8 RECOMMENDATIONS

The present study has been based on information available from the groundwater database. The database has three problems:

1) the quality of the data;
2) the coordinate system used for the horizontal control; and
3) the distribution of the data.

The quality of the data in the groundwater database is affected by two factors: a) the technical training of the persons collecting the data; and b) the quality control of the data. The possible options to upgrade the database include the creation of a “super” database, which includes only verified data. The level of verification would have to include identifying the water well in the field, obtaining meaningful horizontal coordinates for the water well and the verification of certain parameters such as water level and completed depth. An attempt to update the quality of the entire database is not recommended.

The results of the present study indicate that the only readily identifiable aquifer in the surficial deposits is the sand and gravel deposit associated with the Buried Egremont Valley, identified by PFRA in 1995 (CAESA, 1996). There are indications that significant aquifers may be present in the bedrock. These include the Milan Aquifer and sandstone channels in the *continental* Foremost Formation.

The Milan Aquifer could be developed for domestic supplies in the northern two-thirds of the County. However, in the southwestern part of the County, the Aquifer is absent and in the southeastern part of the County, the groundwater would have limited uses without treatment because of the high TDS and high concentrations of chloride ion. It is recommended that a test-drilling program be completed to evaluate the significance of this Aquifer in the County of Thorhild. The program could involve areas where only limited groundwater supplies are available from shallower aquifers; one such area could be northeast of Thorhild where little or no groundwater is available from upper bedrock aquifers.

Sandstone channels exist within the *continental* Foremost Formation. However, because of the regional nature of the present study, identification of individual channels is not possible. Therefore, it is recommended that all existing geophysical logs available for the areas where the *continental* Foremost Formation is present be interpreted in an attempt to delineate where the sandstone channels are expected. After the channels have been delineated, a test-drilling program should be completed to evaluate the method as a means of identifying the location of significant aquifers within the *continental* Foremost Formation.

Another area of concern is the determination of a groundwater budget. There are no observation water-well data to obtain water levels for the groundwater budget. One method to obtain additional water-level data is to solicit the assistance of the water well owners who are stakeholders in the groundwater resource. In the M.D. of Rocky View, water well owners are being provided with a tax credit if they accurately measure the water level in their water well once per week for a year. A pilot project indicated that approximately five years of records are required to obtain a reasonable data set. The cost of a five-year project involving 50 water wells would be less than the cost of one drilling program that may provide two or three observation water wells.

In general, for the next level of study, the database needs updating. It requires more information from existing water wells, and additional information from new ones.

Before an attempt is made to upgrade the level of interpretation provided in this report and the accompanying maps and groundwater query, it is recommended that all water wells for which water well drilling reports are available be subjected to the following actions:

1. The horizontal location of the water well should be determined within 10 metres. The coordinates must be in 10TM NAD 27 or some other system that will allow conversion to 10TM NAD 27 coordinates.
2. A four-hour aquifer test should be performed with the water well to obtain a realistic estimate for the transmissivity of the aquifer in which the water well is completed.
3. Water samples should be collected for chemical analysis after 5 and 115 minutes of pumping, and analyzed for major and minor ions.

In addition to the data collection associated with the existing water wells, all available geophysical logs should be interpreted to establish a more accurate spatial definition of individual aquifers.

There is also a need to provide the water well drillers with feedback on the reports they are submitting to the regulatory agencies. The feedback is necessary to allow for a greater degree of uniformity in the reporting process. This is particularly true when trying to identify the bedrock surface. The water well drilling reports should be submitted to the AEP Resource Data Division in an electronic form. The money presently being spent by AEP and Prairie Farm Rehabilitation Administration (PFRA) to transpose the paper form to the electronic form should be used to allow for a technical review of the data and follow-up discussions with the drillers.

An effort should be made to form a partnership with the petroleum industry. The industry spends millions of dollars each year collecting information relative to water wells. Proper coordination of this effort could provide significantly better information from which future regional interpretations could be made. This could be accomplished by the County taking an active role in the activities associated with the construction of lease sites for the drilling of hydrocarbon wells and conducting of seismic programs.

Groundwater is a renewable resource and it must be managed.

