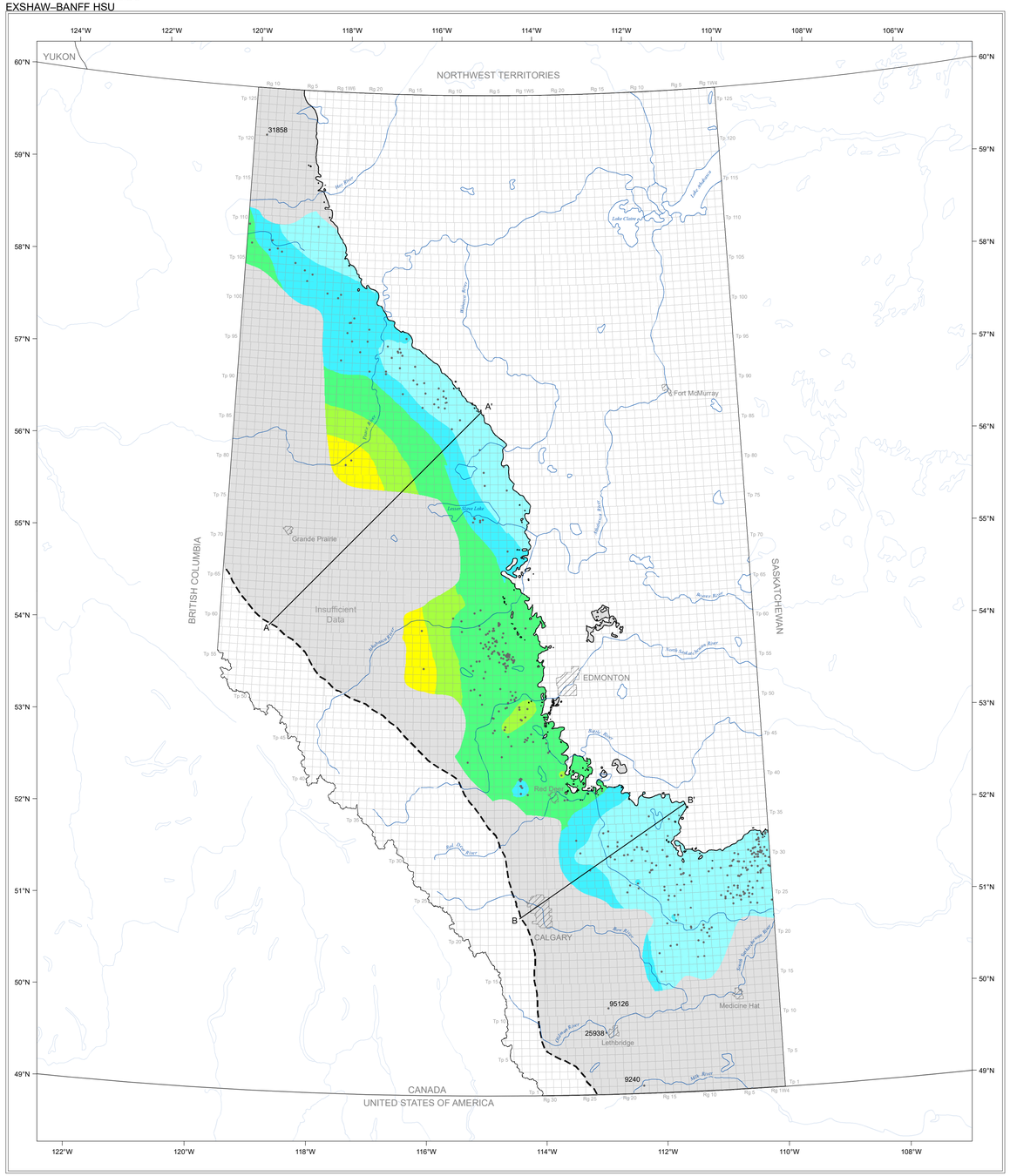
TOTAL DISSOLVED SOLIDS
EXSHAW–BANFF HSU



SYMBOL LEGEND

Total Dissolved Solids (mg/L)

- 6 600 - 30 000
- 30 001 - 50 000
- 50 001 - 100 000
- 100 001 - 150 000
- 150 001 - 200 000

