MINISTRY ASSESSMENT REPORT – DOCP APPROVAL

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Sr. Environmental Protection Officer
Date: March 18, 2020

Statutory Decision Maker: Luc Lachance
Section Head – Solid Waste

File:	17006	**DOCP Submission Date**	January 20, 2020
Application Date:	N/A	**OC Last Amended**	August 31, 2012
Application type:	DOCP Approval		

Applicant:	Columbia Shuswap Regional District (CSRD)		
Application Purpose:	Updated DOCP		
Facility Type:	Municipal Landfill		
Facility Location:	Golden, BC		
WDR Schedule:	WDR Schedule 1 (Municipal Solid Waste Management)		
CPIX Ranking:	L	**Complexity Category:**	Medium

1. Application Request

The DRAFT Design Operations and Closure Plan (DOCP) was received December 30, 2019. The final DOCP was received January 20, 2020. The associated 5-year monitoring update was received December 30, 2019. The associated Conformance Review was received January 8, 2020.

The last amendment was August 31, 2012, when the OC was proactively amended by Environmental Protection staff. At that time, some specific prohibitions on acceptable waste were removed to align with the CSRD Solid Waste Management Plan (SWMP), specifically acceptance of septage and roadkill carcasses. *Landfill Gas Regulation* requirements were also incorporated. Daily and intermediate cover requirements of the OC were harmonized with the *BC Landfill Criteria*. A new Ground Water and Surface Water Quality Impairment clause was added, which was a clause common to many other landfill OC's in that area at that time. Lastly, a detailed Hydrogeological study was required in the OC as well as Design and Operating plan updates to be submitted every 5 years.

2. Background Information

The Columbia Shuswap Regional District (CSRD) operates a municipal landfill in Golden, BC. This landfill has been in operation since the early 1970's (possibly earlier). Permit PR-03119 was issued to the Town of Golden on July 11, 1974. Ownership of the Landfill was transferred to the CSRD and the Permit amended Dec 15, 1986. The permit was converted to OC 17006 on May 5, 2003.

The landfill is sited 2 km NE of the town of Golden, on a bench 120 m above the Kicking Horse River, just upstream of the confluence of that river with the Columbia River (2.4 km to the west of site). It accepts approximately 5,000 t/year of waste from the CSRD (predominantly Golden). As of 2018, approximately 190,000 tonnes of MSW have been deposited on site.

A 15 m buffer exists between the historic landfill areas and current property boundaries (as per the 2003 OC). The CSRD acknowledges that there are places along the property boundary where historically waste had been landfilled within 10 m of the boundary. The 2012 OC stipulated a 50 m buffer, which has been respected in current and future fill plans.

The last approved DOCP was the "Golden Landfill Design, Operations and Closure Plan", dated December 13, 2013, also by Golder. The key updates in that DOCP report included:
-4 fill Phases with an 80 year lifespan
-50+ meter buffer zones
-Metal Plates ("Iron Grizzly") as daily cover
-Progressive closure of areas not expected to receive waste for 30 days
-Development of a conceptual hydrogeological model
-Surface water drainage ditches to South-West and South

-Removal of exposed waste along constructed ditches
-Periodic review of surface water works and re-design, as needed
-Temporary wind fencing at active face, as needed
-Small working face, frequent equipment movement, and adequate cover to discourage birds
-Sampling of runoff that has been in contact with waste and is flowing off the site
-Conceptual Closure Plan and cost estimates
-LFG Generation assessment (CRA)
-Waste Composition Study (TRI Environmental)

The last LFG Plan was "Landfill Gas Generation Assessment Report for the Golden Landfill" dated June 2012, prepared by CRA. The results of their assessment were an estimated generation of 205 tonnes methane for 2012, projected up to 362 tonnes for 2044. As the estimated quantity of methane generated is below the Landfill Gas Regulation threshold of 1000 tonnes/year, no active landfill gas capture system is required.

This DOCP was submitted on January 20, 2020, entitled "Golden Landfill Design, Operations and Closure Plan Update, Golden, BC" authored by Golder Associates Ltd. to cover future landfilling, closure, and post-closure. This landfill has approximately 60 years of operation left under the new fill plan.

An application to amend this OC to remove requirements for the Director to Approve some aspects of landfill operation and generally update this authorization has been discussed with the CSRD and is expected sometime in 2020.

The CSRD Solid Waste Management Plan was approved in 2009 for the period 2009-2029.

3. Compliance Record

There was a compliance inspection in 2019 which resulted in a Warning letter, IR123741. In addition, previous inspection results were: 2017-01-24 Notice - IR47979, 2018-07-27 Warning - IR52671.

