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RESPONSE TO MOECC COMMENTS ON 2015 ANNUAL STATUS REPORT
ENVIRONMENTAL COMPLIANCE APPROVAL NO. A321206

Dear Angela;

As requested, this letter provides our responses to review comments received from the Ministry of Environment and Climate Change (MOECC) on surface water aspects of the 2015 Annual Status Report for the Fenelon Landfill Site. The MOECC comments were provided in a Technical Memorandum from Beth Gilbert (Surface Water Specialist) dated October 17, 2016.

MARTIN CREEK

Review Comment: *I agree that there were no exceedances of the Martin Creek Wetland trigger concentrations in 2015. I also agree that there were no significant leachate impacts on Martin Creek in 2015. Concentrations of toluene in Martin's Creek were detected only in the filtered water samples from SW2 and SW3 and were at levels similar to PWQO (0.8 and 0.9 µg/L), respectively. Adverse impact is not anticipated at this time; however, explanation is needed as to why only the filtered samples detected toluene.*

Response: As shown in Table 13, the only filtered sample that gave a toluene detection was that collected from Station SW-3 in July (0.0008 mg/L). All of the SW-2 filtered samples gave non-detectable toluene concentrations. The toluene detection at SW-2 was on the non-filtered sample collected in October (0.0009 mg/L). Therefore, it is not just filtered samples that gave detectable toluene concentrations. In any event, the toluene concentrations are close to the detection limit of 0.0005 mg/L and it is possible that slight losses during sampling may be the reason why toluene was detected in a filtered sample and not the unfiltered sample or vice versa. We do not have a definitive answer for this.

Review Comment: *Only four samples have been collected at SW16. Preliminary data shows higher chloride, total dissolved solids, iron, and alkalinity than reference station SW2. Since these are leachate indicators additional data is needed from SW16 to determine if these indicators are confounded by other factors. Flow contribution from SW16 should also be considered in terms of potential influence on water quality conditions at downstream locations.*

Response: Agreed. As of the end of 2015, only four samples have been collected from SW16 as this is a fairly new station. The station will continue to be monitored to better understand the variation in water quality and potential factors influencing concentrations. Regarding flow rates, we do provide flow data for SW-16 as well as other stations in Appendix I (first Table). In April 2015, the flow rate at SW16 was estimated at 0.06 m3/s versus 0.27 m3/s at SW2. Both stations had no flow during the July and October sampling events due to dry conditions. Based on this data, the flow at SW16 contributed about 20% of the April 16/15 flow in Martin Creek originating from west of County Road 21. This is considered enough contribution to have a significant influence on downstream water quality.

Review Comment: *If available, I recommend that flow statistics (mean annual flow, average daily flow, mean monthly flows, etc.) are reported for Martin Creek at Mark Road and that these flow statistics are compared to spot flow measurements from SW2, SW3, SW4, and SW16 and to the leachate generation rate.*

Response: The continuous flow monitoring by the Kawartha Region Conservation Authority (KRCA) in Martin Creek at the Mark Road crossing was not carried out for the purpose of the landfill monitoring and was discontinued by KRCA in 2014 at their own discretion. Therefore, only spot flow measurements are available post 2014. Flow rates are estimated by the City at each station in Martin Creek at the time of sampling, including at SW-3 (Mark Road culvert). These spot measurements are considered adequate for assessing the relative contributions to the creek flow from the landfill area versus upstream areas.

Review Comment: *Table 12 summarizes the range of background water quality at SW14, SW16 and SW12. I recommend that descriptive summary statistics (e.g. means, medians and 75lh percentiles) are included.*

Response: Agreed. These statistics will be included in Table 17 in the 2016 Annual Report.

