APPENDIX B

2017 Annual Landfill Report Correspondence

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MEMORANDUM

11 February 2019

To: Don Hayes
Provincial Officer
Sarnia District Office

From: Jeff Markle
Scientist
Technical Support Section

Re: 2017 Annual Landfill Report
Appendix G
Clean Harbors Canada Ltd.
ECA No. A031806
prepared by GHD
dated: 2 March 2018

I have reviewed Appendix G of the 2017 Annual Report for the Clean Harbors landfill site (the Site). Appendix G presents the results from the groundwater monitoring completed at the Site in 2017.

My comments are as follows:

1. Table 1 is a summary of the well completion details. In this table the wells are placed into 6 groups which include shallow, deep, deep shale, Sub-Cell 3, Leachate Collection Trench, and other un-assigned monitoring wells. In the EA completed for the most recent landfill expansion, the following groups were used to describe the hydrostratigraphic units in the conceptual model for the Site: (from the surface down) Active Aquitard; Transition Zone; Inactive Aquitard; Interface Aquifer; and Shale Aquitard. I suggest that these categories used in the EA be applied in the annual reports when grouping the monitoring wells. Obviously those wells specific the Sub-Cell 3 and the Leachate Collection Trench would remain in these specific categories.

2. Table 2 summarizes the monitoring method used for perimeter wells at the Site. Well TW64-16-I is listed under Shallow Wells (Active Aquitard). TW64-16-I is approximately 25-m-deep and should be in the Inactive Aquitard category rather than the Active Aquitard. As well, in Table 1 this well is placed in the Other Un-Assigned category. For clarity I recommend that the classification system presented in the EA be used in the annual reports and please ensure that the classification of the wells is consistent throughout each annual report.

3. TW32-94-III and TW39-99I are shown on Figure 4. TW32-94-III is not listed in Table 1 or 2, and TW39-99I is not listed in Table 2.

4. Section 3.1.1.1.1 Northern Berm, page 12: GHD states that *"As illustrated on Figures C-1 through C-3, these groundwater elevations are slowly decreasing towards the groundwater elevations identified outside of the northern berm."* I agree that there appears to be a declining trend in groundwater levels at the wells in the berm (TW39-99S, TW46-99S and TW61-13S) and in the native soil beneath the berm (TW39-99I, TW46-99I and TW61-13I). One might expect to see a similar trend in the southern berm, but this does not appear to be the case. Please provide some discussion about why we may be seeing a decline in groundwater levels in the northern berm but not in the southern berm.

5. Section 3.1.1.2 Interface Aquifer, page 13: GHD recommends that the cause for the slow recovery rate at TW45-99D be investigated in 2018. I agree with this recommendation.

6. Table 5, pages 19 – 20: GHD lists wells and parameters that exceed the range previously observed for each monitoring location. For TW42-99S electrical conductivity is identified. Table 7 and the figure in Appendix E for this well suggest sulphate should be included as well.

7. The sulphate concentration at TW42-99S is much higher than at all the nearby wells (e.g., TW43-99S, TW50-02A and B, TW51-02A and B, and TW52-02A and B) and there is no obvious reason. As well, the range in concentration of many of the parameters is larger at TW42-99S. In comments provided on past annual reports, I suggested that the seal at this well may be comprised. GHD should review the chemical analysis for this well and comment on the potential that a poor well seal is contributing to the elevate sulphate concentrations.

8. Section 3.1.2.2.2 Organic Chemistry, page 26: Acetone and MEK were detected at TW48-00D and TW49-00D in 2017. GHD suggests these are likely due to cross contamination in the laboratory. GHD recommends that they resample these wells in 2018. I agree with this recommendation and suggest that the ministry split samples with Clean Harbors at these two wells in the next sampling event in 2019.

9. Section 3.2.1 Water Level Data, page 29: GHD recommends development of an operational and maintenance procedure and inspection checklist. I agree with this recommendation.

