Most of the maps in the main body of this report have a complementary, large format map in Appendix C. These maps contain extra data and should be referenced when more detail is required than can be provided by the text map.

B. GWRIS

The AEP Groundwater Resources Information Services (GWRIS) data are available digitally for the County of Barrhead, and the surrounding area. These records include data that directly relate to water wells plus data that are directly or indirectly related to groundwater.

Within the County of Barrhead, there are 3991 records; these data have been included in a Microsoft Access database designated as “Inside”. For the present study, an additional 1937 records have been included for the area immediately adjacent to the County of Barrhead. These data are included in a database designated as “Outside”. In broad terms, AEP breaks down the records into 25 categories. A summary of the number of records in each category and in each database is given in the adjacent table.

Type of Work	Within County	Outside County	Total
Cathodic Protection	0	1	1
Chemistry	1200	565	1765
Coal Test Hole	26	12	38
Core Hole	1	0	1
Deepened	18	11	29
Drill Stem Test Hole	6	2	8
Dry Hole	54	30	84
Dry Hole-Abandoned	20	6	26
Federal Well Survey	2	0	2
Flowing Shot Hole	295	94	389
New Well	1820	1053	2873
New Well-Abandoned	34	8	42
Oil Exploratory	4	1	5
Old Well-abandoned	1	0	1
Old Well-test	8	0	8
Other	1	0	1
Piezometer	1	10	11
Reconditioned	14	5	19
Reconstructed	1	1	2
Spring	10	8	18
Structure Test Hole	18	0	18
Test Hole	30	23	53
Test Hole-Abandoned	18	10	28
Unknown	106	7	113
Well Inventory	303	90	393
Total	3991	1937	5928

All records within the database have been reviewed to correct obvious keying errors and errors in the record locations. Also, UTM coordinates have been added to each record based on the centre of the area given in the AEP location. Based on these UTM coordinates, a ground elevation has been provided for each record, not containing an elevation, from the digital elevation surface. Where lithologic information is provided in the record, a pick for the bedrock surface has been made when the record includes a hole that has been drilled below the bedrock surface.

For the present program, data point references include those from within the County of Barrhead unless otherwise stated.

C. Published and Unpublished Reports

Data have been obtained from published and unpublished maps and reports; the pertinent documents are included in the reference section of this report.

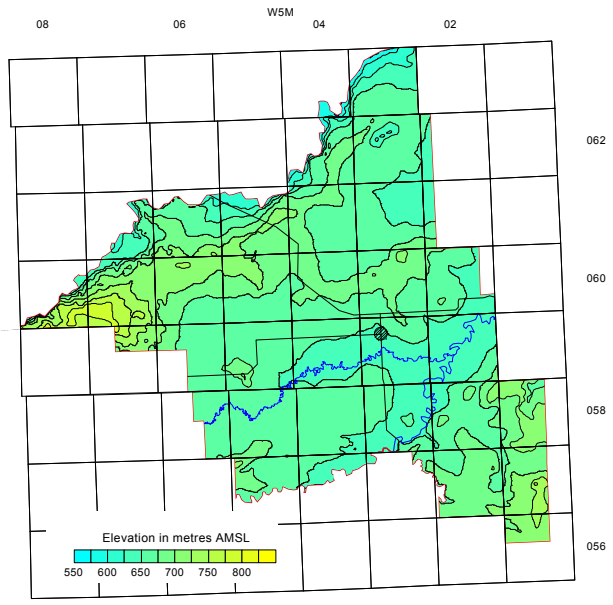
D. Software

The programs used as part of this project include the following: AutoCAD R12; CorelDraw 6, Surfer for Windows, Grapher for Windows, Microsoft Access, Microsoft Excel, and Microsoft Word.

IV. RESULTS

A. Topographic Surface

The topographic surface was created from the data in the digital grid provided by the Provincial Government. These data are provided in a generic 100-metre grid and were converted to a 100-metre grid that is compatible with SURFER, the gridding software used for this project. The gridding density of the topographic data was reduced to a 500-metre grid to prepare the topographic map with a 25-metre contour interval.



Surface Topography

The digital topographic data were used mainly to assign elevation control to data points with UTM coordinates. Typically, a contour map such as the 1:50,000 topographic series from EMR is accurate to plus or minus one half the contour interval, which is 15 metres for the Barrhead area. The accuracy of the digital grid was determined by comparing the elevations for 860 hydrocarbon wells obtained using the digital topographic grid with the elevations obtained by surveying. A summary of the results is as follows:

Error (m)	Hydrocarbon wells No.	%
0 - 2	160	19
2 - 5	232	27
5 - 10	291	34
>10	177	21

The comparison between the two data sets shows that 79% of the elevations determined using the digital topographic grid are within 10 metres of the surveyed elevation; 46% are within 5 metres.

B. GWRIS Data

The AEP Groundwater Resources Information Services (GWRIS) data to July 1995 were used for the present report. Some data are available for all parts of the County except for two areas. The first is the north half of township 063, range 03, west of the fifth Meridian, which according to the County map is crown land. The second area is 4 to 8 kilometres south of the Athabasca River from township 061, range 05 southwest to township 060, range 08, west of the fifth Meridian.

