Silent Valley Waste Services Limited

Silent Valley Landfill

2020 Second Quarter Monitoring Report

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Ove Arup & Partners Ltd
1 West Regent Street
Glasgow G2 1RW
United Kingdom
www.arup.com

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1 Introduction

This 2020 Second 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 April to June 2020 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 First Quarter 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 and is summarised in Appendix B.

2 Discussion of Monitoring Results

2.1 Rainfall

Measured rainfall data is illustrated in **Appendix C**, **Figures C1** to **C3**.

Based on the available data, June recorded the highest monthly rainfall of the quarter and the highest daily rainfall total. These values are similar to those recorded during the same time period in 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 D**, **Table D1**.

The majority of the determinands are compliant.

Well LC5A has continued to record a high ammoniacal nitrogen concentration and will be reviewed in the context of the proposed investigations into LC5A.

Well LC2A also recorded an elevated concentration. However, the average ammoniacal nitrogen concentration had declined throughout the past twelve months, although historically has been shown to fluctuate.

Wells LC2A and LC4A specifically exceeded the AMC for nickel and are showing an increasing trend since last quarter.

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 D**, **Table D2.**

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 D**, **Tables D3** and **D4**, and graphically in **Appendix C**, **Figure C4 and C5**.

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.

Results show these are all compliant.

2.3.2 Downstream Surface Water

SWD and SWD1

Results show these locations are both compliant.

SW1 to SW10

Samples were only collected in April 2020 and results continue to demonstrate that ammoniacal nitrogen, chloride and mercury concentrations are very low. Considering this, these locations were not sampled in May or June 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 C**, **Figures C6** and **C7** and in **Appendix D**, **Table D5.**

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 less 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 showing no recognisable trend. The elevated concentrations recorded upstream likely to be from steel works waste deposited to the north of the landfill and old mine workings in the area.

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 C**, **Figure C8**.

Water levels have remained consistent this quarter.

2.5 Landfill Gas

2.5.1 Landfill Gas Quality Monitoring

The landfill gas monitoring results are presented in **Appendix D**, **Table D6**.

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, GMW13 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 June only
- GMW13 (yellow) every month

Trigger Level

- GMW14/14A (red) every month

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 regard to GMW13 and GMW14/14A consecutive exceedances have been recorded in 2020. However, the gas concentration is reducing each month and nearing the Trigger and Control levels. These 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.

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 First Quarter Monitoring Report, 30th April 2020.

[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 in to 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, 2010 Annual Monitoring Report, document reference 11/7956, February 2011.

[10] Arup, Silent Valley Landfill, Hydrogeological Risk Assessment (Supplementary Revision May 2009), document reference 09/7543, June 2009.

[11] Golder Associates, Establishment of Trigger Levels at Silent Valley landfill site, letter report dated 21 December 2006.

[12] Environment Agency, Guidance on the management of landfill gas, document reference LFTGN03, June 2014.

[13] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

[14] Water Framework Directive - United Kingdom Technical Advisory Group (WFD-UKTAG), “Metal Bioavailability Assessment Tool (M-BAT),” 2014.

[15] Arup, Silent Valley Landfill, 2019 First Quarter Monitoring Report, 30th April 2019.

[16] Arup, Silent Valley Landfill, 2019 Second Quarter Monitoring Report, 31st July 2019.

Appendix A

Details of cut-off and monitoring systems

A1 Pumping cut-off system and monitoring

The following is a summary of the activities that have taken place at the site in relation to the pumping and monitoring system since its installation in 2007.

2007 **October:** The pumping system became operational.

2008 **November/December:** A programme of inspection and maintenance was undertaken to check the level and performance of each well and pump following the findings of the January to September 2008 interim report, which indicated that the cut-off system operated less efficiently post high rainfall events, with concentrations within the compliance wells temporarily increasing. A number of wells were found to be silting up and required cleaning. Details are presented in the Annual Monitoring Report 2008.

2009 **January:** The majority of wells were successfully cleaned. The base of wells TW2, TW7, PW4 and PW10 were found to be above the depth shown on the logs. Deeper replacement wells were installed at TW2, TW6 and TW7, (called TW2A, TW6A and TW7A), construction details as shown in the sketch at the end of this Appendix;

February: Low-draw pumps were installed to improve the situation at PW4, PW7, PW10 and PW14;

March: Existing pumps were replaced with more robust pumps, to cope with silting and iron hydroxide deposition;

April: Pumping from these replacement wells commenced;

November/December: The pumps in wells TW2A and TW6A were overwhelmed during periods of very heavy rainfall, producing impacts in the compliance wells downstream, at GW9 and GW12 and monthly average leachate heads often in excess of permitted values. There was concern that the monitored heads may have been influenced by perched leachate bodies, the monitoring wells having been constructed with slag gravel response zones extending through the body of the landfill. As a result, two more pumping wells were installed alongside each of wells TW2A and TW6A, with the aim that these wells would provide support to the existing wells and prevent further migration of leachate. Pumping tests and the installation of new leachate monitoring wells at the locations of LC1, LC2 and LC4 (LC1A, LC2A and LC4A) were undertaken to obtain additional information on the leachate heads. The new wells were installed with 3m long response zones in contact with the base of the landfill and isolated from potential perched leachate bodies higher up within the landfill mass. As such, they are representative for measuring the hydrostatic head of leachate that acts on the base of the landfill and potentially drives leakage. The wells have consistently indicated leachate heads that are much lower than those measured previously in the corresponding former monitoring wells LC1, LC2 and LC4. This is

considered strong evidence that the average leachate heads derived previously were influenced by perched leachate bodies.

2010 **February:** Wells TW2B, TW2C, TW6B and TW6C were installed alongside wells TW2A and TW6A. The monitoring results indicate there has been an improvement of water quality in GW12 in relation to ammoniacal nitrogen and chloride (i.e. in TW2A, only one exceedance of the compliance limit for ammoniacal nitrogen and no exceedances for chloride were recorded since the installation of the new pumps). However, this improvement was not replicated at GW9 downstream of TW6A, B and C. Extensive investigations including sampling and laboratory analyses have been undertaken to confirm the source of the leachate species encountered in GW9 and measures to address this issue have been undertaken (see Reference [8]). The investigations identified an uncapped plateau area on the eastern flank of the landfill and concluded that one of the sources of the leachate monitored in GW9 may be groundwater infiltrating into the waste body from this uncapped area and flowing towards GW9 within fractured mudstone and sandstone layers, in line with the geological and hydrogeological model also presented in the report. Part of the leachate body in the uncapped waste was also considered to be flowing towards a gabion mattress-lined ditch located on the eastern flank of the landfill. This leachate was found to be diluted by the surface waters flowing in the ditch and potentially by groundwater from the valley sides, and was also considered likely to be impacting GW9. The capping of the eastern plateau was completed in August 2011 (see below).

June/July: A replacement monitoring well LC5A was drilled adjacent to LC5. A back-up compressor has been installed to provide support to the compressor currently in use at Silent Valley.

August: The new leachate well, LC5A, was commissioned and subsequently monitored in accordance with the quarterly monitoring regime.

2011 Leachate pumping was temporarily ceased due to bio-fouling of the pumps and wells. The pumping was shortly after reinstated using gas extraction wells and the pumping continues to date.

August: The capping of the eastern plateau was completed. Since its installation, the levels of ammoniacal nitrogen and chloride in GW10 were observed to have significantly reduced towards the end of 2011; however, these continued to be above the compliance level in GW9 and further sampling was recommended to monitor the trend.

2012: No specific maintenance or upgrades on the monitoring infrastructure were required or undertaken in 2012.

2013 **March to July:** The pump in PW12, which pumps from sandstone strata S3, was found to be not working. Following a number of maintenance works, the pump was still found to be failing. On reinstatement of the electronic groundwater monitoring system in July (see further details

A1.1 Electronic Monitoring System

Since April/May 2009, the water levels within the pumping wells have been continuously monitored using electronic devices installed within the wells, so-called 'divers'. These send water level data at a specified frequency directly to an office-based computer, allowing continuous remote monitoring of the efficiency of the cut-off system. This has enabled immediate investigation and remedial actions to be taken when the water level within any well has risen unacceptably or abnormally.

In March 2013, however, problems have occurred with some of the modems, devices collecting data and sending this information to the office-based computer. During the repair period, the efficiency of parts of the pumping system was monitored manually. The modems have been successfully reinstalled in July 2013 and no further issues have been recorded since then.

A1.2 Future maintenance and reinforcement

The pumping well cut-off system is considered to be both robust and flexible. There is considerable redundancy in its design, both in terms of the spacing of the wells and the capacity of the pumps. The system can be easily modified or augmented by the addition of new wells as necessary (as has already taken place in 2008, 2009 and early 2010). In addition to this, the electronic monitoring system, together with routine on-going maintenance of the wells and pumps and provision of replacement pumps, enables corrective actions to be taken in advance of any acute problem that could have an adverse impact on the local groundwater environment. It is clear that for the significant majority of the site, the pumping system is preventing the impact of leachate species from within the body of the waste (or discharge zone as per the Groundwater Regulations 2009 incorporated into EPN2012) on the groundwater. Where there is the one non-compliance, GW9, Silent Valley has undertaken extensive investigations and works (References [7] and [8]).

Appendix B

Monitoring Regime

B1.1 Rainfall

Rainfall is measured at intervals of 0.5hrs daily, and measurements are used in the assessment of leachate and groundwater monitoring results.

B1.2 Leachate

Monitoring of leachate for both leachate quality and leachate levels is undertaken quarterly in wells LC1A, LC2A, LC4A, LC5A as well as L1A and L1B and L1 for leachate levels only, although L1A, L1B and L1 are no longer considered in the assessment of leachate head.

Leachate drain outfalls LP3A and LP4 are monitored for leachate quality only and LP1 and LP2A are also monitored individually in addition to the monitoring locations agreed in the Permit (Ref. [1]). The results from these are discussed as part of the results obtained from LP3A.

The locations of the monitoring wells and leachate lagoons are presented on **Figure 2**.

Leachate quality is for the determinand suite included in Table 6 and Table 7 of the Aftercare Phase Environmental and Infrastructure Monitoring Program report (Ref. [4]), as required by the Permit (Ref. [1]). A hazardous substance suite is to be carried out every four years in LC1A, LC2A, LC4A, LC5A, L1A, L1B, LP3A and LP4 if there is an increase in contamination, as per the Permit (Ref. [1]).

B1.2.1 Compliance criteria

Assessment limits have been set for leachate head and composition These are summarised in Tables 3.1 and 3.2 below.

B1.2.1.1 Leachate head

As noted in Table 3.1, it is required that the monthly average leachate head level above the base of the landfill in LC1A, LC2A, LC4A and LC5A is less than 3m.

Table 3.1: Leachate Assessment Limits

Measurement	Assessment limit	Assessment Test
Leachate Head/Level	Maximum head assumed in risk assessment (3m)	Mean leachate head measured in wells as set out in the Permit, exceeds assessment limit on three consecutive surveys.
Leachate Composition	Maximum concentration assumed in risk assessment	Mean concentration from wells in waste mass exceeds assessment limit on three consecutive surveys.

B1.2.1.2 Leachate quality

For monitoring leachate quality, a reduced suite of contaminants is tested for on a quarterly basis as per the permit (Ref. [1]). The revised suite of contaminants tested are presented below:

- Manganese (mg/l)
- Mercury (mg/l)

- Nickel (mg/l)
- Zinc (mg/l)
- pH (pH units)
- Conductivity (uS/cm)
- Alkalinity as $CaCO_3$ (mg/l)
- Ammoniacal Nitrogen (mg/l)
- Chloride (mg/l)
- Sulphate (mg/l)
- Redox Potential (mV)
- Total Organic Carbon (TOC) (mg/l)
- Dissolved Oxygen (DO) (mg/l)
- Suspended Solids (mg/l)
- Dissolved Solids (mg/l)

The assessment limits are compared with the calculated mean contaminant concentrations from the monitoring wells in the waste mass. If the mean concentrations from wells in the waste mass exceed the assessment levels on three consecutive surveys, contingency actions will be triggered, as described in the Aftercare Phase Environmental and Infrastructure Monitoring Program report (Ref. [4]) and summarised in Table 3.3.

Table 3.2 Leachate Acceptable Maximum Concentrations AMCs (from Ref. [8])

Contaminant	Acceptable Maximum Concentration AMCs (mg/l)
NH_3	526
Chloride	1408
Sulphate	999
Nickel	0.0681
Zinc	1.38/
Mercury	0.56 µg/l

Table 3.3: Leachate Monitoring Contingency Actions (from Ref. [8])

Contingency Action	Response Time
Report to NRW including initial assessment of possible causes	1 month
Report to NRW on re-appraisal of risk to groundwater and surface water and options for corrective measures	3 months
If risks are acceptable revise assessment criteria as appropriate. Continue monitoring. If risks are not acceptable implement agreed corrective actions (i.e. increase monitoring and frequency as agreed with the NRW)	6 months

B1.3 Surface Water

Surface water sampling of the Nant Merddog is undertaken in accordance with the sampling protocols defined in the Aftercare Phase Environmental and Infrastructure Monitoring Program Report (Ref. [4]) and tested for contaminants as per the Permit (Ref. [1]).

Monitoring of surface water quality is currently being undertaken at the locations and frequencies listed in Table 3.4 in order to identify any adverse impact resulting from escape of leachate from the landfill, particularly in relation to the Nant Merddog.

Monitoring point locations are marked on **Figure 2** and **Figure 3**.

Table 3.4: Surface Water Monitoring Locations

Monitoring Point		Location	Monitoring Frequency
Upstream locations	SWU	On the Nant Merddog, north (upstream) of landfill	Six monthly
	SW2AI	On drainage ditch system on northern perimeter of landfill. The ditch intercepts surface water run-off from the area north of the landfill and discharges to the Nant Merddog	
	SWW4	On drainage ditch system north of the landfill, at point where the northern perimeter ditch system joins the eastern perimeter ditch system	
	SWW1	On ditch system north-west of the landfill	
	SWW2	On ditch system north-west of the landfill	
Downstream locations	SWD	On the Nant Merddog, approximately 70m downstream of the landfill (15m downstream of the point where the diverted stream joins its original course).	Quarterly
	SWD1	On the Nant Merddog, approximately 300m downstream of SWD	
	SW1, SW2, SW3, SW9 and SW10	A stream, feeding into the Nant Merddog some 190m downstream of SWD issuing on the eastern slope of the valley	Monthly
	SW4, SW5, SW6	A potential groundwater out-break, feeding into the Nant Merddog some 155m downstream of SWD issuing on the eastern slope of the valley	
	SW7	Nant Merddog immediately downstream of the above confluence	
	SW8	Nant Merddog immediately downstream of the above stream confluence	

B1.3.1 Compliance criteria

The compliance criteria for surface water quality are the Environmental Quality Standards (EQS) which are appropriate for the Nant Merddog for all contaminants for which these are available.

