H Fraser Consulting
Contaminated Land and Hydrogeology

Land Quality Assessment

Former aluminium slag reprocessing plant

Fenn's Bank, Whitchurch, SY13 3PA

Prepared for: Mark Wakefield Demolition Ltd
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1 INTRODUCTION

H Fraser Consulting Ltd (HFCL) has been instructed by Mark Wakefield Demolition Ltd (MWD) to undertake site investigations at a former aluminium slag reprocessing site in Fenn's Bank, Whitchurch SY13 3PA.

1.1 Background

The site was formerly operated by Befesa Salt Slags Ltd (Befesa) as an aluminium slag reprocessing plant, which latterly also reprocessed Spent Pot Liner (SPL). The site operated under an environmental permit (EP), which is still in force (ref EPR-VP3030BX).

The site is adjacent to, and downgradient of, a landfill formed of waste aluminium slag, which was remediated by the Environment Agency. Leachate from the landfill is known to have formed a plume below the site, and to discharge into local surface water courses. Recent data collected from the site indicates that emission of leachate from the landfill is ongoing. Furthermore, the landfill has emitted or is emitting gas: there is a large (c.50 m by 60 m) on-site surface water lagoon, whose lining has risen to form an 'island' in the lagoon, due to an underlying gas bubble. The landfill may generate both methane and hydrogen, and the gas bubble could comprise either of these gases or a mixture of both.

Under the site's environmental permit, no discharge of water is permitted from the site. While the site was operational, surface water was collected in the lagoon and used in the process. When site operations ceased, surface water was no longer consumed by the process; and in the absence of a formal discharge arrangement, rainfall falling on the site discharged informally via the road system to the nearby Red Brook, and to a field ditch along the south-western site boundary.

MWD has recently purchased the site, and wishes to understand the current site condition, to support sale and/or development of the site, and to assist with surrender of the EP.

H Fraser Consulting Ltd has been involved intermittently at the site since 2018, under instruction from the former site owner, Befesa Salt Slags, and has collated a large dataset of water monitoring results.

1.2 Objective

The objectives of the work undertaken were:

- Assess the condition of the site with regards to land and water contamination, to inform constraints for future site use; and
- Demonstrate the land quality of the site to any future purchasers of the site;
- Assess whether site operations (or ongoing emissions) have had a significant effect on the land condition, and whether any remedial work would be required to surrender the EP for the site.

1.3 Scope of works

The following scope of works was undertaken:

- Site investigation;
- Update of datasets and conceptual model development;
- Environmental Risk Assessments;
- Reporting.

The work has been prepared giving due consideration to government guidance[1], British Standards[2,3,4] and industry guidance[5].

[1] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

[2] BS 5930-2015 'Code of practice for ground investigations'

[3] BS 10175-2011+A1-2013 'Investigation of potentially contaminated sites. Code of practice

[4] BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)

[5] CIRIA report C665 - Assessing risks posed by hazardous ground gases to buildings

2 BACKGROUND INFORMATION

2.1 Site setting

The former aluminium slag reprocessing plant (the 'site') is located at Fenn's Bank near Whitchurch (NGR 350600 339100). The site address is Fenn's Bank, Whitchurch SY13 3PA, however the site is in Wales and is regulated by National Resources Wales (NRW). A site location map is shown in Figure 2.1. The site is accessed from Fenn's Bank Road, which runs southeast from the A495 Ellesmere Road.

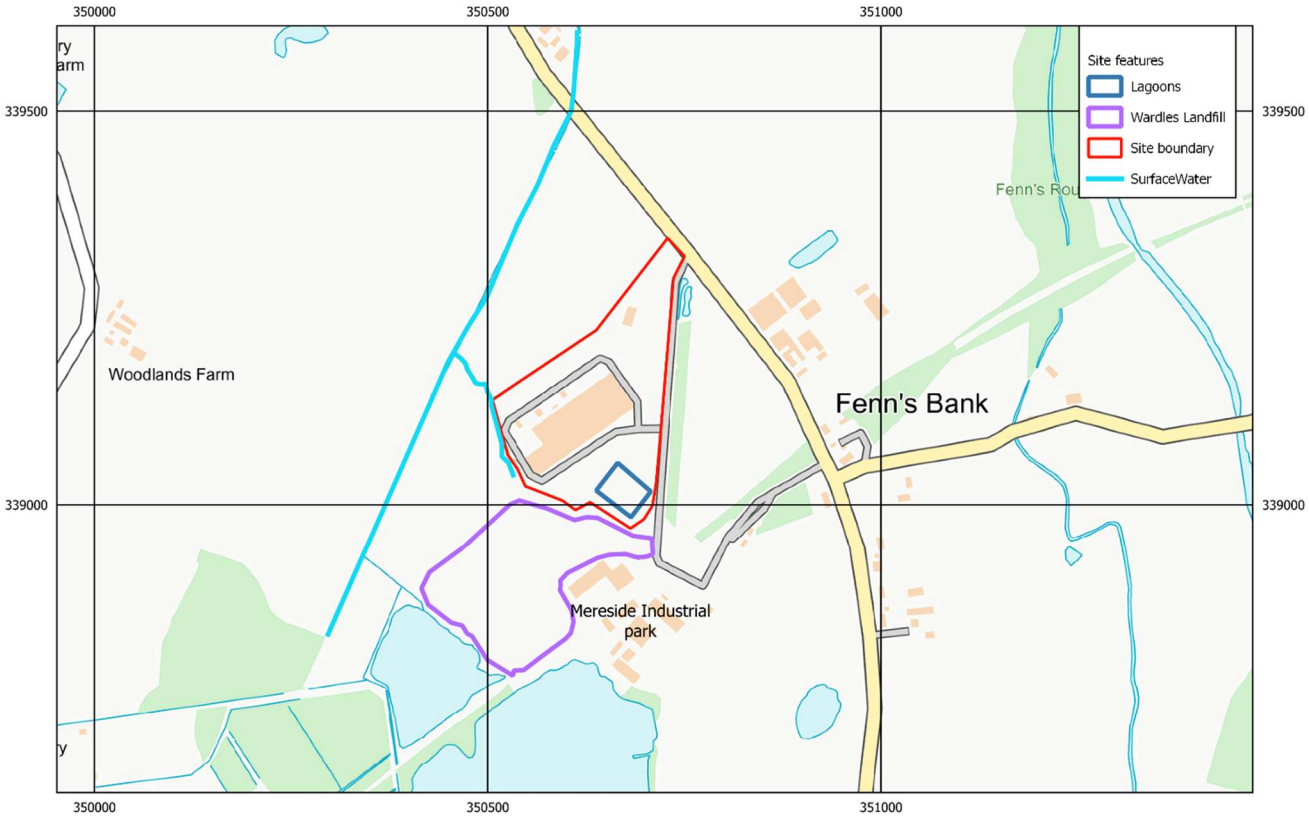


Figure 2.1 Site location and setting

The site is in a predominantly agricultural setting but is bounded to the south by the Mereside Industrial Park, which was formerly HH Wardle (Metals) Ltd (Wardle Metals), an aluminium works that operated from 1940. A landfill associated with the Wardle operations forms the southern boundary of the site, and the access road to the industrial park forms the eastern boundary. Standing water at the base of the landfill feeds a stream along the western boundary of the site. The northern boundary of the site is formed by an earth bund with a field beyond.

The site comprises a car park and office in the north, with the former Plant in the centre-west of the site. A storm water ditch is located on the northeast boundary, and a surface water lagoon is located in the south of the site. The site is in the process of being demolished; the offices are no longer in use.

