

There are 539 records for bedrock water wells that have apparent yield values. In the County, 58% of the yields for water well completed in upper bedrock aquifer(s) are between 1 and 10 m³/day and 33% have yields of between 10 and 100 m³/day. The areas where higher yields are expected are mainly in the western part of the County. In this area, the Lower Horseshoe Canyon Formation is present. The areas where water wells with lower yields are expected are mainly in the eastern two-thirds of the County. Where the Bearpaw and Oldman formations are the upper bedrock, the water well yields are mainly less than 10 m³/day. Within the areas where lower yield water wells are present, there are small areas where higher yields also occur. This is because most water wells within these small areas would be completed in the *continental* Foremost Formation.

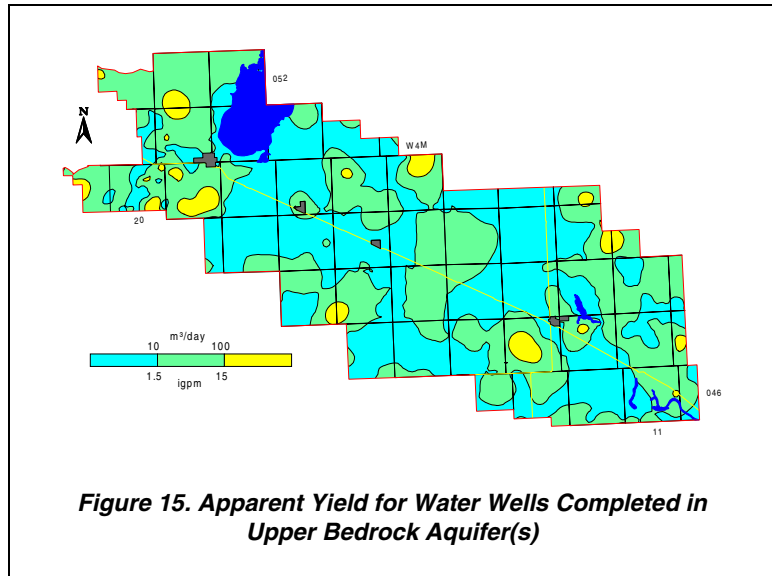


Figure 15. Apparent Yield for Water Wells Completed in Upper Bedrock Aquifer(s)

Aquifer	No. of Water Wells with Apparent Yields	Number of Water Wells with Apparent Yields		
		<10 m ³ /day	10 to 100 m ³ /day	>100 m ³ /day
Lower Horseshoe Canyon	104	45	37	22
Bearpaw	84	59	16	9
Oldman	203	130	66	7
<i>continental</i> Foremost	100	50	43	7
<i>marine</i> Foremost	10	1	5	4
Totals	501	285	167	49

Table 3. Apparent Yields of Bedrock Aquifers

There are 501 apparent yield values that can be assigned to a specific bedrock aquifer. The majority of the water wells completed in the bedrock aquifers have apparent yields that are less than 10 m³/day, as shown in the adjacent table.

5.3.3 Chemical Quality of Groundwater

The TDS concentrations in the groundwaters from the upper bedrock aquifer(s) range from less than 500 to more than 2,000 mg/L. In approximately 50% of the area, TDS values are more than 1,500 mg/L, with only a few areas having TDS concentrations of less than 1,000 mg/L. The lower values are expected mainly in the western and eastern parts of the County.

The relationship between TDS and sulfate concentrations shows that when TDS values in the upper bedrock aquifer(s) exceed 1,200 mg/L, the sulfate concentrations exceed 400 mg/L. The chloride concentrations in the groundwaters from the upper bedrock aquifer(s) exceed 250 mg/L in 50% of the County, most noticeably in the south-central parts.

In more than 95% of the County, the fluoride ion concentrations in the groundwaters from the upper bedrock aquifer(s) are less than 1.5 mg/L.

The Piper tri-linear diagrams¹⁵ (see Appendix A) show that all chemical types of groundwater occur in the bedrock aquifers. However, the majority of the groundwaters are sodium-bicarbonate or sodium-sulfate types.

