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Tir John (Phase 2) Landfill

Annual Monitoring Review January - December 2022

Enovert South Limited

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1 Introduction

1.1 Background

This report has been prepared by Byrne Looby Partners (UK) Ltd (ByrneLooby) on behalf of Enovert South Limited for the Tir John Phase 2 landfill. The report provides a review of the environmental monitoring carried out for the Phase 2 portion of the Tir John Landfill Site by the site operator (Enovert) during 2022.

Tir John Landfill Site comprises an area of approximately 36ha and is situated North of Fabian Way, Port Tennant, Swansea, at National Grid Reference (NGR) SS695936. The Site is located 3km from Swansea and approximately 1km from the coast. The site comprises two separate Permitted areas, an older landfill referred to as Phase 1 and the adjoining operational Phase 2. Phases 1 and 2 are separated by a high voltage electricity transmission line (and the associated standoff distance) that passes through the combined site. The closed and restored Phase 1 area remains the responsibility of the City and County of Swansea, although daily management has been contracted to Enovert.

This report reviews the Phase 2 eastern portion which comprises the Cells 5 to 17 areas. The original Waste Management Licence SWW14L included permission for the development of Phase 2 as Cells 5 - 14. Following a change to the regulatory framework an application for a PPC Permit was made by Swansea City Waste Disposal Limited in 2004 to enable continued operations within Cells 5 - 14 as well as the development for Cells 15 - 17. The permit was subsequently issued as TP3935LA/A001 in 2007 after a successful appeal. Subsequent variations to the permit were made in 2007, 2012, and 2013.

Swansea City Waste Disposal Ltd applied to transfer the permit to the City and County of Swansea at which point an updated Permit was issued as EPR/LP3935EY on the 20/10/2013. There has been a subsequent transfer of the permit to Cory Environmental (Gloucestershire) Ltd and the permit was re-issued as Permit Number EPR/VP3935AT on 30/09/2015. The permit was varied in February 2018 to change the operator and Permit Holder to Enovert South Ltd, and varied again in April 2019 to make minor technical amendments and was issued as EPR/VP3935AT/V004. The most recent Variation, EPR/VP3935AT/V007, was completed in November 2021 to add 15 European Waste Catalogue (EWC) codes to the permit.

1.2 Site History

The site was constructed within an area which was originally part of the Crymlyn Bog. Prior to the 18th century, the bog was seasonally grazed. The north to south Glan-y-Wern canal was constructed to facilitate coal mining within the area and the exploitation of coal seams within the valley. There are a series of former coal drifts in the vicinity of the site, one of which coincides with a depression and forms a spring on the western boundary of the closed site. There is a similar feature 150m to the north.

A coal fired power station was constructed on the footprint of Phase 1, resulted in the generation of large quantities of Pulverised Fuel Ash (PFA). This ash was deposited as a platform above the Crymlyn Bog to the east of the power station platform. The PFA platform continued to be extended until the mid-1980s and forms the subgrade beneath the footprint of the Phase 2 Cells 5 to 15.

In parallel to the later stages of PFA disposal, there was also the disposal of inert waste in the east of the site area (under the footprint of Cells 16 and 17 of the Phase 2). These disposal operations gradually expanded to also include domestic and other non-hazardous wastes from 1979 until the waste management operations were formalised and regulated under the 1985 planning permission which formally authorised the Phase 1 landfill.

Landfilling operations have been undertaken at the site since 1953 in unlined cells and prior to that PFA had, since 1935, been deposited. There has therefore been 50 years of disposal within the permitted area prior to the construction of the first containment cell. Phase 1 was operated between 1985 and the early 1990s for the permanent disposal of municipal, degradable commercial and industrial, inert wastes, within engineered containment cells. Operations then transferred to Phase 2. However, the previously deposited inert wastes below Cells 5 to 15 were largely removed prior to cell formation and it is known that when the baling machinery was not operating in Phase 1, other wastes were deposited over the footprint of Cell 16 and Cell17 areas *i.e.* the current and permitted future operational cells and remain in place.

Consequently, there are wastes deposited outside of (which pre-date) the footprint of the permitted landfills' engineered containment and which lies directly above organic rich sediments.

1.3 Site Setting

The site is located within the Crymlyn Bog, a lowland peaty fen which was the former estuary of the River Clydach and the River Neath. The historically placed PFA is present below much of the waste in Phase 1 where it was pushed out into the bog and overlies the natural superficial alluvial deposits, comprising interbedded peat, clay, silt, sand and gravel layers. The Carboniferous South Wales Lower Coal Measures Formation underlies the alluvium and forms the sides of the valley to the west of the site.

Topographically the ground falls from over 80mAOD to the west of the site to ~10mAOD within the Crymlyn Bog. The local hydrogeology is controlled by springs along the western edge of the valley, which discharge into the Crymlyn Bog. The spring water contributes to the easterly and south-easterly gradient towards the coast. The springs, including the GDW023 spring forms localised groundwater mounds from the valley slopes at the western boundary of the closed site. This spring discharges into the PFA and alluvium that underlie the site.

It is considered likely that the placement of the PFA has increased the compaction of the *in-situ* peats (*i.e*. the original bog sediments) and the low permeability alluvial clay.

1.4 Site Engineering

PFA underlies the Phase 2 Cells 5 – 15 area, with other wastes also underlying the Cell 16 – 17 footprint (Cells 1 - 4 are part of Phase 1 and are discussed separately). Consequently, there are wastes deposited outside of (and pre-dating) the footprint of the permitted landfills' engineered containment. These ash and waste materials lay directly above organic rich sediments. Regulatory and best practice engineering changes have driven the evolution of the Phase 2 containment and leachate management design over the operational life of the site.

The earliest Phase 2 cells (Cells 5 - 11) are lined with a Geosynthetic Clay Liner (GCL) with an overlying 300mm stone drainage blanket. The GCL was placed directly above a shaped PFA formation layer.

For Cells 12 - 14, a rock fill was placed above the PFA to raise the base of the landfill to achieve the desired elevation. The rock fill was overlain by a geotextile to separate the rock fill from a 100mm gritstone formation layer to a 300mm thick Bentonite Enriched Sand (BES) artificial geological barrier. Cells 12 - 14 are then lined with an artificial Geosynthetic Clay Liner (GCL). Leachate is collected via a 300mm quarry gritstone fines drainage layer above the GCL.

Cell 15 construction includes a 300mm thick 20-40mm gravel drainage layer, with inset drainage pipes above a HDPE liner. There is a leak detection layer above the 500mm BES artificial geological barrier, which was placed above a 4m formation layer constructed from imported quarry overburden. Prior to the installation of artificial geological barriers at Cell 16, a groundwater monitoring and control system was installed.

Phase 2 Cells 5, 10, 11, 13 and 14 have been permanently capped with a LLDPE geomembrane. Cells 6 - 8 have a GCL cap, whilst Cells 9 and 12, which abut the operational Cell 16 area has a temporary cap. Cell 15 was capped with GCL during 2021. Cell 16 is the current operational cell. During 2022 the lower flank of Cell 16 was capped with GCL to connect to Cell 15 and Cell 8. These works are to continue into 2023.

1.5 Site Activities

Disposal of non-hazardous wastes is taking place in Cell 16. Disposal operations began in Cell 16 in March 2019 as a continuation of the Cell 15 operations.

Enovert's Operating Procedures (SHE-OP-01 – Waste Acceptance and Control) ensure that wastes are assessed against the relevant permit conditions and waste acceptance procedures prior to being authorised for disposal at the landfill. Each load of waste accepted is inspected visually at the site. Contaminated land, filter cakes and restoration soils have validation samples taken and sent for laboratory analysis. Waste acceptance test results are compared against the site permit conditions to confirm waste description/basic characterisation and acceptability for disposal.

During 2022, compliance testing was undertaken on 283 samples, with only three failures of the acceptance criteria. An investigation was undertaken for the failure, with acceptance only resumed where further evaluation of the data and/ or additional testing could demonstrate the acceptance framework could be met.

The most recent Hydrogeological Risk Assessment Review was undertaken in July 2018 (TerraConsult Report 10127-R08).

1.6 Environmental Monitoring

Schedule 4 of the permit (Permit Tables S4.2 and 4.3) requires that specific performance parameters are reported. These tables are reproduced below as Table 1 and Table 2. Details are from the holistic site and are not specific to the closed site.

Table 1 – Annual Production/Treatment

Table S4.3 Performance Parameters			
Parameter	Frequency of assessment	Annual total	Unit
Potable water used	Annually	2,414	m^3/yr
Energy used (including for leachate treatment)	Annually	167	MWh of electricity
Non-potable water used	Annually	0	m^3/yr

Table 2 – Performance Parameters

Table S4.2: Annual production/treatment	
Leachate: Disposed of off-site; Disposed of to any onsite effluent treatment plant;	**Cubic metres/year** 65,461m^3/yr (from entire site)
Surface water and/or Groundwater: Disposed of off site; Disposed of to any onsite effluent treatment plant	**Cubic metres/year** 71,813m^3/yr (cumulative volume form Phase 1 & 2 areas) Nil
Landfill gas: combustion in flares; combustion in gas engines; Other methods of gas utilisation	**Normalised cubic metres/year** 4,350,000m^3/yr (from entire site) Nil Nil

Quantities are cumulative volumes including operational site (Phase 1) data

The remaining void space at the site has been estimated at 26,299m^3. Settlement figures for 2022 are illustrated on Drawing TJ76.

2 Monitoring Schedule

Enovert South Limited staff carried out environmental monitoring during 2022 at the locations shown on Drawing TJ74 in accordance with the site's Environmental Permit.

3 Gas Monitoring

3.1 In-Waste Gas

3.1.1 Gas Utilisation

Landfill gas must be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and, to the extent possible, used[1]. The Landfill Directive (99/31/EC) requires that wherever landfill gas cannot be utilised, then it must be flared. Landfill gas at Tir John landfill has in recent years been managed via combustion, principally used to generate renewable energy through a Jenbacher 312 Spark Ignition Engine with a capacity of 150 – 650m^3/hr.

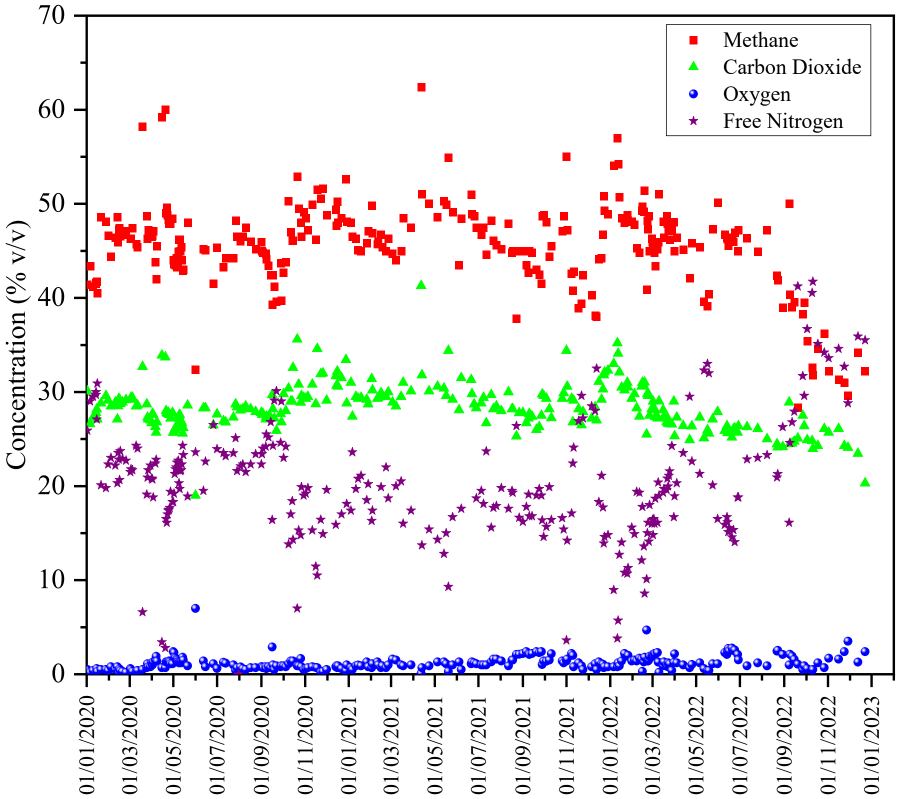
However, during 2022 the gas engine failed, and landfill gas was therefore treated through the on-site flare whilst a replacement was acquired. The on-site flare is in place as a contingency measure for when the engine is down or being serviced and has sufficient capacity (100 – 1,000m^3/hr) to treat all landfill gas produced at the site. Following an extended lead time, the engine was replaced in January 2023 with another Jenbacher 312 Spark Ignition Engine. Landfill gas was therefore primarily treated through the on-site flare during 2022.

Gas yields increased at the site during 2022 to an average of 497m^3/hr. The increase in abstraction can be attributed to the extension of gas extraction across Cell 16 (increased source term) combined with an increase in abstraction to manage odour and prevent gas migration at the site.

During 2022, the gas quality at the gas compound declined (reduction in methane and increase in nitrogen) due to the additional contribution from Cell 16 and increased abstraction (Figure 1). It is apparent that there is a fine balance between optimising the collection of landfill gas and managing migration or odour emissions, particularly within an operational landfill site like Tir John. Notably oxygen did not increase as this is a key component of aerobic respiration. The gas quality is expected to recover in 2023 as methanogenic conditions develop within the youngest cells and the cap at the site is further extended.

[1] Annex I of the Landfill Directive (1999/31/EC) found at https://www.legislation.gov.uk/eudr/1999/31/annex/I/2018-07-04

Figure 1 - Gas Quality at the Gas Management Compound



3.1.2 Gas Collection System

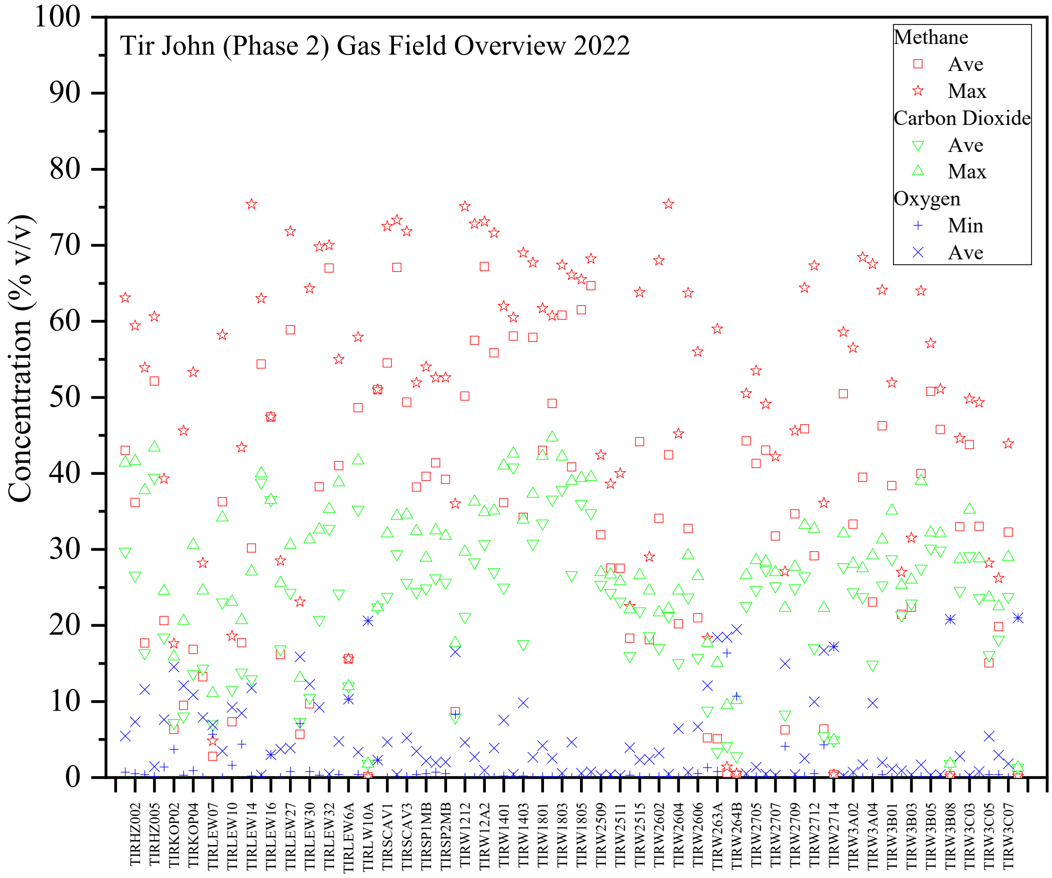
Gas quality and pressure measurements are carried out at the site whilst the system is being balanced to optimise gas collection, prevent emissions and minimise the potential for oxygen ingress into the site. The Tir John landfill gas (Figure 2) is typically a mixture of 40 - 70% methane with 20 - 40% carbon dioxide and typically negligible oxygen.

Carbon monoxide was consistently reported below 100ppm throughout 2022 with a maximum of 29ppm reported. Dräger-tubes have previously been used by Enovert and have demonstrated that there are often false positives reported by the gas analysers used to complete the routine monitoring.

Hydrogen sulphide levels were consistent with that expected for non-hazardous landfill cells and was reported at a maximum of 925ppm during 2022. There were no odour complaints for the site and hydrogen sulphide has remained negligible within the perimeter monitoring wells throughout 2022. Furthermore, site staff are required to carry personal gas alarms at the site for their own protection. No further assessment is therefore considered necessary.

Occasional elevated oxygen levels in excess of 5%v/v were identified at some in-waste wells during 2022 (Appendix B). Where identified, initial investigative steps taken to reduce the elevated concentrations of oxygen are to re-balance the affected well and any surrounding wells. If required, repairs are also made to pipework and seals.

Figure 2 – In-Waste Landfill Gas Quality



3.2 Surface Emissions

Surface emission surveys were undertaken in December 2022. The survey was carried out to determine gas concentrations directly above the capped and temporary capped surfaces at the site. Enovert use a data logging system with GPS to allow the direct transfer of the FID route surveyed to site plans and hence identify areas of the cap which may require remediation. Discrete features, such as abstraction wells and transfer pipework were also surveyed.

The survey was carried out according to the objectives of Environment Agency guidance LFTGN07[2]. Section 2.7 of LFTGN07 states that "*providing subsequent annual walkover surveys of that area demonstrate the surface concentration limits in air are less than 100 parts per million by volume (ppmv) immediately above the surface on the main zones of the cap and less than 1,000ppmv close to any discrete feature, you do not need to carry out subsequent flux box measurements to quantify emissions*".

The survey demonstrates that there is generally good gas control at the site with low emissions (*i.e.* <10ppm) occurring across the majority of the surveyed area. Emissions in the range 100–499ppm were identified adjacent to discrete features such as leachate chambers. Given that the higher

[2] Environment Agency (2010) Guidance on monitoring landfill gas surface emissions. LFTGN07 v2 2010

readings observed occurred adjacent to a discrete feature they are not considered to be significant, and no further actions are required.

More significant emissions in the 100 to >1,000ppm were identified above the operational areas of the site which is consistent with these areas being uncapped. Increased emissions were also identified adjacent to the perimeter of the uncapped cells, and this may reflect the underlying ground conditions (pre-existing wastes). Similar levels of methane were not identified at the perimeter monitoring points indicating that the reported results may be attributed to an error during the survey.

3.3 Perimeter Gas

Ground gas was monitored at 11 perimeter locations surrounding the Phase 2 site in 2022. A summary of the data collected is provided within Table 3

The site is located within the Crymlyn Bog, a lowland peaty fen that contains a biologically active soil microbial community. As a consequence of the site's location, the background soil biogeochemistry is complex and subject to a number of influences including temperature, soil saturation (including marsh areas) and seasonal or weather dependent transitions. This is further complicated by the historical placement of wastes prior to the construction of the containment cells.

Table 3 – Perimeter Ground Gas Summary 2022

Location	Methane		Carbon Dioxide		Oxygen	
	Ave	Max	Ave	Max	Ave	Max
	%v/v		%v/v		%v/v	
TIRGP013	0.0	0.0	1.2	3.3	19.3	21.0
TIRGP014	0.0	0.0	5.5	9.8	13.7	17.5
TIRGP015	0.0	0.0	5.3	10.0	14.5	17.0
TIRGP016	0.0	0.0	8.6	10.9	10.6	12.9
TIRGP017	0.0	0.0	2.3	3.0	18.7	20.9
TIRGP018	0.0	0.0	8.3	13.4	11.8	18.7
TIRGP019	0.0	0.0	5.9	9.8	15.2	19.8
TIRGP020	0.0	0.0	6.6	10.4	12.4	18.7
TIRGP021	1.5	5.5	3.6	7.9	12.0	20.0
TIRGP022	0.0	0.0	0.6	2.2	19.3	21.4
TIRGP023	0.1	0.3	6.6	12.0	7.6	21.2

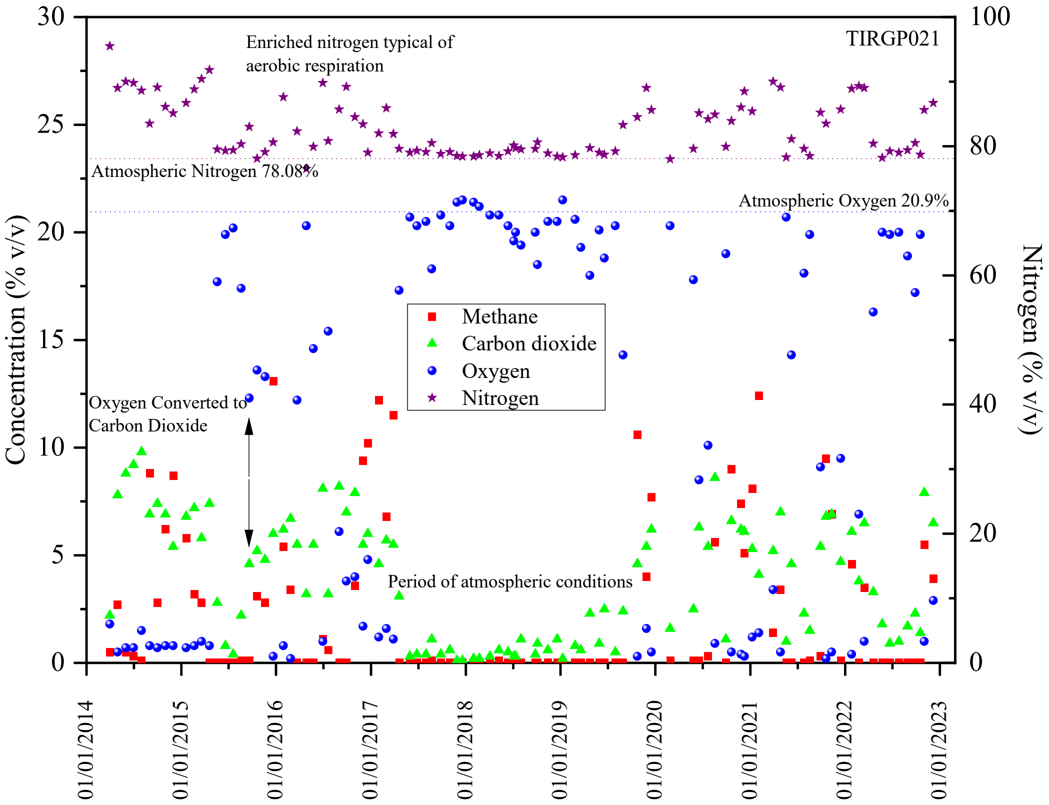
Shaded Cells indicate methane above 1%v/v

Methane is typically negligible within perimeter monitoring wells with the exception of TIRGP021 located in the south-eastern corner of the site, adjacent to Cell 6. During 2022 methane was recorded at a maximum of 5.5%v/v in November. The reported data is consistent with the historical dataset for this location (Figure 3).

Methane in TIRGP021 follows a seasonal pattern with elevated concentrations observed in the wetter winter months. A maximum methane concentration of 10.6%v/v was recorded in October 2019 and this was followed by a maximum of 9%v/v in October 2020 and 12.4%v/v in February 2021.

These spikes with the ground gas profile may be attributable to conditions conducive to anaerobic respiration under optimal seasonal moisture and temperature ground conditions.

Figure 3 – Ground Gas Profile TIRGP021



Although there is the cyclic observation of methane and carbon dioxide at TIRGP021, the ground gas profile (Figure 3) demonstrates that the atmospheric gases are not purged from the ground when methane is present. The observation of nitrogen enrichment is consistent with natural processes; the most likely of which is microbial respiration resulting in a direct conversion of oxygen to carbon dioxide. In this process nitrogen is replenished from air ingress into the soil to replace the respired oxygen and hence is enriched compared to the atmosphere. It is considered likely that as methane continues to be observed during periods of seasonally higher groundwater recharge, then ground conditions were perhaps not favourable to such an *in-situ* regime during autumn 2017 and 2018, allowing greater free exchange of atmospheric gases into the ground.

Methane was recorded at or below 0.3%v/v at all other monitoring points during 2022.

Carbon dioxide is typically in the 2.5%v/v to ~15%v/v range at the perimeter monitoring locations (Figure 4). The majority of perimeter monitoring locations (TIRGP013 – 020) have a ground gas profile consistent with aerobic respiration, *i.e.* nitrogen enrichment along with oxygen conversion to carbon dioxide (Figure 5).

Figure 4 – Perimeter Carbon Dioxide Summary

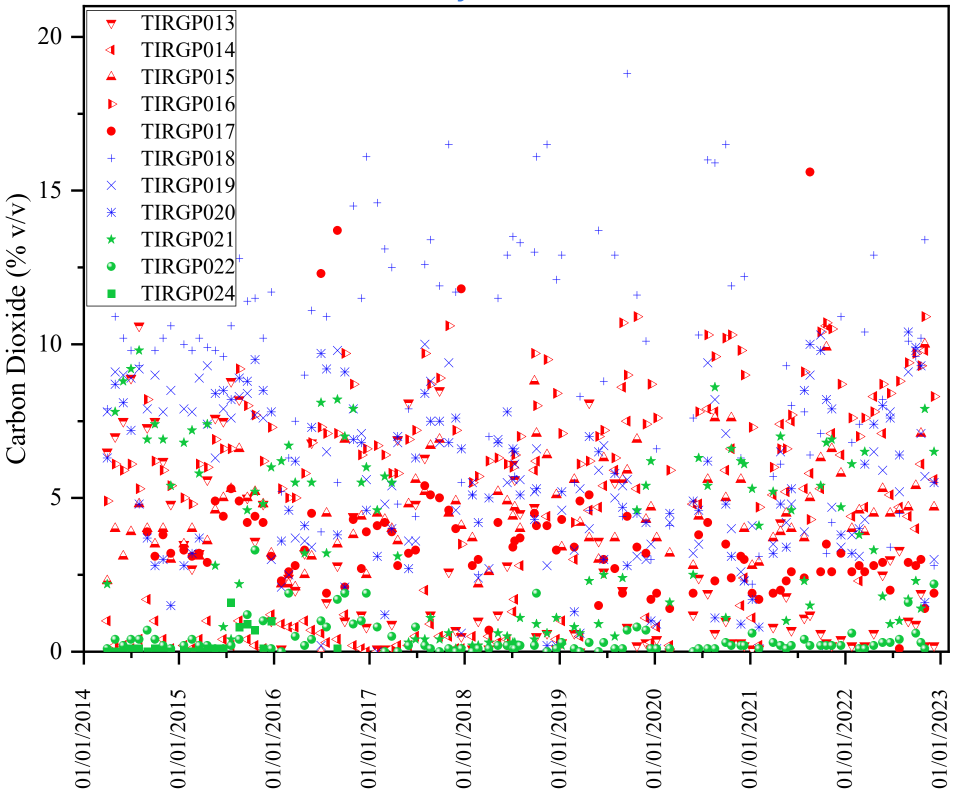


Figure 5 – TIRGP015 Ground Gas Profile

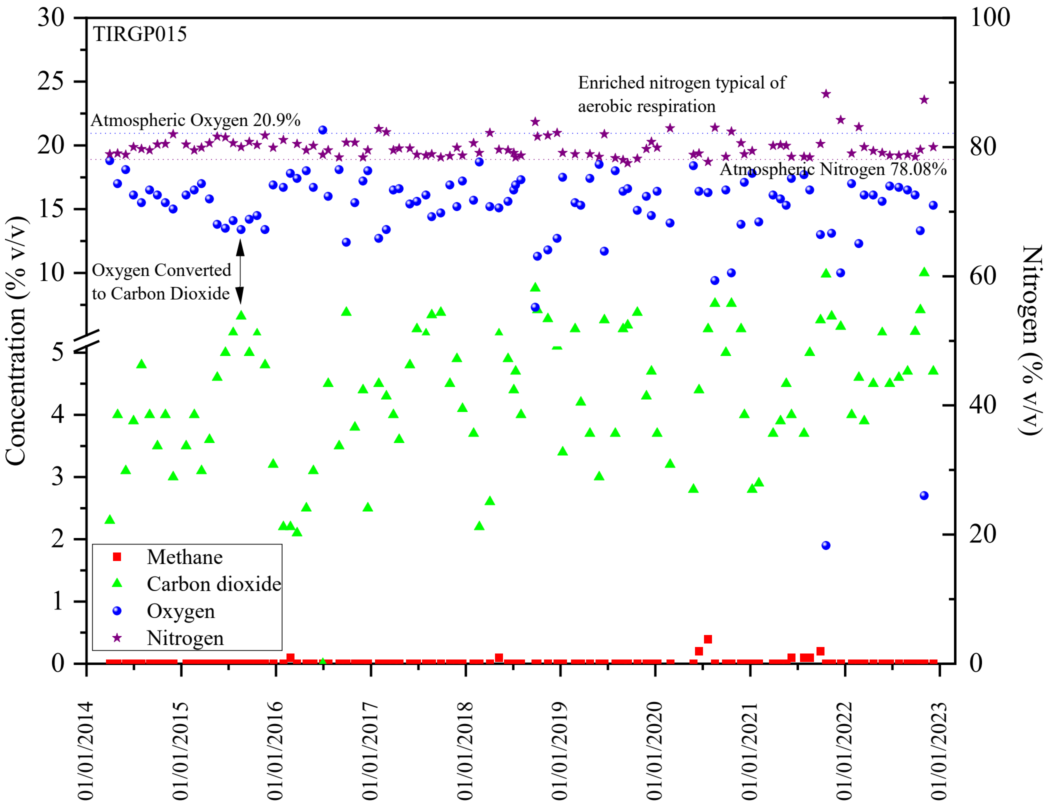
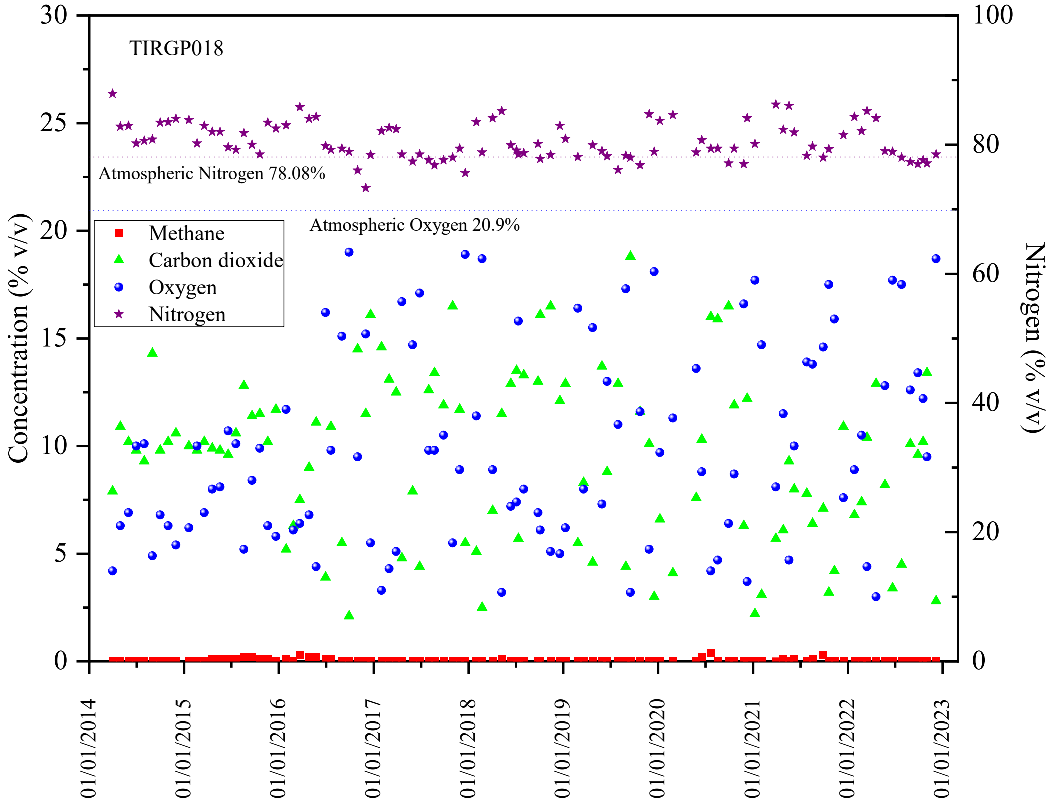


Figure 6 – TIRGP018 Ground Gas Profile



TIRGP018 (Figure 6) has a generally higher baseline carbon dioxide content (at 10 - 19%v/v) than the other locations and follows a cyclical trend which has continued throughout 2022. The reported data at TIRGP018 is within the historic range and there are no increasing trends in carbon dioxide or methane. TIRGP016 also has an average carbon dioxide concentration, 8.6%v/v, however there is less fluctuation in the data range at this location compared to TIRGP018. Carbon dioxide is typically observed in the 5-10%v/v range in TIRGP016.

TIRGP18, TIRGP16 and the adjacent monitoring points (GP17 and GP19) are installed physically lower than the base of the permitted landfill site. Therefore, as any migrating landfill gas from the adjacent cells would vent above ground level at TIRGP016 – 18 the ground gas patterns are unlikely to be derived from the Phase 2 landfill.

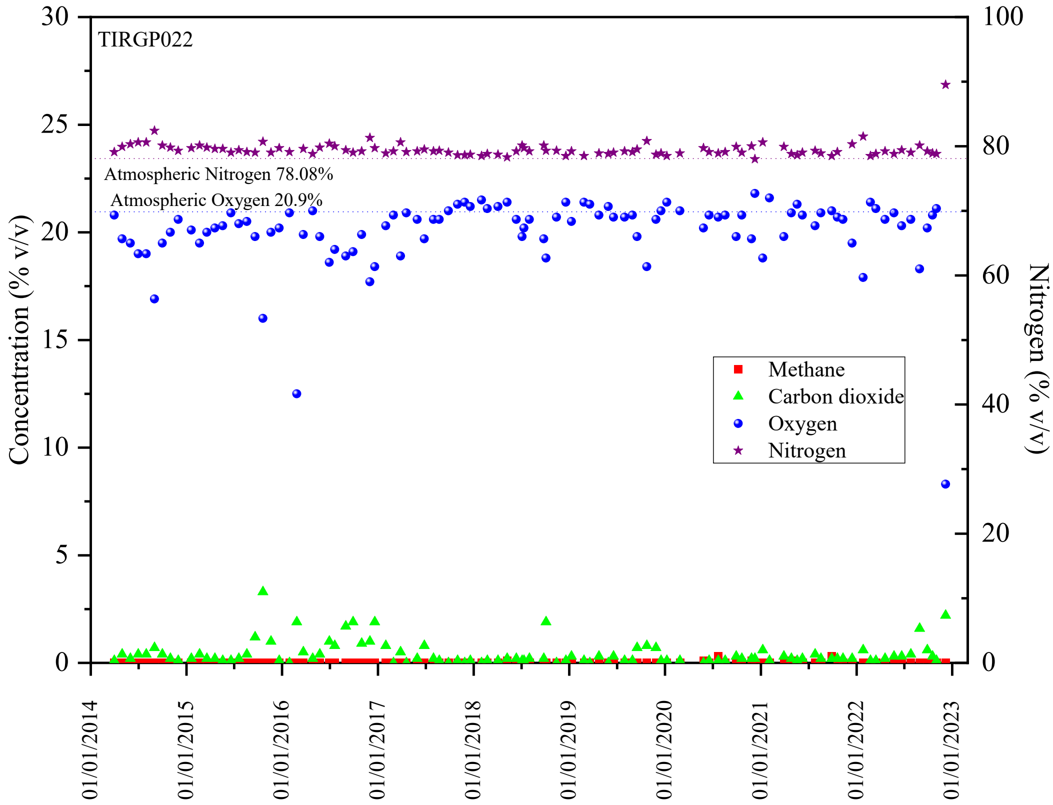
The monitoring points TIRGP013-20 along the northern section of the site were identified within the 2011 Hydrogeological risk assessment[3] to be located within or directly adjacent to historical inert wastes as well as the Crymlyn Bog. Both regimes could support the types of biological respiration resulting in the observed carbon dioxide and hence explain the monitoring programme observations.

TIRGP22 has a different ground gas profile to the other locations, more closely reflecting atmospheric conditions (Figure 7). TIRGP22 has historically only contained the occasional isolated

[3] Drawing B1160000/OP012/Figure 4 Jacobs (2011) Tir John Landfill Hydrogeological Risk Assessment. Report B1160000/OP012/001

carbon dioxide peaks in excess of 2%v/v, displaying a dampened seasonal trend, with otherwise negligible carbon dioxide.

Figure 7 – TIRGP022 Ground Gas Profile



3.4 Summary

Methane was negligible in the perimeter monitoring network during 2022 with the exception of TIRGP021, where methane re-occurred over 1%v/v. Methane has historically routinely been detected during the wetter months at TIRGP021, before depleting in late spring. Carbon dioxide in excess of 5%v/v was observed almost ubiquitously around the perimeter of the site.

Neither the methane nor the carbon dioxide is considered to be related to the permitted landfill operations. It is not known if the seasonally observed methane at TIRGP021 is a consequence of a biogenic source influenced by changing moisture conditions resulting in marsh gas generation, or even historical waste disposal activities. The permitted landfill is a land raise constructed above the surrounding modified and natural topography. Consequently, the ground gas monitoring points are located physically below the base of the landfill site and more likely influenced by the Crymlyn Bog and the historical disposal activities than the permitted Phase 2 landfill.

Carbon dioxide at the majority of the monitoring points was elevated above that expected for free draining open granular soils and is associated with a depletion in oxygen in combination with nitrogen enrichment. This is consistent with natural processes, most likely to be sub-surface microbial aerobic respiration, and concentrations are consistent with expectations for a biologically active soil, such as within a peat bog. Notwithstanding this, similar processes could also occur where there is organic matter within the made ground outside of the engineered containment cells.

4 Water Environmental Monitoring

4.1 Leachate

4.1.1 Leachate Levels

A vertical abstraction system was installed during 2017-2018. Previously leachate was managed passively via a gravity drainage system. Leachate continues to be removed from the site and discharged to sewer.

During 2022, the majority of the site's leachate has been at less than 4m above the base (Figure 8), an environmentally insignificant level for a site benefiting from an engineered liner. There are some areas where leachate heights are in the 5 - 8m range however this is within the range modelled as part of the 2018 HRAR.

Leachate levels at the majority of locations remained consistent with previous years and within the range ~10 – 17mAOD. TIRLEW31 and TIRLEW32 have remained fairly stable throughout 2022 following on from the capping of Cell 15 undertaken in 2020.

