6.5.3 Area North of Tsuu t'ina First Nation and South of the Elbow River

What is the approximate extent and potential (yield and water quality) of the aquifers?

The Sand and Gravel Aquifer(s) are present in 30% of the Tsuu t'ina First Nation Area. In the Area, sand and gravel deposits are expected to be less than five metres thick. Shetsen (1987) shows that the main occurrence of sand and gravel deposits in this Area appear to be nearly perpendicular to the Buried Calgary Valley.

In the Area, apparent yields in the Sand and Gravel Aquifer(s) range from less than ten m³/day to more than 100 m³/day with the higher yields in association with a linear bedrock low, coincidental with the Elbow River.

Groundwaters from water wells completed in the Tsuu t'ina First Nation Area in the surficial deposits are expected to have TDS concentrations of less than 1,000 mg/L.

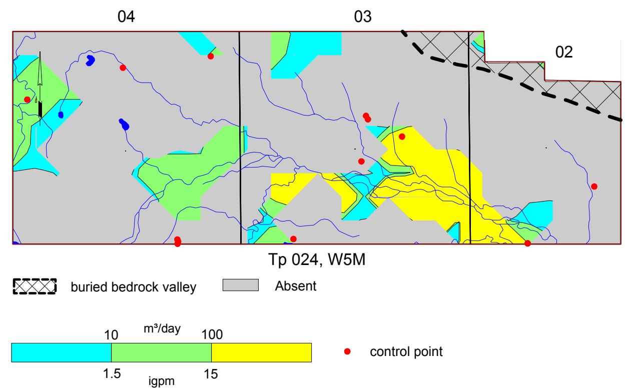

Figure 44. Area North of Tsuu t'ina First Nation and South of the Elbow River - Apparent Yield in Sand and Gravel Aquifer(s)

In the Tsuu t'ina First Nation Area, there are 14 licensed water wells completed in the surficial deposits, of which the largest single potable groundwater allocation is for a water well licensed to Allred's Golf Course in 07-05-024-02 W5M that is authorized to divert 507 m³/day for commercial purposes.

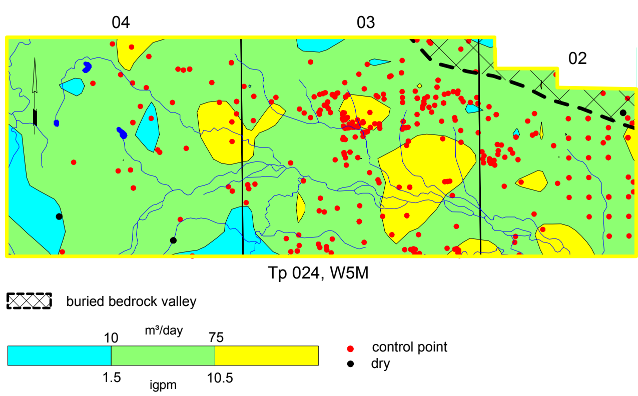

Figure 45. Area North of Tsuu t'ina First Nation and South of the Elbow River - Apparent Yield in Upper Bedrock Aquifer(s)

The upper bedrock in the Area is the Disturbed Belt and the Dalehurst Member (see Figure 37). The higher apparent yields tend to be in water wells completed in the Dalehurst Aquifer. The majority of the control points are in township 024, ranges 02 and 03, W5M (Figure 45). The higher yields south of the Elbow River are expected in the southwestern part of township 024, range 02, W5M and in the southeastern part of township 024, range 03, W5M.

In the Tsuu t'ina First Nation Area, there are 40 licensed water wells completed in the upper bedrock aquifer(s). The highest single allocation of for a water supply well completed in upper bedrock aquifer(s) is 85 m³/day. This water supply well, completed in the Dalehurst Aquifer, is licensed to Elbow River Estates in SW 08-024-02 W5M for municipal purposes.

Groundwaters from water wells completed in the Tsuu t'ina First Nation Area in the upper bedrock aquifer(s) are expected to have TDS concentrations of less than 1,000 mg/L, with the lower TDS concentrations in association with the Buried Calgary Valley.

It might be beneficial to the Tsuu t'ina First Nation to field-verify the water wells within the Area. The level of verification should include obtaining meaningful horizontal coordinates for the water wells and verifying the water level and completed depth.

6.5.4 Area North of Cochrane

What is the approximate extent and potential (yield and water quality) of the aquifers?

The Sand and Gravel Aquifer(s) are mainly absent in the area north of Cochrane. Apparent yields in the Sand and Gravel Aquifer(s), where present, are mainly less than ten m³/day; however, there is only one control point within the Cochrane Area.

