld**

I would just like to put in my 2 cents on this issue. Even though I live nowhere near Turtle Mountain, I see in the proposal that "Treated water would also be chlorinated". I realize that adding chlorine helps keep down bacterial levels in water, but there has got to be a better way of getting "clean" water, like Hydrogen peroxide or ozone treatment.

Chlorinated water has been shown to:
-more than double the risk of bladder and rectal cancers in certain individuals (Epidemiology 1998;9(1):21-28, 29-35) -alter and destroy unsaturated essential fatty acids (EFAs), the building blocks of people's brains and central nervous systems.
-react with organic compounds in water to produce trihalomethanes (THMs) such as carcinogenic (cancer originating) chloroform and carbon tetrachloride -In a study of more than 5,000 pregnant women in the Fontana, Walnut Creek and Santa Clara areas of California, researchers from the state health department found that women who drank more than five glasses a day of tap water that contained over 75 parts per billion of THMs had a 9.5 percent risk of spontaneous abortions, i.e. miscarriage.
-and the list goes on....

I would encourage everyone to educate themselves about the issue of chlorinating our drinking water, it's a very serious issue! A very good link to start with would be http://blogs.mercola.com/sites/articles/archive/2001/01/07/chlorinated-water.aspx

Disposition:
Chlorination is an acceptable method of disinfection for drinking water. Switching sources from lake water to groundwater will reduce the incidence of trihalomethanes (THMs).

**Frank Render**

I point out that while a Provincial employee I have worked on groundwater in the Killarney area. I currently am not affiliated or work for anyone – my concern is for the proper development of the aquifer and groundwater supplies from it. I am also concerned about the longevity of the aquifer complex groundwater supplies developed for the region. I think of the aquifer features in this region as the Manitoba extension of the Spiritwood Aquifer.

Comments:

1) The fact that the presenters are asking for 750 ac/ft of water per annum for a Town of 2500 residents strikes the reader as unusual.

2) Very little new test drilling seems to have been done to define the geologic structure of the aquifer formation that the pumping well was sited in. It appears little was done to try and assess if there were better sites for the water supply site and/or if this in fact was the best site. There really is not sufficient data to determine the outline of the area underlain by the aquifer. Thus it is virtually impossible to sketch an aquifer outline or an aquifer thickness diagram. Therefore the continuity of the aquifer is in question. One of the values of an aquifer thickness diagram is that the amount of groundwater stored in the aquifer can be estimated. Another example of a deficiency, is that while a depth to bedrock map is provided the data was not used to draw a bedrock surface elevation map. Such a map would have helped in assessing the possible layout of the aquifer. Another problem is that the geologic cross-sections extend over large distances and are supported by few geologic testholes. For example in the case of section A-A, fig. 7; a large zone of till is shown without any testhole support. Further, this section shows the sand and gravel deposits terminating and till extending to the northern end of the section without any testhole support. Cross-section B-B Fig. 8, has similar deficiencies. Due to the distances covered on small scale simplified sketchs these deficiencies are masked.

Of course the weakness in the test drilling for this project work also relates to the water quality problems as few test well and samples were available for testing.

3) Pumping test. The pumping test for a production well to pump 400 gpm or 750 ac/ft per year is limited. This is especially true for development in a relatively unknown aquifer. For one thing a test of only 24 hours is limited; 72 hours or more would be in the proper range. The longer test would help define hydraulic problems with the aquifer and the water quality coming from it. The test drawdown diagrams suggest that negative boundaries were affecting the data during the test. Once the test arrangements are established pumping for additional time is relatively easy. There is only one observation well established by the presenters in one direction. The other relatively close observation well was already in being. The third distant observation well is an established well.. This well is also close to an established but unused pumping well; which was also used in the test. That is very little work was done by the presenters to enhance the test work. For some reason semi-log time drawdown plots were not presented – these plots tend to emphasize the occurrence of aquifer boundaries. It is noted that the choice of Transmissivity values from the test analysis presented range from 46,000gal/ft/d to 99,000 gal/ft/day?

