

# CLAREMORRIS HISTORIC LANDFILL, CO. MAYO

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## RESPONSE TO EPA RFI TO SUPPORT CERTIFICATE OF AUTHORISATION APPLICATION

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Prepared for: Mayo County Council



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MAYO COUNTY COUNCIL

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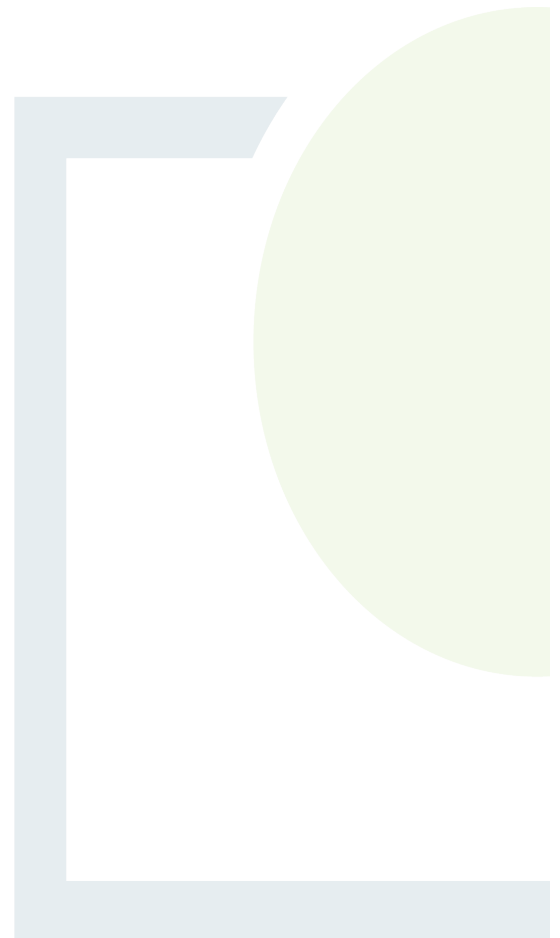
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## CLAREMORRIS HISTORIC LANDFILL, CO. MAYO

### RESPONSE TO EPA RFI TO SUPPORT CERTIFICATE OF AUTHORISATION APPLICATION

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**Abstract:** This document presents the response to the request for information issued by the EPA to support the recent Certificate of Authorisation application made to Mayo County Council for Claremorris Historic Landfill.

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## 1. RESPONSE TO REGULATION 7(2) COMPLIANCE REQUIREMENTS

### 1.1 Background

Mayo County Council (MCC) submitted an application for a Certificate of Authorisation (CoA) for Claremorris Historic Landfill on 14<sup>th</sup> September 2020. The application was accompanied by the following supporting documentation.

- Tier 3 Risk Assessment Claremorris Historic Landfill Site, Co. Mayo September 2020, Rev 0, Issue for CoA Application, 14.09.2020.

The EPA responded on 27<sup>th</sup> November 2020, informing MCC that the application does not comply with Regulation 7(2) of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations, 2008.

In accordance Regulation 7(4), MCC are required to supply the information as requested by the EPA in the response to the Certificate of Authorisation application. FT has prepared responses to the following items as requested by the EPA.

An updated version of the Claremorris Historic Landfill Site Tier 3 Risk Assessment is included in Appendix 7 of this report.

### 1.2 Responses

The following responses have been prepared to each query raised:

- 1. Provide a Non-Technical Summary requested in Section A of the Application Form.**

The Non-Technical Summary is included in Appendix 1 of this document.

- 2. Provide two documents that relate to the Qualified Person required under Section 2.3 of the EPA Code of Practice – Environmental Risk Assessment for Unregulated Waste Disposal Sites.**

A letter (see Appendix 2 of this document) has been prepared by James O'Neill, Chartered Engineer and Panel Engineer on the Engineers Ireland Landfill Register. James was the competent engineer responsible for managing and/or carrying out: Site investigation works, interpretive assessments, works on the Tier 3 risk assessments, proposed remedial measures and the post-remediation monitoring program.

