II. INTRODUCTION

A. Setting

Mountain View County is situated in south-central Alberta. Most of this area is part of the Alberta Plains region, with the western part of the County being part of the Foothills Belt. The County is within the Red Deer River basin; a small part of the County's northern boundary is the James River. The other County boundaries follow township or section lines. The area includes parts of the area bounded by township 029, range 06, W5M in the southwest and township 034, range 27, W4M in the northeast.

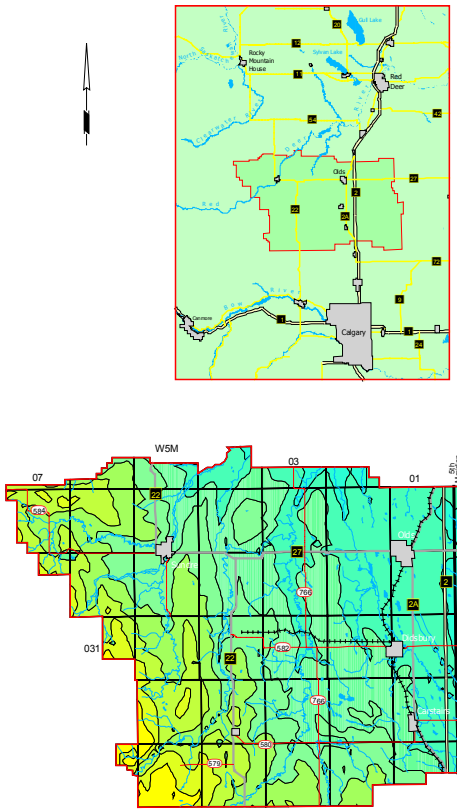

Figure 1. Index Map

Regionally, the topographic surface varies between 900 and 1,350 metres above mean sea level (AMSL). The lowest elevations occur mainly in the eastern part of the County in townships 030 and 31, range 27, W4M and the highest are in the western parts of the County as shown on Figure 1 and page A-2. The area is well drained by numerous streams.

B. Climate

Mountain View County lies within the Dfb climate boundary. This classification is based on potential evapotranspiration[4] values determined using the Thornthwaite method (Thornthwaite and Mather, 1957), combined with the distribution of natural ecoregions in the area. The ecoregions map (Strong and Leggatt, 1981) shows that the County is located in both Low and Mid Boreal Mixedwood regions and the Aspen Parkland region. Increased precipitation and cooler temperatures, resulting in additional moisture availability, influence this vegetation change.

A Dfb climate consists of long, cool summers and severe winters. The mean monthly temperature drops below -3° C in the coolest month, and exceeds 10° C in the warmest month.

The mean annual precipitation averaged from three meteorological stations within the County measured 483 millimetres (mm), based on data from 1962 to 1993. The mean annual temperature averaged 3.1° C, with the mean monthly temperature reaching a high of 15.0° C in July, and dropping to a low of -9.8° C in January. The calculated annual potential evapotranspiration is 495 millimetres.

[4] See glossary

C. Background Information

1) Number, Type and Depth of Water Wells

There are currently records for 7,827 water wells in the groundwater database for the County. Of the 7,827 water wells, 6,908 are for domestic/stock purposes. The remaining 919 water wells were completed for a variety of uses, including industrial, municipal, observation, injection, irrigation, investigation and dewatering. Based on a rural population of 11,277 (Phinney, 1999), there are 2.7 domestic/stock water wells per family of four. It is unknown how many of these water wells may still be active. The domestic or stock water wells vary in depth from 0.60 metres to 177 metres below ground level. Details for lithology[5] are available for 4,882 water wells.

2) Number of Water Wells in Surficial and Bedrock Aquifers

There are 4,114 water well records with sufficient information to identify the aquifer in which the water wells are completed. The water wells that were not drilled deep enough to encounter the bedrock plus water wells that have the bottom of their completion interval above the top of the bedrock are water wells completed in surficial aquifers. Of the 4,114 water wells for which aquifers could be defined, 431 are completed in surficial aquifers, with 80% having a completion depth of less than 30 metres. The adjacent map shows that the water wells completed in the surficial deposits occur mainly in the vicinity of the Town of Sundre in the northwestern part of the County.