For a test of this magnitude there should be the standard cross layout of of observation wells. Atleast 3 wells on each side of the pumping well; laid out on a line parallel to the main length of the aquifer. Further atleast two observation wells on each side of the pumping well; set out perpendicular to the long axis of the test. The spacing of the observation wells should be based on the considered structure of the aquifer and its probable hydraulic characteristic range. If sufficient geologic data were available to define the structure and boundaries of the aquifer then one would anticipate that the long axis of the test would parallel the length of the aquifer. In vertical siting one would expect these wells to be of similar screen length and positioning to the pumping well. In this manner probable boundaries of the formation and their affects on long term pumping

could be assessed. As stated below additional observation wells for both groundwater hydraulics and groundwater chemistry could be sighted at various distances and depths in the formation.

4) Water chemistry: There are too few observation wells to truly determine the variations in water chemistry of this formation. As stated above more test holes should have been done to define the aquifer structure. Groundwater quality test wells could then have been assessed and established. The one attempt to determine the vertical chemistry of the aquifer water by sampling from a screen moved down and up in the same borehole leaves much to be desired. In this approach there is no way of knowing how much water from various parts of the single borehole was mixed in each sample. In order to do this work properly – considering the long term investment in the pumping well, pipeline and water treatment plant infrastructure several ( atleast 4) short screened observation wells should have been set at various depths and properly grouted in place. Then these wells could be sampled a few days after installation and then a month or so later ( atleast several days later). If properly sited these observation wells could then be used to observe water level and water chemical changes in the aquifer during the pumping tests. A serious point to consider is that the data provided with the presentation indicates that the water quality from the pumping well was tending to deteriorate over the 24 hours of pumping. Further: he one significant pumping well, the loading station, located in similar aquifer conditions, some two miles from the presenters test site has shown an EC value of 2000uS/cm. There does not appear to be any recent data on the quality of water from the loading station well.

5) The proposed water treatment system also appears to be planning to get rid of the waste concentrate from the Reverse Osmosis unit by discharging it into the nearby surface water body. No alternative method appears to have been examined. Is this procedure going to become the method in Manitoba?

6) Even though there are a number of groundwater level observation points scattered across the area targeted for the proposed pumping well no attempt seems to have been made to develop a piezometric map for the aquifer. As a consequence there is no assessment of the directions of groundwater flow within the aquifer system. The direction of groundwater flow would seem to be important to assessing the prospects of groundwater recharge and the likelyhood of the water quality in the pumping well deteriorating. However, more observation wells would have allowed the preparing of a comprehensive piezometric map. Some more observation points should have been attempted. This would have improved the prospects for aquifer flow system analysis. Thus some attempt at recharge evaluation could have been possible.

7) There is a section of the report that the presenters call “forward modelling”. The work presented is not really groundwater modeling as usually thought of. Due to the lack of aquifer definition data it would be virtually impossible to develop a computer groundwater model such as Modflow methods provided by the United States Geological Survey. The groundwater calculations done to develop the time drawdown chart projections provided by the presenters could have been done 50 years ago before

computers came into fashion. Whatever way the calculations are done their values depend on the accuracy of the pumping test work.

**Errata:**

One of the omissions that stands out is that while an examination of Map Fig.15 in Groundwater in Manitoba by Betcher, Grove and Pupp;1995 shows the aquifer complex, part of which is presented here, extending to the United States border just 18 miles south of the test site; where it butts against the northern extension of the Spiritwood Aquifer (various United States Geological Survey and State of North Dakota Groundwater Documents). This connection of the aquifer complex in question is not mentioned. The Spiritwood Aquifer in the United States has been defined for over fourty years. The Manitoba aquifer system shown on the Betcher etal map is certainly a part of the Spiritwood aquifer. The Spiritwood aquifer extends from southern Manitoba through North Dakota and into South Dakota. Throughout its length it has similar characteristics of sand and gravel deposits interlayered with glacial tills; to what is known so far about the complex in Manitoba. There may be international agreements that are affected by this proposal? Considering the technical work on and standing the Spiritwood Aquifer system has in the United States, I can not see why one would wont to start calling it another name in Canada.

Disposition:

Additional information was requested from the proponent. The proponent provided information that adequately addressed concerns.

## COMMENTS FROM THE TECHNICAL ADVISORY COMMITTEE:

**Sustainable Resource & Policy Management Branch** The proposed water pipeline is adjacent to a Ducks Unlimited of Canada (DUC) owned parcel. DUC should be contacted to ensure no habitat disturbance results due to the proposed pipeline.

