

Characterization of Belloy, Kiskatinaw and Debolt Water Disposal Zones in the Montney Play Area, Northeastern British Columbia

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Introduction

Intensive development of the Montney Formation tight siltstone and shale play in northeastern British Columbia presents new challenges to operators and to the BC Oil and Gas Commission. One of the key challenges is in accessing appropriate water source and disposal zones to support horizontal drilling and multiple hydraulic fracture completions. Source water can be obtained from surface water bodies, shallow nonsaline aquifers or deep saline aquifers. However, spent completion fluids and produced waters must be injected into deep saline aquifers to ensure that no contamination of surface water or nonsaline groundwater takes place.

The Montney Formation unconventional play fairway spans a broad area across the plains and foothills of the Peace River region, as outlined by the BC Oil and Gas Commission (2012; Figure 1). Potential disposal zones in deep saline aquifers exist across the fairway, but their distribution and injectivity characteristics are highly variable. Geoscience BC's Montney Water Project (<http://www.geosciencebc.com/s/Montney.asp>) provides a comprehensive regional inventory of water resources and potential for deep geological disposal sites in the Montney area, and is an excellent starting point for detailed local work on specific water disposal issues.

Recent water injection activity has shown that more work is required to characterize disposal zone capacity in some areas. BC Oil and Gas Commission and Geoscience BC have collaborated to develop a scope of study that addresses many of the water disposal challenges. The Belloy, Kiskatinaw and Debolt formations have been identified as high-priority disposal zone targets, and thus require detailed assessment (Figure 2).

Keywords: *Montney play area, water disposal, Belloy, Kiskatinaw, Debolt, tight gas*

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Project Summary

Petrel Robertson Consulting Ltd. (PRCL) has undertaken detailed mapping and characterization of the Belloy, Kiskatinaw and Debolt deep saline aquifers as potential water disposal zones throughout the Montney play fairway. While the Debolt Formation was assessed regionally in the foothills area study of the Montney Water Project (<http://www.geosciencebc.com/s/Montney.asp>), there has been no regional work published on Belloy or Kiskatinaw Formation aquifer potential.

Using all available well control, a map suite is being produced for each potential aquifer, including depth to formation, total thickness and net porous reservoir thickness. Conventional core and drill cuttings data are being used to support reservoir quality assessment; complex mixed carbonate-clastic reservoir lithologies make this assessment more challenging (Figure 3). Available stratigraphic and structural information will support identification of reservoir heterogeneity and compartmentalization that may influence accommodation volumes for injection.

Key tasks supporting this study include:

- Identifying known or potential hydrocarbon pools within the target formations that may be influenced by disposal activity. Disposal too close to existing producers may adversely affect production volumes. Whereas, existing depleted or semidepleted pools may offer potential as present or future disposal sites.
- Identifying hydrocarbon exploitation potential in bounding formations that are expected to provide a seal to injected fluids, as hydraulic fracturing may compromise the integrity of this seal.
- Identifying hydrocarbon exploration and development potential in deeper strata—where wells might be required to penetrate a high-pressure disposal zone.
- Identifying mapped faults, fractures and/or structures that may pose seismic risks when significant water volumes are injected. This work will be compiled from existing maps and literature.

