



File: Golden Landfill, Columbia Shuswap Regional District, Operational Certificate 17006
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To: Luc Lachance, Section Head, Solid Waste, Authorizations South,
Ministry of Environment and Climate Change Strategy

From: Rusto Martinka, Hydrogeologist, Mining Authorizations,
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Subject: Groundwater Review of the Golden Landfill

1 Summary

The Columbia Shuswap Regional District (the District) operates a natural attenuation landfill located in Golden, BC. The landfill has operated there since the early 1970s. The District is authorized under Operational Certificate (OC) 17006 to dispose solid municipal waste to land from residential, commercial and light industrial sources, which includes disposal of contaminated soil. In July 2018 the Ministry gave the District a warning letter for several non-compliances with the OC, including some related to groundwater contamination. In response, the District prepared and submitted a hydrogeological characterization report (by Western Water) and last September they also submitted an environmental monitoring plan (by Golder). The objectives of this review are to evaluate the findings and recommendations presented in those reports.

Monitoring data from the landfill indicates that groundwater is contaminated by leachate. The current level of groundwater understanding does not provide a clear concept of the contamination extent, migration pathways, and potential impacts on the neighbouring drinking water aquifer. Additional groundwater investigations are therefore recommended, which should include development of a conceptual model of localized hydrogeology and installation of new monitoring wells.

Given the uncertainties noted above, the proposed monitoring plan should only be considered as preliminary since the need for additional groundwater monitoring locations is obvious. Lastly, the District should begin to develop groundwater mitigation strategies to reduce leachate losses from the landfill.

2 Groundwater Review

The Golden landfill is located about a kilometer north of the Town of Golden and the Kicking Horse River. Topographically located on a valley flank above the town, the landfill is underlain by a glacial till blanket and sedimentary bedrock. The water table is mostly found in the upper bedrock and its inferred flow direction is southwest towards the river. Directly downslope from the landfill the depth to bedrock drastically increases as it forms a steep valley, which is filled by glacial outwash. A provincially mapped aquifer (456) that provides the town's drinking water is contained in that outwash.

Monitoring data from the landfill indicates that leachate has contaminated groundwater. Given the limited groundwater monitoring network and the complexity of fracture-controlled groundwater flow, there is no clear understanding of the contamination extent (both at the landfill and offsite), migration pathways and potential impacts on Aquifer 456. For example, the most impacted monitoring well (MW09-06S) is situated cross-gradient of the inferred groundwater flow direction, while monitoring wells located hydraulically down-gradient of the landfill (MW18-10 and -11) appear unimpacted. Still more confusing, the offsite up-gradient monitoring well (MW10-08) indicates elevated concentrations of leachate indicator parameters. In sum, the inferred groundwater flow direction (southwest) is at odds with the area of groundwater contamination (northwest).

The 2019 hydrogeology characterization report concludes that the landfill is not contributing to a measurable degradation of water quality in Aquifer 456. Based on the observations noted above, that conclusion is likely premature and uncertain. Again, the existing groundwater information does not provide clear understanding of the contamination extent and migration pathways. **Development of a conceptual model of local hydrogeology is therefore deemed necessary.** Linkages between source-pathway-receptor should be used to describe the groundwater system and leachate migration. The model should also outline data gaps that may restrict the groundwater conceptualization and thus the efficacy of groundwater monitoring. Given the lack of groundwater understanding, **it is recommended that the next groundwater investigations are focussed on localized data gaps at the landfill.** In contrast to the recommendations provided in the hydrogeological report (i.e. continued data collection for next two years followed by potential offsite drilling), **I recommend that further groundwater investigations are focused at the landfill and those investigations should be implemented immediately after the conceptual model is complete.** Those efforts should consider monitoring well installations directly next to the waste to characterize leachate and track its concentrations in response to landfill operations and mitigation measures. Additional monitoring wells should also be considered at the western property boundary to better understand the groundwater pathways and evaluate potential offsite migration. Some of the new wells should be advanced using a drilling method that enables characterization of structural geologic features, which would benefit the groundwater conceptualization.

The environmental monitoring plan developed by the District also underlines the notable deficiencies in the conceptual understanding of the groundwater system at the landfill. The proposed monitoring plan should therefore be considered as preliminary, since the need for additional investigations and groundwater monitoring locations is obvious. In the meantime, **it is recommended that the District begins to develop groundwater mitigation strategies to reduce leachate losses from the landfill.**

Finally, the future hydrogeological reports and monitoring plans should consider the following list of improvements:

- Hydraulically test all monitoring wells
- Turbidity of groundwater samples should be reduced to below 50 NTU
- The laboratory analytes should include total dissolved solids, biological and chemical oxygen demand
- A site plan should depict the landfill layout (i.e. what waste is where)

3 Closure

I hope you find this document is useful. Should you have any questions please contact me at 250-751-7056 or Rusto.Martinka@gov.bc.ca.

Sincerely,



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