The following suite of contaminants are tested as per the permit (Ref. [1]), with the addition of calcium which is required for determining the bioavailable metal concentration.

- Manganese (mg/l)
- Mercury (mg/l)
- Nickel (mg/l)
- Zinc (mg/l)
- pH (pH units)
- Conductivity (uS/cm)
- Alkalinity as $CaCO_3$ (mg/l)
- Calcium (mg/l)
- Ammoniacal Nitrogen (mg/l)
- Chloride (mg/l)
- Sulphate (mg/l)
- Redox Potential (mV)
- Total Organic Carbon, filtered (TOC) (mg/l)
- Dissolved Oxygen (DO) (mg/l)
- Suspended Solids (mg/l)

All compliance criteria values, including the updated heavy metals, are set out in **Table 3.5**.

Table 3.5: Compliance Criteria for the Nant Merddog

Contaminant	EQS (µg/l)	Notes
Ammoniacal Nitrogen (unionised)	15	EQS
Sulphate	400 mg/l	EQS
Chloride	250 mg/l	EQS
Nickel (Dissolved)	4	EQS
Zinc (Total)	13.7*	EQS
Mercury (Total)	1	EQS
Manganese	123	EQS

Notes:

* This level is based on the standard EQS value 10.9ug/l plus the Ambient Background Concentration (AMC) of the River Taff of 2.8ug/l [Ref. (12)].

B1.3.2 Contingency Actions

As discussed in the Aftercare Phase Environmental and Infrastructure Monitoring Program report (Ref. [4]), background water quality monitoring upstream of the landfill indicates that concentrations of some determinants may exceed the compliance criteria in some cases. The assessment of breaches of compliance criteria therefore includes an assessment of background levels. Such breaches may be acceptable in cases where they result from background levels. No Assessment Levels are set, but assessment is made by monitoring the data for trends of increasing contaminant concentrations.

If a significant trend of increasing contaminant concentration is identified, then the following contingency actions and timescales should be followed.

Table 3.6: Surface Water Monitoring Contingency Actions (from Ref. [8])

Contingency Action	Response Time
Advise NRW with initial assessment of possible causes e.g. unusual activities, leachate discharges etc.	1 month
Report to NRW on re-appraisal of risk to the Nant Merddog and report on monitoring since the increasing trend was identified.	3 months
If risks are acceptable continued monitoring and assessment will be undertaken with three monthly reporting and risk re-appraisal concerning the contaminants of concern until such time as no continued potentially unacceptable risk is considered to exist.	6 months
If risks are unacceptable agreed corrective measures will be implemented (i.e. increase monitoring location points and increase frequency as agreed with the NRW)	

If there is a particular incident that may result in surface water pollution additional monitoring will be agreed with the NRW.

B1.4 Groundwater

Monitoring of groundwater is undertaken in accordance with Table S3.9 of the Permit (Ref. [1]), the Environment Agency guidance on groundwater monitoring (Ref. [7]) and in line with the monitoring schedule agreed with the NRW, as discussed in the 2010 Annual Monitoring Report (Ref. [8]).

Table?: Groundwater monitoring locations

Location	Monitoring Point	Monitoring Frequency
Upstream	GW3A	Quarterly
	GW4	
	GW11B	
Downstream/ Compliance Wells	GW6	
	GW7	
	GW9	
	GW10	
	GW12	

Well GW11B is a replacement for GW11A.

The locations of the monitoring wells are presented on Figure 2.

For details of previous monitoring undertaken at the site, refer to **Appendix B**.

B1.4.1 Compliance criteria

Control and Trigger Levels have been developed for those contaminants addressed in the Hydrogeological Risk Assessment (Ref. [5]) as shown in **Table 3.6**. These contaminants cover a range of substances indicative of landfill leachate contamination which are potentially harmful to downstream groundwater and to the aquatic environment of the Nant Merddog.

Table 3.7: Groundwater Control and Trigger Levels (and Assessment Level for manganese)

Determinand	Control Levels (mg/l)		Trigger Level (mg/l)
	A	B	
Ammoniacal Nitrogen	0.8*	0.9*	1.0*
Chloride	210*	230*	250*
Mercury	0.0001**	0.00015**	0.0002**
Nickel	0.03*	0.04*	0.05*
Sulphate	300*	350*	400*
Zinc	0.02**	0.035**	0.05**
Manganese	-	-	1.0**

Notes:

* From Hydrogeological Risk Assessment (Ref. [8]).

** From Hydrogeological Risk Assessment Supplementary Revision (Ref. [9]) and Groundwater Monitoring: Trigger Levels report (Ref. [10]).

If the Control or Trigger levels are exceeded on three consecutive monitoring rounds, contingency actions will be triggered, as described in the Aftercare Phase Environmental and Infrastructure Monitoring Program report (Ref. [4]) and summarised in Table 3.8.

Table 3.8: Groundwater Monitoring Contingency Actions (from Ref. [8])

Contingency Action	Response Time
Advise NRW with initial assessment of possible causes e.g. unusual activities.	1 month
Report to NRW on re-appraisal of risks to the Nant Merddog based on risk assessment review and Nant Merddog monitoring and further groundwater monitoring subsequent to breach.	3 months
If risks are acceptable the assessment criteria may be re-evaluated. If monitoring shows concentrations to have fallen back to below the control/trigger levels no further action may be necessary.	6 months
If risks are unacceptable agreed corrective measures will be implemented. The corrective measures if required and appropriate may include additional monitoring (frequency and location).	

If there is a particular incident that may result in groundwater pollution additional monitoring will be agreed with the NRW.

B1.5 Landfill Gas

Landfill gas monitoring is carried out in accordance with the requirements of the Permit (Ref. [1]), monitoring for methane and carbon dioxide at the following locations:

Well ID	Location	Monitoring
GMW8, GMW9, GMW10	Boreholes located within 20m of the waste mass.	No Control or Trigger Levels set for these locations.

GMW1, 17 and 18	Boreholes located outwith the waste mass	No Control or Trigger Levels set for these locations. However, the Permit requires GMW1, 17 and 18 to be monitored.
GMW12 to GMW14A	Boreholes located outwith the waste mass	Trigger and Control Levels derived for these boreholes for all three valve installations.

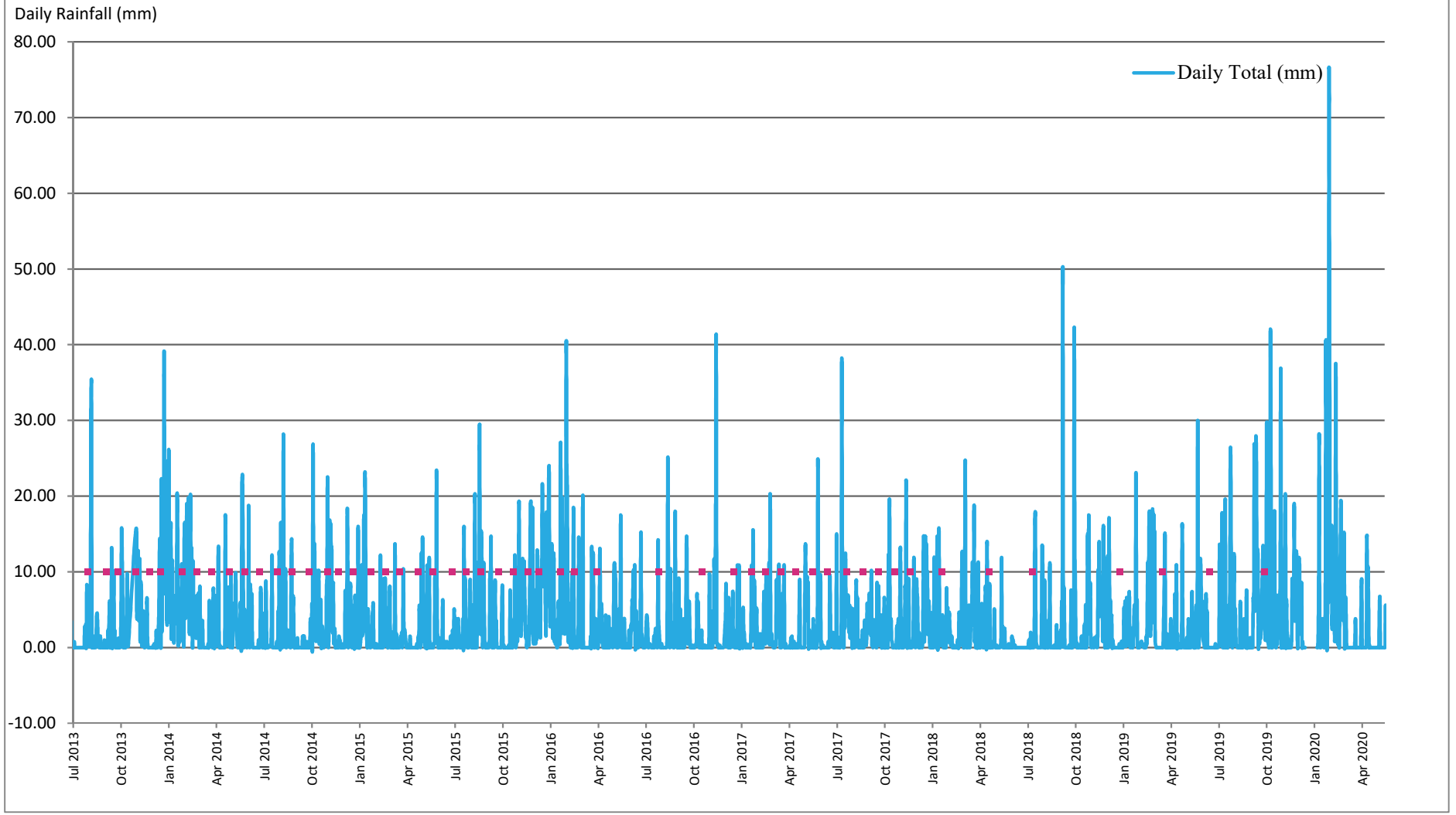
These wells are located around the site perimeter, as shown on **Figure 2**.

Control and Trigger Levels for landfill gas have been established by Golder Associates (Ref. [10]). As stated by Golder Associates (Ref. [10]), single exceedances need no immediate action. However, ongoing exceedances require informing the relevant people and organisation and appropriate measures of identification and solutions identified.