Disposition:

Comments were forwarded to the proponent for information.

**Parks and Natural Areas Branch** No comments

**Western Regional Operations Office in Brandon** Membrane concentrate from the reverse osmosis process would be discharged to Killarney Lake via the existing intake line. The process wastewater would contain elevated levels of calcium, magnesium and sodium but does not mention their projected or relative concentrations. I think we need to know what's in the discharge and their concentrations. With that said there could be a clause in the license incorporating a quarterly/annual sampling of the discharge so that it meets applicable guidelines and once we are satisfied with the process (ie consistent manageable concentrations) the license can be revised and testing be removed from the license.

Question: Would the decommissioning of the existing plant be included in the license. If so the waste streams from this process would have to go to the proper licensed facilities.

Disposition:

Additional information was requested from the proponent. Comments can be addressed via licence conditions.

**Manitoba Water Stewardship**

- The Water Rights Act indicates that no person shall control water or construct, establish or maintain any "water control works" unless he or she holds a valid licence to do so. "Water control works" are defined as any dyke, dam, surface or subsurface drain, drainage, improved natural waterway, canal, tunnel, bridge, culvert borehole or contrivance for carrying or conducting water, that temporarily or permanently alters or may alter the flow or level of water, including but not limited to water in a water body, by any means, including drainage, OR changes or may change the location or direction of flow of water, including but not limited to water in a water body, by any means, including drainage. If a proposal advocates any of the aforementioned activities, an application for a Water Rights Licence to Construct Water Control Works is required. Application forms are available from any office of Manitoba Water Stewardship.
- The proponent needs to be informed that if the proposal in question advocates any construction activities, erosion and sediment control measures should be implemented until all of the sites have stabilized.
- The Department may provide comments pertaining to hazard lands at a later date.
- Currently, the Department's hazard land personnel are seconded to the emergency flood coordination efforts.
- With respect to Section 5.3 relating to surface water
    - During construction, all efforts must be made to avoid impacts to both semi permanent and permanent wetlands. When crossing or working within the natural boundaries of semi permanent and permanent wetlands, construction techniques to minimize disturbance must be implemented.
- Killarney Lake is a recreationally fished body of water. It is also considered highly eutrophic due to accelerated nutrient loading, resulting in periodic winterkills. Substantial resources have been invested in trying to minimize these fish kills from occurring and improve water quality through the use of an aeration system.
    - The Department has concerns pertaining to the membrane concentrate that will be discharged into Lake Killarney.

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        - Will the temperature of the discharge be warmer than the receiving water during the winter months?
        - If the temperature is warmer, what is the size of the discharge plume and is there the potential to have a negative impact on fish and invertebrates should it need to be shut down?
        - How far from shore and in what depth of water is the current intake?

- The proponent has indicated they will conduct long term water quality monitoring on Killarney Lake. If answers to the above are not know perhaps this could be part of their initial monitoring.

- Regarding the pipeline construction

  - The proponent has indicated that they will directional drill all watercourse crossings from outside of the riparian zone and in accordance to the Manitoba Water Services Board's Standard Construction Specifications and the Operational Statements of the Department of Fisheries and Oceans.
  - The proponent should follow the frac-out emergency plan included in the Manitoba Water Services Board's Standard Construction Specifications.
  - The proponent does also indicate that Manitoba Water Services Board's Standard Construction Specifications and a Isolated and Dry Open Cut Stream Crossings Operation Statement of the Department of Fisheries and Oceans do permit intermittent drains to be crossed by open cut trenching.

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- The Department requests verification that the main creek identified in the aerial provided in the proposal will be directional drilled and that the reference to open cut trenching is to smaller drains.

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- Also a monitoring program should be in place if open cut trench is used on the intermittent drains to ensure these areas remain stable.

- The Environment Act Proposal does not include the full context of information that was included in the submission to the Water Use Licensing Section, Manitoba Water Stewardship. The report submitted to the Water Use Licensing Section should have been included as an attachment to the Environment Act Proposal.

