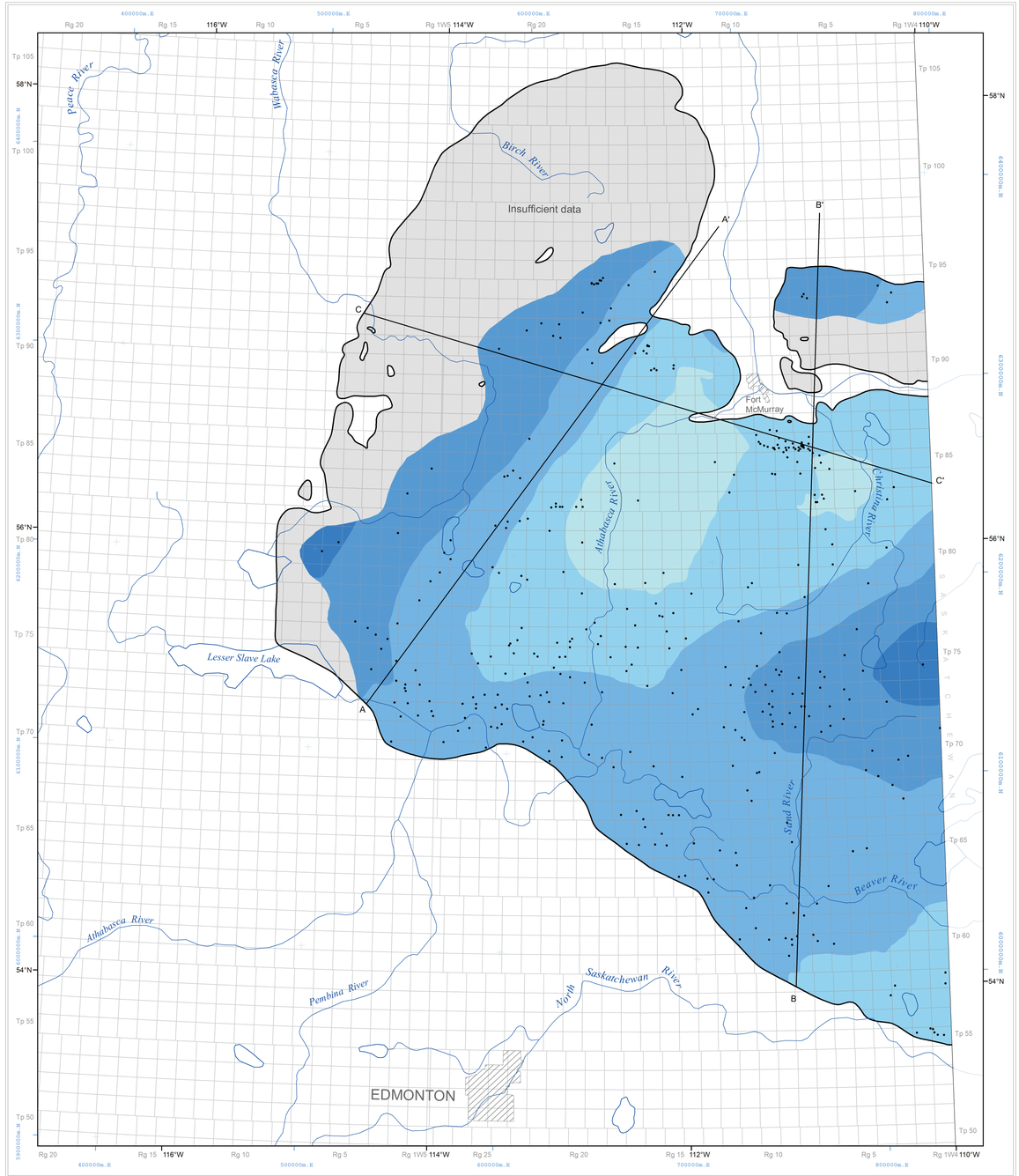
HYDRAULIC HEAD
GRAND RAPIDS HSU



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Map 597

Distribution of Hydraulic Head in the Grand Rapids Hydrostratigraphic Unit

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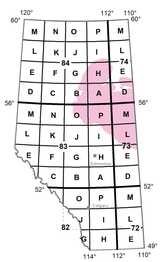
Scale 1:1 250 000

50 25 0 50 100 kilometres
25 12.5 0 25 50 miles

Projection: 10 Degree Transverse Mercator
Datum: North American Datum, 1983



SYMBOL LEGEND

Hydraulic head (m asl)
- 445 - 460
- 461 - 480
- 481 - 500
- 501 - 520
- 521 - 540

Well data point
Hydrostratigraphic unit extent
Cross-section line A — A'
Insufficient data

This map depicts the distribution of hydraulic head in the Grand Rapids hydrostratigraphic unit (HSU). The horizontal and vertical extent of the unit was adopted from the 3D Provincial Geological Framework Model of Alberta, Version 2 (Alberta Geological Survey, 2019a). The relationship of the Grand Rapids HSU with the units above and below as well as its geometry can be seen in Figures 1 and 2.

