

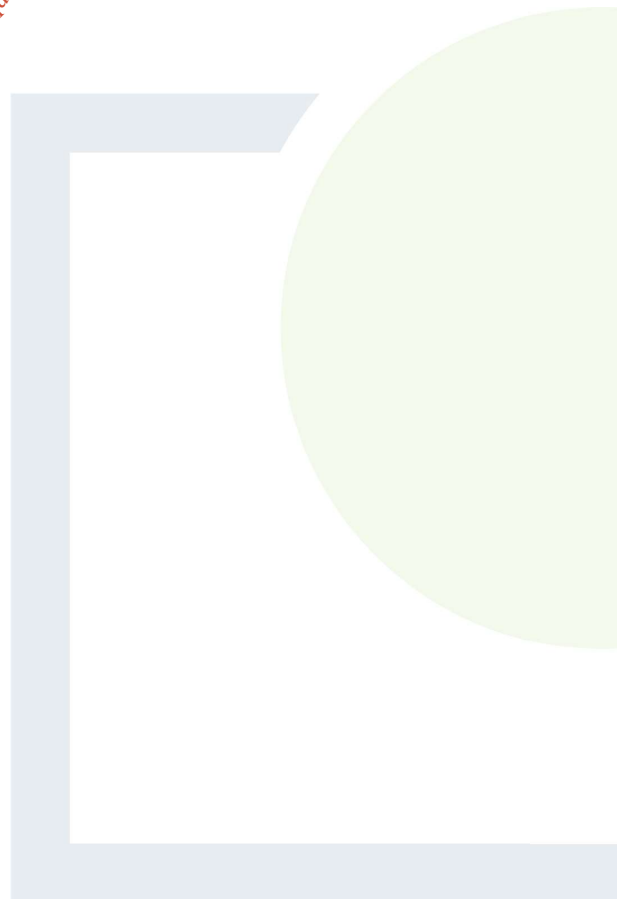


CONSULTANTS IN ENGINEERING,  
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## APPENDIX 3

Parameters and Results for  
Groundwater, Surface Water and  
Landfill Gas Monitoring

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**Table 1: Waste Sampling Results – Solid Waste Analysis**

Parameter	Units	Inert Waste Acceptance Criteria	Non-Hazardous Waste Acceptance Criteria	Hazardous Waste Acceptance Criteria	Sampling Results - Sample ID	
					WS03 (2.5m)	WS08 (3.8m)
Arsenic	l.kg <sup>-1</sup>	<b>0.5</b>	<b>2</b>	<b>25</b>	0.0022	< 0.0010
Barium	l.kg <sup>-1</sup>	<b>20</b>	<b>100</b>	<b>300</b>	0.14	0.0065
Cadmium	l.kg <sup>-1</sup>	<b>0.04</b>	<b>1</b>	<b>5</b>	< 0.00010	< 0.00010
Chromium	l.kg <sup>-1</sup>	<b>0.5</b>	<b>10</b>	<b>70</b>	0.0013	< 0.0010
Copper	l.kg <sup>-1</sup>	<b>2</b>	<b>50</b>	<b>100</b>	0.0015	0.0027
Mercury Dissolved	l.kg <sup>-1</sup>	<b>0.01</b>	<b>0.2</b>	<b>2</b>	< 0.00050	< 0.00050
Molybdenum	l.kg <sup>-1</sup>	<b>0.5</b>	<b>10</b>	<b>30</b>	0.031	0.0065
Nickel	l.kg <sup>-1</sup>	<b>0.4</b>	<b>10</b>	<b>40</b>	0.0057	0.0011
Lead	l.kg <sup>-1</sup>	<b>0.5</b>	<b>10</b>	<b>50</b>	< 0.0010	< 0.0010
Antimony	l.kg <sup>-1</sup>	<b>0.06</b>	<b>0.7</b>	<b>5</b>	0.0042	< 0.0010
Selenium	l.kg <sup>-1</sup>	<b>0.1</b>	<b>0.5</b>	<b>7</b>	0.0028	0.0016
Zinc	l.kg <sup>-1</sup>	<b>4</b>	<b>50</b>	<b>200</b>	0.020	< 0.0010
Chloride	l.kg <sup>-1</sup>	<b>800</b>	<b>15000</b>	<b>25000</b>	16	1.9
Fluoride	l.kg <sup>-1</sup>	<b>10</b>	<b>150</b>	<b>500</b>	0.23	0.35
Sulphate	l.kg <sup>-1</sup>	<b>1000</b>	<b>20000</b>	<b>50000</b>	440	20
Total Dissolved Solids	l.kg <sup>-1</sup>	<b>4000</b>	<b>60000</b>	<b>100000</b>	780	150
Phenol Index	l.kg <sup>-1</sup>	<b>1</b>	--	--	< 0.030	< 0.030
Dissolved Organic Carbon	l.kg <sup>-1</sup>	<b>500</b>	<b>800</b>	<b>1000</b>	35	20
Total Organic Carbon	%	<b>3</b>	<b>5</b>	<b>6</b>	<b>15</b>	0.23
Loss on Ignition	%	--	--	<b>10</b>	<b>25</b>	2.9
Total BTEX	mg/kg	<b>6</b>	--	--	< 0.010	< 0.010
Total PCBs (7 Congeners)	mg/kg	<b>1</b>	--	--	< 0.10	< 0.10
TPH Total WAC (Mineral Oil)	mg/kg	<b>500</b>	--	--	< 10	< 10
Total (Of 17) PAH's	mg/kg	<b>100</b>	--	--	< 2.0	< 2.0
pH		--	<b>&gt;6</b>	--	8.1	7.8
Acid Neutralisation Capacity	mol/kg	--	<b>To evaluate</b>	<b>To evaluate</b>	0.010	0.0070

