

Silent Valley Waste Services
Limited

Silent Valley Landfill

2021 First Quarter Monitoring
Report

Issue | 16 April 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 115825-00

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1 Introduction

This 2021 First Quarter Monitoring Report is a consolidated report detailing the findings of this quarter's results from the surface water, groundwater, landfill gas and leachate results for the monitoring undertaken in the period Jan to March 2021 in accordance with the Silent Valley Environmental Permit (Permit no. MP3835SV [1]) and the Aftercare Phase Environmental and Infrastructure Monitoring Program [5]. The annual report will include a full assessment of the year's results.

The data has been collected as referenced in Schedule 3 of the Consolidated Permit [1]. This report makes reference to the 2019 Annual Monitoring Report [2] and the 2020 Annual Monitoring Report [3].

1.1 Monitoring Regime

The monitoring regime is undertaken in accordance with the Aftercare Phase Environmental and Infrastructure Monitoring Program [5] and in line with the Consolidated Permit [1], which is fully detailed within the 2019 annual report.

2 Discussion of Monitoring Results

2.1 Rainfall

Measured rainfall data is illustrated in **Appendix A, Figures A1 to A3**.

Based on the available data, January recorded the highest monthly rainfall of the quarter (Jan total 196mm) and the highest daily rainfall total (59.2mm on 20th Jan). January rainfall is the highest it has been since 2016. February rainfall is high, but 50% lower than Feb 2020 which was the wettest month on record. March rainfall is similar to last year and previous years.

2.2 Leachate

2.2.1 Leachate Quality Monitoring

Leachate quality monitoring results from within the waste body and from leachate standpipes are presented in **Appendix B, Table B1**.

The majority of the determinands are compliant.

Well LC2A recorded an elevated Ammoniacal Nitrogen concentration. However, the average ammoniacal nitrogen concentration has declined over the past year and historically has been shown to fluctuate. The value recorded for LC2A is below some of the values recorded in the previous year.

Wells LC2A and LC4A specifically exceeded the AMC for zinc which has remained elevated since the last quarter.

Well LC2A exceeded the AMC for Nickel, however this has reduced in concentration since October 2020.

In accordance with the Aftercare Phase Environmental and Infrastructure Monitoring Program report (Ref. [4]), the contingency plan is to be implemented after three consecutive exceedances have been recorded. One of the options for implementing corrective measures to well LC5A was to de-silt or pump the well, however the requirement for this will be reviewed on completion of the forthcoming pumping tests proposed on LC5A.

2.2.2 Leachate Level Monitoring

Leachate level monitoring results are presented in **Appendix B, Table B2**.

The monthly average level for all the wells remains below the required 3.0m, as per the Permit (Ref [1]).

2.3 Surface Water Quality

The surface water quality monitoring results are presented in **Appendix B, Table B3**, and graphically in **Appendix A, Figure A4**.

Commentaries are provided for upstream and downstream monitoring points in the Nant Merddog, including locations SW1 to SW10 located downstream of the landfill, as discussed below.

2.3.1 Upstream Surface Water

Surface water monitoring locations, SWU, SW2A1, SWW4, SWW1 and SWW2 are located downstream of the landfill and monitored on a six-monthly basis in accordance with the Permit requirements. They will be monitored in the second quarter.

2.3.2 Downstream Surface Water

SWD and SWD1

Results show these locations are both compliant.

SW1 to SW10

Sampling in these locations ceased in May 2020. The surface water results for the monitoring points located downstream of the landfill indicate no significant environmental impact on the Nant Merddog.

2.4 Groundwater

2.4.1 Groundwater Quality Monitoring

Groundwater quality monitoring results are presented in graphical in **Appendix A, Figures A5 and A6** and in **Appendix B, Table B4**.

Any non-compliances for both upstream and downstream wells are discussed in the following sections.

2.4.1.1 Upstream Groundwater wells

Well GW3A and GW4

GW3A and GW4 monitor the sandstone strata classified as S3-East, and GW11B had been installed in the sandstone strata classified as S2-West.

In GW3A the mercury concentration continues to remain higher than the trigger level, albeit at a much lower concentration than the previous quarter. Mercury concentrations in GW3A have been continually recorded above the trigger level since April 2018, although the trigger level is applied to the downstream groundwater. Based on previous results these are temporary fluctuations associated with the environment outside of the influence of the landfill.

Manganese has continually been recorded above the assessment level in GW4 with continued fluctuations throughout the years, and this quarter, showing no recognisable trend. The elevated concentrations recorded upstream are likely to be from steel works waste deposited to the north of the landfill and old mine

workings in the area. Manganese is a typical contaminant of mine drainage, which is considered to be impacting the groundwater in the locale of the landfill.

2.4.1.2 Downstream Groundwater wells

The results from the compliance wells indicate that generally the pumping system at the toe of the landfill is continuing to successfully control the potential egress of leachate from the landfill. No issues associated with pump failure within the cut-off system have been recorded so far during 2020 and 2021.

Well GW10

GW10 has been installed in the sandstone strata classified as S3-East. GW10 is compliant.

Well GW9

GW9 has been installed in the sandstone strata classified as S2-East.

GW9 continues to be non-compliant for ammoniacal nitrogen in relation to the Trigger Level of 1mg/l. The recorded value is higher than last quarter but has been shown to fluctuate.

Well GW12

GW12 has been installed in the sandstone strata classified as S2-West. GW12 is compliant.

Wells GW6 and GW7

GW6 and GW7 have been installed in the centre of the valley in the sandstone strata classified as S1. GW6 is compliant.

The manganese concentration in GW7 has been recorded below the assessment level for the first time in 2 years. This has followed a general downwards trend over the last year. Manganese levels have historically been known to fluctuate within this well, and it is considered that the concentrations are also impacted by the upstream groundwater.

2.4.2 Groundwater Levels Monitoring

Groundwater levels are monitored on a quarterly basis in the compliance and upstream wells. The monitoring results are illustrated graphically in **Appendix A, Figure A7**. Water levels have remained consistent this quarter with the first, second and third quarters of 2020.

The 2020 Annual Monitoring Report [3] noted that GW7 had recorded a 5.4m drop in groundwater level during the 2020 fourth quarter. Following a review of the existing data, and considering the level recorded this quarter is consistent to other readings in 2020, it is likely the fourth quarter result was due to an error in the data.

2.5 Landfill Gas

2.5.1 Landfill Gas Quality Monitoring

The landfill gas monitoring results are presented in **Appendix B, Table B5**.

Methane

Methane concentrations continue to be recorded below the respective Control and Trigger Levels (where available) in all monitoring locations.

Carbon Dioxide

Carbon dioxide concentrations were recorded below the respective Control and Trigger Levels, where available, in the majority of monitoring locations with the exception of GMW12 and GMW14/14A.

Carbon dioxide levels have been recorded above the Control and/or Trigger Levels in the following wells (valves);

Control Level

- GMW12 (yellow) in every month
- GMW14/14A (white) in January and March

Trigger Level

- GMW14/14A (red) in every month
- GMW14/14A (yellow) in every month
- GMW14/14A (white) in February

As stated by Golder Associates (Ref. [10]), single exceedances do not require to be actioned. However, if ongoing exceedances are recorded then the relevant people require to be informed and appropriate measures of identification and solutions identified.

In GMW14/14A consecutive exceedances were recorded in 2020. Generally, values have increased from the previous quarter. All valves display an increase from January to February, and all valves exceed the trigger level. In a separate piece of work, a technical note is currently being prepared to investigate this well further. This note includes a review of the conceptual site model and all gas concentrations to date.

GMW12 shows an increasing trend from last quarter, exceeding the control level and approaching the trigger level. However, the concentrations have fallen from that recorded in quarter three of last year. This wells should be reviewed following receipt of next quarter's readings.

3 Conclusion

The monitoring data and interpretation produced in this report has not identified any significant issues relating to contaminant levels recorded above the screening criteria within the leachate and groundwater. Where limited minor exceedances have been identified there is no evidence to suggest they are having a discernible impact on the surrounding environment and the landfill continues to comply with the requirements of the permit.

Based on the 2020 Annual monitoring report [3], the following is still being investigated further;

- The continual high levels of ammoniacal nitrogen concentration within the leachate samples and the 2.32m reduction in leachate head monitoring this quarter within LC5A. Considering well LC5A has been damaged during the past quarter, the leachate data will be reviewed following the installation of a new well. The continuing high levels of ammoniacal nitrogen recorded in the leachate within LC2A should also be investigated with further potential remedial work during the re-installation of LC5A.
- The ongoing carbon dioxide gas exceedances in GMW14/14A. It is recommended that a technical note is prepared which includes a review of the conceptual site model and gas results.

References

- [1] Environment Agency, Silent Valley Landfill Site, Pollution Prevention and Control (England and Wales) Regulations 2000, Landfill (England and Wales) Regulations 2002, Permit number MP3835SV, November 2005, Permit amended as of 04/03/16.
- [2] Arup, Silent Valley Landfill, 2019 Annual Monitoring Report, 31st January 2020.
- [3] Arup, Silent Valley Landfill, 2020 Annual Monitoring Report, 30th January 2021.
- [4] Arup, Silent Valley Landfill, Interim GW9 and Nant Merddog W, Issue May 2015.
- [5] Arup, Silent Valley Landfill, Aftercare Phase Environmental and Infrastructure Monitoring Program, Issue June 2013.
- [6] Arup, Silent Valley Landfill, Hydrogeological Risk Assessment, document reference 04/6363, November 2004.
- [7] Arup, Silent Valley Landfill, Investigation into the Western Flank of the Cut-off System. Compliance Well GW9 and GW10, document reference 115825, August 2011.
- [8] Environment Agency, Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, report reference LFTGN02, June 2014.
- [9] Arup, Silent Valley Landfill, Hydrogeological Risk Assessment (Supplementary Revision May 2009), document reference 09/7543, June 2009.
- [10] Golder Associates, Establishment of Trigger Levels at Silent Valley landfill site, letter report dated 21 December 2006.
- [11] Environment Agency, Guidance on the management of landfill gas, document reference LFTGN03, June 2014.
- [12] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
- [13] Water Framework Directive - United Kingdom Technical Advisory Group (WFD-UKTAG), "Metal Bioavailability Assessment Tool (M-BAT)," 2014.