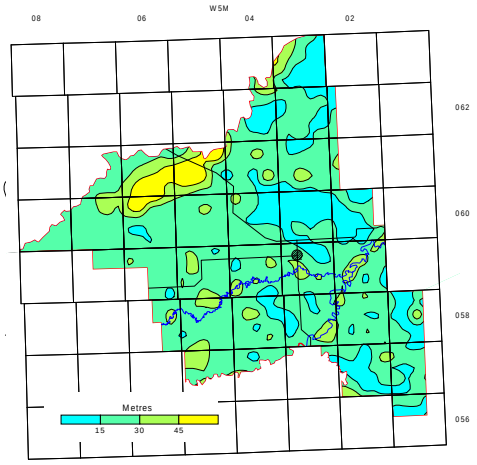
Of the 3991 records available from the AEP database, 2163 are for water wells, of which 1739 have lithologic data along with other details for the water well. The AEP database includes ten types of water well completions. In general terms, the completions can be reduced to three broad categories as follows:

Casing/liner either perforated or slotted	1107	64%
Open hole	571	33%
Screen and/or Gravel Pack	49	3%
Miscellaneous	12	1%

The water well records with lithologic data can be used to determine whether water wells are completed in aquifers in the bedrock or the surficial deposits. For the present breakdown, if the completed depth of a water well is within two metres of the bedrock surface, the water well is considered to have been completed in surficial deposits. This criterion has been used and a separate field in the data base has been assigned “B” for bedrock water wells and “S” for water wells completed in the surficial deposits. Where there are insufficient or conflicting data the field is left blank; there are 38 of the 1739 water wells where the completion is unknown. A list of the water wells in each category is given in Appendix A.

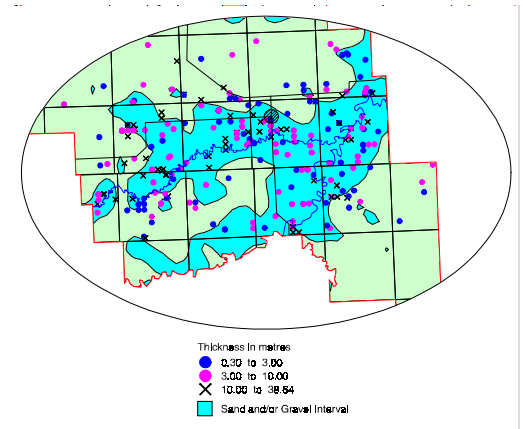
i) Overburden

The overburden thickness map shows that over approximately 60% of the County, the overburden is expected to be less than 30 metres thick. The largest thickness of unconsolidated materials is in Township 061, R 05 and 06, where the overburden thickness generally exceeds 45 metres; in this area, there are three reported occurrences where the overburden is between 80 and 90 metres thick.



Overburden Thickness

Within the overburden materials, deposits of sand and/or gravel, if saturated, can be developed for groundwater supplies. In the County, significant deposits of sand and/or gravel have been identified in association with the Barrhead and Dapp Valleys. However, the sand and/or gravel deposits do not appear to be a single extensive deposit. The area outlined on the map includes a significant number of reported occurrences of sand and/or gravel deposits, but there are also numerous water wells that have been drilled that do not report any significant thickness of sand and/or gravel layers.



Sand and/or Gravel Associated with the Barrhead and Dapp Valleys

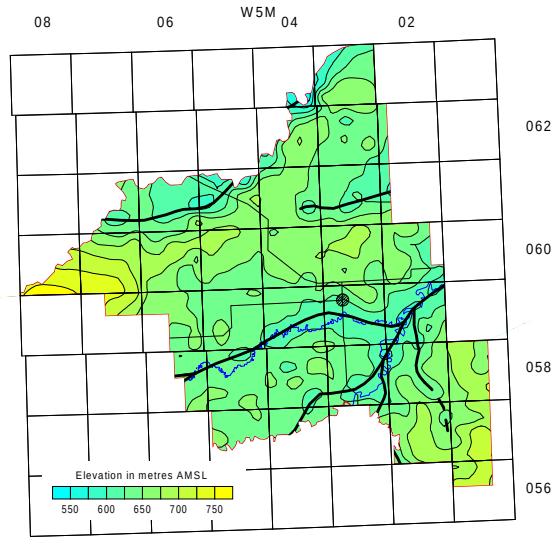
A second sand and/or gravel deposit has been identified in association with the bedrock low designated as the High Prairie Valley. There are very few control points for the Valley and mapping of the sand and/or gravel deposits cannot be done based on the four control points located in Tp 061, R 05 and 06, west of the fifth Meridian. A summary of the data from these four water wells is as follows:

Location	Bedrock			Lowest Surficial Unit		Casing
W5M	hc No.	Depth	Elevation	Lithology	Depth (m)	Depth (m)
NE 17-061-05	3678	70.10	598.90	cemented gravel	56.69-67.97	70.71
SE 18-061-05	3680	84.73	593.42	cemented gravel	79.55-84.73	85.34
NE 26-061-05	3699	89.30	577.90	gravel	84.73-89.3	93.26
NE 12-061-06	3709	85.34	587.32	sand & silt	27.43-85.34	85.34

