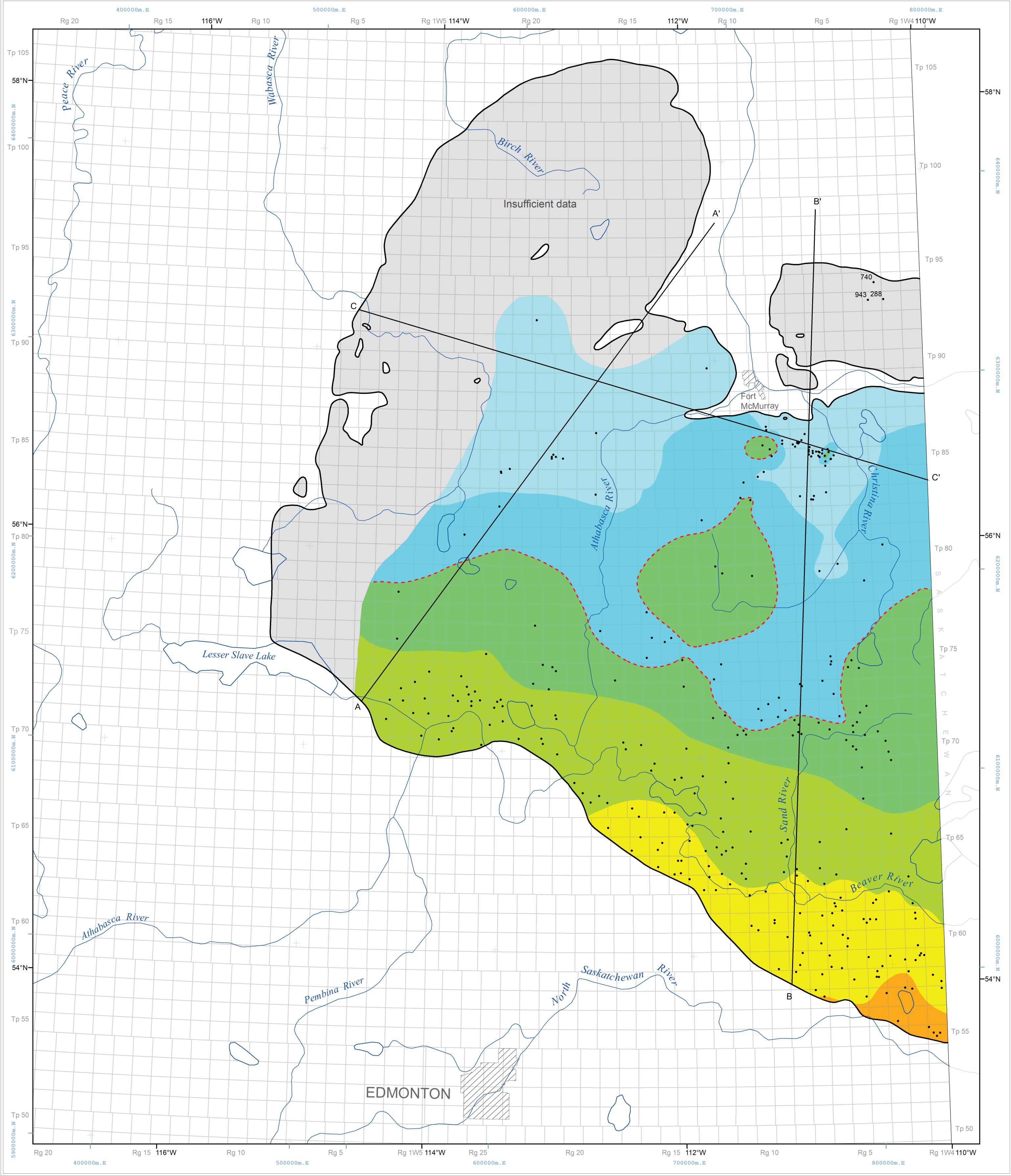


TOTAL DISSOLVED SOLIDS
GRAND RAPIDS HSU



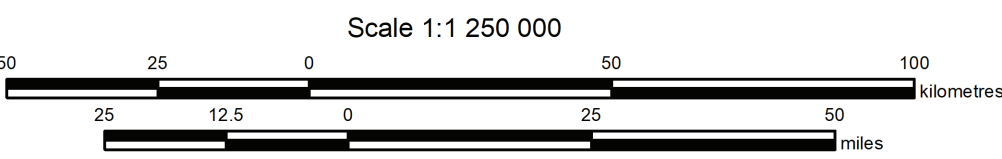
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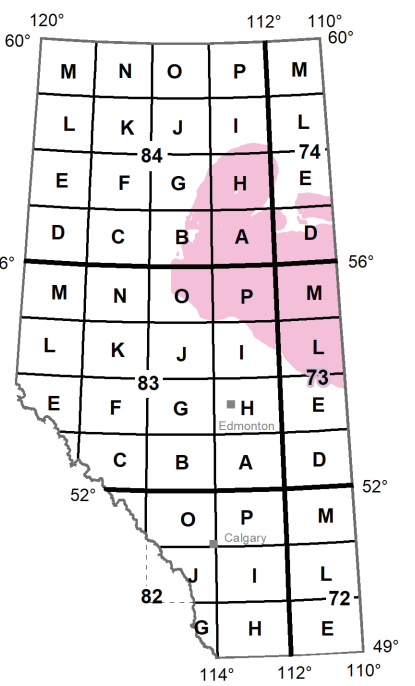
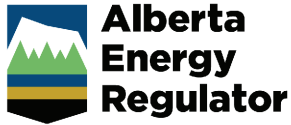
Map 596

Distribution of Total Dissolved Solids in the
Grand Rapids Hydrostratigraphic Unit

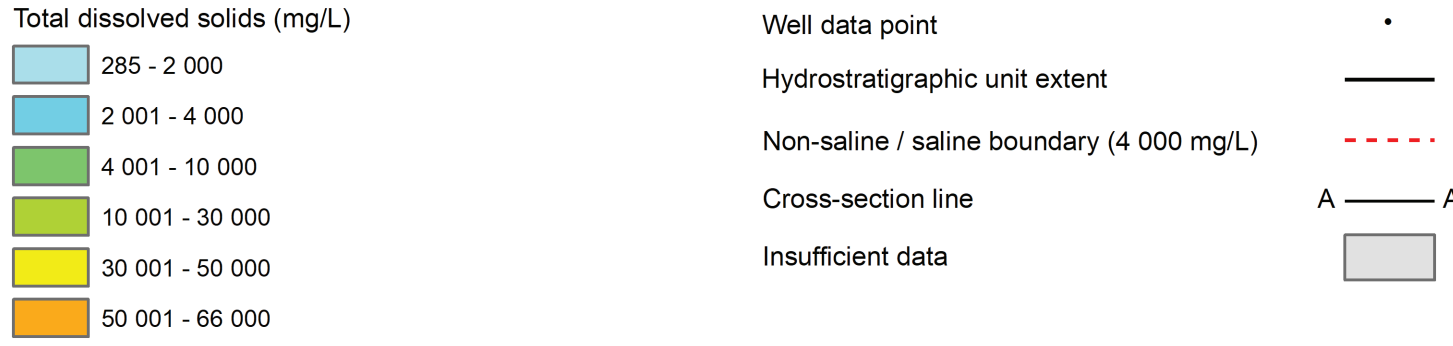
Hydrogeology by: N. Nakevska



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



SYMBOL LEGEND



This map depicts the distribution of total dissolved solids (TDS) in groundwater 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 TDS distribution map is a result of an empirical Bayesian kriging technique using publicly available data from 315 water chemistry analyses from both water wells and oil and gas wells. A screening process modified from Jensen et al. (2013) was used to ensure that only representative formation water chemistries were used. Measured TDS values range from 288 mg/L to 65 855 mg/L. The final gridded map surface was clipped based on the spatial distribution of representative chemistry data. Where data density was insufficient to support the prediction, only data points with TDS values were plotted (i.e., northeast of Fort McMurray). Residual values are plotted at each location (Figure 3) to indicate where underprediction and overprediction occurs compared to the measured TDS values.