Appendix A

Monitoring Results - Graphs

Figure A1
Daily rainfall totals and sampling events (March 2014 - March 2021)

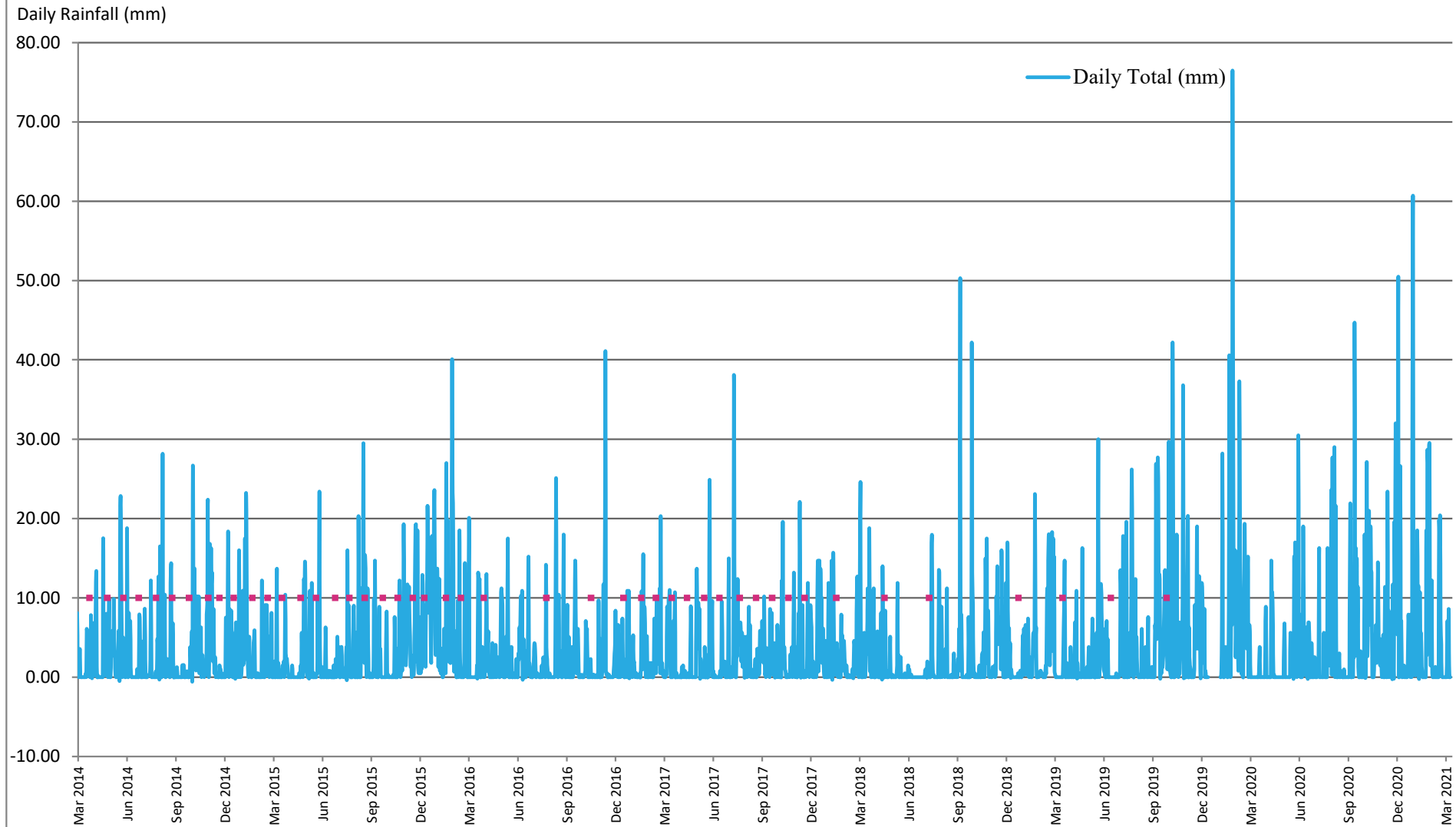


Figure A2
Monthly rainfall totals (April 2014 - March 2021)

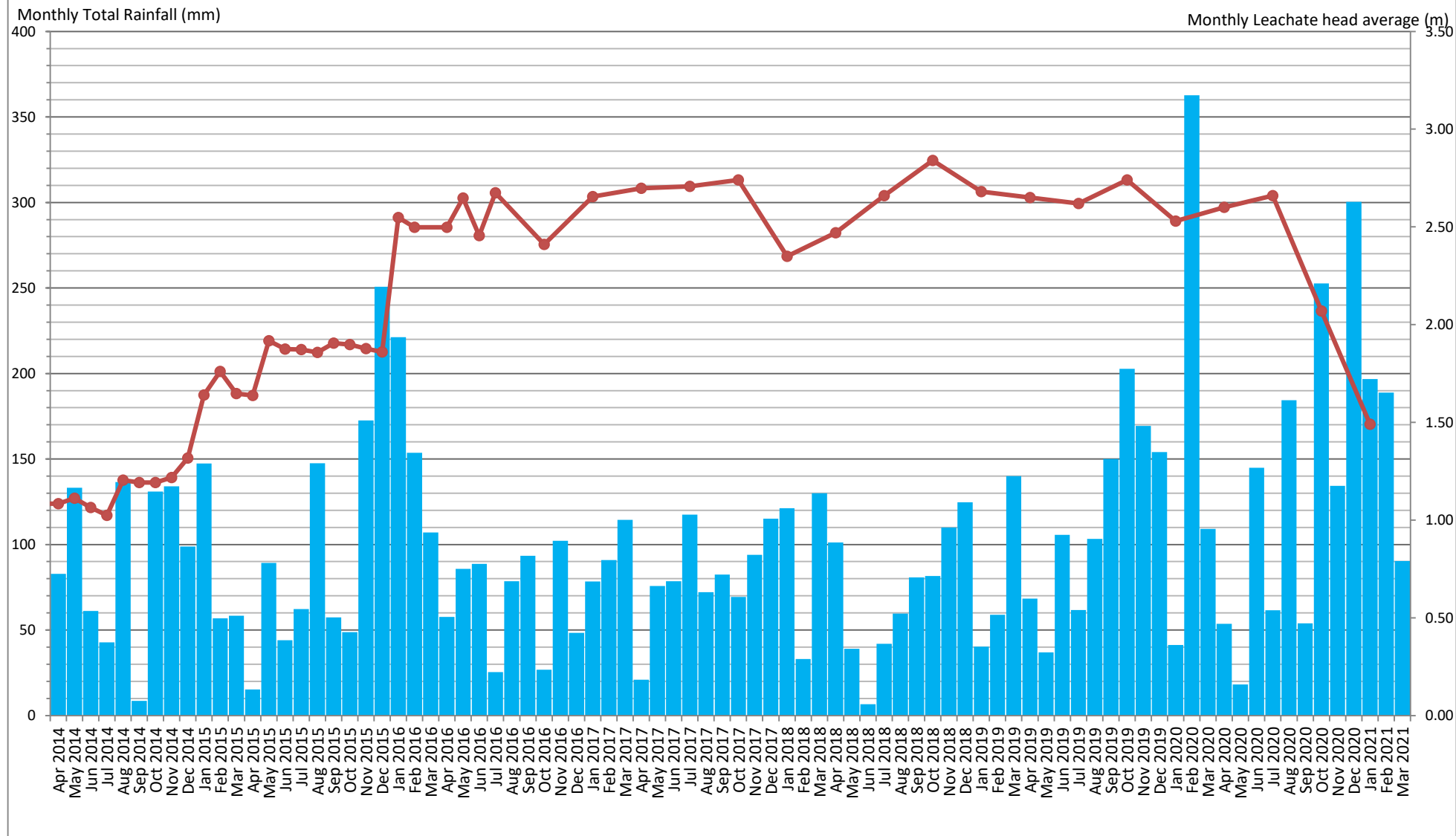


Figure A3
Monthly total rainfall (April 2014 - March 2021)

