B. The Project

This regional study should only be used as a guide. Detailed local studies are required to verify hydrogeological conditions at given locations.

The present project is made up of five parts as follows:

Module 1 - Data Collection and Synthesis
Module 2 - Hydrogeological Maps
Module 3 - Report
Module 4 - Groundwater Query
Module 5 - Familiarization Session

This report and the accompanying maps represent Modules 2 and 3.

C. About This Report

This report provides an overview of (a) the groundwater resources of Special Areas and the M.D., (b) the processes used for the present project, and (c) the groundwater characteristics in Special Areas and the M.D.

Additional technical details are available from files on the CD-ROM to be provided with the final version of this report. The files include the geo-referenced electronic groundwater database, maps showing distribution of various hydrogeological parameters, the groundwater query, and ArcView files. Likewise, all of the illustrations and maps from the present report, plus additional maps, figures and cross-sections, are available on the CD-ROM. For convenience, poster-size maps and cross-sections have been prepared as a visual summary of the results presented in this report. Copies of these poster-size drawings have been forwarded with this report, and are included as page-size drawings in Appendix D.

Appendix A features page-size copies of the figures within the report plus additional maps and cross-sections. An index of the page-size maps and figures is given at the beginning of Appendix A.

Appendix B provides a complete list of maps and figures included on the CD-ROM.

Appendix C includes the following:

1) a procedure for conducting aquifer tests with water wells[3]
2) a table of contents for the Water (Ministerial) Regulation under the new Water Act
3) a flow chart showing the licensing of a groundwater diversion under the new Water Act
4) additional information.

The Water (Ministerial) Regulation deals with the wellhead completion requirement (no more water-well pits), the proper procedure for abandoning unused water wells and the correct procedure for installing a pump in a water well. The new Water Act was proclaimed 01 Jan 1999.

Appendix E provides a list of water wells recommended for field verification.

[3] See glossary

II. Introduction

A. Setting

Special Areas 2, 3, and 4, and the M.D of Acadia are situated in southeastern Alberta. This area is part of the Alberta Plains region. Special Areas and the M.D are within the Red Deer, and the South and North Saskatchewan river basins. A part of the southern border in Special Areas 2 and 3, and the M.D. of Acadia is the Red Deer River; the South Saskatchewan River is the southeastern border of Special Areas 2. The other boundaries follow township or section lines. The study area includes parts of the area bounded by township 037, range 18, W4M in the northwest and township 019, range 01, W4M in the southeast. An overlay showing additional cultural details is in the pocket of this report.

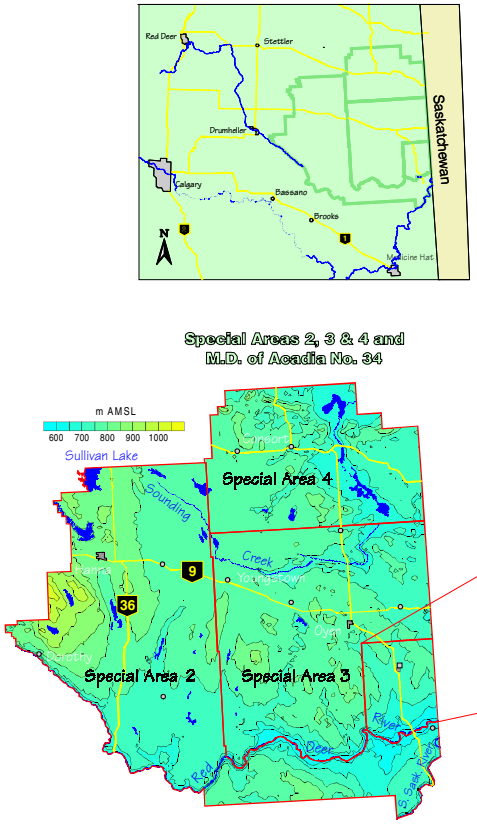

Figure 1. Index Map

Regionally, the topographic surface varies between 580 and 1,040 metres above mean sea level (AMSL). The lowest elevations occur in the Red Deer River Valley and the highest are in the vicinity of the Town of Hanna as shown in Figure 1 and page A-5.

B. Climate

Special Areas 2, 3, 4 and the M.D. of Acadia lie within a semiarid Bsk climate. In a Bsk climate, there is a lack of moisture. This means the mean annual potential evapotranspiration[4] exceeds the mean annual precipitation. This classification is based on potential evapotranspiration 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 Special Areas and the M.D. are located in the Mixed Grass region, a transition between Aspen Parkland and Dry Mixed Grass ecoregions.

The mean annual precipitation averaged from six meteorological stations within the project area measured 337 millimetres (mm), based on data from 1941 to 1993. The annual temperature averaged 2.3 °C, with the mean monthly temperature reaching a high of 17.6 °C in July, and dropping to a low of -15.7 °C in January. The calculated annual potential evapotranspiration is 461 millimetres.

[4] See glossary

C. Background Information

1) Numbers, Types and Depths of Water Wells

There are currently records for 8,079 water wells in the groundwater database for Special Areas and the M.D. Of the 8,079 water wells, 7,128 are for domestic/stock purposes. The remaining 951 water wells were completed for a variety of uses, including municipal, industrial, irrigation and observation. Based on a rural population of 6,289 (Phinney, 1999), there are five domestic/stock water wells per family of four. The domestic or stock water wells vary in depth from 0.6 metres to 260 metres below ground level. Details for lithology[5] are available for 3,333 water wells.