\* Hazardous Waste Landfill Criteria: >6% TOC

\* Items in **bold** are in exceedance of the Inert WAC limit value

\* Items shaded in **green** are in exceedance of the Non-Hazardous WAC limit value

\* Items shaded in **orange** are in exceedance of the Hazardous WAC limit value

**Table 2: Groundwater Depth Analysis**

Borehole ID	Location Gradient	Dip (m) 03/09/19	Groundwater Level (m AOD)
BH01	Down gradient	0.61	17.55
BH02	Upgradient	7.8	19.41

\*Note: Location gradient is in reference to the identified waste deposition area

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**Table 3: Groundwater Sampling Results**

Parameter	Units	EPA IGV Standards <sup>1</sup>	S.I. No. 9 of 2010 Standards <sup>2</sup>	BH01	BH02
pH	pH units	6.5 - 9.5	--	7.67	7.93
Conductivity	mS/cm	1	1.875	1.49	0.424
Dissolved solids, Total (meter)	mg/l	1000	--	1170	343
Dissolved Oxygen	mg/l	no abnormal change	--	3.31	8.63
Alkalinity as CaCO3	mg/l	200	--	660	320
Ammoniacal Nitrogen as N	mg/l	0.15	0.175	26.1	0.313
Total Coliforms	cfu/100 ml	0	--	-	-
Nitrite as N	mg/l	--	0.375	-	-
BOD	mg/l	--	--	-	-
COD	mg/l	--	--	-	-
Sodium	mg/l	150	150	119	22.8
Sulphate as SO4	mg/l	200	250	-	-
Total Oxidised Nitrogen	mg/l	--	--	<0.1	<0.1
Total Organic Carbon	mg/l	--	--	24.5	9.49
Arsenic	µg/l	7.5	10	12.4	0.934
Barium	µg/l	--	100	164	8.61
Boron	µg/l	750	1000	189	197
Cadmium	µg/l	3.75	5	<0.08	<0.08
Calcium	mg/l	--	200	156	64.5
Chloride	mg/l	30	24	214	22.5
Chromium	µg/l	30	37.5	<1	<1
Copper	µg/l	30	1500	<0.3	2.46
Cyanide	mg/l	0.01	0.038	<0.05	<0.05
Fluoride	mg/l	0.8	1	<0.5	<0.5
Iron	mg/l	0.2	--	12.3	0.171
Lead	µg/l	10	7.5	0.261	0.473
Magnesium	mg/l	--	50	48.2	6.66
Manganese	µg/l	50	--	1310	1250
Mercury	µg/l	1	0.75	<0.01	-
Nickel	µg/l	20	15	3.79	1.72
Phosphorus	µg/l	--	--	20.1	32.1
Potassium	mg/l	5	--	29.7	1.42

