

Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Standard Landfill Site

Flintshire County Council Waste Management Services

Annual Monitoring Review 2016

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STANDARD LANDFILL SITE**ANNUAL MONITORING REVIEW 2016****TABLE OF CONTENTS**

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Site Location and Surrounding Land-use	1
1.3	Site History and Development	1
2.0	ENVIRONMENTAL CONTEXT	2
2.1	Geology	2
2.2	Hydrogeology	2
2.3	Hydrology	2
3.0	LANDFILL GAS	3
3.1	Introduction	3
3.2	Perimeter Boreholes	3
3.3	Trace Gas Monitoring	3
3.4	Engine and Flare Emission Monitoring	4
4.0	GROUNDWATER	5
4.1	Introduction	5
4.2	Groundwater Levels	5
4.3	Groundwater Quality	5
5.0	LEACHATE	8
5.1	Introduction	8
5.2	Leachate Levels	8
5.3	Leachate Quality	8
6.0	SURFACE WATER.....	10
6.1	Introduction	10
6.2	Surface Water Quality	10
7.0	CONCLUSIONS	11
7.1	Landfill gas	11
7.2	Groundwater	11
7.3	Leachate	11
7.4	Surface Water	12

DRAWINGS

0987/1/002 - Environmental Monitoring Locations

APPENDICES

- Appendix 1:** Perimeter Landfill Gas Monitoring Summary Table
- Appendix 2:** Groundwater Level and Quality Summary Tables
- Appendix 3:** Leachate Level and Quality Summary Tables
- Appendix 4:** Surface Water Quality Summary Table

1.0 INTRODUCTION

1.1 Background

1.1.1 This report has been compiled in accordance with the Waste Management Licence for Standard Landfill Site, Buckley, which requires an annual review of the monitoring data collected at the site. The data reviewed by this report was collected between the 1st of January and the 19th of January 2016. Data collected in January 2017 was monitoring deferred from December 2016.

1.1.2 This report records and discusses the monitoring data collected for landfill gas, groundwater, leachate, and surface water at the site.

1.2 Site Location and Surrounding Land-use

1.2.1 Standard Landfill Site is located approximately 1 km north-east of Buckley town centre, Flintshire, North Wales (NGR SJ 290 650). The site is accessed via the B5127 (Liverpool Road).

1.2.2 The site is bounded to the east by Burntwood Road where several residential properties have boundaries within 50m of the eastern extreme of the site. To the west of the site lies agricultural land, separated from the landfill boundary by a water course. The Spencer Industrial Estate, which comprises several small industrial units, is situated beyond the southern site boundary. The A55 dual carriageway runs adjacent to the northern boundary.

1.2.3 A Site of Special Scientific Interest (SSSI), namely The Buckley Claypits and Commons, is located close to the site. Standard Landfill is also surrounded by the Deeside and Buckley Newt Site Special Area of Conservation.

1.3 Site History and Development

1.3.1 Standard Landfill Site was developed in the void created by a former open cast coal mine extending to approximately 13.3 ha. The site was excavated to a depth of approximately 100 mAOD (metres Above Ordnance Datum). The site entrance is at 141 mAOD.

1.3.2 The site comprises six distinct cells. They were developed on the basis of containment of leachate by basal and side slope engineering with engineered clay, and subject to construction quality assurance.

1.3.3 Infilling at the site commenced in January 1990. Capping has been completed at site with a 1.0 mm welded flexible membrane cap. Restoration soils were installed over the plastic cap. The site restoration was completed in 2004.

2.0 ENVIRONMENTAL CONTEXT

2.1 Geology

- 2.1.1 The underlying geology of the site consists of a sequence of grey mudstone with sandstone bands, interbedded with coal. The coal bands are between 0.2 m and 1.5 m thick, while the mudstone / sandstone bands can be up to 26 m thick in places, but are more commonly found with thicknesses in the order of 10 m.
- 2.1.2 Bands of pure mudstone are also present at the site, indicating a heterogeneous nature to the mudstone/sandstone lithology. Shales are also noted as occurring in conjunction with the coal bands. In a few instances, bands of black mudstone are found at depths greater than 100 mAOD.

2.2 Hydrogeology

- 2.2.1 Groundwater flow at the site is predominantly through silt and mud bands. There is also potential groundwater flows at the site through adducts and old workings, present in the underlying coal measures.

2.3 Hydrology

- 2.3.1 The site is enclosed by streams to the west and north. There are several large bodies of surface water at the site. There is a pond situated approximately 500 m west of the site, in agricultural fields and there is also a large lake 500 m south of the site.

3.0 LANDFILL GAS

3.1 Introduction

- 3.1.1 Routine landfill gas (LFG) monitoring was carried out on a weekly basis at 29 perimeter boreholes during the review period. Methane, carbon dioxide, oxygen, relative pressure and atmospheric pressure were all recorded during each monitoring visit. In waste gas is monitored annually via trace gas analysis and engine and flare emissions testing.
- 3.1.2 Borehole locations are shown on Environmental Monitoring Locations drawing in Appendix 1.
- 3.1.3 A summary and time series graphs displaying methane and carbon dioxide concentrations and can be found in Appendix 2.

3.2 Perimeter Boreholes

Methane

- 3.2.1 Methane was only detected at BH22 during 2016 but remained below the trigger limit (1.0 %) with a maximum concentration of 0.6 %.
- 3.2.2 Higher methane concentration was observed in previous years at BH22 with a maximum of 2.9 % in February 2014. Concentration however stabilised at a very low concentration during this review period.

Carbon Dioxide

- 3.2.3 Carbon dioxide was detected at all locations throughout the review period, but did not exceed trigger levels during 2016. Average carbon dioxide concentrations ranged from 1.3 % in BH1 and 2.6 % in BH5.7.

3.3 In Waste Gas Monitoring

Trace Gas Monitoring

- 3.3.1 Annual trace gas monitoring was carried out by Envirodat Air Quality and Environmental Consultants on 29th of April 2016 (see report included in Appendix 1). The sample point was described as Inlet Line to Utilisation Plant. The ambient temperature was 9.8 °C and the atmospheric pressure, 995 mb.
- 3.3.2 Annual trace gas monitoring was carried out by Envirodat Air Quality and Environmental Consultants on 29th of April 2016 (see report included in Appendix 1). The sample point was

described as Inlet Line to Utilisation Plant. The ambient temperature was 9.8 °C and the atmospheric pressure, 995 mb.

3.3.3 Bulk landfill gas was sampled for methane, carbon dioxide and oxygen and was reported to contain:

- Methane 49 % v/v
- Carbon dioxide 20.3 % v/v
- Oxygen 0.0 % v/v

3.3.4 Laboratory analysis was undertaken for components identified in Table 1.1 of the Environment Agency document 'Guidance for Monitoring Trace Gas Components in Landfill Gas (LFTGN 04).

3.3.5 Of the 29 trace gases, 12 were detected. These were 1,2-dichloroethene, 1-pentene, benzene, carbon disulphide, dimethyl disulphide, ethanal (acetaldehyde), ethanethiol, furan, methanol (formaldehyde), styrene, toluene and trichlorethene.

3.3.6 Of these, three exceeded their Environmental Assessment Levels (EALs¹). Those were benzene, carbon disulphide (short and long term EAL) and toluene (short and long term EAL).

Engine and Flare Emission Monitoring

3.3.7 Monitoring of the emissions from the flare and landfill gas engine was carried out by Envirodat Air Quality and Environmental Consultants on 29th of April and 9th May 2016 (see report included in Appendix 1). Engine and flare exhausts were both sampled for oxides of nitrogen (as NO₂), carbon monoxide (CO), volatile organic compounds (VOCs as carbon), moisture and oxygen.

3.3.8 All substances remained below the respective Emission Limit Values at the flare and at the engine.

¹ Environment Agency, April 2010, H1 Annex F – Air Emissions, Table B5: Environmental Assessment Levels for Air (for the protection of human health).

4.0 GROUNDWATER

4.1 Introduction

4.1.1 During the review period groundwater levels were recorded on a monthly basis at groundwater monitoring boreholes GW1, GW2, GW2R, GW3, GW4R, GW5, GW6 and GW7R. Location GW2R was installed in October 2016 to replace GW2.

4.1.2 Groundwater quality samples were taken on a quarterly basis and analysed for the range of determinants listed below:

Total organic carbon, alkalinity (as CaCO₃), ammoniacal nitrogen, chloride, chemical oxygen demand (COD), electrical conductivity, dissolved oxygen, pH, total oxidised nitrogen (TON), sulphate, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, zinc, total xylenes, toluene.

4.1.3 Samples collected in Q4 were analysed for a more extensive suite of hazardous substances.

4.2 Groundwater Levels

4.2.1 Groundwater level data was recorded on a monthly basis in metres below ground level (mBGL) and metres above Ordnance Datum (mAOD).

4.2.2 GW2 was dry during 2016 due to a blockage and was replaced in October with GW2R. No ordinance data is available for GW2R, so levels are only presented as a dip to liquid in meters below ground level (mBGL).

4.2.3 Groundwater level remained relatively stable in GW5, while GW1, GW3 and GW6 showed some seasonal variation. Groundwater level within GW4 and GW7 decreased over the year. However the two locations did not follow a similar trend, with GW7 fluctuating.

4.2.4 Time Series graphs of the groundwater levels, in metres below ground level (mBGL) and metres above Ordnance Datum (mAOD) are included in Appendix 3.

4.3 Groundwater Quality

4.3.1 In May 2013, a leachate outbreak was detected at the north-west edge of the site, close to gas monitoring borehole 2.2. A faulty air pump allowed leachate to escape the site into a drainage ditch, which was overgrown. Elevated ammoniacal nitrogen, chloride, BOD, COD and heavy metal concentrations were subsequently detected within GW6. The air pump was replaced and pooled leachate within the drainage ditch was pumped back into the leachate collection system.

4.3.2 The ammoniacal nitrogen concentration has shown a generally decreasing trend since a leachate outbreak in 2013. The concentration of ammoniacal nitrogen was lower at GW6 in

2016 than in previous review periods. A summary of the groundwater quality within GW6 over the review period is displayed in Table 2 below:

Table 2: Groundwater Quality within GW6 during 2016

Parameter	Units	GW6			
Carbon		Q1	Q2	Q3	Q4
Organic Carbon, Total	mg/l	32.4	-	-	15.2
Inorganics		Q1	Q2	Q3	Q4
Alkalinity, Total as CaCO ₃	mg/l	23.2	55	44.5	24
Ammoniacal Nitrogen as N	mg/l	52.6	35.7	26.4	51
Ammoniacal Nitrogen as NH ₄	mg/l	-	-	33.9	-
BOD, unfiltered	mg/l	<1	<1	<1	2.32
Chloride	mg/l	159	-	243	195
COD, unfiltered	mg/l	136	124	82.4	112
pH	pH Units	5.62	5.78	5.49	5.33
Sulphate	mg/l	320	-	354	356
Total Oxidised Nitrogen as N	mg/l	66.8	68	282	110
Filtered (Dissolved) Metals		Q1	Q2	Q3	Q4
Cadmium (diss.filt)	mg/l	0.00207	0.00291	0.0042	0.0029
Calcium (diss.filt)	mg/l	55.7	-	-	80.5
Copper (diss.filt)	mg/l	0.00372	0.00502	0.0191	0.00377
Iron (diss.filt)	mg/l	0.028	0.0307	0.0438	0.0288
Lead (diss.filt)	mg/l	0.000543	0.000546	0.022	0.000375
Magnesium (diss.filt)	mg/l	28.4	32.2	40	38.6
Nickel (diss.filt)	mg/l	0.0823	0.105	0.171	0.0995
Potassium (diss.filt)	mg/l	39.2	38.1	32.3	45
Sodium (diss.filt)	mg/l	150	172	181	226
Zinc (diss.filt)	mg/l	0.108	0.128	0.234	0.121

- 4.3.3 Table 2 indicates that ammoniacal nitrogen concentration within GW6 was highest in the first and fourth quarters at 52.6 mg/l and 51.0 mg/l respectively. None of the results show any significant peaks in concentration however, suggesting that the groundwater quality at this location has stabilised.
- 4.3.4 Ammoniacal nitrogen concentrations remained significantly lower in locations GW1, GW2R, GW3, GW4, and GW7. Ammoniacal nitrogen concentrations at GW5 were slightly higher, ranging from 2.7 mg/l during the fourth quarter to 9.28 mg/l in the third quarter.
- 4.3.5 Near-neutral pH was recorded at locations GW1, GW2R, GW3, GW4, GW5 and GW7. In GW6 pH was lower, ranging between 5.3 and 5.78.
- 4.3.6 Chloride concentrations remained relatively low in GW1, GW2R, GW4R, GW5 and GW7, varying between 8.6 mg/l and 82.5 mg/l. Concentration at GW3 was slightly higher, ranging from 39.2 mg/l to 147 mg/l. Chloride concentrations in GW6 were between 159 mg/l and 243 mg/l.

- 4.3.7 Concentrations of metals remained low in GW1, GW2R, GW3, GW4, GW5 and GW7.
- 4.3.8 Cadmium, iron and lead concentrations were typically below the detection limit at GW1 and GW3. Concentrations were low at GW4, GW6 and GW7 during the review period. Iron concentration was highest at GW5 throughout 2015 with a maximum of 21.3 mg/l in October.
- 4.3.9 Magnesium and nickel concentrations were relatively low at all locations and similar to the previous review period.
- 4.3.10 Potassium concentrations were notably higher in GW6 with a maximum of 45 mg/l in the last quarter. Concentrations at the remaining locations varied between 8.7 mg/l and 14.7 mg/l.
- 4.3.11 Sodium concentrations were notably higher in GW6 with a maximum of 226 mg/l in the final quarter. Concentrations at the remaining locations varied between 15.3 mg/l in GW5 and 76.3 mg/l in GW7.
- 4.3.12 Mineral oil was detected in low concentrations at GW5 and GW7 in the final quarter with concentrations of 0.03 mg/l and 0.06 mg/l respectively.
- 4.3.13 No cyanide, xylenes, SVOCs or VOCs were detected in the annual suite at any of the groundwater locations with the exception at GW6. A low concentration of 0.000232 mg/l azinphos-ethyl was detected at GW6. Trace concentrations of the total unfiltered mercury were also detected in all locations during October 2016.

5.0 LEACHATE

5.1 Introduction

- 5.1.1 Leachate levels at four leachate monitoring locations were recorded monthly. Samples from all chambers were collected and analysed quarterly.
- 5.1.2 Samples collected in Q4 were tested for a suite of metals and hazardous substances.
- 5.1.3 Well locations are shown on the Environmental Monitoring Location drawing in Appendix 1.

5.2 Leachate Levels

- 5.2.1 Leachate levels were recorded on a monthly basis. A time series graphs displaying leachate levels, in metres above cell base, can be found in Appendix 4.
- 5.2.2 All leachate levels remained relatively stable throughout the review period. The maximum leachate depth was 1.86 m above base at LC7.
- 5.2.3 Leachate is pumped from Standard Landfill to a holding tank. Leachate is then tankered to the leachate treatment plant at the nearby Brookhill Landfill Site. The quality of the final discharge from this plant is discussed in the environmental monitoring data reviews for Brookhill Landfill Site.

5.3 Leachate Quality

- 5.3.1 Concentrations of ammoniacal nitrogen fluctuated throughout the review period. The highest concentration of ammoniacal nitrogen occurred in LC2, at 2550 mg/l.
- 5.3.2 COD concentrations fluctuated throughout the review period with no overriding trend observed, a similar result to 2015. The highest COD concentration was observed in LC2 where a concentration of 3050 mg/l was recorded in Q4.
- 5.3.3 The pH remained relatively stable in all locations, ranging from 7.39 to 8.5.
- 5.3.4 Thirty four hazardous parameters were detected within the leachate as part of the annual suite, as detailed in Table 3 below.

Table 3: Hazardous Substances detected within the Leachate

Parameter	Unit	LC2	LC3	LC4	LC7
Semi-Volatile Organic Compounds (SVOCs)					
bis(2-Ethylhexyl) phthalate (aq)	mg/l	<0.008	<0.008	0.0107	<0.008
Total SVOC TIC	mg/l	23.5	4.55	3.59	3.38
Volatile Organic Compounds (VOCs)					
1,3,5-Trimethylbenzene	mg/l	0.00397	0.00101	0.00151	0.00118
1,4-Dichlorobenzene	mg/l	0.00294	<0.001	0.00432	0.00159
4-iso-Propyltoluene	mg/l	0.00659	<0.001	<0.001	<0.001
Benzene	mg/l	0.00325	<0.001	0.00189	<0.001
Chlorobenzene	mg/l	0.00218	<0.001	0.00172	<0.001
Ethylbenzene	mg/l	<0.001	<0.001	0.00107	<0.001
m,p-Xylene	mg/l	0.00436	<0.001	<0.001	<0.001
Naphthalene	mg/l	0.00954	<0.001	0.00306	<0.001
o-Xylene	mg/l	0.0122	0.00259	0.00546	0.00334
Toluene	mg/l	0.00277	0.00106	0.00118	<0.001
Combined Pesticides / Herbicides					
Azinphos-ethyl	mg/l	0.00028	0.000548	0.00112	0.00103
p,p-Methoxychlor	mg/l	0.00122	<0.00001	<0.00001	<0.00001
Permethrin I	mg/l	0.00097	<0.00001	<0.00001	<0.00001
Miscellaneous Organics					
Dibutyl tin	mg/l	0.000036	<0.000015	<0.000005	<0.00001
TICS					
Benzothiazolone	mg/l	0.164	0.0566	0.106	0.0521
Bicyclohexadecanone	mg/l	-	0.0622	-	-
Butylbenzenesulfonamide	mg/l	-	-	0.101	-
Dimethylbenzoic acid	mg/l	1.9	0.0446	-	-
Ditertbutylhydroxyphenylpropionic acid	mg/l	1.19	0.921	1.21	0.792
Ethylmethylbenzenesulfonamide	mg/l	0.0579	-	0.0478	-
Hexadecanoic acid	mg/l	-	0.0819	0.121	0.093
Hexadecenoic acid	mg/l	-	-	-	0.0777
Methyl(methylpropyl)Benzeneacetic acid	mg/l	0.254	-	-	-
Methyl[butyl]phenylpropanoic acid	mg/l	0.0829	-	-	-
mixed hydrocarbons	mg/l	13.1	2.51	0.856	1.32
Octadecanoic acid	mg/l	-	-	0.0917	-
Tertbutylphenol	mg/l	-	-	0.0412	-
Triisopropylphosphate	mg/l	-	-	0.0647	-
Phenol(methylethylidene)bis	mg/l	0.111	-	-	-
trimethylhexanoic acid	mg/l	6.35	0.878	0.952	1.04
trimethylhexanoic acid	mg/l	-	-	-	-
Trimethylbenzoic acid	mg/l	-	-	-	-

6.0 SURFACE WATER

6.1 Introduction

6.1.1 Surface water samples are routinely taken from four locations; SW1, SW2, SW4 and SW5 which are shown on the Environmental Monitoring Locations drawing in Appendix 1.

6.1.2 Surface water samples are analysed on a quarterly basis for:

Alkalinity (as CaCO₃), ammoniacal nitrogen, biological oxygen demand (BOD), chemical oxygen demand (COD), cyanide, nitrate, nitrite, pH, total oxidised nitrogen (TON), arsenic, cadmium, copper, iron, lead, magnesium, mercury, nickel, potassium, sodium, zinc, total phenols and a detailed pesticides and herbicides suite.

6.1.3 In addition, samples are tested for a more extensive annual suite, comprising mineral oils, xylenes, toluene and hazardous substances suite of VOCs and SVOCs.