2) Numbers of Water Wells in Surficial and Bedrock Aquifers

There are 2,512 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 bedrock are water wells completed in surficial aquifers. Of the 2,512 wells for which aquifers could be defined, 1,080 are completed in surficial aquifers, with 70% having a completion depth of less than 30 metres. The adjacent map shows that the majority of the water wells completed in the surficial deposits occur in the eastern half of the project area, and frequently in the vicinity of linear bedrock lows.

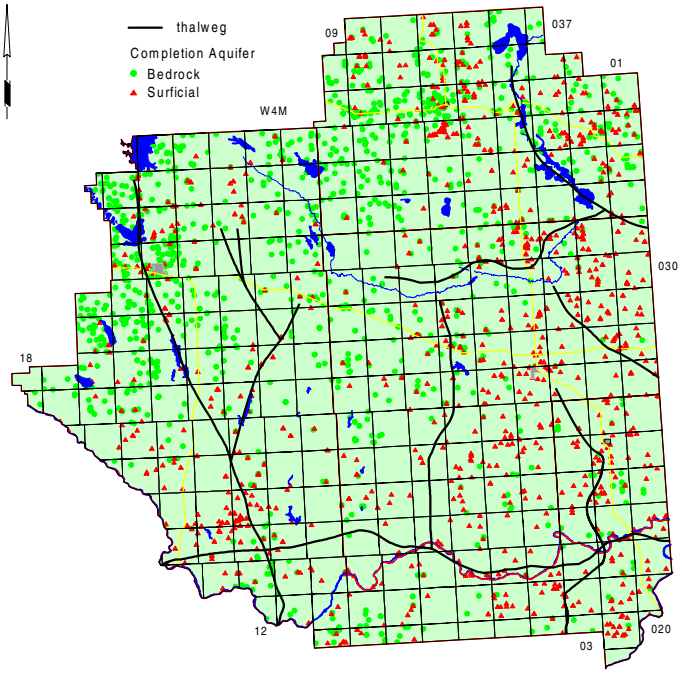

Figure 2. Location of Water Wells

The 1,432 water wells that have the top of their completion interval below 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 mainly in the northern and western parts of Special Areas.

[5] See glossary

3) Casing Diameter and Types

Data for casing diameters are available for 3,594 water wells, with 2,000 (56%) indicated as having a diameter of less than 275 mm and 1,594 having a diameter of more than 300 mm. The casing diameters of greater than 300 mm are mainly bored or dug water wells and those with a surface-casing diameter of less than 275 mm are usually drilled water wells. More than 80% of the large-diameter water wells were completed before 1950.

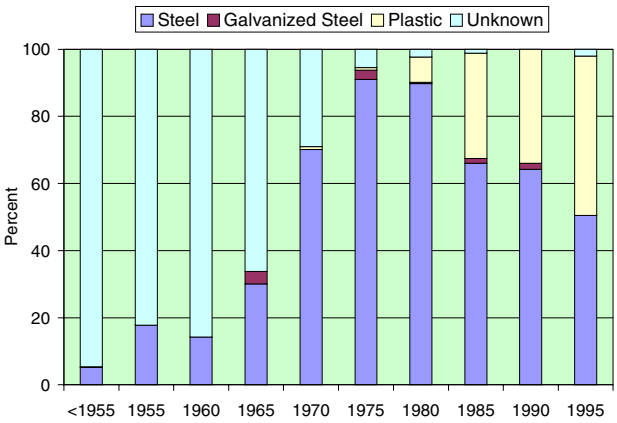

Figure 3. Surface Casing Types used in Drilled Water Wells

In Special Areas and the M.D., 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 being used in 51% of the water wells being drilled in Special Areas and the M.D. in the 1990s. Steel and galvanized steel were the main casing types until the start of the 1980s, at which time plastic casing started to replace the use of steel and galvanized steel casings.

Galvanized steel surface casing was used in a maximum of 4% of the new water wells from the 1950s to the early 1990s. Galvanized steel was last used in April 1991.

4) Requirements for Licensing

Water wells not used for household use and providing groundwater with total dissolved solids (TDS) of less than 4,000 milligrams per litre (mg/L) must be licensed. At the end of 1996, 288 groundwater allocations were licensed in the project area. Of the 288 licensed groundwater users, 229 are for agricultural purposes, and the remaining 59 are for municipal, industrial, diversion, domestic and other purposes. The total maximum authorized diversion from the water wells associated with these licences is 11,935 cubic metres per day (m^3/day), of which 39% is for diversion purposes, 25% is allotted for agricultural use, 22% is allotted for industrial use, and 12% is allotted for municipal use. The remaining 2% of the water wells have been licensed for domestic and other uses as shown in Table 1 on the following page.

The largest licensed groundwater allocation within the project area is for Manalta Coal Ltd., having a “diversion” of 4,400 m^3/day. When a groundwater use is listed as “diversion”, the activity is usually related to dewatering[6] activities. The largest licensed industrial groundwater allocation within Special Areas and the M.D. is for a water source well completed in the Oldman Aquifer in 16-25-027-02 W4M owned by Talisman Energy Inc., having an allocation of 432 m^3/day. The largest potable groundwater diversion licensed within Special Areas and the M.D. is for the Village of Consort, having a diversion of 259 m^3/day. The Village of Consort has four licences, for a total allocation of 590 m^3/day. The remaining licences for municipal purposes are for the villages of Cereal, Empress and Veteran, and the M.D. of Acadia.

[6] See glossary