The 2019 inspection Warning noted non-compliance with 10 sections of the OC:
-Leachate Surfacing evident (also observed in 2017)
-Litter (no litter fencing being utilized at active face)
-Groundwater impairment (multiple exceedances of GW quality parameters)*
-Causes of GW impairment not clearly identified or abated*
-Wildlife and Vector control (birds, deer present)
-Litter Control (litter present on-site and off-site)
-"Design & Operations Plan" not updated within 5 years (due 2018)
-"Landfill Monitoring Plan" not updated within 5 years (due 2018)
-"5-year Report" not submitted within 5 years (due 2018)
-"Closure Plan" not updated within 5 years (due 2018)

*Road salt storage or disposal was later determined to be at least partially responsible for some of these exceedances.

This detailed (33 page) Warning letter covers many aspects of operation of the Golden Landfill. The updated DOCP addresses many causes of these non-compliances (leachate seeps, groundwater impairment and causes). Outstanding reports and plans have all been received as of January 2020.

Further email correspondence between ENV Compliance staff and CSRD staff regarding these inspection reports concluded:
"there are genuine concerns with impacts to groundwater from the site that have been highlighted in numerous reports. The Ministry suggests resolving the issues found in the report and investing efforts in the management of issues on site"

Litter and wildlife/vector control measures are discussed in the 2019 DOCP, but no significant changes are proposed.

It should be noted that in each Inspection Report, the inspectors have assessed the non-compliance at this site as a Leve 3 Category B on the Non-Compliance Decision Matrix:
https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/natural-resource-law-enforcement/environmental-compliance/how-compliance-is-assessed

The suggested response to this level of non-compliance, using the matrix, is "Warning" or "Administrative Penalty." At this level of non-compliance, it is unlikely that an Investigation or Charges under the Act would occur, according to this matrix. ENV compliance policy includes progressive responses to non-compliance, such that continued non-compliance will result in an elevated response level. Should the noted non-compliances continue to occur in the future without the situation improving, the most likely response would be an Administrative Monetary Penalty ($ fine) issued to the CSRD, according to this matrix.

The OC provides a legal right to the holder to discharge under specific terms; that right is not taken away lightly. Where non-compliance is re-occurring, or there is an unwillingness to comply with the OC or willful non-compliance, there are escalating levels of response available to ENV Compliance staff (AMP->Investigation->Court Charge->Order). ENV generally works with the OC holder to remedy the non-compliance over time unless pollution is observed or there is an imminent risk of pollution, in which case Orders can be issued to immediately remedy or prevent pollution or face significant consequences.

ENV Authorizations staff may also amend the OC proactively to ensure protection of the environment. A proactive amendment to this OC was completed on October 31, 2019 to reduce the level of contamination in contaminated soil authorized to be landfilled at this site from Hazardous Waste level to Industrial Land Use level (HW- to IL-). This change is permanent, subject to future OC amendments.

4. Design, Operations, and Closure Plan (DOCP) Review

The primary updates to the 2013 DOCP in this 2019 version involve further clean surface water diversion from waste deposition areas, drainage improvements, progressive closure, and implementing an engineered liner for future waste cells with leachate collection and potentially treatment starting in 2027. It is clear that this DOCP proposes very significant improvements to the protection of the environment at this landfill. Installation of a liner system is only required for new landfills or lateral expansions of an existing landfills under the 2016 *Landfill Criteria*.

SME Review:

This DOCP report and Environmental Monitoring Plan were submitted for an ENV Subject Matter Expert (SME) review for Hydrogeology (groundwater). The following SME was tasked with this review:

-Rusto Martinka , Hydrogeologist, Mining Operations

Rusto provided initial comments (Nov 7, 2019) on the Draft DOCP and Draft 5 Year Monitoring Plan (EMP), and then provided a 2nd set of comments on the finalized documents (Jan 23, 2020). His comments are attached in the Appendices. Rusto also utilized the "2018 Hydrogeological Characterization Report: by Western Water Associates Ltd. for his review.

Initial Comments:

Rusto's initial comments on the Draft DOCP and 5 year plan included (see attached memo):

"The objectives of this review are to evaluate the groundwater monitoring components in the EMP and groundwater protection measures in the DOCP."

"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."

"the inferred groundwater flow direction (southwest) is at odds with the area of groundwater contamination (northwest)."

"The 2018 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."

"the existing groundwater information does not provide clear understanding of the contamination extent and migration pathways."

Rusto's initial recommendations included:
-Development of a conceptual model of local hydrogeology (groundwater flow);
-Groundwater investigations should focus on localized data gaps at the landfill (drilling wells near the landfill);
-Further groundwater investigations (wells) should be undertaken, focused at the landfill and to be implemented immediately after the conceptual model is complete.