- 3. Section B of the Application Form states that the applicant is the landowner of the site however, Section 1 of Tier 3 Assessment states that the site is currently under private ownership. State the owner of the site.**

Following a review of the capping and land ownership boundaries as presented in *Drawing Number P2348-0400-0001 Rev. B* and *Drawing Number P2348-0400-0002 Rev. B* included in Appendix 7 of the Tier 3 Assessment Report (Appendix 7 of this report) it was confirmed that the majority of the proposed capping area is owned by the applicant, Mayo County Council, and the lands adjacent to the south-western end of the applicant's ownership boundary are privately owned by Mrs. Finnigan.



- 4. The site boundary shown in Drawing Number P2348-0400-0001 of Tier 3 Assessment differs from the site boundary in Drawing annotated as “EPA Risk ranking Report S22-02588” of Claremorris Historic Landfill Pilot Project Tier 2 Investigation 2010’ report. Provide, or refer to, a drawing that shows the correct boundary.**

Drawing Number P2348-0400-0001 Rev. B and Drawing Number P2348-0400-0002 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) provides site ownership boundaries and the proposed a capping area.

A review of the OSI aerial images from 1995 (1), one year before the closure of the landfill, provide an indication of the landfill’s footprint which showed similarities with the site boundary in Drawing annotated as “EPA Risk ranking Report S22-02588” of Claremorris Historic Landfill Pilot Project Tier 2 Investigation 2010.

In addition, the site investigation report of the site included in Appendix 2 of Tier 3 Assessment Report (Appendix 7 of this document) indicates the presence of waste in ST01, ST02, ST03 and ST06.

Capping boundary in both Drawing Number P2348-0400-0001 Rev. B and Drawing Number P2348-0400-0002 Rev. B have been amended to include those additional areas where waste was found in the site investigation. Ownership boundaries were also amended accordingly to indicate the lands affected by the proposed remediation area.

- 5. Considering that waste was found in slit trenches ST01, ST02, ST03 and ST06, which are outside the site boundary, provide reasoning for not extending the site boundary to include these locations.**

Capping boundary in both Drawing Number P2348-0400-0001 Rev. B and Drawing Number P2348-0400-0002 Rev. B have been amended to include those additional areas where waste was found in the site investigation. Refer to Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this document) for amended drawings.

Slit trench (ST) ST03 is within the waste body.

Slit trenches ST01, ST02 and ST06 were used to inform the capping boundary and show waste being present at the boundary with peat being present removed from the boundary.

In the case of ST06 the location of the trench on Figure 3.1 in the Tier 3 is shown removed from the boundary because there was a drainage ditch on the boundary where the GPS co-ordinate was taken. The trench at the proposed boundary i.e. the drain showed evidence of waste. Going east the slit trench shows only peat.

- 6. Table 6-1 of Tier 3 Assessment gives an assumption that the site was operational through the 1970s and states that the anecdotal evidence suggests that the landfilling activities ceased in around 1980. It is noted however that Section B of the Application Form states that the landfill was operational from circa 1982 to circa 1996. State the operational period of the landfill.**

After reviewing the data available it can be confirmed that the information in the “Source” column of Table 6-1 of Tier 3 Assessment referring to the operational years of the landfill being between 1970 and 1985 is incorrect. The operational years of the landfill are from 1982 to 1996 as specified in the ‘Claremorris Historic Landfill Project Tier 2 Investigation 2010’ report included in Appendix 1 of Tier 3 Assessment Report (Appendix 7 of this document).



**7. Waste sampling results show that hazardous waste acceptance criteria (WAC) was reached for Dissolved Organic Carbon, Total Organic Carbon and Loss on Ignition, as shown in Table 4-1 of Tier 3 Assessment. State the cause of the criteria for hazardous waste being reached for these parameters. Please state types of hazardous waste deposited.**

Dissolved Organic Carbon, Total Organic Carbon and Loss of Ignition are described by the Environmental Protection Agency (EPA) as follows:

- Dissolved Organic Carbon (DOC): 'is defined as the carbon contained in solution of less than 0.45 µm in size.' (2)
- Total Organic Carbon (TOC): 'natural organic matter (usually measured as Total Organic Carbon (TOC))'. (3)
- Loss on Ignition (LOI): 'measures the quantity of organic matter in the sample that can be combusted at 550°C. The loss in weight during combustion equates to the mass of organic matter in the sample.' (4)

Boreholes and trial pit logs from JS Drilling Site Investigation Report from January 2011 describes waste, where encountered, as mainly domestic with some construction and demolition waste was observed in TP01 and TP02.