Figure 8 – Leachate Height

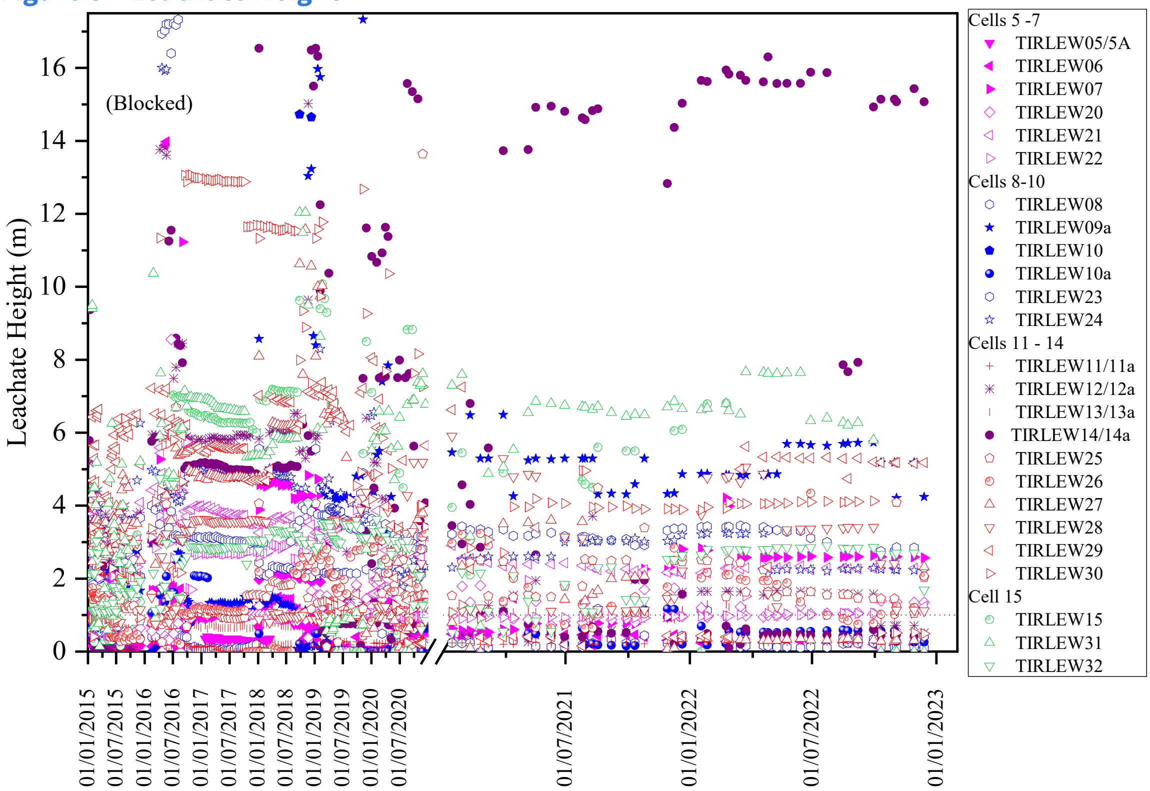
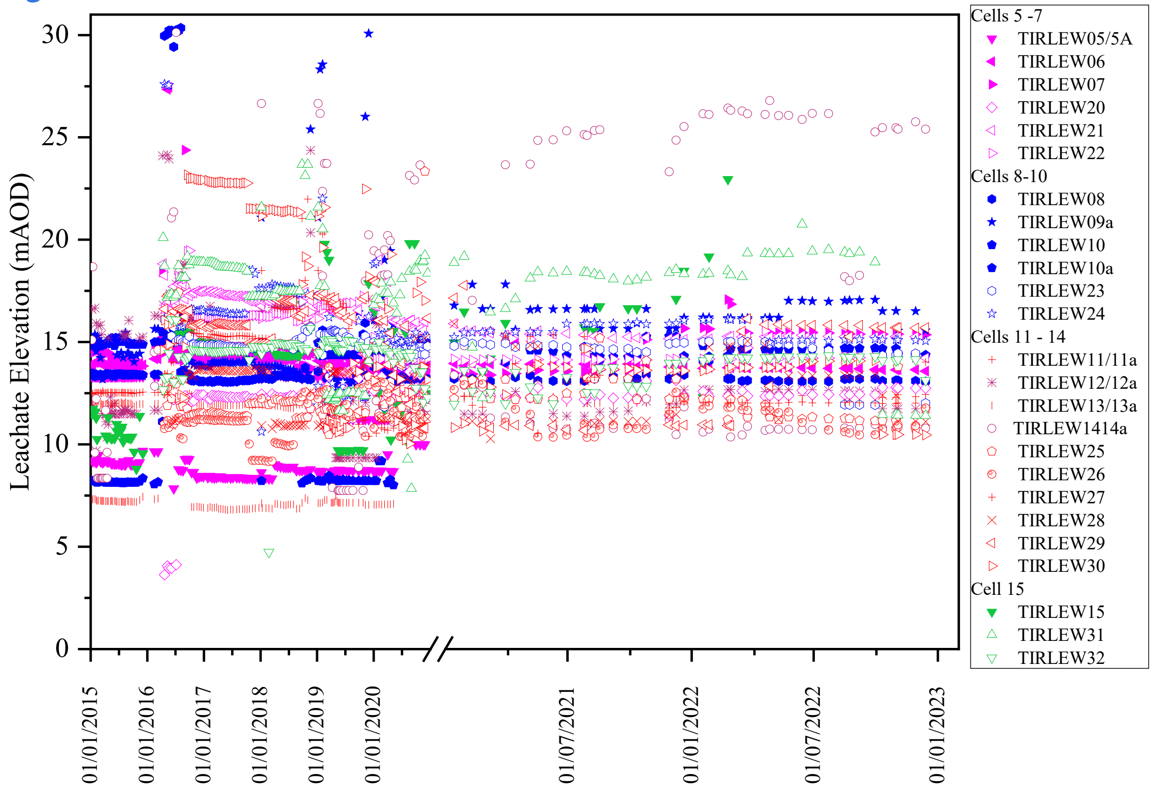


Figure 9 – Leachate Elevation



The reported data at TIRLEW14 is significantly elevated compared to the rest of the site. This monitoring point was partially blocked, and the data appears to be representative of a perched layer reflective of moisture above the blockage.

The leachate volume within the site is monitored in two locations for the majority of cells and one location in the smaller cells (Drawing TJ74).

4.2 Leachate Quality

The leachate at Tir John Phase 2 comprises of an ammoniacal-N and potassium rich sodium-bicarbonate-chloride solution with organic components. The strongest leachate (*i.e.* the highest ammoniacal-N) is present within the youngest cells, *i.e.* Cell 16, Cell 15 and Cell 12 which neighbours the operational area (Table 4). There is a depleted leachate in the older cells with reducing ammoniacal-N and Chloride (Cells 5-7 and Cells 8-10). Due to the reducing strength of the older cells leachate there is a reducing source term in this area of the site and the pollution potential from Cells 5-7 is declining.

Table 4 – Leachate Matrix Constituents 2022

Sample Point	Date	pH	EC µS/cm	NH_4-N mg/l	COD mg/l	BOD mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l
Cells 5-7										
LEW05A	16/11/22	7.8	2,100	82	130	23	34	150	71	160
LEW22	16/11/22	7.7	7,500	440	1400	16	72	780	370	930
Cells 8-10										
LEW23	18/05/22	7.5	3,200	130	450	18		720	250	66
	16/11/22	6.7	1,900	109	170	9	39	120	48	120
LEW25	18/05/22	7.4	3,400	280	320	13		440	180	67
	16/11/22	7.2	2,700	150	110	12	49	160	79	160
Cells 11,13&14										
LEW26	18/05/22	7.8	1,200	0.2	110	< 1		180	78	160
	16/11/22	7.4	1,600	0.3	110	2	33	160	78	140
LEW28	18/05/22	7.9	9,900	720	2,200	47		1,100	390	1,100
	16/11/22	8.3	2,200	160	170	2	19	180	82	210
LEW29	18/05/22	7.6	5,800	350	510	19		620	260	470
	16/11/22	7.6	4,200	230	320	14	85	380	180	340
Cells 12&15										
LEW12a	18/05/22	7.9	12,000	1,300	2,200	56		1,700	550	2200
	16/11/22	8.1	19,000	1,500	2,000	170	77	1,700	610	2300
LEW31	18/05/22	7.8	20,000	1,400.0	4,900	130		2,100	920	2900
	16/11/22	8.0	24,000	2,000.0	4,800	220	52	2,300	610	2600
Cell 16										
LEW16	18/05/22	8.3	9,900	2,600	10,000	3200		2,600	1,200	3300
	16/11/22	7.9	17,000	1,300	4,700	1200	100	1,400	780	1800

The priority metal and metalloids are also typical of a non-hazardous leachate (Table 5). Mercury continues to remain below detection limits during 2022. Arsenic was reported at <0.004-0.4mg/l and typically remained below the EQS of 0.05mg/l throughout 2022.

Cadmium is typically reported below the limit of detection with the exception of LEW26 which saw cadmium at 0.11µg/l during May 2022. During the subsequent monitoring visit cadmium had returned to below the limit of detection of <0.08µg/l in LEW26.

Copper was found in negligible quantities across the monitoring locations, whilst zinc and lead were reported at higher and more variable concentrations. Lead was reported in the 0.0001-0.02mg/l range while zinc is in the 0.01-0.6mg/l range.

Table 5 – Leachate Priority Metals 2022

Sample Point	Date	Cd µg/l	Hg ug/l	Cr mg/l	Cu mg/l	Ni mg/l	Zn mg/l	Pb mg/l	As mg/l
Cells 5-7									
LEW05A	16/11/2022	< 0.08	< 0.005		0.014	0.025	0.06	< 0.001	0.013
LEW22	16/11/2022	< 0.08	< 0.005		0.021	0.029	0.17	< 0.001	0.033
Cells 8-10									
LEW23	18/05/2022	< 0.02	< 0.005	0.015	0.002	0.045	0.03	0.0009	0.024
LEW23	16/11/2022	< 0.08	< 0.005		< 0.0007	0.005	0.01	< 0.001	0.018
LEW25	18/05/2022	< 0.02	< 0.005	0.007	0.004	0.020	0.02	< 0.0002	0.004

Sample Point	Date	Cd	Hg	Cr	Cu	Ni	Zn	Pb	As
		µg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
LEW25	16/11/2022	< 0.08	< 0.005		0.090	0.036	0.66	< 0.001	0.010
Cells 11,13&14									
LEW26	18/05/2022	0.11	< 0.005	0.002	0.082	0.022	0.10	0.0003	0.003
LEW26	16/11/2022	< 0.08	< 0.005		0.063	0.019	0.09	< 0.001	0.004
LEW28	18/05/2022	< 0.02	< 0.005	0.064	0.025	0.180	0.19	0.0250	0.041
LEW28	16/11/2022	< 0.08	< 0.005		0.062	0.029	0.07	< 0.001	0.010
LEW29	18/05/2022	< 0.02	< 0.005	0.006	0.003	0.027	0.01	0.0002	0.019
LEW29	16/11/2022	< 0.08	< 0.005		0.004	0.031	0.04	< 0.001	0.016
Cells 12&15									
LEW12a	18/05/2022	< 0.02	< 0.005	0.098	0.096	0.200	0.33	0.0100	0.039
LEW12a	16/11/2022	< 0.08	< 0.005		0.052	0.200	0.20	0.0060	0.024
LEW31	18/05/2022	< 0.02	< 0.005	0.410	0.008	0.250	0.17	0.0210	0.085
LEW31	16/11/2022	< 0.08	< 0.005		0.004	0.350	0.13	0.0090	0.074
Cell 16									
LEW16	18/05/2022	< 0.02	< 0.005	2.200	0.014	0.230	0.26	0.0160	0.400
LEW16	16/11/2022	< 0.08	< 0.005		0.011	0.150	0.14	0.0030	0.300

A hazardous substances screen was carried out in May and November 2022 (Table 6). The non-hazardous herbicide mecoprop was identified the most frequently within the leachate, in the 0.1-73µg/l range whilst the herbicide dichloroprop was reported at lower concentrations, between 0.1µg/l and 7µg/l. Phenols were identified as present within all of the landfill cells, with the older cells containing lower concentrations than younger cells.

Polyaromatic hydrocarbons (PAHs) were observed in the younger cells but were absent from the older cells. Where reported, PAHs typically remained below the leachate screening level of 10µg/l[4] and are therefore insignificant within the leachate.

The BTEX substances are volatile and are primarily removed via the landfill gas system, although a proportion does dissolve into solution. Consequently, these are continually formed throughout the stabilisation phase of all organic matter in the presence of moisture. Concentrations of these BTEX substances can be high in young wastes, however, once microbial processes commence their presence within leachates is usually limited as they are readily degradable. The only significant concentrations were reported in Cell16 (LEW16) which is the operational Cell as a presence is associated with fresh wastes.

[4] Environment Agency (Dec 2011) Horizontal Guidance Note H1 - Annex J3. Additional guidance for the hydrogeological risk assessments for landfills and the derivation of groundwater control levels and compliance limits. Appendix 6 - Analytical framework for screening landfill leachates. Tables A6.1 - A6.3

Table 6 – Leachate Organic Substances Identified

Location	Date	Ethyl benzene	Toluene	m,p-xylenes	o-xylene	1,2,4 trimethylbenzene	Naphthalene	p-Isopropyltoluene	Pentachlorophenol	Phenol	Dichloroprop	Mecoprop
		µg/l										
LEW05A	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	2	< 0.02	2.6
LEW12a	18/05/2022	< 1	< 1	< 1	< 1	< 1	8	< 1	< 0.05	16	< 0.02	24.0
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	< 1.0	0.4	24.0
LEW16	18/05/2022	31	41	29	17	10	< 0.01	15	1.7	33000	7.0	57.0
	16/11/2022	8	15	7	4	< 1	2	< 1	< 0.05	2200	0.1	25.0
LEW22	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	5	< 0.02	73.0
LEW23	18/05/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	5	< 1	< 0.02	1.0
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	2	< 0.02	0.1
LEW25	18/05/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	2	< 0.02	29.0
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	2	< 0.02	29.0
LEW26	18/05/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	< 1	< 0.02	< 0.02
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	1	< 0.02	< 0.02
LEW28	18/05/2022	< 1	50	< 1	< 1	< 1	< 0.01	< 1	< 0.05	8	< 0.02	27.0
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	2	0.1	3.6
LEW29	18/05/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	4	< 0.02	4.6
	16/11/2022	< 1	< 1	< 1	< 1	< 1	< 0.01	< 1	< 0.05	3	0.1	4.9
LEW31	18/05/2022	< 1	13	15	9	7	< 0.01	< 1	< 0.05	23	1.9	17.0
	16/11/2022	4	14	6	< 1	< 1	3	< 1	< 0.05	77	< 0.02	15.0

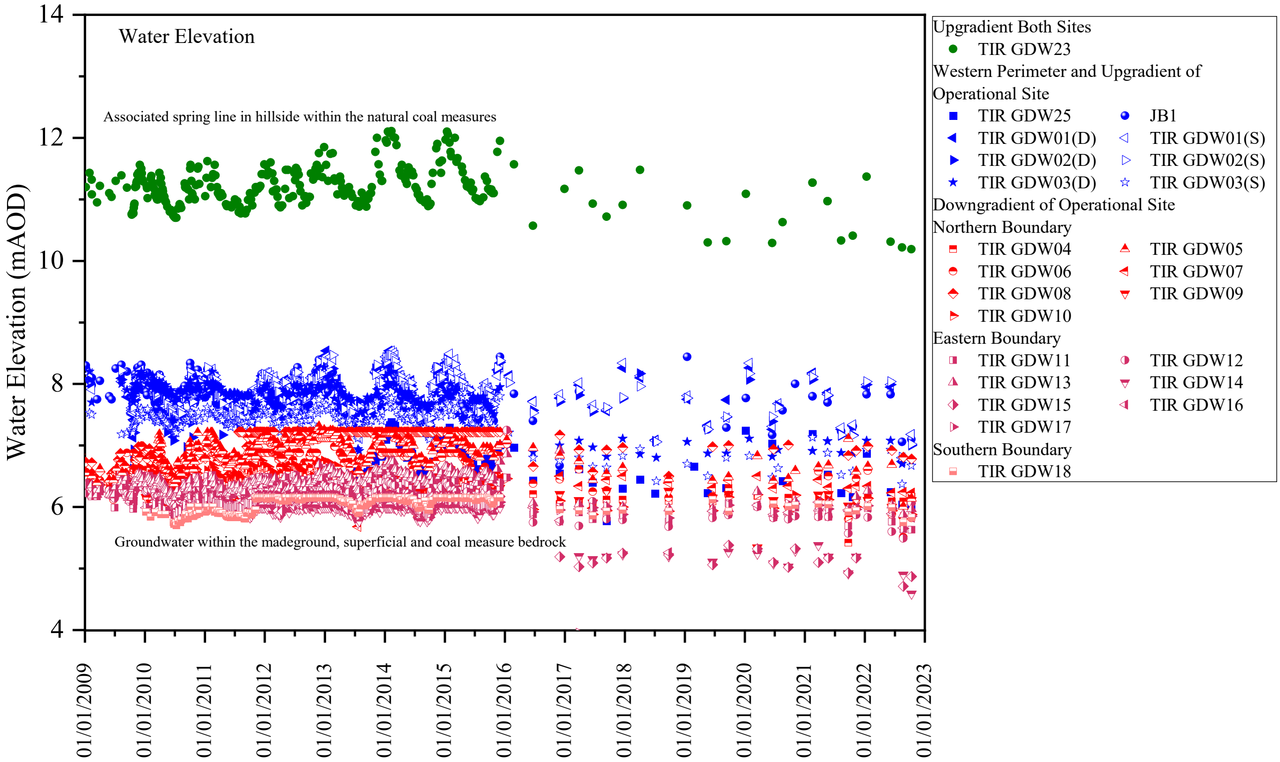
4.3 Groundwater

Groundwater monitoring is carried out in the bedrock, the *in-situ* superficial deposits and the waste / PFA platform beneath the waste. Groundwater monitoring was undertaken on a quarterly basis during 2022.

4.3.1 Groundwater Levels

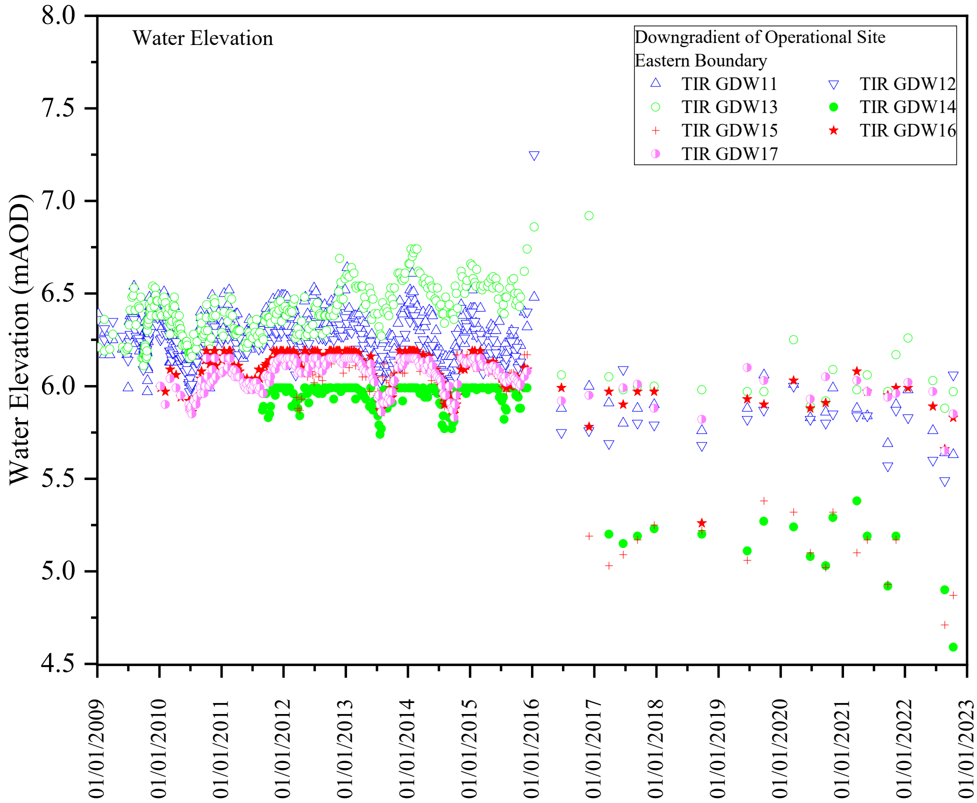
Groundwater elevations during 2022 were consistent with the seasonal trends observed in previous years, except for GDW14 and GDW15 where groundwater levels remain low in comparison to historical levels (Figure 10). This could be an artefact to the groundwater abstraction for the Cell 16 underdrainage programme.

Figure 10 – Groundwater Elevation



GDW14 and GDW15 are located at the interface of the Cell 16 extension area at the east of the site. Groundwater elevations have been artificially reduced from 5.8 - 6.2mAOD in 2015 to ~5 - 5.3mAOD in 2017 – 2022 (Figure 11). The likelihood is that this is a product of the management of the groundwater via controls designed to induce a minimum unsaturated zone beneath Cell 16 (and also Cell 15 extension) to allow attenuation before entering the saturated horizon. This dewatering sphere of influence is also apparent in adjacent monitoring points. GWD16 and GWD17 which are located to the south-east of Cell 16 and the future /undeveloped Cell 17 are at the fringes of the dewatering sphere of influence.

Figure 11 – Groundwater Elevation, Eastern Boundary



A seasonal fluctuation can be observed in the upgradient GDW23 (to the west of Phase 1) and the upgradient locations to the north and west of Phase 2 in the valley feature between the operational and closed phases. The seasonal trends are dampened within the deeper response zone of dual depth monitoring points, as well as on the north, east and south perimeter of the operational site as the groundwater becomes influenced by the groundwater within the bog and the PFA platform.

Groundwater recharge is dominated by springs on the valley slopes to the west of the closed Phase 1 landfill (*e.g.* GDW23) where groundwater levels are between 12.1mAOD in the winter high and 11.0mAOD in the summer low. There is then an easterly fall in groundwater height coincident with the fall of topography from the valley slopes into the superficial alluvial sediment valley fill.

4.3.2 Groundwater Quality

Monitoring is carried out for matrix substances (Table 7) and ‘typical’ leachate indicator substances including ammoniacal-N and chloride. The groundwater is a calcium-bicarbonate solution with secondary sulphate, sodium, potassium and chloride. Additional time series plots for each location are presented in the appendices.

Table 7 – Groundwater Matrix Summary (Average 2022)

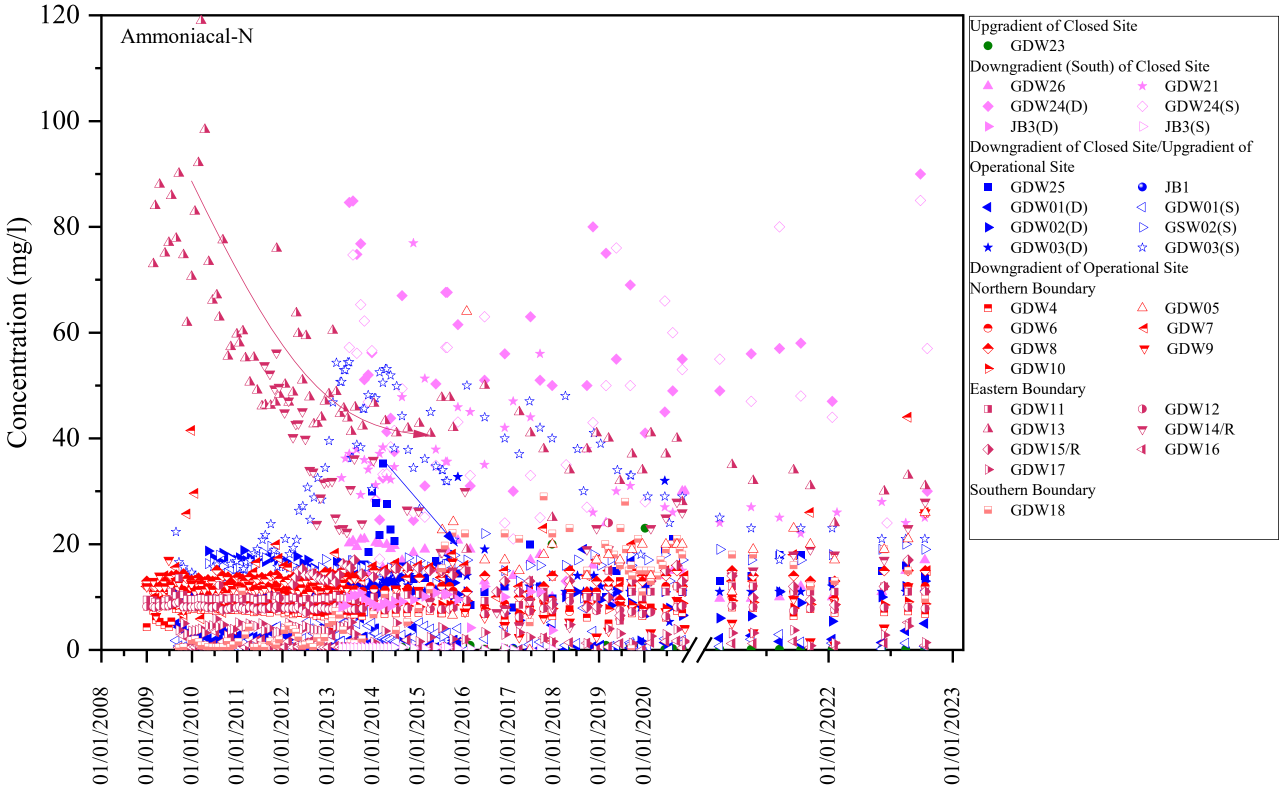
Location	pH	NH_4-N mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l
GDW01(D)	7.4	3.0	97	39	54	27	52	11
GDW01(S)	8.4	0.9	27	15	53	23	36	92
GDW02(D)	6.8	10.1	170	40	54	24	47	8
GDW02(S)	6.9	19.0	400	86	230	56	178	69
GDW03(D)	6.3	11.3	40	22	23	5	26	2
GDW03(S)	7.3	21.5	120	19	30	22	28	5
GDW04	6.1	7.1	34	13	35	9	33	7
GDW05	7.3	20.8	71	64	280	40	28	3
GDW06	6.5	11.4	85	15	42	10	28	4
GDW07	6.9	23.7	490	69	50	33	95	426
GDW08	7.0	14.5	165	32	68	18	25	1
GDW09	6.9	10.8	210	52	53	19	49	17
GDW10	7.3	8.7	170	20	38	12	31	2
GDW11	6.9	11.3	145	22	57	10	63	2
GDW12	7.5	7.9	71	69	19	39	23	1
GDW13	7.0	29.5	150	53	104	31	123	2
GDW16	6.2	2.0	34	13	41	8	50	16
GDW17	6.3	2.5	133	24	92	12	190	99
GDW18	7.2	14.2	170	39	94	38	102	101

Table 8 –Permit Limit Comparison

Sample Point	NH_4-N			Cl		
	Ave	Max	Limit	Ave	Max	Limit
GDW01(D)	3	5		52	57	
GDW01(S)	1	1		36	45	
GDW02(D)	10	13		47	59	
GDW02(S)	19	20		178	190	
GDW03(D)	11	12		26	27	
GDW03(S)	22	23		28	29	
GDW04	7	7	**12**	33	37	**100**
GDW05	21	26	**25**	28	29	**100**
GDW06	11	12	**16**	28	37	**100**
GDW07	24	44	**15**	95	110	**250**
GDW08	15	15	**20**	25	29	**100**
GDW09	11	26	**16**	49	82	**100**
GDW10	9	9	**15**	31	36	**100**
GDW11	11	12	**15**	63	63	**100**
GDW12	8	8	**12**	23	23	**100**
GDW13	30	33		123	130	
GDW16	2	5	**4**	50	65	**100**
GDW17	3	5	**10**	190	200	**300**
GDW18	14	19	**5**	102	150	**300**

Shaded cells indicate Permit Limit Exceedance

Figure 12 – Groundwater Ammoniacal-N



Ammoniacal-N has remained stable during 2022 and consistent with the historical dataset in the majority of monitoring locations (Figure 12). An increase in ammoniacal-N at GDW16, GDW09 and GDW05 was reported during 2022 along with an elevated data point at GDW7.

Ammoniacal-N in GDW07 has followed a pattern of a generally consistent fluctuation between 10 and 20mg/l, interspersed with higher short term reported concentrations in the 25 – 45mg/l range. These elevated spikes were most prominent in the 2009 – 2012 period and have recently (2021 and 2022) reoccurred (Figure 13). There is no correlation with increasing chloride as would be expected if leachate seepage or spillage had occurred.

During 2022 the Permit Limit was exceeded on two occasions during August and October at 44mg/l and 26mg/l respectively (Table 8). It is considered likely that the ammoniacal-N Permit Limit exceedances at GDW07 during 2022 are an artefact of an incomplete understanding of this background fluctuation, with the limit based on too narrow a dataset.

Figure 13 – Groundwater Matrix Chemistry GDW7

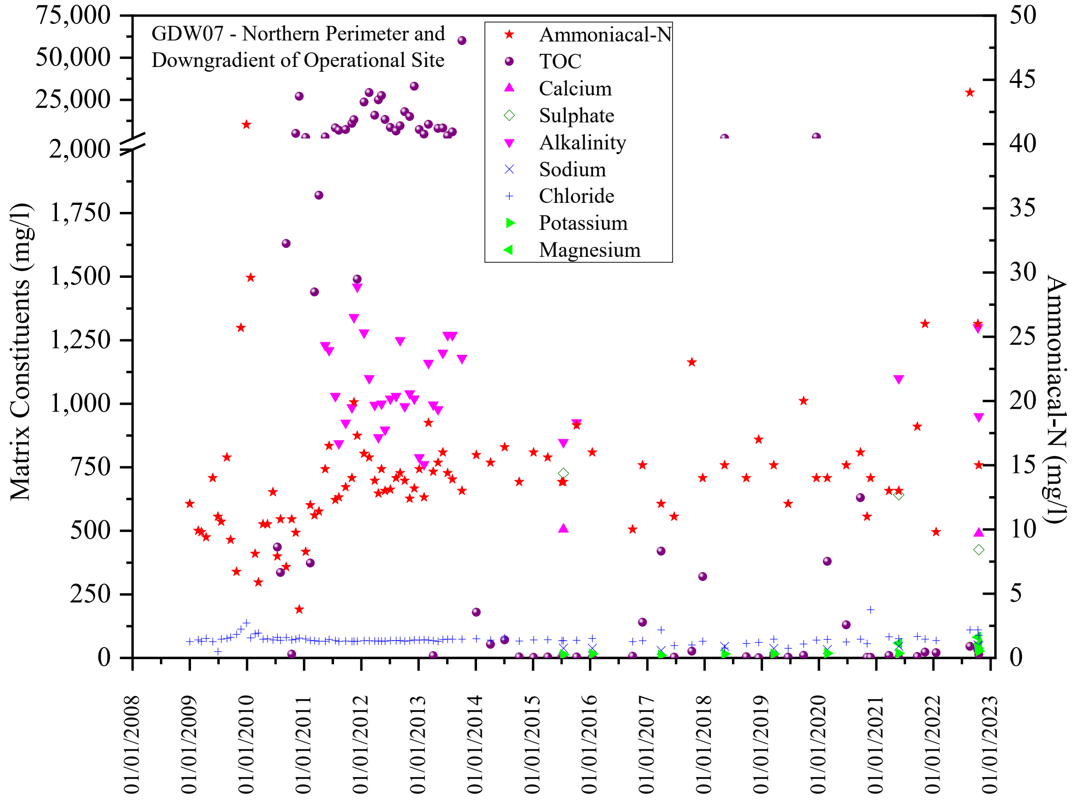
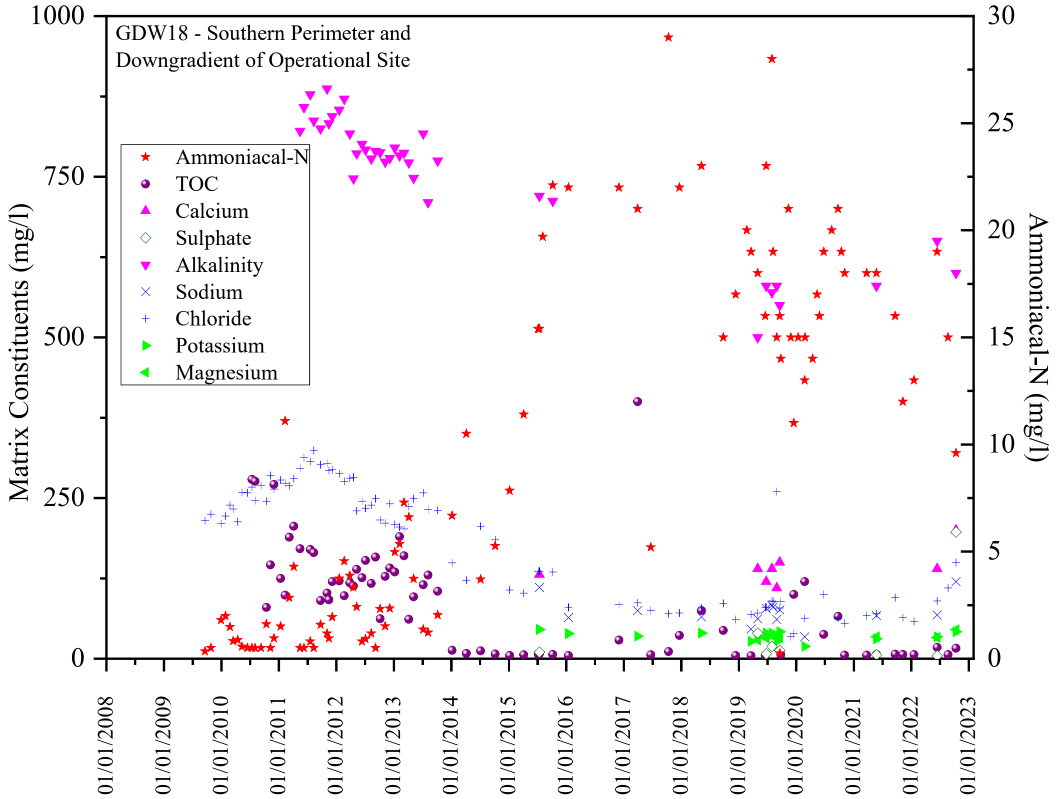


Figure 14 – Groundwater Matrix Chemistry GDW18

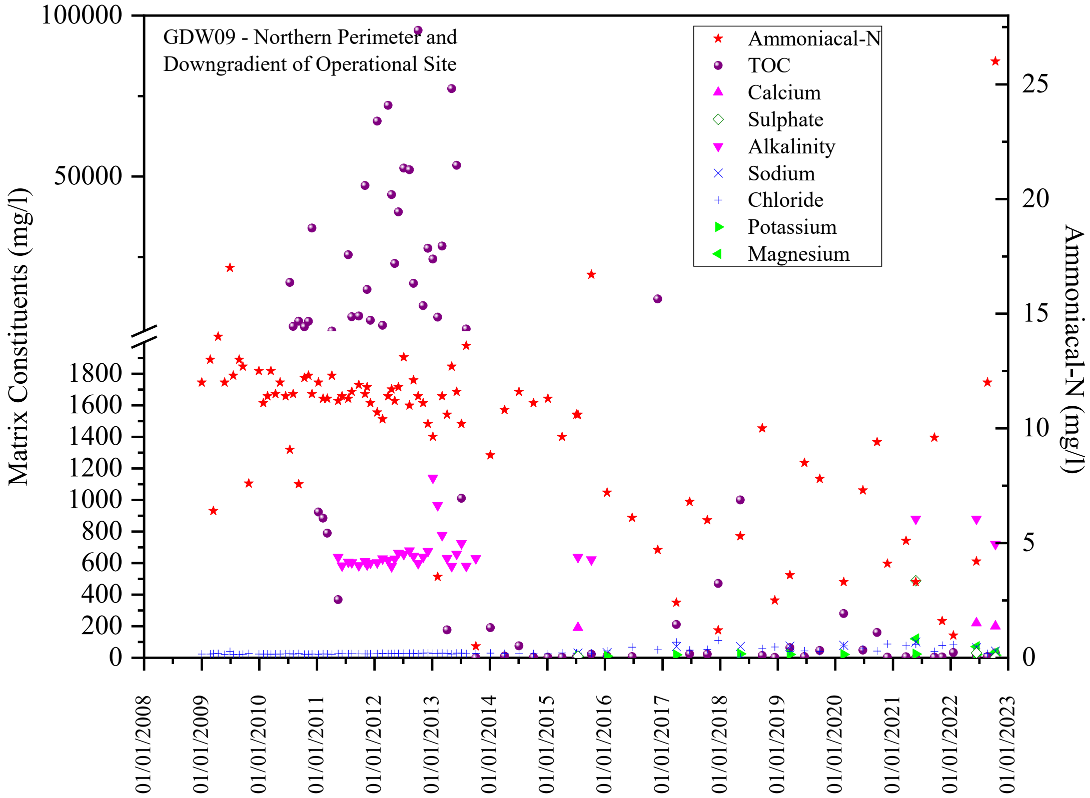


There is a step change in ammoniacal-N at GDW18 which occurred in 2015-2016 when levels increased from ~5mg/l to ~25mg/l in 2016 before stabilising at this range during the following years, with the occasional outlier (Figure 14). However, in parallel to the increase in ammoniacal-N, chloride, alkalinity and COD all followed a depleting profile. Such a pattern is inconsistent with a continued outbreak or leakage of a non-hazardous landfill leachate.

The profile however more akin to that expected from waters originating in the Crymlyn Bog, rather than the Phase 2 leachates.

Ammoniacal-N in GDW09 peaked at 26mg/l during October 2022 (Figure 15). Historically ammoniacal-N has remained below 18mg/l and from 2016-2021 was reported in the 0.9-10mg/l range. This spike in ammoniacal-N during 2022 was not associated with an increase in any other matrix ions and is not characteristic of a landfill signature.

Figure 15 – Groundwater Matrix Chemistry GDW09



Ammoniacal-N at GDW05 has followed a multiyear fluctuating pattern between 15 and 30mg/l. However, within this pattern occasional lower (5-10mg/l) and higher (~65mg/l) data has been observed as isolated points. During 2022, ammoniacal-N followed the general pattern, with one observation of 26mg/l ammoniacal-N, which although it marginally exceeds the 25mg/l ammoniacal-N Permit Limit, is within the precision range of the analysis. Chloride however at 25-30mg/l is environmentally negligible and definitively indicative that there is not a Phase 2 landfill leachate influence in the groundwater at GDW05 (Figure 16).

