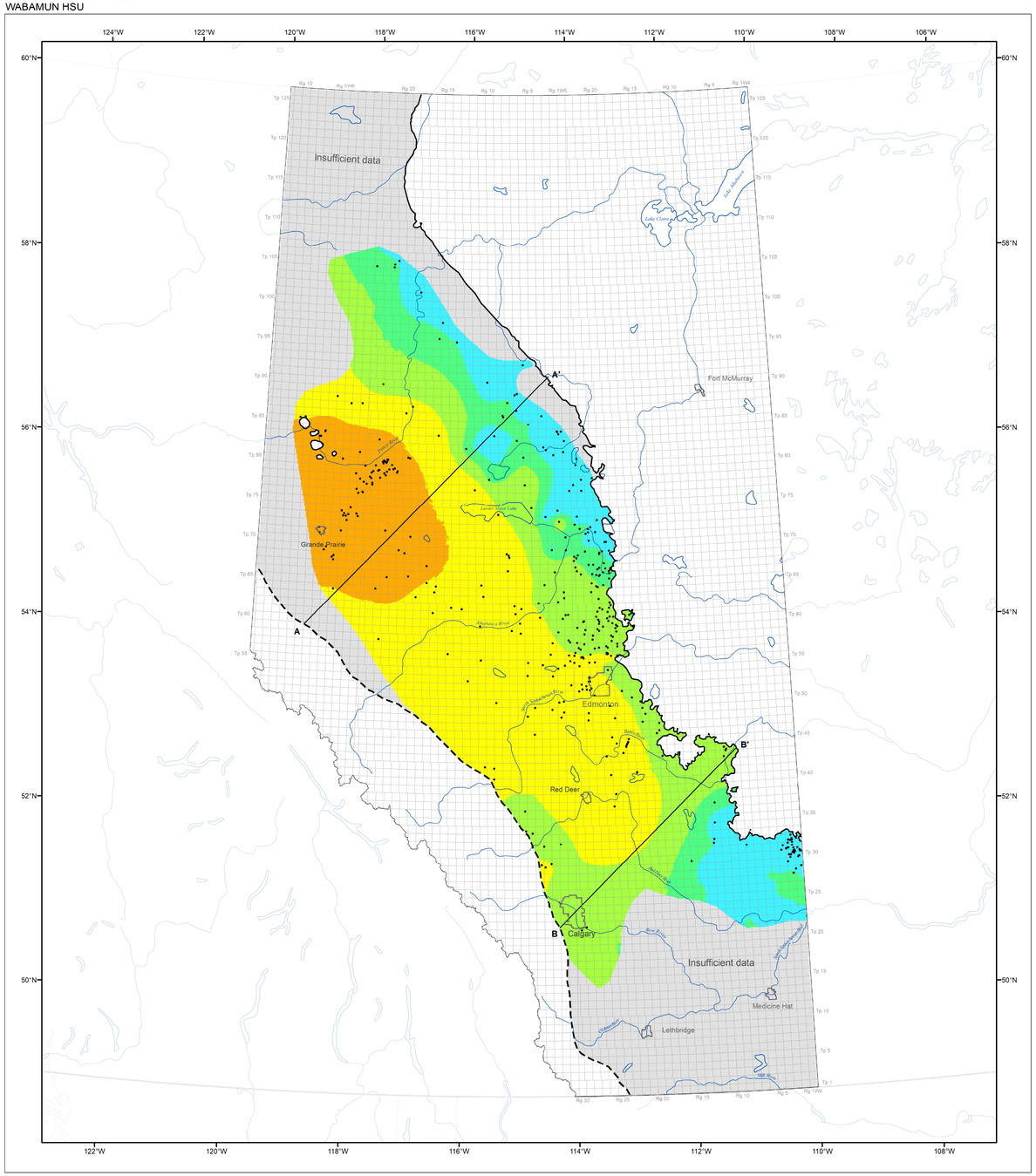
TOTAL DISSOLVED SOLIDS
WABAMUN HSU



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Map 546

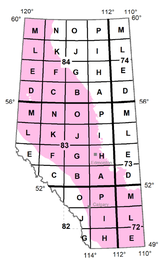
Distribution of Total Dissolved Solids in the Wabamun Hydrostratigraphic Unit

Hydrogeology by: J. Brinsky

Scale 1:3 000 000

100 50 0 100 200 kilometers
50 25 0 50 100 miles

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



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SYMBOL LEGEND

Total dissolved solids (mg/L)
- 8 000 - 30 000
- 30 001 - 50 000
- 50 001 - 100 000
- 100 001 - 200 000
- 200 001 - 300 000

Well data point
Wabamun Group zero thickness edge
Eastern limit of main Cordilleran deformation
Cross-section line A ——— A'
Insufficient data

This map depicts the concentration of total dissolved solids (TDS) in groundwater in the Wabamun hydrostratigraphic unit (HSU). The horizontal and vertical extent of the unit was adopted from the 3D Provincial Geological Framework Model of Alberta, Version 1 (Branscombe et al., 2018). The relationship of the Wabamun HSU with units above and below as well as its geometry can be seen in Figure 1 and Figure 2.