Municipal waste is generally high in organic matter content which would explain the exceedance of the hazardous waste acceptance criteria in the three parameters defined above.

**8. The site investigations show that the base of waste was not reached in trial pits TP01, TP02, TP04 and TP06 and that waste was found outside the site boundary in the slit trenches listed under Point 5 above. State how the total amount of waste deposited, stated to be approximately 191,000 tonnes, was calculated and whether this calculation reflects the fact that the base of waste was not reached at the said trial pits and that waste was found outside the site boundary. Please include also the volume for the total amount of deposited waste in m<sup>3</sup>.**

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The estimated amount of total waste deposited in Claremorris Historical Landfill has been reviewed based on the amended boundaries presented in *Drawing Number P2348-0400-0001 Rev. B* and *Drawing Number P2348-0400-0002 Rev. B* included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report), resulting in a total of **279,623 tonnes**.

An average waste thickness of 5.25 m was assumed for the purpose of the calculations. The results of the site investigation undertaken by JS Drilling in 2010 indicate that the base of waste was only reached in BH01, TP05 and TP07. The depths of the waste layer, excluding the top fill layers, are 5.3 m, 3.6 m and 5.2 m for BH01, TP05 and TP07 respectively. As the base of waste in TP05 is considerably lower than the average across the site investigation it was not used to estimate the average waste thickness.

The amended footprint area of the historical landfill is estimated to be 38,044 m<sup>2</sup>.

For the purpose of this calculation an estimated waste density of 1.4 tonne/m<sup>3</sup> was applied.

The estimated total volume of waste in the revised Tier 3 is 199,731 m<sup>3</sup>.



- 9. Seven trial pits were dug within the site, as shown in Figure 3.1 of Tier 3 Assessment. It is noted that trial pit TP01 is located 80 m from TP02 and 85 m from TP03, while other trial pits are located at a shorter distance from each other, from example TP04 and TP07. Provide justification on the trial pit distribution and why more trial pits were not dug considering the extent of the site.**

The site investigation was restricted in some areas due to inaccessibility and poor ground conditions as indicated for example in TP04 log included in JS Drilling Site Investigation Report from 2011 (Appendix 2 of Tier 3 Assessment Report included in Appendix 7 of this document).

The site boundaries have been amended as detailed in response to query No. 4. Figure 3.1 (Rev. 1) in Tier 3 Assessment Report (Appendix 7 of this report).

The trial pit findings from the site investigations undertaken by JS Drilling show similar waste types and it is considered that the results obtained from the site investigation are sufficient to demonstrate waste type interred within the historical landfill and that the insitu cap thickness is less than 1.0 m cover.

- 10. Section 3.1.5 of Tier 3 Assessment states that the maximum anticipated waste footprint is presented in Figure 3.3. However, Figure 3.3 is not included in the Assessment. Please provide a drawing showing the extent of the waste body.**

Refer to capping boundary in Drawing Number P2348-0400-0001 Rev. B and Drawing Number P2348-0400-0002 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report).

- 11. The applicant proposed that future surface water monitoring is carried out at locations shown in Drawing No. P2348-0400-0001. However, due to the fact that groundwater flows towards south/south-east, as indicated in Figures 4.2 and 4.3 of Tier 3 Assessment, and the landfill leachate may potentially migrate via groundwater into the said Kilbeg-Malone River, the monitoring location SW5, as shown in the drawing, may not reflect the actual impact from the deposited waste on the river. Accordingly, please propose an additional surface water monitoring location (SW6), southeast of the landfill. Provide an updated drawing showing all surface water monitoring locations.**

Refer to Drawing Number P2348-0400-0001 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) for proposed surface water monitoring locations.