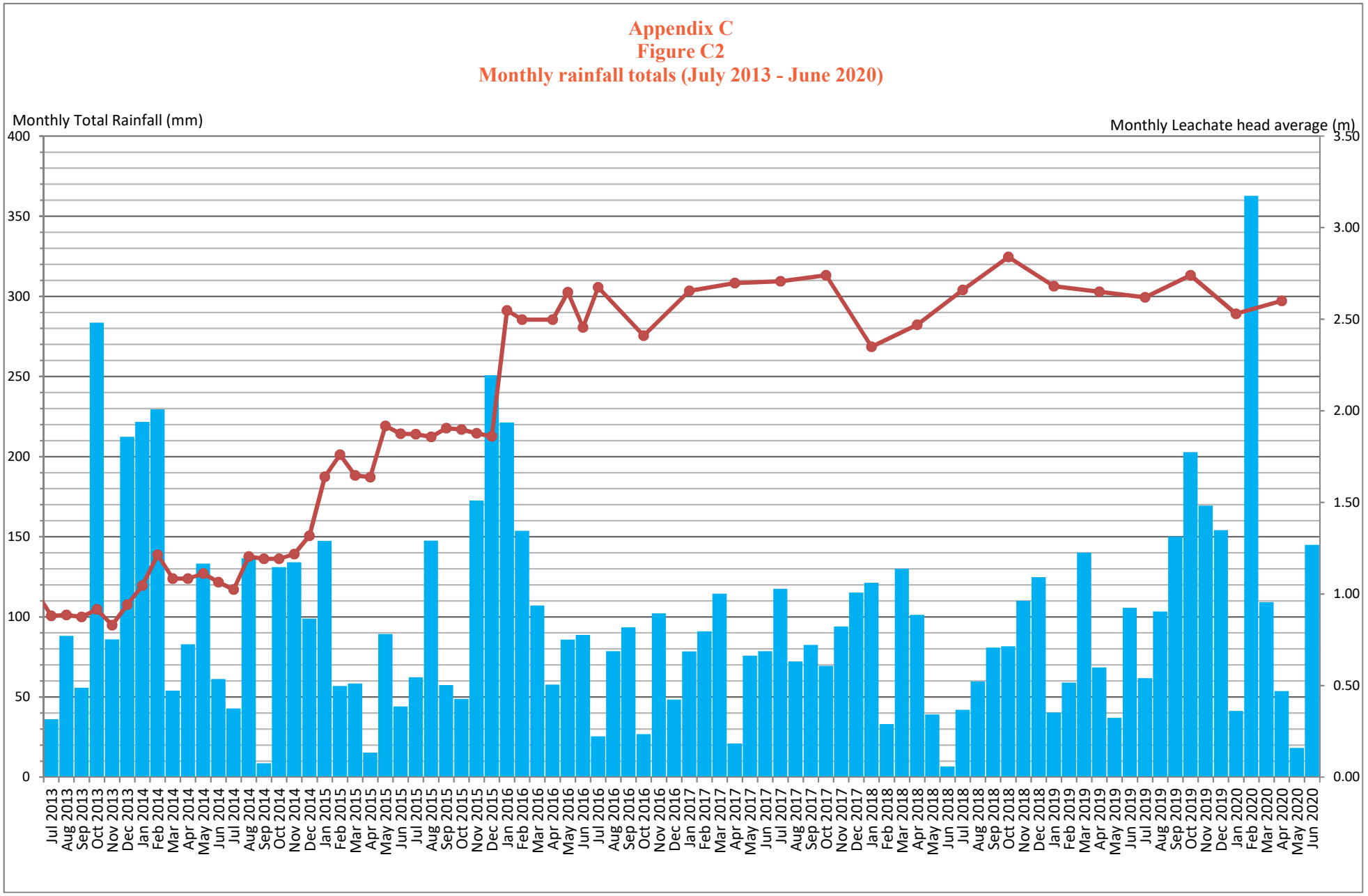
Appendix C

Monitoring Results - Graphs

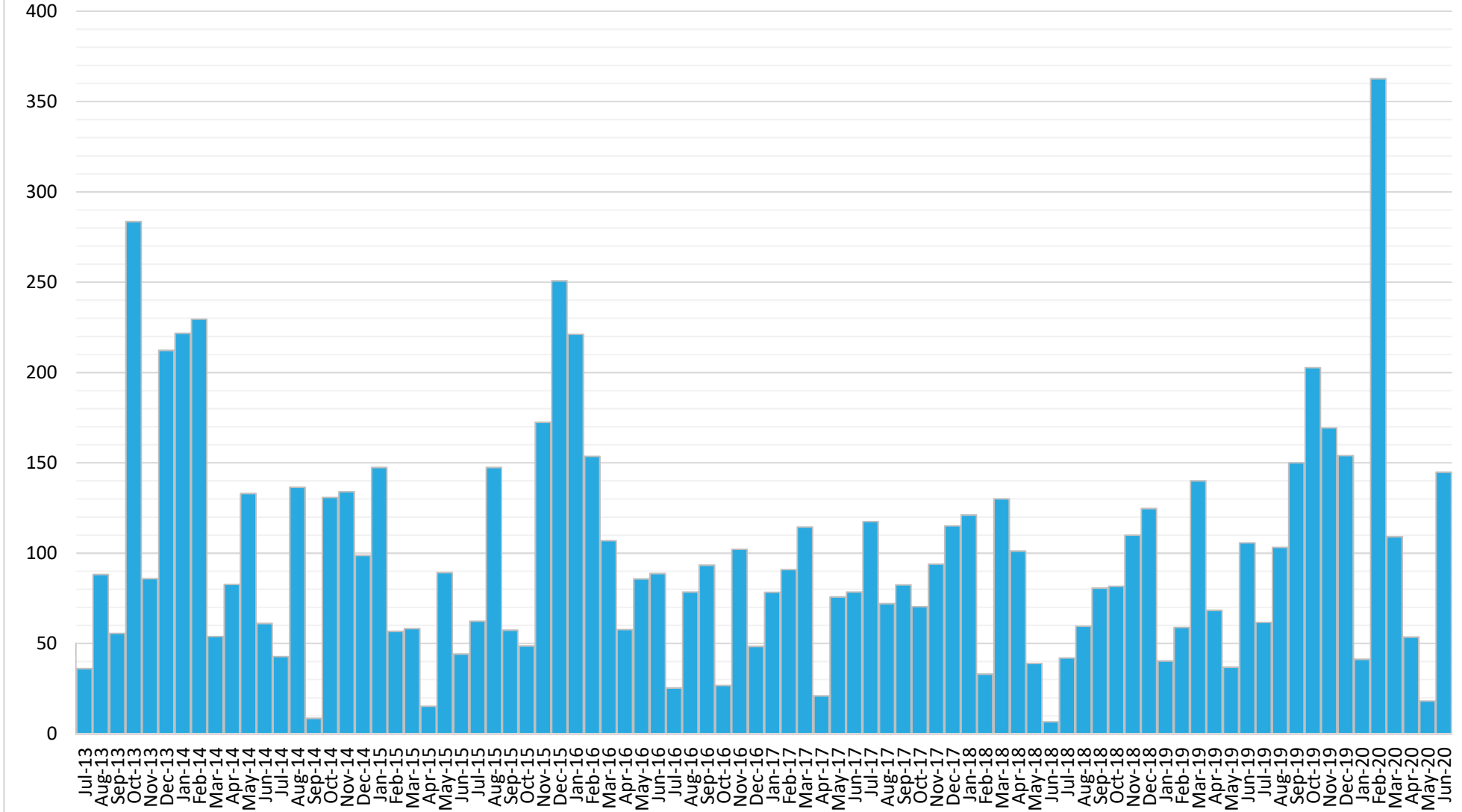
Appendix C
Figure C1
Daily rainfall totals and sampling events (July 2013 - June 2020)



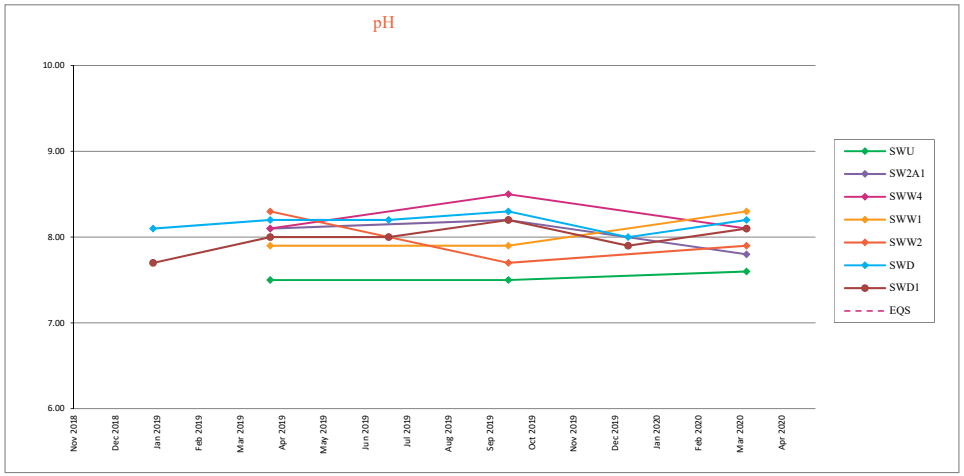
Appendix C
Figure C2
Monthly rainfall totals (July 2013 - June 2020)

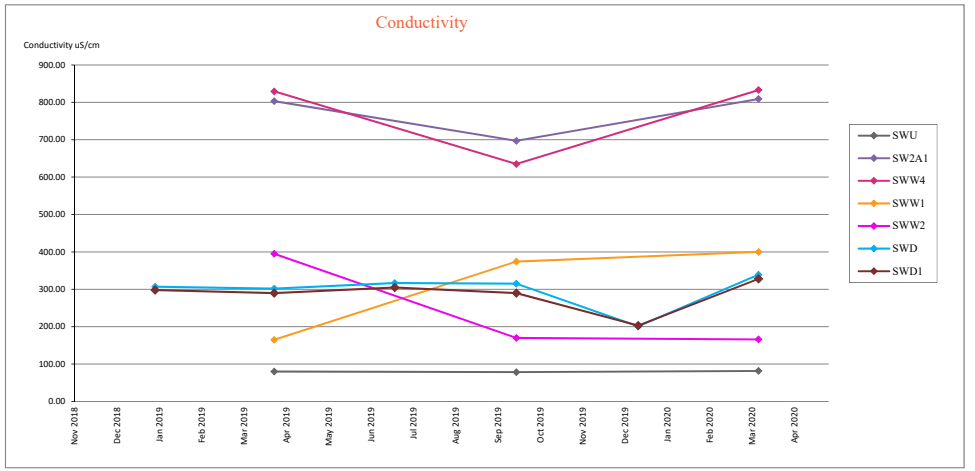


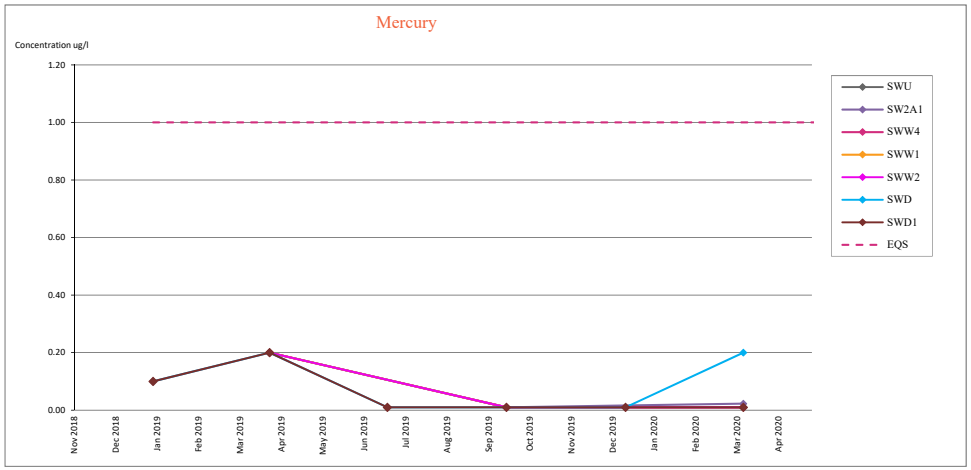
Appendix C
Figure C3
Monthly total rainfall (July 2013 - June 2020)

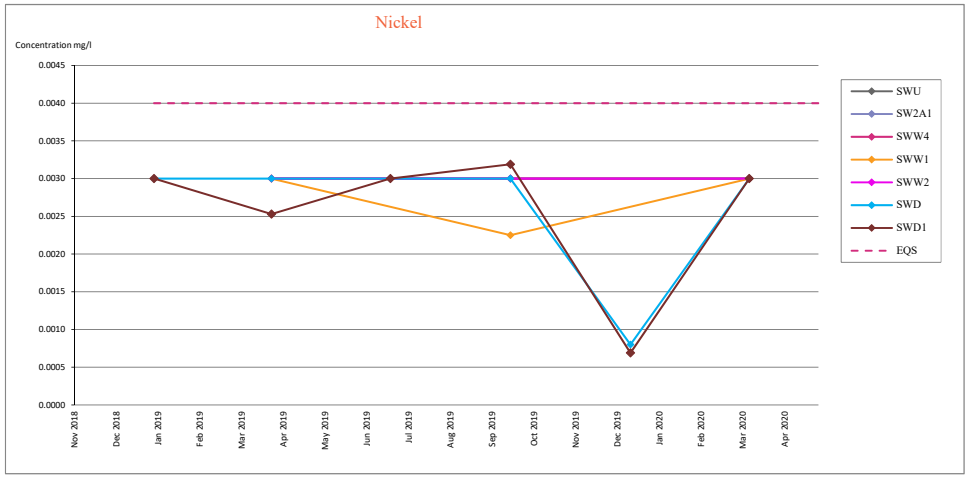


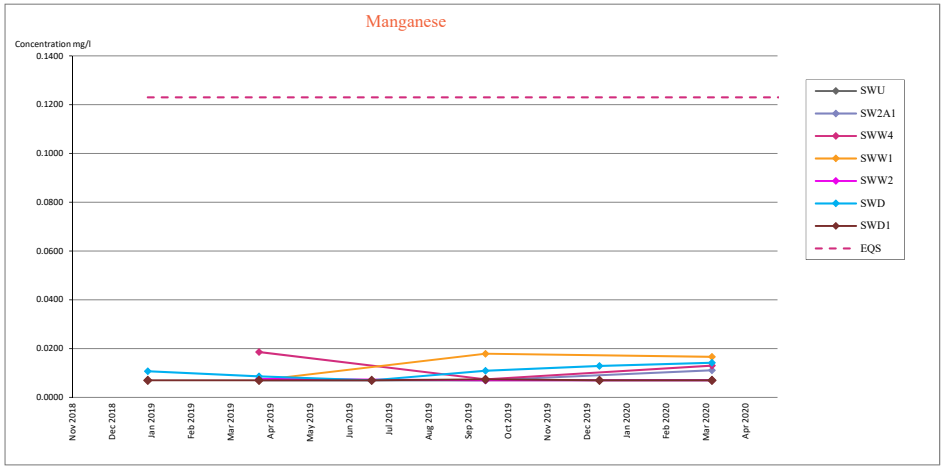
APPENDIX C
Figure C4
Surface water monitoring graphs