Additional formation-scale hydrogeological maps for the Grand Rapids HSU are shown in Figures 4 and 5. Figure 4 shows the distribution of hydraulic head in the Grand Rapids HSU, with hydraulic heads calculated using fresh water density. Figure 5 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.

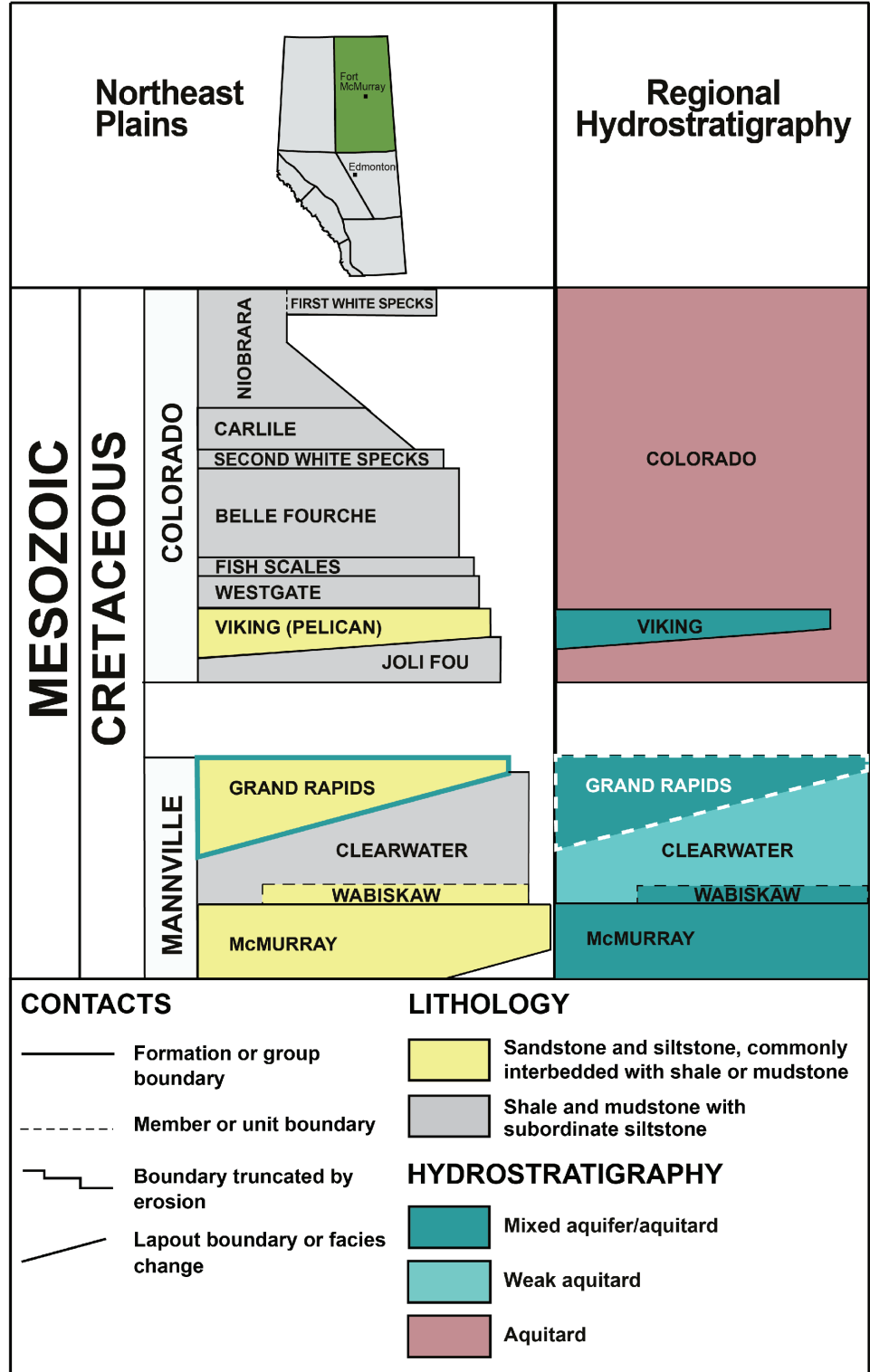


Figure 1. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019b). Solid teal lines highlight the Grand Rapids stratigraphic unit. Dashed white lines depict the Grand Rapids HSU within the regional hydrostratigraphy. Strata above the Colorado Group are not shown.