Figure 16 – Groundwater Matrix Chemistry GDW05

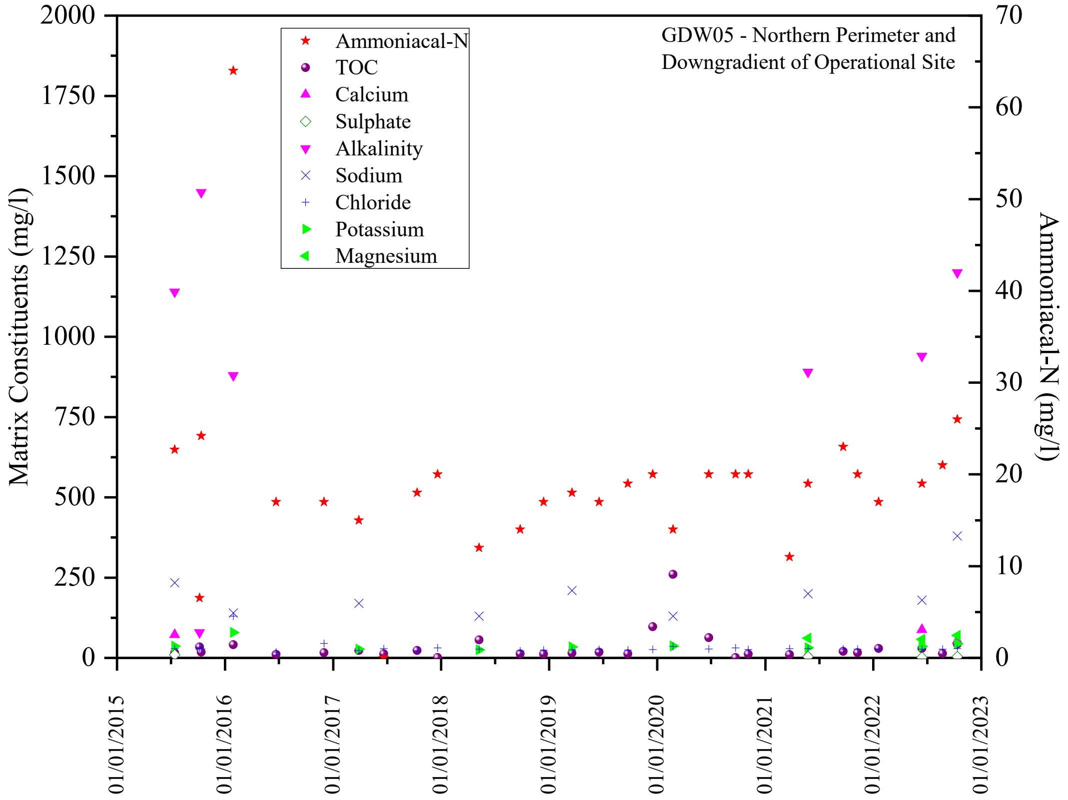
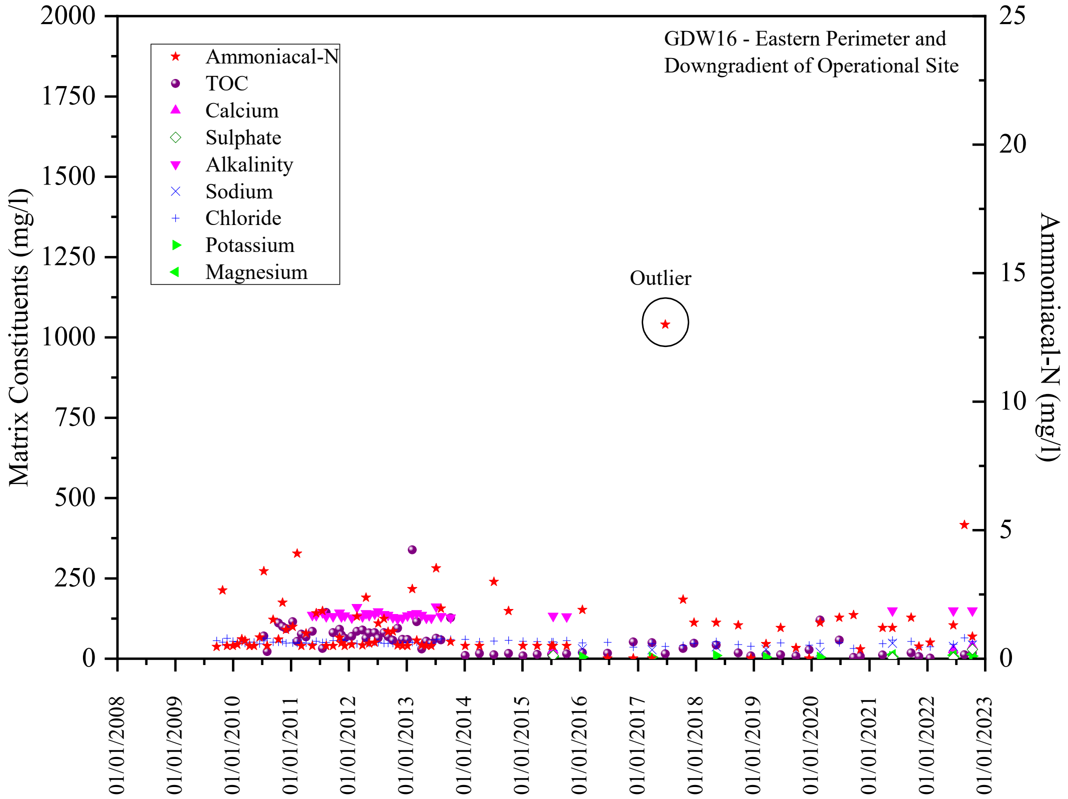


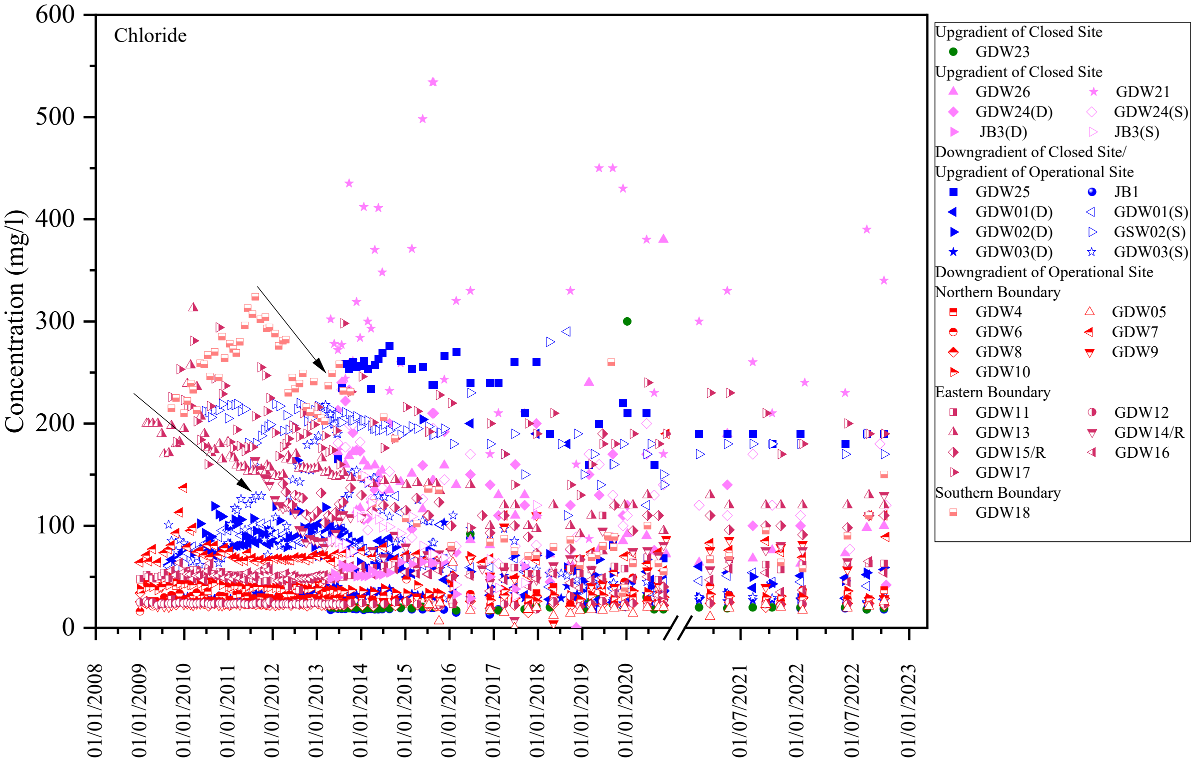
Figure 17 – Groundwater Matrix Chemistry GDW16



At GDW16 ammoniacal-N was consistent with previously reported concentrations, <0.0015-1.7mg/l for the 2018-2021 period, with the exception of one elevated result of 5.2mg/l in August 2022 (Figure 17). This exceeded the permit limit of 4mg/l (Table 8). During the subsequent (October) monitoring visit, ammoniacal-N had returned to 0.86mg/l significantly below the permit limit. There was no associated increase in chloride when the ammoniacal-N permit limit was exceeded. Chloride ad GDW16 remained stable and within the 32-56mg/l range through the year.

Chloride has been reported below 250mg/l (the Drinking Water Standard) at the Phase 2 site (Figure 18) and has not exceeded any of the (respective 100mg/l, 250mg/l and 300mg/l) Permit Limits throughout the 2022 monitoring period (Table 8).

Figure 18 – Groundwater Chloride



4.3.3 Priority Metals

The groundwater priority metals are summarised in Table 9. Mercury and arsenic are hazardous substances. Mercury is typically reported below the limit of detection, <0.005µg/l, with the only notable concentration reported at GDW01(S) at 0.023µg/l which is significantly below the DWS of 1µg/l.

Arsenic is environmentally insignificant in the groundwater and is consistently reported below the 50µg/l Environmental Quality Standard (EQS) with the exception of GDW01(S) where arsenic was observed at 55µg/l and is most likely an artefact of the PFA host material.

Table 9 – Groundwater Priority Metal Summary (Max 2022)

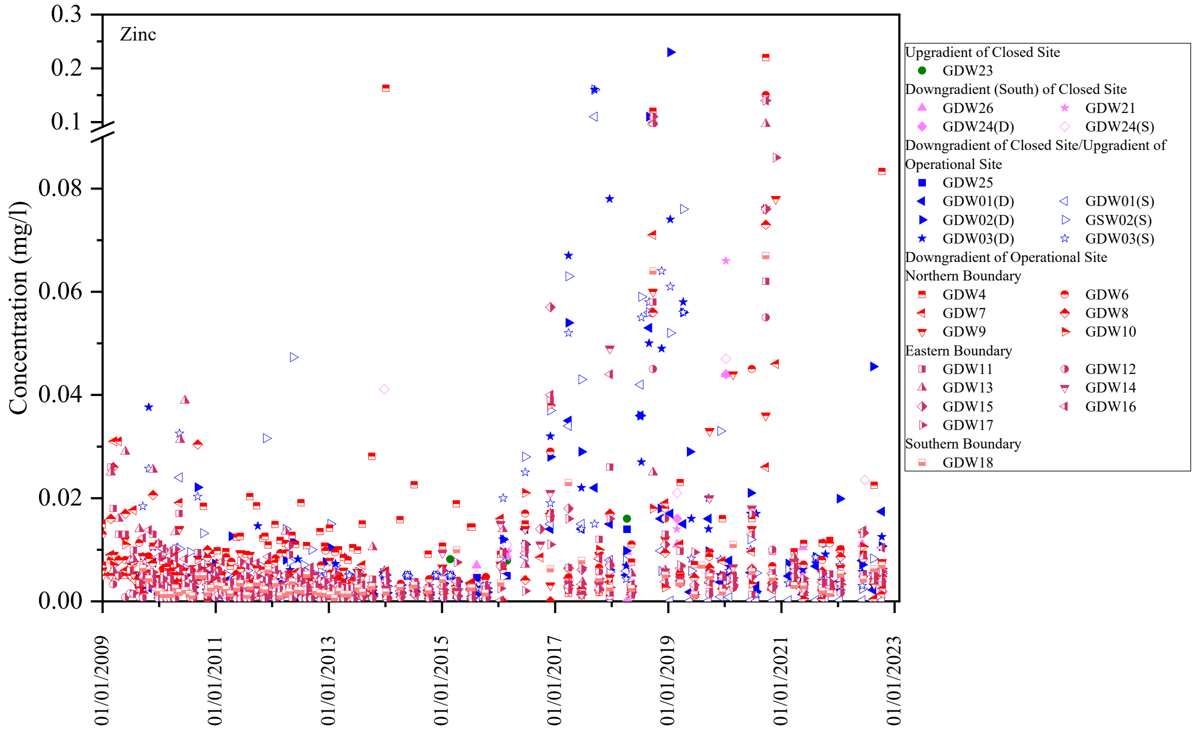
Sample Point	Fe	Mn	Cd	Hg	Cr	Cu	Ni	Zn	Pb	As
	mg/l	mg/l	µg/l	µg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
GDW01(D)	0.14	0.89	0.03	<0.005	0.002	0.003	0.0005	0.017	<0.0002	0.011
GDW01(S)	0.08	0.16	0.03	0.023	0.002	0.001	0.0005	0.008	<0.0002	0.055
GDW02(D)	0.09	4.40	0.06	<0.005	0.004	0.002	0.0007	0.046	<0.0002	0.011
GDW02(S)	0.52	0.89	<0.02	<0.005	0.009	0.008	0.0009	0.008	<0.0002	0.002
GDW03(D)	0.52	0.88	<0.02	<0.005	0.003	0.003	0.0006	0.013	<0.0002	0.002
GDW03(S)	0.09	1.90	0.02	<0.005	0.003	0.002	0.0006	0.007	0.0005	0.004
GDW04		0.44	0.08	<0.005	0.006	0.004	0.0062	0.083	0.0013	0.029
GDW05		0.21	0.03	<0.005	0.007	0.009	0.0028	0.005	0.0004	0.012
GDW06		0.50	0.04	<0.005	0.004	0.007	0.0017	0.010	0.0005	0.003
GDW07		0.77	<0.02	<0.005	0.008	0.006	0.0008	0.010	<0.0002	0.009
GDW08		0.94	<0.02	<0.005	0.005	0.006	0.0013	0.013	0.0003	0.005
GDW09		0.86	<0.02	<0.005	0.008	0.005	0.0028	0.008	<0.0002	0.027
GDW10		0.49	0.03	<0.005	0.005	0.004	0.0008	0.011	<0.0002	0.003
GDW11		1.40	<0.02	<0.005	0.005	0.004	0.0016	0.005	0.0003	0.003
GDW12		0.63	<0.02	<0.005	0.004	0.003	0.0019	0.006	<0.0002	0.008
GDW13		1.70	<0.02	<0.005	0.008	0.008	0.0012	0.009	<0.0002	0.004
GDW16		0.32	<0.02	<0.005	0.002	0.003	0.0014	0.014	<0.0002	0.004
GDW17		1.20	0.04	<0.005	0.003	0.003	0.0055	0.013	0.0004	0.008
GDW18		0.99	0.08	<0.005	0.005	0.003	0.0059	0.007	0.0003	0.014

Shaded cells indicate Permit Limit Exceedance

Lead was reported approximating or below the limit of detection and remained below the DWS of 0.01mg/l throughout 2022. Cadmium was consistently reported below the Permit limit of 1µg/l during 2022 and remained in the 0.02-0.08µg/l range (Table 9).

Copper was reported in the 0.001-0.008mg/l which is significantly below the DWS of 2mg/l. Chromium was reported at a similar level to copper, in the 0.002-0.009mg/l range which is environmentally insignificant and below the DWS of 0.05mg/l. Nickel is similarly low to negligible.

Figure 19 – Groundwater Zinc



Zinc remained below the 0.075mg/l permit limit at all locations except GDW04 during 2022 (Figure 19). At GDW04 zinc was marginally elevated at 0.083mg/l during October, prior to this zinc had remained below the permit limit at this location during 2022. It is likely that the groundwater at GDW04 is being influenced by the PFA platform as arsenic and nickel are slightly elevated in this location.

The most likely cause of any changes in metal content is likely to be due to the expected redox cycling from changes in groundwater levels, whereby metals oxides and sulphides are sequentially oxidised and precipitated depending on the redox potential. The signature of the priority metals and metalloids in GDW04 point appears to be an iron oxide with arsenic, nickel and zinc coprecipitate.

4.3.4 Phosphate Substances

Groundwater phosphate is monitored in accordance with the environmental permit for both the inorganic phosphate species and as the organo-complex tributyl phosphate. Tributyl phosphate was not identified within the groundwater during 2022 and was consistently reported below the limit of detection of <0.1µg/l. This is consistent with the historical dataset for this substance.

The Operator changed laboratories during 2021 and the new accredited laboratory are unable to achieve a limit of detection (LOD) of less than the Permitted Limit using accredited analytical methods. Whilst the LOD is above the Permit limit of 0.02µg/l there is no indication that a significant change in the groundwater geochemistry has occurred during 2022. Tributyl phosphate is also significantly below the AA Environmental Quality Standard of 50µg/l.

Reactive phosphorus (also known as orthophosphate) was reported above the 0.05mg/l Permit limit at several locations during 2022 (Table 10). The most significant exceedances were reported towards the north of the site at GDW05, GDW07 and GDW09.

Where reported, orthophosphate oscillated above and below the limit of detection throughout the year and was generally not persistently identified with the exception of GDW05, however, it is noted that in Quarter 2 the result for GDW05 was at the limit of detection, 0.062mg/l.

The LOD for orthophosphate is above the permit limit of 0.05mg/l as accredited laboratory are unable to achieve a limit of detection (LOD) of less than the Permitted limit using accredited analytical methods.

The most likely source of groundwater phosphates is from the PFA that was placed under and around the site prior to the development of Phase 2. Consequently, an exceedance of the current permit limits in their current format does not indicate that the Phase 2 landfill has influenced the surrounding environment.

Table 10 – Groundwater Orthophosphate Summary

Location	Orthophosphate (mg/l)			
	Q1	Q2	Q3	Q4
GDW01(D)	0.09	< 0.062	< 0.062	0.38
GDW01(S)	0.09	< 0.062	0.35	0.27
GDW02(D)	< 0.062	0.13	< 0.062	< 0.062
GDW02(S)	0.06	< 0.062	< 0.062	0.11
GDW03(D)	< 0.062	< 0.062	< 0.062	< 0.062
GDW03(S)	0.44	< 0.062	< 0.062	< 0.062
Permit Limit	**0.05**			
GDW04	< 0.062	< 0.062	0.07	0.14
GDW05	0.48	0.06	0.43	4.80
GDW06	< 0.062	< 0.062	< 0.062	< 0.062
GDW07	< 0.062	*	2.00	2.70
GDW08	< 0.062	< 0.062	< 0.062	0.50
GDW09	1.20	0.08	< 0.062	2.60
GDW10	< 0.062	< 0.062	0.14	0.14
GDW11	< 0.062	< 0.062	< 0.062	< 0.062
GDW12	< 0.062	< 0.062	< 0.062	< 0.062
GDW13	< 0.062	< 0.062	< 0.062	< 0.062
GDW16	< 0.062	< 0.062	< 0.062	< 0.062
GDW17	< 0.062	< 0.062	< 0.062	< 0.062
GDW18	< 0.062	< 0.062	< 0.062	< 0.062
GDW14 R	< 0.062	< 0.062	< 0.062	< 0.062
GDW15 R	< 0.062	< 0.062	< 0.062	< 0.062

*Replacement sample taken 18/10/22 (1.5mg/l)

4.3.5 Organic Screen including Hazardous Substances

A hazardous substances suite was carried out in June 2022. No hazardous substances were reported in the majority of monitoring locations with the exception of GDW2(S) and GDW3(D)(Table 11). Triphenyltin was reported at low concentrations in both monitoring locations however, has not been identified in the leachate. Triphenyltin is a banned fungicide meaning that is it unexpected in the groundwater.

Table 11 – Substances Present over the Limit of Detection

Substance	Units	TIRGDW 2 (S)	TIRGDW 3 (D)
		07/06/2022	
Herbicides & Pesticides			
Triphenyltin (chloride)	µg/l	0.082	0.031

Permit Limits have been set for specific organic substances within the groundwater including Atrazine, Benzo pyrene, Cis-1,2-dichloroethene and Dichloroprop. These substances are monitored quarterly and were all recorded below their respective limits of detection and Permit limits throughout 2022. It is noted that the limit of detection for Atrazine exceeds the permit limit as this low level of Atrazine is undetectable by UKAS accredited methods of analysis.

4.4 Environmental Transects

To understand the background 'baseline' data of the Crymlyn Bog sampling, additional monitoring points have been installed along three transects which extend perpendicular to the Phase 2 Tir John Landfill Site into the bog. Transects EMT2, EMT6 & EMT7 are to the east of Cell 16, the southeast of the future Cell 7 and to the north of Cell 13 respectively.

The Environmental Monitoring Transects (EMTs) comprise a series of monitoring points at 2m, 4m, 8m, 16m, 32m, and 64m intervals, each of which has a shallow (1m) and deep (2m) response zone. The data from the annual screen, 01/03/2022, is presented in Table 12.

Table 12 – Transect Water Quality

Sample Point	pH	NH_4-N	Cl	SO_4	DOC	BOD	Ca	NO_3	Orthophosphate as PO_4	P
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
TIR ETM2 (1a)	7.1	9.30	49	17	11	2	100	0.15	< 0.062	0.38
TIR ETM2 (1b)	7.3	50.00	55	4	20	60	92	0.15	7.10	3.80
TIR ETM2 (2a)	7.1	11.00	57	9	13	3	100	0.13	0.17	0.26
TIR ETM2 (2b)	7.4	29.00	79	4	10	6	130	0.13	< 0.062	0.47
TIR ETM2 (3a)	7.2	3.90	45	17	6	3	92	0.13	< 0.062	0.18
TIR ETM2 (3b)	6.7	12.00	130	9	106	4	20	3.16	1.50	0.90
TIR ETM2 (4a)	6.9	1.20	50	13	9	3	100	0.15	< 0.062	0.12
TIR ETM2 (4b)	6.7	4.60	91	9	104	6	6	1.87		0.05
TIR ETM2 (5a)	7.2	1.50	39	17	8	43	82	0.09	< 0.062	0.25
TIR ETM2 (5b)	6.8	0.65	41	13	16	7	57	0.23	0.32	0.16
TIR ETM2 (6a)	7.0	0.03	31	11	8	3	69	0.15	0.08	0.08
TIR ETM2 (6b)	6.5	85.00	48	12	1720	270	67	0.18	40.00	13.00
TIR ETM6 (1a)	6.8	0.06	62	12	6	1	82	0.15	0.09	1.40
TIR ETM6 (1b)	5.8	2.70	140	5	16	9	15	0.25	0.26	1.30
TIR ETM6 (2a)	6.2	0.04	66	5	5	6	47	0.11	< 0.062	0.86
TIR ETM6 (2b)	6.3	9.00	130	4	20	7	32	0.19	5.20	3.10
TIR ETM6 (3a)	6.6	0.14	43	5	7	1	62	0.11	< 0.062	1.90

Sample Point	pH	NH_4-N	Cl	SO_4	DOC	BOD	Ca	NO_3	Orthophosphate as PO_4	P
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
TIR ETM6 (3b)	5.8	0.11	110	3	18	1	9	0.14	0.38	0.38
TIR ETM6 (4a)	6.0	0.05	41	3	5	3	23	0.08	< 0.062	3.00
TIR ETM6 (4b)	6.3	0.37	76	6	32	1	10	0.25	1.80	1.20
TIR ETM6 (5a)	6.1	0.10	51	2	6	3	25	0.06	< 0.062	1.80
TIR ETM6 (5b)	5.6	0.32	130	5	27	9	10	0.23	< 0.062	0.19
TIR ETM6 (6a)	6.3	0.07	59	3	16	4	15	0.22	0.09	2.30
TIR ETM6 (6b)	6.5	0.03	31	6	13	1	38	0.14	0.14	0.28
TIR ETM7 (1a)	6.7	0.07	19	3	7	1	17	0.29	0.06	2.20
TIR ETM7 (1b)	7.4	0.34	15	4	4	1	49	0.01	0.42	4.30
TIR ETM7 (2a)	6.5	0.12	17	2	8	3	20	0.29	< 0.062	1.40
TIR ETM7 (2b)	7.6	40.00	25	1	4	2	72	0.02	< 0.062	3.40
TIR ETM7 (3a)	6.5	4.50	18	3	10	2	18	0.12	0.07	4.00
TIR ETM7 (3b)	7.7	33.00	52	1	4	4	85	0.11	0.08	2.80
TIR ETM7 (4a)	6.8	0.06	18	3	5	1	27	0.05	< 0.062	1.50
TIR ETM7 (4b)	7.8	3.80	82	4	4	3	140	0.14	< 0.062	3.60
TIR ETM7 (5a)	7.0	0.04	48	1	7	< 1	53	0.09	< 0.062	1.20
TIR ETM7 (5b)	7.3	1.70	180	1	5	2	170	0.05	0.19	1.50
TIR ETM7 (6a)	7.0	1.00	25	2	5	3	48	0.01	< 0.062	2.20
TIR ETM7 (6b)	6.8	0.12	93	1	4	3	130	0.04	< 0.062	1.90

The data obtained for 2022 was broadly similar to that obtained in previous years. The data demonstrative of a complex relationship whereby the nutrients ammoniacal-N and phosphorus are present as a series of elevated pockets where *in-situ* conditions must dominate rather than a progressively migrating leachate dispersion plume. This relation is further complicated as for EMT2, and potentially EMT6, the groundwater drawdown induces a hydraulic gradient from the bog towards the Cell 16 perimeter.

Chloride across the transects was typically in the similar range and distribution with depth and distance from the site at EMT2 (Figure 20) and EMT7 (Figure 22). At EMT6 chloride at 6a (64m from the site, 1m depth) has reduced from the spike observed in 2021 back to previously observed concentrations (Figure 21).

Figure 20 – EMT2 Chloride

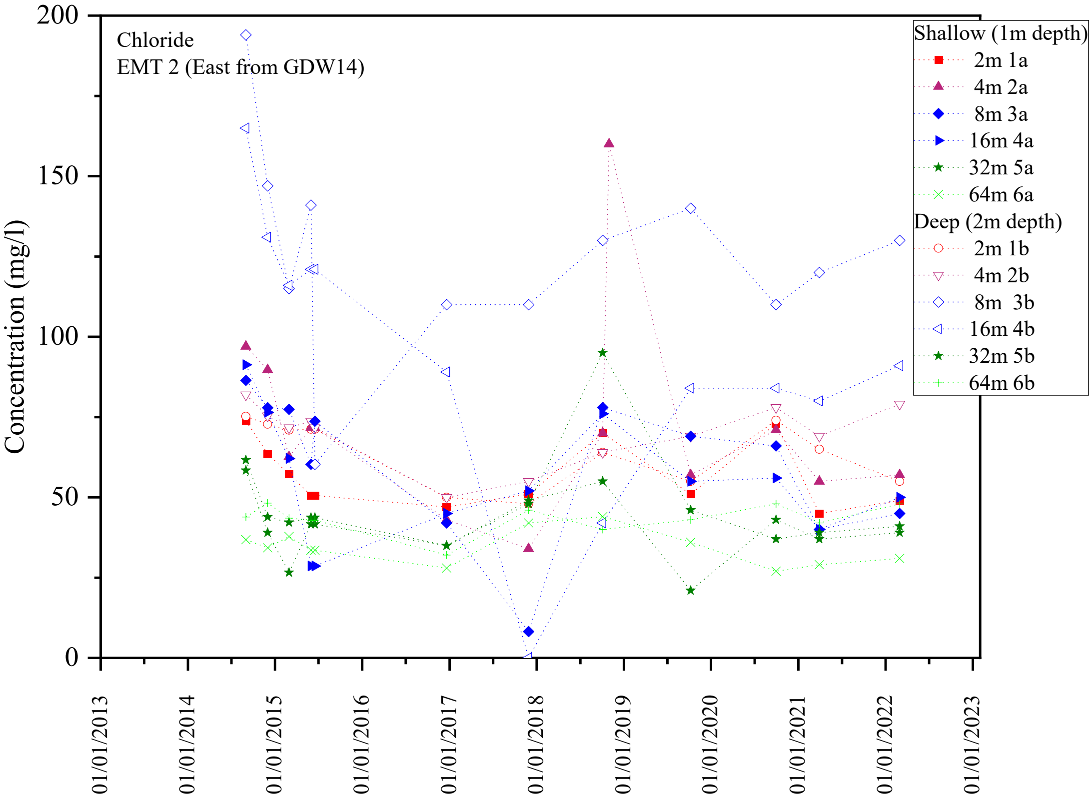


Figure 21 – EMT6 Chloride

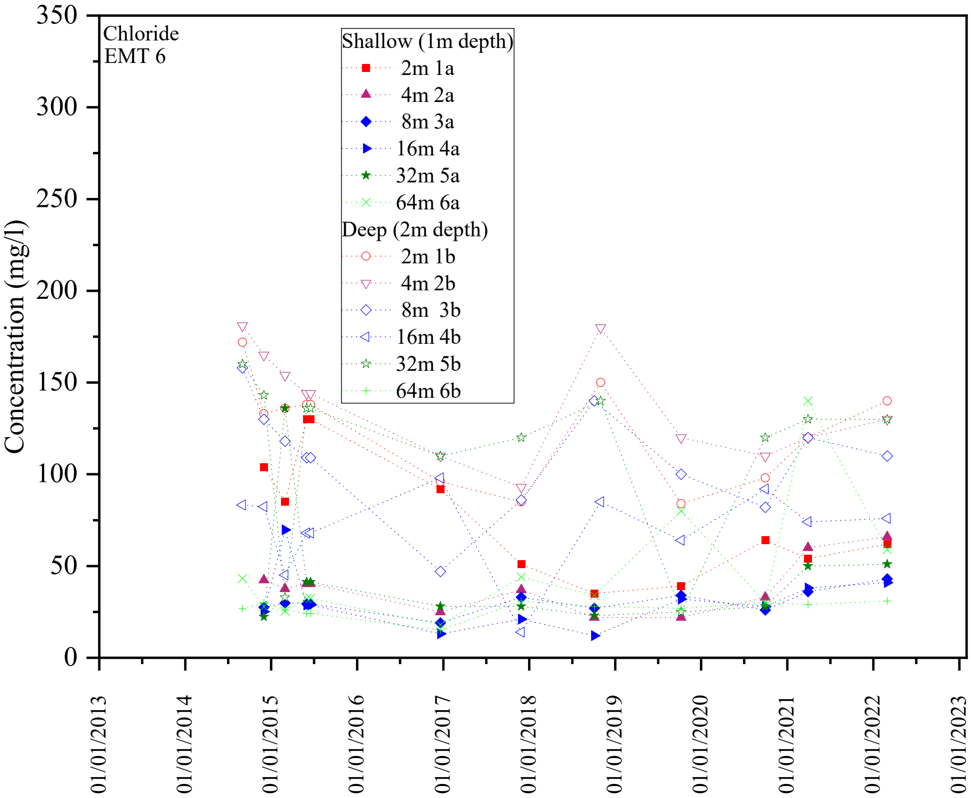


Figure 22 – EMT7 Chloride

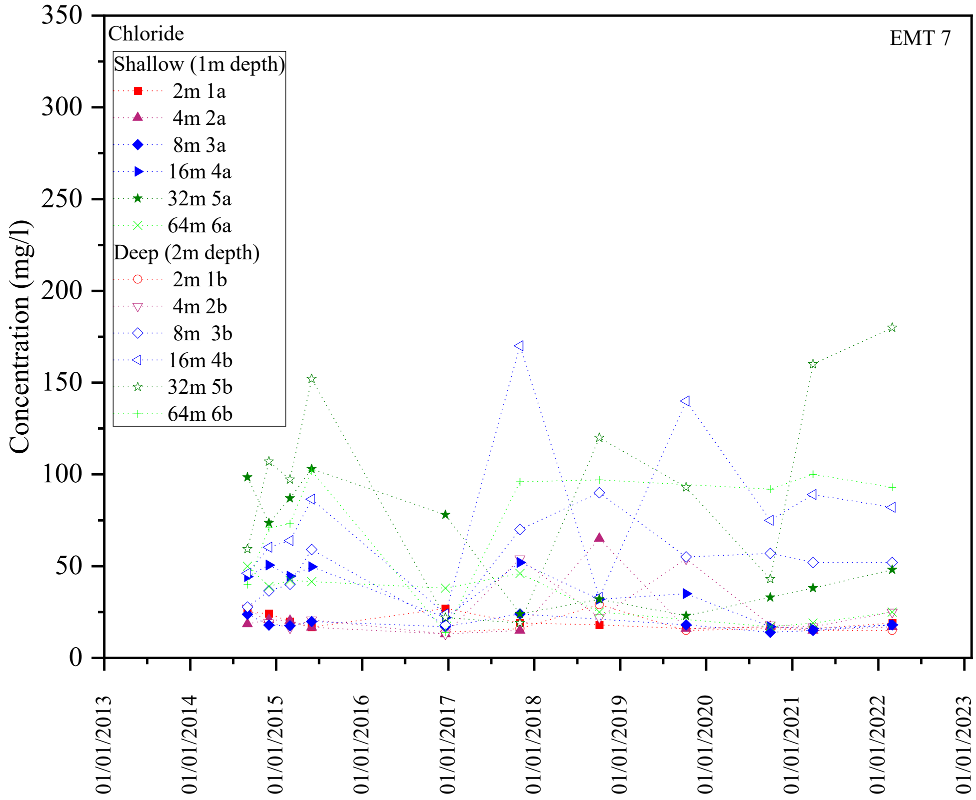


Figure 23 – EMT2 Ammoniacal-N

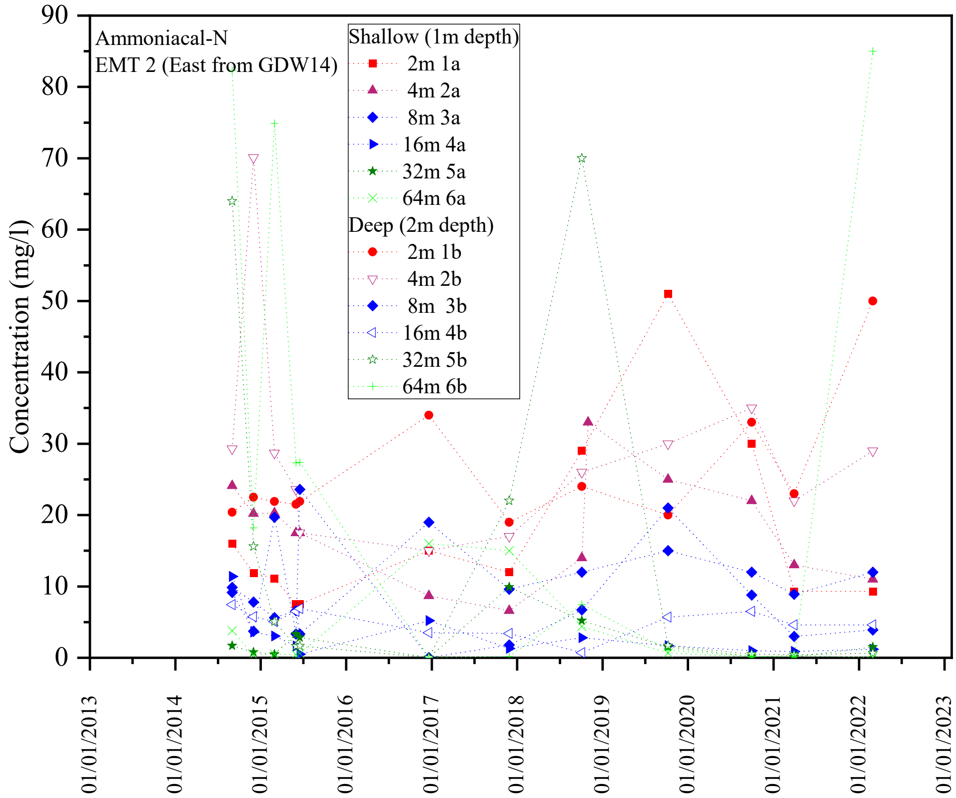


Figure 24 – EMT6 Ammoniacal-N

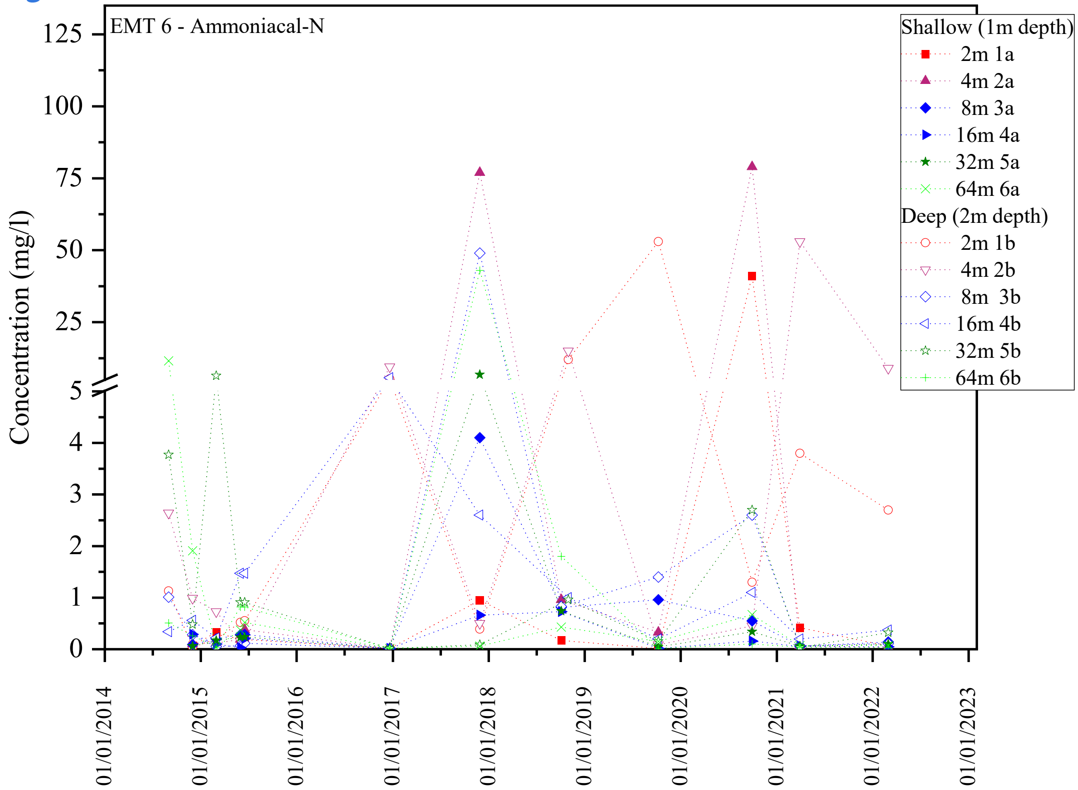
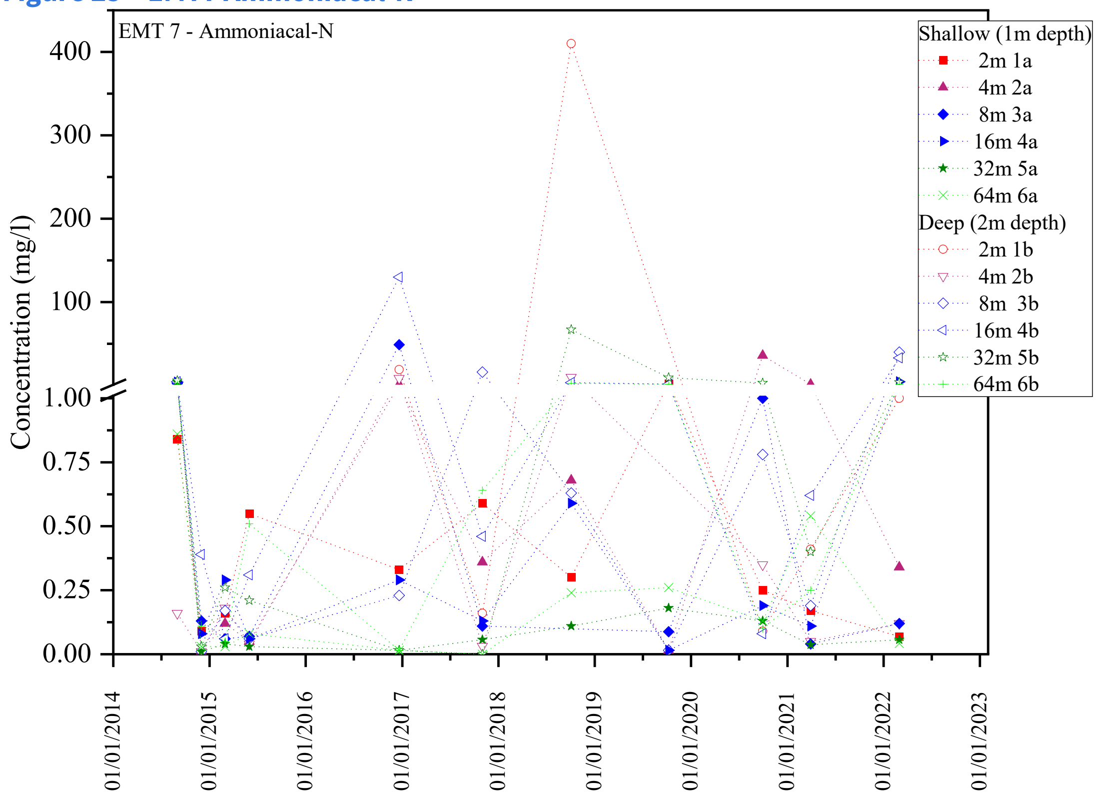


Figure 25 – EMT7 Ammoniacal-N



Ammoniacal-N is frequently reported at its highest concentration in the mid-distance or most distant monitoring points from the site in EMT7 to the north of the site. To the southeast EMT2 and

EMT6 typically report the highest concentrations closest to the site. There are also no particular time series relationships or link between chloride and ammoniacal-N which would be expected for a leachate influence as displayed in Figure 20 to Figure 25.

