

**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

PERMIT BW2692IM

**2021 Annual Review of
Environmental
Monitoring Results**

Report Number 2191r1v1d0222

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Executive Summary

Tata Steel UK Limited (Tata) has operated Morfa Hazardous Landfill in accordance with an Environmental Permit since December 2004.

The landfill contains waste that is currently producing a leachate with moderate mineralised content (~4000 microS/cm). The leachate is characterised by elevated pH and alkalinity primarily due to the leaching of slag cover materials. Under these conditions trace metal mobility is limited and few substances are present at persistently elevated concentrations. Containment of this leachate within the lining systems is being achieved. Monitoring of the surrounding groundwater quality does, however, reveal that it has already been partially impacted by leachate from other unlined areas where made ground is exposed to leaching. The proximity of the site to the sea is also thought to be influencing groundwater chemistry.

As the landfill accepts asbestos, routine monitoring is coordinated by the landfill operator. This monitoring has shown that airborne fibres are below the level of analytical detection and within Permit limits.

By June 2022, Tata is required to prepare a review of the Hydrogeological Risk Assessment underpinning the landfill design. This will provide further opportunity for reviewing the data gathered to date.

1 INTRODUCTION

Tata Steel UK Limited (Tata) operates the Morfa Hazardous Landfill (MHL) in accordance with Permit BW2692IM. The Permit was issued by the Environment Agency (now Natural Resources Wales) on 17 December 2004. The Permit only applies to part of the original waste management site, with approximately 40% being closed upon the commencement of adjacent Morfa Non-Hazardous Landfill (MNHL) and MHL. The closed part of the site is referred to as Morfa Closed Landfill (MCL). The location of Morfa Landfill and the relevant position of MHL, MNHL and MCL is shown on Figures 1 and 2.

Tata submits a report to NRW on a three-monthly basis, which compares the monitoring results for leachate, surface and groundwater and air quality monitoring against the relevant Permit criteria. Additionally, a summary review of all monitoring data is required on an annual basis. This report is the summary annual monitoring report for MHL for the period January – December 2021 and is intended to discharge Part (a) of Permit condition 4.2.1.

In accordance with the Permit an annual topographic survey of the landfill has also been undertaken.

Previous annual monitoring reports have also been prepared by Geotechnology and are listed in References. Separate annual monitoring reports describe the monitoring undertaken at MNHL and MCL.

2 REGULATORY FRAMEWORK

The Permit defines the regulatory emission limits that must be met at MHL. These include leachate limit levels, emission limits to air for particulates and landfill gas, emission limits for surface water and Trigger Levels for emissions into groundwater. Collectively, these limits are referred to as Assessment Criteria in this report.

After the issue of the PPC Permit in December 2004, Geotechnology presented a revised set of Assessment Criteria for groundwater, surface water and leachate in accordance with the Permit Improvement Conditions. These revised Assessment Criteria were initially presented by Geotechnology following a review of the Hydrogeological Risk Assessment (HRA) (see Geotechnology report 403.1/1/1006 Review of Hydrogeological Risk Assessment) after commencement of landfilling. These criteria were further updated following feedback from NRW (see Geotechnology letter 403/reviewHRA/lt1/BR/kp dated 17 January 2007 to the EA) and in the previous annual monitoring report (see Geotechnology report 528.1/0/0307).

The new Compliance levels for groundwater were incorporated into the Permit Variation Notice (No SP3633MK) which was issued by NRW in May 2007. The Variation Notice wholly superseded the original PPC Permit. The Assessment Criteria for leachate and surface water are not presented in the Variation Notice but are within the reports referenced above.

On 11 June 2008, Tata requested several additional minor changes to the Permit. These were agreed by NRW on 30 July 2008.

During 2008 and 2009, copper (Cu) was detected at several positions which prompted Tata to implement several contingency actions and notifications. The occurrence of Cu was not considered to be related to seepage from MHL and the concentration levels were significantly below the concentration level of the freshwater EQS (0.028 microg/l based on average annual hardness of ~250 mg/l CaCO₃). Consequently, Geotechnology suggested in the 2008 annual monitoring report that the Cu trigger and control levels should be increased. Following submission of the 2008 annual monitoring report to NRW in March 2009, review comments were received in August 2009 (see compliance Assessment Report CAR 2627). In their review comments, NRW requested that the investigation to establish whether the laboratory is the cause of the previously observed elevated levels of Cu should be completed before the trigger levels are increased. The findings of this investigation were reported in the 2009 annual report and concluded that the lab or any other aspect of the monitoring was not the source of the Cu. In response to these findings, NRW accepted the proposed trigger and control levels in CAR 03354 (dated 28 April 2010).

In the 2012 HRA review, new assessment levels were presented for leachate, groundwater and surface water (see Geotechnology report 1178r1v1d0712). These were also consolidated in a letter to NRW from Tata on 4 February 2013. Given the acceptance of these new levels towards the end of 2012, Tata only started implementing the use of these new control and compliance levels in January 2013.

New criteria (compliance levels and control levels) were proposed in the 2017 annual review but NRW did not formally comment upon these until 2020. In the meantime, Tata continued to implement the criteria developed in 2013. Despite these latter criteria being implemented for many years, NRW queried their use during 2020. During these discussions it became apparent that there was confusion but Geotechnology understands that this situation has now been clarified via a Permit Variation completed in 2021 (Permit Variation

EPR/BW2692IM/V005). The intention of the Variation is to consolidate the currently accepted assessment criteria and monitoring regimes.

In this report, the criteria set out in the current Permit have been used to assess the monitoring results alongside the internal control levels.

3 MONITORING

The full monitoring network available to Tata for all the landfills is shown in Figure 2. The specific monitoring network for MHL is shown in Figure 3.

3.1 Monitoring Network Infrastructure

3.1.1 Landfill Leachate

The landfill leachate infrastructure is performing well.

3.1.2 Groundwater Monitoring Network

The integrity of the groundwater monitoring network is inspected monthly. The monitoring network is performing well but clearance of small areas of dense vegetation would make access easier and safer. Minor repairs to some headworks are also required.

During 2021, BH28 (and BH17 adjacent to MNHL) were found to be blocked. Replacement wells are planned for February 2022.

3.1.3 Shallow Piezometer Monitoring Network

A series of shallow piezometers have been manually installed into the shallow aquifer along the boundary with Margam Moors, as shown on Figure 2. These have been routinely monitored since 2006. This aspect of the monitoring network would benefit from routine vegetation clearance and measures to reduce the opportunity of livestock damaging piezometers on the edge of Margam Moors.

Where vegetation clearance is required, Geotechnology suggests that it would first be prudent for Tata to first inform NRW, particularly in this areas close to or within the SSSI. As vegetation clearance is required throughout the growing season this will mean that vegetation clearance will need to occur during bird nesting.

3.1.4 Surface Water Monitoring Network

The integrity, access and safety of each of the surface monitoring locations are inspected monthly. Installation of hand/rope rails would aid in the safe recovery of surface water samples as would routine vegetation clearance. Dense vegetation is preventing routine safe access.

3.1.5 Gas Monitoring Network

Quarterly gas monitoring is required at internal well GA30 during post closure phase.

3.1.6 Dust Monitoring Network

Dust monitoring was undertaken by Tata Environment Department. Dust monitoring is no longer a Permit requirement.

3.2 Action required

- Small areas of vegetation require routine clearance to facilitate routine safe access to several monitoring locations
- Hand / rope rails should be installed at several surface water monitoring positions
- Site weather stations should be routinely maintained to ensure they continue to operate satisfactorily

4 SITE ACTIVITY

4.1 Hazardous Waste Deposition

A summary of the waste types and tonnages deposited at the landfill as recorded by the landfill operator is regularly submitted to NRW in accordance with the Permit requirements. A graphical record of waste deposition is presented in Appendix 8, and below. In 2019, 207.95 tonnes of waste was deposited. In 2020, this dropped to 46.5 tonnes, the lowest annual total deposited. In 2021, 557 tonnes was landfilled.

As the cell is fully open to the elements, leachate is being produced and treated from rainfall falling over the entire cell footprint. This will continue unless measures are taken to reduce the area exposed to rainfall and infiltration.

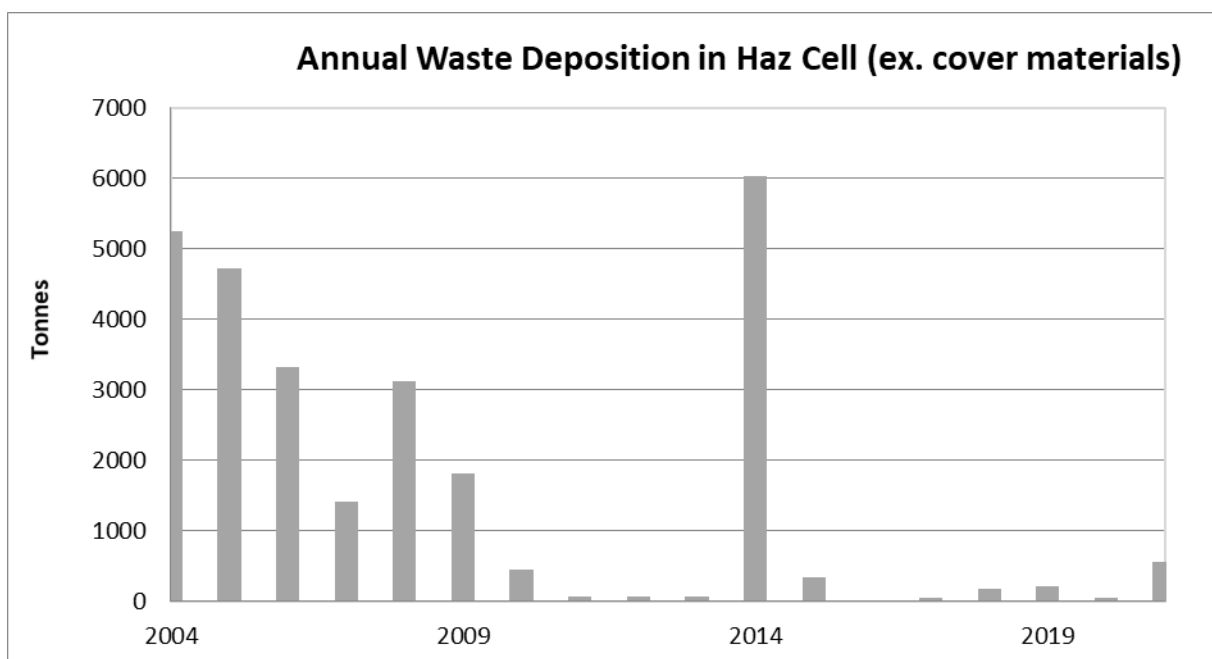


Chart 4-1 Waste deposition at Hazardous Landfill

During March 2014, fire waste containing cement bound asbestos was moved from temporary storage at Cell 2 of MNHL and deposited in Cell 2 of MHL. The movement of the waste was, at times, observed by NRW and following completion of the works Geotechnology prepared a Validation Report documenting the works undertaken (see report 1327r1v1d0314).

4.2 Progressive Restoration

Progressive restoration of each cell should occur once it has been filled as this will limit leachate generation and enable better environmental control. Full restoration is not, however, feasible until a further sub-cell is constructed due to the need to maintain stable outer slope angles. Geotechnology understands that Tata is to approach NRW regarding this aspect in 2022.

4.3 Leachate Management

Until 2019, leachate was collected from the sump by vacuum pumps and tankered away from the landfill using 10m³ or 15m³ road-going tankers. These tankers took the leachate to the wastewater treatment facility at the steel works. This system has now been replaced by a fixed pumped system, discharging directly into the works via a holding / balancing tank facility.

The new system involves pumping leachate from all cells at MNHL and MHL (currently five cells). There are three individual leachate pipe runs, one for the two MNHL Biocell sumps, one for the two non-hazardous cell sumps and one for the MHL cell sump. The pumping at each cell can be float controlled to ensure that leachate heads are within permitted trigger and maximum limits.

The three individual pipe runs discharge initially into a holding/balancing tank located on the permitted Waste Transfer Station hardstanding (concreted) area near to the DLS offices. The balance tank is also float controlled and combines all leachates for further pumping into the end discharge sump within the main works, located at Morfa Coke Ovens, Gas Holder Deep Sump. Flowmeters are located at each sump location, and at the balance tank, to record individual and cumulative leachate outflows. The use of flowmeters will provide a check on the potential for leakage from any of the three pipes entering the balance tank.

The installation of the leachate pipework system was carried out in accordance with the principles of the Construction Quality Assurance (CQA) Plan and Specification (Geotechnology report 1486r1v2d0917). Validation was documented in Geotechnology report 1486r2v1d0719. A plan of the as-built system is reproduced in Figure 4.

4.4 Restoration of Morfa Closed Landfill (MCL)

Phased restoration of unlined MCL was completed in 2013 having started in 2004. The restoration involved placement of geomembranes which, in combination, provide gas and surface water management as well as providing barriers to precipitation ingress and gas egress. The sympathetic restoration also involves the placement of sand on top of the geomembranes, creating dune morphology like the surrounding land.

As part of the re-profiling to achieve stable restoration surfaces, the opportunity was taken to recover materials for use in the steel making process. During this aspect of the works, wastes were temporarily exposed to weathering and leaching prior to them being reprofiled and capped.

4.5 Construction and Landfilling at Non Hazardous Landfill

Two biodegradable cells (Biocells A and B) and two non-hazardous waste cells (Cells 1 and 2) have been constructed at the adjacent MNHL. During 2021, the biodegradable waste cell was extended into Cell 1, creating additional biodegradable waste capacity.

4.6 Summary of Landfilling and Restoration Activity

The timeline of landfill construction and operation is summarised in Table 4-1.

Table 4-1 Summary of landfilling activity to date

Activity	Start	Finish
Construction of MNHL Cell 1	1 June 2004	19 October 2004
Construction of MHL Cell 1	1 June 2004	19 October 2004
Restoration of MCL	September 2004	8 June 2013
Construction of MNHL Biocell A	14 June 2004	8 September 2004
Construction and operation of waste treatment centre	5 December 2006	Ongoing
Construction of MNHL Biocell B	August 2007	13 October 2007
Construction of MNHL Cell 2	6 May 2008	31 July 2009
Landfilling of HMS filter cake in MNHL Biocell 2	28 October 2008	Ongoing
Construction of MHL Cell 2	October 2011	Ongoing
Temporary storage of fire waste	25 June 2011	14 March 2014
Construction of recharge trench pipeline sections A & B	30 Aug 2012	12 Oct 2012
Connection of recharge trenches to ponds and commissioning of system	Ongoing	(Partly completed during 2016 but damaged due to vandalism)
Installation and operation of new leachate pumping system	2018	October 2019
Construction of Biocell Extension Ci	April 2020	Estimated March 2022
Capping of Biocells	December 2021	Estimated March 2022

5 TOPOGRAPHIC SURVEY, SETTLEMENT AND VOID SPACE

The Permit requires an annual topographic survey to be completed.

5.1 Topographic Survey

A topographic survey of the operational landfill cells was carried out on 8 January 2021 and a repeat survey on 14 January 2022. Following data acquisition, the digital data was imported into a digital terrain model for each of the cells to calculate the available void space.

Since 2013 the surveys have been completed using an unmanned aerial vehicle (UAV) with survey control established using dGPS land-based Hiper-SR equipment. The UAV data is then used together with ground control points to create a digital terrain model. This method of surveying collects data points at significantly closer intervals than methods previously used and is therefore able to create a more detailed topographic model, as shown in Figure 5.

A series of figures generated from this survey are included in Appendix 10. These figures include topographic contour plans, waste reprofiling isopachytes and slope gradient maps.

The most recent survey has been compared to the approved top of waste surface with the resultant isopachyte provided in Appendix 10. This identifies a substantial area on the northwestern and southwestern edges of sub-cell 1 where the waste is currently above the proposed top of waste surface. Due to the nature of the waste deposited in this cell, an assessment should be undertaken to determine whether this material could be incorporated into a modified waste profile.

There is a further area along the northern boundary of both sub cells where waste levels exceed the temporary waste surface. This area will eventually be abutted by additional waste following construction and filling of sub-cell 3. It is therefore seen as unnecessary to remove this waste providing the construction of sub-cell 3 is undertaken.

5.2 Remaining Void Space

The currently available void space in the hazardous landfill cell is summarised in Table 5-1. This has been derived by comparing the waste surface surveyed on 14 January 2022 with the temporary top of waste surface for Hazardous Sub-Cells 1 & 2.

Table 5-1 Current Cell Volume Capacity

Volumes (m ³)	Hazardous Sub Cell 1	Hazardous Sub Cell 2
Total	24529.29	37401.04
Used as of Jan 2021	25072.17	26129.28
Available as of Jan 2022	-542.88	11271.76
% Available Space	Full	30.14

Once the remainder of the hazardous landfill has been constructed a further 89060m³ will become available.

5.3 Waste Settlement

A comparison of the recent topographic survey with the survey from January 2021 has shown that the differences between the survey models for Hazardous Sub-Cell 1 are within the tolerances of the survey method. The settlement of the waste over this time period is therefore considered to be negligible.

As sub-cell 2 is still active, it is not possible to make a meaningful assessment of waste settlement at this time.

It is anticipated that once the sub-cells have been capped and restored, a series of permanent markers will be installed for the annual monitoring of settlement.

5.4 Waste Slopes

The stability risk assessment (Geotechnology Report 245.1, November 2003) for the Hazardous landfill allows for Temporary waste slopes at the working face to have a gradient of 1V:2H. The report states that permanent slopes should have a gradient no greater than 1V:2.5H.

A slope gradient map has been derived from the Topographic Survey and is included in Appendix 10. The map has been assessed for slopes which exceed the gradients permitted by the SRA and identifies areas where slope gradients exceed tolerable values.

Many of the external faces of Sub-Cell 1 exceed the gradient permitted for temporary slopes in the SRA. Given the nature of the wastes deposited in this cell, an assessment should be made of the best method for reprofiling these slopes to comply with the short- and long-term gradients permitted by the SRA. It should be noted that these are relatively short slopes with a height slope height of <2m.

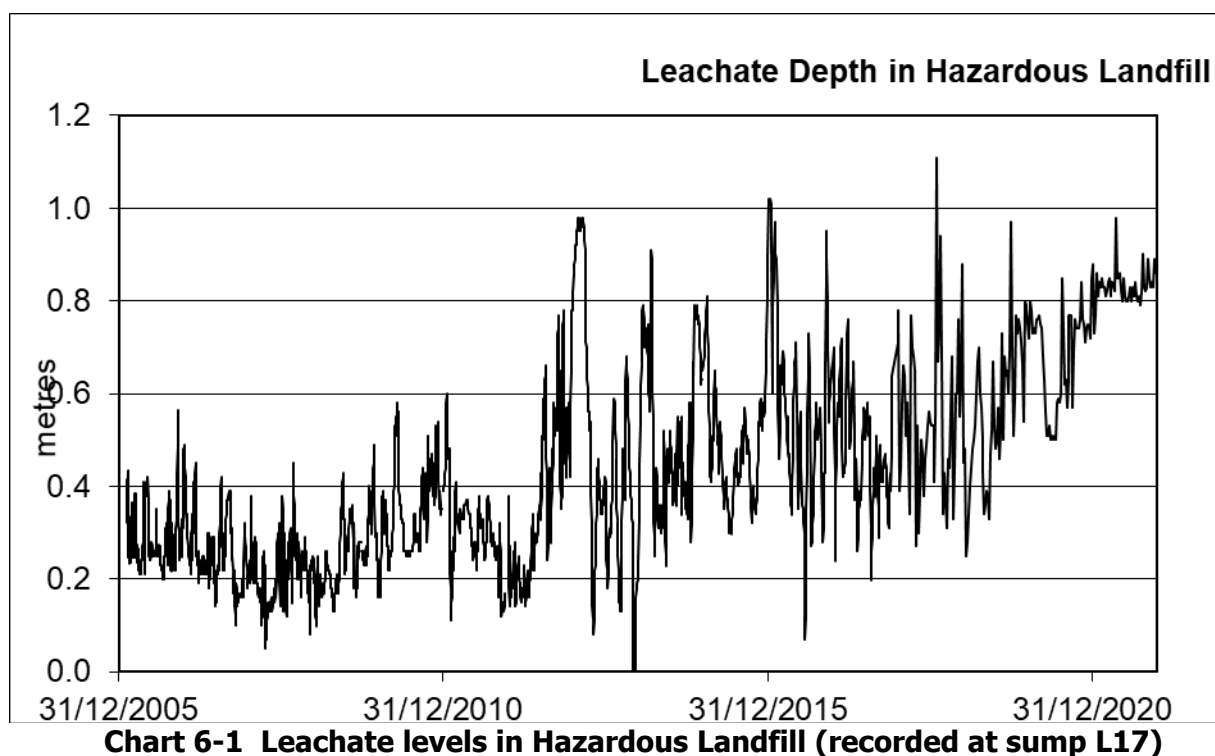
The gradient map also identifies sections of the northern boundary of both sub-cells which have slope gradients in excess of 1:2, and a slope height of 3-4m. A measurement of overall slope gradient find it to be generally shallower than 1:2. As the overall slope gradient meets the required gradient for working faces in the SRA and these localized over-steep areas will be covered by the placement of wastes in sub-cell 3, it is not seen as necessary to reprofile these localized areas.

6 LEACHATE

6.1 Leachate Level

Based on monitoring undertaken by the landfill operator, the variation of leachate head is illustrated in Appendix 1 and Chart 6-1. In accordance with the Permit conditions, the head of leachate has not exceeded one metre above the base of leachate monitoring point (L17) apart from a few weeks at the start of 2016 and in August 2018. At GA30, leachate has never been found to be present.

During 2021, leachate levels did come close to the Permit limit and there does appear to be an increasing baseline. This should be carefully evaluated within the context of the new leachate management system to ensure that heavy, intense and prolonged rainfall events do not result in elevated leachate levels.



To maintain leachate levels within the Permit levels, significant quantities of leachate are extracted and taken back into the steelworks for treatment. Given the large volumes involved, Geotechnology has previously suggested that Tata could consider measures to reduce the volume, such as progressive restoration. As the leachate levels have not been reduced to the same lower levels as previous, and the waste may be close or at its field capacity, leachate levels can be potentially expected to respond quickly in response to rainfall.

6.2 Leachate Chemistry

The temporal variation of leachate chemistry is graphically illustrated in Appendix 2.

As the waste landfilled at MHL does not contain a large degradable component, the evolution of the leachate is not following the same path which is well documented for municipal solid wastes. Rather, the leachate chemistry is being controlled by mostly inorganic processes.

Leachate chemistry is currently characterised by elevated pH (pH 12 – 13) and moderate electrical conductivity (~4000 micros/cm). Over the past five years the concentration of several parameters has typically declined, although mineralisation has increased during 2020 and 2021, as shown in the graphs in Appendix 2. This appears to be as a consequence of increased alkalinity. This may reflect the ratio between slag cover materials and some of the industrial wastes covered.

Under the highly alkaline conditions, trace metals (including hazardous substances cadmium and mercury) are typically present at low levels or below the level of detection. During 2020, trace metals were once again at low concentrations with cadmium and mercury not being detected. In 2021, Cadmium was detected at up to 8.4 microg/l, mercury was not detected, lead was up to 29.3 microg/l.

Due to the nature of the waste streams, very low levels of hydrocarbons, volatile organic compounds (VOC's) and semi VOC's have been detected to date. During 2021 these compounds were not detected.

6.3 Assessment against Control Levels and LandSim Criteria

The modest mineralised content of the leachate is reflected in the summary provided in Table 6-1. This shows selected key parameters to be well within the modelled levels from the most recent HRA and Permit control levels.

Table 6-1 Evaluation of Leachate Chemistry

	Ammonia	Arsenic	Chloride
	mg/l	mg/l	mg/l
LandSim PDF*	Triangular (0.05, 10, 50)	Triangular (0.005, 0.3, 3)	Log Triangular (1000, 10000, 61000)
Permit control Levels	70	3	70000
Leachate chemistry 2018			
Maximum 2018 Leachate chemistry (L17)	<0.05	0.0007	72.8
Leachate chemistry 2019			
Maximum 2019 Leachate chemistry (L17)	0.25	0.0586	79.1
Leachate chemistry 2020			
Maximum 2020 Leachate chemistry (L17)	0.62	0.0006	87.1
Leachate chemistry 2021			
Maximum 2021 Leachate chemistry (L17)	1.09	0.494	112
*PDF – Probability Density Function used to describe statistical distribution of parameter. Triangular and Log Triangular are the PDFs used in most recent HRA. Values in parenthesis are minimum, most likely and maximum values used in LandSim model			

6.4 Contingency Actions Taken

No specific contingency actions were required but Tata has continued to improve operation and management of leachate levels.

7 GROUNDWATER

The results of the groundwater monitoring are presented in Appendix 3 and Appendix 4. Also provided in Appendix 7 are spatial plots of selected groundwater chemistry.

7.1 Groundwater Level and Flow

Groundwater levels and flow around the landfill are like levels previously observed. Levels are shown in Appendix 3 alongside contour plans and time series charts.

7.2 Groundwater Quality

The water quality monitoring continues to indicate that groundwater within the vicinity of MHL is impacted to a variable extent, particularly in the shallow aquifer around BH12. For most parameters, the concentration in groundwater is higher than that observed in leachate sump L17. This is because the area surrounding the landfill, particularly to the south, contains legacy slag deposits and access roadways are constructed of slag and these materials are open to leaching. Groundwater may also be influenced by seepage from MCL.

Similar variations are also observed in other monitoring positions around the landfill cell (BH25 – BH29), although the trend is not as distinct, and the temporal variations are different. Given the proximity of some of the positions to the sea there may also be a saline / tidal influence on groundwater quality and water level. This would appear to be particularly the case at BH27 and BH28, both of which are located on the western seaward side of the landfill. At BH27 for instance, both sodium and chloride are at higher concentration than at some of the other groundwater monitoring wells and leachate. There is also a potential 'cyclical' pattern where pH falls from ~pH 9 to pH 7 during a 12 month period before returning to ~pH 9. This may be due to localised changes in drainage patterns and tidal influences. To the northwest of the site, there is also a possibility that activities in the operational yard of the landfill could affect shallow groundwater recharge and seepage.

The characterisation monitoring conducted since the start of monitoring has included the analysis of an extensive list of volatile and semi volatile organic compounds in leachate and groundwater. This data has clearly shown the widespread impact of seepage from MCL and potentially other areas on groundwater, upgradient and downgradient of the landfill. The occurrence of these compounds is not related to MHL, as many of the compounds have not been found in leachate and where the compounds are detected, they are typically found at lower concentration levels. No VOCs or SVOCs have been detected in the groundwater samples analysed by the Tata laboratories since 2009.

The key point to note is that the data continues to indicate that MHL is not having a discernible impact on groundwater.

7.3 Assessment against Permit Compliance Level

As shown by the summary in Table 7-1 and 7-2, there have been no persistent breaches of the trigger levels in the last two years.

As noted previously, increased chloride continues to be observed at BH27S. The concentration levels observed are higher than those found in leachate and the spikey nature

of the hydrochemistry suggests that there are localised processes occurring, possibly related to its proximity to the sea. This has been the case for several years. As the concentration of chloride is higher than that in the landfill cell, leachate escape from MHL is not considered to be the source.

Table 7-1 Comparison of selected groundwater chemistry with Trigger Levels in 2020

		Arsenic microg/l	Chloride mg/l
	Trigger Level	50	250
BH25S	05/02/2020	16.1	91.6
BH25S	15/06/2020	26.8	138
BH25S	20/07/2020	27.4	105
BH25S	04/12/2020	12.9	71.1
BH26S	05/02/2020	3.6	37.65
BH26S	16/06/2020	26.8	50.4
BH26S	20/07/2020	9.6	59.2
BH26S	04/12/2020	9.3	61.1
BH28S	05/02/2020	3	175
BH28S	16/06/2020	2.5	97
BH28S	20/07/2020	3.2	124
BH29S	05/02/2020	11.6	143
BH29S	15/06/2020	4.3	149
BH29S	20/07/2020	8.3	120
BH29S	04/12/2020	5	115
No data available for BH12S due to insufficient groundwater being present at time of sampling			

Table 7-2 Comparison of selected groundwater chemistry with Trigger Levels in 2021

		Arsenic microg/l	Chloride mg/l
	Trigger Level	50	250
BH12S		Insufficient to sample	
BH12S		Insufficient to sample	
BH12S		Insufficient to sample	
BH12S		6	45.22
BH25S	23/03/2021	12.4	123
BH25S	29/06/2021	<60	111
BH25S	06/09/2021	0.08	108.90
BH25S	06/12/2021	14.6	75.1
BH26S	23/03/2021	3.1	42.97
BH26S	10/06/2021	26.9	39.73
BH26S	07/09/2021	0.09	566.10
BH26S	06/12/2021	2.8	58.2
BH28S	23/03/2021		
BH28S	10/06/2021	39.2	93
BH28S	07/09/2021		
BH28S	06/12/2021	4.7	140
BH29S	23/03/2021	4.1	223
BH29S	10/06/2021	<60	156
BH29S	07/09/2021	0.06	91.80
BH29S	06/12/2021	10.5	129
No data available for BH12S due to insufficient groundwater being present at time of sampling			

The reader should note that the latest Permit indicates the trigger level for Chloride to be 250 microg/l in Table S3.2. This is a typographical error and should be 250 mg/l. Tata should point this out to NRW.

8 SURFACE WATER

8.1 Surface Water Levels

The results of the surface water monitoring are presented in Appendix 5 and Appendix 6. Spatial variations in selected water chemistry are also provided in Appendix 7.

8.2 Assessment against Permit Control Levels

Surface water immediately northeast of MHL on Margam Moors is already known to be significantly impacted by seepage from MCL, as there is a well-developed highly alkaline springline.

Due to the low risk that MNHL directly poses to surface water under active management control and the historical impact of seepage from MCL, there are no Permit Compliance Limits for surface water. Instead, there are two assessment levels (AL1 and AL2). An evaluation of the 2020 and 2021 datasets against these levels is presented in Table 8-1. This analysis reveals no persistent breaches.

Table 8-1 Comparison of surface water quality at SW13 with assessment levels

	Arsenic	Chloride
	microg/l	mg/l
Control level 1	35.00	100.00
Control level 2	40.00	150.00
30/06/2020	16.7	115
20/07/2020	21.6	<0.03
27/10/2020	2.9	85.7
23/03/2021	2.8	96.9
10/06/2021	70	84.3
06/09/2021	0.12	88.11
06/12/2021	1.3	157

Over the past four years, elevated alkalinity has been observed at SW4, particularly during the period May-November. As this monitoring position is upstream of the landfill, the changes are not related to processes occurring at the landfill.

Other surface water sample locations immediately downstream of the landfill (SW13 and SW14) do not show such variations and the chemistry observed during recent years is consistent.

Sample SW15 is taken from pooled water (because of the ground surface intersecting shallow groundwater) to the north of the landfill. This position is close to a slag hardstanding used for vehicle storage and maintenance. The water chemistry observed at this position has also remained relatively consistent, like that at SW13 and SW14, although the alkalinity concentration has been variable since 2015. The cause of these variations is unclear but could be related to variations in pool water level resulting in exposure and subsequent flushing of made ground dominated by slag.

8.3 Contingency Actions Taken

No contingency actions were required.

9 AMENITY

9.1 Complaints

As far as Geotechnology is aware, no complaints relating to the landfill have been received by either Tata, the Landfill Operators or NRW.

9.2 Particulates

Historically, Tata has routinely monitored dust around the Morfa landfills for many years. A previous review of data lead Tata to question the environmental benefit of monitoring at the continued frequency. A full description of the work that led to this conclusion was set out in the 2017 annual report for MNHL (see Geotechnology report 1761r1v1d0218). On this basis, Tata previously requested that dust monitoring is no longer undertaken and this was accepted when the Permit was recently updated and Varies. Therefore, during 2021, no dust monitoring occurred and it is no longer a Permit requirement.

During dry periods the landfill operator actively suppresses all trafficked routes with surface water extracted from surface water at SW1. This limits the opportunity for release of particulates during vehicular movements.

The monitoring of airborne asbestos fibres is discussed in a separate section.

9.3 Odour

The landfill is not a significant source of odour.

9.4 Pests

The landfill does not attract significant pest numbers.

9.5 Noise and Vibration

The landfilling operations is not a significant source of noise and there are few receptors within close proximity apart from SSSI.

9.6 Litter

The industrial wastes deposited at MHL are quickly covered following deposition. In the most part, the wastes do not typically contain significant light fractions susceptible to wind-blown dispersion.

10 ASBESTOS

10.1 Assessment against Permit Compliance Levels

Asbestos results are reported throughout the year from monitoring undertaken at approximately quarterly intervals from each corner of the landfill (not dust monitoring positions D15, D16 and D19). The monitoring is not always coordinated to coincide with asbestos deposition.

All the 2021 quarterly monitoring results were below the analytical level of detection (0.001 fibres/ml). Consequently, all monitoring results are below the 0.002 fibres/ml Permit Emission Limit over a four-hour monitoring period. The results provided by the landfill operator are included in Appendix 9.

10.2 Contingency Actions Taken

No contingency actions have been required as all asbestos measurements were below the emission limit.

As noted by NRW, it would be desirable, and help inform current risk assessments, if the asbestos monitoring coincide with asbestos disposal.

11 SUMMARY AND RECOMMENDATIONS

11.1 Environmental Protection

The initial risk assessments completed as part of the Permit Application indicated the potential of the landfill to emit non-hazardous pollutants substances to groundwater and potentially, surface water. There was also the potential that the landfill could generate dust and asbestos during landfilling activity and associated vehicular movements and earthworks.

Groundwater and surface water within the vicinity are already known to be impacted by other activities not related to the current landfill. Based on the monitoring data gathered to date there is no significant evidence to suggest that the landfill is not behaving as initially predicted. This means that the identified receptors remain protected.

11.2 Regulatory Framework

Relative to the applicable Assessment Criteria, the following key observations are made:

- Leachate chemistry at L17 has become more dilute in the last decade. Leachate chemistry now appears to be dominated by the leaching of alkaline materials, probably mostly cover materials, within the landfill.
- No asbestos fibres have been detected during the quarterly monitoring programme to date.

11.3 Actions Required

Small areas of vegetation require clearance to facilitate safe access to several monitoring locations

References

List of Previous Annual Reports

528.1/0/0307. Annual Review of Landfill Monitoring Results for Morfa Non-Hazardous and Hazardous Landfills. March 2007.

621.1/0/0108. Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. January 2008.

765r1v1d0209. 2008 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2009.

908r1v1d0310. 2009 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. March 2010.

1046r1v1d0211. 2010 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2011.

1129r1v1d0412. 2011 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. April 2012.

1210r1v1d0313 2012 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. March 2013

1292r1v1d0314 2013 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. March 2014

1393r1v1d0215 2014 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2015

1503r1v1d0316 2015 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. March 2016

1618r1v1d0217 2016 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2017

1762r1v1d0218 2017 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2018

1866r1v1d0219 2018 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2019

1966r1v1d0120 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2020

2093r1v1d0221 Annual Review of Landfill Monitoring Results for Morfa Hazardous Landfill. February 2021

Figure 1 Site Location Plan



Reproduced from the Ordnance Survey Land Ranger Map
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Figure 2 Available Monitoring Network

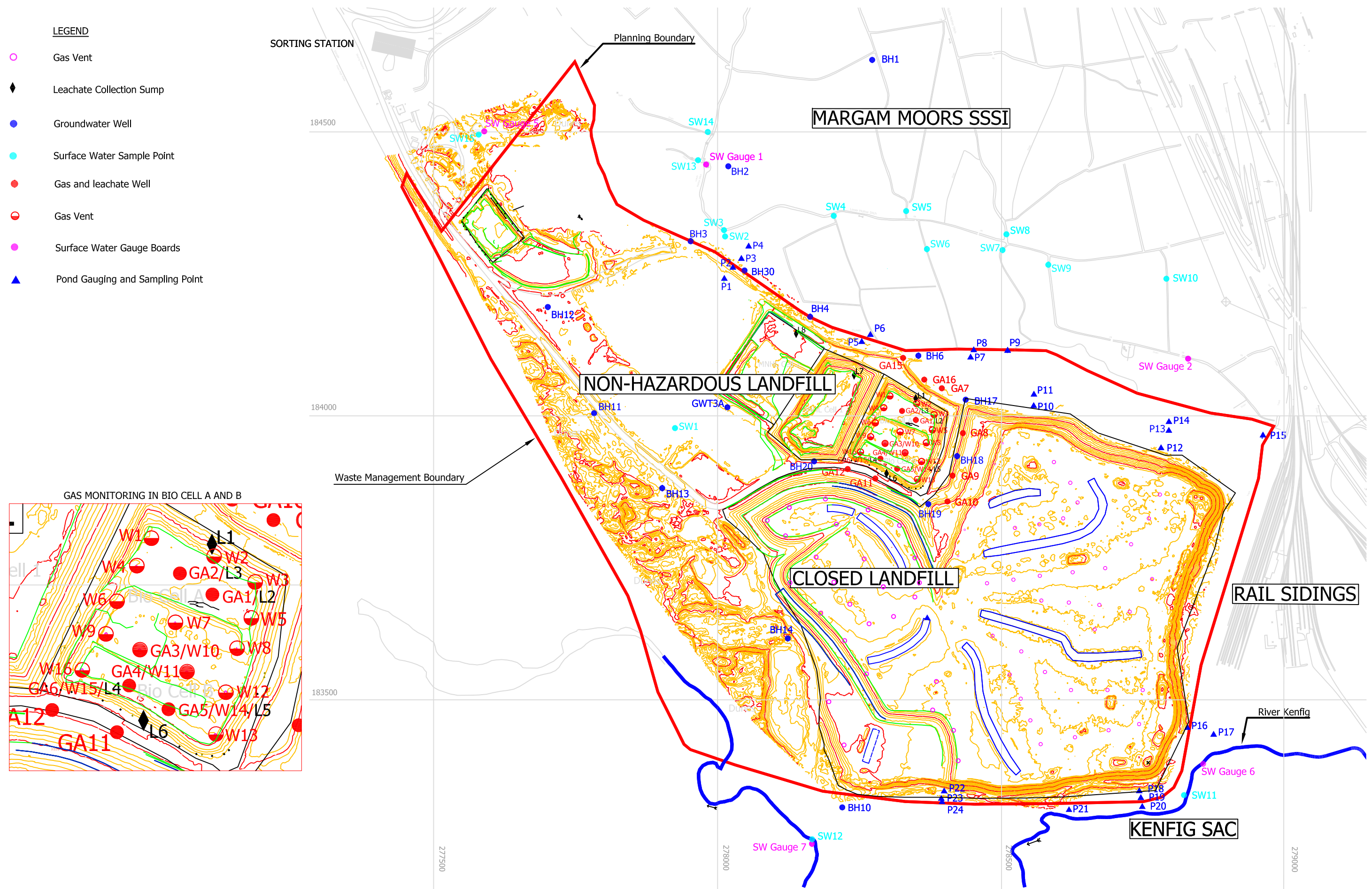
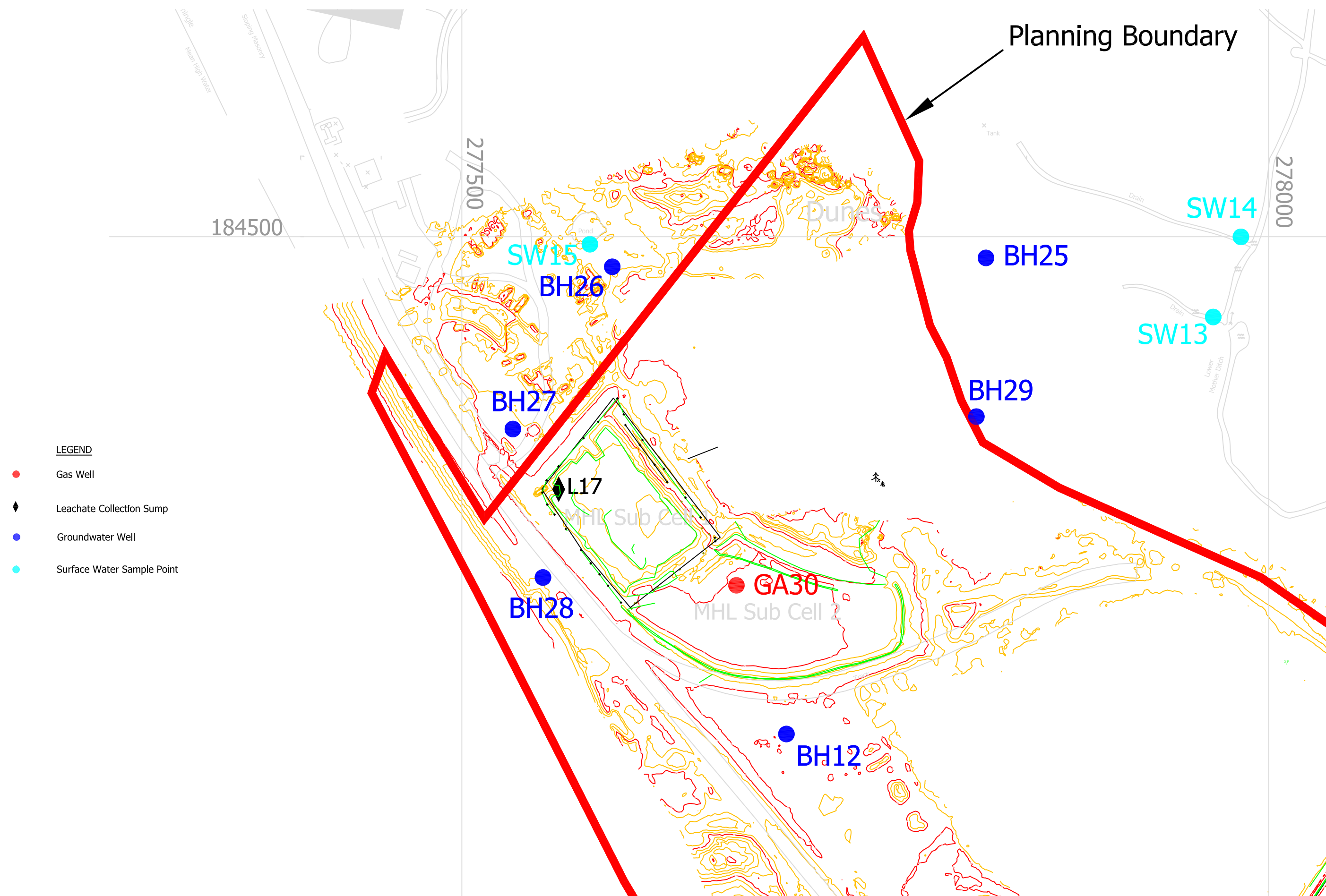
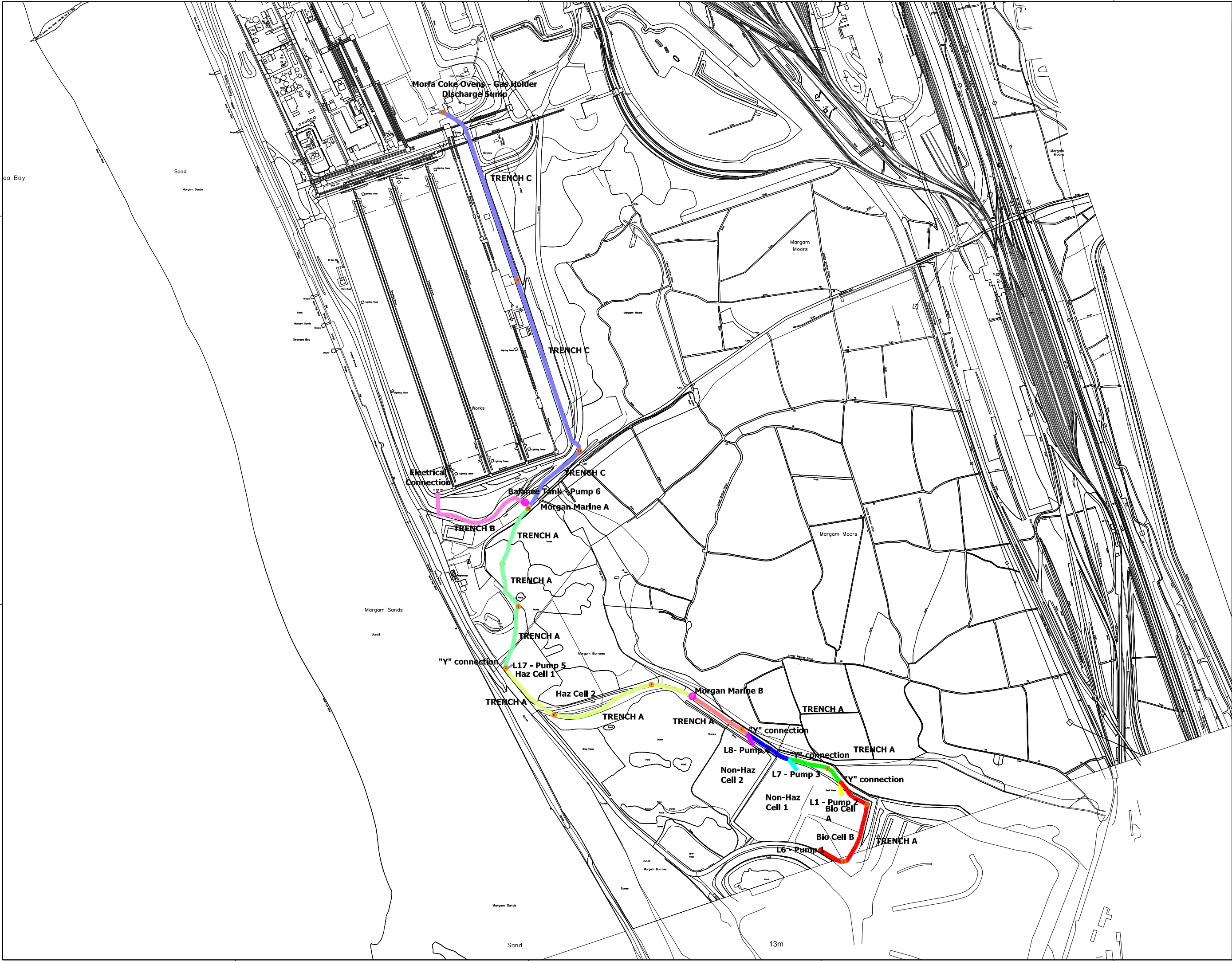