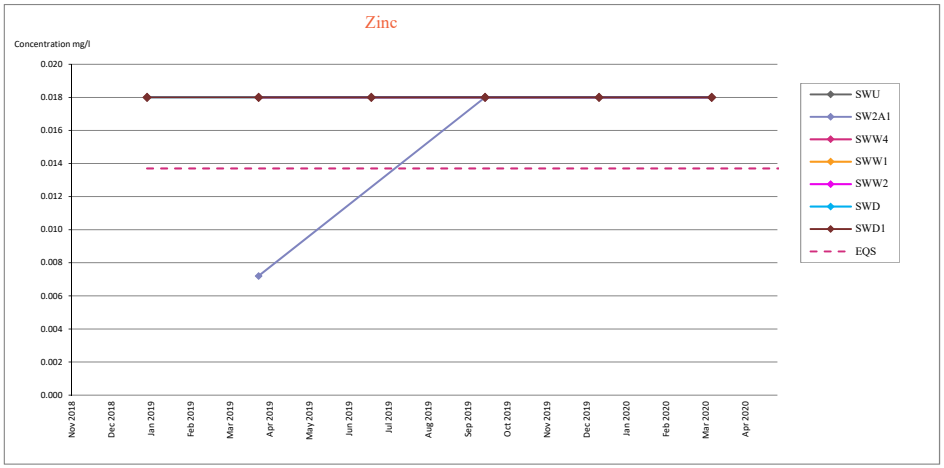


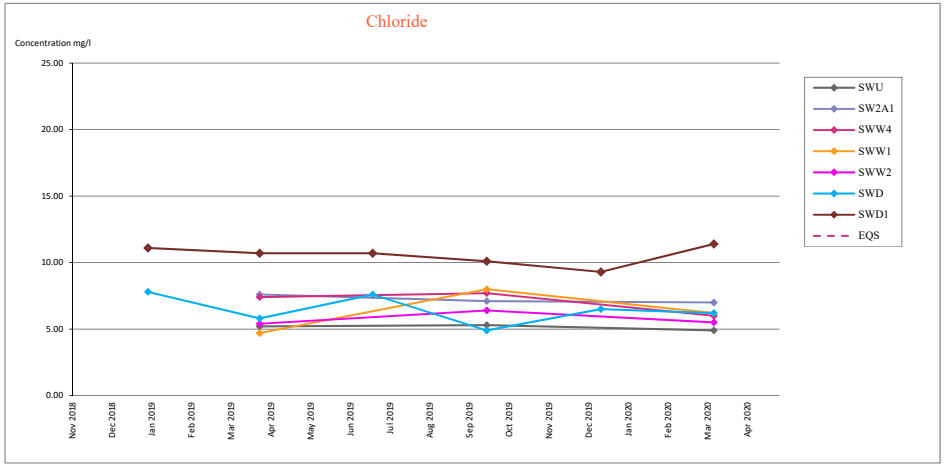


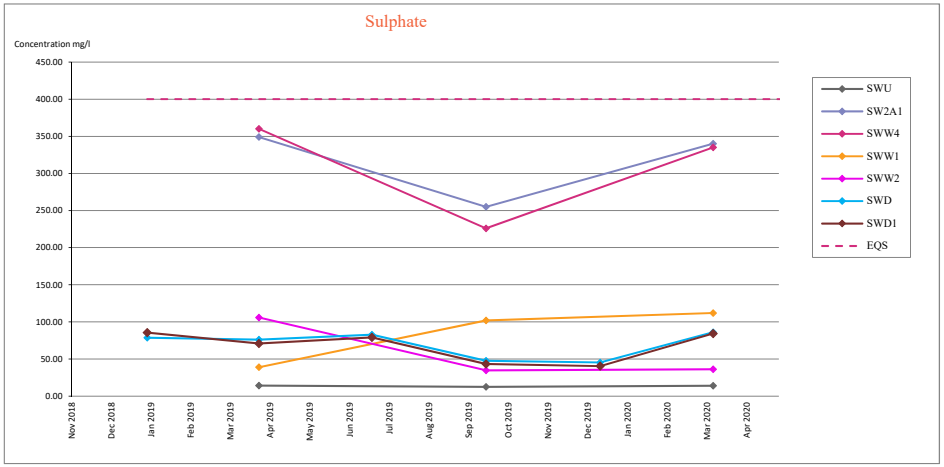


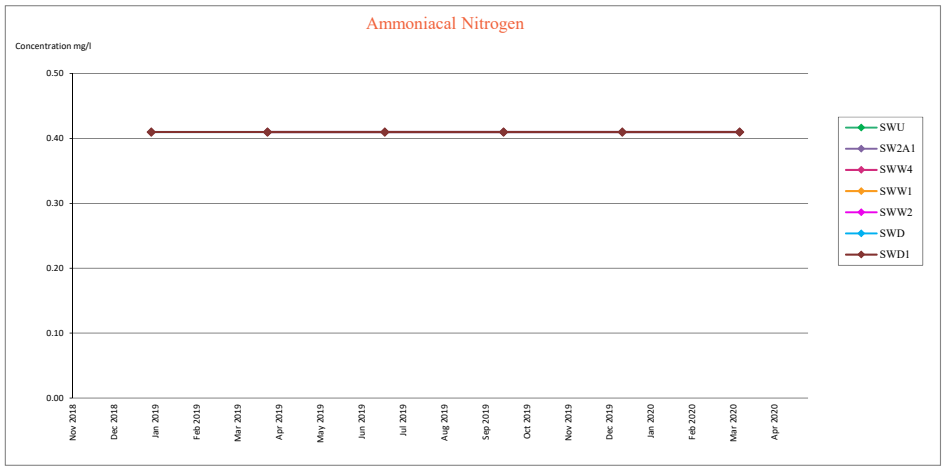



Manganese
Concentration mg/l
0.1400
0.1200
0.1000
0.0800
0.0600
0.0400
0.0200
0.0000
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SW2A1
SWW4
SWW1
SWW2
SWD
SWD1
EQS


Zinc
Concentration mg/l
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SW2A1
SWW4
SWW1
SWW2
SWD
SWD1
EQS


Chloride
Concentration mg/l
25.00
20.00
15.00
10.00
5.00
0.00
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SW2A1
SWW4
SWW1
SWW2
SWD
SWD1
EQS


Sulphate
Concentration mg/l
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SW2A1
SWW4
SWW1
SWW2
SWD
SWD1
EQS


Ammoniacal Nitrogen
Concentration mg/l
0.50
0.40
0.30
0.20
0.10
0.00
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SW2A1
SWW4
SWW1
SWW2
SWD
SWD1

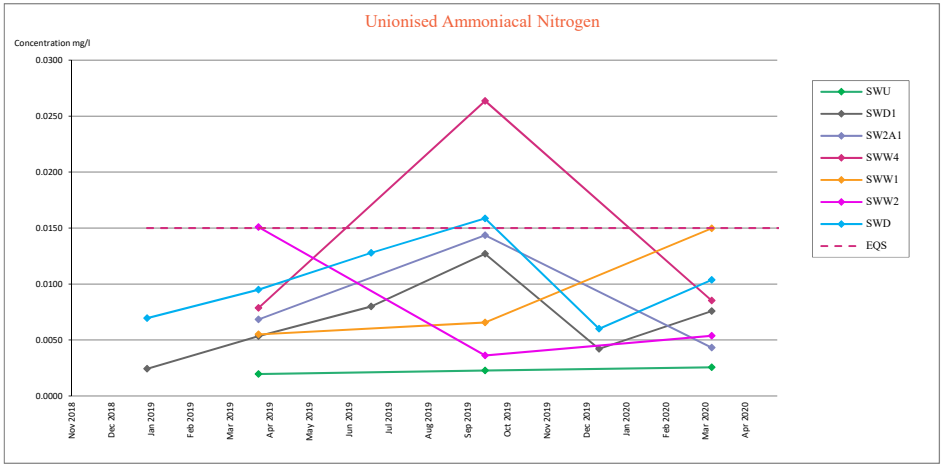
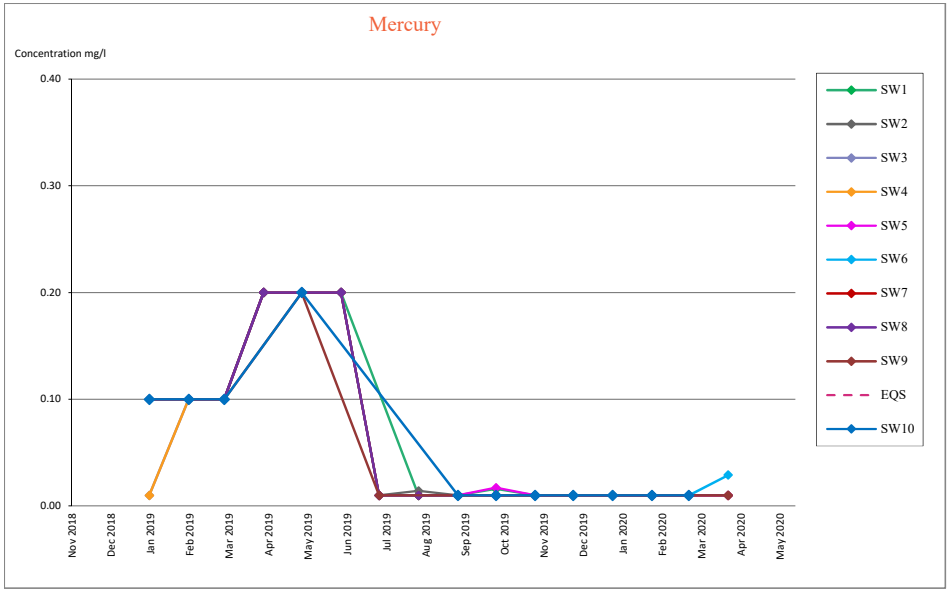
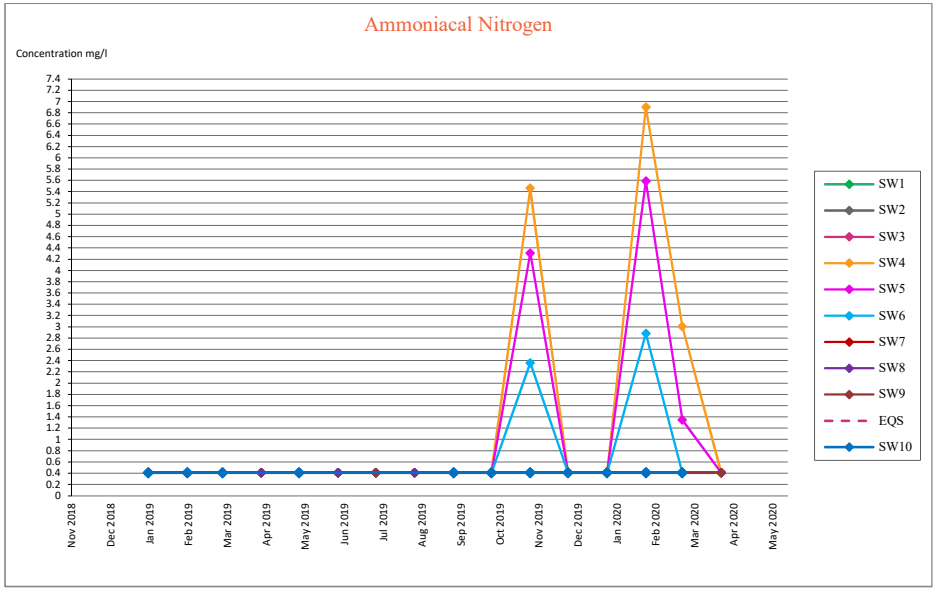
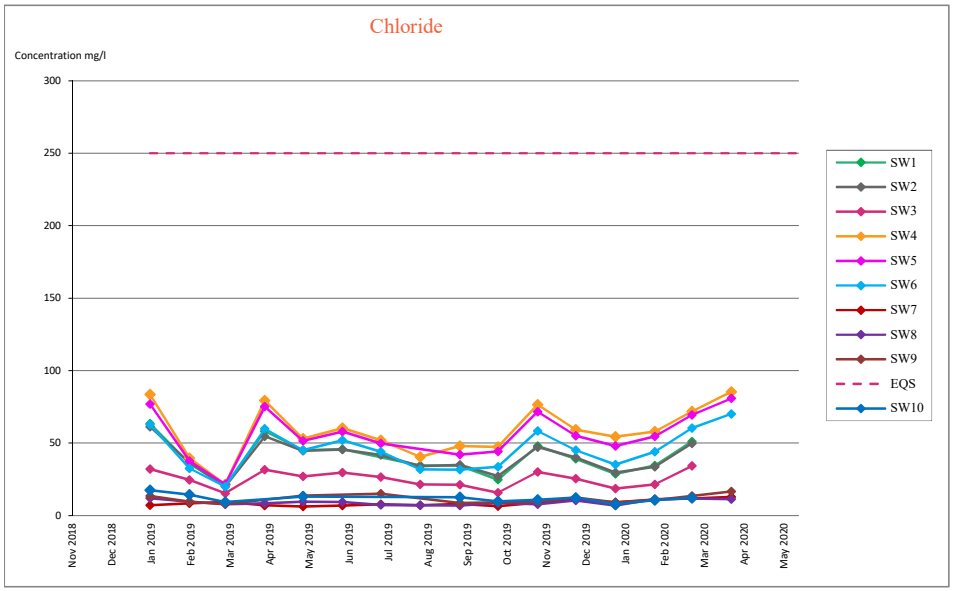

Unionised Ammoniacal Nitrogen
Concentration mg/l
0.0300
0.0250
0.0200
0.0150
0.0100
0.0050
0.0000
Nov 2018
Dec 2018
Jan 2019
Feb 2019
Mar 2019
Apr 2019
May 2019
Jun 2019
Jul 2019
Aug 2019
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
SWU
SWD1
SW2A1
SWW4
SWW1
SWW2
SWD
EQS

Figure C5

Surface water monitoring graphs (SW1 to SW10)

