

### 5.3.5 Grand Centre Aquifer

The Grand Centre Aquifer comprises the permeable parts of the Grand Centre Formation, is the uppermost geological unit in the area, and has a thickness that is mainly less than 25 metres.

#### 5.3.5.1 Depth to Top

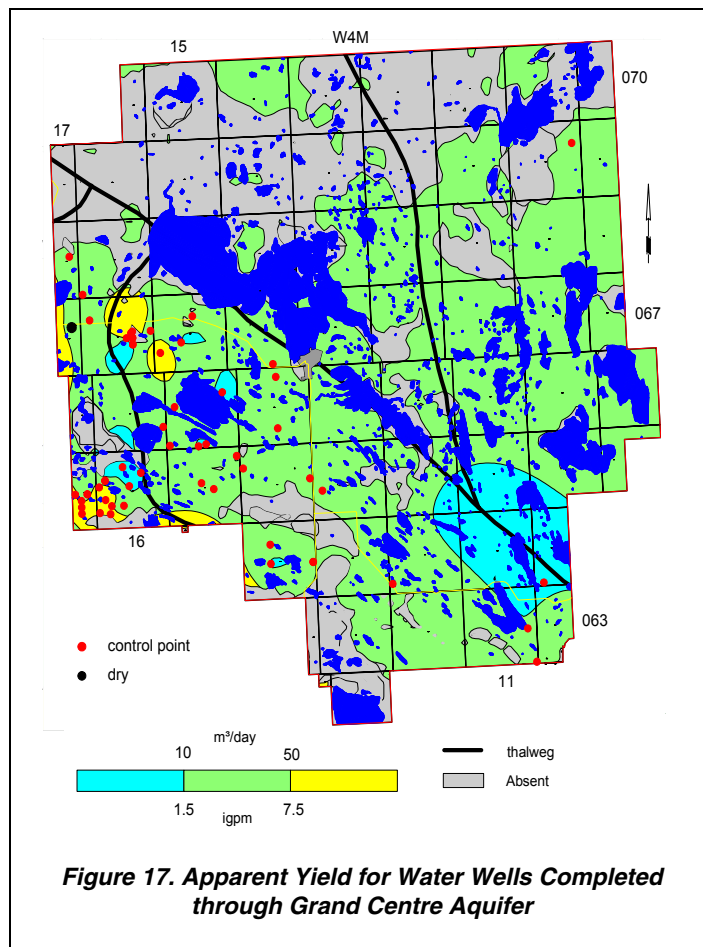
The depth to the top of the Grand Centre Formation is a function of the thickness of the postglacial stratified deposits. The Grand Centre Formation lies at the surface in most places, except where it is buried by postglacial stratified sediment (Andriashek and Fenton, 1989).

#### 5.3.5.2 Apparent Yield

The apparent yields for individual water wells completed through the Grand Centre Aquifer are mainly in the range of 10 to 50 m<sup>3</sup>/day, with 46 (84%) of the 55 values being less than 50 m<sup>3</sup>/day (Table 3). Of the 46 values, 21 are for bored water wells. Shown on the adjacent map is the location of one dry test hole in NW 24-067-17 W4M.

In the County, there are three licensed groundwater water wells completed through the Grand Centre Aquifer, with a total authorized diversion 26 m<sup>3</sup>/day; all three licensed users are for agricultural purposes. Each of the three licensed water wells could be linked to a water well in the AENV groundwater database.

In 1974, Alberta Environment supervised the completion of seven bored water wells for the Lac La Biche Mission Settlement (Kerr, April 1978a). Of the seven bored water wells, two water wells could supply potable groundwater to the community. An aquifer test conducted with the bored water well (38-07) in 03-03-067-14 W4M indicated an apparent yield of ten m<sup>3</sup>/day.



5.3.5.3 Quality

The groundwaters from the Grand Centre Aquifer are a calcium-magnesium-bicarbonate type (see Piper diagram on CD-ROM). The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and nitrate + nitrite (as N) in the groundwaters from water wells completed in the Grand Centre Aquifer in the County have been compared to the SGCDWQ and median concentrations from all surficial deposits in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median value of **TDS** concentration exceeds the guideline.

