

### 5.3.6 Upper Scollard Aquifer

The Upper Scollard Aquifer comprises the permeable parts of the Upper Scollard Formation that underlie the Haynes Member, and subcrops under the surficial deposits in the western quarter of the County. Structure contours have been prepared for the top of the Formation. The structure contours show the Upper Scollard Formation ranges in elevation from less than 840 to more than 1,000 metres AMSL and has a thickness of in the order of 80 metres. The non-pumping water level in the Upper Scollard Aquifer slopes mainly toward Serviceberry Creek and toward the Rosebud River in the northern part of the County.

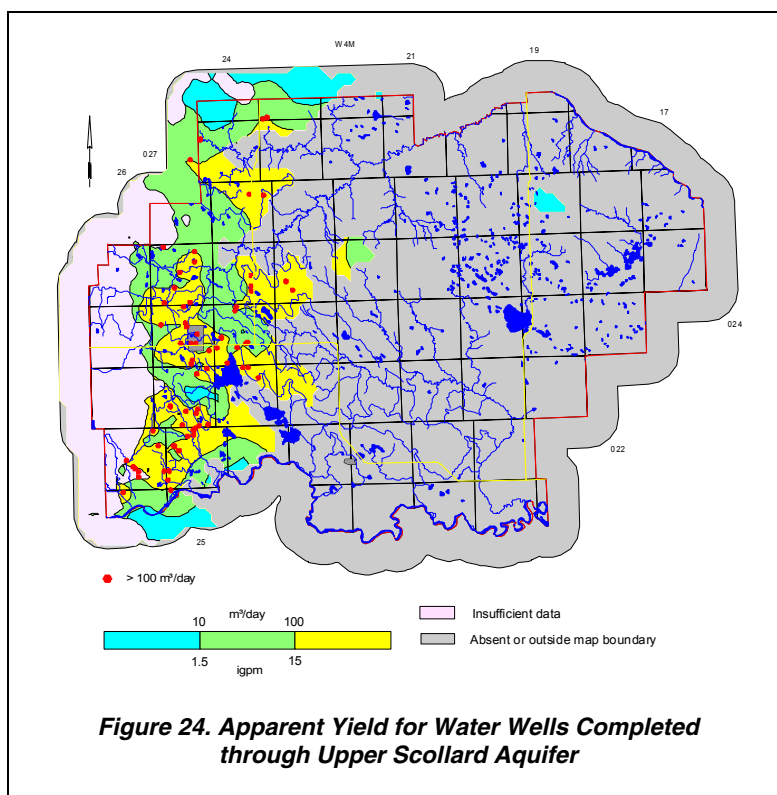
#### 5.3.6.1 Depth to Top

The depth to the top of the Upper Scollard Formation ranges from less than 20 metres below ground surface at the eastern extent to more than 100 metres in the western part of the County (page A-40).

#### 5.3.6.2 Apparent Yield

The apparent yields for individual water wells completed through the Upper Scollard Aquifer range mainly from 10 to 100 m<sup>3</sup>/day; however, forty percent of the water wells completed in the Upper Scollard Aquifer have apparent yields that are greater than 100 m<sup>3</sup>/day. The adjacent map indicates that water wells with apparent yields of more than 100 m<sup>3</sup>/day are expected in a number of areas. In these areas, weathering processes may be increasing the local permeability.

In the County, there are 29 licensed water wells that are completed in the Upper Scollard Aquifer, that are authorized to divert a total of 966 m<sup>3</sup>/day; the highest single allocation is 487 m<sup>3</sup>/day for a water supply well used to supply groundwater to a subdivision in 11-23-023-27 W4M. The next highest allocations of more than 80 m<sup>3</sup>/day are for two water supply wells used for municipal purposes, one in 04-07-024-27 W4M and one in NE 19-024-28 W4M. Five of the 29 licensed water wells could be linked to a water well in the AENV groundwater database.



An extended aquifer test was conducted in September 1998 with a water supply well for the Hutterian Brethren of Wheatland in 06-20-025-23 W4M; the water supply well is completed from 15.5 to 21.6 metres below ground surface in the Upper Scollard Aquifer. The aquifer test consisted of 3,003 minutes of pumping at 194 lpm and 6,661 minutes of recovery. Analysis of the aquifer test results indicated the water supply well has a long-term yield of 74 m<sup>3</sup>/day, based on an aquifer transmissivity of 215 m<sup>2</sup>/day and an effective transmissivity of 31.8 m<sup>2</sup>/day (HCL, October 1999). This water supply well is currently licensed to divert 50 m<sup>3</sup>/day of groundwater.