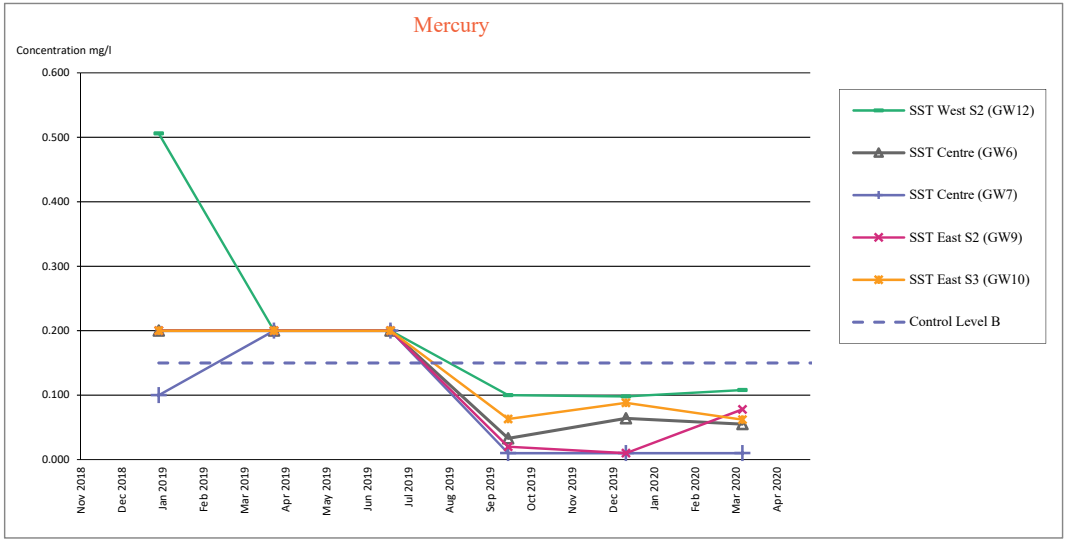


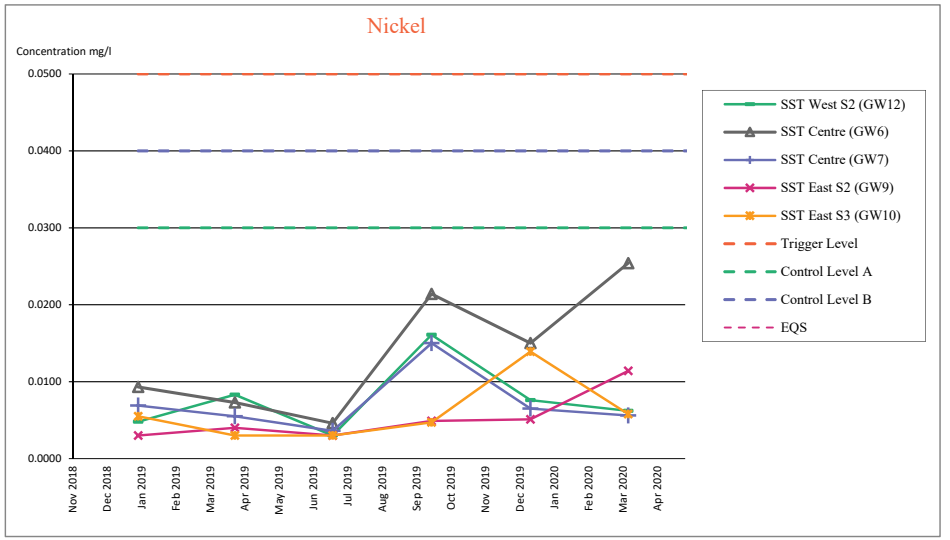


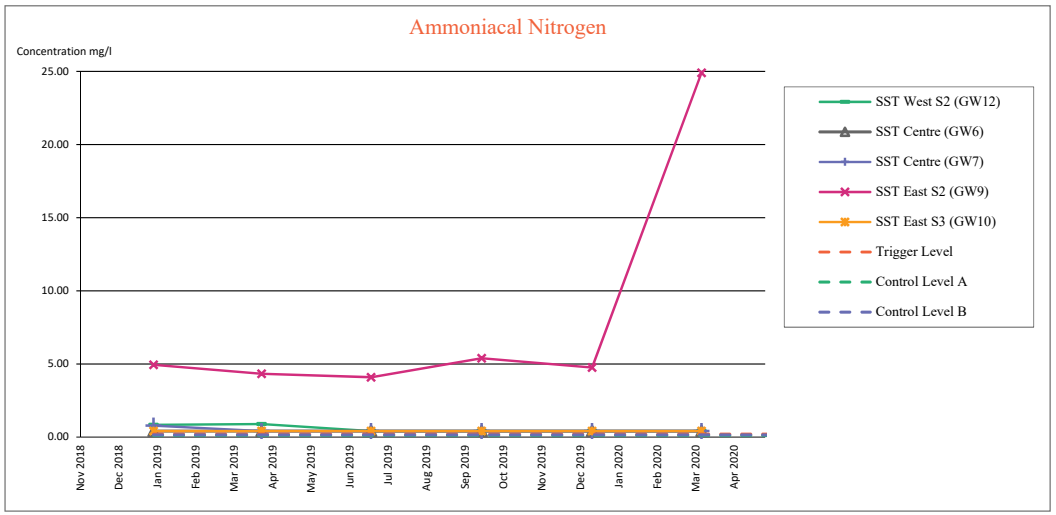


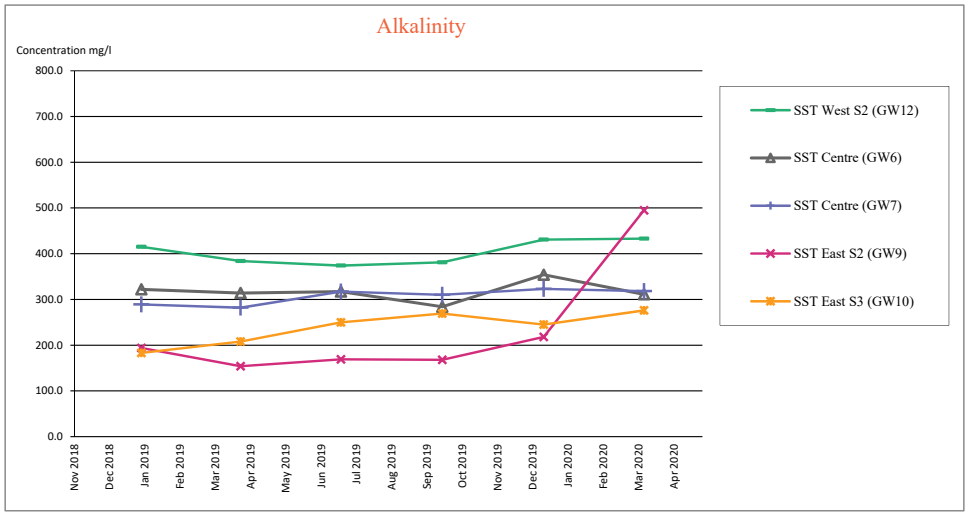
Note. Sampling of SW1 - SW10 ceased from May 2020