AT EMT 2 there was a significantly elevated ammoniacal-N reading of 85mg/l in 2002 at the 6b location which is 64m from the site. These elevated levels were previously reported in 2015 and 2016 at this location (Figure 23).

A similar trend in ammoniacal-N is reported in EMT6 with decreasing concentrations with distance from the site. Consequently, ammoniacal-N is considered to be restricted to the outer edges of the bog at the southern edge of the Made Ground. However, the inverse relationship between chloride and distance from the site is not as pronounced at EMT6 compared to EMT2.

There are several contributing processes of which *in-situ* biological activity within the Crymlyn Bog is a key factor. Although the PFA and other historical wastes which pre-date the Phase 2 Landfill could potentially contribute nutrients and stimulate biological processes within the bog there does not appear to be a constant flux from the historical wastes into the adjacent bog. Neither is there an apparent influence from the Phase 2 leachate.

The data is indicative of a groundwater regime primarily influenced by localised conditions of each monitoring point and any relationship with the landfill and the historical operations is limited.

4.5 Boreholes GDW16A and GDW16B

A condition of the continuation of the landfill into Cell 16, was the implementation of a Perimeter Control System (PCS) as a means to manage pore pressures and monitor the effects of the new landfill above an area of historic wastes in order to alleviate the potential for a historic leachate to be displaced into the bog when the cell area is loaded.

Groundwater monitoring was originally undertaken at the PCS monitoring points whilst construction works were undertaken in mid-2018. These were replaced by the Cell 16 PCS BH16A and PCS BH16B, as located at the edge of Cell 16 as shown on Figure 26 as permanent monitoring points, with data available from December 2019.

PCS BH16A and PCS BH16B are located at an increasing distance from the edge of Cell 16, but within the ring of Perimeter monitoring points. They are in close proximity to Perimeter monitoring point GDW13, and provide a closer surveillance location to PCS (mid) and therefore can act as a surveillance points for migrating leachate influenced groundwater prior to entering the bog.

PCS BH16A & 16B were monitored on a monthly basis throughout 2021 and a quarterly basis during 2022. The data collected demonstrates that ammoniacal-N (Figure 27) and chloride (Figure 28) are consistent with that of the surrounding monitoring points and within the bog along Environmental Monitoring Transect EMT2, after the data “settled”, after for example, the depletion phase data apparent for GDW13 between 2009 and 2015.

Figure 26 -Groundwater Monitoring Points Adjacent to PCS BH16A & PCS BH16B

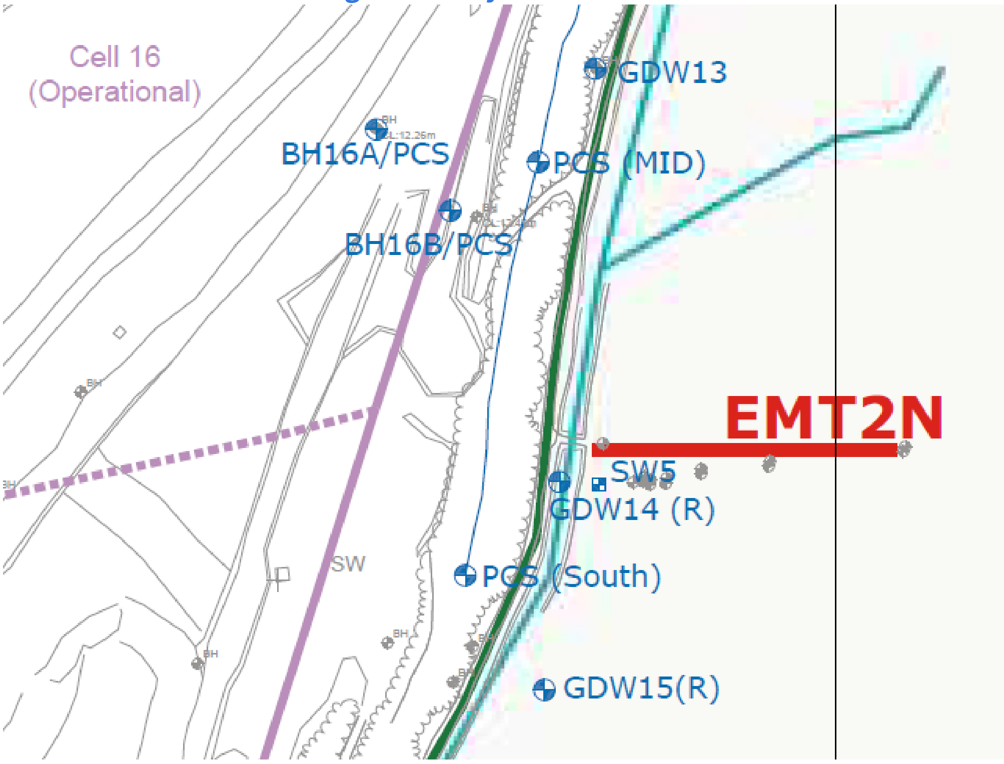


Figure 27 -Edge of Cell 16 Groundwater Ammoniacal-N (2009 – 2022)

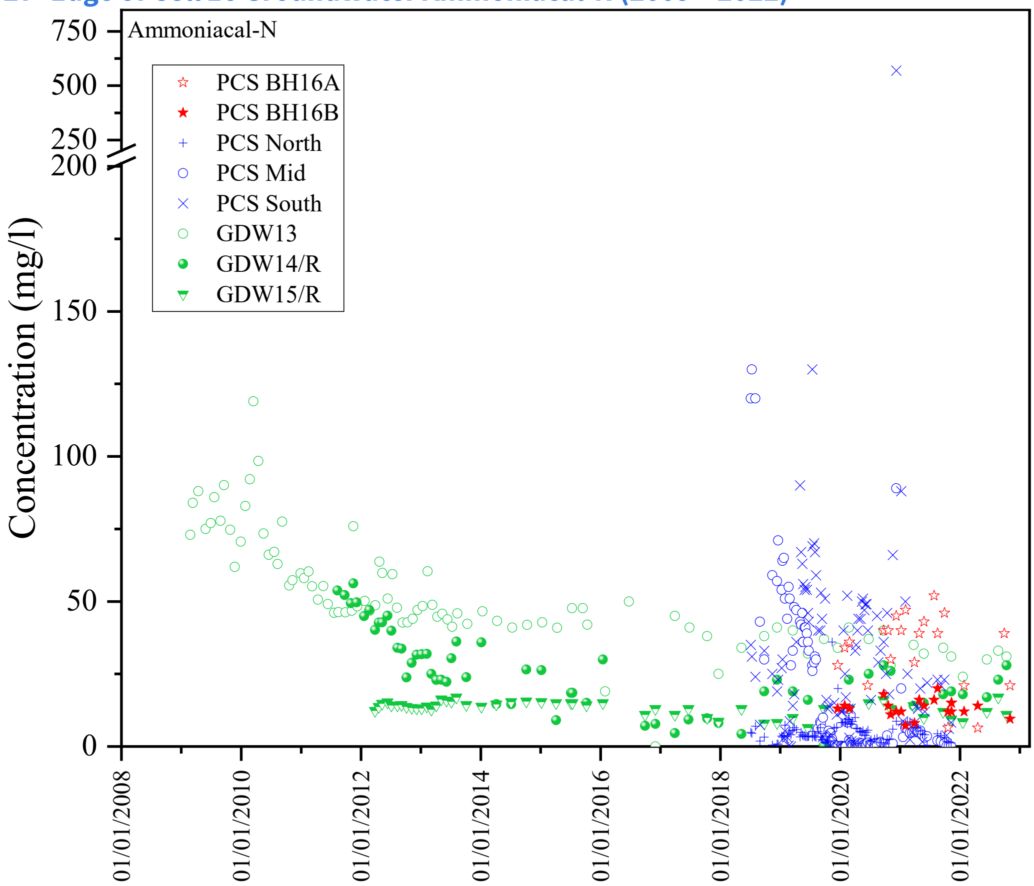
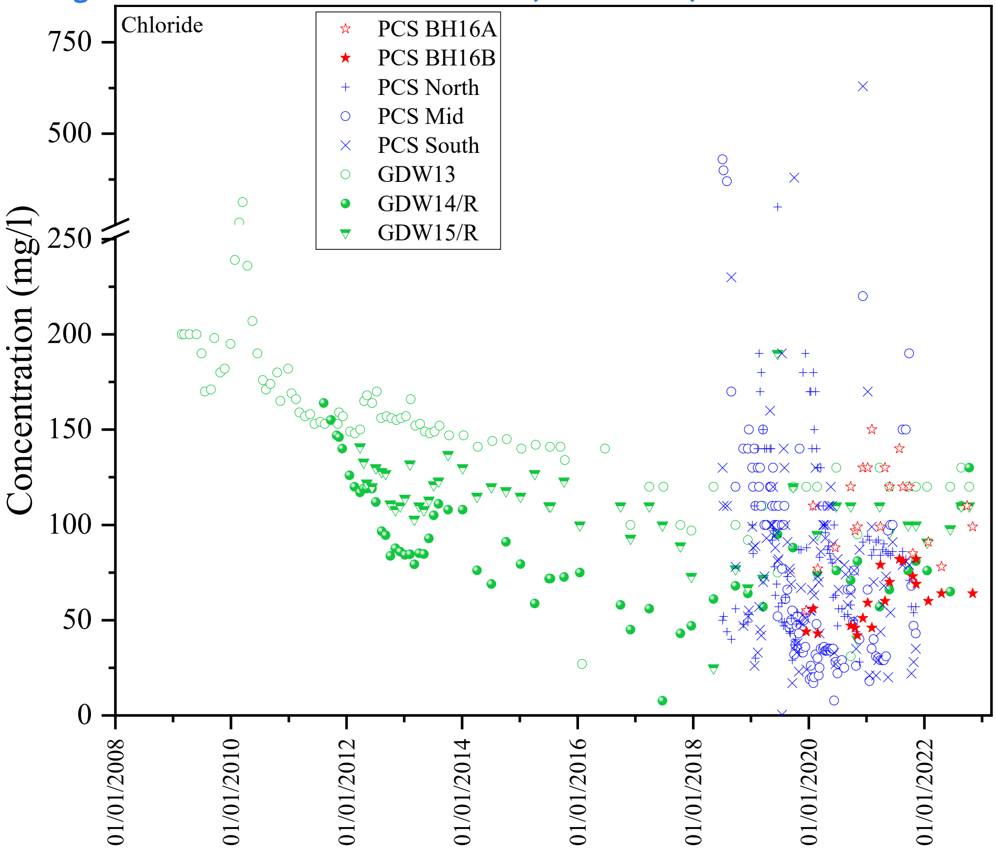


Figure 28 – Edge of Cell 16 Groundwater Chloride (2009 – 2022)



The data profiles for the original PCS series followed the same depletion profile for that of GDW13, GDW14 /14R and GDW15 / 15R observed from 2009 to 2015, was also observed at the PCS series locations during 2018 and 2019, before stabilising at the same range as is being observed for all of the monitoring points between GDW13 and GDW15/15R, and at EMT2.

The data is superficially suggestive that there is a concentration gradient from PCS BH16A to PCS BH16B (Figure 29 and Figure 30), whereby maximum ammoniacal-N and chloride are at

- 52mg/l to 20mg/l ammoniacal-N;
- 150mg/l reducing to 82mg/l chloride

are however considered as misleading given the historical trends and patterns, as there is not a continuous reducing gradient to the next ring of monitoring points at GDW13 – GDW15R as well as EMT2. The data is instead illustrative of the natural variation in the system as well as the propensity for localised concentrations. It is in that respect that the PCS BH16A & 16B data is as reflective of a gradient from external to the site as to one from internal to the site.

At this time the full extent of the actual fluctuation is unknown, however, as Figure 27 and Figure 28 illustrate 52mg/l ammoniacal-N and 150mg/l chloride are not necessarily maximum concentrations which could be observed. However, given the locations of GDW13, GDW14R and GDW15R, it is considered that specific BH16A & BH16B Permit Limits are not required, as a compliance function is already provided for in the permit by GDW13 – GDW15R. Nevertheless Action Levels could be applied at 60mg/l ammoniacal-N and 175mg/l chloride, as 15% above present background.

Figure 29 – Edge of Cell 16 Recent Groundwater Ammoniacal-N

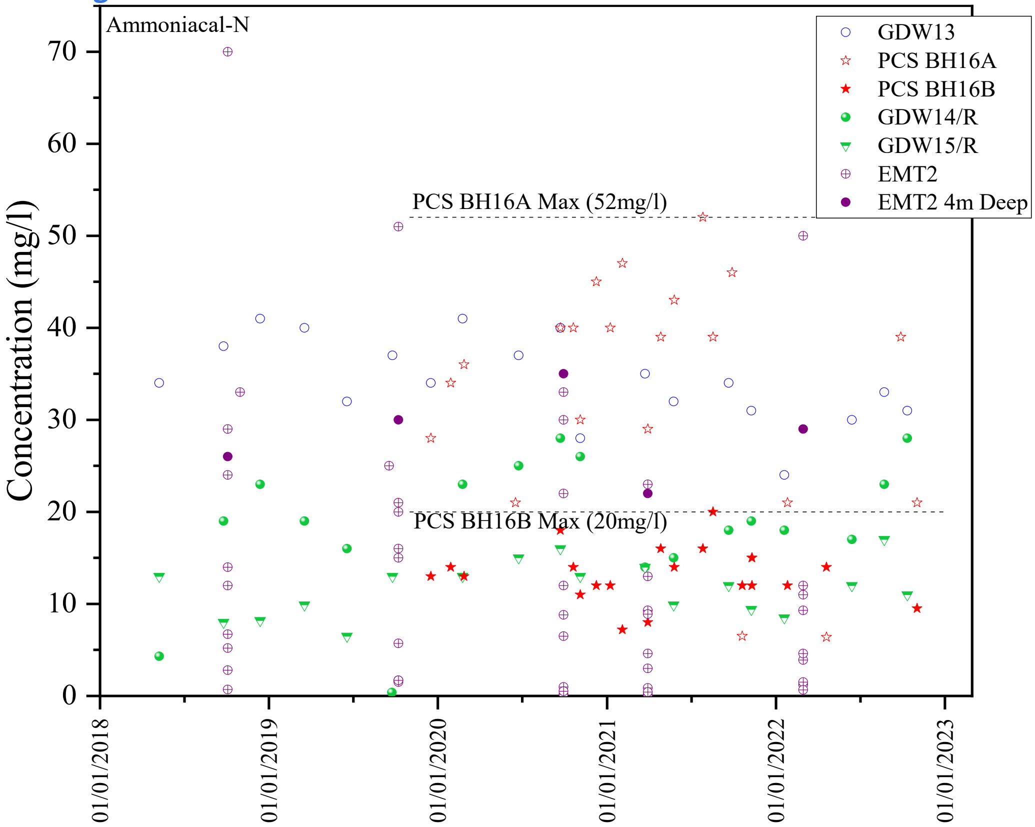
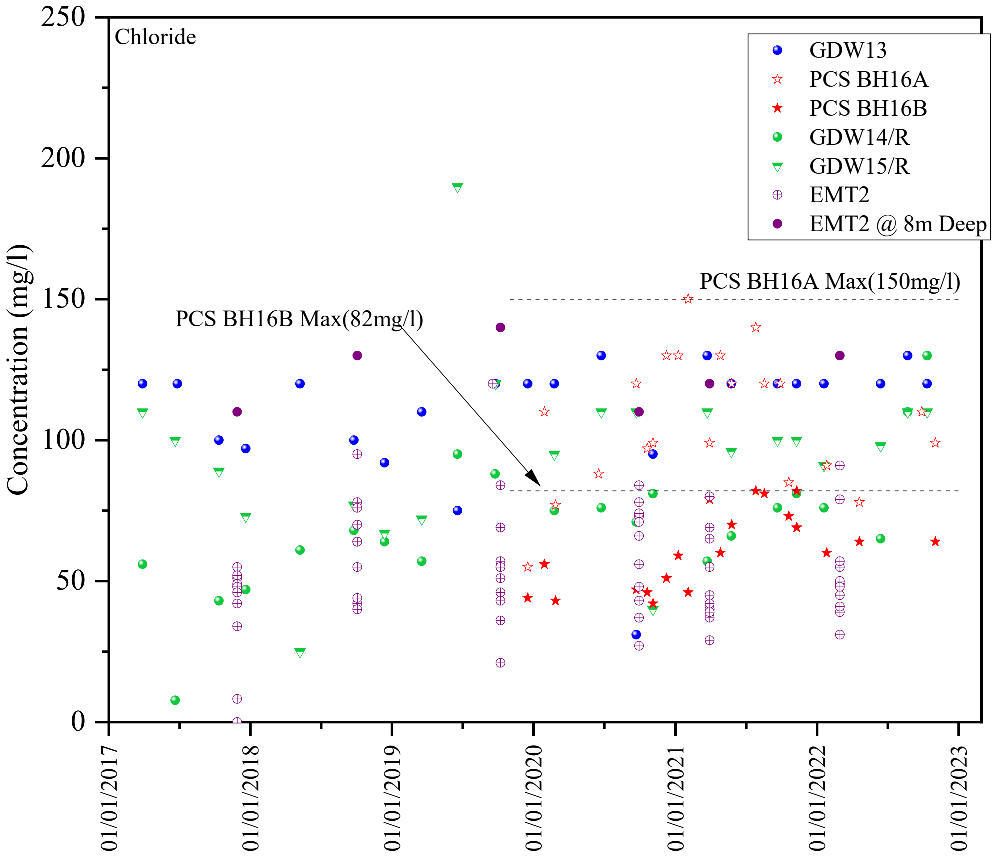


Figure 30 – Edge of Cell 16 Recent Groundwater Chloride



4.6 Groundwater Summary

Groundwater elevation is responsive to seasonal recharge patterns. This response is strongest in the westerly upgradient and upslope locations. The effect decreases in the deeper response zone of paired monitoring points and the downgradient perimeter boreholes as the groundwater joins the water levels of the bog and within the PFA platform.

Ammoniacal-N and chloride are present within the groundwater. Neither substance appears to be related to the Phase 2 landfill leachate. The source of these parameters is considered to be *in-situ* and will include the pre Phase 2 deposited materials including the beneath the site and the adjacent organic rich sediments. These are estuarine in origin, therefore elevated chloride and ammoniacal-N is to be expected. In addition to the estuarine sediments, groundwater is recharged via springs emanating from Coal Measures consequently redox cycling of some substances is to be expected. This results in a groundwater chemistry that can be characterised as a series of localised biogeochemical systems. There is no indication of an influence from the Phase 2 landfill on groundwater chemistry.

4.7 Surface Water

Surface water drainage is collected in perimeter interception channels and drains which transfer the surface run-off to flow attenuation lagoons. This flow attenuated surface water is then discharged from the lagoon via a low energy pumped multi-outlet trickle head system to the Crymlyn Bog to the south of the site.

During storm periods, when the surface water system and flow balancing lagoons are inundated, excess water travels via weirs into a connecting perimeter catchment channel, known as 'The Ditch' which transfers surface water to the southeast of the site. The Ditch surrounds the downgradient perimeter of the Phase 2 site and is unlined. Consequently, The Ditch is in continuity with groundwater within the Crymlyn Bog and generally acts as a seepage channel. The Ditch terminates in the south east corner of the landfill site where any remaining flow in the channel dissipates into the Crymlyn Bog.

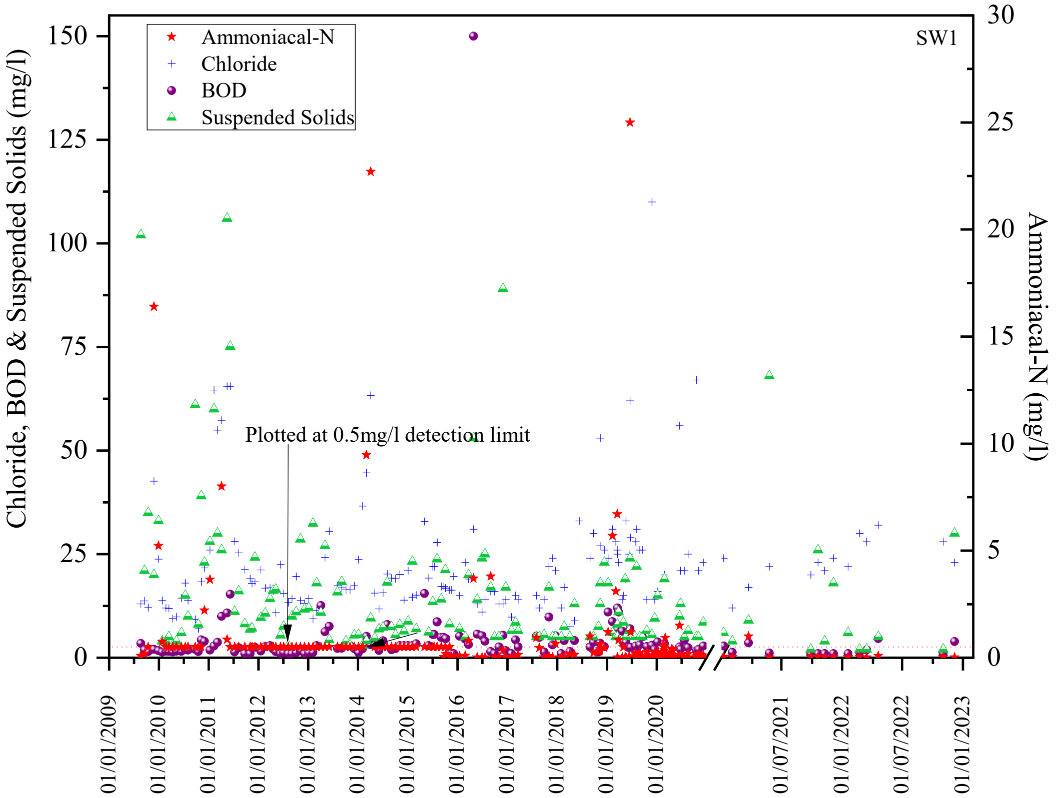
However, surface water within the lagoon has been maintained at a low level and no storm event has ever exceeded the weir height.

Table 13 – Surface Water Quality Summary 2022

Sample Point	NH_4-N		BOD		Cl		Susp. Solids	
	mg/l							
	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Permit Limit SW1	**0.5**		**20**				**40**	
SW1	0.04	0.09	2.3	4.6	27	32	8	30
SW2	3.30	4.50	2.8	6.7	33	38	17	90
SW3	2.37	8.70	3.3	8.2	40	73	11	47
SW4	17.13	33.00	2.9	7.7	75	120	7	20

There were no Permit Limit exceedances during 2022 at SW1. Ammoniacal-N at SW1 was recorded below the 0.5mg/l EQS (and Permit limit) throughout 2022.

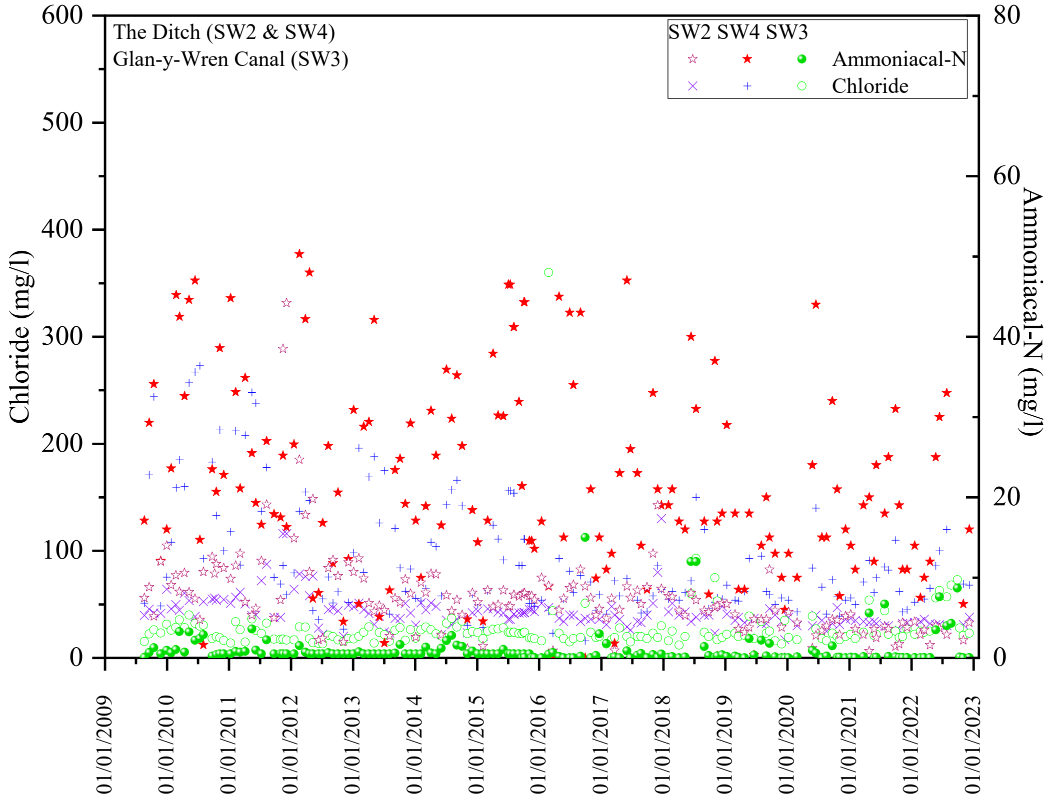
Figure 31 – Surface Water Permit Limit Substances



The Glan-y-Wern canal (SW3) is considered as representative of an essentially static water body, which can contain stagnant water conditions and is generally isolated from the surrounding water systems, albeit that there will be some continuity with the bog pore water particularly during high recharge periods.

The Ditch (SW2 and SW4) is however more complex. Chloride remained below its DWS of 250mg/l at SW2 and SW4(Figure 32) and has remained stable at both points since 2016. Ammoniacal-N, however, is elevated and has historically fluctuated between <5mg/l and 47mg/l at SW4. This trend has continued through 2022.

Figure 32 – Surface Water Ammoniacal-N and Chloride



There is a general declining trend of ammoniacal-N at the SW2 monitoring point with 2022 concentrations been recorded in the 1 – 4.5mg/l range. Previously ammoniacal-N has been observed in the 5 - 10mg/l range at SW2.

Ammoniacal-N variability within the Ditch is likely to be due to a greater hydraulic continuity with the anoxic conditions within the Crymlyn Bog in the downstream sampling location (SW4) compared to the upstream location (SW2).

The priority metals are at low to negligible within the surface water. Lead was reported below or approximating the limit of detection as was chromium, both in the <0.0002-0.0003mg/l range. Copper and nickel were at 0.7-7µg/l with zinc reported in the 4-34 µg/l range.

Table 14 – Surface Water Priority Metals Summary

Sample Point	Date	Fe	Mn	Cd	Cr	Cu	Ni	Zn	Pb
		mg/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l
SW1	02/11/2022	0.008	0.005	< 0.02	0.0003	0.007	0.0007	0.004	0.0003
SW2	02/11/2022	0.330	0.620	< 0.02	< 0.0002	0.002	0.0022	0.005	< 0.0002
SW3	11/10/2022	0.043	0.057	0.11	< 0.0002	0.004	0.0017	0.034	< 0.0002
SW4	02/11/2022	0.330	0.820	0.03	< 0.0002	0.008	0.0019	0.016	< 0.0002

5 Amenity

5.1 Complaints

The Operator's complaints procedure is compliant to the relevant clauses of ISO14001 and involves the capture and implementation of immediate corrective action for every complaint. There are processes that review the effectiveness of the corrective action and if necessary, further preventative action is undertaken to prevent reoccurrence of the complaint.

There were two complaints received at the Tir John landfill during 2022, both regarding overgrown vegetation and shrubs into neighbouring properties.

5.2 Weather Data

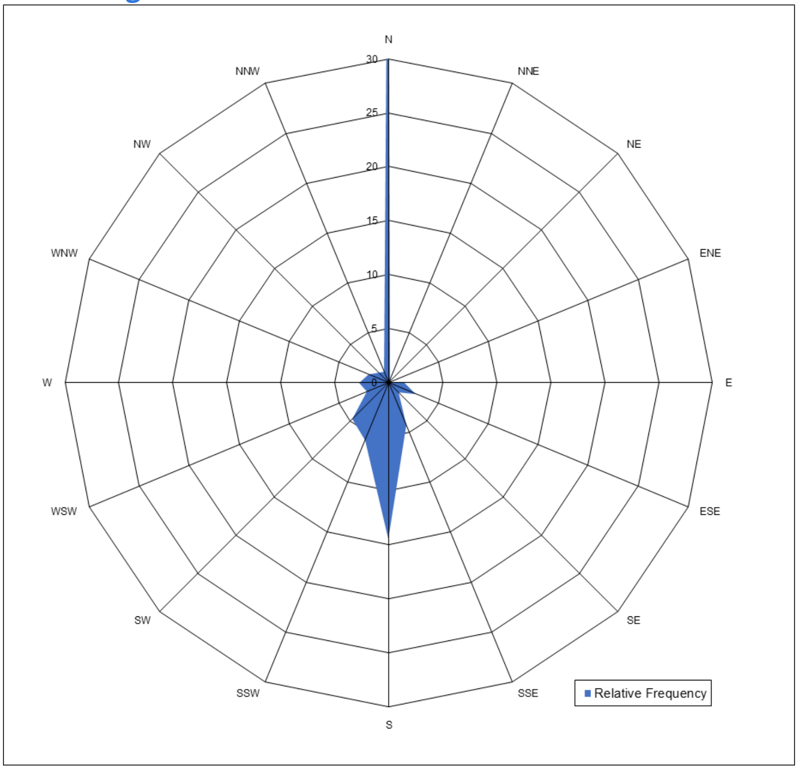
Given the close association of potential nuisance emissions to weather conditions, the weather monitoring data are summarised in Table 15.

Temperature ranges were consistent with expectations for the sites location and total rainfall was consistent with that previously observed in 2017 and 2018, albeit that the Winter months of early 2022 saw uncharacteristically low rainfall.

Table 15 – Rainfall and Temperature Summary

Month	Temperature (2022)			Rainfall						
	Min	Max	Ave	2016	2017	2018	2019	2020	2021	2022
	°C			mm / month						
January	-2	7	14	49	79	144	78	105	184	9
February	0	9	15	104	70	51	62	202	104	2
March	1	10	19	106	113	135	99	67	53	8
April	-1	11	21	71	28	62	68	38	15	45
May	6	14	21	91	15	47	28	12	156	58
June	7	16	26	112	74	36	73	144	29	73
July	9	18	33	48	13	130	35	91	73	30
August	9	19	32	103	65	31	140	159	5	41
September	5	16	23	131	143		164	40	22	69
October	5	15	21	54	52	17	194	205	29	145
November	2	12	18	99	83	125	142	96	4	238
December	-5	6	14	49	121	117	180	199	2	137
			Total	**1,016**	**854**	**895**	**1,263**	**1356**	**674**	**854**

Figure 33 – Wind Rose Diagram 2022



6 Summary

Landfilling operations have been undertaken at the site since 1953 in unlined cells and prior to that PFA had been deposited since 1935. There has therefore been 50 years of disposal within the permitted area prior to the construction of the first containment cell. The current phase of operations commenced in the 1990s.

The site is located within a former river estuary cut into the South Wales Coal Measures, which was subsequently infilled by silts, clays, sands and peat deposits to form fenland conditions (The Crymlyn Bog).

There is no evidence of landfill gas migration from the Phase 2 of the Tir John landfill site. Similarly, there is no indication that there are ongoing leachate seepages or spillages to groundwater or surface water even though leachate is locally elevated within the site.

A Hydrogeological Risk Assessment (HRA) Review for the Tir John Phase 2 landfill was undertaken during 2018. This review demonstrated that the landfill was not causing a discernible impact on the hydrogeological system. This conclusion continues to be validated by the monitoring data collected to date. The HRA review recommended a revision to the monitoring schedules to reduce the list of specific substances incorporated within the permit schedule, to a suite more appropriate to the actual leachate inventory.

The groundwater quality is poor for a potable water supply. For example ammoniacal-N is relatively high. However, this is due to the background influences which dominate the groundwater chemistry. This is likely to include leaching from the PFA, biological activity within the organic rich host sediments, which is contributing to anaerobic and anoxic conditions as well as potential long term minor influences from historical wastes outside of the containment cells and groundwater recharge from the Coal Measures.

It is unlikely that the presence of waste within the engineered containment cells is exerting a discernible environmental impact.

Appendix A – Perimeter Gas Summary and Figures

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Tir John Phase 2 Landfill Site
Perimeter Gas Summary January - December 2022

Location	Methane			Carbon dioxide			Oxygen			Balance			Carbon Monoxide			Hydrogen Sulphide			Atmospheric pressure			Relative Pressure			CH_4/CO_2		
	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
	%v/v			%v/v			%v/v			%v/v			ppm			ppm			mb			mb			ratio		
TIRGP013	0.0	0.0	0.0	0.1	1.2	3.3	16.6	19.3	21.0	78.9	79.5	80.5	0.0	0.0	0.0	0.0	0.3	1.0	1002	1018	1034	-1.5	0.0	0.5	0.0	0.0	0.0
TIRGP014	0.0	0.0	0.0	2.3	5.5	9.8	2.1	13.7	17.5	78.5	80.8	88.1	0.0	0.0	0.0	0.0	0.2	1.0	1004	1019	1034	-0.3	0.0	0.3	0.0	0.0	0.0
TIRGP015	0.0	0.0	0.0	3.9	5.3	10.0	2.7	14.5	17.0	78.5	80.2	87.3	0.0	0.1	1.0	0.0	0.3	2.0	1004	1019	1035	-0.3	0.0	0.2	0.0	0.0	0.0
TIRGP016	0.0	0.0	0.0	7.0	8.6	10.9	5.3	10.6	12.9	78.5	80.7	84.2	0.0	0.0	0.0	0.0	0.3	1.0	1004	1018	1034	-0.4	0.0	0.2	0.0	0.0	0.0
TIRGP017	0.0	0.0	0.0	0.1	2.3	3.0	16.9	18.7	20.9	78.5	79.0	80.1	0.0	0.1	1.0	0.0	0.5	2.0	1004	1019	1035	-0.3	0.0	0.4	0.0	0.0	0.0
TIRGP018	0.0	0.0	0.0	2.8	8.3	13.4	3.0	11.8	18.7	77.0	79.9	85.2	0.0	0.1	1.0	0.0	0.3	2.0	1004	1019	1034	-0.3	0.0	0.2	0.0	0.0	0.0
TIRGP019	0.0	0.0	0.0	3.0	5.9	9.8	11.8	15.2	19.8	77.1	78.9	80.1	0.0	0.3	3.0	0.0	0.3	1.0	1004	1019	1035	-0.2	0.1	0.4	0.0	0.0	0.0
TIRGP020	0.0	0.0	0.0	1.6	6.6	10.4	9.4	12.4	18.7	78.5	81.0	84.3	0.0	0.2	1.0	0.0	0.4	2.0	1004	1019	1034	-0.3	0.2	1.4	0.0	0.0	0.0
TIRGP021	0.0	1.5	5.5	0.9	3.6	7.9	0.4	12.0	20.0	78.2	82.9	89.3	0.0	0.0	0.0	0.0	0.8	3.0	1003	1018	1034	-0.1	0.1	0.3	0.0	0.2	0.8
TIRGP022	0.0	0.0	0.0	0.1	0.6	2.2	8.3	19.3	21.4	78.5	80.1	89.5	0.0	0.0	0.0	0.0	0.6	2.0	1003	1019	1035	-0.3	0.1	0.3	0.0	0.0	0.0
TIRGP023	0.0	0.1	0.3	0.1	6.6	12.0	0.3	7.6	21.2	78.7	85.7	91.6	0.0	1.2	4.0	0.0	1.8	5.0	1004	1019	1035	-2.7	-0.2	0.4	0.0	0.0	0.0