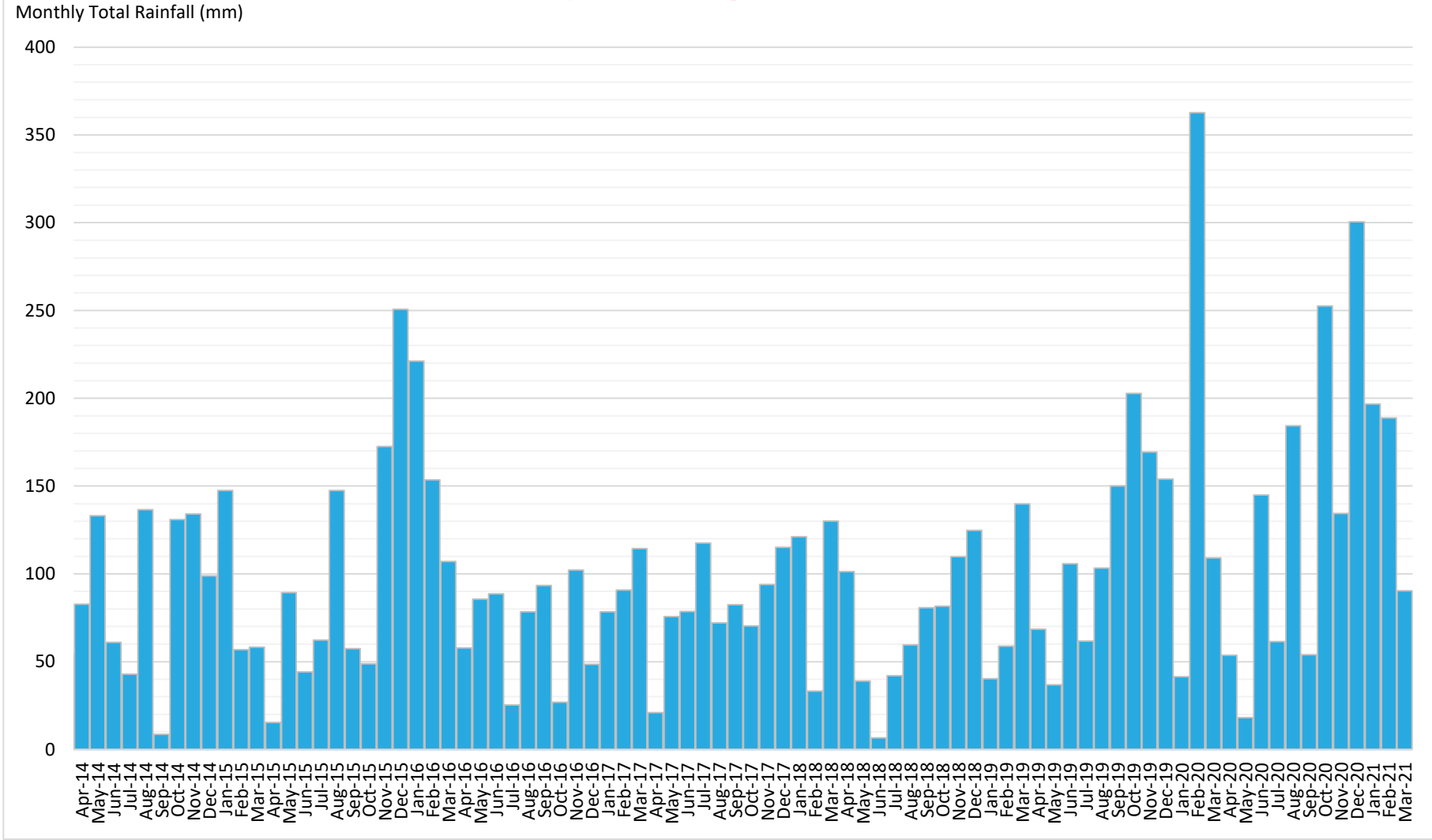


Figure A4
Surface water monitoring graphs

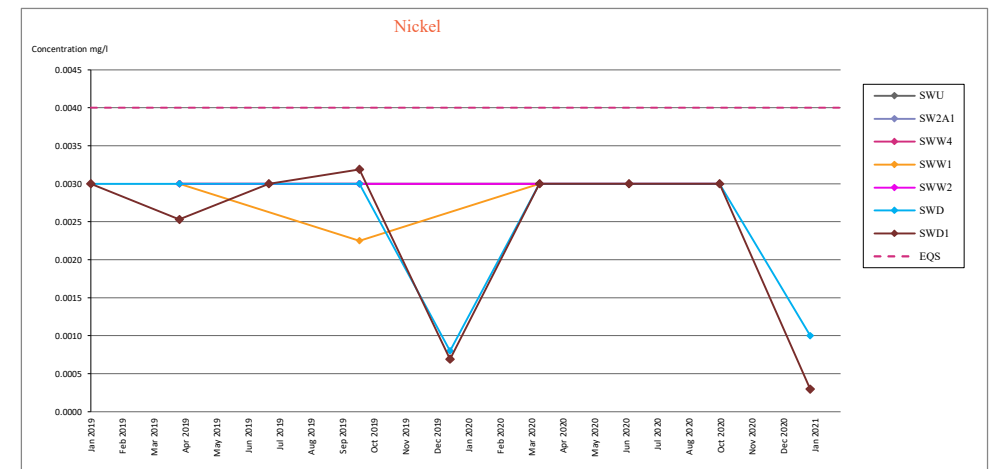
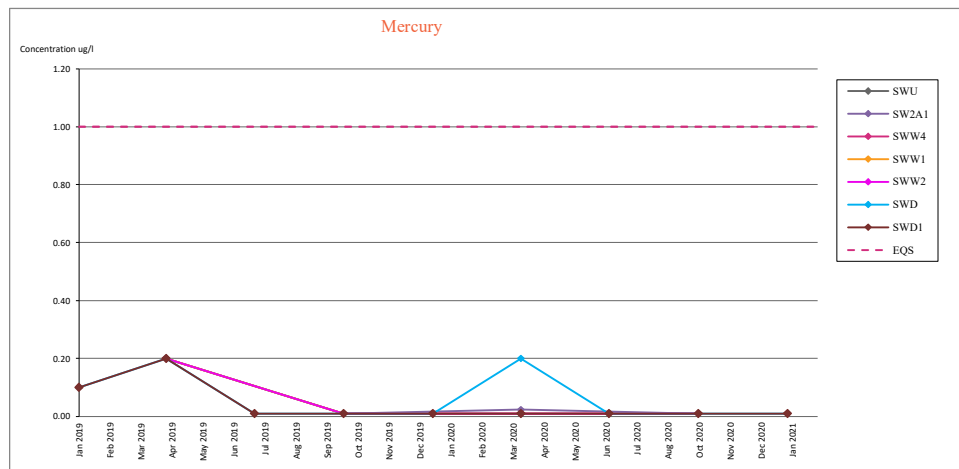
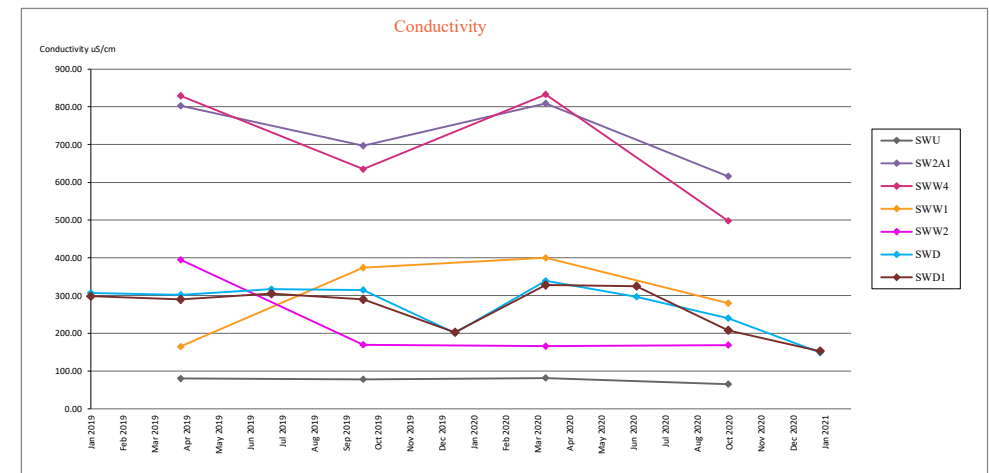
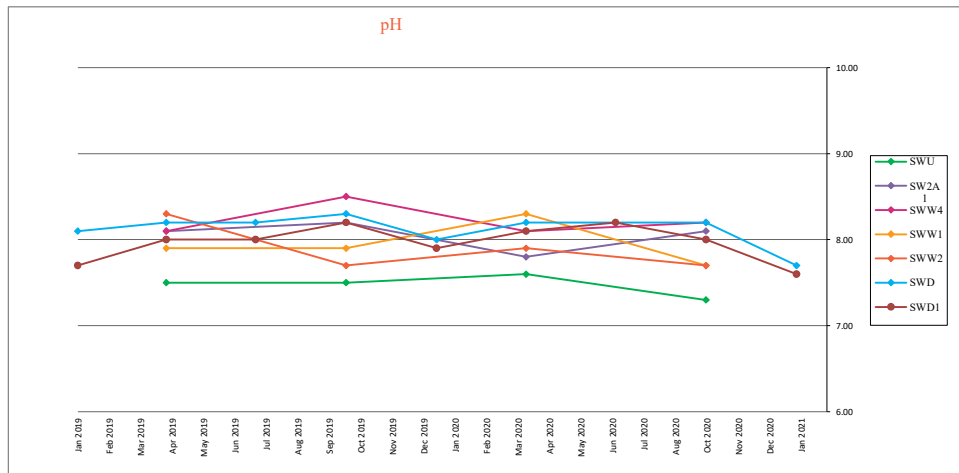
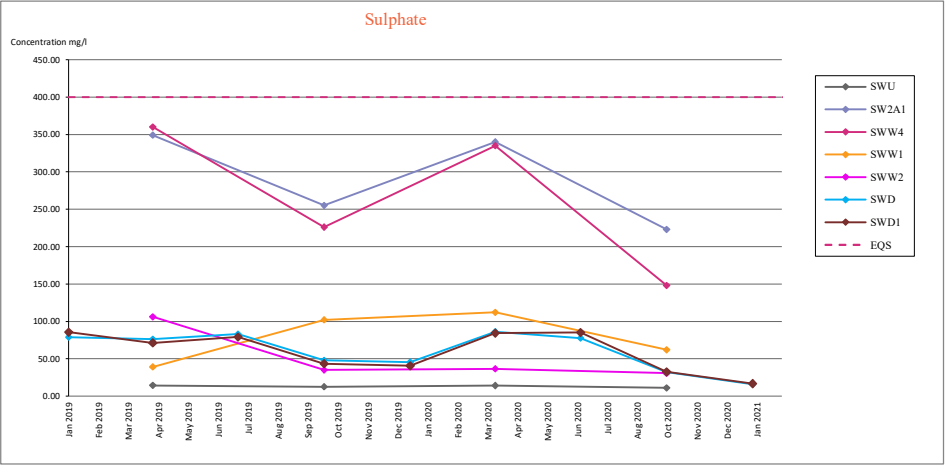
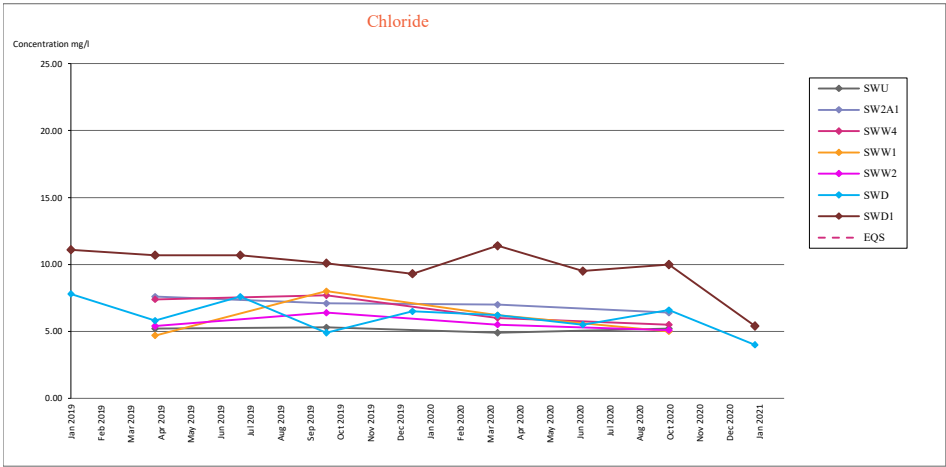