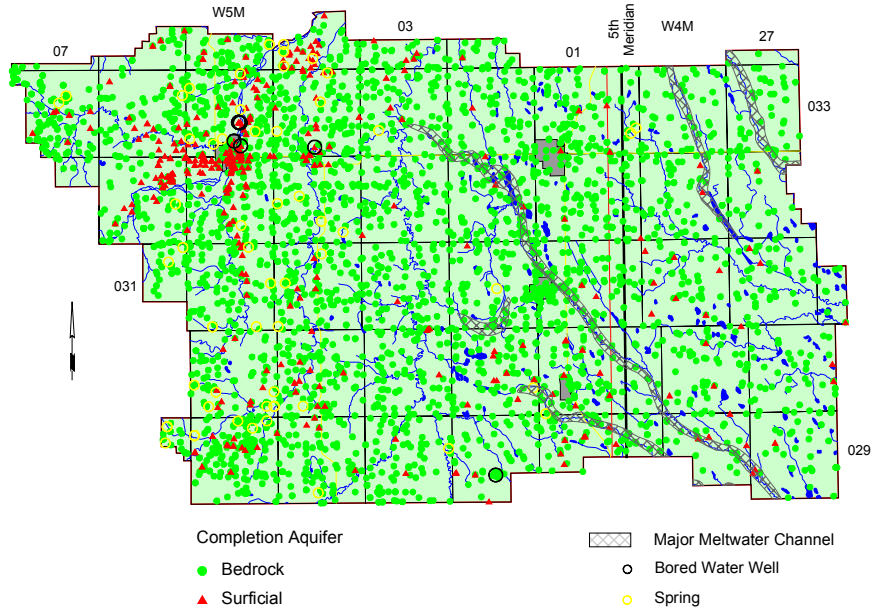

Figure 2. Location of Water Wells

The 3,683 water wells that have the top of their completion interval deeper than the top of the bedrock are referred to as bedrock water wells. From Figure 2, it can be seen that water wells completed in bedrock aquifers occur throughout the County.

There are currently records for 63 springs in the groundwater database, located mainly in the vicinity of the Red Deer River and the Little Red Deer River valleys. Two-thirds of the 27 available chemical values for springs have total dissolved solids (TDS) concentrations of less than 500 milligram per litre (mg/L).

[5] See glossary

3) Casing Diameter and Type

Data for casing diameters are available for 4,777 water wells, with 4,768 (99%) indicated as having a diameter of less than 275 mm and nine having a diameter of more than 275 mm. The casing diameters of greater than 275 mm are mainly bored or dug water wells and those with a surface-casing diameter of less than 275 mm are drilled water wells. There are only nine large-diameter or bored water wells in the County and they are mainly in the areas where major meltwater channels are present in association with major river valleys as shown on Figure 2.

In the County, steel, galvanized steel and plastic represent 99% of the materials that have been used for surface casing in drilled water wells over the last 40 years. Until the 1960s, the type of surface casing used in drilled water wells was mainly undocumented. Steel casing was in use in the 1950s and is still used in 98% of the water wells being drilled in the County in the 1990s. Steel is the main casing type used since surface casing type has been documented.

Galvanized steel and plastic surface casing have been used in less than 2% of the new water wells; galvanized steel was last used in September 1983.

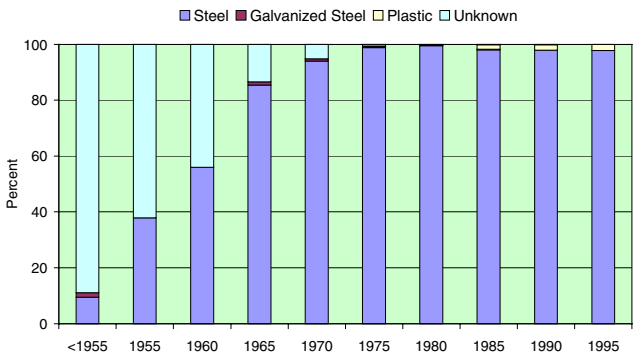

Table 1. Surface Casing Types used in Drilled Water Wells

4) Requirements for Licensing

Water wells used for household needs in excess of 1,250 cubic metres per year and providing groundwater with TDS of less than 4,000 mg/L must be licensed. At the end of 1999, 288 groundwater allocations were licensed in the County. Of the 288 licensed groundwater users, 193 could be linked to the AENV groundwater database. Of the 288 licensed groundwater users, 249 are for agricultural purposes, and the remaining 39 are for municipal, industrial, commercial, recreation, exploration and dewatering purposes. The total maximum authorized diversion from the water wells associated with these licences is 6,519 cubic metres per day (m^3/day), although actual use could be less. Of the 6,519 m^3/day, 51% is allotted for agricultural use, and 40% is allotted for municipal use. The remaining 9% has been licensed for industrial, commercial, recreation and dewatering use as shown in Table 2 on the following page; a figure showing the locations of the licensed users can be found in Appendix A (page A-4) and on the CD-ROM.

The largest potable groundwater allocation within the County is for the Town of Sundre, having a diversion of 1,352 m^3/day. The water supply well, used for municipal purposes, is completed in the Sand and Gravel Aquifer.

The following table shows a breakdown of the 288 licensed groundwater allocations by the aquifer in which the water well is completed. The largest total licensed allocations are in the Dalehurst and Lacombe aquifers; the majority of the groundwater is used for agricultural and municipal purposes.

Aquifer **	No. of Diversions	Licensed Groundwater Users* (m³/day) Agricultural	Commerical	Industrial	Municipal	Recreation	Dewatering	Total	Percentage
Sand and Gravel	13	116	0	0	1,352	0	64	1,532	23
Disturbed Aquifer	2	10	0	0	0	0	0	10	0
Dalehurst	137	1,207	124	159	1,233	27	0	2,750	42
Lacombe	99	1,744	27	37	24	0	0	1,832	28
Bedrock	7	66	0	122	0	0	0	188	3
Unknown	30	207	0	0	0	0	0	207	3
Total	288	3,350	151	318	2,609	27	64	6,519	100
Percentage		51	2	5	40	0	1	100	

* - data from AENV ** - identification of Aquifer by HCL

Table 2. Licensed Groundwater Diversions

Based on the 1996 Agriculture Census, the calculated water requirement for livestock for the County is in the order of 22,095 m³/day. Of the 22,095 m³/day average calculated livestock use, AENV has licensed a groundwater diversion of 3,350 m³/day (15%) and a licensed surface-water diversion of 1,227 m³/day (6%). The remaining 79% of the calculated livestock use would have to be mainly from unlicensed sources.