2.2 Site history

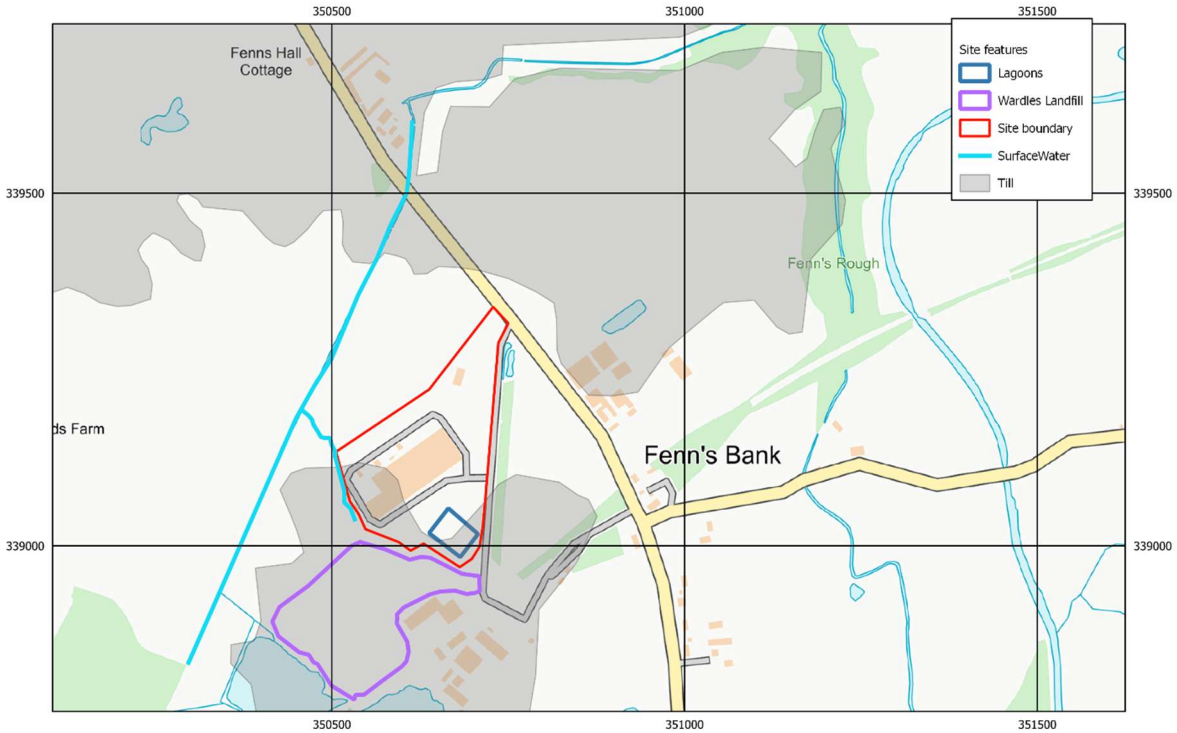
The site was undeveloped until 1998 when Wardle built a Total Reclamation Plant (TRP) to recycle aluminium salt slag generated from the aluminium works to the south. The Wardle site is shown on the earliest historical maps as Fenn's Bank Brick and Tile works. Clays were excavated from three

pits. Anecdotal information reported by Entec[6] (2008) suggests that excavation of the clay ceased when the volume of water flowing into the pits could not be controlled. The pits were left flooded, creating Bulls Head, Wheatsheaf and North pool.

Wardle Metals began operations at the aluminium works in World War II and began depositing waste material in the North Pool from this time. Waste disposal volumes were around 1,000 m^3/year in the 1950s but increased as production volumes increased; by the early 1990s 300,000 m^3/year were deposited. The pool was filled above the water level by 1993, and in 1995 there was a large-scale fish kill in Wheatsheaf pool caused by pollution from the operations. In 1996 changes were made to the level controls on Wheatsheaf and Bull's Head pools, and leachate pumping commenced. Another pollution incident affected Bull's Head Pool in 1998, and the Total Reclamation Plant (TRP) was commissioned. In 1999, leachate abstraction from waste boreholes ceased, and leachate abstraction from a perimeter ditch to the TRP commenced. In 2002 the landfill was reprofiled and capped, with leachate pumping to the TRP. This is reported to have ceased in 2003, although monitoring was ongoing. The TRP was operated from 2000 to 2004 by Remetal Total Reclamation Plant Limited, and then operated by Befesa Salt Slags Limited from 2004 until 2020, when the process closed down. Befesa Salt Slags was sold to Markos Properties (Whitchurch) Ltd in 2023 and renamed Markos Commercial Limited.

2.3 Geology

The site is underlain by glacial deposits comprising alternating layers of Glacial Till and Sand and Gravels[7]. These are mapped as Till in the south of the site and Glacial Sands and Gravels in the north of the site, as shown on Figure 2.2.



[6] Entec, 2008. Update of the conceptual model of the Wardle Landfill Site

[7] https://mapapps2.bgs.ac.uk/geoindex/home.html

Figure 2.2 Superficial Geology

These strata have been proven to depths of up to 25 m bgl. The bedrock underlying the area are Triassic strata comprising the Branscombe Mudstone Formation (mudstones with partings veined by halite).

However, Glacial Clay between the sand layers is not always continuous and is sometimes present at surface. Geological logs from drilling at the Befesa site (Amec Foster Wheeler, 2017) show the upper 3 m of the soil profile to variably comprise sand, silt, and/or clay.

The target strata for the historic brick pits are thought to be the Till, and it is likely that the underlying sand was exposed in some locations due to clay extraction.

2.4 Hydrogeology

The sand and gravel deposits are classified by the Environment Agency as a Secondary A aquifer, and the Till is a secondary (undifferentiated) aquifer. The aquifer is a Water Framework Directive Groundwater Body, named the Weaver and Dane Quaternary Sand and Gravel Aquifers (water body ID GB41202G991700).

Groundwater levels are very close to ground level in the winter months to the south of the site, and groundwater flow is towards the north or northwest. Anecdotally, the brick pits that pre-dated the Wardle site are thought to have been abandoned when inflowing groundwater could no longer be controlled, suggesting that the excavations extended beyond the clay into the underlying sand and gravel.

2.4.1 Groundwater abstractions

Four historic groundwater abstractions are located within 2 km of the site. Two are located to the south-east of the site and two to the south; the closest abstraction to the site was 1357 m away. They were for general farming and domestic use. No potable abstractions are present within 2 km of the site[8].

2.5 Hydrology

The Bull's Head Pool lies c. 190 m to the southwest of the site, and the Wheatsheaf Pool lies c. 175 m to the south. A ditch runs northwest from the Bull's head pool, to join a brook running northeast approximately 70 m northwest of the site. A smaller ditch (the field ditch) runs from a large pool at the base of the landfill along the western site boundary to join this brook, which continues to run northeast, under Fenn's Bank Road. This is known locally as the Red Brook (note that mapping shows this to be a tributary of the Red Brook, which it joins c. 675 m northeast of Fenn's Bank Road however, this report refers to the more local watercourse as the Red Brook). The general direction of drainage is to the north. The Red Brook is a tributary of the River Dee, which lies c. 13 km to the northwest at its closest point.

The site is in the Wych Upper (Worthenbury Upper) surface water catchment, within the Worthenbury Operational Catchment, within the Dee Management Catchment. The Wych Upper Water Body (surface water) has poor ecological status. A point source of ammonia from landfill leachate is listed as a Reason for Not Achieving Good status (RNAG).

[8] Groundsure. Enviro Insight. 2024.

The nearest Environment Agency (EA) water quality monitoring point on the Red Brook downstream of the site is NW-RSN0534, described as 'Red Brook 100 m downstream from confluence with Stagg Brook[9]. Monthly sampling was carried out at this location in 2021. A summary of the relevant analyses is shown in Table 2.1.

Table 2.1 EA Monitoring on the Red Brook

Determinand	Units	2021 Average
pH		7.77
Temperature of Water	°C	9.88
Conductivity at 25 C	µs/cm	740.44
Cadmium, Dissolved	µg/l	0.03
Ammoniacal Nitrogen as N	mg/l	0.37
Nitrogen, Total Oxidised as N	mg/l	9.56
Nitrate as N	mg/l	9.46
Nitrite as N	mg/l	0.09
Ammonia un-ionised as N	mg/l	0.00
Chloride	mg/l	88.36
Orthophosphate, reactive as P	mg/l	0.14
Lead, Dissolved	µg/l	0.76
Sodium, Dissolved	mg/l	55.64
Potassium, Dissolved	mg/l	13.02
Magnesium, Dissolved	mg/l	16.71
Calcium, Dissolved	mg/l	64.44
Zinc, Dissolved	µg/l	15.86
Chromium, Dissolved	µg/l	1.02
Nickel, Dissolved	µg/l	2.01
Aluminium, Dissolved	µg/l	73.36
Copper, Dissolved	µg/l	6.14
Manganese, Dissolved	µg/l	74.78
Iron, Dissolved	µg/l	436.67
Strontium, Filtered	µg/l	202.09
Sulphate, Dissolved as SO4	mg/l	47.55
Barium, Dissolved	µg/l	230.91
Boron, Dissolved	µg/l	130.00
Nitrogen, Total as N	mg/l	11.23

On the site itself, there is a storm water lagoon in the south of the site, and a storm ditch and reedbed in the north of the site. The overflow from the storm ditch is to the site drainage system, which is linked via a pipe to an outfall into the Red Brook. A field ditch runs past the western site boundary from the landfill to the Red Brook. Observations during recent site visits indicate that

[9] https://environment.data.gov.uk/water-quality/view/sampling-point/NW-RSN0534

drainage of rainfall is occurring in the northwestern corner of the site linking to the field ditch. Figure 2.3 shows the surface water and drainage features at the site.