The lack of clarity in the available data and data gaps were significantly concerning that Rusto initially recommended stepping back and re-evaluating the conceptual understanding of the local hydrogeology (groundwater flow) at this site, followed immediately by drilling new monitoring wells at or very near to the landfill boundary. These activities would ideally fill data gaps and hopefully bring greater understanding to the groundwater flow pathways and the potential for environmental impacts.

Report Revision:

A meeting was held between CSRD Staff and their Qualified Professionals (Golder) via conference call on Dec 2, 2019 to discuss Rusto's initial comments and to seek clarity regarding the key issues identified. The following topics were discussed in this meeting:
-Assessments of past QPs (Western Water Associates Ltd.) and historic context of current work
-Historic waste deposition areas
-Groundwater flow direction inconsistencies
-Chloride well contamination from road salt storage and street sweepings disposal
-Utilizing Chloride:Bromide ratio to "fingerprint" a contamination source (road salts vs. landfill)
-Background wells, domestic wells
-Isotope monitoring for landfill associated groundwater plume
-COD/BOD monitoring for leachate seeps
-Progressive closure, Lining new landfill phases, surface water diversion
-Next monitoring update for 2021
-Landfill is a long-life asset, more information will be available as more monitoring occurs

Subsequent to this meeting, the 5 year Monitoring Plan and DOCP were updated, finalized, and submitted (Dec 30, 2019) to the Ministry.

Additional Comments:

Rusto provided a 2nd set of comments and recommendations based on the updated DOCP and EMP on January 23, 2020 (see attached memo):

Regarding the EMP:

"This review concludes that the revised EMP incorporates most of the recommendations provided by ENV. The recommendation to complete an additional groundwater investigation will be revisited after two more years of increased water level and chemistry monitoring, and new isotope sampling.

This approach is deemed adequate, since it is expected to improve the groundwater conceptualization at the landfill, especially the source-pathway linkages."

"By the end of 2021, additional investigations, including the installation of new monitoring wells, will be considered if the groundwater monitoring indicates exceedances of drinking water standards at concentrations considered above the background."

"This review concludes that the revised EMP is improved"

"The EMP describes actions to be implemented if groundwater monitoring results indicate exceedances of drinking water standards. Missing is the need to notify any neighbouring properties of likely or actual migration of substances from the landfill."

Rusto's level of comfort with the Monitoring Plan improved with the addition of more frequent water level and chemistry monitoring, as well as isotope sampling. These investigations will help improve the conceptualization of groundwater migration at the site, which satisfies his initial recommendation to revisit the conceptual model at this site. Additional language on retaining a QP to assess offsite migration was also helpful but Rusto noted no mention of notifying neighbours of offsite migration.

Regarding the DOCP:
"The DOCP provides several water management and engineering measures aimed at protecting groundwater. These include installation of daily and intermediate covers over exposed refuse, progressive installation of final covers, and non-contact surface water diversions. Installation of liners and leachate collection systems are proposed below new development phases"

"the final cover design should be informed by future landfill performance and environmental monitoring assessments, as well as the expected post closure leachate generation rates. Accordingly, the final closure components should be detailed in the future DOCP updates, which are required every five years."

Rusto notes the DOCP proposes many measures aimed at protecting groundwater and that opportunities to finalize designs and assess post-closure leachate generation rates will be available in future DOCP amendments.

5. General Assessment

Public Concerns:

Members of the Golden community, predominantly owners of property near the landfill, have expressed significant concerns with the location and current operation/management of the landfill. Concerns have been received by ENV Compliance and Authorizations staff. Detailed letters have also been distributed to MLAs, local officials, and Land Remediation Branch.

These concerns relate to:

1. Groundwater contamination migrating offsite and potentially contaminating groundwater beneath adjacent private property, and eventually Aquifer 456, one of the drinking water sources for the City of Golden;
2. Leachate seeping from the landfill to adjacent private property;
3. Storm water (potentially contaminated) migrating off site during precipitation events and during snow melt;
4. Litter being spread from the active face to other parts of the landfill and to adjacent private property; also the significant detrimental effect this litter and vectors have had on vegetation;
5. Deer becoming habituated to landfill waste and presenting a hazard to motorists on the adjacent roads;
6. Receipt of hydrocarbon contaminated soil at the landfill and attendant environmental risks;
7. Lack of Surface water monitoring (runoff);
8. Lack of revegetation in buffer zone;
9. The Conformance Review for this landfill found the landfill in compliance with the Landfill Criteria, but ENV Compliance inspections results have found Non-Compliance with the OC;
10. Meteorological data used in QP reports is from the Airport, which may have a slightly different climate than the landfill;
11. Requiring closure of the landfill due to non-compliances and environmental impact.