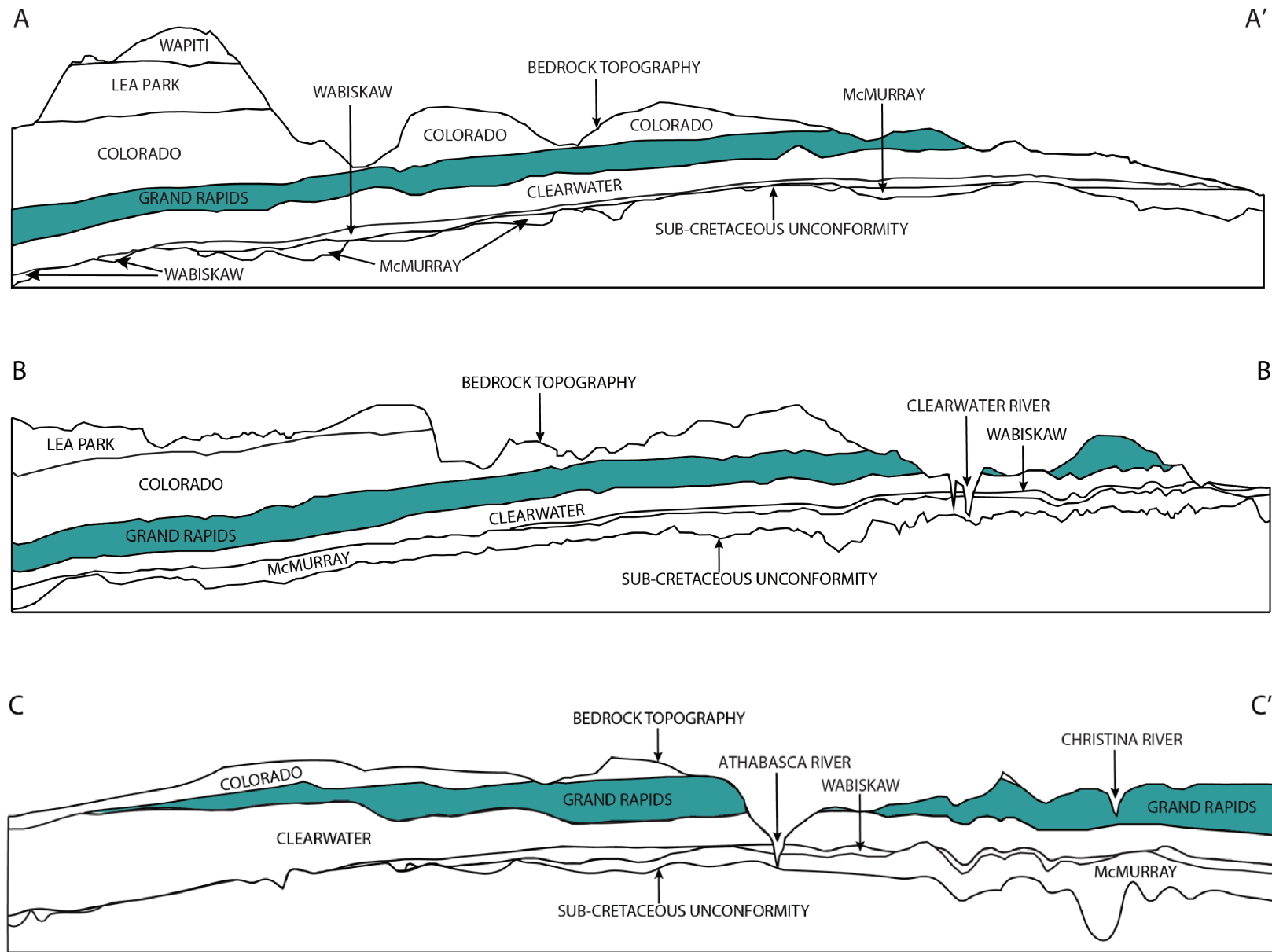


Figure 2. Schematic cross-sections identifying the geometry and variable thickness of the Grand Rapids HSU (not to scale).

