Ministry of the Environment and Climate Change

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M E M O R A N D U M

October 17, 2016

TO: D. Fisher
Senior Environmental Officer
Peterborough District Office, Eastern Region

FROM: B. Gilbert
Surface Water Specialist
Technical Support Section, Eastern Region

RE: Fenelon Landfill Site Annual Status Report January 1 to December 31, 2015, dated May 2016

Fenelon Landfill Site, 341 Mark Road
Lot 16, Concession 4
Former Township of Fenelon, City of Kawartha Lakes
Environmental Compliance Approval No. A321206

As requested, I have reviewed the 2015 annual status report prepared by Golder Associates Limited (GAL) for the City of Kawartha Lake (CKL), dated May 2016. The report was prepared by F.S. Barone, Ph.D., P.Eng.

I offer the following comments for your consideration with respect to surface water impact concerns.

Background

The Fenelon Landfill Site (WDS) has been in operation since 1972 and is operated by the City of Kawartha Lakes Environmental Compliance Approval (ECA) A321206, dated January 20, 2016. The ECA allows for the use and operation of a 21.3 hectare site and a 102.6 ha contaminant attenuation zone south and east of the site. The site is approved for the disposal of solid non-hazardous, domestic, commercial, and industrial wastes and is also licensed as a household hazardous waste (HHW) depot. The site also acts as: a collection and transfer facility for waste electronics, a reuse centre, and a leaf and yard waste composting facility.

Phase 1 of the site commenced in a former sand and gravel pit and extended to the west into the adjacent Martins Creek Provincially Significant Wetland (PSW) which surrounds the site, the exception being the northeast boundary. The majority of the Phase 1 (6.1 ha) operation is in the wetland. The site is operated as a natural attenuation facility. The amended ECA allows filling in Phase 2 (1.9 ha) of the site and requires final cover on Phase 1 up to the Phase 1-2 boundary by December 31, 2016. The remaining capacity in Phase 1 is reported to be 0.9 years as of December 2015.

The ECA includes an updated Design and Operations (D&O) Report which describes updates to the surface water and groundwater monitoring programs and trigger mechanisms.

- Samples were not collected at SW12, SW13, SW15, and SW16 in summer and fall due to dry conditions. The 30 m off set locations at WP 4, SW13 and SW15 were also dry.
- The conductivity survey was carried out in May. Surface water samples at 30 m distance from the toe at transect lines WP-4, SW-13, SW15 were collected in April.
- The Martin Creek Wetland between County Road 21 and Mark Road is a major contributor to the flow measured in Martin Creek at Mark Road in April 2015.
- It is not possible to establish a background station further downstream of SW2. It is recommended that both SW2 and SW16 be used as background stations for Martin Creek.
- For background stations SW2 and SW16 in Martin Creek, PWQO exceedances occurred for phosphorus and zinc, the latter of which was on an unfiltered sample. Phosphorous exceedances at background stations are likely due to biodegradation in the wetland.
- For background station SW14 in the PSW adjacent to the waste mound, PWQO were exceeded for iron, total phosphorous (TP), and zinc and may be related to dissolution of metals from soils and vegetation due to natural decomposition associated with acidic conditions in the wetland.
- Elevated concentrations of key leachate indicator parameters occur naturally within the creek and wetland area.
- SW12, SW13, SW15 located close to the toe showed concentrations greater than PWQO for indicator parameters iron, TP, aluminium, copper and zinc. Iron, TP and zinc were observed to exceed PWQO at SW14, although at lower concentrations indicative of natural sources. The PWQO exceedances at SW12, SW13, SW15 are indicative of landfill impact.
- Prior to final cover completion, impacts to the wetland along the periphery of Phase 1 are expected, since it was designed as a natural attenuation facility and most of Phase 1 was constructed in the wetland. Future Phase 2 area is situated on a sand esker and is not expected to have a significant effect on wetland water quality.
- The results of the conductivity transect monitoring indicate a decreasing trend in conductivity with increasing distance from the toe. With some extrapolation, surface water impacts extend about 30 m out from the toe into the wetland.
- Results of the key leachate indicator concentrations in Martin Creek for 2015 are summarized in Table 13 and Figures 15a-15 and indicate consistent slightly higher iron and DOC downstream at SW3 and SW4 in comparison to SW2 and SW16, even for filtered samples. This may be due to inputs from the natural wetland between County Road 21 and SW3. Data in Table 13 indicate no significant water quality impact on Martin Creek attributable to the landfill. This is supported by the absence of any significant impacts on groundwater at the new wetland monitoring well WP6-13 installed immediately adjacent to Martin Creek at the Mark Road culvert.
- Slightly elevated concentrations relative to PWQO at the Martin Creek downstream stations SW3 and SW4 were obtained for iron and TP. Elevated concentrations of iron and TP at the downstream surface water stations are likely related to inputs from the natural wetland between County Road 21 and Mark Road.
- Free cyanide was less than the detection limit at all Martin Creek stations.
- Concentrations of PCBs at SW3 were below the method detection limit.
- VOC were not detected at concentrations exceeding the method detection limits at the Martin Creek stations in 2015.
- The surface water trigger locations are at 30 m from the toe along the WP4, SW13, and SW15 transect lines. These transect lines indicated the greatest impact during the May 2014 survey. A 30 m distance to the trigger point takes into account the landfill was originally licensed as a natural attenuation facility with the wetland representing a key component of the natural attenuation system. The 30 m provides a reasonable buffer

zone for this purpose. With completion of the final cover construction on Phase 1, impacts to the wetland in close proximity to the landfill will be minimized.

