

Silent Valley Waste Services
Limited

Silent Valley Landfill

2020 First Quarter Monitoring
Report

Issue | 30 April 2020

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1 Introduction

This 2020 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 January to March 2020 in accordance with the Silent Valley Environmental Permit (Permit no. MP3835SV [1]) and the Aftercare Phase Environmental and Infrastructure Monitoring Program [4]. 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].

1.1 Monitoring Regime

The monitoring regime is undertaken in accordance with the Aftercare Phase Environmental and Infrastructure Monitoring Program [4] 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**.

Unfortunately, the rainfall data is incomplete and missing results from 27th Dec – 22nd January as the weather station failed and required replacing. The replacement was installed and operating from 23rd January 2020.

Based on the available data, February recorded the highest monthly rainfall of the quarter with 362.64mm, and also the highest daily rainfall total with 75.4mm. March recorded a monthly rainfall total of 109.1mm and January recorded 41.3mm excluding the missing 22 days.

The values recorded for this quarter differ to those recorded during the same time period in previous years as March 2020 was considerably dryer than previous years. February 2020 was wetter than previous years, recording the highest rainfall level since monitoring began in 2008 (refer to previous monitoring reports). Three storms; Ciara, Dennis and Jorge, hit the UK during February 2020 leading to Met Office reports that it was the wettest February on record.

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**.

Leachate well LC1A continues to be unsampled due to lack of leachate present and well L1A was recorded as dry. Samples were obtained from L1B, LC2A, LC4A and LC5A.

The majority of the determinands are compliant.

With the exception of ammoniacal nitrogen and zinc, the average values for the monitored contaminants from the first quarter were below the AMC values. Well LC5A has continued to record a high ammoniacal nitrogen concentration, with a value of 2130mg/l, lower than last quarter's value of 2180mg/l. This has resulted in the average value of ammoniacal nitrogen being 789mg/l which is above the AMC of 526mg/l. Well LC2A also recorded an elevated concentration. Although ammoniacal nitrogen levels remain above the AMC, there is no identifiable increasing or decreasing trend with levels constantly fluctuating.

The continuing high levels of ammoniacal nitrogen recorded will be reviewed in the context of the proposed investigations into LC5A.

Mercury concentrations in wells LC2A and LC5A were unable to be determined due to matrix interference in the sample, likely due to the presence of sediment, recorded by the laboratory. However, where a result has been obtained it has remained below level of detection, a continuing trend since 2013.

The average zinc concentration was recorded as 1.855mg/l, higher than last quarter and above the AMC value of 1.380mg/l. Wells LC2A and LC4A specifically exceeded the AMC for zinc and are suggesting 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. Therefore, there are no results for this quarter.

2.3.2 Downstream Surface Water

SWD and SWD1

Ammoniacal nitrogen has remained below the measured level of detection of 0.41mg/l in both locations. Unionised ammoniacal nitrogen was also recorded below the assessment criteria.

Chloride and sulphate concentrations were reported well below the applied EQS levels, both indicating a decrease from last quarter.

Nickel, zinc, mercury and manganese concentrations have all been recorded below the EQS assessment criteria in both SWD and SWD1.

Results show these locations are both compliant.

SW1 to SW10

Samples were collected from the majority of locations from January to March 2020. Sample locations SW1 and SW10 were dry in July and SW5, SW9 and SW10 were dry during August.

During the reporting period, ammoniacal nitrogen was measured below the laboratory detection limit of 0.41mg/l at all monitored locations in January and the majority of locations during February and March.

Similar to last quarter, concentrations of ammoniacal nitrogen above the level of detection were recorded in SW4, SW5 and SW6, however these are located within tributaries and not the Nant Merddog itself. The three monitoring points are located along the same tributary, closest to the landfill and the concentrations decrease as it flows towards the Nant Merddog, dropping to <0.41mg/l where the tributary joins the river.

Chloride levels have also slightly increased at all locations, decreasing the closer they get to the river. This suggests there is a potential impact from the landfill on this tributary but not on the Nant Merddog.

Mercury was recorded below the laboratory detection limit at all monitored locations.

Chloride was measured well below the EQS limit during the first quarter with levels showing an increasing trend.

These break outs are from the same groundwater body as that monitored by GW9 and therefore it is considered that currently the non-compliance at GW9 continues to show no discernible impact on the Nant Merddog.

Monitoring of these downstream locations has been conducted monthly as per the Permit (Ref. [1]). However, the agreed twenty-four months of monitoring has now been completed and a report on these and the environmental consequence of the GW9 noncompliance will now be prepared for agreement with NRW.

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**.

The groundwater quality results for both upstream and downstream compliance wells are discussed in the following sub-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.

Ammoniacal nitrogen concentrations continue to be measured below the laboratory limit of detection (0.41mg/l) and chloride has continued to be measured at low concentrations. Nickel concentrations have continued to be low in GW4 with GW3A recording a slight decrease from last quarter.

Mercury was recorded below screening criteria in GW4. In GW3A the concentration has increased again since last quarter to 0.620mg/l, the highest recorded since May 2014. 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 concentrations continue to be elevated in GW4, recording a level of 1.84mg/l, a slight increase from last quarter's level of 1.82mg/l. In GW3A concentrations continue to be measured below the laboratory limit of detection.

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

Zinc has continued to be below the level of detection in GW3A, however control level A has been exceeded in GW4 with a concentration of 0.034mg/l.

The elevated metals are considered to be outside the influence of the landfill and therefore representative of the environment external to 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.

Well GW10

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

Ammoniacal nitrogen and zinc have continued to record below level of detection while mercury was measured at 0.09mg/l which is below the screening criteria.

Nickel concentrations were recorded at 0.0139mg/l, a slight increase from last quarter but remaining well below the screening criteria.

Manganese concentrations have recorded an exceedance of 6.46mg/l, well above the Assessment Level of 1mg/l. This is a significant increase from the previous year and the first exceedance since end 2018.

Chloride and sulphate concentrations were both well below the assessment criteria.

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. Monitoring results have been showing a general decreasing trend with occasional increases which are considered to be associated with seasonal variations and periods of persistent elevated rainfall.

Mercury, Zinc, Nickel and Manganese remain below the assessment and control levels.

The chloride concentration was 40.7mg/l, a decrease from last quarter's result of 54.3mg/l and the sulphate level was 67.2mg/l which is an increase on last quarter's result of 20.1mg/l, both still well below the control and Trigger Levels.

Well GW12

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

Ammoniacal nitrogen and zinc have been recorded below level of detection.

Mercury has been recorded slightly above the level of detection and should be closely monitored during 2020. Nickel has been recorded lower than last quarter's result, remaining below the screening criteria.

A sulphate level of 321mg/l was recorded, which is above the Control Level A of 300mg/l and slightly lower than last quarter's result of 328mg/l but remaining below 400mg/l. Consistently levels have been recorded above 300mg/l since 2013 and have been fluctuating between the control and trigger levels. However, a decreasing trend seems to be forming which could be confirmed by next quarter's results. The elevated levels do not seem to have a direct correlation with elevated rainfall or increase in water level and are not recorded in any other monitoring well.

Manganese has reduced significantly since last quarter which indicates there was not a rising trend in this well.

Wells GW6 and GW7

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

Ammoniacal nitrogen concentrations were recorded below the analytical detection limit in both wells.

The manganese concentration in GW6 was recorded as 0.463mg/l compared to 0.662mg/l in the previous quarter, remaining below the assessment criteria. The manganese level in GW7 has been recorded as 1.28mg/l, above the assessment level of 1.0mg/l but a decrease from the last quarter indicating a downward trend. 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. Elevated background manganese concentrations have been observed at similar levels at the upstream groundwater well GW4, suggesting a source of manganese other than the landfill.

Mercury, nickel, zinc, chloride and sulphates have continued to record well below assessment criteria in both wells.

2.4.2 Groundwater Levels Monitoring

Groundwater levels are monitored on a quarterly basis in the compliance and upstream wells, as discussed in **Section 3.4**. The monitoring results are illustrated graphically in **Appendix C, Figure C8**.

During the first quarter the water levels have remained fairly consistent with the last quarter. GW11B was only installed in September/October 2019 therefore a trend cannot yet be commented on.

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 GMW5, GMW13 and GMW14/14A.

Control Level

- GMW5 (white) in Jan only
- GMW13 (yellow) each month

Trigger Level

- GMW13 (yellow) in Jan and Feb only
- 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, two consecutive trigger exceedances have been recorded in the first quarter. The levels dropped below the trigger level again in March indicating a decreased concentration. However, they remain above the control level and these wells should be reviewed following receipt of next quarter's readings.

Well GMW5 recorded exceedances throughout 2020, however, the exceedances initially recorded in January within the white valve have reduced to below the trigger and control levels by the end of the quarter. With the changes in concentrations occurring in different valves, the readings for the second quarter of 2020 should be closely monitored to determine if these remain consistent

Considering 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, Interim GW9 and Nant Merddog W, Issue May 2015.
- [4] Arup, Silent Valley Landfill, Aftercare Phase Environmental and Infrastructure Monitoring Program, Issue June 2013.
- [5] Arup, Silent Valley Landfill, Hydrogeological Risk Assessment, document reference 04/6363, November 2004.
- [6] Arup, Silent Valley Landfill, Investigation into the Western Flank of the Cut-off System. Compliance Well GW9 and GW10, document reference 115825, August 2011.
- [7] Environment Agency, Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, report reference LFTGN02, June 2014.
- [8] Arup, Silent Valley Landfill, 2010 Annual Monitoring Report, document reference 11/7956, February 2011.
- [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.
- [14] Arup, Silent Valley Landfill, 2019 First Quarter Monitoring Report, 30th April 2019.
- [15] 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

below), it was evident that the pump in this location was continuing to have issues. The pump was consequently changed in August and the groundwater levels within the well have since returned to the required level. Maintenance issues were also recorded in the eastern section of the cut-off system, wells between April and September 2013 in TW10.

December: Although there is no current evidence to suggest issues with the efficacy of the BSC pipe located in the southern flank of Phase 1 landfill, SVWS commissioned the installation of four additional leachate monitoring wells (BH1 to BH4) along the alignment of the BSC pipe in December. The objective is for these boreholes to be monitored to confirm both the nature and level of leachate within the Phase 1 area and any long-term trends in leachate level (note that monitoring has temporarily ceased due to the works undertaken for the capping of Phase 1 landfill – see following sentence). During the installation of these wells, observations indicated that the capping of Phase 1 landfill was not typical of a low permeability capping system and further investigations, including the excavation of 19no shallow trial pits, confirmed that the existing capping was likely to not be preventing infiltration of rainwater. SVWS are currently undertaking works to improve the capping of the Phase 1 area in order to achieve a reduction in the leachate production and achieve regulatory compliance (see below).

2014 July: Earthworks for the installation of the capping system in Phase 1 landfill commenced. A combination of cut and fill is used to slacken the existing landfill slope angles to a maximum gradient of 1V:2.5H to achieve a stable angle for the capping system.

July to September: Further issues were identified within the eastern section of the cut-off system, particularly in TW11, and also in TW10 and PW14, all installed within the Sandstone S3 stratum. Pump failure was recorded in TW11 from July the 7th till September the 4th. After a number of attempts, the pump was finally retrieved and further delay in a pump reinstatement was caused by the delivery of required replacement parts. In addition, pumps installed in TW10 and PW14 repeatedly failed after service, however are now fully operational.