Public Concerns - Discussion

1. Groundwater

Groundwater contamination/offsite migration is a legitimate concern/uncertainty at this site. As a natural attenuation landfill, it is understood that leachate (contaminated groundwater) will be generated and move with the groundwater beneath the landfill to some extent. The environmental risk posed by this contaminated groundwater depends on a number of factors, including but not limited to: groundwater flow, groundwater uses and proximity, and contaminant flux (mass flow) from the landfill which is affected by landfill size and authorized works in place.

Western Water Associated Limited were commissioned by the CSRD in 2018 to characterize the hydrogeological setting and potential impact of the landfill. CSR Drinking water standards were exceeded at several monitoring wells. An offsite, near-field well (MW 10-08) exhibited CSR DW exceedances; this well was intended as a background (up-gradient or side-gradient) well. It was

determined that this well is likely impacted by road salt and is not a good candidate for a background well. The locations of the wells, from the 5 Year Monitoring Plan:

The only on-site well at that time, MW 9-6 S/D, at the West boundary of the landfill has exhibited CSR DW exceedances for landfill associated contaminants as well. Chloride was elevated, but when a bromide/chloride ratio was analyzed, the contamination appeared to be somewhat between the characteristic Br/Cl ratios of "road salt" and "landfill leachate". This well is likely partially impacted by road salt/street sweepings being stored/deposited at the landfill site. This well is also located down-gradient of an old, closed Ministry of Forests landfill, which may be impacting it to some degree.

Attempts to drill additional wells on the south-west (down-gradient) corner of the landfill were unsuccessful in the 1990's and also in 2010. CSRD drilled 2 additional wells on the South boundary of the landfill 2018, MW 18-10 and MW 18-11 following the 2018 WWAL recommendations. These sub-bedrock wells have detected elevated landfill associated contaminants but still exhibit very high turbidity, likely from the drilling process. MW 18-10 exhibited turbidity of 267-661 NTU, but TSS samples were high at 260-1190 mg/L. MW 18-11 exhibited turbidity of >4000 NTU and TSS of 2980-171,000 mg/L, so essentially a thick slurry. More time is needed for these wells to clear and provide representative information regarding downstream groundwater quality in those locations.

MW 18-10, on the south boundary of the landfill installed at 36 m below grade(in bedrock) exhibits landfill influence as chloride and nitrate exceed CSR DW standards for groundwater. WWAL surmised:

> "there is potential that groundwater beneath a portion of the neighbouring property exceeds groundwater quality standards".

The DOCP concludes:

> "MW 18-11, which is installed in bedrock to a depth of 146.3 m below grade, does not appear to be impacted by landfill leachate."

This monitoring well would be the closest well to the main body of Aquifer 456, but as is still exhibiting very high turbidity, as noted.

As the additional wells drilled in 2018 have yet to provide useful data, it appears that the situation is essentially the same now as it was for WWAL in 2018. Rusto's comments included:

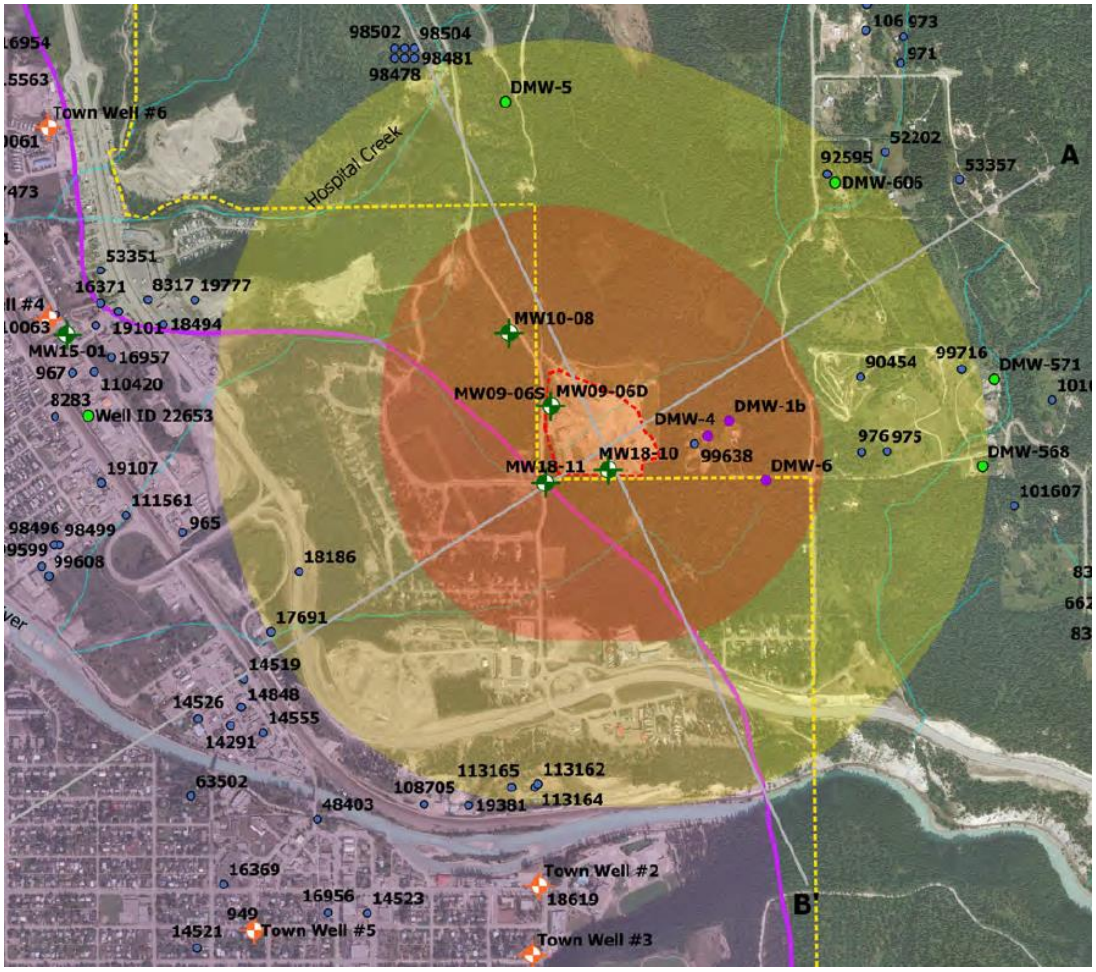
> "drilling new wells should be revisited after two more years of increased water level and chemistry monitoring, and new isotope sampling. The potential for offsite migration and more clear delineation of the groundwater plume should be reassessed at the end of this period. Any changes required to the DOCP could be incorporated in the next iteration."