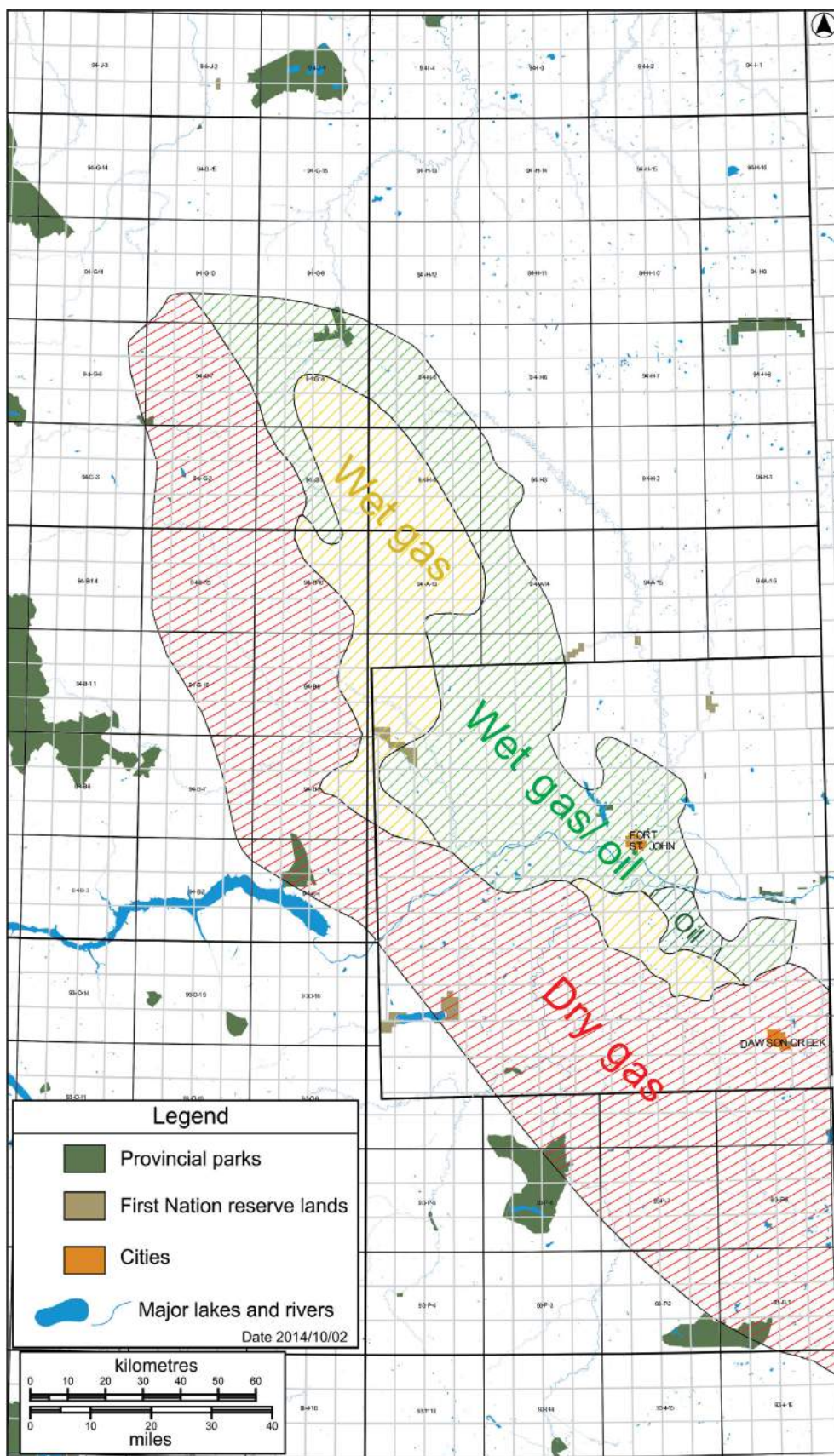


Figure1. Base map showing Montney Formation play fairway in Peace River area of northeastern British Columbia. Play area boundaries are from BC Oil and Gas Commission (undated).

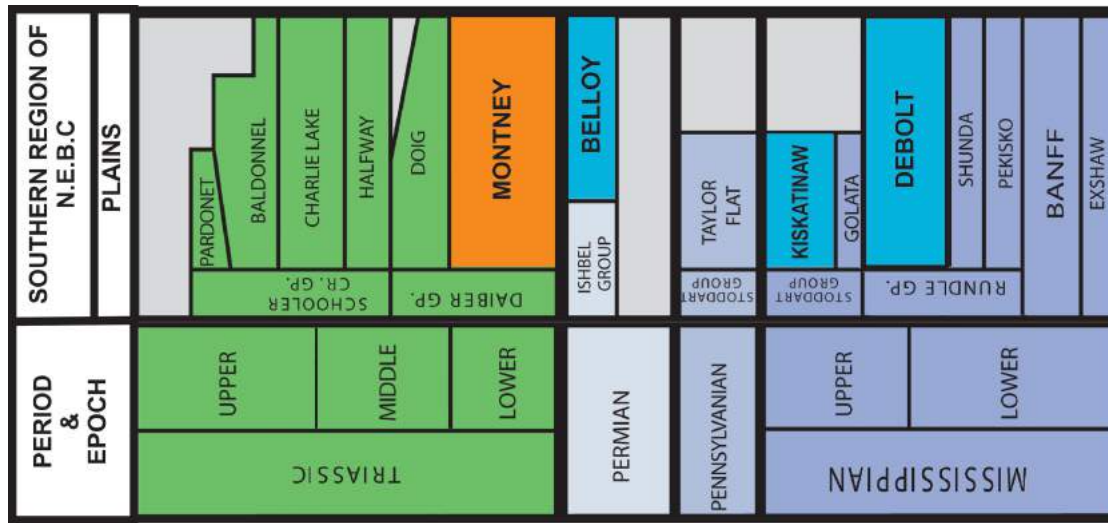


Figure 2. Stratigraphic correlation chart, Peace River plains area of northeastern British Columbia (N.E.B.C.; from BC Ministry of Energy and Mines, 2012). Montney Formation gas reservoir is highlighted in orange, whereas prospective disposal zones in the Belloy, Kiskatinaw and Debolt formations are highlighted in teal.