Review Comment: *Confirmation is needed regarding the sampling conducted at stations SW14, SW12, SW13, and SW15, relative to the distance of the sampling point relative to the toe of Phase 1 waste. I recommend that the data provided in Appendix I indicate the distance that samples were collected from the toe of the waste for stations SW12, SW14, SW14, SW15. This is indicated for some of the data, but not all. This is so the routine sampling data (fixed location/distance) can be readily distinguished from the sampling conducted as part of the conductivity monitoring (distance based and will vary from year to year).*

Response: As shown in Figure 12, the routine/fixed surface water stations SW12, 13 and 15 are all at approximately 10 m out from the toe of the Phase 1 waste fill area. Station SW 14 (background) is not along the landfill periphery. The distances from the landfill toe are noted in Appendix I only if the sample was collected along the transect line rather than at the routine/fixed station. We will clarify this in Appendix I of the 2016 Report.

MARTIN CREEK WETLAND EAST OF MARK ROAD

Review Comment: *The groundwater trigger concentration of 0.8 µg/L for toluene was exceeded on one occasion at WP6-13 (3.9 µg/L) adjacent to Martin Creek and is not shown on Figure H.2.4.*

Response: Agreed. The vertical scale on Figure H.2-4 will be revised to show the 3.9 ug/L toluene concentration measured in October 2015. The subsequent (November 2015) event gave <0.5 ug/L at all the Martin Creek Protection Trigger Wells and therefore no action was required with respect to the groundwater trigger mechanism shown in Figure 11.

Review Comment: *Trigger Mechanism - Page 17 of the report incorrectly refers to 0.8 µg/L as a CWQG for tolune; 0.8 µg/L is the PWQO. The CWQG is 2 µg/L.*

Response: Agreed. This will be revised in the 2016 Annual Report.

Review Comment: *Appendix F compares groundwater chemistry to the Ontario Drinking Water Quality Standards. For the sentry groundwater monitoring wells included in the Martin Creek protection and Martin Creek Wetland protection groundwater trigger mechanisms, comparison should also be made to PWQO and CWQG, where PWQO do not exist (e.g. chloride).*

Response: This request is best addressed by including the sentry wells in Table 9. Table 9 shows the PWQO and/or CWQG exceedances for monitoring wells in proximity to the waste fill area and Martin Creek Wetland. We will revise the table to include the sentry wells in the vicinity of Martin Creek (i.e., MW 26, 27-3 and 28-3) and the sentry wells for the Martin Creek Wetland east of Mark Road (i.e., MW 12, 14, 15 and 16).

MARTIN CREEK WETLAND ADJACENT TO PHASE 1

Review Comment: *In 2015, I agree that leachate impacts are evident around the toe of the site. Shallow groundwater at wetland point WP4 shows the highest concentrations of leachate indicators. Iron, aluminium, chromium, cobalt, vanadium, zinc, TP, and un-ionized ammonia exceed PWQO and were elevated above background (WP1). Potassium, DOC, alkalinity, total dissolved solids, and boron were elevated above background.*

Response: Comment acknowledged.

Review Comment: *Surface water in the wetland at 25 m and 30 m from the toe along transect WP4 showed elevated concentrations in terms of chloride, iron, potassium, total ammonia, total alkalinity, dissolved solids, and boron, relative to background wetland conditions at SW14. Concentrations of chloride and boron were less than the long-term CWQG values of 120 mg/Land 1.5 mgL, respectively. However, PWQO exceedances occurred for: aluminium (0.19, 3.7 mg/L, exceeding 0.075 mg/L), cadmium (0.00027, 0.00059 mg/L, exceeding 0.0009 mg/L), cobalt (0.006, 0.0025 mg/L, exceeding 0.0002 mg/L), copper (0.0087 mg/L, 0.0068 mg/L) lead (0.021, exceeding 0.005 mg/L), and Zn (0.412 and 0.03 mg/L, exceeding 0.02 µg/L). I recommend that the annual report characterize leachate well concentrations for these metals and compare this to background groundwater and surface water concentrations to determine if the PWQO exceedances in surface water around the toe of the waste are leachate related, landfill related, or naturally occurring.*