10. Section 3.3 Engineered Systems: After purging and sampling the water levels at wells TW48-00D and TW48-16S both take a little over 2 months to recover. Both of these wells are part of a group of wells located along a transect used to evaluate the influence of the leachate collection system on the shallow groundwater flow. This disruption in the water levels from purging and sampling makes it difficult to interpret the water levels along the transect. Clean Harbors may wish to consider deferring sampling at these two wells for one or two years to establish a baseline between the water levels in all the wells in this transect.

11. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient: This section presents the water level monitoring results in the leachate collection trench (LCT) and the transect established to evaluate the performance of the LCT. Evaluation of the operation and performance of the LCT is detailed in the document Groundwater and Landfill Performance Monitoring Programs, dated 9 December 2015. Based on results presented in the 2017 AMR, it is not clear that all the elements of the approved monitoring program are being fulfilled. In particular, it appears that the inward gradient to the leachate collection trench is not being maintained as assumed in the approved landfill design. For example:

    a. Figure 15 shows that the water levels in the active Aquitard are lower than the bottom of the leachate collection system (LCS) after approximately October 2017. Therefore, the inward gradient (into the landfill) is not maintained all year.

    b. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient, page 32, paragraph 3 states: *"From mid-August to the end of December, an outward groundwater flow from Sub-Cell 19 ... was present."*

    c. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient, page 32 states: *"...on the basis of the horizontal hydraulic gradients measured along the western leachate collection system transect, leachate migration beyond the collection*

system is possible, however leachate migration would not reach the Site boundary."

The inward hydraulic gradient to the LCS was an important design feature of the expansion. The consultant needs to comment on this issue and in particular consider how these outward hydraulic gradients may change the predictions made in the EA for the landfill expansion. While GHD suggests leachate migration will not reach the Site boundary, they need to provide a more thorough analysis and discussion to support this supposition.

12. The groundwater and landfill performance monitoring programs for the landfill expansion are specified in the Final Draft Groundwater and Landfill Performance Monitoring Programs dated 9 December 2015. Section 4.3.1, Groundwater Level Monitoring – Perimeter Collection Trench, page 28, of that document states: *"The following settings will be established initially by the operator: pump activation when the liquid level in the sump reaches an elevation of 196.5 mASL; and pump shut off at 195.5 mASL. These settings are selected to minimize turbulent flow ... and to ensure that the volume of leachate [sic] pumped can be actively managed with the available storage... A 'high' level warning system, triggered when the water level reaches 197.5 mASL, will be installed as a backup..."*. In addition, Section 4.4.2 specifies the compliance triggers for the Perimeter Trench Performance Monitoring Program and the Performance of Engineered Landfill System. With respect to the perimeter trench on page 29 it states: *"The pumps will initially be set to run when the level in the sump reaches a height 196.5 mASL and to shut off when the level drops to 195.5 mASL. As noted, the 'off' setting may be adjusted downward as experience is gained with system operation."*

    Based on the water level data presented in the 2017 AMR it is not clear that the operational parameters and compliance triggers and actions are being followed. Please provide rationale, justification and a detailed discussion of the potential implications presented by the current operations of the leachate collection system.

13. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient, page 32: GHD recommends installation of transducers in the pond and ditch west of Sub-Cell 19. This information is necessary to evaluate if inward gradients towards Sub-Cell 19 can be maintained. Given that the presence of inward gradients was a significant design feature in the landfill expansion, this information is necessary and I agree with this recommendation.

14. The 2016 AMR presents hydrographs for PTS-01, LCS OW1-15, PTS-02, LCS OW2-15, PTS-03, LCS OW3-15, PTS-04, LCS OW4-15. I was not able to find hydrographs for the PTS series monitoring locations in the 2017 AMR. Please ensure hydrography for all monitoring points are provided in each AMR.

15. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient, page 32, final paragraph: GHD recommends lowering the set point 0.2 m each month to investigate the influence of the LCS on the Active Aquitard. I agree with this recommendation.

16. Section 3.3.1.2.1 Active Aquitard Groundwater Gradient, page 32: The water level data for TW64-16-II appear to respond to precipitation events. GHD suggests that the seal may be compromised and recommends that the seal be investigated. I agree with this recommendation.

17. In Tables 3.7 and 3.8 TW47-99D should likely be TW47-00D.

18. Section 4.1.1.2 Interface Aquifer RUC Exceedances, page 35 and 36: Barium (TW22-99D and TW47-00D) and boron (TW22-99D, TW47-00D and TW60-13D) exceed the RUC. GHD should discuss possible causes for these elevated parameters.

19. It would be helpful if the RUC limit (where applicable) was added to the control charts presented in Appendix E of the Groundwater Monitoring Report.

20. Shewhart Control Charts are used to evaluate the groundwater quality data. One benefit of this method is that it does not assume or require the data to follow a normal distribution. However, it assumes the data are independent and identically distributed (i.e., there is no serial correlation), and the data are not influenced by seasonal effects. I looked through the previous annual reports and could not find any analysis and discussion on whether the data satisfy these two assumptions. I suggest that GHD randomly select two water quality datasets from each group (Active Aquitard, Interface Aquifer, Deep Monitoring Well, Deep Shale Monitoring Well – i.e., 8 data sets) and evaluate if the data are independent and not influenced by seasonal effects. If serial correlation is present and is too high, then the data may need to be preprocessed prior to the application of the Control Chart.

21. GHD replaced nondetects with values of ½ the detection limit. While this is a simple and straight forward method of handling non-detects, the substitution of this somewhat arbitrary value may influence subsequent statistical analyses completed using the modified data set. GHD should provide some discussion on the appropriateness of, and justification for, substituting ½ the detection limit for nondetect values. As well, GHD should discuss the possible effects of this approach on the trend analysis and other summary statistics.

22. In Table 15, for clarity please provide values for the median and standard deviation in addition to the UCL.

23. The equation for calculating the UCL is presented in previous annual reports. For clarity, please include this equation in each annual report.

24. I reviewed the trend results presented in Table 16 and figures in Appendix E of the Groundwater Monitoring Report and provide the following comments:
    a. In several cases it appears that the trend line may be influenced by the non-detect values. For example: bromide at OW32-90D; bromide and fluoride at TW22-99D; bromide and fluoride at TW45-99D; sulphate and fluoride at TW47-00D, etc. Therefore, a discussion on possible impacts on the trend analysis from the use of ½ detection limit for nondetect values is warranted.
    b. At TW47-00D, chloride, potassium, sodium, barium and boron exceeded their respective UCL. GHD should provide a discussion.
    c. For OW32-90S some of the 'baseline' data used to calculate the UCLs have elevated concentrations. GHD needs to justify using these as baseline data.
    d. It is not clear if GHD assessed the fit of the linear regression lines by looking at the residuals to ensure the quality of the fit, the constancy of the variance, the normality of the residuals and the independence of the data. I suggest that GHD randomly select a few data sets and check the above mentioned qualities. These can be reported in a subsequent annual monitoring report.

25. In subsequent annual monitoring reports please provide electronic versions of the water level data and water quality data so that some of the analyses and interpretation presented in the report can be duplicated and verified. Please note that provision of these data is part of the approved Groundwater and Landfill Performance Monitoring Programs dated 9 December 2015.

26. Hydrographs for select monitoring wells equipped with transducers and data loggers are provided in Appendix B. It would be very helpful if GHD provided notations on the hydrographs that denote when the wells have been purged for sampling so that the reader/reviewer does not have to speculate what the cause of the observed water level disturbances may be.

27. Section 6. Recommendations: GHD makes eight recommendations. I agree with all these recommendations.

Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change 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.

Jeff Markle
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cc. H. Geurts