Compliance wells graphs

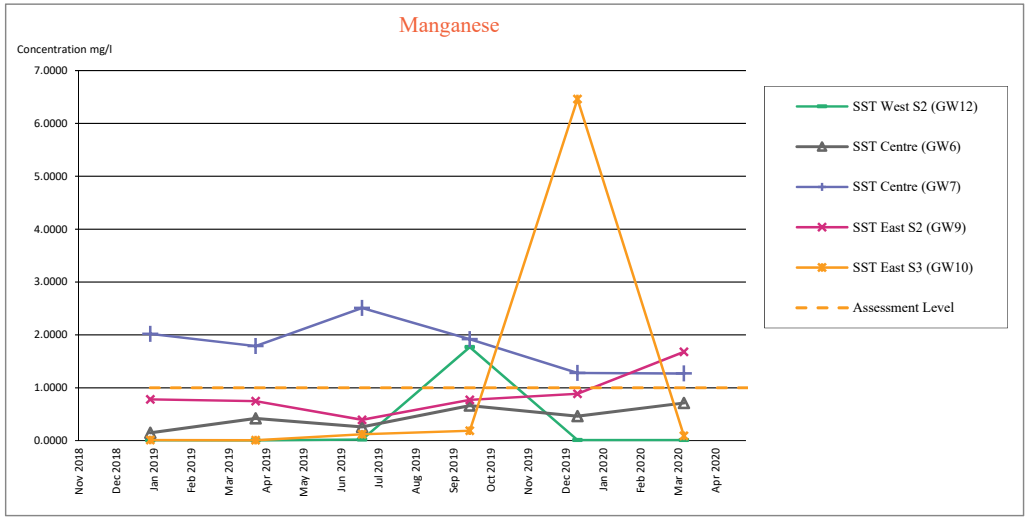


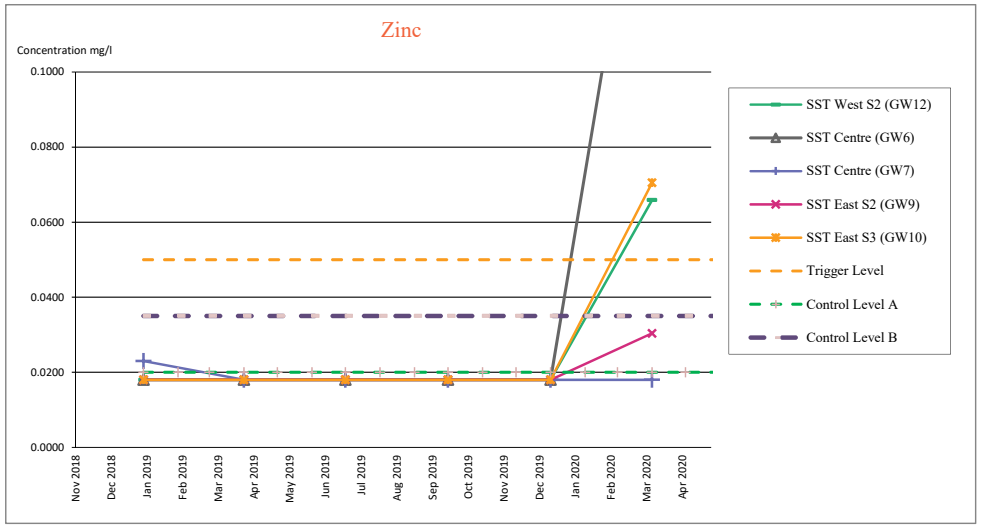


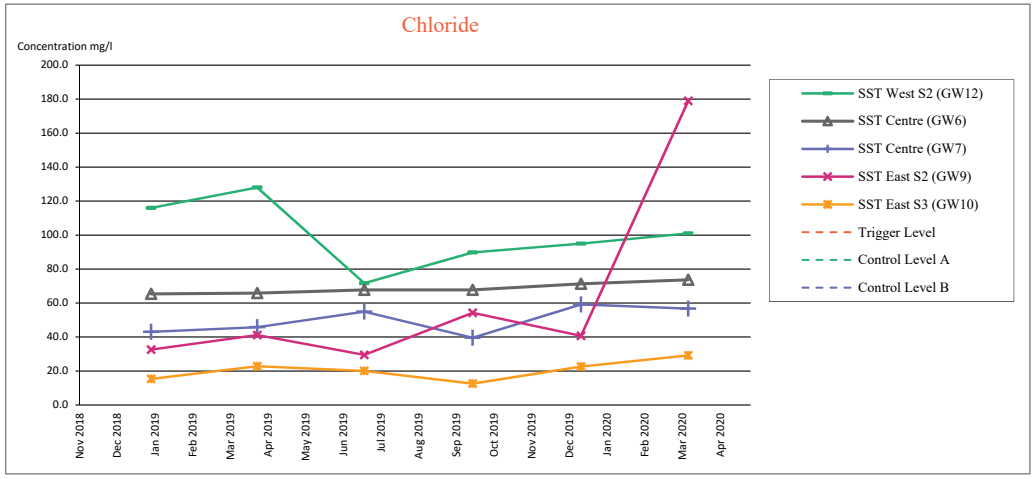


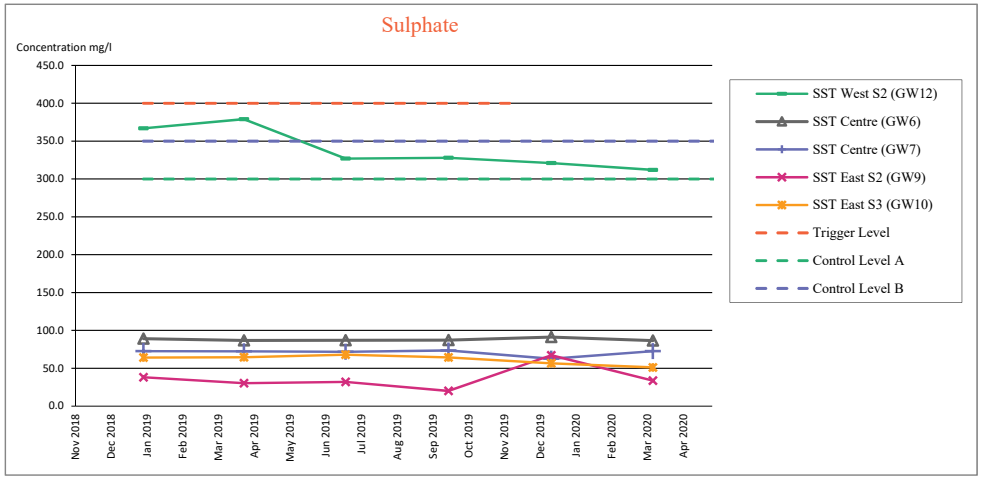


Compliance wells graphs

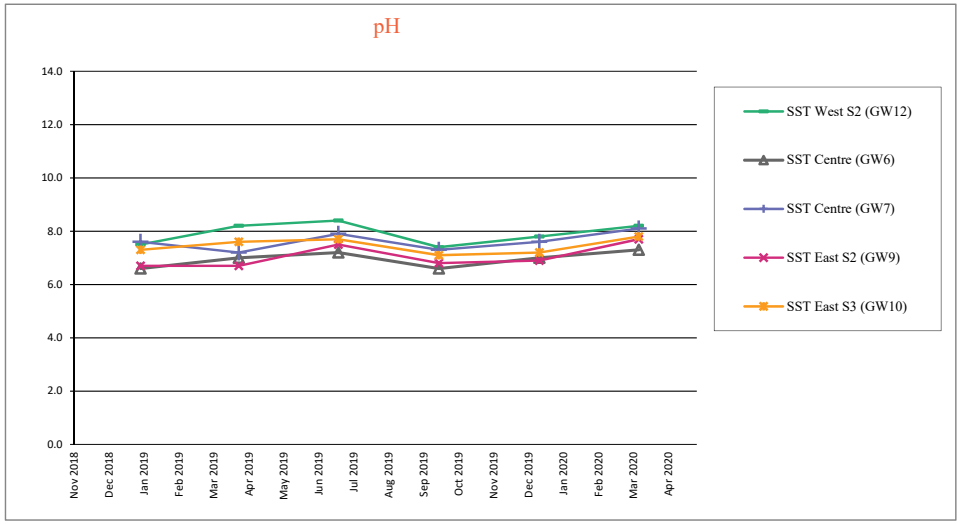




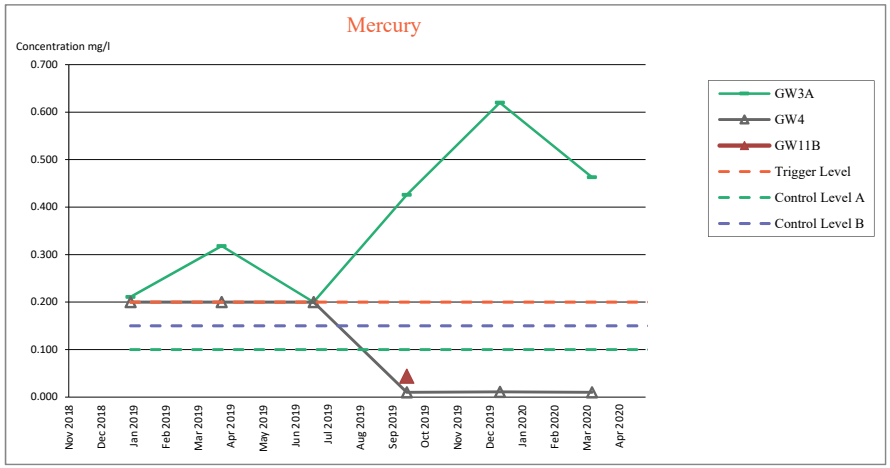


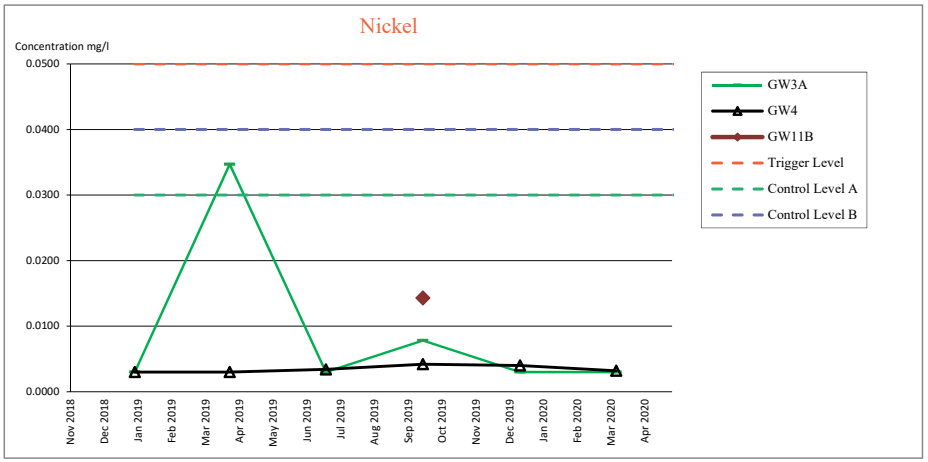


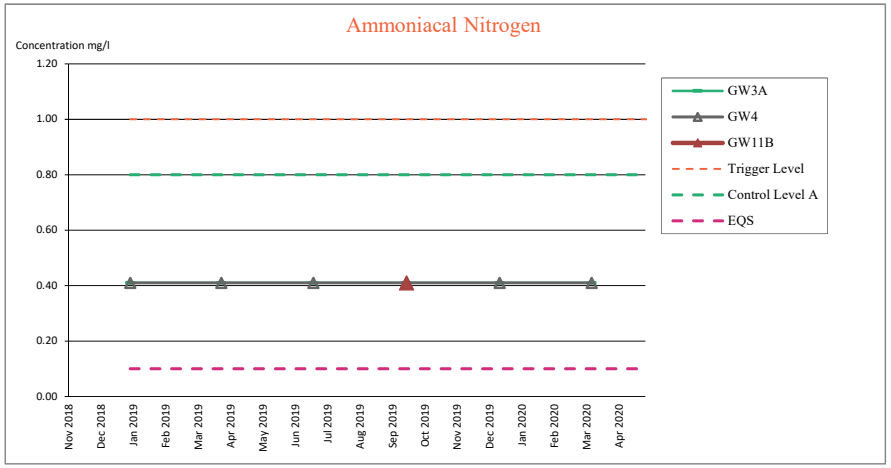
Compliance wells graphs

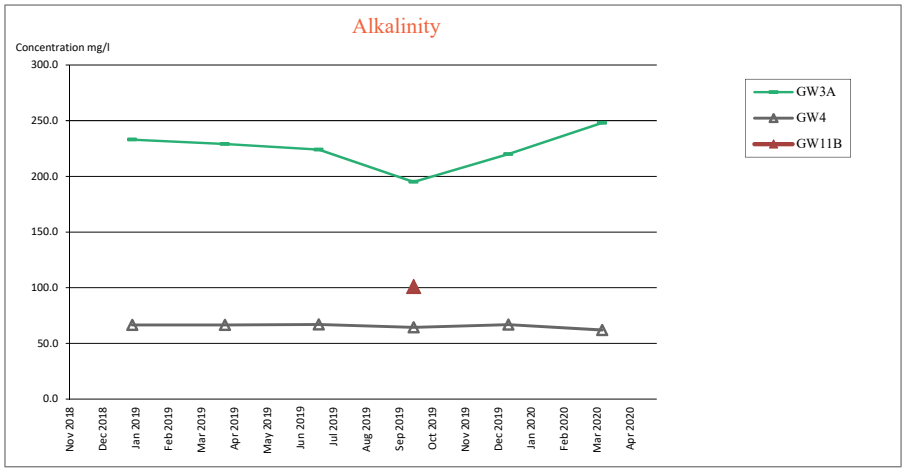


APPENDIX C
Figure C7
Groundwater quality monitoring results - Upstream wells graphs

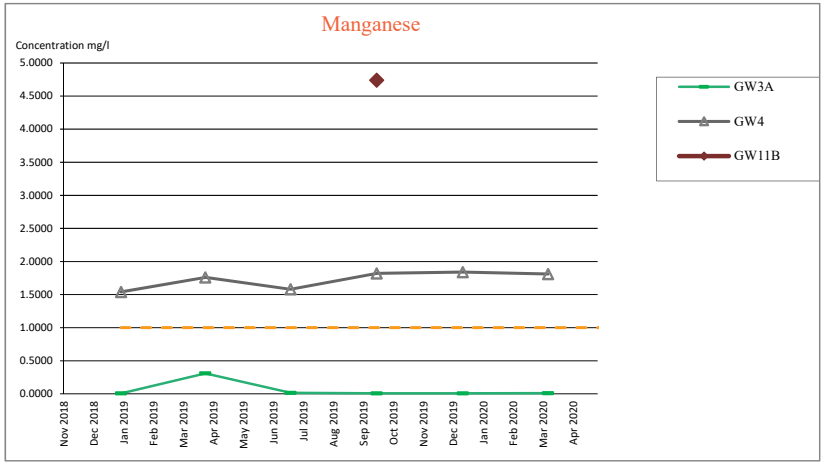


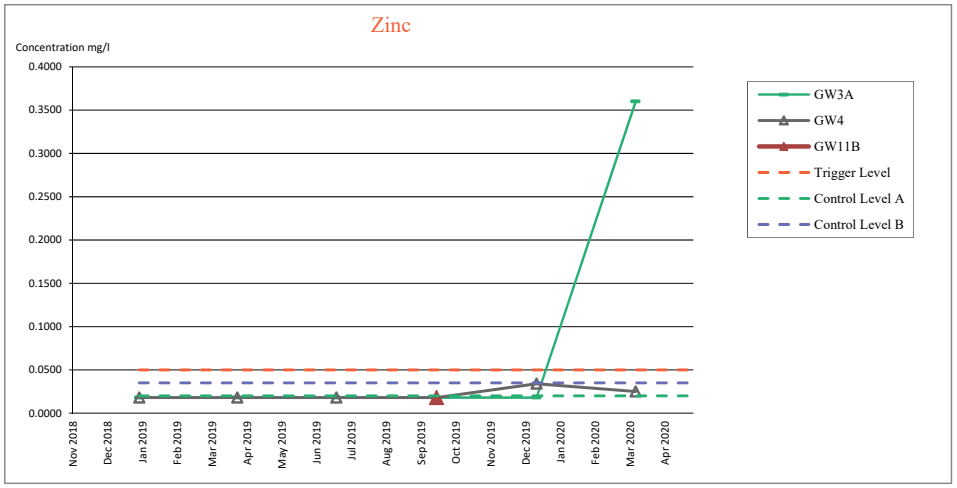


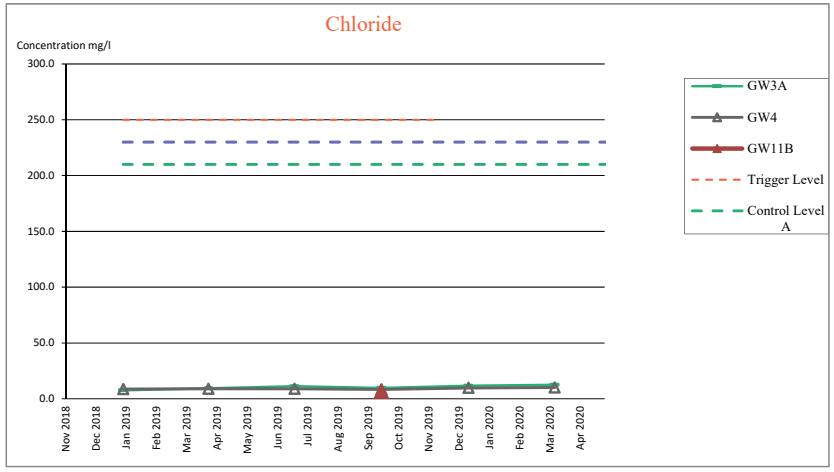




APPENDIX C
Figure C7
Groundwater quality monitoring results - Upstream wells graphs







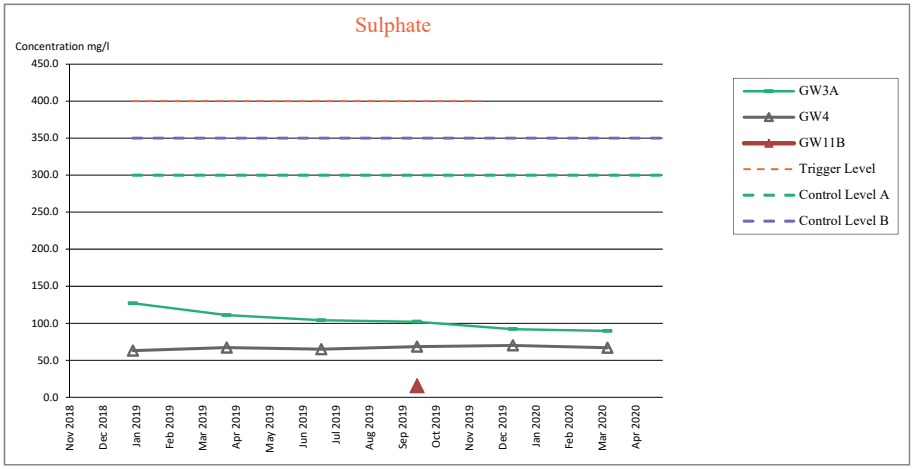
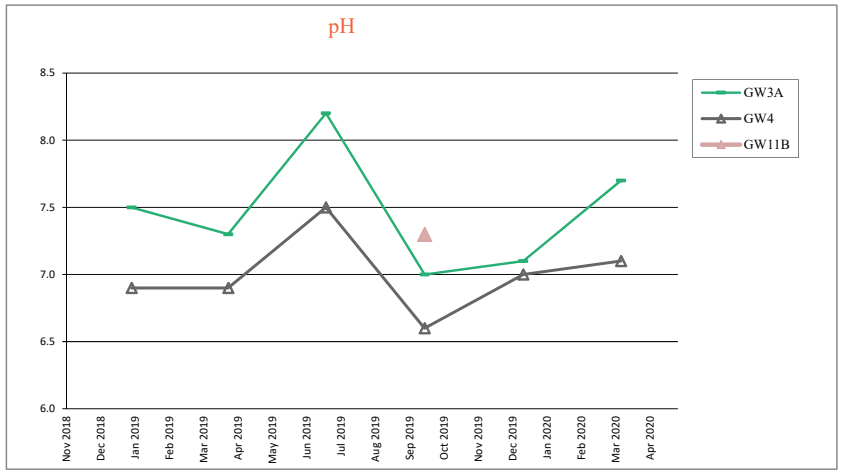
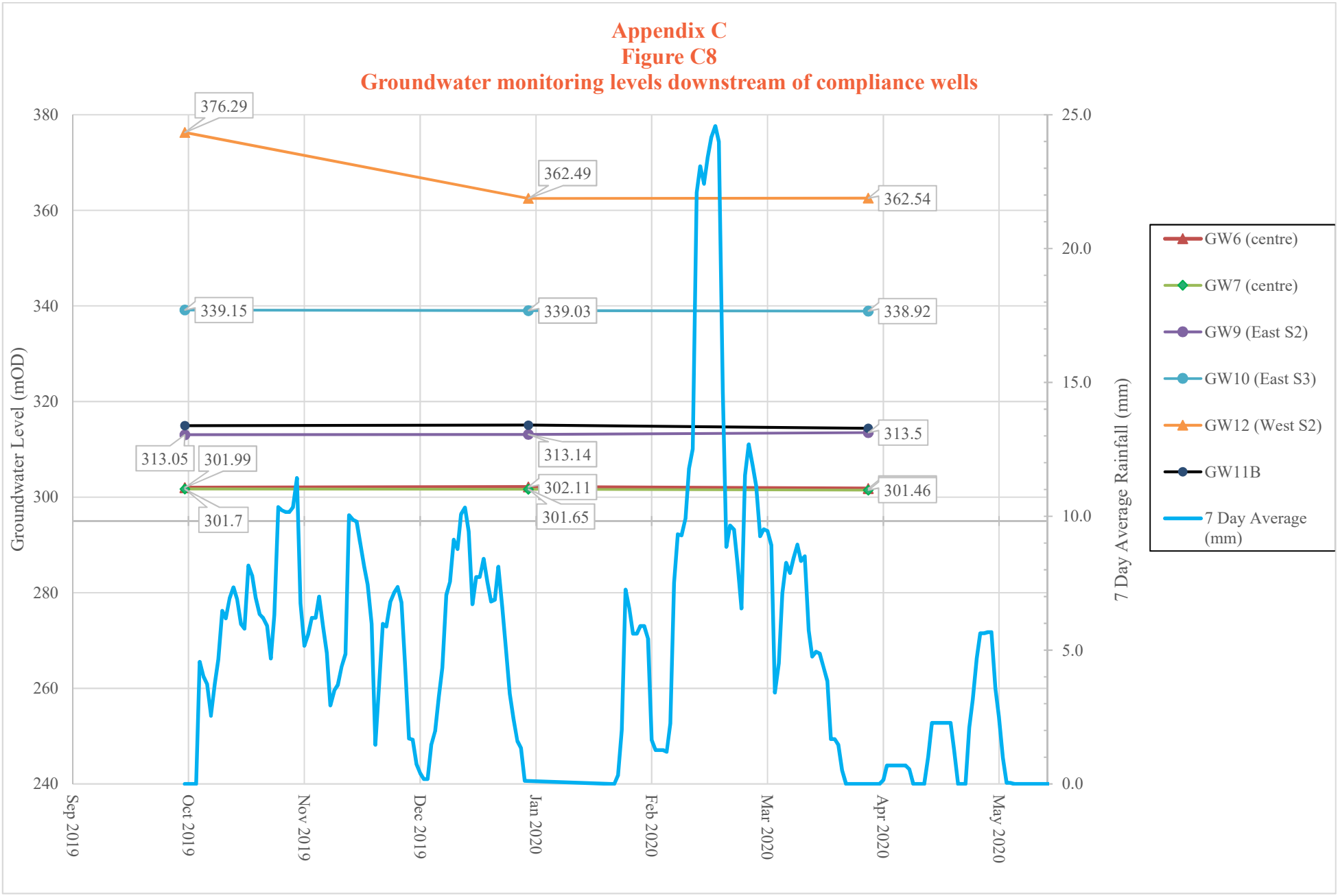


Figure C7
Groundwater quality monitoring results - Upstream wells graphs



Appendix C
Figure C8
Groundwater monitoring levels downstream of compliance wells



Appendix D

Monitoring Results - Tables

Appendix D
Table D1
Leachate Monitoring Results

April 2020														
LOCATION	**Units**	**L1A**		**L1B**	**LC1A**		**LC2A**		**LC4A**		**LC5A**	**Maximum concentration (mg/l)**	**Average concentration (mg/l)**	**Acceptable Maximum Concentration (AMC) (mg/l)**		**LP3A**		**LP4**
Date Sampled	-													-				
Manganese in filtrate as Mn	mg/l	0.897		0.487	N/S		0.138		0.702		0.449	**0.8970**	**0.5346**	**--**		0.0161		0.24
Mercury, filt trace as Hg	mg/l	0.000016	<	0.00001	N/S	<	0.0002	<	0.0002	<	0.0002	**0.0002**	**0.0001**	**0.00056**		0.000012	<	0.00001
Nickel in filtrate as Ni	mg/l	0.0528		0.0127	N/S		**0.108**		0.0102		**0.172**	**0.1720**	**0.07114**	**0.0681**		0.0081		0.0071
Zinc, ultra-low filtered as Zn	mg/l	0.02	<	0.018	N/S		0.052	<	0.018		0.104	**0.104**	**0.0424**	**1.380**	<	0.018	<	0.018
pH	pH Units	7.8		8	N/S		8.2		7.5		8.3	**8.30**	**7.9600**	**--**		8.3		8.4
Conductivity- Electrical 20C	uS/cm	2790		2050	N/S		11300		4230		24400	**24400**	**8954.0000**	**--**		1710		1770
Alkalinity as CaCO3	mg/l	1400		604	N/S		5950		2710		12400	**12400**	**4612.8000**	**--**		456		742
Ammoniacal Nitrogen as N	mg/l	20.2		4.51	N/S		**783**		300		**2170**	**2170.00**	**655.542**	**526**	<	0.41		26
Chloride as Cl	mg/l	267		177	N/S		872		209		2210	**2210**	**747.0000**	**1408**		258		173
Sulphate as SO4	mg/l	54.8		385	N/S		505		26.2		843	**843**	**362.8000**	**999**		258		173
Redox Potential (see note 4)	mV	102		100	N/S		150		27		79	**150**	**91.6000**	**--**		105		124
Total Suspended Solids	mg/l	868		24	N/S		3660		2690		54	**3660**	**1459.2000**			14		5
Solids, Total Dissolved 180 deg C	mg/l	1910		1610	N/S		5380		1840		11300	**11300**	**4408.0000**			1230		1210
Dissolved Oxygen, Fixed	mg/l	0.5	<	2.2	N/S	<	0.5	<	0.5	<	0.5	**2**	**0.8400**			6.3		4.8
TOC (filtered)	mg/l	42.6		26.4	N/S		297		62.8		1370	**1370**	**359.7600**			16.9		18.4

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. NS denotes 'not sampled.
7. * denotes 'no result for filtered mercury analysis due to interference from sample matrix'.

