

BGP	Base of Groundwater Protection
DEM	Digital Elevation Model
DST	drill stem test
EUB	Alberta Energy and Utilities Board
GCDWQ	Guidelines for Canadian Drinking Water Quality
NPWL	non-pumping water level
TDS	Total Dissolved Solids
WSW	Water Source Well or Water Supply Well

**M.D. OF BONNYVILLE**  
**Appendix B**

**Maps and Figures on CD-ROM**

## 1) General

- Index Map/Surface Topography
- Location of Water Wells and Springs
- Casing Diameter Used in Water Wells
- Surface Casing Types used in Drilled Water Wells
- Licensed Water Wells
- Depth to Base of Groundwater Protection
- Generalized Cross-Section (for terminology only)
- Geologic Column
- Hydrogeological Map
- Depth of Existing Water Wells
- Cross-Section A - A'
- Cross-Section B - B'
- Cross-Section C - C'
- Cross-Section D - D'
- Cross-Section E - E'
- Cross-Section F - F'
- Bedrock Topography
- Surficial Geology
- Estimated Water Well Use Per Section
- Water Wells Recommended for Field Verification

## 2) Surficial Aquifers

### a) Surficial Deposits

- Thickness of Surficial Deposits
- Non-Pumping Water-Level Surface in Surficial Deposits Based on Water Wells Less than 20 metres Deep
- Total Dissolved Solids in Groundwater from Surficial Deposits
- Sulfate in Groundwater from Surficial Deposits
- Chloride in Groundwater from Surficial Deposits
- Nitrate + Nitrite (as N) in Groundwater from Surficial Deposits
- Total Hardness in Groundwater from Surficial Deposits
- Piper Diagram - Surficial Deposits
- Thickness of Sand and Gravel Deposits
- Amount of Sand and Gravel in Surficial Deposits
- Thickness of Sand and Gravel Aquifer(s)
- Apparent Yield for Water Wells Completed in Sand and Gravel Aquifer(s)
- Changes in Water Levels in Sand and Gravel Aquifer(s)

### b) Upper Sand and Gravel

- Thickness of Upper Surficial Deposits
- Thickness of Upper Sand and Gravel (not all drill holes fully penetrate surficial deposits)
- Thickness of Upper Sand and Gravel Aquifer
- Apparent Yield for Water Wells Completed through Upper Sand and Gravel Aquifer

### i) Grand Centre Formation

- Thickness of Grand Centre Formation
- Non-Pumping Water-Level Surface - Grand Centre Aquifer
- Apparent Yield for Water Wells Completed through Grand Centre Aquifer
- Total Dissolved Solids in Groundwater from Grand Centre Aquifer
- Sulfate in Groundwater from Grand Centre Aquifer
- Chloride in Groundwater from Grand Centre Aquifer
- Nitrate + Nitrite (as N) in Groundwater from Grand Centre Aquifer
- Piper Diagram - Grand Centre Aquifer

**ii) Sand River Formation**

Depth to Top of Sand River Formation  
Structure-Contour Map - Sand River Formation  
Thickness of Sand River Formation  
Non-Pumping Water-Level Surface - Sand River Aquifer  
Apparent Yield for Water Wells Completed through Sand River Aquifer  
Total Dissolved Solids in Groundwater from Sand River Aquifer  
Sulfate in Groundwater from Sand River Aquifer  
Chloride in Groundwater from Sand River Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Sand River Aquifer  
Piper Diagram - Sand River Aquifer

**iii) Marie Creek Formation**

Depth to Top of Marie Creek Formation  
Structure-Contour Map - Marie Creek Formation  
Thickness of Marie Creek Formation  
Non-Pumping Water-Level Surface - Marie Creek Aquifer  
Apparent Yield for Water Wells Completed through Marie Creek Aquifer  
Total Dissolved Solids in Groundwater from Marie Creek Aquifer  
Sulfate in Groundwater from Marie Creek Aquifer  
Chloride in Groundwater from Marie Creek Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Marie Creek Aquifer  
Piper Diagram - Marie Creek Aquifer

**iv) Ethel Lake Formation**

Depth to Top of Ethel Lake Formation  
Structure-Contour Map - Ethel Lake Formation  
Thickness of Ethel Lake Formation  
Non-Pumping Water-Level Surface - Ethel Lake Aquifer  
Apparent Yield for Water Wells Completed through Ethel Lake Aquifer  
Total Dissolved Solids in Groundwater from Ethel Lake Aquifer  
Sulfate in Groundwater from Ethel Lake Aquifer  
Chloride in Groundwater from Ethel Lake Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Ethel Lake Aquifer  
Piper Diagram - Ethel Lake Aquifer