Figure A.1 – Perimeter Gas Monitoring Point TIRGP013

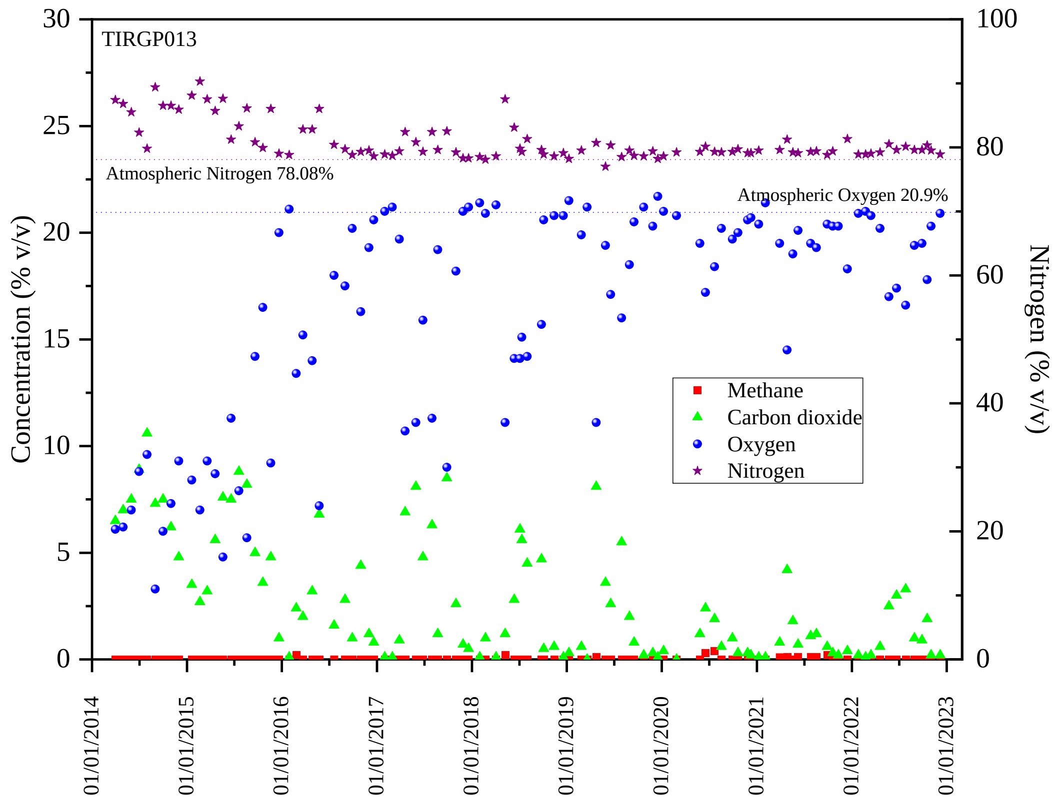


Figure A.2 – Perimeter Gas Monitoring Point TIRGP014

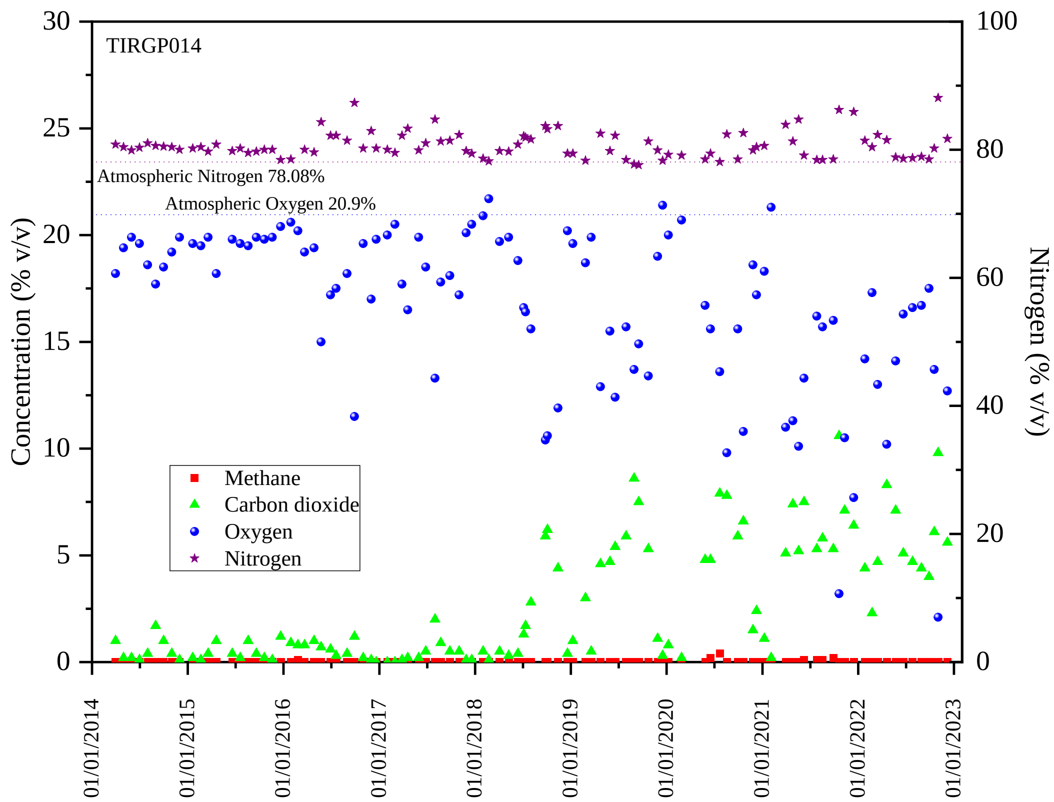


Figure A.3 – Perimeter Gas Monitoring Point TIRGP015

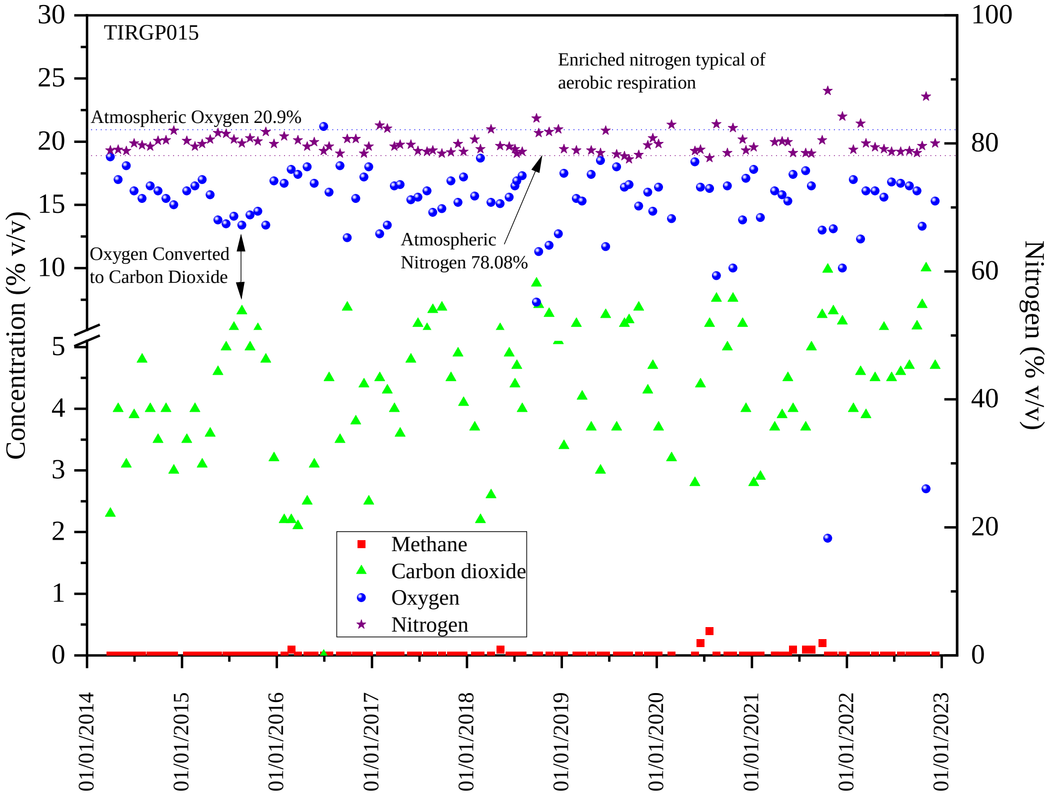


Figure A.4 - Perimeter Gas Monitoring Point TIRGP016

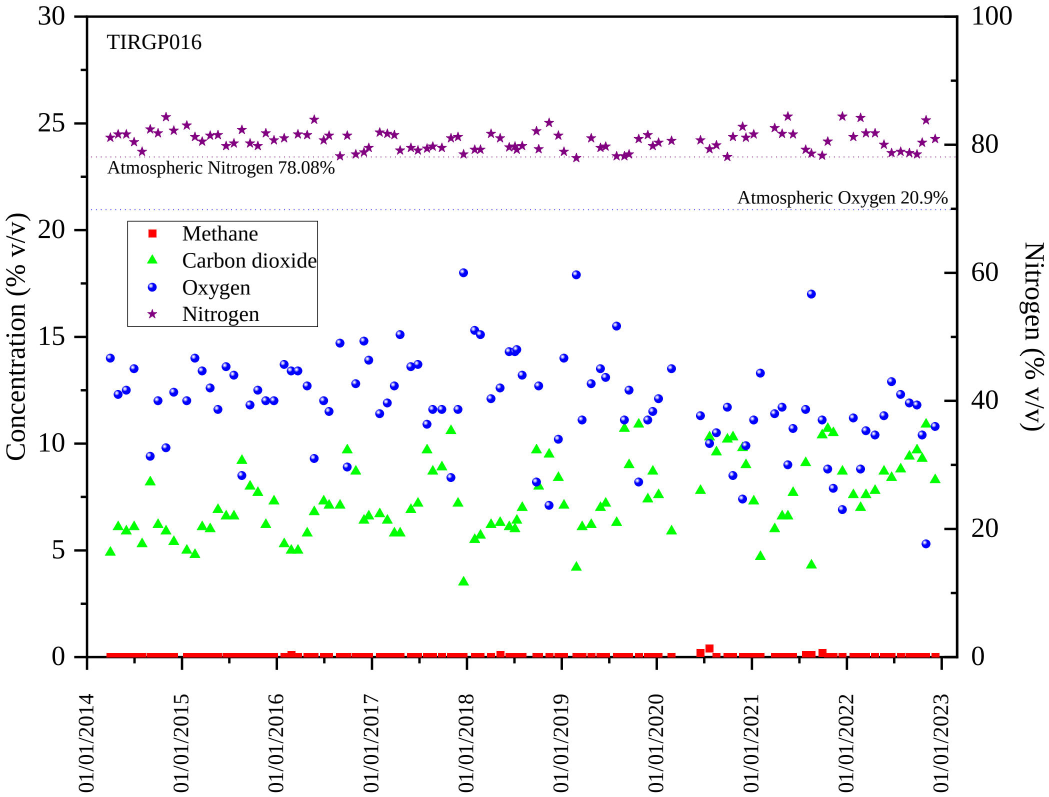


Figure A.5 - Perimeter Gas Monitoring Point TIRGP017

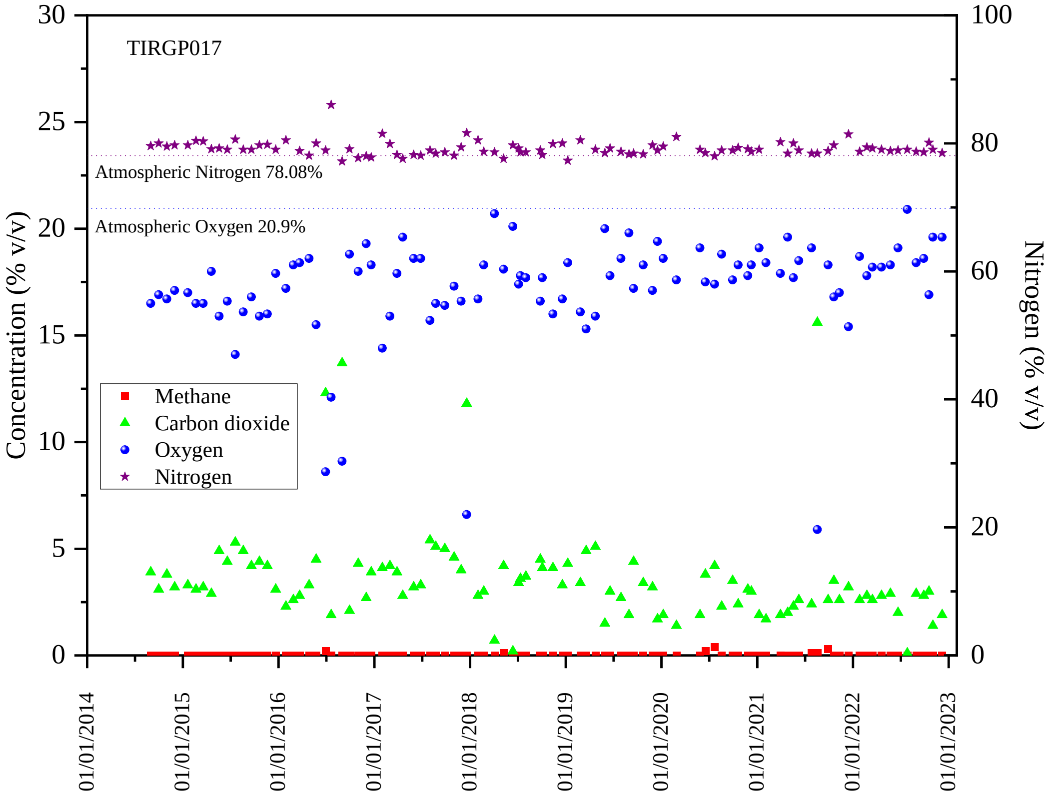


Figure A.6 - Perimeter Gas Monitoring Point TIRGP018

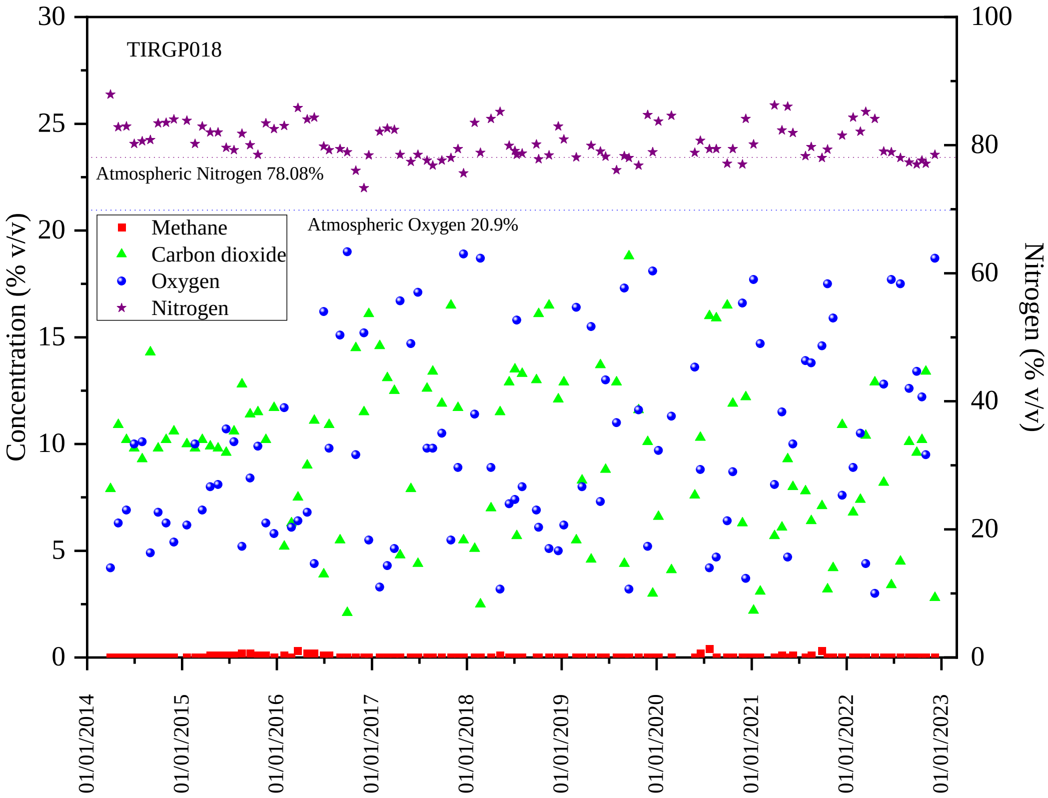


Figure A.7 - Perimeter Gas Monitoring Point TIRGP019

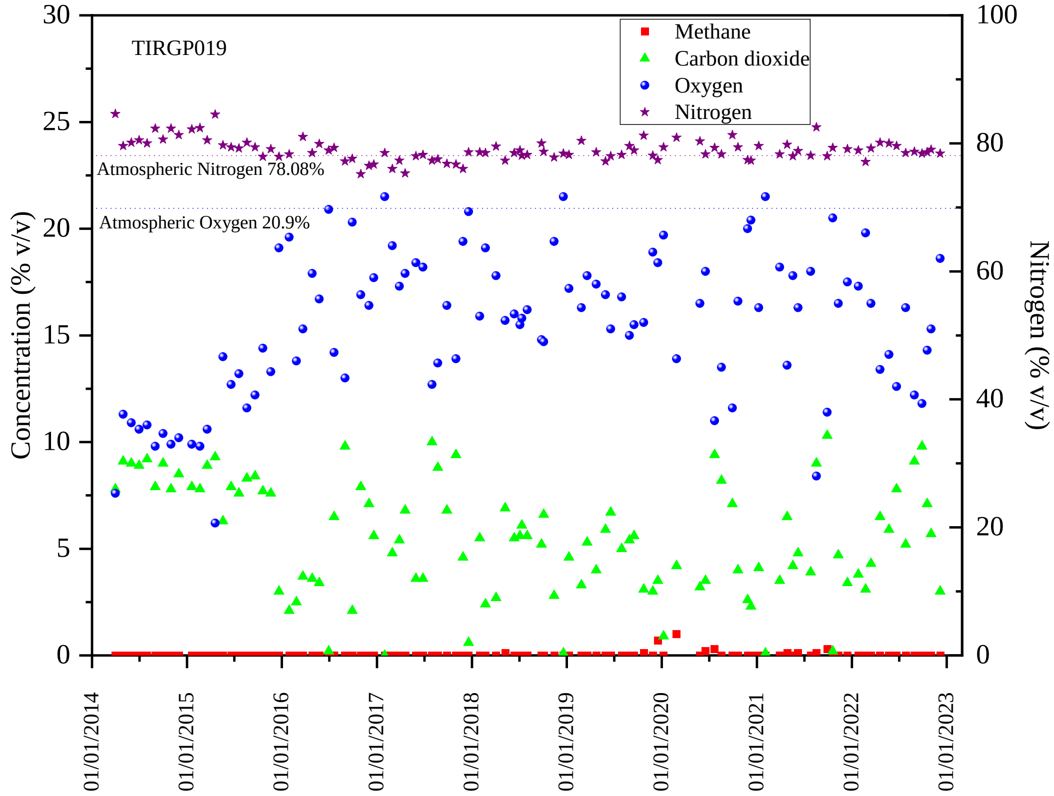


Figure A.8 - Perimeter Gas Monitoring Point TIRGP020

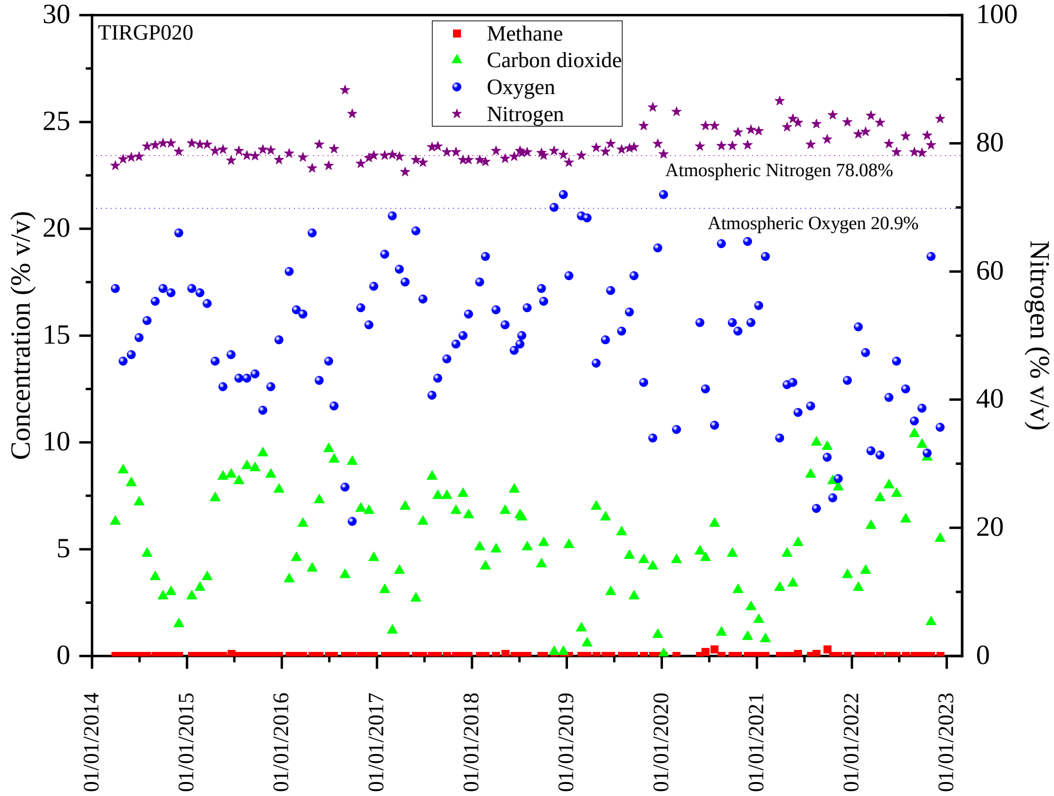


Figure A.9 - Perimeter Gas Monitoring Point TIRGP021

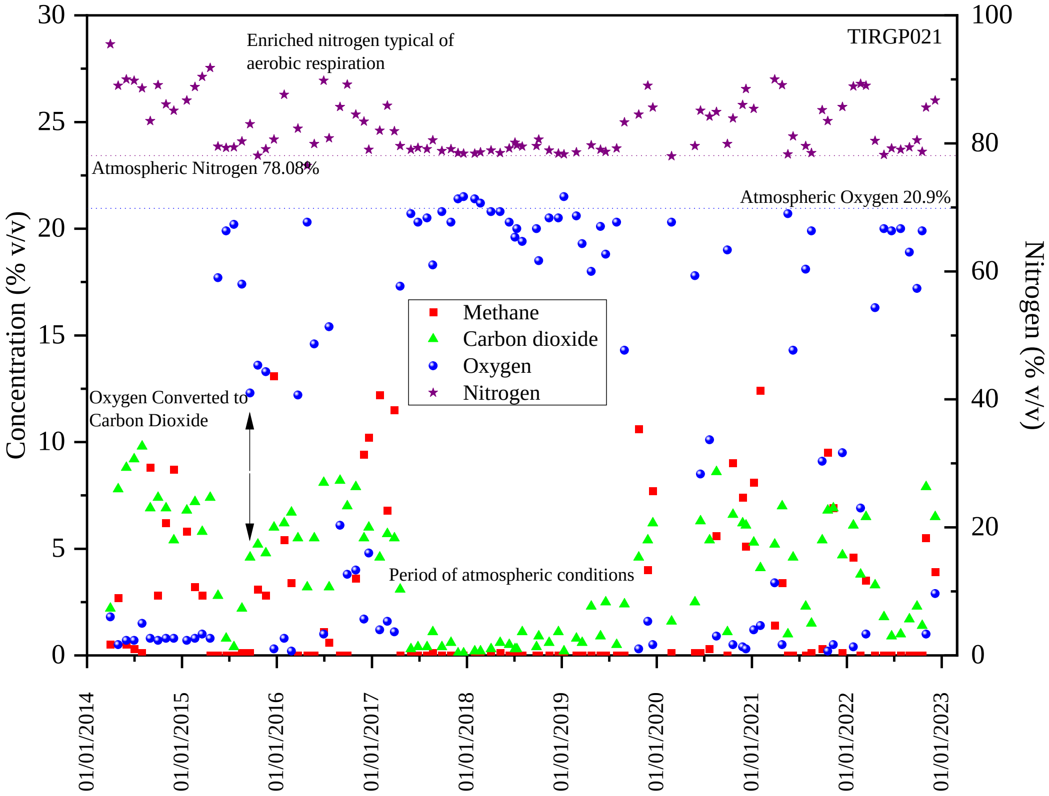


Figure A.10 - Perimeter Gas Monitoring Point TIRGP022

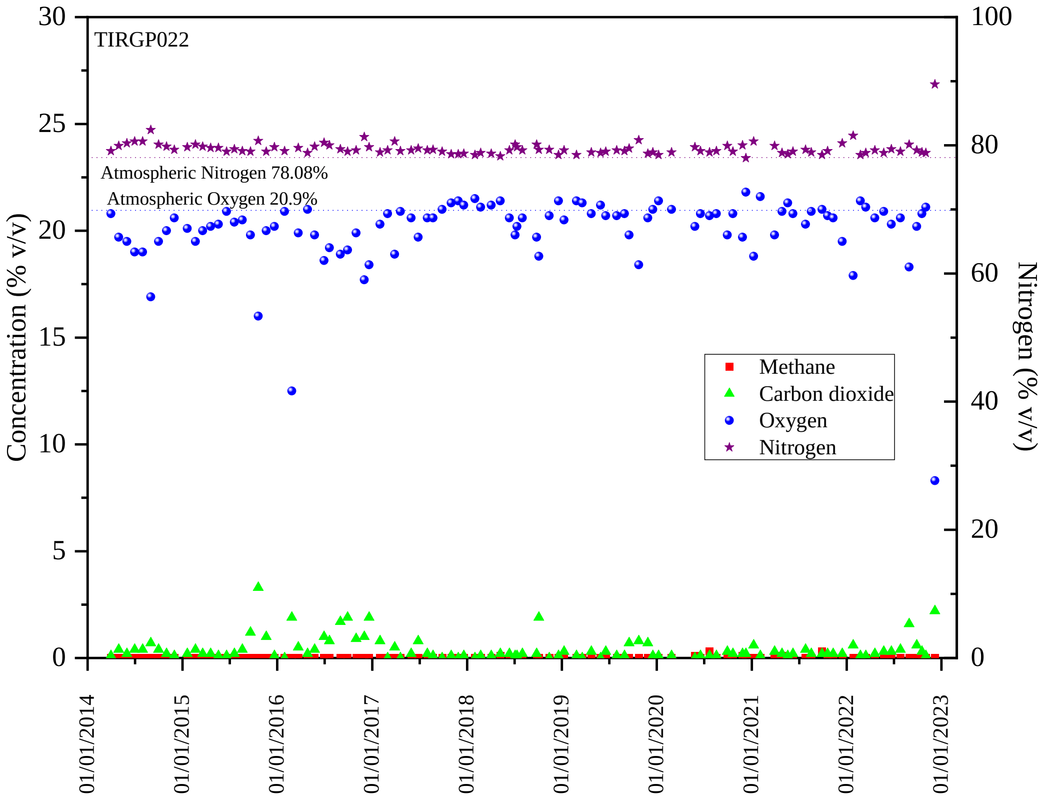
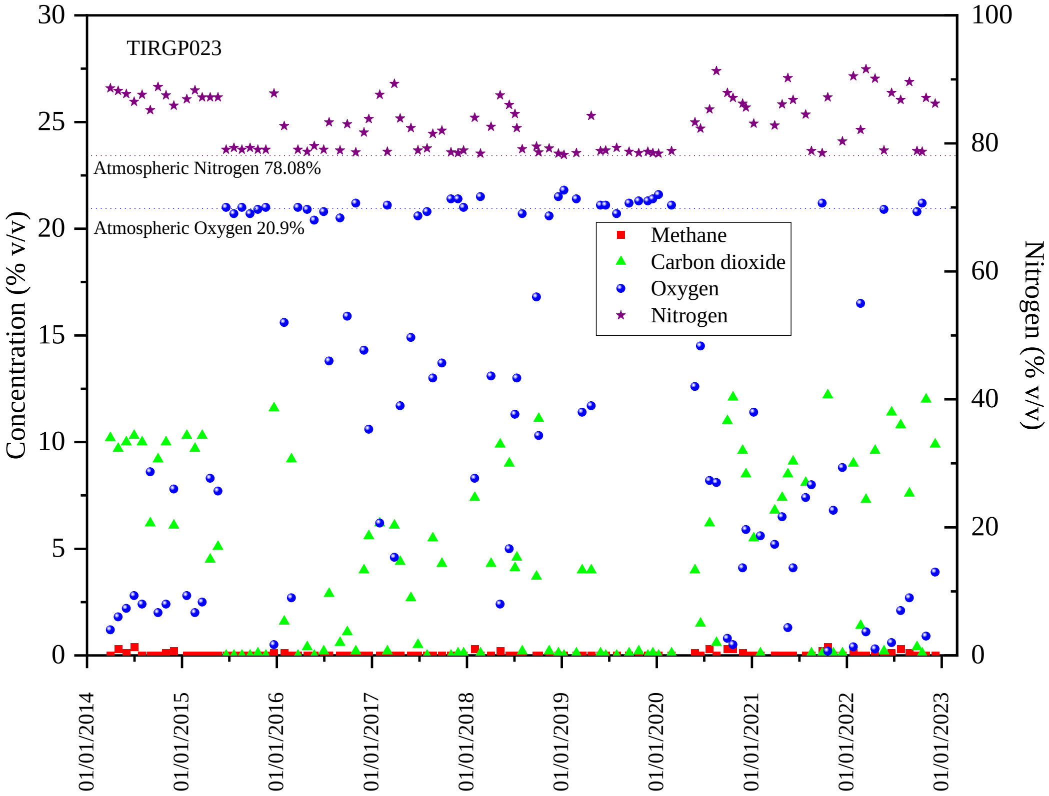


Figure A.11 - Perimeter Gas Monitoring Point TIRGP023



Appendix B – Gas Management Field Summary

Tir John Phase 2 Landfill Site
In-Waste Gas Summary January - December 2022

Location	Methane			Carbon Dioxide			Oxygen			Balance			Carbon Monoxide			Hydrogen Sulphide			Atmospheric pressure			Relative Pressure			CH4/CO2		
	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
	%v/v			%v/v			%v/v			%v/v			ppm			ppm			mb			mb					
TIRHZ001	0.1	43.0	63.1	0.2	29.7	41.4	0.7	5.5	20.8	0.0	22.7	78.9	4.0	11.4	29.0	0.0	4.4	11.0	998	1011	1036	-21.3	-0.6	20.3	0.1	1.2	1.7
TIRHZ002	0.5	36.2	59.4	0.2	26.6	41.6	0.5	7.3	20.9	1.2	29.9	78.4	4.0	11.0	29.0	0.0	6.2	13.0	998	1013	1036	-20.7	-0.5	20.5	0.1	1.4	2.5
TIRHZ003	0.1	17.7	53.9	0.3	16.4	37.8	0.4	11.6	22.2	7.9	54.4	79.2	0.0	8.2	24.0	0.0	7.7	14.0	998	1013	1036	-0.2	0.1	0.4	0.0	0.6	1.4
TIRHZ005	43.7	52.1	60.6	34.7	39.4	43.4	0.1	1.5	3.5	0.0	7.7	18.4	9.0	19.3	26.0	0.0	53.0	407.0	995	1013	1033	-21.6	-11.8	0.2	1.3	1.3	1.4
TIRKOP01	0.6	20.6	39.3	9.0	18.4	24.5	1.4	7.6	19.7	34.5	53.3	72.7	0.0	1.0	2.0	0.0	1.7	6.0	999	1012	1037	-1.1	0.1	0.9	0.1	0.9	1.6
TIRKOP02	0.2	6.3	17.6	4.0	7.2	15.9	3.7	14.6	21.6	62.8	71.9	75.7	0.0	0.3	1.0	0.0	1.0	4.0	997	1014	1037	-0.3	0.2	1.3	0.1	0.7	1.5
TIRKOP03	0.2	9.5	45.6	0.9	8.0	20.6	0.3	12.1	20.9	33.5	70.4	92.9	0.0	1.6	11.0	0.0	2.0	17.0	984	1010	1035	-0.4	0.2	1.0	0.1	0.8	2.2
TIRKOP04	0.2	16.8	53.3	2.8	13.7	30.6	0.9	10.9	22.0	15.2	58.6	88.1	0.0	1.4	4.0	0.0	1.9	9.0	984	1010	1037	-0.5	0.3	1.5	0.0	0.9	1.8
TIRLEW06	0.4	13.3	28.2	0.6	14.3	24.6	0.0	7.9	18.3	47.5	64.5	83.3	0.0	1.4	5.0	0.0	0.8	5.0	985	1008	1035	-0.6	0.1	1.1	0.0	0.9	1.5
TIRLEW07	0.5	2.8	4.8	1.9	7.0	11.1	5.7	6.9	8.6	78.6	83.3	89.4	0.0	1.0	2.0	1.0	4.0	9.0	1004	1005	1005	-0.9	-0.2	0.5	0.1	0.7	1.6
TIRLEW08	1.9	36.3	58.2	6.5	23.0	34.2	0.0	3.5	14.7	12.5	37.2	81.2	0.0	7.6	24.0	0.0	1.2	6.0	985	1010	1034	-1.6	-0.2	0.9	0.3	1.5	2.3
TIRLEW10	0.5	7.3	18.6	1.5	11.5	23.1	1.6	9.2	18.5	61.4	71.9	90.6	0.0	2.1	11.0	0.0	2.3	12.0	985	1010	1034	-0.6	0.1	0.8	0.1	0.6	1.2
TIRLEW12	1.0	17.7	43.4	3.3	13.8	20.7	4.4	8.5	14.6	31.5	60.0	85.8	0.0	1.1	3.0	0.0	2.6	12.0	984	1005	1034	-32.0	-3.9	1.1	0.1	1.2	2.1
TIRLEW14	0.1	30.2	75.4	0.1	12.9	27.1	0.2	11.8	22.1	0.0	45.4	79.0	0.0	1.8	13.0	0.0	0.7	4.0	984	1007	1034	-0.7	0.3	1.3	0.0	1.6	3.0
TIRLEW15	42.8	54.4	63.0	36.7	38.8	40.0	0.1	0.3	0.7	0.0	6.7	18.4	10.0	14.2	19.0	0.0	138.8	822.0	996	1012	1034	-6.1	-0.1	6.6	1.1	1.4	1.6
TIRLEW16	47.4	47.4	47.4	36.5	36.5	36.5	3.0	3.0	3.0	13.1	13.1	13.1	6.0	6.0	6.0	0.0	0.0	0.0	1036	1036	1036	-20.4	-20.4	-20.4	1.3	1.3	1.3
TIRLEW25	0.2	16.2	28.5	2.5	16.9	25.6	0.0	3.7	9.9	46.4	63.2	88.3	0.0	1.5	10.0	0.0	3.3	25.0	985	1008	1034	-1.9	-0.1	1.3	0.0	0.9	1.6
TIRLEW27	0.2	58.9	71.8	0.2	24.3	30.6	0.8	3.9	20.8	0.0	14.2	78.8	0.0	3.1	12.0	0.0	1.7	7.0	996	1010	1034	-0.8	0.1	0.7	1.0	2.3	3.3
TIRLEW29	0.2	5.7	23.1	1.2	7.3	13.1	7.1	15.9	21.1	48.9	71.1	79.4	0.0	0.7	2.0	0.0	1.6	6.0	997	1011	1035	-0.6	0.0	0.6	0.1	0.7	2.2
TIRLEW30	0.1	9.7	64.3	0.1	10.5	31.3	0.8	12.3	20.7	3.6	67.5	81.4	0.0	1.7	11.0	0.0	1.3	5.0	996	1012	1034	-0.6	0.2	1.4	0.1	0.6	2.1
TIRLEW31	1.5	38.3	69.8	6.9	20.7	32.6	0.3	9.2	18.8	0.0	32.2	72.8	0.0	2.8	7.0	0.0	1.5	4.0	997	1010	1034	-1.0	0.0	0.4	0.2	1.5	2.2
TIRLEW32	62.8	67.0	70.0	29.6	32.7	35.3	0.0	0.5	1.4	0.0	1.2	6.1	0.0	3.8	14.0	0.0	4.8	22.0	984	1009	1026	-5.5	-0.1	4.3	1.9	2.0	2.2
TIRLEW33	0.3	41.0	55.0	3.2	24.2	38.8	0.4	4.8	20.1	5.7	30.0	76.4	5.0	11.4	29.0	0.0	5.4	13.0	998	1014	1036	-21.4	-7.5	3.9	0.1	1.5	2.6
TIRLEW6A	15.6	15.6	15.6	12.0	12.0	12.0	10.3	10.3	10.3	62.1	62.1	62.1	4.0	4.0	4.0	2.0	2.0	2.0	1019	1019	1019	0.1	0.1	0.1	1.3	1.3	1.3
TIRLEW9B	19.0	48.6	57.9	15.2	35.2	41.7	0.4	3.4	12.4	0.0	12.9	53.4	0.0	9.5	17.0	0.0	24.2	134.0	998	1009	1036	-6.8	-1.9	0.9	1.3	1.4	1.4
TIRLW10A	0.1	0.1	0.1	1.8	1.8	1.8	20.6	20.6	20.6	77.5	77.5	77.5	1.0	1.0	1.0	1.0	1.0	1.0	1019	1019	1019	0.1	0.1	0.1	0.1	0.1	0.1
TIRLW12A	51.0	51.0	51.0	22.4	22.4	22.4	2.3	2.3	2.3	24.3	24.3	24.3	4.0	4.0	4.0	1.0	1.0	1.0	1019	1019	1019	-0.7	-0.7	-0.7	2.3	2.3	2.3
TIRSCAV1	0.5	54.5	72.5	1.6	23.8	32.1	0.0	4.7	19.8	0.0	18.0	78.1	0.0	2.6	6.0	0.0	3.3	9.0	984	1009	1036	-22.4	-4.3	11.7	0.3	2.1	2.5
TIRSCAV2	39.0	67.1	73.3	24.6	29.4	34.4	0.0	0.4	1.3	0.0	4.6	35.2	0.0	2.8	12.0	0.0	3.5	15.0	984	1010	1036	-27.1	-5.3	30.0	1.5	2.3	2.7
TIRSCAV3	0.9	49.4	71.8	4.4	25.6	34.6	0.1	5.2	20.4	0.0	20.6	74.3	0.0	2.3	11.0	0.0	2.0	16.0	988	1011	1035	-2.8	-0.5	1.5	0.2	1.8	2.3
TIRSP1MA	1.4	38.2	51.9	6.6	24.4	32.4	0.4	3.5	19.7	14.8	33.9	72.3	0.0	2.5	5.0	0.0	4.4	25.0	984	1009	1036	-82.7	-35.6	-9.9	0.2	1.5	2.1
TIRSP1MB	28.1	39.6	54.0	14.9	24.9	28.9	0.5	2.2	8.7	16.2	33.4	48.3	0.0	1.6	5.0	0.0	1.3	7.0	988	1011	1037	-84.0	-34.6	-17.7	1.2	1.6	1.9
TIRSP2MA	32.2	41.4	52.6	16.7	26.2	32.5	0.7	1.9	6.5	14.2	30.5	43.5	0.0	3.4	10.0	0.0	5.3	24.0	984	1011	1036	7.6	105.3	157.9	1.3	1.6	2.0
TIRSP2MB	27.7	39.2	52.6	15.8	25.6	31.8	0.5	2.0	8.6	14.9	33.1	47.9	0.0	1.7	5.0	0.0	2.1	11.0	988	1011	1038	16.3	114.2	159.5	1.2	1.5	1.8
TIRW1211	0.4	8.7	36.0	0.7	7.9	17.7	8.3	16.5	18.9	38.0	66.9	79.4	0.0	2.3	9.0	0.0	1.5	5.0	998	1013	1036	-0.7	0.1	1.5	0.1	0.9	2.0
TIRW1212	0.9	50.2	75.1	4.0	21.1	29.7	0.0	4.6	21.2	0.0	25.4	77.8	0.0	3.2	14.0	0.0	6.4	35.0	983	1010	1036	-9.8	-0.6	1.4	0.2	2.1	2.8
TIRW12A1	3.2	57.5	72.8	6.5	28.3	36.3	0.0	2.7	18.7	0.0	12.6	71.6	0.0	3.1	8.0	0.0	5.2	28.0	983	1012	1035	-21.1	-4.0	3.8	0.5	1.9	3.0
TIRW12A2	59.6	67.2	73.1	26.5	30.7	34.9	0.0	0.9	2.2	0.0	2.5	8.4	0.0	2.5	6.0	0.0	9.1	64.0	983	1008	1035	-37.0	-13.3	1.1	2.0	2.2	2.6
TIRW12A3	8.6	55.9	71.6	6.9	27.0	35.1	0.0	3.9	16.4	0.0	14.1	68.1	0.0	2.2	6.0	0.0	3.1	16.0	983	1011	1026	-1.8	-0.2	1.1	1.3	2.0	2.5
TIRW1401	0.3	36.2	62.0	3.4	25.0	41.0	0.2	7.5	19.1	0.0	31.6	77.2	1.0	7.3	18.0	0.0	2.5	8.0	983	1013	1034	-11.2	-2.3	1.5	0.1	1.3	1.7
TIRW1402	54.7	58.1	60.5	37.4	40.8	42.6	0.1	0.4	0.6	0.0	2.2	7.4	3.0	6.0	11.0	0.0	2.8	5.0	996	1012	1034	-5.4	-2.0	0.7	1.4	1.4	1.5
TIRW1403	0.2	34.2	69.0	0.2	17.6	33.9	0.2	9.8	22.3	0.0	39.0	82.2	0.0	4.0	9.0	0.0	5.6	19.0	983	1008	1034	-5.0	-0.4	3.5	0.2	1.6	2.1
TIRW1404	24.6	57.9	67.7	15.4	30.8	37.3	0.0	2.7	12.9	0.0	9.6	47.1	0.0	5.4	17.0	0.0	14.7	83.0	983	1006	1034	-6.2	-0.6	1.7	1.6	1.9	2.1
TIRW1801	1.1	43.0	61.7	6.6	33.4	42.3	0.1	4.2	19.5	0.0	19.8	72.8	0.0	4.3	12.0	0.0	23.0	140.0	983	1006	1034	-0.2	28.3	206.2	0.2	1.1	1.5
TIRW1802	0.3	49.2	60.7	2.7	36.6	44.7	0.1	2.5	20.7	0.0	13.0	76.3	1.0	5.6	14.0	0.0	85.7	925.0	983	1008	1034	-3.6	-0.9	1.4	0.1	1.2	1.7
TIRW1803	47.5	60.8	67.4	29.3	37.8	42.2	0.0	0.6	3.6	0.0	2.5	18.4	1.0	5.0	13.0	0.0	13.3	78.0	983	1010	1034	-4.7	0.1	7.5	1.5	1.6	2.3
TIRW1804	0.3	40.8	66.1	3.4	26.6	39.0	0.0	4.6	20.1	0.0	28.9	76.2	1.0	5.1	17.0	0.0	14.9	131.0	983	1010	1035	-4.2	-0.7	1.3	0.1	1.3	1.9
TIRW1805	51.3	61.5	65.5	28.9	36.0	39.4	0.0	0.6	2.2	0.0	3.6	17.6	0.0	5.2	12.0	0.0	18.5	117.0	982	1008	1034	-1.1	5.0	12.3	1.6	1.7	1.8
TIRW1806	60.0	64.7	68.2	30.0	34.8	39.5	0.0	0.8	3.2	0.0	1.4	7.7	0.0	5.3	16.0	0.0	6.7	58.0	983	1010	1034	-3.2	0.6	3.2	1.7	1.9	2.1
TIRW2509	20.3	31.9	42.4	23.3	25.4	27.0	0.0	0.3	0.8	31.4	42.4	54.9	0.0	0.9	5.0	0.0	3.3	15.0	985	1006	1034	-1.8	-0.5	0.3	0.8	1.3	1.7
TIRW2510	17.1	27.5	38.6	20.1	24.3	26.7	0.0	0.4	1.0	35.6	47.8	59.3	0.0	0.5	2.0	0.0	3.5	12.0	985	1006	1034	-1.8	-0.6	0.6	0.8	1.1	1.5
TIRW2511	18.9	27.5	40.0	21.0	23.2	25.8	0.0	0.3	1.5	33.9	49.1	58.3	0.0	1.8	7.0	0.0	3.9	14.0	985	1010	1034	-5.8	-1.1	0.4	0.8	1.2	1.6
TIRW2512	15.1	18.3	22.5	12.3	16.0	22.1	0.3	3.9	7.9	55.1	61.8	67.3	0.0	1.3	3.0	0.0	1.0	2.0	1003	1014	1026	-0.1	0.7	1.6	0.9	1.2	1.4
TIRW2515	3.0	44.2	63.8	6.3	21.9	26.6	0.1	2.3	15.3	12.5	31.6	75.4	0.0	3.6	13.0	0.0	4.8	39.0	981	1008	1035	-17.8	-4.1	2.3	0.5	1.9	2.8
TIRW2601	0.2	18.1	29.0	0.8	18.6	24.6	0.0	2.4	20.8	45.3	60.9	78.2	0.0	0.5	1.0	0.0	2.2	12.0	996	1012	1034	-2.4	-0.4	0.8	0.3	0.9	1.2
TIRW2602	0.2	34.1	68.0	1.5	17.0	21.7	0.1	3.2	20.2	14.2	45.6	86.2	0.0	1.7	10.0	0.0	2.2	10.0	984	1010	1034	-1.3	0.0	2.4	0.1	1.8	3.9
TIRW2603	25.3	42.4	75.4	20.1	21.2	22.2	0.1	0.4	0.9	1.8	35.9	52.7	0.0	2.0	11.0	0.0	3.7	18.0	985	1009	1034	-16.5	-4.5	-0.2	1.2	2.0	3.4