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10 GLOSSARY

Apparent Yield	a regional analysis term referring to the rate a properly completed water well could be pumped, if fully penetrating the aquifer.
Aquifer	a formation, group of formations, or part of a formation that contains saturated permeable rocks capable of transmitting groundwater to water wells or springs in economical quantities.
Aquitard	a confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer.
Available Drawdown	in a confined aquifer, the distance between the non-pumping water level and the top of the aquifer. in an unconfined aquifer (water table aquifer), two thirds of the saturated thickness of the aquifer.
Facies	the aspect or character of the sediment within beds of one and the same age (Pettijohn, 1957).
Fluvial	produced by the action of a stream or river.
Hydraulic Conductivity	the rate of flow of water through a unit cross-section under a unit hydraulic gradient; units are length/time.
Lacustrine	fine-grained sedimentary deposits associated with a lake environment and not including shore-line deposits.
Surficial Deposits	includes all sediments above the bedrock.
Transmissivity	the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient: a measure of the ease with which groundwater can move through the aquifer. Apparent Transmissivity: the value determined from a summary of aquifer test data, usually involving only two water-level readings. Effective Transmissivity: the value determined from late pumping and/or late recovery water-level data from an aquifer test. Aquifer Transmissivity: the value determined by multiplying the hydraulic conductivity of an aquifer by the thickness of the aquifer.

COUNTY OF LAMONT NO. 30

Appendix B

MAPS AND FIGURES ON CD-ROM

CD-ROM

A) Database
B) ArcView Files
C) Query
D) Maps and Figures

1) General

Index Map
Location of Water Wells
Depth of Existing Water Wells
Bedrock Topography
Bedrock Geology
Cross-Section A - A'
Cross-Section B - B'
Geologic Column
Generalized Cross-Section
Risk of Groundwater Contamination
Relative Permeability

2) Surficial Aquifers

a) Surficial Deposits

Thickness of Surficial Deposits
Amount of Sand and Gravel in Surficial Deposits
Thickness of Sand and Gravel Aquifer
Non-Pumping Water Level in Water Wells Shallower than 15 metres
Non-Pumping Water Level in Surficial Deposits
Apparent Yield for Water Wells Completed through Sand and Gravel Aquifer
Total Dissolved Solids in Groundwater from Surficial Deposits
Sulfate in Groundwater from Surficial Deposits
Chloride in Groundwater from Surficial Deposits
Piper Diagram - Surficial Deposits

b) First Sand and Gravel

Thickness of First Sand and Gravel
Saturated First Sand and Gravel

c) Upper Sand and Gravel

Thickness of Upper Surficial Deposits
Thickness of Upper Sand and Gravel
Apparent Yield for Water Wells Completed through Upper Sand and Gravel Aquifer

d) Lower Sand and Gravel

Depth to Top of Lower Sand and Gravel Aquifer
Structure-Contour Map - Top of Lower Surficial Deposits
Thickness of Lower Surficial Deposits
Thickness of Lower Sand and Gravel Aquifer
Apparent Yield for Water Wells Completed through Lower Sand and Gravel Aquifer
Non-Pumping Water Level in Lower Sand and Gravel Aquifer

3) Bedrock Aquifers

a) General

Non-Pumping Water Level in Upper Bedrock Aquifer
Apparent Yield for Water Wells Completed in Upper Bedrock Aquifer
Total Dissolved Solids in Groundwater from Upper Bedrock Aquifer
Sulfate in Groundwater from Upper Bedrock Aquifer
Chloride in Groundwater from Upper Bedrock Aquifer
Piper Diagram - Bedrock Aquifers
Recharge/Discharge Areas between Surficial Deposits and Upper Bedrock Aquifer

b) Bearpaw Aquifer

Depth to Top of Bearpaw Formation
Structure-Contour Map - Top of Bearpaw Formation
Non-Pumping Water Level - Bearpaw Aquifer
Apparent Yield for Water Wells Completed through Bearpaw Aquifer
Total Dissolved Solids in Groundwater from Bearpaw Aquifer
Sulfate in Groundwater from Bearpaw Aquifer
Chloride in Groundwater from Bearpaw Aquifer
Piper Diagram - Bearpaw Aquifer
Recharge/Discharge Areas between Surficial Deposits and Bearpaw Aquifer