An extended aquifer test was conducted in August 1986 with a water supply well at the Green Drop Carseland batching plant in SE 16-022-26 W4M, located approximately 6,400 metres north of the Bow River, and completed from 81.1 to 97.5 metres below ground surface in the Upper Scollard Aquifer. The aquifer test consisted of 1,440 minutes of pumping at 91 lpm and 1,320 minutes of recovery and indicated a long-term yield of 60 m<sup>3</sup>/day based

on an apparent transmissivity of 11.8 m<sup>2</sup>/day and an effective transmissivity of 5.5 m<sup>2</sup>/day. The water supply well is currently licensed to divert 44 m<sup>3</sup>/day of groundwater (HCL, August 1986).

### 5.3.6.3 Quality

The groundwaters from the Upper Scollard Aquifer are mainly a bicarbonate-to-sulfate type, with sodium as the main cation (see Piper diagram on CD-ROM). Total dissolved solids concentrations range mainly between 500 and 1,000 mg/L, with more than 90% of the groundwater samples having TDS concentrations of greater than 500 mg/L. The TDS concentrations of less than 500 mg/L may be a result of more active flow systems and shorter flow paths. The sulfate concentrations are mainly less than 500 mg/L. Nearly 75% of the chloride concentrations from the Upper Scollard Aquifer are less than ten mg/L.

Constituent	No. of Analyses	Range for County in mg/L			All Bedrock Median	Recommended Maximum Concentration SGCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	176	370	2716	837	1069	500
Sodium	118	41	896	305	350	200
Sulfate	171	11	1440	300	285	500
Chloride	170	0	95	8	13	250
Fluoride	160	0	10	1.1	0.7	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)  
 SGCDWQ - Summary of Guidelines for Canadian Drinking Water Quality  
 Federal-Provincial Subcommittee on Drinking Water, March 2001

**Table 10. Apparent Concentrations of Constituents in Groundwaters from Upper Scollard Aquifer**

A chemical analysis of a groundwater sample collected from the water supply well in 06-20-025-23 W4M in March 1999 indicates the groundwater is a sodium-sulfate type, with a TDS concentration of 2,090 mg/L, a sulfate concentration of 1,050 mg/L, a chloride concentration of 15.9 mg/L, and a fluoride concentration of 0.531 mg/L (HCL, October 1999).

The chemical analysis results for a groundwater sample collected from the water supply well in SE 16-022-26 W4M in September 1985 indicate the groundwater is a sodium-bicarbonate type, has a TDS concentration of 559 mg/L, a sulfate concentration of 165 mg/L, a chloride concentration of 19 mg/L, and a fluoride concentration of 0.80 mg/L (HCL, August 1986).

The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and fluoride in the groundwaters from water wells completed in the Upper Scollard Aquifer in the County have been compared to the SGCDWQ and median concentrations from all upper bedrock aquifer(s) in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median values of TDS and sodium exceed the guidelines. The median concentrations of sulfate and fluoride from water wells completed in the Upper Scollard Aquifer are greater than the median concentrations from water wells completed in all upper bedrock aquifer(s).

### 5.3.7 Lower Scollard Aquifer

The Lower Scollard Aquifer comprises the porous and permeable parts of the Lower Scollard Formation that underlie the Upper Scollard Formation, and subcrops under the surficial deposits mainly in the western third of the County. Structure contours have been prepared for the top of the Formation. The structure contours show the Lower Scollard Formation ranges in elevation from less than 760 to more than 960 metres AMSL and has an average thickness of 30 metres. The non-pumping water level in the Lower Scollard Aquifer is downgradient to the north toward the Rosebud River and toward the Bow River in the southern part of the County.

#### 5.3.7.1 Depth to Top

The depth to the top of the Lower Scollard Formation ranges from less than 20 metres below ground surface at the eastern extent to more than 200 metres in the western part of the County (page A-43).