Figure 3 MHL Monitoring Network





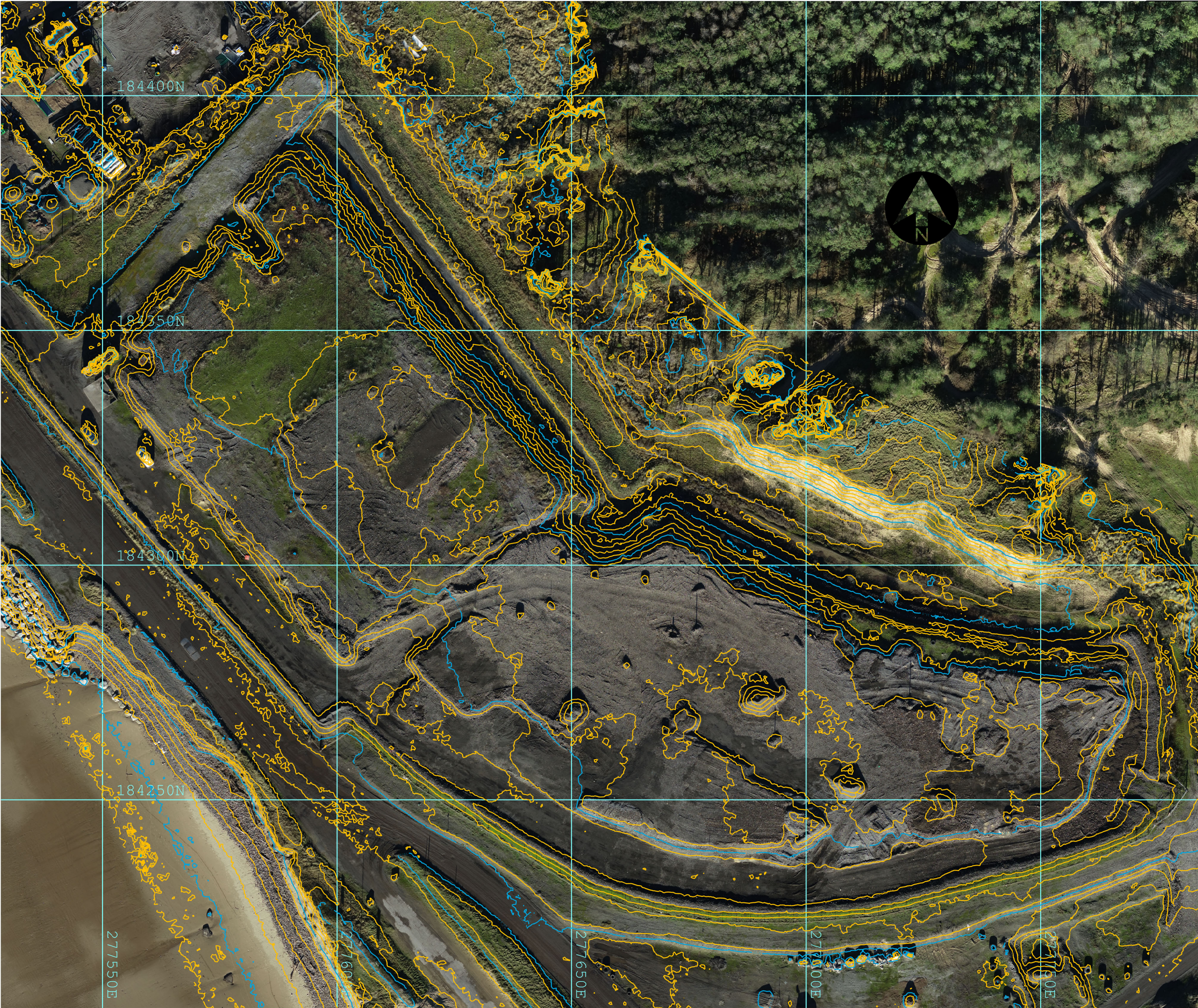
Drawing Number 2191/4

Legend

- Sump Number
- Survey Check Point (see Table 7-1)
- Location of Electrical Control Panel - Morgan Marine A or B
- Chainage A
- Chainage B
- Chainage C
- Chainage D
- Chainage E
- Chainage F
- Chainage G
- Chainage H
- Chainage I
- Chainage J
- Chainage K
- Chainage L

NOTE

Rev	Date	Status/Amendments
CLIENT		
TATA STEEL (UK) Ltd.		
PROJECT		
MORFA HAZARDOUS LANDFILL PORT TALBOT		
TITLE		
LEACHATE PIPE ROUTE		
DRAWING NUMBER		REVISION
2191/4		0
SCALE AT A1	DATE	DRAWN
1:4000	01.20	AJ/KT
CHECKED		



Drawing Number 2191/5

Legend

 Prominent Contour (2.5m)

 Normal Contour (0.5m)

Notes

Digital survey model generated using Pix4D image processing software.

Imagery acquired by DJI Phantom 4 pro RTK photogrammetry survey on 14 January 2022.

Survey control installed using Topcon Hiper SR dGPS Network Rover.

OS Grid spacing at 50m

Rev	Date	Status/Ammendments	
CLIENT			
Tata Steel (UK) Limited			
PROJECT			
MHL Annual Report			
TITLE			
Topographic Plan of Landfill			
DRAWING NUMBER		REVISION	
2191/5		0	
DATE	DRAWN	CHECKED	SCALE AT A3
01.22	KJT		1:750
Geotechnology Limited Ty Coed, Cefn-yr-Allt, Aberdulais, Neath SA10 8HE 01639 775293 www.geotechnology.net 			

**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

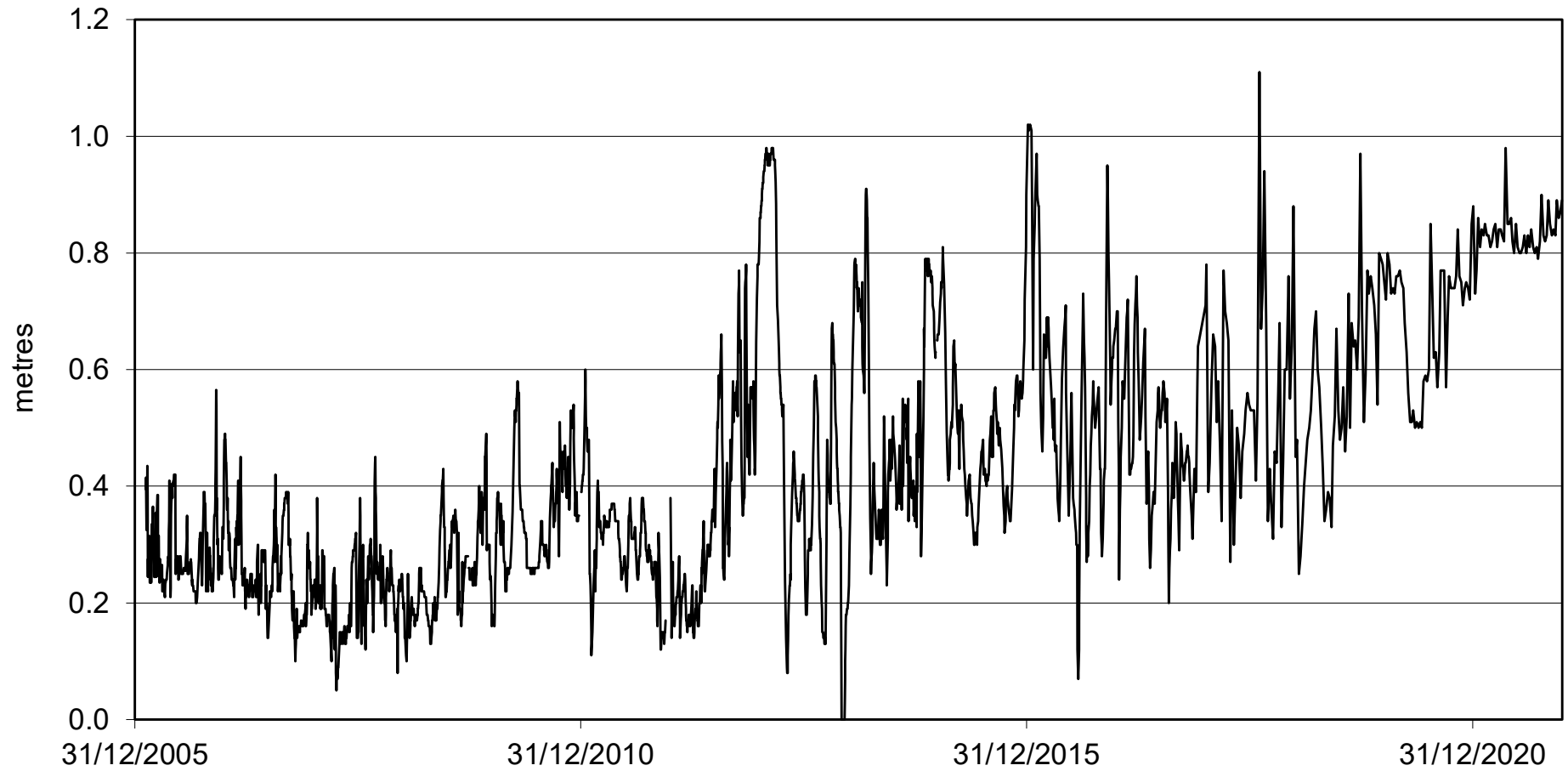
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**2021 Annual Review of
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**Appendix 1
Temporal Variation of
Leachate Levels**

Report Number 2191r1v1d0222

Leachate Depth in Hazardous Landfill



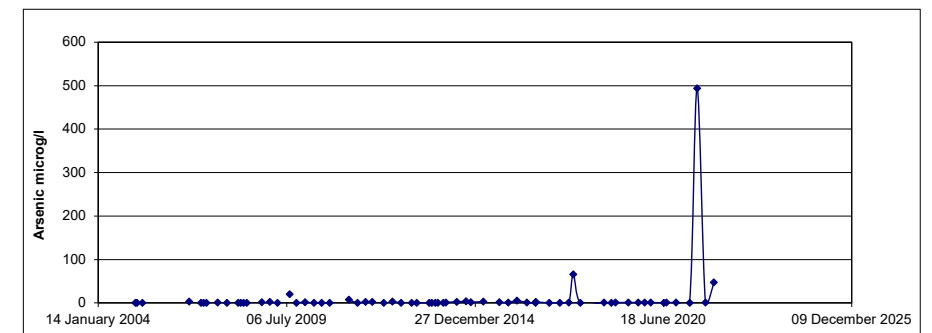
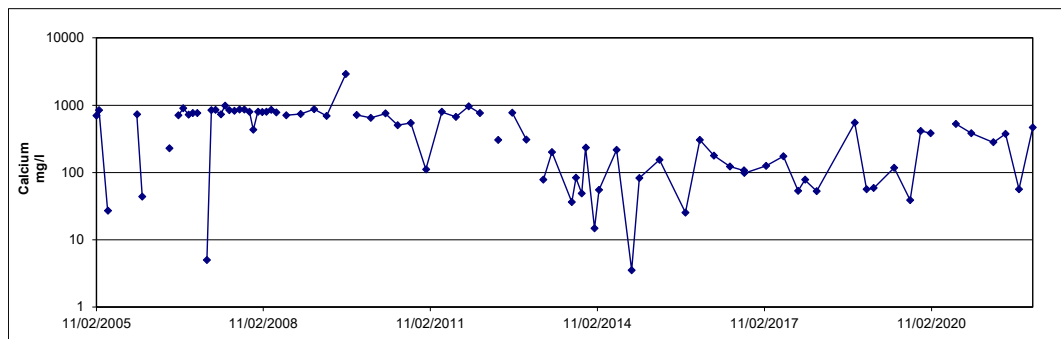
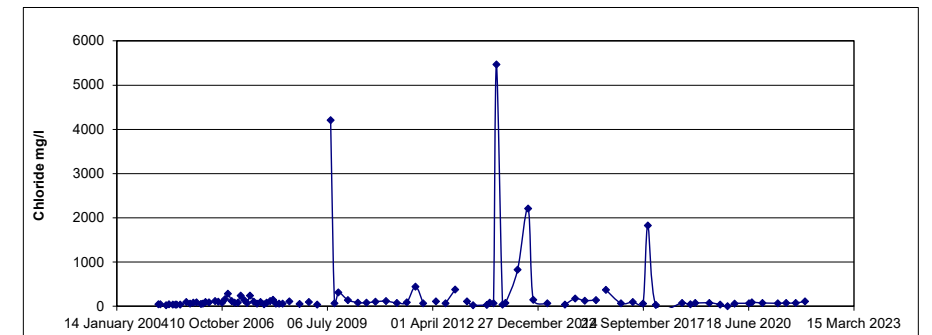
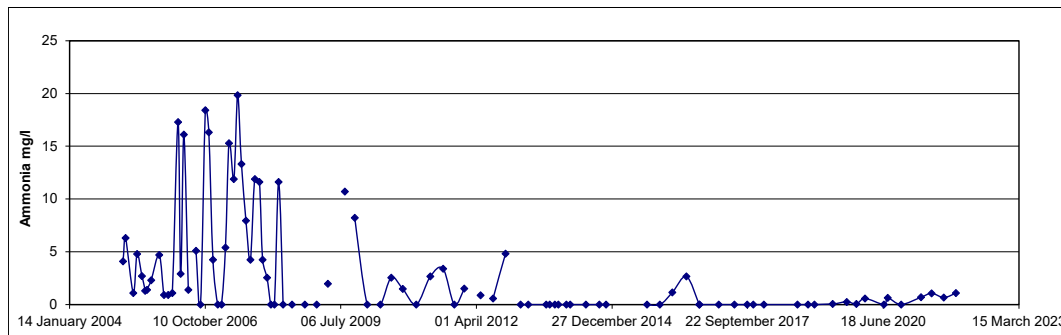
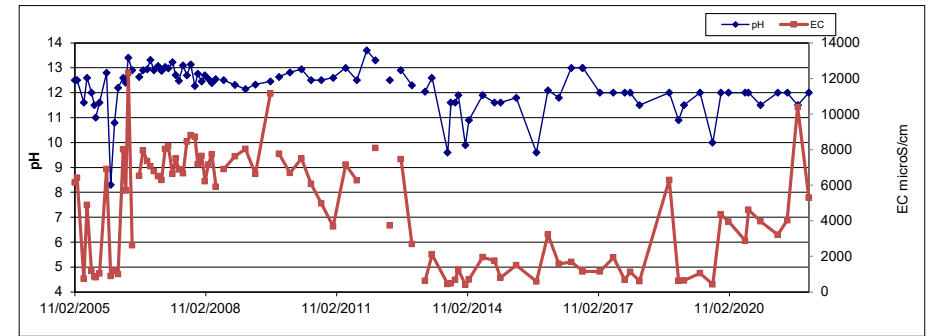
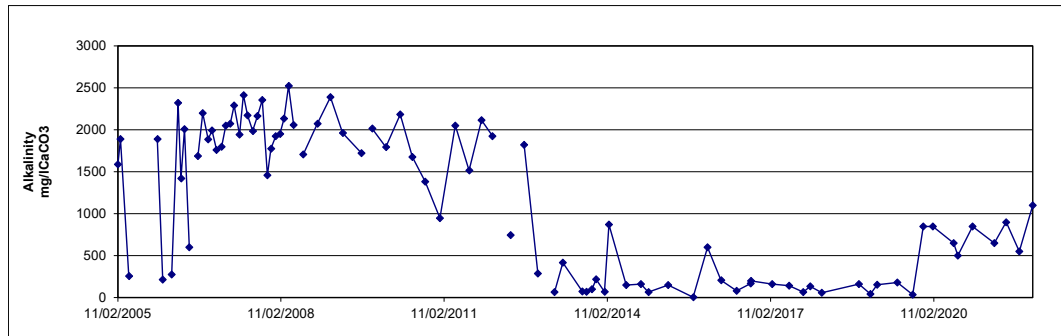
**MORFA HAZARDOUS
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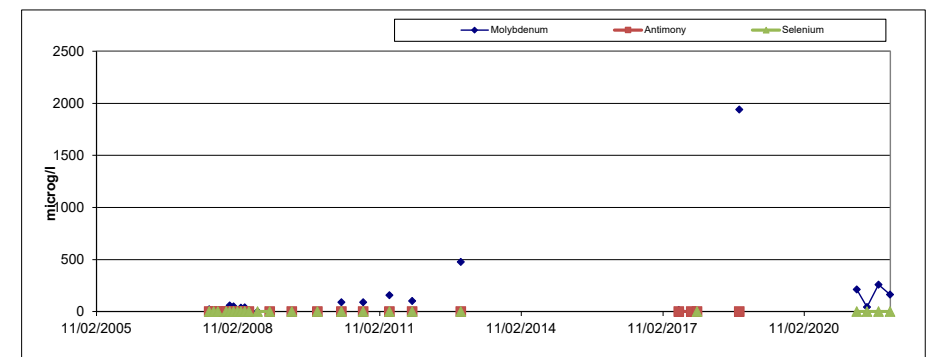
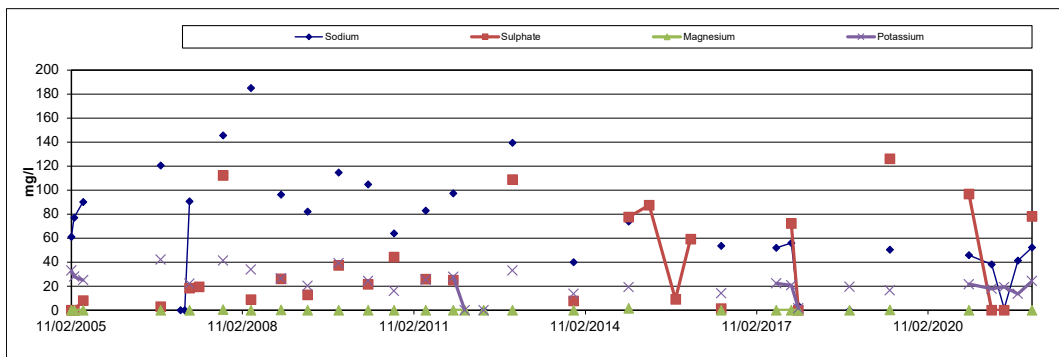
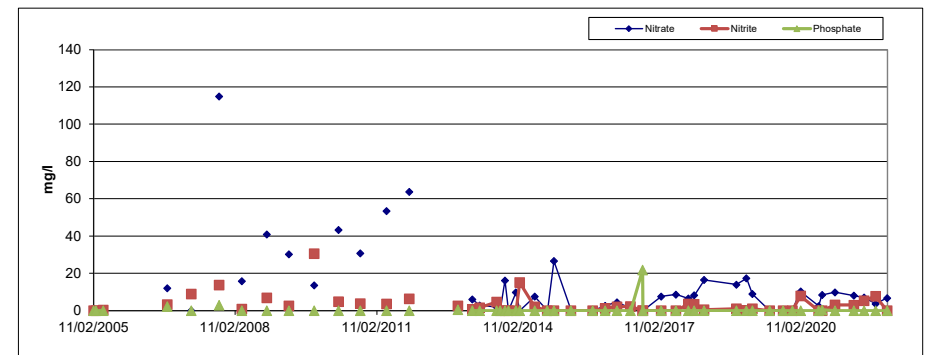
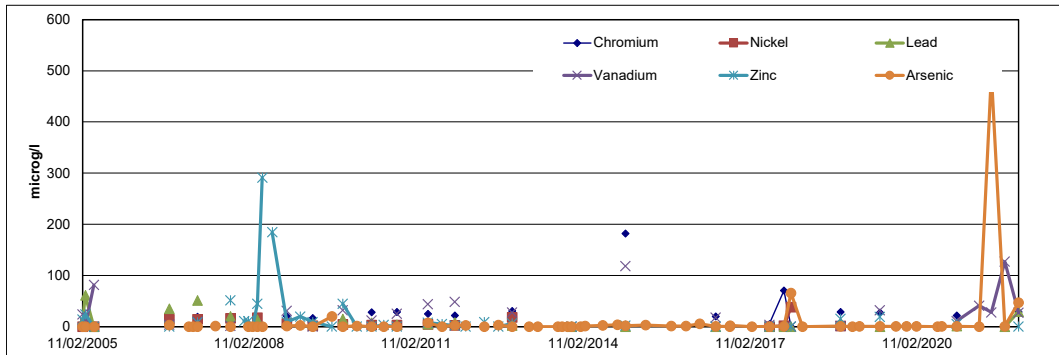
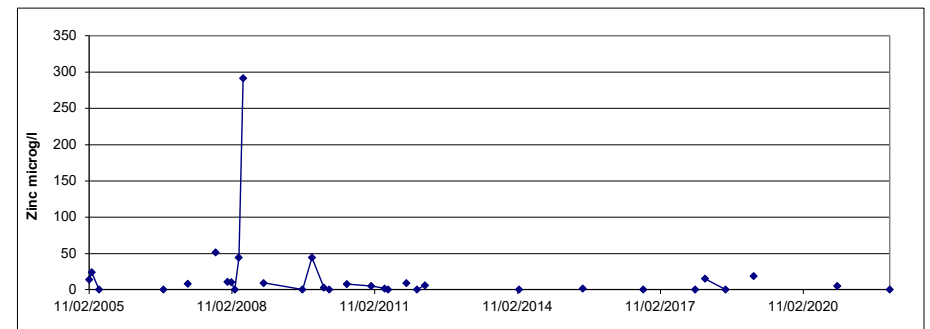
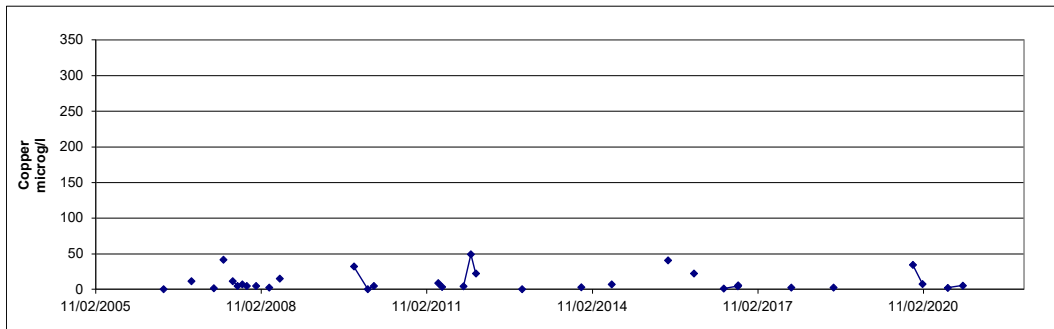
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**Appendix 2
Temporal Variation of
Leachate Chemistry**

Report Number 2191r1v1d0222





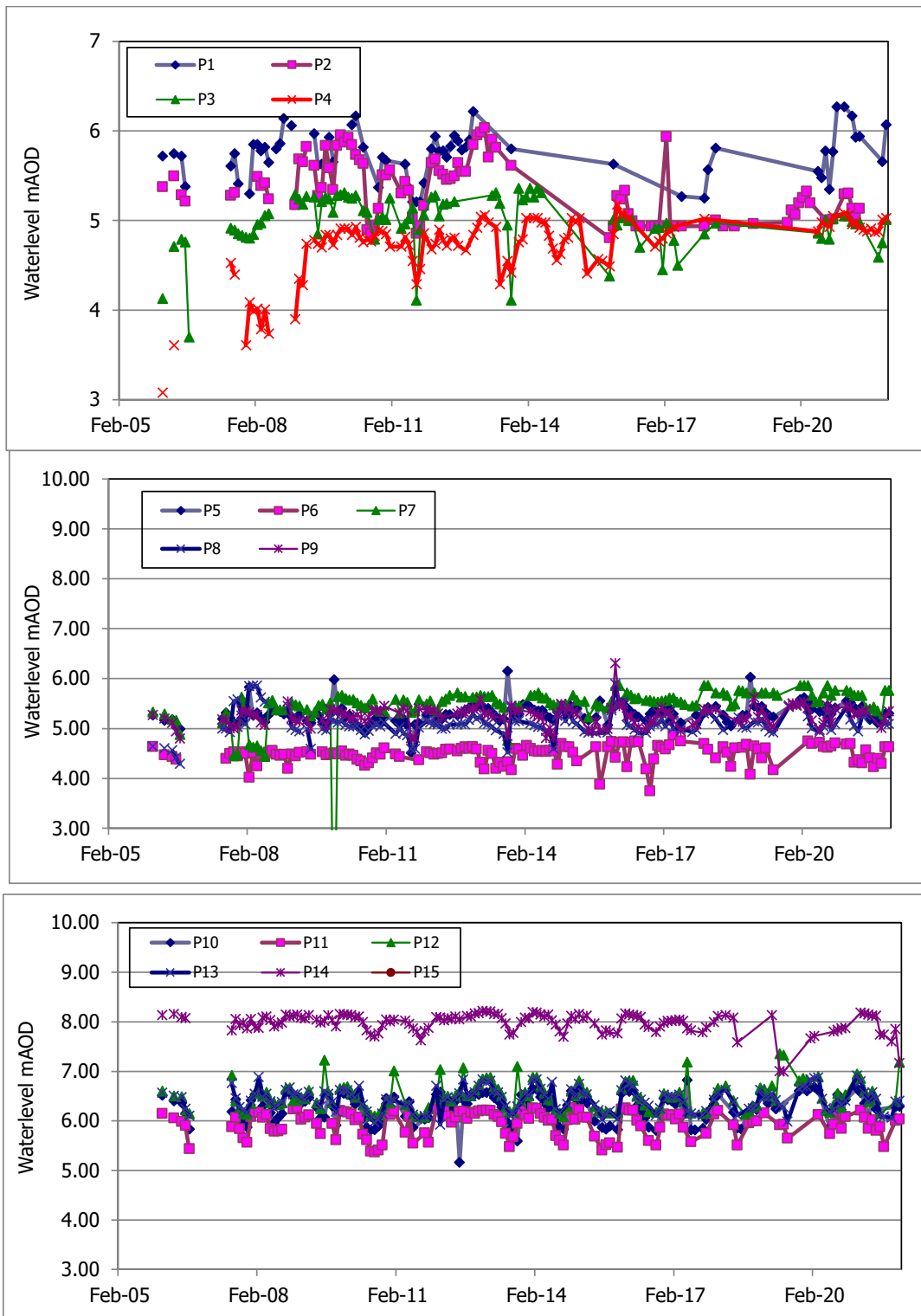
**MORFA HAZARDOUS
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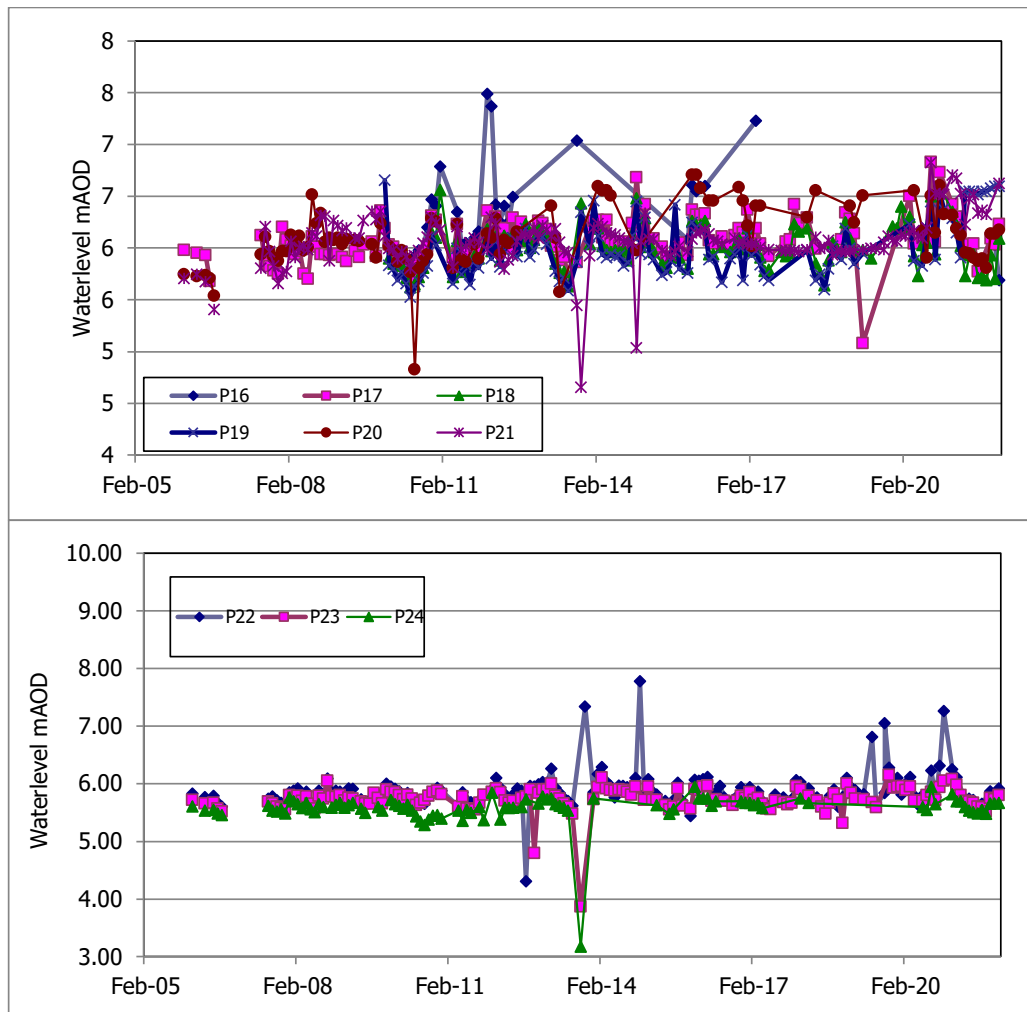
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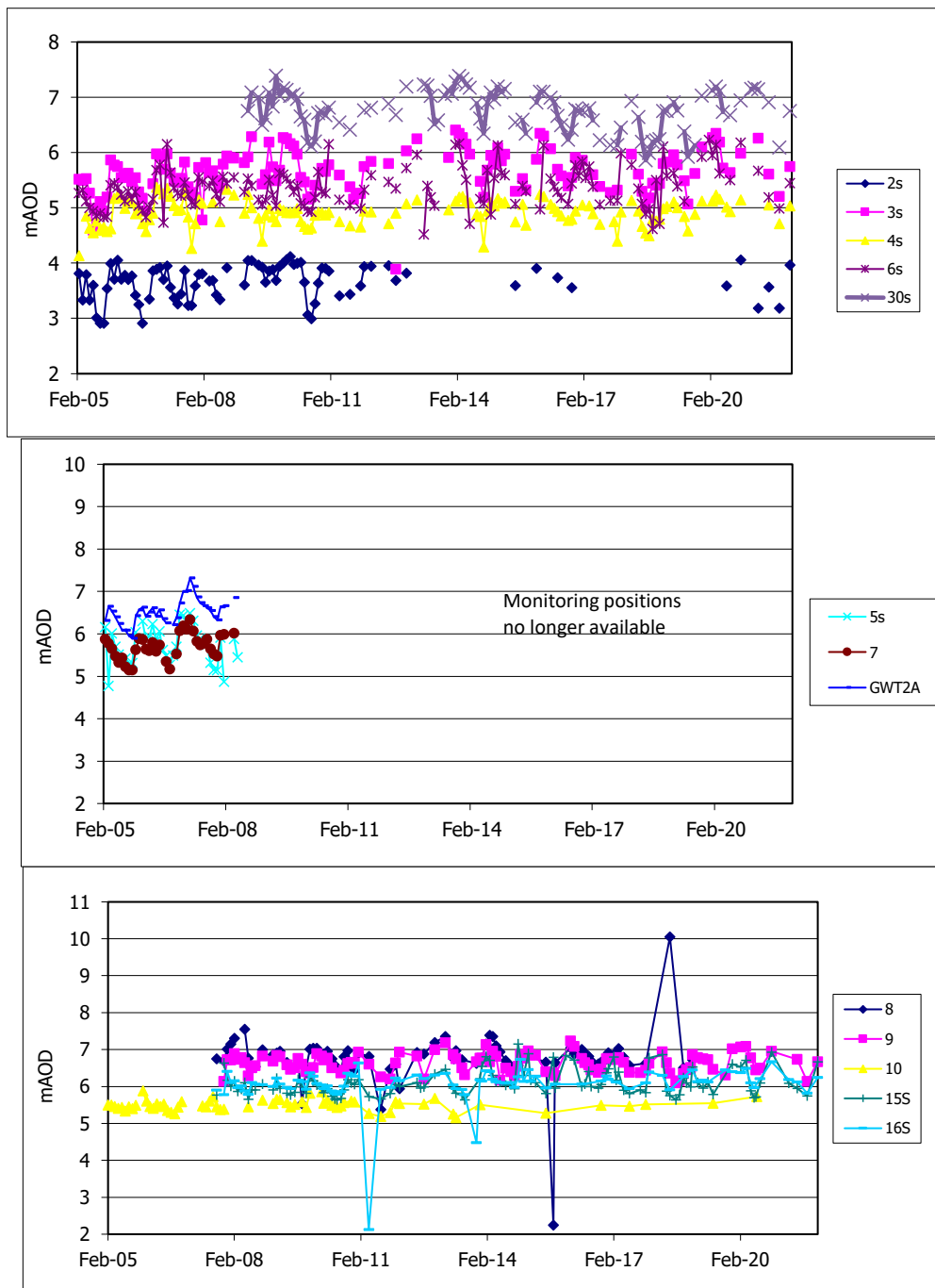
**2020 Annual Review of
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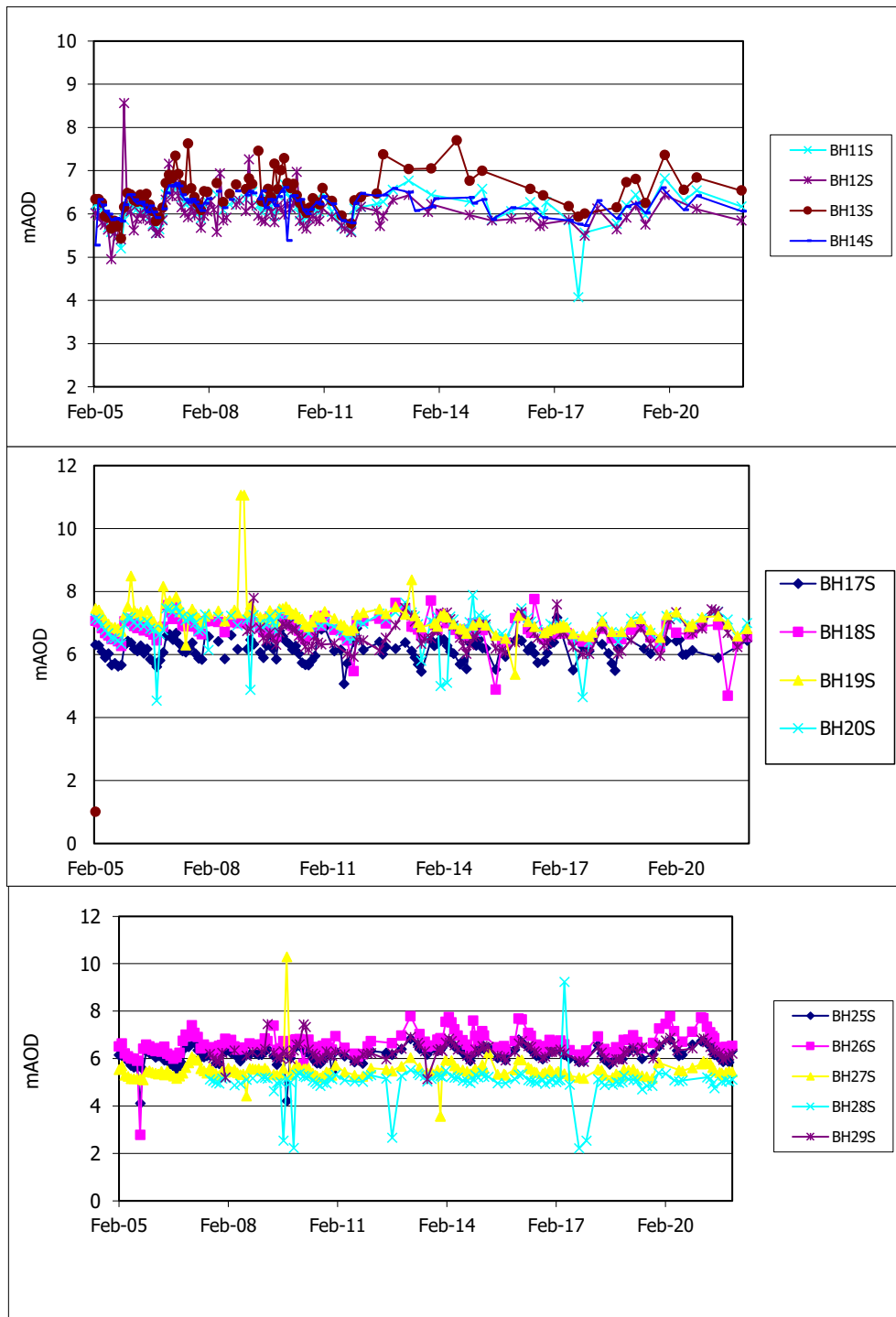
**Appendix 3
Temporal Variation of
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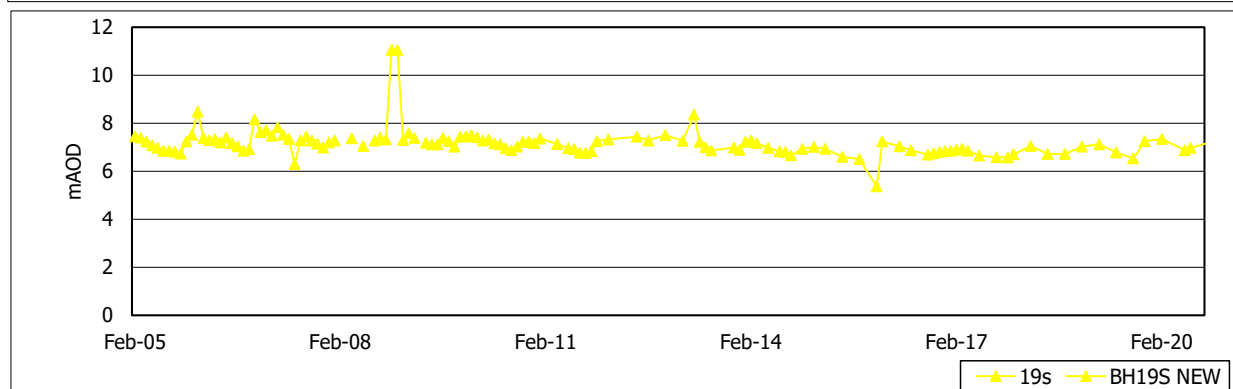
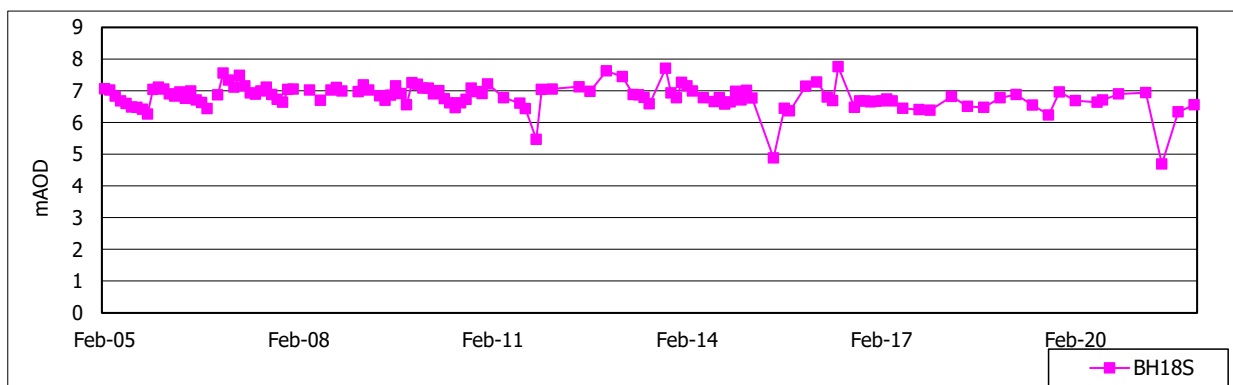
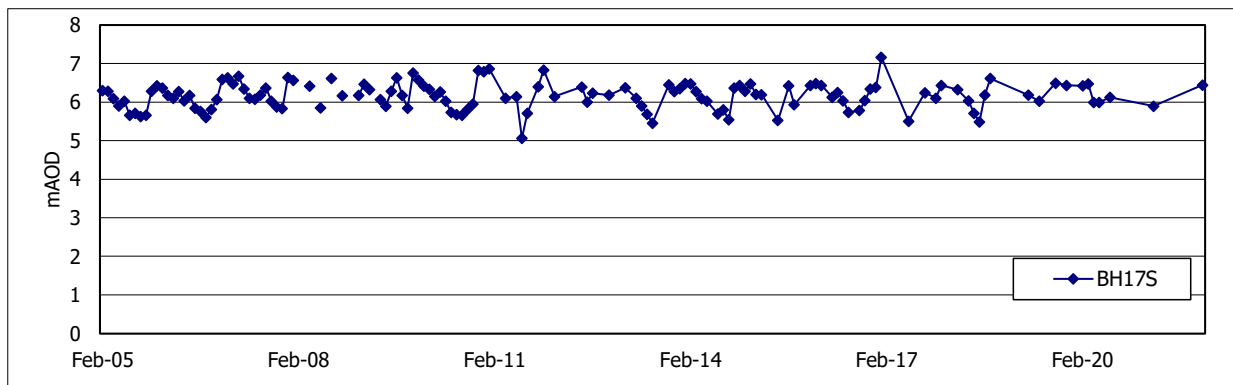
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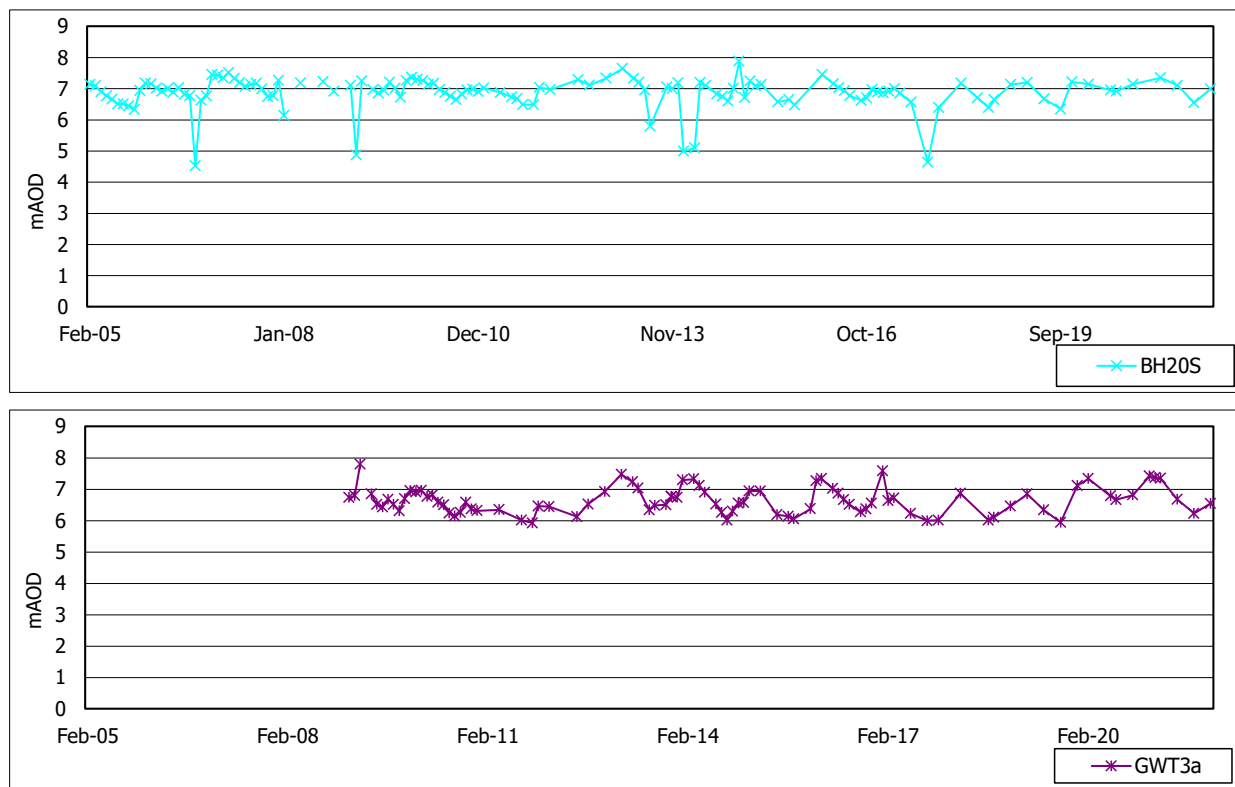