Tir John Phase 2 Landfill Site
In-Waste Gas Summary January - December 2022

Location	Methane			Carbon Dioxide			Oxygen			Balance			Carbon Monoxide			Hydrogen Sulphide			Atmospheric pressure			Relative Pressure			CH4/CO2		
	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
	%v/v			%v/v			%v/v			%v/v			ppm			ppm			mb			mb					
TIRW2604	0.3	20.2	45.2	2.9	15.1	24.6	0.0	6.4	22.0	34.6	58.3	77.8	0.0	1.6	12.0	0.0	0.7	4.0	985	1008	1035	-2.0	-0.2	1.5	0.1	1.1	3.0
TIRW2605	1.8	32.8	63.7	14.2	23.7	29.2	0.0	0.7	6.1	6.9	42.8	78.2	0.0	2.2	14.0	0.0	3.2	17.0	984	1010	1035	-2.2	-0.4	0.6	0.1	1.3	2.2
TIRW2606	0.3	21.0	56.0	5.6	15.8	26.5	0.5	6.7	17.6	17.0	56.5	78.9	0.0	2.7	12.0	0.0	3.0	17.0	997	1011	1034	-0.6	0.2	1.6	0.1	1.0	2.1
TIRW261A	0.1	5.2	18.3	0.1	8.8	17.7	1.3	12.1	21.9	62.7	73.9	77.9	0.0	3.0	9.0	0.0	0.3	1.0	984	1008	1026	-0.5	0.1	0.7	0.1	0.6	1.0
TIRW263A	0.2	5.1	59.0	0.3	3.4	15.1	0.8	18.4	21.6	25.1	73.1	80.1	0.0	2.5	12.0	0.0	0.8	3.0	984	1010	1035	-9.6	-1.3	1.7	0.1	0.7	3.9
TIRW264A	0.0	0.6	1.4	0.2	4.2	9.5	16.4	18.5	20.9	72.8	76.8	79.6	0.0	2.1	12.0	0.0	1.1	3.0	984	1007	1027	-45.3	-9.5	0.8	0.0	0.2	0.5
TIRW264B	0.2	0.3	0.5	0.4	2.8	10.2	10.7	19.5	22.3	75.6	77.4	79.2	0.0	2.1	13.0	0.0	0.7	3.0	982	1009	1035	-7.0	-0.6	4.9	0.1	0.2	0.5
TIRW265A	29.6	44.3	50.5	19.7	22.6	26.6	0.0	0.5	0.9	26.7	32.7	47.5	0.0	1.6	13.0	0.0	2.1	11.0	984	1008	1035	-20.6	-9.0	-3.5	1.3	2.0	2.3
TIRW2705	28.2	41.3	53.5	20.6	24.7	28.6	0.1	1.4	5.6	18.0	32.6	47.3	0.0	0.7	2.0	0.0	1.7	10.0	985	1007	1034	-15.4	-6.4	-0.1	1.2	1.7	2.1
TIRW2706	36.2	43.1	49.1	25.6	27.3	28.4	0.1	0.4	0.8	22.4	29.2	36.4	0.0	0.9	2.0	0.0	3.9	16.0	985	1008	1034	-12.7	-6.9	-4.5	1.3	1.6	1.8
TIRW2707	21.8	31.8	42.2	23.4	25.2	27.0	0.0	0.3	0.8	31.3	42.8	52.0	0.0	0.4	1.0	0.0	5.3	18.0	985	1007	1034	-2.1	-0.4	0.8	0.8	1.3	1.6
TIRW2708	0.1	6.3	27.1	0.2	8.3	22.3	4.1	15.0	21.0	46.5	70.5	81.3	0.0	0.6	2.0	0.0	0.8	3.0	985	1010	1034	-0.4	0.1	0.7	0.1	0.6	1.2
TIRW2709	20.9	34.7	45.6	22.8	24.9	27.7	0.1	0.4	0.9	26.3	40.0	54.4	0.0	0.9	4.0	0.0	4.6	15.0	985	1005	1034	-3.2	-1.4	0.1	0.8	1.4	1.9
TIRW2711	1.0	45.9	64.4	7.2	26.5	33.2	0.1	2.5	17.2	1.8	25.2	74.6	0.0	3.6	15.0	0.0	31.6	272.0	996	1011	1034	-5.5	-2.1	1.2	0.1	1.6	2.6
TIRW2712	0.2	29.2	67.3	2.5	17.0	32.7	0.5	10.0	21.5	3.2	43.8	76.4	0.0	3.0	6.0	0.0	5.3	34.0	996	1011	1034	-0.2	0.3	1.2	0.1	1.1	2.3
TIRW2713	0.1	6.4	36.1	0.3	5.4	22.3	4.3	16.7	22.3	37.3	71.5	81.1	0.0	2.5	11.0	0.0	2.5	16.0	982	1008	1034	-4.5	-0.4	0.8	0.1	0.7	1.9
TIRW2714	0.4	0.4	0.4	4.9	4.9	4.9	17.2	17.2	17.2	77.5	77.5	77.5	3.0	3.0	3.0	0.0	0.0	0.0	1001	1001	1001	0.3	0.3	0.3	0.1	0.1	0.1
TIRW3A01	32.7	50.5	58.6	24.7	27.7	32.1	0.0	0.2	0.8	11.2	21.6	40.6	0.0	1.0	3.0	0.0	5.8	35.0	984	1008	1034	-12.2	-3.9	-0.3	1.2	1.8	2.3
TIRW3A02	6.6	33.3	56.5	20.5	24.4	28.1	0.0	0.7	4.6	15.4	41.6	71.8	0.0	1.3	3.0	0.0	3.1	21.0	984	1008	1034	-18.1	-2.5	0.3	0.3	1.3	2.1
TIRW3A03	22.6	39.5	68.4	18.1	23.7	27.5	0.0	1.7	6.1	4.1	35.1	52.9	0.0	2.4	17.0	0.0	2.1	8.0	984	1010	1034	-5.4	-1.3	0.6	0.8	1.7	2.5
TIRW3A04	0.7	23.1	67.5	0.6	14.9	29.2	0.0	9.8	20.7	4.9	52.2	77.9	0.0	1.3	4.0	0.0	1.5	4.0	984	1010	1034	-1.4	-0.1	1.0	0.2	1.3	2.6
TIRW3A06	32.0	46.2	64.1	17.6	25.3	31.3	0.4	2.0	6.3	4.0	26.5	40.3	0.0	3.0	9.0	0.0	3.3	14.0	984	1009	1033	-17.4	-5.2	1.1	1.2	1.9	2.4
TIRW3B01	17.7	38.4	51.9	19.3	28.7	35.1	0.0	1.1	5.9	15.8	31.8	57.2	0.0	0.7	2.0	0.0	2.9	22.0	985	1006	1034	-5.5	-2.0	0.1	0.9	1.3	1.8
TIRW3B02	9.6	21.5	27.0	17.7	21.4	25.3	0.0	0.9	2.6	48.0	56.3	67.5	0.0	1.8	10.0	0.0	3.6	26.0	985	1009	1034	-1.5	-0.3	0.4	0.4	1.0	1.3
TIRW3B03	11.1	22.4	31.5	19.7	22.9	26.0	0.0	0.4	1.7	42.7	54.3	66.0	0.0	0.6	2.0	0.0	3.4	22.0	985	1009	1034	-3.2	-0.4	0.7	0.5	1.0	1.4
TIRW3B04	1.3	40.0	64.0	8.8	27.5	39.0	0.1	1.7	11.0	0.8	30.9	78.9	0.0	0.9	3.0	0.0	4.5	31.0	986	1009	1034	-33.3	-10.7	0.7	0.2	1.4	1.9
TIRW3B05	39.3	50.8	57.1	27.5	30.1	32.2	0.0	0.3	0.8	13.3	18.8	30.2	0.0	2.5	12.0	0.0	7.6	35.0	984	1007	1033	-34.0	-15.9	-9.0	1.3	1.7	2.1
TIRW3B07	34.6	45.8	51.1	26.2	29.9	32.1	0.0	0.4	0.9	18.1	24.0	35.6	0.0	2.0	11.0	0.0	6.4	29.0	984	1008	1034	-14.5	-9.6	-5.9	1.2	1.5	1.8
TIRW3B08	0.2	0.2	0.2	1.8	1.8	1.8	20.8	20.8	20.8	77.2	77.2	77.2	1.0	1.0	1.0	1.0	1.0	1.0	1020	1020	1020	0.1	0.1	0.1	0.1	0.1	0.1
TIRW3C01	2.2	33.0	44.6	7.9	24.6	28.7	0.0	2.8	18.4	25.9	39.7	71.5	0.0	1.2	3.0	0.0	3.9	14.0	985	1008	1034	-6.7	-2.2	0.3	0.3	1.3	1.6
TIRW3C03	33.2	43.8	49.8	25.2	29.1	35.2	0.0	0.3	0.9	17.3	26.8	38.4	0.0	3.6	13.0	0.0	4.3	22.0	985	1007	1024	-21.6	-11.8	-3.4	1.2	1.5	2.0
TIRW3C04	15.5	33.0	49.3	18.2	23.6	28.8	0.0	0.8	2.3	19.7	42.6	62.6	0.0	0.5	2.0	0.0	2.6	12.0	985	1007	1034	-2.1	-0.5	0.6	0.8	1.4	2.0
TIRW3C05	2.0	15.1	28.2	3.7	16.1	23.7	0.4	5.4	16.5	47.7	63.4	81.1	0.0	1.3	8.0	0.0	1.2	8.0	985	1009	1034	-1.9	-0.2	0.4	0.2	0.9	1.4
TIRW3C06	10.1	19.8	26.2	8.8	18.1	22.5	0.4	3.0	13.1	52.6	59.1	68.0	0.0	1.9	9.0	0.0	1.4	3.0	985	1011	1035	-1.2	-0.3	0.3	0.6	1.1	1.4
TIRW3C07	2.9	32.3	43.9	10.1	23.7	29.0	0.0	1.8	13.9	29.1	42.2	73.1	0.0	0.8	2.0	0.0	2.5	14.0	985	1010	1034	-9.3	-2.4	0.5	0.3	1.3	1.7
TIRW3C08	0.2	0.2	0.2	1.3	1.3	1.3	21.0	21.0	21.0	77.5	77.5	77.5	1.0	1.0	1.0	2.0	2.0	2.0	1020	1020	1020	0.0	0.0	0.0	0.2	0.2	0.2

Appendix C – Water Quality Summary and Figures

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Tir John Phase 2 Landfill Site
Leachate Quality Summary January - December 2022

Sample Point	Date	pH	EC	NH_4-N	COD	BOD	Mg	Na	K	Cl	Cd	Hg	Cr	Cu	Ni	Zn	Pb	As
			uS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
LEW05A	16/11/2022	7.8	2100	82.0	130	23	34	150	71	160	< 0.08	< 0.005		0.014	0.025	0.06	< 0.001	0.013
LEW12a	18/05/2022	7.9	12000	1300.0	2200	56		1700	550	2200	< 0.02	< 0.005	0.098	0.096	0.200	0.33	0.0100	0.039
LEW12a	16/11/2022	8.1	19000	1500.0	2000	170	77	1700	610	2300	< 0.08	< 0.005		0.052	0.200	0.20	0.0060	0.024
LEW16	18/05/2022	8.3	9900	2600.0	10000	3200		2600	1200	3300	< 0.02	< 0.005	2.200	0.014	0.230	0.26	0.0160	0.400
LEW16	16/11/2022	7.9	17000	1300.0	4700	1200	100	1400	780	1800	< 0.08	< 0.005		0.011	0.150	0.14	0.0030	0.300
LEW22	16/11/2022	7.7	7500	440.0	1400	16	72	780	370	930	< 0.08	< 0.005		0.021	0.029	0.17	< 0.001	0.033
LEW23	18/05/2022	7.5	3200	130.0	450	18		720	250	66	< 0.02	< 0.005	0.015	0.002	0.045	0.03	0.0009	0.024
LEW23	16/11/2022	6.7	1900	9.6	170	9	39	120	48	120	< 0.08	< 0.005		< 0.0007	0.005	0.01	< 0.001	0.018
LEW25	18/05/2022	7.4	3400	280.0	320	13		440	180	67	< 0.02	< 0.005	0.007	0.004	0.020	0.02	< 0.0002	0.004
LEW25	16/11/2022	7.2	2700	150.0	110	12	49	160	79	160	< 0.08	< 0.005		0.090	0.036	0.66	< 0.001	0.010
LEW26	18/05/2022	7.8	1200	0.2	110	< 1		180	78	160	0.11	< 0.005	0.002	0.082	0.022	0.10	0.0003	0.003
LEW26	16/11/2022	7.4	1600	0.3	110	2	33	160	78	140	< 0.08	< 0.005		0.063	0.019	0.09	< 0.001	0.004
LEW28	18/05/2022	7.9	9900	720.0	2200	47		1100	390	1100	< 0.02	< 0.005	0.064	0.025	0.180	0.19	0.0250	0.041
LEW28	16/11/2022	8.3	2200	160.0	170	2	19	180	82	210	< 0.08	< 0.005		0.062	0.029	0.07	< 0.001	0.010
LEW29	18/05/2022	7.6	5800	350.0	510	19		620	260	470	< 0.02	< 0.005	0.006	0.003	0.027	0.01	0.0002	0.019
LEW29	16/11/2022	7.6	4200	230.0	320	14	85	380	180	340	< 0.08	< 0.005		0.004	0.031	0.04	< 0.001	0.016
LEW31	18/05/2022	7.8	20000	1400.0	4900	130		2100	920	2900	< 0.02	< 0.005	0.410	0.008	0.250	0.17	0.0210	0.085
LEW31	16/11/2022	8.0	24000	2000.0	4800	220	52	2300	610	2600	< 0.08	< 0.005		0.004	0.350	0.13	0.0090	0.074

Tir John Phase 2 Landfill Site
Groundwater Quality Summary January - December 2022

Sample Point	Date	pH	EC	NH_4-N	COD	BOD	TOC	Ca	Mg	Na	K	Cl	SO_4	Alkalinity	Fe	Mn	Cd	Hg	Cr	Cu	Ni	Zn	Pb	As	MCPP
			uS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
GDW01(D)	12/01/2022	7.5	700	2.0	7300	4	2			54	21	51			0.01	0.34	0.02	< 0.005	0.0024	0.0017		0.004	< 0.0002	0.0082	< 0.02
	07/06/2022	7.6	560	1.4	810	18	0	97	39	53	27	49	11	450	0.14	0.59	0.03	< 0.005	< 0.0002	0.0007	< 0.0005	0.008	< 0.0002	0.0072	< 0.02
	16/08/2022	7.3	860	3.6	810	120	4			56	30	52			0.01	0.49	0.03	< 0.005	< 0.0002	0.0030		0.002	0.0002	0.0113	< 0.02
	11/10/2022	7.2	870	5.0	160	62	16			54	28	57			0.05	0.89	< 0.02	< 0.005	< 0.0002	< 0.0005		0.017	< 0.0002	0.0065	< 0.02
GDW01(S)	12/01/2022	7.7	650	1.3	2800	5	2			52	20	45			0.02	0.16	0.03	< 0.005	0.0019	0.0012		0.002	< 0.0002	0.0183	< 0.02
	07/06/2022	8.4	350	0.2	130	33	< 0.1	27	15	51	22	29	92	190	0.08	0.03	< 0.02	< 0.005	< 0.0002	< 0.0005	< 0.0005	0.001	< 0.0002	0.0553	< 0.02
	16/08/2022	8.4	460	1.3	1400	150	9			63	30	41			< 0.004	0.02	< 0.02	< 0.005	< 0.0002	< 0.0005		0.008	< 0.0002	0.0168	< 0.02
	11/10/2022	8.9	400	0.7	770	16	6			47	21	28			< 0.004	0.03	< 0.02	0.023	< 0.0002	< 0.0005		0.004	< 0.0002	0.0549	< 0.02
GDW02(D)	12/01/2022	7.2	960	5.4	520	20	4			66	25	29			0.02	3.10	0.05	< 0.005	0.0043	0.0011		0.020	< 0.0002	0.0107	< 0.02
	07/06/2022	6.6	700	10.0	47	42	2	170	40	49	24	46	8	610	0.09	4.40	< 0.02	< 0.005	< 0.0002	0.0007	0.0007	0.007	< 0.0002	0.0032	< 0.02
	16/08/2022	6.6	1100	12.0	26	24	4			51	24	54			0.03	4.00	< 0.02	< 0.005	< 0.0002	0.0019		0.046	< 0.0002	0.0005	< 0.02
	11/10/2022	6.6	1100	13.0	28	23	18			51	22	59			0.06	4.00	0.06	< 0.005	< 0.0002	0.0021		0.011	< 0.0002	0.0016	< 0.02
GDW02(S)	12/01/2022	6.9	2100	18.0	430	8	5			200	53	180			0.10	0.74	< 0.02	< 0.005	0.0093	0.0080		0.002	< 0.0002	0.0024	< 0.02
	07/06/2022	7.1	1200	19.0	54	46	4	400	86	260	53	170	69	1300	0.52	0.19	< 0.02	< 0.005	< 0.0002	0.0040	0.0009	0.002	< 0.0002	0.0021	< 0.02
	16/08/2022	6.8	2400	20.0	170	71	5			210	57	190			0.26	0.86	< 0.02	< 0.005	< 0.0002	0.0033		0.008	< 0.0002	0.0012	< 0.02
	11/10/2022	6.8	2000	19.0	100	49	29			250	61	170			0.34	0.89	< 0.02	< 0.005	< 0.0002	< 0.0005		0.005	< 0.0002	0.0009	< 0.02
GDW03(D)	12/01/2022	6.4	500	12.0	400	7	6			20	5	27			0.07	0.88	< 0.02	< 0.005	0.0032	0.0034		0.002	< 0.0002	0.0007	< 0.02
	07/06/2022	6.3	470	11.0	58	9	3	40	22	22	4	27	2	240	0.52	0.76	< 0.02	< 0.005	< 0.0002	0.0010	0.0006	0.006	< 0.0002	0.0004	< 0.02
	16/08/2022	6.2	480	11.0	51	24	4			25	5	24			0.19	0.75	< 0.02	< 0.005	< 0.0002	0.0019		0.003	< 0.0002	0.0017	< 0.02
	11/10/2022	6.4	490	11.0	190	10	11			23	5	26			0.07	0.63	< 0.02	< 0.005	< 0.0002	0.0008		0.013	< 0.0002	0.0006	< 0.02
GDW03(S)	12/01/2022	7.5	790	23.0	78	2	5			40	20	28			0.09	1.60	< 0.02	< 0.005	0.0032	0.0010		0.007	0.0005	0.0036	< 0.02
	07/06/2022	7.2	620	21.0	11	10	3	120	19	25	21	28	5	470	0.09	1.90	< 0.02	< 0.005	< 0.0002	0.0017	0.0006	0.003	< 0.0002	0.0013	< 0.02
	16/08/2022	7.2	850	21.0	36	14	4			28	24	25			0.02	1.80	< 0.02	< 0.005	< 0.0002	0.0013		0.005	< 0.0002	0.0008	< 0.02
	11/10/2022	7.3	840	21.0	64	3	10			25	22	29			0.01	1.60	0.02	< 0.005	< 0.0002	0.0006		0.006	< 0.0002	0.0017	< 0.02
GDW04	19/01/2022	6.5		7.0			22					33					0.03		0.0058	0.0033		0.010	0.0013	0.0174	< 0.02
	14/06/2022	6.4		7.1			27	60	21	37	12	33	3	340		0.44	0.03	< 0.005	0.0010	0.0019	0.0062	0.009	0.0012	0.0287	< 0.02
	23/08/2022	5.6		7.3			34					28					0.04		0.0009	0.0023		0.023	0.0009	0.0178	< 0.02
	12/10/2022	5.8		6.8			38	9	5	32	5	37	10	72		0.11	0.08	< 0.005	0.0005	0.0042	0.0059	0.083	0.0009	0.0164	< 0.02
GDW05	19/01/2022	7.3		17.0			29					27					< 0.02		0.0071	0.0089		0.005	< 0.0002	0.0084	< 0.02
	14/06/2022	7.1		19.0			29	88	58	180	36	27	2	940		0.21	0.03	< 0.005	0.0006	0.0009	0.0028	0.002	0.0004	0.0095	< 0.02
	23/08/2022	7.2		21.0			14					27					< 0.02		0.0005	0.0005		0.002	0.0004	0.0118	< 0.02
	12/10/2022	7.7		26.0			43	54	70	380	44	29	4	1200		0.20	< 0.02	< 0.005	0.0009	0.0042	0.0014	0.005	< 0.0002	0.0113	< 0.02
GDW06	19/01/2022	6.6		9.5			8					37					< 0.02		0.0039	0.0071		0.010	0.0005	0.0019	< 0.02
	14/06/2022	6.5		12.0			14	60	12	37	9	28	2	300		0.50	< 0.02	< 0.005	< 0.0002	0.0025	0.0006	0.008	< 0.0002	0.0022	< 0.02
	23/08/2022	6.4		12.0			8					23					0.04		0.0002	0.0009		0.004	< 0.0002	0.0019	< 0.02
	12/10/2022	6.6		12.0			16	110	18	47	11	24	7	380			< 0.02	< 0.005	< 0.0002	0.0012	0.0017	0.007	< 0.0002	0.0028	< 0.02
GDW07	19/01/2022	6.8		9.8			21					69					< 0.02		0.0078	0.0061		0.010	< 0.0002	0.0050	< 0.02
	23/08/2022	6.8		44.0			46					110					< 0.02		0.0008	< 0.0005		< 0.0005	< 0.0002	0.0019	< 0.02
	12/10/2022	7.1		26.0			31		82	51	38	110		1300			< 0.02	< 0.005	0.0015	< 0.0005	0.0008	0.001	< 0.0002	0.0024	< 0.02
	18/10/2022	7.0		15.0			14	490	55	48	27	89	426	950		0.77	< 0.02	< 0.005	0.0005	< 0.0005	0.0005	0.003	< 0.0002	0.0087	0.07
GDW08	19/01/2022	7.0		13.0			12					29					< 0.02		0.0054	0.0056		0.009	0.0003	0.0054	< 0.02
	14/06/2022	7.0		15.0			21	150	23	59	16	24	1	660		0.94	< 0.02	< 0.005	< 0.0002	0.0026	0.0008	0.013	< 0.0002	0.0025	< 0.02
	23/08/2022	6.9		15.0			10					24					< 0.02		0.0005	< 0.0005		0.004	< 0.0002	0.0019	< 0.02
	12/10/2022	7.2		15.0			18	180	41	77	19	22		700			< 0.02	< 0.005	< 0.0002	< 0.0005	0.0013	0.005	< 0.0002	0.0032	< 0.02
GDW09	19/01/2022	7.0		1.0			32					82					< 0.02		0.0077	0.0050		0.007	< 0.0002	0.0260	< 0.02
	14/06/2022	6.9		4.2			12	220	70	64	20	57	31	880		0.86	< 0.02	< 0.005	< 0.0002	< 0.0005	0.0028	0.004	< 0.0002	0.0170	< 0.02
	23/08/2022	6.7		12.0			7					27					< 0.02		0.0003	< 0.0005		0.003	< 0.0002	0.0136	< 0.02
	12/10/2022	7.0		26.0			31	200	34	42	17	29	4	720			< 0.02	< 0.005	< 0.0002	< 0.0005	0.0015	0.008	0.0002	0.0271	< 0.02
GDW10	19/01/2022	7.2		8.6			10					30					< 0.02		0.0047	0.0040		0.003	< 0.0002	0.0032	< 0.02
	14/06/2022	7.3		8.5			16	150	19	37	12	36	2	530		0.49	< 0.02	< 0.005	< 0.0002	0.0016	0.0008	0.011	< 0.0002	0.0027	< 0.02
	23/08/2022	7.0		9.1			7					29					0.03		< 0.0002	0.0012		0.004	< 0.0002	0.0017	< 0.02
	12/10/2022	7.6		8.7			15	190	20	39	11	29	2	550			< 0.02	< 0.005	< 0.0002	0.0007	0.0007	0.006	< 0.0002	0.0023	< 0.02
GDW11	19/01/2022	7.0		11.0			20					62					< 0.02		0.0046	0.0042		0.005	< 0.0002	0.0015	< 0.02
	14/06/2022	6.8		12.0			13	140	21	57	10	63	1	710		1.40	< 0.02	< 0.005	< 0.0002	< 0.0005	0.0005	0.005	< 0.0002	0.0030	< 0.02
	23/08/2022	6.7		11.0			7					63					< 0.02		< 0.0002	0.0005		0.005	< 0.0002	0.0012	< 0.02
	12/10/2022	7.0		11.0			18	150	23	56	10	63	2	540			< 0.02	< 0.005	< 0.0002	< 0.0005	0.0016	0.004	0.0003	0.0021	< 0.02
GDW12	19/01/2022	7.4		7.6			8					23					< 0.02		0.0036	0.0031		0.002	< 0.0002	0.0048	< 0.02
	14/06/2022	7.5		8.0			13	66	64	19	39	23	1	520		0.63	< 0.02	< 0.005	< 0.0002	0.0006	0.001	0.005	< 0.0002	0.0082	< 0.02
	23/08/2022	7.3		8.1			6					22					< 0.02		0.0003	0.0006		0.006	< 0.0002	0.0048	< 0.02

Tir John Phase 2 Landfill Site
Groundwater Quality Summary January - December 2022

Sample Point	Date	pH	EC	NH_4-N	COD	BOD	TOC	Ca	Mg	Na	K	Cl	SO_4	Alkalinity	Fe	Mn	Cd	Hg	Cr	Cu	Ni	Zn	Pb	As	MCPP
			uS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l
	12/10/2022	7.7		7.8			14	76	73	19	39	23	1	530			< 0.02	< 0.005	< 0.0002	0.0005	0.0019	0.004	< 0.0002	0.0067	< 0.02
GDW13	19/01/2022	6.9		24.0			24					120					< 0.02		0.0076	0.0037		0.004	< 0.0002	0.0014	< 0.02
	14/06/2022	7.0		30.0			13	140	52	97	31	120	2	740		1.70	< 0.02	< 0.005	< 0.0002	0.0016	0.0012	0.009	< 0.0002	0.0012	< 0.02
	23/08/2022	6.8		33.0			9					130					< 0.02		0.0002	< 0.0005		0.004	< 0.0002	0.0038	< 0.02
	12/10/2022	7.3		31.0			20	160	53	110	31	120	2	730			< 0.02	< 0.005	< 0.0002	0.0083	0.0007	0.004	< 0.0002	0.0006	< 0.02
GDW16	19/01/2022	6.3		0.6			2					37					< 0.02		0.0024	0.0030		0.003	< 0.0002	0.0039	< 0.02
	14/06/2022	6.0		1.3			19	28	11	38	8	45	3	150		0.32	< 0.02	< 0.005	0.0002	0.0024	0.0014	0.014	< 0.0002	0.0027	< 0.02
	23/08/2022	6.1		5.2			12					65					< 0.02		0.0003	0.0011		0.005	< 0.0002	0.0019	< 0.02
	12/10/2022	6.2		0.9			17	40	14	43	8	54	29	150			< 0.02	< 0.005	0.0003	0.0018	0.0014	0.010	< 0.0002	0.0021	< 0.02
GDW17	19/01/2022	6.4		1.3			2					180					< 0.02		0.0033	0.0031		0.005	0.0004	0.0039	< 0.02
	14/06/2022	6.3		2.8			14	76	19	95	11	200	2	210		1.20	< 0.02	< 0.005	< 0.0002	0.0008	0.003	0.013	0.0002	0.0029	< 0.02
	23/08/2022	6.1		4.5			12					190					0.04		< 0.0002	0.0007		0.005	< 0.0002	0.0024	< 0.02
	12/10/2022	6.5		1.4			12	190	29	88	12	190	196	240			< 0.02	< 0.005	0.0002	0.0006	0.0055	0.006	< 0.0002	0.0084	< 0.02
GDW18	19/01/2022	7.3		13.0			6					58					< 0.02		0.0053	0.0031		0.005	0.0003	0.0096	< 0.02
	14/06/2022	7.3		19.0			18	140	33	68	34	90	5	650		0.99	< 0.02	< 0.005	< 0.0002	0.0008	0.0027	0.004	< 0.0002	0.0138	< 0.02
	23/08/2022	7.0		15.0			6					110					< 0.02		0.0004	< 0.0005		0.006	< 0.0002	0.0031	< 0.02
	12/10/2022	7.2		9.6			16	200	45	120	42	150	197	600			0.08	< 0.005	< 0.0002	0.0008	0.0059	0.007	< 0.0002	0.0054	< 0.02

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Tir John Landfill Site
Surface Water Quality Summary January - December 2022

Sample Point	Date	pH	NH_4-N	COD	BOD	TOC	Na	K	Cl	SO_4	Alk	Fe	Mn	Cd	Cr	Cu	Ni	Zn	Pb	Susp. Solids
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SW1	19/01/2022	7.9	0.03	10	< 1	4			22											6
	23/02/2022	8.2	0.05	10	1	4			30											< 2
	16/03/2022	7.9	< 0.015	12	2	7			28											< 2
	20/04/2022	7.9	0.09	55	5	13			32											5
	02/11/2022	8.1	0.02	23	< 1	6	15	3.8	28	44	330	0.008	0.0051	< 0.02	0.0003	0.0066	0.0007	0.0039	0.0003	< 2
	07/12/2022	8.1	< 0.015	21	4	6			23											30
SW2	19/01/2022	7.4	4.50	8	< 1	4			33											5
	23/02/2022	7.5	2.90	4	< 1	3			34											< 2
	16/03/2022	7.3	3.50	10	3	7			36											4
	20/04/2022	7.3	1.60	23	2	4			32											2
	24/05/2022	7.5	4.00	23	4	6			31											90
	14/06/2022	7.6	3.70	8	7	6			31											5
	27/07/2022	7.7	2.90	12	5	5			30											38
	02/11/2022	7.4	2.20	22	2	4	21	12	31	33	310	0.33	0.62	< 0.02	< 0.0002	0.0024	0.0022	0.0051	< 0.0002	2
	07/12/2022	7.4	4.40	16	< 1	5			38											< 2
SW3	19/01/2022	7.4	0.05	8	< 1	4			22											< 2
	23/02/2022	7.3	0.02	12	< 1	3			25											< 2
	16/03/2022	7.3	0.04	9	< 1	6			24											< 2
	20/04/2022	7.1	0.04	12	3	5			25											2
	24/05/2022	7.7	3.50	27	8	9			56											14
	14/06/2022	7.6	7.60	27	2	11			63											21
	27/07/2022	7.6	4.00	11	8	5			57											6
	23/08/2022	7.9	4.30	18	5	6			68											47
	28/09/2022	7.7	8.70	54	7	5			73											32
	11/10/2022	7.2	0.11	10	< 1	9	20	6	28	34	130	0.043	0.057	0.11	< 0.0002	0.0042	0.0017	0.0342	< 0.0002	< 2
	02/11/2022	6.9	< 0.015	31	1	8			21											< 2
	07/12/2022	7.5	0.06	12	< 1	6			23											< 2
SW4	19/01/2022	7.5	14.00	14	2	6			52											20
	23/02/2022	7.7	7.50	17	< 1	5			57											< 2
	16/03/2022	7.5	10.00	8	3	9			55											8
	20/04/2022	7.5	12.00	100	6	7			65											4
	24/05/2022	7.8	25.00	53	1	14			86											8
	14/06/2022	7.9	30.00	37	8	10			100											7
	27/07/2022	8.0	33.00	18	3	10			120											< 2
	02/11/2022	7.6	6.70	37	2	9	57	20	69	210	380	0.33	0.82	0.03	< 0.0002	0.0082	0.0019	0.0157	< 0.0002	9
	07/12/2022	7.7	16.00	22	< 1	7			68											3

