

there are low-yield areas within the area. However, these variations may be a reflection of the quality of the data or variations in the local hydrogeology.

For the most part, the chemical quality of the groundwater is suitable for domestic needs. There are local problem areas where the chloride or sulfate concentration is high. The dissolved iron in the bedrock groundwater over approximately one half of the County is above 0.3 mg/L, the concentration above which staining will start. Over approximately 50% of the area where the is subcropping, the sulfate concentration of the bedrock groundwaters is less than 50 mg/L and the bicarbonate concentration exceeds 600 mg/L. In this area, the groundwater from water wells completed in the bedrock aquifers could be expected to contain varying amounts of hydrogen sulfide.

B. Aquifers in the Unconsolidated Sediments

An attempt has been made to delineate the areas where sand and/or gravel deposits can be expected in the unconsolidated sediments. One area of approximately 300 square kilometres has been defined in the southern part of the County. This is an area where the Barrhead and Dapp linear bedrock lows are present and sand and/or gravel can be expected. At this time, it is unclear as to whether the sand and/or gravel deposits are continuous. The apparent safe-yield for the sand and/or gravel deposits is less than 30 m³/day. However, the results of one aquifer test indicate that a water well completed in the sand and/or gravel deposits may have a long-term yield of in the order of 100 m³/day. Ideally, a suitably completed water well could be expected to provide at least a few hundred cubic metres per day from these deposits.

C. Groundwater Protection

The groundwater needs to be protected from overuse and from contamination. In areas where the groundwater supplies are considered to be abundant, there is a concern that use may exceed replenishment and hence depletion of the resource. To better understand the sustainability of the groundwater supply, there is a need for widespread monitoring of water levels at various locations in the groundwater flow system and in various aquifers. At this time there are too few meaningful data to establish a sustainable groundwater yield.

The groundwaters where there is an elevated NO₂+NO₃ concentration and an elevated chloride concentration, are suspect of being contaminated. The location in township 061, range 04, W4M is in a groundwater recharge area where the near surface materials are permeable and the possibility of significant contamination is present.

VI. CONCLUSIONS

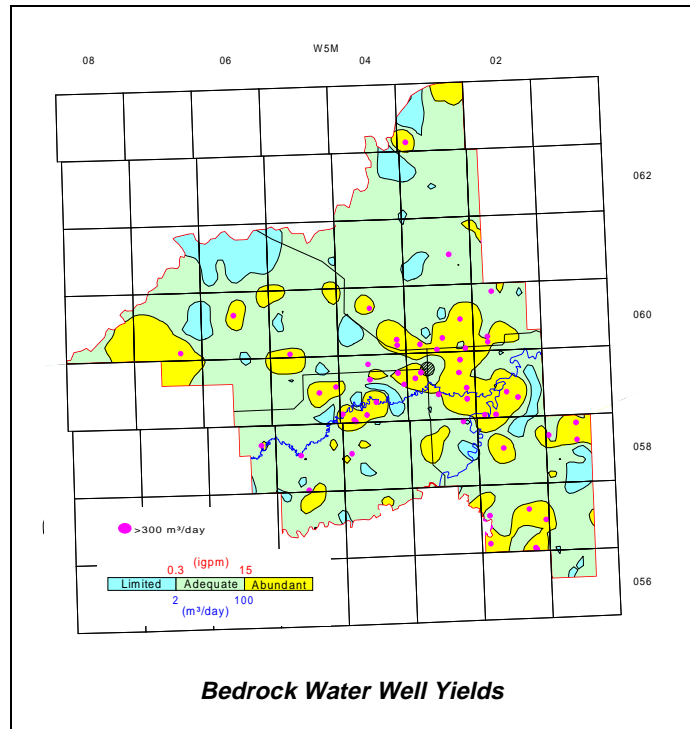
Hydrogeological data from various sources have been synthesized and interpreted and are presented on 11 maps and 4 cross-sections. The interpreted hydrogeological data are also accessible through a "Groundwater Query". The groundwater query is a computer program that operates under Windows 95 to allow specific information to be obtained for proposed water wells by ¼ section or by legal subdivision.

Over approximately 12% of the County, water wells completed in bedrock aquifers are expected to have long-term yields of less than 2 m³/day (0.3 igpm). For a country residential development, a yield of 1.1 m³/day/lot is considered adequate. In the majority of the County, water wells completed in the bedrock are expected to have long-term yields of between 2 and 100 m³/day (0.3 and 15 igpm). This volume of water would be adequate for most developments except those requiring a significant quantity of water, such as large feedlots or market gardens. Higher yields are expected from bedrock water wells over approximately 20% of the County.