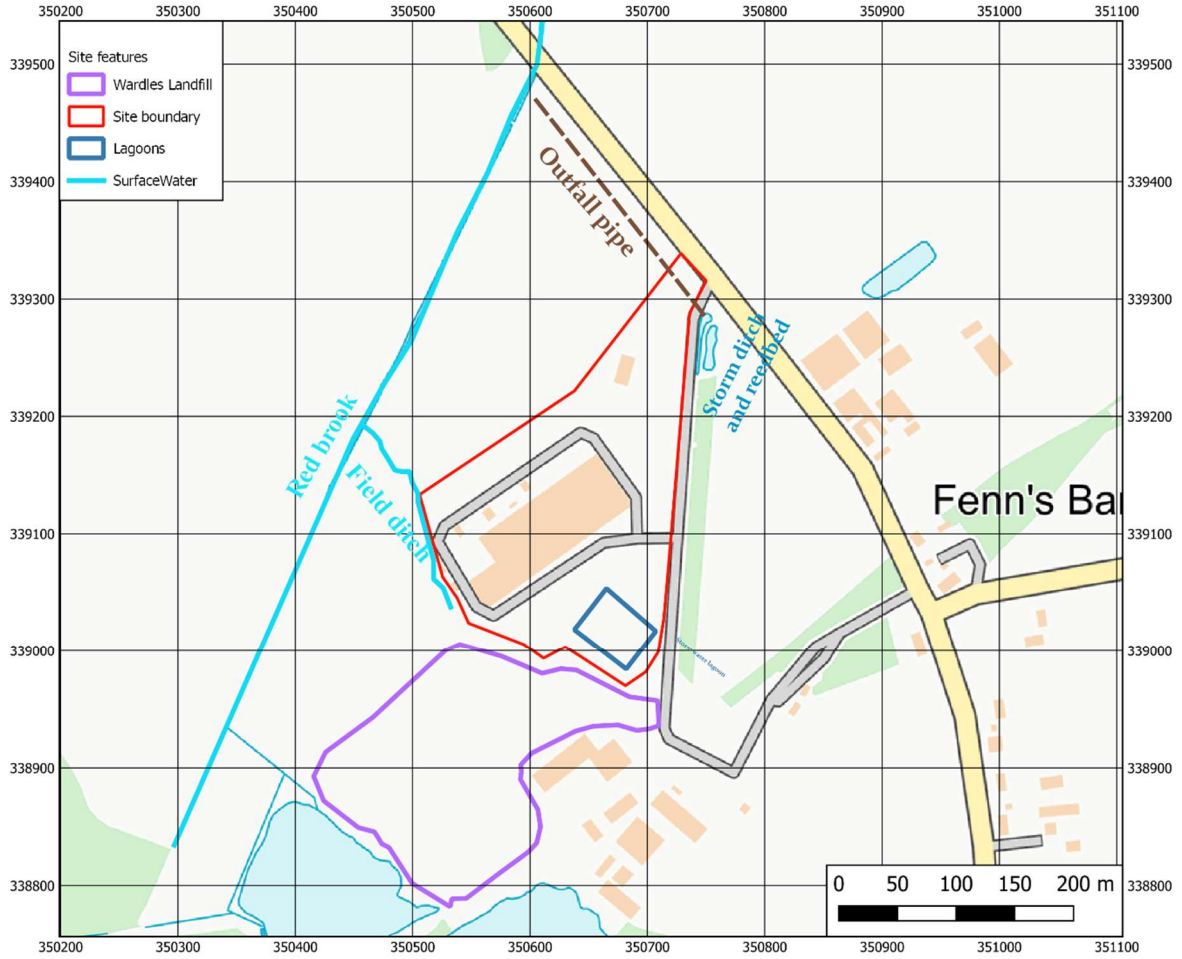


Figure 2.3 Hydrology features

2.5.1 Surface water abstractions

Two historical surface water abstractions lie within 2km of the site. These include Bull's Head Pool and Fenn's Pool located 186 m and 388 m to the south-west of the site respectively. The water was used for dust suppression and direct spray irrigation and are no longer in use.

2.6 Historic water quality concentrations

Entec (2008)[6] report the following

Pre-capping (pre-2002): In 1999 the leachate was characterised by very high chloride (12,400mg/l to 203,000mg/l), sodium and potassium (19,250 to 74,000mg/l and 13,080 to 430,000mg/l respectively), ammonium (800 to 7,040mg/l N), and sulphate (1,180 to 3,319mg/l). Chloride concentration was typically 5 to 6 times higher than sea water (chloride concentration of about 18,000 mg/l) and consequently its density was greater than fresh water (estimated as 1.125g/cm^3). Elevated concentrations of iron (up to 25.2mg/l), copper (up to 51mg/l), and lead (up to 50mg/l) were also measured.

Post-capping (post-2002): chloride and ammoniacal-nitrogen concentrations were found to decrease significantly, with 2008 concentrations <23 000 mg/l and 1000 mg/l respectively.

Amec Foster Wheeler (2018)[10] report the following ammonia concentrations from sampling in 2017:

- Background groundwater quality (upstream of the landfill) was 0.93 – 1.5 mg/l;
- Landfill leachate was 186 – 744 mg/l;
- Downgradient of the landfill and upgradient of the site, groundwater concentrations were 690 mg/l;
- Onsite groundwater concentrations were 1.94mg/l, 1.58 mg/l and 179 mg/l;
- Groundwater concentrations downstream of the landfill and adjacent to the western boundary ditch were 1.56 and 4.65 mg/l;
- Surface water concentration from a manhole in the field to the east was 248 mg/l; and
- The concentration in surface water ponding at the west of the site was 536 mg/l, and from 164 mg/l to 240 mg/l in the western boundary ditch.

It is evident that the landfill continues to impact surface water and groundwater quality in the area around the site. Whilst the site was operational, there were on-site sources of ammonia that had the potential to also contribute to ammonia concentrations. However, the site has now been decommissioned, with the only operations being storage of material within buildings, i.e., under cover. The operations that generated ammonia in the past have ceased.

2.7 Landfill deposits

NRW has made the following reports available, concerning the landfill to the south of the site:

- Entec, 2008[6]. Update of the conceptual model of the Wardle Landfill Site
- Entec 2010[11]. Technical Note. Wardle Landfill Borehole Remedial Works and Monitoring Data Review
- Amec 2011[12]. Technical Note. Wardle Landfill 2011 Annual Monitoring Review
- Amec Foster Wheeler, 2018[10]. 2017 Drilling and Monitoring report

Prior to development, the land on and around the Befesa site was associated with HH Wardle (Metals) Ltd, which operated as an aluminium works since 1940. The foundry buildings are still present to the south of the site and share an access road. Waste materials from the process were disposed of in a flooded clay brick pit south of the Befesa site. This practice continued until 1998 when the Environment Agency Wales closed the tip.

The waste material (both slag and dross) consists of aluminium oxide (Al_2O_3) with minor amounts of aluminium nitride (3.5% pers. comm. Befesa), aluminium carbide, copper salts and large quantities of salt. The main ions are aluminium, chloride, sodium, magnesium, copper, iron, zinc and ammonia. Leaching tests indicate the most leachable ions are chloride, sodium, potassium, calcium, sulphate and ammonia. Most of the metals (i.e., aluminium) are relatively insoluble.[6]

The waste is highly reactive (both on contact with rain and exposure to the atmosphere). Reaction of the waste will result in generation of methane (CH_4 from carbides), ammonium and ammonia gas (from nitride), and hydrogen, as follows:

[10] Amec Foster Wheeler, 2018. Natural Resources Wales, Wardle Landfill, 2017 Drilling and Monitoring report (final)

[11] Entec2010. Technical note. Wardle Landfill Borehole Remedial Works and Monitoring Data Review.

[12] Amec 2011. Technical Note. Wardle Landfill 2011 Annual Monitoring Review

$$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3\downarrow + 3CH_4$$

$$AlN + 3H_2O \rightleftharpoons NH_3 + Al(OH)_3$$

$$2Al + 6H_2O \rightleftharpoons 2Al(OH)_3 + 3H_2$$

These reactions are exothermic and so will result in high temperatures (up to 100° C have been measured) in the waste. Sodium, potassium and chloride will also be readily leached from salt by water entering the waste (salt is added during the smelting process) in addition to calcium, sulphate and ammonia. Most of the metals (i.e., aluminium) are relatively insoluble.[6]

Post-capping (post-2002) leachate composition: chloride and ammoniacal-nitrogen concentrations were found to decrease significantly, with concentrations <23 000 mg/l and 1000 mg/l, respectively.[6]

The landfill was capped and reprofiled in 2002, to reduce the pollution potential of the landfill. Nonetheless, the landfill represents an ongoing source of ammonia; waste was placed below the water table, so there is the potential for ongoing hydrolysis to create ammonia which could impact shallow and deep groundwater. As the water table is very shallow in this area, there is also the potential for discharge of polluted groundwater to surface.

Figure 2.4 shows Wardle's aluminium foundry buildings prior to the development of the TRP site, and during the landfilling operation. It can be seen that there is an area to the north of the foundry that was clearly being worked, but is not part of the current landfill footprint. This area was not capped as part of the remedial works undertaken at the landfill in 2002. Figure 2.5 shows an estimate by Befesa of the area of uncapped deposits. This indicates that there are local deposits of waste that may be generating ammonia which is freely discharging into the environment.