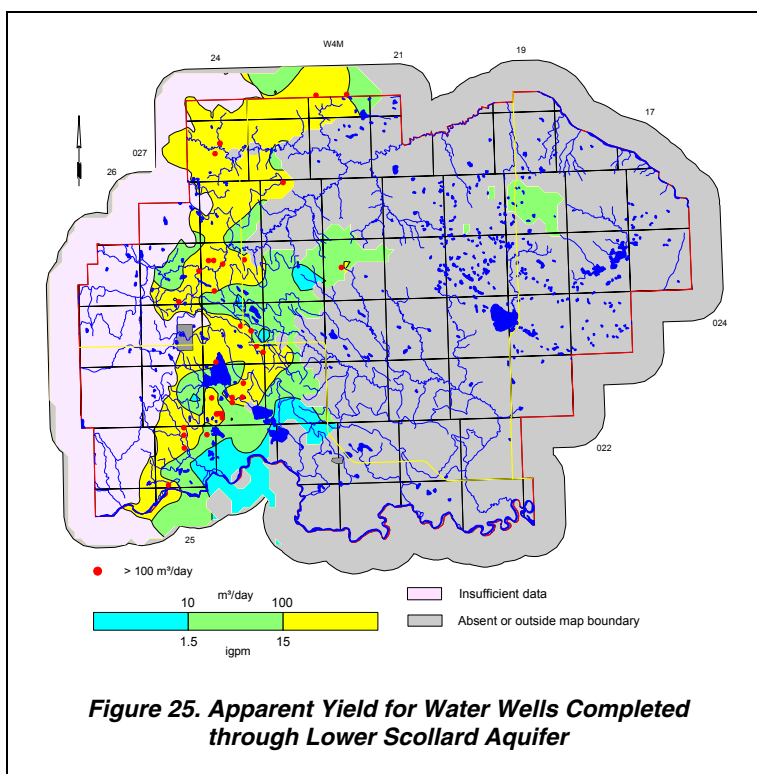
#### 5.3.7.2 Apparent Yield

The apparent yields for individual water wells completed through the Lower Scollard Aquifer range mainly from 10 to 100 m<sup>3</sup>/day, with more than 85% of the values being greater than ten m<sup>3</sup>/day.

In the County, there are 15 licensed water wells that are completed in the Lower Scollard Aquifer, for a total authorized diversion of 728 m<sup>3</sup>/day. There are four water supply wells that are each licensed to divert 124 m<sup>3</sup>/day for a stock yard operation. Three of the four water supply wells are in section 8, township 023, range 24, W4M and the fourth water supply that is licensed for 124 m<sup>3</sup>/day is in NW 5-023-24 W4M. Fourteen of the 15 licensed water wells could be linked to a water well in the AENV groundwater database.

From 1978 to 1984, Thiessen Farms Ltd. diverted groundwater from three water supply wells completed mainly in the Lower Scollard Aquifer in SW 23-022-25 W4M. An extended aquifer test conducted with one of these water supply wells indicated a long-term yield of 185 m<sup>3</sup>/day (HCL, April 1980). The three water supply wells were subsequently licensed to divert up to 178 m<sup>3</sup>/day. In 1985, four water supply wells were completed in SE 23-022-25 W4M, mainly within the Lower Scollard Aquifer. The four water supply wells in SE 23-022-25 W4M are currently licensed to divert a total of 145 m<sup>3</sup>/day for agricultural purposes.

In 1994, three water supply wells completed in the Lower Scollard Aquifer were drilled at a second Thiessen Farms Ltd. operation in the south half of section 8, township 023, range 24, W4M. An extended aquifer test with one of these water supply wells indicated a long-term yield of 315 m<sup>3</sup>/day based on an apparent transmissivity of 80 m<sup>2</sup>/day, an effective transmissivity of 30 m<sup>2</sup>/day and a storage coefficient of 0.0004 (HCL, November 1994). These three water supply wells are completed in the Lower Scollard Aquifer and are currently licensed to divert 124.5 m<sup>3</sup>/day each.



An extended aquifer test conducted in March 1999 with a water supply well for the Hutterian Brethren of Wheatland in 13-20-025-23 W4M completed from 25.0 to 30.5 metres below ground surface in the Lower Scollard Aquifer. The aquifer test consisted of 3,226 minutes of pumping at 152 litres per minute and 5,645 minutes of recovery and indicated a long-term yield of 56.3 m<sup>3</sup>/day based on an aquifer transmissivity of 57.6 m<sup>2</sup>/day and an effective transmissivity of 8.9 m<sup>2</sup>/day (HCL, October 1999). This water supply well is currently licensed for 50 m<sup>3</sup>/day.

**5.3.7.3 Quality**

The groundwaters from the Lower Scollard Aquifer are a sodium-sulfate type (see Piper diagram on CD-ROM). Total dissolved solids concentrations range mainly between 500 and 1,500 mg/L, with more than 65% of the groundwater samples having TDS concentrations of greater than 1,000 mg/L. The sulfate concentrations are mainly greater than 150 mg/L, with more than 40% of the groundwater samples having sulfate concentrations of greater than 500 mg/L. Nearly 35% of the chloride concentrations from the Lower Scollard Aquifer are less than ten mg/L.