Constituent	No. of Analyses	Range for County in mg/L			All Surficial Median	Recommended Maximum Concentration GCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	42	327	3160	925	1220	500
Sodium	38	5	943	150	230	200
Sulfate	42	5	1519	211	235	500
Chloride	42	1	269	11	40	250
Nitrate + Nitrite (as N)	39	0	17	0.0	0.0	10

Concentration in milligrams per litre unless otherwise stated  
 Note: indicated concentrations are for Aesthetic Objectives except for Nitrate + Nitrite (as N), which is for Maximum Acceptable Concentration (MAC)  
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**Table 5. Concentrations of Constituents in Groundwaters from Grand Centre Aquifer**

The median concentrations of TDS, sodium, sulfate and chloride from water wells completed in the Grand Centre Aquifer are below the median concentrations from water wells completed in all surficial deposits.

A groundwater sample collected from the AENV bored water well No. 38-07 has a TDS concentration of 577 mg/L, a sodium concentration of 14, a sulfate concentration of 128 mg/L, a chloride concentration of 36 mg/L, and a nitrate as (N) concentration of 6.1 mg/L (Kerr, April 1978a).

### 5.3.6 Sand River Aquifer

The Sand River Aquifer comprises the permeable parts of the Sand River Formation, which underlies the Grand Centre Formation. The Sand River Formation has a thickness in the order of 25 metres. Structure contours have been prepared for the top of the Sand River Formation. The structure contours show the Sand River Formation ranges in elevation from less than 570 to more than 670 metres AMSL (see CD-ROM).

#### 5.3.6.1 Depth to Top

The depth to the top of the Sand River Formation ranges from less than ten metres below ground level to more than 30 metres at the Formation edges (Page A-30).

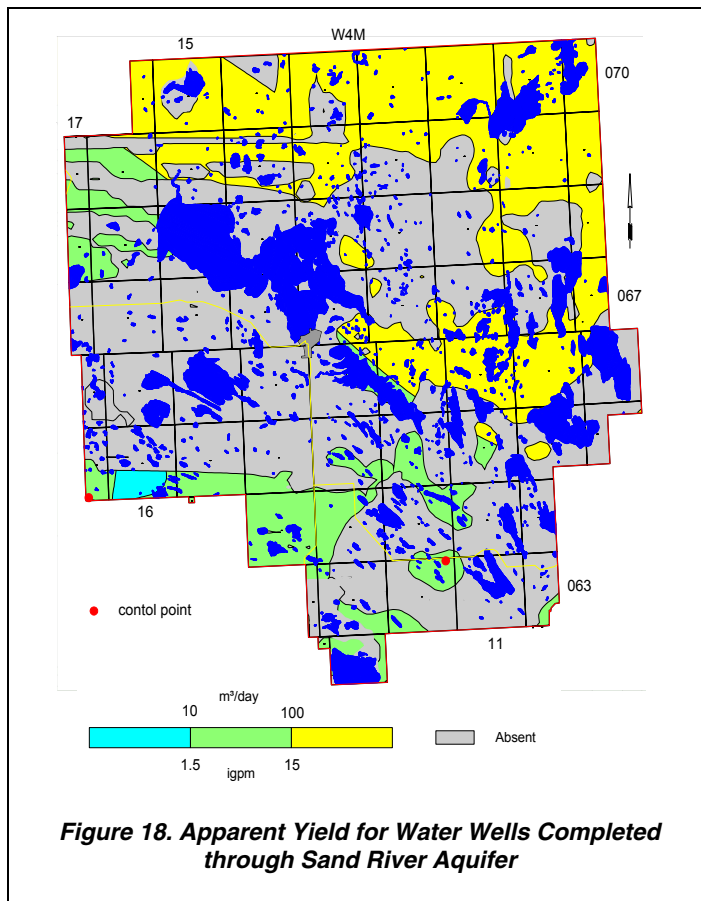
#### 5.3.6.2 Apparent Yield

In the County, there are only two control points for apparent yield for water wells completed through the Sand River Aquifer. The higher yields in the northern half of the County are the reflection of gridding a control point outside the County in township 068, range 08, W4M.

In the County, there are no licensed groundwater water wells that are completed in the Sand River Aquifer.