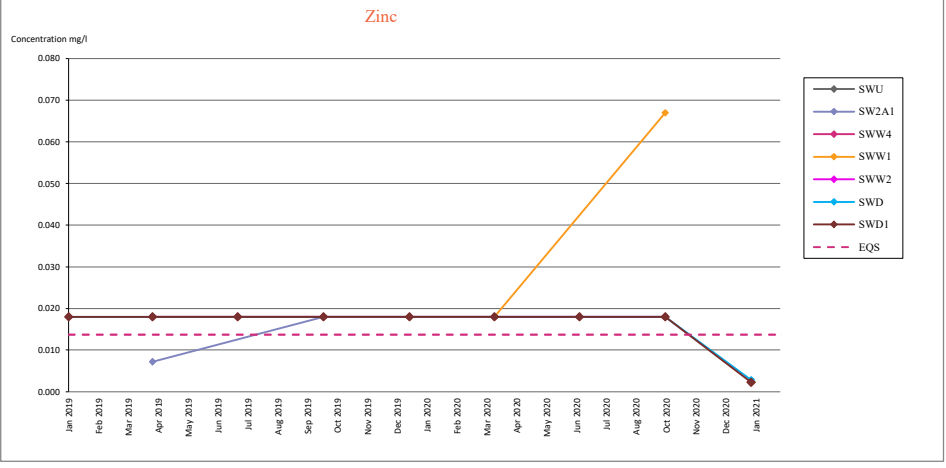
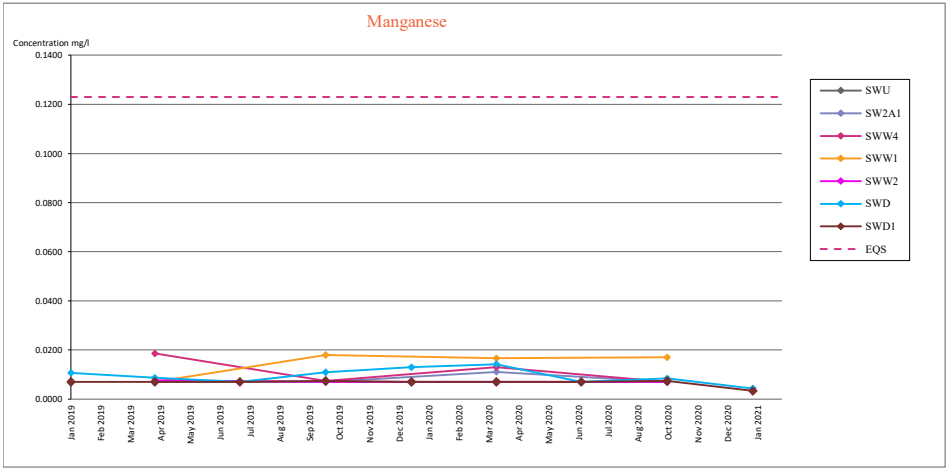
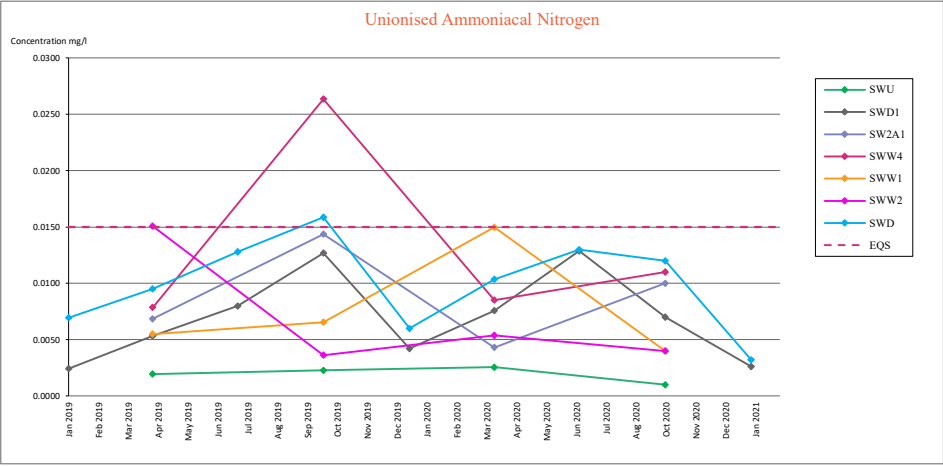
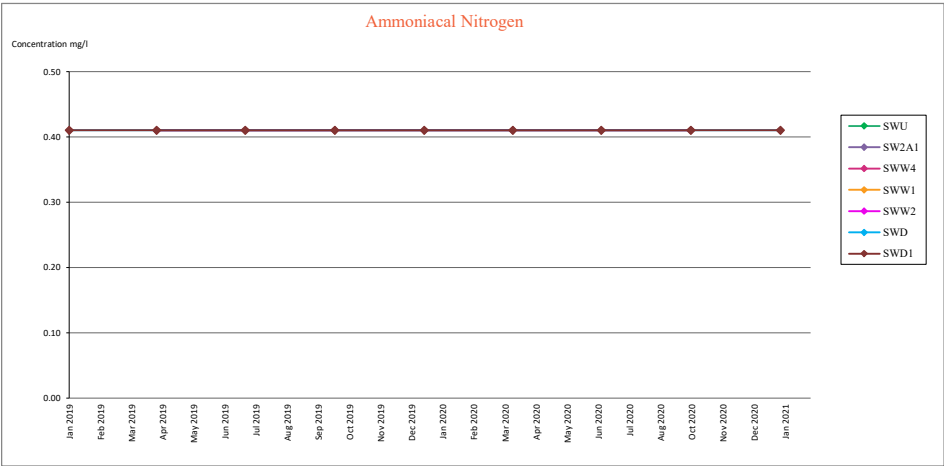
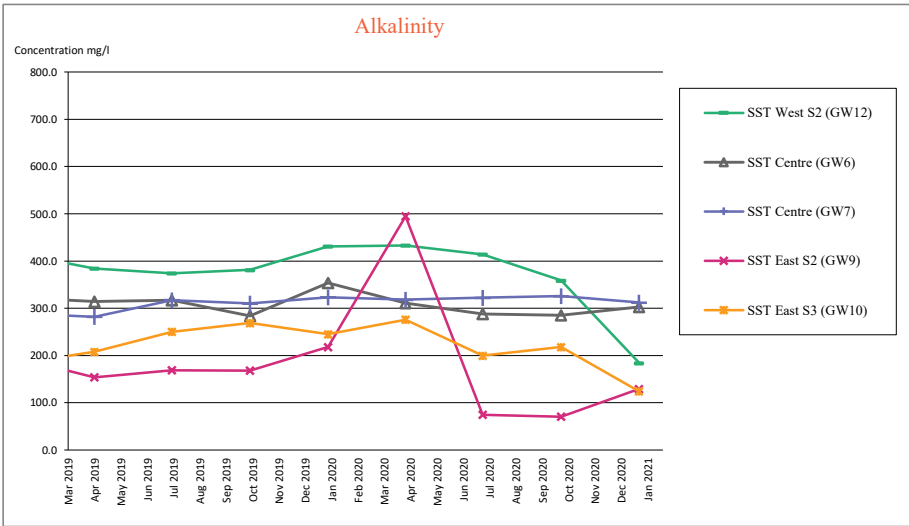
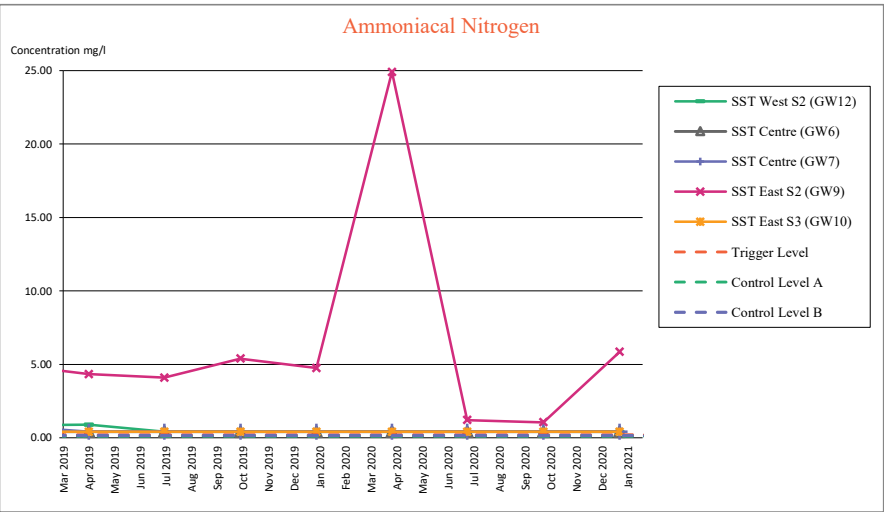
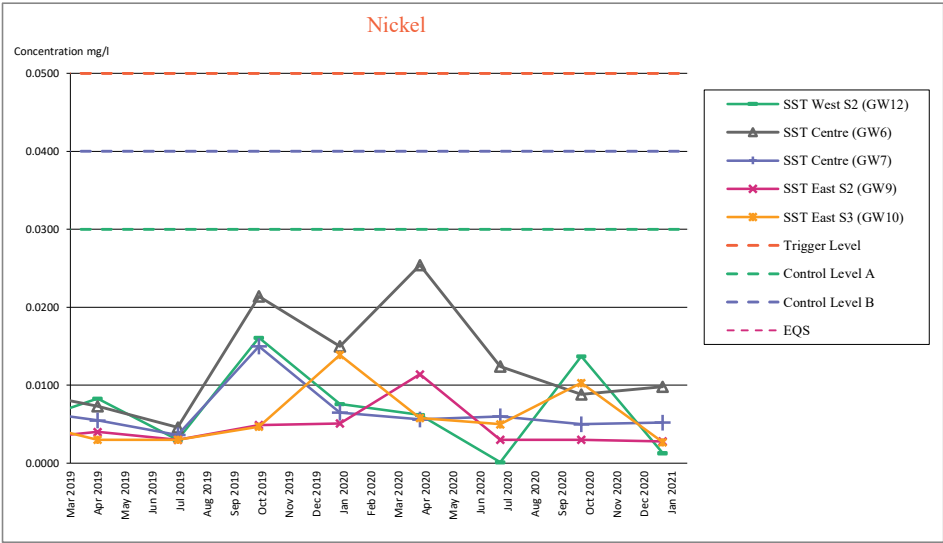
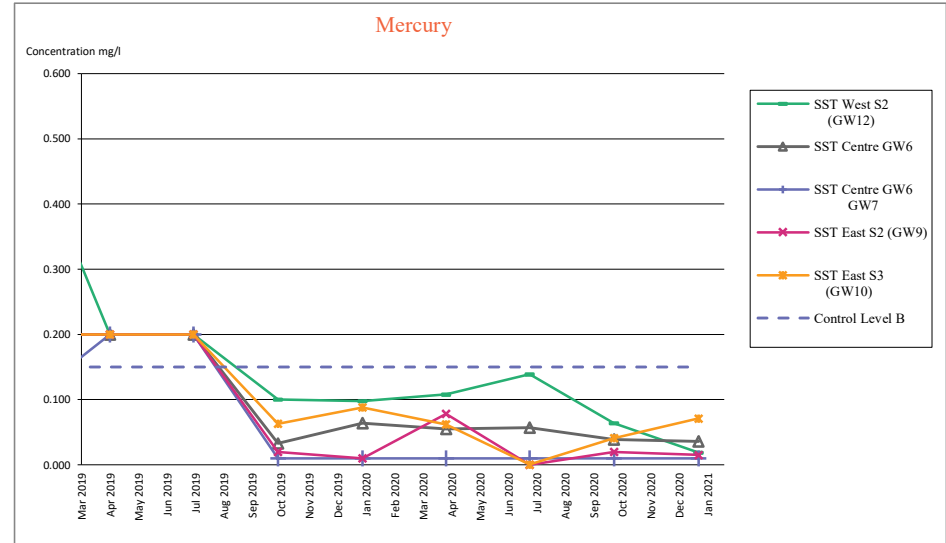