Parameter	Units	EPA IGV Standards <sup>1</sup>	S.I. No. 9 of 2010 Standards <sup>2</sup>	BH01	BH02
Uranium	mg/l	<b>0.009</b>	--	-	-
Zinc	µg/l	<b>100</b>	<b>75</b>	8.6	8.03
Mineral Oil	µg/l	<b>10</b>	--	<100	<b>3340</b>
MTBE	µg/l	<b>30</b>	<b>10</b>	<1	<1
<b>Semi-Volatile Organic Compounds (SVOCs)</b>					
1,2,4-Trichlorobenzene	µg/l	<b>0.40</b>	--	<0.01	<0.01
2,4,6-Trichlorophenol	µg/l	<b>200</b>	--	<2	<20
2-Chlorophenol	µg/l	<b>200</b>	--	<2	<20
Benzo(k)fluoranthene	µg/l	<b>0.05</b>	--	<2	<20
Hexachlorobenzene	µg/l	<b>0.03</b>	--	<2	<20
Hexachlorobutadiene	µg/l	<b>0.1</b>	--	<2	<20
Nitrobenzene	µg/l	<b>10</b>	--	<2	<20
n-Nitroso-n-dipropylamine	µg/l	--	--	<2	<20
Pentachlorophenol	µg/l	<b>2</b>	--	<2	<20
Phenol	µg/l	<b>0.5</b>	--	<2	<20
<b>Combined Pesticides / Herbicides</b>					
Aldrin	µg/l	<b>0.01</b>	--	<0.01	<0.01
Atrazine	µg/l	<b>1</b>	<b>0.075</b>	<0.01	<0.01
Chlorfenvinphos	µg/l	<b>5</b>	--	<0.01	<0.01
Dichlorvos	µg/l	<b>0.001</b>	--	<0.01	<0.01
Dieldrin	µg/l	--	<b>0.075</b>	<0.01	<0.01
Permethrin I	µg/l	<b>20</b>	--	<0.01	<0.01
Permethrin II	µg/l	<b>20</b>	--	<0.01	<0.01
Simazine	µg/l	<b>1</b>	<b>0.075</b>	<0.01	<0.01
4,4 – DDT	µg/l	--	<b>0.075</b>	-	-
<b>Organics</b>					
Benzo(alpha)pyrene	µg/l	<b>0.01</b>	<b>0.0075</b>	<2	<20
Vinyl Chloride	µg/l	<b>0.375</b>	<b>0.375</b>	<1	<1
Benzene	µg/l	<b>1</b>	<b>0.75</b>	<1	<1
Total Trichloroethane	µg/l	<b>500</b>	--	<1	<1
Total Tetrachloroethene	µg/l	<b>40</b>	<b>7.5</b>	<1	<1
1,2-Dichloroethane	µg/l	<b>3</b>	<b>2.25</b>	<1	<1
<b>Volatile Organic Compounds (VOCs)</b>					
Naphthalene	µg/l	<b>1</b>	<b>0.075</b>	<b>1.29</b>	<1

<sup>1</sup> IGV-Interim Guideline Values, from EPA, Towards Setting Guideline Values for the Protection of Groundwater in Ireland, 2003.

<sup>2</sup> OTV-Overall threshold value, European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010) as amended in 2011, 2012, 2016.

\* Items shaded in **bold** are in exceedance of the EPA IGV Standards

\* Items shaded in **orange** are in exceedance of the Drinking Water Regulations

**Table 4: Perimeter Well Monitoring Results October 2019**

Date: 23/10/2019						
Sample Station	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	Atmospheric Pressure	Staff Member	Weather
	(% v/v)	(% v/v)	(% v/v)	(mbar)		
BH01	0.6	0.4	24.5	1005	Emily Archer	Overcast, heavy rain showers, 10-14°C
BH02	0.4	0.3	23.6			