Response: Leachate is sampled at the leachate well MW 7-13 only during the Spring monitoring event each year. In 2014 and 2015, this leachate well was dry during the Spring monitoring event. Data from the previous monitoring event (October/13) is shown in Appendix F. For the metals noted in the review comment, concentrations exceeding PWQO in the leachate sample were obtained for only aluminum (0.08 mg/L versus 0.075 mg/L) and cobalt (0.005 mg/L versus 0.00002 mg/L). Concentrations for cadmium, copper, lead and zinc in the leachate sample were below PWQO. Although leachate quality can vary at different locations in the landfill, the data from this single leachate well indicates that there is a naturally occurring component contributing to the PWQO exceedances at the wetland surface water stations along the periphery of the Phase I fill area. Note that in early 2017, this leachate well was re-constructed as MW7-17 to a greater depth within the waste.

Review Comment: *Based on data in Appendix I, I am not able to confirm un-ionized ammonia concentrations in surface water at WP2, WP3, WP4, and WPS due to lack of field pH and temperature. Also, I am unable to confirm the distance at which some of the surface water samples at SW15, SW14, SW13, and SW12 occurred relative to the toe of the waste. Clarification should be provided.*

Response: Clarification regarding the locations of the SW 12, SW14 and SW15 surface water stations relative to the toe of the waste is provided above. Where a distance from the toe is not given in Appendix I, the sample was collected from the routine/fixed station at 10 m out from the toe rather than along the transect line.

Field measurements for surface water pH and temperature along the transect lines at Wetland Probes WP 2, WP 3 and WP 4 were obtained but were inadvertently not presented in Appendix I. They will be included in the 2016 Report. In all cases, the unionized ammonia concentrations obtained using the field data were less than the PWQO value of 0.02 mg/L.

Review Comment: *In 2015, iron concentrations were greater than background (<1 mg/L) and greater than PWQO at SW12 (15 m, 6.64 mg/L), SW13 (21.7 mg/L), and WP4 (25 m, 14.7 mg/L). I recommend future reports determine if high iron concentrations around the toe of the waste coincide with elevations in other leachate indicators.*

Response: Yes, elevated iron concentrations around the toe of the waste do coincide with elevations in other leachate indicator parameters such as TDS, chloride, COD and conductivity. As noted in Section 4.3.2, the landfill was designed and approved as a natural attenuation facility and most of Phase I was constructed within the wetland. As such some impacts to the wetland along the immediate periphery of Phase I are expected, particularly during the operating period prior to completion of final cover construction. Overall, the landfill continues to operate satisfactory as a natural attenuation site.

Review Comment: *In 2015, un-ionized ammonia concentrations did not exceed the PWQO at SW12, SW13, SW14, or SW15. I recommend field pH and temperature are reported in Appendix I for surface water near WP2, WP3, WP4, and WPS.*

Response: Agreed. These data will be provided in Table I in the 2016 Annual Report. See response above.

Review Comment: *Zinc concentrations at well points WP1-WP5 are extremely high (< 1 mg/L to 193 mg/L) and show potential for impairment to surface water. Well point WP6 has very low zinc concentrations. Clarification is needed regarding whether there was a different pipe material used at WP6.*

Response: As noted in Section 3.5, the high zinc concentrations at the drive point wells WP 1 to WP 5 (all located within the wetland) are due to corrosion of the zinc coating on the metal pipe. The metal pipe used for these wetland wells was driven by hand to approximately 2.5 m depth. WP 6 is in a more accessible location that allowed the installation of a 51 mm diameter PVC screen/riser pipe using a Geo-probe rig. WP6 is therefore not susceptible to corrosion and leaching of zinc. In the 2016 Annual Report, we will include a recommendation that the City attempt to replace the metal wetland probes with approximately 2 m deep by 50 mm diameter PVC wells installed using a hand auger.