- Well data point
- Hydrostratigraphic unit extent
- Eastern limit of main Cordilleran deformation
- Cross-section line A —— A'
- Insufficient data

This map depicts the distribution of total dissolved solids (TDS) in groundwater in the Exshaw–Banff hydrostratigraphic unit (HSU). The horizontal and vertical extent of the unit was adopted from the Geological Framework of Alberta, Version 3 (Alberta Geological Survey, 2021). The relationship of the Exshaw–Banff 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 424 water chemistry analyses from 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 5495 mg/L to 184 865 mg/L. The final gridded map surface was clipped based on the spatial distribution of representative chemistry data. Where data density was insufficient to generate a TDS grid, data points are plotted with TDS labels only. Residual values are plotted at each location (Figure 3) to indicate where underprediction or overprediction occurs compared to the measured TDS values.

Additional formation-scale hydrogeological maps for the Exshaw–Banff HSU are shown in Figures 4 and 5. Figure 4 illustrates the distribution of hydraulic head in the Exshaw–Banff HSU, with hydraulic heads calculated using fresh water density. Figure 5 shows the water driving force (WDF) vector map for the Exshaw–Banff HSU. The WDF vector 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). Overall, buoyancy does not appear to have a significant effect on groundwater flow in the Exshaw–Banff HSU.

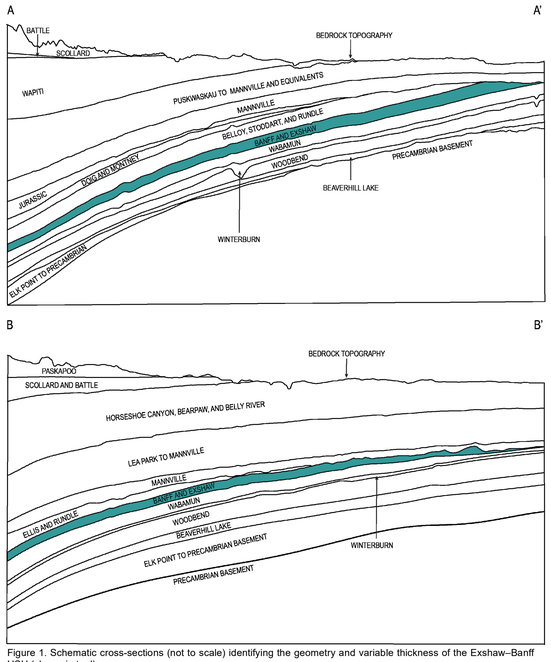


Figure 1. Schematic cross-sections (not to scale) identifying the geometry and variable thickness of the Exshaw–Banff HSU (shown in teal).

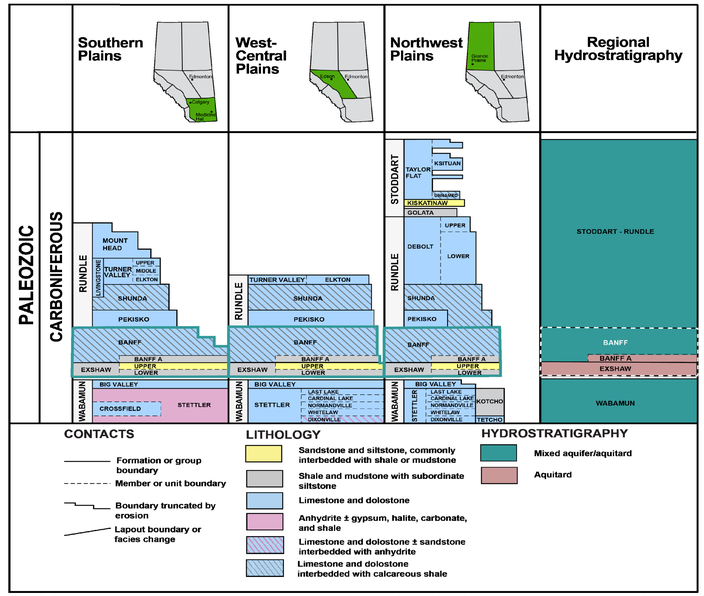


Figure 2. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019). Solid teal lines depict the top and base of the stratigraphic units combined for mapping the Exshaw–Banff HSU. Dashed white lines depict the Exshaw–Banff HSU within the regional hydrostratigraphy. Strata above the Stoddard Group and below the Wabamun Group are not shown.