**Table 5: Surface Water Sampling Results**

Parameter	Units	MAC <sup>1</sup>	EQS <sup>2</sup>	Upstream	Downstream
				SW01 03.09.2019	SW02 03.09.2019
<b>Inorganics</b>					
Ammoniacal Nitrogen as N	mg/l	--	≤0.140 (95%ile)	<0.2	<0.2
Conductivity @ 20 deg.C	mS/cm	<b>1</b>	--	0.113	0.119
Fluoride	mg/l	<b>0.5</b>	--	<0.5	<0.5
Dissolved Oxygen	mg/l	--	95%ile>80% saturation, 95%ile<120% saturation	10.8	10.5
pH	pH Units	--	6.0-9.0	7.19	7.1
Phosphate (Ortho as PO <sub>4</sub> )	mg/l	<b>0.5</b>	--	<0.05	<0.05
Chloride	mg/l	<b>40</b>	--	19.3	19.2
COD, unfiltered	mg/l	<b>250</b>	--	41.3	45.3
Total Cyanide	mg/l	<b>0.01</b>	--	<0.05	<0.05
BOD, unfiltered	mg/l	--	≤2.6 (95%ile)	-	-
Total Alkalinity as CaCO <sub>3</sub>	mg/l	--	--	24.4	18.7
Total Suspended Solids	mg/l	<b>50</b>	--	<4	4.47
Total Oxidised Nitrogen as N	mg/l	<b>2</b>	--	0.997	1.15
Sulphate (soluble) as S	mg/l	<b>200</b>	--	<1	1.73



Parameter	Units	MAC <sup>1</sup>	EQS <sup>2</sup>	Upstream	Downstream
				SW01	SW02
				03.09.2019	03.09.2019
Total Organic Carbon	mg/l	NAC**	--	13	15.8
<b>Dissolved Metals (Filtered)</b>					
Mercury (diss.filt)	µg/l	--	0.07	<0.01	<0.01
Arsenic (diss.filt)	µg/l	--	25	<0.5	<0.5
Barium (diss.filt)	µg/l	1	--	2.92	2.86
Boron (diss.filt)	µg/l	2	--	<10	10.5
Cadmium (diss.filt)	µg/l	0.45	0.08	<0.08	<0.08
Chromium (diss.filt)	µg/l	32	4.7	<1	<1
Copper (diss.filt)	µg/l	100	30	3.13	2.97
Lead (diss.filt)	µg/l	--	7.2	0.31	0.349
Manganese (diss.filt)	µg/l	300	--	38.3	38.2
Nickel (diss.filt)	µg/l	--	20	2.18	2.18
Phosphorus (diss.filt)	µg/l	--	0.075	29	28.4
Selenium (diss.filt)	µg/l	0.01	--	<1	<1
Thallium (diss.filt)	µg/l	--	--	<2	<2
Zinc (diss.filt)	µg/l	--	100	11.3	11.2
Sodium (Dis.Filt)	mg/l	200	--	10.7	10.8
Magnesium (Dis.Filt)	mg/l	--	--	2.64	2.62
Potassium (Dis.Filt)	mg/l	--	--	1.57	1.55
Calcium (Dis.Filt)	mg/l	--	--	7.29	7.19
Iron (Dis.Filt)	mg/l	0.2	--	0.631	0.668
<b>Mineral Oil / Oils &amp; Greases</b>					
Mineral oil >C10 C40 (aq)	µg/l	--	--	<100	<100
<b>PCB's</b>					
PCB congener 28	µg/l	--	--	<0.015	<0.015
PCB congener 52	µg/l	--	--	<0.015	<0.015
PCB congener 101	µg/l	--	--	<0.015	<0.015
PCB congener 118	µg/l	--	--	<0.015	<0.015
PCB congener 138	µg/l	--	--	<0.015	<0.015
PCB congener 153	µg/l	--	--	<0.015	<0.015
PCB congener 180	µg/l	--	--	<0.015	<0.015
Sum of detected EC7 PCB's	µg/l	--	--	<0.105	<0.105
<b>Semi-Volatile Organic Compounds (SVOCs)</b>					

