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MEMORANDUM

13 January 2023

To: Jessica Brown
Environmental Officer
Sarnia District Office

From: Jeff Markle
Scientist
Technical Support Section

Re: Appendix G
2021 Annual Monitoring Report
Clean Harbors Lambton Facility Landfill
Clean Harbors Canada Inc.
ECA No. A031806
prepared by Dillon Consulting
dated: 21 March 2022

I have reviewed Appendix G of the 2021 Annual Report for the Clean Harbors landfill site. Appendix G presents the results from the groundwater monitoring completed at the Site in 2021.

My comments on the 2021 Annual Monitoring Report (AMR) are as follows:

1. Section 3.1, page 10: Dillon identifies several monitoring wells that require repair. Please ensure that the outcome of these repairs is documented in the 2022 AMR along with verification that the work was completed by a licensed contractor. If the work was not completed in 2022, then please provide rationale for not competing the work and a schedule for completion of the work.

2. Section 3.3.1, Table 3.5, page 19: Comparison to 2020 AMR, shows several wells are identified as having trends in their water quality data for the first time while other wells, which previously had trends, no longer have trends. Where an important metric like a trend has changed between AMRs, some discussion should be provided in the AMR. As

well, some discussion on the regression methods is warranted so it is clear what methods were used to identify trends. Please provide further discussion in the 2022 AMR.

3. In 2019 and late-2020 the inward gradients were not maintained in Sub-Cell 3. As a result, in the 2020 AMR GHD recommended that the *"…functionality of the Sub-Cell 3 be evaluated on this observation and the lack of consistent operation from extraction well pumps in 2020.*" This action and associated results are not documented clearly in the 2021 AMR. See Comments 4, 5 and 10 below for additional discussion on this topic.

4. In the 2019 and 2020 AMR, GHD recommended the development of an operational and maintenance procedure and an inspection checklist. It is not clear from the 2021 AMR if this has been completed though recommendations in Section 7 suggest it has not been completed. Please provide an update on the status of this recommendation. If development of the procedure was not completed in 2022, please provide a timeline for completion.

5. Section 4.1, page 26: Dillon states that "*…the HCL is not controlling groundwater levels in Sub-Cell 3 as designed.*" This is the third year the inward hydraulic gradient has not be maintained consistently through out the year in Sub-Cell 3. At the end of Section 4.1 Dillon states "*Significant surface works have occurred in the Sub-Cell 3 area in 2020 and 2021. As recommended in the 2020 Monitoring Report, an operational and maintenance procedure and an inspection checklist should be developed to provide assurance that Sub-Cell 3 groundwater extraction system is operating as designed.*" I could not find an overview of this work in the 2021 AMR or a description of the work that is to be completed. Please provide a plan and schedule detailing the actions that have and will be completed to resolve this issue.

6. Section 4.2, page 28: Dillon presents Table 4.2 and states that "*No statistically significant increasing trend were identified in the monitoring data for these monitoring wells.*" When making a statement that no statistically significant trends are found, details on the statistical tests and assumptions need to be provided. Without this additional information, there is no way to evaluate the validity of the statement. Please provide the necessary additional information in the 2022 AMR.

7. As noted by GHD in Section 2.3 of the 2020 AMR "*The LCS was designed to operate as a hydraulic trap, such that the operating level of the LCS is less than the landfill leachate level, the adjacent groundwater elevations, and the surface water ponds. The intention is the Active Aquitard water level is greater (higher) than the leachate level in the LCS system in order to create an inward gradient for groundwater towards the LCS… The monitoring wells in the southern berm (TW50-02A/B, TW51-02A/B, and TW52-02A/B) were removed as part of the remedial construction work. Therefore the performance*

monitoring associated with the Southern Berm was not completed in 2020 and will be removed from the monitoring program." Later in Section 5.0, page 30, GHD states: "*As the southern berm and these wells have been removed, it is not possible to evaluate the performance of the engineered landfill system around the southern berm.*" While I acknowledge that the transect in the Southern Berm area can no longer be used to evaluate the LCS performance, Clean Harbors needs to reinstall a transect of wells or propose and implement an alternative form of monitoring to demonstrate that the LCS is performing as intended. I could not find any recommendation in the 2021 AMR relating to this issue. Clean Harbors needs to clarify how they will demonstrate that inward hydraulic gradients are maintained on the southern portion of Cell 19 in the 2022 AMR.