#### 5.3.6.3 Quality

There are sufficient data from three water wells to determine the groundwater type from the Sand River Aquifer; these data show that the groundwaters are calcium-magnesium bicarbonate and calcium-magnesium-sulfate types (see Piper diagram on CD-ROM). The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and nitrate + nitrite (as N) in the groundwaters from water wells completed in the Sand River Aquifer in the County have been compared to the SGCDWQ and median concentrations from all surficial deposits in the



**Figure 18. Apparent Yield for Water Wells Completed through Sand River Aquifer**

Constituent	No. of Analyses	Range for County in mg/L			All Surficial Median	Recommended Maximum Concentration GCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	3	493	2481	2238	1220	500
Sodium	3	46	121	108	230	200
Sulfate	3	72	1462	1250	235	500
Chloride	3	3	4	4	40	250
Nitrate + Nitrite (as N)	2	0	0	0.0	0.0	10

Concentration in milligrams per litre unless otherwise stated  
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**Table 6. Concentrations of Constituents in Groundwaters from Sand River Aquifer**

adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median values of TDS and sulfate exceed the guidelines.

The median concentrations of TDS and sulfate from the three analyses of water wells completed through the Sand River Aquifer exceed the mean TDS and sulfate concentrations of all surficial deposits.

### 5.3.7 Marie Creek Aquifer

The Marie Creek Aquifer comprises the permeable parts of the Marie Creek Formation, which underlies the Sand River Formation. The Marie Creek Formation has a thickness of mainly less than 30 metres (see CD-ROM). Structure contours have been prepared for the top of the Marie Creek Formation. The structure contours show the Marie Creek Formation ranges in elevation from less than 560 to more than 640 metres AMSL.

#### 5.3.7.1 Depth to Top

The depth to the top of the Marie Creek Formation ranges from less than ten metres below ground level to more than 30 metres at the Formation edges (Page A-33).

#### 5.3.7.2 Apparent Yield

The apparent yields for individual water wells completed through the Marie Creek Aquifer range mainly from 10 to 100 m<sup>3</sup>/day. Eighty percent of the water wells completed in the Marie Creek Aquifer have apparent yields that are less than 100 m<sup>3</sup>/day. The control points are mainly south of the Buried Helena Valley.

In the County, there is one water well that is completed in the Marie Creek Aquifer and is licensed for 6.7 m<sup>3</sup>/day for agricultural purposes. This water well could be linked to a water well in the AENV groundwater database.

Extended aquifer tests conducted with two water source wells completed in the Marie Creek Aquifer in NW 20-062-03 W4M (M.D. of Bonnyville) indicated a total long-term yield of 820 m<sup>3</sup>/day from both water source wells, based on an effective transmissivity of 180 metres squared per day (m<sup>2</sup>/day) (HCL, 1988b).