- 12. Section 4 of Tier 3 Assessment states that surface water was monitored at two locations in 2009. Provide results of this monitoring. Please also carry out surface water monitoring upstream and downstream of the closed landfill. Please have regard to parameters listed in European Communities Environmental Objectives (Surface Waters) Regulations, 2009, as amended.**

Table 1-1 below summarises the monitoring results from 2009 in the two locations shown in Figure 4.1 of Tier 3 Assessment Report (Appendix 7 of this report) and two additional locations upstream (SW1) and downstream (SW5) of the closed landfill from November 2020 (refer to drawing P2348-0400-0001 Rev. B in Appendix 7 of Tier 3 Assessment Report for monitoring locations). The results of the surface water sampling have been assessed against the Maximum Admissible Concentration (MAC) and the Environmental Quality Standard (EQS) for Surface Waters Regulations (2009) (as amended) assessment criteria.

Other monitoring locations proposed under the remediation works were inaccessible due to dense vegetation and poor ground conditions. Four additional surface water monitoring locations (SW2, SW3, SW4 and SW6) will be sampled as part of the proposed remediation works subject to the CoA being granted.



Refer to Appendix 3 and Appendix 4 of this document for comprehensive laboratory analysis results from 2009 and 2020 respectively.

It is noted that the upstream sampling location from 2009 is located approximately 2.1 km south from the upstream sampling location from November 2020 which is located adjacent to the historical landfill. On the other hand, the downstream sampling locations from 2009 and 2020 are relatively close to each other.

The results summarised in Table 1-1 indicate that inorganic parameters such as Ammonia (as N), Molybdate Reactive Phosphorus (MRP) and Biochemical Oxygen Demand (BOD) exceed the Environmental Quality Standards (EQS) established in the European Communities Environmental Objectives (Surface Waters) Regulations. The Maximum Allowable Concentration (MAC) of cyanide was exceeded at the downstream location in 2009, however results from the sampling undertaken in 2020 show that the concentrations of cyanide are below the MAC and the results in 2009 may have been an isolated case of cyanide exceedance caused by agricultural activities in the adjacent lands.

The recorded exceedances of MPR and ammonia (as N) may be an indication of agricultural runoff from the surrounding agricultural fields, rather than direct impact from the landfill as concentration is particularly higher in the upstream location SW1. On the other hand, the exceedance of BOD at both upstream and downstream locations in the 2020 results may be linked the high organic content in municipal waste and direct impact to surface waters from leachate generated within the waste body.

Analytical results from metals show that EQS concentrations were exceeded for cadmium (2020, u/s and d/s), chromium (2009, d/s) and phosphorus (2009, u/s and d/s). The exceedance of cadmium and chromium may be related to the incineration of municipal waste during the operational years of the landfill and direct impact to surface waters from leachate generated within the waste body. The recorded exceedances of molybdate reactive phosphorus may be an indication of agricultural runoff from the surrounding agricultural fields.

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**Table 1-1: Groundwater Sampling Results**

Parameter	Units	Maximum Allowable Concentration (MAC) (5)*	Environmental Quality Standard (EQS) (5)**	U/S Location 08.06.2009	D/S Location 08.06.2009	SW1 27.11.2020	SW5 27.11.2020
<b>Inorganics</b>							
Ammoniacal Nitrogen as N	mg/l	--	High status ≤ 0.040 (mean) and ≤ 0.090 (95%ile) Good status ≤ 0.065 (mean) and ≤ 0.140 (95%ile)	<0.2	1.6	15	0.268
Conductivity @ 20 deg.C	mS/cm	--	--	0.551	0.671	0.985	0.449
Fluoride	mg/l	0.5	--	-	-	<0.1	<0.1
Dissolved Oxygen	-	--	Lower Limit 95%ile>80% saturation Upper Limit 95%ile<120% saturation	5.81 mg/l	-	102.3 %Sat	101.8 %Sat
pH	pH Units	--	6.0-9.0	8.54	8.24	7.4	7.3
Molybdate Reactive Phosphorus (MRP unfiltered) as PO4-P	mg/l	--	High status ≤ 0.025 (mean) and ≤ 0.045 (95%ile) Good status ≤ 0.035 (mean) and ≤ 0.075 (95%ile)	-	-	0.198	0.025