Figure A4
Surface water monitoring graphs

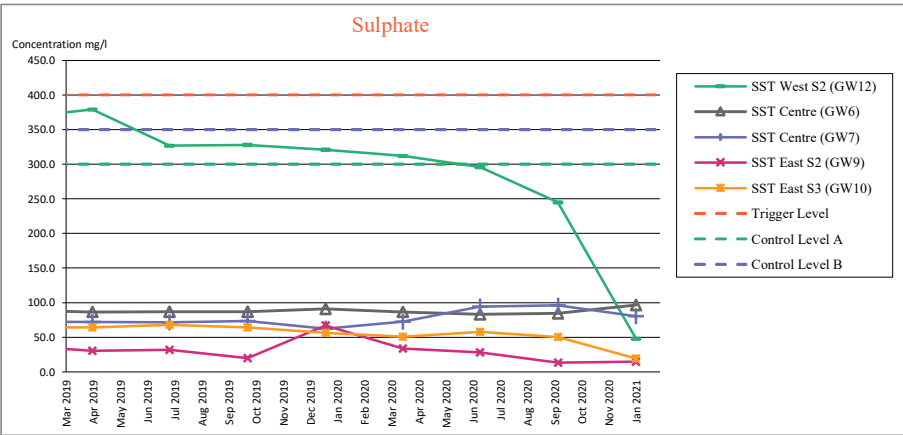
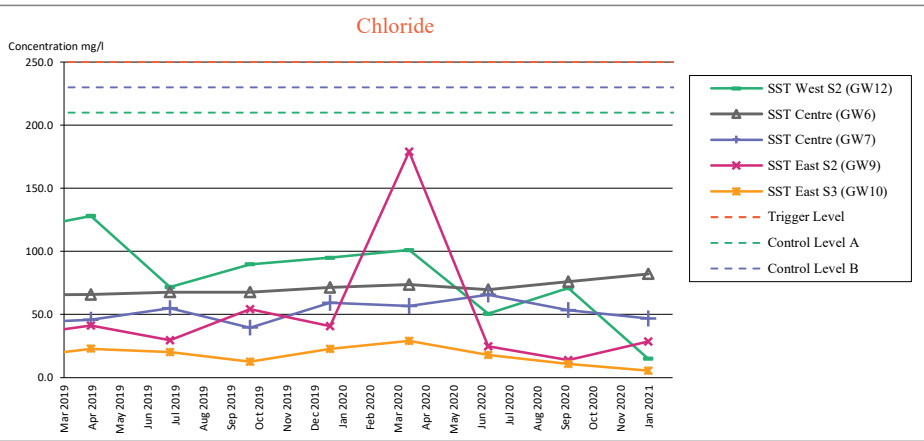
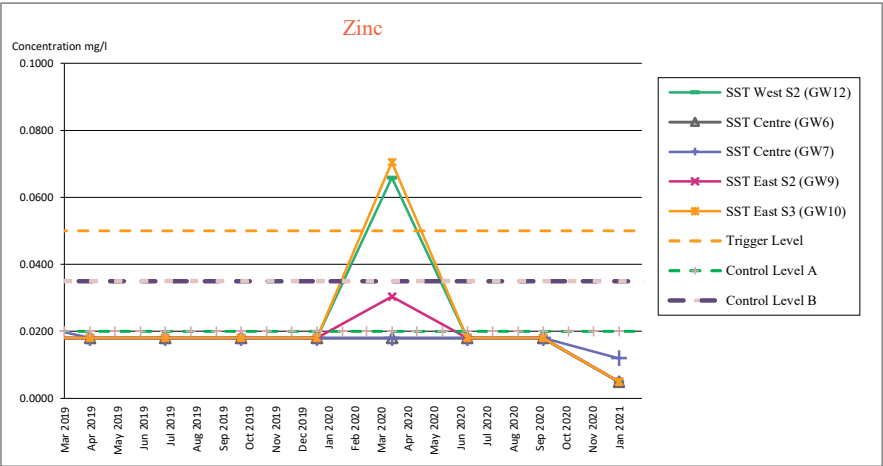
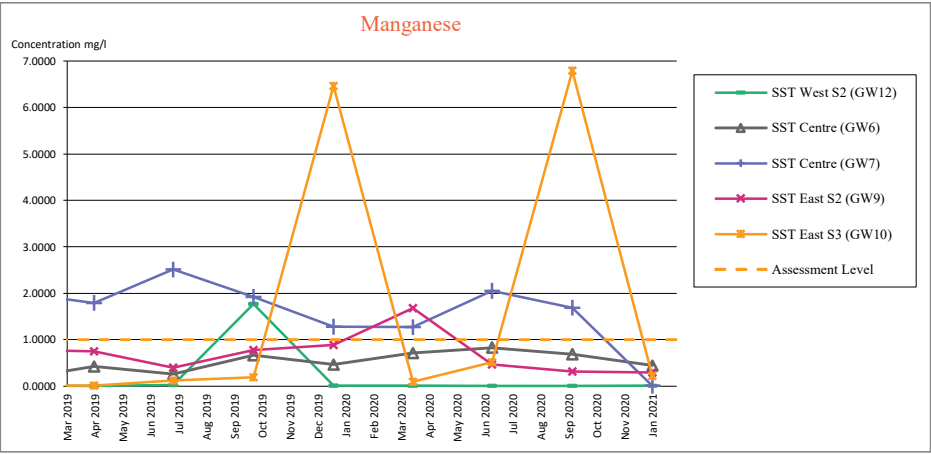




Compliance wells graphs



Compliance wells graphs



Compliance wells graphs

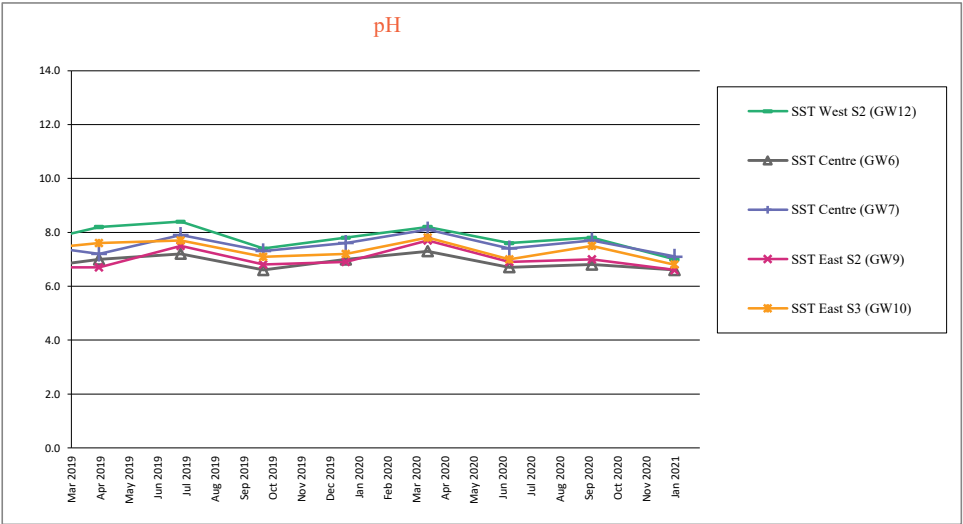


Figure A6
Groundwater quality monitoring results - Upstream wells graphs

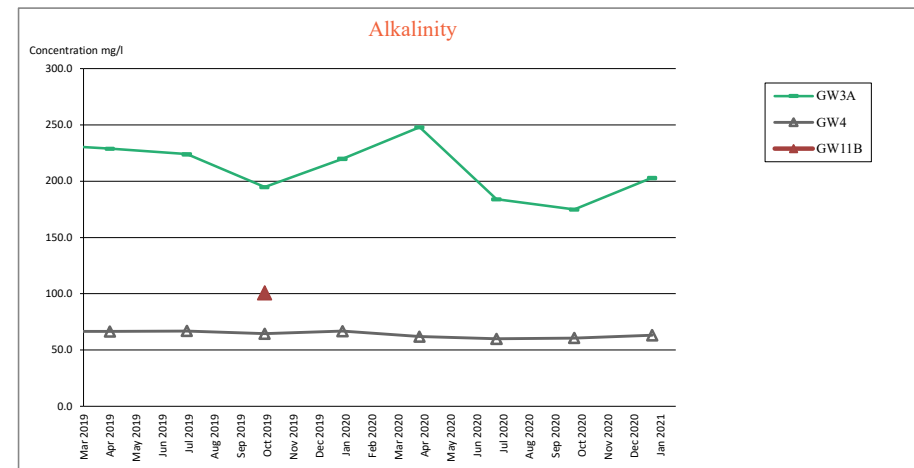
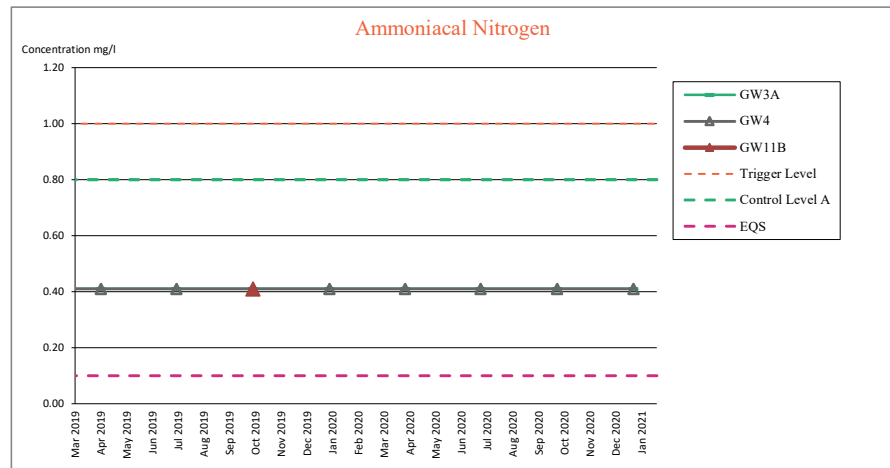
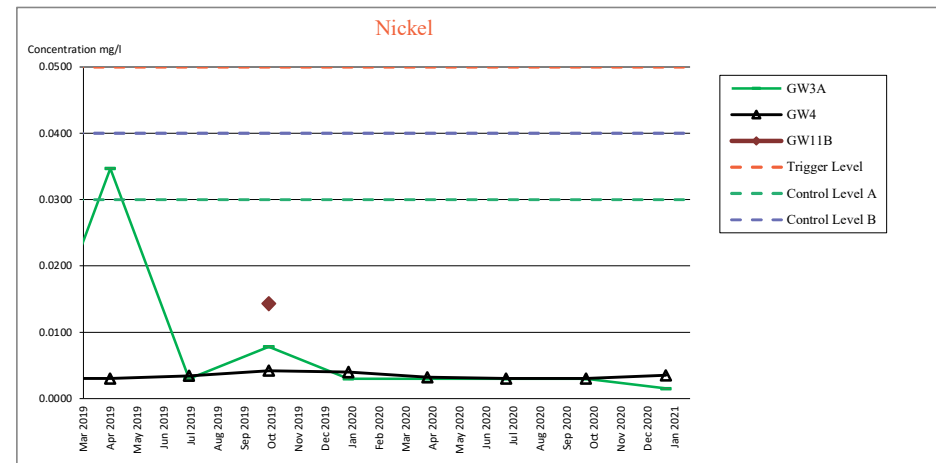
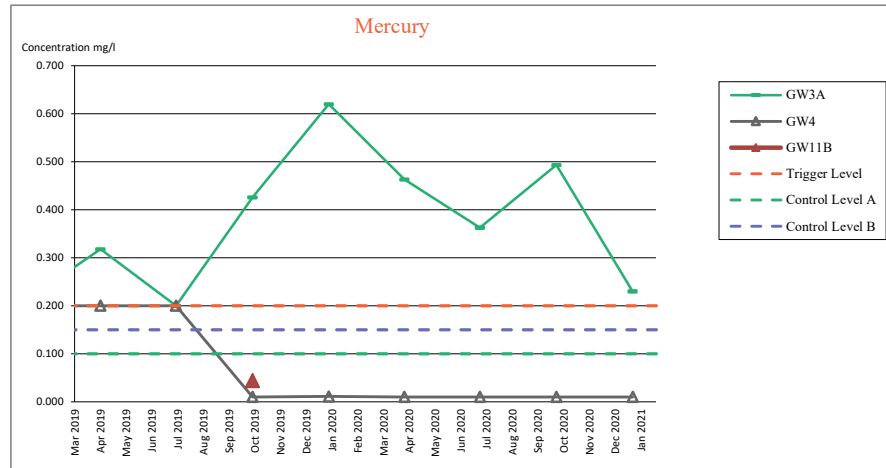


