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Dear Les

Cleanaway Banksia Road Landfill 2020 Annual Groundwater Monitoring Programme (as per Licence L8904/2015/1) - Report Overview

360 Environmental Pty Ltd (360 Environmental) was commissioned by Cleanaway Solid Waste Pty Ltd (Cleanaway) to compile groundwater monitoring results for the 2020 monitoring period for the Banksia Road Waste Disposal Site, located at Lot 2, Banksia Road, Crooked Brook, WA (the Site).

The biannual sampling is required to comply with the water monitoring requirements of the Prescribed Premises Licence No. L8904/2015/1 (issue date 3 August 2015), issued by the Department of Water and Environmental Regulation (DWER).

The key outcomes from the 2020 report are summarised below.

1 Site Overview

Cleanaway has operated the Class III (mid-level) landfill site at the Banksia Road site in Dardanup since approval was granted in 2006. The Site is operational as an active Class II and III landfill (DWER Category 64) and a liquid waste facility (DWER Category 61) and contains liquid waste cells, solid waste cells, stormwater collection dams and leachate collection ponds.

The eastern portion of the site has been operated as a landfill since approximately 2000 and received only Class II waste until approximately 2006. Since then, the landfill has been receiving both Class II and Class III waste comprising a mixture of municipal, commercial, and industrial waste, as well as residue from Water Corporation wastewater treatment plants. There are currently nine landfill Waste Disposal Cells of which seven are being actively filled, in addition to two liquid and tailings Waste Disposal Cells.

A secondary waste disposal area exists at the top of Cells 3, 4, 4b, 5, 6 and 12 which is typically used for asbestos and quarantine waste placement.

An ephemeral watercourse, Crooked Brook, is located approximately 1 km south and southwest of the site. The brook flows in a north-westerly direction into the Preston River approximately 5.5 km to the west of the Site.

Drilling and installation of groundwater monitoring bores has confirmed the presence of two groundwater systems at the site, a shallow superficial aquifer between 20 m and 50 m (in the eastern higher elevation portion of the site and the deeper) below the surface and the permanent, confined aquifer (Leederville Aquifer) between 35 m and 40 m below the surface.

Groundwater within the superficial formation generally flows westward. Previous investigations at the Site have reported minimal groundwater within the superficial formation (i.e., in shallow groundwater bores) and the likely suggestion is that the system is seasonally perched, and the perched layers are inconsistent and discontinuous across the Site.

The Leederville aquifer in general serves as a domestic water supply for the Dardanup area and is the most utilised aquifer in the area. The Priority 1 Dardanup water reserve is located approximately 2.5 km to the northwest of the sites north western boundary, however the site itself is not located within a drinking water protection area.

2 Monitoring Sites

The groundwater monitoring network targets both the superficial and the Leederville aquifers through shallow and deep groundwater wells at nine locations across the Site. There are a total of 28 groundwater wells onsite however during the 2020 monitoring program, only 20 were able to be sampled during both the April and October 2020 sampling rounds due to the several wells being dry or blocked.

Refer to Section 3.4, Table 5 of the 360 Environmental 2020 Annual Compliance Report

3 Analytical Suite

The laboratory analytical suite utilised for the 2020 bi-annual monitoring complies with Table 2.4.1 of the DWER Licence and comprised major ions, metals, nutrients and organic analytes. All groundwater samples were submitted to laboratories that are National Association of Testing Authorities (NATA) accredited for the required analysis.

Refer to Section 3.4, Table 5 of the 360 Environmental 2020 Annual Compliance Report

4 Key Findings

The key findings of the 2020 groundwater monitoring program are summarised below with references to the annual report for further detail.

4.1 Groundwater Flow Direction

Groundwater elevations were consistent with previous investigations and groundwater flow direction in the shallow superficial aquifer was consistently to the northwest. In the Leederville aquifer a consistent groundwater depression is present at GW7D, which results in groundwater flow towards the central portion of the site.

Refer to Section 5.2 of the 360 Environmental 2020 Annual Compliance Report

4.2 Groundwater Quality

Groundwater at the site is generally acidic and fresh with pH values below the lower pH range for drinking water with the exception of GW7D, which has reported fluctuating near neutral to alkaline pH and may be damaged; further investigation of GW7D is required to understand this fluctuation.

Groundwater could be used for non-potable, potable and livestock watering purposes.

Refer to Section 5.3 of the 360 Environmental 2020 Annual Compliance Report

4.3 Analytical Results

Laboratory analytical results are summarised below:

- Limited and isolated exceedances of drinking water (DW), non-potable use (NPUG) and long-term irrigation (LTI) criteria were only reported in GW1S (TRH C_{10}-C_{34}), GW1D (Cl and Al), GW5S (Cl, Al, Ni, TRH C_{10}-C_{34}), and GW7S (TN) during the 2020 GMEs. No exceedances of Stock Water Guidelines (SWG) were reported.
- Limited and isolated occurrences of other heavy metals (Cd, Cr, Cu, Fe, Pb, and Zn), nitrogen, phosphorus, ammonia, PFAS and PAHs were reported above the limit of reporting (LOR) but below assessment criteria indicating concentrations present do not pose a risk to potential receptors.
- BTEX, phenols, PCBs, OC/OP pesticides, TCE/PCE and atrazine were all reported below LOR in the groundwater.

Refer to Section 5.4 of the 360 Environmental 2020 Annual Compliance Report

4.4 Interpretation

- Concentrations of major ions, TRH, PFAS, Cr, Ni and nutrients were reported in concentrations of up to 100x greater in the leachate ponds than in the groundwater suggesting that there is no connection between the leachate ponds and the

groundwater. Further no mounding of the groundwater is seen in the vicinity of the ponds.

- Spatially across the site it is noted that:
  - With the exception of those analytes that can be naturally occurring in the environment (e.g major ions, metals, and nutrients), detections of analytes are low in concentration and spatially isolated indicating an absence of source associated with the landfill operations.
  - The groundwater wells located upgradient (i.e upstream) of the landfill infrastructure (GW5S), and cross-gradient of landfill infrastructure (GS1S) reported elevated concentrations of chloride, aluminium, nickel and TRH above guidelines. This indicates that elevated concentrations of these analytes may be naturally occurring in groundwater within the region or representative of ambient conditions (i.e. an up-gradient anthropogenic source).
- Time series plots indicate that the majority of analytes are stable and within historical ranges with the exception of:
  - Chloride, total phosphorus, TDS and Zn which have been steadily increasing in GW1D
  - Total nitrogen and nitrate which have been steadily rising in SE6D and SE3D
  - Potassium which has reported significant reductions in concentration in GW1S/D and GW7S/D since 2018
  - Al, Pb and Cl which have been in GW5S
  - Chloride which is increasing in SE3D.

Refer to Section 6.2 and 6.3 of the 360 Environmental 2020 Annual Compliance Report

5 Conclusions

Based on the 2020 and historical groundwater and leachate pond analysis there is little evidence to suggest that the landfill operations have impacted the underlying groundwater aquifer. The minor guideline exceedances are generally in up or cross-gradient monitoring locations that would not be impacted by landfill operations indicating they are representative of background conditions.

This summary should be read in conjunction with the 2020 Annual Compliance Report (360 Environmental)

For and on behalf of 360 Environmental Pty Ltd

Julie Palich – Principal Hydrogeochemist