EXECUTIVE SUMMARY

This study addresses the hydrogeological and geomechanical favourability of wastewater injection into the Belloy and Debolt formations in Northeastern British Columbia. Initial work on reservoir characterization and geologic favourability mapping was performed by Petrel Robertson Consulting Ltd., and that work helped define the two focus areas for this analysis. The Belloy focus area is a Northwest-Southeast trending, irregularly shaped strip approximately 20 to 30 km wide centered on the Northeast portion of T.80, R.18W6. The Debolt focus area is also irregularly shaped, approximately 30 km in diameter and centered on E-94-A.

The study is divided into two main components – a hydrogeological analysis and a geomechanical analysis. In the hydrogeological analysis, detailed in section 2.0 of the report, formation pressures in the Belloy, Debolt and overlying Lower Montney formations as well as hydraulic head and formation water salinity in the Belloy and Debolt were determined through a rigorous data screening and quality control process. Due to limited data availability in the focus areas, the hydrogeological analysis was performed over broader study areas in order to reveal trends within the focus areas themselves. In the geomechanical analysis, detailed in section 3.0 of the report, in situ stresses and rock properties were determined using a wide range of data types and applied to the assessment of risk due to injection-induced slip on preexisting fractures or faults. Like in the hydrogeological analysis, regional data were frequently used in the geomechanical analysis when data were limited inside the focus areas.

The results of the hydrogeological analysis indicates that the Belloy and Debolt are hydrodynamically distinct from the Lower Montney in the focus areas. Pressure difference mapping across the contact with the Lower Montney indicates that the pressure difference across the Montney/Belloy boundary ranges from 28 MPa in the southwest to near zero in the northwest. Similarly the pressure difference across the Montney/Debolt boundary ranges from 78 MPa in the foothills region to approximately 4 MPa in the northeast. Hydraulic head in the Belloy ranges from 675m to 775m, consistent with a relatively high permeability aquifer, and shows gradual variation except in a few regions disrupted by faulting. Hydraulic head in the Debolt is more compartmentalized than in the Belloy due to the higher prevalence of faults. Debolt head values range from under 500m to just under 1,200m. Faulting in both areas also

has a significant effect on salinity trends, although salinity data were particularly sparse in the Belloy focus area, limiting the ability to make a regional interpretation.

The geomechanical analysis found that in both focus areas, the minimum and maximum principal stresses are both horizontal, and the vertical stress is the intermediate principal stress. The ratio of horizontal stresses ranges from approximately 1.5 to 2. Maximum horizontal stress is generally oriented Northeast-Southwest and is slightly more rotated to the east in the Debolt area than in the Belloy. To the extent possible, fracture populations were measured in image logs throughout the two study areas. Fractures in the Montney tend to strike more to the East-West than in the underlying target formations, especially in the Belloy study area. Fractures also seem less abundant in the Montney. The evaluation of geomechanical risk revealed that, in general, lower pressure increases are required to cause fractures in the Debolt Formation to become critically-stressed than in the Belloy. From a critically-stressed fracture/fault perspective, the southeastern part of the Belloy study area and the southwestern part of the Debolt study area are the most favourable for injection, however it should be noted that there are several mapped faults at the southwestern edge of the Debolt area.

The results of this study are significantly limited by both data availability and the limited evaluation of geomechanical risk. This study should be considered useful for a regional perspective on potential fluid injection sites, but specific injection programs should not be planned without site-specific data gathering and geomechanical modeling, as discussed in section 4.3 of the report.