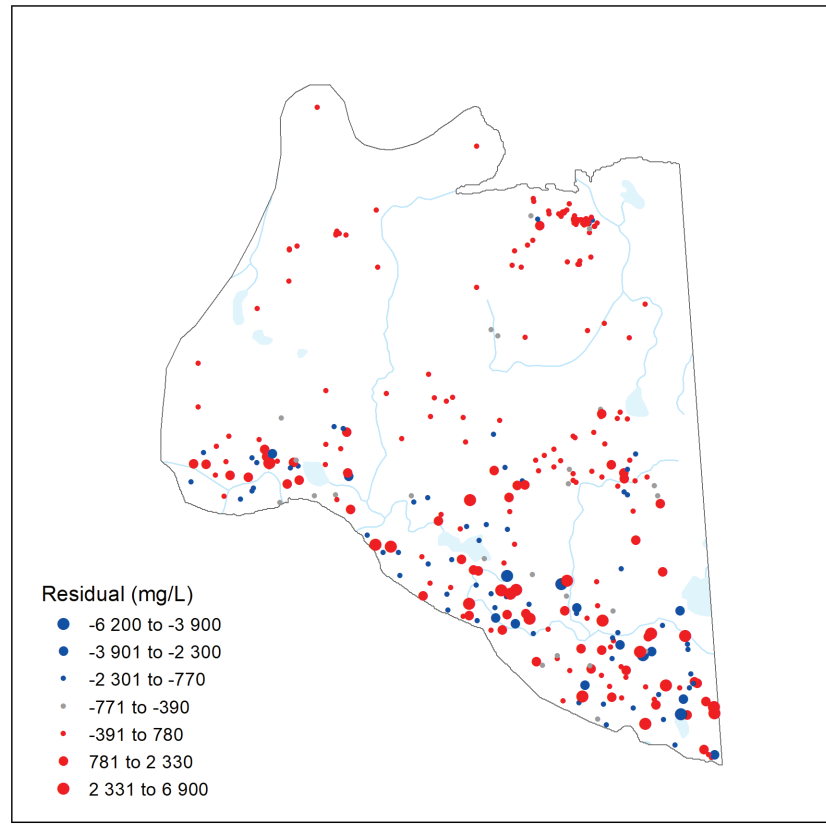


Figure 3. Calculated residuals between the modelled distribution of TDS and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