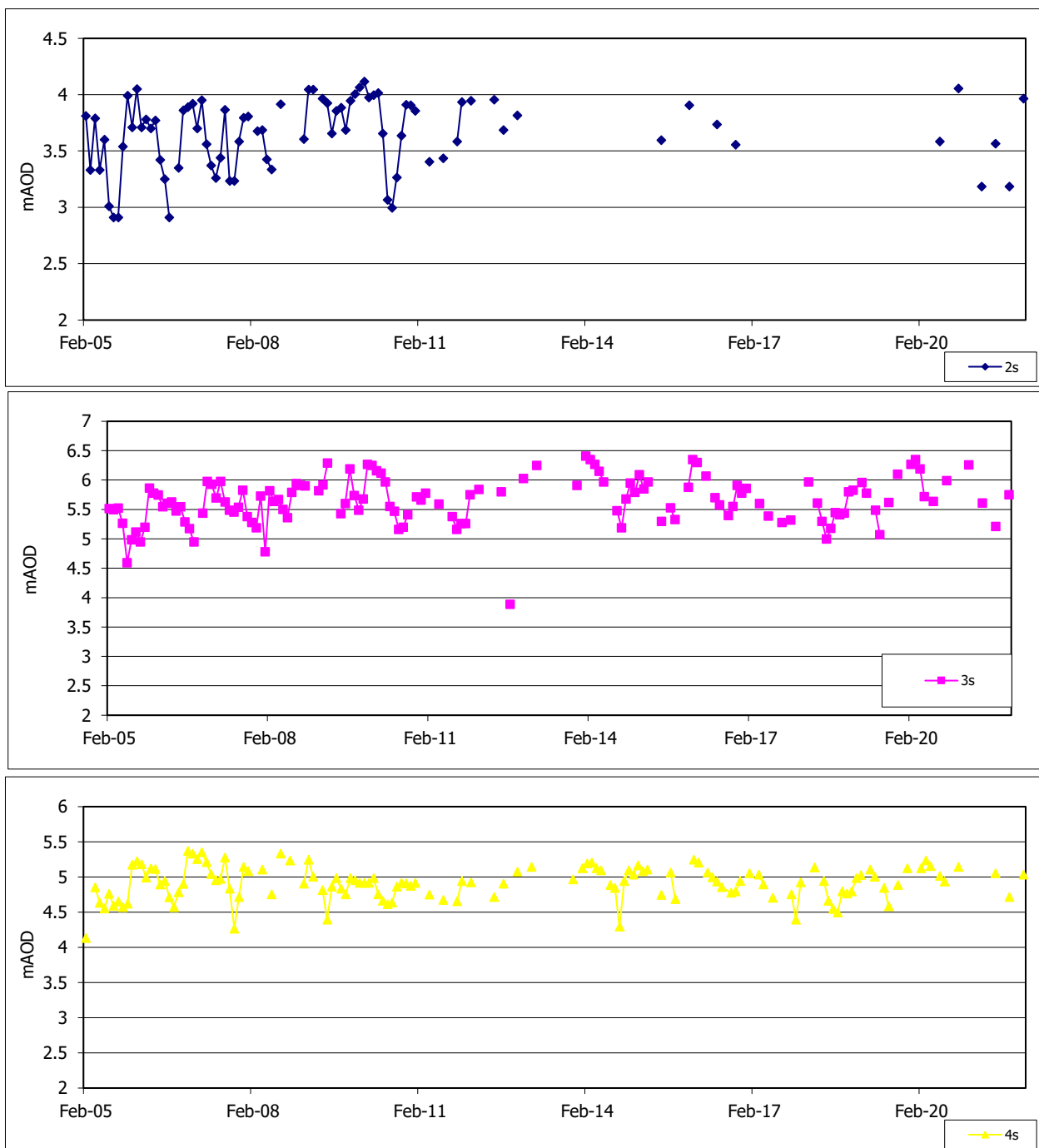


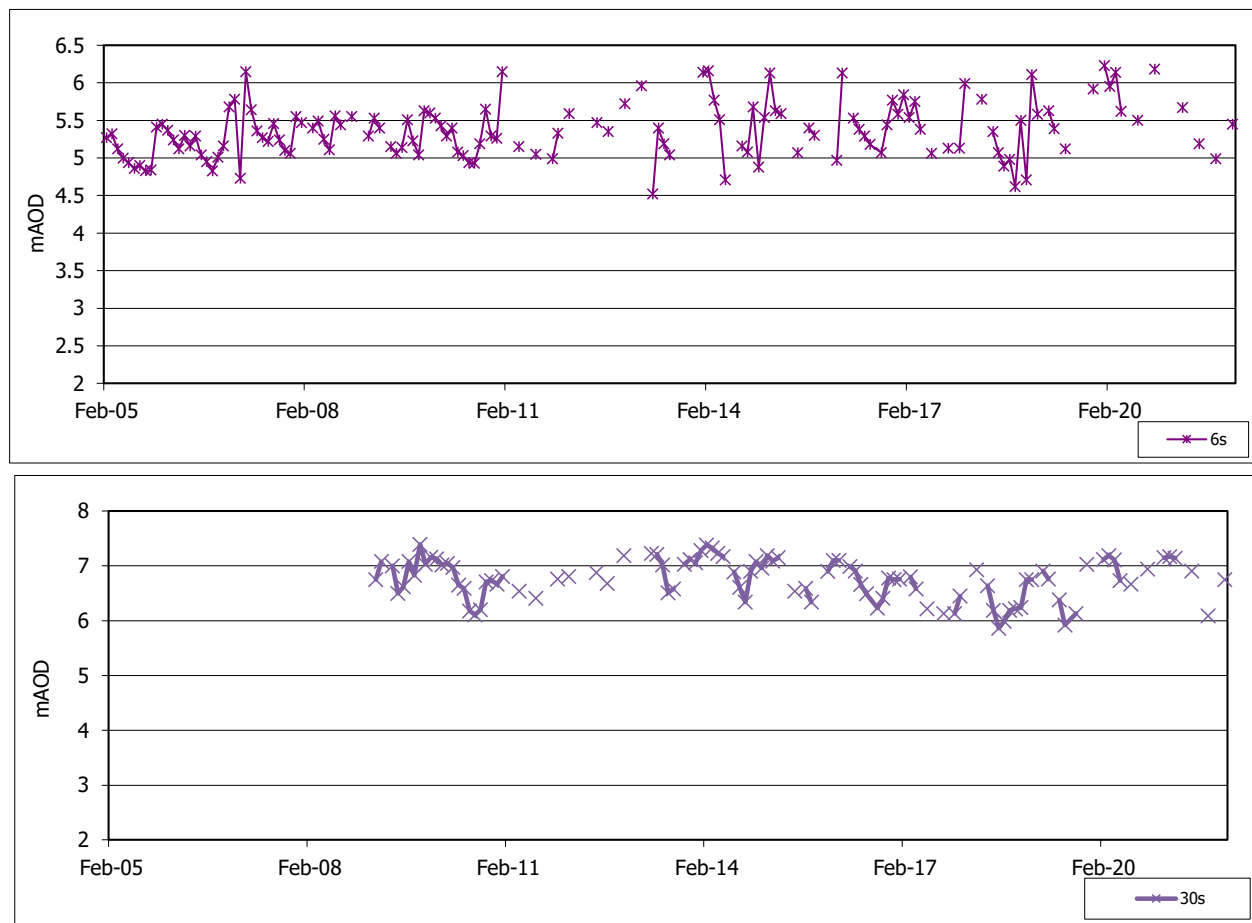


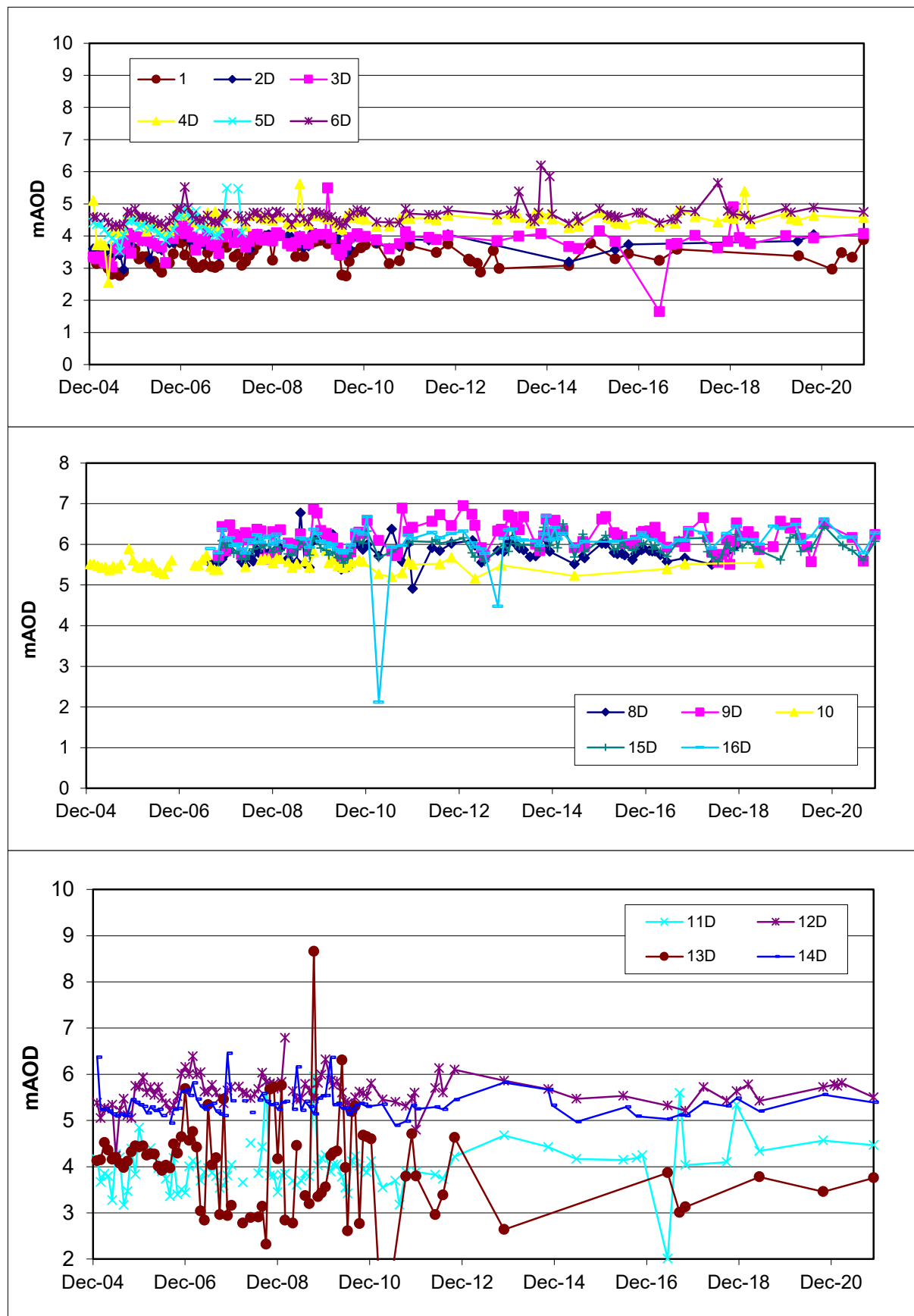


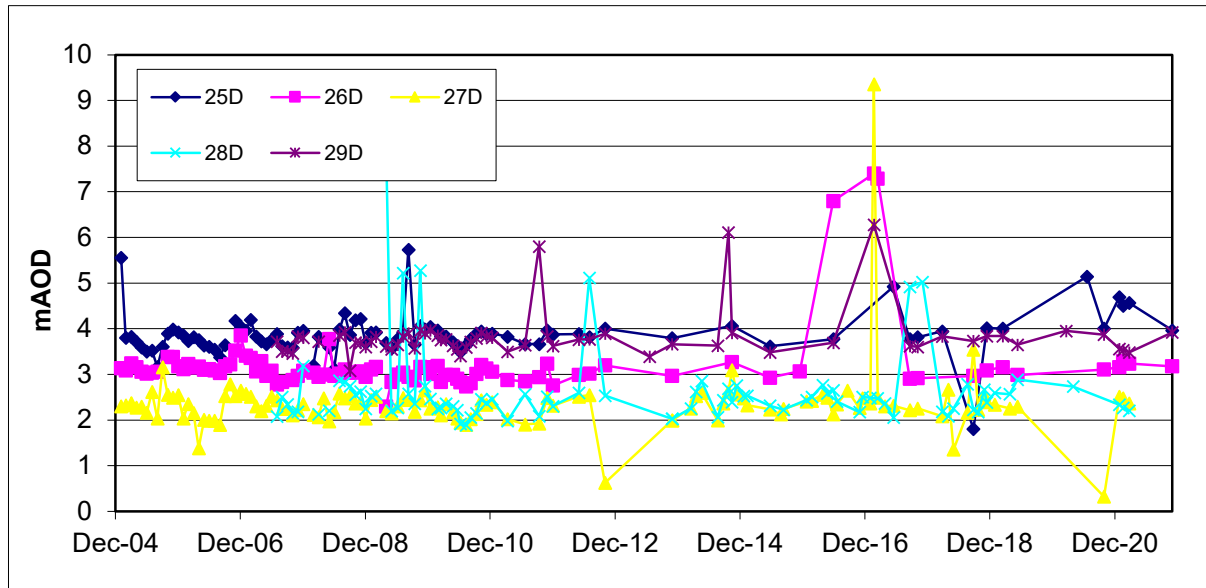
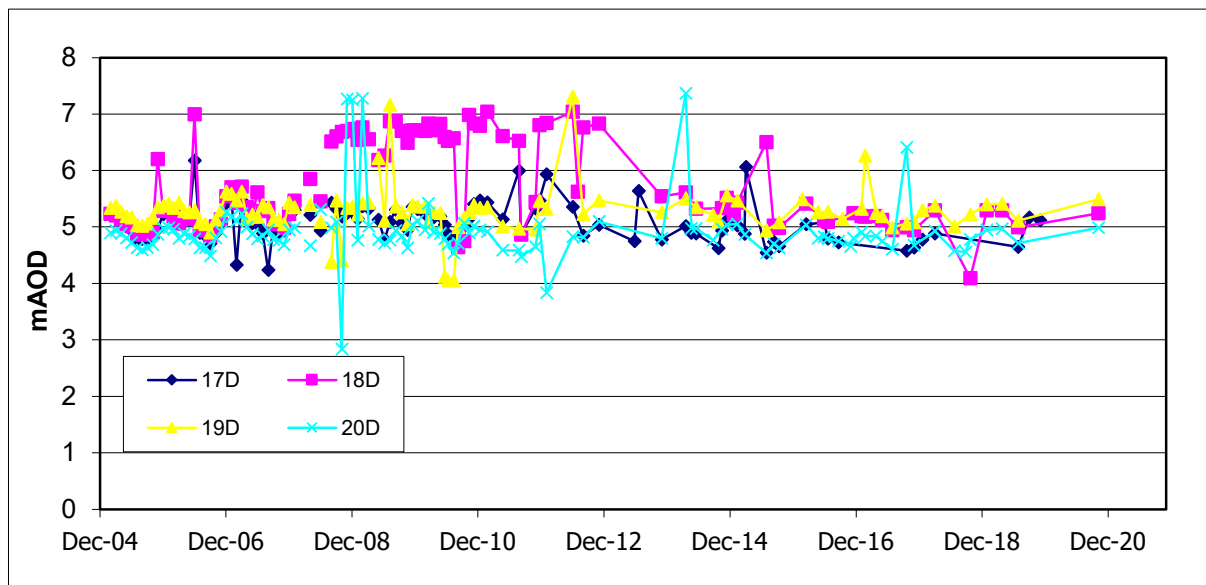












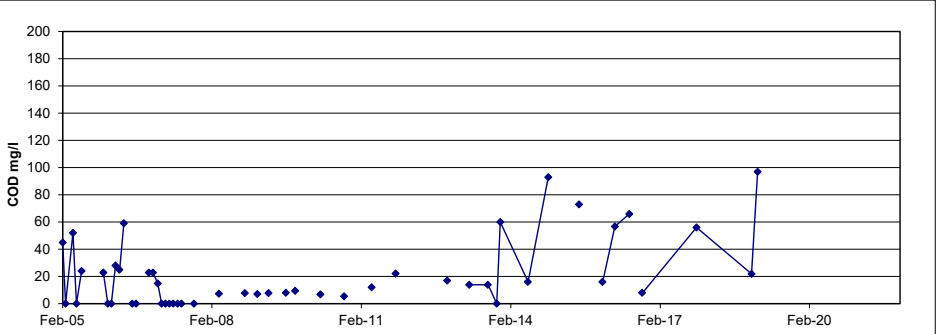
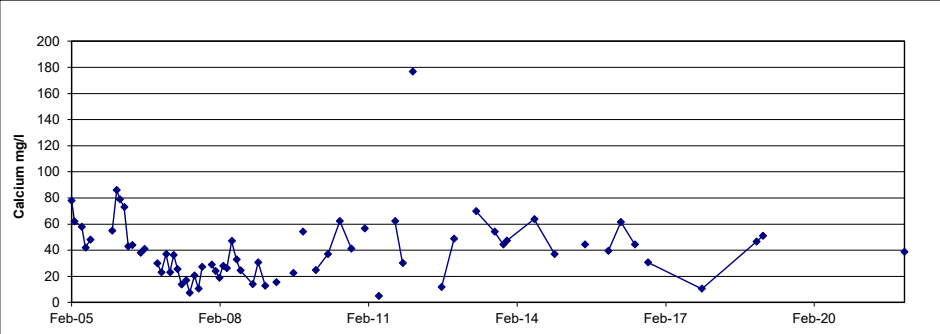
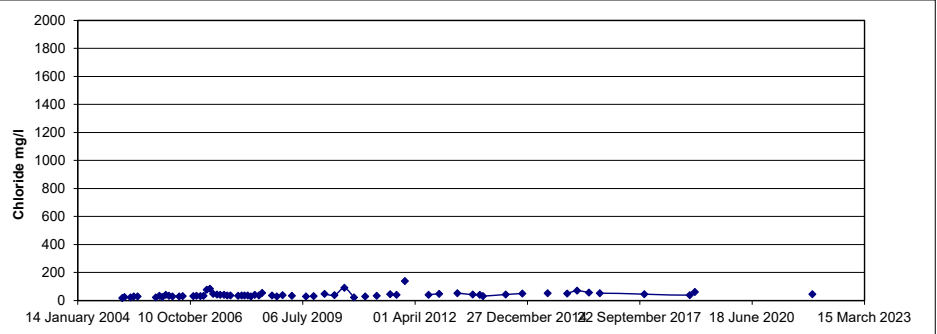
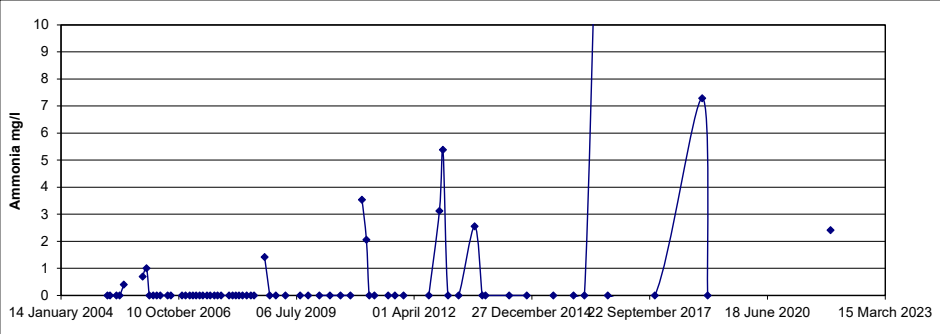
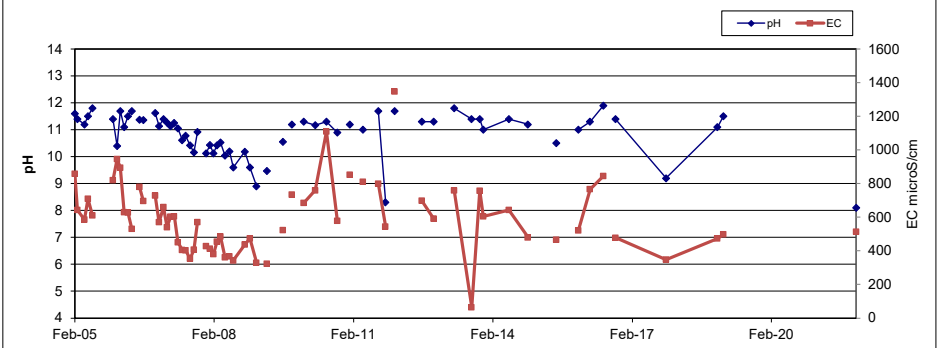
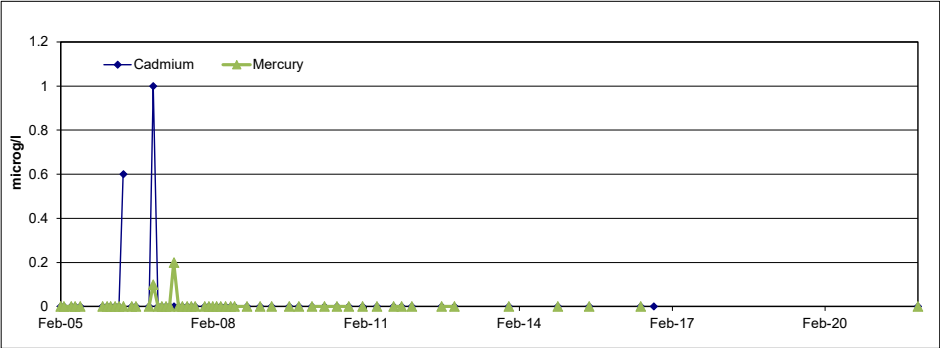
**MORFA HAZARDOUS
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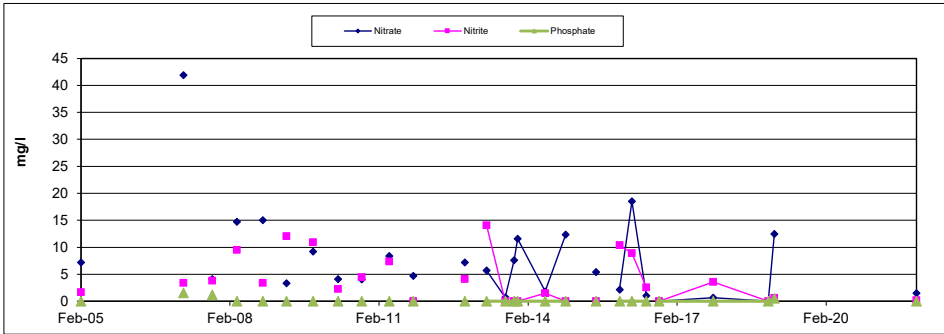
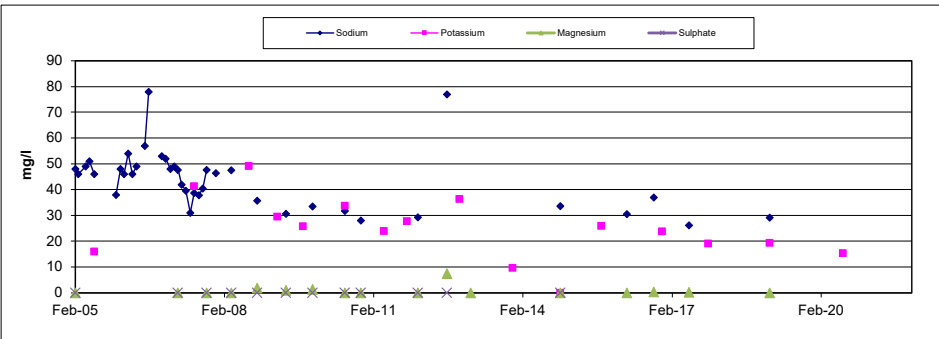
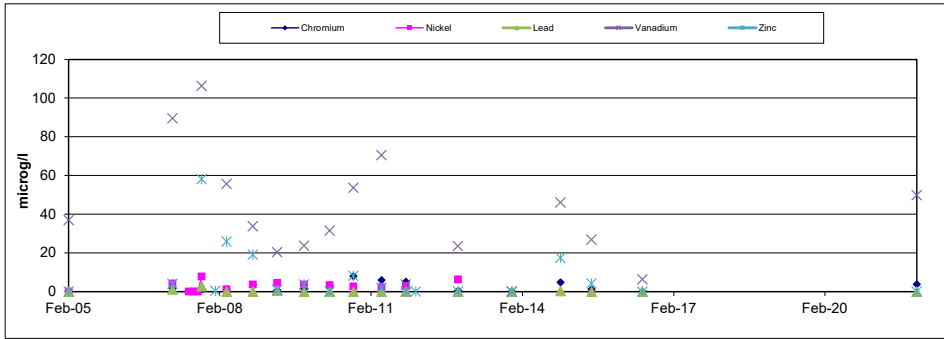
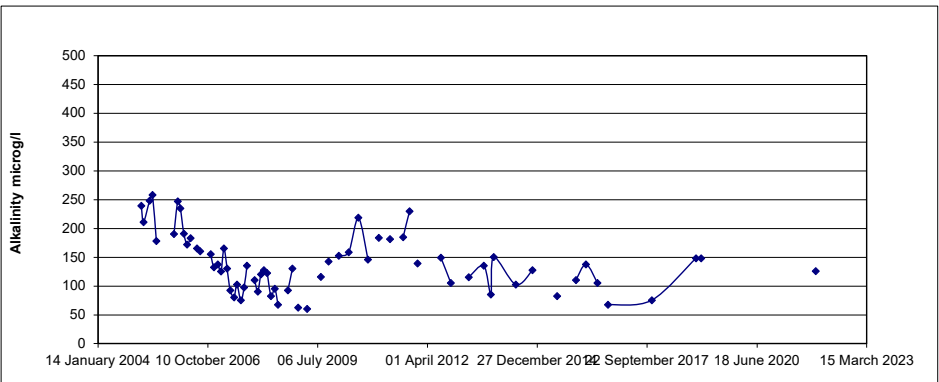
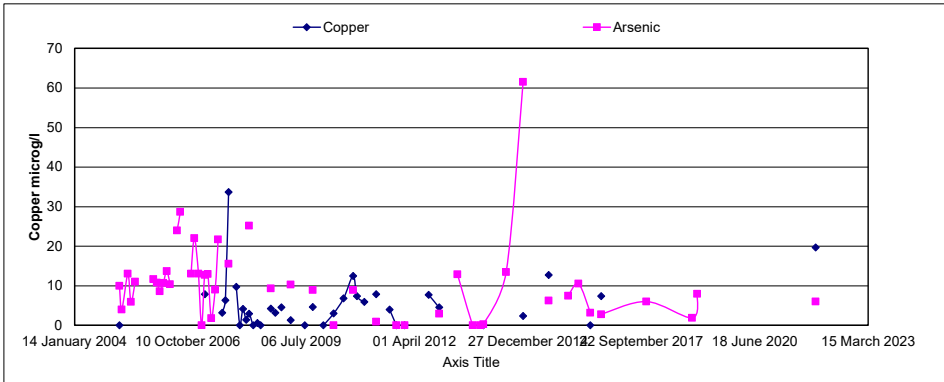
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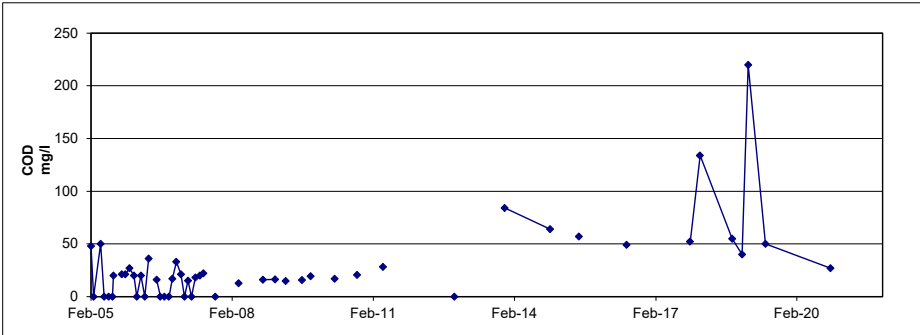
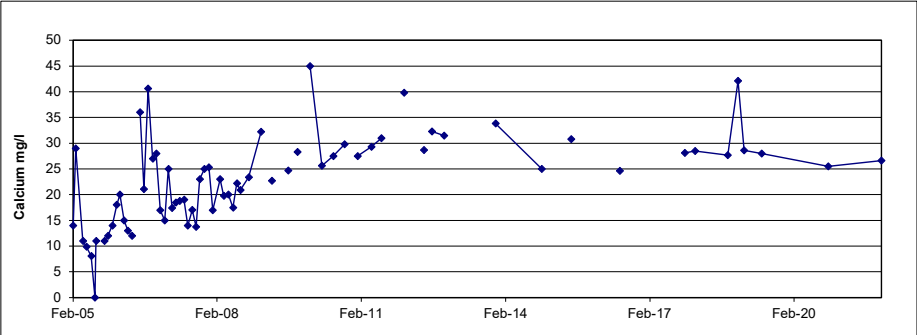
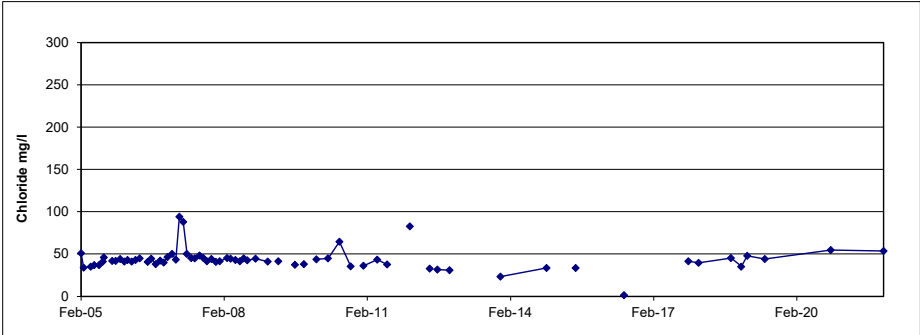
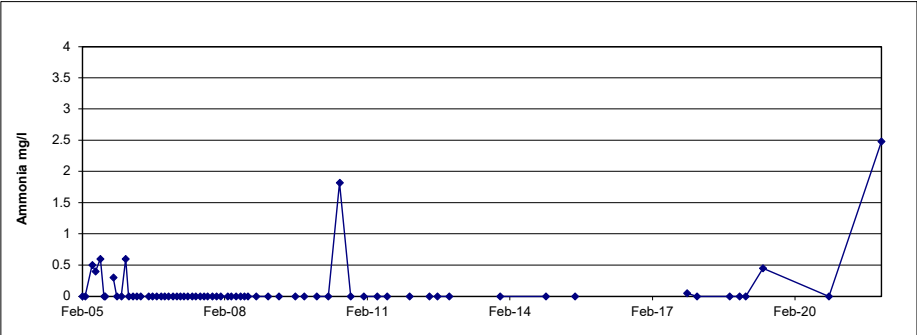
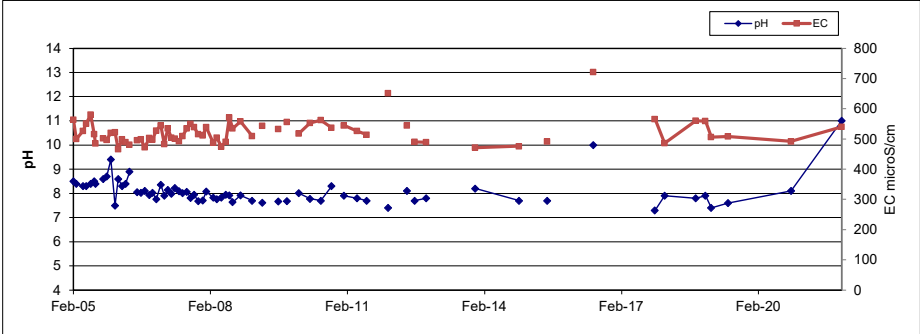
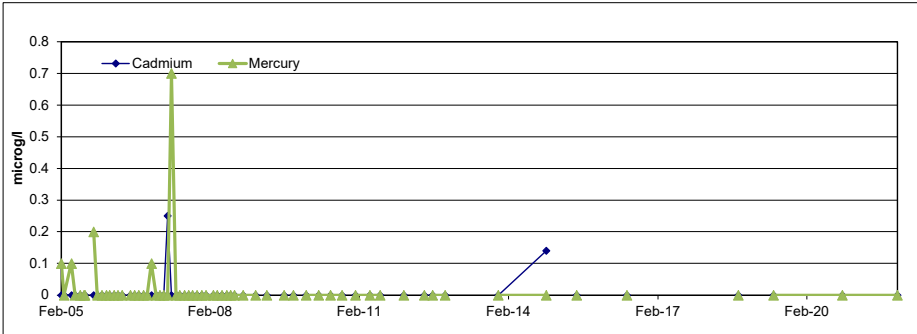
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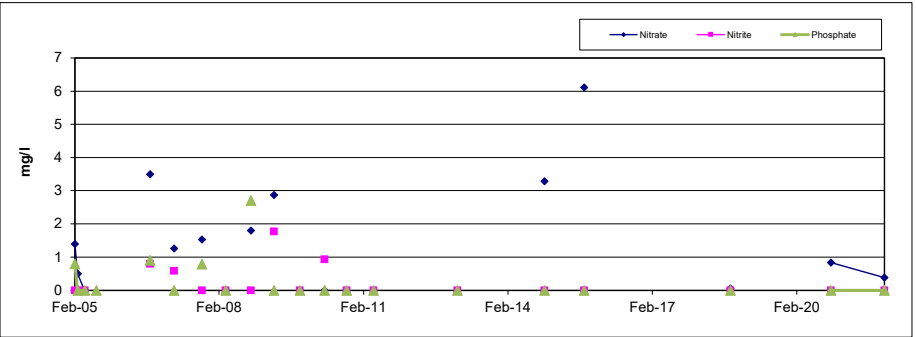
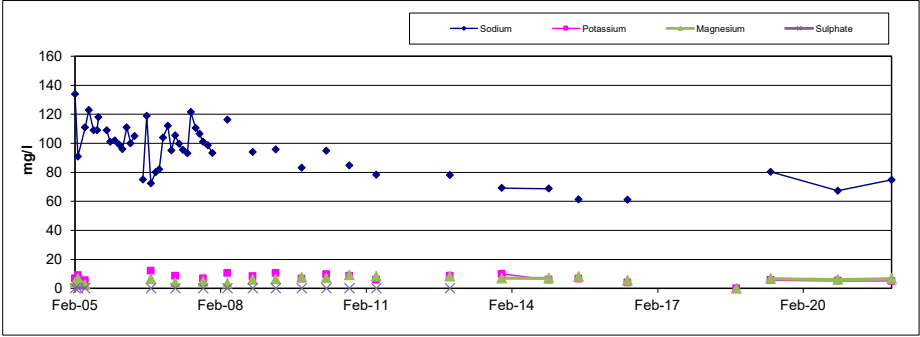
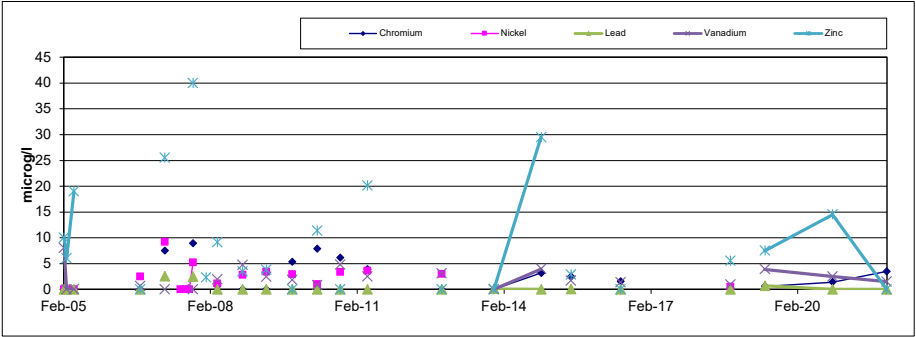
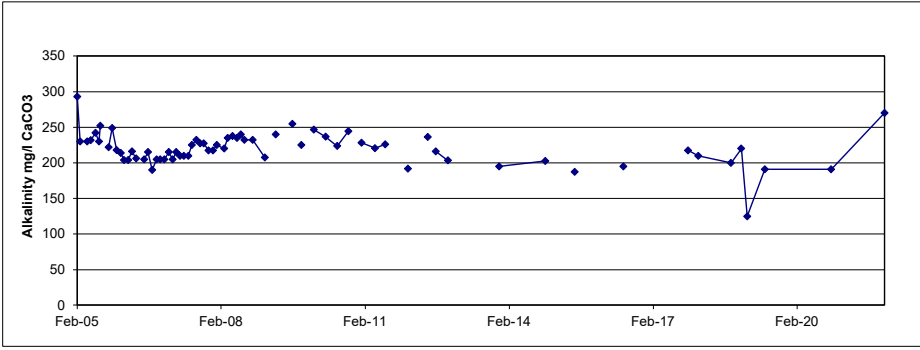
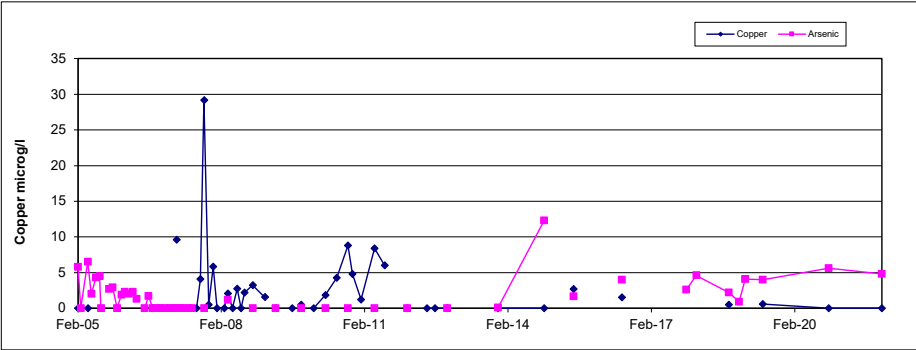
**Appendix 4
Temporal Variation of
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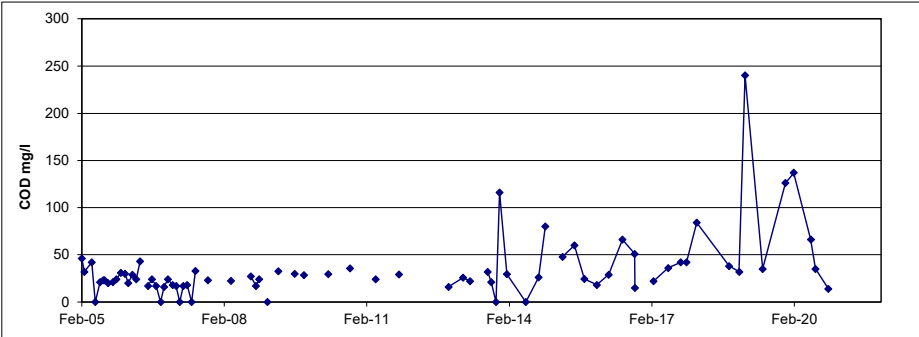
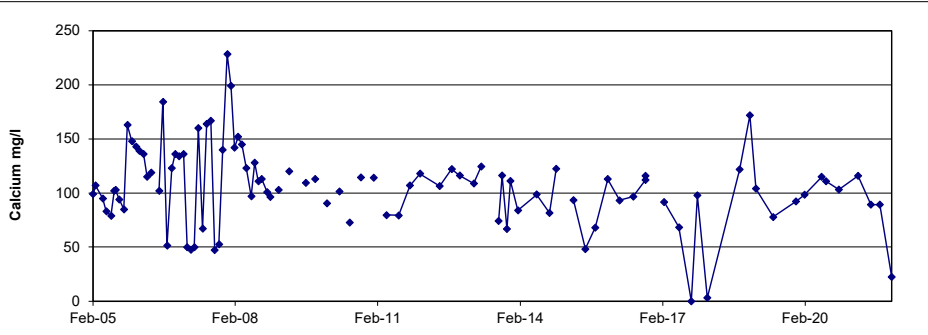
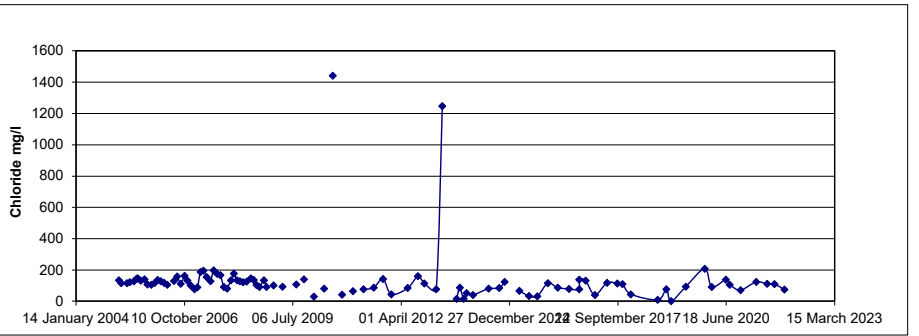
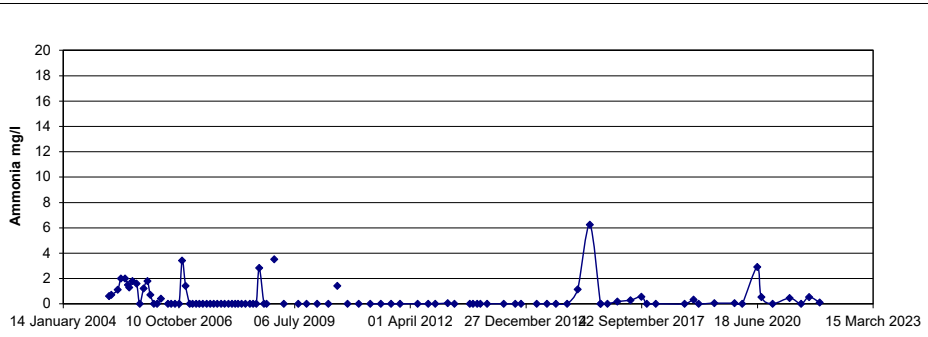
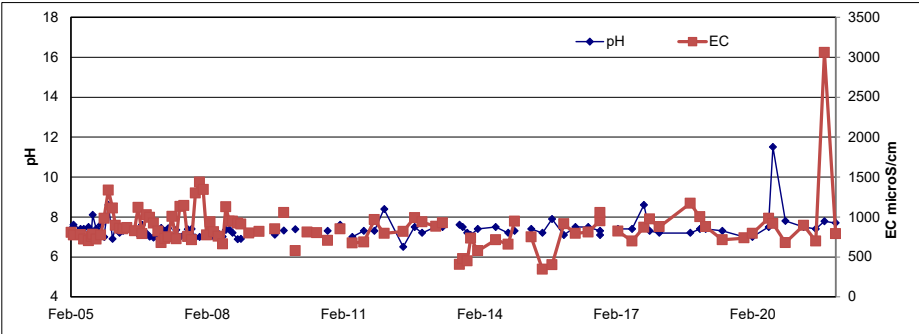
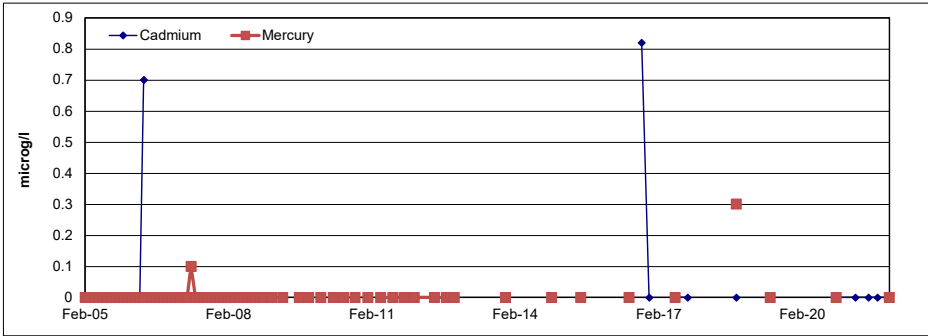
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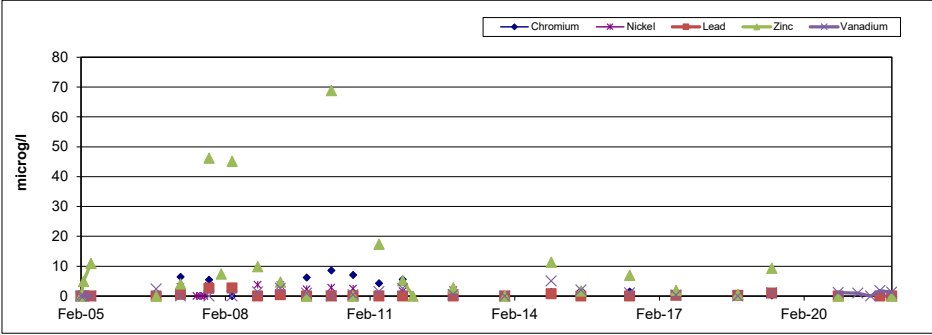
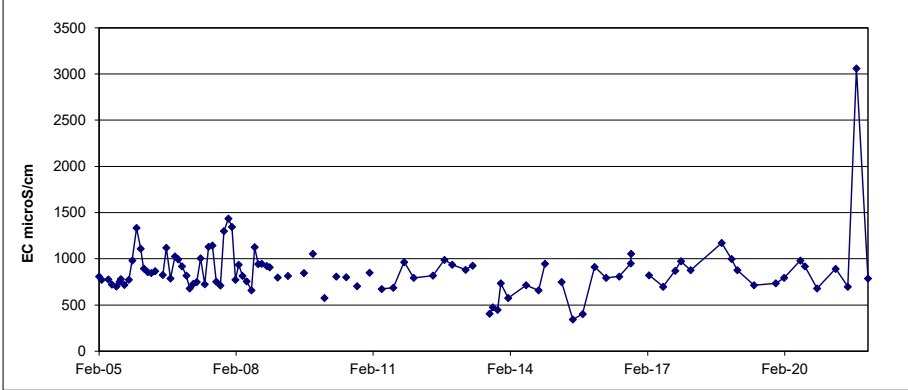
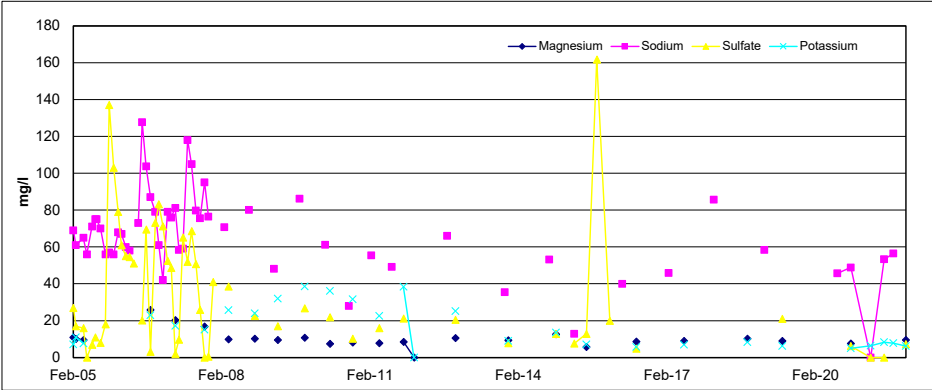
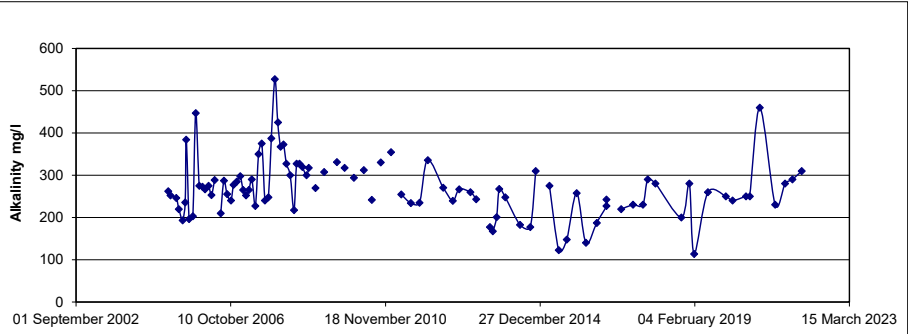
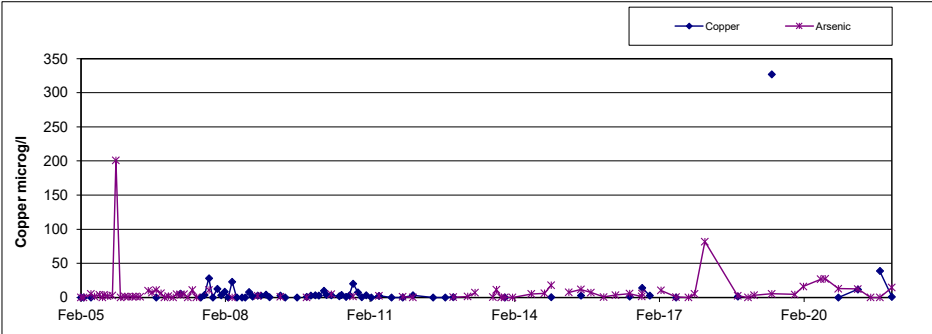