2015 January: capping of Phase 1 landfill is ongoing, with the earthworks largely complete. In addition to the new capping, improvements are also being made to both the surface water drainage and the leachate drain at the toe of the landfill. A new access track has also been constructed across the landfill to provide access for construction and future maintenance.

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 CaCO₃ (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.

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.

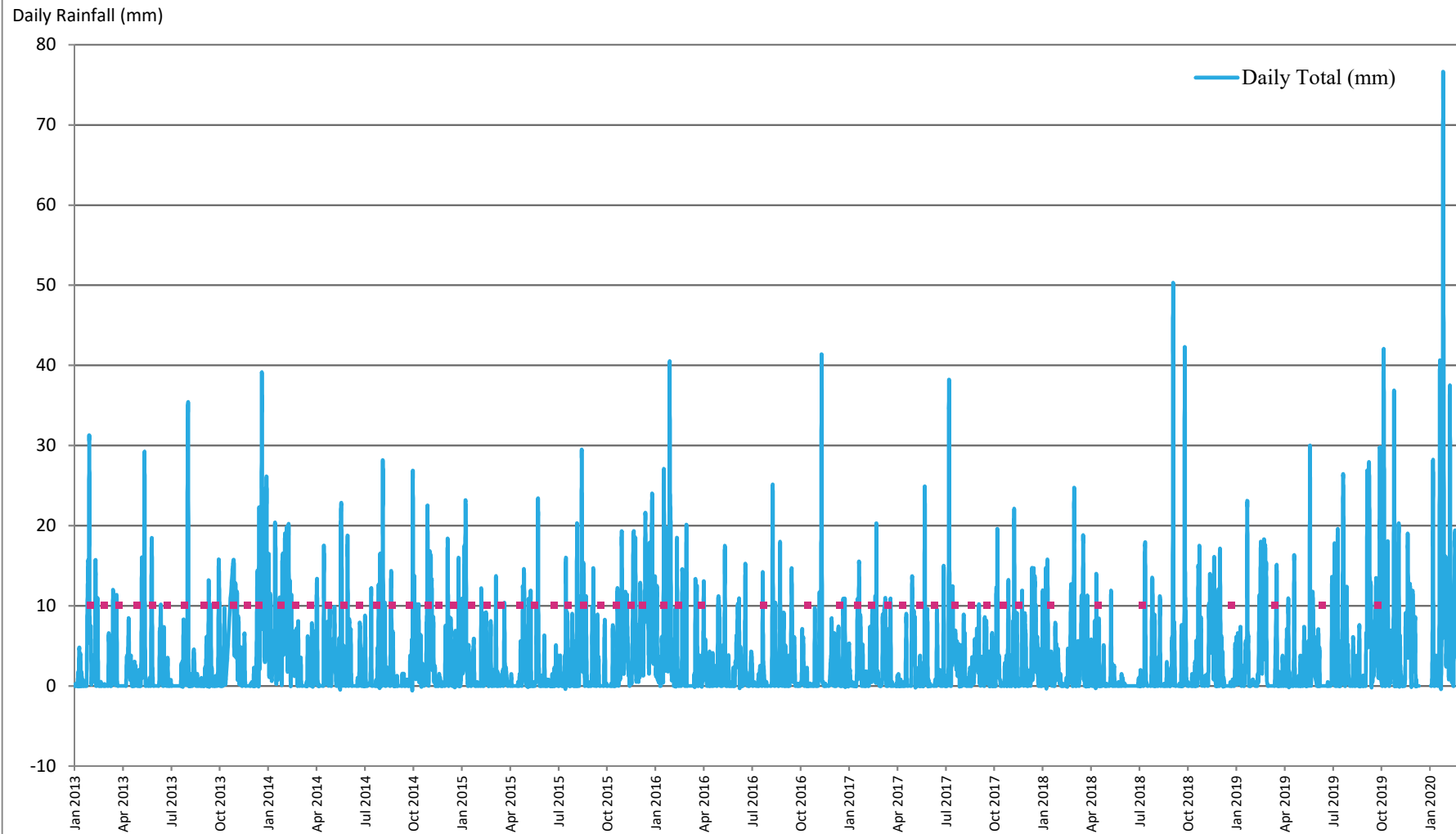
These wells are located around the site perimeter, as shown on **Figure 2**.

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.