A preliminary chloride and nitrate mass-flux from the landfill was estimated (using Darcy's Flux equation) by WWAL to be 0.1% and 0.2% of the annual flux of these parameters through the down-gradient Aquifer 456; the landfill appeared to not be a significant source of these contaminants to the downstream aquifer 456 as a whole.

The following statement was made by WWAL:

> "With the data gaps that existed prior to 2018, it was not possible to characterize groundwater flow within the bedrock aquifer underlying the site with any degree of certainty."

It should be noted that water quality guidelines and/or CSR standards are exceeded for arsenic, lithium, strontium, fluoride, iron, manganese and cobalt at the historically monitored wells, the new 2018 wells, and 8 domestic wells (see map below). Three of these wells are East of the landfill (side-gradient, or up-gradient, purple dots below), while 4 others surveyed in 2018 are far to the West, and up-gradient to the North, North-West or East (green dots below). These exceedances for these parameters were interpreted by WWAL to be "naturally occurring within the bedrock" as distribution was widespread and predominantly up-gradient.



The OC includes the requirement:

> "The landfill must be operated in a manner such that ground or surface water quality does not decrease beyond that specified by the British Columbia Water Quality Guidelines, or other appropriate criteria as may be specified by the Director, at or beyond the landfill property boundary."

After the 2021 monitoring season, the CSRD will provide an update to the 5- year Monitoring Plan, which will help guide future groundwater investigations. Further requirements for monitoring or assessment could be incorporated in the OC at that time as needed. Groundwater contamination will continue to be a concern at this site and must be tracked closely in ongoing authorizations and compliance work as more information becomes available.

2. Seeps

The proposed surface water management (ongoing), progressive closure (ongoing), and leachate collection (2027) included in the DOCP should significantly reduce the risk of leachate seeps forming and migrating offsite.