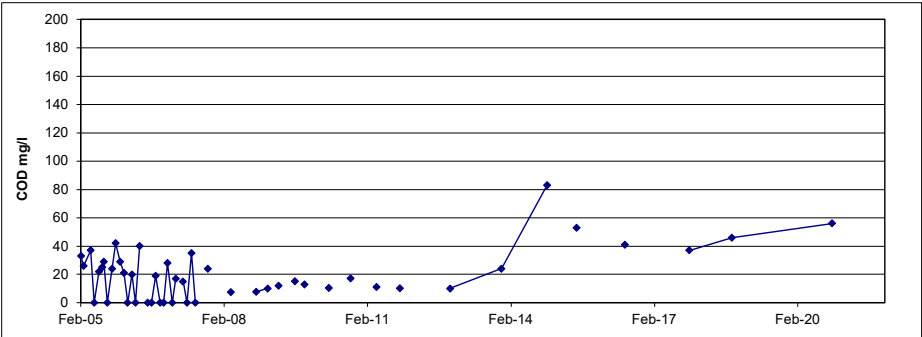
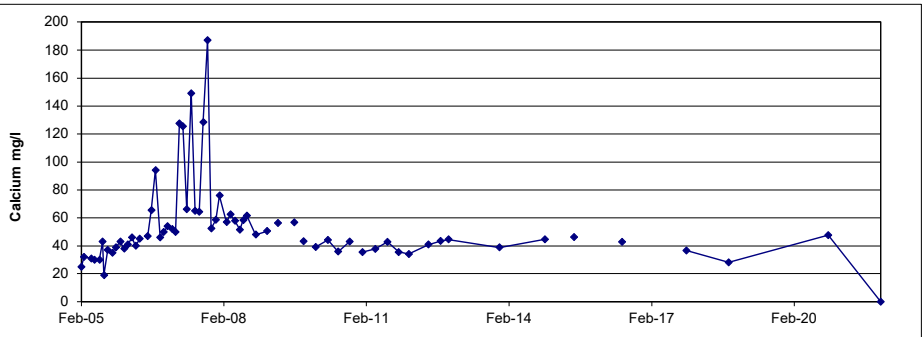
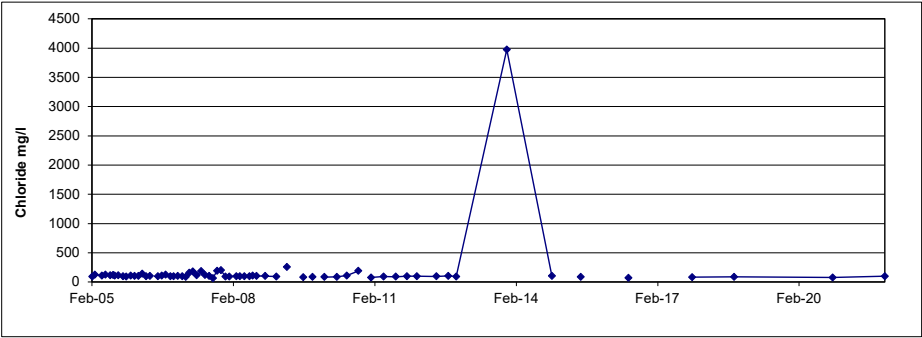
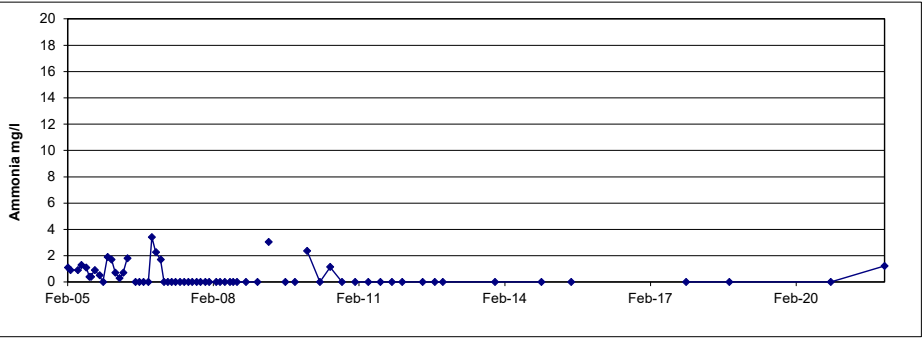
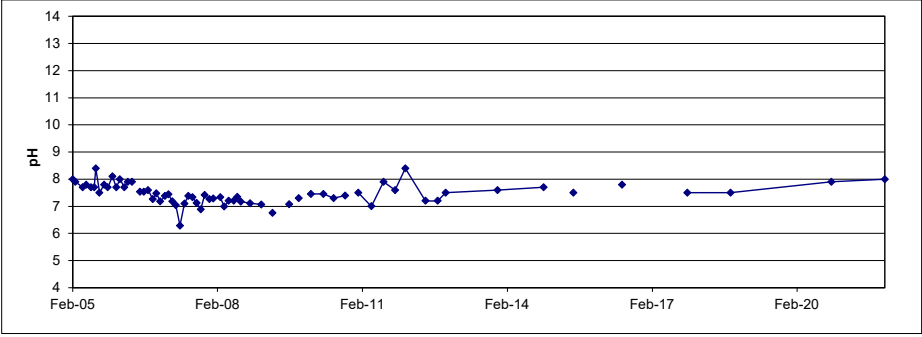
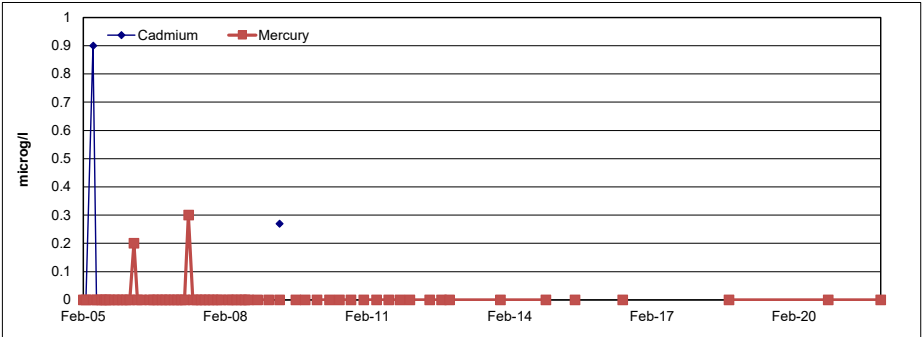


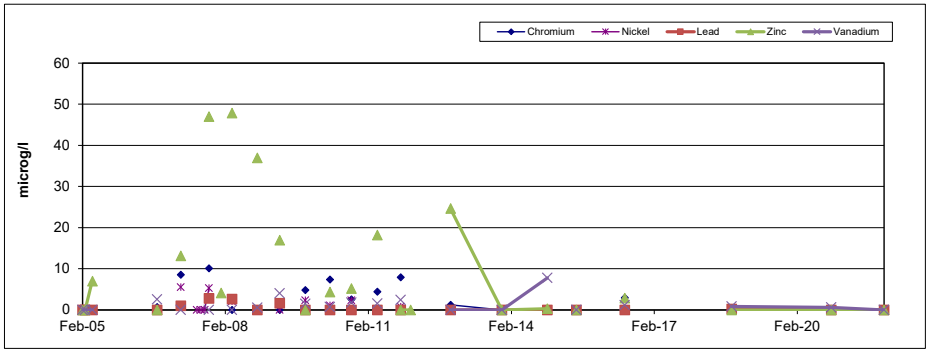
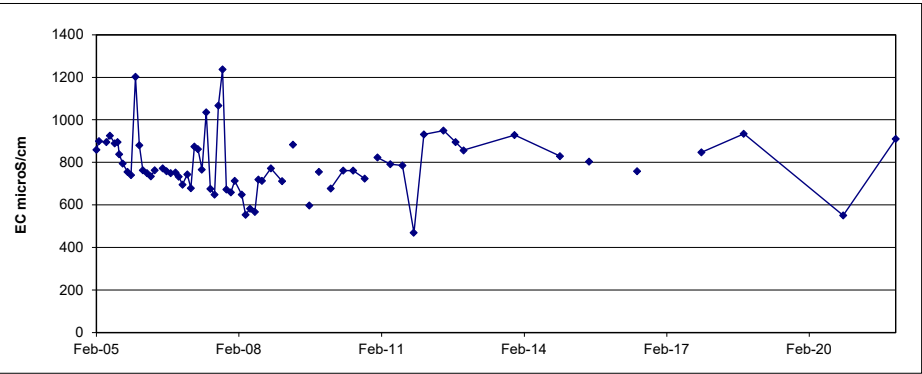
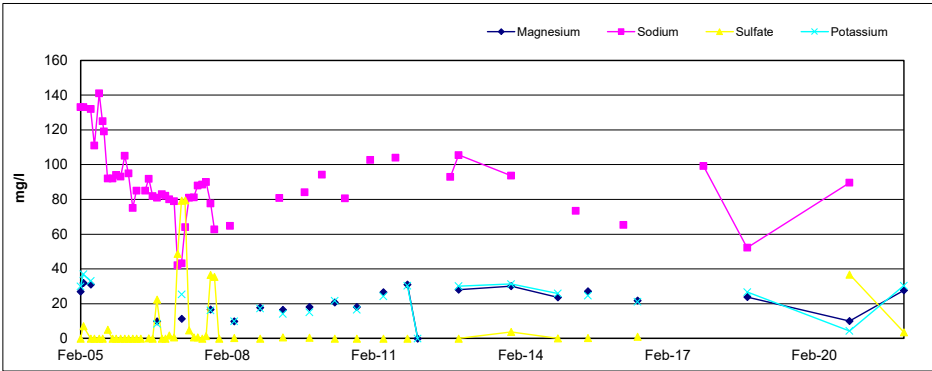
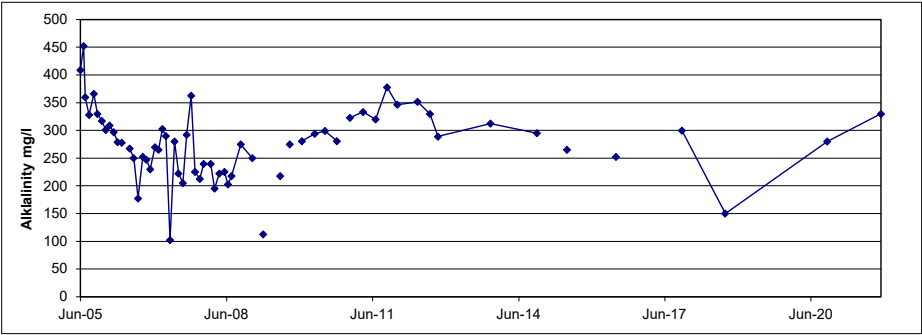
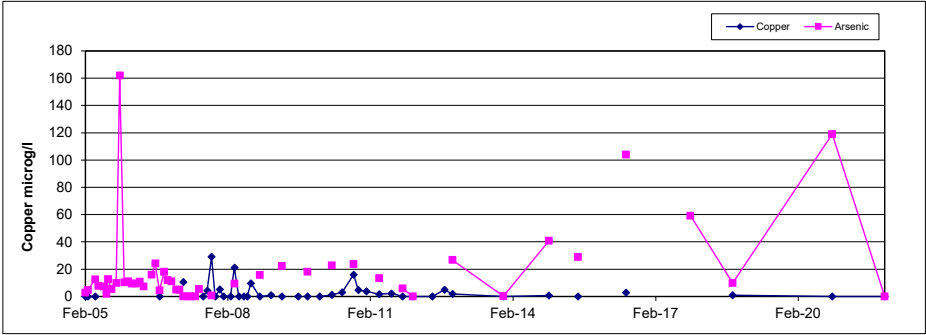


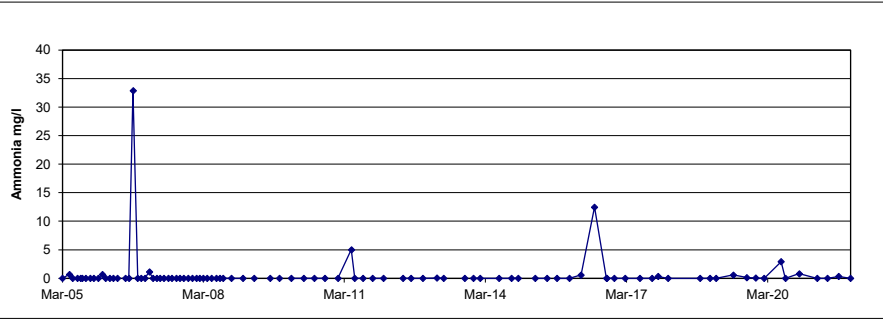
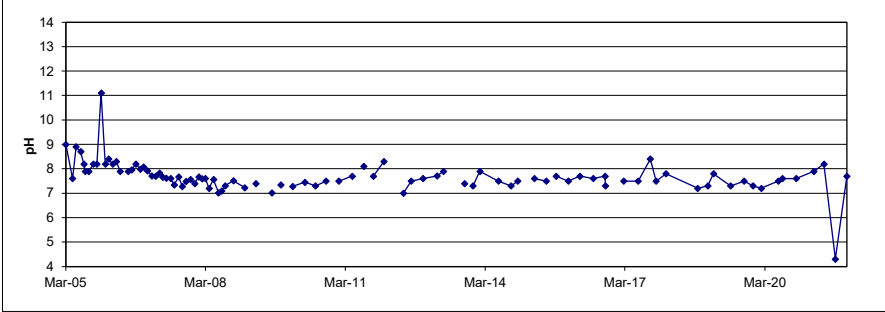
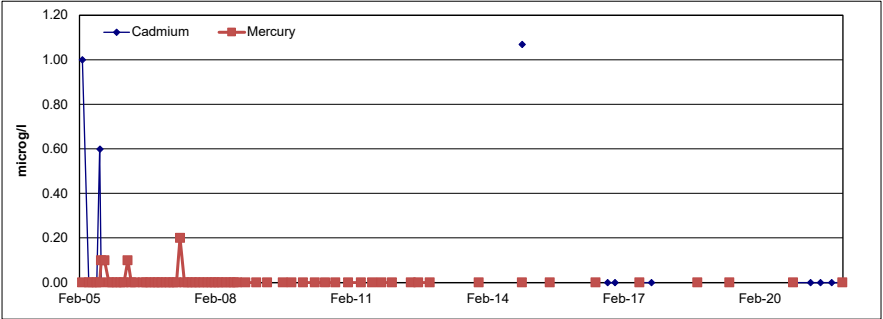


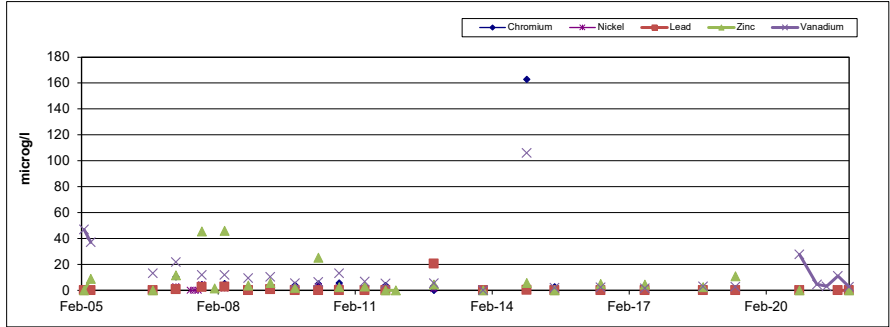
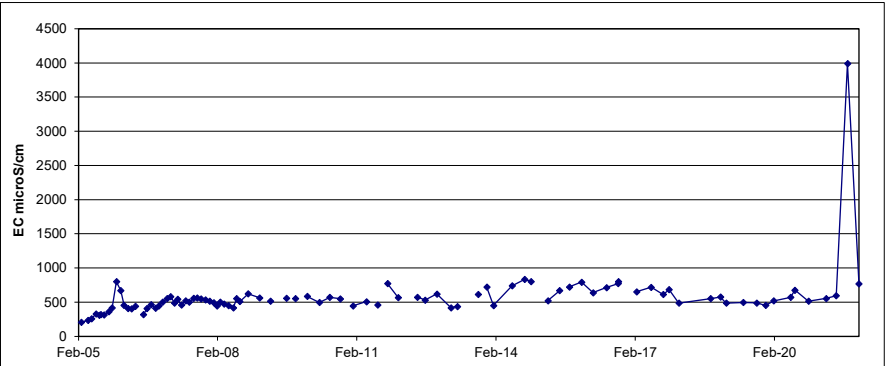
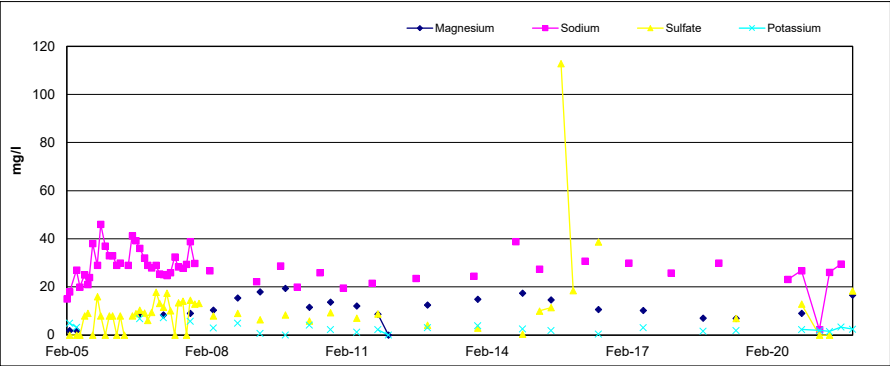
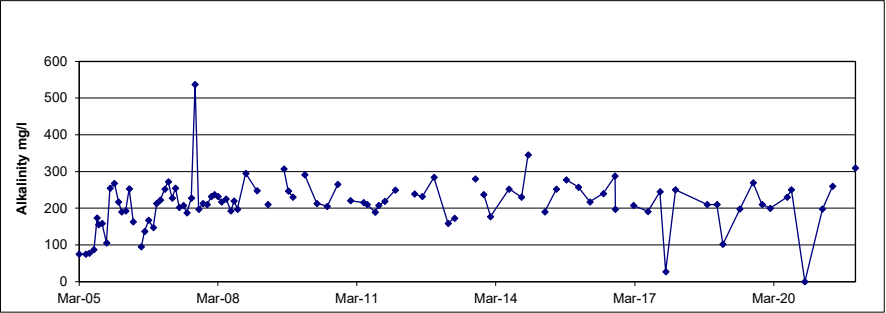
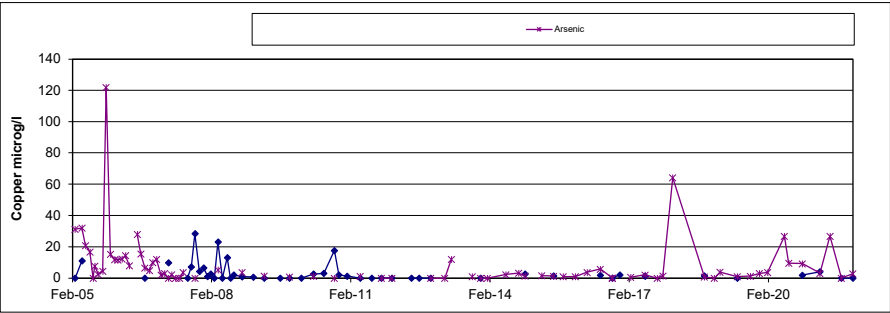


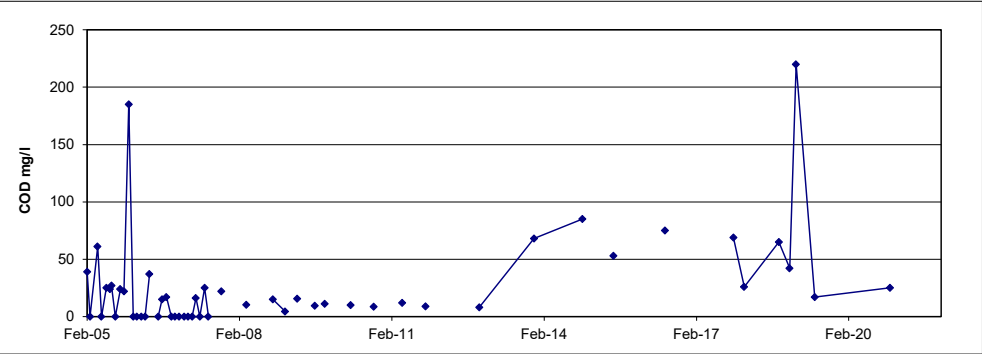
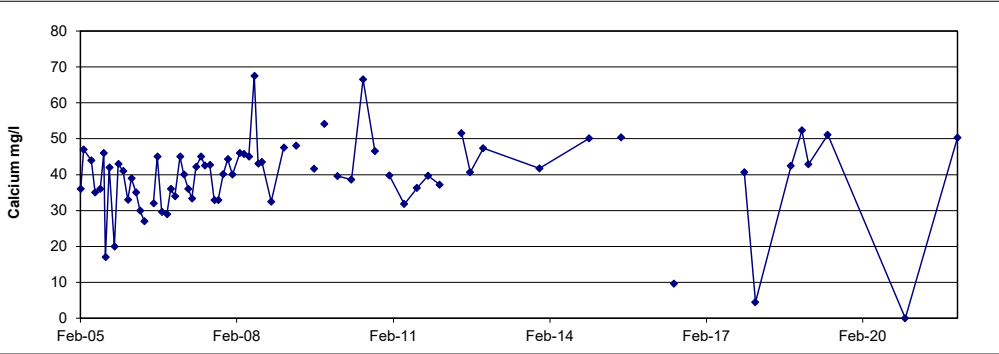
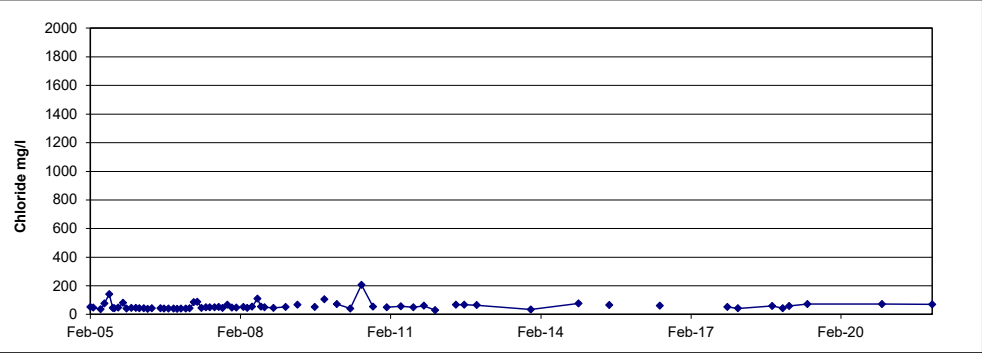
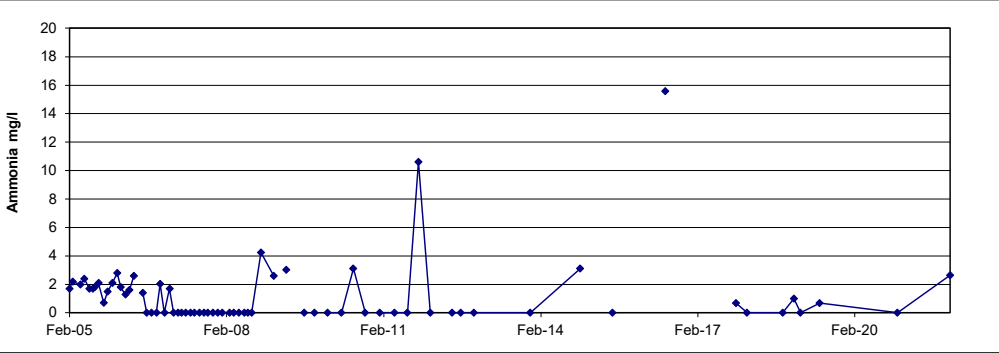
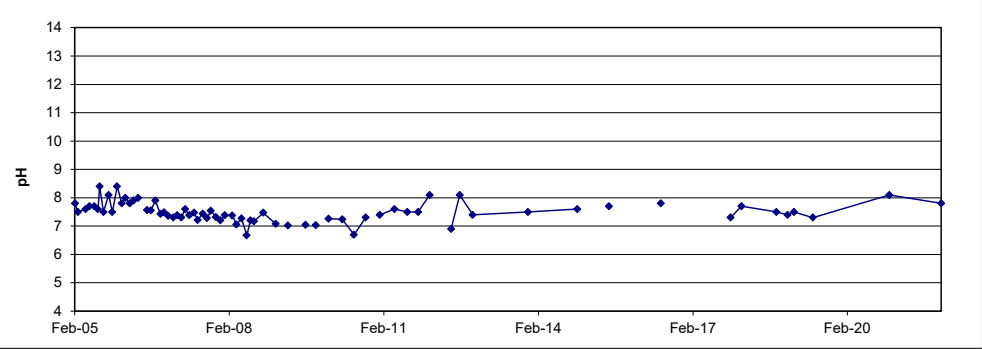
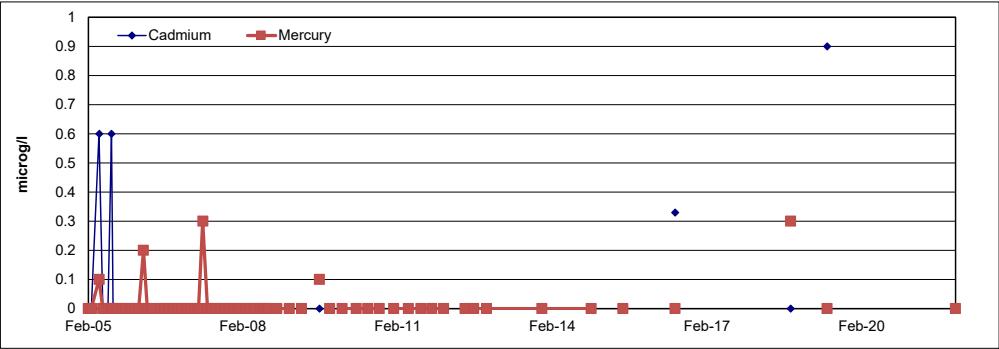