Parameter	Units	Maximum Allowable Concentration (MAC) (5)*	Environmental Quality Standard (EQS) (5)**	U/S Location	D/S Location	SW1	SW5
				08.06.2009	08.06.2009	27.11.2020	27.11.2020
Chloride	mg/l	--	--	15	28.1	40.7	16.7
COD, unfiltered	mg/l	--	--	27.8	47.3	39	39
Total Cyanide	mg/l	<b>0.01</b>	--	-	<b>&lt;0.05</b>	<0.009	<0.009
BOD, unfiltered	mg/l	--	High status ≤ 1.3 (mean(1)) or ≤ 2.2 (95%ile) Good status ≤ 1.5 (mean(1)) or ≤ 2.6 (95%ile)	<1	2.37	<b>&lt;3</b>	<b>&lt;3</b>
Total Alkalinity as CaCO <sub>3</sub>	mg/l	--	--	250	285	488	212
Total Suspended Solids	mg/l	--	--	4	7	4	<2
Sulphate (soluble) as S	mg/l	--	--	<3	29.5	19.9	11
Total Organic Carbon	mg/l	<b>NAC***</b>	--	-	-	-	-
<b>Dissolved Metals (Filtered)</b>							
Mercury (diss.filt)	µg/l	--	<b>0.07</b>	<0.01	<0.01	0.02	<0.01
Arsenic (diss.filt)	µg/l	--	<b>25</b>	-	-	<0.6	<0.6
Barium (diss.filt)	µg/l	--	--	-	-	-	-
Boron (diss.filt)	µg/l	--	--	-	-	129	16
Cadmium (diss.filt)	µg/l	<b>1.5</b>	<b>0.25</b>	<0.22	<0.22	<b>&lt;0.6</b>	<b>&lt;0.6</b>
Chromium (diss.filt)	µg/l	<b>32</b>	<b>4.7</b>	<0.7	<b>9.03</b>	1	0.6
Copper (diss.filt)	µg/l	--	<b>30</b>	2.17	4.47	<1.2	1
Lead (diss.filt)	µg/l	--	<b>7.2</b>	<0.4	<0.4	<0.6	1
Manganese (diss.filt)	µg/l	--	--	8.53	77.7	189	36
Nickel (diss.filt)	µg/l	--	<b>20</b>	<1.5	2.01	2	2



Parameter	Units	Maximum Allowable Concentration (MAC) (5)*	Environmental Quality Standard (EQS) (5)**	U/S Location	D/S Location	SW1	SW5
				08.06.2009	08.06.2009	27.11.2020	27.11.2020
Phosphorus (diss.filt)	mg/l	--	High status ≤ 0.010 (mean) Good status ≤ 0.025 (mean)	0.170	<0.105	-	-
Selenium (diss.filt)	µg/l	--	--	-	-	-	-
Thallium (diss.filt)	µg/l	--	--	-	-	-	-
Zinc (diss.filt)	µg/l	--	100	11.2	13.4	19	7
Sodium (Dis.Filt)	mg/l	--	--	7.34	17.5	28	10
Magnesium (Dis.Filt)	mg/l	--	--	3.73	5.65	20	4
Potassium (Dis.Filt)	mg/l	--	--	<2.34	<2.34	30	2
Calcium (Dis.Filt)	mg/l	--	--	124	139	138	88
Iron (Dis.Filt)	mg/l	--	--	0.0821	0.139	0.553	0.464

\* Items shaded in **bold** are in exceedance of the European Communities MACs  
 \*\* Items shaded in **orange** are in exceedance of the 2009 EQS Regulations  
 \*\*\* NAC – no abnormal change



**13. It is noted that gas monitoring was carried out at one location within the waste body (BH01) and one location outside the waste body (BH02) in 2010. Please carry out gas monitoring at the existing monitoring locations BH01, BH02 and at least two additional locations within the waste body.**

Gas monitoring was conducted at location BH01 on the 27<sup>th</sup> of November 2020 and results are presented in Table 1-2 below. Monitoring results from November 2010 are also included in the table for comparison purposes. Gas monitoring at BH02 was not possible due to damage to the monitoring location. MCC proposes to repair the damage to BH02 and carry out regular monitoring from BH02 moving forward. It is further proposed that three additional monitoring locations (BH03, BH04 and BH05) shall be installed and gas pump trials be conducted as part of the remediation works subject to the CoA application being granted. Refer to Drawing Number P2348-0400-0001 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) for proposed monitoring locations.