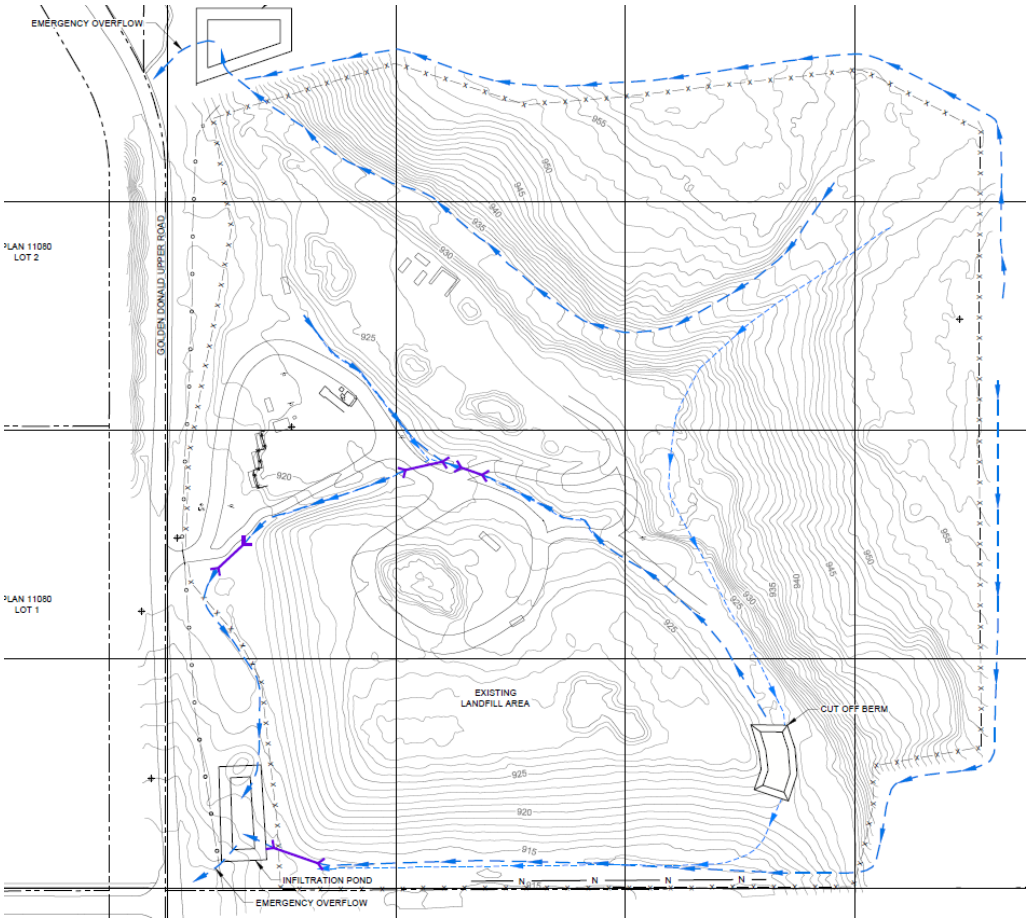
One of the concerned citizens noted that one of the surface water diversion ditches to the South was "dug in previously landfilled soil and therefore would function to create more leachate as water filters down through it." The 2013 DOCP included the following language:

> "Exposed waste along courses of the ditches should be removed (e.g. by pickup, or by excavating the waste and filling the excavated locations"

This issue should be brought to the attention of Compliance Staff for review in future inspections.

3. Stormwater Migration

Stormwater has been sampled from adjacent properties during precipitation events and exhibited landfill associated contaminants. The DOCP includes several improvements to surface water management: diversion ditches to the north and East, a cut off berm to divert stormwater from leaving site on the South Boundary to runoff ponds on the west side of the site (which would drain to road ditches), additional ditching in the central portion of the landfill, and road super elevation draining to ditching on the uphill side of landfill roads. See diagram below (existing ditches are the fine dashed line, the heavy dashed line is proposed works in this DOCP).



These improvements should reduce the frequency and magnitude of these stormwater breakouts if implemented as presented in the DOCP. It is noted that some of these measures were proposed in the 2013 DOCP and may not have been fully implemented. As this DOCP covers a 5-year period, it is expected that the majority of these improvements would be completed in the coming 5 years (by 2025). A condition of DOCP approval could be included to ensure the proposed upgrades are implemented, given the measures proposed in the 2013 DOCP appear to have not been fully implemented in some cases:

> "The OC Holder must provide an implementation schedule for the proposed Surface Water Management works detailed in the DOCP by December 31, 2020."

Surface water diversion ditches excavated along the southern boundary of the landfill may have unearthed previously landfilled waste as well. A requirement to assess the surface water diversion ditches along the southern boundary could be included in this DOCP Approval:

> "Surface water diversion works along the south boundary of the landfill must be assessed for adequacy as well as interception of historic landfilled waste by December 31, 2020. Adequate final cover over historic waste must be achieved and maintained."

This DOCP also proposes lining of new cells and progressive closure which should help reduce the potential for contaminant load to this stormwater in the future.

4. Litter

The OC requires:

> "The best practical means must be used to prevent the scatter of litter. Any litter scattered into the neighbouring property, along access roads, in drainage ditches, along litter-control fences, into surrounding trees or elsewhere on the landfill site must be cleaned up. The frequency of clean up and other additional requirements for refuse scatter control must be determined by the Director."

Although this clause seems to be adequate for ensuring containment of litter, the site inspections and comments from neighbours clearly indicate that litter is present all over the landfill site and also on adjacent land. I would recommend that a condition of the DOCP approval be considered:

> "Litter fencing must be set up around the active face while waste is being deposited such that the spread of litter is minimized. Daily cover must be adequate to prevent wildlife from accessing the waste near the active face after the landfill operating hours. Intermediate cover, of at least 300 mm thickness, which may include the 150 mm daily cover thickness should be placed in areas not actively being filled to discourage wildlife from accessing waste.
>
> Should litter be spread beyond the active face, litter collection must be initiated, at least quarterly. Should litter spread beyond the landfill boundary, litter collection must be attempted at least quarterly
>
> Records of litter collection efforts including photographs, must be kept on site for the past 2 years of operations.