- The trigger concentrations are based on PWQO for boron and un-ionized ammonia, and CWQG for chloride. GAL reports no exceedances of the Martin Creek Wetland trigger concentrations.
- The trigger is two consecutive surface water monitoring events exceeding any of the trigger concentrations for one or more of the trigger parameters, not necessarily the same parameter each time. This is followed by re-sampling within one month after the second exceedance result is received. If the exceedance is confirmed by re-sampling, an assessment will be carried out to determine the cause of impact within one year following receipt of the second consecutive exceedance. If the landfill is the cause, a contingency plan will be developed and implemented. Potential contingencies include low permeability membrane and/or discontinuation of landfilling.

GAL recommends the following with respect to surface water concerns:

- Monitoring in 2016 should continue to closely follow the ground and surface water monitoring program outlined in the Updated Design and Operations Report. In some cases, such as the surface water monitoring along the wetland transect line, more monitoring was carried out in 2015 than required by the ECA.
- Construct Phase 2 of the landfill in 2016 in accordance with the updated Design and Operations Plan.
- Going forward it is recommended that both SW2 and SW16 be used as the Martin Creek background stations.

Reviewer's Comments

Martin Creek

- 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.
- 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.
- 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.
- 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 75th percentiles) are included.
- 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).

Martin Creek Wetland east of Mark Road

- 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.
- 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.
- 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).

Martin Creek Wetland adjacent to Phase 1

- 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.
- 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/L and 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.
- Based on data in Appendix I, I am not able to confirm un-ionized ammonia concentrations in surface water at WP2, WP3, WP4, and WP5 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.
- 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.
- 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 WP5.

- 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.
- 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).
- 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.
- 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.
- 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.
- 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.

<u>General</u>

- I recommend the following additions to future AMRs to improve the value of the reports:
  - A discussion of past transect conductivity monitoring events in the context of whether the leachate plume is consistent in location/extent within surface waters in the PSW.
  - Evaluation whether the surface water trigger locations around the toe of the waste continue to be appropriate based on the conductivity evaluations along the six transects.
  - For Martin's Creek: a table comparing upstream/reference site surface water quality data (SW2, SW16) to downstream/exposure stations (SW3, SW4, SW11, WP6-13) and comparison to PWQO, or CWQG where no PWQO exists.
  - For Martin Creek wetland around toe of waste: a table comparing shallow groundwater quality around the toe of the waste to surface water quality in the wetland, relevant PWQO or CWQG, and background surface water quality represented by SW14 for the monitoring year.

- I bring to your attention that there is a missing Appendix in the November 2015 D&O Plan. It is page 263 of page 265 in the pdf document. It is referred to as Appendix A (Martin Creek Wetland Conductivity Monitoring Program), found within Appendix H (Ground and Surface Water Monitoring Program and Trigger Mechanisms) of the D&O Plan. I believe the report exists and was authored by Heather Dzurko at the City of Kawartha Lakes.

- I bring to your attention that condition 8(10) of the ECA only speaks to the surface water trigger mechanism for the wetland adjacent to the toe of the WDS. The details (parameters, concentrations) of the remaining portions of ground and surface water trigger mechanism are contained in the annual report (sections 3.6 and 4.4) and in Appendix H of the Updated D&O Plan (Nov 2015).

- I note that the report indicates that the final cover over Phase 1 is anticipated to reduce the impact around the toe of the WDS. However, the report also indicates that final cover will not be in place until 2017. I bring to your attention that this may extend the time frame of potential for impact to surface waters in the wetland in the immediate vicinity of the Phase 1 waste mound. I note condition 7(12) (a) and (b) of the ECA which, states December 31, 2016 for final cover placement over Phase 1, up to the Phase 1-2 boundary.

- In correspondence dated January 22, 2015, GAL estimated that surface water stations under the influence of surface runoff would be expected to improve within 1 year of final cover placement over Phase 1, and stations more influenced by upwelling of leachate impacted groundwater are expected to show gradual improvement over several years. I recommend future annual monitoring reports identify stations under the influence of surface runoff vs. groundwater upwelling and evaluate whether improvement has occurred in water quality.

- The report implies that there is a 30 m distance surrounding the toe of Phase 1 of the site which allows for natural attenuation within the wetland. It should be clarified that the natural attenuation and contaminant attenuation zone (CAZ) concept applies to groundwater beneath the wetland only. Any surface water within the wetland is not part of a CAZ. PWQO apply to surface waters on-and off-site, regardless of CAZ.

- The detection limits for total PCB and cadmium need to be less than their respective PWQO of 0.001 µg/L, and 0.0002 mg/L.

- Vinyl chloride was not included in the VOC scan and should be included in future.

Please do not hesitate to contact me if you have any questions.

B. Gilbert, M.Sc.
BG/dv

ec: G. Faaren, Water Resources Unit Supervisor
P. Taylor, Technical Support Section Manager
C. Redmond, Peterborough District Supervisor

c: R. Holland, Groundwater Unit
File SW KL MA 03 06 Fenelon Landfill Site
File SW 11 02 07 02 MA, Martin Creek, Trent River Basin
BG/IDS # 3046-AAWKBL