Appendix D
Table D2
Leachate Head Levels

		Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
LC1A	Elevation of base of landfill mAOD	357.62			357.62			357.62			357.62		
	Elevation at top of casing mAOD	398.85			398.85			398.85			398.85		
	Depth to leachate from top of casing (m)	40.34			40.30								
	Leachate elevation (mAOD)	358.51			358.55			398.85			398.85		
	Calculated leachate head (m)	0.89			0.93								
LC2A	Elevation of base of landfill mAOD	362.49			362.49			362.49			362.49		
	Elevation at top of casing mAOD	401.12			401.12			401.12			401.12		
	Depth to leachate from top of casing (m)	35.75			35.63								
	Leachate elevation (mAOD)	365.37			365.49			401.12			401.12		
	Calculated leachate head (m)	2.88			3.00								
LC4A	Elevation of base of landfill mAOD	372.27			372.27			372.27			372.27		
	Elevation at top of casing mAOD	401.14			401.14			401.14			401.14		
	Depth to leachate from top of casing (m)	26.86			26.87								
	Leachate elevation (mAOD)	374.28			374.27			401.14			401.14		
	Calculated leachate head (m)	2.01			2.00								
LC5A	Elevation of base of landfill mAOD	350.14			350.14			350.14			350.14		
	Elevation at top of casing mAOD	380.75			380.75			380.75			380.75		
	Depth to leachate from top of casing (m)	26.26			26.13								
	Leachate elevation (mAOD)	354.49			354.62			380.75			380.75		
	Calculated leachate head (m)	4.35			4.48								
L1	Casing height (mAOD)	357.00			357.00			357.00			357.00		
	Leachate (mbgl)	21.01			21.01								
	Leachate (m AOD)	335.99			335.99			357.00			-		
	Base of landfill (m AOD)	336.80			336.80			336.80			336.80		
	Depth of well from top of casing (m)	21.03			21.03			21.04					
	Base of well (m AOD)	335.97			335.97			335.96			357.00		
	Calculated leachate head (m)	-0.81			-0.81								
L1A*	Casing height (mAOD)	355.79			355.79			355.79			355.79		
	Leachate (mbgl)	20.84			19.90								
	Leachate (m AOD)	334.95			335.89			355.79			355.79		
	Base of landfill (m AOD)	316.64			316.64			316.64			316.64		
	Depth of well from top of casing (m)	20.91			20.93			20.93			20.88		
	Base of well (m AOD)	334.88			334.84			334.88			334.84		
	Calculated leachate head (m)	18.31			19.25								
L1B*	Casing height (mAOD)	354.80			354.80			354.80			354.80		
	Leachate (mbgl)	24.32			25.05								
	Leachate (m AOD)	330.48			329.75			354.80			354.80		
	Base of landfill (m AOD)	319.60			319.60			319.60			319.60		
	Depth of well from top of casing (m)	34.86			34.86			34.88			34.86		
	Base of well (m AOD)	319.94			319.34			319.94			319.34		
	Calculated leachate head (m)	10.88			10.15								

2019	Quarterly Leachate Head Averages (m)
January	2.53
February	N/S
March	N/S
April	2.60
May	N/S
June	N/S
July	#DIV/0!
August	N/S
September	N/S
October	#DIV/0!
November	N/S
December	N/S

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.

Appendix D
Table D3
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	Zinc, ultra-low total as Zn	pH	Conductivity- Electrical 20C	Alkalinity as CaCO3	Ammoniacal Nitrogen as N	Unionised Ammoniacal Nitrogen **	Measured surface water temperature	Chloride as Cl	Sulphate as SO4	Solids, Suspended	Dissolved oxygen	TOC (Filtered)	Calcium
				ug/l	mV	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
	Freshwater EQS**			1	-	0.03	0.1*	0.05*	-	-	-	-	0.015**	-	250	400	-	-	-	-
April	Upstream of Landfill	SWU		< 0.01	153	< 0.0070	< 0.0030	< 0.018	7.6	81.6	16.8	< 0.41	0.0026	7.80	4.9	14	2	9.1	< 0.7	6.15
		SW2AI		0.023	180	0.0113	< 0.0030	0.044	7.8	809	91.2	< 0.41	0.0043	8.70	7	340	250	11	8.1	116
		SWW4		< 0.01	158	0.013	< 0.0030	< 0.018	8.1	833	102	< 0.41	0.0085	8.70	6	335	5	8.9	8.3	113
	NW Ditch System	SWW1		< 0.01	150	0.0166	< 0.0030	< 0.018	8.3	400	95	< 0.41	0.0150	10.30	6.2	112	5	11.2	1.4	38.7
		SWW2		< 0.01	139	< 0.0070	< 0.0030	< 0.018	7.9	166	37.2	< 0.41	0.0054	8.60	5.5	36.3	2	10.2	< 0.7	15.1
	Downstream of Landfill	SWD		< 0.01	157	0.0142	< 0.0030	< 0.018	8.2	339	94.8	< 0.41	0.0104	8.30	6.2	86.1	10	12.7	1.3	42.7
		SWD1		< 0.01	160	< 0.0070	< 0.0030	< 0.018	8.1	328	76.4	< 0.41	0.0076	7.10	11.4	84.3	2	11.4	1.7	36.6
May	Upstream of Landfill	SWU		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
		SW2AI	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
		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
	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
		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
	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
		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
June	Upstream of Landfill	SWU		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
		SW2AI	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
		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
	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
		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
	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
		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
	Minimum			< 0.0100	139.0	< 0.007	< 0.003	< 0.0180	7.6	81.6	16.80	< 0.41	0.0026	7.10	4.90	14.00	2.00	< 8.90	< 0.70	6.15
	Maximum			0.0230	180.0	0.017	0.003	0.0435	8.3	833.0	102.00	< 0.41	0.01	10.30	11.40	340.00	250.00	12.70	8.30	116.00
	Count			7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Notes
The redox potential was not measured on site and there is a possibility that it has changed between sampling and analysis
N/S - Not sampled
Unionised ammoniacal nitrogen based on measured Temperature
Environmental Quality Standard EQS 1 for freshwater is derived to protect the most sensitive aquatic life.
North Western (ditch system)

Exceedance of EQS
Upstream of Nant Merddog
Downstream of Nant Merddog

MONTH	LOCATION	DATE		Mercury, ultra-low total as Hg		Ammoniacal Nitrogen as N	Chloride as Cl
				ug/l		mg/l	mg/l
	Freshwater EQS			1		n/a	250
January	SW1	20/01/2020	<	0.01	<	0.41	28.9
	SW2	20/01/2020	<	0.01	<	0.41	29.7
	SW3	20/01/2020	<	0.01	<	0.41	18.6
	SW4	20/01/2020	<	0.01	<	0.41	54.5
	SW5	20/01/2020	<	0.01	<	0.41	48
	SW6	20/01/2020	<	0.01	<	0.41	35.3
	SW7	20/01/2020	<	0.01	<	0.41	9.2
	SW8	20/01/2020	<	0.01	<	0.41	7
	SW9	20/01/2020	<	0.01	<	0.41	9.3
	SW10	20/01/2020	<	0.01	<	0.41	7.9
February	SW1	12/03/2020	<	0.01	<	0.41	34.5
	SW2	12/03/2020	<	0.01	<	0.41	33.8
	SW3	12/03/2020	<	0.01	<	0.41	21.6
	SW4	12/03/2020	<	0.01		6.9	58
	SW5	12/03/2020	<	0.01		5.59	54.8
	SW6	12/03/2020	<	0.01		2.88	44.2
	SW7	12/03/2020	<	0.01	<	0.41	11.2
	SW8	12/03/2020	<	0.01	<	0.41	11.5
	SW9	12/03/2020	<	0.01	<	0.41	10.8
	SW10	12/03/2020	<	0.01	<	0.41	10.7
March	SW1	25/03/2020	<	0.01	<	0.41	51.2
	SW2	25/03/2020	<	0.01	<	0.41	49.8
	SW3	25/03/2020	<	0.01	<	0.41	34.3
	SW4	25/03/2020	<	0.01		3.01	72
	SW5	25/03/2020	<	0.01		1.35	69.5
	SW6	25/03/2020	<	0.01	<	0.41	60.5
	SW7	25/03/2020	<	0.01	<	0.41	11.9
	SW8	25/03/2020	<	0.01	<	0.41	11.9
	SW9	25/03/2020	<	0.01	<	0.41	13.7
	SW10	25/03/2020	<	0.01	<	0.41	12.2
April	SW1	20/04/2020		NS		NS	NS
	SW2	20/04/2020		NS		NS	NS
	SW3	20/04/2020		NS		NS	NS
	SW4	20/04/2020	<	0.01	<	0.41	85.5
	SW5	20/04/2020	<	0.01	<	0.41	80.9
	SW6	20/04/2020		0.03	<	0.41	70.2
	SW7	20/04/2020	<	0.01	<	0.41	12.9
	SW8	20/04/2020	<	0.01	<	0.41	11.5
	SW9	20/04/2020	<	0.01	<	0.41	16.7
	SW10	20/04/2020		NS		NS	NS
Minimum			<	0.0100	<	0.4100	7.0
Maximum				0.0290		6.9000	85.5
Count				36.00		36.00	36.00

Appendix D
Table D5
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[a])**		**0.05**	**(0.05[a])**	--	--	--	**1**	--	--	**250**	**400**	--	--	--
Control Level A					**(0.1[aa])**	--	**0.03**	**(0.02[aa])**	--	--	--	**0.8**	--	--	**210**	**300**	--	--	--
Control Level B					**(0.15[aa])**	--	**0.04**	**(0.035[aa])**	--	--	--	**0.9**	--	--	**230**	**350**	--	--	--
Assessment Level					--	**(1.0[a])**	--	--	--	--			--	--	--	--	--	--	--
UPSTREAM WELLS																			
SST East S3																			
GW3A	Jan-19	08/01/19	17839308	92	0.211	< 0.0070	< 0.0030	< 0.0180	7.5	585.0	233.0	< 0.41			7.6	127.0	90.8	11.9	2.1
	Feb-19		Quarterly																
	Mar-19																		
	Apr-19	01/04/19	18095225	-	0.318	0.3090	0.0347	< 0.0180	7.3	601.0	229.0	< 0.41			9.3	111.0	416.0	7.2	2.4
	May-19		Quarterly																
	Jun-19																		
	Jul-19	01/07/19	18369026	-44	< 0.20	0.0141	< 0.0030	< 0.0180	8.2	558.0	224.0	< 0.41			11.2	104.0	85.9	9.1	4.5
	Aug-19		Quarterly																
	Sep-19																		
	Oct-19	14/10/19	18694531	164	0.426	< 0.0070	0.0078	< 0.0180	7.0	516.0	195	< 0.41			9.7	102.0	69.0	5.9	1.7
	Nov-19		Quarterly																
	Dec-19																		
	Jan-20	21/01/20	18977407	15	0.620	< 0.0070	< 0.0030	< 0.0180	7.1	496.0	220.0	< 0.41			11.6	92.0	72.5	9.1	1.4
	Feb-20		Quarterly																
	Mar-20																		
	Apr-20	21/04/20	1860909	157	0.463	0.0089	< 0.0030	< 0.3600	7.7	560.0	248.0	< 0.41	0.0048	13.2	12.5	89.6		8.0	1.6
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		
GW4	Jan-19	08/01/19	17839309	92	< 0.20	1.5400	< 0.0030	< 0.0180	6.9	241.0	66.6	< 0.41			8.6	63.0	15.1	2.7	< 0.7
	Feb-19		Quarterly																
	Mar-19																		
	Apr-19	01/04/19	18095226	146	< 0.20	1.7600	< 0.0030	< 0.0180	6.9	274.0	66.6	< 0.41			8.9	67.1	15.7	2.3	1.1
	May-19		Quarterly																
	Jun-19																		
	Jul-19	01/07/19	18369027	-80	< 0.20	1.5800	0.0034	< 0.0180	7.5	256.0	67.0	< 0.41			8.9	64.9	16.3	2.4	2.6
	Aug-19		Quarterly																
	Sep-19																		
	Oct-19	14/10/19	18694532	170	< 0.01	1.8200	0.0042	< 0.0180	6.6	266.0	64.4	< 0.41			8.3	68.4	16.1	7.1	< 0.7
	Nov-19		Quarterly																
	Dec-19																		
	Jan-20	21/01/20	18977408	9	0.011	1.8400	0.0040	0.0340	7.0	258.0	66.8	< 0.41			9.7	70.0	16.6	2.3	0.7
	Feb-20		Quarterly																
	Mar-20																		
	Apr-20	21/04/20	1860909	152	< 0.01	1.8100	0.0032	0.0251	7.1	261.0	62.0	< 0.41	0.0010	10.0	10.1	66.8		2.0	0.8
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		
GW11B	Jan-19	Not sampled																	
	Feb-19		Quarterly																
	Mar-19																		
	Apr-19	Not sampled																	
	May-19		Quarterly																
	Jun-19																		
	Jul-19	Not sampled																	
	Aug-19		Quarterly																
	Sep-19																		
	Oct-19	16/10/19	18702426	151	0.044	4.7400	0.0143	< 0.0180	7.3	222.0	101.0	< 0.41	0.0007		6.7	15.5	24.6	3.5	4.3
	Nov-19		Quarterly																
	Dec-19																		
	Jan-20	Not sampled																	
	Feb-20		Quarterly																
	Mar-20																		
	Apr-20	Not sampled																	
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		