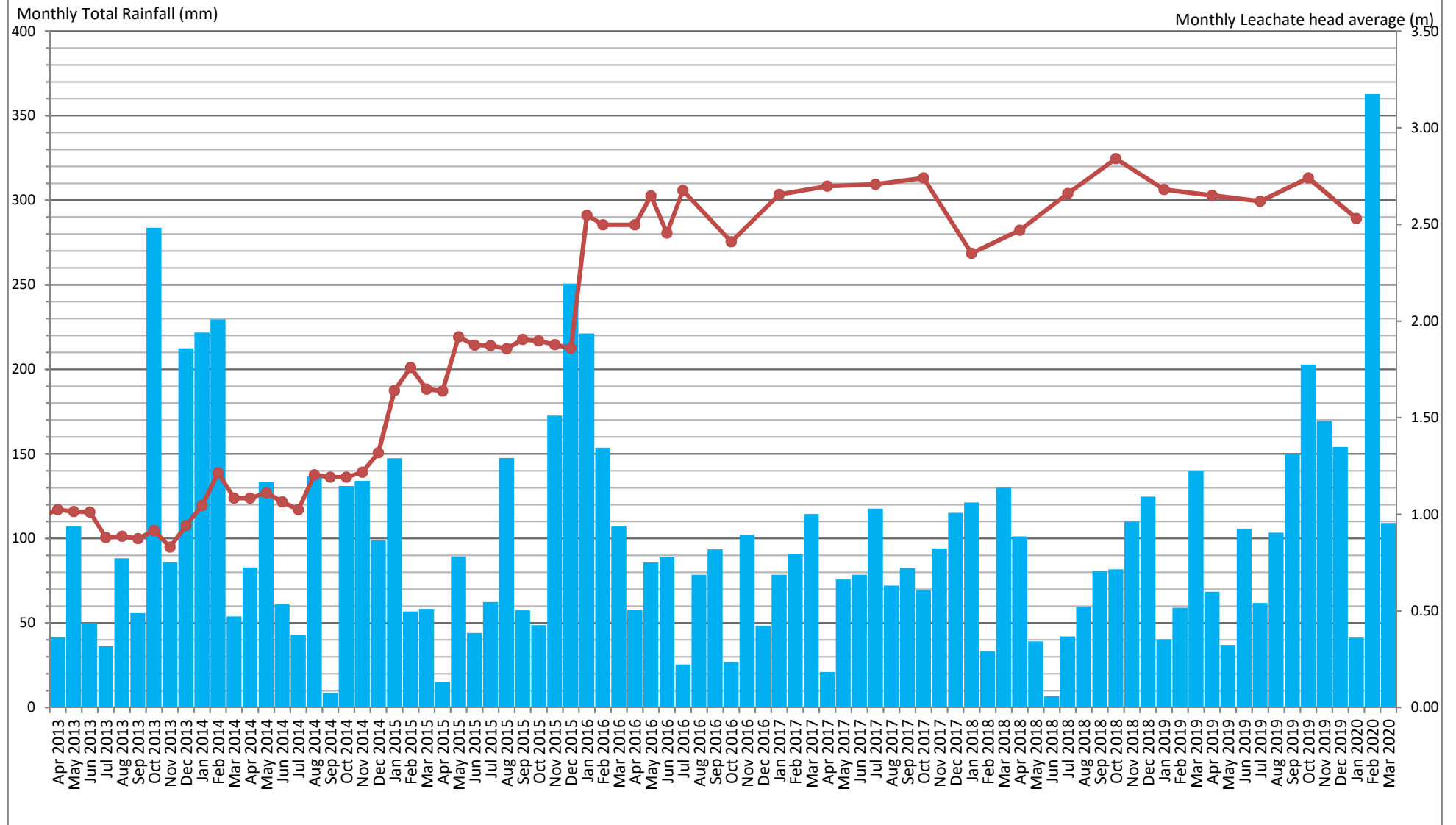
Appendix C

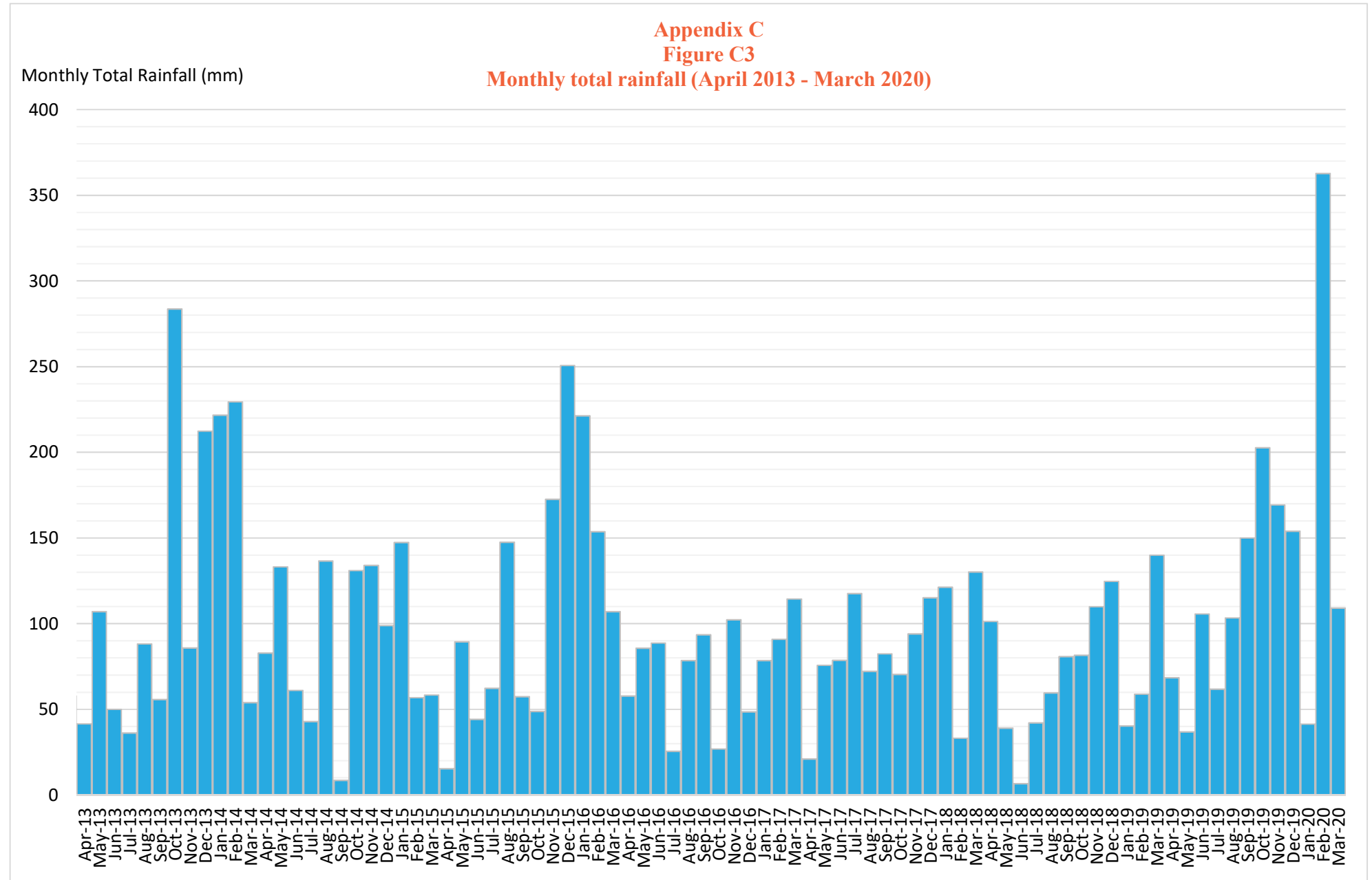
Monitoring Results - Graphs

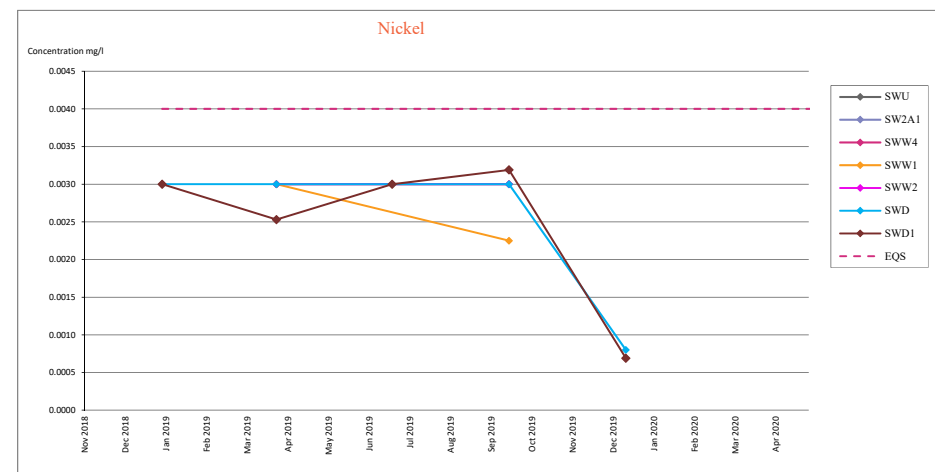
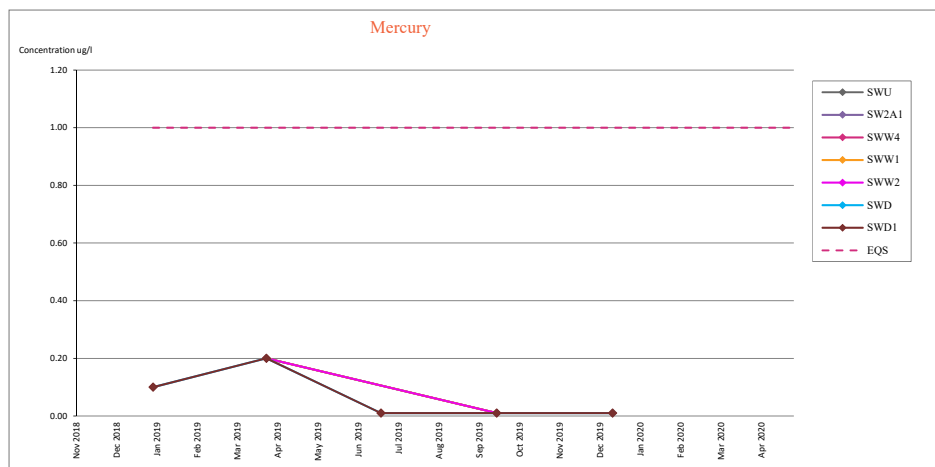
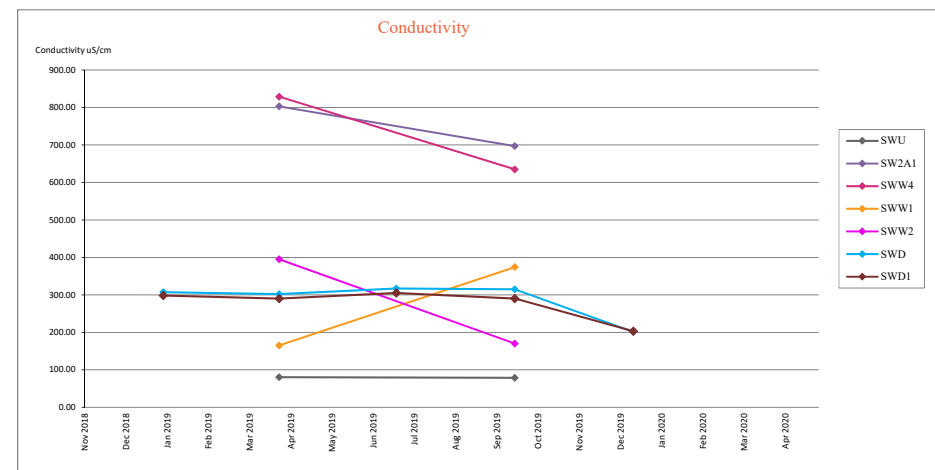
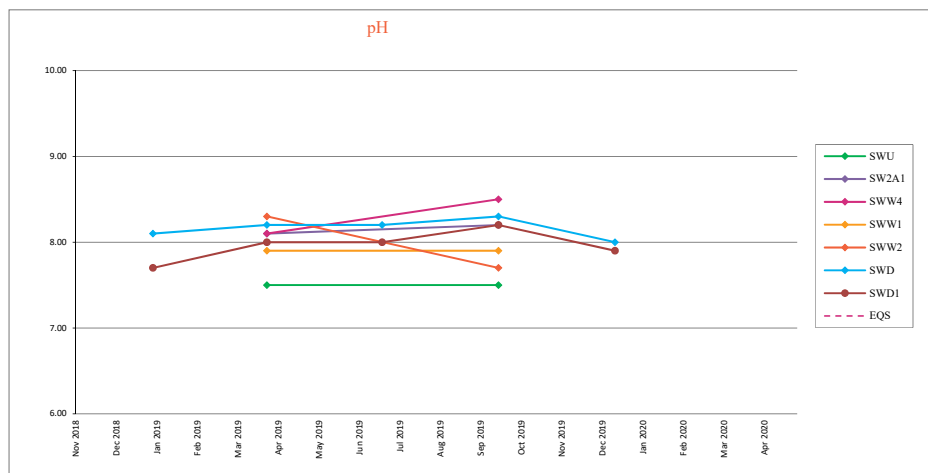
Appendix C
Figure C1
Daily rainfall totals and sampling events (January 2013 - March 2020)

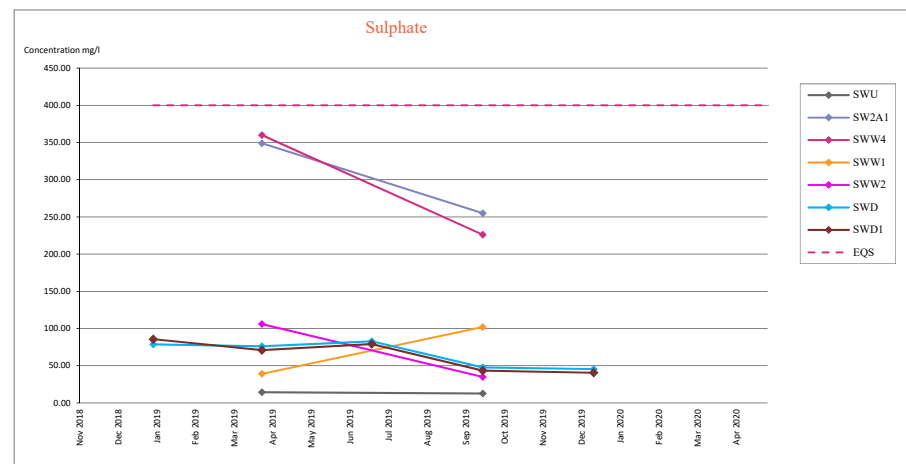
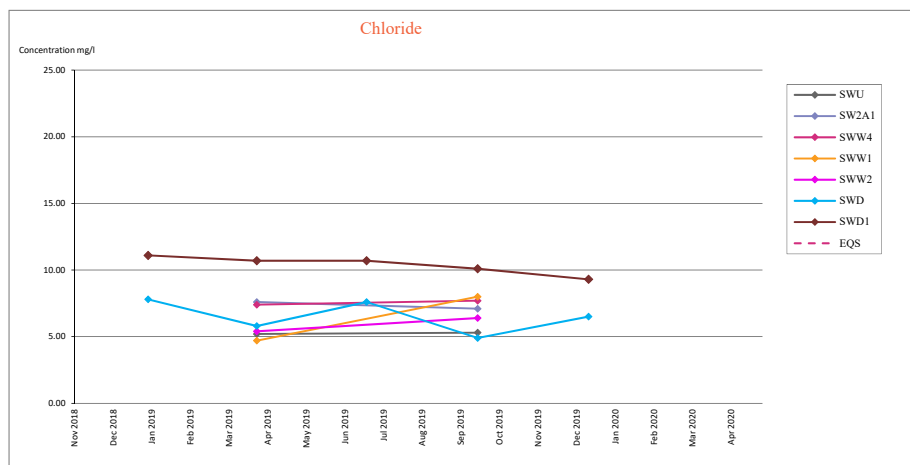
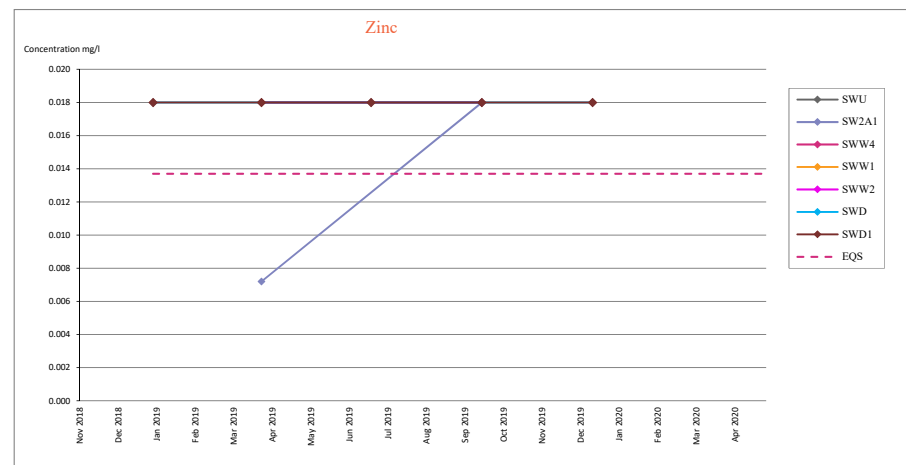
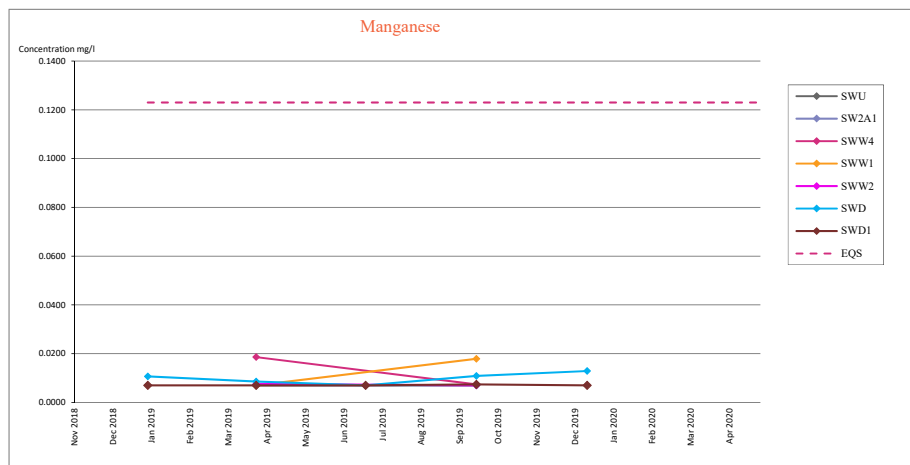