Figure A6
Groundwater quality monitoring results - Upstream wells graphs

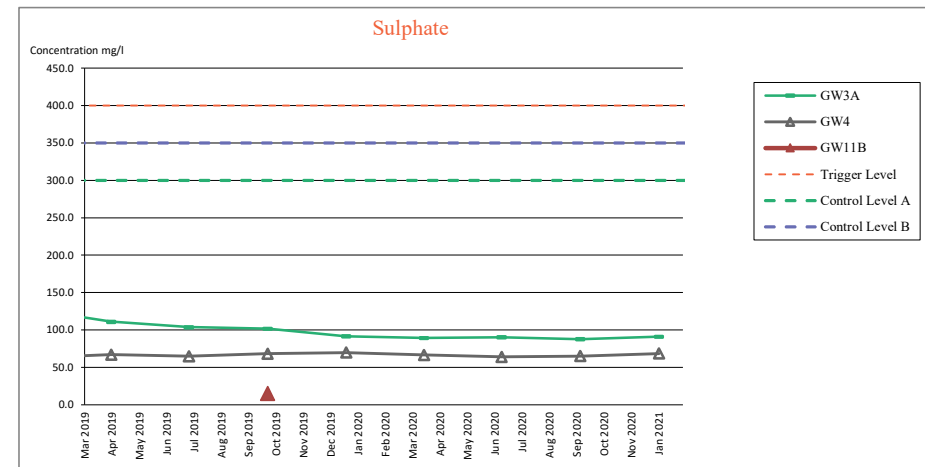
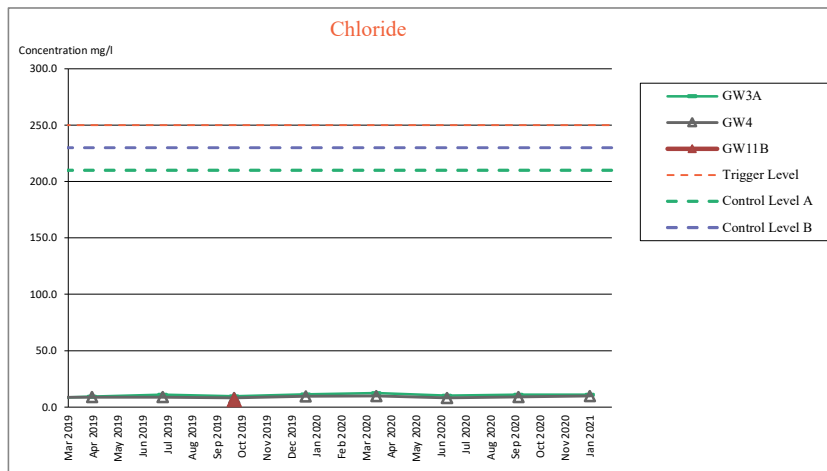
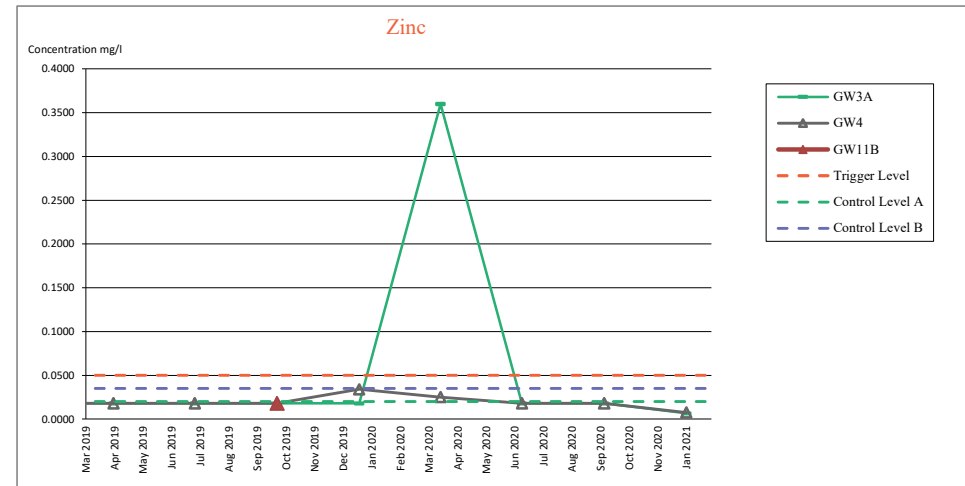
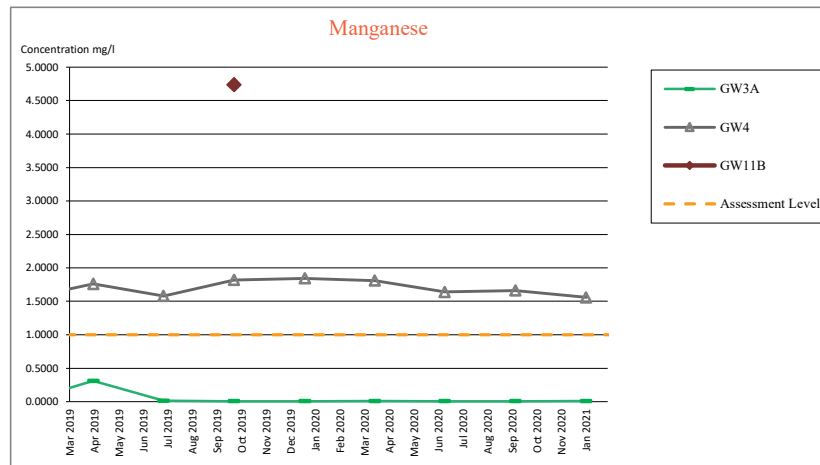


Figure A6
Groundwater quality monitoring results - Upstream wells graphs

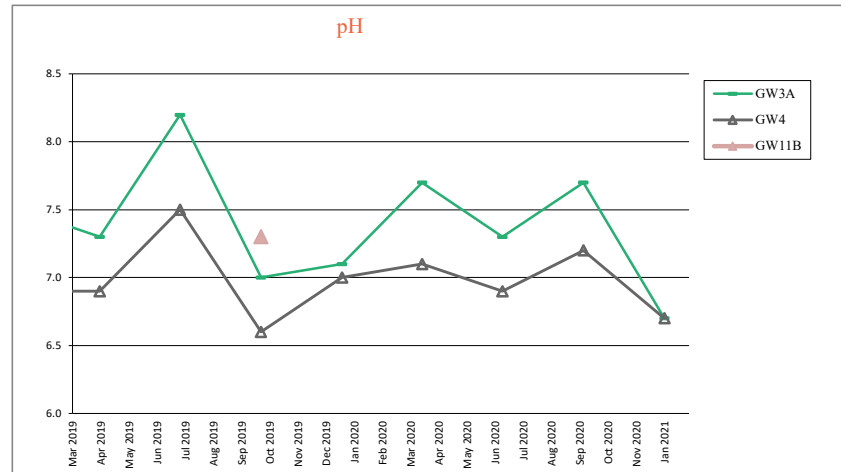
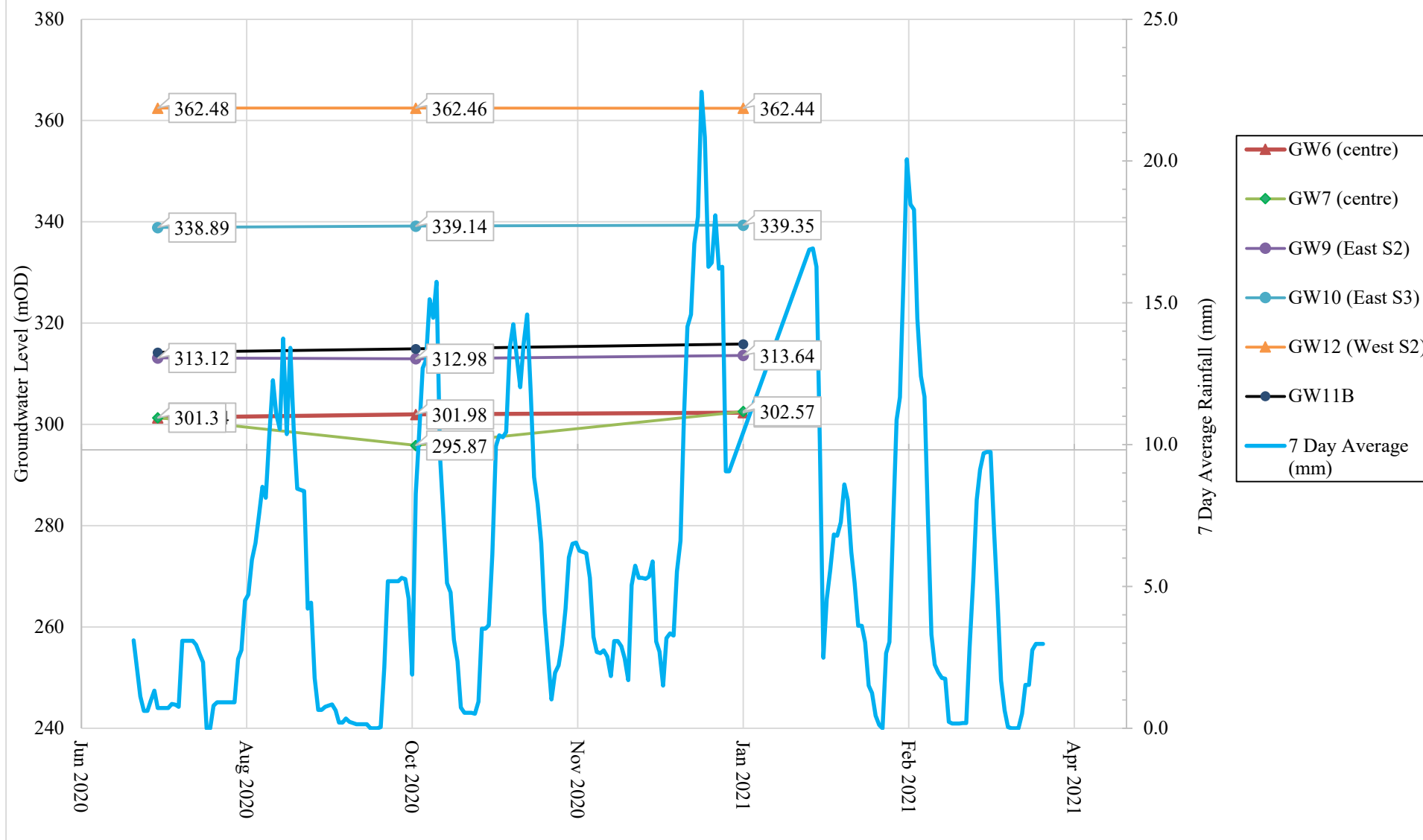


Figure A7
Groundwater monitoring levels downstream of compliance wells



Appendix B

Monitoring Results - Tables

Appendix B
Table B1
Leachate Monitoring Results

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January 2021												
LOCATION	Units	L1A	L1B	LC1A	LC2A	LC4A	LC5A	Maximum concentration (mg/l)	Monthly Average (mg/l)	Acceptable Maximum Concentration (AMC) (mg/l)	LP3A	LP4
Date Sampled	-							-	-	-		
Manganese in filtrate as Mn	mg/l	N/S	0.414	N/S	0.158	0.718	N/S	0.718	0.43	--	0.028	0.045
Mercury, filt trace as Hg	mg/l	N/S	< 0.0001	N/S	< 0.0002	< 0.0002	N/S	0.0002	0.000166667	0.00056	< 0.01	< 0.01
Nickel in filtrate as Ni	mg/l	N/S	< 0.0066	N/S	0.097	0.011	N/S	0.097	0.0382	0.0681	0.0029	0.0027
Zinc, ultra-low filtered as Zn	mg/l	N/S	0.017	N/S	2.72	5.69	N/S	5.69	2.809	1.38	0.015	0.013
pH	pH Units	N/S	8.1	N/S	8.3	7.6	N/S	8.3	8	--	8.5	8
Conductivity- Electrical 20C	uS/cm	N/S	1640	N/S	10900	4250	N/S	10900	5596.666667	--	1000	953
Alkalinity as CaCO3	mg/l	N/S	469	N/S	5260	2640	N/S	5260	2789.666667	--	336	331
Ammoniacal Nitrogen as N	mg/l	N/S	4.54	N/S	760	271	N/S	760	345.18	526	< 0.41	1.67
Chloride as Cl	mg/l	N/S	97.6	N/S	831	209	N/S	831	379.2	1408	58.1	N/S
Sulphate as SO4	mg/l	N/S	297	N/S	454	15	N/S	454	255.3333333	999	131	41.8
Redox Potential ^(see note 4)	mV	N/S	118	N/S	146	141	N/S	146	135	--	102	129
Total Suspended Solids	mg/l	N/S	8	N/S	3830	6020	N/S	6020	3286	--	6	100
Solids, Total Dissolved 180 deg C	mg/l	N/S	1240	N/S	5170	1850	N/S	5170	2753.333333	--	715	5
Dissolved Oxygen, Fixed	mg/l	N/S	2.5	N/S	< 0.5	<0.5	N/S	2.5	1.5	--	7	671
TOC (filtered)	mg/l	N/S	14.1	N/S	263	63.2	N/S	263	113.4	--	7.7	6.6

Notes

1. < denotes 'less than'.
2. L1A,L1B, LC1A, LC2A,LC4A, LC5A: Wells in Waste.
3. -- denotes 'no acceptable maximum concentration available'.
4. The redox potential was not measured on site and there is a possibility that it has changed between sampling and analysis
5. LC5A is a replacement for LC5 well.
6. N/S denotes 'not sampled'.