Figure C.1- Leachate Chloride

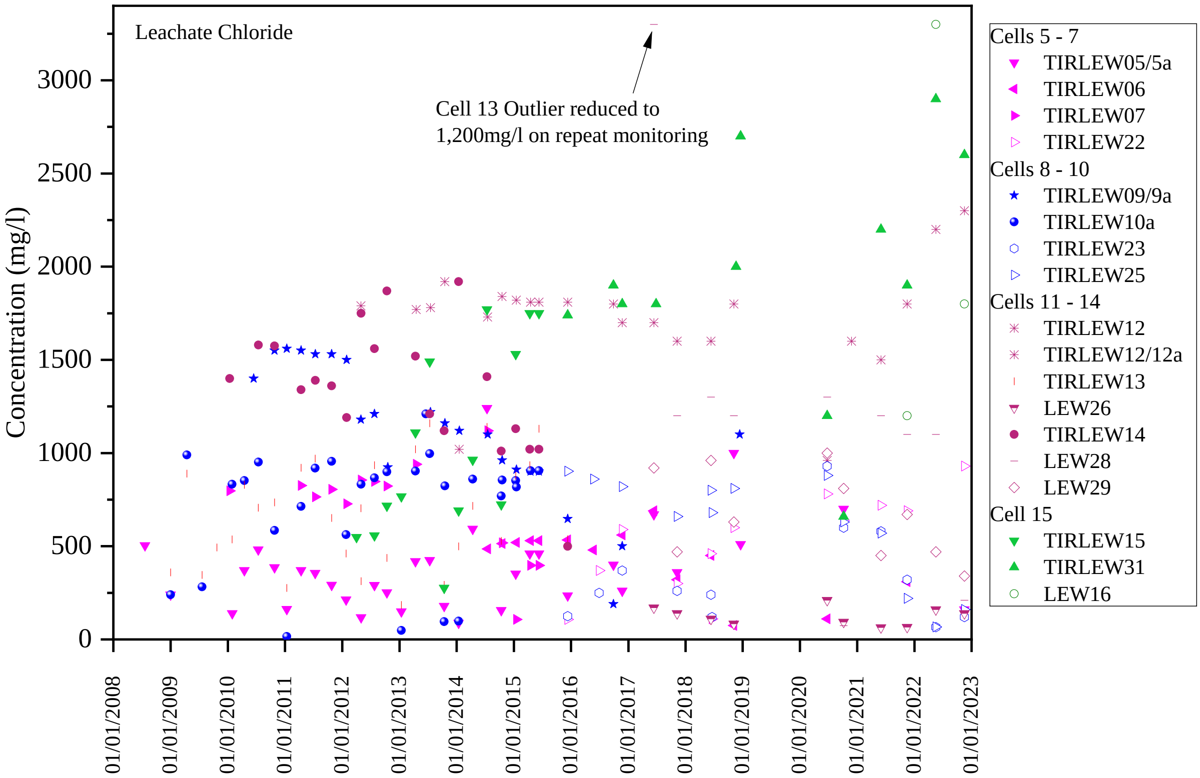

Figure C.2 - Leachate Ammoniacal-N

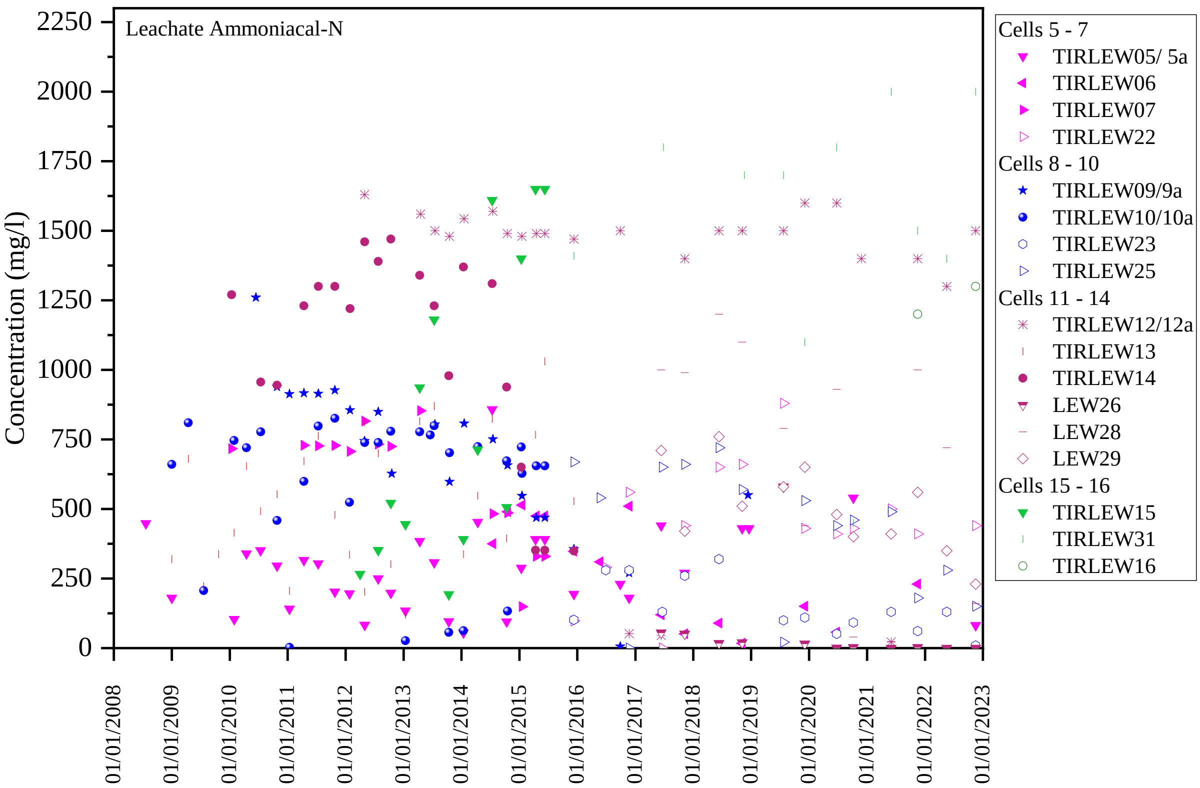

Figure C.3 - Groundwater Monitoring Point GDW01D

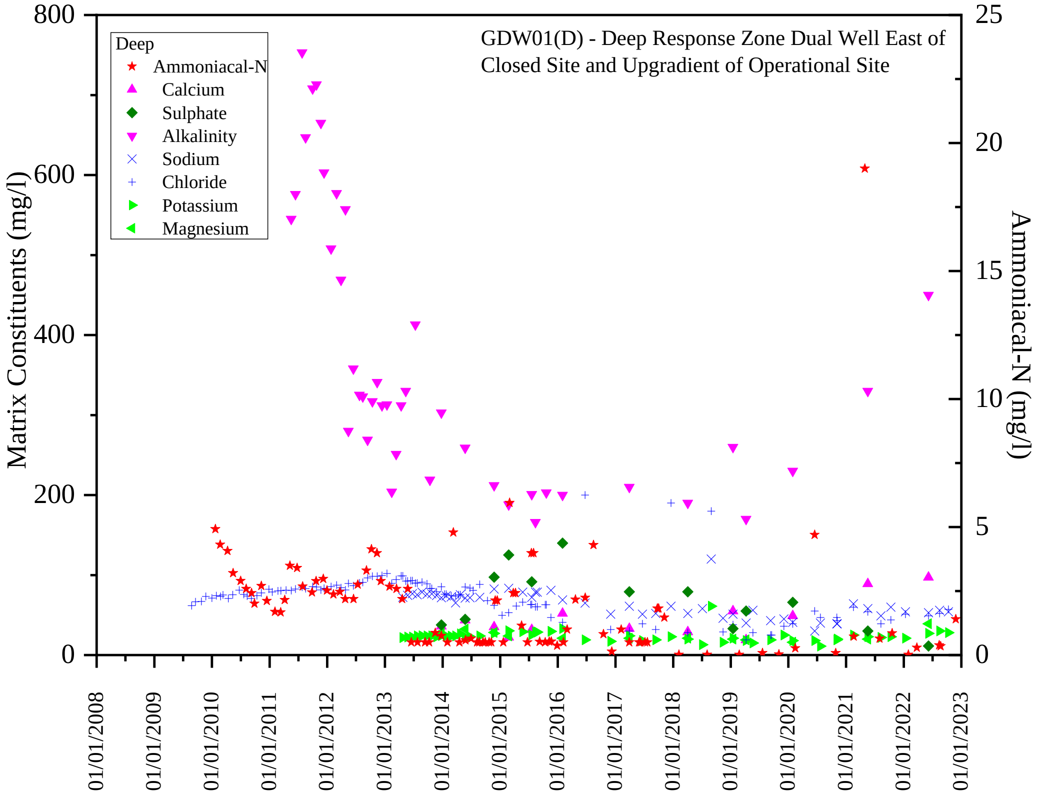

Figure C.4 - Groundwater Monitoring Point GDW01S

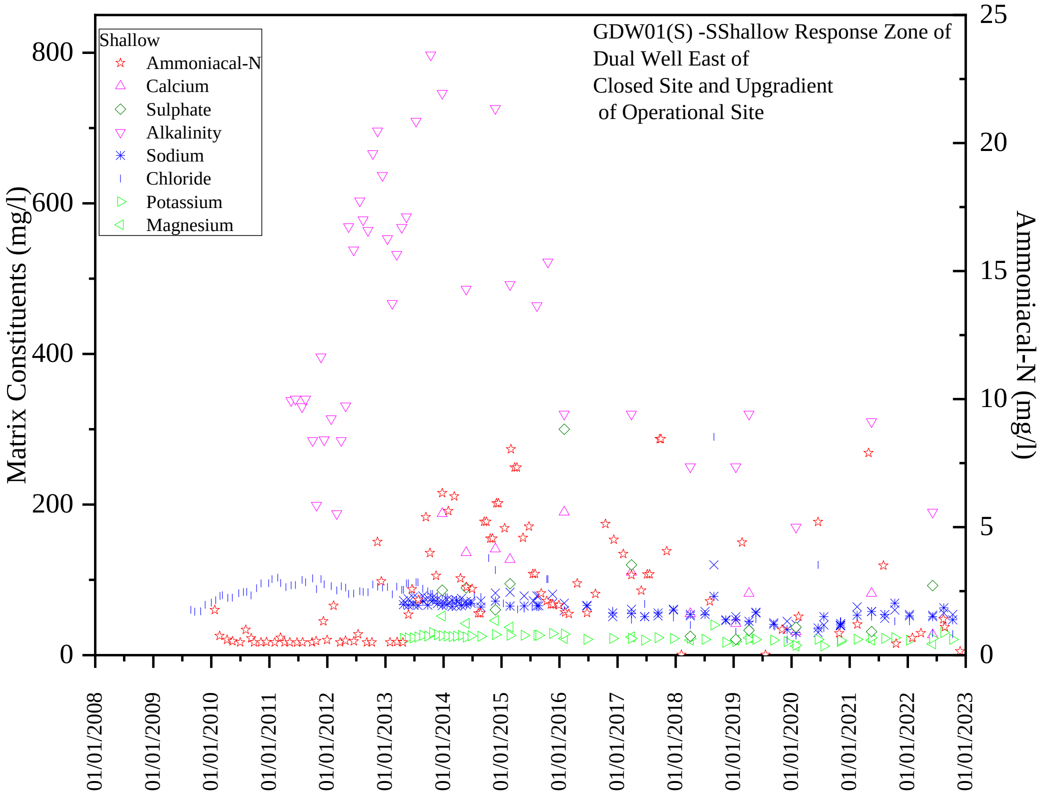

Figure C.5 - Groundwater Monitoring Point GDW02D

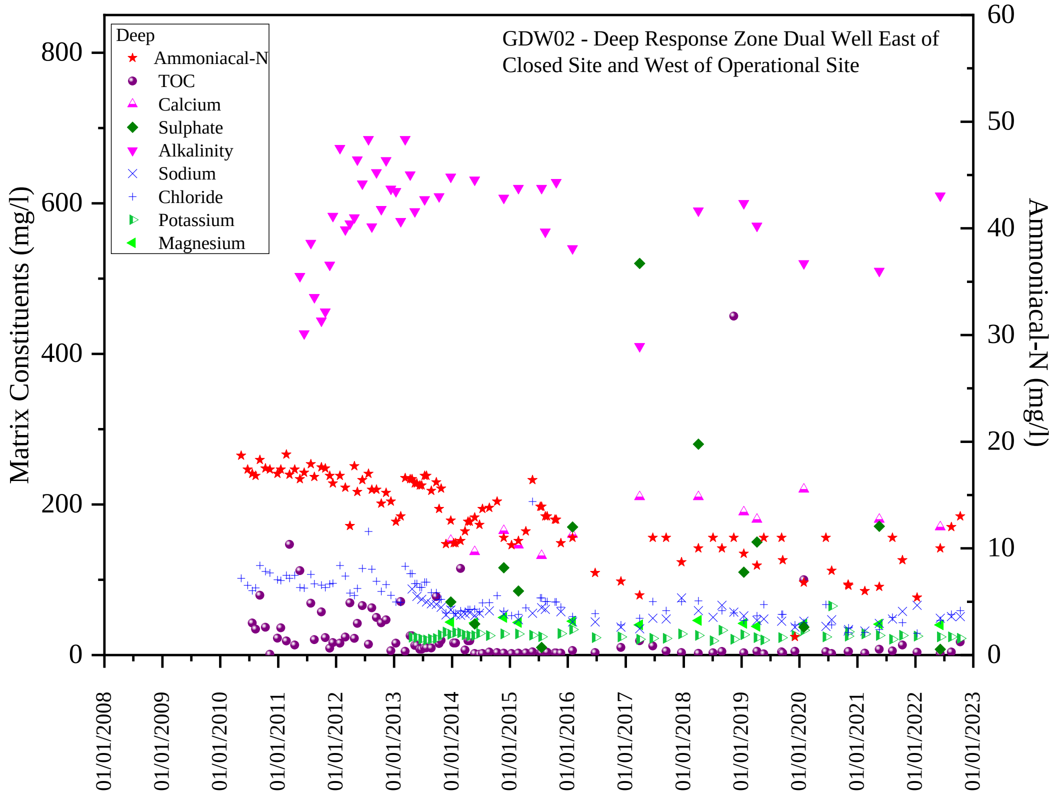

Figure C.6 – Groundwater Monitoring Point GDW02S

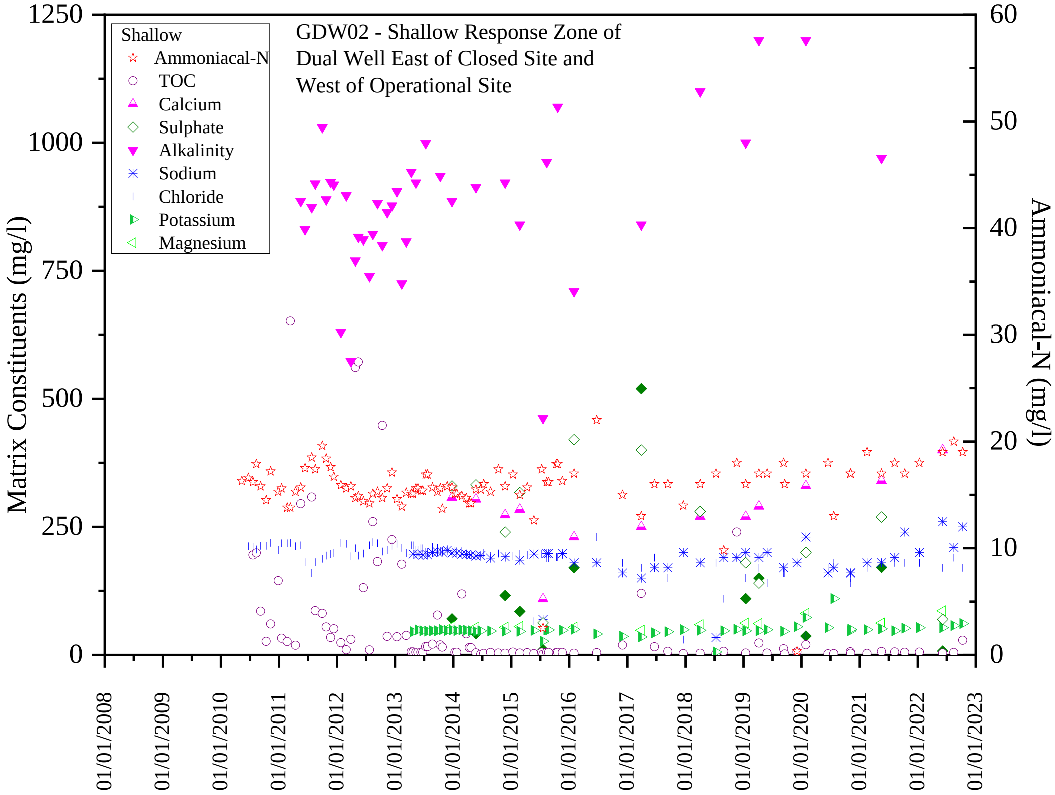

Figure C.7 - Groundwater Monitoring Point GDW03

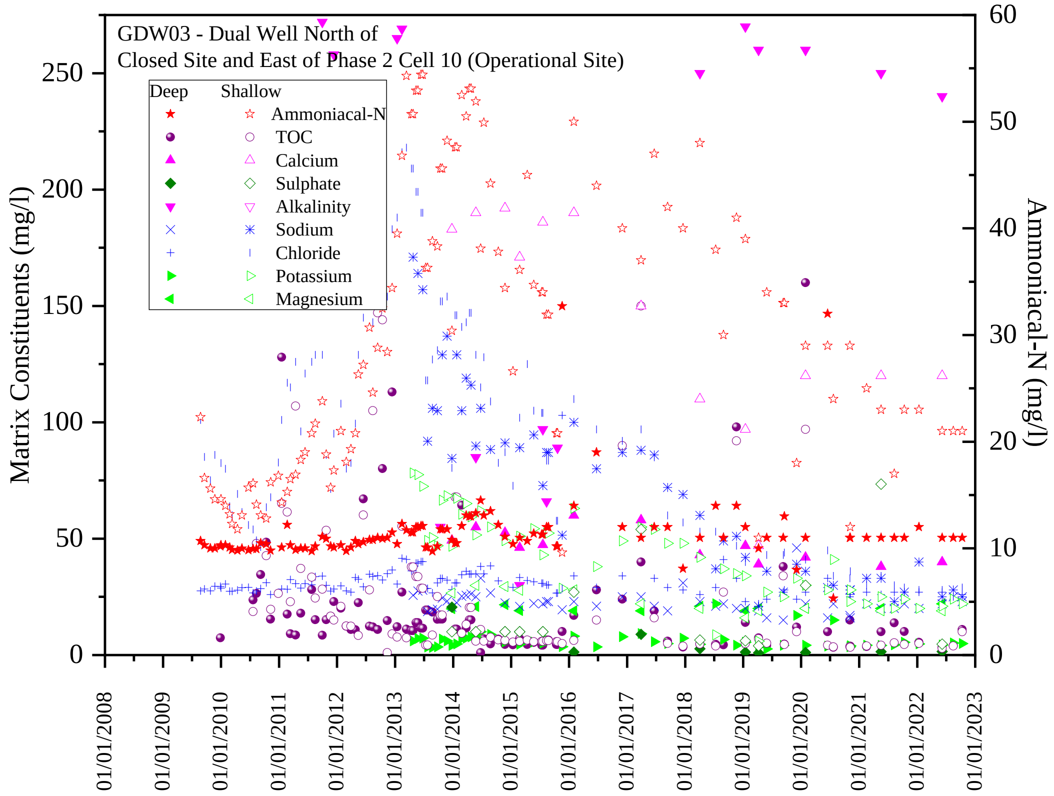

Figure C.8 - Groundwater Monitoring Point GDW04

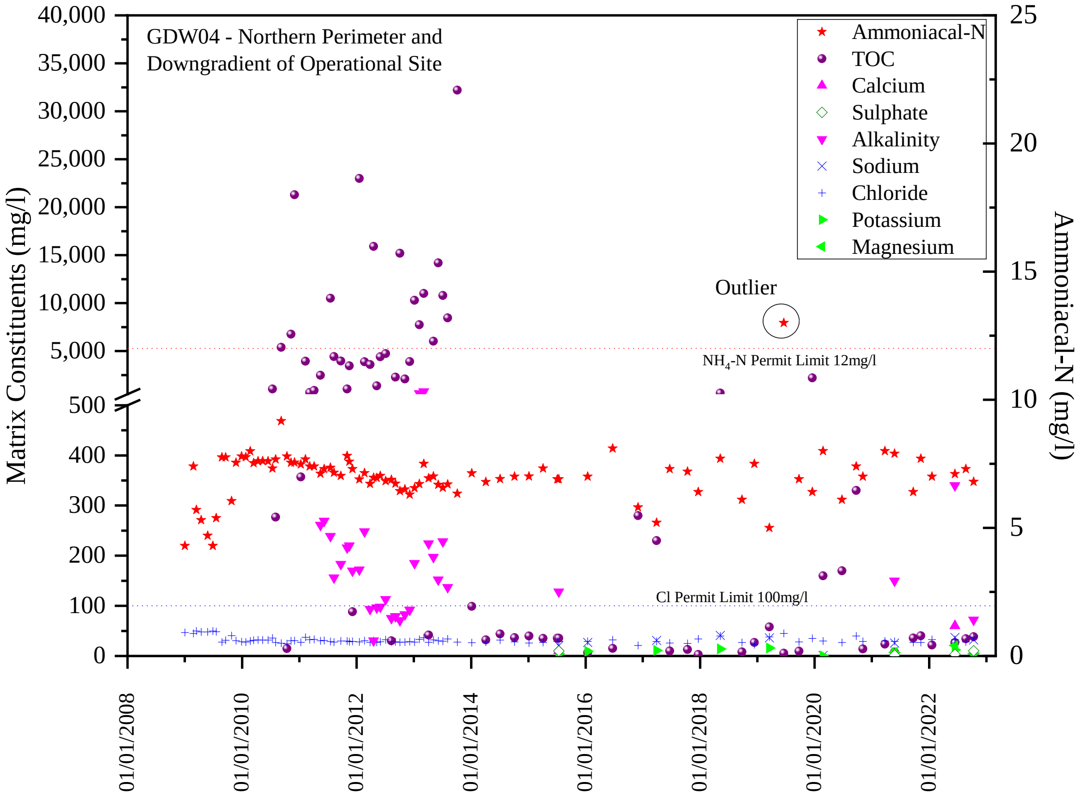

Figure C.9 - Groundwater Monitoring Point GDW05

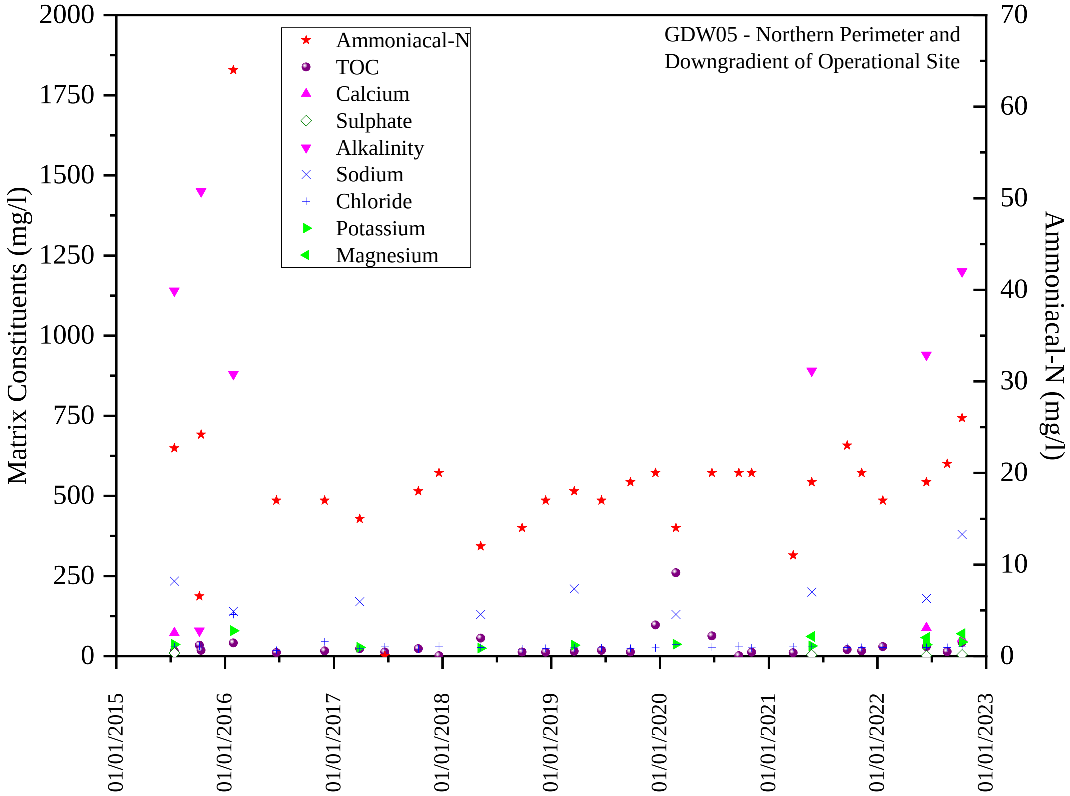

Figure C.10 - Groundwater Monitoring Point GDW06

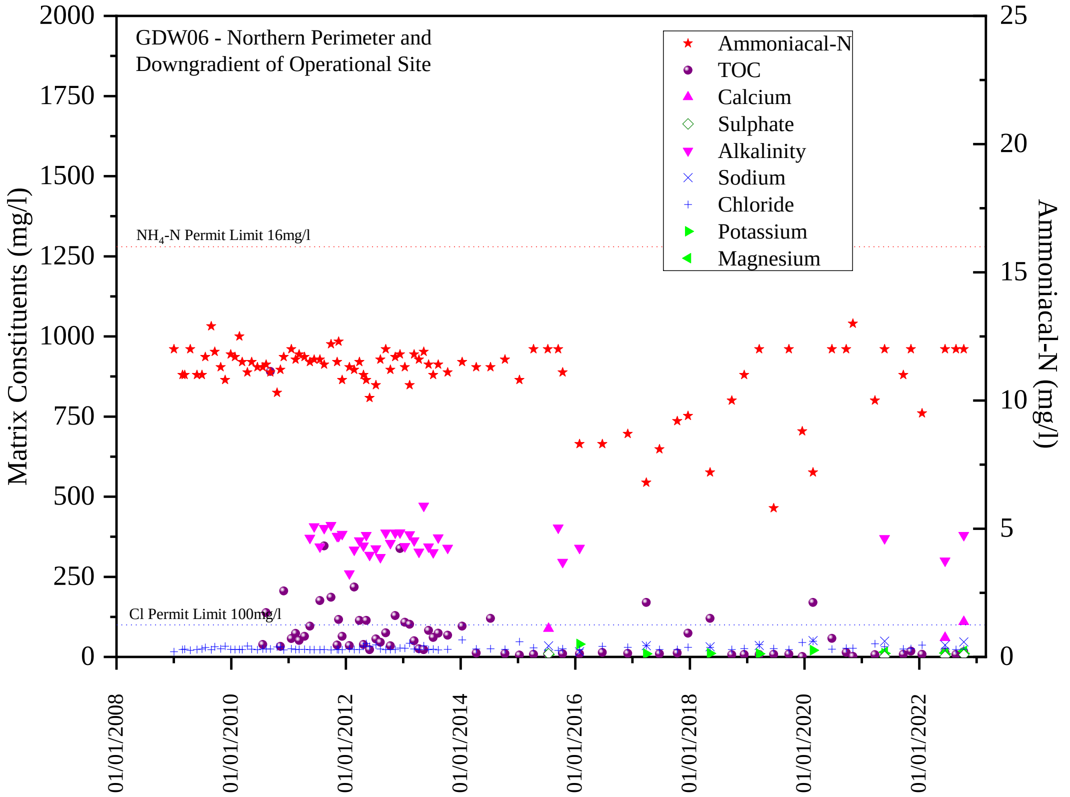

Figure C.11 - Groundwater Monitoring Point GDW07

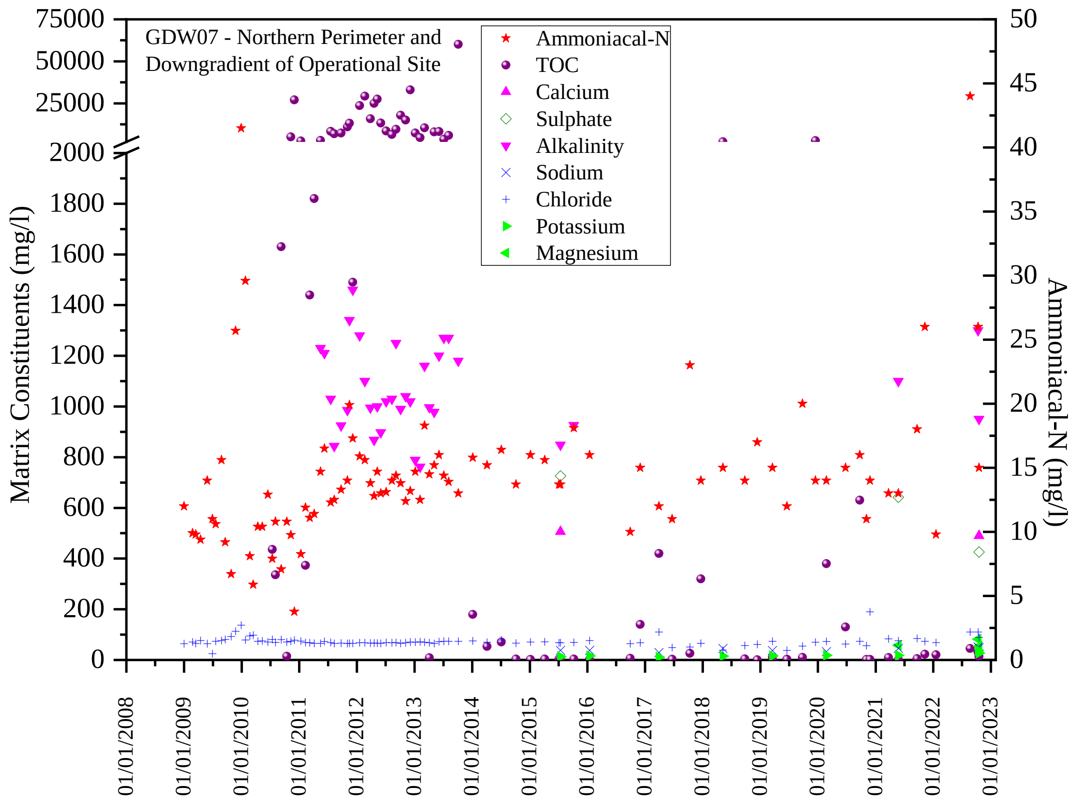

Figure C.12 - Groundwater Monitoring Point GDW08

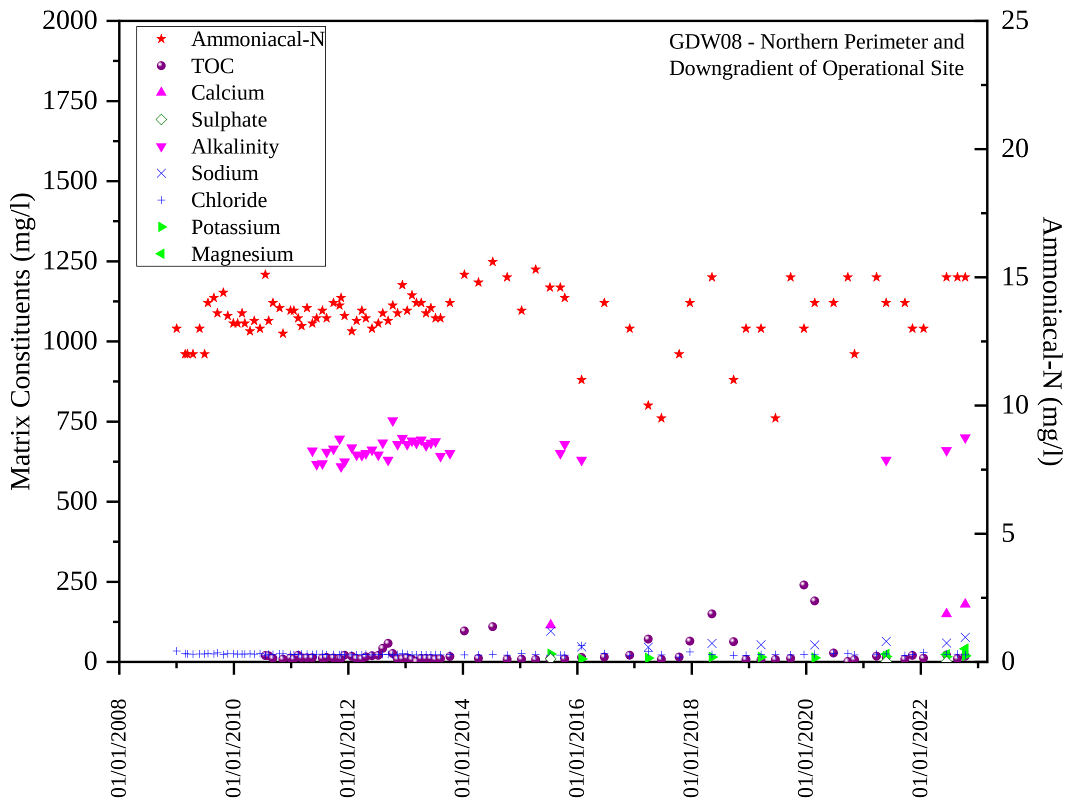

Figure C.13 - Groundwater Monitoring Point GDW09

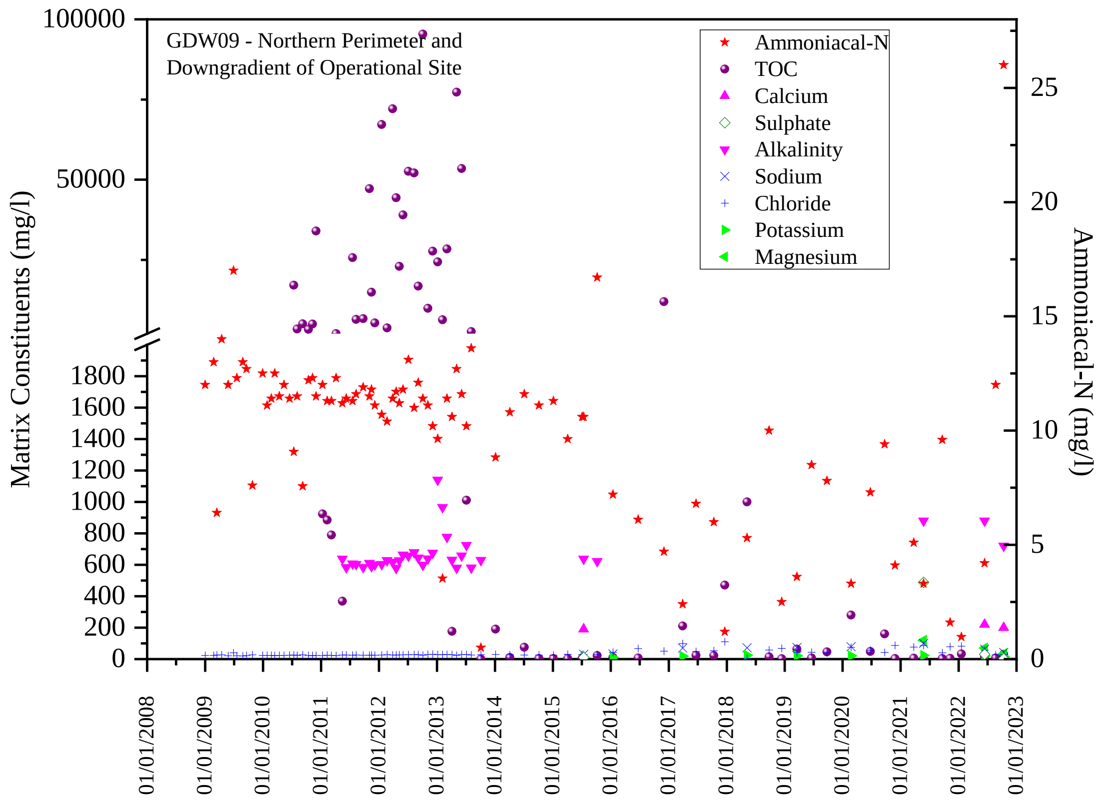

Figure C.14 - Groundwater Monitoring Point GDW10

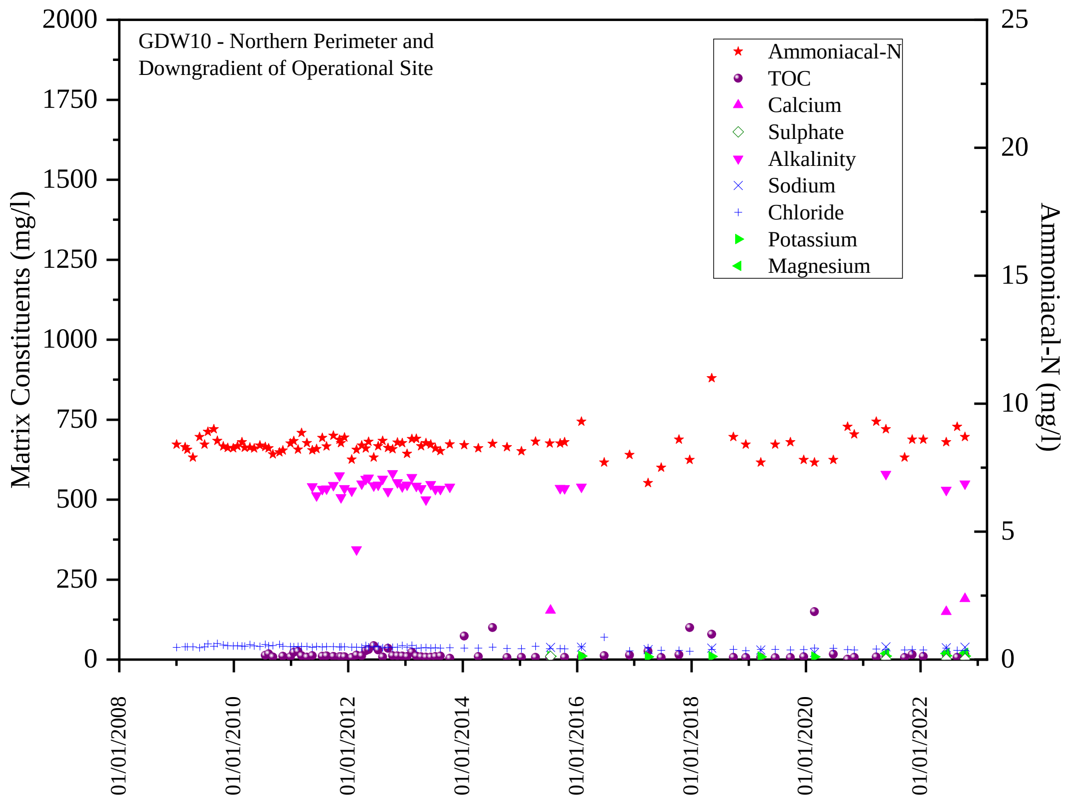

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Figure C.15 - Groundwater Monitoring Point GDW11