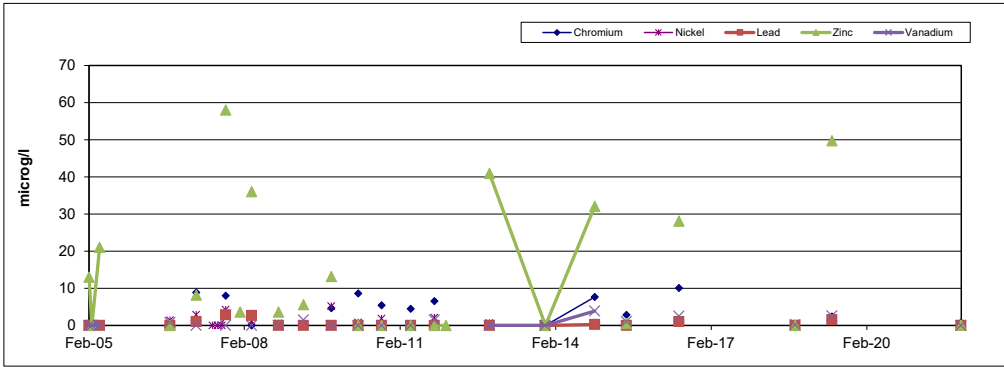
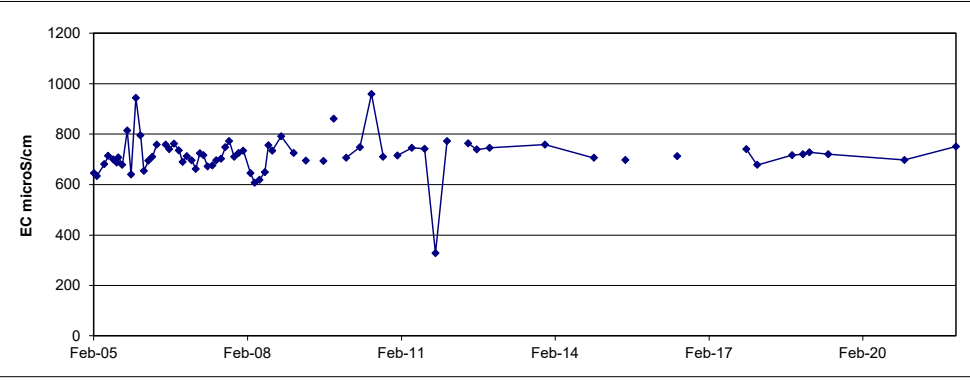
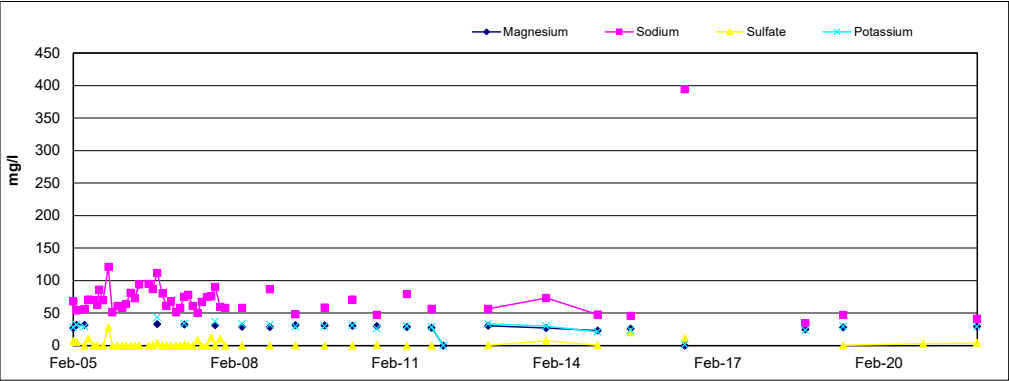
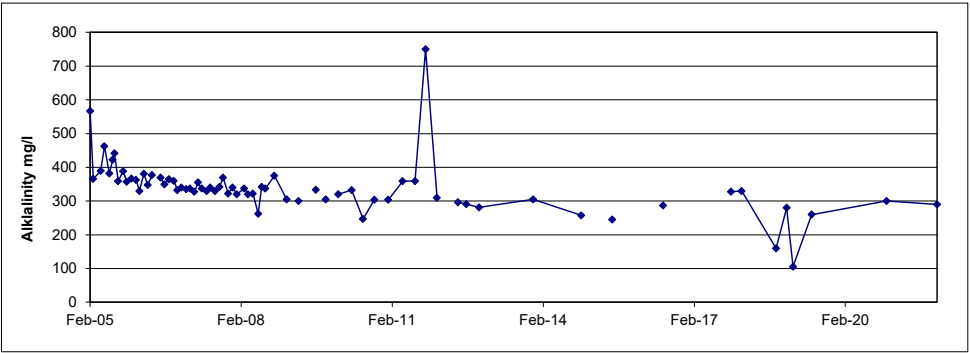
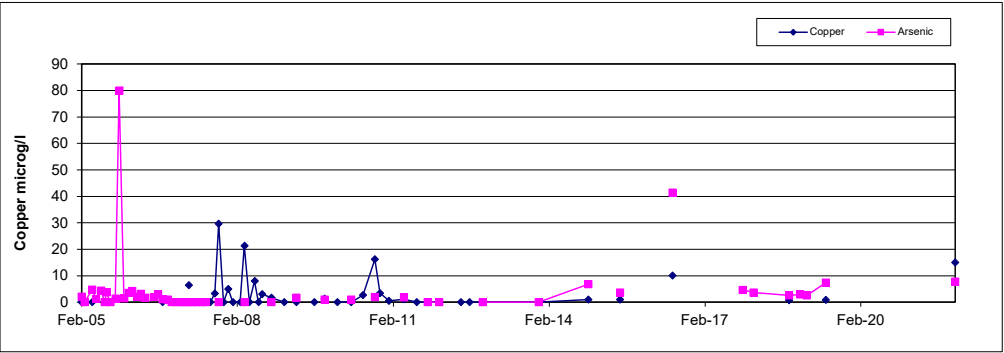


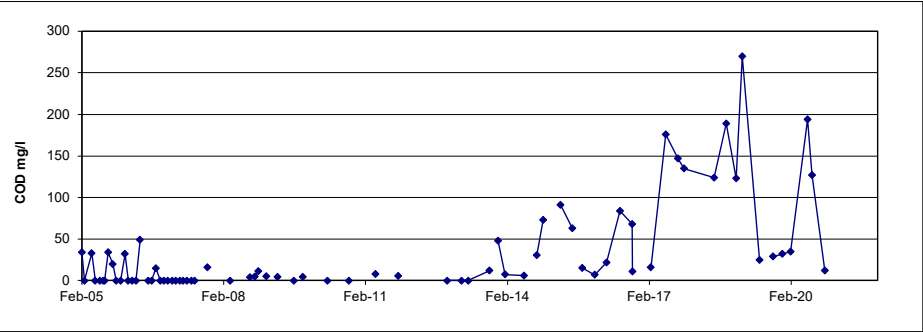
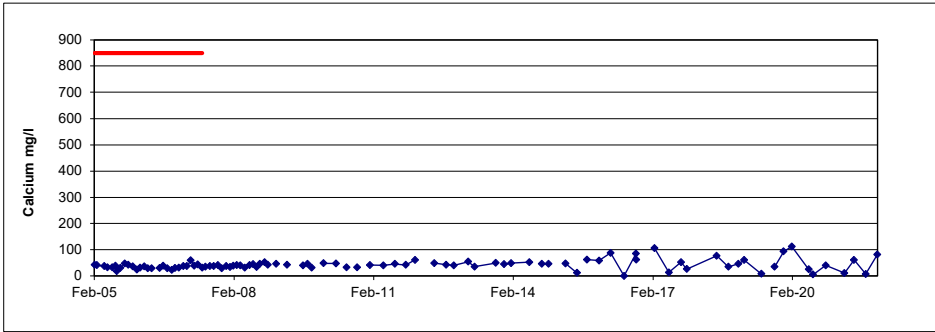
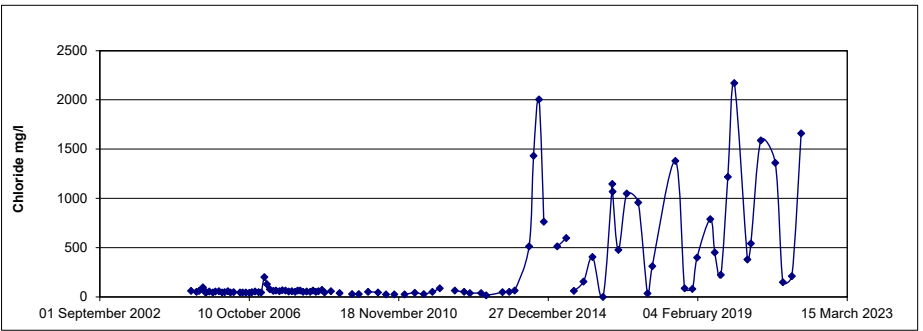
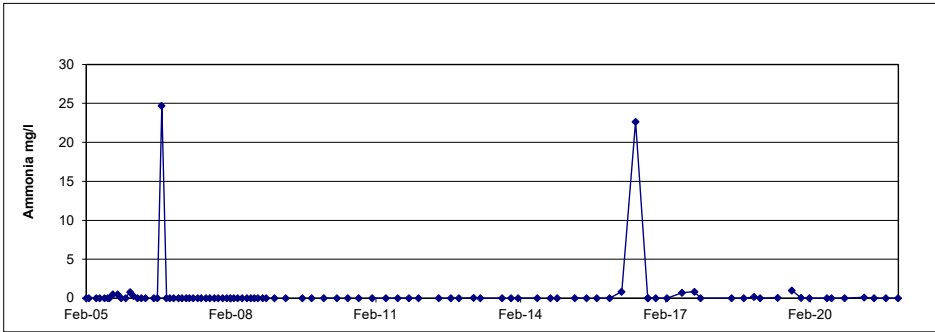
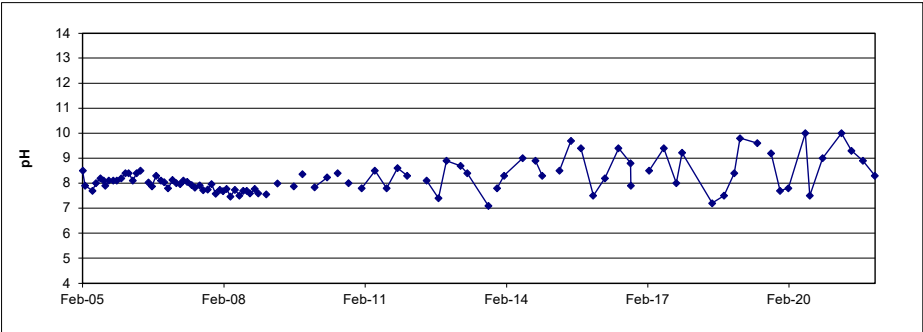
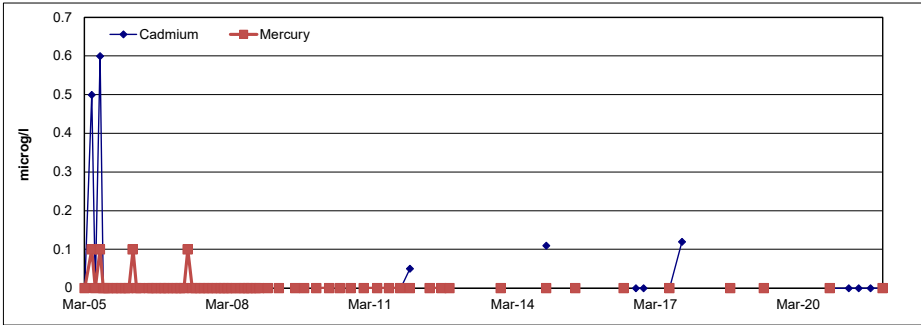


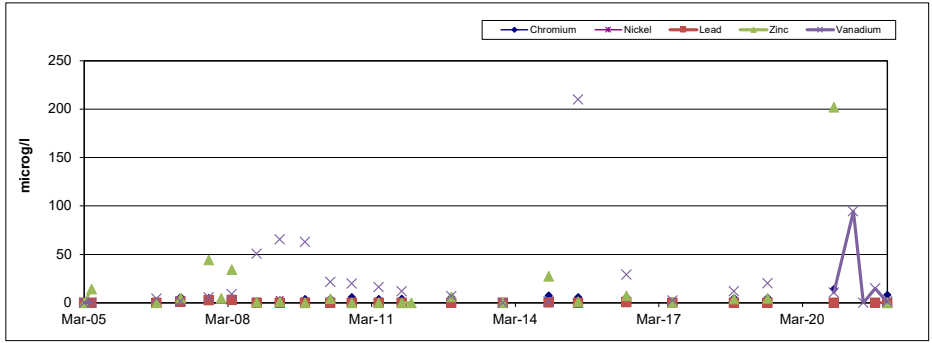
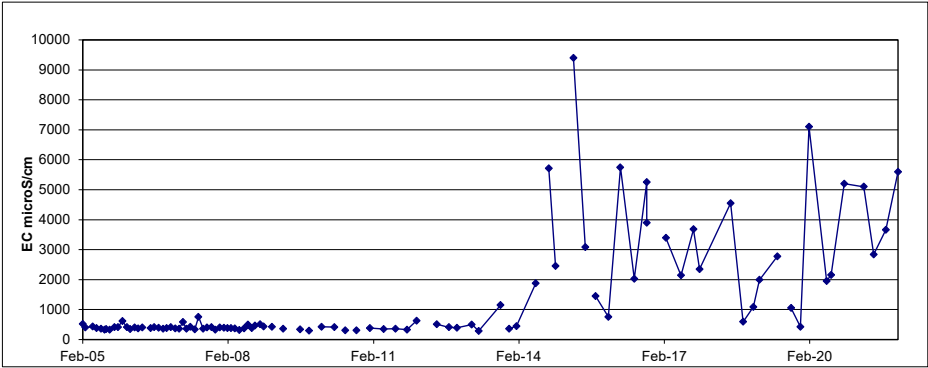
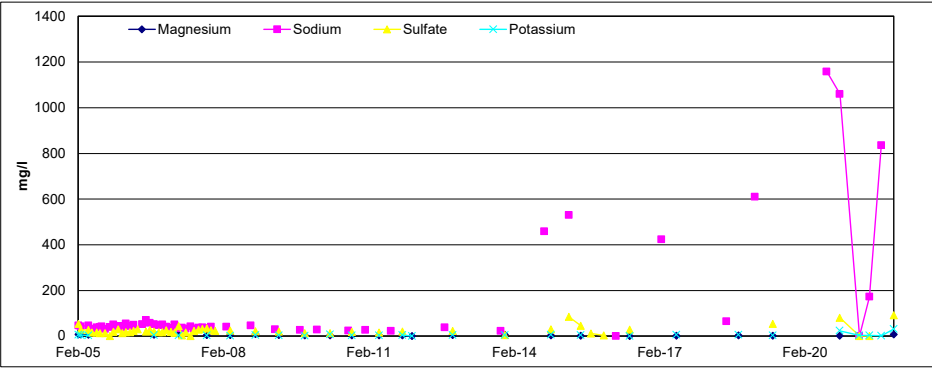
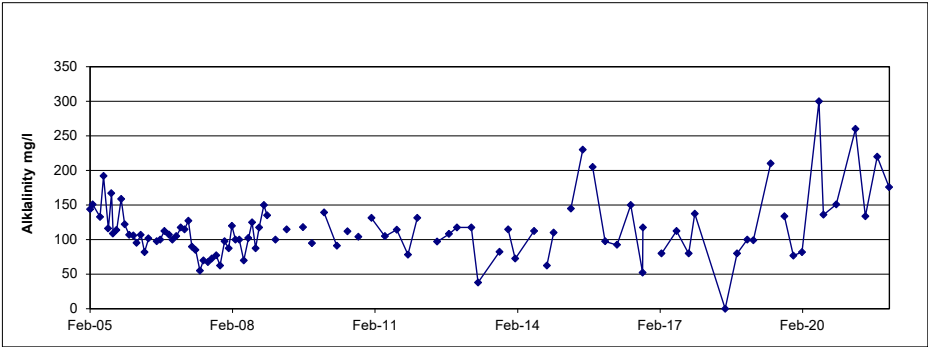
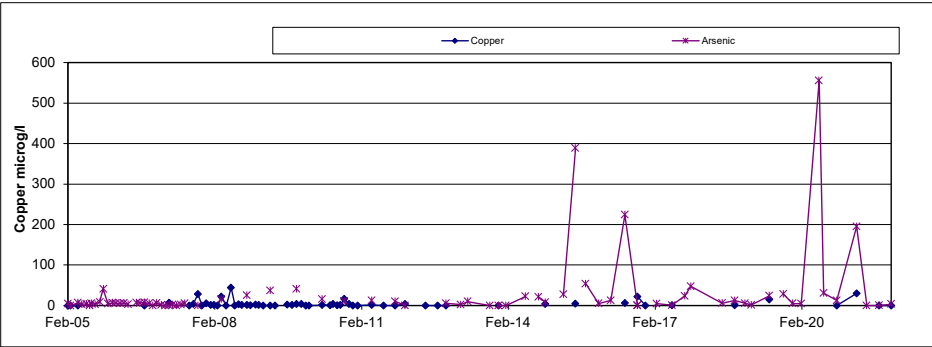


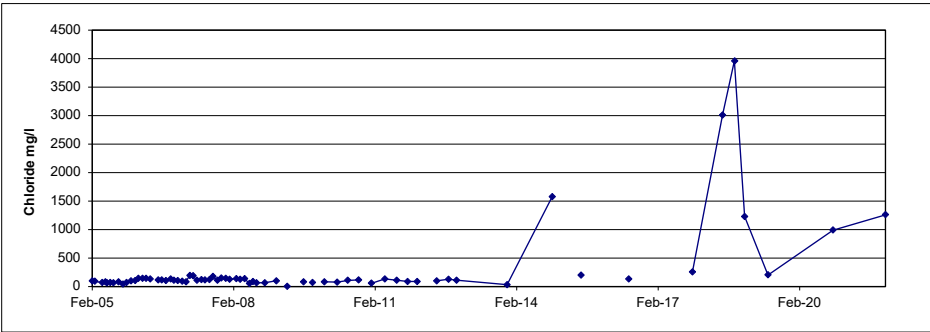
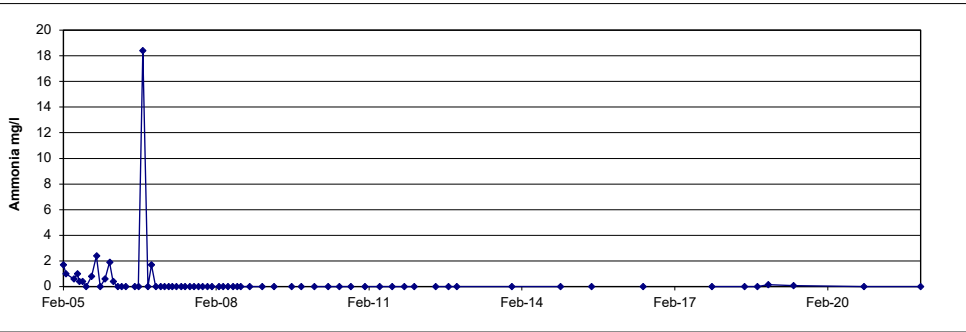
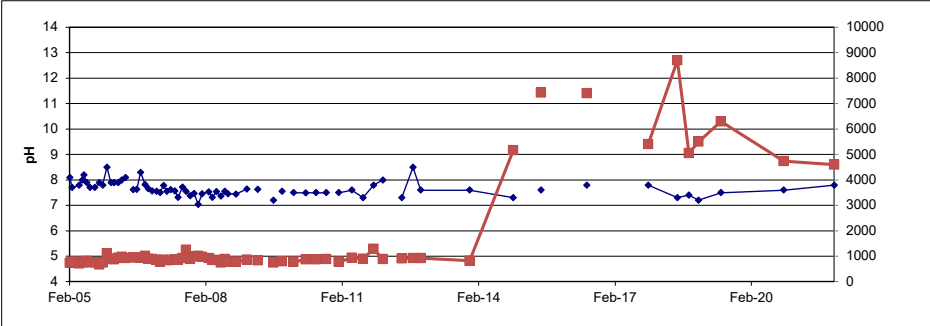
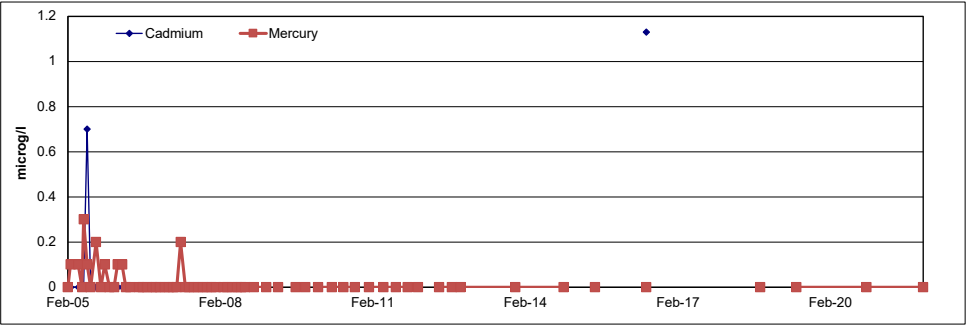


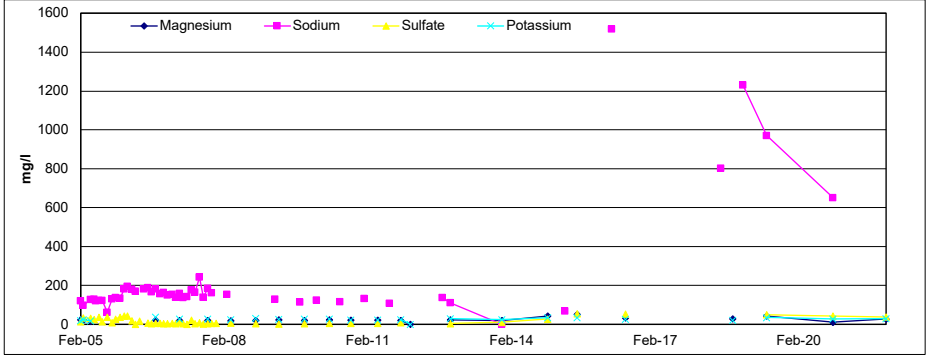
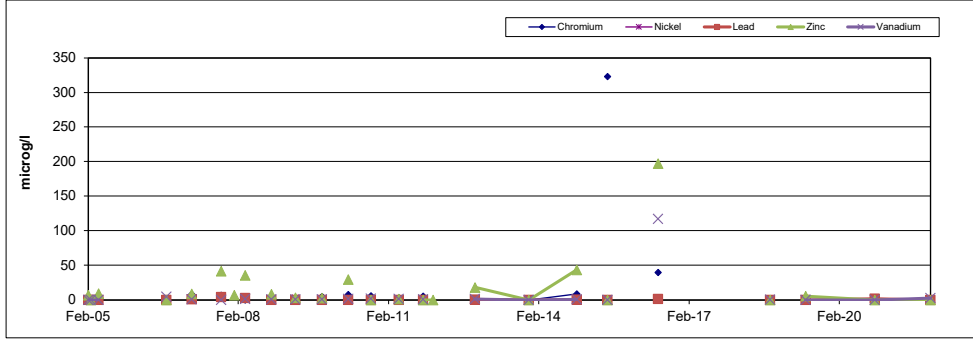
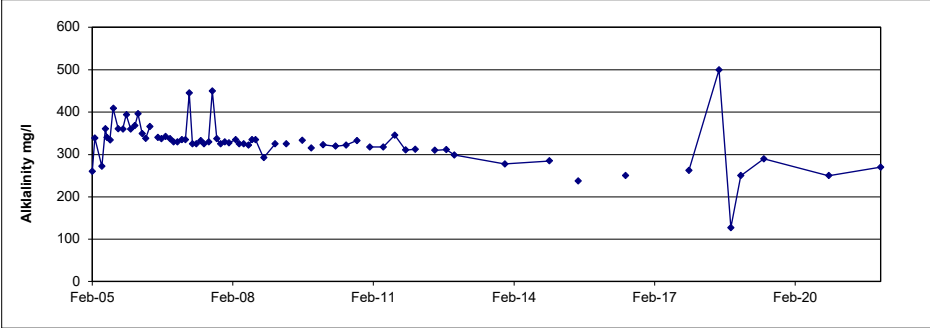
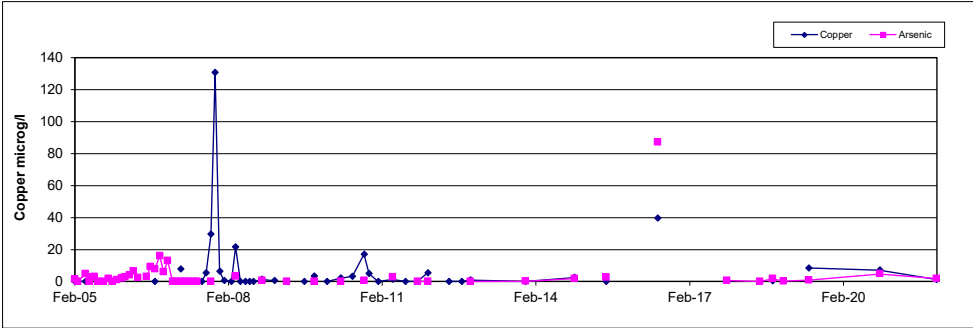
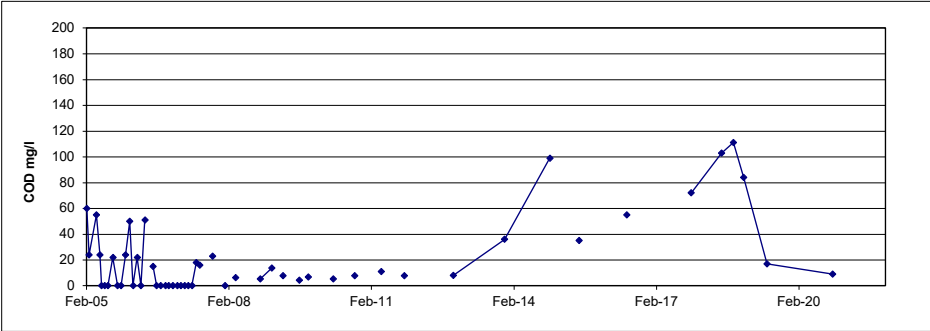
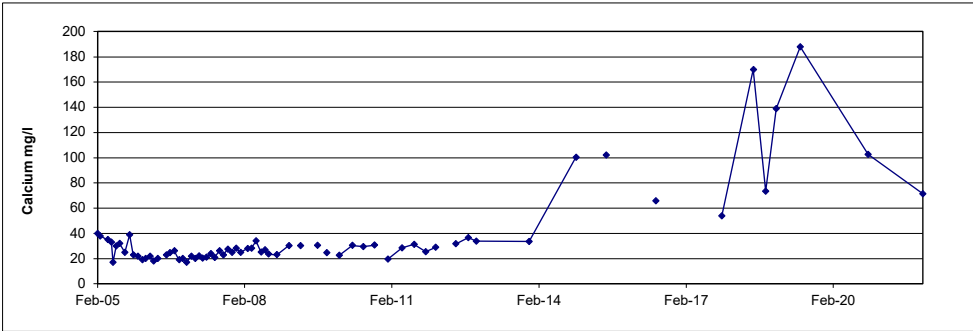


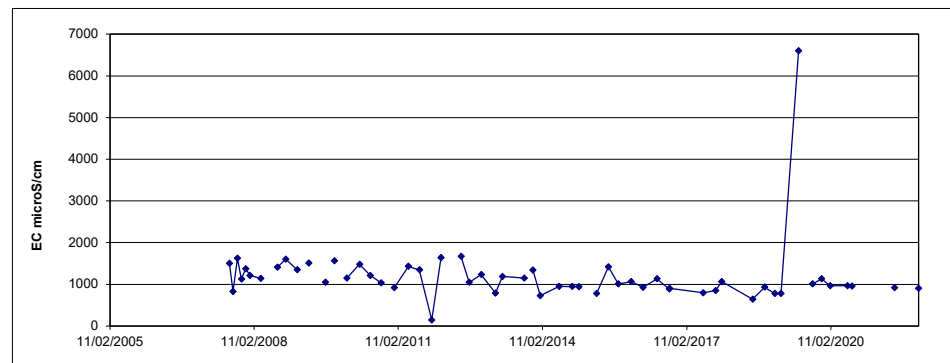
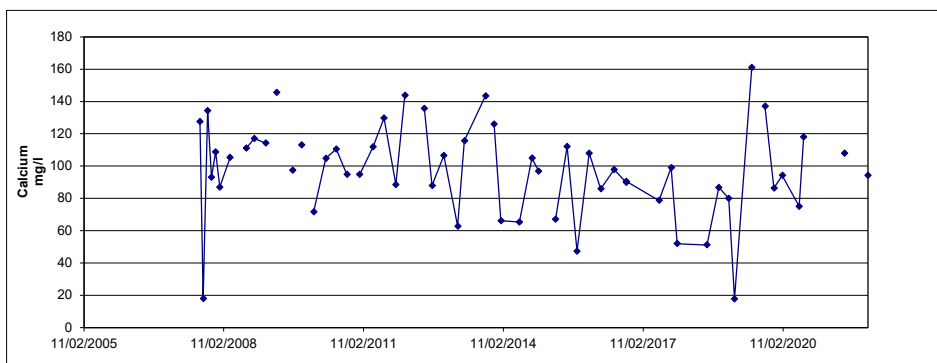
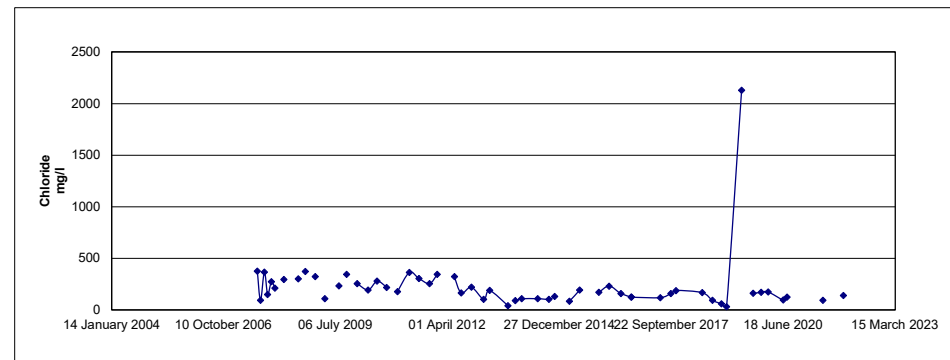
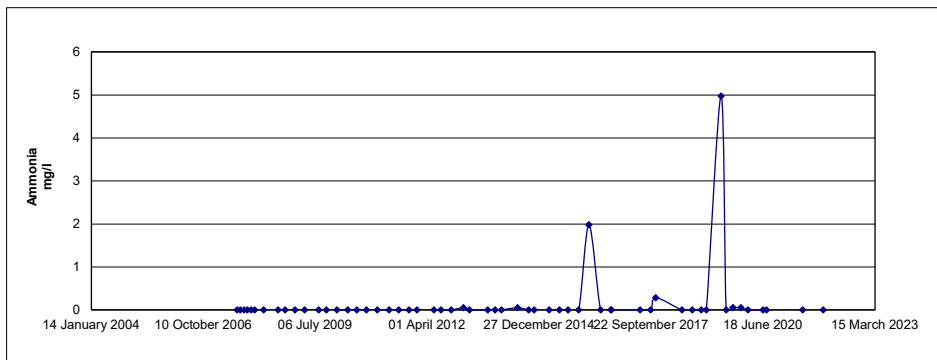
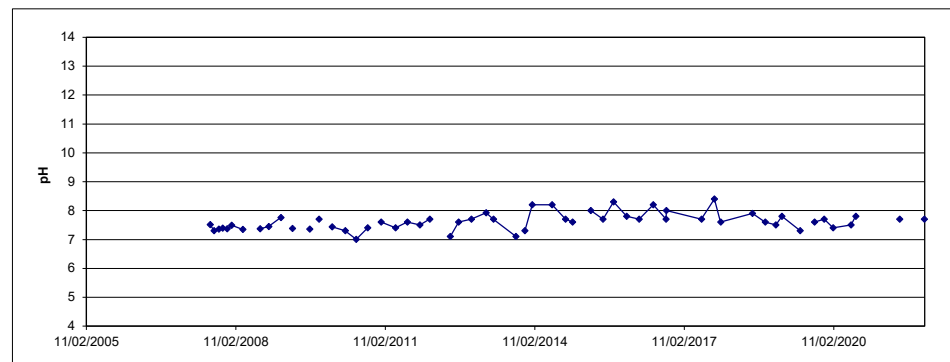
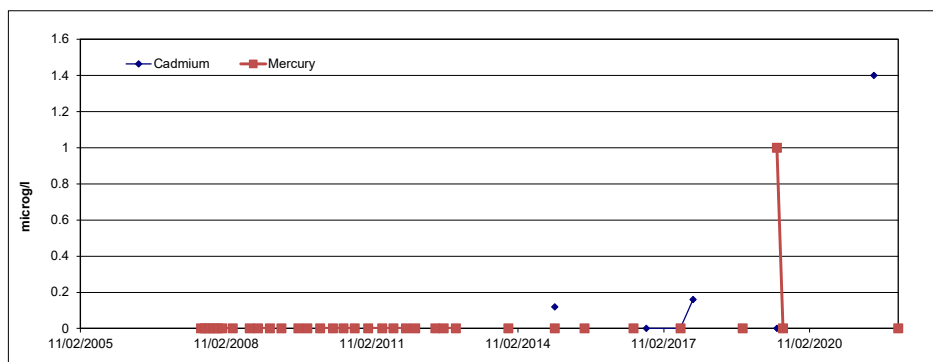


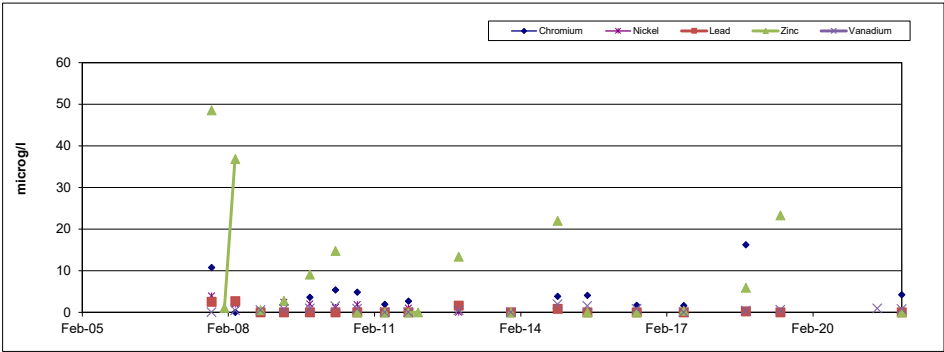
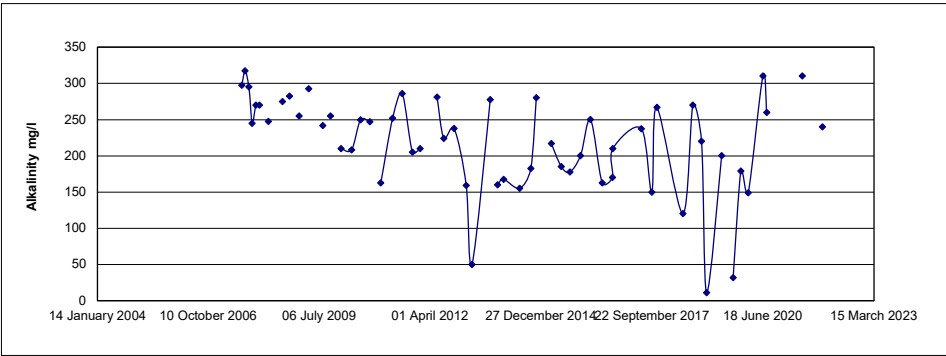
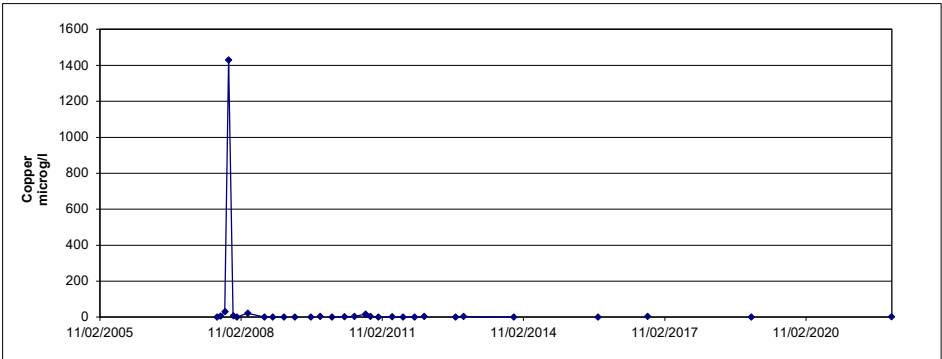


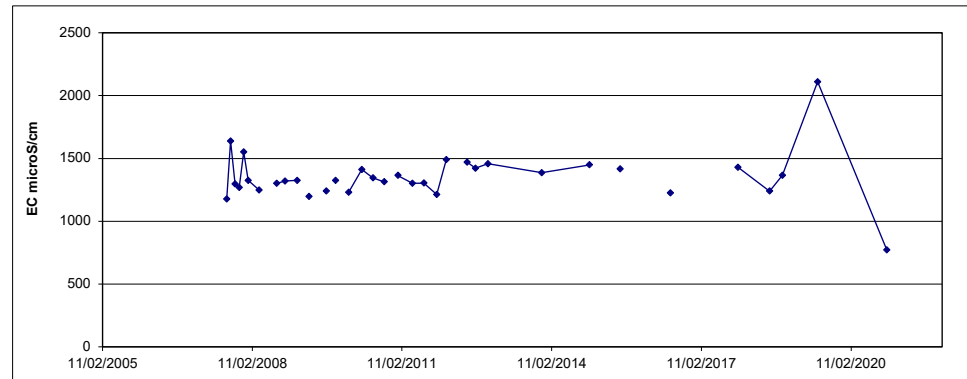
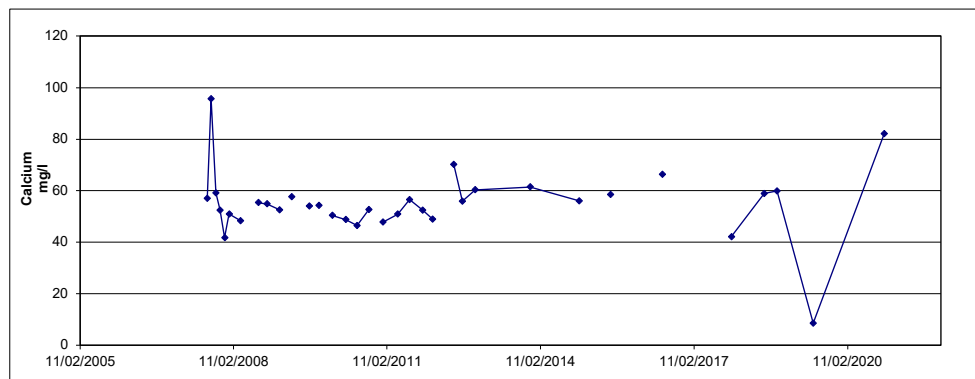
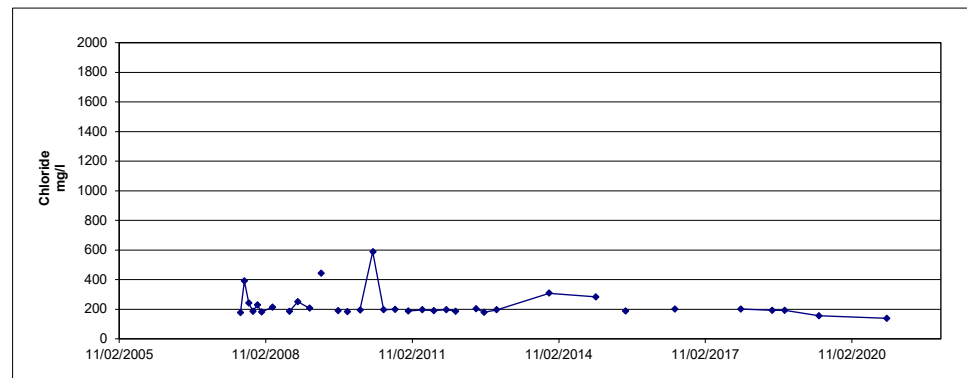
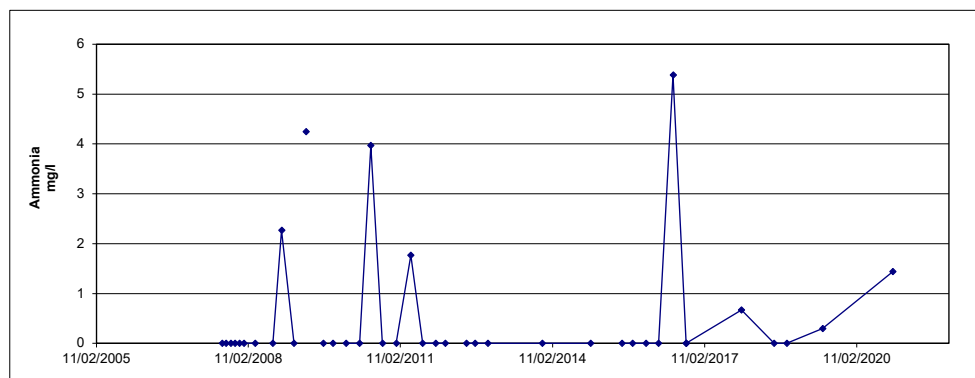
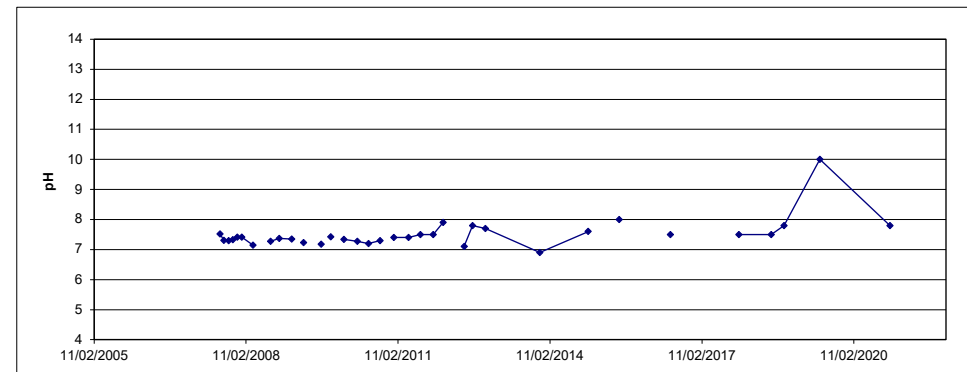
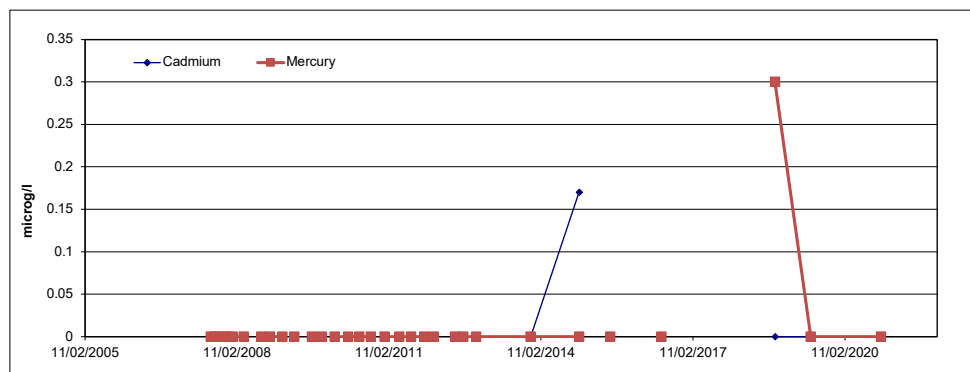