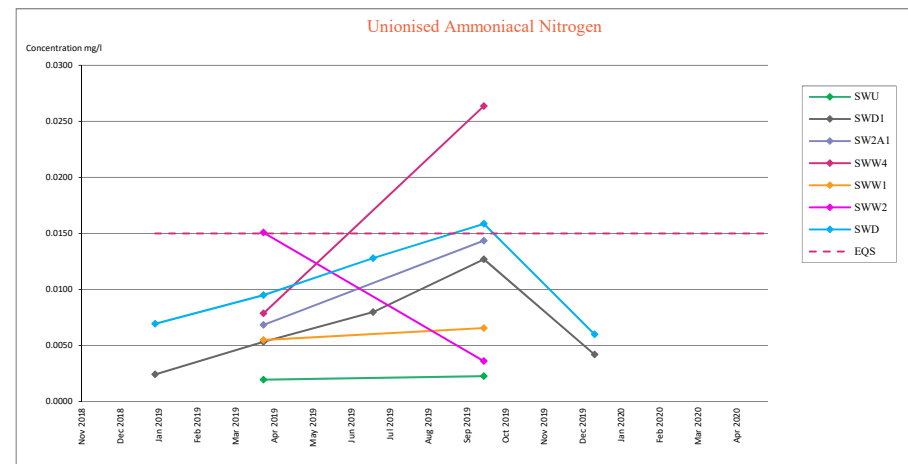
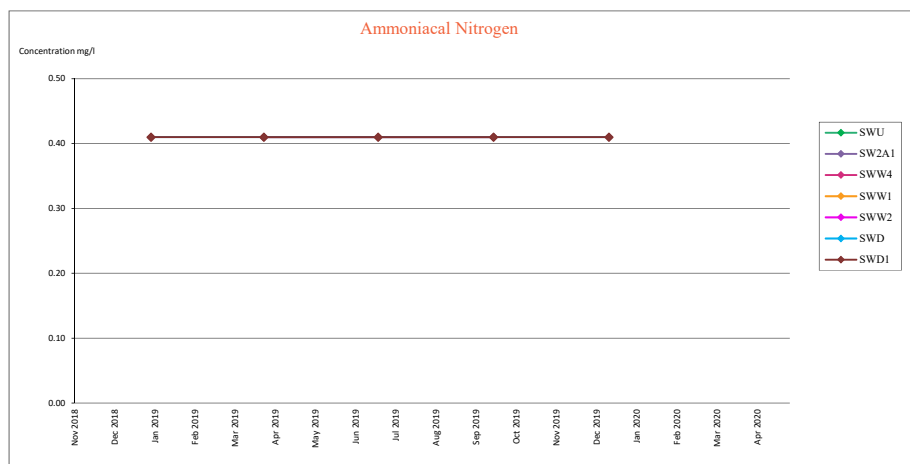
Appendix C
Figure C2
Monthly rainfall totals (April 2013 - March 2020)











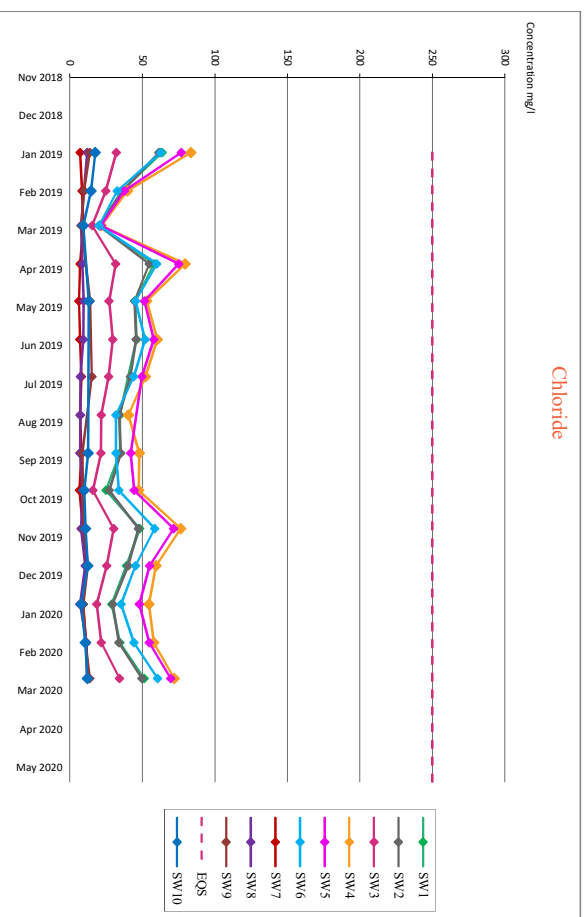
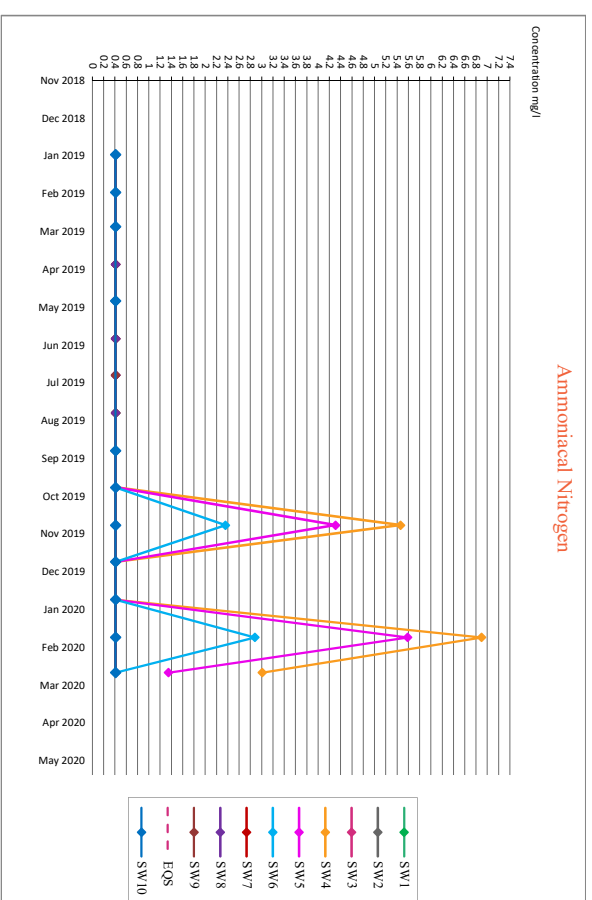
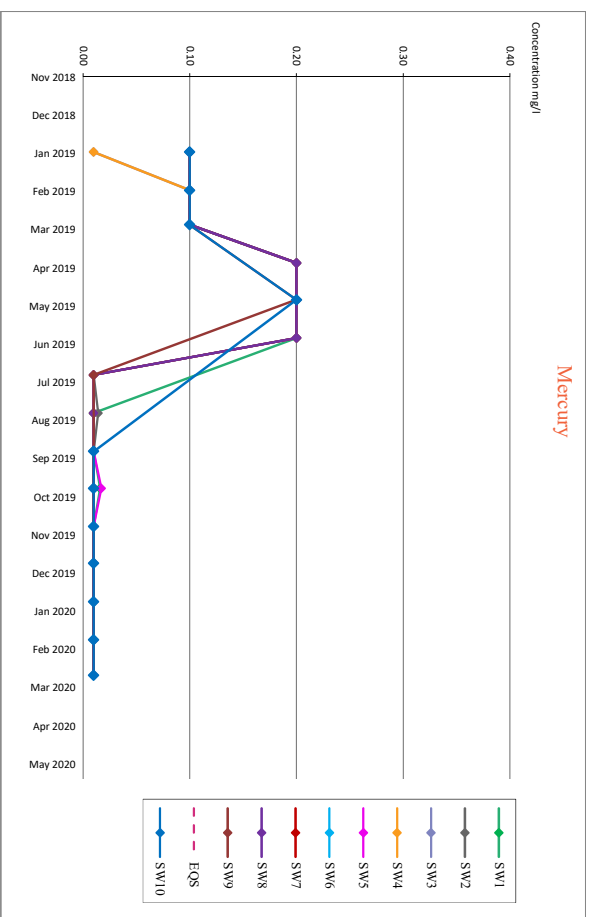