6.1.4 A results summary and time series graphs of the laboratory analysis of the surface water samples are presented in Appendix 5.

6.2 Surface Water Quality

6.2.1 Ammoniacal nitrogen concentrations in all locations remained below the detection limit throughout 2016. This shows a significant improvement in surface water quality compared to 2015, when a maximum concentration of 19.0 mg/l was detected in SW4.

6.2.2 COD concentration was also significantly lower in all locations during this review period compared to 2015 results. The highest peak detected during 2015 was 7000 mg/l, compared to a maximum of 58.6 mg/l during October 2016.

6.2.3 The pH in the surface water was stable, ranging between 7.2 (SW1) and 8.2 (SW1).

6.2.4 No phenols, pesticides or herbicides were detected in the surface water locations during 2016.

7.0 CONCLUSIONS

7.1 Landfill gas

- 7.1.1 Methane was only detected at BH22 during 2015 but remained below the trigger limit (1.0 %).
- 7.1.2 Carbon dioxide was detected at all locations throughout the review period, but did not exceed trigger levels during 2016.
- 7.1.3 Twelve trace gases were detected at the inlet port sampling point. Of these benzene, carbon disulphide and toluene alone exceeded their respective EALs.
- 7.1.4 All substances remained below the respective Emission Limit Values at the flare and at the engine.

7.2 Groundwater

- 7.2.1 GW2 was dry during 2016 due to a blockage and was replaced in October with GW2R. Groundwater level remained relatively stable in GW5, while GW1, GW3 and GW6 showed some seasonal variation. Groundwater level within GW4 and GW7 decreased over the year. The two locations did not follow a similar trend, with GW7 fluctuating.
- 7.2.2 GW6 continues to display the highest concentrations of most parameters potentially due to the residual impact of the leachate outbreak close to this borehole which was detected in May 2013. Key leachate indicator parameters have continued to decrease in concentration over 2016.
- 7.2.3 In a similar result to 2015, concentrations of chloride, iron, magnesium, manganese, nickel, potassium and sodium were detected in GW6 at concentrations considerably higher than those within the other groundwater locations during this review period.
- 7.2.4 No cyanide, mineral oil, xylenes, SVOCs or VOCs were detected in any of the groundwater locations with one exception at GW6. A low concentration of 0.000232 mg/l azinphos-ethyl was detected at GW6. Trace concentrations of the total unfiltered mercury were also detected in all locations during October 2016.

7.3 Leachate

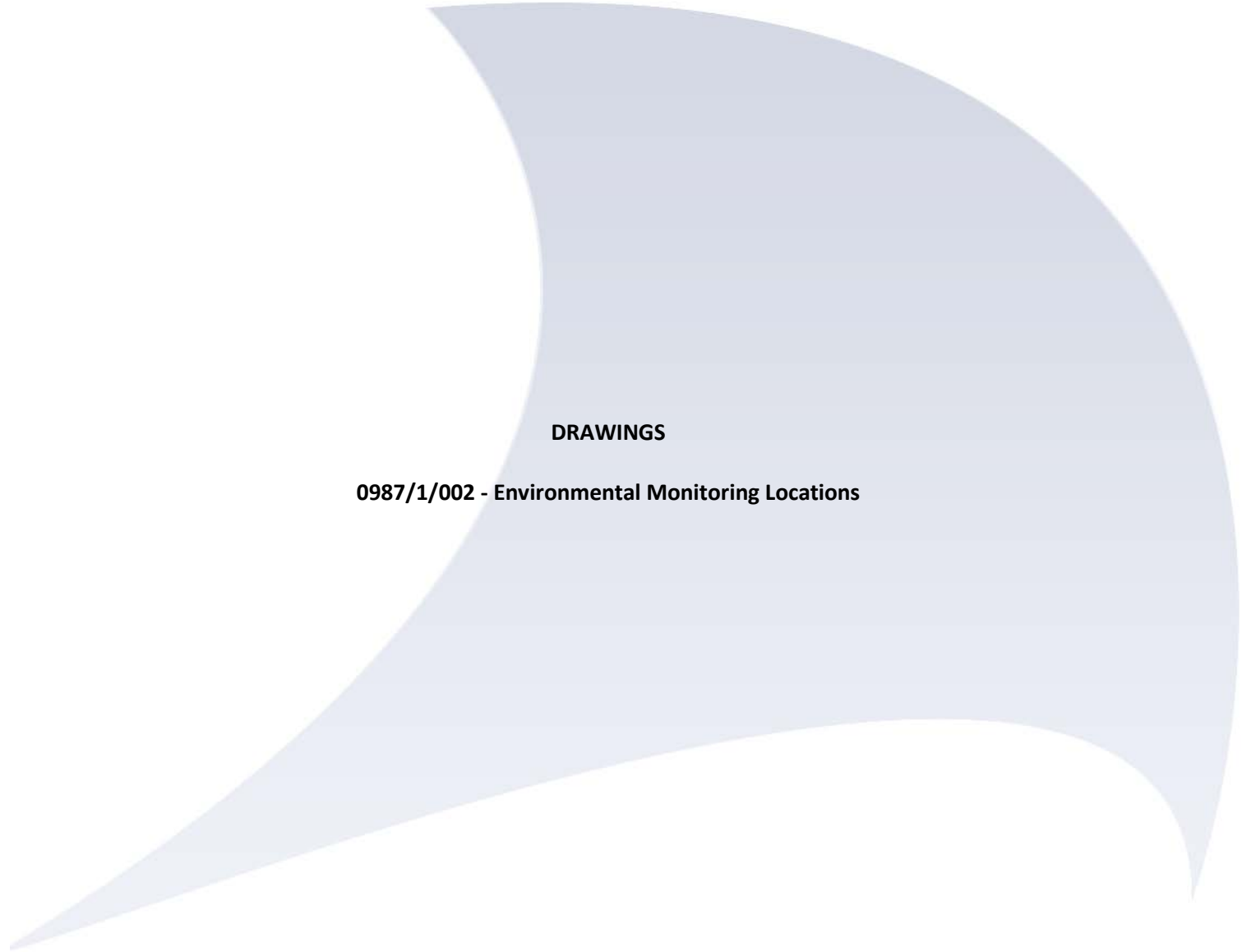
- 7.3.1 All leachate levels remained relatively stable throughout the review period with no significant fluctuations at all locations.
- 7.3.2 Concentrations of ammoniacal nitrogen and COD fluctuated throughout the review period. pH remained relatively stable in all locations. Leachate quality results indicate that a medium to strong leachate is present. This is to be expected given the age of the waste mass and the closed and capped nature of the site.

7.3.3 34 hazardous parameters were detected within the leachate as part of the annual suite.

7.4 Surface Water

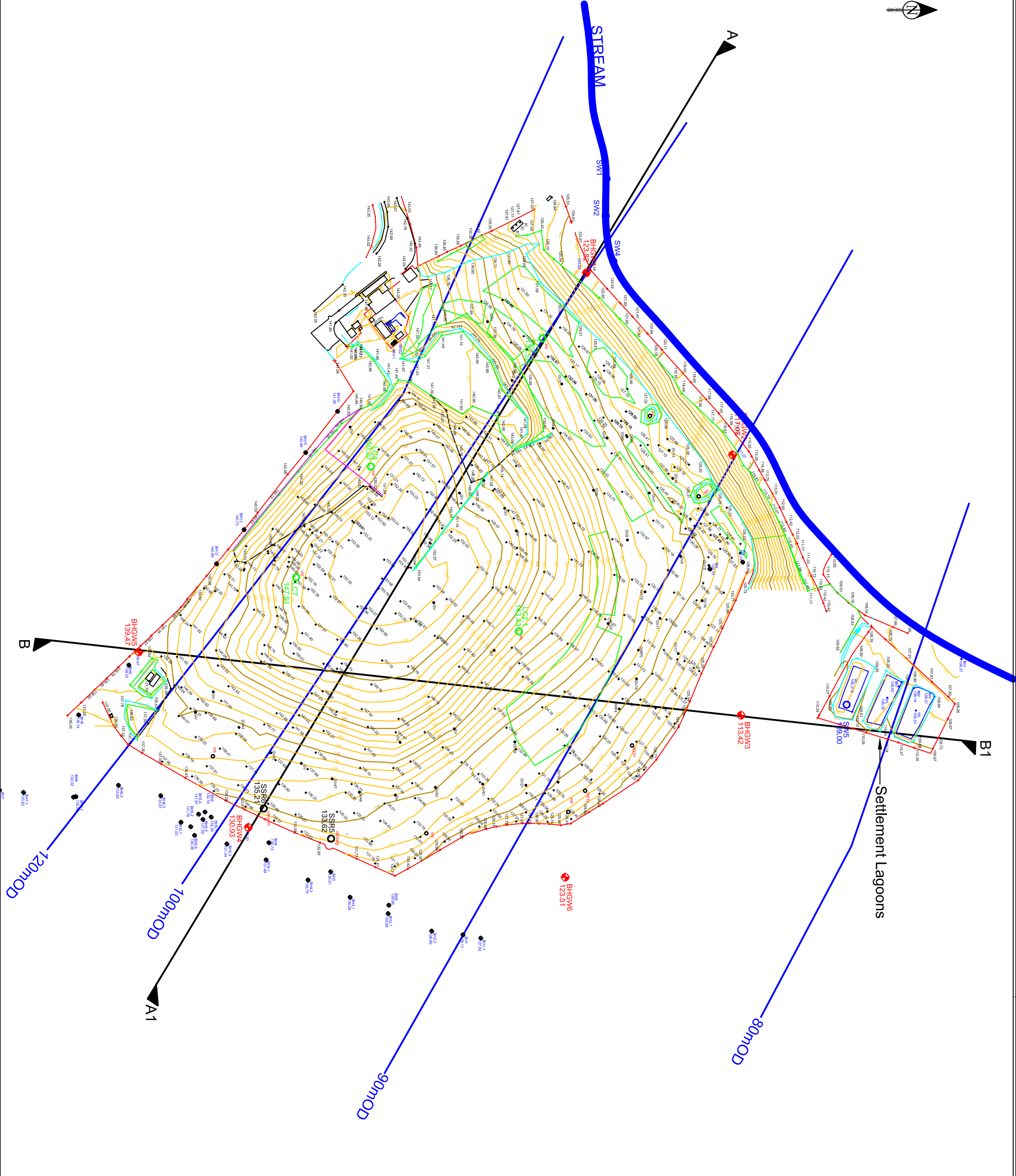
7.4.1 Ammoniacal nitrogen was not detected in any of the surface water locations showing an improvement since the peak in concentration observed during 2015. COD concentration also decreased significantly at all locations since 2015.

7.4.2 No phenols, pesticides or herbicides were detected in the surface water locations during 2016.



DRAWINGS

0987/1/002 - Environmental Monitoring Locations



Notes

-  Groundwater Borehole
-  Side Slope Riser
-  Leachate Chamber
-  Surface Water Monitoring Point
-  Cross Section
-  Ground Water Contours

Notes

Monitoring Point Height (mOD)
Given Below Identity Number

Ground Water Contour Based on
2005 Levels



Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX



Site
**Standard Landfill
Buckley**

Title
**Environmental Monitoring
Locations**

Scale	1:1500	@ A2
Drawing No.	0987/1/002	
Rev	Date	Description
File	Standard Landfill3863a-TCL Revision001.dwg	
Date	03/09	Engineer CB
Drawn	SH	Checked JB

APPENDIX 1

APPENDIX 1 – LANDFILL GAS

Table 1: Perimeter Landfill Gas

Location		CH4 (%v/v)	Trigger (%v/v)	CO2 (%v/v)	Trigger (%v/v)	Location		CH4 (%v/v)	Trigger (%v/v)	CO2 (%v/v)	Trigger (%v/v)
BH 1	Min	0.0	1.0	0.2	5.37	BH 4.1	Min	0.0	1.0	1.1	7.12
	Max	0.0		1.9			Max	0.0		3.2	
	Ave	0.0		1.3			Ave	0.0		2.0	
	Count	52		52			Count	52		52	
BH 1.1	Min	0.0	1.0	1.0	5.35	BH 4.2	Min	0.0	1.0	1.2	8.59
	Max	0.0		2.6			Max	0.0		2.8	
	Ave	0.0		1.8			Ave	0.0		1.8	
	Count	52		52			Count	52		52	
BH 2.0	Min	0.0	1.0	1.0	7.05	BH 5.0	Min	0.0	1.0	1.4	19.42
	Max	0.0		2.6			Max	0.0		2.9	
	Ave	0.0		1.7			Ave	0.0		2.1	
	Count	52		52			Count	52		52	
BH 2.1	Min	0.0	1.0	1.1	7.57	BH 5.1	Min	0.0	1.0	1.0	5.8
	Max	0.0		3.2			Max	0.0		3.0	
	Ave	0.0		2.3			Ave	0.0		1.8	
	Count	52		52			Count	52		52	
BH 2.2	Min	0.0	1.0	1.2	5.82	BH 5.2	Min	0.0	1.0	1.0	9.64
	Max	0.0		3.6			Max	0.0		2.8	
	Ave	0.0		2.2			Ave	0.0		1.9	
	Count	52		52			Count	52		52	
BH 3.0	Min	0.0	1.0	1.1	6.7	BH 5.3	Min	0.0	1.0	1.2	6
	Max	0.0		3.5			Max	0.0		2.9	
	Ave	0.0		2.1			Ave	0.0		1.8	
	Count	52		52			Count	52		52	
BH 3.1	Min	0.0	1.0	1.1	7.76	BH 5.4	Min	0.0	1.0	1.4	16.03
	Max	0.0		2.9			Max	0.0		3.5	
	Ave	0.0		1.8			Ave	0.0		2.4	
	Count	52		52			Count	52		52	
BH 4.0	Min	0.0	1.0	1.0	10.65	BH 5.5	Min	0.0	1.0	1.1	17.06
	Max	0.0		3.6			Max	0.0		3.3	
	Ave	0.0		2.2			Ave	0.0		2.0	
	Count	52		52			Count	52		52	

APPENDIX 1 – LANDFILL GAS

Location		CH4 (%v/v)	Trigger (%v/v)	CO2 (%v/v)	Trigger (%v/v)	Location		CH4 (%v/v)	Trigger (%v/v)	CO2 (%v/v)	Trigger (%v/v)
BH 5.7	Min	0.0	1.0	1.4	7.07	BH 12	Min	0.0	10	1.1	6.48
	Max	0.0		3.9			Max	0.0		2.7	
	Ave	0.0		2.6			Ave	0.0		1.8	
	Count	52		52			Count	52		52	
BH 6.0	Min	0.0	1.0	1.2	8.92	BH 13	Min	0.0	10	1.4	5.2
	Max	0.0		2.9			Max	0.0		2.9	
	Ave	0.0		2.1			Ave	0.0		2.2	
	Count	52		52			Count	52		52	
BH 6.1	Min	0.0	1.0	1.1	3.72	BH 15	Min	0.0	1	1.4	8.3
	Max	0.0		2.8			Max	0.0		3.6	
	Ave	0.0		1.9			Ave	0.0		2.2	
	Count	52		52			Count	52		52	
BH 6.2	Min	0.0	1.0	1.1	6.12	BH 16	Min	0.0	1	1.1	3
	Max	0.0		2.6			Max	0.0		2.6	
	Ave	0.0		1.9			Ave	0.0		1.7	
	Count	52		52			Count	52		52	
BH 6.3	Min	0.0	1.0	1.4	8.24	BH 22	Min	0.1	1	1.1	3.1
	Max	0.0		2.6			Max	0.6		2.6	
	Ave	0.0		1.9			Ave	0.3		1.8	
	Count	52		52			Count	52		52	
BH 7.0	Min	0.0	1.0	1.0	6.2						
	Max	0.0		2.9							
	Ave	0.0		1.9							
	Count	52		52							
BH 7.1	Min	0.0	1.0	1.0	5.49						
	Max	0.0		2.3							
	Ave	0.0		1.6							
	Count	52		52							
BH 9.0	Min	0.0	1.0	1.2	10.72						
	Max	0.0		2.6							
	Ave	0.0		2.1							
	Count	52		34							



4251

ANALYSIS OF THE TRACE LANDFILL GAS

AT

Standard Landfill Site
Spencers Industrial Estate
Buckley
Flintshire
CH7 3LY

Commissioned by: Mr Phil Mulhall

Of

Flintshire County Council
Alltami Depot
Mold Road - Alltami
Flintshire
CH7 6LG

Date of Survey:

29th April 2016

Compiled By:

Yu Shen
Project Manager

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Project Manager
Mcerts Level II (TE1, 2, 3 & 4)

Signed:



Dated: 27th May 2016

CONTENTS

- 1.** INTRODUCTION
- 2.** PLANT DESCRIPTION
- 3.** SAMPLING PROCEDURES
- 4.** RESULTS
- 5.** DISCUSSION & CONCLUSION

APPENDICES:

APPENDIX A: Site Information & Preliminary Gas Measurements
APPENDIX B: Trace Gas Results
APPENDIX C: Historical Trace Gas Chart

1. INTRODUCTION

- 1.1 EnviroDat Limited was commissioned by Mr Phil Mulhall, on behalf of Flintshire County Council, to measure the trace gas components from landfill gas located at Standard Landfill Site. Sampling was performed on the 29th April 2016.
- 1.2 The sampling was conducted in response to permit requirements (Permit No. 37073). Monitoring was conducted with reference to the Environment Agency document 'Guidance for Monitoring Trace Components in Landfill Gas' (LFTGN 04).

2. PLANT DESCRIPTION

- 2.1 Landfill gas is currently utilised by CHP plant. Samples of the fuel gas were taken from a feed system for trace gas analysis after the gas booster.

3. SAMPLING PROCEDURES

- 3.1 Trace gas sampling was performed from the fuel gas inlet, with analysis for components identified in Table 1.1 of the EA LFTGN04 guidance note. General site information is presented in Appendix A.
- 3.2 Mixed bed, automated thermal desorption (ATD) tubes were used for sampling of the priority volatile organic species prior to analysis by gas chromatography with mass spectrometry (GC/MS), in accordance with EA recommendations and documented EnviroDat protocol, SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at SAL Ltd, Manchester.

- 3.3 The LFTGN04 designated 'priority' carbonyl components (i.e. methanal and ethanal) were sampled onto dinitrophenylhydrazine (DNPH) impregnated, silica gel sorbent tubes prior to analysis by high performance liquid chromatography (HPLC) incorporating an ultraviolet (UV) detection system, in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at SAL Ltd, Manchester.
- 3.4 Arsenic was sampled onto an activated charcoal sorbent tube prior to analysis by inductively coupled plasma/optical emission spectrometry (ICP/OES), in accordance with EA recommendations and SPTGN04. The results are presented in Appendix B. The analytical component of the work was conducted at SAL Ltd, Manchester.
- 3.5 Hydrogen sulphide was sampled into a Tedlar bag with analysis by GC/MS (by SAL Ltd) in accordance with SPTGN04. The results are presented in Appendix B.

4. RESULTS

- 4.1 Field measurements of the 'bulk gases' are given in Appendix A.
- 4.2 Measured concentrations of the EA 'priority' trace components for the landfill gas are given in Appendix B.

5. DISCUSSION AND CONCLUSION

- 5.1 The aim of the survey was to measure trace components from the landfill gas at Standard Landfill Site.
- 5.2 The levels of trace components within the landfill gas are of a range and magnitude not dissimilar to what would be expected and can be regarded as comparable with biogenic gas of this nature from other sources. Appendix C shows the variation of trace gas parameters over time.