Parameter	Units	MAC <sup>1</sup>	EQS <sup>2</sup>	Upstream	Downstream
				SW01	SW02
				03.09.2019	03.09.2019
1,2,4-Trichlorobenzene	µg/l	--	0.4	<4	<1
1,2-Dichlorobenzene	µg/l	--	--	<4	<1
2,4,6-Trichlorophenol	µg/l	--	--	<4	<1
2-Chlorophenol	µg/l	--	--	<4	<1
Anthracene	µg/l	0.4	0.1	<4	<1
Bis(2-Ethylhexyl) phthalate	µg/l	--	--	<8	<2
Benzo(b)fluoranthene	µg/l		0.03	<4	<1
Benzo(k)fluoranthene	µg/l		0.03	<4	<1
Benzo(a)pyrene	µg/l	0.1	0.05	<4	<1
Benzo(g,h,i)perylene	µg/l		0.002	<4	<1
Indeno(1,2,3-cd)pyrene	µg/l		0.002	<4	<1
n-Dibutyl phthalate	µg/l	--	--	<4	<1
Fluoranthene	µg/l	--	--	<4	<1
Hexachlorobenzene	µg/l	0.05	0.01	<4	<1
Hexachlorobutadiene	µg/l	0.6	0.1	<4	<1
Nitrobenzene	µg/l	--	--	<4	<1
Naphthalene	µg/l		2.4	<4	<1
Pentachlorophenol	µg/l	1	0.4	<4	<1
Phenol	µg/l	46	8	<4	<1
<b>Volatile Organic Compounds (VOCs)</b>					
Dichlorodifluoromethane	µg/l	--	--	<1	<1
Vinyl chloride	µg/l	0.5	--	<1	<1
Trichlorofluoromethane	µg/l	--	--	<1	<1
1,1-Dichloroethene	µg/l	--	10	<1	<1
Dichloromethane	µg/l	--	20	<3	<3
Methyl tertiary butyl ether (MTBE)	µg/l	--	--	<1	<1
1,1,1-Trichloroethane	µg/l	--	10	<1	<1
Carbontetrachloride	µg/l	--	--	<1	<1
1,2-Dichloroethane	µg/l	--	10	<1	<1
Benzene	µg/l	50	10	<1	<1
Trichloroethene	µg/l	--	--	<1	<1
Toluene	µg/l	--	10	<1	<1
Tetrachloroethene	µg/l	--	10	<1	<1

Parameter	Units	MAC <sup>1</sup>	EQS <sup>2</sup>	Upstream	Downstream
				SW01	SW02
				03.09.2019	03.09.2019
Chlorobenzene	µg/l	--	--	<1	<1
Ethylbenzene	µg/l	--	--	<1	<1
m,p-Xylene	µg/l	--	10	<1	<1
o-Xylene	µg/l	--	10	<1	<1
4-iso-Propyltoluene	µg/l	--	--	<1	<1
1,2-Dichlorobenzene	µg/l	--	--	<1	<1
1,2,4-Trichlorobenzene	µg/l	--	--	<1	<1
Hexachlorobutadiene	µg/l	0.6	0.1	<1	<1
<b>Combined Pesticides / Herbicides</b>					
1,2,4-Trichlorobenzene	µg/l	--	--	<0.01	<0.01
Aldrin	µg/l	--	--	<0.01	<0.01
Alachlor	µg/l	--	--	<0.01	<0.01
Atrazine	µg/l	--	--	<0.01	<0.01
Chlorfenvinphos	µg/l	--	--	<0.01	<0.01
Chlorpyrifos	µg/l	--	--	<0.01	<0.01
Dichlobenil	µg/l	--	--	<0.01	<0.01
Dichlorvos	µg/l	--	--	<0.01	<0.01
Dieldrin	µg/l	--	--	<0.01	<0.01
Endosulphan I	µg/l	--	--	<0.01	<0.01
Endosulphan II	µg/l	--	--	<0.02	<0.02
Hexachlorobenzene	µg/l	--	--	<0.01	<0.01
Hexachlorobutadiene	µg/l	--	--	<0.01	<0.01
Malathion	µg/l	--	--	<0.01	<0.01
Parathion	µg/l	--	--	<0.01	<0.01
Pentachlorobenzene	µg/l	--	--	<0.01	<0.01
Permethrin I	µg/l	--	--	<0.01	<0.01
Permethrin II	µg/l	--	--	<0.01	<0.01
Prometryn	µg/l	--	--	<0.01	<0.01
Simazine	µg/l	--	--	<0.01	<0.01
Trifluralin	µg/l	--	--	<0.01	<0.01
4,4 – DDT	µg/l	--	--	<0.01	<0.01

**Notes:**

- <sup>1</sup> Maximum Admissible Concentration (MAC), as classified by European Communities (Quality of Surface Water intended for abstraction of drinking water) Regulations 1989 (S.I No. 294 of 1989)
- <sup>2</sup> Environmental Quality Standard (EQS), European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I No. 272 of 2009)
- \* 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

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