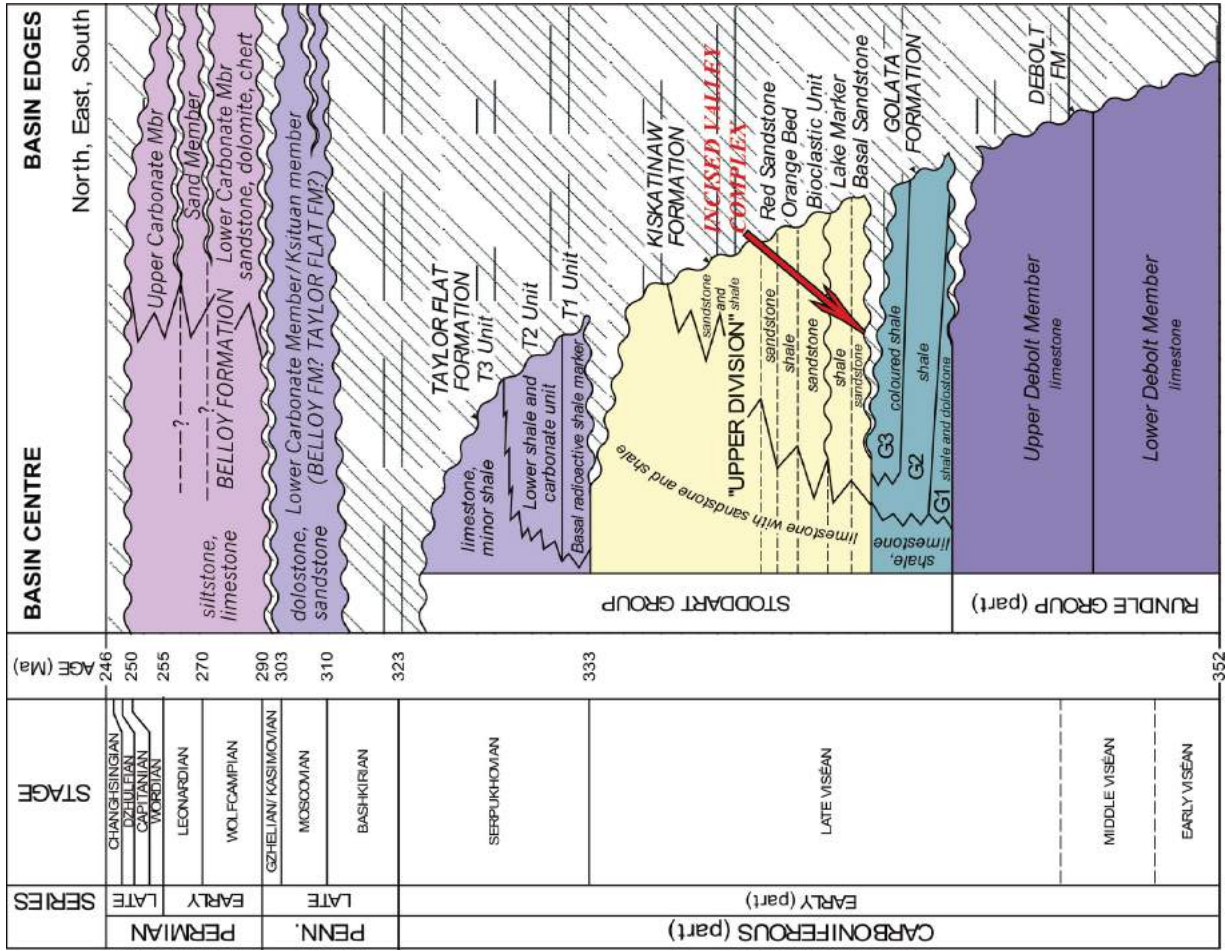


Figure 3. Detailed stratigraphic section of the Debolt Formation through to the Belloy Formation (Carboniferous to Permian) in Peace River plains area of northeastern British Columbia and adjacent Alberta (from Barclay et al., 2002).

To summarize project findings, mapping will be integrated to develop a high/medium/low favourability ranking for each potential aquifer. High favourability will indicate areas with good aquifer characteristics and capacity, with few or no risks arising from hydrocarbon prospectivity or activity, whereas low favourability will indicate poor aquifer characteristics and/or significant risks from existing or prospective hydrocarbon developments within or impacting upon target aquifers.

Next Steps

Upon completion of PRCL's mapping and characterization work, Geoscience BC will engage Canadian Discovery Ltd. to complete a focused assessment of aquifer hydrogeology, including projections of capacity to accept flowback and produced fluids.

Acknowledgments

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