Because of the type of sediments in the upper bedrock, there are no regional aquifers, since the sedimentary layers tend to be lenticular. However, one interval has been identified where coal layers are more common. This interval is approximately 100 metres thick and, where present, water wells tend to have shorter completion intervals. The base of the coal zone interval is approximately 340 metres above the top of the Lea Park Formation. The coal zone is not present in the northeastern part of the County and is below the deepest water wells on the west side of the County.

In addition to the regional trend of the water wells completed in the bedrock aquifers, there are individual locations where water wells have projected yields of greater than 300 m³/day. The very local high-yield water wells are believed to be completed in aquifers with fracture permeability; the long-term yields of these water wells could be expected to be less than the indicated water well yield because of aquifer boundary conditions.

In approximately 60% of the County of Barrhead, sand and/or gravel aquifers are expected. The most significant accumulations are along the northern part of the County and are in association with the High Prairie Valley. Water wells completed in these sand and/or gravel deposits are expected to have yields of in excess of several hundred cubic metres per day.



There are other areas in the County where sand and/or gravel deposits may be present. In the central part, there are numerous locations where sand and/or gravel deposits are reported to be present. These reports are mainly in association with the Dapp and Barrhead bedrock lows. In the areas outlined, the majority of water wells report the presence of sand and/or gravel deposits. However, the cross-sections suggest that the sand and/or gravel deposits are not continuous. Water wells completed in the sand and/or gravel deposits associated with the Dapp and Barrhead bedrock lows have low projected long-term yields, which may be a reflection of their completion rather than an indication of the permeability of the deposits. Certainly, further investigation of the sand and/or gravel deposits would be warranted if significant quantities of groundwater were needed.

There are too few data to determine sustainability of the groundwater supply. At the present time, there are approximately 1500 rural residents in the County of Barrhead. If each person uses 250 litres per day, then 400 m³/day would be needed for the residents. There are 177 licensed groundwater diversions within the County of Barrhead. The total quantity of groundwater allowed under the diversions is 1698 m³/day. There are no indications from the AEP observation water wells that groundwater supplies are being depleted. However, the observation water wells are such a limited sampling as to be almost meaningless.

Extrapolation of the present data suggests that more than 80% of the County of Barrhead is a groundwater recharge area. However, this observation is based on a very limited data set.

VII. RECOMMENDATIONS

The analysis of digital hydrogeological data continues to have a problem with spatial control. To improve the elevation control, it is necessary to use the Maps Alberta 1:20,000 DEM data. Once the improved topographic control is available, it would be necessary to improve the horizontal control of the water wells. A first approximation to the horizontal positioning of the water wells could be accomplished with the ENR 1:50,000 maps and aerial photos. However, a field-verified water well survey would eventually be needed. During the field-verified water well survey, a water level would be measured in the water well when it was identified. It is recommended that a program be put in place to obtain the data necessary to improve the spatial control.

There is also a need to obtain data to establish the sustainability of the groundwater supply through the monitoring of groundwater levels. The present method of drilling and completing observation water wells is very expensive and very site specific. There is a need to use existing water wells throughout the County to do the water-level monitoring. The process could involve either having the water well users measure the water level in their water wells on a weekly basis, or have a contractor measure water levels in several tens of water wells four times per year. Either approach would provide better water-level fluctuation coverage for the County at a significantly lower cost than the completion of observation water wells. Once data have been collected for a few years, a better understanding of the groundwater sustainability could be obtained. It is recommended that a program to collect water-level data be set up as part of a sustainability program for agriculture.

After the spatial control has been improved and a better resolution of the existing data is obtained, it is recommended that the sand and/or gravel deposits associated with the Dapp and Barrhead Valleys be investigated in greater detail. The sand and/or gravel aquifers should be capable of providing significant quantities of groundwater for agricultural needs. However, before the development begins, background water-level data should be collected by the groundwater monitoring program.

A coal zone, which is approximately 100 metres thick, has been identified as a possible regional aquifer. There is a need to investigate the significance of this interval in more detail, particularly in the western part of the County. This would require the drilling of water test holes to the bottom of the coal zone to determine if the coal layers are fractured at depth.

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