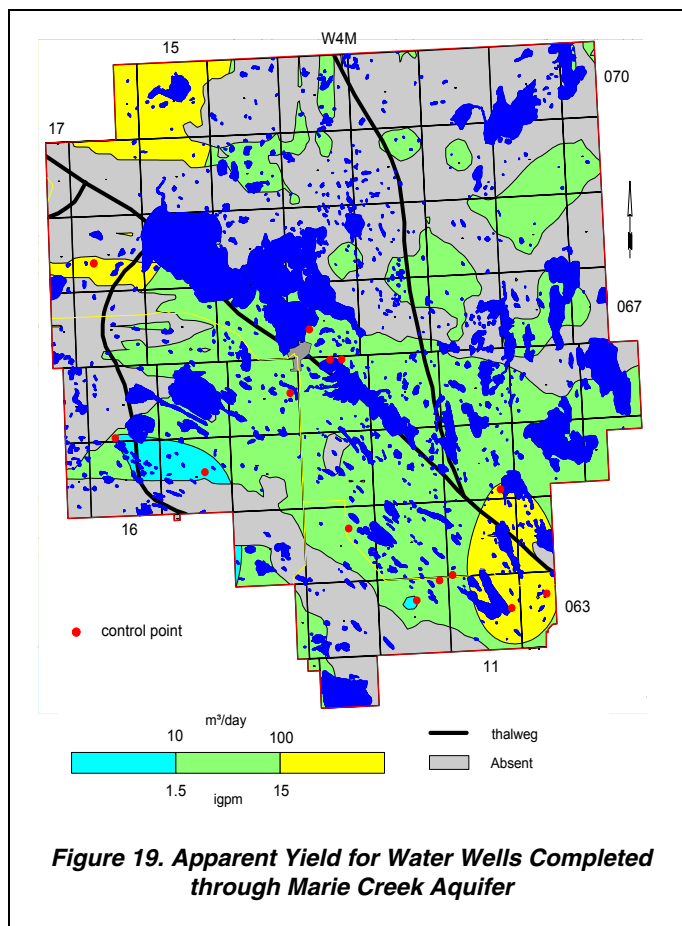
#### 5.3.7.3 Quality

The groundwaters from the Marie Creek Aquifer are mainly a calcium-magnesium-bicarbonate type (see Piper diagram on CD-ROM). The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and nitrate + nitrite (as N) in the groundwaters from water wells completed in the Marie Creek Aquifer in the County have been compared to the SGCDWQ and median concentrations from all surficial deposits in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median value of **TDS** exceeds the guidelines. The median concentration of sulfate from water wells completed in the Sand River Aquifer exceeds the median sulfate concentration from water wells completed in all surficial deposits.

Constituent	No. of Analyses	Range for County in mg/L			All Surficial Median	Recommended Maximum Concentration GCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	9	415	2569	1190	1220	500
Sodium	8	6	425	50	230	200
Sulfate	9	31	1025	466	235	500
Chloride	9	1	66	3	40	250
Nitrate + Nitrite (as N)	5	0	0	0.0	0.0	10

Concentration in milligrams per litre unless otherwise stated  
Note: indicated concentrations are for Aesthetic Objectives except for Nitrate + Nitrite (as N), which is for Maximum Acceptable Concentration (MAC)  
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**Table 7. Concentrations of Constituents in Groundwaters from Marie Creek Aquifer**



**Figure 19. Apparent Yield for Water Wells Completed through Marie Creek Aquifer**

A groundwater sample from one of the water source wells in NW 20-062-03 W4M has a TDS concentration of 352 mg/L, a sodium concentration of 28 mg/L, a sulfate concentration of 3 mg/L, a chloride concentrations of 7 mg/L, and a nitrate + nitrite (as N) of less than 0.2 mg/L.

### 5.3.8 Ethel Lake Aquifer

The Ethel Lake Aquifer comprises the permeable parts of the Ethel Lake Formation, which underlies the Marie Creek Formation. The Ethel Lake Formation has an average thickness of two metres but can be more than 30 metres (see CD-ROM). Structure contours have been prepared for the top of the Ethel Lake Formation. The structure contours show the Ethel Lake Formation ranges in elevation from less than 550 to more than 620 metres AMSL.

#### 5.3.8.1 Depth to Top

The depth to the top of the Ethel Lake Formation ranges from less than 15 metres below ground level to more than 45 metres at the Formation edges (Page A-36).