**v) Bonnyville Formation**

Depth to Top of Bonnyville Formation  
Structure-Contour Map - Bonnyville Formation  
Thickness of Bonnyville Formation  
Non-Pumping Water-Level Surface - Bonnyville Aquifer  
Apparent Yield for Water Wells Completed through Bonnyville Aquifer  
Total Dissolved Solids in Groundwater from Bonnyville Aquifer  
Sulfate in Groundwater from Bonnyville Aquifer  
Chloride in Groundwater from Bonnyville Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Bonnyville Aquifer  
Piper Diagram - Bonnyville Aquifer

**vi) Muriel Lake Formation**

Depth to Top of Muriel Lake Formation  
Structure-Contour Map - Muriel Lake Formation  
Thickness of Muriel Lake Formation  
Non-Pumping Water-Level Surface - Muriel Lake Aquifer  
Apparent Yield for Water Wells Completed through Muriel Lake Aquifer  
Total Dissolved Solids in Groundwater from Muriel Lake Aquifer  
Sulfate in Groundwater from Muriel Lake Aquifer  
Chloride in Groundwater from Muriel Lake Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Muriel Lake Aquifer  
Piper Diagram - Muriel Lake Aquifer

**vii) Bronson Lake Formation**

Depth to Top of Bronson Lake Formation  
Structure-Contour Map - Bronson Lake Formation  
Thickness of Bronson Lake Formation  
Non-Pumping Water-Level Surface - Bronson Lake Aquifer  
Apparent Yield for Water Wells Completed through Bronson Lake Aquifer  
Total Dissolved Solids in Groundwater from Bronson Lake Aquifer  
Sulfate in Groundwater from Bronson Lake Aquifer  
Chloride in Groundwater from Bronson Lake Aquifer  
Nitrate + Nitrite (as N) in Groundwater from Bronson Lake Aquifer  
Piper Diagram - Bronson Lake Aquifer

**viii) Empress Formation - Unit 3**

Depth to Top of Empress Formation - Unit 3  
Structure-Contour Map - Empress Formation - Unit 3  
Thickness of Empress Formation - Unit 3  
Non-Pumping Water-Level Surface - Empress Aquifer - Unit 3  
Apparent Yield for Water Wells Completed through Empress Aquifer - Unit 3  
Total Dissolved Solids in Groundwater from Empress Aquifer - Unit 3  
Sulfate in Groundwater from Empress Aquifer - Unit 3  
Chloride in Groundwater from Empress Aquifer - Unit 3  
Nitrate + Nitrite (as N) in Groundwater from Empress Aquifer - Unit 3  
Piper Diagram - Empress Aquifer - Unit 3

**ix) Empress Formation - Unit 2**

Depth to Top of Empress Formation - Unit 2  
Structure-Contour Map - Empress Formation - Unit 2  
Thickness of Empress Formation - Unit 2

**c) Lower Sand and Gravel (Empress Formation - Unit 1)**

Depth to Top of Empress Formation - Unit 1  
Structure-Contour Map - Empress Formation - Unit 1  
Thickness of Empress Formation - Unit 1  
Non-Pumping Water-Level Surface - Empress Aquifer - Unit 1  
Apparent Yield for Water Wells Completed through Empress Aquifer - Unit 1  
Total Dissolved Solids in Groundwater from Empress Aquifer - Unit 1  
Sulfate in Groundwater from Empress Aquifer - Unit 1  
Chloride in Groundwater from Empress Aquifer - Unit 1  
Nitrate + Nitrite (as N) in Groundwater from Empress Aquifer - Unit 1  
Piper Diagram - Empress Aquifer - Unit 1  
Recharge/Discharge Areas in Empress Aquifer - Unit 1

**3) Bedrock Aquifers**

**a) Lea Park Formation**

Depth to Top of Lea Park Formation  
Structure-Contour Map - Lea Park Formation

**b) Milk River Formation**

Depth to Top of Milk River Formation  
Structure-Contour Map - Milk River Formation

**c) undivided Colorado Group**

Depth to Top of *undivided* Colorado Group  
Structure-Contour Map - *undivided* Colorado Group

**4) Hydrographs and Observation Water Wells**

Hydrographs  
AENV Observation Water Wells Having Similar Water-Level Trends  
Annual Precipitation vs Water Levels in AENV Obs WW No. 193  
Annual Groundwater Production vs Water Levels in AENV Obs WW No. 200

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**Appendix C**

**General Water Well Information**

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