Exceedance of AMC (per well)
Exceedance of AMC (monthly average)

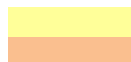


Table B2
Leachate Head Levels

		Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
LC1A	Elevation of base of landfill mAOD	357.62											
	Elevation at top of casing mAOD	398.85											
	Depth to leachate from top of casing (m)	40.39											
	Leachate elevation (mAOD)	358.46											
	Calculated leachate head (m)	0.84											
LC2A	Elevation of base of landfill mAOD	362.49											
	Elevation at top of casing mAOD	401.12											
	Depth to leachate from top of casing (m)	35.54											
	Leachate elevation (mAOD)	365.58											
	Calculated leachate head (m)	3.09											
LC4A	Elevation of base of landfill mAOD	372.27											
	Elevation at top of casing mAOD	401.14											
	Depth to leachate from top of casing (m)	26.84											
	Leachate elevation (mAOD)	374.30											
	Calculated leachate head (m)	2.03											
LC5A	Elevation of base of landfill mAOD	350.14											
	Elevation at top of casing mAOD	380.75											
	Depth to leachate from top of casing (m)	DAMAGED											
	Leachate elevation (mAOD)												
	Calculated leachate head (m)												
L1	Casing height (mAOD)	357.00											
	Leachate (mbgl)	29.16											
	Leachate (m AOD)	327.84											
	Base of landfill (m AOD)	336.80											
	Depth of well from top of casing (m)	21.03											
	Base of well (m AOD)	335.97											
	Calculated leachate head (m)	-8.96											
L1A*	Casing height (mAOD)	355.79											
	Leachate (mbgl)												
	Leachate (m AOD)	-											
	Base of landfill (m AOD)	316.64											
	Depth of well from top of casing (m)	20.91											
	Base of well (m AOD)	334.88											
	Calculated leachate head (m)												
L1B*	Casing height (mAOD)	354.80											
	Leachate (mbgl)	26.75											
	Leachate (m AOD)	328.05											
	Base of landfill (m AOD)	319.60											
	Depth of well from top of casing (m)	34.86											
	Base of well (m AOD)	319.94											
	Calculated leachate head (m)	8.45											

2021	Quarterly Leachate Head Averages (m)
January	1.99
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

 Minimum monthly leachate head average
 Maximum monthly leachate head average

Notes:**Top of casings were re-surveyed in August 2019**

1. LC1A top of casing is 1710mm above ground level.

2. LC2A top of casing is 820mm above GL.

3. LC4A top of casing is 1040mm above GL.

4. LC5A top of casing is 1050mm above GL.

* Well not included in monthly average.

Note: L1 is generally dry or with very little water in it.

Table B3
Surface Water Monitoring Results

Month	Location	Date	Mercury, ultra-low total as Hg	Redox Potential	Manganese in filtrate as Mn	Nickel in filtrate as Ni	Bioavailable Ni	Zinc, ultra- low total as Zn	Bioavailable Zn	pH	Conductivity- Electrical 20°C	Alkalinity as CaCO3	Ammoniacal Nitrogen as N	Unionised Ammoniacal Nitrogen **	Measured surface water	Chloride as Cl	Sulphate as SO4	Solids, Suspended	Dissolved oxygen	TOC (Filtered)	Calcium			
			ug/l	mV	mg/l	mg/l	mg/l	mg/l	mg/l		uS/cm	mg/l	mg/l	mg/l	°C	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l			
January	Freshwater EQS**			1	-	0.123	0.004	0.004	0.0137	0.0137	-	-	-	-	0.015**	-	250	400	-	-	-			
	Upstream of Landfill	SWU	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SW2A1		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SWW4		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
	NW Ditch System	SWW1	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SWW2		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
	Downstream of Landfill	SWD	20/01/2021 <	0.01	119.00	0.0043	0.0010	0.0002	0.0130	0.003	7.70	149.00	65.60	<	0.41	0.0032	7.8	4.00	15.80	7.00	11.00	2.10	27	
		SWD1		20/01/2021 <	0.01	121.00	0.0033	0.0014	0.0003	0.010	0.002	7.60	153.00	57.80	<	0.41	0.0026	8.1	5.40	16.70	24.00	10.90	3.30	23
	February	Upstream of Landfill	SWU	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S		
			SW2A1		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S		
SWW4			N/S		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
NW Ditch System		SWW1	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SWW2		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
Downstream of Landfill		SWD	Quarterly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
SWD1	N/S	N/S		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S				
March	Upstream of Landfill	SWU	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SW2A1		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SWW4		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
	NW Ditch System	SWW1	Six-monthly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
		SWW2		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
	Downstream of Landfill	SWD	Quarterly	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S			
SWD1	N/S	N/S		N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S				
Minimum			<	0.0100	119.0	<	0.003	<	0.001	<	0.0100	7.6	149.0	57.80	<	0.41	0.0026	7.80	4.00	15.80	7.00	10.90	2.10	23.00
Maximum			<	0.0100	121.0	0.004	0.001		0.0130	7.7	153.0	65.60	<	0.41	0.00	8.10	5.40	16.70	24.00	11.00	3.30	27.00		

Notes

1.The redox potential was not measured on site and there is a possibility that it has changed between sampling and analysis

2.N/S - Not analysed

3.Unionised ammoniacal nitrogen based on measured

4.Environmental Quality Standard EQS 1 for freshwater is derived to protect the most sensitive aquatic life.

5.NW Ditch - North Western (ditch system)

	Exceedance of EQS
	Upstream of Nant Merddog
	Downstream of Nant Merddog

Table B4
Groundwater monitoring results

Location	Month	Date	Test reference number	Redox Potential	Mercury, filtrate as Hg	Manganese in filtrate as Mn	Nickel in filtrate as Ni	Zinc, ultra-low filtered as Zn	pH	Electrical Conductivity 20C	Alkalinity as CaCO3	Ammoniacal Nitrogen as N	Unionised Ammoniacal Nitrogen ***	Measure water temperature	Chloride as Cl	Sulphate as SO4	Calcium	D.O. concentration	TOC (Filtered)
				mV	ug/l	mg/l	mg/l	mg/l	pH units	uS/cm	mg/l	mg/l	mg/l	°C	mg/l	mg/l	mg/l	mg/l	mg/l
Trigger Level					(0.2 ^m)		0.05	(0.05 ^m)	--	--	--	1	--	--	250	400	--	--	--
Control Level A					(0.1 ^m)	--	0.03	(0.02 ^m)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15 ^m)	--	0.04	(0.035 ^m)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0 ^m)	--	--	--	--	--	--	--	--	--	--	--	--	--
GW11B	Dec-19																		
	Jan-20	Not sampled	Quarterly																
	Feb-20																		
	Mar-20	Not sampled	Quarterly																
	Apr-20																		
	May-20	Not sampled	Quarterly																
	Jun-20																		
	Jul-20	Not sampled	Quarterly																
	Aug-20																		
	Sep-20	Not sampled	Quarterly																
	Oct-20																		
	Nov-20	Not sampled	Quarterly																
	Dec-20																		
	Jan-21	Not sampled	Quarterly																
	Feb-21																		
	Mar-21																		
	Apr-21																		
	May-21																		
	Jun-21																		
	Jul-21																		
	Aug-21																		
	Sep-21																		
	Oct-21																		
	Nov-21																		
	Dec-21																		
DOWNSTREAM WELLS / COMPLIANCE WELLS																			
SST West S2																			
GW12	Jan-19	08/01/19	17839315	75	0.506	0.0092	0.0048	< 0.0180	7.5	1770.0	415.0	0.84			116.0	367.0	131.0	5.0	12.7
	Feb-19	Quarterly																	
	Mar-19																		
	Apr-19	01/04/19	18095232	113	< 0.200	< 0.0070	0.0083	< 0.0180	8.2	1970.0	384.0	0.89			128.0	379.0	151.0	3.7	13.9
	May-19	Quarterly																	
	Jun-19																		
	Jul-19	01/07/19	18369033	-89	< 0.20	0.0208	< 0.0030	< 0.0180	8.4	1470.0	374.0	< 0.41			71.7	327.0	124.0	6.4	8.4
	Aug-19	Quarterly																	
	Sep-19																		
	Oct-19	14/10/19	18694538	89	< 0.100	1.7700	0.0161	< 0.0180	7.4	1610	381	< 0.41			89.8	328	135	3.4	10.3
	Nov-19	Quarterly																	
	Dec-19																		
	Jan-20	21/01/20	18977414	40	0.098	0.0102	0.0076	< 0.0180	7.8	1660.0	431.0	< 0.41			95.0	321.0	151.0	4.0	11.8
	Feb-20	Quarterly																	
	Mar-20																		
	Apr-20	21/04/20	1860909	183	0.11	0.0130	0.0062	0.0659	8.2	1660.0	433.0	< 0.41	0.0254	20.8	101.0	312.0		4.8	9.3
	May-20	Quarterly																	
	Jun-20																		
	Jul-20	21/07/20		133	0.14	< 0.0070	0.0001	< 0.0180	7.6	1360.0	414.0	< 0.41	0.0059	19.1	50.6	296.0	129.0	6.2	6.0
	Aug-20	Quarterly																	
	Sep-20																		
	Oct-20	29/10/20	19827623	-20	0.06	< 0.0070	0.0137	< 0.0180	7.8	1340.0	359.0	< 0.41	0.0100	19.8	70.9	245	122	6.6	7.7
	Nov-20	Quarterly																	
	Dec-20																		
SST Centre	Jan-21	20/01/21	20069623	137	0.019	0.0081	0.0013	< 0.0050	7.0	454.0	184.0	< 0.41	0.0016	20.1	15.0	48.3	55.0	8.8	2.4
	Feb-21																		
	Mar-21																		
	Apr-21																		
	May-21																		
	Jun-21																		
	Jul-21																		
	Aug-21																		
	Sep-21																		
	Oct-21																		
	Nov-21																		
	Dec-21																		
	SST Centre																		
GW6	Jan-19	08/01/19	17839310	47	< 0.20	0.1480	0.0093	< 0.0180	6.6	764.0	322.0	< 0.41			65.4	89.1	50.6	4.5	3.6
	Feb-19	Quarterly																	
	Mar-19																		
	Apr-19	01/04/19	18095227	95	< 0.20	0.4210	0.0073	< 0.0180	7.0	832.0	314.0	< 0.41			65.9	86.7	56.2	2.6	5.0
	May-19	Quarterly																	
	Jun-19																		
	Jul-19	01/07/19	18369028	-63	< 0.20	0.2610	0.0046	< 0.0180	7.2	821.0	317.0	< 0.41			67.7	86.9	58.1	2.7	5.9
	Aug-19	Quarterly																	
	Sep-19																		
	Oct-19	14/10/19	18694533	176	0.033	0.6620	0.0214	< 0.0180	6.6	788	284	< 0.41			67.7	87.2	44.5	7.3	4.1
	Nov-19	Quarterly																	
	Dec-19																		
	Jan-20	21/01/20	18977409	30	0.064	0.4630	0.0150	< 0.0180	7.0	854.0	354.0	< 0.41			71.3	91.2	61.0	3.5	7.1
	Feb-20	Quarterly																	
	Mar-20																		
Apr-20	21/04/20	1860909	170	0.06	0.7120	0.0254	< 0.0180	7.3	869.0	311.0	< 0.41	0.0018	12.0	73.7	86.6		3.5	4.2	
May-20	Quarterly																		
Jun-20																			
Jul-20	21/07/20	19513250	116	0.06	0.8270	0.0124	< 0.0180	6.7	786.0	288.0	< 0.41	0.0005	12.4	69.7	83.3	54.9	3.1	3.9	
Aug-20	Quarterly																		