**Table 1-2: Landfill Gas Monitoring Results November 2010 and November 2020**

Sample Station	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	Atmospheric Pressure	Staff Member
	(% v/v)	(% v/v)	(% v/v)	(mbar)	
<b>Date: 26/11/2010</b>					
BH01	78.1	32.2	0	0959	AMR
<b>Date: 27/11/2020</b>					
BH01	53.7	22	24.2	-	N/A

In accordance with the Environmental Protection Agency (EPA) Code of practice (CoP) (2007), the trigger level for methane outside the waste body is 1% v/v and for carbon dioxide is 1.5% v/v.

As can be seen in Table 1-2, concentrations of both CO<sub>2</sub> and CH<sub>4</sub> at monitoring borehole BH01, located within the waste body, exceed the limits set in the CoP.

**14. It is noted that groundwater monitoring was undertaken at location BH02 on 2<sup>nd</sup> December 2010 and the measured parameters were Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Faecal and Total Coliforms. Please carry out groundwater monitoring upgradient and downgradient of the waste body, having regard to parameters listed in European Communities Objectives (Groundwater) Regulations, 2010, as amended. Please note that the upgradient and downgradient monitoring locations must be representative of the actual footprint of the deposited waste on groundwater, considering that the groundwater flows towards south/south-east.**

The results of groundwater samples analysed from BH02 in 2010 and November 2020 at the site have been assessed against the EPAs Interim Guideline Values (IGVs) and the Overall Threshold Value Range (OTVR) from the European Groundwater Regulations (2010) assessment criteria (as amended). A summary of the results reported for each parameter is outlined in Table 1-3. The comprehensive laboratory report from November 2020 is presented in Appendix 5 of this report.

It is proposed that three additional ground water monitoring locations (BH03, BH04 and BH05) shall be installed as part of the proposed remediation works subject to the CoA being granted. Refer to Drawing Number P2348-0400-0001 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) for proposed monitoring locations.



The results of the groundwater monitoring from BH02 indicate some exceedances of the IGVs and OTV groundwater limit values.

Samples recovered from monitoring well BH02 reported an ammoniacal nitrogen (as N) concentration of 3.2 mg/l, which exceeds OTVR and IGV limit values. Ammoniacal N at this concentration indicates the landfill may be impacting groundwater quality downgradient of the landfill.

Potassium levels of 11.0 mg/l was detected at BH02 exceeds the OTVR limit. Potassium concentrations at this level may be an indication of impact on groundwater quality from the landfill.

The elevated concentrations of iron, manganese and zinc of 2.89 mg/l, 385 µg/l and 121 µg/l respectively at borehole BH02 exceeding the IGVs limit values may be associated to the local bedrock hydrochemistry and agricultural activities in surrounding lands.

The exceedance of the OTVR of molybdate reactive phosphorus (2.09 mg/l) from monitoring well BH02 indicate an impact on groundwater from agricultural activities in surrounding lands.

In summary, based on the presence of elevated ammonia and potassium concentrations, it can be assumed that the landfill waste body may be impacting groundwater quality locally.

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**Table 1-3: Groundwater Sampling Results**

Parameter	Units	EPA IGV Standards (6)*	S.I. No. 9 of 2010 Standards OTVR (7)**	BH02	BH02
				02.12.2010	27.11.2020
Ammoniacal Nitrogen as N	mg/l	0.15	0.065 - 0.175	-	3.2
Conductivity @ 20 deg.C	mS/cm	1	0.8 – 1.875	-	0.903
Total Dissolved Solids	mg/l	1000	--	-	500
Fluoride	mg/l	1	--	-	<0.1
Dissolved Oxygen	mg/l	--	NAC***	-	-
pH	pH Units	6.0-9.5	--	-	6.7
Phosphate (Orto as PO <sub>4</sub> )	mg/l	0.03	--	-	-
Molybdate Reactive Phosphorus (MRP unfiltered) as PO <sub>4</sub> -P	mg/l	--	0.035	-	2.09
Chloride	mg/l	30	24 - 187.5	-	28.9
COD, unfiltered	mg/l	--	--	482	-
Total Cyanide	mg/l	0.01	0.0375	-	<0.009
BOD, unfiltered	mg/l	--	--	28	-
Total Alkalinity as CaCO <sub>3</sub>	mg/l	NAC	--	-	-
Total Suspended Solids	mg/l	--	--	-	-
Total Oxidised Nitrogen	mg/l	--	--	-	-
Sulphate (soluble) as S	mg/l	200	187.5	-	62.9
Total Organic Carbon	mg/l	--	--	-	18
<b>Dissolved Metals (Filtered)</b>					
Mercury (diss.filt)	µg/l	1	0.75	-	0.01
Arsenic (diss.filt)	µg/l	10	7.5	-	<0.6
Barium (diss.filt)	µg/l	100	--	-	-