APPENDIX A

Site Information & Preliminary Gas Measurements

TABLE A: Site Information & Preliminary Gas Measurements

Sample Position Details			
Date	29/04/2016	Site	Standard Landfill Site
Ambient Temperature	9.8°C	Atmospheric Pressure	995mbar
Monitoring Organisation (s)	EnviroDat Ltd	Analytical Laboratory	SAL Ltd
Location of Sampling Point	Inlet Line to Utilisation Plant	Area of Influence of collection system sampled	All capped areas of the site
Type of Sampling Point	Valve	Temperature of gas	8.9°C, at sample flow meter
Vacuum on Sampling	None, Positive pressure	Type of waste	Domestic, Industrial, Commercial & Hazardous
		Age of Waste	-
Status of Gas System	Fully Operational, Steady State	Other	-
Parameter	Concentration	Units	Comments
Methane*	49.9	%	-
Carbon Dioxide*	20.3	%	-
Oxygen*	0.0	%	-
Nitrogen*	29.8	%	Assumed to be balance of gas
Hydrogen Sulphide*	-	ppmv	Not required
Carbon Monoxide*	-	ppmv	

Notes: * Raw result obtained from client.

APPENDIX B

Trace Gas Results

TABLE B: Trace Gas Results

Trace Gases - Test 1							
	Test Duration	Flow Rate	Flowmeter	Volume	Ambient T	Barometric P	Volume
	(min)	(ml/min)	CAL Factor	(l as sampled)	(°C)	(kPa)	(l @ STP)
VOC	5	50	1.074	0.27	9.75	99.5	0.25
Aldehydes	20	200	0.9496	3.80	9.75	99.5	3.60
Arsenic	60	200	0.9496	11.40	9.75	99.5	10.80
Compound	Mass of TG (ng)	LoD of TG (ng)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)	
1, 1 - dichloroethane		10	< 39	µg/m3	-	Y	
1, 2 - dichloroethane		10	< 39	µg/m3	-	N	
1, 1 - dichloroethene		10	< 39	µg/m3	-	Y	
1, 2 - dichloroethene	270	30	1061	µg/m3	-	Y	
1, 3 - butadiene		10	< 39	µg/m3	-	Y	
1 - butanethiol		10	< 39	µg/m3	-	Y	
1 - pentene	420	10	1650	µg/m3	-	Y	
1 - propanethiol		10	< 39	µg/m3	-	Y	
2 - butoxyl ethanol		10	< 39	µg/m3	-	N	
Arsenic (as As)		1000	< 93	µg/m3	-	Y	
Benzene	650	10	2553	µg/m3	-	Y	
Butyric acid		10	< 39	µg/m3	-	N	
Carbon disulphide	78	10	306	µg/m3	a	N	
Chloroethane		30	< 118	µg/m3	-	N	
Chloroethene (vinyl chloride)		10	< 39	µg/m3	-	Y	
Dimethyl disulphide	29	10	114	µg/m3	-	N	
Dimethyl sulphide		10	< 39	µg/m3	-	Y	
Ethanal (acetaldehyde)	1100	100	305	µg/m3	-	Y	
Ethanethiol	110	10	432	µg/m3	-	N	
Ethyl butyrate		25	< 98	µg/m3	-	N	
Furan (1,4-epoxy-1,3 butadiene)	42	10	165	µg/m3	-	N	
Methanal (formaldehyde)	200	100	56	µg/m3	a	Y	
Methanethiol		30	< 118	µg/m3	-	N	
Styrene	56	10	220	µg/m3	-	N	
Tetrachloromethane		10	< 39	µg/m3	-	Y	
Toluene	3100	10	12177	µg/m3	c	N	
Trichloroethene	27	9	106	µg/m2	-	Y	
Compound	Concentration in ppm	LOD of TG (ppm)	Concentration	Units	Analysis Notes (See below)	Analysis UKAS Accredited (Y/N)	
Hydrogen sulphide		10	< 15179	µg/m3	-	N	

*H2S value is equivalent to <10 ppm, values in heighlited box are expressed as ppm and not ng

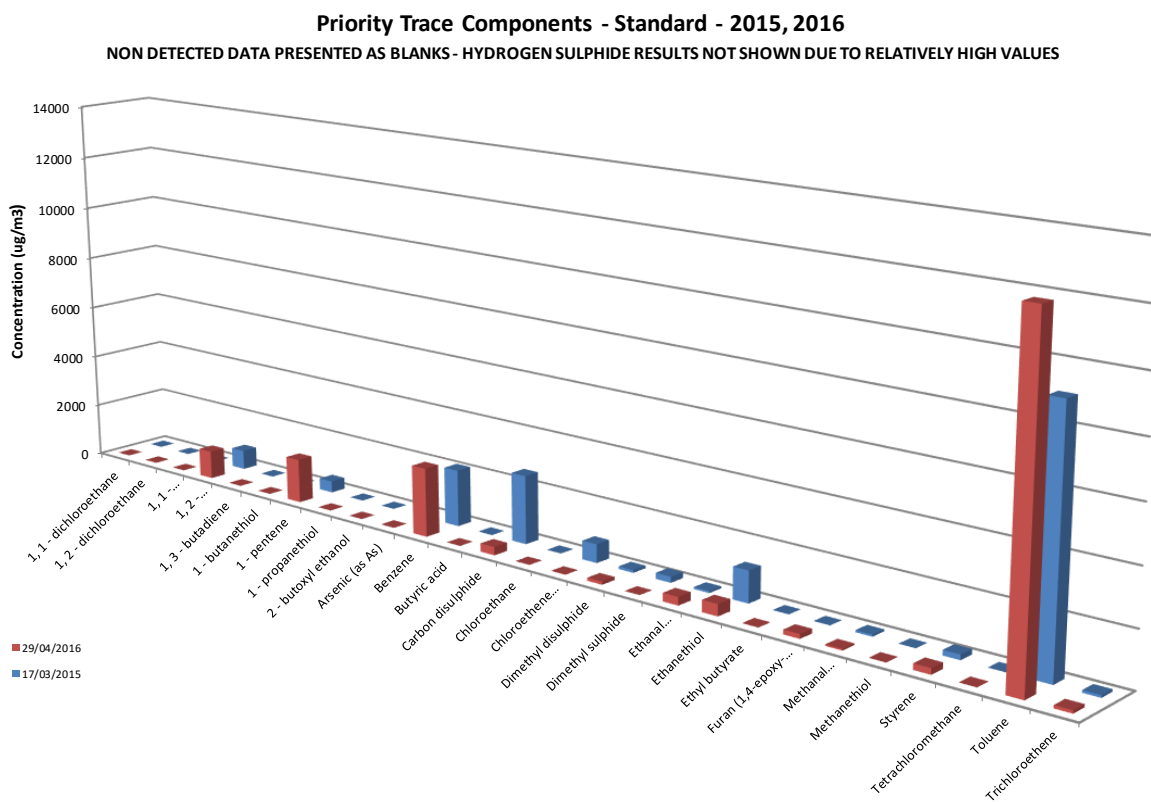
(a) – Results have been blank corrected
(b) – Results should be considered a minimum due to detector saturation
(c) – Results should be viewed with caution due to being outside of the instrument calibration range

Reference to UKAS (final column) relates to the accreditation status of the analysis only, sampling is covered under EnviroDat Accreditation scope.

APPENDIX C

Historical Trace Gas Chart

TABLE C: Historical Trace Gas Chart



**Report for the Periodic Monitoring of Emissions to Air from the Landfill
Gas Engine and Flare Stack Located at Standard Landfill Site, Buckley.**

Part 1: Executive Summary

Permit Number: 37073

Operator: Flintshire County Council

Installation: Standard Landfill Site (Engine & Flare)



4251

Monitoring dates: 29th April & 9th May 2016

Job Number: **R16220**

Version: 1

Address: **Flintshire County Council**

Alltami Depot

Mold Road - Alltami

Flintshire, CH7 6LG

Monitoring Organisation: **EnviroDat Ltd**

Address: Science & Technology Centre

Earley Gate

Whiteknights Road

Reading RG6 6BZ

Date of Report: 27th May 2016

Report Approved By: Yu Shen

MCERTS Registration Number: MM 06 727 (Level II, TE1, 2, 3 & 4)

Function: Project Manager (Team Leader)

Signed:

CONTENTS

	Page No.
Part 1: Executive Summary	
1.1 Monitoring Objectives	3
1.2 Monitoring Results	4
1.3 Operating Information	6
1.4 Monitoring Deviations	6
Part 2: Supporting Information	
2.1 Appendix I: General Information	7
2.2 Appendix II: Emission Point Reference Data & Results	13
2.3 Appendix III: Uncertainty Calculations	23
2.4 Appendix IV: Moisture Calculations	27

PART 1: EXECUTIVE SUMMARY

1.1 Monitoring Objectives

Flintshire County Council operates a landfill gas engine and a flare stack at its facility located at Standard Landfill site. This combustion plant has the potential to pollute the atmosphere. Consequently, these processes are subject to regulation and periodic environmental monitoring is necessary under this regulation.

Methane is produced as a by-product of the decomposition of organic waste that is buried within the site (methanogenesis). This methane is extracted and pumped through inert piping to the engine or flare for combustion, the scale of which is dictated according to local engineering, operational requirements and methanogenic rate. The flare is designed to operate when excess gas is produced or for periods of engine maintenance.

EnviroDat Limited was requested to undertake a monitoring campaign on the engine and flare stacks. This work forms part of the annual compliance test. The pollutants monitored within the engine and flare emissions, as required under permit 37073 are summarised below:

Substances to be monitored	Emission Point Identification	
	Engine	Flare Stack
Oxides of Nitrogen (as NO ₂)	✓	✓
Carbon Monoxide	✓	✓
Volatile Organic Compounds (VOCs)	✓	✓
Oxygen (for correction)	✓	✓
Moisture (for correction)	✓	✓
Special requirements	None requested	

1.2 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Estimate of Uncertainty (2σ at 95% confidence)	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method (see note below)	Operating Status
Engine	Oxides of Nitrogen (as NO ₂)	650	336	±20	mg(N)m ⁻³	101.3kPa, 273K, dry gas, 5% Oxygen	29/04/2016	10:30-11:30	BS EN 14792	A	At 92% MCR
	Carbon Monoxide	1500	671	±44	mg(N)m ⁻³				BS EN 15058	A	
	Volatile Organic Compounds (VOCs as carbon)	1750	1484	±54	mg(N)m ⁻³				BS EN 12619	A	
	Moisture	-	9.8	n/a	%	101.3kPa, 273K, dry gas		10:30-11:30	BS EN 14790	A	
	Oxygen	-	5.85	±0.37	%			10:30-11:30	BS EN 14789	A	

NOTE:

- A. EnviroDat Ltd MCerts/UKAS Accredited for sampling and analysis.
- B. EnviroDat Ltd MCerts/UKAS Accredited for sampling only, UKAS Accredited analysis conducted by sub-contract laboratory.
- C. EnviroDat Ltd MCerts/UKAS Accredited for sampling only (further clarification is given in section 1.4). Analysis of this component is not UKAS Accredited.
- D. The method for sampling and analysis is not MCerts/UKAS Accredited, method follows documented in-house procedure (further clarification is given in section 1.4).

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Estimate of Uncertainty (2σ at 95% confidence)	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method (see note below)	Operating Status
Flare Stack	Oxides of Nitrogen (as NO ₂)	150	63.3	±6.8	mg(N)m ⁻³	101.3kPa, 273K, dry gas, 3% Oxygen	09/05/2016	11:00-12:00	BS EN 14792	A	At 55% MCR
	Carbon Monoxide	50	6.8	±2.7	mg(N)m ⁻³				BS EN 15058	A	
	Volatile Organic Compounds (VOCs as carbon)	10	7.2	±0.3	mg(N)m ⁻³				BS EN 12619	A	
	Moisture	-	9.1	n/a	%	101.3kPa, 273K, dry gas		11:00-12:00	BS EN 14790	A	
	Oxygen	-	13.50	±0.64	%			11:00-12:00	BS EN 14789	A	

NOTE:

- A. EnviroDat Ltd MCerts/UKAS Accredited for sampling and analysis.
- B. EnviroDat Ltd MCerts/UKAS Accredited for sampling only, UKAS Accredited analysis conducted by sub-contract laboratory.
- C. EnviroDat Ltd MCerts/UKAS Accredited for sampling only (further clarification is given in section 1.4). Analysis of this component is not UKAS Accredited.
- D. The method for sampling and analysis is not MCerts/UKAS Accredited, method follows documented in-house procedure (further clarification is given in section 1.4).

1.3 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
								Substance	CEMS Results	Periodic Monitoring Results	Units
Engine	29/04/2016	Combustion	Continuous	Landfill Gas	N/A	None	Producing 600kWe (92% MCR)	N/A	N/A	N/A	N/A
Flare Stack	09/05/2016	Combustion	Continuous	Landfill Gas	N/A	None	Burning 275m ³ /hr (55% MCR)	N/A	N/A	N/A	N/A

1.4 Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Engine	None	None	None
Flare Stack	None	None	None

PART 2: SUPPORTING INFORMATION

2.1 Appendix I: General Information

2.1.1 Monitoring organisation staff details

Monitoring at Standard Landfill Site was conducted by the following EnviroDat Engineers:

Team Leader, Yu Shen – Mcerts Level II (TE1, 2, 3 & 4)	MM06 727
Team Leader, David Littlewood – Mcerts Level II (TE1, 2, 3 & 4)	MM06 772
Assistant, Danny Gibbons – Mcerts Trainee	MM15 1326
Assistant, Dean Kyle – Mcerts Level I	MM12 1188

2.1.2 Monitoring organisation method details

2.1.2.1 Standard Reference Conditions

All pollutant concentrations measured have been expressed at standard reference conditions of 273K, 101.3kPa, dry gas and 5% O₂ for the engine and 3% O₂ for the flare.

2.1.2.2 NO_x (as NO₂)

A sample of the duct gas was passed via a short high temperature probe and down a heated PTFE line to a gas conditioner used to remove moisture. The conditioned (dry) gas then passed to a Horiba PG250 analyser, which, following specific pre-treatment of the NO_x within the sample, measured the concentration of NO_x (as NO₂) by chemiluminescent detector, in accordance with EnviroDat Ltd. documented procedure SP14792, which implements the requirements of the standard reference method (SRM) BSEN14792. The detector and sampling system was checked prior to, and immediately following, testing to ensure operational conformity. This involved ensuring the absence of sample egress or air ingress, span and zero gas checks and system response times as necessary. All raw data was logged at 60-second intervals via a Grant Instruments Squirrel Datalogger and these are presented in Appendix II. An estimate of the uncertainty associated with the monitoring is also presented, as Appendix III.

2.1.2.3 CO

A sample of the duct gas was passed via a short high temperature probe and down a heated PTFE line to a gas conditioner used to remove moisture. The conditioned (dry) gas then passed to a Horiba PG250 analyser, which measured the concentration of CO by non-dispersive infrared (NDIR) detector, in accordance with EnviroDat Ltd. documented procedure SP15058 which implements the requirements of the SRM BSEN15058. The detector and sampling system was checked prior to, and immediately following, testing to ensure operational conformity. This involved ensuring the absence of sample egress or air ingress, span and zero gas checks and system response times as necessary. All raw data was logged at 60-second intervals via a Grant Instruments Squirrel Datalogger and these raw data are presented in Appendix II. An estimate of the uncertainty associated with the monitoring is also presented, as Appendix III.

2.1.2.4 Total VOCs

VOC sampling was performed using a Signal 3010HM analyser that measures by use of a heated flame ionisation detector (FID) in accordance with SP12619, which implements the requirements of the SRM BSEN12619:2013. The VOC analyser was positioned prior to the gas conditioner and measured the sample gas 'hot and wet.' The result was subsequently corrected to dry values. The detector and sampling system was checked prior to, and immediately following, testing to ensure operational conformity. This involved ensuring the absence of sample egress or air ingress, span and zero gas checks and system response times as necessary. All raw data was logged at 60-second intervals via a Grant Instruments Squirrel Datalogger and these raw data are presented in Appendix II. An estimate of the uncertainty associated with the monitoring is also presented, as Appendix III.

2.1.2.5 O₂

A sample of the duct gas was passed via a short high temperature probe and down a heated PTFE line to a gas conditioner used to remove moisture. The conditioned (dry) gas then passed to a Horiba PG250 analyser, which measured the concentration of O₂ by was measured by a zirconia cell, as detailed in documented procedure SP14789, which implements the requirements of the SRM BSEN14789. The detector and sampling system was checked prior to, and immediately following, testing to ensure operational conformity. This involved ensuring the absence of sample egress or air ingress, span and zero gas checks and system response times as necessary. All raw data was logged at 60-second intervals via a Grant Instruments Squirrel Datalogger and the raw data are presented in Appendix II. An estimate of the uncertainty associated with the monitoring is also presented, as Appendix III.

Determination of oxygen is essential for adjusting the prescribed pollutants to reference oxygen levels as detailed in the sites permit. This was performed in the following manner:

$$\text{Conc}_{\text{ref}} = \text{Conc}_{\text{meas}} \times \frac{(20.95 - \text{O}_{2\text{ref}})}{(20.95 - \text{O}_{2\text{meas}})}$$

Whereby, Conc_{ref} was the concentration at reference conditions and $\text{Conc}_{\text{meas}}$ was the measured concentration, $\text{O}_{2\text{ref}}$ is the oxygen reference conditions and $\text{O}_{2\text{meas}}$ is the measured oxygen value.

2.1.2.6 Moisture

Moisture levels in the stack were determined gravimetrically to the requirements of BSEN14790, which implements the requirements of the SRM BSEN14790. The equipment consisted of an Apex Instruments USEPA Method Five apparatus. This consisted of a heated probe, heated filter and impinger bucket, connected to the sampling console. The console contained a calibrated dry gas meter. The data obtained from this system combined with the gravimetric increases allowed water content to be calculated. The moisture correction factor was calculated in the following manner:

$$\frac{(100 - [\text{H}_2\text{O}]_{\text{reference}})}{(100 - [\text{H}_2\text{O}]_{\text{measured}})}$$

This correction factor is only applied to the VOC result and was not applied to the combustion gases as the sample train for combustion gases uses a gas conditioner to remove moisture and introduces dried gas to the analyser. The raw data relating to the moisture test is presented as Appendix IV.