Figure 2.4 Conditions prior to development of the current site

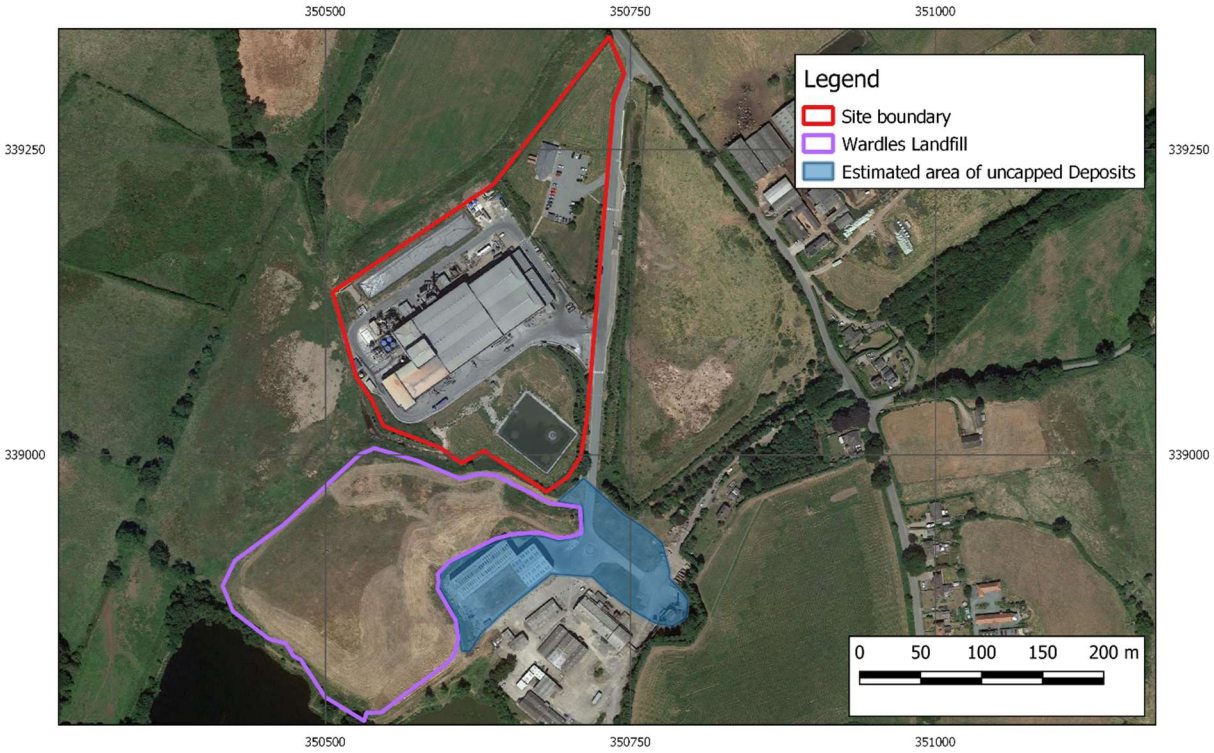


Figure 2.5 Befesa site and landfill deposits to the south

It is not known to what extent, if any, the land beneath the TRP site was impacted by the aluminium foundry activities, including waste deposits, prior to the development of the site.

2.8 Designations

DEFRA's Magic Maps[13] application was viewed. Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) is located approximately 1 km to the south-west of the site boundary. The site also lies within a Site of Special Scientific Interest (SSSI) impact risk zone.

The Red Brook flows into the Wych Brook which is a tributary of the River Dee (Afon Dyfrdwy); this then flows through the River Dee SSSI and the River Dee and Bala Lake (Afon Dyfrdwy a Llyn Tegid) SAC located to the north of the site.

2.9 Previous reports

A number of site investigations and subsequent reports were produced by HFCL for the former site owner and operator, Befesa Salt Slags Ltd. Selected reports are summarised below.

2.9.1 30496R1 Befesa Salt Slags Ltd: Water management assessment (August 2021)

The report provided the following information to support decisions regarding site decommissioning and compliance with its Environmental Permit:

- Quantification of water flows at the site,
- Prediction of the quality of future site discharge and impacts on the receiving water (the Red Brook): *Dilution calculations indicated that allowing the site to discharge passively via an existing outfall would not cause EQS to be exceeded in the Red Brook. A risk assessment*

[13] https://magic.defra.gov.uk/MagicMap.aspx

determined that the risks to the Red Brook are low, subject to monitoring to confirm the assumptions in the site assessment.

- Assessment of options for management of the surface water lagoon:
    - 6-months monitoring p*roposed, during which the site is allowed to discharge and impacts on the brook closely monitored, to confirm the predicted results. During this period, the storm water lagoon can be discharged into the site drainage*
    - *In the long-term, it is proposed to let rainfall dependent surface water and influent groundwater discharge passively from the existing site outfall with no monitoring, with this proposal to be reviewed in light of the results of the monitoring period.*

The conclusions and recommendations from the report are provided for reference:

> *"Befesa wish to decommission the plant at their site at Fenn's Bank, Whitchurch. The existing environmental permit does not allow discharge of water from the site, however the process that formerly consumed water has now ceased, and a discharge consent is required to allow rainfall dependent run-off and groundwater derived flow to discharge from the site. While the office block is operational, the site discharge also includes domestic type treated sewage effluent from a package treatment plant.*
>
> *Surface water and groundwater quality in the immediate environs are significantly impacted by leachate from an historic landfill on the southern border of the site. The landfill, which was capped in 2002, contains salt slag from a former aluminium foundry. Leachate contains high concentrations of ammonia, chloride, sodium and sulphate and also a range of metals.*
>
> *An extensive programme of surface water and groundwater monitoring has been undertaken at the Befesa site to develop a surface water management strategy as the site is decommissioned. There is a storm water lagoon on site that will also be decommissioned. An existing outfall from the site is currently capped off; the receiving water is the Red Brook.*
>
> *The water monitoring programme identified pH, sulphate, chloride, ammonia, cadmium, chromium, copper, lead, mercury, nickel, zinc and iron above the Environmental Quality Standards (EQS) in and around the site. Nitrate, nitrite, sodium, manganese, selenium, iron and aluminium were present above the drinking water standard (DWS). Surface water and groundwater quality on the site were consistent with impact from leachate derived from the landfill to the south.*
>
> *Groundwater levels are very high at the site, and groundwater discharges to surface in the wet winter months and inundates the site drainage system. It is not practicable to separate the drainage system from groundwater inflow. If the site drainage system were to remain capped off, the excess water at the site would informally discharge to the road system to the east and north, and to a field ditch on the western boundary, ultimately discharging to the Red Brook.*
>
> *The monitoring programme has allowed an average site concentration to be predicted, and flow in the Red Brook and flow generated on the site to be estimated. Dilution calculations indicate that allowing the site to discharge passively via an existing outfall will not cause EQS to be exceeded in the Red Brook. A risk assessment has been undertaken and the risks to the Red Brook are considered to be low, provided that a period of monitoring is undertaken to confirm the assumptions in the site assessment.*
>
> *It is proposed that a period of monitoring from July to November is implemented, during which the site is allowed to discharge and impacts on the brook closely monitored, to confirm the predicted results. During this period, the storm water lagoon can be discharged into the*

site drainage system in a carefully managed way. A monitoring programme is proposed to prevent impacts to the Red Brook. In the long-term, it is proposed to let rainfall dependent surface water and influent groundwater discharge passively from the existing site outfall with no monitoring, with this proposal to be reviewed in light of the results of the monitoring period."

The report was informed by the following three technical notes:

- 30496TN4 Lagoon Investigation
- 30496TN5 Sampling programme
- 30496TN6 Dilution calculations

These are summarised below.

2.9.2 30496TN4 Lagoon Investigation (July 2021)

The surface water lagoon required either decommissioning or long term management, depending on the future plans for the site. The technical note presented the results of investigations into sludge and water quality in the lagoon, to assist with appraisal of decommissioning/management options.

The volume of sludge in the base of the storm water lagoon has been estimated as c. 320 m^3, based on depth profiling.

Sampling of the sludge indicated that TPH is present at concentrations of up to 4840 mg/kg, comprising predominantly aliphatic hydrocarbons in the range EC21- EC35. No hydrocarbons below the EC10-EC12 were detected. The results indicate that the hydrocarbons present are unlikely to present a significant risk to the environment due to low toxicity and mobility of the species present. This is confirmed by leachate testing, where TPH was not present above the limit of detection. PAHs were present in sludge at concentrations up to 5.14 mg/kg, which is considered a relatively minor concentration, and were not detected in leachate. No BTEX, MTBE or VOCs were detected in soils or leachate. Organic contaminants were not present above the limit of detection in the lagoon water sample.

The results indicate that the lagoon water is not likely to present a risk to the environment with regard to organic contamination. The inorganic quality of the water should be considered alongside the wider site drainage water in terms of the potential for discharge to the site outfall without harm to the environment.

2.9.3 30496TN5 Sampling Programme (July 2021)

This technical note presented results of a monthly surface water sampling programme undertaken between December 2020 and June 2021.