Groundwater monitoring results

Location	Month	Date	Test reference number	Redox Potential	Mercury, filtrate as Hg	Manganese in filtrate as Mn	Nickel in filtrate as Ni	Zinc, ultra-low filtered as Zn	pH	Electrical Conductivity 20C	Alkalinity as CaCO3	Ammoniacal Nitrogen as N	Unionised Ammoniacal Nitrogen ***	Measure water temperature	Chloride as Cl	Sulphate as SO4	Calcium	D.O. concentration	TOC (Filtered)	
				mV	ug/l	mg/l	mg/l	mg/l	pH units	uS/cm	mg/l	mg/l	mg/l	°C	mg/l	mg/l	mg/l	mg/l	mg/l	
Trigger Level					(0.2 ⁿ)		0.05	(0.05 ⁿ)	--	--	--	1	--	--	250	400	--	--	--	
Control Level A					(0.1 ⁿ)	--	0.03	(0.02 ⁿ)	--	--	--	0.8	--	--	210	300	--	--	--	
Control Level B					(0.15 ⁿ)	--	0.04	(0.035 ⁿ)	--	--	--	0.9	--	--	230	350	--	--	--	
Assessment Level					--	(1.0 ⁿ)	--	--	--	--	--	--	--	--	--	--	--	--	--	
GW7	Sep-20																			
	Oct-20	29/10/20	19827619	-26	0.04	0.6860	0.0088	< 0.0180	6.8	838.0	285.0	< 0.41	0.0010	12.2	76	84.8	48.3	2.4	4.1	
	Nov-20		Quarterly																	
	Dec-20																			
	Jan-21	20/01/21	20069618	137	0.036	0.4410	0.0098	< 0.0050	6.6	901.0	303.0	< 0.41	0.0004	12.0	82.2	96.6	54.0	4.1	4.8	
	Feb-21		Quarterly																	
	Mar-21																			
	Apr-21																			
	May-21																			
	Jun-21																			
	Jul-21																			
	Aug-21																			
	Sep-21																			
	Oct-21																			
	Nov-21																			
	Dec-21																			
	Jan-19	08/01/19	17839311	90	<	0.10	2.0200	0.0069	0.0230	7.6	766.0	289.0	0.78			43.1	72.7	71.0	4.9	5.6
	Feb-19		Quarterly																	
	Mar-19																			
	Apr-19	01/04/19	18095228	104	<	0.20	1.7900	0.0055	< 0.0180	7.2	794.0	282.0	< 0.41			45.8	72.3	70.4	3.5	5.7
	May-19		Quarterly																	
	Jun-19																			
	Jul-19	01/07/19	18369029	-33	<	0.20	2.5100	0.0036	< 0.0180	7.9	875.0	317.0	< 0.41			54.9	71.7	80.4	3.0	5.8
	Aug-19		Quarterly																	
	Sep-19																			
	Oct-19	14/10/19	18694534	195	<	0.01	1.9200	0.0150	< 0.0180	7.3	815.0	310	< 0.41			39.6	73.5	72.5	8.3	5.2
	Nov-19		Quarterly																	
Dec-19																				
Jan-20	21/01/20	18977410	44	<	0.01	1.2800	0.0065	< 0.0180	7.6	900.0	323.0	< 0.41			59.2	62.6	84.7	4.3	6.4	
Feb-20		Quarterly																		
Mar-20																				
Apr-20	21/04/20	1860909	175	<	0.01	1.2700	0.0056	< 0.0180	8.1	888.0	318.0	< 0.41	0.0104	11.4	56.7	72.6		4.9	6.2	
May-20		Quarterly																		
Jun-20																				
Jul-20	21/07/20	19513251	124	<	0.01	2.0500	0.0060	< 0.0180	7.4	968.0	322.0	< 0.41	0.0021	11.6	65.7	94.2	88.3	3.7	6.5	
Aug-20		Quarterly																		
Sep-20																				
Oct-20	29/10/20	19827620	-26	<	0.01	1.6900	0.0050	< 0.0180	7.7	927.0	326.0	< 0.41	0.0040	12.0	53.4	96.2	83.8	3.5	5.0	
Nov-20		Quarterly																		
Dec-20																				
Jan-21	20/01/21	20069619	111	<	0.010	0.0071	0.0052	0.0120	7.1	837.0	312.0	< 0.41	0.0011	11.8	46.9	80.6	85.0	4.1	5.3	
Feb-21		Quarterly																		
Mar-21																				
Apr-21																				
May-21																				
Jun-21																				
Jul-21																				
Aug-21																				
Sep-21																				

Groundwater monitoring results

	Exceedance of Control Level
	Exceedance of Trigger Level
	Exceedance of Assessment Level

* The redox potential was not measured on site and there is a possibility that it has changed between sampling and analysis {*/}

** Unionised ammoniacal nitrogen based on measured Temperature and pH; unionised ammoniacal nitrogen = total ammonia/(1+10^{(10.055-(0.0324*Tc)-pH)}), where T°C is measured water temperature.

^a Ammonia result confirmed on duplicate analysis.

Table B5
Landfill Gas Monitoring Results

METHANE (% by Volume)														CARBON DIOXIDE (% by Volume)													
Location	Valve	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Comments	
GMW7	Yellow Valve	0	0	0										0.2	0.2	0.6											Yellow Valve,12 depth
	White Valve	0	0	0										0.2	0.2	0.6											White Valve, 5m depth
	Trigger Levels	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Control Levels	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Trigger Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3		
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32		
GMW12	Red Valve	0	0	0										0.4	0.4	2.3											Red Valve, 26.3m depth
	Yellow Valve	0	0	0										2.8	2.7	2.8											Yellow Valve,15m depth
	White Valve	0	0	0										0.4	0.9	1											White Valve, 5m depth
	Trigger Level Red	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
	Trigger Level Yellow	1	1	1	1	1	1	1	1	1	1	1	1	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	
	Trigger Level White	1	1	1	1	1	1	1	1	1	1	1	1	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
	Control Level Red	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	4	4	4	4	4	4	4	4	4	4	4	4	4	
	Control Level Yellow	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Control Level White	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5	5	5	5	5	5	5	5	5	5	5	5	5		
GMW13	Red Valve	0	0	0										1.4	1.5	1.1											Red Valve, 26.3m depth
	Yellow Valve	0.1	0.1	0.1										4.2	4.9	4.8											Yellow Valve,15m depth
	White Valve	0	0	0										2.1	2.4	0											White Valve, 5m depth
	Trigger Level Red	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	
	Trigger Level Yellow	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6	6	6	6	6	6	6	6	6	6	6	6	6	
	Trigger Level White	1	1	1	1	1	1	1	1	1	1	1	1	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	
	Control Level Red	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	
	Control Level Yellow	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
Control Level White	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32		
GMW14/14A	Red Valve	0	0	0										1.7	3.4	3.7											Red Valve, 26.3m depth
	Yellow Valve	0	0	0										6	6.5	6.3											Yellow Valve,15m depth
	White Valve	0	0	0										5.1	5.5	5.3											White Valve, 5m depth
	Trigger Level Red	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
	Trigger Level Yellow	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	
	Trigger Level White	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	
	Control Level Red	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Control Level Yellow	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	
Control Level White	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9		
GMW1**	Red Valve	0	0.3	0.4										2.1	6	2.8											Red Valve, 23.5m depth
	Yellow Valve	2.6	0	0										1.2	0.1	0											Yellow Valve,14.7m depth
	White Valve	0	1.2	0.8										0	0.9	0.6											White Valve, 6.5m depth
GMW8*	Yellow Valve	8.6	9.4	8.9										8.3	7.6	7.7											Yellow Valve,17.5m depth
	White Valve	0	0	0										4	3.7	3.9											White Valve, 5.7m depth
GMW9*	Red Valve	0	0	0										1.9	1.8	1.9											Red Valve, 27m depth
	Yellow Valve	25.3	27.7	27.6										8.6	8.7	9.1											Yellow Valve,15m depth
	White Valve	0.1	0.1	0										0.1	0.1	0.1											White Valve, 8.5m depth
GMW10*	Red Valve	14.8	15	0.1										4.3	3.7	7.8											Red Valve, 19.5m depth
	Yellow Valve	15.6	18	0										2.6	2.3	0.1											Yellow Valve,15m depth
	White Valve	16.5	14.5	12.1										6.5	7.2	8.3											White Valve, 8m depth
GMW17**	Red Valve	0	0	0										1.4	1.5	1.3											Red Valve, 26.3m depth
	Yellow Valve	0	0	0										5.1	5.1	4.8											Yellow Valve,15m depth
	White Valve	0	0	0										2.5	4	3.1											White Valve, 5m depth
GMW18**	Yellow Valve	0	0	0.9										0	1.5	1.4											Yellow Valve,12 depth
	White Valve	0	0	0										5.1	4.9	5.4											White Valve, 5m depth

Notes:
1. Water denotes 'water in well - reading abandoned'.
2. NT denotes 'reading not taken'.
3. NT in GMW14 is due to cattle quarantine paddock around well location.
4. Where the asterisc (*) is present, no trigger levels have been set, as high levels of methane and carbon dioxide gas are recorded. This is likely to be associated with the presence of bog/marshland.
5. Where two asteriscs (**) are present, no trigger levels have been set, as not require by the Permit (Reference [2]).

Exceedance of Trigger

Exceedance of Control