Figure C6
Groundwater quality monitoring results - Compliance wells graphs

Compliance wells graphs

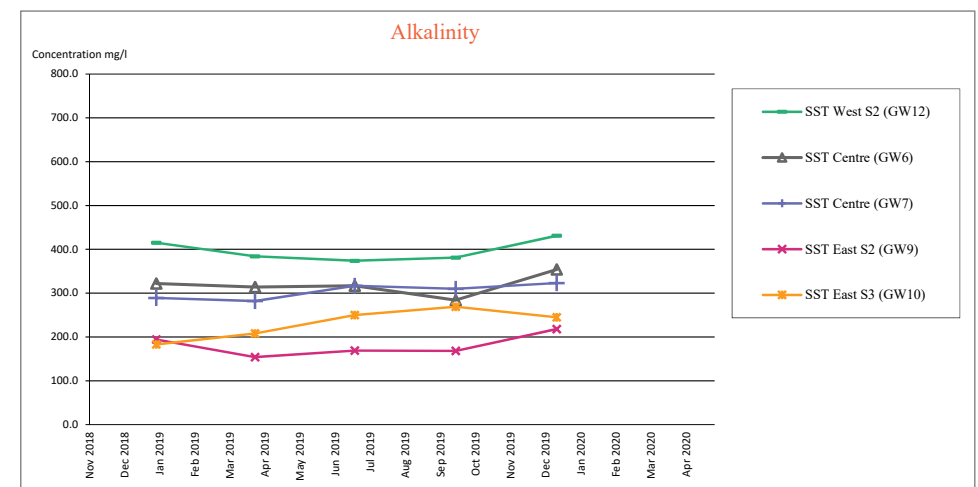
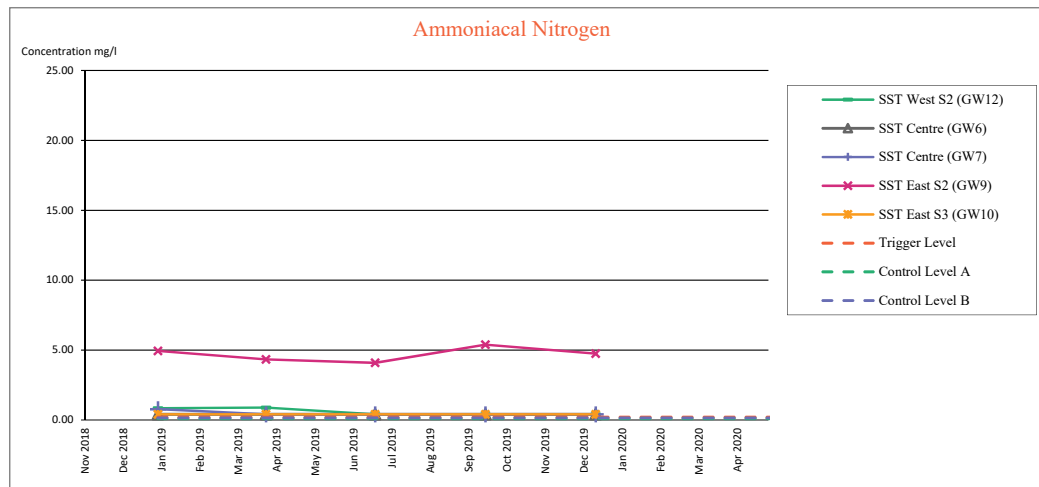
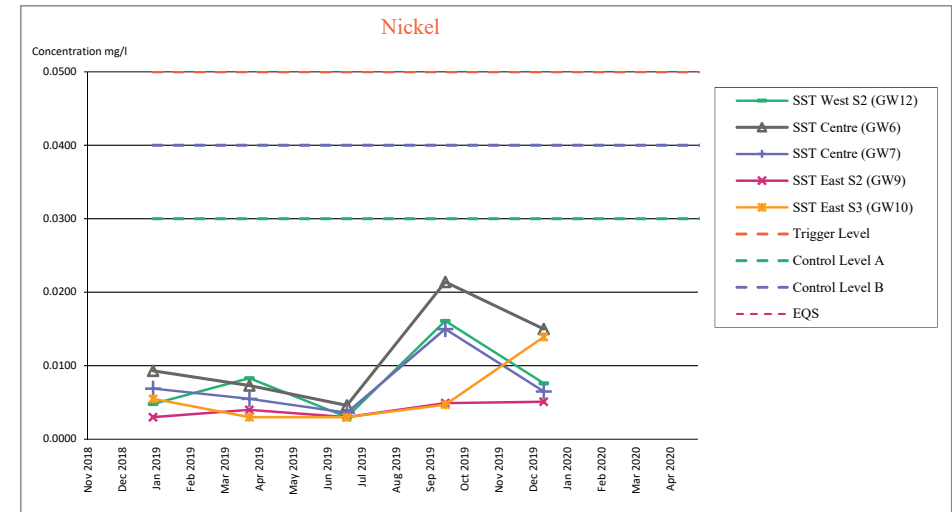
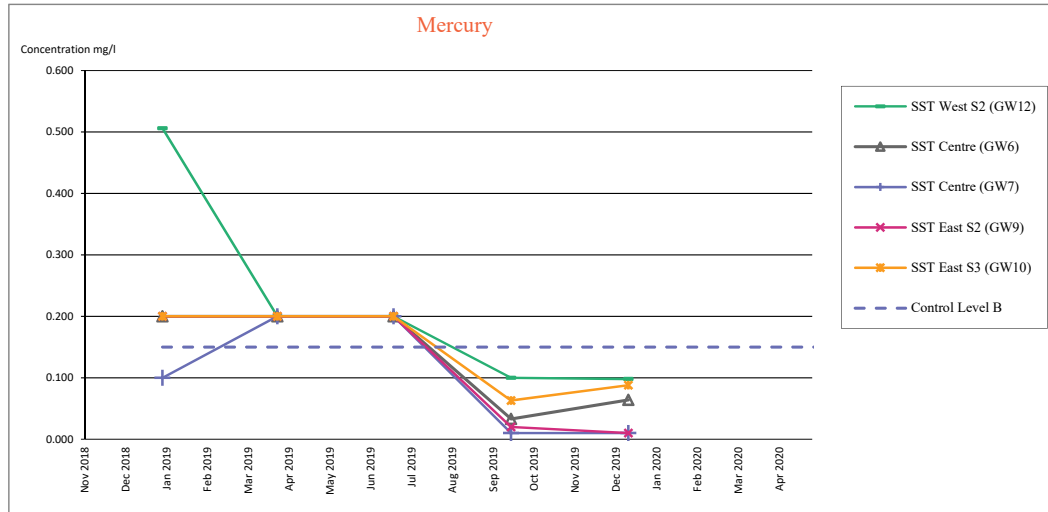


Figure C6

Groundwater quality monitoring results - Compliance wells graphs

Compliance wells graphs

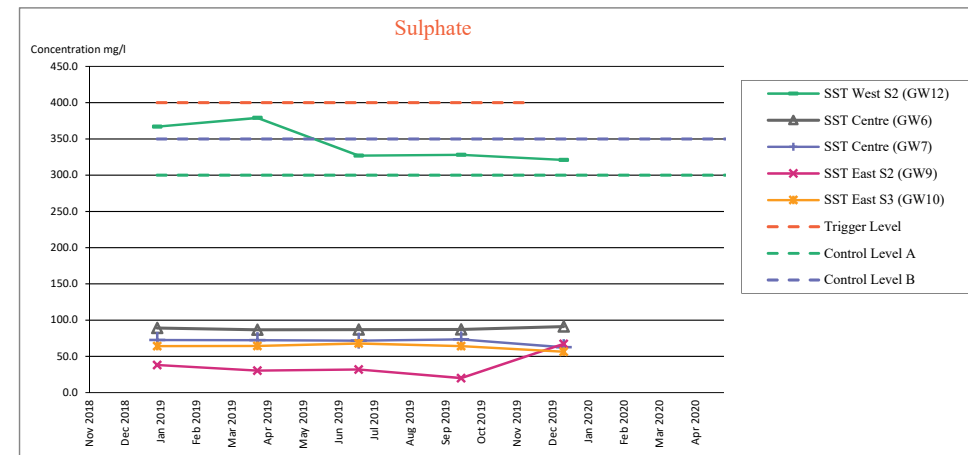
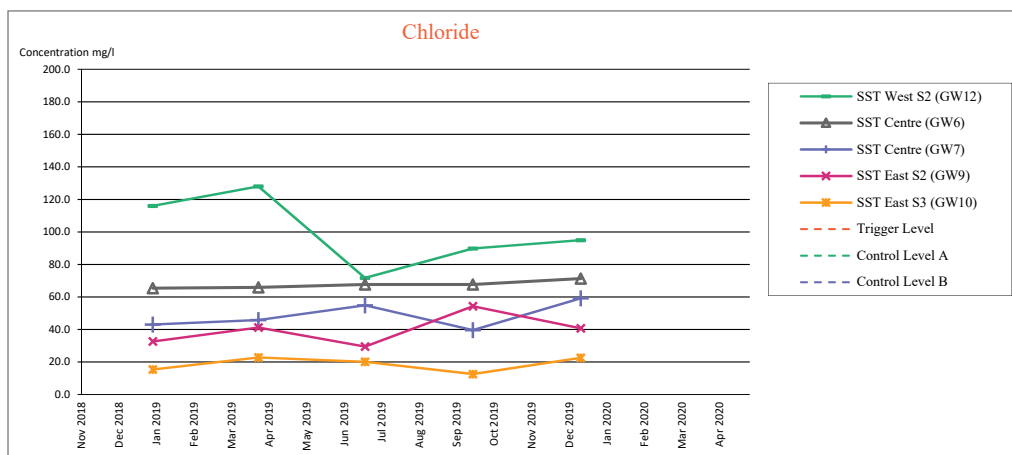
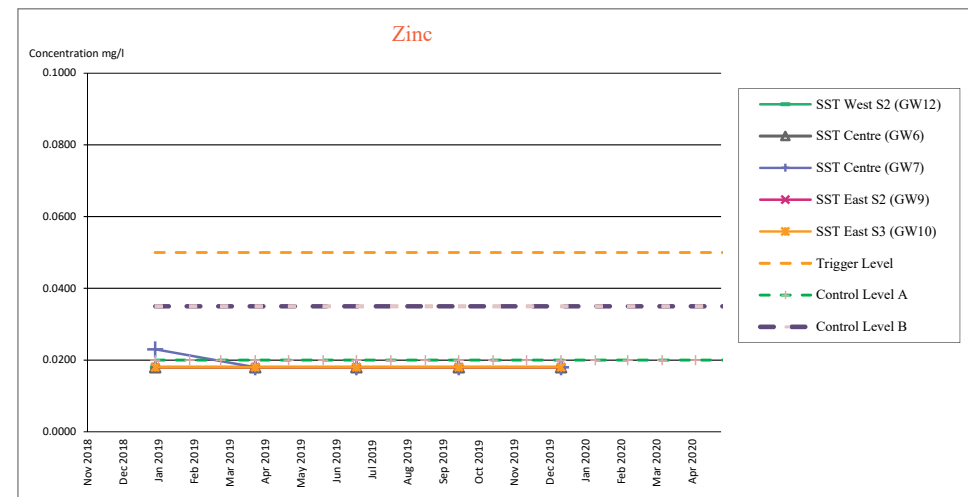
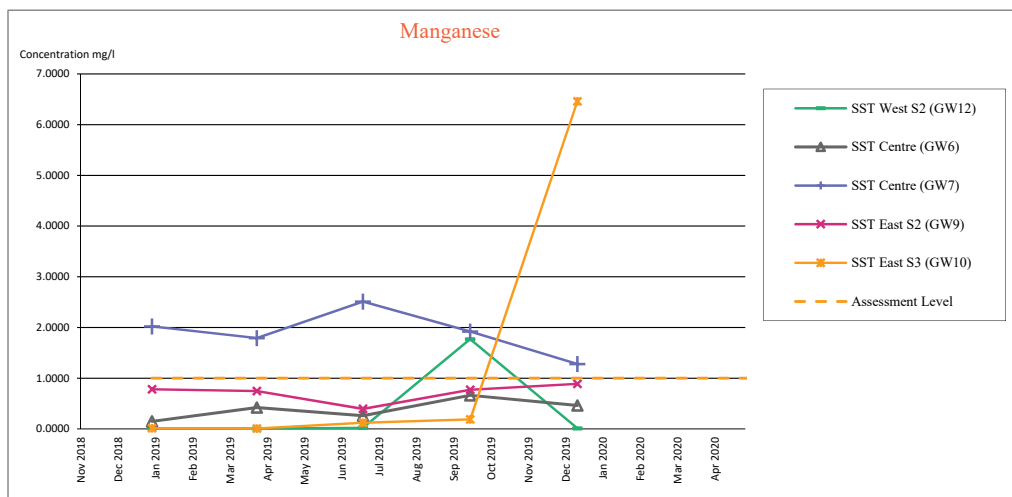