Methodology

The hydraulic head distribution map is a result of an ordinary kriging technique using publicly available static water levels from 121 water wells and pressure data from 259 drillstem tests from oil and gas wells. A screening process modified from Jensen et al. (2013) was used to ensure that only representative pressures were used to calculate equivalent freshwater hydraulic heads. The final gridded map surface was clipped based on the spatial distribution of representative data. Residual values are plotted at each location (Figure 3) to indicate where underprediction and overprediction occurs compared to the measured hydraulic head values. Using the methodology of Singh et al. (2017) the Cumulative Interference Index (CII) was determined and used to identify and remove tests that have been influenced by production or injection (Figure 4).

Additional formation-scale hydrogeological maps for the Grand Rapids HSU are presented in Figures 5 and 6. Figure 5 shows the distribution of total dissolved solids in the Grand Rapids HSU. Figure 6 shows the water driving force (WDF) map for the Grand Rapids HSU. The WDF map allows identification of areas where the buoyancy effect of formation water density has the potential to change the inferred magnitude and direction of groundwater flow (Singh et al., 2017). Buoyancy does not appear to have a significant effect on groundwater flow in the Grand Rapids HSU.

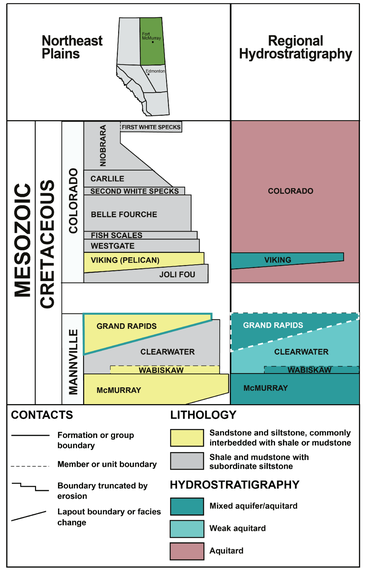


Figure 1. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019b). Solid teal lines highlight the Grand Rapids stratigraphic unit. Dashed white lines depict the Grand Rapids HSU within the regional hydrostratigraphy. Strata above the Colorado Group are not shown.

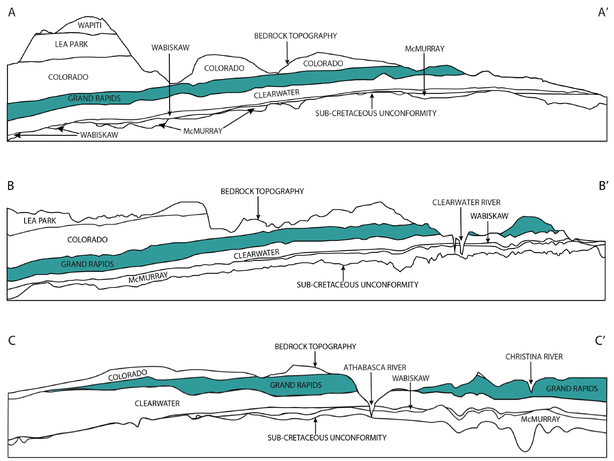


Figure 2. Schematic cross-sections identifying the geometry and variable thickness of the Grand Rapids HSU (not to scale).

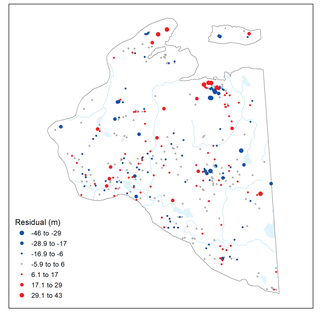


Figure 3. Calculated residuals between the modelled distribution of hydraulic head and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

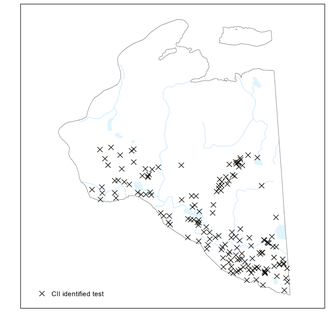


Figure 4. Location of tests that may have been influenced by production or injection and were removed during the Cumulative Interference Index (CII) process.

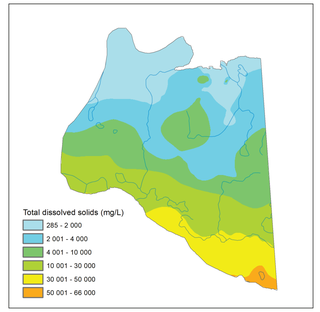


Figure 5. Distribution of total dissolved solids in the Grand Rapids HSU (Nakevska, 2020). The map extent is based on the spatial distribution of TDS data and differs from the extent of the main map.

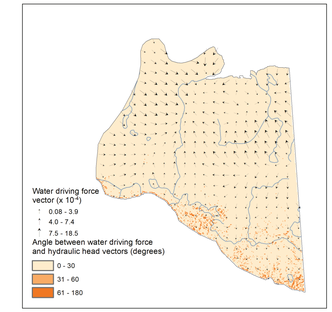


Figure 6. Water driving force map of the Grand Rapids HSU. The map covers only the area where hydraulic head and TDS gridded surfaces overlap.

Acknowledgements

Data processing support by S. Stewart. Water driving force map created by A. Singh. Base data from the Atlas of Canada (Natural Resources Canada, 2012) and Spatial Data Warehouse, Ltd.

References

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Recommended Reference Format

Nakevska, N. (2020): Distribution of hydraulic head in the Grand Rapids hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 597, scale 1:1 250 000.

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