- The sand and gravel aquifer being considered for development is highly confined by about 50 metres of locally-derived till which would be expected to have a very low hydraulic conductivity and effectively isolate the aquifer from the near-surface over long time periods. The aquifer has also been shown to be quite extensive, extending for kilometers and locally exceeding 50 metres in thickness. Support for the extensive continuity of the aquifer is provided, to some degree, by observing water level responses to the pumping test in relatively distant provincial observation wells. The lateral boundaries of the aquifer are somewhat uncertain but, given the established broad extent of the aquifer, this is not considered to be a significant issue for this proposed development.

- The following comments regard the test work that was undertaken, recommendations made, and some of the science aspects of the proposal:

  - The consultant for the proponent has equated water quality with groundwater age, stating that the upper fresher groundwater is considered to be younger

than the lower poorer quality groundwater. This is not necessarily correct although in the context of this aquifer one might expect it to be a reasonable assumption. Nonetheless, given the highly confined nature of the aquifer, these groundwaters are likely very old, perhaps the original waters contained within the sediments during deposition as has been found for other similar aquifers in Manitoba.

- Although water quality does deteriorate somewhat with depth, the water quality in the lower parts of the aquifer is not so different from the upper parts of the aquifer as to cause concern. The proponent's consultant is likely correct that water quality from the pumping well will stabilize quickly. Nonetheless, the careful monitoring of water quality in the early stages of development is a sound recommendation.

- The consult's report states that seasonal and longer term water level changes recorded in observation wells are evidence of active recharge occurring, although the magnitude of recharge has not been estimated. Given the highly confined nature of the aquifer and the expected very low hydraulic conductivity of the surrounding tills, it is difficult to imagine significant recharge occurring to the aquifer under undeveloped conditions (perhaps suggesting a thinner till cover over the aquifer nearby?). Consequently, the assumption of no recharge occurring that was made in calculating the 20-year drawdown predictions is probably reasonable. However, development of a local drawdown cone once development begins will induce leakage of groundwater from the confining materials which will lessen the drawdown impacts. Unfortunately the pumping test was only 24 hours in duration so leakage effects could not be evaluated.

- The pumping test was only 24 hours in duration. In this type of situation it would have been appropriate for a longer test to have been undertaken to look for boundary effects and leakage.

- The proponent's consultant should have discussed the interpretation of the pumping test data in somewhat greater detail, specifically the meaning of the deviations of the drawdown/recovery data from the theoretical curves and whether this may indicate that the aquifer will respond in a less predictable manner than has been presented.

- The proposed groundwater level monitoring plan is well considered, particularly the recommendation for water level monitoring in the three relatively distant provincial observation wells. In highly confined aquifers and where there is significant heterogeneity, monitoring of "aquifer" rather than just local responses to pumping is necessary to allow for adaptive management and, eventually, a better assessment of the long-term sustainable yield of the aquifer.

- In summary, while some questions remain about the proposal, as has been pointed out by the proponent's consultant, a certain degree of uncertainty is inherent in virtually all groundwater development proposals. In this case, it is the Department's opinion that despite some limitations/uncertainties in the Environment Act Proposal, the proponent has established a reasonably detailed understanding of the aquifer and expected impacts from pumping, has shown that pumping would very likely be sustainable over the long term, and has proposed a well considered monitoring program. The Department recommends that additional work is not needed prior to approving and issuing an Environment Act Licence, the proposed monitoring must be conducted.

- Since a significant portion of the monitoring relies on provincial observation wells it would seem appropriate for the proponent to enter into a written agreement with the Province regarding the long-term operation of these wells to provide monitoring information for the proposed development. A contact person is [Contact given].

Disposition:

Additional information was requested from the proponent. The proponent provided information that adequately addressed concerns. Some comments can be addressed via licence conditions.

**Historic Resources Branch** No concerns.

If at any time however, significant heritage resources are recorded in association with these lands during development, the Historic Resources Branch may require that an acceptable heritage resource management strategy be implemented by the developer to mitigate the affects of development on the heritage resources.

Disposition:

Comments were forwarded to the proponent for information.