5. Wildlife Habituation

The OC requires:

> "Vectors (carriers capable of transmitting a pathogen from one organism to another including, but not limited to flies and other insects, rodents, and birds) must be controlled by the application of cover material at the required frequency or by such additional methods as specified by the Director. Wildlife control fencing must be maintained around the perimeter of the landfill site and must be electrified for at least the active bear season of each year.
>
> This landfill must be operated so as to minimize the attraction of wildlife such as bears and birds by applying cover at required frequencies and instituting a good housekeeping program."

Although this clause seems adequate for preventing wildlife habituation and discouraging vectors from accessing the waste, site inspection and comments from neighbours clearly indicate that deer and ravens have become habituated to waste as a food source and spreading waste from the active face and to adjacent properties. I would recommend that the following condition of the DOCP Approval be considered:

> "the OC holder must cause a Qualified Professional to assess the issues of wildlife habituation and litter dispersion at this landfill and provide recommendations within 1 year to help remedy these issues."

6. Hydrocarbon Contaminated Soil

Soil contaminated up to "CSR Industrial Land Use" standards (IL-) is authorized to be deposited on site. The CSRD was previously authorized to deposit of up to Hazardous Waste levels (HW-) contaminated soil, but a proactive amendment was completed on October 31, 2019 adjusting the authorized contaminant level authorized down to Industrial Waste levels (IL-). The Statutory Decision Maker in that Decision wrote:

> "the receipt of contaminated soils at the landfill, … needs to be carefully re-evaluated to ensure the ongoing protection of human health and the environment."

As there is no zoning in the area where the landfill is located, and the "actual land use" is identified as a refuse disposal site, typically considered an "Industrial Land use." The CSR standards are sufficiently conservative to be protective of the environment for a given land use. Landfilling soil that is below the industrial land use threshold (IL-) should pose minimal risk to the environment, by definition. Any risk that this soil may pose to the environment would be reduced by implementing the measures within the DOCP: lining new phases, leachate collection, surface water diversion, and progressive closure.

7. Surface Water Monitoring

"Surface Water Monitoring" with respect to environmental discharge authorizations typically refers to the monitoring of bodies of water that may be impacted by the authorized discharge. This usually means ponds, lakes, streams, or rivers and the purpose of the monitoring is to evaluate year-to-year and longer terms trends. As there are no such water bodies near the site (the Kicking Horse River is ~1 km to the south), no surface water monitoring is recommended in this DOCP.

Monitoring of periodic surface water runoff that may be contaminated with landfill contaminants which is migrating off-site would be a best practice, but is not typically specified within an authorizing document. These samples have been done at times in the past and could be done in the future as a best practice or would likely be required in relation to any unauthorized discharge (spill) at this site in the future. Requiring monitoring of periodic surface water runoff that may be contaminated should be considered in future OC amendments.

8. Revegetating Buffer Zone

The 50 m buffer zone has been defoliated in places and the Landfill Criteria stipulates that buffer zones be vegetated in the 35 m closest to the boundary. This is not discussed in the DOCP and could be included as a condition of DOCP approval or in future OC amendments.

9. Conformance Review

Under the *2016 Landfill Criteria for Municipal Solid Waste* (*Landfill Criteria*), Section 2.2, Conformance of Existing Landfills, conformance of each landfill with the *Landfill Criteria* should be evaluated in a Conformance Review. Should the Conformance Review identify a need for upgrades, an Upgrading Plan with the schedule for all proposed upgrades should be included. The CSRD retained Golder Associates Ltd. to conduct a Conformance Review for the Golden Landfill.

The only deficiencies (with the *Landfill Criteria*) noted in the Conformance Review were a lack of landfill gas monitoring along the eastern boundary of the landfill site, and a lack of leachate monitoring. The upgrading plan recommended installing gas probe wells along the eastern boundary and initiating leachate monitoring once a liner system is in place and leachate is being collected.

There are several sections of the Conformance Review that indicate the CSRD is in compliance with their OC, rather than the *Landfill Criteria*, and therefore are not identified to be in non-conformance. This is not the intent of a Conformance Review as the OC predates the *Landfill Criteria,* and a Conformance Review is intended to assess conformance with the *Landfill Criteria* specifically, not an OC. This feedback will be provided to the CSRD for consideration of revising this Conformance Review.