Parameter	Units	EPA IGV Standards (6)*	S.I. No. 9 of 2010 Standards OTVR (7)**	BH02 02.12.2010	BH02 27.11.2020
Boron (diss.filt)	µg/l	<b>1000</b>	<b>750</b>	-	34
Cadmium (diss.filt)	µg/l	<b>5</b>	<b>3.75</b>	-	<0.6
Chromium (diss.filt)	µg/l	<b>30</b>	<b>37.5</b>	-	<0.6
Copper (diss.filt)	µg/l	<b>30</b>	<b>1500</b>	-	3
Lead (diss.filt)	µg/l	<b>10</b>	<b>7.5</b>	-	3
Manganese (diss.filt)	µg/l	<b>50</b>	--	-	<b>385</b>
Nickel (diss.filt)	µg/l	<b>20</b>	<b>15</b>	-	2
Phosphorus (diss.filt)	mg/l	--	--	-	-
Selenium (diss.filt)	µg/l	--	--	-	-
Thallium (diss.filt)	µg/l	--	--	-	-
Zinc (diss.filt)	µg/l	<b>100</b>	--	-	<b>121</b>
Sodium (Dis.Filt)	mg/l	<b>150</b>	<b>150</b>	-	15
Magnesium (Dis.Filt)	mg/l	<b>50</b>	--	-	12
Potassium (Dis.Filt)	mg/l	<b>5</b>	--	-	<b>11</b>
Calcium (Dis.Filt)	mg/l	<b>200</b>	--	-	177
Iron (Dis.Filt)	mg/l	<b>0.2</b>	--	-	<b>2.897</b>

\* Items shaded in **bold** are in exceedance of the EPA Interim Guideline Value (IGV). (6)

\*\* Items shaded in **orange** are in exceedance of S.I. No. 9 of 2010 Overall Threshold Value Range (OTVR). (7)

\*\*\* NAC – no abnormal change.



**15. It is noted that leachate monitoring was carried out at locations BH01 on 2<sup>nd</sup> December 2010 and the measured parameters were BOD and COD. Please carry out leachate monitoring at BH01 and at least two additional locations within the waste body, having regard to parameters listed in European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.**

The leachate analysis results from BH01 in 2010 and November 2020 are compared to the concentrations provided for typical methanogenic leachates as per the EPA Landfill Site Design Manual (8), as summarised in Table 1-4(8) below. It is further proposed that two additional monitoring locations, LW01 and LW02 shall be installed as part of the remediation works subject to the CoA Application being granted. Refer to Drawing Number *P2348-0400-0001 Rev. B* included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) for proposed monitoring locations.

The comprehensive laboratory report from November 2020 is presented in Appendix 6 to this report.

When assessed against typical landfill leachate parameters reported in the EPA Landfill Site Design Manual, the leachate composition at the Claremorris landfill appears to be generally more representative of the minimum to maximum concentrations of the methanogenic phase.

The results of this assessment are in line with the age of the site and the nature of the waste encountered.