**Mines Branch** No concerns.

**Manitoba Infrastructure and Transportation** No concerns.

**Community Planning Services Branch**

1. upgrading the Killarney water supply system has been a municipal goal for some time because of difficulties over the years of using the surface waters of Killarney Lake as the source for the Town's water
2. the recent discovery of a ground water source with an ample supply of good quality water has been welcome news for local residents
3. the report by W. L. Gibbons and Associates is a wealth of information about the proposed upgrading of the Killarney water supply system but does contain one glaring error --it would seem that the new water treatment plant will be located along Young Street next to the existing facility on the north shore of Killarney Lake (and not along

Lakeshore Drive on the south shore as recorded in the report and the newspaper advertisement)

4. Figure 1.2: Proposed Raw Water Pipeline Route in the report does show the proposed pipeline terminating at the Young Street site of the existing water facility on the north shore of the Lake
5. the pipeline is proposed to be located within the public road right-of-way in both rural and urban areas of the municipality
6. that same report does not contain site plans for the new water treatment plant or the well site
7. the local zoning by-laws do apply to the rural and urban components of the proposed water supply development
8. the well site is located on the SW Quarter of Section 21-3-16 West which is northeast of Killarney in the rural areas of the municipality within the Agriculture General "AG80" Zone and subject to the General Provisions section of the zoning by-law which allows for the development of public utilities and facilities
9. the well site is located in a rural area populated by family farms which focus on production of livestock and annual crops --there is a small cattle operation located about a mile west of the well site and a large dairy operation located about 1.5 miles north
10. the water treatment plant site is located in Killarney along Young Street on property zoned as "O" Open Space --this zone allows public utilities and public works including pipelines as permitted uses --the zoning by-law does not include required yard or minimum parcel size requirements for the proposed development
11. the water treatment plant is surrounded on three sides by existing residential development and on the south by the lake shoreline
12. in it's review of the proposal, CPS did not identify any land use planning issues with the proposed water supply upgrading proposal or the intended development (including the well site, the pipeline, and the water treatment plant)

**Medical Officer of Health – Assiniboine and Brandon RHAs** Effects on human health and well being are expected to be positive as parameters that currently exceed Guidelines for Canadian Drinking Water Quality will be addressed through the proposed upgrade.

**Canadian Environmental Assessment Agency** I have completed a survey of federal departments with respect to determining interest in the project noted above. I can confirm that the project information provided has been reviewed by all federal departments with a potential interest. I am enclosing copies of all the responses for your file.

Based on the responses to the federal survey, the application of the Canadian Environmental Assessment Act (the Act) may be required for this project. Through the delivery of the Communities Component of the Building Canada Fund, Western Economic Diversification (WD) may provide federal funding to this project.

Environment Canada (EC) provided comments for consideration. Health Canada (HC) can provide specialist advice, if specifically requested. Natural Resources Canada (NRCan) may provide expertise, if requested.

Additionally, the Canadian Transportation Agency (CTA) has notified us that an environmental assessment under the Act may be necessary. The CTA has indicated that they require the status of any agreements between the utility authority and any federally regulated railway relating to crossings before they can determine their environmental responsibilities for this project. The CTA contact for this project is [Contact given].

Disposition:

WD, EC, the CTA, and CEAA will be included on the TAC for the project.

**ADDITIONAL INFORMATION:**

Additional information was requested from the proponent on April 28, 2009.

A satisfactory response was received on May 20, 2009 (dated May 19, 2009) and is attached to this summary.

**PUBLIC HEARING:**

No requests were received for a public hearing. Accordingly, a public hearing is not recommended.

**RECOMMENDATION:**

All provincial comments received on the Proposal can be addressed as licence conditions, or have been forwarded to the Applicant's representative for information. Therefore, it is recommended that the Development be licensed under The Environment Act subject to the limits, terms and conditions as described on the attached Draft Environment Act Licence. It is further recommended that enforcement of the Licence be assigned to the Western Region.

PREPARED BY:
Holly Poklitar
Environmental Assessment and Licensing -Environmental Land Use Section
May 28, 2009; updated June 2, 2009
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W.L. Gibbons & Associates Inc.
64 St. Andrew Road Winnipeg, MB R2M 3H6

May 19, 2009 File: Killarney

MB Conservation
Environmental Assessment & Licensing Branch
Suite 160, 123 Main Street
Winnipeg, MB R3C 1A5
Attention: Ms. Holly Poklitar

Dear Ms. Poklitar:

**RE: Municipality of Killarney – Turtle Mountain**
**Water Supply Upgrading Program**
**MB Environment Act Class 2 EAP Submission**
**Follow-up Information**

On behalf of the Municipality of Killarney – Turtle Mountain, W.L. Gibbons and Associates Inc. is submitting the following supplementary information in response to your letter request of April 28, 2009.