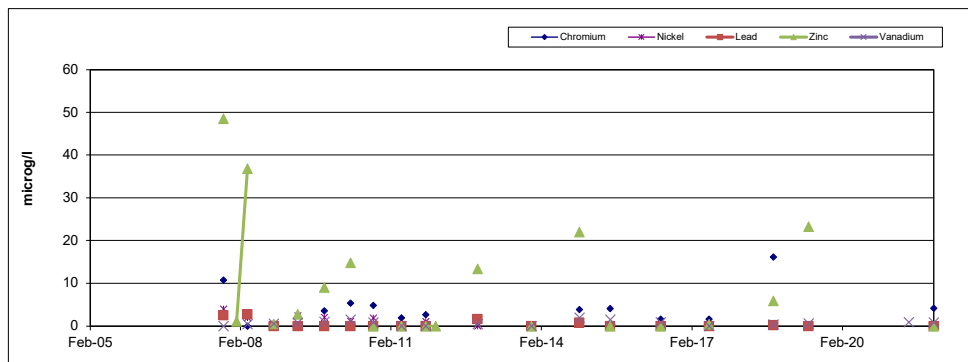
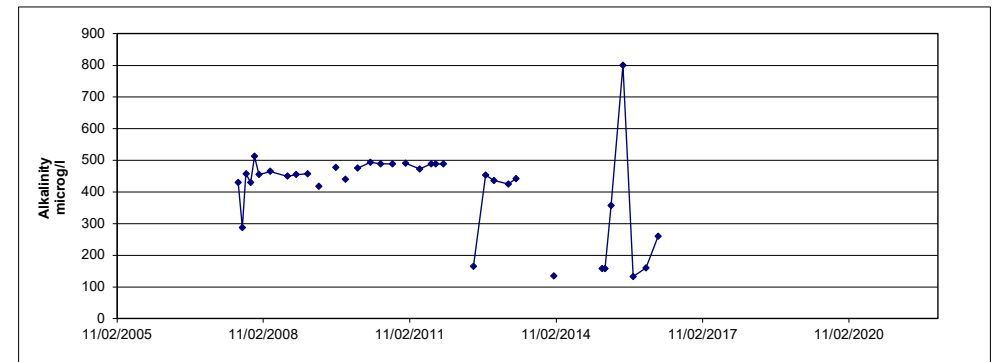
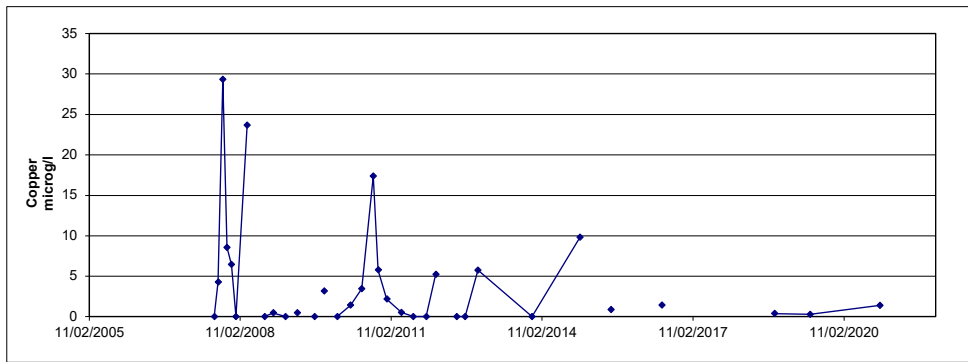


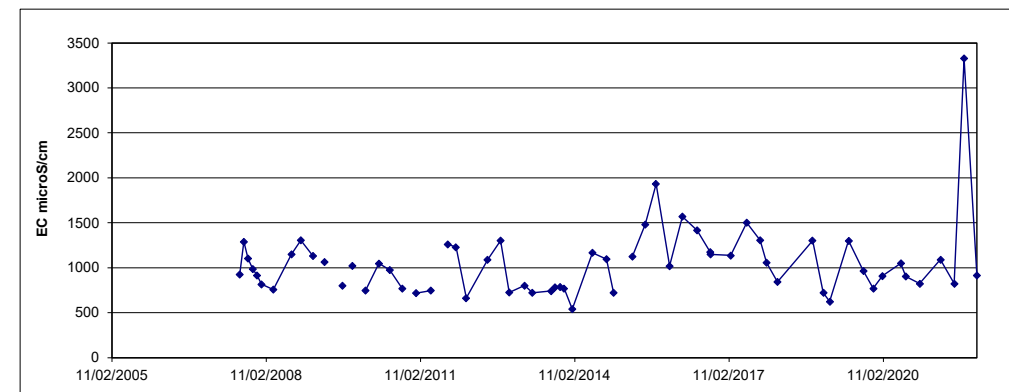
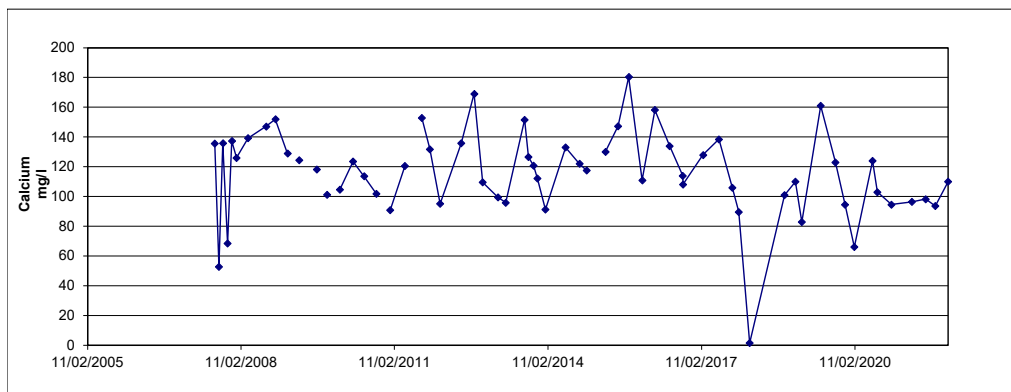
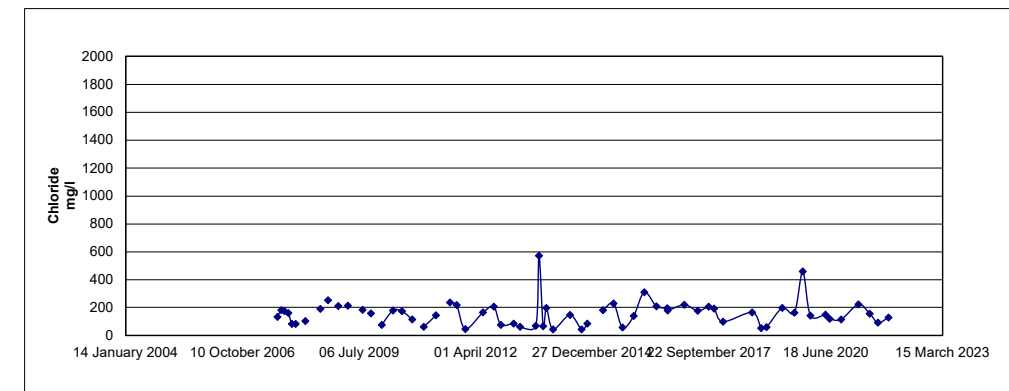
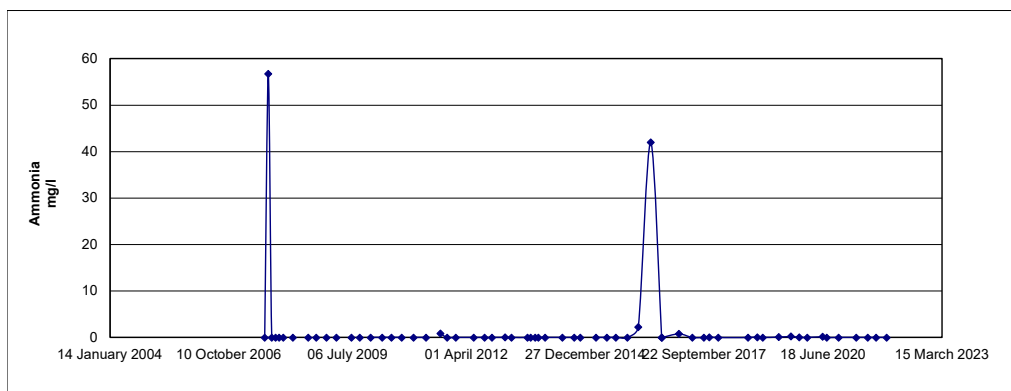
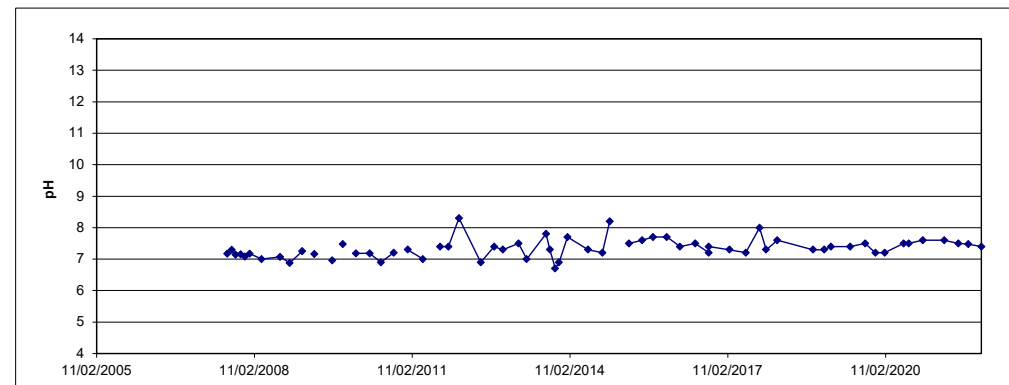
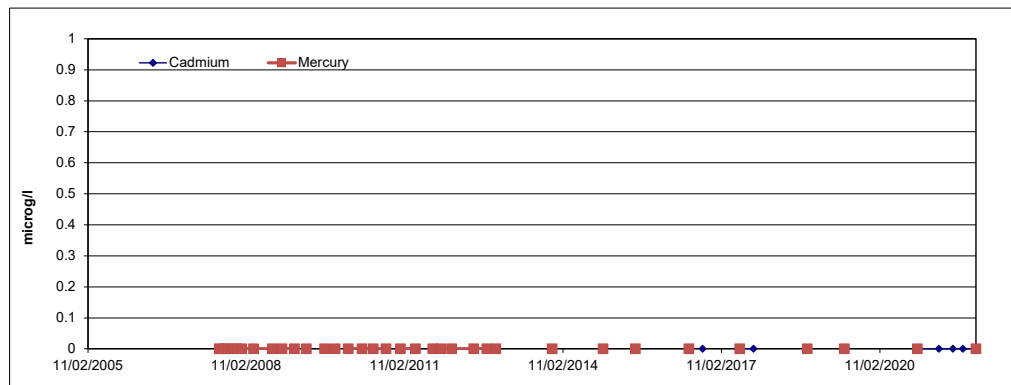


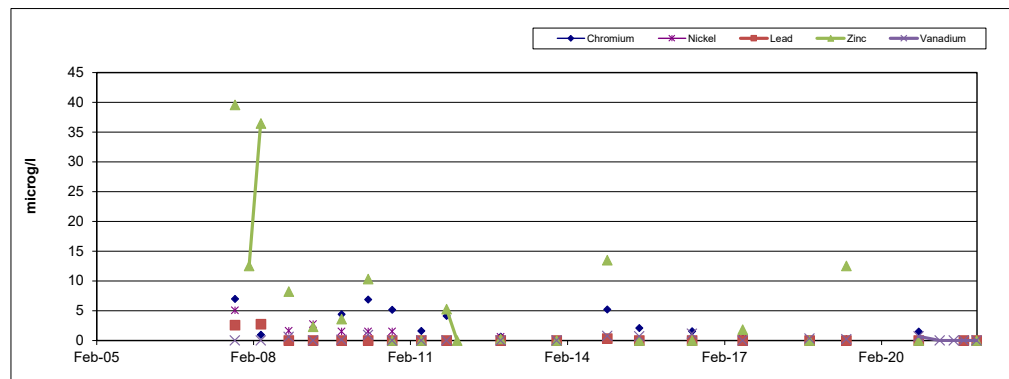
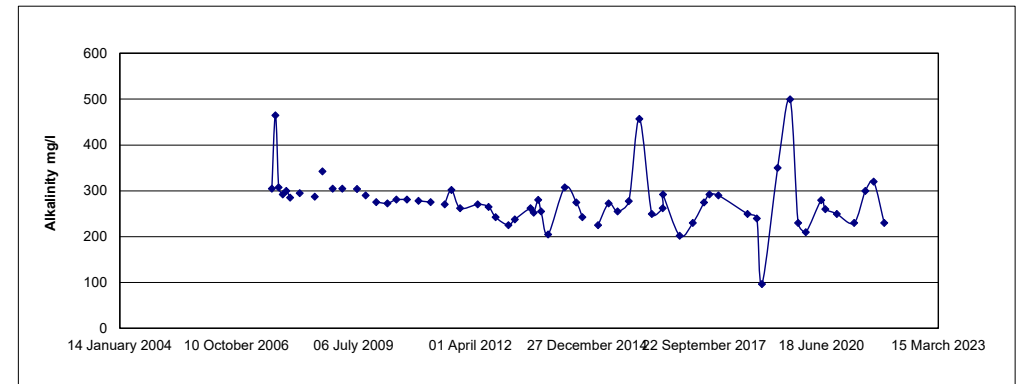
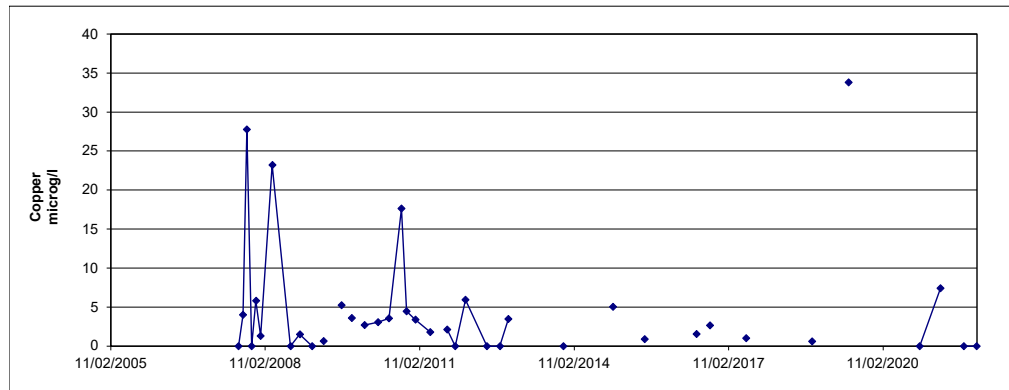


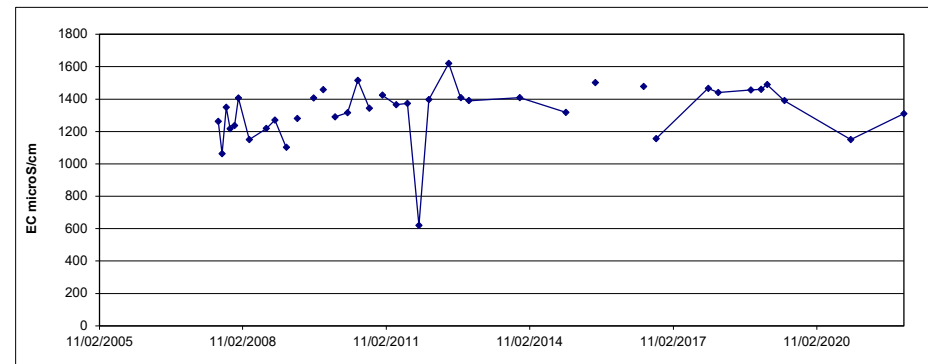
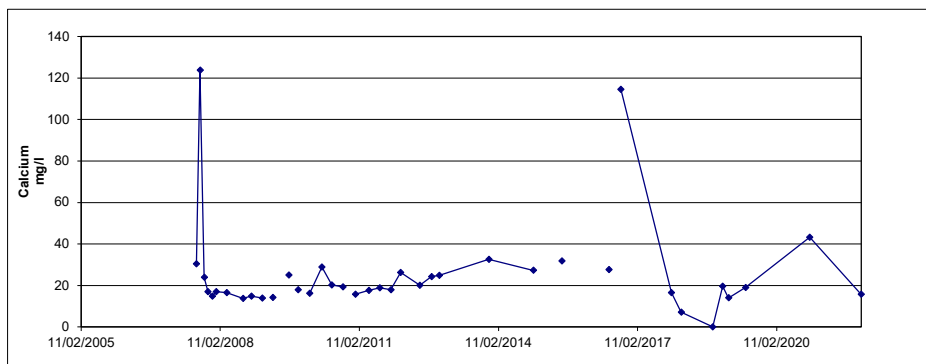
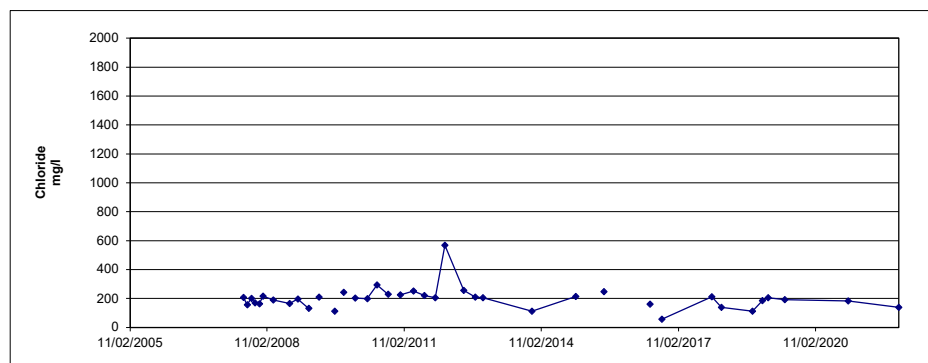
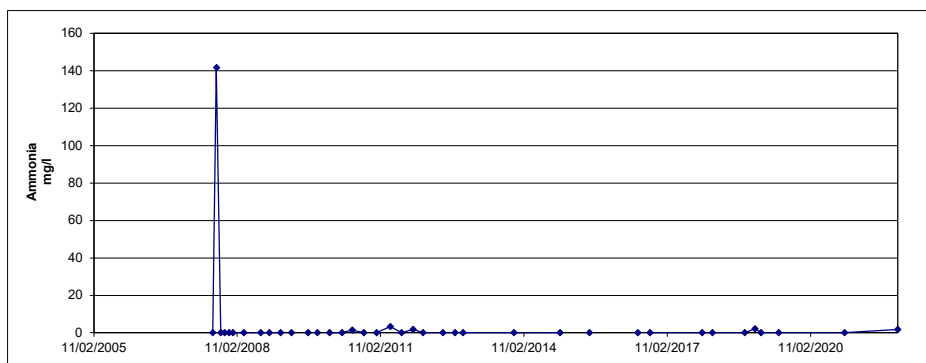
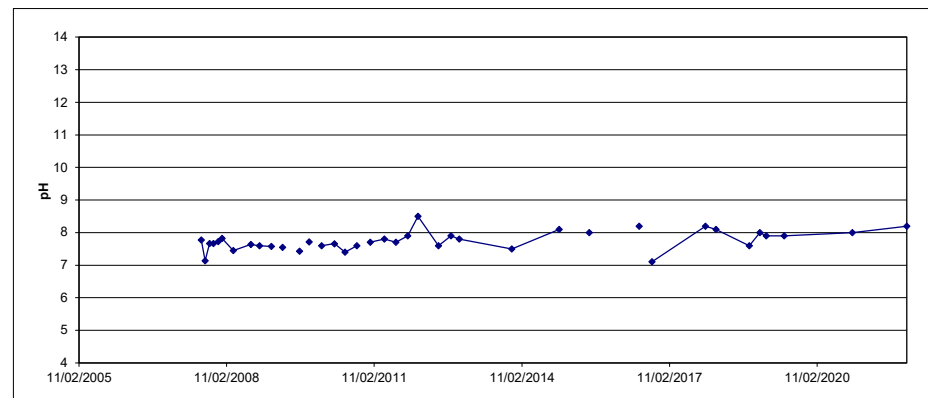
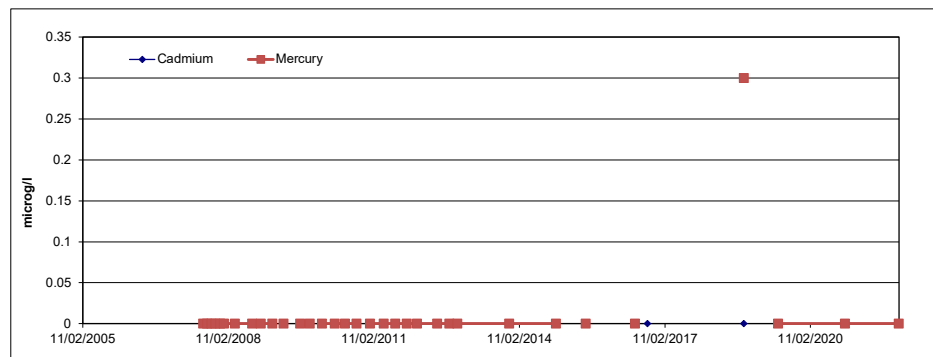


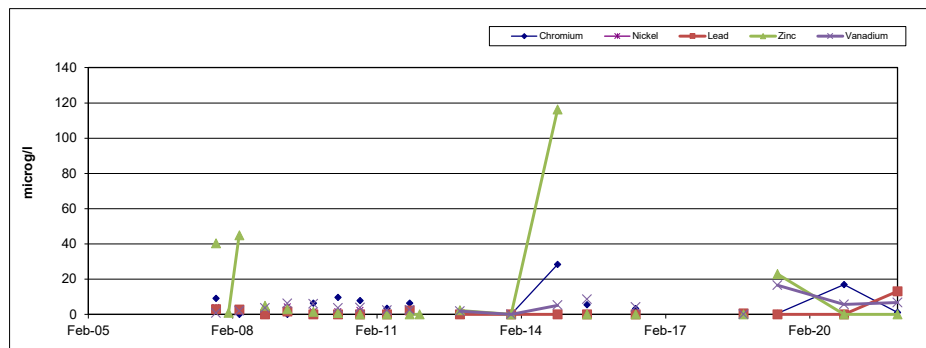
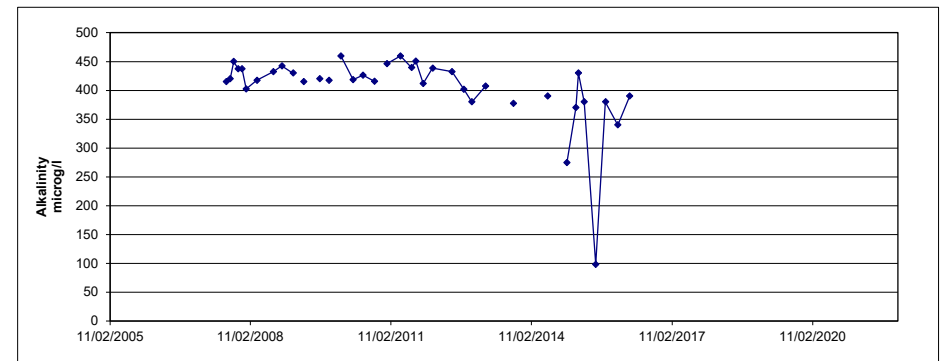
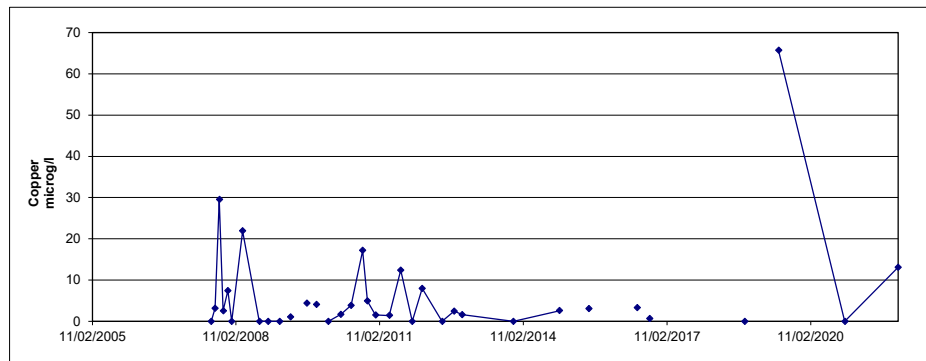












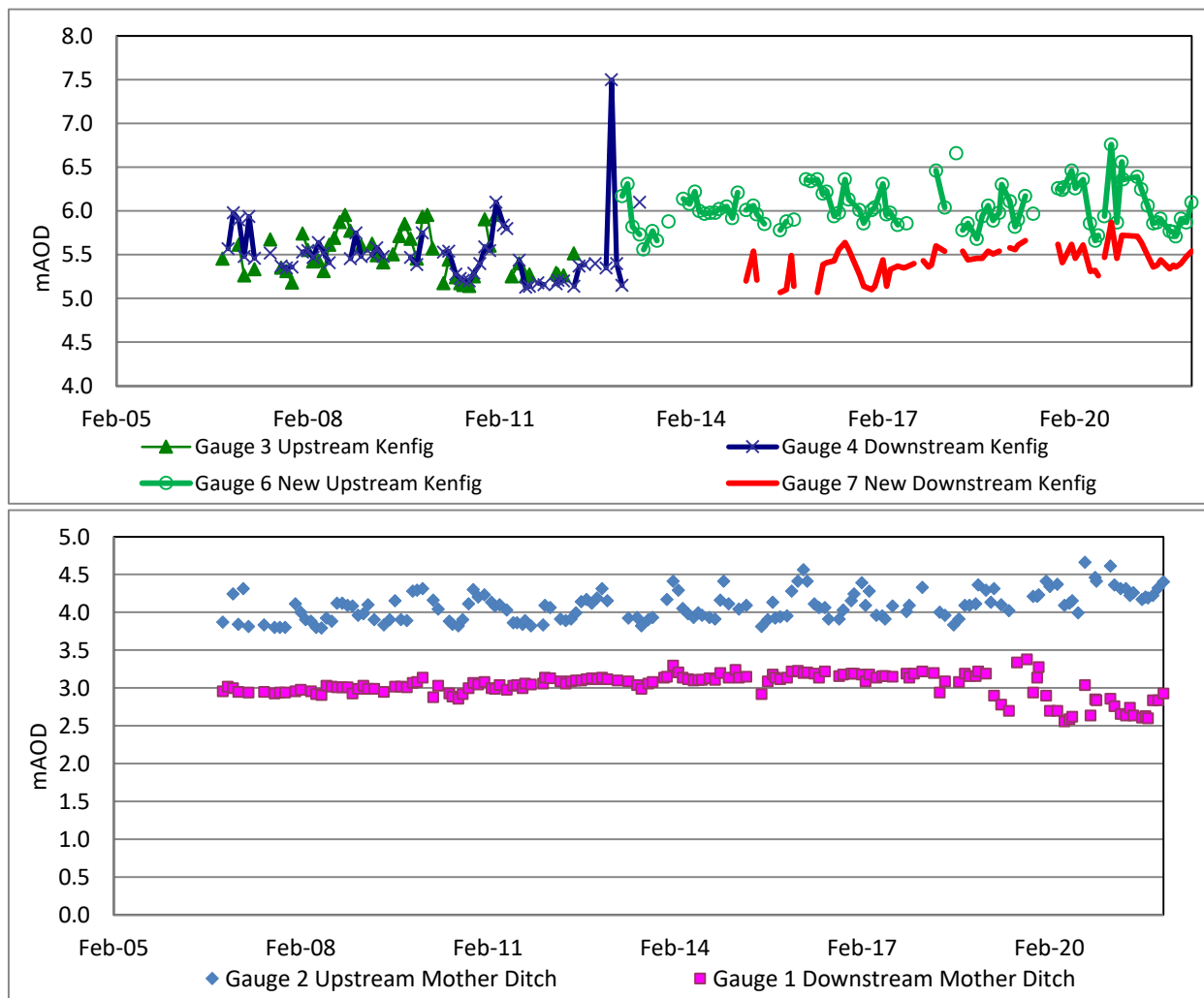
**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

PERMIT BW2692IM

**2020 Annual Review of
Environmental
Monitoring Results**

**Appendix 5
Temporal Variation of
Surface Water Levels**

Report Number 2191r1v1d0222



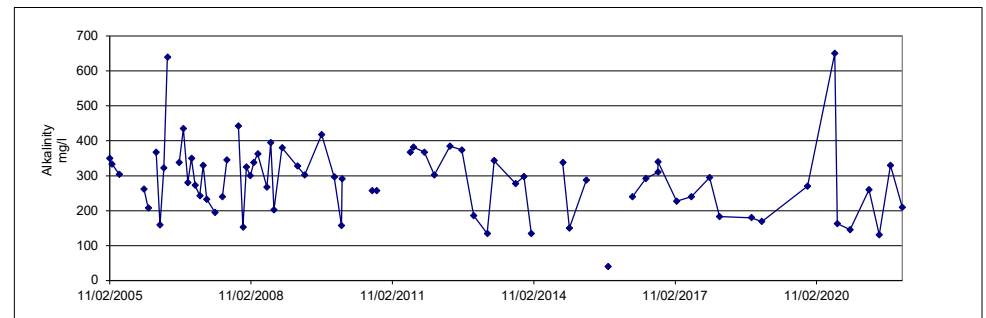
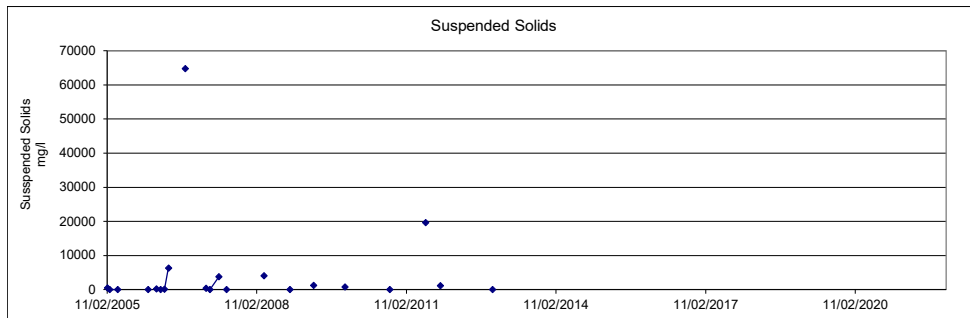
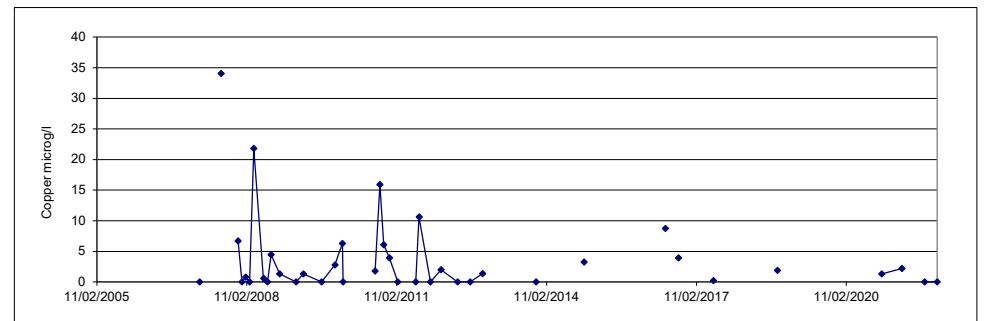
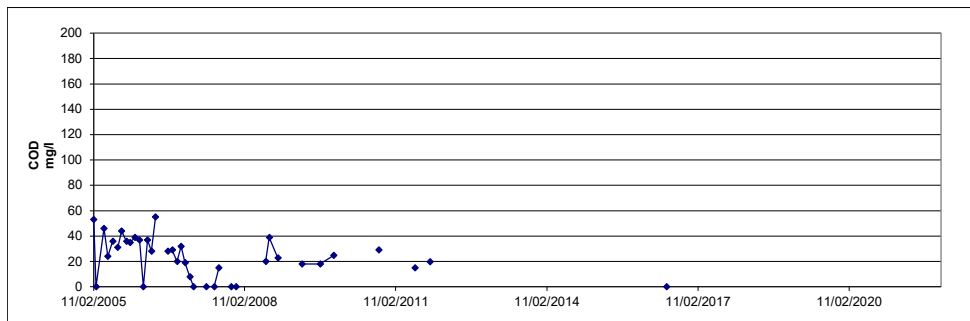
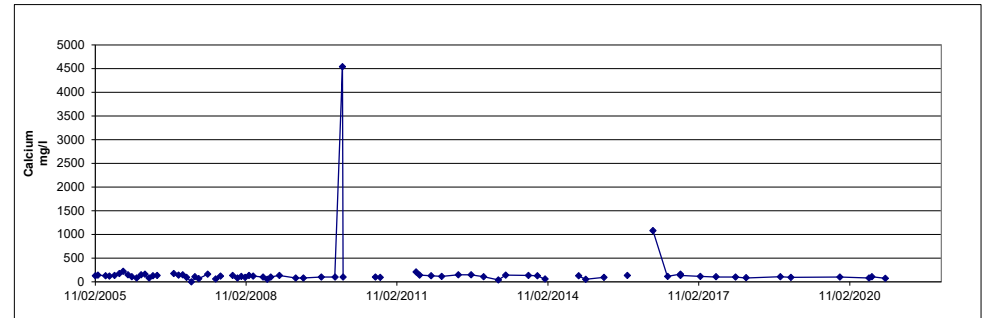
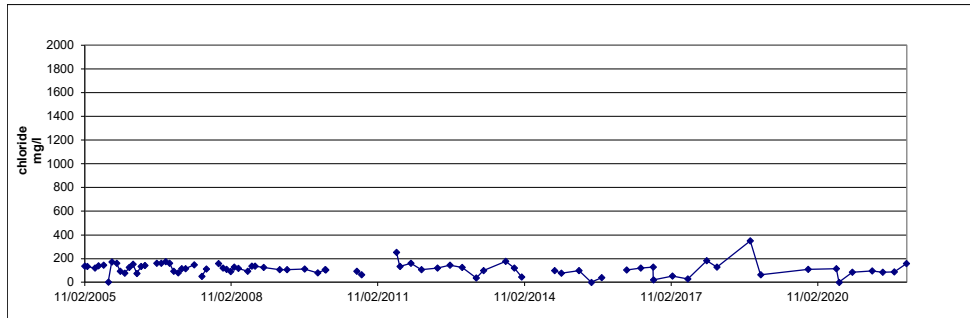
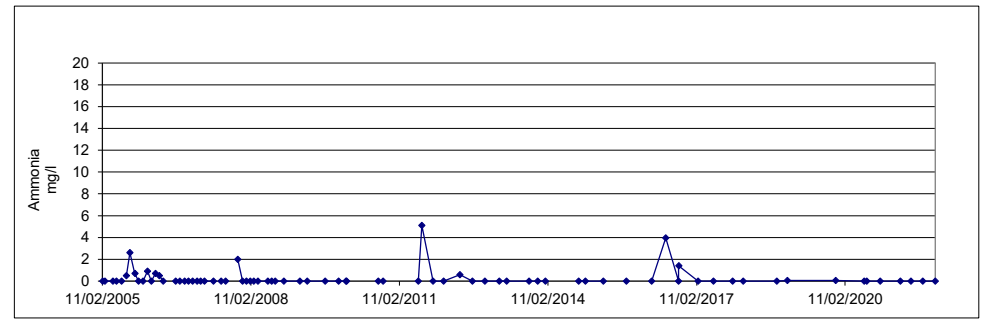
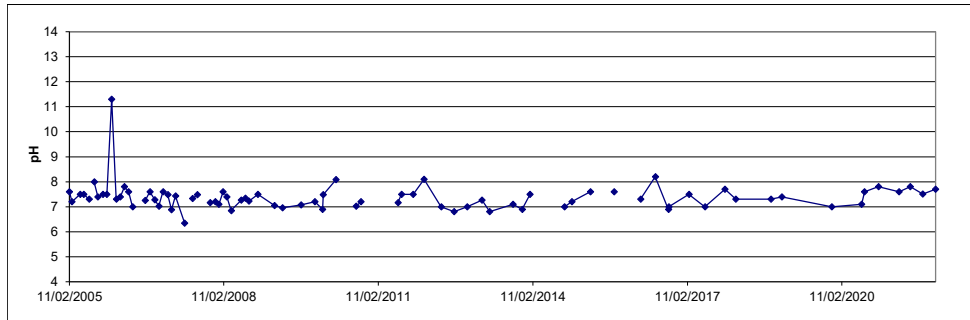
**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

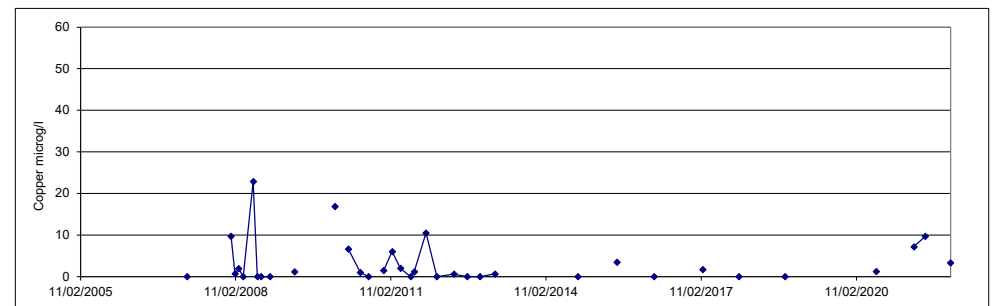
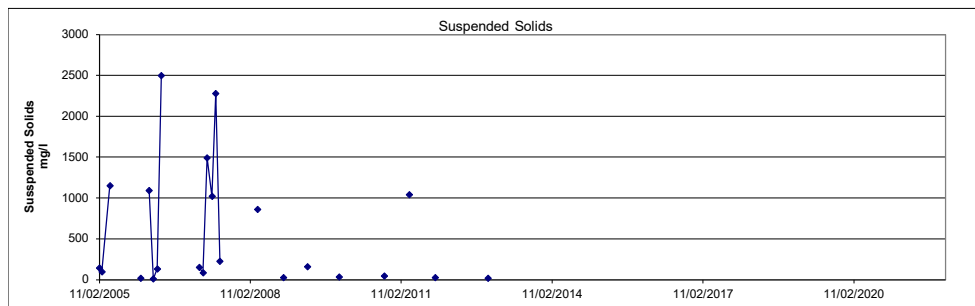
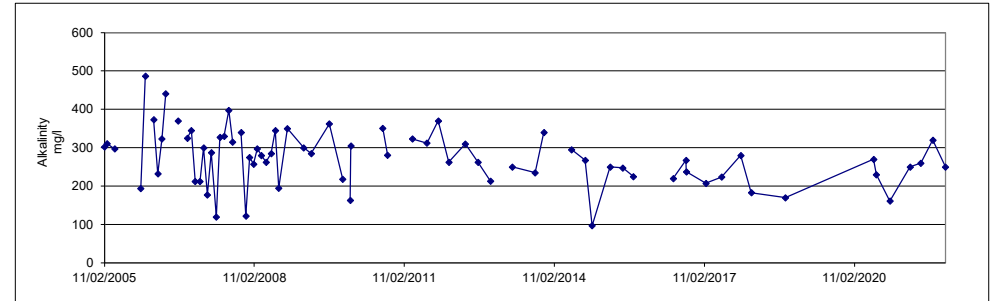
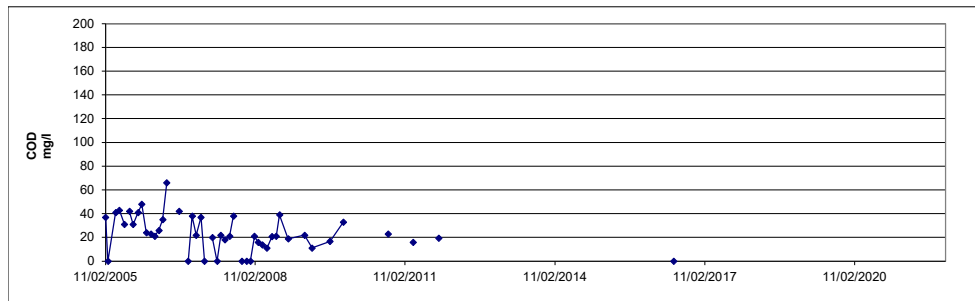
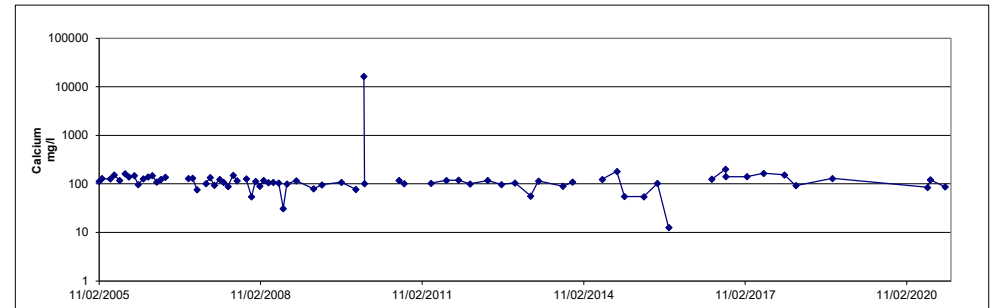
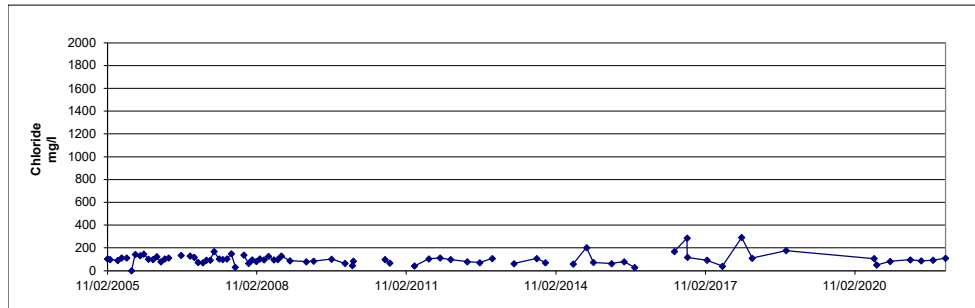
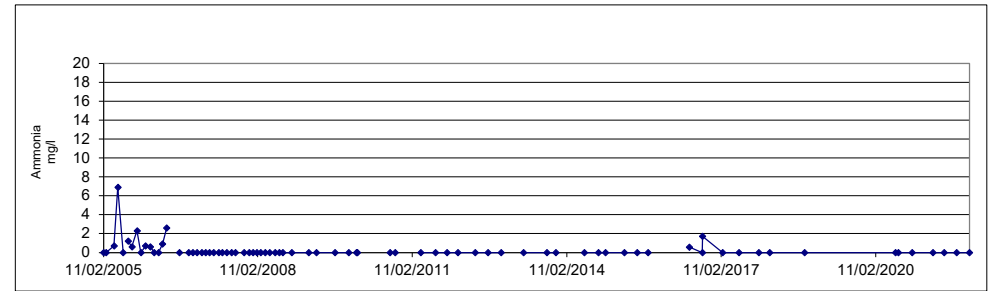
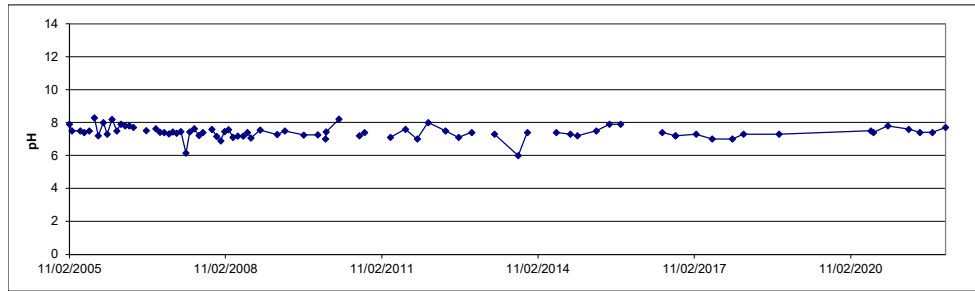
PERMIT BW2692IM