Figure C6

Groundwater quality monitoring results - Compliance wells graphs

Compliance wells graphs

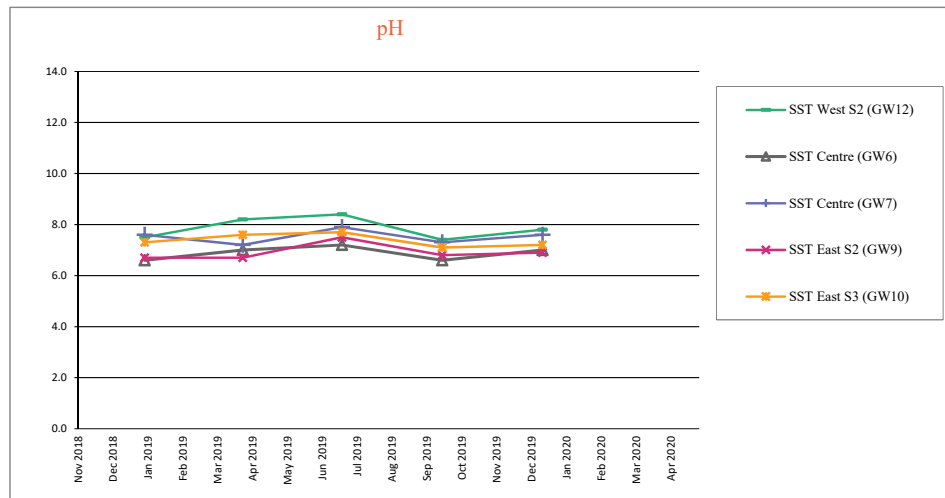


Figure C7

Groundwater quality monitoring results - Upstream wells graphs

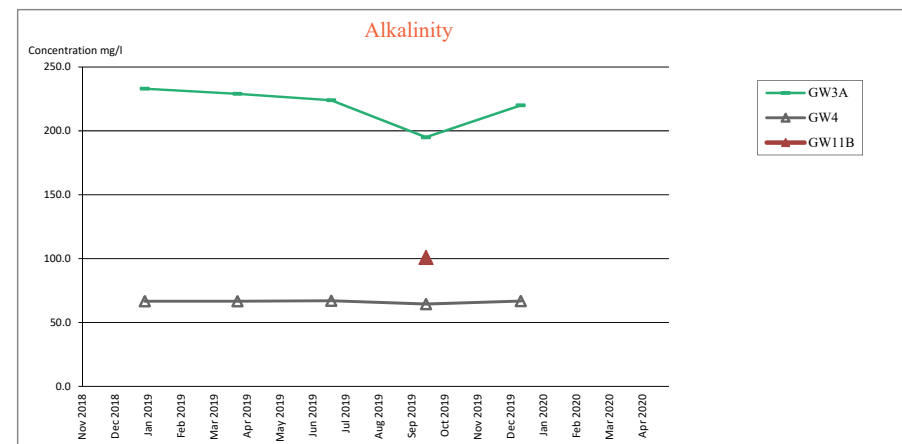
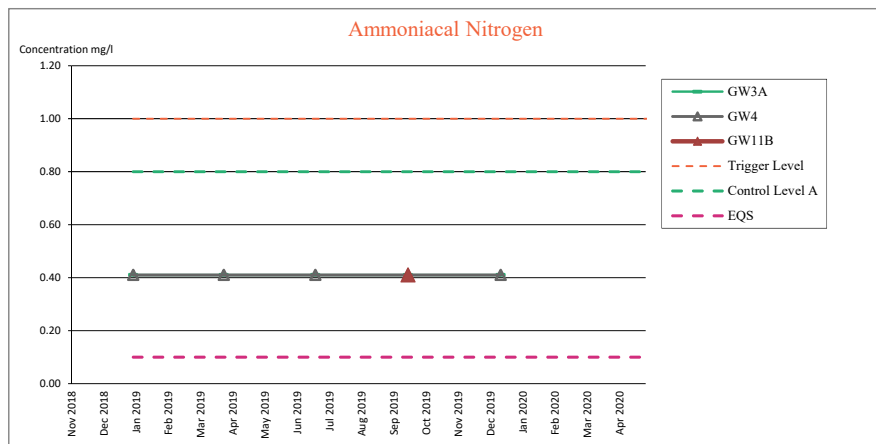
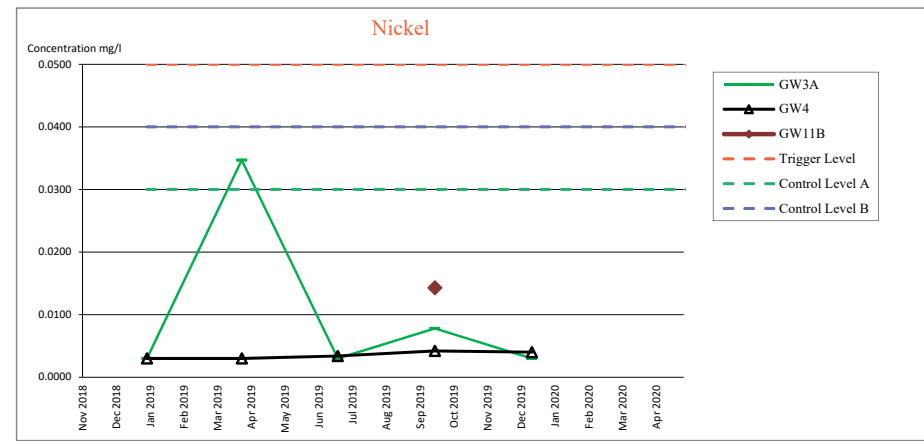
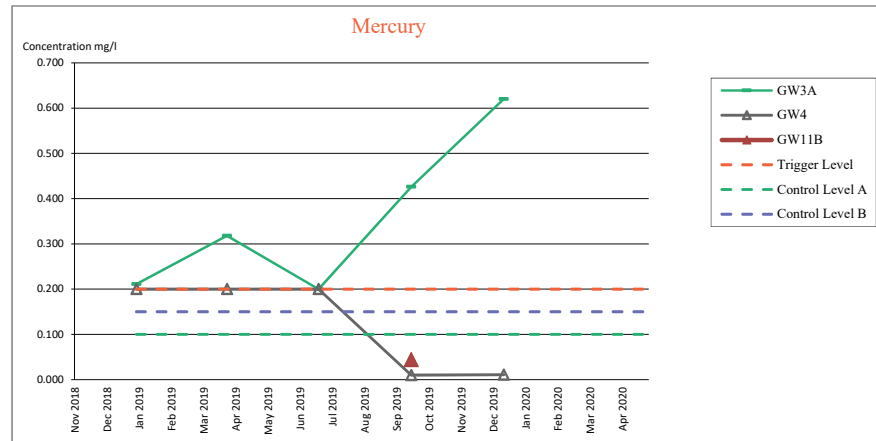
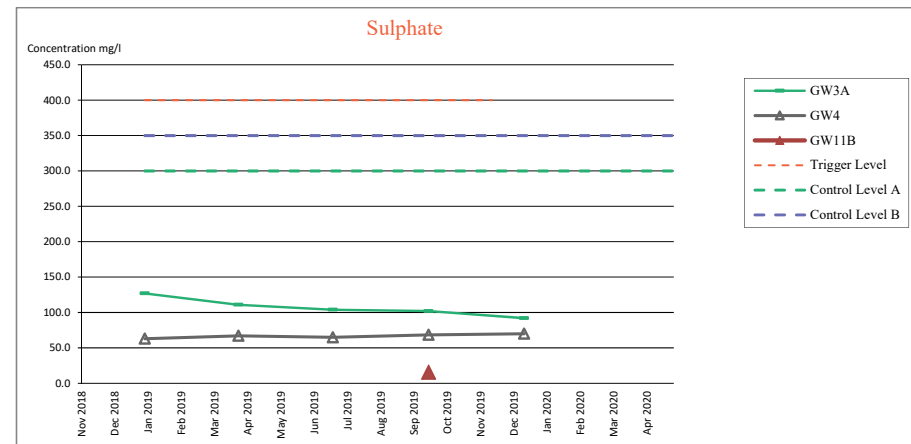
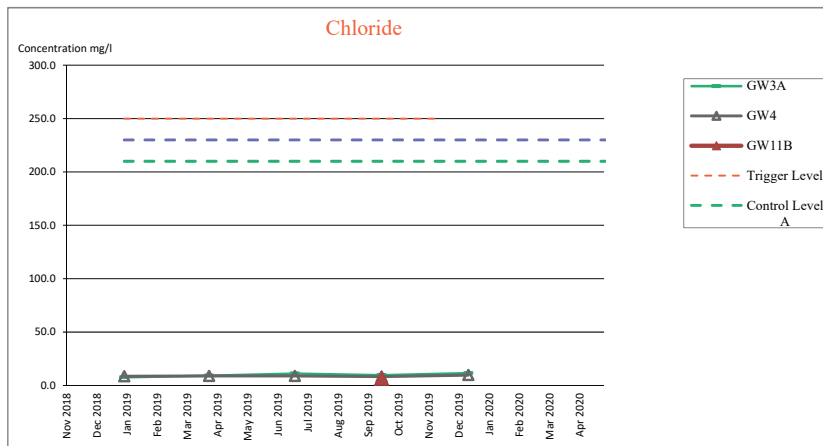
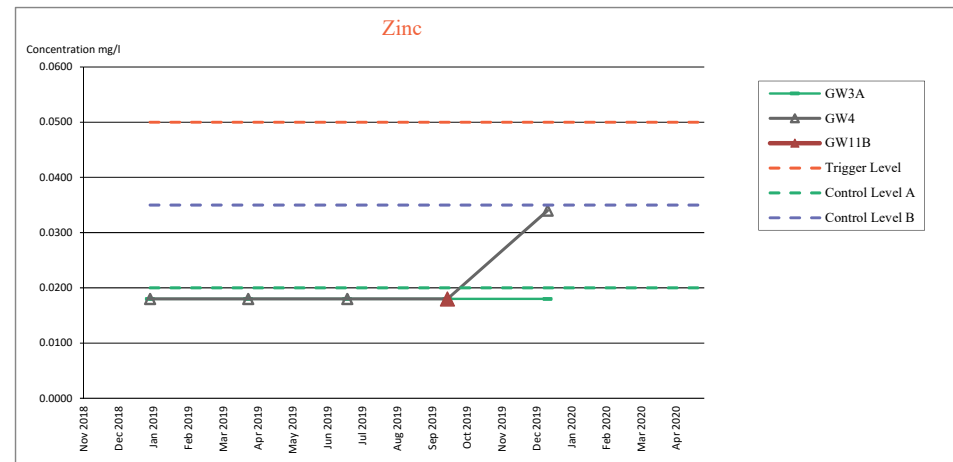
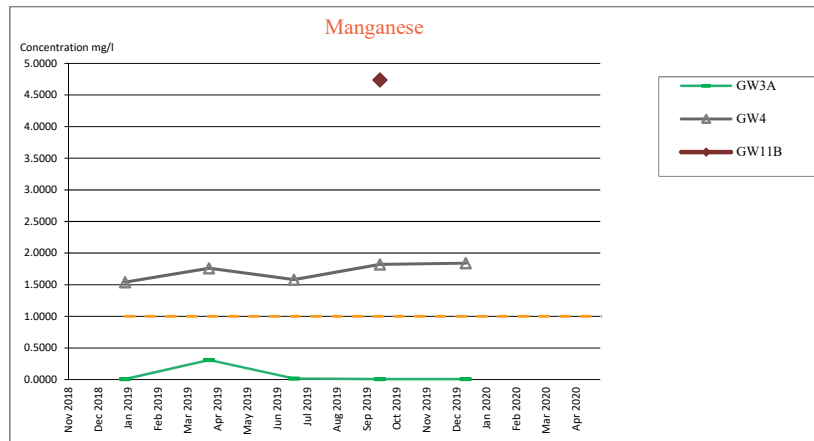
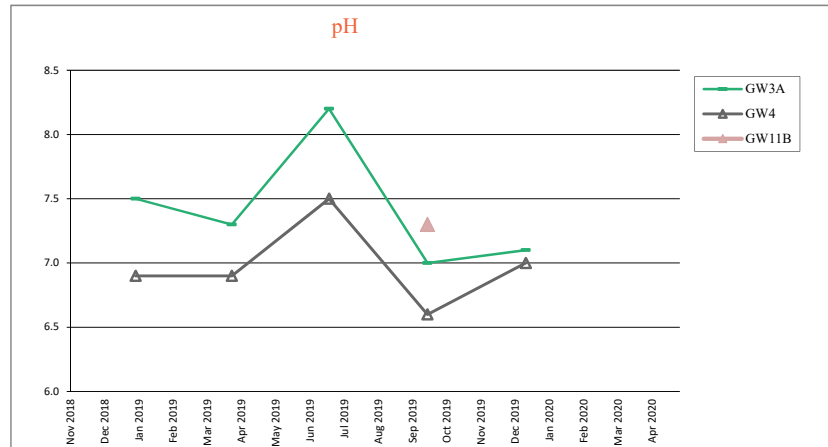
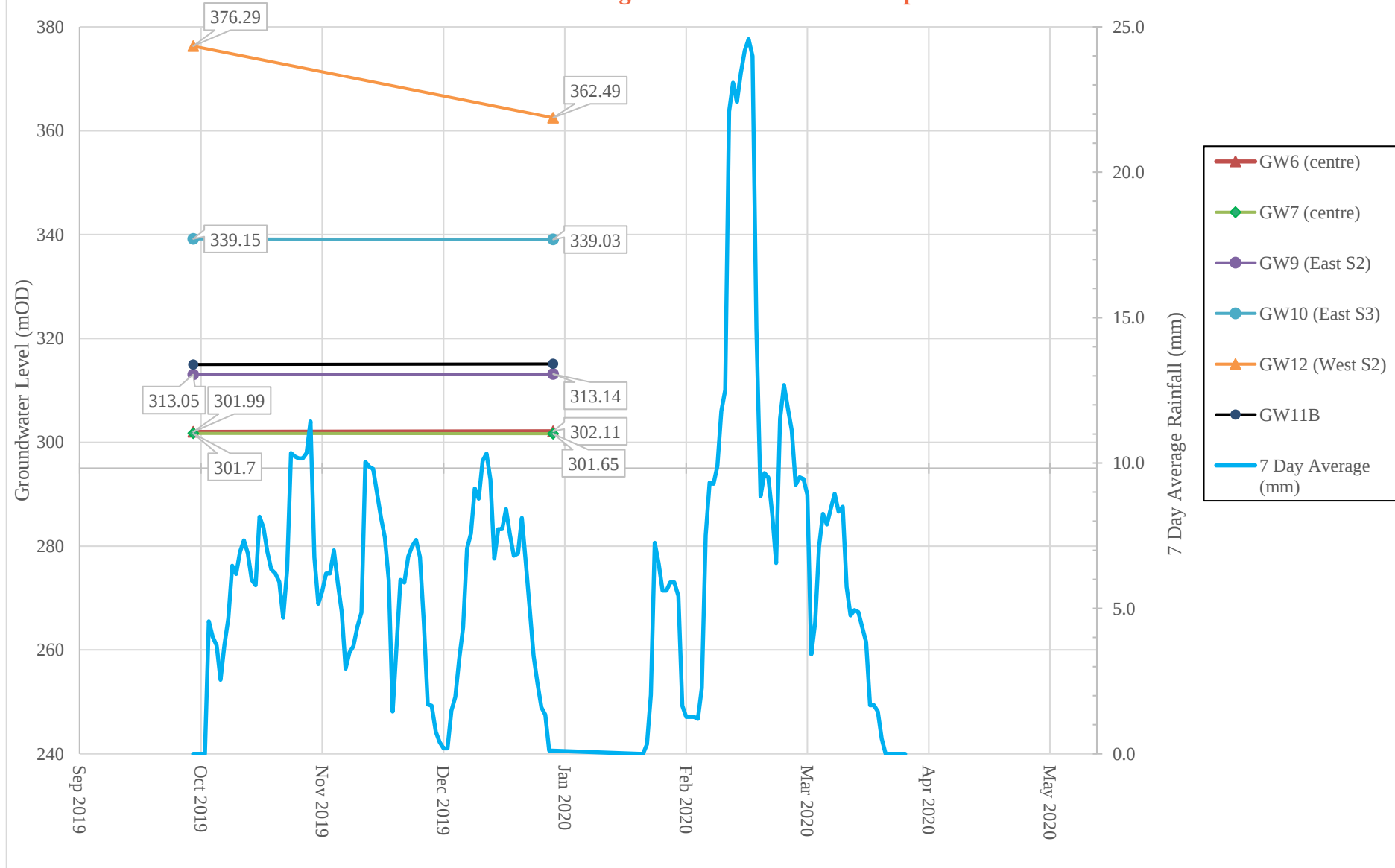