Groundwaters from water wells completed in the Cochrane Area in the surficial deposits are expected to have TDS concentrations of between 500 and 1,000 mg/L.

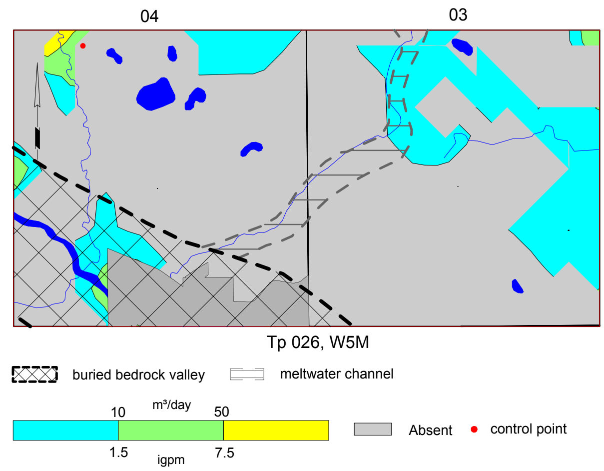

Figure 46. Area North of Cochrane - Apparent Yield in Sand and Gravel Aquifer(s)

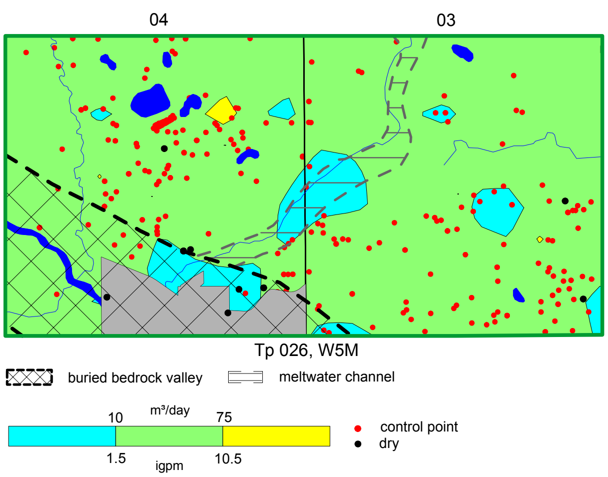

Figure 47. Area North of Cochrane - Apparent Yield in Upper Bedrock Aquifer(s)

The upper bedrock in the Area is the Disturbed Belt and the Dalehurst Member (see Figure 37). The apparent yields are mainly between 10 and 100 m³/day. The majority of the control points are north and east of the northern limits of Cochrane (Figure 45).

The largest potable groundwater allocation is 23.6 m³/day for a water well used for municipal purposes. This water well is completed in the Disturbed Belt in 11-21-026-04 W5M.

Groundwaters from water wells completed in the Cochrane Area in the upper bedrock aquifer(s) are expected to have TDS concentrations of less than 1,000 mg/L, with the lower TDS concentrations associated with the Dalehurst Aquifer.

6.5.5 Shepard Area

Comment on the apparent water quality problems (high fluoride, iron, and sodium) in existing water wells in this area.

In the Shepard Area, there are no chemistry data in the groundwater database for water wells completed in the surficial deposits. Based on the gridding procedure used to process the data points outside of the Shepard Area, TDS concentrations from water wells completed in the surficial deposits are expected to range between 1,000 and 2,000 mg/L.

Based on the results of the gridding procedure from control points outside the Shepard Area, the groundwater quality for surficial water wells in the Shepard Area is similar to other areas in the M.D., with the possible exception of nitrate + nitrite (as N) concentrations, which may be slightly higher in the Shepard Area (see CD-ROM).

The upper bedrock in the Shepard Area is the Lacombe Member (see Figure 37).