Appendix D
Table D5
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[a])**		**0.05**	**(0.05[a])**	--	--	--	**1**	--	--	**250**	**400**	--	--	--
	Control Level A				**(0.1[aa])**	--	**0.03**	**(0.02[aa])**	--	--	--	**0.8**	--	--	**210**	**300**	--	--	--
	Control Level B				**(0.15[aa])**	--	**0.04**	**(0.035[aa])**	--	--	--	**0.9**	--	--	**230**	**350**	--	--	--
	Assessment Level				--	**(1.0[a])**	--	--	--	--			--	--	--	--	--	--	--
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																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		
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																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		
GW7	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																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		

Appendix D
Table D5
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[a])**		**0.05**	**(0.05[a])**	--	--	--	**1**	--	--	**250**	**400**	--	--	--
	Control Level A				**(0.1[aa])**	--	**0.03**	**(0.02[aa])**	--	--	--	**0.8**	--	--	**210**	**300**	--	--	--
	Control Level B				**(0.15[aa])**	--	**0.04**	**(0.035[aa])**	--	--	--	**0.9**	--	--	**230**	**350**	--	--	--
	Assessment Level				--	**(1.0[a])**	--	--	--	--			--	--	--	--	--	--	--
SST East S2																			
GW9	Jan-19	08/01/19	17839312	58	< 0.20	0.7810	< 0.0030	< 0.0180	6.7	520.0	194.0	4.94			32.6	38.1	34.1	2.6	2.9
	Feb-19		Quarterly																
	Mar-19																		
	Apr-19	01/04/19	18095229	92	< 0.20	0.7470	0.0040	< 0.0180	6.7	557.0	154.0	4.33			41.2	30.4	35.8	2.3	4.7
	May-19		Quarterly																
	Jun-19																		
	Jul-19	01/07/19	18369030	-71	< 0.200	0.3940	< 0.0030	< 0.0180	7.5	467.0	169.0	4.09			29.5	31.9	30.1	3.6	3.0
	Aug-19		Quarterly																
	Sep-19																		
	Oct-19	14/10/19	18694535	179	0.020	0.7710	0.0049	< 0.0180	6.8	613.0	168.0	5.39			54.3	20.1	32.7	8.4	7.4
	Nov-19		Quarterly																
	Dec-19																		
	Jan-20	21/01/20	18977411	33	0.01	0.8880	0.0051	< 0.0180	6.9	555.0	218.0	4.75			40.7	67.2	35.5	1.8	4.9
	Feb-20		Quarterly																
	Mar-20																		
	Apr-20	21/04/20	1860909	186	0.08	1.6800	0.0114	0.0304	7.7	1570.0	495.0	24.90	0.2604	11.7	179.0	33.7		4.4	14.0
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		
SST East S3																			
GW10	Jan-19	08/01/19	17839313	60	< 0.20	0.0125	0.00550	< 0.0180	7.3	471.0	183.0	< 0.41			15.4	64.2	63.2	8.1	4.8
	Feb-19		Quarterly																
	Mar-19																		
	Apr-19	01/04/19	18095230	88	< 0.200	0.0075	< 0.0030	< 0.0180	7.6	563.0	208.0	< 0.41			22.8	64.5	89.1	6.5	6.8
	May-19		Quarterly																
	Jun-19																		
	Jul-19	01/07/19	18369031	-29	< 0.200	0.1220	< 0.0030	< 0.0180	7.7	615.0	250.0	< 0.41			20.1	67.9	74.8	8.5	7.9
	Aug-19		Quarterly																
	Sep-19																		
	Oct-19	14/10/19	18694536	184	0.063	0.1880	0.0047	< 0.0180	7.1	612.0	269.0	< 0.41			12.6	64.3	85.8	8.1	5.3
	Nov-19		Quarterly																
	Dec-19																		
	Jan-20	21/01/20	18977412	30	0.09	6.4600	0.0139	< 0.0180	7.2	584.0	245.0	< 0.41			22.6	56.5	66.1	< 0.5	10.4
	Feb-20		Quarterly																
	Mar-20																		
	Apr-20	21/04/20	1860909	164	0.06	0.0900	0.0058	**0.0705**	7.8	688.0	276.0	< 0.41	0.0047	9.9	29.2	51.1		6.7	6.9
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		

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

Notes
* 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$^{(10.055-(0.0324*T_C)-pH)}$), where T°C is measured water temperature.
^ Ammonia result confirmed on duplicate analysis.

Appendix D
Table D6
Landfill Gas Monitoring Results

Location	Valve	METHANE (% by Volume)												CARBON DIOXIDE (% by Volume)											
		Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Comments
Date monitored																										
	Red Valve	0.1	0	0	0	0	0							0.4	0.2	0.3	0.6	0.8	0.9							Red Valve, 25.5m depth
	Yellow Valve	0.1	0	0	0	0	0							0	0	0	0	0.1	0							Yellow Valve,14m depth
	White Valve	0.1	0	0	0	0	0							0	0	0	0	0	2							White Valve, 4m 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	-	-	-	-	-	-	-	-	-	-	-	-	
GMW2	Trigger Level Red	-	-	-	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	-	-	-	-	-	-	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	
	Control Level Red	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	
	Red Valve	0.1	0	0	0	0	0							5.9	4.3	4.0	3.8	3	2.8							Red Valve, 19m depth
	Yellow Valve	0.1	0	0	0	0	0							0.1	0.0	0.9	0.3	2	0.6							Yellow Valve,9m depth
	White Valve	0.2	0	0	0	0	0							18.9	0.6	0.1	0	0	0							White Valve, 3.5m 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	-	-	-	-	-	-	-	-	-	-	-	-	
GMW3	Trigger Level Red	-	-	-	-	-	-	-	-	-	-	-	-	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	
	Trigger Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	24.02	24.02	24.02	24.02	24.02	24.02	24.02	24.02	24.02	24.02	24.02	24.02	
	Control Level Red	-	-	-	-	-	-	-	-	-	-	-	-	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	
	Red Valve	0.1	0	0	0	0	0							0	0.1	0.2	0.1	0.4	0.8							Red Valve, 30m depth
	Yellow Valve	0.1	0	0	0	0	0							0.2	0	0	0	0	0							Yellow Valve,20m depth
	White Valve	0.1	0	0	0	0	0							0	0	0	0	0.1	0.1							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	-	-	-	-	-	-	-	-	-	-	-	-	
GMW4	Trigger Level Red	-	-	-	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	-	-	-	-	-	-	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	
	Control Level Red	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	
	Red Valve	0.1	0	0	0	0	0							5.9	5.1	5.2	5.4	5.1	5.2							Red Valve, 26.3m depth
	Yellow Valve	0.1	0	0	0	0	0							2.9	3	0.7	1.7	1.9	2.1							Yellow Valve,15m depth
	White Valve	0.1	0	0	0	0	0							4.6	4	3.3	3	1.9	2.2							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	-	-	-	-	-	-	-	-	-	-	-	-	
GMW5	Trigger Level Red	-	-	-	-	-	-	-	-	-	-	-	-	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	
	Trigger Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	
	Control Level Red	-	-	-	-	-	-	-	-	-	-	-	-	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
	Red Valve	0.1	0	0	0	0	0.1							3.6	2.7	2.9	3.1	3.7	3.7							Red Valve, 26.3m depth
	Yellow Valve	0.1	0	0	0	0	0							2.8	2.9	1.8	1.5	1.1	1.3							Yellow Valve,15m depth
	White Valve	0.1	0	0	0	0	0							2	1.1	1.2	1.1	1.3	1.4							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	-	-	-	-	-	-	-	-	-	-	-	-	
GMW6	Trigger Level Red	-	-	-	-	-	-	-	-	-	-	-	-	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
	Trigger Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	5	5	5	5	5	5	5	5	5	5	5	5	
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	
	Control Level Red	-	-	-	-	-	-	-	-	-	-	-	-	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	

Appendix D
Table D6
Landfill Gas Monitoring Results

METHANE (% by Volume)

Location	Valve	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
GMW7	Yellow Valve	0.1	0	0	0	0	0						
	White Valve	0.1	0	0	0	0	0						
	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	-	-	-	-	-	-	-	-	-	-	-	-
	Trigger Level White	-	-	-	-	-	-	-	-	-	-	-	-
	Control Level Yellow	-	-	-	-	-	-	-	-	-	-	-	-
	Control Level White	-	-	-	-	-	-	-	-	-	-	-	-
GMW12	Red Valve	0.1	0	0	0	0	0						
	Yellow Valve	0.1	0	0	0	0	0						
	White Valve	0.2	0.1	0.1	0.1	0.1	0.1						
	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
	Trigger Level Yellow	1	1	1	1	1	1	1	1	1	1	1	1
	Trigger Level White	1	1	1	1	1	1	1	1	1	1	1	1
	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
	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
	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
GMW13	Red Valve	0.1	0	0	0	0	0						
	Yellow Valve	0.1	0	0	0	0	0						
	White Valve	0.1	0	0	0	0	0						
	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
	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
	Trigger Level White	1	1	1	1	1	1	1	1	1	1	1	1
	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
	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
	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
GMW14/14A	Red Valve	0.2	0	0	0	0	0						
	Yellow Valve	0.3	0.1	0.1	0.1	0.1	0.1						
	White Valve	0.4	0	0	0	0	0.1						
	Trigger Level Red	1	1	1	1	1	1	1	1	1	1	1	1
	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
	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
	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
	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
	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
GMW1**	Red Valve	0.7	0.1	0.5	0	0.1	0						
	Yellow Valve	1	0.7	12.2	23.6	25.7	19.9						
	White Valve	0.1	1.4	1	water	0.1	0.1						
GMW8*	Yellow Valve	11.4	11.4	3.8	3.3	1.1	2.6						
	White Valve	0.1	0	0	0	0	0						
GMW9*	Red Valve	0.1	0	0	0	0	0						
	Yellow Valve	32.4	34.5	30.9	25.9	21.8	20.9						
	White Valve	0.2	0.1	0.1	0	0	0.1						
GMW10*	Red Valve	0.1	0	0	0	15.8	30.2						
	Yellow Valve	34.4	46.5	0	0	10	25.6						
	White Valve	0.1	1.2	1.3	0	0.1	0.3						
GMW17**	Red Valve	0.1	0	0	0	0	0						
	Yellow Valve	nt	0	0	0	0	0						
	White Valve	0.2	0	0	0	0	0						
GMW18**	Yellow Valve	0.2	0	0	0	0	0						
	White Valve	0.1	0	0	0	0	0						

CARBON DIOXIDE (% by Volume)

Location	Valve	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Comments
GMW7	Yellow Valve	0.5	0.3	0.4	0.6	0.3	0.8							Yellow Valve,12 depth
	White Valve	0.5	0.3	0.4	0.6	0.3	0.7							White Valve, 5m depth
	Trigger Levels	-	-	-	-	-	-	-	-	-	-	-	-	
	Control Levels	-	-	-	-	-	-	-	-	-	-	-	-	
	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	
	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	
	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	0.6	0.6	0.9	0.7	1.1	0.7							Red Valve, 26.3m depth
	Yellow Valve	0.4	0.5	1.8	0	2.2	2.5							Yellow Valve,15m depth
	White Valve	1.2	0.5	0.8	0.6	0.7	0.7							White Valve, 5m depth
	Trigger Level Red	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	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	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	4	4	4	4	4	4	4	4	4	4	4	4	
	Control Level Yellow	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	5	5	5	5	5	5	5	5	5	5	5	5	
GMW13	Red Valve	1.6	1	0.9	1.3	1.1	1.2							Red Valve, 26.3m depth
	Yellow Valve	6.8	6.8	5.9	5.7	5.9	5.6							Yellow Valve,15m depth
	White Valve	2.9	0	2.2	2.5	2.5	2.8							White Valve, 5m depth
	Trigger Level Red	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	6	6	6	6	6	6	6	6	6	6	6	6	
	Trigger Level White	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	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	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	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	3.3	4.3	3.8	2.3	1.6	1.6							Red Valve, 26.3m depth
	Yellow Valve	5.3	4.7	3.6	3.3	3.3	3							Yellow Valve,15m depth
	White Valve	5.5	5.4	4.5	2.3	3.1	3.2							White Valve, 5m depth
	Trigger Level Red	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	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	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	1	1	1	1	1	1	1	1	1	1	1	1	
	Control Level Yellow	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	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	4.1	2.2	4.3	0	0.4	0							Red Valve, 23.5m depth
	Yellow Valve	2.7	0.7	5.1	4.8	9.5	10.9							Yellow Valve,14.7m depth
	White Valve	0	1.1	0.9	water	0.1	1.2							White Valve, 6.5m depth
GMW8*	Yellow Valve	9.7	8.7	3.3	3.5	1.7	3.7							Yellow Valve,17.5m depth
	White Valve	4.7	3.9	3.9	4.2	2.2	3.9							White Valve, 5.7m depth
GMW9*	Red Valve	2.1	1.8	1.7	1.8	1.7	1.7							Red Valve, 27m depth
	Yellow Valve	10.3	9.5	10	11.9	12.3	12.9							Yellow Valve,15m depth
	White Valve	0.1	0.1	0.1	0.1	0.1	0.1							White Valve, 8.5m depth
GMW10*	Red Valve	5.2	1.1	6.7	5.6	9.6	11.1							Red Valve, 19.5m depth
	Yellow Valve	5.9	5.7	6.7	4.5	8.4	10.7							Yellow Valve,15m depth
	White Valve	7.9	8.8	8.8	9	8.8	8.5							White Valve, 8m depth
GMW17**	Red Valve	1.5	1.4	1.1	1.2	1.3	1.2							Red Valve, 26.3m depth
	Yellow Valve	nt	5.2	4.5	4.1	4.1	3.7							Yellow Valve,15m depth
	White Valve	3.6	3.3	2.9	3.9	4	4.5							White Valve, 5m depth
GMW18**	Yellow Valve	0.3	0.1	0.6	1.6	0.5	0							Yellow Valve,12 depth
	White Valve	6.7	4.9	4.08	5.5	3.9	4.1							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 asterisks (**) are present, no trigger levels have been set, as not require by the Permit (Reference [2]).

Exceedance of Trigger
Exceedance of Control