**Item 1 – Response to Mr. Frank Renders Comments**

As requested in your letter of April 28, 2009, we are providing the following supplementary information concerning Queries Number 1-4, 6 and 7.

**Query 1** – The method of determination of the forecast 20 year design water requirement for this system is documented in full in Section 1.2 of the Environment Act Proposal (EAP). This demand projection was prepared by the Manitoba Water Services Board (MWSB) using currently accepted procedures and standards for this type of forecast.

**Query 2** – The interpretation of the geology of the area was completed in consideration of all available information including all previous and current test holes. For simplicity and clarity, only select test holes are illustrated on the figures included in the reports for this project. The full set of test hole logs is publicly available from the GWDrill database maintained by the Groundwater Management Section (GMS) of MB Water Stewardship. Reviewers of the report who wish to complete a more in-depth review of the information are encouraged to obtain a complete set of the logs for this area, to supplement the information provided. Furthermore, it is recognized that the full extent of the aquifer has not been defined, nor is it a requirement of the provincial approvals process that the full extent be defined. Our professional opinion is that the extent of the potential groundwater resource has been sufficiently defined to support approvals for a project of this nature. We note that GMS in their review of the proposal also commented on the uncertainty inherent in all groundwater development proposals and concur that sufficient definition of the potential resource has been provided to support this proposal (see MB Water Stewardship comments dated April 28, 2009).

**Query 3** – The pumping test met or exceeded the requirements of Manitoba Form H – Requirements for High Capacity Aquifer Pumping Tests to Support Applications For Water Rights Licenses (Copy Appended). This includes the flow rate and duration requirements, as well as the requirements for observation wells and water level readings. The pumping test methodology also meets or exceeds the appropriate ASTM standards for pumping tests as well as Best Practices for tests of this nature.

**Query 4** – As with the extensive test hole information for this area, for simplicity and clarity only the results of specific water quality tests directly relevant to this investigation has been included in this report. Additional water quality information from this area is publicly available from the databases maintained by the Groundwater Management Section (GMS) of MB Water Stewardship. Reviewers of the report who wish to complete a more in-depth review of the information are encouraged to obtain a complete set of the water quality data for this area, to supplement the information provided. With regards to the allegations that water quality was deteriorating during the 24 hour pumping test, we note that there is no substantive evidence of significant deterioration in water quality in the results from either the 2008 24 hour pumping test, or the 2007 24 hour pumping test. As noted in the Groundwater Assessment Study, minor changes did occur and are considered normal. We note that GMS in their review of the proposal also commented on the water quality distribution in the aquifer and concurred that the water quality will likely stabilize quickly following the initiation of long term pumping (see MB Water Stewardship comments dated April 28, 2009).

**Query 6** – As discussed on Page 13 of the Groundwater Assessment Study, the groundwater flow direction is to the north to northeast towards the Pembina River Valley. This section of the report also includes discussion of the recharge and discharge mechanisms active in this aquifer.

**Query 7** – To quote Dr. E. Poeter from her 2006 Cross Country Darcy Lecture, "Hydrogeology is modeling, starting from the moment a hydrogeologist stands on a hil and develops a concept of the system; continuing with the application of an analytical model such as Darcy's Law, the Theis equation, or chemical equilibria; and sometimes extending to elaborate numerical models." The "forward modeling" utilized in this analysis involves the use of accepted analytical modeling methods for a project of this nature. As noted by Mr. Render, there is insufficient information to undertake a more elaborate numerical modeling exercise for this project. Nor is such an elaborate exercise considered warranted for a project of this nature.

**Item 2 – Reverse Osmosis Membrane Reject Concentrations**

MWSB has the primary responsibility for the design of the water treatment system and has provided the following estimates of the requested concentrations: $CaCO_3$ – 1,380 mg/l; $MgCO_3$ – 825 mg/l; and, $NaCO_3$ – 825 mg/l. Based on a 20 year projected water demand, the concentrate flow is 3 L/s over a 20 hour period. Initially, it is estimated that the concentrate flow would be 3 L/s over a 12 hour plant run time.