8. Section 7.0, page 32: Dillon recommends that sampling in the perimeter monitoring well network be reduced from twice per year to once per year. I do not support this broad recommendation. It may well be that the monitoring at some specific wells can be rationalized, but without a detailed analyses and justification for each specific monitoring location, I can not support a reduction in the sampling frequency at an operating landfill site.

9. Section 7.0, page 32: Dillon recommends that monitoring wells that require maintenance be repaired. I agree with this recommendation and suggest that Clean Harbors should undertake this work in a timely fashion and that a reasonable time frame would be within 4 to 6 months of the need for repairs being identified.

10. Section 7.0, page 32: Dillon makes 3 recommendations pertaining to Sub-Cell 3. I agree with each of these recommendations and note that the third recommendation has been made in the AMRs since 2019. Based on the 2021 AMR, it is not clear what the overall work plan is for Sub-Cell 3. Furthermore, it is not clear if there is a schedule for implementing and completing the work. It is my opinion that we require a clear and concise workplan relating to Sub-Cell 3. The plan should include rationale for the work, objectives by which the success of the works can be measured and a comprehensive schedule for completion of the work. If this information has been presented elsewhere other than in the AMR, please provide the relevant documents.

11. Section 7.0, page 32: Dillion reiterates two recommendations from the 2020 AMR relating to the engineered landfill system performance assessment. If these recommendations have not been implemented at the time of writing the 2022 AMR, then reasons / justification for why they have not been completed should be provided, along with a schedule for their implementation.

12. The 2019 and 2020 AMRs assess the hydraulic gradients in the southwest corner of Cell 19 using fluid levels from several monitoring points including PTS-02, PTS-03 and LCSOW02-15. Figure 19 in the 2021 AMR does not include fluid levels at these three locations. Please provide a rationale / justification for not using the fluid levels at these monitoring points in the performance assessment.

Below I have restated my comments provided on the 2019 Annual Monitoring Report. In red underlined text I have indicated if these comments have been addressed or require additional information and remain outstanding.

1. Section 2.3 page 8: As part of the remedial response to a leachate seep in the spring of 2019, Clean Harbors removed the southern berm and infilled the south ditch. The monitoring wells in the southern berm were removed as part of the remedial construction work. **Please confirm that the monitoring wells were abandoned in accordance with the Wells Regulation.**

   I can not find any response in the 2020 or 2021 AMRs to this comment. Please provide a response in the 2022 AMR.

2. Section 3.1.2, page 10: GHD notes that the water levels at TW45-99D are inconsistent with water levels within the Interface Aquifer. GHD attributes these differences to slow recharge at TW45-99D. They recommend that TW45-99D be redeveloped to assess if the screen and sandpack can be rehabilitated to improve well recharge. **I agree with this recommendation.**

   In Section 3.1, page 10, of the 2021 AMR, TW45-99D is listed as one of the monitoring wells requiring repair. This suggests Clean Harbors has not yet completed the necessary rehabilitation actions. Please provide a schedule for completion of these repairs.

3. Section 3.2, page 12: In this section on the perimeter groundwater quality GHD recommends that "*… the leachate indicator parameters are re-evaluated using samples collected from the leachate collection system in 2020.*" **I agree with this recommendation; however, I note that the leachate quality in the leachate collection system reflects the leachate quality for only the new expansion area and may not reflect the leachate quality in the previously filled areas where expansion activity has not yet occurred. Any re-evaluation of the indicator parameters should consider this reality.**

   No further comment at this time.