2.1.3 Monitoring organisation equipment and gas check list references

EQUIPMENT - (BJ15 JKF)			
Item	Reference	Calibration Due	PAT Due
Portable Gas Analyser	PGA#01	04-Feb-17	Oct-16
Flame Ionisation Detector Analyser	FID#05	22-Oct-16	Oct-16
Gas Conditioner	COND#03	01-Nov-16	Oct-16
NOx Converter	CONV#03	08-Mar-17	Oct-16
Data Logger	DL#04	22-Nov-16	-
Digital Barometer	DB#18	11-Aug-17	-
Balance	BAL#05	03-Apr-17	-
Heated Line	HL#13	10-Nov-16	-
Heated Line Controller	HLC#13	10-Nov-16	Oct-16
'Apex' Kit	APEX#04	See each item	Oct-16
Dry Gas Meter ('Apex')	DGM#11	13-Oct-16	-
Timepiece ('Apex')	TP#15	08-Oct-16	-
Thermocouple ('Apex')	TC#35	13-Oct-16	-
Thermocouple Reader ('Apex')	TCR#16	13-Oct-16	-
Thermocouple Reader ('Apex')	TCR#17	13-Oct-16	-
Thermocouple Reader ('Apex')	TCR#18	13-Oct-16	-
Manometer ('Apex' Orange)	MAN#08	08-Oct-16	-
Manometer ('Apex' Red)	MAN#09	08-Oct-16	-
Thermocouple ('Apex' Dogleg Exit)	TC#03	28-Oct-16	-
Thermocouple (Stack Temperature Check)	TC#44	04-Jan-17	-
Timepiece	TP#17	05-Feb-17	-

EQUIPMENT – (PX65 WNR)			
Item	Reference	Calibration Due	PAT Due
Portable Gas Analyser	PGA#02	25-Jan-17	Oct-16
Flame Ionisation Detector Analyser	FID#02	19-Apr-17	Oct-16
Gas Conditioner	COND#02	07-Mar-17	Oct-16
Data Logger	DL#05	04-Nov-16	-
Digital Barometer	DB#15	27-Feb-17	-
Balance	BAL#03	03-Apr-17	-
Heated Line ¹	HL#03B	04-Jan-17	-
Heated Line ²	HL#05	04-Jan-17	-
Heated Line Controller ¹	HLC#06	04-Jan-17	Oct-16
Heated Line Controller ²	HLC#04	04-Jan-17	Oct-16
Heated Filter Holder	HFH#01	31-Jan-17	Oct-16
‘Apex’ Kit	APEX#03	See each item	Oct-16
Dry Gas Meter (‘Apex’)	DGM#06	03-Sep-16	-
Timepiece ¹ (‘Apex’)	TP#12	03-Sep-16	-
Timepiece ²	TP#08	22-Dec-16	-
Thermocouple ¹	TC#28	08-Oct-16	-
Thermocouple ² (‘Apex’ Dogleg Exit)	TC#20	03-Sep-16	-
Thermocouple ³ (‘Apex’ Dry Gas Meter)	TC#30	03-Sep-16	-
Thermocouple ⁴	TC#43	08-Oct-16	-
Thermocouple Reader (‘Apex’) ¹	TCR#12	03-Sep-16	-
Thermocouple Reader ²	TCR#09	08-Oct-16	-

GAS CYLINDERS (PX65 WNR)			
	Certificate No.	Level (ppm)	Validity
'Zero' Gas (%) ¹	D909084	99.999%	-
'Zero' Gas (%) ²	N10000018	8.11% O ₂ in N ₂	-
Carbon Monoxide Span Gas ²	EU66HUH	149.5	10-Mar-17
Nitrogen Dioxide Span Gas ²	EU66HUH	101.5	10-Mar-17
Oxygen Span Gas (%) ²	7700651	8.01	07-May-17
VOC Span Gas ²	7700651	7.94	07-May-17

GAS CYLINDERS – (BJ15 JKF)			
	Certificate No.	Level (ppm)	Validity
'Zero' Gas (%)	GU93FNZ	99.999%	n/a
Carbon Monoxide Span Gas	GU93DEQ	1276	09-Mar-17
Nitrogen Dioxide Span Gas	GU93DEQ	256.7	09-Mar-17
VOC Span Gas	DW75BEU	614	13-Mar-17
Oxygen Span Gas (%)	DW75BEU	7.87	13-Mar-17

2.2 Appendix II: Emission Point Reference Data & Results

2.2.1 Photograph of Sampling Location on Engine



Engine sampled from
10mm turbo port on
vertical section of approx.
0.25m diameter stack.

2.2.2 Photograph of Sampling Location on Flare

Flare sampled from
flanged port on vertical
section of approx. 1.0m
diameter stack.
Accessed via Aluminium
Tower Scaffolding
erected by PASMA
Trained staff.



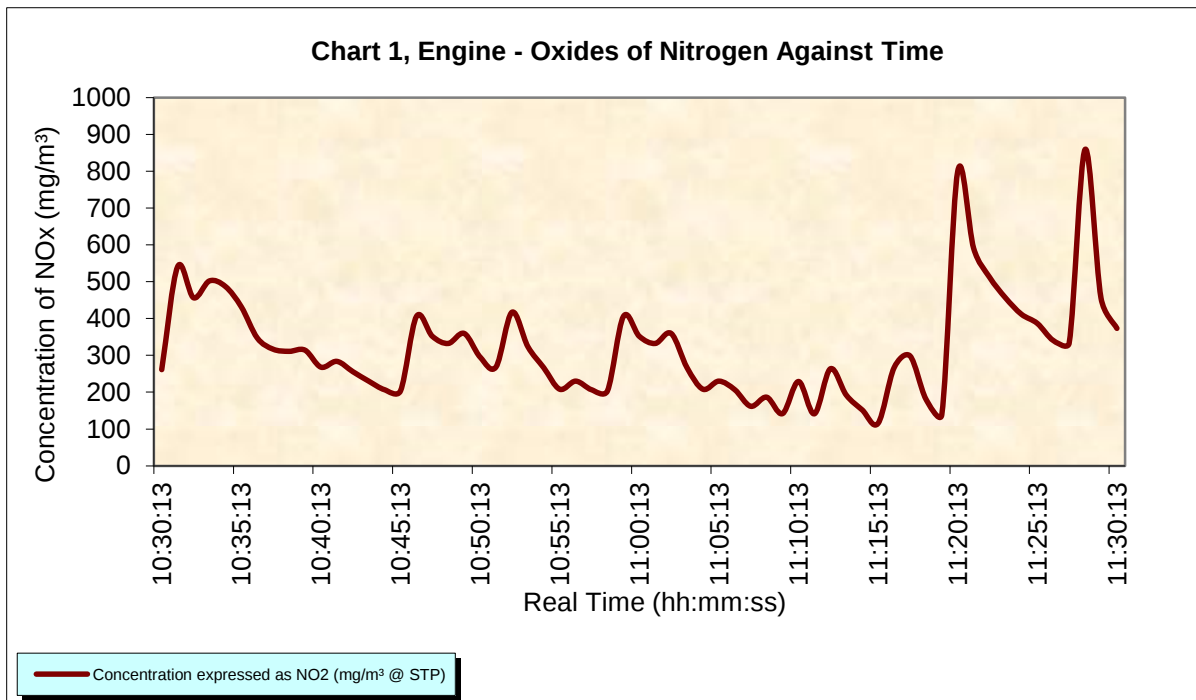
2.2.3 Homogeneity testing

BS EN 15259 stipulates that the exhaust gases emitted from combustion processes are tested to ensure homogeneity and that a representative sample is obtained during the monitoring, subject to a number of caveats as elucidated in Environment Agency guidance MID15259. The details of the testing at each emission point are summarised below:

Stack	Result of Homogeneity Testing
Engine	N/A –homogeneity testing only required on stacks exceeding 1.13 m diameter, as specified in MID 15259. Homogeneity assumed and single point sampling acceptable
Flare Stack	N/A – Due to the health & safety implications of working on a live flare, homogeneity assumed and single point sampling acceptable.

2.2.4 Gas analyser site measurements and calibrations

The data in Charts 1 to 6 and in Tables 1 & 2 are expressed in mgm^{-3} @ STP and is uncorrected for O_2 . In addition, VOC results are expressed as methane equivalent. This data was subsequently converted to reference oxygen concentrations (Section 1.2) with the addition of moisture correction for VOCs. Analyser calibration data is shown in Tables 3 & 4.



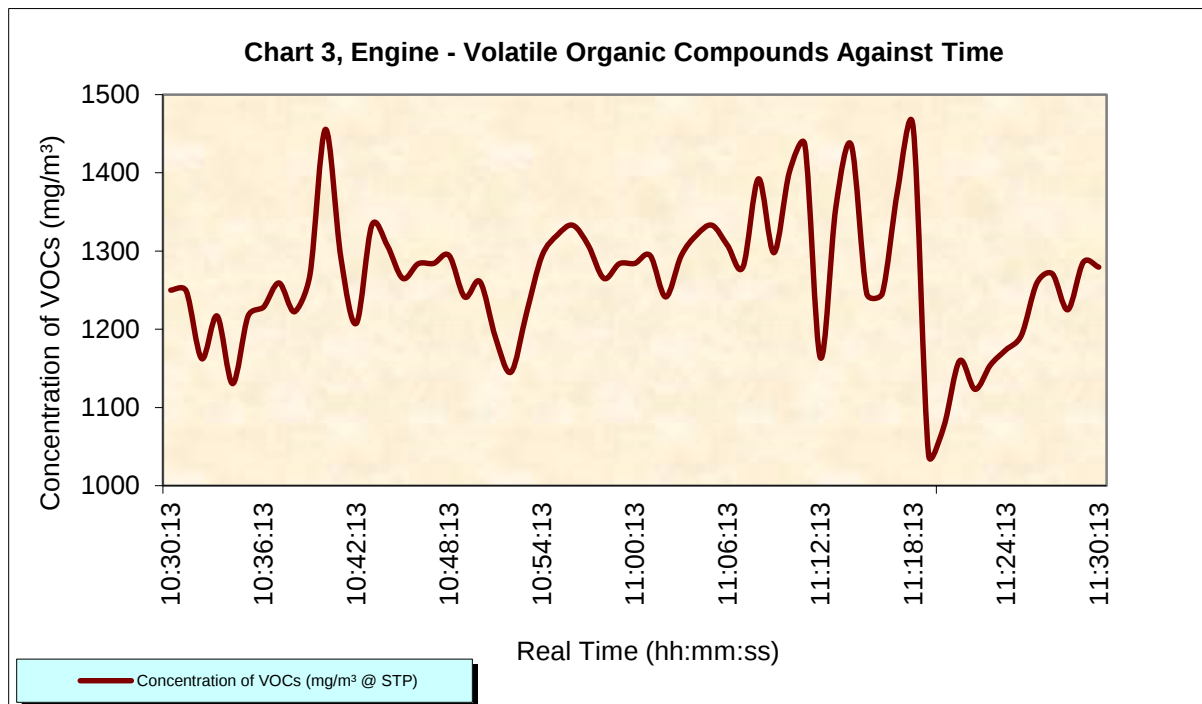
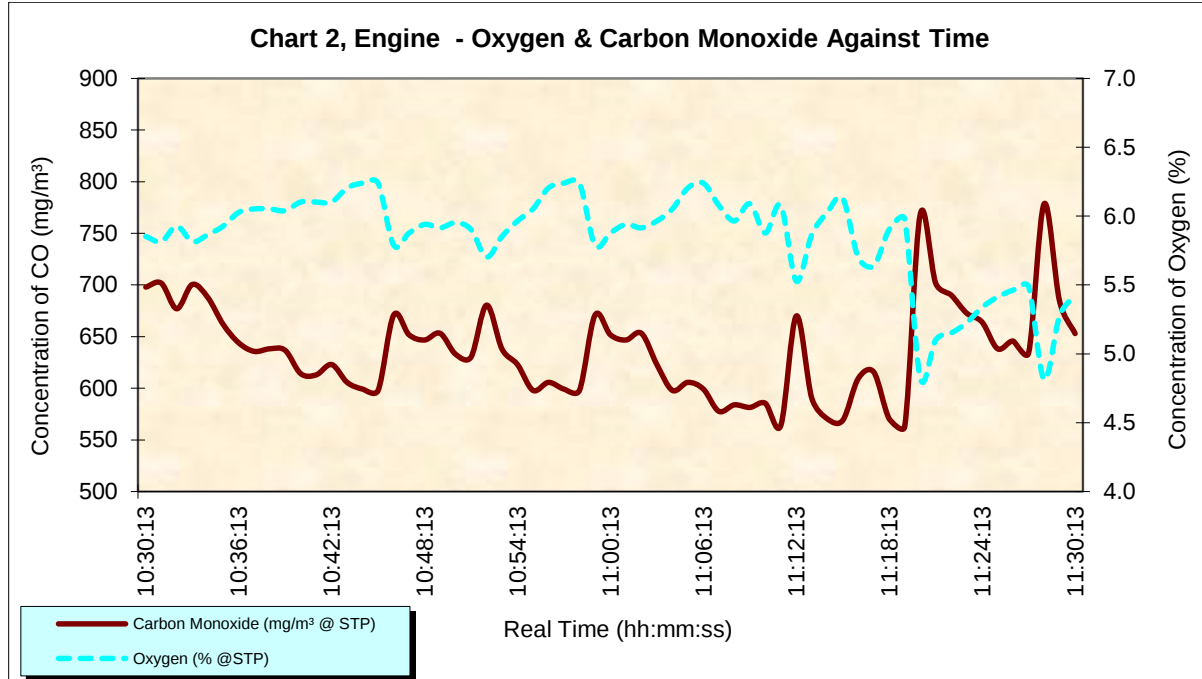


Chart 4, Flare - Oxides of Nitrogen Against Time

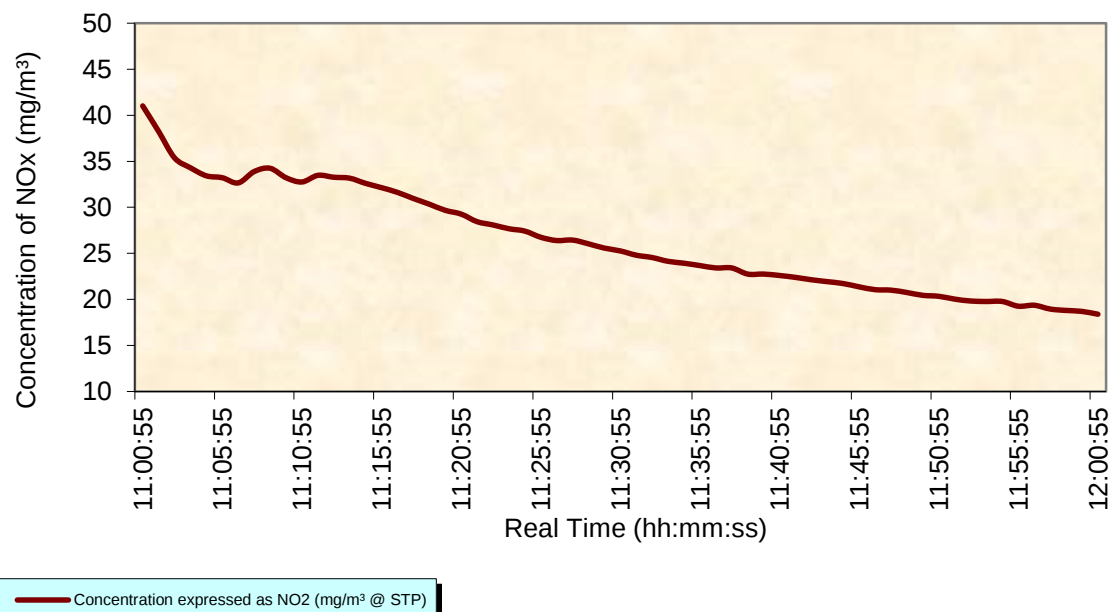
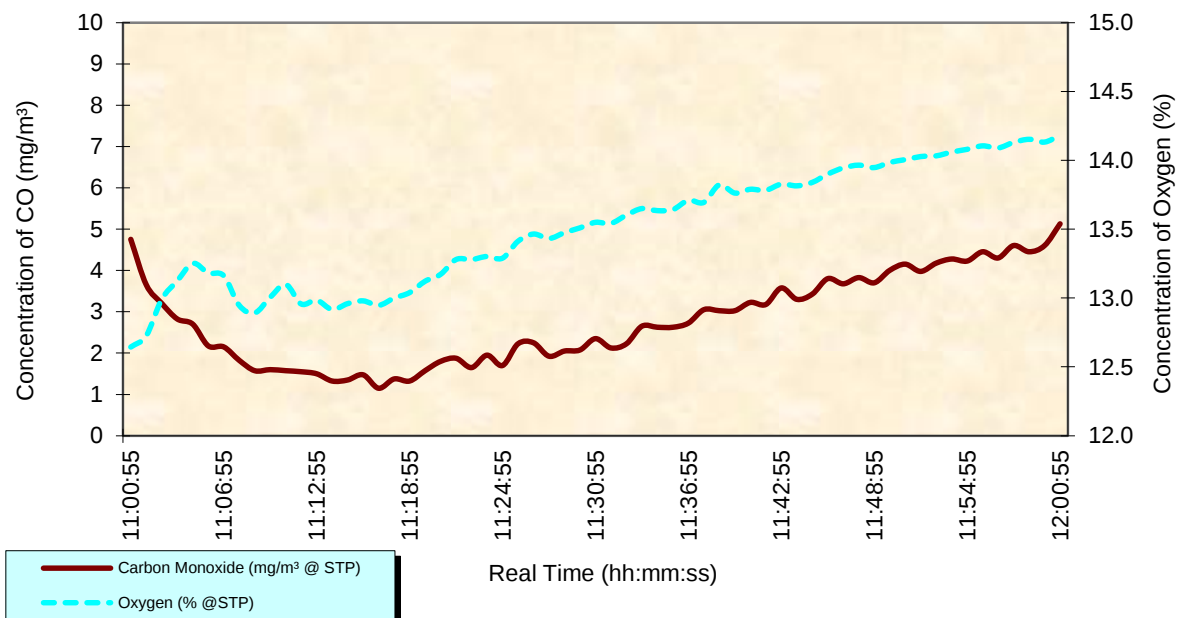


Chart 5, Flare - Oxygen & Carbon Monoxide Against Time



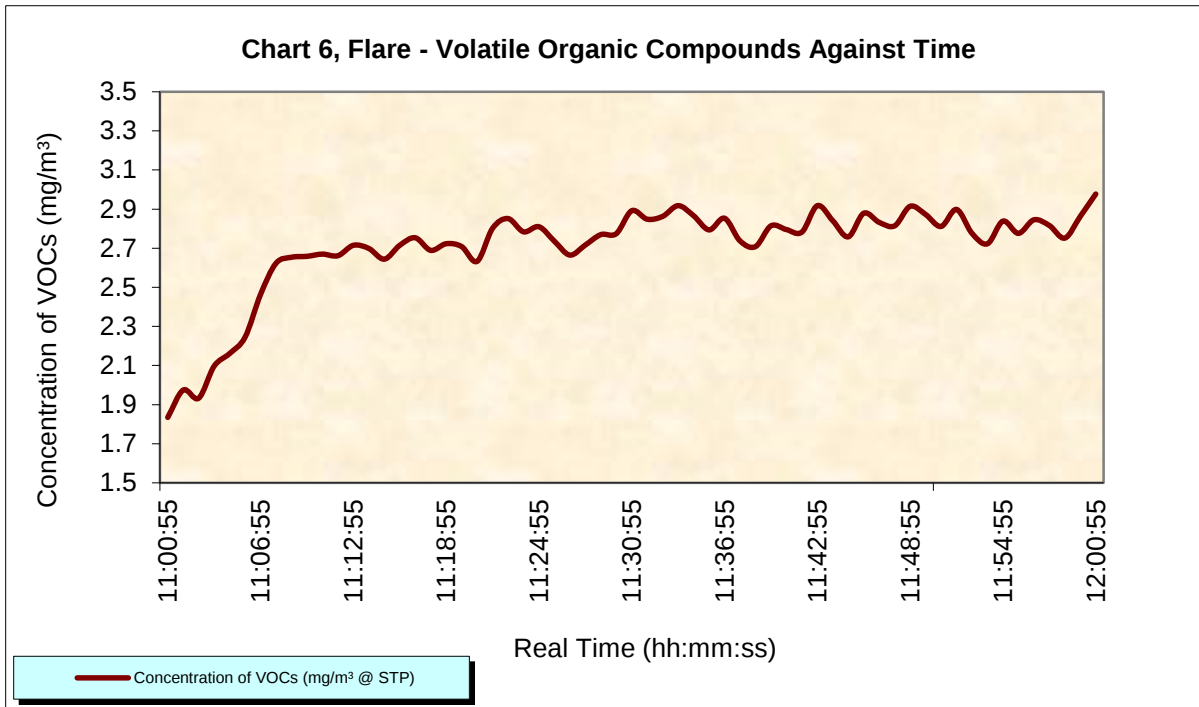


Table 1 – Engine, Raw Data

Time	Oxygen (%) (Dry Gas)	VOC (mgC/m ³) (Wet Gas)	CO (mg/m ³) (Dry Gas)	Nox (mg/m ³) (Dry Gas)	Comment
10:30:13	5.9	1250.2	698.0	261.1	
10:31:13	5.8	1249.1	701.8	540.7	
10:32:13	5.9	1162.6	677.0	456.3	
10:33:13	5.8	1217.1	700.5	502.1	
10:34:13	5.9	1130.6	688.0	487.0	
10:35:13	5.9	1217.1	661.8	431.7	
10:36:13	6.0	1228.5	644.0	347.2	
10:37:13	6.1	1259.4	635.8	316.6	
10:38:13	6.1	1222.6	638.3	310.8	
10:39:13	6.0	1270.0	636.8	314.0	
10:40:13	6.1	1455.8	614.3	267.9	
10:41:13	6.1	1291.7	613.0	283.6	
10:42:13	6.1	1207.8	623.0	255.8	
10:43:13	6.2	1333.1	605.8	229.9	
10:44:13	6.2	1307.3	599.3	206.5	
10:45:13	6.2	1265.3	598.0	203.5	
10:46:13	5.8	1283.9	670.8	405.5	
10:47:13	5.9	1284.4	651.8	351.6	
10:48:13	5.9	1294.4	646.8	332.3	
10:49:13	5.9	1241.5	653.3	359.4	
10:50:13	6.0	1260.8	633.0	295.2	
10:51:13	5.9	1189.4	630.3	268.5	
10:52:13	5.7	1145.4	680.5	417.0	
10:53:13	5.9	1220.8	638.0	323.4	
10:54:13	6.0	1294.1	623.0	266.1	
10:55:13	6.1	1320.8	598.0	207.9	
10:56:13	6.2	1333.1	605.8	229.9	
10:57:13	6.2	1307.3	599.3	206.5	
10:58:13	6.2	1265.3	598.0	203.5	
10:59:13	5.8	1283.9	670.8	405.5	
11:00:13	5.9	1284.4	651.8	351.6	
11:01:13	5.9	1294.4	646.8	332.3	
11:02:13	5.9	1241.5	653.3	359.4	
11:03:13	6.0	1294.1	623.0	266.1	
11:04:13	6.1	1320.8	598.0	207.9	
11:05:13	6.2	1333.1	605.8	229.9	
11:06:13	6.2	1307.3	599.3	206.5	
11:07:13	6.1	1279.9	577.8	161.6	
11:08:13	6.0	1392.6	584.0	186.3	
11:09:13	6.1	1298.1	581.5	141.8	
11:10:13	5.9	1401.4	585.5	228.9	
11:11:13	6.1	1435.7	564.0	141.2	
11:12:13	5.5	1163.9	670.0	263.4	
11:13:13	5.9	1355.9	590.5	192.0	

