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Targeting the Calgary Buried Valley Aquifer: A Water Solution in the Bow Valley

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Summary

Securing a sustainable groundwater supply for a low-carbon industrial operations facility in the Bow Valley near Exshaw, AB required balancing cost, regulatory constraints, and environmental impact. Piping water from existing infrastructure was deemed cost-prohibitive and although in proximity, the Bow River was inaccessible due to rail infrastructure and subject to the South Saskatchewan River Basin moratorium on new diversion licences. Similarly, although highly prospective, shallow groundwater is in direct hydraulic connection with the adjacent Bow River and therefore subject to the same restrictions for new licensing. Purchasing a diversion licence from existing users was also uncertain and costly, requiring private negotiations, licensing fees, and legal costs combined with the cost of drilling a new well. Given these constraints, the project focused on the Calgary Buried Valley Aquifer (CBVA), a deep-seated (>175 mbgs) Cenozoic buried channel aquifer that had been largely unexplored.

The CBVA is a preglacial fluvial system extending westward from southeastern Alberta through Calgary and into the Bow Valley. Previous investigative drilling confirmed its presence in Canmore, Dead Man's Flats, and Exshaw, with additional wells suggesting its continuation west. The basal gravels exhibit a fining-upward sequence, indicating their fluvial origin predating the Canmore and Bow Valley glaciations. Water levels within the aquifer rise near the surface in Canmore, Dead Man's Flats, and Exshaw with the possibility of flowing artesian conditions in certain areas. While the exact lateral extent of the CBVA remains uncertain, its high permeability and regional connectivity makes it a significant potential water source in the Bow Valley (Toop and de la Cruz, 2002).

Although the CBVA had been regionally mapped, recent attempts to target it in Exshaw, AB resulted in missing the aquifer and limited local drilling data amplified the uncertainty of the channel extent presenting added risk to exploring to these depths for a drinking water supply. Additional constraints included land titles, a pipeline right-of-way, a railway right-of-way, limiting available drill sites and identifying a qualified driller to complete the water well in a highly permeable coarse-grained fluvial channel at these depths. The licensing process also required waivers to drill below 150 mbgl and following well installation, proof that the CBVA was not hydraulically connected to surficial aquifers.

Results and Future Work

The CBVA was successfully drilled at the site and pumping test data demonstrated that the aquifer is prolific. Licencing of the CBVA water supply well secured a sustainable source of drinking water. Additionally, borehole data confirmed the presence of a thick alluvial fan system in the overlying sediments, which informed the subsequent development of an open-loop geothermal heating and cooling system for the site. This project underscores the potential of buried valley aquifers to support municipal and industrial groundwater supply in the Bow Valley, while also providing valuable data for the feasibility of integrating geothermal energy systems in shallower alluvial fan systems.

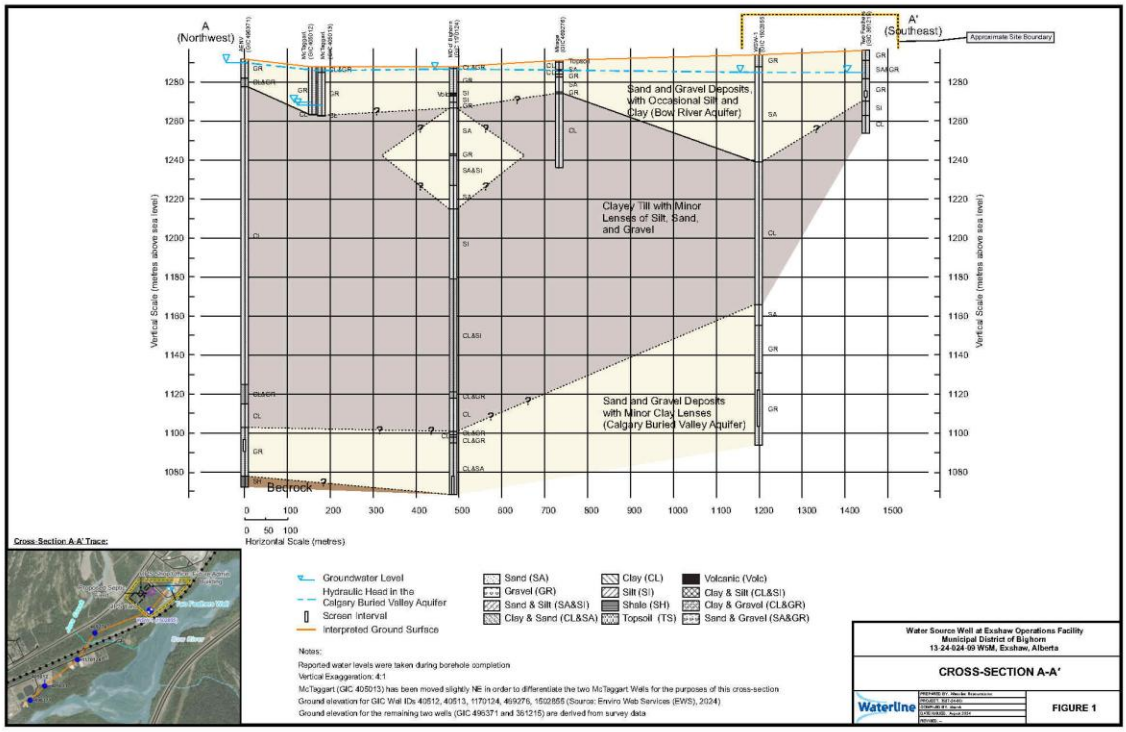

Figure 1: Hydrogeological Cross-Section A-A'

Acknowledgements

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References

Toop, D.C., N.N. de la Cruz, 2002. Hydrogeology of the Canmore Corridor and Northwestern Kananaskis Country, Alberta; Alberta Environment, Hydrogeology Section, Edmonton, Alberta; Report to Western Economic Partnership Agreement, Western Economic Diversification Canada.