4. Section 3.2, page 14: GHD states that "*To properly assess the potential changes to leachate conditions over time, the leachate quality from the LCS, and the seasonal fluctuations, the collection and submission of leachate samples during the spring and fall is recommended. GHD recommends the submissions of leachate samples consisting of general indicators, major and minor ions semi-annually, total metals annually, and VOC biennial (sampled in odd years), starting in the spring of 2020. The recommend sampling and analysis plan for leachate samples from Cell 19 is based on the parameters and frequency of the Active Aquitard sampling and analysis plan and will provide insight into the evolution of leachate quality within the active landfill cell.*" **I agree with this recommendation.**

It appears that this recommendation has not been implemented. In the 2020 AMR, Section 3.2, page 14, GDH states: "*Samples from the leachate collection system (LCS) were not collected by Clean Harbors in 2020 due to abnormal operation of the LCS.*" I could not find any comment in the 2021 AMR relating to the collection and analyses of leachate samples from the LCS in the expansion area. If Clean Harbors has decided not to implement GHD's recommendation, then this should be stated and justification and rationale provided.

5. Section 3.2.1.1, page 18: GHD constructed Piper plots to assist with interpreting the inorganic groundwater chemistry within the Active Aquitard and the Interface Aquifer. DHG notes that "*Samples from the LCS for select leachate indicator parameters were not collected by Clean Harbors in 2019 due to abnormal operation of the LCS. Samples collected from the LCS were not considered representative in 2019. Leachate data will be plotted with the Active Aquitard groundwater data for future reports to compare leachate and Active Aquitard geochemistry.*" In addition to the samples collected from the LCS, it may be instructive to include leachate quality data previously collected at the site to reflect the range in leachate quality at the Site.

It appears that this recommendation was not implemented. Please provide rationale for not considering this suggestion.

6. Section 3.2.1.2, page 18: GHD states that "*VOC samples were collected in spring 2019. There were no organic compounds detected in Active Aquitard samples, with the exception of toluene detected at OW35-90S and TW45-99S. Toluene was detected at concentrations below the ODWS and the PWQO.*" I was not able to find any follow-up discussion on possible causes of the low concentrations of toluene observed at these wells or recommendations for further investigation. **GHD should provide further discussion. Also see comment 8.**

Toluene was not detected in 2021, suggesting this was an anomaly. No further comment.

7. Section 3.2.2.1, page 20 and 21: GHD notes that the while chloride and sodium at TW45-99D show statistically significant increasing trends, other leachate indicator parameters show decreasing or no trends. GHD suggests the increasing chloride and sodium may be due to slow recharge at this well and are unlikely resultant of landfill impacts. **This may be a reasonable explanation, but the water quality trends at this well should be watched following the proposed redevelopment recommended by GHD as noted in comment 2.**

   No further comment.

8. Section 3.2.2.2, page 22: MEK was detected at TW60-13D in 2019. GHD recommends resampling this well in 2020. **I agree that TW60-13D should be sampled for VOCs in 2020. Given that toluene was detected in the Active Aquitard at OW35-90S and TW45-99S in 2019, I suggest that DHG consider sampling these two wells for VOCs in 2020.**

   TW60-13D was resampled in 2020. MEK was not detected but benzene was detected. TW60-13D is an Interface Aquifer monitoring well and GHD concludes that the presence of benzene is related to naturally-occurring petroleum compounds found regionally in the Kettle Point Formation. I agree with this conclusion and there has been significant work completed at this site in the past to support this conclusion. While OW35-90S and TW45-99S were not sampled in 2020, toluene was not detected in these wells in 2021.

   No further comment.

9. Section 3.3.1.1, Page 24: GHD states that "*In the absence of other elevated indicator parameters, the RUC exceedance for fluoride at TW30-94 is not considered to be landfill-related.*" **I agree with this conclusion.**

   No further comment.