Time	Oxygen (%) (Dry Gas)	VOC (mgC/m ³) (Wet Gas)	CO (mg/m ³) (Dry Gas)	Nox (mg/m ³) (Dry Gas)	Comment
11:14:13	6.0	1435.7	570.5	151.8	
11:15:13	6.1	1245.7	569.0	115.5	
11:16:13	5.7	1245.7	609.5	266.1	
11:17:13	5.6	1378.1	615.8	298.6	
11:18:13	5.9	1458.5	570.5	181.2	
11:19:13	6.0	1039.2	563.0	138.9	
11:20:13	4.8	1076.9	768.3	799.6	
11:21:13	5.1	1159.7	701.8	590.6	
11:22:13	5.2	1123.4	690.3	512.1	
11:23:13	5.2	1154.6	672.8	456.1	
11:24:13	5.3	1173.9	664.0	411.6	
11:25:13	5.4	1192.5	638.3	386.7	
11:26:13	5.5	1259.4	645.8	340.4	
11:27:13	5.5	1271.1	634.3	333.2	
11:28:13	4.8	1225.1	778.5	859.0	
11:29:13	5.3	1285.9	684.3	455.6	
11:30:13	5.4	1279.6	653.0	373.1	

Table 2 – Flare, Raw Data

Time	Oxygen (%) (Dry Gas)	VOC (mgC/m ³) (Wet Gas)	CO (mg/m ³) (Dry Gas)	Nox (mg/m ³) (Dry Gas)	Comment
11:00:55	12.6	1.8	4.8	41.0	
11:01:55	12.7	2.0	3.7	38.2	
11:02:55	13.0	1.9	3.2	35.4	
11:03:55	13.1	2.1	2.8	34.3	
11:04:55	13.3	2.2	2.7	33.4	
11:05:55	13.2	2.2	2.2	33.2	
11:06:55	13.2	2.5	2.2	32.7	
11:07:55	12.9	2.6	1.8	33.9	
11:08:55	12.9	2.7	1.6	34.2	
11:09:55	13.0	2.7	1.6	33.2	
11:10:55	13.1	2.7	1.6	32.8	
11:11:55	13.0	2.7	1.6	33.5	
11:12:55	13.0	2.7	1.5	33.3	
11:13:55	12.9	2.7	1.3	33.2	
11:14:55	13.0	2.6	1.4	32.6	
11:15:55	13.0	2.7	1.5	32.1	
11:16:55	12.9	2.8	1.2	31.6	
11:17:55	13.0	2.7	1.4	31.0	
11:18:55	13.0	2.7	1.3	30.3	
11:19:55	13.1	2.7	1.6	29.7	
11:20:55	13.2	2.6	1.8	29.3	
11:21:55	13.3	2.8	1.9	28.4	
11:22:55	13.3	2.9	1.7	28.1	

Time	Oxygen (%) (Dry Gas)	VOC (mgC/m ³) (Wet Gas)	CO (mg/m ³) (Dry Gas)	Nox (mg/m ³) (Dry Gas)	Comment
11:23:55	13.3	2.8	2.0	27.7	
11:24:55	13.3	2.8	1.7	27.4	
11:25:55	13.4	2.7	2.2	26.7	
11:26:55	13.5	2.7	2.3	26.4	
11:27:55	13.4	2.7	1.9	26.4	
11:28:55	13.5	2.8	2.1	26.0	
11:29:55	13.5	2.8	2.1	25.6	
11:30:55	13.6	2.9	2.4	25.3	
11:31:55	13.5	2.8	2.1	24.8	
11:32:55	13.6	2.9	2.2	24.5	
11:33:55	13.7	2.9	2.7	24.1	
11:34:55	13.6	2.9	2.6	23.9	
11:35:55	13.6	2.8	2.6	23.7	
11:36:55	13.7	2.9	2.7	23.4	
11:37:55	13.7	2.7	3.1	23.4	
11:38:55	13.8	2.7	3.0	22.7	
11:39:55	13.8	2.8	3.0	22.7	
11:40:55	13.8	2.8	3.2	22.6	
11:41:55	13.8	2.8	3.2	22.4	
11:42:55	13.8	2.9	3.6	22.1	
11:43:55	13.8	2.8	3.3	21.9	
11:44:55	13.8	2.8	3.4	21.7	
11:45:55	13.9	2.9	3.8	21.4	
11:46:55	13.9	2.8	3.7	21.0	
11:47:55	14.0	2.8	3.8	21.0	
11:48:55	13.9	2.9	3.7	20.7	
11:49:55	14.0	2.9	4.0	20.4	
11:50:55	14.0	2.8	4.2	20.3	
11:51:55	14.0	2.9	4.0	20.0	
11:52:55	14.0	2.8	4.2	19.8	
11:53:55	14.1	2.7	4.3	19.8	
11:54:55	14.1	2.8	4.2	19.8	
11:55:55	14.1	2.8	4.5	19.3	
11:56:55	14.1	2.8	4.3	19.4	
11:57:55	14.1	2.8	4.6	18.9	
11:58:55	14.2	2.8	4.5	18.8	
11:59:55	14.1	2.9	4.6	18.7	
12:00:55	14.2	3.0	5.1	18.4	

Table 3 – Engine, Analyser Calibration Data

ANALYSER CALIBRATION DATA (Engine)					
Pre Sampling Check					
		NO (ppm)	CO (ppm)	O2 (%)	VOC's (ppm)
Range		500	2000	25	1000
Zero Gas	Cylinder No.	GU93FNZ			AIR
Span Gas	Cylinder No.	GU93DEQ		DW75BEU	
	Certified Value	256.7	1276	7.87	614
Zero Check	Value	0.2	0	0.02	7
<2 x repeatability (Yes/No)		YES	YES	YES	YES
Down Line Zero & Span Check					
Zero Gas	Value	0.2	-2	0.11	-3
	<2% of span	YES	YES	YES	YES
Span Gas	Value	257.8	1278	7.85	609
	Within 2% of span	YES	YES	YES	YES
Post Sampling Drift Check					
Zero Gas	Value	1.8	2	0.11	3
	Drift (%)	0.6	0.3	0.0	1.0
	Validation	No Correction Required	No Correction Required	No Correction Required	No Correction Required
Span Gas	Value	254.4	1277	7.76	609
	Drift (%)	1.3	0.1	1.1	0.0
	Validation	No Correction Required	No Correction Required	No Correction Required	No Correction Required

Table 4 – Flare, Analyser Calibration Data

ANALYSER CALIBRATION DATA (Flare)					
Pre Sampling Check					
		NO (ppm)	CO (ppm)	O2 (%)	VOC's (ppm)
Range		250	200	25	10
Zero Gas	Cylinder No.	D909084			AIR
Span Gas	Cylinder No.	EU66HUH		7700651	
	Certified Value	101.5	149.5	8.01	7.94
Zero Check	Value	0.3	0.1	0.02	0.02
<2 x repeatability (Yes/No)		YES	YES	YES	YES
Down Line Zero & Span Check					
Zero Gas	Value	0	-0.5	0.1	-0.12
	<2% of span	YES	YES	YES	YES
Span Gas	Value	102.1	150.2	7.94	7.92
	Within 2% of span	YES	YES	YES	YES
Post Sampling Drift Check					
Zero Gas	Value	0	-0.3	0.11	-0.01
	Drift (%)	0.0	0.1	0.1	1.4
	Validation	No Correction Required	No Correction Required	No Correction Required	No Correction Required
Span Gas	Value	101.8	149.6	7.98	8.01
	Drift (%)	0.3	0.4	0.5	1.1
	Validation	No Correction Required	No Correction Required	No Correction Required	No Correction Required

2.3 Appendix III: Uncertainty Calculation

2.3.1 Engine, Uncertainties

NOx - Measurement performance related to stationary conditions				
Performance characteristic			Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero			U _{r0}	0.80
Standard deviation of repeatability at span level			U _{rs}	0.10
Lack of fit			U _{fit}	2.37
Drift			U _{odr}	7.76
volume or pressure flow dependence			U _{spres}	0.06
atmosphseric pressure dependence			U _{apres}	1.78
ambient temperature dependence			U _{temp}	0.40
NH3 (20 mg/m3)			U _{interf}	0.14
CO2 (15%)			-	0.02
H2O (30%)			-	0.01
Error in logger voltage			-	0.50
Dependence on voltage			U _{vdt}	0.03
Converter efficiency			U _{ceff}	1.47
losses in the line (leak)			U _{leak}	3.68
Uncertainty of calibration gas			U _{calib}	3.68
NOx Measurement uncertainty		Result	318.58	mg/m ³
Combined uncertainty			9.93	mg/m ³
Expanded uncertainty	k = 2		19.86	mg/m ³
Uncertainty corrected to std conds			19.86	mg.m-3 (corrected)
Expanded uncertainty	expressed with a level of confidence of 95%		3.06 % ELV	
Expanded uncertainty	expressed with a level of confidence of 95%		19.86 mg.m ⁻³ of result	

CO - Measurement performance related to stationary conditions				
Performance characteristic			Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero			U _{r0}	0.80
Standard deviation of repeatability at span level			U _{rs}	0.10
Lack of fit			U _{fit}	5.77
Drift			U _{odr}	18.10
volume or pressure flow dependence			U _{spres}	0.00
atmosphseric pressure dependence			U _{apres}	3.46
ambient temperature dependence			U _{temp}	0.00
CO2 (15%)			U _{interf}	0.00
N2O (40mgm3)			-	0.00
CH4 (57mgm3)			-	0.00
H2O (1%)			-	0.00
Dependence on voltage			U _{volt}	0.03
Error in Logger reading			-	2.00
losses in the line (leak)			U _{leak}	7.34
Uncertainty of calibration gas			U _{calib}	7.34
CO Measurement uncertainty			Result	635.27
Combined uncertainty				22.01
Expanded uncertainty			k = 2	44.03
Uncertainty corrected to std conds				44.03
Expanded uncertainty			expressed with a level of confidence of 95%	2.94 % ELV
Expanded uncertainty			expressed with a level of confidence of 95%	44.03 mg.m ⁻³ of result

VOC - Measurement performance related to stationary conditions				
Performance characteristic			Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero			U _{r0}	0.80
Standard deviation of repeatability at span level			U _{rs}	0.10
Lack of fit			U _{fit}	3.74
Drift			U _{odr}	16.67
volume or pressure flow dependence			U _{spres}	0.00
atmosphseric pressure dependence			U _{apres}	2.24
ambient temperature dependence			U _{temp}	0.00
NH3 (20 mg/m3)			U _{interf}	0.00
CO2 (15%)			-	0.00
H2O (30%)			-	0.00
Error on Logger voltage			-	1.00
Dependence on voltage			U _{vdt}	0.03
losses in the line (leak)			U _{leak}	14.63
Uncertainty of calibration gas			U _{calib}	14.63
VOC Measurement uncertainty		Result	1266.84	mg/m ³
Combined uncertainty			26.94	mg/m ³
Expanded uncertainty	k = 2		53.88	mg/m ³
Uncertainty corrected to std conds			53.88	mg.m-3 (corrected)
Expanded uncertainty	expressed with a level of confidence of 95%		3.08 % ELV	
Expanded uncertainty	expressed with a level of confidence of 95%		53.88 mg.m ⁻³ of result	

Oxygen - Measurement performance related to stationary conditions				
Performance characteristic		Uncertainty	Value of uncertainty quantity	
Standard deviation of repeatability at zero		U _{r0}	0.20	
Standard deviation of repeatability at span level		U _{rs}	0.03	
Lack of fit		U _{fit}	0.07	
Drift		U _{odr}	0.10	
volume or pressure flow dependence		U _{spres}	0.00	
atmopsheric pressure dependence		U _{apres}	0.02	
ambient temperature dependence		U _{temp}	0.06	
CO2 (15%)		-	0.00	
NO(300)		-	0.06	
NO2(30)		-	0.00	
dependence on voltage		U _{volt}	0.02	
losses in the line (leak)		U _{leak}	0.07	
Error in Logger voltage		-	0.03	
Uncertainty of calibration gas		U _{calib}	0.07	
O2 Measurement uncertainty		Result	5.85	%vol
Combined uncertainty			0.18	%vol
% of value			3.13	%
Expanded uncertainty		expressed with a level of confidence of 95%	6.26 % of value	
Expanded uncertainty		expressed with a level of confidence of 95%	0.37 % vol	

2.3.2 Flare, Uncertainties

NOx - Measurement performance related to stationary conditions				
Performance characteristic			Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero			U _{r0}	0.80
Standard deviation of repeatability at span level			U _{rs}	0.10
Lack of fit			U _{rlt}	1.18
Drift			U _{odr}	3.11
volume or pressure flow dependence			U _{spres}	0.03
atmosphseric pressure dependence			U _{apres}	0.30
ambient temperature dependence			U _{temp}	0.12
NH3 (20 mg/m3)			U _{interf}	0.14
CO2 (15%)			-	0.02
H2O (30%)			-	0.01
Error in logger voltage			-	0.25
Dependence on voltage			U _{volt}	0.03
Converter efficiency			U _{ceff}	0.12
losses in the line (leak)			U _{leak}	0.30
Uncertainty of calibration gas			U _{calib}	0.30
NOx Measurement uncertainty		Result	26.28	mg/m ³
Combined uncertainty			3.39	mg/m ³
Expanded uncertainty	k = 2		6.78	mg/m ³
Uncertainty corrected to std conds			6.78	mg.m-3 (corrected)
Expanded uncertainty		expressed with a level of confidence of 95%	4.52 % ELV	
Expanded uncertainty		expressed with a level of confidence of 95%	6.78 mg.m ⁻³ of result	

CO - Measurement performance related to stationary conditions				
Performance characteristic		Uncertainty	Value of uncertainty quantity	
Standard deviation of repeatability at zero		U_{r0}	0.80	
Standard deviation of repeatability at span level		U_{rs}	0.10	
Lack of fit		U_{rlt}	0.58	
Drift		U_{odr}	1.17	
volume or pressure flow dependence		U_{spres}	0.00	
atmospheric pressure dependence		U_{apres}	0.12	
ambient temperature dependence		U_{temp}	0.00	
CO2 (15%)		U_{interf}	0.00	
N2O (40mgm3)		-	0.00	
CH4 (57mgm3)		-	0.00	
H2O (1%)		-	0.00	
Dependence on voltage		U_{volt}	0.03	
Error in Logger reading		-	0.20	
losses in the line (leak)		U_{leak}	0.03	
Uncertainty of calibration gas		U_{calib}	0.03	
CO Measurement uncertainty		Result	2.81	mg/m ³
Combined uncertainty			1.33	mg/m ³
Expanded uncertainty		k = 2	2.66	mg/m ³
Uncertainty corrected to std conds			2.66	mg.m-3 (corrected)
Expanded uncertainty		expressed with a level of confidence of 95%	5.32 % ELV	
Expanded uncertainty		expressed with a level of confidence of 95%	2.66 mg.m ⁻³ of result	

VOC - Measurement performance related to stationary conditions				
Performance characteristic			Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero			U _{r0}	0.80
Standard deviation of repeatability at span level			U _{rs}	0.10
Lack of fit			U _{fit}	0.04
Drift			U _{odr}	0.11
volume or pressure flow dependence			U _{spres}	0.00
atmospheric pressure dependence			U _{apres}	0.01
ambient temperature dependence			U _{temp}	0.00
NH3 (20 mg/m3)			U _{interf}	0.00
CO2 (15%)			-	0.00
H2O (30%)			-	0.00
Error on Logger voltage			-	0.01
Dependence on voltage			U _{vdt}	0.03
losses in the line (leak)			U _{leak}	0.03
Uncertainty of calibration gas			U _{calib}	0.03
VOC Measurement uncertainty		Result	2.72	mg/m ³
Combined uncertainty			0.16	mg/m ³
Expanded uncertainty	k = 2		0.33	mg/m ³
Uncertainty corrected to std conds			0.33	mg.m-3 (corrected)
Expanded uncertainty	expressed with a level of confidence of 95%		3.29 % ELV	
Expanded uncertainty	expressed with a level of confidence of 95%		0.33 mg.m ⁻³ of result	

Oxygen - Measurement performance related to stationary conditions				
Performance characteristic		Uncertainty	Value of uncertainty quantity	
Standard deviation of repeatability at zero		U_{r0}	0.20	
Standard deviation of repeatability at span level		U_{rs}	0.03	
Lack of fit		U_{fit}	0.16	
Drift		U_{odr}	0.16	
volume or pressure flow dependence		U_{spres}	0.00	
atmospheric pressure dependence		U_{apres}	0.01	
ambient temperature dependence		U_{temp}	0.02	
CO2 (15%)		-	0.00	
NO(300)		-	0.06	
NO2(30)		-	0.00	
dependence on voltage		U_{volt}	0.02	
losses in the line (leak)		U_{leak}	0.16	
Error in Logger voltage		-	0.03	
Uncertainty of calibration gas		U_{calib}	0.16	
O2 Measurement uncertainty		Result	13.50	%vol
Combined uncertainty			0.32	%vol
% of value			2.38	%
Expanded uncertainty	expressed with a level of confidence of 95%	4.75 % of value		
Expanded uncertainty	expressed with a level of confidence of 95%	0.64 % vol		