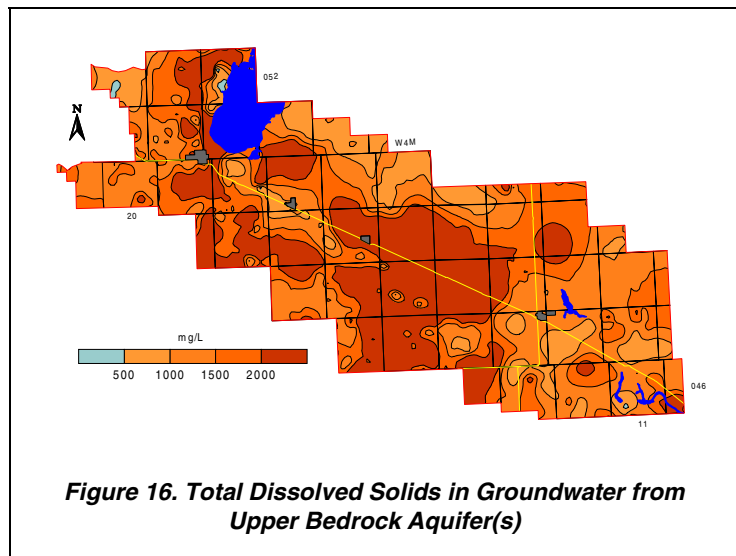


Figure 16. Total Dissolved Solids in Groundwater from Upper Bedrock Aquifer(s)

¹⁵ See glossary

5.3.4 Lower Horseshoe Canyon Aquifer

The Lower Horseshoe Canyon Aquifer comprises the porous and permeable parts of the Lower Horseshoe Canyon Formation that underlies the western part of the County. The thickness of the Lower Horseshoe Canyon Formation is generally less than 80 metres; in the eastern two-thirds of the County, the Lower Horseshoe Canyon Formation has been eroded. The lowest 70 metres of the Horseshoe Canyon Formation tend to contain more porous and permeable materials.

5.3.4.1 Depth to Top

The depth to the top of the Lower Horseshoe Canyon Formation is mainly less than 40 metres below ground level and is a reflection of the thickness of the surficial deposits. Close to the western edge of the County, the Lower Horseshoe Canyon Formation is more than 75 metres thick. In these areas, water well depths would need to be in the order of 100 metres to fully penetrate the lower part of the Formation, assuming a thickness of 20 metres for the surficial deposits.

5.3.4.2 Apparent Yield

The apparent yields for individual water wells completed through the Lower Horseshoe Canyon Aquifer are mainly in the range of 10 to 100 m³/day. The areas where water wells with higher yields are expected are mainly in township 050, range 19, W4M. There is no apparent relationship between expected water well yield and thickness of the Aquifer.

5.3.4.3 Quality

The groundwaters from the Lower Horseshoe Canyon Aquifer are mainly sodium-bicarbonate, sodium-sulfate or sodium-chloride types (see CD-ROM). The TDS concentrations for groundwaters from the Lower Horseshoe Canyon Aquifer range from less than 1,000 to more than 2,000 mg/L. The higher values of TDS occur mainly in townships 049 and 050, ranges 18 and 19, W4M. When TDS values in the groundwaters from the Lower Horseshoe Canyon Aquifer exceed 1,300 mg/L, the sulfate concentrations exceed 400 mg/L.

The chloride concentrations of the groundwaters from the Lower Horseshoe Canyon Aquifer can be expected to be less than 100 mg/L. In a few areas, in the western part of the County, the chloride concentrations exceed 250 mg/L.

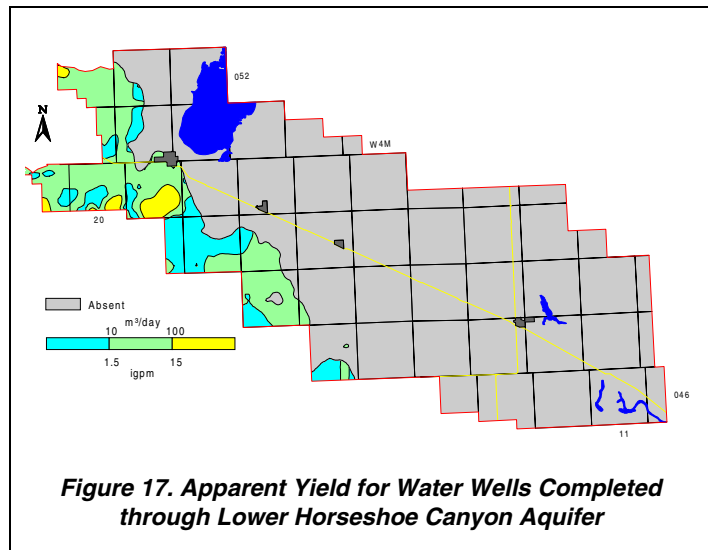


Figure 17. Apparent Yield for Water Wells Completed through Lower Horseshoe Canyon Aquifer

5.3.5 Bearpaw Aquifer

The Bearpaw Aquifer comprises the porous and permeable parts of the Bearpaw Formation and subcrops in the west-central part of the County. The Bearpaw Formation is generally less than 80 metres thick and is present only in the western half of the County; in the remainder of the County, the Bearpaw Formation has been eroded.