A groundwater sample collected from a water supply well in SE 23-022-25 W4M in July 1978 is a sodium-sulfate type, with a TDS concentration of 906 mg/L, a sulfate concentration of 405 mg/L, a chloride concentration of 29 mg/L and a fluoride concentration of 2.32 mg/L (HCL, April 1980).

A groundwater sample collected from a water supply well in SW 08-023-24 W4M in June 1994 is a sodium-sulfate type, with a TDS concentration of 1,047 mg/L, a sulfate concentration of 554 mg/L, a chloride concentration of 10 mg/L, and a fluoride concentration of 2.08 mg/L (HCL, November 1994).

A groundwater sample collected from a water supply well in 13-20-025-23 W4M in May 1999 is a sodium-sulfate type, with a TDS concentration of 1,119 mg/L, a sulfate concentration of 440 mg/L, a chloride concentration of 11 mg/L, and a fluoride concentration of 2.3 mg/L (HCL, October 1999).

The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and fluoride in the groundwaters from water wells completed in the Lower Scollard Aquifer in the County have been compared to the SGCDWQ and median concentrations from all upper bedrock aquifer(s) in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median values of **TDS** and **sodium** exceed the guidelines. The median concentrations of TDS, sodium, sulfate and fluoride from water wells completed in the Lower Scollard Aquifer are greater than the median concentrations from water wells completed in all upper bedrock aquifer(s).

Constituent	No. of Analyses	Range for County in mg/L			All Bedrock Median	Recommended Maximum Concentration SGCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	103	320	6238	1190	1069	500
Sodium	62	161	930	390	350	200
Sulfate	99	25	4332	450	285	500
Chloride	99	3	798	12	13	250
Fluoride	81	0	7	1.0	0.7	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)  
 SGCDWQ - Summary of Guidelines for Canadian Drinking Water Quality  
 Federal-Provincial Subcommittee on Drinking Water, March 2001

**Table 11. Apparent Concentrations of Constituents in Groundwaters from Lower Scollard Aquifer**

### 5.3.8 Upper Horseshoe Canyon Aquifer

The Upper Horseshoe Canyon Aquifer comprises the permeable parts of the Upper Horseshoe Canyon Formation that underlie the Lower Scollard Formation. The Upper Horseshoe Canyon Formation subcrops under the surficial deposits in approximately 75% of the County. Structure contours have been prepared for the top of the Formation. The structure contours show the Upper Horseshoe Canyon Formation ranges in elevation from less than 720 to more than 960 metres AMSL and has a thickness of up to 100 metres. The non-pumping water level in the Upper Horseshoe Canyon Aquifer is downgradient to the north toward the Rosebud River and toward the Bow River in the southern part of the County.

#### 5.3.8.1 Depth to Top

The depth to the top of the Upper Horseshoe Canyon Formation is variable, ranging from less than ten metres at the eastern extent to more than 250 metres in the western part of the County (page A-46).

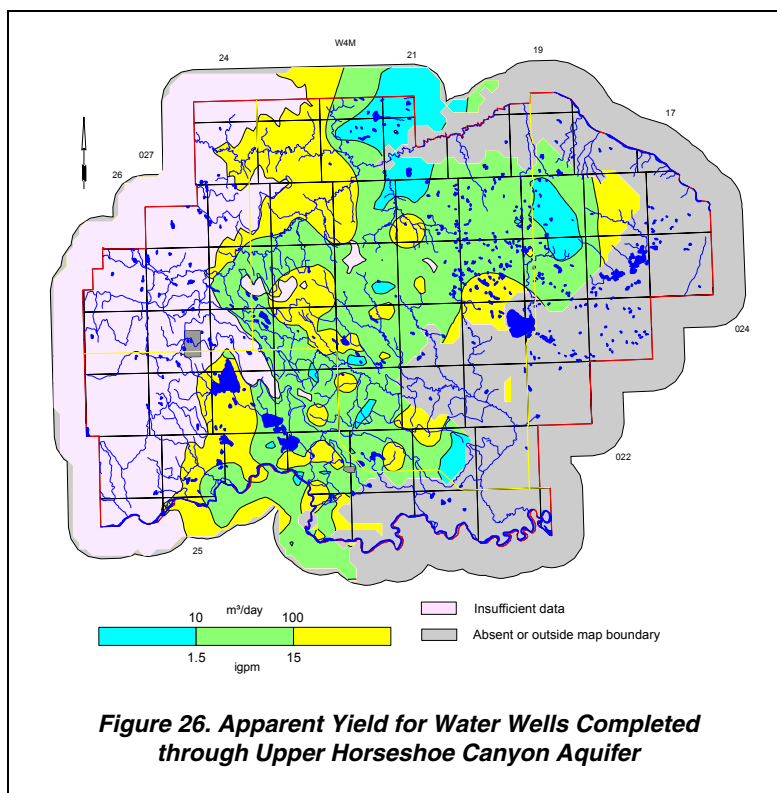
#### 5.3.8.2 Apparent Yield

The apparent yields for individual water wells completed through the Upper Horseshoe Canyon Aquifer range mainly from 10 to 100 m<sup>3</sup>/day, with more than 75% of the values being greater than ten m<sup>3</sup>/day.