c) Oldman Aquifer

Depth to Top of Oldman Formation
Structure-Contour Map - Top of Oldman Formation
Non-Pumping Water Level - Oldman Aquifer
Apparent Yield for Water Wells Completed through Oldman Aquifer
Total Dissolved Solids in Groundwater from Oldman Aquifer
Sulfate in Groundwater from Oldman Aquifer
Chloride in Groundwater from Oldman Aquifer
Piper Diagram - Oldman Aquifer
Recharge/Discharge Areas between Surficial Deposits and Oldman Aquifer

d) *continental* Foremost Aquifer

Depth to Top of *continental* Foremost Formation
Structure-Contour Map - Top of continental Foremost Formation
Non-Pumping Water Level - *continental* Foremost Aquifer
Apparent Yield for Water Wells Completed through *continental* Foremost Aquifer
Total Dissolved Solids in Groundwater from *continental* Foremost Aquifer
Sulfate in Groundwater from *continental* Foremost Aquifer
Chloride in Groundwater from *continental* Foremost Aquifer
Piper Diagram - *continental* Foremost Formation
Recharge/Discharge Areas between Surficial Deposits and *continental* Foremost Aquifer

e) Milan Aquifer

Depth to Top of Milan Aquifer
Structure-Contour Map - Top of Milan Formation
Non-Pumping Water Level - Milan Aquifer
Apparent Yield for Water Wells Completed through Milan Aquifer
Total Dissolved Solids in Groundwater from Milan Aquifer
Sulfate in Groundwater from Milan Aquifer
Chloride in Groundwater from Milan Aquifer
Piper Diagram - Milan Aquifer
Recharge/Discharge Areas between Surficial Deposits and Milan Aquifer

f) Lea Park Aquitard

Depth to Top of Lea Park Formation
Structure-Contour Map - Top of Lea Park Formation
Non-Pumping Water Level - Lea Park "Aquitard"
Apparent Yield for Water Wells Completed in Lea Park "Aquitard"
Total Dissolved Solids in Groundwater from Lea Park "Aquitard"

COUNTY OF THORHILD NO. 7

Appendix C

GENERAL WATER WELL INFORMATION

Domestic Water Well Testing

Purpose and Requirements

The purpose of the testing of domestic water wells is to obtain background data related to:

1) the non-pumping water level for the aquifer - Has there been any lowering of the level since the last measurement?
2) the specific capacity of the water well, which indicates the type of contact the water well has with the aquifer;
3) the transmissivity of the aquifer and hence an estimate of the projected long-term yield for the water well;
4) the chemical, bacteriological and physical quality of the groundwater from the water well.

The testing procedure involves conducting an aquifer test and collecting of groundwater samples for analysis by an accredited laboratory. The date and time of the testing are to be recorded on all data collection sheets. A sketch showing the location of the water well relative to surrounding features is required. The sketch should answer the question, "If this water well is tested in the future, how will the person doing the testing know this is the water well I tested?"

The water well should be taken out of service as long as possible before the start of the aquifer test, preferably not less than 30 minutes before the start of pumping. The non-pumping water level is to be measured 30, 10, and 5 minutes before the start of pumping and immediately before the start of pumping which is to be designated as time 0 for the test. All water levels must be from the same designated reference, usually the top of the casing. Water levels are to be measured during the pumping interval and during the recovery interval after the pump has been turned off; all water measurements are to be with an accuracy of ± 0.01 metres.

During the pumping and recovery intervals, the water level is to be measured at the appropriate times. An example of the time schedule for a 4-hour test is as follows, measured in minutes after the pump is turned on and again after the pump is turned off:

1,2,3,4,6,8,10,13,16,20,25,32,40,50,64,80,100,120.

For a four-hour test, the reading after 120 minutes of pumping will be the same as the 0 minutes of recovery. Under no circumstance will the recovery interval be less than the pumping interval.

Flow rate during the aquifer test should be measured and recorded with the maximum accuracy possible. Ideally, a water meter with an accuracy of better than ±1% displaying instantaneous and total flow should be used. If a water meter is not available, then the time required to completely fill a container of known volume should be recorded, noting the time to the nearest 0.5 seconds or better. Flow rate should be determined and recorded often to ensure a constant pumping rate.