5.3.5.1 Depth to Top

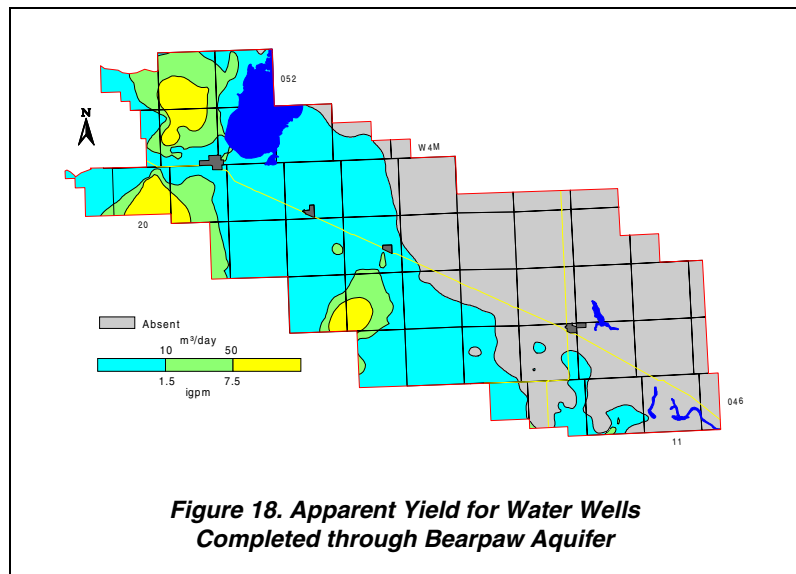
The depth to the top of the Bearpaw Formation is mainly less than 100 metres below ground level. The largest area where the top of the Bearpaw is more than 100 metres below ground level is in the western part of the County. In this area, the Bearpaw Formation underlies the Lower Horseshoe Canyon Formation and the depth to the top of the Bearpaw Formation can exceed 140 metres.

5.3.5.2 Apparent Yield

The apparent yields for water wells completed through the Bearpaw Aquifer are mainly less than 10 m³/day. Higher yields occur mainly in ranges 16, 19 and 20, W4M. These higher yields may be related to inaccurate classification due to poor stratigraphic control.

5.3.5.3 Quality

The groundwaters from the Bearpaw Aquifer are mainly sodium-bicarbonate, sodium-sulfate or sodium-chloride types (see CD-ROM). The TDS concentrations are expected to be mainly less than 2,000 mg/L. The higher values occur mainly in the southern and southwestern parts of the County. The sulfate concentrations are mainly less than 500 mg/L. Chloride concentrations in the groundwaters from the Bearpaw Aquifer are mainly less than 250 mg/L, although there are areas where the chloride concentrations exceed 250 mg/L. The main areas where the chloride concentrations in the groundwaters from the Bearpaw Aquifer are expected to be more than 250 mg/L are in townships 049 and 050, ranges 18 and 19, W4M.



5.3.6 Oldman Aquifer

The Oldman Aquifer comprises the porous and permeable parts of the Oldman Formation. The Oldman Formation is present under most of the County, being absent only in small areas in the northeastern and southeastern parts of the County. The thickness of the Oldman Formation is in the order of 60 metres in the western half of the County. In the eastern half of the County, the Oldman Formation subcrops below the surficial deposits and the thickness decreases to zero in areas where the underlying *continental* Foremost Formation subcrops.

5.3.6.1 Depth to Top

The depth to the top of the Oldman Formation is mainly less than 20 metres in the eastern part of the County where it subcrops. In the western part of the County where the Oldman is below the Bearpaw and the Lower Horseshoe Canyon formations, the depth to the top of the Oldman Formation can be more than 240 metres.

5.3.6.2 Apparent Yield

The apparent yields for individual water wells completed through the Oldman Aquifer are expected to be mainly less than 10 m³/day. The higher water well yields expected in the western part of the County, as shown on the adjacent map, reflect the gridding of a limited amount of data in that part of the County. The limited amount of data is a result of the depth of burial of the Oldman Formation, which is at a depth of more than 100 metres south and west of Beaverhill Lake.

The patchy areas of higher yields in township 050, ranges 15 and 16, W4M and township 047, ranges 10, 12 and 13, W4M may be a result of inadequate stratigraphic control.

5.3.6.3 Quality

Groundwaters from the Oldman Aquifer are mainly sodium-bicarbonate, sodium-sulfate or sodium-chloride-type waters. TDS concentrations are expected to be in the order of 500 to 3,000 mg/L, although there is a paucity of data west of range 15 and south of Highway 14. When TDS values exceed 1,200 mg/L, the sulfate concentrations exceed 400 mg/L.