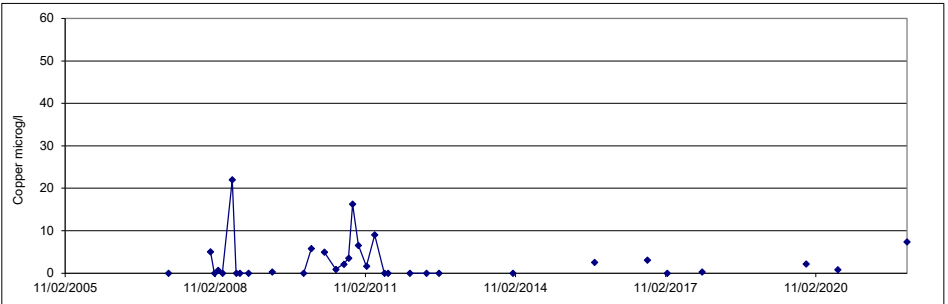
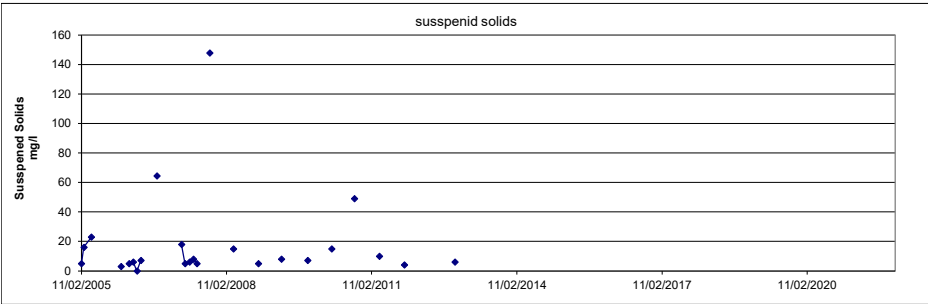
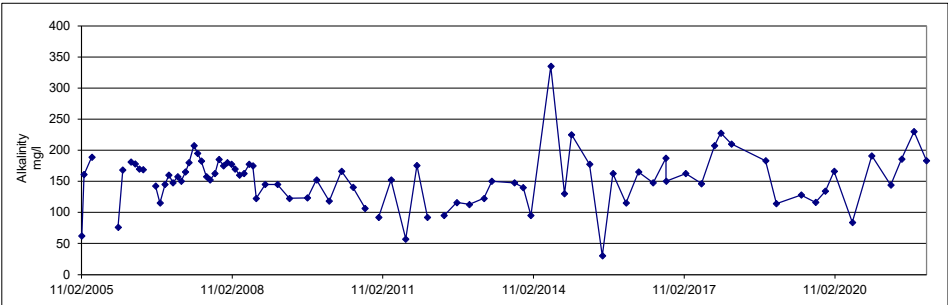
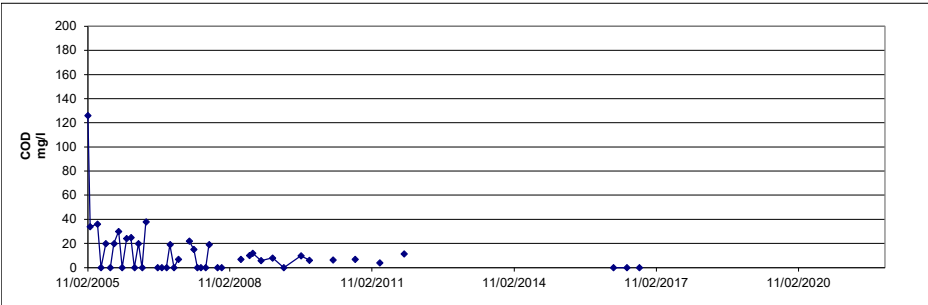
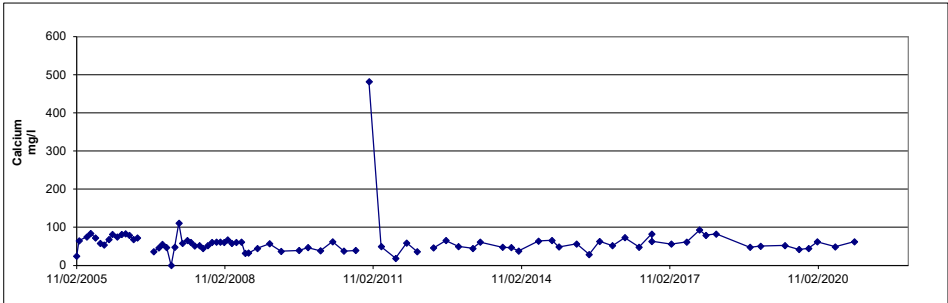
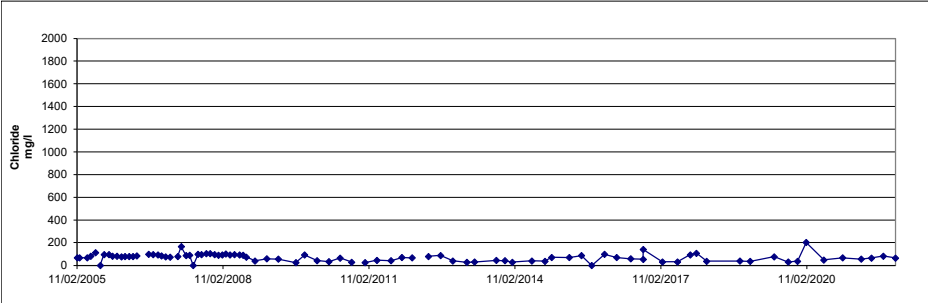
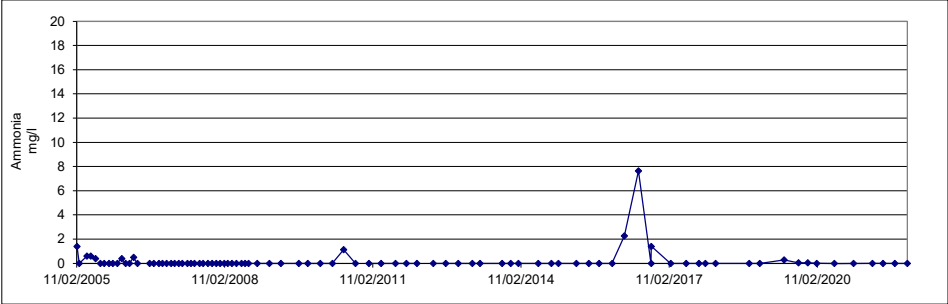
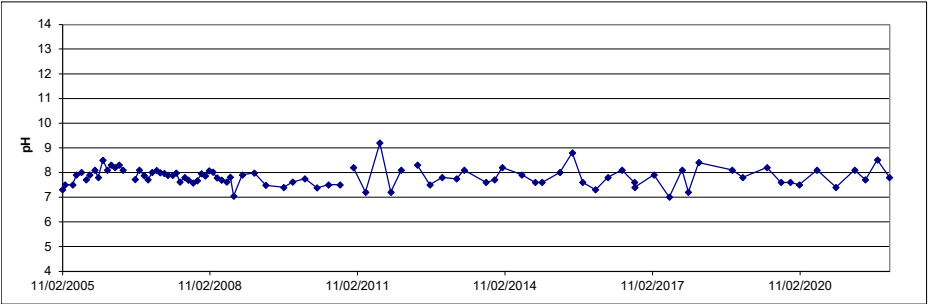
**2020 Annual Review of
Environmental
Monitoring Results**

**Appendix 6
Temporal Variation of
Surface Water
Chemistry**

Report Number 2191r1v1d0222







**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

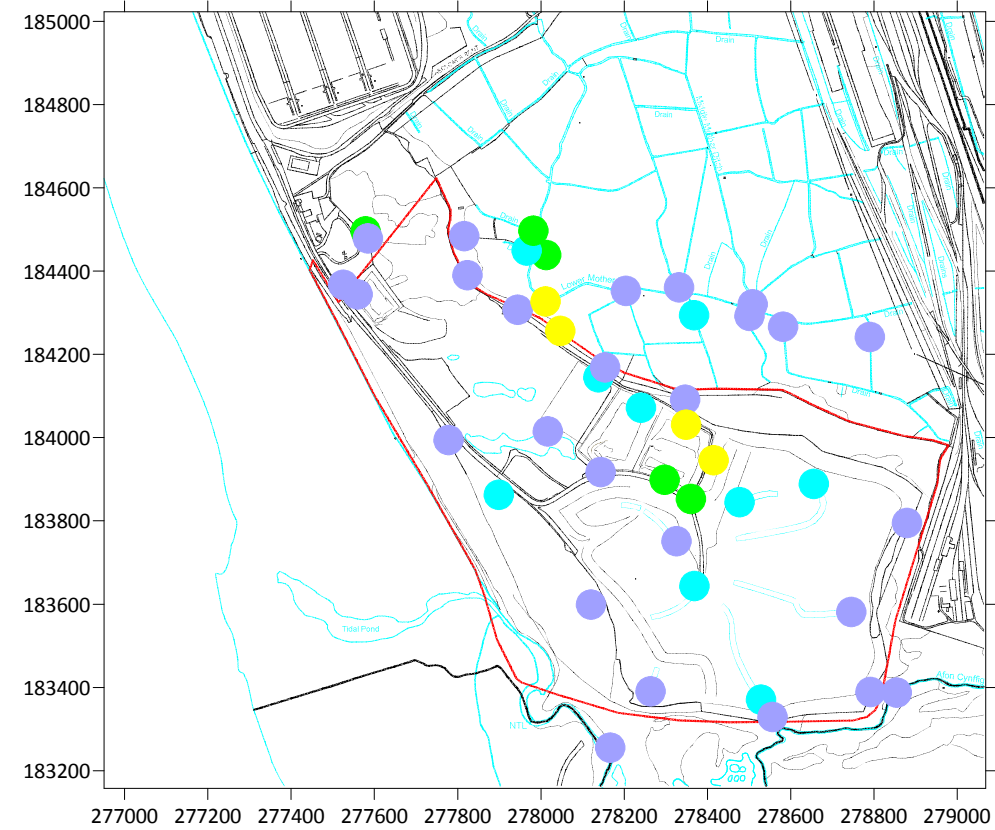
PERMIT BW2692IM

**2020 Annual Review of
Environmental
Monitoring Results**

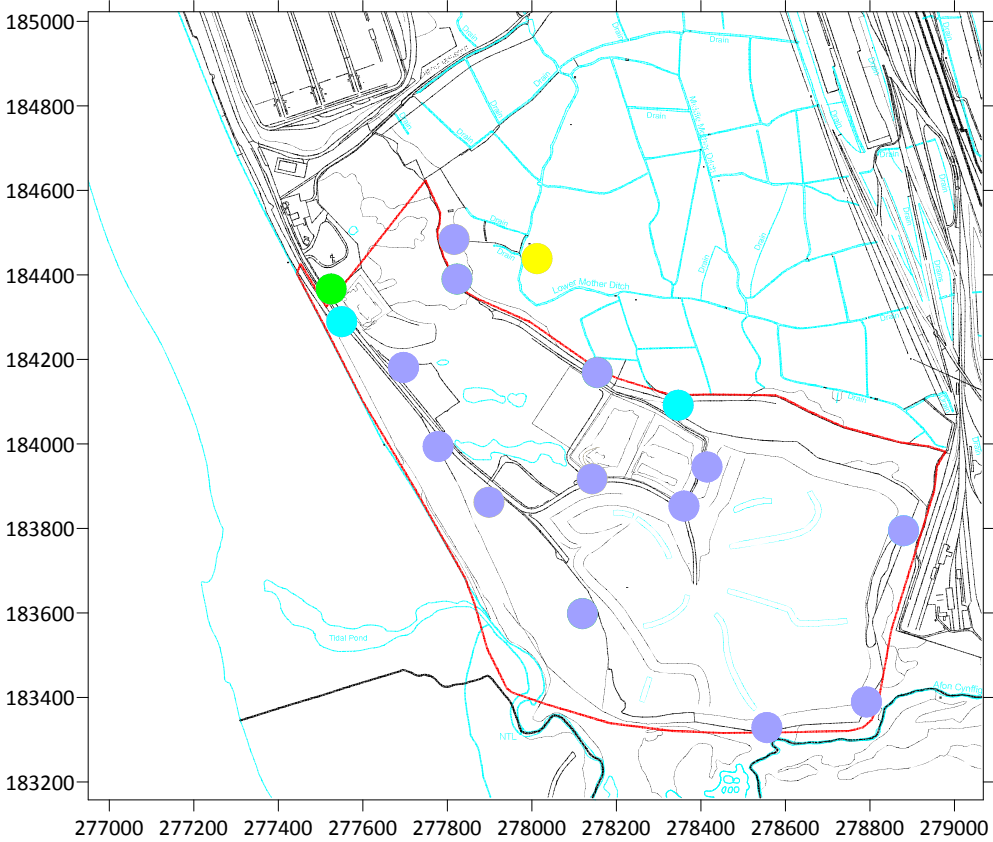
**Appendix 7
Spatial Distribution of
Key Parameters**

Report Number 2191r1v1d0222

Copper in Groundwater, Leachate and Surface Water (microg/l)

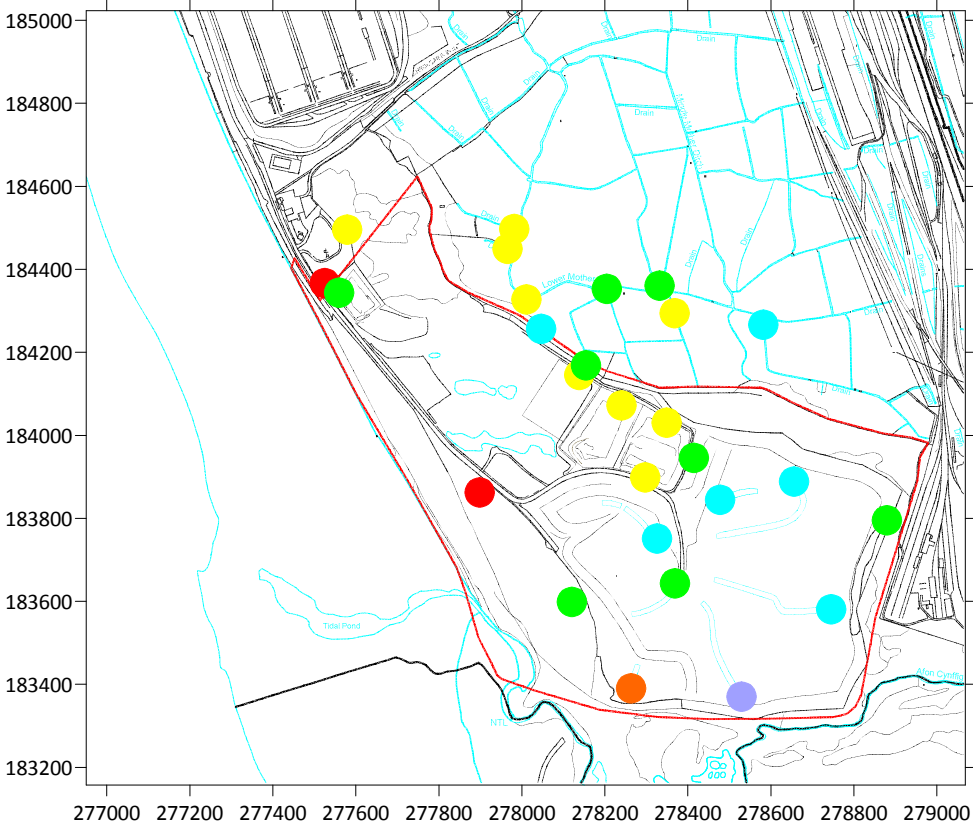


Q4, 2020 - Shallow GW, Leachate, Ponds and Surface Water

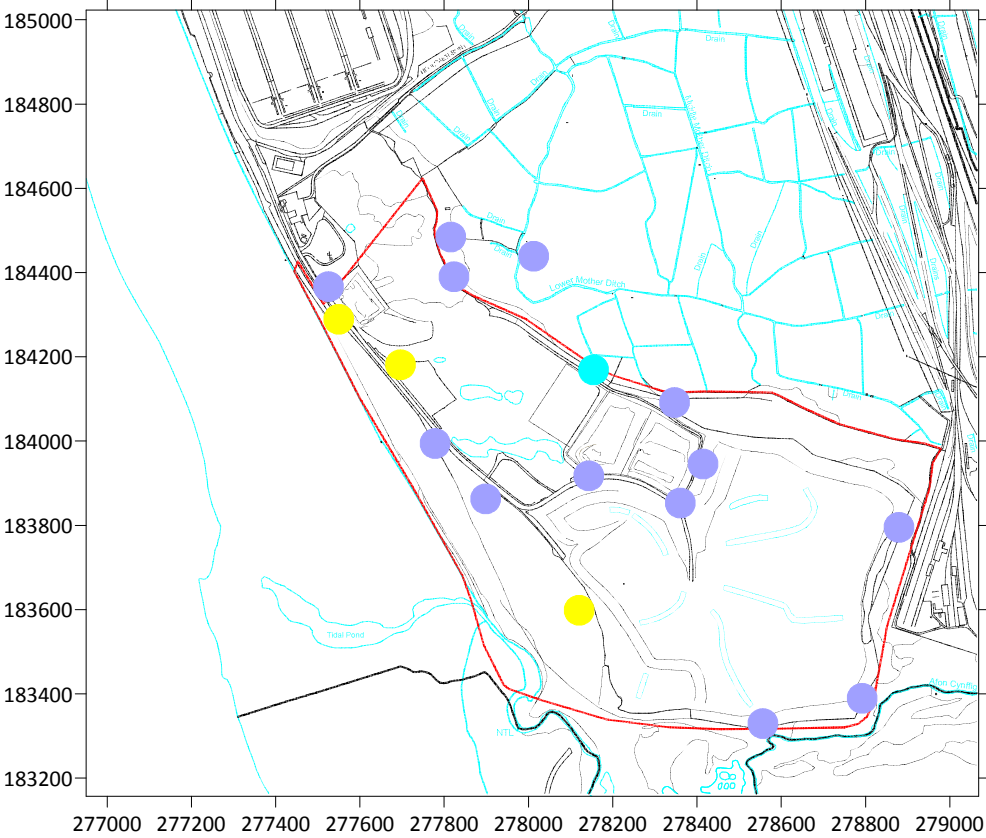


Q4, 2020 - Deep Groundwater

Zinc in Groundwater, Leachate and Surface Water (microg/l)

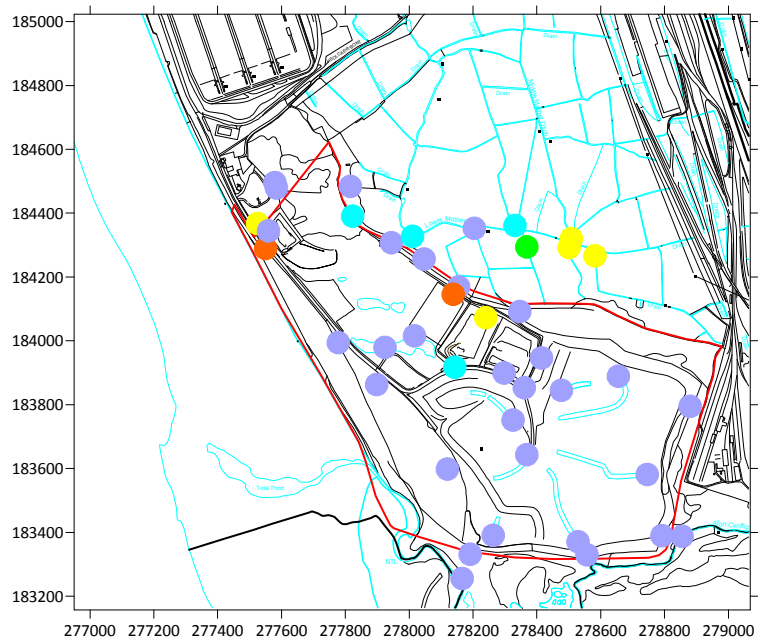


Q4, 2020 - Shallow GW, Leachate, Ponds and Surface Water

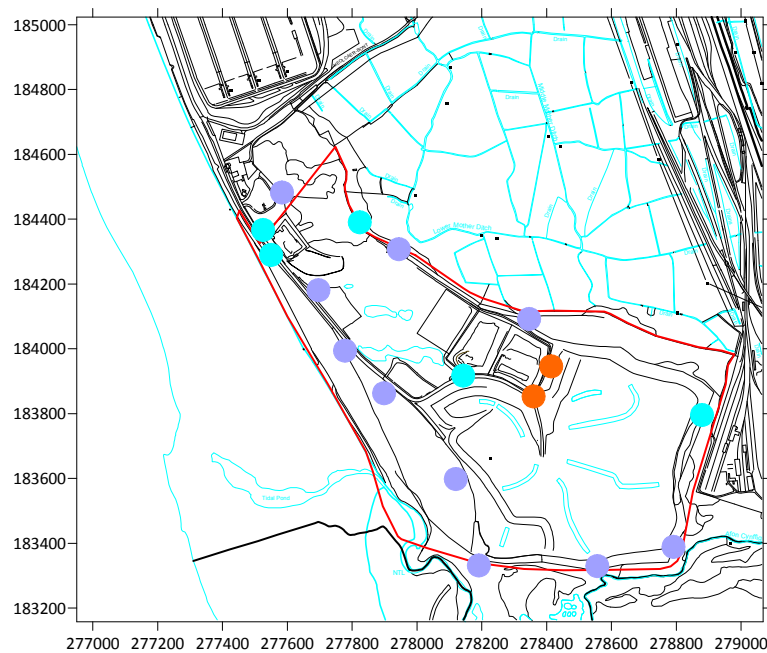


Q4, 2020 - Deep Groundwater

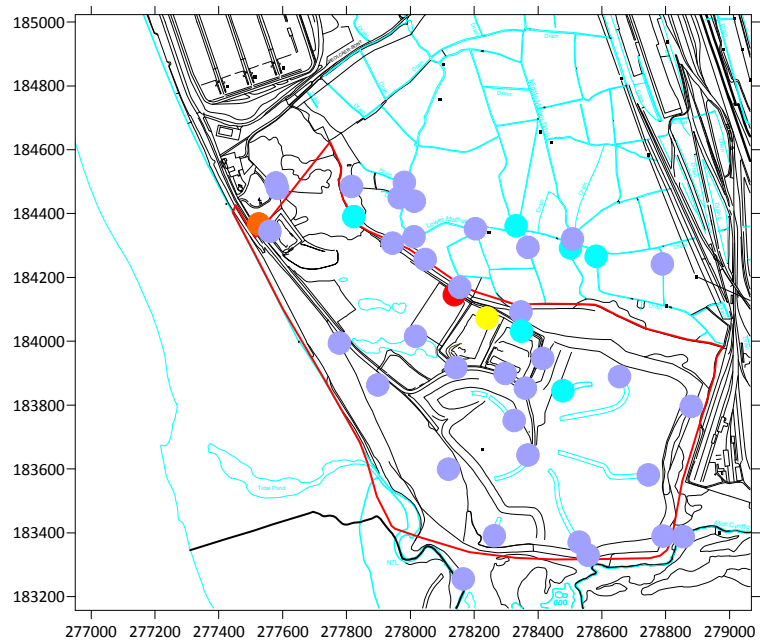
Chloride in Groundwater, Leachate and Surface Water (mg/l)



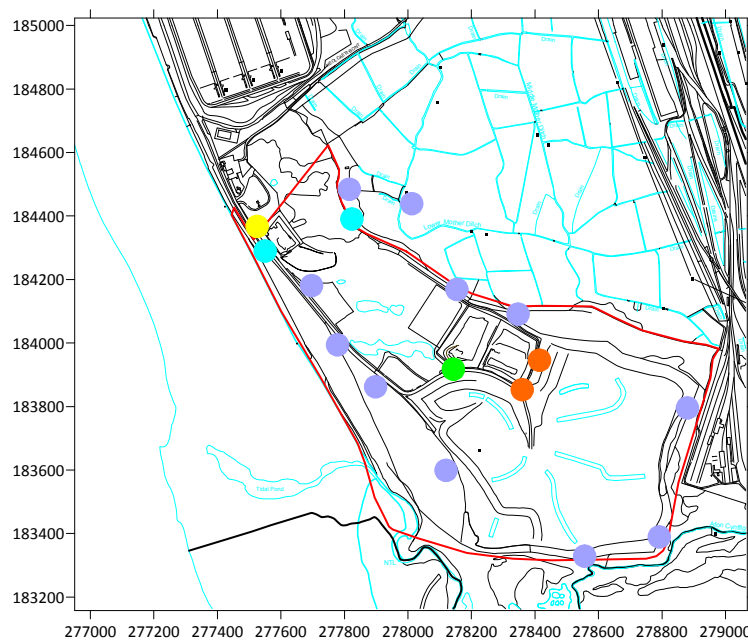
June 2019 - Shallow GW, Leachate, Ponds and Surface Water



June 2019 - Deep Groundwater

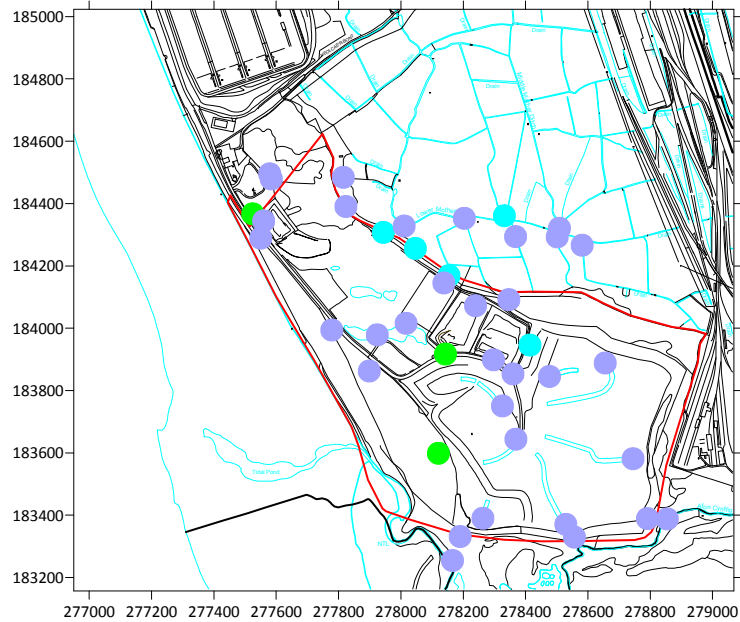


Q4, 2020 - Shallow GW, Leachate, Ponds and Surface Water

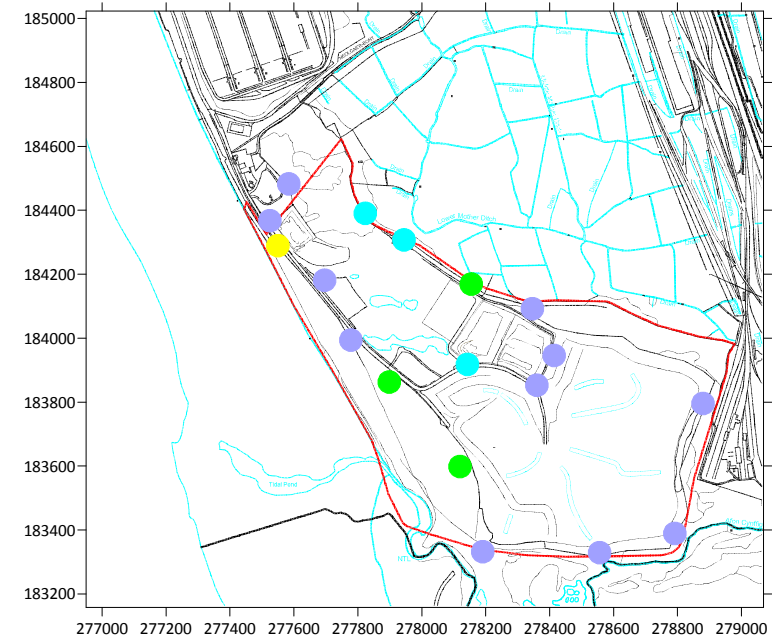


Q4 2020 - Deep Groundwater

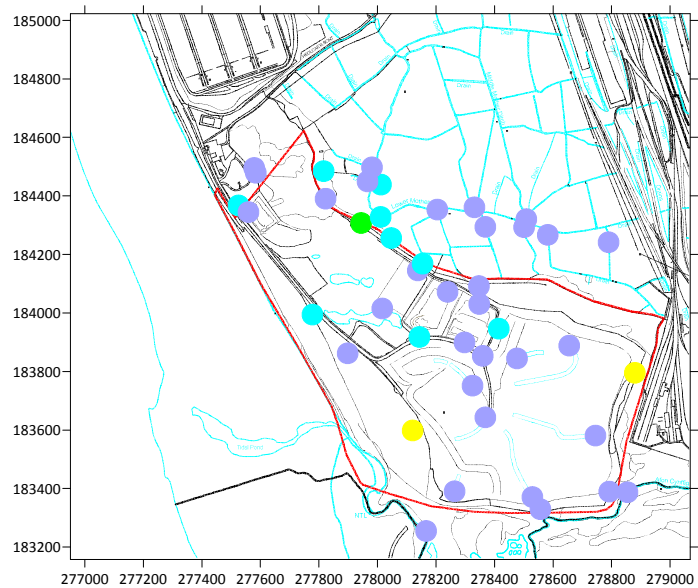
Arsenic in Groundwater, Leachate and Surface Water (microg/l)



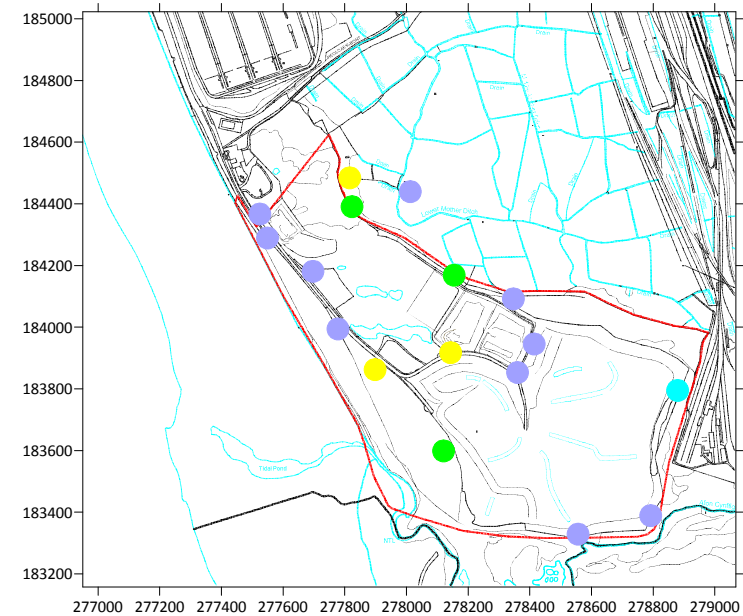
June 2019 - Shallow GW, Leachate, Ponds and Surface Water



June 2019 - Deep Groundwater

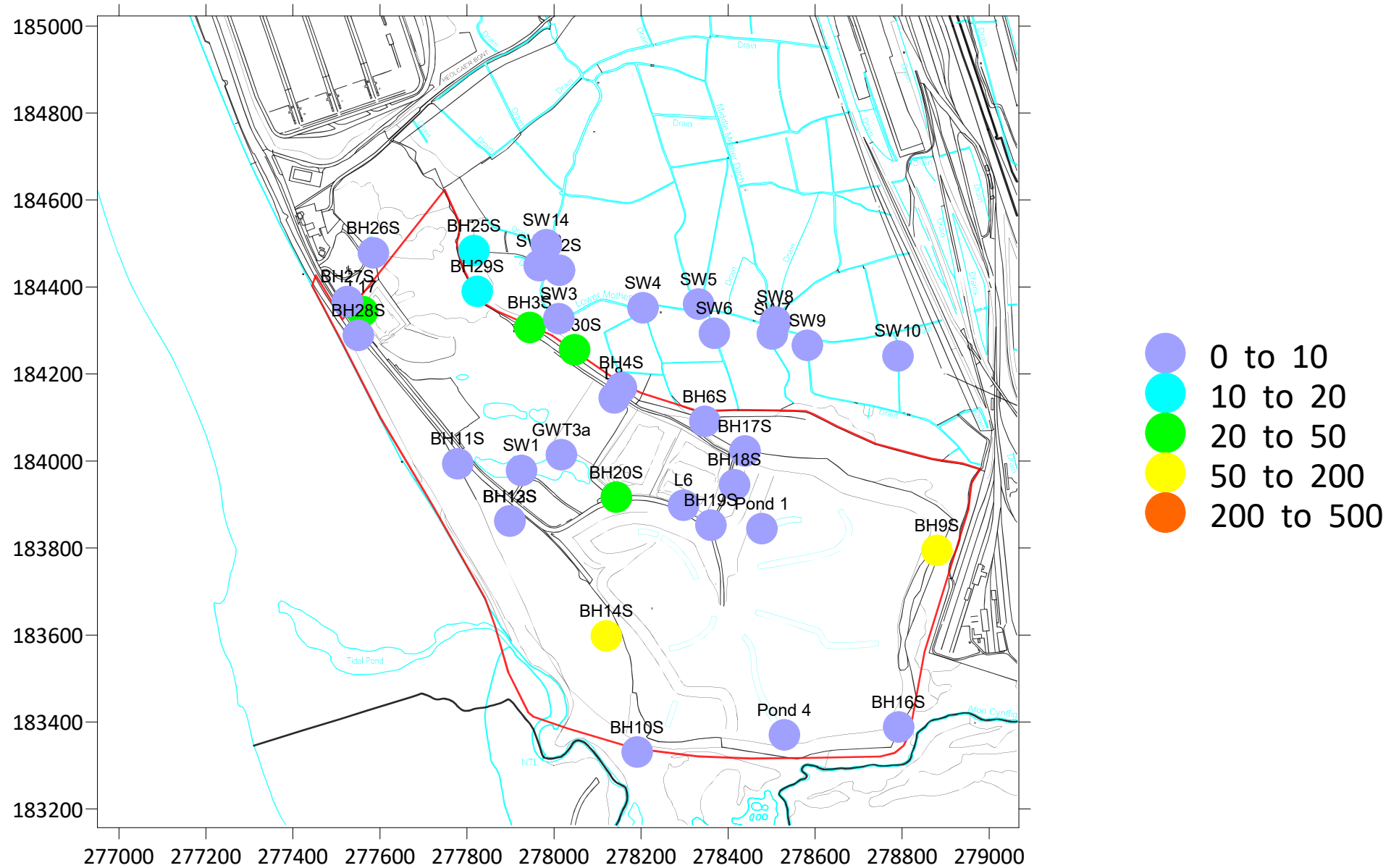


Q4, 2020 - Shallow GW, Leachate, Ponds and Surface Water



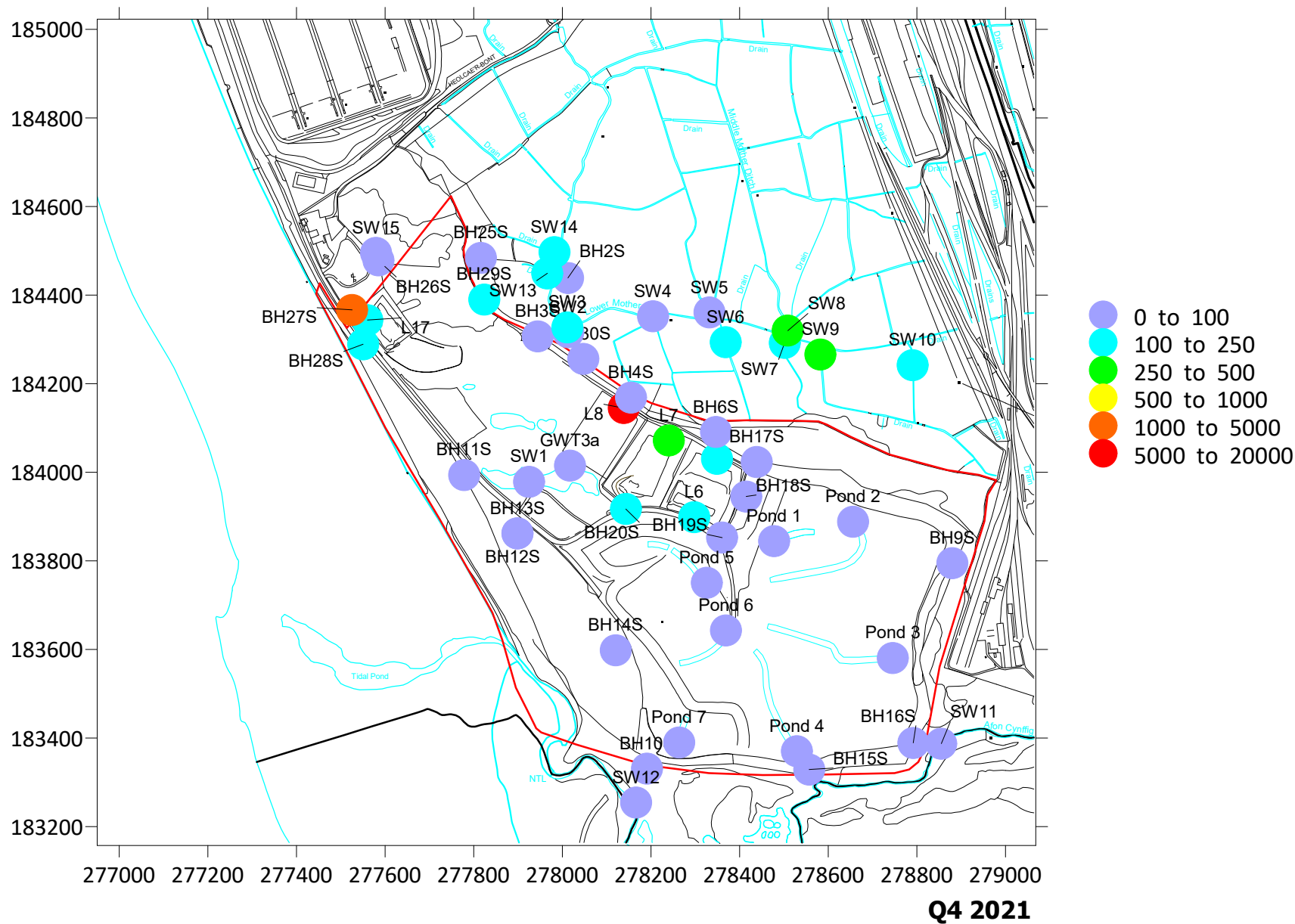
Q4, 2020 - Deep Groundwater

Arsenic in Groundwater, Leachate and Surface Water (microg/l)



Q4, 2021 - Shallow GW, Leachate, Ponds and Surface Water

Chloride in Groundwater, Leachate and Surface Water (mg/l)



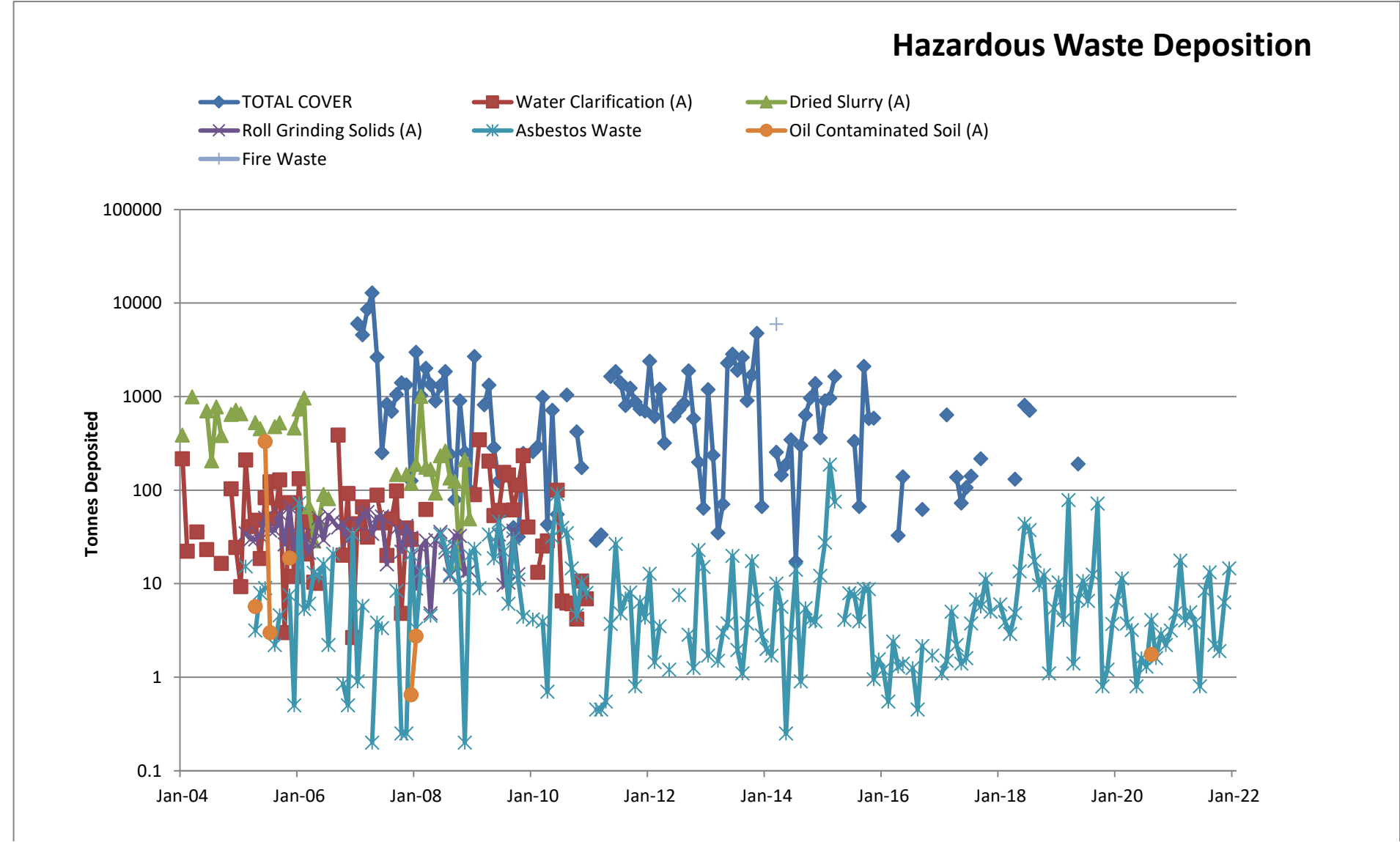
**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

PERMIT BW2692IM

**2020 Annual Review of
Environmental
Monitoring Results**

**Appendix 8
Record of Landfilled
Waste**

Report Number 2191r1v1d0222



**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

PERMIT BW2692IM

**2020 Annual Review of
Environmental
Monitoring Results**

**Appendix 9
Asbestos Monitoring
Results**

Report Number 2191r1v1d0222



D'Arcy Business Park
D'Arcy Way, Llandarcy
Neath, SA10 6EJ
Tel: 01792 323223
Fax: 01792 323236
e-mail: info@anchem.co.uk
www.anchem.co.uk
Company No. 4768038

Airborne Fibre Test Report

Date counted	25/01/2021
Slides Counted by	C. Edds

Client	Darlow Lloyd and Sons
Site Location	Darlow Lloyd Landfill Site, Tata Steel, Port Talbot.
Areas and Description of Work	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration

Test Slide	AS329	NPL Block Visible	5
Stage Micrometer	AS327	Graticule Diameter μm	100

[illegible]



0934

Issue Date	25/01/2021
Test Report	A98064-1

Airborne Fibre Test Report (cont.)