- pH, sulphate, chloride, ammonia and iron were present above the EQS, and nitrate, nitrite, sodium iron and aluminium were present above the DWS.
- The main indicators of impacted water quality are considered to be chloride and ammonia.
    - Onsite, these vary widely with no consistent pattern of spatial distribution or increase and decrease in concentrations.
    - In the 'Field Ditch', located between the site and the landfill, chloride and ammonia increased sharply in response to very dry weather. The primary control on concentrations in the Field ditch is thought to be dilution of the landfill leachate source with rainwater in wet periods.

- In the Red Brook, west of the site, the concentration of chloride and ammonia appears to be impacted by loading from the field ditch, flows from upstream, groundwater, and geology

2.9.4 30496TN6.1 Dilution calculations (January 2022)

This technical note presented the results of dilution calculations assessing the likely impact of discharge of surface water from the site on the quality of the receiving water, the Red Brook. The methodology used was outlined in Environment Agency guidance for assessing surface water pollution risk (updated 10 August 2021).[14] Dilution calculations indicated that discharge from the site at the average of measured site concentrations was unlikely to have a significant impact on concentrations in the Red Brook due to the amount of dilution in the Red Brook and/or the very high background concentrations.

More specifically, at the Red Brook immediately downstream of the discharge point:

- concentrations of chloride, ammonia, sodium, aluminium, copper, and manganese were predicted to occasionally exceed EQS (or DWS) when the background concentration exceeded the EQS.
- the concentration of copper was predicted to always exceed the EQS as the background concentration always exceeds the EQS.
- it was never the case that the site contribution caused the predicted breach of the EQS.
- the contaminants of concern in the site discharge were considered to arise from the impacts to local groundwater and surface water quality from the landfill to the south of the site, with concentrations in the future discharge dependant on the relative quantities of clean rainfall, impacted groundwater and impacted surface water.

The calculations indicated that in the long term the site could be allowed to passively discharge without ongoing monitoring. However, it was recommended that the site be allowed to discharge in a controlled manner with a robust monitoring programme in the short term in order to confirm the effects on surface water quality.

2.9.5 30496TN8 Phosphate (January 2022)

Befesa had made an application to vary their Environmental Permit, to allow discharge from the site, and a second application for a discharge consent. The application to vary the licence was in the process of being validated.

However, NRW had stated that, regionally, discharge licence applications could not be determined: a recently published report by NRW[15] highlighted concerningly high levels of phosphorus in the Welsh River SACs, including the River Dee; the Befesa site is located in the catchment of the River Dee. As a result of this report, NRW were not determining discharge licence applications in the affected catchments until further studies are complete. As a result, Befesa instructed H Fraser Consulting Ltd to investigate phosphorous concentrations at the site and local receiving waters.

[14] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit#screening-tests-freshwaters

[15] NRW report 'Compliance Assessment of Welsh River SACs against Phosphorous targets' shows that five (Dee, Cleddau, Teifi, Usk, Wye) of the nine SAC rivers in Wales are failing to meet the targets set out by the Joint Nature Conservation Committee (JNCC) in 2016 to protect our Special Areas of Conservation (SACs).

This technical note presented the results of those investigations, and calculations of the relevant Environmental Quality Standards (EQS) for phosphorus, which are calculated on a site-specific basis.

The NRW report sets a target phosphorus concentration of 50 µg/l for the relevant River Dee subcatchment. Sampling results indicated high background concentrations, likely related to the landfill. The average site value is 34.1 µg/l, significantly less than the background in the Red Brook (which has an average of 161 µg/l upstream of the site), and less than the target for the River Dee of 50 ug/l. We concluded that discharge from the site was likely to improve phosphorous concentrations in the Red Brook, which are clearly impacted by upstream sources of phosphorous.

2.9.6 30496TN9.1 Transport Modelling (March 2022)

The landfill to the south is known to impact the surrounding environment, with the field drain to the west of the site and groundwater significantly impacted by a range of contaminants, with ammonia and chloride being of particular concern. To better understand the potential extent and impact of the landfill contaminants on the local environment, transport modelling was undertaken to assess the expected lateral extent of a contaminant plume from the landfill, and the resulting effect on the groundwater quality under the Befesa site.

Modelling suggested that transport of landfill leachate is a viable explanation for the observed concentrations of ammonia and chloride in groundwater. Furthermore, transport through high permeability anthropogenic material (such as sub-base below the foundation slab and around drains) and groundwater flooding could result in concentrations of chloride and ammonia observed in samples from drains and surface water at the site.

2.9.7 30495TN11 Final monitoring report (December 2022)

This technical note presents the results of the 22 months of a monthly surface and groundwater sampling programme, undertaken between December 2020 and October 2022. Also presented are the results of dilution calculations undertaken to assess the likely impact of discharge of surface water from the site on the quality of the receiving water, the Red Brook.

- Patterns of ammonia and chloride concentrations are summarised below:
    - On-site continued to vary widely with no consistent pattern of spatial distribution or increase and decrease in concentrations, except that concentrations were slightly lower in the wetter months from January to April, when dilution from rainwater is at a maximum.
    - Both ammonia and chloride were highest in the Field Ditch, with concentration decreasing downstream away from the landfill. Concentrations generally are higher in the summer months in response to dry weather. The primary control on concentrations in the Field ditch is thought to be dilution of the landfill leachate source with rainwater in wet periods.
    - In the Red Brook, west of the site, the affect the concentration of chloride and ammonia continued to be impacted by loading from the field ditch, flows from upstream and groundwater
- The groundwater flow direction below the site was consistently to the northwest, with a gradient of between 0.011 - 0.013. This is consistent with groundwater flow being towards the Red Brook.
- As expected, groundwater levels are highest in the wetter winter months (November to March) and lowest in the summer months.

- Dilution calculations undertaken in 30496TN6.1 were updated based on new sampling and rainfall data. As before, dilution calculations indicated that discharge from the site at the average of measured site concentrations is unlikely to have a significant impact on concentrations in the Red Brook due to the amount of dilution in the Red Brook and/or the very high background concentrations.

3 SITE INVESTIGATIONS

A series of site investigation works were undertaken at the site by H Fraser Consulting Ltd, from December 2023 to July 2024; these are summarised below and detailed in this section.

- 11 - 14 December 2023 - Borehole drilling, installation, and soil sampling;
- 18 December 2023 - hand auguring for installation of gas spikes and soil sampling;
- 16 - 18 January 2024 – Surface water, groundwater and gas monitoring;
- 26 June 2024 - groundwater sampling and gas monitoring; and
- 12 July 2024 – gas sampling.

3.1 Borehole drilling and installation

The drilling and installation of ten new boreholes was undertaken between 11and 14 of December 2023 by VC Drilling using a shell and augur rig under the supervision of Xenia Boyes and Juan Pablo Castaneda.

The weather conditions were cold and dry, and the site was flooded in a number of locations.

Six boreholes were drilled to 3 m bgl and installed with piezometers for groundwater monitoring, and four were drilled to 2 m bgl and installed with shallow (<1m) gas monitoring probes. Flushing of the boreholes to remove any sediment was undertaken following drilling. Two soil samples were taken from each borehole.

3.1.1 Sample methodology

The following methodology was used for taking samples:

- All soil samples were screened for visual and olfactory evidence of contamination.
- Samples were taken directly from each location either using a hand trowel or directly into the jar with a gloved hand at the desired depth.
- To reduce the potential for cross contamination, the trowel was cleaned using deionised water and blue towel and a new pair of disposable nitrile gloves was used for each sample collected and discarded following use.
- All samples collected were placed in jars and tubs supplied by UKAS accredited I2 laboratories (I2), which were then capped, labelled with a unique identifier and placed in chilled cool boxes prior to transportation to the laboratory under standard chain of custody documentation for analysis.
- Following receipt of the samples by I2, the soil samples were scheduled for analysis for the identified contaminants of concern:
    - Asbestos in soil,
    - Inorganics including pH, total chloride, fluoride and ammonia nitrogen;
    - Organics including Speciated polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs);
    - Heavy metals and metalloids including aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, vanadium and zinc.

The results are detailed in Section 4.1.

The borehole locations are presented in Figure 3.1; a summary of the borehole installations is presented in Table 3.1 below and borehole logs are presented in Appendix A.