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**Table 1-4: Leachate Sampling Results Comparison Against Methanogenic Leachates Composition (8)**

Analysis	Units	Minimum	Maximum	Median	Mean	Sample ID	
						BH01 02/12/2010	BH01 27/11/2020
Ammoniacal Nitrogen as N	mg/l	283	2040	902	889	-	161
Conductivity @ 20 deg.C	mS/cm	5.99	19.3	10.00	11.5	-	3.04
Total Dissolved Solids	mg/l	-	-	-	-	-	-
Fluoride	mg/l	-	-	-	-	-	<0.1
Dissolved Oxygen	mg/l	-	-	-	-	-	-
pH	pH Units	6.8	8.2	7.35	7.52	-	6.8
Phosphate (Orto as PO <sub>4</sub> )	mg/l	0.3	18.4	2.7	4.3	-	-
Molybdate Reactive Phosphorus (MRP unfiltered) as PO <sub>4</sub> -P	mg/l	-	-	-	-	-	2.01
Chloride	mg/l	570	4710	1950	2074	-	135
COD, unfiltered	mg/l	622	8000	1770	2307	6160	-
Total Cyanide	mg/l	-	-	-	-	-	<0.009
BOD <sub>5</sub>	mg/l	97	1770	253	374	2972	23
BOD <sub>20</sub>	mg/l	110	1900	391	544	2972	23
Total Alkalinity as CaCO <sub>3</sub>	mg/l	3000	9130	5000	5376	-	-
Total Suspended Solids	mg/l	184	2270	555	733	-	-
Sulphate	mg/l	<5	322	35	67	-	<5
Total Oxidised Nitrogen	mg/l	-	-	-	-	-	-
<b>Dissolved Metals (Filtered)</b>							
Mercury (diss.filt)	µg/l	-	-	-	-	-	<0.2
Arsenic (diss.filt)	µg/l	-	-	-	-	-	13
Barium (diss.filt)	µg/l	-	-	-	-	-	-
Boron (diss.filt)	µg/l	-	-	-	-	-	537
Cadmium (diss.filt)	µg/l	<10	80	<10	15	-	1
Chromium (diss.filt)	µg/l	<30	560	70	90	-	35
Copper (diss.filt)	µg/l	<20	620	70	130	-	91
Lead (diss.filt)	µg/l	<40	1900	130	200	-	75
Manganese (diss.filt)	µg/l	40	3590	300	460	-	645



Analysis	Units	Minimum	Maximum	Median	Mean	Sample ID	
						BH01 02/12/2010	BH01 27/11/2020
Nickel (diss.filt)	µg/l	<30	600	140	170	-	36
Phosphorus (diss.filt)	mg/l	-	-	-	-	-	-
Selenium (diss.filt)	µg/l	-	-	-	-	-	-
Thallium (diss.filt)	µg/l	-	-	-	-	-	-
Zinc (diss.filt)	µg/l	30	6700	780	1140	-	517
Sodium (Dis.Filt)	mg/l	474	3650	1400	1480	-	107
Magnesium (Dis.Filt)	mg/l	40	1580	166	250	-	66
Potassium (Dis.Filt)	mg/l	100	1580	791	854	-	130
Calcium (Dis.Filt)	mg/l	23	501	117	151	-	278
Iron (Dis.Filt)	mg/l	1.6	160	15.3	27.4	-	73.142

**16. Provide a map showing the proposed surface water drainage system. Include locations where the surface water drains discharge to.**

Refer to Drawing Number P2348-0400-0001 Rev. B included in Appendix 7 of Tier 3 Assessment Report (Appendix 7 of this report) for proposed surface water drainage.

**1.3 References**

1. OSI, Ordnance Survey Ireland. *GeoHive*. [Online] <http://map.geohive.ie/>.
2. EPA, The Environmental Protection Agency. *Strive Report Series No. 35. SoilC - Measuring and Modelling of Soil Carbon Stocks and Stock Changes in Irish Soils*. 2009.
3. —. *EPA Drinking Water Guidance On Disinfection By-Products. Advice Note No.4 Version 2. Disinfection By-Products in Drinking Water*.
4. —. *Protocol For The Evaluation of Biodegradable Municipal Waste Sent to Landfill*. 2011.
5. eISB, electronic Irish Statute Book. *S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations*. 2009, 2015 (Amendment) and 2019 (Amendment).
6. EPA, The Environmental Protection Agency. *Towards Setting Guideline Values for The Protection of Groundwater in Ireland*. 1993.
7. eISB, electronic Irish Statute Book. *S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations*. 2010, 2011 (Amendment), 2012 (Amendment) and 2016 (Amendment).
8. EPA, The Environmental Protection Agency. *Landfill Manuals - Landfill Site Design*. 2000.