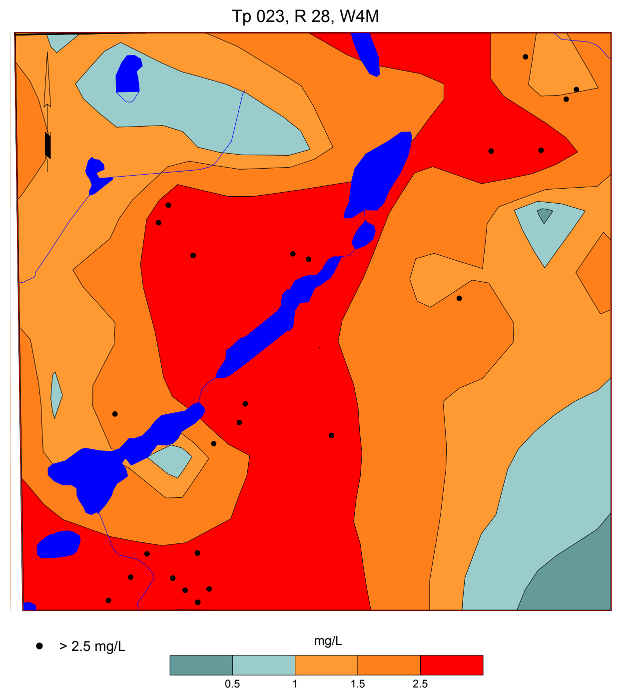

Figure 48. Shepard Area – Fluoride in Upper Bedrock Aquifer(s)

Groundwaters from water wells completed in the Shepard Area in the upper bedrock aquifer(s) are expected to have TDS concentrations mainly of less than 1,000 mg/L. In the Shepard Area, most bedrock water wells are completed within 200 metres of the top of the Lacombe Member, and therefore, higher sulfate concentrations occur. These higher sulfate concentrations are consistent with the results of the regional analysis shown on Figure 20 on page 24 of this report. The TDS and chloride concentrations from bedrock water wells in the Shepard Area are also similar to other groundwater-quality trends found in the Lacombe Aquifer in other parts of the M.D.

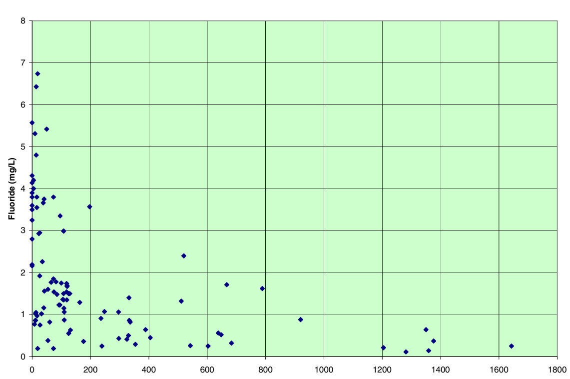

Figure 49. Shepard Area – Total Hardness vs. Fluoride in Upper Bedrock Aquifer(s)

In the Shepard Area, approximately 30% of the groundwater samples from upper bedrock aquifer(s) have fluoride concentrations that are greater than 2.5 mg/L. The fluoride values of greater than 2.5 mg/L occur mainly in the north-central part of the Area. In general, when total hardness is less than 150 mg/L, fluoride can be up to 7 mg/L; for total hardness values of greater than 100 mg/L, fluoride concentrations are mainly less than 1.0 mg/L, as shown in Figure 49.

7. 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
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 first step would be to field-verify the 264 existing water wells listed in Appendix E. These water well records indicate that a complete water well drilling report is available along with at least a partial chemical analysis. 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. There are two water wells for which the M.D. has responsibility, neither one of which satisfies the above criteria; the two M.D.-operated water wells are shown in Appendix E. It is recommended that these two M.D.-operated water wells plus the 264 water wells be field-verified, water levels be measured, a water sample be collected for analysis, and a short aquifer test be conducted. An attempt to update the quality of the entire database is not recommended.

Before an attempt is made to provide a major upgrade to the level of interpretation provided in this report, the accompanying maps and the groundwater query, it is recommended that the 264 water wells listed in Appendix E for which water well drilling reports are available, plus the two M.D.–operated water wells, be subjected to the following actions (see pages C-2 to C-3):

1) The horizontal location of the water well should be determined within ten 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 (two hours of pumping and two hours of recovery) 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 five and 115 minutes of pumping, and analyzed for major and minor ions.

This additional information would provide a baseline to be used for comparison to either existing chemical analyses or aquifer tests, or to determine if future monitoring would be necessary if significant changes in the aquifer parameters had occurred.

A list of the 266 water wells that could be considered for the above program is given in Appendix E and on the CD-ROM.

An attempt to link the AENV groundwater and licensing databases was about 70% successful in this study (see CD-ROM). About 30% of licensed water wells do not appear to have corresponding records in the AENV groundwater database. There is a need to improve the quality of the AENV licensing database. It is recommended that attempts be made in a future study to find and add missing drilling records to the AENV groundwater database and to determine the aquifer in which the licensed water wells are completed.