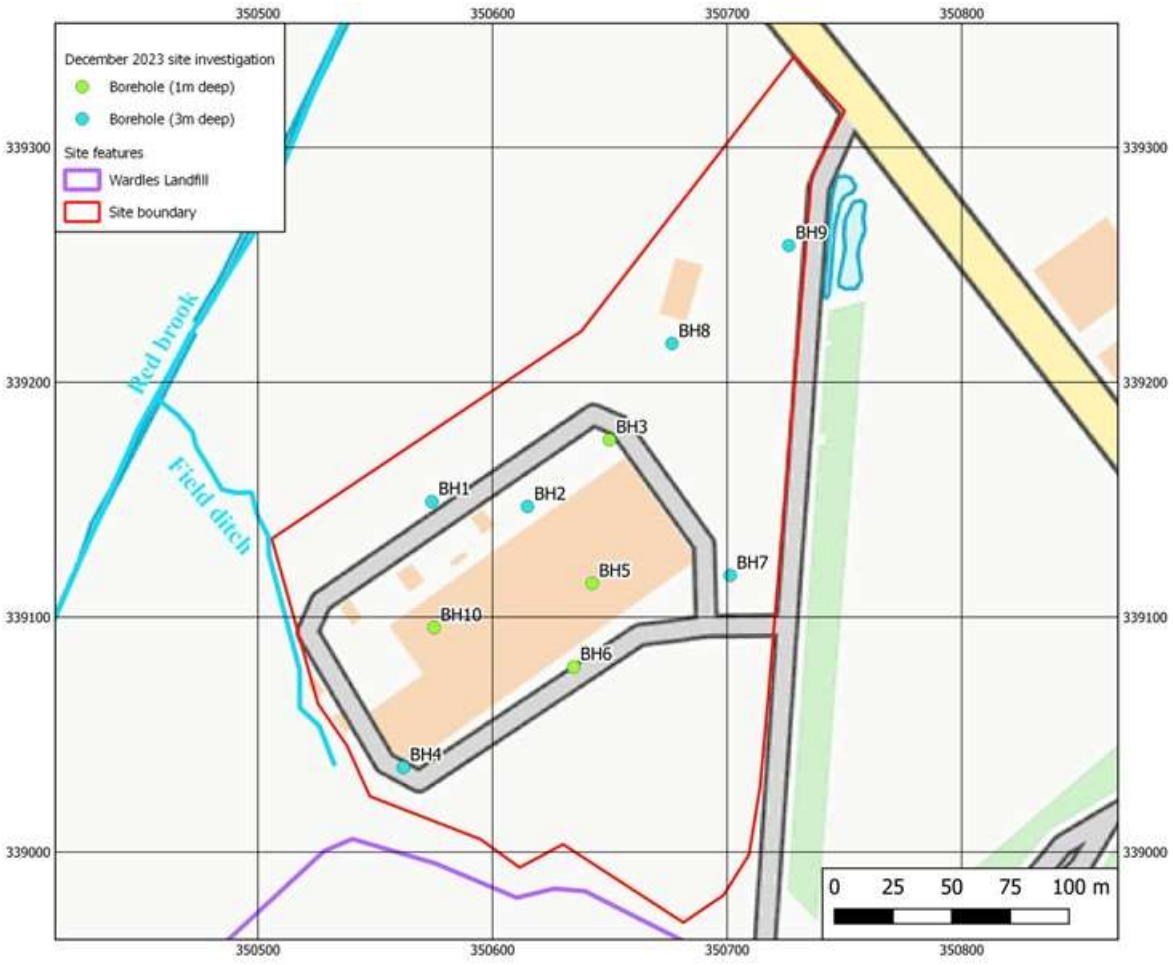


Figure 3.1: Location of new boreholes

The table below provides a summary of the borehole installations.

Table 3.1 Borehole installations

Borehole	X	Y	Datum (m aOD)	Screened interval (m bgl)	Screened interval (m aOD)	Datum type
BH1	350574	339149	90.480	2 - 3	88.48 – 87.48	Casing top
BH2	350615	339147	90.471	2 - 3	88.47 – 87.47	Casing top
BH3	350650	339175	90.520	0.6 – 0.8	89.92 – 89.72	Casing top
BH4	350562	339036	90.374	2 - 3	88.37 – 87.37	Casing top
BH5	350643	339114	90.169	0.6 – 0.8	89.57 – 89.37	Casing top

Borehole	X	Y	Datum (m aOD)	Screened interval (m bgl)	Screened interval (m aOD)	Datum type
BH6	350635	339079	90.383	0.6 – 0.8	89.78 – 89.58	Casing top
BH7	350701	339118	90.221	0.6 – 0.8	89.62 – 89.42	Casing top
BH8	350676	339216	90.657	2 - 3	88.66 – 87.66	Casing top
BH9	350726	339258	90.538	1 - 3	89.54 – 87.54	Casing top
BH10	350575	339096	90.641	0.2 – 0.6	90.44 – 90.04	Casing top

3.1.2 Ground conditions

The soil types encountered during investigations are summarised in Table 3.2 below:

Table 3.2 Ground conditions

Geological Unit	Top of layer (m bgl)	Base of layer (m bgl)	Layer thickness (m)	Description
Topsoil/Made Ground	0	0.3 – 1.4	0.3 – 1.4	Sandy, gravelly silt or clay with quartz, brick and concrete, metal and plastic fragments in a number of locations. Some organic matter in the topsoil.
Clay with silt, sand and gravel (TILL)	0.3 – 1.4	3 -	1.6 – 2.5	Soft to stiff, light brown, reddish, sandy CLAY with light grey bands containing silt, sand and gravel. Silt ranges from red-brown to dark brown-black, soft to firm and slightly sandy and / or gravelly. Sand ranges from red to light brown and grey to green and is fine to coarse with some grey layers of slightly gravelly silt and clay. Organic matter is present in some areas.

3.2 Hand auguring and gas spike installation

Twenty-five shallow soil samples were taken across the soft landscaped areas of the site by Roz Cox and Juan Pablo Castaneda using a hand augur and a trowel. Gas spikes of 0.4 m in length were installed in eleven areas by tapping into the ground with a mallet, ensuring all holes were covered and a gas tap was fitted. Note that this approach was taken to facilitated gas monitoring above the water table; owing to the high water table, conventional monitoring piezometers are likely to give unreliable estimates of gas concentrations and flows.

The weather conditions were cold and overcast and the site was flooded in a number of locations, resulting in the original selected locations being moved to areas that at the time on site were dry

and considered to be at a lower risk of being flooded. The locations of the soil samples and gas spikes are presented on Figure 3.2 and Figure 3.3 respectively.

Soil samples were taken from each location using the same sample methodology and analysis as listed in 3.1.1 . The results are detailed in Section 4.1.