Diagram		Comments (Opinions and Interpretations herein are outside the scope of UKAS accreditation)
98064/04 Hazardous Waste Cell (Asbestos Only) 98064/01 98064/03 Beach - Haul Road 98064/02 98064/05 = Field Blank - not read/required.		Background air tests to establish airborne fibre concentrations at areas stated. The method of sampling is based on HSG 248 however the sampling volume and fields counted have been increased to achieve a limit of detection of 0.001f/cm³ compared with 0.01 f/cm³ for clearance testing purposes. Flow rates were checked at hourly intervals for any changes. All tests are less than 0.001f/cm³ which is below the limit of quantification. Within satisfactory limits.
Report Authoriser	C Edds	Air Sampling Undertaken in accordance with ANC/AS/2 & HSG248 Fibre Counts in accordance with HSG248 Sketch is not to scale and is an approximate representation only. Sample positions are indicated by numbers corresponding to the sample reference number suffix.
Signature		



Airborne Fibre Test Report

Certificate Reference	A98936-1
Date of Issue	29/04/2021

This report shall not be reproduced except in full without approval of the laboratory

Client	Darlow Lloyd and Sons Darlow Lloyd and Sons, Tata Steel, Port Talbot.
Area of Test	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration
Contractor	N/A

Site Address	Darlow Lloyd Landfill Site, Tata Steel, Port Talbot.
Work Brief	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration

Timer	Rotameter	Slides Counted	Pressure mb	Temp °C	Barometer	NPL Slide	NPL Block Visible	Stage Micrometer	Graticule µm	Sampled	Tested
AS617	AL057	Mobile Lab (MF69 ORJ)	1013	9	AS119	AS329	5th	AS327	101	29/04/2021	29/04/2021
										By C Edds	By C Edds

Fibre Count Details														
Sample No	Location	Test Type	Pump	Head	Start	End	Flow start	Flow End	Average	Volume	Fibres	Fields	F/cm ³	LOQ
98936/01	Hazardous Waste Cell (NE)	Background	AS442	AS442	10:00	15:02	8.0	8.0	8	2416	9.5	400	<0.01	0.001
98936/02	Hazardous Waste Cell (SE)	Background	AS443	AS443	10:03	15:05	8.0	8.0	8	2416	6	400	<0.01	0.001
98936/03	Hazardous Waste Cell (SW)	Background	AS444	AS444	10:05	15:07	8.0	8.0	8	2416	7.5	400	<0.01	0.001
98936/04	Hazardous Waste Cell (NW)	Background	AS445	AS445	10:06	15:08	8.0	8.0	8	2416	8	400	<0.01	0.001
98936/05	Opened at site (no air)	Field Blank									Not Required			

Air Sampling Undertaken in accordance with ANC/AS/2, ANC/AS/7 & HSG248. Fibre Counts in accordance with HSG248.



0934



Airborne Fibre Test Report

Certificate Reference

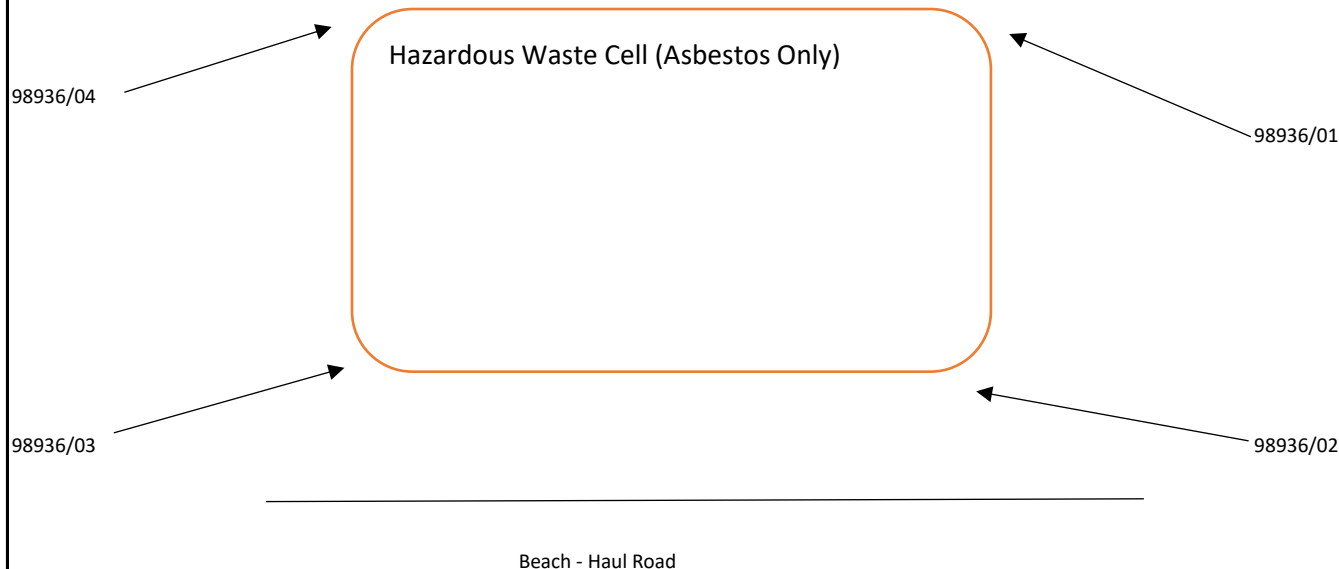
A98936-1

Date of Issue

29/04/2021

Comments (Opinions & interpretations based herein are outside the scope of our UKAS accreditation)

Background air tests to establish airborne fibre concentrations at areas stated.

The method of sampling is based on HSG 248 however the sampling volume and fields counted have been increased to achieve a limit of detection of 0.001f/cm³ compared with 0.01 f/cm³ for clearance testing purposes. Flow rates were checked at hourly intervals for any changes.**Diagram**

98936/05 - Field Blank (Not Required)

Purpose of test**Personal**

To measure exposure for compliance with the Control of Asbestos Regulations or assessment of the suitability of respirator protection

Background

To establish the prevailing fibre concentration. This is often carried out before an activity which may lead to airborne asbestos contamination

Leak

To ensure that the integrity of the asbestos enclosure remains intact and that airborne respirable fibres are not escaping

Reassurance

Conducted in certain circumstances to confirm that the residual fibre concentrations are below the limit of quantification or the background after a remedial action.

Air Sampling Undertaken in accordance with ANC/AS/2 & HSG248 Fibre Counts in accordance with HSG248 Sketch is not to scale and is an approximate representation only.

Sample positions are indicated by numbers corresponding to the sample reference number suffix.

Air tests revealed airborne fibre levels to be below the limit of quantification of the test at less than 0.0010 fibres per cm³ of air. Within satisfactory limits.

Authorised Signatory

C Edds

Signed



Airborne Fibre Test Report

Certificate Reference

A99657-1

Date of Issue

13/07/2021

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Client	Darlow Lloyd and Sons Darlow Lloyd and Sons, Tata Steel, Port Talbot.
Area of Test	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration
Contractor	N/A

Site Address	Darlow Lloyd Landfill Site, Tata Steel, Port Talbot.
Work Brief	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration

Timer	Rotameter	Slides Counted	Pressure mb	Temp °C	Barometer	NPL Slide	NPL Block Visible	Stage Micrometer	Graticule µm	Sampled	Tested
AS617	AL057	Mobile Lab (MF69 ORJ)	1017	22	AS119	AS329	5th	AS327	101	13/07/2021	13/07/2021
										By	By
										C Edds	C Edds

Fibre Count Details														
Sample No	Location	Test Type	Pump	Head	Start	End	Flow start	Flow End	Average	Volume	Fibres	Fields	F/cm ³	LOQ
99657/01	Hazardous Waste Cell (NE)	Background	AS441	AS441	09:50	14:52	8.0	8.0	8	2416	11	400	<0.001	0.001
99657/02	Hazardous Waste Cell (SE)	Background	AS443	AS443	09:54	14:56	8.0	8.0	8	2416	12.5	400	<0.001	0.001
99657/03	Hazardous Waste Cell (SW)	Background	AS444	AS444	10:00	15:02	8.0	8.0	8	2416	10	400	<0.001	0.001
99657/04	Hazardous Waste Cell (NW)	Background	AS445	AS445	10:03	15:05	8.0	8.0	8	2416	9.5	400	<0.001	0.001
99657/05	Opened at site (no air)	Field Blank									Not Required			

Air Sampling Undertaken in accordance with ANC/AS/2, ANC/AS/7 & HSG248. Fibre Counts in accordance with HSG248.



0934



Airborne Fibre Test Report

Certificate Reference

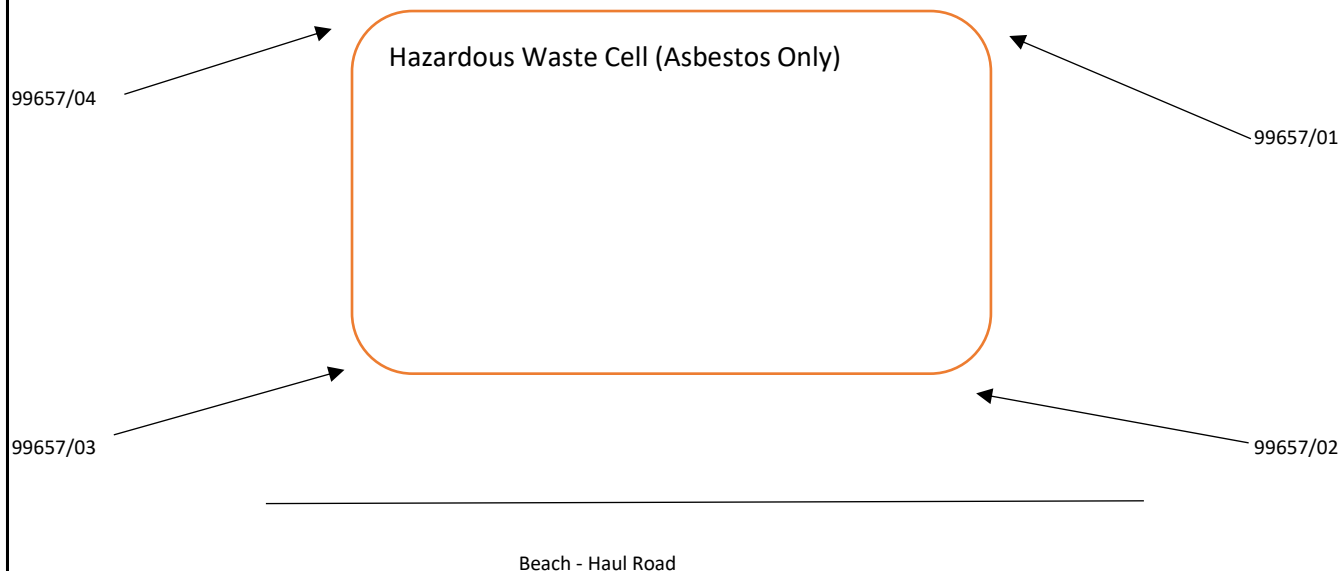
A99657-1

Date of Issue

13/07/2021

Comments (Opinions & interpretations based herein are outside the scope of our UKAS accreditation)

Background air tests to establish airborne fibre concentrations at areas stated.

The method of sampling is based on HSG 248 however the sampling volume and fields counted have been increased to achieve a limit of detection of 0.001f/cm³ compared with 0.01 f/cm³ for clearance testing purposes. Flow rates were checked at hourly intervals for any changes.**Diagram**

99657/05 - Field Blank (Not Required)

Purpose of test**Personal**

To measure exposure for compliance with the Control of Asbestos Regulations or assessment of the suitability of respirator protection

Background

To establish the prevailing fibre concentration. This is often carried out before an activity which may lead to airborne asbestos contamination

Leak

To ensure that the integrity of the asbestos enclosure remains intact and that airborne respirable fibres are not escaping

Reassurance

Conducted in certain circumstances to confirm that the residual fibre concentrations are below the limit of quantification or the background after a remedial action.

Air Sampling Undertaken in accordance with ANC/AS/2 & HSG248 Fibre Counts in accordance with HSG248 Sketch is not to scale and is an approximate representation only.

Sample positions are indicated by numbers corresponding to the sample reference number suffix.

Air tests revealed airborne fibre levels to be below the limit of quantification of the test at less than 0.0010 fibres per cm³ of air. Within satisfactory limits.

Authorised Signatory

C Edds

Signed

Airborne Fibre Test Report

Certificate Reference	A100449-1
Date of Issue	28/10/2021

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Client	Darlow Lloyd and Sons
Address	Darlow Lloyd and Sons, Tata Steel, Port Talbot.
Area of Test	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration
Contractor	N/A

Site Address	Darlow Lloyd Landfill Site, Tata Steel, Port Talbot.
Work Brief	Hazardous Waste Cell, Darlow Lloyd, Landfill Site, Tata Steel - Background Perimeter monitoring to asbestos waste cell to ascertain airborne fibre concentration

Timer	Rotameter	Slides Counted	NPL Slide	NPL Block Visible	Stage Micrometer	Graticule μm	Sampled	Tested
AS617	AL057	Mobile Lab (MF69 ORJ)	AS329	5th	AS327	101	28/10/2021 C Edds	28/10/2021 C Edds

Fibre Count Details														
Sample No	Location	Test Type	Pump	Head	Start	End	Flow start	Flow End	Average	Volume	Fibres	Fields	F/cm ³	LOQ
100449/01	Hazardous Waste Cell (NE)	Background	AS441	AS441	09:50	14:52	8.0	8.0	8	2416	11	400	<0.001	0.001
100449/02	Hazardous Waste Cell (SE)	Background	AS443	AS443	09:54	14:56	8.0	8.0	8	2416	12.5	400	<0.001	0.001
100449/03	Hazardous Waste Cell (SW)	Background	AS444	AS444	10:00	15:02	8.0	8.0	8	2416	10	400	<0.001	0.001
100449/04	Hazardous Waste Cell (NW)	Background	AS445	AS445	10:03	15:05	8.0	8.0	8	2416	9.5	400	<0.001	0.001
100449/05	Opened at site (no air)	Field Blank												

Air Sampling Undertaken in accordance with ANC/AS/2, ANC/AS/7 & HSG248. Fibre Counts in accordance with HSG248 for respirable fibres not asbestos fibres

Airborne Fibre Test Report

Certificate Reference	A100449-1
Date of Issue	28/10/2021

Comments (Opinions & interpretations based herein are outside the scope of our UKAS accreditation)

Background air tests to establish airborne fibre concentrations at areas stated.

The method of sampling is based on HSG 248 however the sampling volume and fields counted have been increased to achieve a limit of detection of 0.001f/cm³ compared with 0.01 f/cm³ for clearance testing purposes. Flow rates were checked at hourly intervals for any changes.

Diagram

The diagram shows a central rounded rectangle labeled "Hazardous Waste Cell (Asbestos Only)". Four arrows point to the corners of this rectangle from sample positions: 100449/04 (top-left), 100449/01 (top-right), 100449/03 (bottom-left), and 100449/02 (bottom-right). Below the rectangle is a horizontal line labeled "Beach - Haul Road". At the bottom left, it says "100449/05 - Field Blank (Not Required)".

Purpose of test	
Personal	To measure exposure for compliance with the Control of Asbestos Regulations or assessment of the suitability of respirator protection
Background	To establish the prevailing fibre concentration. This is often carried out before an activity which may lead to airborne asbestos contamination
Leak	To ensure that the integrity of the asbestos enclosure remains intact and that airborne respirable fibres are not escaping
Reassurance	Conducted in certain circumstances to confirm that the residual fibre concentrations are below the limit of quantification or the background after a remedial action.
Near Source	To assess the release and spread of fibre concentrations near sources of release e.g. inside enclosures, work without an enclosure and releases from known sources etc.
Far Source	Conducted around the perimeter to assess ambient site conditions where there may be other workers, public access or residential and commercial buildings

Air Sampling Undertaken in accordance with ANC/AS/2 & HSG248 Fibre Counts in accordance with HSG248 Sketch is not to scale and is an approximate representation only.

Sample positions are indicated by numbers corresponding to the sample reference number suffix.

Air tests revealed airborne fibre levels to be below the limit of quantification of the test at less than 0.0010 fibres per cm³ of air. Within satisfactory limits.

Authorised Signatory	C Edds
----------------------	--------

Signed	
--------	--

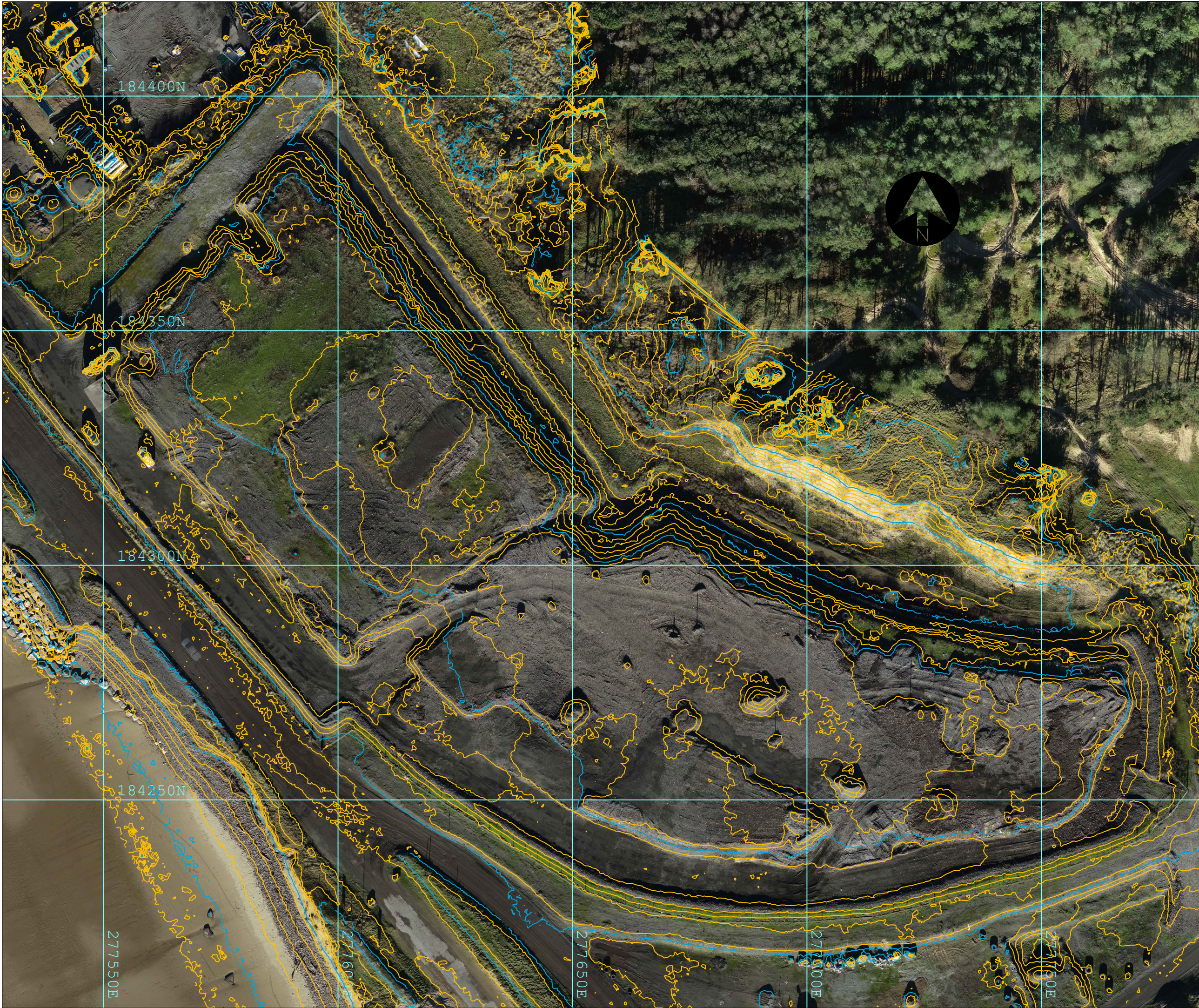
**MORFA HAZARDOUS
LANDFILL
PORT TALBOT**

PERMIT BW2692IM

**2020 Annual Review of
Environmental
Monitoring Results**

**Appendix 10
Annual Volume Report
Figures**

Report Number 2191r1v1d0222



Drawing Number 2197/1

Legend

Prominent Contour (2.5m)

Normal Contour (0.5m)

Notes

Digital survey model generated using Pix4D image processing software.

Imagery acquired by DJI Phantom 4 pro RTK photogrammetry survey on 14 January 2022.

Survey control installed using Topcon Hiper SR dGPS Network Rover.

OS Grid spacing at 50m

Rev	Date	Status/Ammendments

CLIENT

Darlow Lloyd & Sons

PROJECT

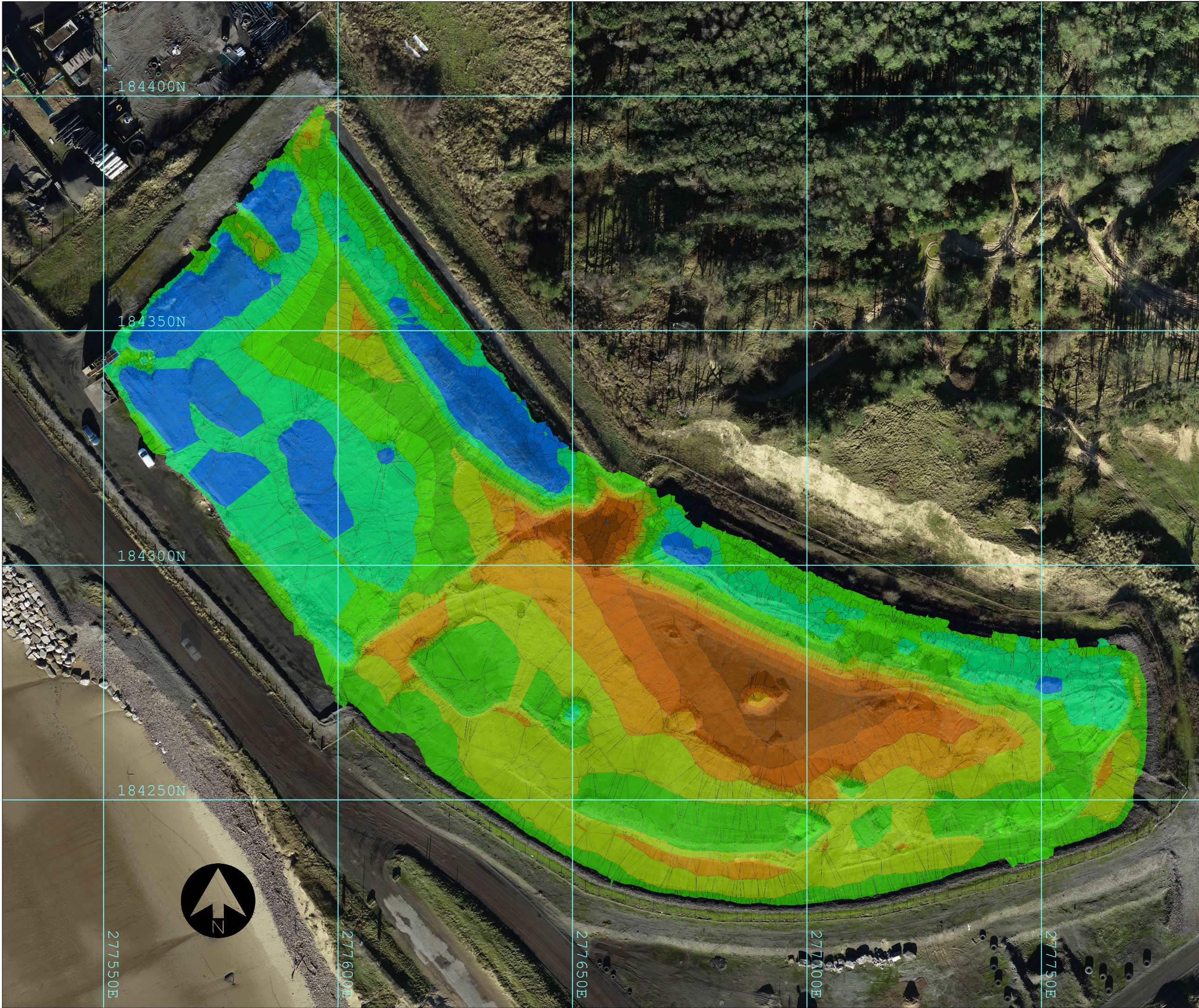
Morfa Volumes 2021

TITLE

Hazardous Landfill
Topographic Survey

DRAWING NUMBER			REVISION
2197/1			0
DATE	DRAWN	CHECKED	SCALE AT A3
01.22	KJT		1:750

Geotechnology Limited
Ty Coed, Cefn-yr-Allt,
Aberdulais, Neath
SA10 8HE
01639 775293
www.geotechnology.net



Drawing Number 2197/4

Legend

Height ranges

3.5

3.0

2.5

2.0

1.5

1.0

0.5

0.0

-0.5

-1.0

-1.5

-2.0

-2.5

Notes

Isopachyte generated by subtracting approved top of waste contours from 14 January 2022 topographic drone survey.

Positive levels indicate remaining capacity.

Negative levels indicate waste is currently over-height.

OS Grid spacing at 50m

Rev	Date	Status/Ammendments

CLIENT

Darlow Lloyd & Sons

PROJECT

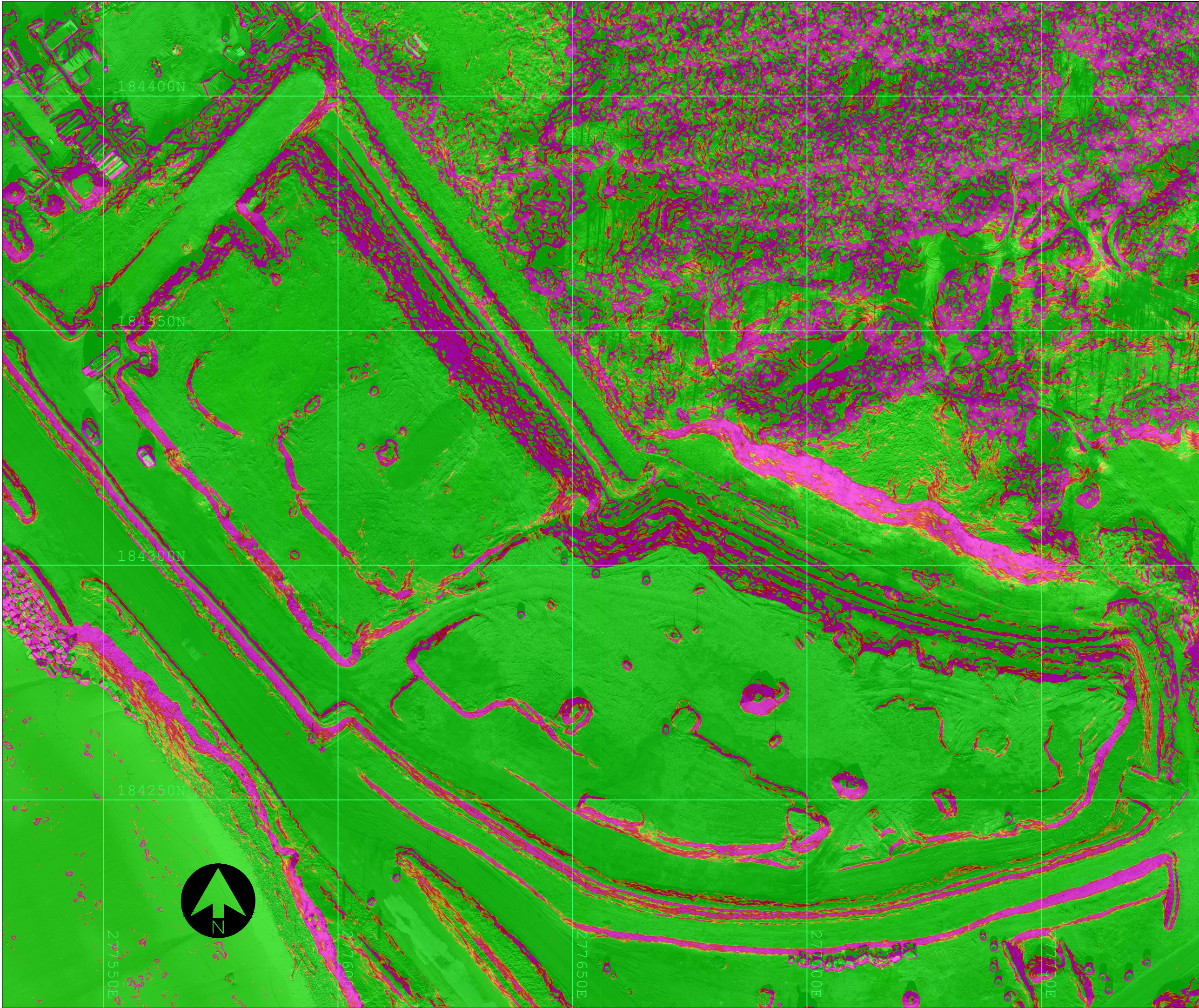
Morfa Volumes 2021

TITLE

Hazardous Landfill
Waste Profile Isopachyte

DRAWING NUMBER			REVISION
2197/4			0
DATE	DRAWN	CHECKED	SCALE AT A3
02.22	KJT		1:750

Geotechnology Limited
Ty Coed, Cefn-yr-Allt,
Aberdulais, Neath
SA10 8HE
01639 775293
www.geotechnology.net



Drawing Number 2197/6

Legend

>1:2

<1:2

<1:2.5

<1:3

<1:3.5

Notes

Slope gradients in Vertical:Horizontal ratio format

OS Grid spacing at 50m

Rev	Date	Status/Ammendments

CLIENT

Darlow Lloyd & Sons

PROJECT

Morfa Volumes 2021

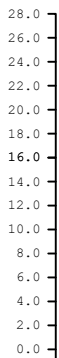
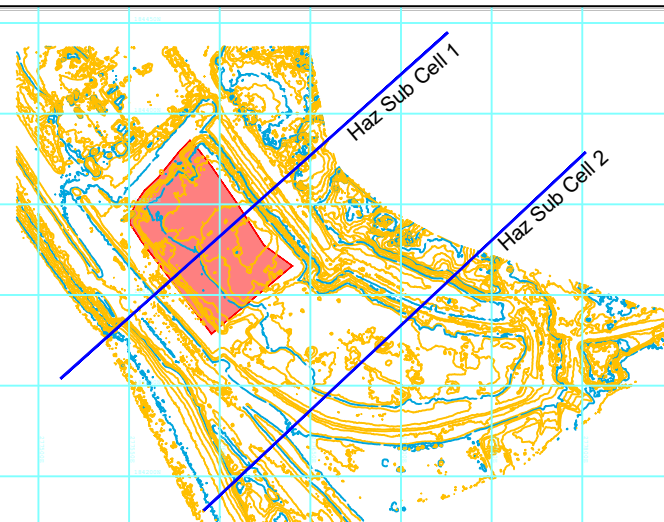
TITLE

Hazardous Landfill
Slope Gradient Map

DRAWING NUMBER			REVISION
2197/6			0
DATE	DRAWN	CHECKED	SCALE AT A3
02.22	KJT		1:750

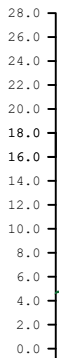
Geotechnology Limited
Ty Coed, Cefn-yr-Allt,
Aberdulais, Neath
SA10 8HE
01639 775293
www.geotechnology.net





Regular offsets	Final Waste Levels	Temp Waste Levels	14Jan22	Base Levels
0.000	10.705	10.661	10.514	10.661
5.000	10.681	10.641	11.259	9.332
10.000	11.049	10.943	11.259	8.455
15.000	11.502	11.271	12.049	8.435
20.000	11.955	11.599	12.287	8.430
25.000	12.408	11.984	12.395	8.429
30.000	12.861	12.451	13.488	8.473
35.000	13.314	12.951	13.779	8.544
40.000	13.767	13.451	13.775	8.573
45.000	14.218	13.951	13.835	8.587
50.000	14.665	14.451	13.978	8.604
55.000	15.111	15.000	13.876	8.626
60.000	15.558	15.000	13.922	8.665
65.000	15.744	12.850	13.851	8.714
70.000	16.000	12.850	11.235	8.774
75.000	16.226	11.097	8.803	8.835
80.000	16.301	9.344	8.844	9.157
85.000	16.377	8.368	8.388	9.187
90.000	16.453	8.069	8.069	9.205
95.000	16.528	8.069	8.069	9.223
100.000	16.604	8.069	8.069	9.241
105.000	16.679	8.069	8.069	9.258
110.000	16.755	8.069	8.069	9.276
115.000	16.831	8.069	8.069	9.294
120.000	16.906	8.069	8.069	9.312
125.000	16.981	8.069	8.069	9.330
130.000	17.056	8.069	8.069	9.347
135.000	17.131	8.069	8.069	9.380
140.000	17.206	8.069	8.069	9.415
145.000	17.281	8.069	8.069	9.450
150.000	17.356	8.069	8.069	9.484
155.000	17.431	8.069	8.069	9.519
160.000	17.506	8.069	8.069	9.553
165.000	17.581	8.069	8.069	9.599
170.000	17.656	8.069	8.069	12.171
175.000	17.731	8.069	8.069	
180.000	17.806	8.069	8.069	
185.000	17.881	8.069	8.069	
190.000	17.956	8.069	8.069	
195.000	18.031	8.069	8.069	
200.000	18.106	8.069	8.069	
205.000	18.181	8.069	8.069	
210.000	18.256	8.069	8.069	
215.000	18.331	8.069	8.069	
220.000	18.406	8.069	8.069	
225.000	18.481	8.069	8.069	
230.000	18.556	8.069	8.069	
235.000	18.631	8.069	8.069	
240.000	18.706	8.069	8.069	
245.000	18.781	8.069	8.069	
250.000	18.856	8.069	8.069	
255.000	18.931	8.069	8.069	
260.000	19.006	8.069	8.069	
265.000	19.081	8.069	8.069	
270.000	19.156	8.069	8.069	
275.000	19.231	8.069	8.069	
280.000	19.306	8.069	8.069	
285.000	19.381	8.069	8.069	

Hazardous Sub-Cell 1



Regular offsets	Final Waste Levels	Temp Waste Levels	14Jan22	Base Levels
0.000			4.670	
5.000			4.981	
10.000			5.345	
15.000			5.744	
20.000			5.753	
25.000			6.765	
30.000			8.460	
35.000			8.433	
40.000			9.373	
45.000			9.612	
50.000			9.713	
55.000			9.385	
60.000			8.956	
65.000			8.975	
70.000			9.107	
75.000	7.545		9.806	
80.000	12.409		10.436	
85.000	13.854	12.431	10.006	
90.000	13.218	13.237	10.270	
95.000	13.564	13.570	10.684	
100.000	13.908	13.918	12.235	12.408
105.000	14.260	14.266	11.807	12.438
110.000	14.607	14.606	11.874	10.530
115.000	14.955	14.953	13.234	9.261
120.000	15.309	15.299	13.234	9.401
125.000	15.656	15.618	13.228	9.437
130.000	16.000	15.928	13.301	9.464
135.000	16.264	16.259	13.455	9.519
140.000	16.398	16.393	13.479	9.564
145.000	16.458	15.039	12.880	9.591
150.000	16.519	13.723	12.870	9.638
155.000	16.567	12.407	13.174	9.669
160.000	16.272	11.092	13.854	9.686
165.000	16.000	9.851	13.107	9.710
170.000	15.584		13.082	9.725
175.000	15.000		13.278	9.752
180.000	14.624		12.494	9.855
185.000	14.000		11.544	9.916
190.000	13.664		9.940	9.876
195.000	13.184		9.288	9.916
200.000	12.800		9.340	9.930
205.000	12.512		9.171	9.956
210.000	12.287		10.187	9.989
215.000	12.088		13.001	10.023
220.000			14.050	10.057
225.000			14.029	10.091
230.000			12.706	10.135
235.000			12.388	10.222
240.000				11.816
245.000				12.427
250.000				
255.000				
260.000				
265.000				
270.000				
275.000				
280.000				
285.000				

Hazardous Sub-Cell 2

Drawing Number 2197/8

Legend



Notes

Sections have 2X Vertical Exaggeration

Rev	Date	Status/Ammendments

CLIENT

Tata Steel UK

PROJECT

Morfa Hazardous Landfill Restoration Scheme

TITLE

Restoration Sections

DRAWING NUMBER

2197/8

REVISION

ATE

02.22

DRAWN

KJT

CHECKED

DRAFT

SCALE AT A3

As Shown

Geotechnology Limited
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