Figure C7
Groundwater quality monitoring results - Upstream wells graphs





Appendix C
Figure C8
Groundwater monitoring levels downstream of compliance wells



Appendix D

Monitoring Results - Tables

Appendix D
Table D1
Leachate Monitoring Results

115825

January 2020												
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	0.3	N/S	0.128	0.727	0.385	0.727	0.385	--	0.0324	0.156
Mercury, filt trace as Hg	mg/l	N/S	< 0.0002	N/S	SEE A/C	< 0.0002	SEE A/C	< 0.00002	< 0.00002	0.00056	0.000013	< 0.00001
Nickel in filtrate as Ni	mg/l	N/S	0.0065	N/S	0.093	0.0114	0.156	0.156	0.0667	0.0681	0.0052	0.0053
Zinc, ultra-low filtered as Zn	mg/l	N/S	0.0285	N/S	4.47	2.74	< 0.18	4.47	1.855	1.380	< 0.018	0.0274
pH	pH Units	N/S	8.1	N/S	8.4	7.7	8.3	8.40	8.125	--	8.4	8.2
Conductivity- Electrical 20C	uS/cm	N/S	1800	N/S	11100	4200	25200	25200.0	10575.0	--	1540	1830
Alkalinity as CaCO3	mg/l	N/S	480	N/S	5750	2460	12000	12000.0	5172.5	--	416	594
Ammoniacal Nitrogen as N	mg/l	N/S	8.3	N/S	750	269	2130	2130.0	789	526	0.64	12.2
Chloride as Cl	mg/l	N/S	107	N/S	869	206	2280	2280.0	866	1408	115	115
Sulphate as SO4	mg/l	N/S	366	N/S	371	9.3	526	526.0	318	999	218	284
Redox Potential (see note 4)	mV	N/S	143	N/S	88	38	97	143.0	91.5	--	138	133
Total Suspended Solids	mg/l	N/S	18	N/S	4810	1760	56	4810.0	1661.0		5	6
Solids, Total Dissolved 180 deg C	mg/l	N/S	1340	N/S	5240	1830	11900	11900.0	5077.5		1070	1280
Dissolved Oxygen, Fixed	mg/l	N/S	3.7	N/S	<0.5	<0.5	<0.5	3.70	3.7		7.3	6.1
TOC (filtered)	mg/l	N/S	17.4	N/S	326	63.6	1920	1920.0	581.8		14	16.3

Notes

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

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											
	Leachate elevation (mAOD)	358.51			398.85			398.85			398.85		
	Calculated leachate head (m)	0.89											
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											
	Leachate elevation (mAOD)	365.37			401.12			401.12			401.12		
	Calculated leachate head (m)	2.88											
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											
	Leachate elevation (mAOD)	374.28			401.14			401.14			401.14		
	Calculated leachate head (m)	2.01											
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											
	Leachate elevation (mAOD)	354.49			380.75			380.75			380.75		
	Calculated leachate head (m)	4.35											
L1	Casing height (mAOD)	357.00			357.00			357.00			357.00		
	Leachate (mbgl)	21.01											
	Leachate (m AOD)	335.99			357.00			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											
L1A*	Casing height (mAOD)	355.79			355.79			355.79			355.79		
	Leachate (mbgl)	20.84											
	Leachate (m AOD)	334.95			355.79			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											
L1B*	Casing height (mAOD)	354.80			354.80			354.80			354.80		
	Leachate (mbgl)	24.32											
	Leachate (m AOD)	330.48			354.80			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											

2019	Quarterly Leachate Head Averages (m)
January	2.53
February	N/S
March	N/S
April	#DIV/0!
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.

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 20°C	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)
Freshwater EQS**			µg/l	mV	mg/l	mg/l	mg/l		µS/cm	mg/l	mg/l	mg/l	°C	mg/l	mg/l	mg/l	mg/l	mg/l
			1	-	0.03	0.1*	0.05*	-	-	-	-	0.015**	-	250	400	-	-	-
J a n u a r y	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
		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
		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
	NW Ditch System	SWW1	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
	Downstream of Landfill	SWD	20/01/2020	< 0.01	-15.00	0.0129	0.00	< 0.02	8.00	201.00	53.20	< 0.41	0.0060	6.90	6.50	45.40	2.00	11.50
		SWD1	20/01/2020	< 0.01	-10.00	0.0070	0.00	< 0.02	7.90	203.00	53.40	< 0.41	0.0042	5.30	9.30	40.50	4.00	11.70
	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
		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
		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
F e b r u a r y	NW Ditch System	SWW1	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
	Downstream of Landfill	SWD	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
M a r c h	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
		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
		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
	NW Ditch System	SWW1	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
	Downstream of Landfill	SWD	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
	Minimum		< 0.0100	-15.0	< 0.007	< 0.003	< 0.0180	7.9	201.0	53.20	< 0.41	0.0042	5.30	6.50	40.50	2.00	< 11.50	< 1.30
	Maximum		< 0.0100	-10.0	0.013	0.003	0.0180	8.0	203.0	53.40	< 0.41	0.01	6.90	9.30	45.40	4.00	11.70	1.30
	Count		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

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

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	
J a n u a r y	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
F e b r u a r y	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
M a r c h	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
Minimum			<	0.0100	<	0.4100	7.0
Maximum			<	0.0100	<	6.9000	72.0
Count				30.00		30.00	30.00

Notes:

pH values based on measured pH at SWD and SWD1.

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°)	1	0.05	(0.05°)	1						250	400			
Control Level A					(0.1°)	--	0.03	(0.02°)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15°)	--	0.04	(0.035°)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0°)	--	--	--	--	--	--	--	--	--	--	--	--	--

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	Quarterly																							
	May-20																								
	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																								
	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		6.7	15.5	24.6	3.5		4.3
	Nov-19	Quarterly																							
	Dec-19																								
	Jan-20																								
	Feb-20	Quarterly																							
	Mar-20																								
	Apr-20																								
	May-20	Quarterly																							
	Jun-20																								
	Jul-20																								
	Aug-20	Quarterly																							
	Sep-20																								
	Oct-20																								
	Nov-20	Quarterly																							
	Dec-20																								

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°)	--	0.05	(0.05°)	--	--	--	1	--	--	250	400	--	--	--
Control Level A					(0.1°)	--	0.03	(0.02°)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15°)	--	0.04	(0.035°)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0°)	--	--	--	--	--	--	--	--	--	--	--	--	--
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																		
	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																		
	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																		
	May-20	Quarterly																	
	Jun-20																		
	Jul-20																		
	Aug-20	Quarterly																	
	Sep-20																		
	Oct-20																		
	Nov-20	Quarterly																	
	Dec-20																		

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)		0.05	(0.05)				1			250	400			
Control Level A					(0.1*)	--	0.03	(0.02*)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15*)	--	0.04	(0.035*)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0*)	--	--	--	--	--	--	--	--	--	--	--	--	--
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																		
	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																		
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		

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^{(0.055-0.0124(TC)-pH)}), where TC is measured water temperature.
 ^ Ammonia result confirmed on duplicate analysis.