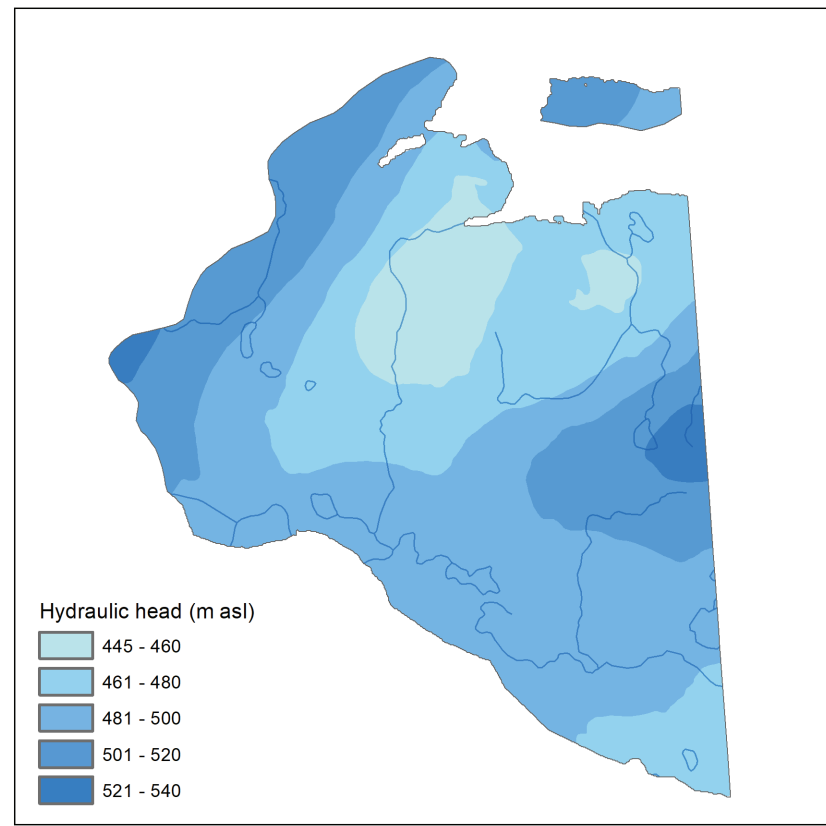


Figure 4. Distribution of hydraulic head in the Grand Rapids HSU (Nakevska, 2020). The map extent is based on the spatial distribution of hydraulic head data and differs from the extent of the main map.

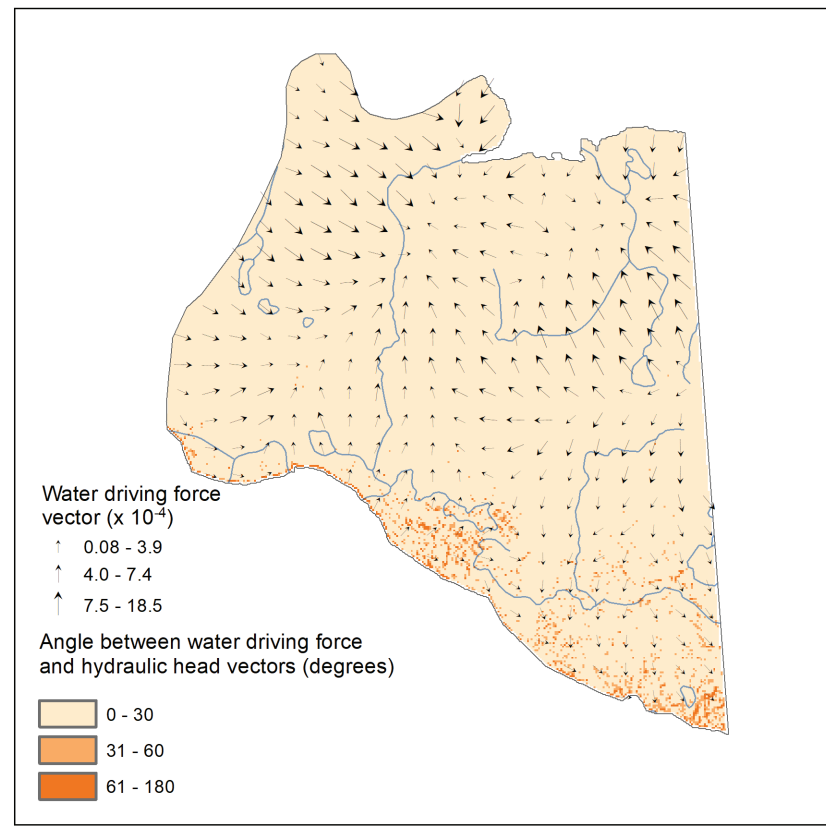


Figure 5. Water driving force map of the Grand Rapids HSU. The map covers only the area where hydraulic head and TDS gridded surfaces overlap.

Acknowledgements

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