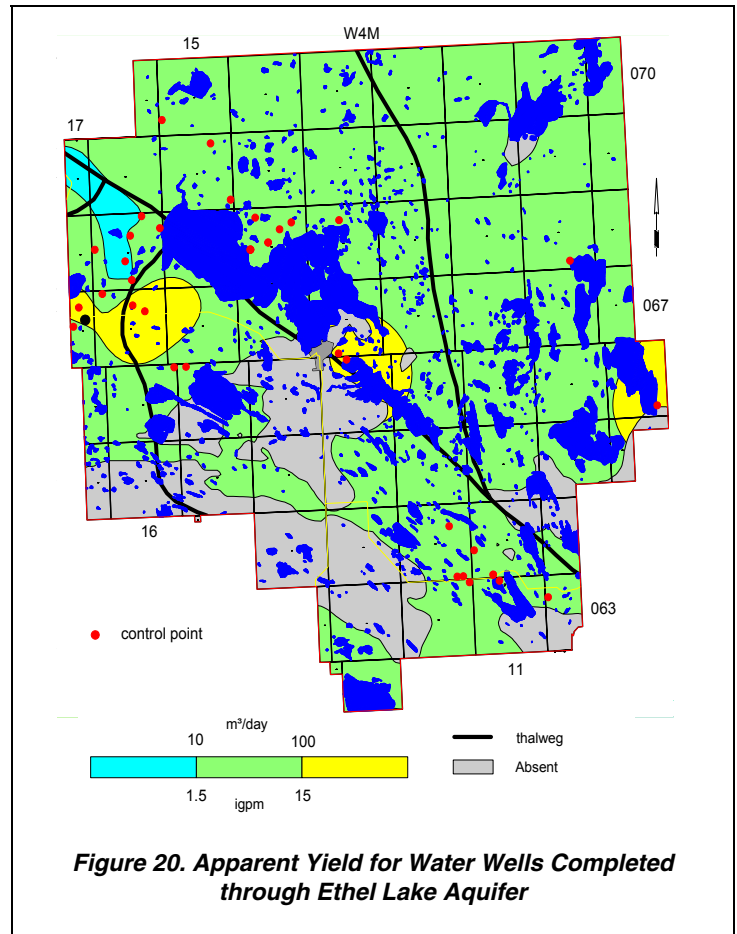
#### 5.3.8.2 Apparent Yield

The apparent yields for individual water wells completed through the Ethel Lake Aquifer range mainly from 10 to 100 m<sup>3</sup>/day. Fifty percent of the water wells completed in the Ethel Lake Aquifer have apparent yields that are less than 50 m<sup>3</sup>/day. The fewest number of control points are east of the Buried Imperial Mills Valley.

In the County, there are no licensed water wells that are completed in the Ethel Lake Aquifer.

#### 5.3.8.3 Quality

The groundwaters from the Ethel Lake Aquifer are mainly a calcium-magnesium-bicarbonate type (see Piper diagram on CD-ROM). The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and nitrate + nitrite (as N) in the groundwaters from water wells completed in the Ethel Lake Aquifer in the County have been compared to the SGCDWQ and median concentrations from all surficial deposits in the adjacent table. Of the five constituents that have been compared to the SGCDWQ, the median



**Figure 20. Apparent Yield for Water Wells Completed through Ethel Lake Aquifer**

Constituent	No. of Analyses	Range for County in mg/L			All Surficial Median	Recommended Maximum Concentration GCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	23	332	1824	777	1220	500
Sodium	15	23	597	121	230	200
Sulfate	23	13	750	234	235	500
Chloride	23	0	212	4	40	250
Nitrate + Nitrite (as N)	16	0	1	0.0	0.0	10

Concentration in milligrams per litre unless otherwise stated  
 Note: indicated concentrations are for Aesthetic Objectives except for Nitrate + Nitrite (as N), which is for Maximum Acceptable Concentration (MAC)  
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**Table 8. Concentrations of Constituents in Groundwaters from Ethel Lake Aquifer**

value of TDS exceeds the guidelines.

The median concentrations of TDS, sodium, sulfate and chloride from water wells completed in the Ethel Lake Aquifer are below the median concentrations from water wells completed in all surficial deposits.

### 5.3.9 Bonnyville Aquifer

The Bonnyville Aquifer comprises the permeable parts of the Bonnyville Formation, which underlies the Ethel Lake Formation. The Bonnyville Formation has a thickness of mainly less than 50 metres (see CD-ROM). In the County, the Bonnyville Formation is widespread. Structure contours have been prepared for the top of the Bonnyville Formation. The structure contours show that the top of the Bonnyville Formation ranges in elevation from less than 540 to more than 620 metres AMSL.