Review Comment: *Toluene is identified as a leachate indicator. I recommend toluene is analyzed at surface water stations in proximity to Phase 1 of the waste (SW12, SW13, SW14, and SW15).*

Response: Agreed. For the 2017 monitoring, toluene will be added to the list of parameters for the surface water stations SW 12, SW 13 and SW 15 located in close proximity to Phase I. Toluene will also be added to the list of parameters for the background surface water station SW 14.

Review Comment: *I am not aware of any additional monitoring that was completed in respect of the monitoring along the wetland transect lines than what is required by the ECA/D&O Report. With regard to the spring conductivity monitoring conducted along six transects, it is my understanding that locations with the highest conductivity readings along each radial transect and with the lowest conductivity readings along each transect would have samples collected and submitted for analysis for the same suite of surface water parameters that are currently monitored. Based on Figure 14 and Appendix I, it appears that samples were not collected at the highest conductivity reading along each transect. Clarification is needed.*

Response: Samples were collected at the transect lines at typically 15 m and either 25 m or 30 m out from the toe of the waste. In some cases, such as for the transect lines at SW 13 and SW 12, the 15 m offset location gave the highest conductivity and was where a sample was collected. In other cases, such as for the transect lines at WP 2 and WP 3, the 10 m offset gave the highest conductivity but sample collection was not possible due to insufficient surface water being present at the time. The sample was instead collected at the 15 m offset where sufficient water was present.

Review Comment: *Figure 14 shows that conductivity measurements were not collected at 5 m increments from the toe of the waste along transect lines. Clarification is needed.*

Response: Surface conditions were examined at each 5 m increment along the transect lines and conductivity readings were taken where surface water was present. For Figure 14, the absence of conductivity data at a 5 m increment means that surface water was not present at the location.

Review Comment: *I recommend extending WP4 and SW15 conductivity transects beyond 30 m up to a distance to where background conductivity is achieved in order to delineate the extent of the leachate plume in surface water within the PSW.*

Response: Agreed. This will be attempted for the 2017 conductivity monitoring. Note however that for the May 2015 conductivity monitoring event, the stations along the transect lines at WP4 and SW15 were dry except at 25 m out from the toe of landfill at WP4.

Review Comment: *In 2015, conductivity monitoring occurred 1 month after the surface and groundwater sampling programs. The spring-time conductivity monitoring survey could be better harmonized with the ground and surface water sampling.*

Response: Agreed. A recommendation will be made in the 2016 Annual Report that the conductivity monitoring be conducted closer to the time of the Spring groundwater / surface water monitoring event. This will commence with the 2017 annual conductivity monitoring.

GENERAL

We will incorporate the recommendations in the 2016 Annual Report.

Regarding the recommendation for a table comparing Martin Creek upstream and downstream water quality with PWQO and CWQG, it should be noted that Table 9 of the 2015 Annual Report provides this comparison. We will continue to include this table in future reports. Please note that the contracted laboratory cannot achieve a PCB detection limit of 0.001 µg/L using standard methods. A detection limit of 0.001 µg/L can be achieved using speciality labs at considerable expense. Considering that PCB's have not been an issue at this site, we request that the MOECC allow the use of the lowest possible detection level achievable by the contracted laboratory (Caduceon) which is 0.05 µg/L.

Vinyl chloride results for surface water sampling are shown in Appendix I (page 9 of 10).

Regarding final cover placement, the north slope of Phase I was capped in 2016. Capping of the remaining top surface area of Phase I was not possible in 2016 as final contours were not yet achieved. The remaining top surface area will be capped in the summer of 2017.

We trust that the above responses to the MOECC review comments meet your requirements. Please contact us should you have any questions or require further clarification.

GOLDER ASSOCIATES LTD.

Frank Barone

Frank Barone (Ph.D, P.Eng)
Principal

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