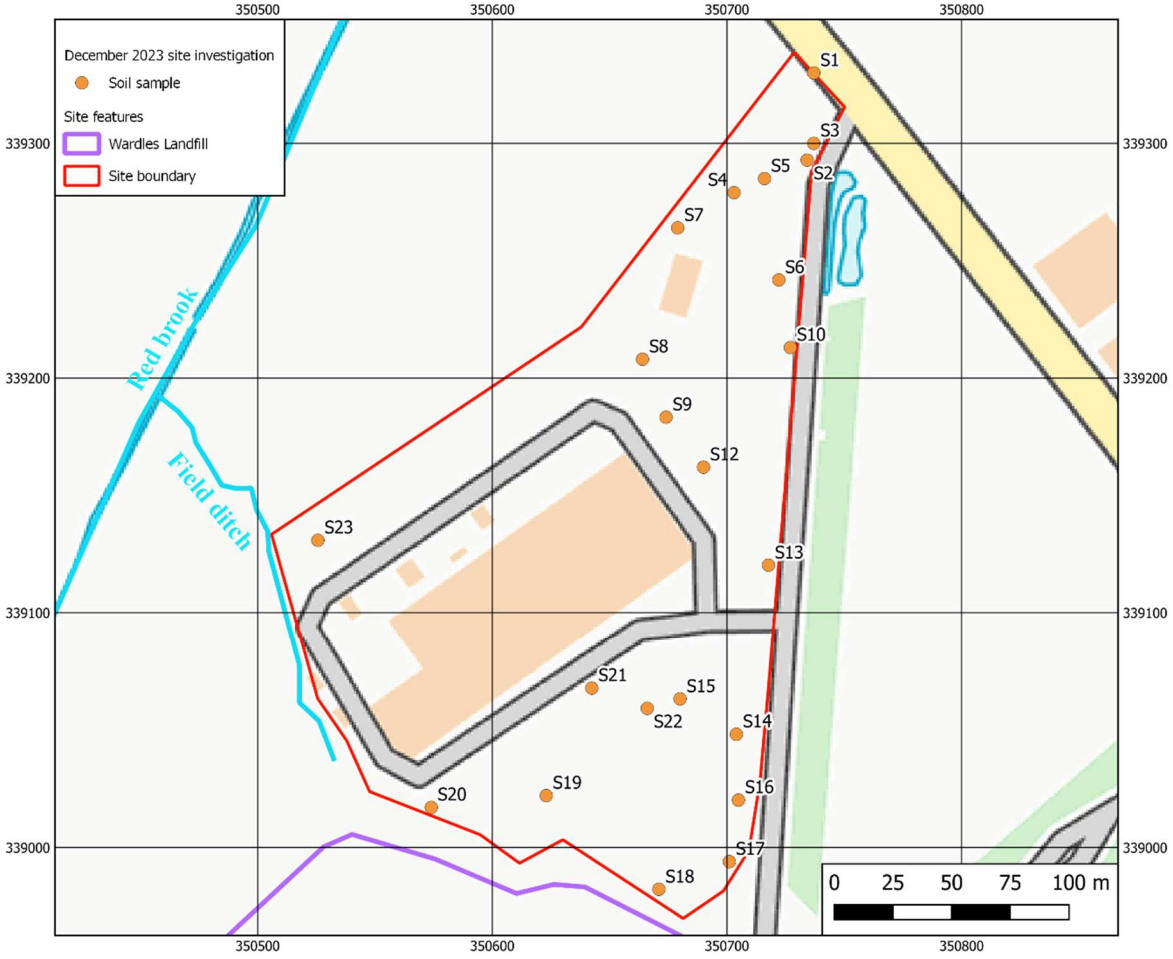


Figure 3.2 Location of soil samples

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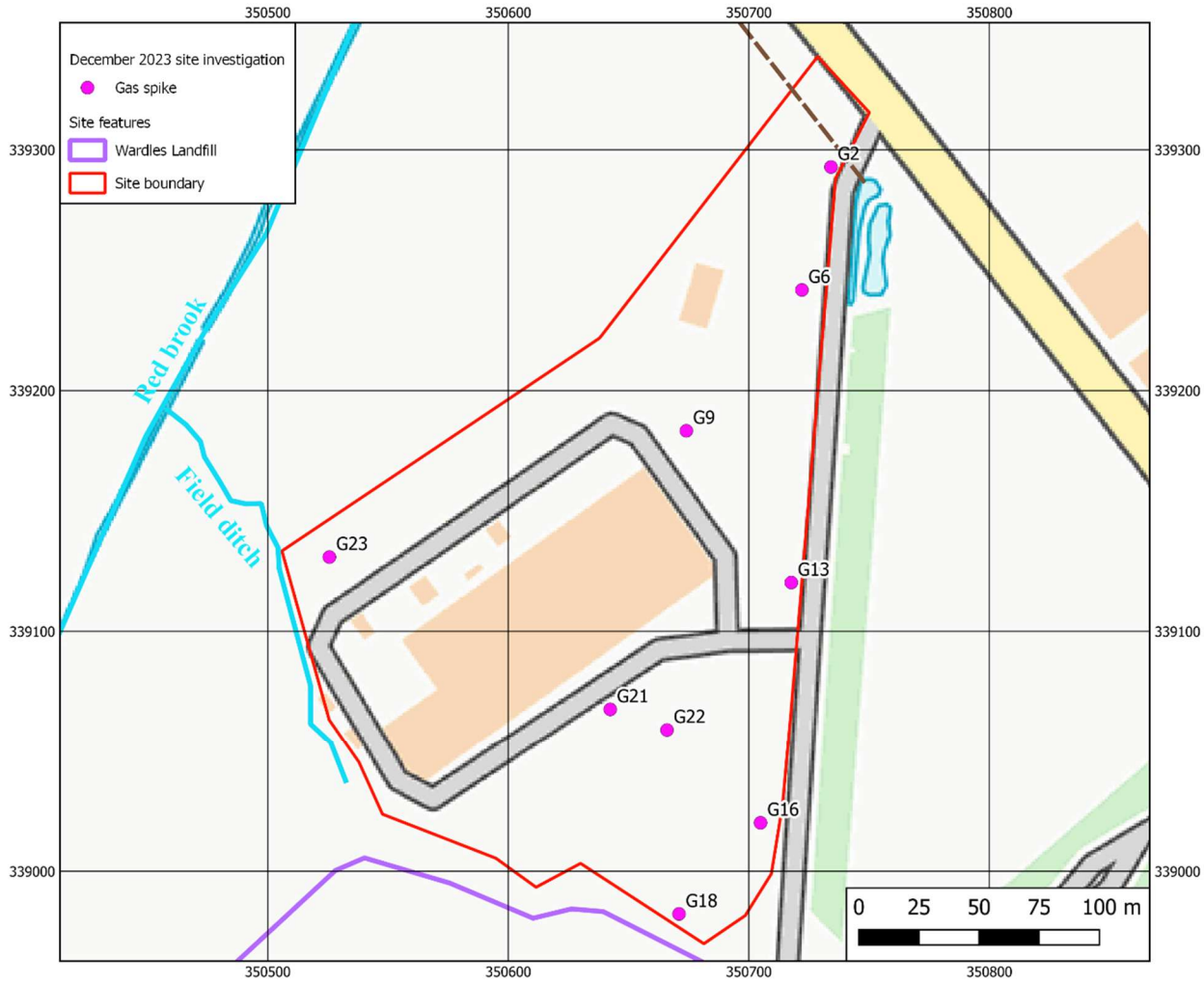

Figure 3.3 Location of gas spikes
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3.3 Surface water and groundwater sampling

Surface water sampling and groundwater sampling were undertaken between 16 and 18 January 2024 and on 26 June 2024 by Xenia Boyes and Juan Pablo Castenada Venegas in 28 locations across the site as presented in Figure 3.4 which shows historic and recent sampling locations.

Surface water sampling was undertaken in 19 locations across the site that have historically been sampled.

Groundwater sampling was conducted in 4 historical boreholes and 5 of the newly installed boreholes; BH4 had been destroyed during general works on site due to being located in an area of site that flooded (Figure 3.1). It is normally not possible to sample all water locations due to some being dry, a few being destroyed/inaccessible due to the demolition and some of the old boreholes having new padlocks that couldn't be accessed. All locations sampled throughout the history of site investigations is presented in Table 3.3; those sampled during 2024 are identified.

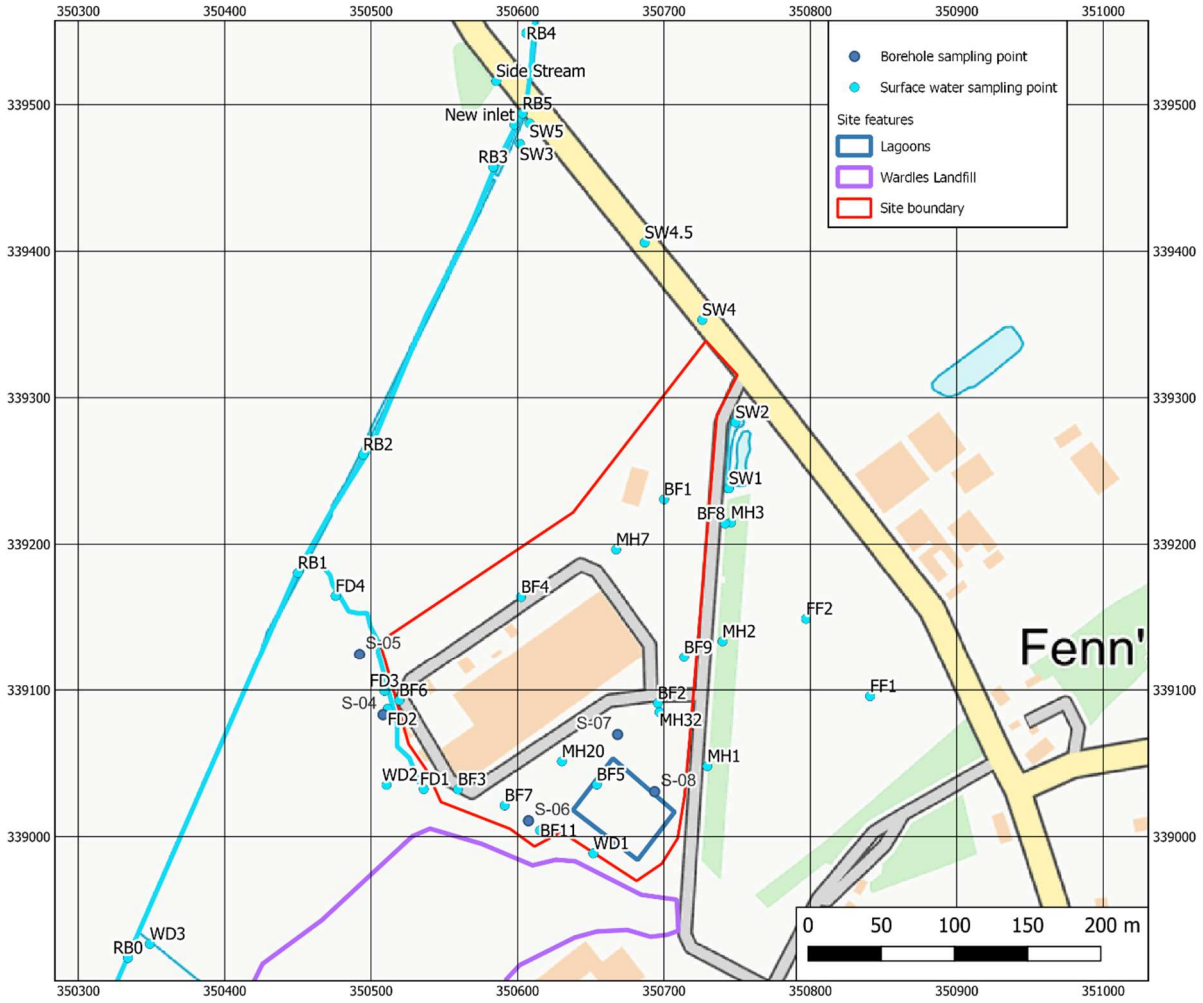

Figure 3.4 All sampling locations (historic and recent)