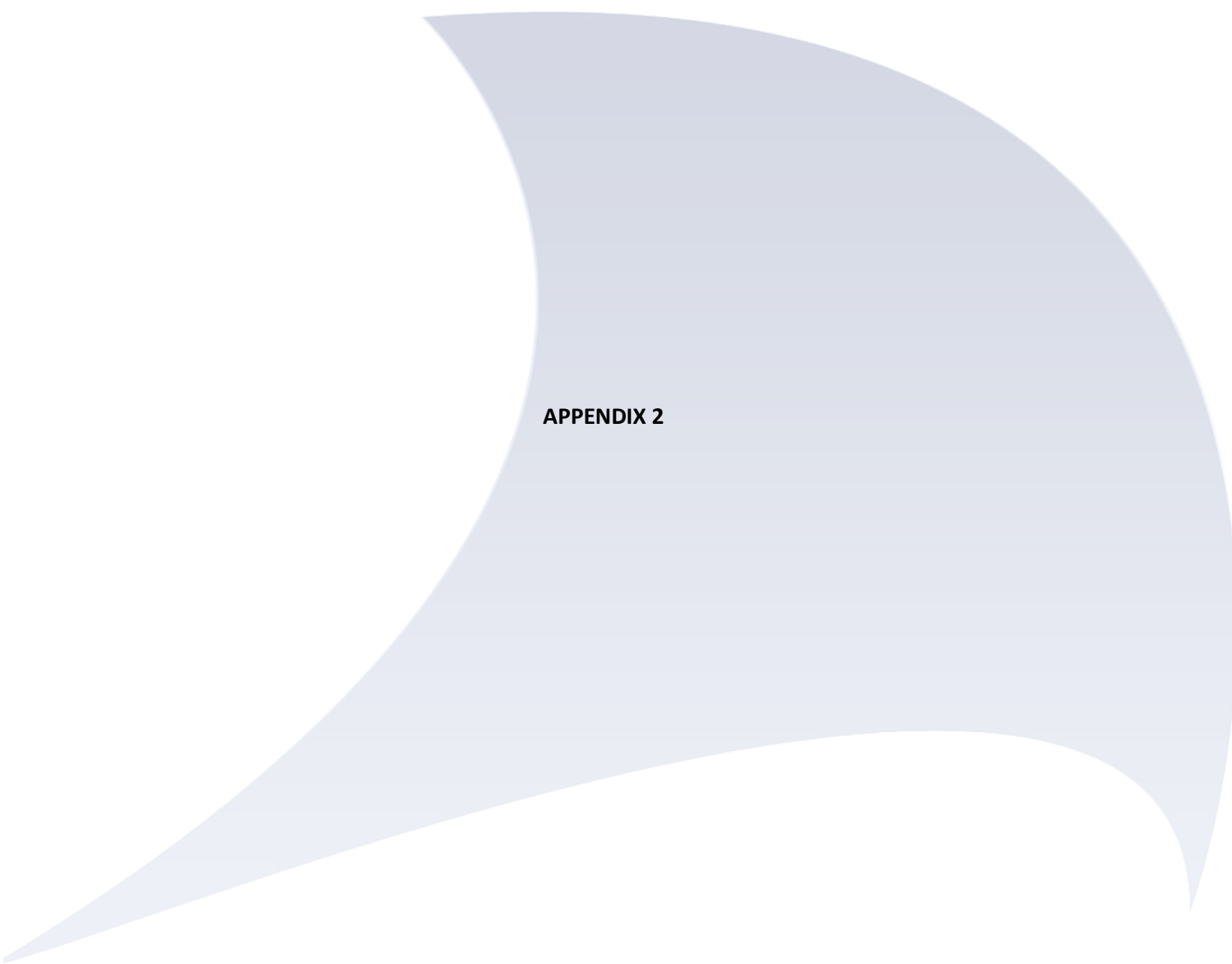
2.4 Appendix IV: Moisture Calculations

2.4.1 Engine, Moisture

Test No	T1		Site	Flintshire CC		
Date	29-4-16			Standard LFS		
pbar (mbar)	984		Stack	Engine		
pbar (mmHg)	738		Job Number:	R16220		
Nozzle Diameter (mm)	n/a		Site Team:	YS + DG		
Temp of Meter (in)/(out) deg. C	9		Data Entered By:	Yu Shen		
ΔH_{ave} (mmH ₂ O)	10.0					
DGM Cal Factor (Y)	1.0256					
			Enter Data into coloured cells only			
Start Volume Reading	716.9052	m ³	Start time	10:30	hr:min	
End Volume Reading	717.4720	m ³	End time	11:30	hr:min	
Volume Sampled	0.5813	m ³	Total time	01:00	hr:min	
IMPINGER	1	2	3	4	Initials of Analyst	
Absorber Solution (Type):	H2O	H2O	KO IMP	SILICA		
Sample No:	n/a	n/a	n/a	n/a		
Analysis Required:	n/a	n/a	n/a	n/a		
Initial Weight of Impingers plus absorber (g)	771.2	779.4	641.3	850.4	YS	
Final Weight of Impingers plus absorber (g)	811.2	780.1	641.2	857.7	DG	
Weight Gain (g)	40.0	0.7	-0.1	7.3		
Total Weight Gain (1+2+3+4) (g)	47.9					
Gas Volume of water at 0 °C (l)	59.64					
Gas Meter volume at 0 °C (l)	547.52					
Moisture content of Gases (%)	9.8					

2.4.2 Flare, Moisture

Test No	T2		Site	Flintshire CC		
Date	9-5-16			Standard LFS		
pbar (mbar)	990		Stack	Flare		
pbar (mmHg)	743		Job Number:	R16220		
Nozzle Diameter (mm)	n/a		Site Team:	DL + DK		
Temp of Meter (in)/(out) deg. C	21		Data Entered By:	Yu Shen		
ΔH_{ave} (mmH ₂ O)	10.0		Enter Data into coloured cells only			
DGM Cal Factor (Y)	0.9706					
Start Volume Reading	0.0000	m ³	Start time	11:00	hr:min	
End Volume Reading	0.4987	m ³	End time	12:00	hr:min	
Volume Sampled	0.4840	m ³	Total time	01:00	hr:min	
IMPINGER	1	2	3	4	Initials of Analyst	
Absorber Solution (Type):	H2O	H2O	KO IMP	SILICA		
Sample No:	n/a	n/a	n/a	n/a		
Analysis Required:	n/a	n/a	n/a	n/a		
Initial Weight of Impingers plus absorber (g)	736.5	771.0	659.4	801.3	DK	
Final Weight of Impingers plus absorber (g)	765.4	774.0	659.6	804.4	DK	
Weight Gain (g)	28.9	3.0	0.2	3.1		
Total Weight Gain (1+2+3+4) (g)	35.2					
Gas Volume of water at 0 °C (l)	43.82					
Gas Meter volume at 0 °C (l)	439.69					
Moisture content of Gases (%)	9.1					



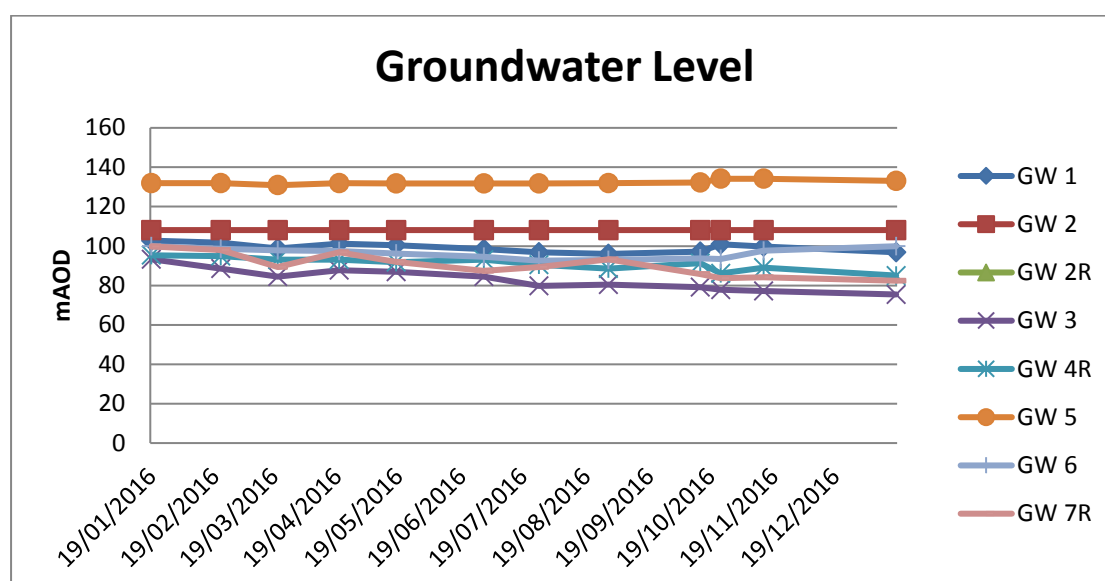
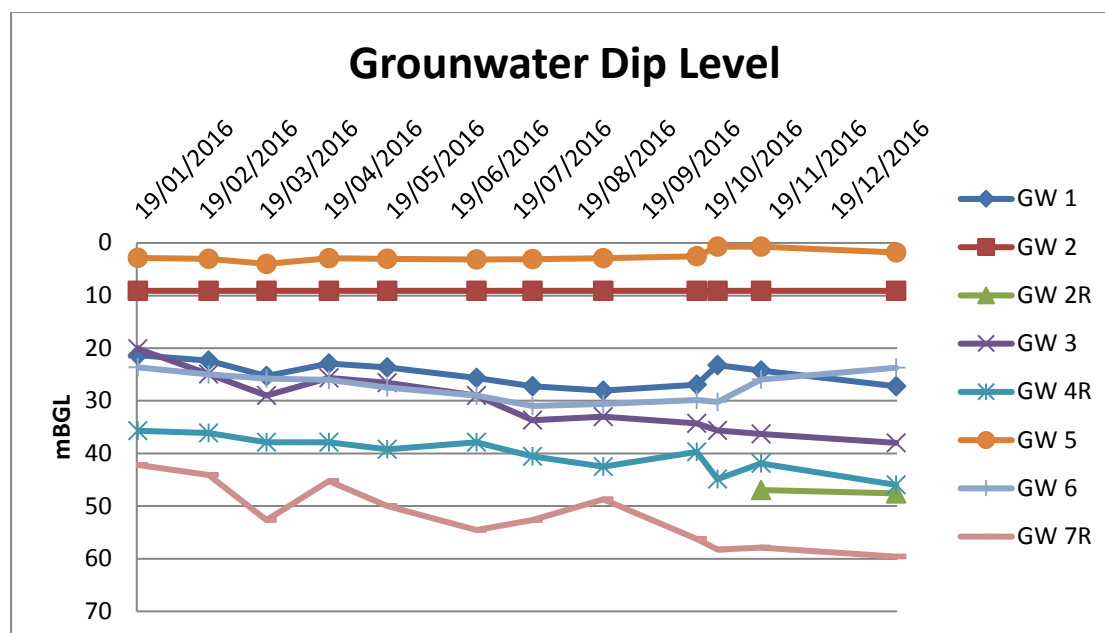
APPENDIX 2

APPENDIX 2 - GROUNDWATER

Table 1: Groundwater Levels

Location	Data	Dip Level (mBGL)	GW Level (mAOD)
GW 1	Minimum	21.32	96.02
	Maximum	28.06	102.76
	Average	24.84	99.24
GW 2	Minimum	9.10	108.11
	Maximum	9.10	108.11
	Average	9.10	108.11
GW 2R	Minimum	46.95	-
	Maximum	47.58	-
	Average	47.27	-
GW 3	Minimum	20.11	75.43
	Maximum	37.99	93.31
	Average	30.50	82.92
GW 4R	Minimum	35.69	85.03
	Maximum	45.97	95.31
	Average	40.02	90.98
GW 5	Minimum	0.71	130.88
	Maximum	3.98	134.15
	Average	2.55	132.31
GW 6	Minimum	23.63	92.59
	Maximum	30.98	99.94
	Average	27.34	96.23
GW 7R	Minimum	42.18	82.40
	Maximum	59.60	99.82
	Average	51.83	90.17

APPENDIX 2 - GROUNDWATER



APPENDIX 2 - GROUNDWATER**Table 2 – Quarterly monitoring data, Q1**

Parameter	Units	GW1	GW3	GW4R	GW5	GW6
Carbon						
Organic Carbon, Total	mg/l	<3	3.26	8.48	24.7	32.4
Inorganics						
Alkalinity, Bicarbonate as CaCO ₃	mg/l	101	256	247	378	23.2
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	1.25	<0.3	6.72	52.6
BOD, unfiltered	mg/l	2.35	<1	<1	<2.5	<1
Chloride	mg/l	48.1	51.9	24.8	18.2	159
Chlorine, Total (Residual)	mg/l	5	0.04	0.04	27	0.07
COD, unfiltered	mg/l	422	23.9	29.5	143	136
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as NO ₃	mg/l	3.33	1.02	4.52	<0.3	295
Nitrite as NO ₂	mg/l	<0.25	<0.05	<0.05	0.147	0.335
pH	pH	6.19	6.86	6.84	6.77	5.62
Sulphate	mg/l	199	193	238	33.5	320
Total Oxidised Nitrogen as N	mg/l	0.772	0.235	1.03	<0.1	66.8
Filtered (Dissolved) Metals						
Arsenic (diss.filt)	mg/l	<0.00012	<0.00012	0.000399	0.0133	0.000787
Cadmium (diss.filt)	mg/l	<0.0001	<0.0001	0.000141	<0.0001	0.00207
Calcium (diss.filt)	mg/l	50	76.4	118	83.2	55.7
Copper (diss.filt)	mg/l	<0.00085	<0.00085	0.00296	<0.00085	0.00372
Iron (diss.filt)	mg/l	<0.019	<0.019	<0.019	<0.019	0.028
Lead (diss.filt)	mg/l	<0.00002	<0.00002	<0.00002	0.000106	0.000543
Magnesium (diss.filt)	mg/l	24.3	32.4	33.2	11	28.4
Mercury (diss.filt)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Nickel (diss.filt)	mg/l	0.00112	0.00158	0.00575	0.00295	0.0823
Potassium (diss.filt)	mg/l	9.76	10.9	11	8.67	39.2
Sodium (diss.filt)	mg/l	27	55.2	22.2	24.6	150
Zinc (diss.filt)	mg/l	0.0168	0.00703	0.0182	0.035	0.108
Phenols						
Cresols	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006
Phenol	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002
Phenols, Total Detected monohydric	mg/l	<0.016	<0.016	<0.016	<0.016	<0.016
Xylenols	mg/l	<0.008	<0.008	<0.008	<0.008	<0.008

APPENDIX 2 - GROUNDWATER**Table 3 - Quarterly monitoring data, Q2**

Parameter	Units	GW1	GW3	GW4R	GW5	GW6
Inorganics						
Alkalinity, Total as CaCO ₃	mg/l	70	270	162	650	55
Ammoniacal Nitrogen as N	mg/l	<0.2	0.982	0.432	6.02	35.7
BOD, unfiltered	mg/l	<2.5	2.26	3.85	48.9	<1
COD, unfiltered	mg/l	114	26.5	62.6	3980	124
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as NO ₃	mg/l	5.32	4.4	0.926	26	300
Nitrite as NO ₂	mg/l	<0.04	0.268	<0.04	4.22	0.744
pH	pH	6.09	7.08	6.2	6.57	5.78
Total Oxidised Nitrogen as N	mg/l	1.21	1.07	0.214	7.15	68
Filtered (Dissolved) Metals						
Arsenic (diss.filt)	mg/l	0.000304	0.000314	0.000313	0.00159	0.00281
Cadmium (diss.filt)	mg/l	<0.0001	<0.0001	0.0002	<0.0001	0.00291
Copper (diss.filt)	mg/l	<0.00085	0.000886	0.00213	<0.00085	0.00502
Iron (diss.filt)	mg/l	<0.019	0.0717	0.0536	13.4	0.0307
Lead (diss.filt)	mg/l	0.000136	0.000247	0.00009	0.000126	0.000546
Magnesium (diss.filt)	mg/l	25.8	30.8	24.1	10.2	32.2
Mercury (diss.filt)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Nickel (diss.filt)	mg/l	0.00209	0.00271	0.0685	0.00415	0.105
Potassium (diss.filt)	mg/l	9.42	11	7.7	8.7	38.1
Sodium (diss.filt)	mg/l	25.7	50.3	32.5	15.3	172
Zinc (diss.filt)	mg/l	0.0145	0.00941	0.0816	0.00333	0.128
Phenols						
Phenols, Total Detected 5 speciated	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025

Parameter	Units	GW1	GW3	GW4R	GW5	GW6
Combined Pesticides / Herbicides						
Aldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
alpha-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Atrazine	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
Azinphos-ethyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Azinphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
beta-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Carbophenothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorfenvinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorothalonil	mg/l	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Chlorpyrifos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorpyrifos methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
cis-Chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Diazinon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dichlorvos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 2 - GROUNDWATER

Parameter	Units	GW1	GW3	GW4R	GW5	GW6
Combined Pesticides / Herbicides						
Dieldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dimethoate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Disulfoton	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan sulphate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Ethion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Etrimphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenitrothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenthion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
gamma-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor epoxide	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Hexachlorobenzene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Isodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Malathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Methyl parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Mevinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pendimethalin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Phosalone	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pirimiphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Propetamphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Quintozone (PCNB)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Simazine	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
Tecnazene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Telodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trans-chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triadimefon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triallate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triazophos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trifluralin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 2 - GROUNDWATER

Table 4 - Quarterly monitoring data, Q3

Parameter	Units	GW1	GW3	GW4R	GW5	GW6	GW7
Inorganics							
Alkalinity, Total as CaCO ₃	mg/l	47.5	190	205	513	44.5	315
Ammoniacal Nitrogen as N	mg/l	<0.2	1.16	<2	7.22	26.4	1.13
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	1.49	<3	9.28	33.9	1.45
BOD, unfiltered	mg/l	<1.5	<1.88	19.5	9.2	<1	<1
Chloride	mg/l	52.2	39.2	82.5	11.2	243	51.7
Chlorine, Total (Residual)	mg/l	0.02	0.07	0.02	4.4	0.08	0.05
COD, unfiltered	mg/l	172	32.9	376	1340	82.4	13.3
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as NO ₃	mg/l	3.42	1.61	<0.3	<0.3	282	<0.3
Nitrite as NO ₂	mg/l	<0.05	<0.05	0.116	<0.05	0.106	<0.05
pH	pH	6.08	6.76	6.05	6.54	5.49	6.99
Sulphate	mg/l	214	170	207	53.4	354	140
Total Oxidised Nitrogen as NO ₃	mg/l	3.42	1.63	<0.3	<0.3	282	<0.3
Filtered (Dissolved) Metals							
Iron (diss.filt)	mg/l	0.0324	<0.019	<0.019	21.3	0.0438	0.672
Magnesium (diss.filt)	mg/l	25.9	32.6	24.6	15	40	33.4
Potassium (diss.filt)	mg/l	10.6	12.7	10.1	18.8	32.3	14.5
Sodium (diss.filt)	mg/l	30.2	23.9	43.9	36.2	181	71.4
Unfiltered (Total) Metals							
Arsenic (tot.unfilt)	mg/l	0.00312	<0.002	0.023	1.17	0.00533	0.0929
Cadmium (tot.unfilt)	mg/l	<0.0005	<0.0005	0.00556	0.00416	0.0042	0.00354
Calcium (tot.unfilt)	mg/l	58.5	84	108	225	93	76.8
Copper (tot.unfilt)	mg/l	0.00468	<0.004	0.0586	0.181	0.0191	0.0468
Lead (tot.unfilt)	mg/l	0.00237	<0.0005	0.178	0.45	0.022	0.0378
Mercury (tot.unfilt)	mg/l	0.0106	0.000027	<0.00002	0.000491	0.000024	0.000024
Nickel (tot.unfilt)	mg/l	0.00399	0.00202	0.495	0.129	0.171	0.0598
Zinc (tot.unfilt)	mg/l	0.108	0.0117	3.15	0.415	0.234	0.658
Phenols							
Phenols, Total Detected monohydric	mg/l	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016