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

METHANE (% by Volume)														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	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	0.1	0	0										0.5	0.3	0.4											Yellow Valve,12 depth	
	White Valve	0.1	0	0										0.5	0.3	0.4											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	-	-	-	-	-	-	-	-	-	-	-	-	-		
	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	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	1.32			
GMW12	Red Valve	0.1	0	0										0.6	0.6	0.9											Red Valve, 26.3m depth	
	Yellow Valve	0.1	0	0										0.4	0.5	1.8											Yellow Valve,15m depth	
	White Valve	0.2	0.1	0.1										1.2	0.5	0.8											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	0.1	0	0										1.6	1	0.9											Red Valve, 26.3m depth	
	Yellow Valve	0.1	0	0										6.8	6.8	5.9											Yellow Valve,15m depth	
	White Valve	0.1	0	0										2.9	0	2.2											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	0.2	0	0										3.3	4.3	3.8											Red Valve, 26.3m depth	
	Yellow Valve	0.3	0.1	0.1										5.3	4.7	3.6											Yellow Valve,15m depth	
	White Valve	0.4	0	0										5.5	5.4	4.5											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	0.7	0.1	0.5										4.1	2.2	4.3											Red Valve, 23.5m depth	
	Yellow Valve	1	0.7	12.2										2.7	0.7	5.1											Yellow Valve,14.7m depth	
	White Valve	0.1	1.4	1										0	1.1	0.9											White Valve, 6.5m depth	
GMW8*	Yellow Valve	11.4	11.4	3.8										9.7	8.7	3.3											Yellow Valve,17.5m depth	
	White Valve	0.1	0	0										4.7	3.9	3.9											White Valve, 5.7m depth	
GMW9*	Red Valve	0.1	0	0										2.1	1.8	1.7											Red Valve, 27m depth	
	Yellow Valve	32.4	34.5	30.9										10.3	9.5	10											Yellow Valve,15m depth	
	White Valve	0.2	0.1	0.1										0.1	0.1	0.1											White Valve, 8.5m depth	
GMW10*	Red Valve	0.1	0	0										5.2	1.1	6.7											Red Valve, 19.5m depth	
	Yellow Valve	34.4	46.5	0										5.9	5.7	6.7											Yellow Valve,15m depth	
	White Valve	0.1	1.2	1.3										7.9	8.8	8.8											White Valve, 8m depth	
GMW17**	Red Valve	0.1	0	0										1.5	1.4	1.1											Red Valve, 26.3m depth	
	Yellow Valve	nt	0	0										nt	5.2	4.5											Yellow Valve,15m depth	
	White Valve	0.2	0	0										3.6	3.3	2.9											White Valve, 5m depth	
GMW18**	Yellow Valve	0.2	0	0										0.3	0.1	0.6											Yellow Valve,12 depth	
	White Valve	0.1	0	0										6.7	4.9	4.08											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

Appendix D
Table D1
Leachate Monitoring Results

January 2020												
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	0.3	N/S	0.128	0.727	0.385	0.727	0.385	--	0.0324	0.156
Mercury, filt trace as Hg	mg/l	N/S	< 0.0002	N/S	SEE A/C	< 0.0002	SEE A/C	< 0.00002	< 0.00002	0.00056	0.000013	< 0.00001
Nickel in filtrate as Ni	mg/l	N/S	0.0065	N/S	0.093	0.0114	0.156	0.156	0.0667	0.0681	0.0052	0.0053
Zinc, ultra-low filtered as Zn	mg/l	N/S	0.0285	N/S	4.47	2.74	< 0.18	4.47	1.855	1.380	< 0.018	0.0274
pH	pH Units	N/S	8.1	N/S	8.4	7.7	8.3	8.40	8.125	--	8.4	8.2
Conductivity- Electrical 20C	uS/cm	N/S	1800	N/S	11100	4200	25200	25200.0	10575.0	--	1540	1830
Alkalinity as CaCO3	mg/l	N/S	480	N/S	5750	2460	12000	12000.0	5172.5	--	416	594
Ammoniacal Nitrogen as N	mg/l	N/S	8.3	N/S	750	269	2130	2130.0	789	526	0.64	12.2
Chloride as Cl	mg/l	N/S	107	N/S	869	206	2280	2280.0	866	1408	115	115
Sulphate as SO4	mg/l	N/S	366	N/S	371	9.3	526	526.0	318	999	218	284
Redox Potential (see note 4)	mV	N/S	143	N/S	88	38	97	143.0	91.5	--	138	133
Total Suspended Solids	mg/l	N/S	18	N/S	4810	1760	56	4810.0	1661.0		5	6
Solids, Total Dissolved 180 deg C	mg/l	N/S	1340	N/S	5240	1830	11900	11900.0	5077.5		1070	1280
Dissolved Oxygen, Fixed	mg/l	N/S	3.7	N/S	<0.5	<0.5	<0.5	3.70	3.7		7.3	6.1
TOC (filtered)	mg/l	N/S	17.4	N/S	326	63.6	1920	1920.0	581.8		14	16.3

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'.

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											
	Leachate elevation (mAOD)	358.51			398.85			398.85			398.85		
	Calculated leachate head (m)	0.89											
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											
	Leachate elevation (mAOD)	365.37			401.12			401.12			401.12		
	Calculated leachate head (m)	2.88											
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											
	Leachate elevation (mAOD)	374.28			401.14			401.14			401.14		
	Calculated leachate head (m)	2.01											
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											
	Leachate elevation (mAOD)	354.49			380.75			380.75			380.75		
	Calculated leachate head (m)	4.35											
L1	Casing height (mAOD)	357.00			357.00			357.00			357.00		
	Leachate (mbgl)	21.01											
	Leachate (m AOD)	335.99			357.00			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											
L1A*	Casing height (mAOD)	355.79			355.79			355.79			355.79		
	Leachate (mbgl)	20.84											
	Leachate (m AOD)	334.95			355.79			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											
L1B*	Casing height (mAOD)	354.80			354.80			354.80			354.80		
	Leachate (mbgl)	24.32											
	Leachate (m AOD)	330.48			354.80			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											

2019	Quarterly Leachate Head Averages (m)
January	2.53
February	N/S
March	N/S
April	#DIV/0!
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.

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)							
				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							
Freshwater EQS**				1	-	0.03	0.1*	0.05*	-	-	-	-	0.015**	-	250	400	-	-	-							
J a n u a r y	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							
		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							
		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							
	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							
		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							
	Downstream of Landfill	SWD	20/01/2020	<	0.01	-15.00	0.0129	0.00	<	0.02	8.00	201.00	53.20	<	0.41	0.0060	6.90	6.50	45.40	2.00	11.50	1.30				
		SWD1	20/01/2020	<	0.01	-10.00	<	0.0070	0.00	<	0.02	7.90	203.00	53.40	<	0.41	0.0042	5.30	9.30	40.50	4.00	11.70	1.30			
F e b r u a r y	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						
		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						
		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						
M a r c h	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						
		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						
		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	-15.0	<	0.007	<	0.003	<	0.0180	7.9	201.0	53.20	<	0.41	0.0042	5.30	6.50	40.50	2.00	<	11.50	<	1.30
Maximum				<	0.0100	-10.0		0.013		0.003		0.0180	8.0	203.0	53.40	<	0.41	0.01	6.90	9.30	45.40	4.00		11.70		1.30
Count				2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

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

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	
J a n u a r y	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
F e b r u a r y	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
M a r c h	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
Minimum			<	0.0100	<	0.4100	7.0
Maximum			<	0.0100	<	6.9000	72.0
Count				30.00		30.00	30.00

Notes:

pH values based on measured pH at SWD and SWD1.

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)	1	(0.05)	1							250	400			
Control Level A					(0.1")	--	0.03	(0.02")	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15")	--	0.04	(0.035")	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0")	--	--	--	--	--	--	--	--	--	--	--	--	--

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	Quarterly																					
	May-20																						
	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																						
	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	6.7	15.5	24.6	3.5		4.3
	Nov-19	Quarterly																					
	Dec-19																						
	Jan-20																						
	Feb-20	Quarterly																					
	Mar-20																						
	Apr-20																						
	May-20	Quarterly																					
	Jun-20																						
Jul-20																							
Aug-20	Quarterly																						
Sep-20																							
Oct-20																							
Nov-20	Quarterly																						
Dec-20																							

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°)	--	0.05	(0.05°)	--	--	--	1	--	--	250	400	--	--	--
Control Level A					(0.1°)	--	0.03	(0.02°)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15°)	--	0.04	(0.035°)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0°)	--	--	--	--	--	--	--	--	--	--	--	--	--
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																		
	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																		
	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																		
	May-20	Quarterly																	
	Jun-20																		
	Jul-20																		
	Aug-20	Quarterly																	
	Sep-20																		
	Oct-20																		
	Nov-20	Quarterly																	
	Dec-20																		

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)		0.05	(0.05)				1			250	400			
Control Level A					(0.1*)	--	0.03	(0.02*)	--	--	--	0.8	--	--	210	300	--	--	--
Control Level B					(0.15*)	--	0.04	(0.035*)	--	--	--	0.9	--	--	230	350	--	--	--
Assessment Level					--	(1.0*)	--	--	--	--	--	--	--	--	--	--	--	--	--
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																		
	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																		
	May-20		Quarterly																
	Jun-20																		
	Jul-20																		
	Aug-20		Quarterly																
	Sep-20																		
	Oct-20																		
	Nov-20		Quarterly																
	Dec-20																		

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^{(0.055-0.0124(TC)-pH)}), where TC is measured water temperature.
 ^ Ammonia result confirmed on duplicate analysis.

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

METHANE (% by Volume)														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	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	0.1	0	0										0.5	0.3	0.4											Yellow Valve,12 depth	
	White Valve	0.1	0	0										0.5	0.3	0.4											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	-	-	-	-	-	-	-	-	-	-	-	-	-		
	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	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	1.32			
GMW12	Red Valve	0.1	0	0										0.6	0.6	0.9											Red Valve, 26.3m depth	
	Yellow Valve	0.1	0	0										0.4	0.5	1.8											Yellow Valve,15m depth	
	White Valve	0.2	0.1	0.1										1.2	0.5	0.8											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	0.1	0	0										1.6	1	0.9											Red Valve, 26.3m depth	
	Yellow Valve	0.1	0	0										6.8	6.8	5.9											Yellow Valve,15m depth	
	White Valve	0.1	0	0										2.9	0	2.2											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	0.2	0	0										3.3	4.3	3.8											Red Valve, 26.3m depth	
	Yellow Valve	0.3	0.1	0.1										5.3	4.7	3.6											Yellow Valve,15m depth	
	White Valve	0.4	0	0										5.5	5.4	4.5											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	0.7	0.1	0.5										4.1	2.2	4.3											Red Valve, 23.5m depth	
	Yellow Valve	1	0.7	12.2										2.7	0.7	5.1											Yellow Valve,14.7m depth	
	White Valve	0.1	1.4	1										0	1.1	0.9											White Valve, 6.5m depth	
GMW8*	Yellow Valve	11.4	11.4	3.8										9.7	8.7	3.3											Yellow Valve,17.5m depth	
	White Valve	0.1	0	0										4.7	3.9	3.9											White Valve, 5.7m depth	
GMW9*	Red Valve	0.1	0	0										2.1	1.8	1.7											Red Valve, 27m depth	
	Yellow Valve	32.4	34.5	30.9										10.3	9.5	10											Yellow Valve,15m depth	
	White Valve	0.2	0.1	0.1										0.1	0.1	0.1											White Valve, 8.5m depth	
GMW10*	Red Valve	0.1	0	0										5.2	1.1	6.7											Red Valve, 19.5m depth	
	Yellow Valve	34.4	46.5	0										5.9	5.7	6.7											Yellow Valve,15m depth	
	White Valve	0.1	1.2	1.3										7.9	8.8	8.8											White Valve, 8m depth	
GMW17**	Red Valve	0.1	0	0										1.5	1.4	1.1											Red Valve, 26.3m depth	
	Yellow Valve	nt	0	0										nt	5.2	4.5											Yellow Valve,15m depth	
	White Valve	0.2	0	0										3.6	3.3	2.9											White Valve, 5m depth	
GMW18**	Yellow Valve	0.2	0	0										0.3	0.1	0.6											Yellow Valve,12 depth	
	White Valve	0.1	0	0										6.7	4.9	4.08											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