5) Groundwater Chemistry and Base of Groundwater Protection

Groundwaters from the surficial deposits can be expected to be chemically hard with a high dissolved iron content. High nitrate and nitrite (as N) were not evident in the available chemical data for the surficial or upper bedrock aquifer(s); a plot of nitrate and nitrite (as N) in surficial aquifers is on the accompanying CD-ROM. The TDS concentrations in the groundwaters from the upper bedrock in the County are generally less than 1,500 mg/L. Groundwaters from the bedrock aquifers frequently are chemically soft with generally low concentrations of dissolved iron. The chemically soft groundwater is high in sodium concentration. More than 15% of the chemical analyses indicate a fluoride concentration above 1.5 mg/L, with most the exceedances occurring in the eastern part of the County (see CD-ROM).

The minimum, maximum and average concentrations of TDS, sodium, sulfate, chloride and fluoride in the groundwaters from water wells completed in the upper bedrock in the County have been compared to the Guidelines for Canadian Drinking Water Quality (GCDWQ) in Table 3. Of the five constituents compared to the GCDWQ, average values of TDS and sodium concentrations exceed the guidelines.

Constituent	Range for County in mg/L Minimum	Maximum	Average	Recommended Maximum Concentration GCDWQ
Total Dissolved Solids	102	6032	857	500
Sodium	0	1495	222	200
Sulfate	0	3800	217	500
Chloride	<1	1038	14	250
Fluoride	0	5.9	0.8	1.5

Concentration in milligrams per litre unless otherwise stated
Note: indicated concentrations are for Aesthetic Objectives except for Fluoride, which is for Maximum Acceptable Concentration (MAC)
GCDWQ - Guidelines for Canadian Drinking Water Quality, Sixth Edition Minister of Supply and Services Canada, 1996

Table 3. Concentrations of Constituents in Groundwaters from Upper Bedrock Aquifer(s)

Alberta Environment (AENV) defines the Base of Groundwater Protection as the elevation below which the groundwater is expected to have more than 4,000 mg/L of total dissolved solids. By using the ground elevation, and the elevation of the Base of Groundwater Protection provided by the Alberta Energy and Utilities Board (EUB), a depth to the Base of Groundwater Protection can be determined. These values are gridded using the Kriging[6] method to prepare a depth to the Base of Groundwater Protection surface. This depth, for the most part, would be the maximum drilling depth for a water well for agricultural purposes or for a potable water supply. If a water well has total dissolved solids exceeding 4,000 mg/L, the groundwater use does not require licensing by AENV. In the County, the depth to Base of Groundwater Protection ranges from less than 300 metres to more than 1,100 metres below ground level, as shown on Figure 3.

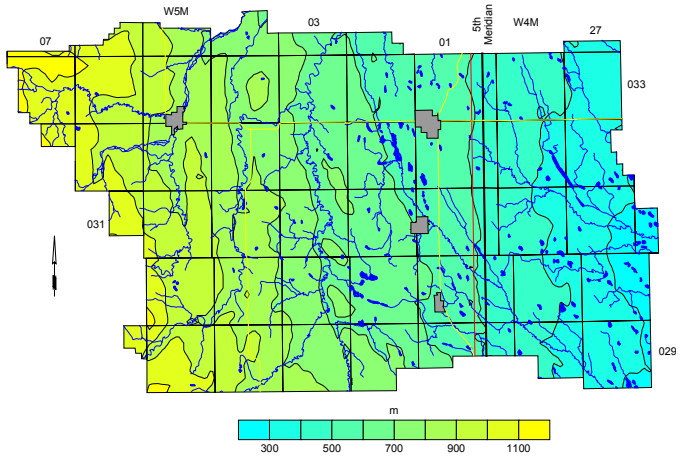

Figure 3. Depth to Base of Groundwater Protection (after EUB, 1995)

Of the 4,114 water wells with completed depth data, none are completed below the Base of Groundwater Protection and of the 2,418 values for TDS available, only two exceed 4,000 mg/L.

Proper management of the groundwater resource requires water-level data. These data are often collected from observation water wells. At the present time, there are two AENV-operated observation water wells within the County. Additional data can be obtained from some of the licensed groundwater diversions. In the past, the data for licensed diversions have been difficult to obtain from AENV, in part because of the failure of the licensee to provide the data.

However, even with the available sources of data, the number of water-level data points relative to the size of the County is too few to provide a reliable groundwater budget (see section 6.0 of this report). The most cost-efficient method to collect additional groundwater monitoring data would be to have the water well owners measuring the water level in their own water well on a regular basis.

[6] See glossary