**Item 3 – Reverse Osmosis Membrane Reject Temperatures**

MWSB estimates that the membrane reject stream would have a temperature of 5 to 7 degrees Celsius.

**Item 4 – Creek Crossings**

All creek crossings will be drilled as per standard MWSB creek crossing procedures.

We trust that you will find this information to be sufficient to issue the requested Class 2 Environment Act License. If you have any questions or require further information, please contact the undersigned at (204) 771-4389 or swiecek@mts.net.

Sincerely,

Steve Wiecek, P.Geo., P.Eng.
Senior Geologic Engineer
swiecek@mts.net

SJW/sw

cc: Mr. Jim Dowsett – CAO – Killarney – Turtle Mountain
Mr. Dave Shwaluk, P. Eng. - MWSB

FORM H

# Requirements for High Capacity Aquifer Pumping Tests to Support Applications for a Water Rights Licence

Manitoba Conservation
Water Branch

200 Saulteaux Crescent
Winnipeg, Manitoba
R3J 3W3

## FLOW RATE

The flow rate should be kept as constant as possible and should be monitored at least every hour during the test. The flow should be monitored by a device such as a standard orifice meter or a weir box capable of reading the rate to within five percent accuracy. Also, it is desirable that the pumping rate be as close to the desired licence pumping rate as conditions permit.

## DISPOSAL OF WATER

Water from the pumped well should be disposed of in such a manner as to prevent recirculation to the water bearing zone being tested.

## OBSERVATION WELLS

Where the water bearing zone being tested is buried under a substantial thickness of low permeability material, one observation well should be established at a distance from the pumped well equal to twice the thickness of the water bearing zone being tested, but not further than 91 metres.

Where the water bearing zone being tested is not buried under a substancial thickness of low permeability material, two observation wells should be established in the lower part of the water bearing zone being tested, one being 9 to 12 metres from the pumped well and the other being 24 to 30 metres from the pumped well. Preferably both wells should be established in the same direction from the pumped well.

## WATER LEVEL READINGS

**Timing:**

Very careful observation of time is essential to obtaining accurate test data. The water level readings in the pumped and observation well(s) should be measured at the same instant for the first hour of the test and should be measured as close to the same time as possible for the remainder of the pumping time.

During the first ten minutes of the test the water levels should be read every minute. During the next ten minutes water levels should be read every two minutes. Thence, the water levels should be read once every five minutes until the first hour of testing has elapsed. For the next hour, readings should be taken every 15 minutes. Then for the following two hours, the water levels should be recorded once every half hour. Thence, water levels should be recorded once an hour until the test is completed.

**Measurement:**

The water level measurements within the observation wells should be recorded with engineering or construction type measuring tapes or preferably with electric measuring tapes commonly used in ground-water observation work. The readings in the observation wells should be measured to within 0.3 centimetres accuracy. In the pumping well, water levels should be recorded either with an electric water level measuring taped or with an airline water level measuring device. The readings in the pumping well should be measured to 3.0 centimetres.

## DURATION OF THE TESTING

The pumping test should be run at the same continuous pumping rate until equilibrium conditions are reached or for a minimum of 24 hours. Equilibrium conditions exist when the waters levels in all observation wells have remained stable for at least six hours. If, at the end of the 24 hours equilibrium conditions have not been reached, the test should continue at the established pumping rate until these conditions are reached; or a total time of 48 hours has elapsed.

OR

The duration of the pumping test may be as otherwise directed by the Director, Water Branch or his Agents.

## RECOVERY TEST

Once the pumping interval of the test has been completed, the recovery water levels in the pumping and the observation wells should be recorded in exactly the same manner, particularly with respect to timing of the readings, as the drawdown readings, for a period equal at least to the duration of the pumping test or until the water levels have returned to normal.

## GENERAL

The above test work is required in order to assess the functioning of the pumping well and more importantly the capability of the aquifer to sustain the withdrawal rate that has been requested. The data collected will help make sure that a viable water supply system is established prior to proceeding with full scale development. The information will also be available should there be problems with the pumping well in the future. The original data can also be used to assess future aquifer problems.

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