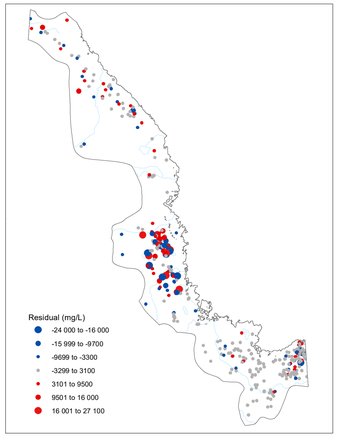


Figure 3. Calculated residuals between the modelled distribution of TDS and measured values. Symbol classes are based on the standard deviation of the measured residuals.

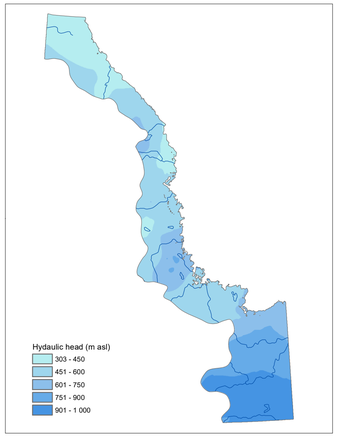


Figure 4. Distribution of hydraulic head in the Exshaw–Banff HSU (Brinsky, 2024). The map extent is based on the spatial distribution of hydraulic head data and differs from the extent of the main map.

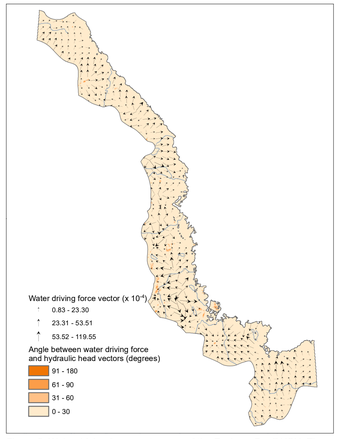


Figure 5. Water driving force vector map of the Exshaw–Banff HSU. The map covers only the area where the hydraulic head and TDS gridded surfaces overlap.

Alberta Geological Survey
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Map 646

Distribution of Total Dissolved Solids in the Exshaw–Banff Hydrostratigraphic Unit

Hydrogeology by: J. Brinsky

Scale 1:3 000 000

100 50 0 100 200 Kilometres
50 25 0 50 100 miles

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

Acknowledgements

Data processing support by S. Stewart. Base data from the Atlas of Canada (Natural Resources Canada, 2012) and Spatial Data Warehouse, Ltd.

References

Alberta Geological Survey (2019): Alberta Table of Formations; Alberta Energy Regulator, URL <https://ags.aer.ca/publications/table_of_formations_2019.html> [October 2019].

Alberta Geological Survey (2021): Geological Framework of Alberta, version 3 (interactive app and map, methodology, model, dataset, story maps, web maps); Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Interactive Application <https://gfa-v3-ags-aer.hub.arcgis.com> [December 2021].

Brinsky, J. (2024): Distribution of hydraulic head in the Exshaw–Banff hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 647, scale 1:3 000 000.

Jensen, G.K.S., Rostron, B., Palombi, D. and Melnik, A. (2013): Saskatchewan Phanerozoic Fluids and Petroleum Systems project: hydrogeological mapping framework; *in* Summary of investigations 2013, v.1, Saskatchewan Geological Survey, Saskatchewan Ministry of the Economy, Miscellaneous Report 2013–4.1, Paper A-5,10 p.

Natural Resources Canada (2012): CanVec digital topographic data; Natural Resources Canada, Earth Sciences Sector. URL<https://open.canada.ca/data/en/dataset/8ba2aa2a-7bb9-4448-b4d7-f164409fe056> [May 2021].

Singh, A., Palombi, D., Nakevska, N., Jensen, G. and Rostron, B. (2017): An efficient approach for characterizing basin-scale hydrodynamics; Marine and Petroleum Geology, p. 332–340, URL <https://dx.doi.org/10.1016/j.marpetgeo.2017.02.015>.

Recommended Reference Format

Brinsky, J. (2024): Distribution of total dissolved solids in the Exshaw–Banff hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 646, scale 1:3 000 000.

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