While there are a few areas where water-level data are available, on the overall, there are an insufficient number of water levels to set up a groundwater budget. Water well owners in the Irricana – Beiseker Area were provided with a tax credit if they accurately measured the water level in their water well once per week for a year. The pilot project indicated that approximately five years of records are required to obtain a reasonable data set. It is recommended that water well owners who are stakeholders in the groundwater resource in other parts of the M.D., particularly in areas of potential water-level decline, initiate a similar project. Monitoring of water levels in domestic and stock water wells is a practice that is recommended by PFRA in the “Water Wells That Last for Generations” manual and accompanying videos (Appendix C). It is recommended that the regular monitoring of water levels in domestic and stock water wells be continued in the Irricana-Beiseker area and to expand the program to other parts of the M.D. Of the 264 water wells recommended for field verification, 55 of the 255 bedrock water wells are in areas of water-level decline. Because the flow through the Lower Sand and Gravel Aquifer is less than the total of the licensed and unlicensed diversions, it is recommended that a groundwater-monitoring program be established.

A second approach to obtain water-level data would be to conduct a field survey to identify water wells not in use that could be used as part of an observation water well network. M.D. personnel and/or local residents could measure the water levels in the water wells regularly.

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. One method of obtaining uniformity would be to have the water well drilling reports submitted to the AENV Resource Data Division in an electronic form. The money presently being spent by AENV 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 M.D. 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.

In summary, for the next level of study, the database needs updating. The updating of information for existing water wells requires more details for the water wells listed in Appendix E; the additional information for new water wells is mainly better spatial control.

Groundwater is a renewable resource and it must be managed.

8. References

AGRA Earth & Environmental Limited. July 1996. SulFer Works Inc. Aquifer Evaluation of the Water Supply for Proposed SulFer Works Inc. Plant at Irricana, Alberta. Irricana Area. NE 33-27-26 W4M.

Agriculture Canada Prairie Farm Rehabilitation Administration. Regina, Saskatchewan. 1996. 1996 Agriculture Census (CD-ROM).

Agriculture, Food and Rural Development. 1995. Water Requirements for Livestock. Agdex 400/716-1.

Alberta Energy and Utilities Board. June 1995. AEUB ST-55. Alberta's Usable Groundwater Database.

Alberta Research Council. March 31, 1995. Mapping and Resource Exploration of the Tertiary and Preglacial Formations of Alberta. Canada/Alberta Partnership on Minerals. Project Number: M92-04-008.

Allong, A. F. 1967. Sedimentation and Stratigraphy of the Saskatchewan Gravels and Sands in Central and Southern Alberta. University of Wisconsin. M. Sc. (Geology) Thesis. 130 p.

Alberta Department of Environment, Pollution Control Division, Municipal Engineering Branch. Jul-1975. Chestermere Lake Sanitary Survey. 024-28 W4M.

Alberta Department of Environment. July 1973. Earth Sciences and Licensing Division, Water Rights Branch. Well #048, E.J. Lord, SE 1-27-1 W5M. 01-027-01 W5M.

Alberta Department of Environment. 1974. Beiseker Town Water Supply. 12-028-26 W4M.

Alberta. Atmospheric Environment Services. 1986. Alberta Environment. Climate of Alberta with data for Yukon and Northwest Territories, Report. Yukon and Northwest Territories.

Allan, J. A. 1943. Alberta Geological Survey. Geology.

Allan, J. A., and J. L. Carr. 1947. Alberta Geological Survey. Geology of Highwood-Elbow Area, Alberta

Allan, John A., and J. O. G. Sanderson. 1945. Alberta Geological Survey. Geology of Red Deer and Rosebud Sheets, Alberta. Red Deer and Rosebud Area.

Associated Engineering Services Ltd. September 1973. Evaluation of Groundwater Supply for Norcal KOA Campground Ltd. NE 1/4 13-26-1 W5M.

Bayrock, L. A., and T. H. Reimchen. 1980. Alberta Geological Survey. Surficial Geology of the Alberta Foothills and Rocky Mountains. NTS 83L, NTS 83F, NTS 83B, NTS 82O, NTS 82J, NTS 82G, NTS 82H.

Beckie Hydrogeologists Ltd. Groundwater Consultants. November 5, 1979. W. P. Truch & Associates Ltd. Sam Livingston Fish Hatchery. Inglewood Wells.

Bernard, D. W. Groundwater Consultants Ltd. Nov-1986. Mercon Engineering Consultants Ltd. and Municipal District of Rocky View. Country Village Water Co-op. Water Supply Well PW1-86. SW 12-25-3 W5M. 12-025-03 W5M.

Bibby, R. 1979. Alberta Geological Survey. Estimating Sustainable Yield to a Well in Heterogeneous Strata.

Borneuf, D. 1972. Research Council of Alberta. Hydrogeology of the Drumheller Area.