APPENDIX 2 - GROUNDWATER

Table 5 – Annual monitoring data, Q4 (detected substances highlighted)

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Carbon								
Organic Carbon, Total	mg/l	3.35	5.59	4.69	3.9	3.52	15.2	<3
Inorganics								
Alkalinity, Total as CaCO ₃	mg/l	50	115	115	100	140	24	325
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	0.487	<0.3	<0.3	2.71	51	1.5
BOD, unfiltered	mg/l	<1	<1.25	<1	<1	<5	2.32	<1
Chloride	mg/l	77.6	80.6	147	56.3	8.6	195	47.1
Chlorine, Total (Residual)	mg/l	0.03	<0.01	0.04	<0.01	0.18	<0.01	0.1
COD, unfiltered	mg/l	143	99.6	32	58.5	632	112	870
Cyanide, Free	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as N	mg/l	6.37	1.51	11.7	0.509	<0.0677	110	<0.0677
Nitrite as N	mg/l	<0.0152	<0.0152	<0.0152	<0.0152	<0.0152	0.438	<0.0152
pH	pH	6.17	6.31	6.37	6.56	6.57	5.33	7
Sulphate	mg/l	216	203	180	346	12.4	356	148
Total Oxidised Nitrogen as N	mg/l	6.37	1.52	11.8	0.515	<0.1	110	<0.1
Filtered (Dissolved) Metals								
Arsenic (diss.filt)	mg/l	<0.00051	<0.00051	0.000701	0.00077	0.00366	0.000943	0.0186
Cadmium (diss.filt)	mg/l	<0.00008	0.000221	<0.00008	0.000227	<0.00008	0.0029	<0.00008
Calcium (diss.filt)	mg/l	63.8	70.7	96.6	113	41.3	80.5	72.3
Copper (diss.filt)	mg/l	<0.00085	<0.00085	<0.00085	<0.00085	<0.00085	0.00377	<0.00085
Iron (diss.filt)	mg/l	0.0523	0.102	<0.019	<0.019	5.39	0.0288	2.91
Lead (diss.filt)	mg/l	<0.0001	0.000152	<0.0001	<0.0001	0.000101	0.000375	0.000313
Magnesium (diss.filt)	mg/l	27.8	31.6	33.7	38	5.54	38.6	29.9
Mercury (diss.filt)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Nickel (diss.filt)	mg/l	0.00175	0.0385	0.00799	0.0441	0.00305	0.0995	0.0192
Potassium (diss.filt)	mg/l	9.73	9.4	12	9.47	4.45	45	12.6
Sodium (diss.filt)	mg/l	29.9	36.5	61.7	34.7	5.58	226	76.3
Zinc (diss.filt)	mg/l	0.0194	0.0295	0.0174	0.0591	0.00877	0.121	0.00975
Phenols								
2,3,5-Trimethylphenol	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
2-Isopropylphenol	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Cresols	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Phenol	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Phenols, Total Detected 5 speciated	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Xylenols	mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

APPENDIX 2 - GROUNDWATER

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Mineral Oil / Oils & Greases								
Mineral oil >C10 C40 (aq)	mg/l	<0.01	<0.01	<0.01	<0.01	0.0331	<0.01	0.0661
Semi-Volatile Organic Compounds (SVOCs)								
1,2,4-Trichlorobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichlorobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4,5-Trichlorophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4,6-Trichlorophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dichlorophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dimethylphenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dinitrotoluene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,6-Dinitrotoluene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chloronaphthalene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chlorophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Methylnaphthalene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Methylphenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Nitroaniline (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Nitrophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3-Nitroaniline (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Bromophenylphenylether (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chloro-3-methylphenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chloroaniline (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chlorophenylphenylether (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Methylphenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Nitroaniline (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Nitrophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Azobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
bis(2-Chloroethoxy)methane (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
bis(2-Chloroethyl)ether (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
bis(2-Ethylhexyl) phthalate (aq)	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Butylbenzyl phthalate (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbazole (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenzofuran (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Diethyl phthalate (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dimethyl phthalate (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorobutadiene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorocyclopentadiene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachloroethane (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Isophorone (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Dibutyl phthalate (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Dioctyl phthalate (aq)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrobenzene (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Nitroso-n-dipropylamine (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pentachlorophenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phenol (aq)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total SVOC TIC	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

APPENDIX 2 - GROUNDWATER

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Volatile Organic Compounds (VOCs)								
1,1,1,2-Tetrachloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,1-Trichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2,2-Tetrachloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trimethylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dibromo-3-chloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dibromoethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3,5-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3,5-Trimethylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,2-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chlorotoluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chlorotoluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-iso-Propyltoluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromochloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromodichloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromoform	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromomethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbon disulphide	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbontetrachloride	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,3-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibromochloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibromomethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichlorodifluoromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichloromethane	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ethylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorobutadiene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Isopropylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
m,p-Xylene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methyl tertiary butyl ether (MTBE)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
o-Xylene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Propylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
sec-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Styrene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-Amyl methyl ether (TAME)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

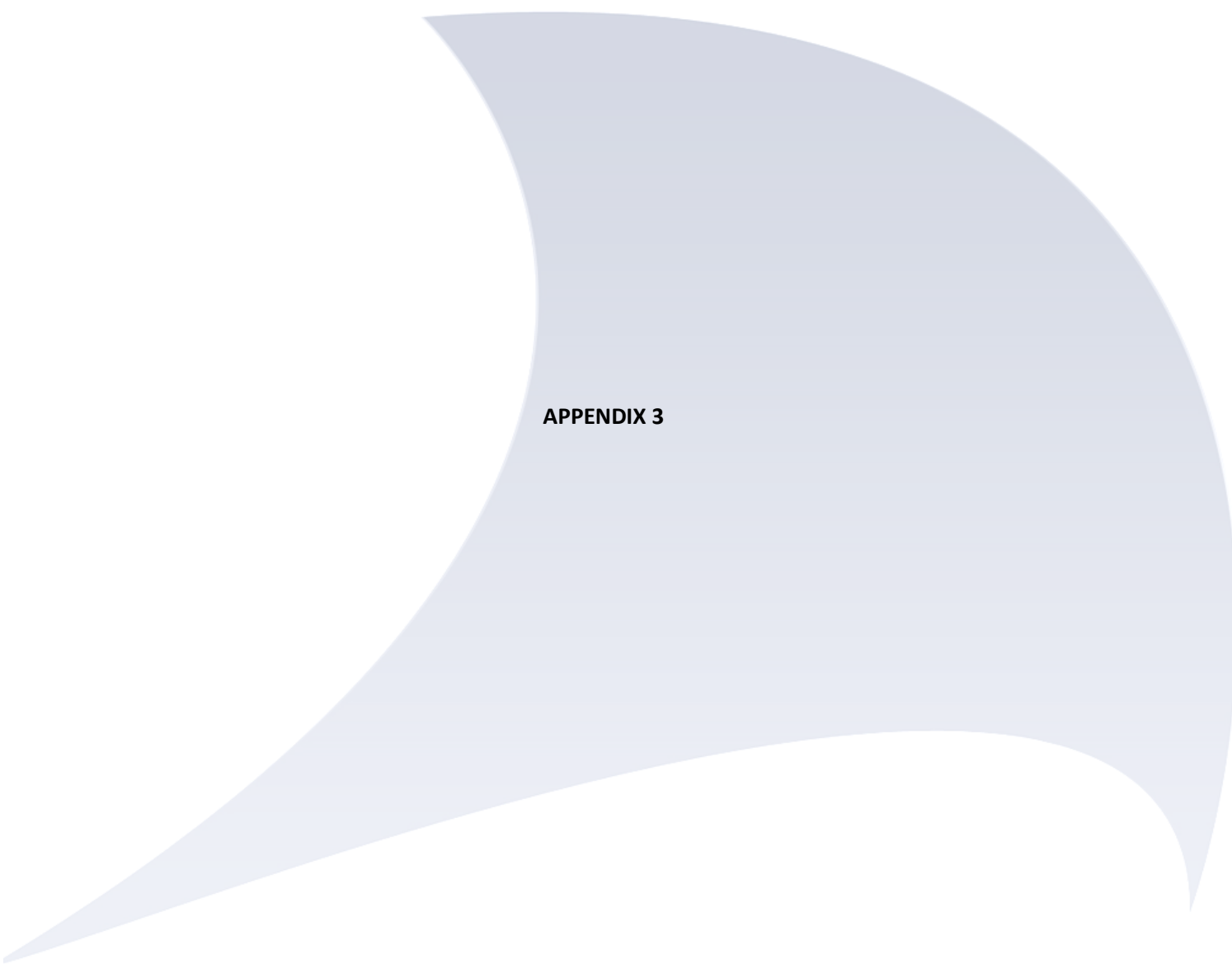
APPENDIX 2 - GROUNDWATER

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Volatile Organic Compounds (VOCs)								
tert-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetrachloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,3-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichlorofluoromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vinyl chloride	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Combined Pesticides / Herbicides								
Aldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
alpha-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Azinphos-ethyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000232	<0.00001
Azinphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
beta-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Carbophenothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorfenvinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorothalonil	mg/l	<0.00001	<0.00001	<0.00005	<0.00005	<0.00001	<0.00005	<0.00001
Chlorpyrifos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorpyrifos methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
cis-Chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Diazinon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dichlorvos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dieldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dimethoate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Disulfoton	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan sulphate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Ethion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Etrimphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenitrothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenthion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
gamma-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor epoxide	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Hexachlorobenzene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Isodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Malathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Methyl parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Mevinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 2 - GROUNDWATER

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Combined Pesticides / Herbicides								
o,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pendimethalin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Phosalone	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pirimiphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Propetamphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Quintozene (PCNB)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tecnazene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Telodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trans-chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triadimefon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triallate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triazophos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trifluralin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Miscellaneous Organics								
Dibutyl tin	mg/l	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Tetrabutyl tin	mg/l	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002
Tributyl tin	mg/l	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001
Triphenyl tin	mg/l	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001

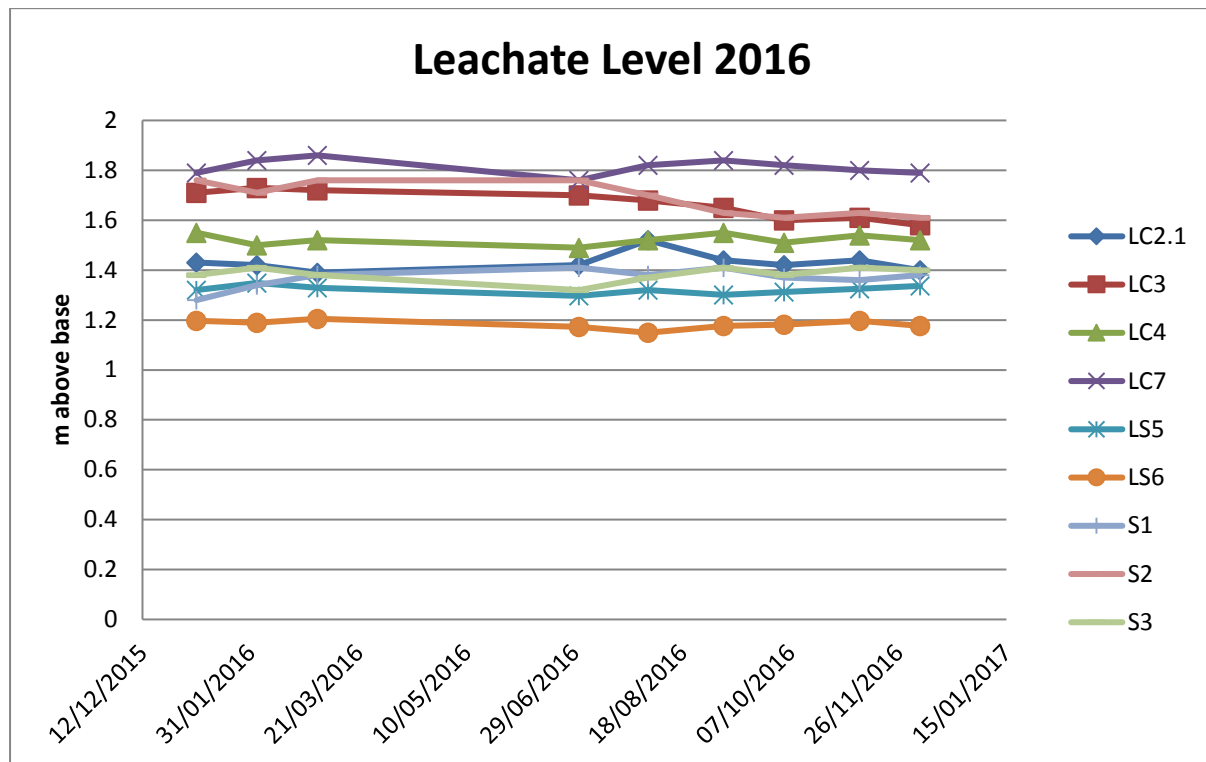


APPENDIX 3

APPENDIX 3 - LEACHATE

Table 1: Leachate Levels

Location	Leachate head (m above cell base)		
	Min	Max	Average
LC2.1	1.39	1.52	1.43
LC3	1.58	1.73	1.68
LC4	1.49	1.55	1.52
LC7	1.76	1.86	1.82
LS5	1.30	1.35	1.32
LS6	1.15	1.20	1.19
S1	1.28	1.41	1.36
S2	1.61	1.76	1.70
S3	1.32	1.41	1.39



APPENDIX 3 - LEACHATE

Table 2 –Leachate monitoring Data, Quarter 1

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Inorganics										
Alkalinity, Total as CaCO ₃	mg/l	4480	4580	3380	4480	665	3520	2780	4330	7520
Ammoniacal Nitrogen as NH ₄	mg/l	2550	1060	820	1560	37.3	88.3	176	1070	1760
BOD, unfiltered	mg/l	170	157	<15	132	6.87	9.37	>81.3	85.4	130
Chloride	mg/l	1120	1260	1140	1160	107	867	684	1130	1780
Chlorine, Total (Residual)	mg/l	0.25	0.46	0.22	0.32	0.16	0.38	40	74	0.25
COD, unfiltered	mg/l	2920	1650	855	1780	175	135	790	1240	2140
Conductivity @ 20 deg.C	mS/cm	10.5	10.8	8.51	10.7	1.83	8.38	6.48	10	15.2
pH	pH	7.83	7.87	8.51	7.86	8	7.83	7.78	7.9	7.79
Total Oxidised Nitrogen as N	mg/l	<0.2	4.11	4.58	<0.2	3.82	<0.2	0.852	<0.1	<1
Filtered (Dissolved) Metals										
Magnesium (diss.filt)	mg/l	67.5	93.4	77.2	78.9	39.7	58.4	65.1	30.6	<0.36
Potassium (diss.filt)	mg/l	448	489	392	479	44.5	338	273	200	<10
Sodium (diss.filt)	mg/l	992	1140	982	1040	108	748	614	978	2.44

Table 3 – Leachate monitoring data, Quarter 2

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Inorganics										
Alkalinity, Total as CaCO ₃	mg/l	1830	3710	4060	3200	-	-	-	-	-
Ammoniacal Nitrogen as NH ₄	mg/l	1410	496	722	421	-	-	-	-	-
BOD, unfiltered	mg/l	119	83.8	59.1	93.9	<1.5	18.2	111	95.1	101
Chloride	mg/l	1980	1140	1350	868	-	-	-	-	-
COD, unfiltered	mg/l	2270	746	902	828	-	-	-	-	-
pH	pH Units	7.97	7.76	7.75	7.68	-	-	-	-	-
Sulphate	mg/l	4.52	303	2.51	420	-	-	-	-	-
Total Oxidised Nitrogen as N	mg/l	0.231	0.938	0.212	<0.2	-	-	-	-	-
Filtered (Dissolved) Metals										
Calcium (diss.filt)	mg/l	59.8	136	102	159	-	-	-	-	-
Magnesium (diss.filt)	mg/l	91.4	102	77.4	113	-	-	-	-	-
Potassium (diss.filt)	mg/l	683	269	374	191	-	-	-	-	-
Sodium (diss.filt)	mg/l	1600	786	896	558	-	-	-	-	-

APPENDIX 3 - LEACHATE

Table 4 – Leachate monitoring data, Quarter 3

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Inorganics										
Alkalinity, Total as CaCO ₃	mg/l	7560	9440	4170	4860	2760	5060	-	5760	4900
Ammoniacal Nitrogen as N	mg/l	1520	2060	717	821	147	795	1590	1080	1080
Ammoniacal Nitrogen as NH ₄	mg/l	1950	2650	922	1060	189	1020	2040	1390	1390
BOD, unfiltered	mg/l	<50	232	<30	<50	<5	90.2	159	104	105
Chloride	mg/l	1990	2510	1150	1250	580	1440	2090	1770	1780
Chlorine, Total (Residual)	mg/l	2.5	3.5	0.4	2	1.4	0.04	3	3	2
COD, unfiltered	mg/l	2340	2630	965	1310	89.2	1310	3060	1910	1850
Conductivity @ 20 deg.C	mS/cm	16.4	20	8.86	10.5	5.74	10.9	17.1	12.4	11.3
pH	pH Units	7.88	8.12	7.84	7.9	7.57	7.8	8.11	8.11	8.28
Total Oxidised Nitrogen as N	mg/l	0.239	0.2	0.158	0.16	0.186	0.272	0.228	1.54	6.05
Total Oxidised Nitrogen as NO ₃	mg/l	1.06	0.883	0.699	0.71	0.822	1.2	1.01	6.8	26.8
Filtered (Dissolved) Metals										
Magnesium (diss.filt)	mg/l	48.2	13.3	87.6	-	52	98.7	73.5	81.3	84.3
Potassium (diss.filt)	mg/l	715	955	370	-	187	524	854	668	689
Sodium (diss.filt)	mg/l	1850	2030	1070	-	527	1240	1770	1570	1640

APPENDIX 3 - LEACHATE

Table 5 – Leachate monitoring data, Quarter 4 (detected substances highlighted)