The sand and/or gravel deposits associated with the High Prairie Valley have been developed to provide groundwater supplies for the Hamlet of Fort Assiniboine and for at least two industrial developments upstream from the County of Barrhead.

ii) Bedrock Topography

Over 1900 control points have been used to prepare the bedrock topography map. The 1914 points include 42 from the Alberta Research Council's bedrock topography maps. The bedrock picks from the water well drillers' reports are difficult in many instances because there is an interchange between the terminology used for unconsolidated sediment and bedrock sediments. The difficulty in making the picks is evident from the cross-sections that are discussed later. A total of 1872 values for the elevation of the bedrock surface were obtained from the groundwater database.



Bedrock Topography

The grid that has been used to prepare the bedrock topography map was prepared using the Kriging method. The grid used a node spacing of 2000 metres and a linear nomogram. Because of the lack of horizontal control, several water wells occupy the same UTM coordinates. When more than one value for the bedrock surface is given at a particular location, the gridding procedure averages the values for bedrock surface. This approach tended to remove some inconsistencies resulting from uncertainties in the data.

Bedrock elevations range from a high of more than 750 metres above mean sea level (AMSL) in the western part of the map area to a low of less than 550 metres AMSL in the most northerly part of the County. The bedrock topography map shows three named and three unnamed linear depressions in the bedrock surface. The northernmost is the High Prairie Valley, which coincides with the present-day Athabasca River Valley through townships 062 and 063, ranges 03 and 04, W5M. In townships 061, ranges 05, 06 and 07, the linear bedrock low is up to eight kilometres south of the present-day Athabasca River Valley. The elevation of the bedrock surface along the High Prairie Valley is mainly less than 625 metres AMSL.

In the southern part of the County, two linear bedrock lows converge in Tp 059, R 02, W5M. The Dapp Valley has several control points that indicate the elevation of the bedrock surface within the Valley is below an elevation of 600 metres AMSL. However, when all of the bedrock surface control points are used to prepare the bedrock topography map, the bedrock surface is only below 600 m AMSL in Tp 059, R 02, W5M.

The bedrock low that is joining the Dapp Valley in Tp 059, R 02, W5M from the north has been designated as the Barrhead Valley. Several control points along the trend of this bedrock low are below 600 metres AMSL. However, the 600-metre AMSL contour line is not present within the area where the Barrhead Valley is present.

In Tp 061, R 02 to 04, a linear bedrock low, which appears to be a tributary to the Dapp Valley, joins the Dapp Valley east of the County of Barrhead. Because of the absence of consistent reports of a topographically low bedrock surface, there is some uncertainty as to the significance of this bedrock low and to its positioning. The problem appears to be the identification of sandstone below the bedrock as “sand”.

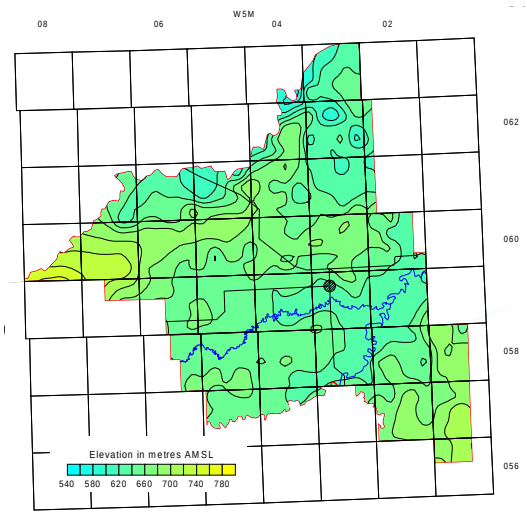
There are no control points for the bedrock surface in Tp 060, R 08 and the west half of R 07, and there are only a few control points in Tp 061, R 06 and 07, W5M.

iii) Non-Pumping Water Level (NPWL)

The non-pumping water level is given on most water well drillers’ reports. This water level has been converted to an elevation by subtracting the non-pumping water level from the elevation obtained from the digital elevation surface. Even though the digital elevation is portrayed as ground level, the difference between ground level and top of casing is less than the absolute accuracy of all the data.

a) Bedrock Aquifers

Non-pumping water-level elevations in bedrock aquifers range from 538 to 741 metres AMSL. There are 639 locations where there is more than one water well at a particular location with a NPWL given. In many instances, the water wells can be completed at different depths and have different water levels. To prepare the non-pumping water-level surface, the average of all values at any given location was used. The water-level surface throughout more than 90% of the area is between 600 and 700 metres AMSL. The water level is generally at the lowest elevation in topographically low areas, with one exception. In Tp 062, R 03, W5M the water-level surface is below 600 m AMSL, despite the ground elevation being more than 100 metres above the Athabasca River. The water-level surface is at its highest level at the western edge of the County.



Non-Pumping Water Level in Bedrock Aquifers