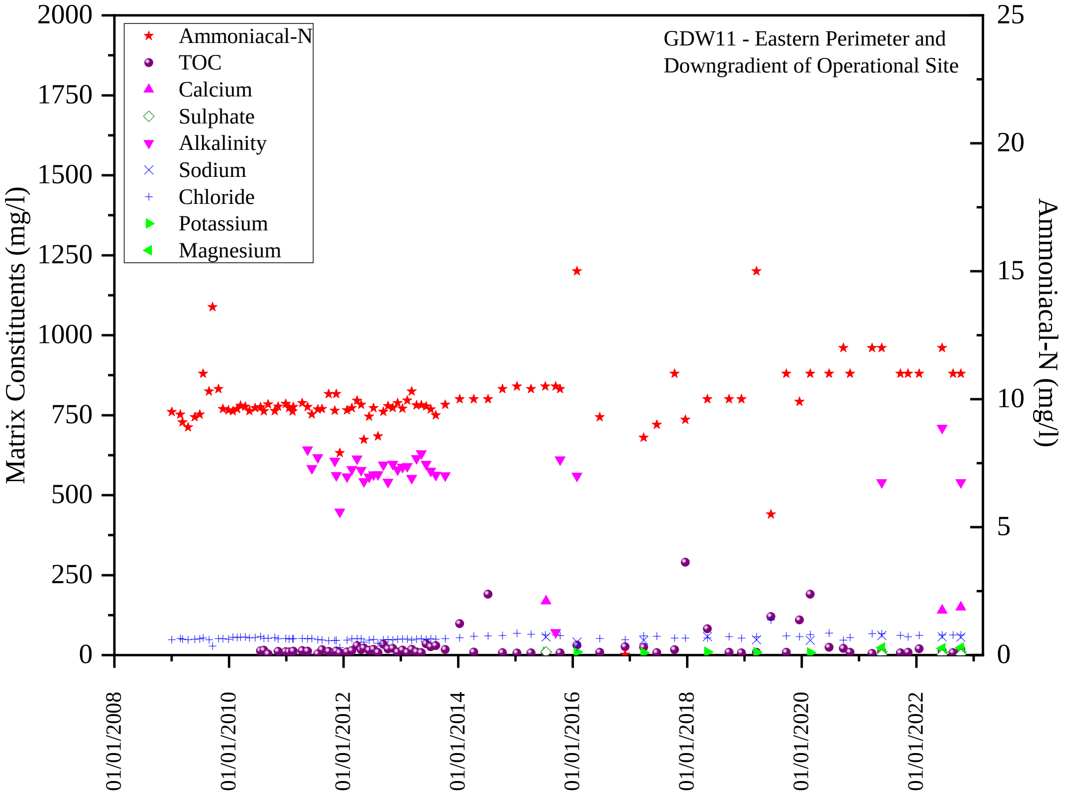


Figure C.16 - Groundwater Monitoring Point GDW12

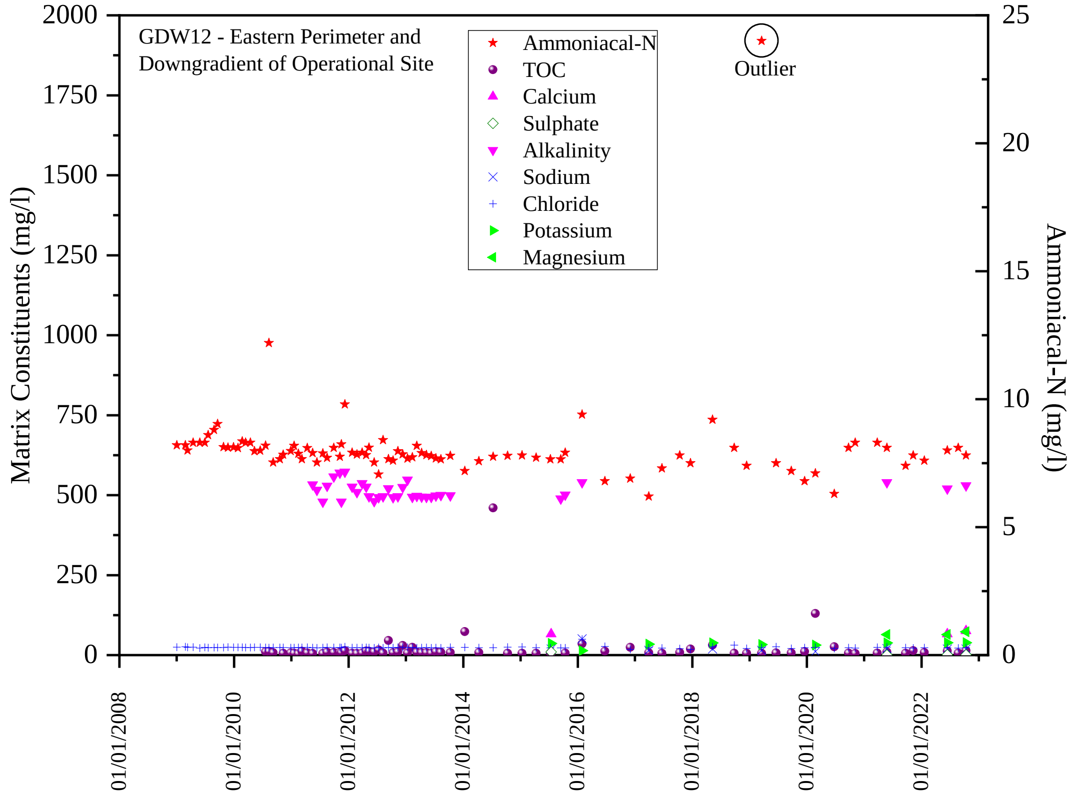


Figure C.17 - Groundwater Monitoring Point GDW13

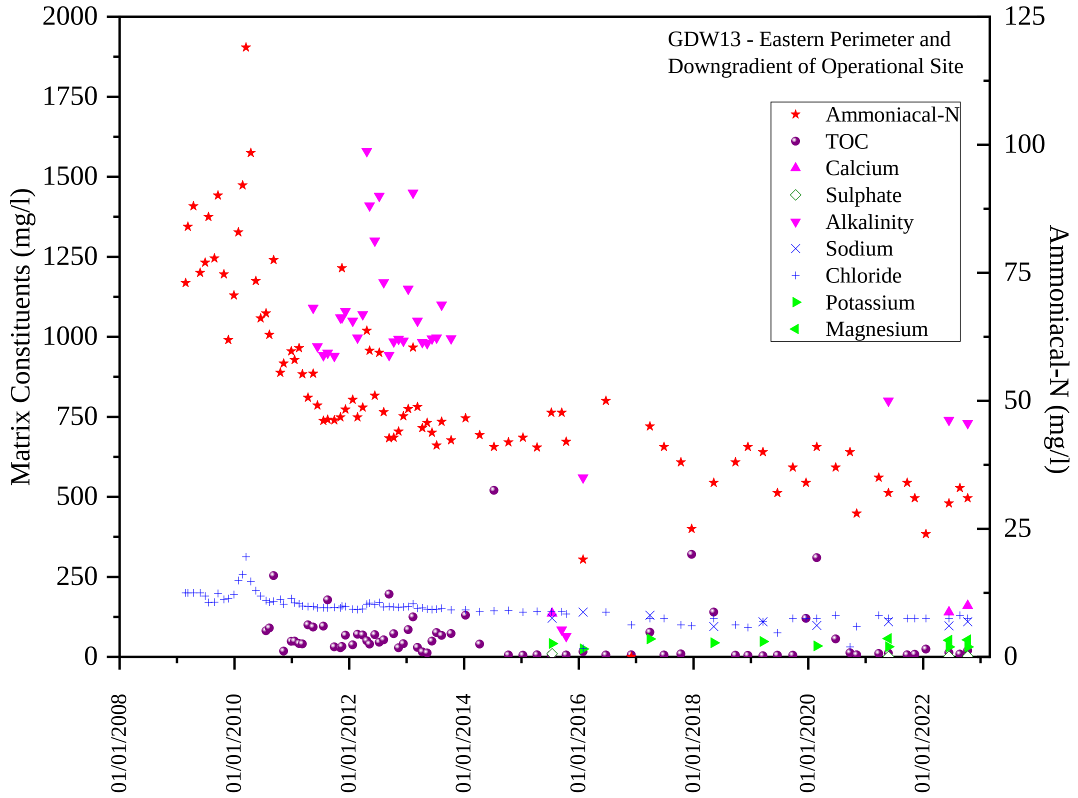


Figure C.18 - Groundwater Monitoring Point GDW14

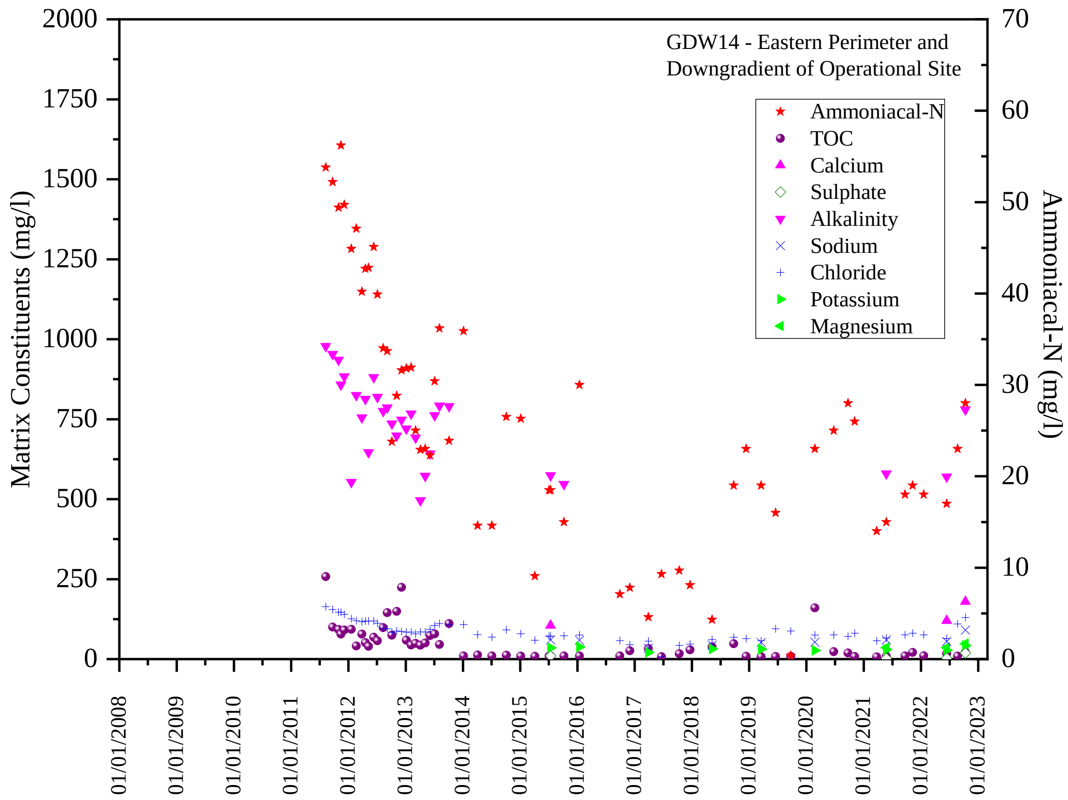


Figure C.19 - Groundwater Monitoring Point GDW15

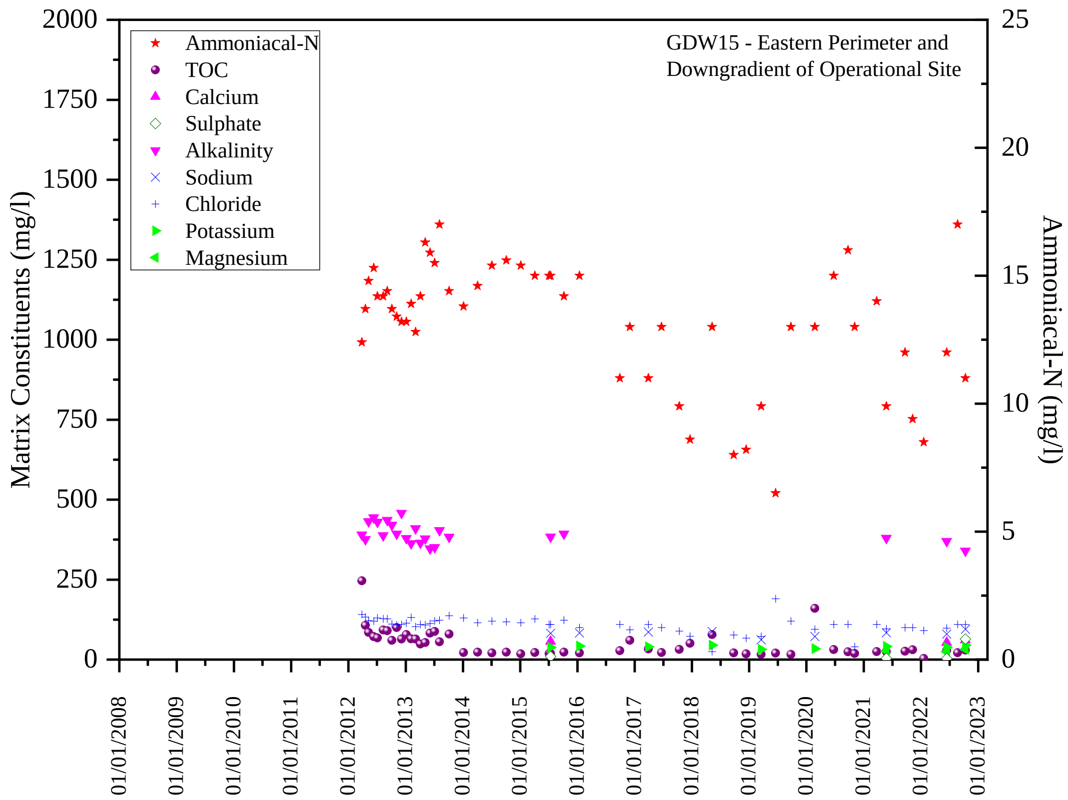


Figure C.20 - Groundwater Monitoring Point GDW16

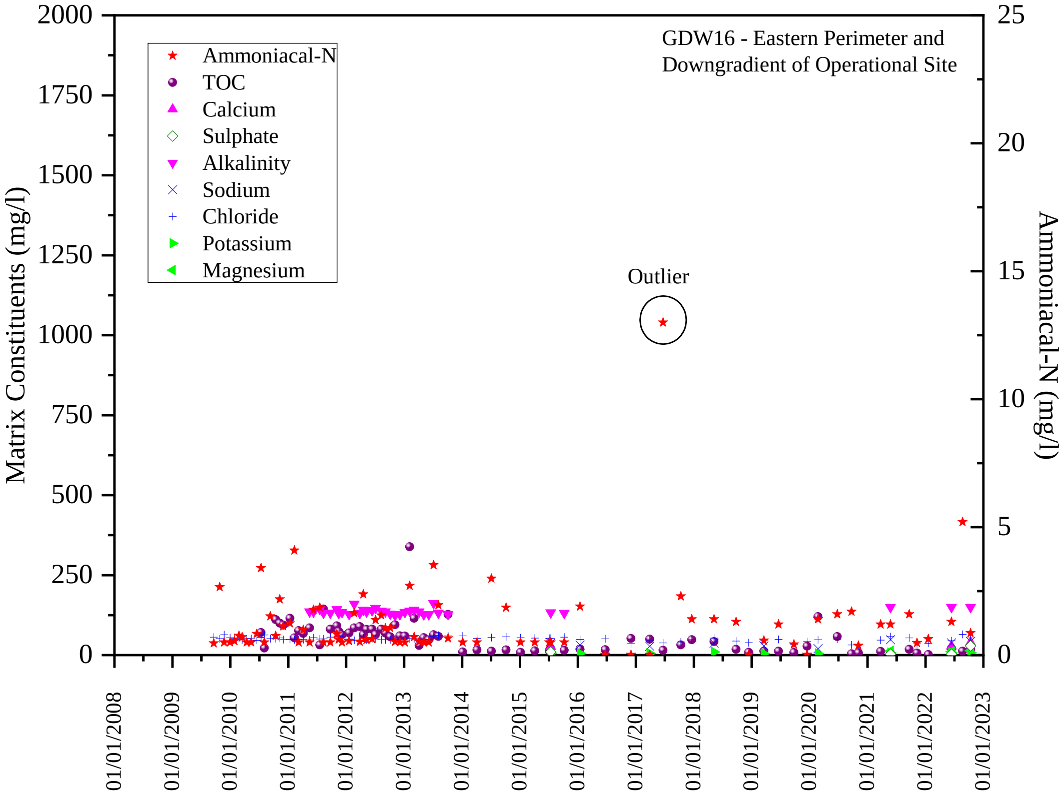


Figure C.21 - Groundwater Monitoring Point GDW17

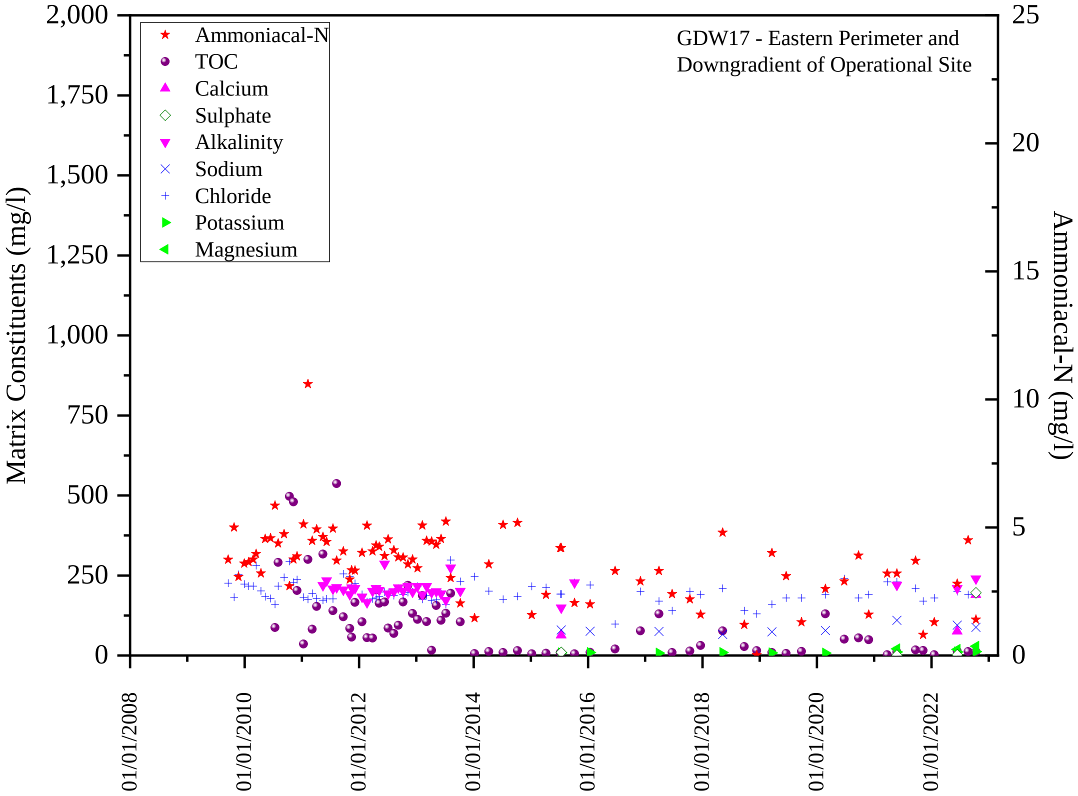


Figure C.22 - Groundwater Monitoring Point GDW18

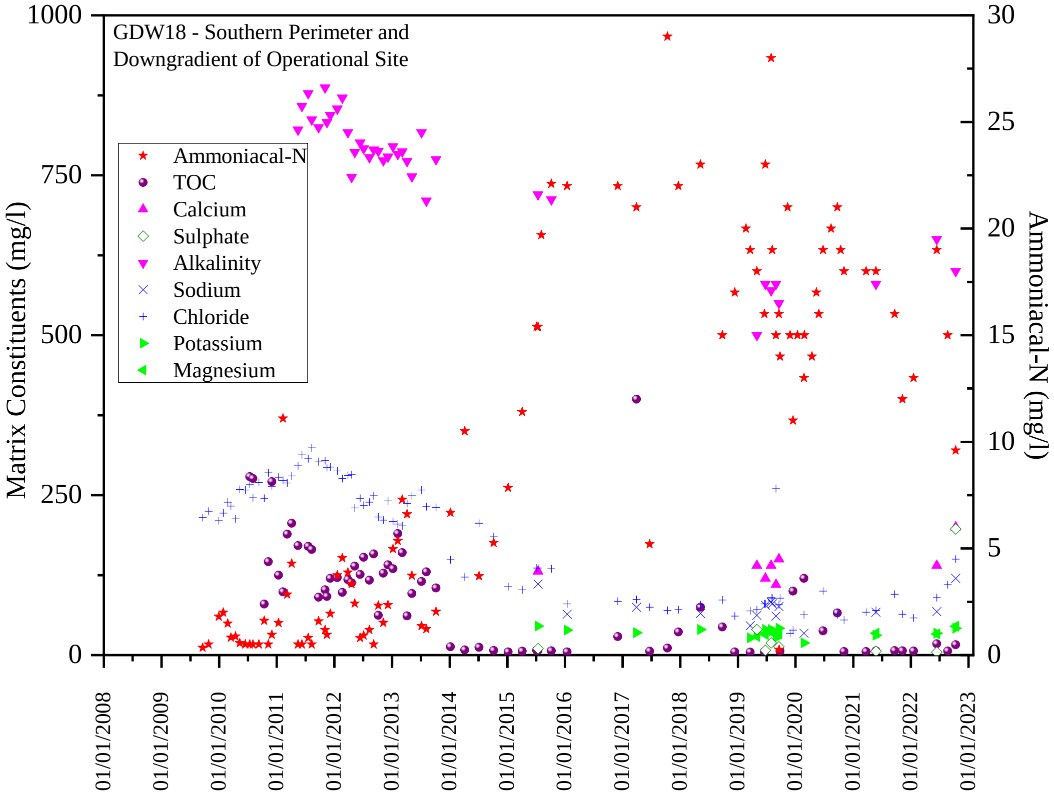


Figure C.23 – Surface Water Monitoring Point SW1

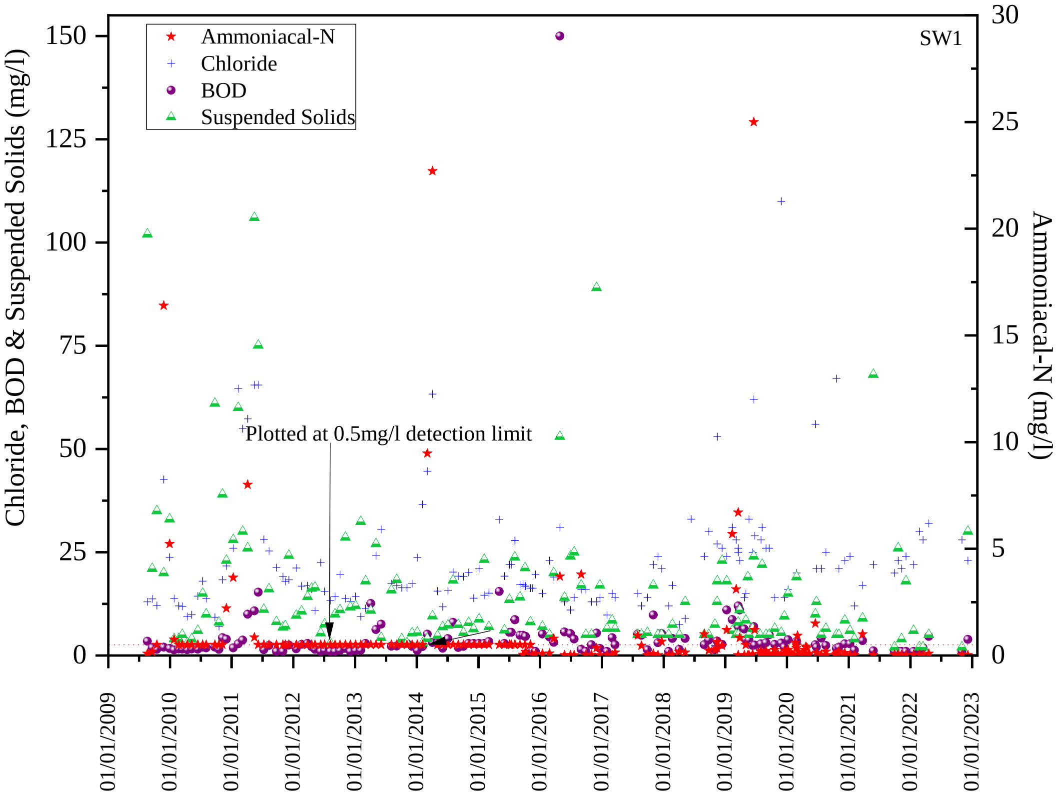


Figure C.24 – Surface Water Monitoring Point SW2

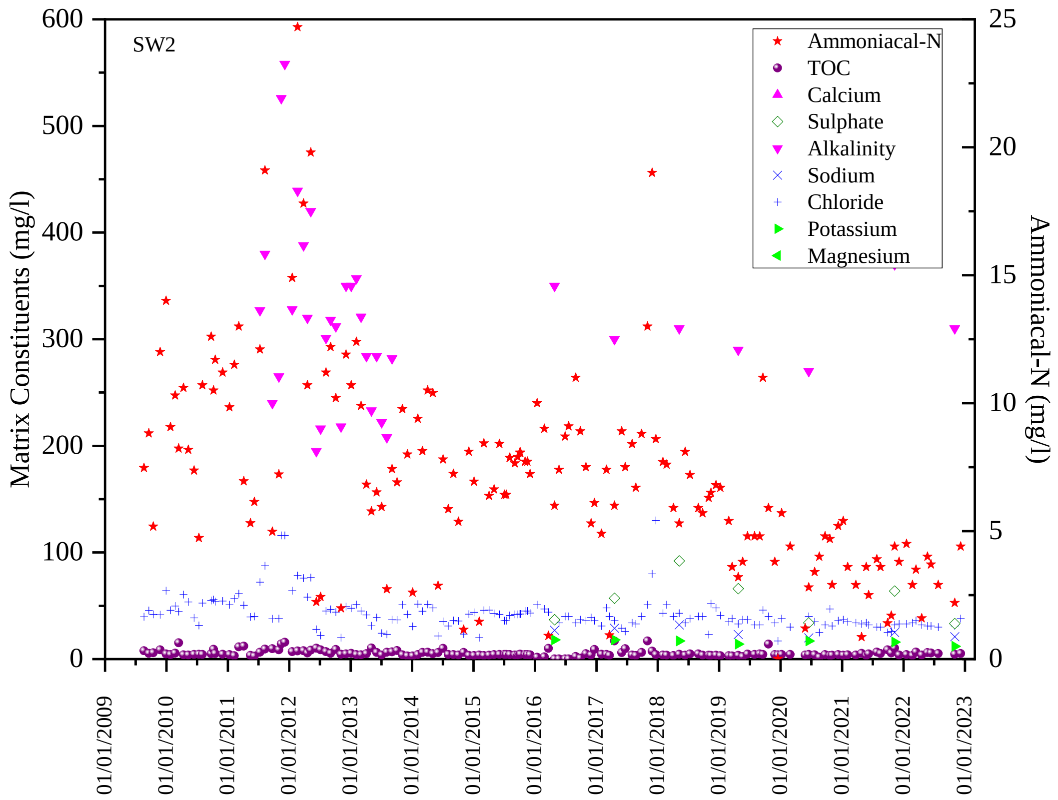


Figure C.25 – Surface Water Monitoring Point SW3

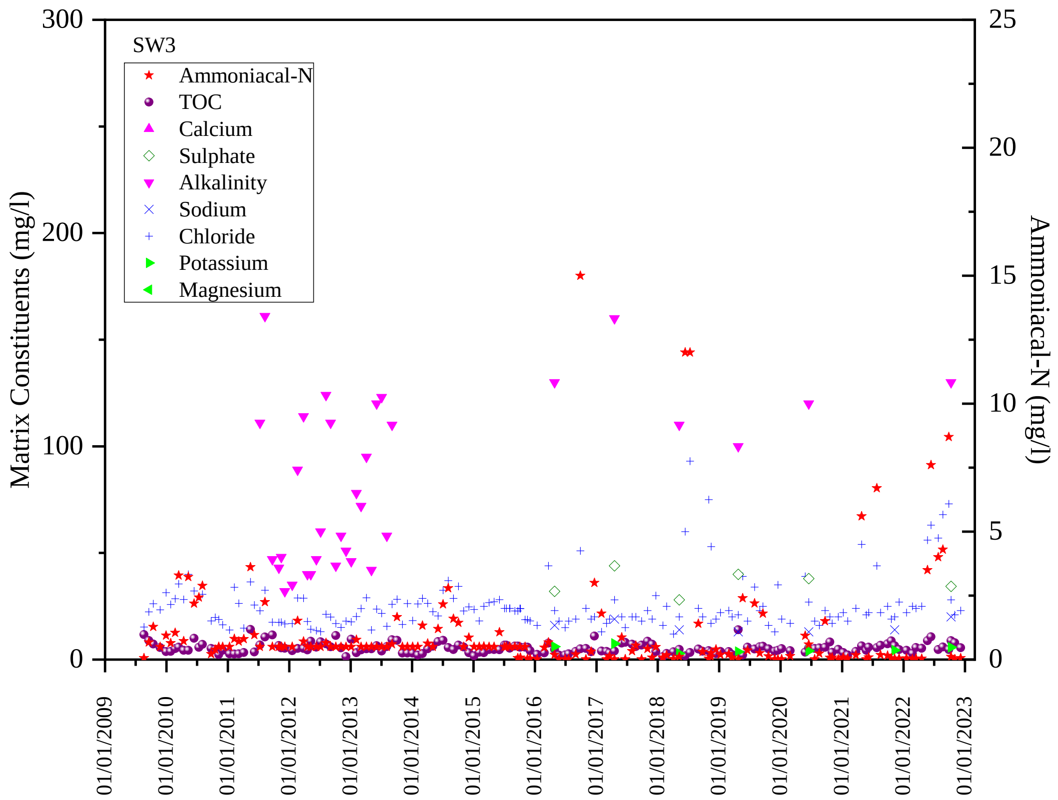
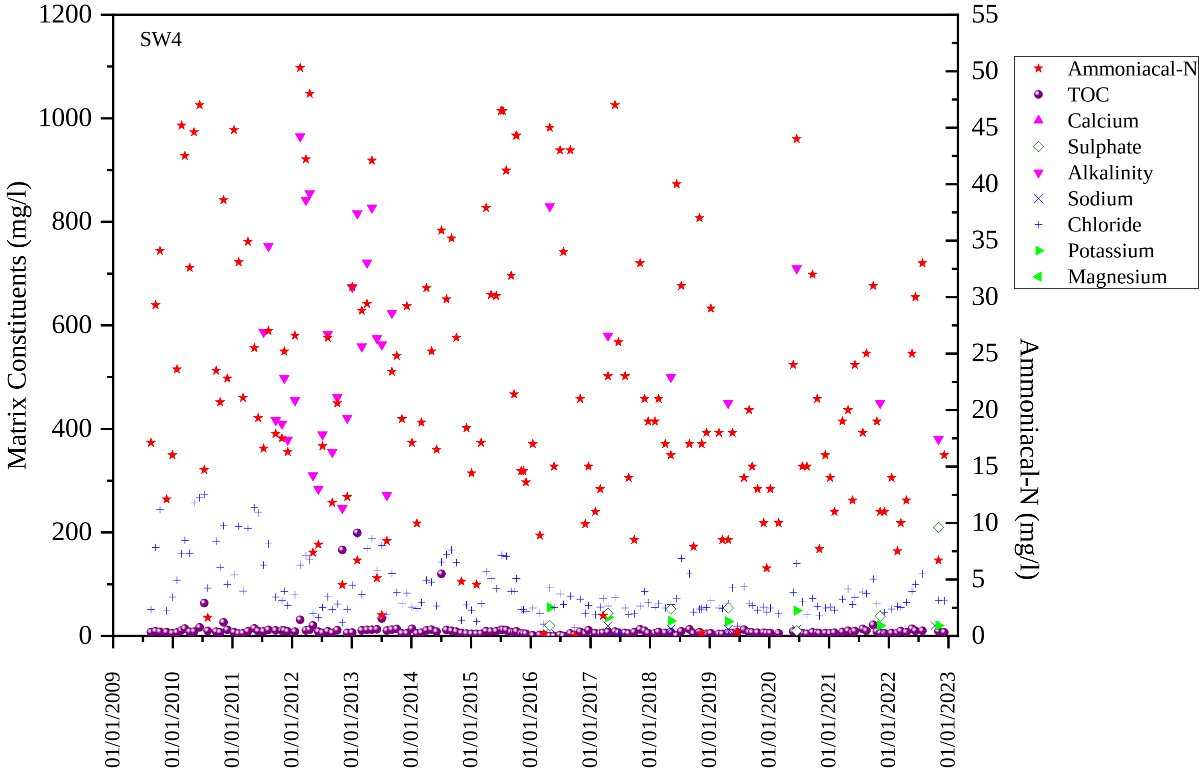
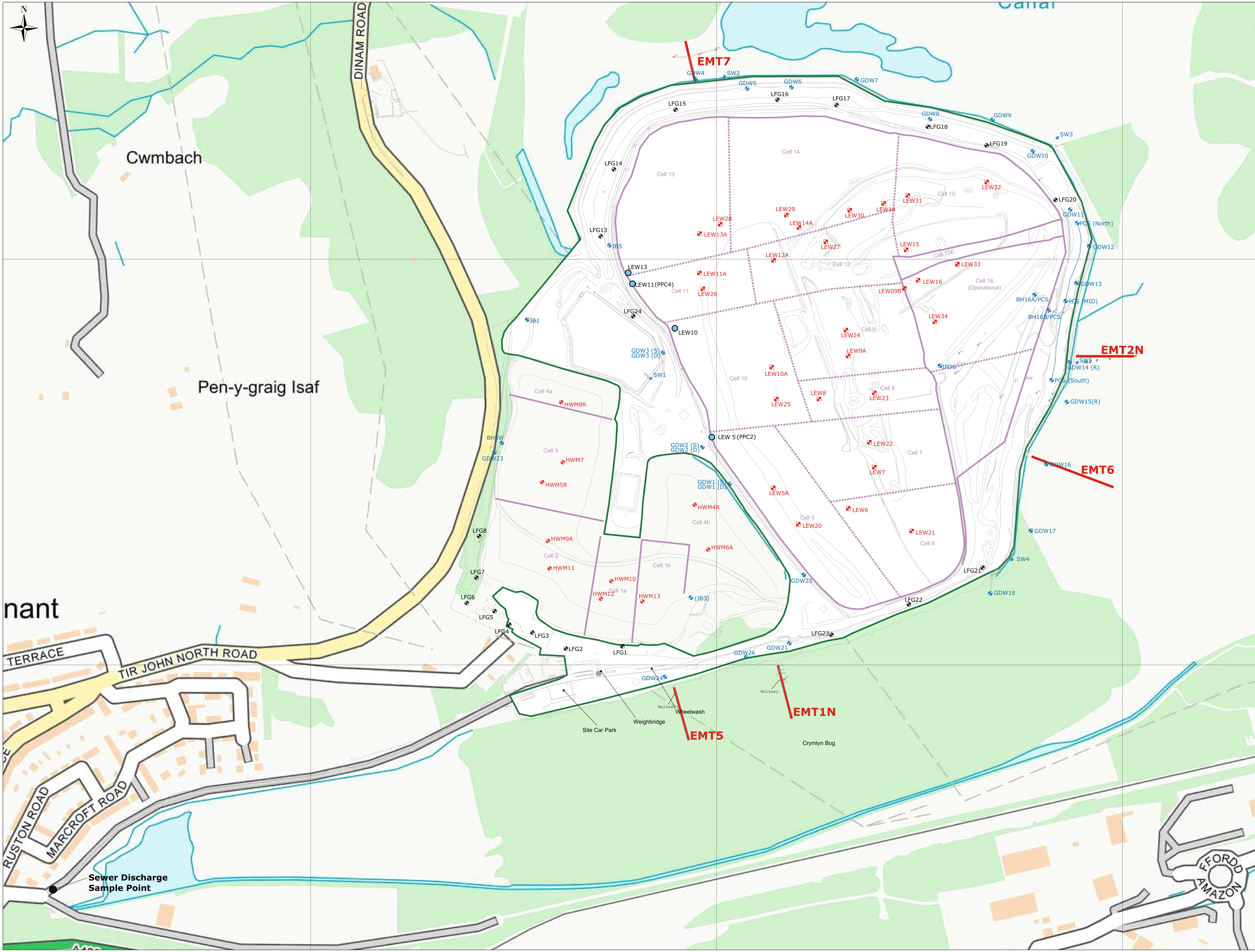


Figure C.26 – Surface Water Monitoring Point SW4



Drawings



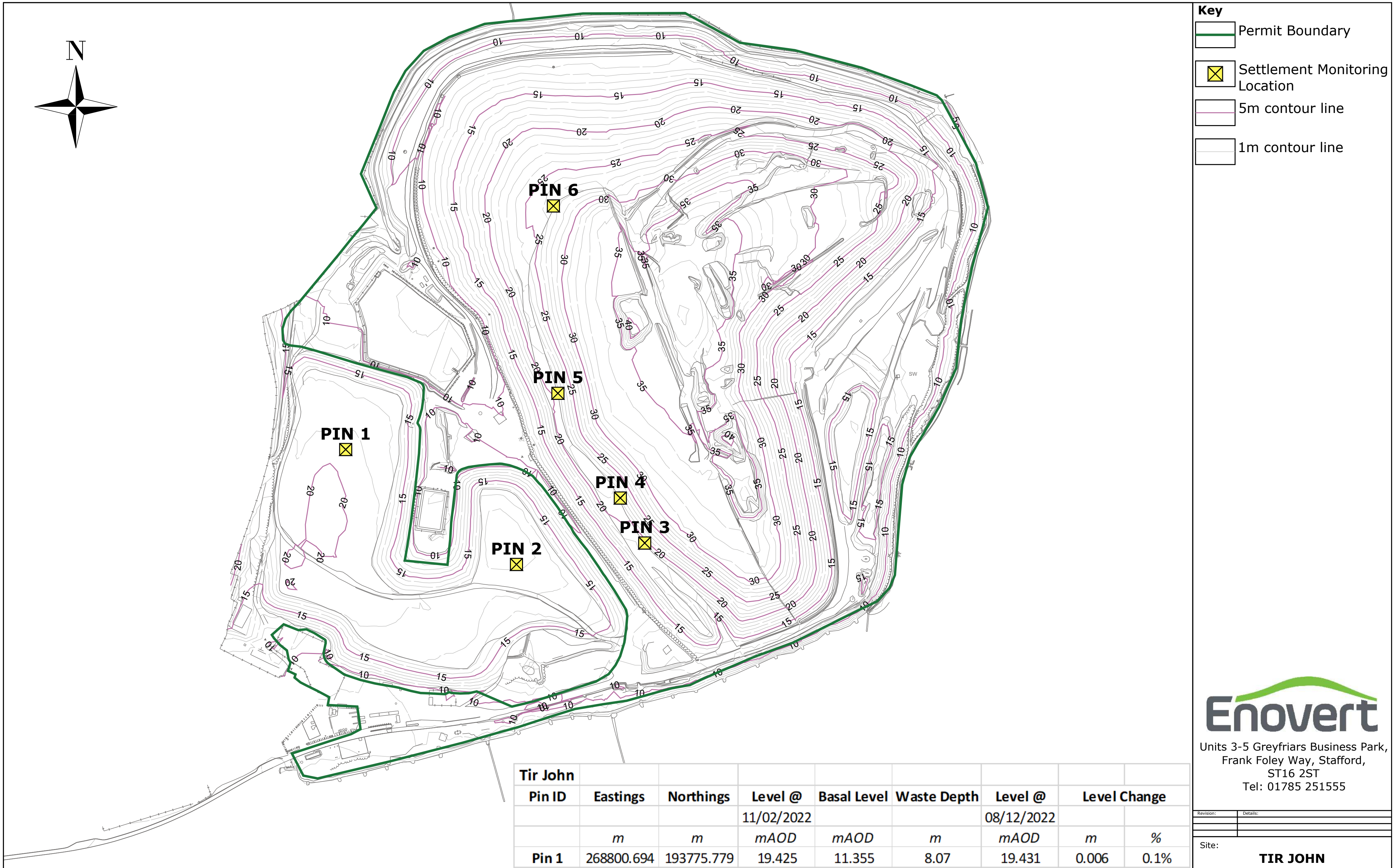
Key

- Permit Boundary
- Leachate extraction sump
- Leachate monitoring well
- Surface water monitoring point
- Ground water monitoring borehole
- Gas monitoring borehole
- Drainage sump
- ( ) Not in use

Enovert

Units 3-5 Greyfriars Business Park,
Frank Foley Way, Stafford, ST16 2ST
Tel: 01785 251555

Revision:	Details:
Site:	TIR JOHN
Title:	Environmental Monitoring Locations
Drawn: TJG	Date: 13-1-23
Scale @A1:	1:2000
Drawing number	TJ74



Tir John								
Pin ID	Eastings	Northings	Level @	Basal Level	Waste Depth	Level @	Level Change	
			11/02/2022			08/12/2022		
	m	m	mAOD	mAOD	m	mAOD	m	%
Pin 1	268800.694	193775.779	19.425	11.355	8.07	19.431	0.006	0.1%
Pin 2	268976.598	193657.36	19.248	9.218	10.03	19.235	-0.013	-0.1%
Pin 3	269108.71	193679.429	19.096	10.663	8.433	19.14	0.044	0.5%
Pin 4	269083.601	193725.789	20.848	10.137	10.711	20.85	0.002	0.0%
Pin 5	269019.3	193833.71	20.137	10.405	9.732	20.123	-0.014	-0.1%
Pin 6	269014.656	194026.778	26.206	8.786	17.42	26.184	-0.022	-0.1%

Enovert

Units 3-5 Greyfriars Business Park,
Frank Foley Way, Stafford,
ST16 2ST
Tel: 01785 251555

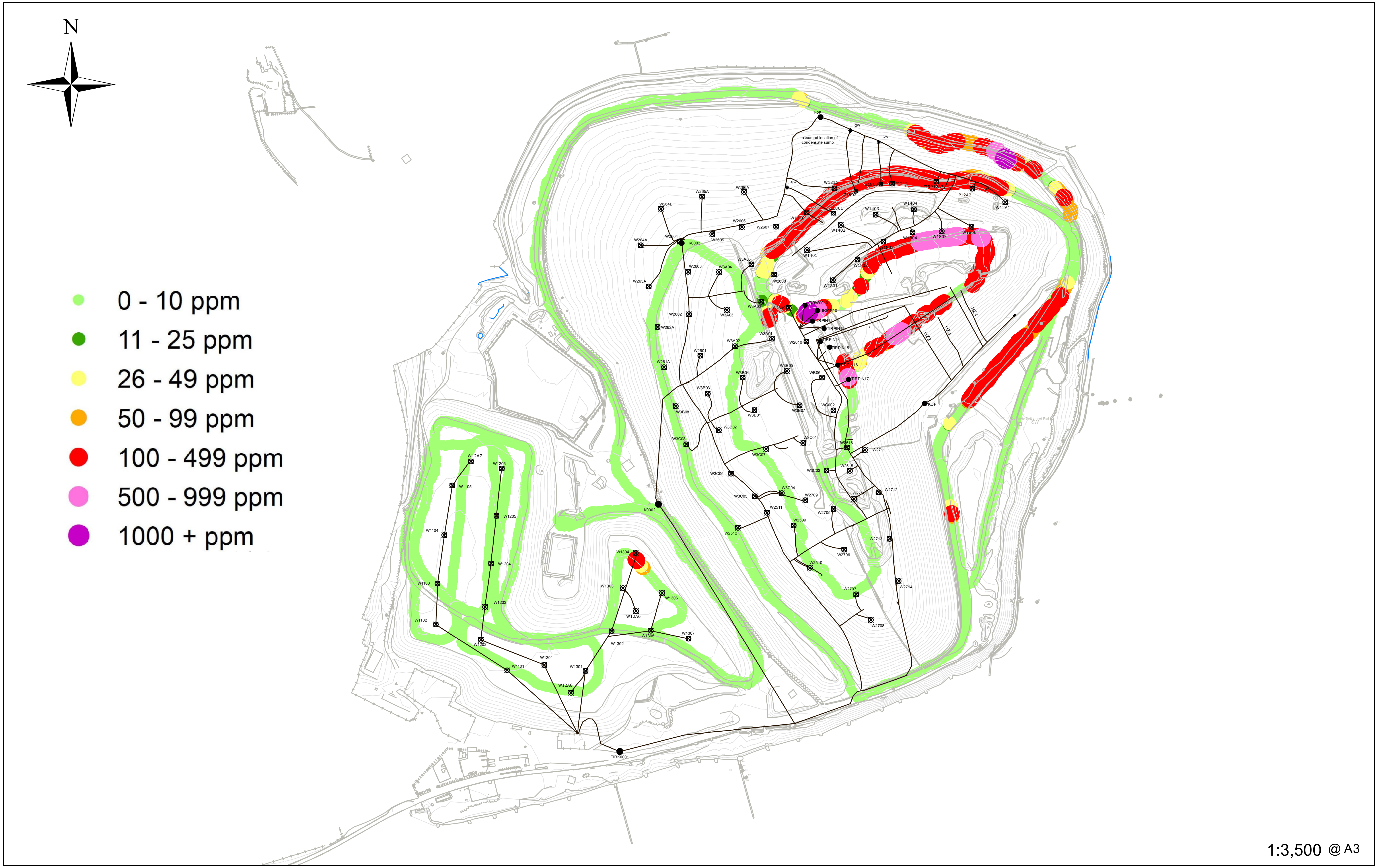
Revision: Details:

Site: **TIR JOHN**

Title: **Site Survey**

Drawn	Date:	Scale @A4:
TJG	6-3-23	1:5000

Drawing number **TJ76**



TIR JOHN
FID Survey Dated 21-12-22

Enovert

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