Notable area of conformance with the OC, without discussing the *Landfill Criteria* include:

- Vectors and Wildlife: IN CONFORMANCE
  "Electric Bear fencing surrounds the site and is operational. Waste compaction and covering is performed per OC requirements. However, deer are able to jump over the fence after hours and dig up MSW. Birds are able to pick up the exposed MSW and take it off-site."
- Vectors and Wildlife Management: IN CONFORMANCE

"Electric fence surrounds the site. Waste Compaction and covering activities meet OC requirements."

Other areas of the Conformance Review indicate conformance, but note non-conformance:

- Cover Placement: IN CONFORMANCE
  "Soil and alternative daily cover are applied to the active face on a daily basis. Alternate daily cover consists of steel plates. Some leachate breakouts were noted during the site visit. When a new lift is started along the outer slope of the landfill, the CSRD should consider stripping away the underlying intermediate cover to encourage the downward flow of leachate and thereby reduce the potential for leachate breakouts along the slope. This should only be done immediately prior to placing the overly MSW in the new lift."
- Nuisance Controls: IN CONFORMANCE
  "Practices in place to address litter, odour and dust. As the time of the site visits, litter was prevalent in areas immediate adjacent to active filling operations. However, on-site litter collection occurs at least once per year."

The conclusion of the Conformance Review is:

"It is important to note the Golder is of the opinion that the Golden Landfill essentially conforms with the requirements of it's OC and as such, is in regulatory compliance."

Recommendations for conditions of DOCP approval have been made in other sections of this Memo that pertain those sections.

10. Meteorological Data

The risk of utilizing met data from the golden airport to approximate conditions at the landfill (2.5 km distant) was assessed by reviewing the topography and distances involved with ENV Hydrologist Kyle Terry. His assessment was that there could be some differences in the precipitation at the airport and the landfill, but that difference is likely small. It is rare to have met data from such a close location with many projects, so this risk of using airport data to approximate the conditions at the landfill could easily be mitigated by utilizing a conservative approach when utilizing this data.

11. Landfill Closure prior to planned closure

The CSRD has engaged a Qualified Professional to produce a Landfill Alternative Cost study for the Golden landfill in 2020. The study will look at costing, pros/cons, and environmental impacts associated with such options as status quo (landfilling at the existing site), landfill closure and either incineration, new site or transfer to an existing CSRD landfill. The results of this study will be shared with the public in 2020 and may help put the costs of premature closure in perspective. Depending on the outcome of the study, the Ministry can decide on next steps such as whether a Solid Waste Plan Amendment should be completed.

Other Considerations – Discussion

In Rusto's 2nd SME report, the final cover hydraulic conductivity was discussed:

> "the conceptual cover design consists of, in part, a mineral soil with a hydraulic conductivity on the order of 10-5 cm/s. The 2016 Landfill Criteria states that such conductivity value is suitable for landfill covers in arid regions, which the Golden area is not. Hence, lower conductivity value (e.g. 10-7 cm/s) of the cover material would be more protective."

Also:

> "Ultimately, the final cover design should be informed by future landfill performance and environmental monitoring assessments, as well as the expected post-closure leachate generation rates. Accordingly, the final closure components should be detailed in the future DOCP updates, which are required every five years."

The LF Criteria state that the HC in the order of 10-5 cm/s be used in arid or semi-arid regions. Further, the Criteria states:
"Though arid and non-arid regions are not only characterized by annual precipitation levels, as a general guidance, areas with less than 500 mm of annual precipitation can be considered arid and semi-arid."

Golden receives approximately 582 mm of precipitation annually (Golden Airport), but some of the QP assessments utilized values in the 480 mm range, so the determination of appropriate hydraulic conductivity for the final cover system is likely within the realm of professional judgement (QP and/or SME). The CSRD should seek clarification on this point in future work. The final cover design can be refined in future interactions with CSRD staff, keeping Rusto's comments and the LF Criteria in mind.

Summary

Overall, the DOCP has been developed in accordance with the Landfill Criteria Second Edition (2016) and represents a significant improvement to the protection of the environment at this site. The outstanding issues identified by our SME should be addressed through an OC amendment process to be triggered by a condition in the DOCP Approval Letter. The suggested condition of approval is:

> "The OC Holder must apply for an amendment to update several aspects of this Operational Certificate by May 31, 2020."

It is noted that the surface water diversion works, liner system, and leachate collection system must be designed/engineered by a Qualified Professional prior to construction.

6. Recommendations

I recommend that the DOCP be Approved with conditions. A draft approval letter is appended.

Brad McCandlish, P.Eng.
Senior Environmental Protection Officer

Peer Reviewed by: Roshan D'Souza, EPO

APPENDICES

-SME Reports

2019-11-07 Golden Landfill - ENV groun

2020-01-23 Golden Landfill - ENV groun

-Draft DOCP Approval Letter

2020-03-18 DRAFT Golden DOCP Approv