In the County, there are 16 licensed water wells completed in the Upper Horseshoe Canyon Aquifer, for a total authorized diversion of 265 m<sup>3</sup>/day; the highest single diversion of 50.7 m<sup>3</sup>/day is for the Village of Hussar water supply well in 16-22-024-20 W4M used for municipal purposes. Fifteen of the sixteen licensed water wells could be linked to a water well in the AENV groundwater database.

Extended aquifer tests with two water supply wells (WSW No. 1-97 and WSW No. 2-97) were conducted for the Hutterian Brethren of Hillview in August 1998. These two water supply wells in NW 05-028-21 W4M are completed in the Upper Horseshoe Canyon Aquifer. Water Supply Well No. 1-97 is completed from 15.9 to 20.7 metres below ground surface in the upper part of the Upper Horseshoe Canyon Aquifer and WSW No. 2-97 is completed from 46.3 to 51.5 metres below ground surface in the lower part of the Upper Horseshoe Canyon Aquifer.

The results of the extended aquifer test with WSW No. 1-97 indicated a long-term yield of 28 m<sup>3</sup>/day, based on 5,777 minutes of pumping at 25.9 lpm, 10,043 minutes of recovery, and apparent and effective transmissivities of 11.6 m<sup>2</sup>/day. The results of the extended aquifer test with WSW No. 2-97 indicated a long-term yield of 19 m<sup>3</sup>/day, based on 2,084 minutes of pumping at 53.1 lpm and 15,341 minutes of recovery, an apparent transmissivity of 2.9 m<sup>2</sup>/day and an effective transmissivity of 1.9 m<sup>2</sup>/day (HCL, September 1999). Water Supply Well No. 1-97 is currently licensed to divert 29 m<sup>3</sup>/day of groundwater and WSW No. 2-97 is currently licensed to divert 19 m<sup>3</sup>/day of groundwater, both for agricultural purposes.



**Figure 26. Apparent Yield for Water Wells Completed through Upper Horseshoe Canyon Aquifer**

### 5.3.8.3 Quality

The groundwaters from the Upper Horseshoe Canyon Aquifer are mainly a bicarbonate-to-sulfate type, with sodium as the main cation (see Piper diagram on CD-ROM). Total dissolved solids concentrations range mainly between 500 and 1,000 mg/L, with more than 65% of the groundwater samples having TDS concentrations of greater than 1,000 mg/L. The sulfate concentrations range from less than 100 to more than 500 mg/L. Eighty percent of the chloride concentrations from the Upper Horseshoe Canyon Aquifer are less than 100 mg/L.

The groundwaters from WSW Nos. 1-97 and 2-97 are a sodium-bicarbonate type. A groundwater sample collected from WSW No. 1-97 in September 1998 has a TDS concentration of 1,390 mg/L, a sulfate concentration of 464 mg/L, a chloride concentration of 4.2 mg/L, and a fluoride concentration of 0.21 mg/L. A groundwater sample collected from WSW No. 2-97 in September 1998 has a TDS concentration of 837 mg/L, a sulfate concentration of 0.5 mg/L, a chloride concentration of 165 mg/L, and a fluoride concentration of 2.23 mg/L. (HCL, September 1999).

The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and fluoride in the groundwaters from water wells completed in the Upper Horseshoe Canyon Aquifer in the County have been compared to the SGCDWQ and median concentrations from all upper bedrock aquifer(s) in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median values of **TDS** and **sodium** exceed the guidelines. The median concentrations of TDS, sodium, sulfate and chloride from water wells completed in the Upper Horseshoe Canyon Aquifer are greater than the median concentrations, and fluoride is equal to the median concentrations from water wells completed in all upper bedrock aquifer(s).

Constituent	No. of Analyses	Range for County in mg/L			All Bedrock Median	Recommended Maximum Concentration SGCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	372	394	7176	1213	1069	500
Sodium	224	27	1250	420	350	200
Sulfate	365	0	3293	326	285	500
Chloride	367	0	1403	24	13	250
Fluoride	319	0	5	0.7	0.7	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)  
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**Table 12. Apparent Concentrations of Constituents in Groundwaters from Upper Horseshoe Canyon Aquifer**