Methodology

The TDS distribution map is a result of an empirical Bayesian kriging technique using publicly available data from 481 water chemistry analysis from oil and gas wells. A screening process modified from Jensen et al. (2013) was used to identify potentially contaminated water samples and ensure that only representative formation water chemistries were used. Measured TDS values range from 8048 mg/L to 265 072 mg/L. The final gridded map 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 measured TDS values.

Additional formation-scale hydrogeological maps for the Wabamun HSU are presented in Figures 4 and 5. Figure 4 shows the distribution of hydraulic head in the Wabamun HSU, with hydraulic heads calculated using a fresh water density. Figure 5 shows the water driving force (WDF) map for the Wabamun HSU. The WDF vector map allows identification of areas where formation water density (buoyancy) has the potential to change the inferred magnitude and direction of groundwater flow (Singh et al., 2017). For the majority of the Wabamun HSU, buoyancy does not appear to have a significant effect on groundwater flow. However, buoyancy appears to have some influence in the northwestern portion of the Wabamun HSU and the central area of the map near the Wabamun HSU zero thickness edge.

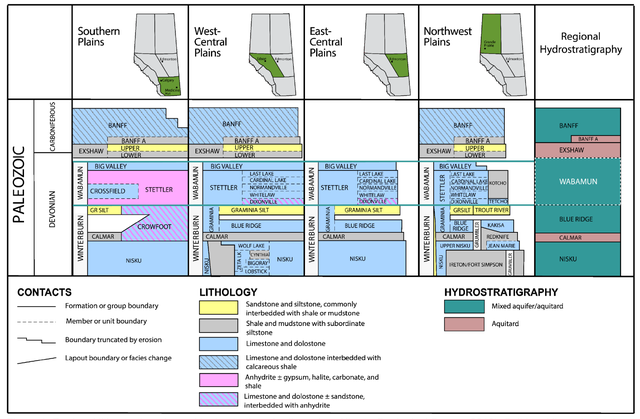
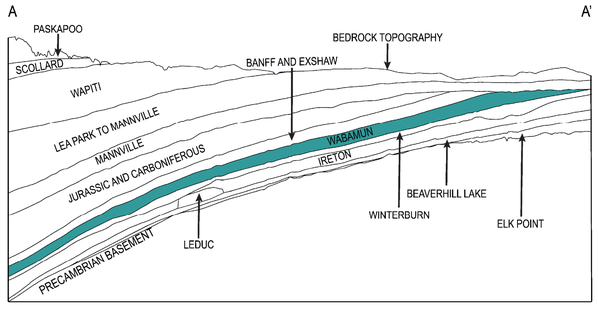


Figure 1. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019). Solid teal lines depict the top and base of stratigraphic units combined for mapping the Wabamun HSU. Dashed white lines depict the Wabamun HSU within the regional hydrostratigraphy. Strata above the Banff HSU and below the Nisku HSU are not shown.



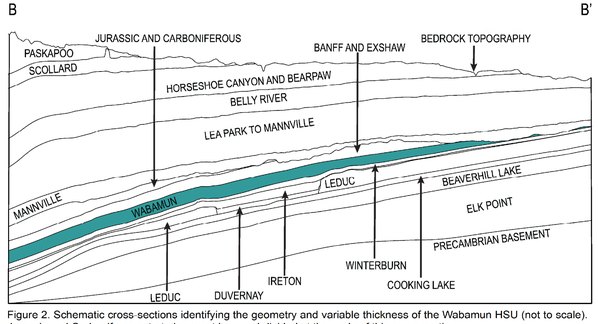


Figure 2. Schematic cross-sections identifying the geometry and variable thickness of the Wabamun HSU (not to scale). Jurassic and Carboniferous strata have not been subdivided at the scale of this cross-section.

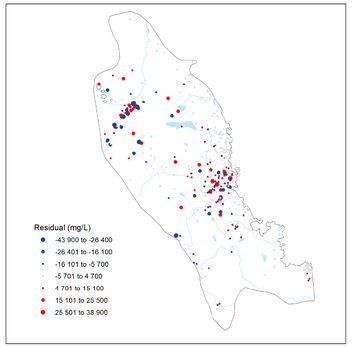


Figure 3. Calculated residuals between the modelled distribution of TDS and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

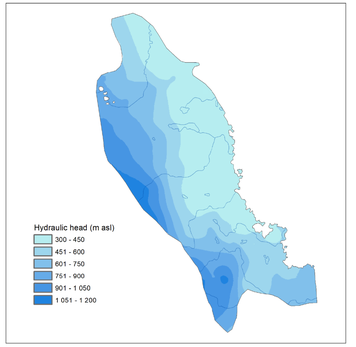


Figure 4. Distribution of hydraulic head in the Wabamun HSU (Brinsky, 2020).

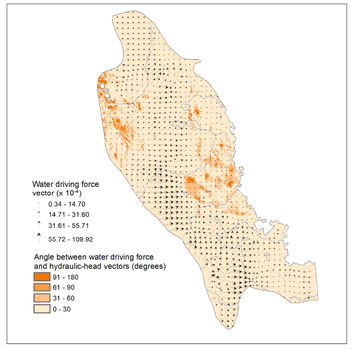


Figure 5. Water driving force map for the Wabamun HSU.

Acknowledgements

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

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Recommended Reference Format

Brinsky, J. (2020): Distribution of total dissolved solids in the Wabamun hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 546, scale 1:3 000 000.

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