10. Section 4.1, page 26-27: GHD discusses the water levels and vertical gradients in the HCL in 2019. They state that "*Based on these observations, an upward vertical gradient from the Interface Aquifer to the HCL was not maintained during 2019 at extraction well EW2a-01… Groundwater elevation trigger levels and response actions should be developed to help ensure that the Sub-Cell 3 groundwater extraction system performs as intended throughout the year. To ensure the performance and longevity of the Sub-Cell 3 groundwater extraction system, it is recommended an operational and maintenance procedure and an inspection checklist be assessed.*" Subsequently in Section 4.3, page 28: GHD notes that "*The water levels and hydraulic gradients measured in the HCL in*

2019 indicate that the remedial system is not operating as intended to maintain an upward gradient."

Maintaining the hydraulic gradient into the HCL in Sub-cell 3 is the primary purpose of the HCL and is a critical operational component without which the HCL is compromised. It is not clear to me from reading the report why or how this situation occurred without it being noted and appropriate actions taken. Furthermore, no explanation is provided.

The dataloggers in the HCL monitoring and extraction wells are to be downloaded quarterly in accordance with the approved Groundwater and Landfill Performance Monitoring Programs dated 9 December 2015. The approved monitoring program is silent on data review after downloading. There needs to be a quick review of the data to ensure the system is operating within the design parameters. If the system is not operating within the design parameters, or if it is predicted that it may soon be out of compliance, then there needs to be established actions. **It is my opinion that Clean Harbors needs to develop a procedure detailing operational oversight of the HCL as recommended by GHD.**

See comments above on the 2021 AMR.

11. In Section 5, page 29, GHD recommends that "*…Clean Harbors investigate the condition of the LCS standpipes in the spring of 2020 and assess potential causes for the failure of transducer direct read cables. Rehabilitation and maintenance of the LCS standpipes, and/or replacement of direct read cables is recommended, depending on the findings of the investigation.*

The transducer water level data from the LCS standpipes is critical assessment of the performance of the engineered landfill system when the LCS is operating in automatic mode since it allows comparison of the pumping system and the point between pumps to be assessed." Subsequently in Section 5.1, page 30, GHD states "*However, during most of 2019 an inward gradient was not maintained from the property boundary to the LCS. Clean Harbors is working to re-establish the LCS to normal operations.*"

Like the operation of the HCL in Sub-cell 3, maintenance of inward gradients to the LCS is a key design feature of the expansion area. Failing to maintain this inward gradient should be avoided. Review and evaluation of this information needs to occur throughout the year so that pending non-compliance can be identified, and actions can be taken to avoid loss of the inward gradients. **As recommended for Sub-cell 3, Clean Harbors should develop and implement procedure for reviewing the water level data in a timely manner and promptly taking actions necessary to ensure the proper operation of the LCS.**

See comments above on the 2021 AMR.

12. Section 5.2, page 31: GHD notes that "*Clean Harbors is planning to complete construction in this area in 2020 to reconfigure the surface water system. New surface water pond was approved to be constructed to the south of the landfill. The new surface water pond will be constructed where the southern berm is and will inherently create an inward gradient towards the LCS, thus eliminating requirements for the southern berm monitoring program.*" Subsequently in Section 5.3, page 33, GHD states that "*The installation of the surface water management amendments in 2020 will required other changes to the groundwater monitoring program and assessment associated with the LCS. The stormwater management ponds will be the primary method of maintaining an inward gradient at the facility through pond level water management and the transect concept developed in 2015 will need to be amended.*"

    I agree that Clean Harbors will need to provide an updated monitoring plan to reflect the new conditions in the southern portion of the site. The monitoring program must demonstrate that the inward gradients to the LCS are maintained.

    An updated plan has not been provided in either the 2020 AMR or the 2021 AMR. Please provide an updated monitoring plan detailing how Clean Harbors will demonstrate that inward gradients are maintained along the southern portion of Cell 19 along with an implementation schedule.

13. Section 7, page 34: GHD recommends that Clean Harbors "*Establish groundwater elevation trigger levels and response actions to help assess the performance of the Sub-Cell 3 groundwater extraction system as monitoring data is collected throughout the year.*

    As indicated in comments 10 and 11, plans are required for both the HCL in Sub-cell 3 and the LCS.

    See comments above on the 2021 AMR.

Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment, Conservation and Parks regarding subsurface conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

If you have any questions, please contact me.

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