Chloride concentrations in the groundwaters from the Oldman Aquifer are mainly less than 250 mg/L in ranges 10 to 12, W4M, where the Formation subcrops. The indications are that west of range 12, W4M, the chloride concentrations are expected to be over 250 mg/L.

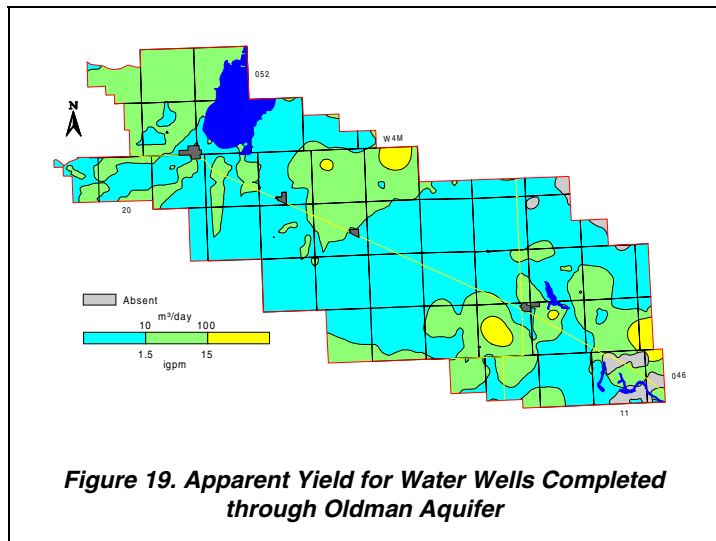


Figure 19. Apparent Yield for Water Wells Completed through Oldman Aquifer

5.3.7 *continental* Foremost Aquifer

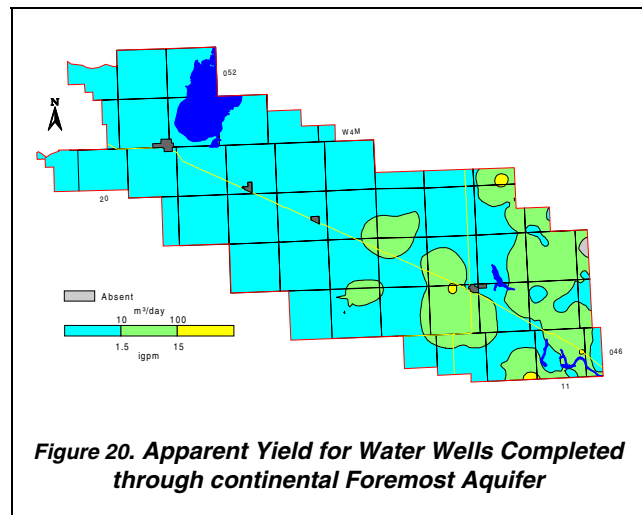
The *continental* Foremost Aquifer comprises the porous and permeable parts of the *continental* Foremost Formation and subcrops in a few small areas in the northeastern and southeastern parts of the County. The thickness of the *continental* Foremost Aquifer can be more than 160 metres in the western half of the County. The *continental* Foremost Formation consists mainly of shale deposits with minor amounts of coal and sandstone present. The sandstone deposits usually occur as narrow linear channel deposits.

5.3.7.1 *Depth to Top*

The *continental* Foremost Formation is present under the entire County. The depth to the top of the Formation is variable, ranging from less than 20 metres where it subcrops in the eastern part of the County, to more than 280 metres in the western part of the County. In most of the area, the Base of Groundwater Protection occurs within the *continental* Foremost Formation.

5.3.7.2 *Apparent Yield*

The apparent yields for individual water wells completed in the *continental* Foremost Aquifer are mainly less than 10 m³/day, based on data from the groundwater database. The adjacent map indicates that apparent yields of more than 100 m³/day are expected where the Aquifer subcrops and this could be a result of increased permeability due to weathering processes. There are little or no data from the groundwater database for the Aquifer west of range 14, W4M, and the map indicates that expected water well yields are mainly less than 10 m³/day. The low yields presented in the majority of the County could be a result of the gridding procedure used to process a very limited number of data points.



5.3.7.3 *Quality*

Groundwaters from the *continental* Foremost Aquifer are mainly sodium-bicarbonate, sodium-sulfate or sodium-chloride-type waters. TDS concentrations in the groundwaters from the *continental* Foremost Aquifer are expected to be in the order of 1,000 to 3,000 mg/L.

In the eastern part of the County, when TDS values of the groundwaters from the *continental* Foremost Aquifer exceed 1,200 mg/L, the sulfate concentrations exceed 400 mg/L. Also, the chloride concentrations in these groundwaters are mainly less than 100 mg/L where the Formation subcrops.