#### 5.3.9.1 Depth to Top

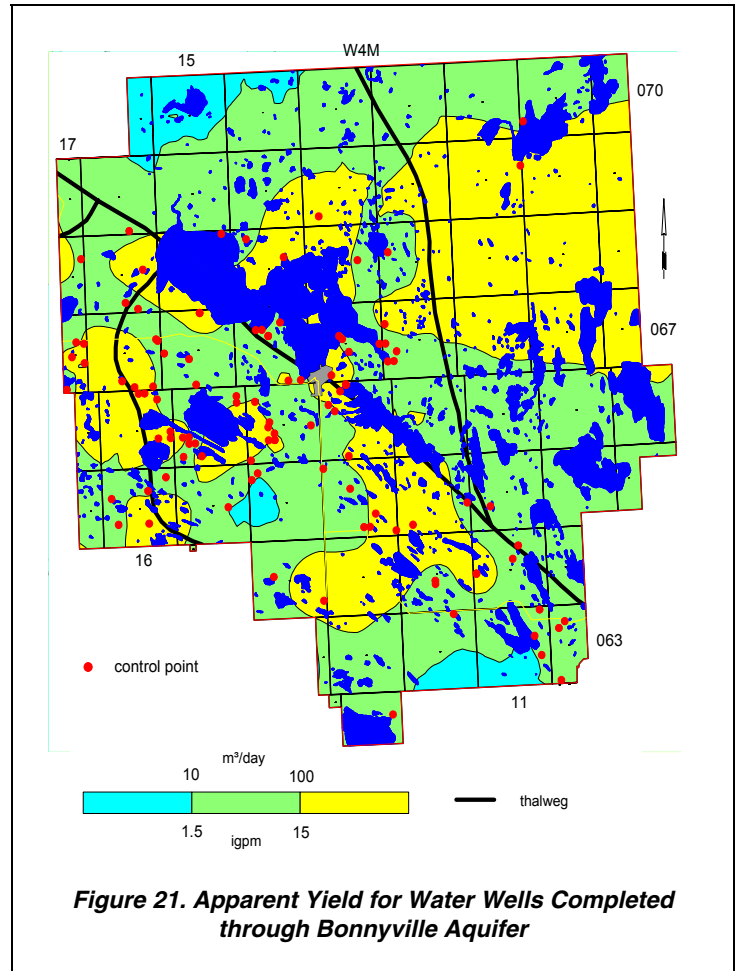
The depth to the top of the Bonnyville Formation ranges from less than 30 metres below ground level to more than 60 metres (Page A-39).

#### 5.3.9.2 Apparent Yield

The apparent yields for individual water wells completed through the Bonnyville Aquifer are mainly in the range of 10 to 100 m<sup>3</sup>/day, with more than 60% of the values being more than 50 m<sup>3</sup>/day.

In the County, there are no licensed groundwater water wells completed through the Bonnyville Aquifer.

In October and November 1973, Alberta Environment supervised the completion of four water wells for the Elinor Lake Metis Settlement (Kerr, April 1978b). The AENV water supply well (27-02) was completed from 33 to 36 metres below ground surface in the Bonnyville Aquifer. A three-hour aquifer test conducted with the water supply well indicated a long-term yield of 11.4 m<sup>3</sup>/day.



**Figure 21. Apparent Yield for Water Wells Completed through Bonnyville Aquifer**



### 5.3.9.3 Quality

The groundwaters from the Bonnyville Aquifer are mainly a bicarbonate type, with calcium-magnesium or sodium as the main cation (see Piper diagram on CD-ROM). The minimum, maximum and median concentrations of TDS, sodium, sulfate, chloride and nitrate + nitrite (as N) in the groundwaters from water wells completed in the Bonnyville Aquifer in the County have been compared to the SGCDWQ and median concentrations from all surficial deposits 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.

Constituent	No. of Analyses	Range for County in mg/L			All Surficial Median	Recommended Maximum Concentration GCDWQ
		Minimum	Maximum	Median		
Total Dissolved Solids	61	315	35132	1280	1220	500
Sodium	51	13	917	238	230	200
Sulfate	60	5	1484	279	235	500
Chloride	62	0	6600	48	40	250
Nitrate + Nitrite (as N)	53	0	68	0.0	0.0	10

Concentration in milligrams per litre unless otherwise stated  
 Note: indicated concentrations are for Aesthetic Objectives except for Nitrate + Nitrite (as N), which is for Maximum Acceptable Concentration (MAC)  
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**Table 9. Concentrations of Constituents in Groundwaters from Bonnyville Aquifer**

The median concentrations of TDS, sodium, sulfate and chloride are greater than the median concentrations from water wells completed in all surficial deposits.

A groundwater sample collected from the AENV Water Supply Well No. 27-02 has a TDS concentration of 342 mg/L, a sodium concentration of 13 mg/L, a sulfate concentration of 10 mg/L, a chloride concentration of 2 mg/L, and a nitrate as (N) concentration of 0.1 mg/L (Kerr, April 1978b).