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Carbon										
Organic Carbon, Total	mg/l	-	304	265	272	-	-	-	587	578
Inorganics										
Alkalinity, Total as CaCO ₃	mg/l	7880	2870	4180	4330	1720	405	320	6620	6800
Ammoniacal Nitrogen as N	mg/l	1980	917	665	585	-	-	-	1240	1230
Ammoniacal Nitrogen as NH ₄	mg/l	-	-	-	-	10.4	13.5	12.6	1590	1580
BOD, unfiltered	mg/l	148	361	68.7	67.2	<1	<1	<1	<50	<50
Chloride	mg/l	2250	679	1120	1130	442	86.2	35	1630	1630
Chlorine, Total (Residual)	mg/l	1.58	0.14	0.78	1.18	0.58	0.05	0.06	1.58	1.98
COD, unfiltered	mg/l	2300	3050	985	820	47.2	47.7	40.4	1810	1780
Conductivity @ 20 deg.C	mS/cm	-	-	-	-	4.91	2.09	1.47	-	-
Cyanide, Free	mg/l	17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
pH	pH	<0.05	7.93	7.65	7.95	7.68	7.66	7.39	7.95	7.96
Sulphate	mg/l	7.77	385	16.5	228	-	-	-	42.1	43.3
Total Oxidised Nitrogen as N	mg/l	<0.5	<0.2	0.288	<0.2	0.237	0.569	4.8	0.205	<0.2
Filtered (Dissolved) Metals										
Cadmium (diss.filt)	mg/l	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.000161	<0.00008	<0.00008	<0.00008
Calcium (diss.filt)	mg/l	-	215	177	169	-	-	-	104	89.6
Magnesium (diss.filt)	mg/l	77.9	61.5	164	82.4	55.8	71.9	42.3	109	95.7
Mercury (diss.filt)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Potassium (diss.filt)	mg/l	627	257	569	401	148	23.5	26.6	800	698
Sodium (diss.filt)	mg/l	1550	561	1470	1080	397	69.2	36.6	2050	1760
Mineral Oil / Oils & Greases										
Mineral oil >C10 C40 (aq)	mg/l	0.0422	<0.01	0.845	<0.01	<0.01	<0.01	<0.01	<0.01	-

APPENDIX 3 - LEACHATE

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Semi-Volatile Organic Compounds (SVOCs)										
1,2,4-Trichlorobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
1,2-Dichlorobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
1,3-Dichlorobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
1,4-Dichlorobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,4,5-Trichlorophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,4,6-Trichlorophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,4-Dichlorophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,4-Dimethylphenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,4-Dinitrotoluene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2,6-Dinitrotoluene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Chloronaphthalene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Chlorophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Methylnaphthalene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Methylphenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Nitroaniline (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
2-Nitrophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
3-Nitroaniline (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Bromophenylphenylether (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Chloro-3-methylphenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Chloroaniline (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Chlorophenylphenylether (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Methylphenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Nitroaniline (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
4-Nitrophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Azobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Benzo(k)fluoranthene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
bis(2-Chloroethoxy)methane (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
bis(2-Chloroethyl)ether (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
bis(2-Ethylhexyl) phthalate (aq)	mg/l	<0.008	<0.008	0.0107	<0.008	<0.002	<0.002	<0.002	<0.008	<0.008
Butylbenzyl phthalate (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Carbazole (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Dibenzofuran (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Diethyl phthalate (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Dimethyl phthalate (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004

APPENDIX 3 - LEACHATE

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Hexachlorobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Hexachlorobutadiene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Hexachlorocyclopentadiene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Hexachloroethane (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Isophorone (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
n-Dibutyl phthalate (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
n-Dioctyl phthalate (aq)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.005	<0.005	<0.005	<0.02	<0.02
Nitrobenzene (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
n-Nitroso-n-dipropylamine (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Pentachlorophenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Phenol (aq)	mg/l	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004
Total SVOC TIC	mg/l	23.5	4.55	3.59	3.38	<0.01	<0.01	<0.01	10.8	11.6
Volatile Organic Compounds (VOCs)										
1,1,1,2-Tetrachloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,1-Trichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2,2-Tetrachloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trimethylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dibromo-3-chloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dibromoethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3,5-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3,5-Trimethylbenzene	mg/l	0.00397	0.00101	0.00151	0.00118	<0.001	<0.001	<0.001	0.00236	0.00217
1,3-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	mg/l	0.00294	<0.001	0.00432	0.00159	<0.001	<0.001	<0.001	0.002	0.00187
2,2-Dichloropropane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chlorotoluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chlorotoluene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

APPENDIX 3 - LEACHATE

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
4-iso-Propyltoluene	mg/l	0.00659	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	mg/l	0.00325	<0.001	0.00189	<0.001	<0.001	<0.001	<0.001	0.00285	0.00253
Bromobenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromochloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromodichloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromoform	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromomethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbon disulphide	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbontetrachloride	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorobenzene	mg/l	0.00218	<0.001	0.00172	<0.001	<0.001	<0.001	<0.001	0.0027	0.00249
Chloroethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroform	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,3-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibromochloromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibromomethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichlorodifluoromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichloromethane	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ethylbenzene	mg/l	<0.001	<0.001	0.00107	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorobutadiene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Isopropylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
m,p-Xylene	mg/l	0.00436	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00242	0.00225
Methyl tertiary butyl ether (MTBE)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/l	0.00954	<0.001	0.00306	<0.001	<0.001	<0.001	<0.001	0.00215	0.00171
n-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
o-Xylene	mg/l	0.0122	0.00259	0.00546	0.00334	<0.001	<0.001	<0.001	0.00919	0.00776
Propylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
sec-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Styrene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-Amyl methyl ether (TAME)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-Butylbenzene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetrachloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	mg/l	0.00277	0.00106	0.00118	<0.001	<0.001	<0.001	<0.001	0.00127	0.00114
trans-1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,3-Dichloropropene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichloroethene	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

APPENDIX 3 - LEACHATE

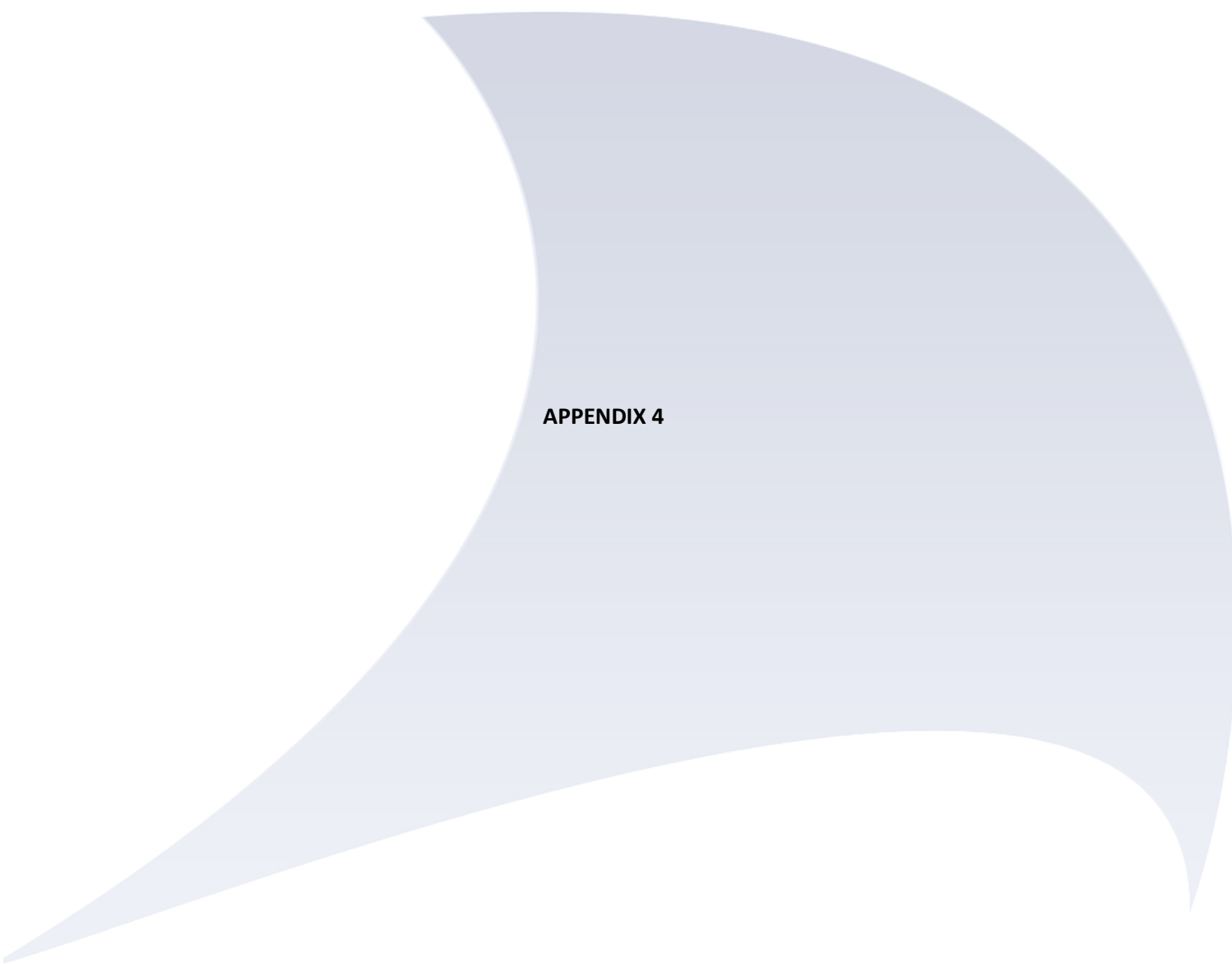
Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Trichlorofluoromethane	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vinyl chloride	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Combined Pesticides / Herbicides										
Aldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
alpha-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Azinphos-ethyl	mg/l	0.00028	0.000548	0.00112	0.00103	<0.00001	<0.00001	<0.00001	0.000607	0.000643
Azinphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
beta-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Carbophenothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorfenvinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorothalonil	mg/l	<0.00005	<0.00001	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00001
Chlorpyrifos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chlorpyrifos methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
cis-Chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Diazinon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dichlorvos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dieldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dimethoate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Disulfoton	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan sulphate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Endrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Ethion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Etrimphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenitrothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fenthion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
gamma-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor epoxide	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Hexachlorobenzene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Isodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Malathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Methyl parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 3 - LEACHATE

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Mevinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
o,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-Methoxychlor	mg/l	0.00122	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
p,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pendimethalin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin I	mg/l	0.00097	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Phosalone	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Pirimiphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Propetamphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Quintozone (PCNB)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tecnazene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Telodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trans-chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triadimefon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triallate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Triazophos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Trifluralin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Miscellaneous Organics										
Dibutyl tin	mg/l	0.000036	<0.000015	<0.000005	<0.00001	<0.000005	<0.000005	<0.000005	<0.00003	<0.000005
Tetrabutyl tin	mg/l	<0.000012	<0.000006	<0.000002	<0.000004	<0.000002	<0.000002	<0.000002	<0.000012	<0.000002
Tributyl tin	mg/l	<0.000006	<0.000003	<0.000001	<0.000002	<0.000001	<0.000001	<0.000001	<0.000006	<0.000001
Triphenyl tin	mg/l	<0.000006	<0.000003	<0.000001	<0.000002	<0.000001	<0.000001	<0.000001	<0.000006	<0.000001
TICS										
Benzothiazolone	mg/l	0.164	0.0566	0.106	0.0521	-	-	-	0.0907	0.0926
Bicyclohexadecanone	mg/l	-	0.0622	-	-	-	-	-	-	-
Butylbenzenesulfonamide	mg/l	-	-	0.101	-	-	-	-	0.0942	0.099
Dimethylbenzoic acid	mg/l	1.9	0.0446	-	-	-	-	-	0.13	0.132
Ditertbutylhydroxyphenylpropionic acid	mg/l	1.19	0.921	1.21	0.792	-	-	-	2	1.98
Ethylmethylbenzenesulfonamide	mg/l	0.0579	-	0.0478	-	-	-	-	0.0589	0.057

APPENDIX 3 - LEACHATE

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Hexadecanoic acid	mg/l	-	0.0819	0.121	0.093	-	-	-	-	-
Hexadecenoic acid	mg/l	-	-	-	0.0777	-	-	-	-	-
Methyl(methylpropyl)Benzeneacetic acid	mg/l	0.254	-	-	-	-	-	-	0.0844	0.0943
Methyl[butyl]phenylpropanoic acid	mg/l	0.0829	-	-	-	-	-	-	0.0807	0.0897
mixed hydrocarbons	mg/l	13.1	2.51	0.856	1.32	-	-	-	4.51	5.47
Octadecanoic acid	mg/l	-	-	0.0917	-	-	-	-	-	-
Tertbutylphenol	mg/l	-	-	0.0412	-	-	-	-	-	-
Triisopropylphosphate	mg/l	-	-	0.0647	-	-	-	-	-	-
Phenol(methylethylidene)bis	mg/l	0.111	-	-	-	-	-	-	-	-
trimethylhexanoic acid	mg/l	6.35	0.878	0.952	1.04	-	-	-	-	-
trimethylhexanoic acid	mg/l	-	-	-	-	-	-	-	3.72	3.5
Trimethylbenzoic acid	mg/l	-	-	-	-	-	-	-	0.0743	0.0765



APPENDIX 4

APPENDIX 4 – SURFACE WATER

Table 1 – Quarterly monitoring data, Q1

Parameter	Units	SW2	SW4	SW5
Inorganics				
Alkalinity, Total as CaCO ₃	mg/l	124	191	54.5
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	<0.3	<0.3
BOD, unfiltered	mg/l	<1	<1	<1
Chloride	mg/l	107	64.9	18.8
Chlorine, Total (Residual)	mg/l	<0.01	0.04	0.06
COD, unfiltered	mg/l	20.2	19.5	32.4
Conductivity @ 20 deg.C	mS/cm	0.794	0.766	0.251
Nitrate as NO ₃	mg/l	1.61	15.9	0.31
pH	pH Units	8.05	8.07	7.65
Sulphate	mg/l	138	132	49.1
Total Oxidised Nitrogen as N	mg/l	0.371	3.61	<0.1
Filtered (Dissolved) Metals				
Iron (diss.filt)	mg/l	<0.019	0.0322	0.114
Magnesium (diss.filt)	mg/l	16.1	14.4	6.25
Potassium (diss.filt)	mg/l	7.74	8.65	5.04
Sodium (diss.filt)	mg/l	64.2	38.4	15.9
Unfiltered (Total) Metals				
Calcium (tot.unfilt)	mg/l	80	108	25.4

APPENDIX 4 – SURFACE WATER

Table 2 - Quarterly monitoring data, Q2

Parameter	Units	SW1	SW2	SW4	SW5
Inorganics					
Alkalinity, Total as CaCO ₃	mg/l	129	160	160	140
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2
BOD, unfiltered	mg/l	<1	3.32	<1	<1
COD, unfiltered	mg/l	22.5	25.3	45.5	39.5
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05
Nitrate as NO ₃	mg/l	0.489	<0.07	5.31	<0.07
Nitrite as NO ₂	mg/l	<0.04	<0.04	0.114	<0.04
pH	pH Units	7.67	8.01	8.02	7.86
Total Oxidised Nitrogen as N	mg/l	0.122	<0.02	1.23	<0.02
Filtered (Dissolved) Metals					
Arsenic (diss.filt)	mg/l	0.00124	0.00104	0.00111	0.000969
Cadmium (diss.filt)	mg/l	<0.0001	<0.0001	<0.0001	<0.0001
Copper (diss.filt)	mg/l	0.00258	0.00214	0.00457	0.0015
Iron (diss.filt)	mg/l	0.745	0.0251	0.043	0.0716
Lead (diss.filt)	mg/l	0.000731	0.000221	0.000279	0.000172
Magnesium (diss.filt)	mg/l	24.4	16.7	12.2	17.7
Mercury (diss.filt)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Nickel (diss.filt)	mg/l	0.0141	0.0089	0.00772	0.00278
Potassium (diss.filt)	mg/l	8.14	7.22	7.23	2.82
Sodium (diss.filt)	mg/l	25.3	37.6	30.4	14.8
Zinc (diss.filt)	mg/l	0.0259	0.00484	0.014	0.00962
Phenols					
Phenols, Total Detected 5 speciated	mg/l	<0.025	<0.025	<0.025	<0.025
Combined Pesticides / Herbicides					
Aldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
alpha-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Atrazine	mg/l	<0.001	<0.001	<0.001	<0.001
Azinphos-ethyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Azinphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
beta-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Carbophenothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Chlorfenvinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Chlorothalonil	mg/l	<0.00002	<0.00002	<0.00002	<0.00002
Chlorpyrifos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Chlorpyrifos methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
cis-Chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Diazinon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Dichlorvos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Dieldrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Dimethoate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Disulfoton	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Endosulphan sulphate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Endrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Ethion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Etrimphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Fenitrothion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Fenthion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
gamma-Hexachlorocyclohexane (HCH / Lindane)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Heptachlor epoxide	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Hexachlorobenzene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 4 – SURFACE WATER

Parameter	Units	SW1	SW2	SW4	SW5
Isodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Malathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Methyl parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Mevinphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
o,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
o,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
o,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDE	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
p,p-DDT	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
p,p-Methoxychlor	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
p,p-TDE (DDD)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Parathion	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Pendimethalin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin I	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Permethrin II	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Phosalone	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Pirimiphos-methyl	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Propetamphos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Quintozone (PCNB)	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Simazine	mg/l	<0.001	<0.001	<0.001	<0.001
Tecnazene	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Telodrin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Trans-chlordane	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Triadimefon	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Triallate	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Triazophos	mg/l	<0.00001	<0.00001	<0.00001	<0.00001
Trifluralin	mg/l	<0.00001	<0.00001	<0.00001	<0.00001

APPENDIX 4 – SURFACE WATER**Table 3 - Quarterly monitoring data, Q3**

Parameter	Units	SW1	SW2	SW4	SW5
Inorganics					
Alkalinity, Total as CaCO ₃	mg/l	170	180	75.9	149
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	<0.3	<0.3	<0.3
BOD, unfiltered	mg/l	10.6	<1	2.47	15.3
Chloride	mg/l	50	59.9	22.5	21.3
Chlorine, Total (Residual)	mg/l	0.04	0.04	0.02	0.02
COD, unfiltered	mg/l	58.6	21.6	28.3	206
Conductivity @ 20 deg.C	mS/cm	0.744	0.668	0.318	0.39
Nitrate as NO ₃	mg/l	<0.3	<0.3	7.39	<0.3
pH	pH Units	8.17	7.75	7.21	7.06
Sulphate	mg/l	187	143	60.1	45.7
Total Oxidised Nitrogen as N	mg/l	<0.1	<0.1	1.71	<0.1
Filtered (Dissolved) Metals					
Iron (diss.filt)	mg/l	0.0982	<0.019	0.0233	0.396
Magnesium (diss.filt)	mg/l	23.5	21.5	3.89	19.6
Potassium (diss.filt)	mg/l	11.5	6.24	6.5	4.41
Sodium (diss.filt)	mg/l	38.5	45.9	17.5	18.4
Unfiltered (Total) Metals					
Calcium (tot.unfilt)	mg/l	111	99.2	49	48

APPENDIX 4 – SURFACE WATER**Table 4 - Annual monitoring data, Q4**

Parameter	Units	SW1	SW2	SW4	SW5
Inorganics					
Alkalinity, Total as CaCO ₃	mg/l	50	135	135	150
Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	<0.3	<0.3	<0.3
BOD, unfiltered	mg/l	11.5	11.7	8.92	2.16
Chloride	mg/l	21.5	61.7	84.6	77.9
Chlorine, Total (Residual)	mg/l	0.04	0.05	0.02	0.02
COD, unfiltered	mg/l	273	32.1	23.9	33.7
Conductivity @ 20 deg.C	mS/cm	0.231	0.732	0.714	0.656
Nitrate as NO ₃	mg/l	6.11	5.14	0.424	10
pH	pH Units	7.15	7.34	7.77	7.7
Sulphate	mg/l	50.2	220	149	126
Total Oxidised Nitrogen as N	mg/l	1.39	1.17	0.102	2.28
Filtered (Dissolved) Metals					
Iron (diss.filt)	mg/l	0.0509	0.0207	<0.019	0.0196
Magnesium (diss.filt)	mg/l	5.96	23.3	16.5	13.3
Potassium (diss.filt)	mg/l	3.98	7.14	7.75	9.81
Sodium (diss.filt)	mg/l	14.1	38.8	50.5	46.5



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