3.3.1 Sample methodology

The following sampling protocols were undertaken:

- Groundwater samples:
  - Low flow purging and sampling with assessment of well-head parameters (dissolved oxygen (DO), electrical conductivity (EC), pH, redox and temperature);
  - At least one well volume was purged from the borehole prior to sampling.
- Cross-contamination prevention measures in place;
  - Retention of samples in clean vessels supplied by the laboratory with appropriate preservatives and vessel type.
- Transport to UKAS accredited laboratory under chain of custody procedures.
- The samples were scheduled for analysis for the identified contaminants of concern:
  - Inorganics including pH, electrical conductivity, sulphate, chloride, fluoride, phosphate, ammonia, nitrate, nitrite and alkalinity;
  - Organics including Speciated polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPHs);

- Monoaromatics and oxygenates including benzene, toluene, ethylbenzene, p&m xylene and o xylene (BTEX) and methyl tertiary butyl ether (MTBE);
- Heavy metals and metalloids including aluminium, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium and zinc.

Table 3.3 below list all historic sampling points, with identification of sampling undertaken during 2024. Water sampling points in 2024 are shown in Figure 3.5.

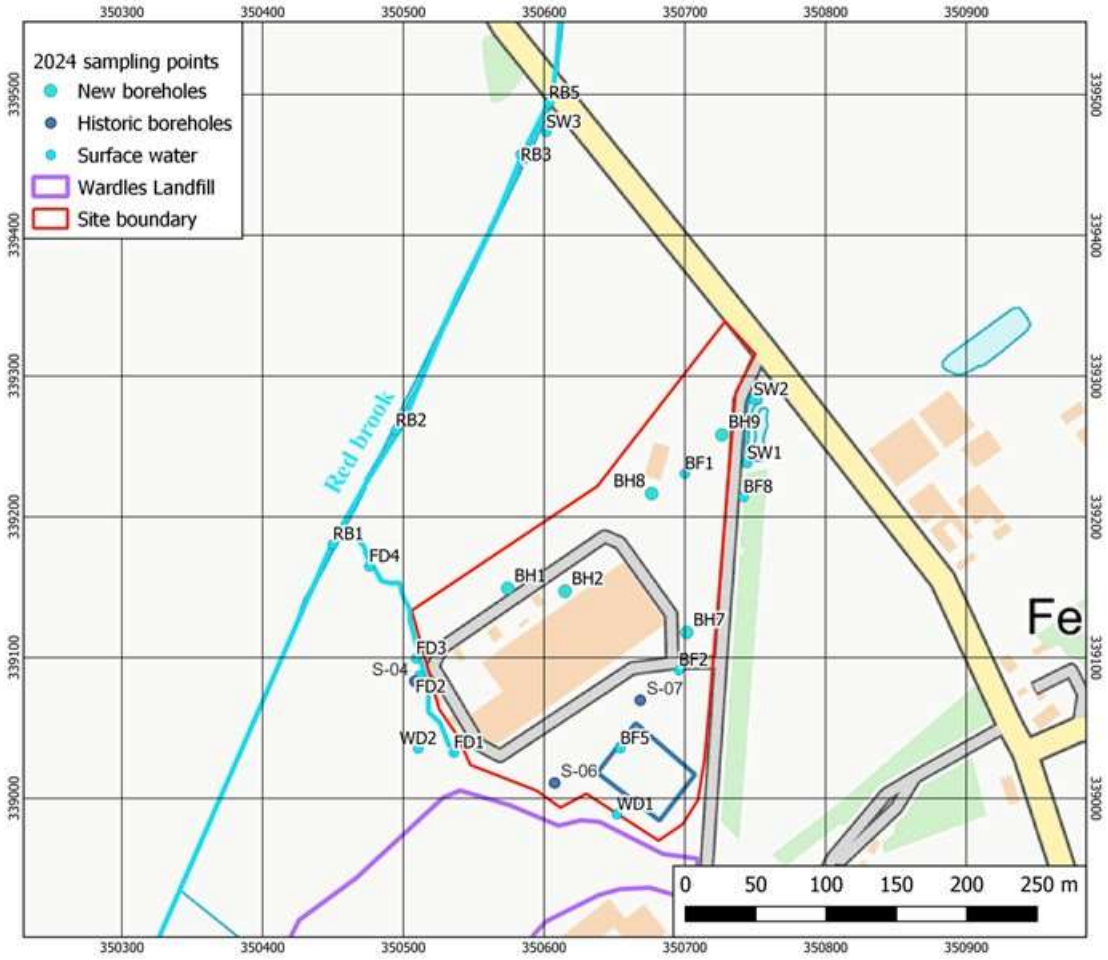

Figure 3.5 2024 water sampling points

Table 3.3: Description of ground and surface water sampling points.

Name	Location	Sampled
S-04	Borehole by field ditch (upstream)	2024
S-05	Borehole by field ditch (downstream)	Historically
S-06	Borehole west of lagoon	2024
S-07	Borehole north of lagoon	2024
S-08	Borehole northeast of lagoon	Historically
BF1	Befesa car park	2024
BF2	Befesa yard: eastern corner	2024

Name	Location	Sampled
BF3	Befesa southwest corner ponding	Historically
BF4	Befesa yard: western corner	Historically
BF5	Lagoon	2024
BF6	Befesa yard: southern corner	Historically
BF7	Ponded water in grass, by mast	Historically
BF8	Ponded water on road by weighbridge	2024
BF9	Manhole	Historically
MH1	Access road manhole 1	Historically
MH2	Access road manhole 2	Historically
MH3	Access road manhole 3	Historically
FF1	Farmers field manhole 1	Historically
FF2	Farmers field manhole 2	Historically
SW1	Southern end of storm water ditch	2024
SW2	Northern site discharge point (Befesa pump 5)	2024
FD1	Surface water ponding between Befesa and landfill	2024
FD2	Farmers ditch upstream of BH12	2024
FD3	Farmers field ditch downstream of BH12	2024
FD4	Farmers field ditch upstream of confluence Red Brook	2024
RB1	Red Brook upstream of farmers field confluence	2024
RB2	Red Brook downstream of farmers field confluence	2024
RB3	Red Brook upstream of Befesa discharge	2024
RB4	Red Brook downstream of Befesa discharge	2024 (RB5)
BH1	Newly installed boreholes	2024
BH2	Newly installed boreholes	2024
BH3	Newly installed boreholes	Gas BH
BH4	Newly installed boreholes	Destroyed
BH5	Newly installed boreholes	Gas BH
BH6	Newly installed boreholes	Gas BH
BH7	Newly installed boreholes	2024
BH8	Newly installed boreholes	2024
BH9	Newly installed boreholes	2024
Occasional sampling		
MH7	Manhole between site office and plant	Historically
MH32	Manhole near plant entrance (by BF2)	Historically
MH20	Manhole between lagoon and plant	Historically
RB0	Red Brook upstream of confluence of stream west of landfill (WD3)	Historically
SW3	Outflow from site discharge pipe	2024
SW4	Informal site discharge on road	Historically

Name	Location	Sampled
SW4.5	Informal site discharge midway along road	Historically
SW5	Marshy area next to Red Brook fed by informal site discharge	Historically
WD1	Marshy area between stormwater lagoon and landfill	2024
WD2	Marshy area at the foot of the landfill (Wardle's land)	2024
WD3	Stream west of landfill	Historically
Side Stream	Small steam that joins Red Brook downstream of site discharge	Historically

3.3.2 Groundwater elevations

Groundwater depths encountered in the boreholes drilled in 2024 were recorded between 0.1 m bgl and 1.27 m bgl. Groundwater depths, measured during drilling and on each sampling round, are presented in Table 3.4.

Groundwater elevations have been plotted as contours, as shown on Figure 3.5. Results show high groundwater levels underlying the concrete slab, with groundwater flow direction variably to the northeast, north, and northwest.

Table 3.4 Groundwater data

Borehole	Groundwater level							
	16 January 2024		21 June 2024		26 June 2024		12 July 2024	
	(m bgl)	(m aOD)	(m bgl)	(m aOD)	(m bgl)	(m aOD)	(m bgl)	(m aOD)
S-04	0.45	89.20						
S-06	0.415	90.17						
S-07	0.54	90.07						
BH1	0.9	89.58	1.27	89.21			1.09	89.39
BH2			0.405	90.07	0.37	90.10	0.34	90.13
BH3	0.57	89.95	0.38	90.14	0.62	89.90	0.88	89.64
BH5			0.1	90.07	0.15	90.02	0.16	90.01
BH6			0.305	90.08	0.315	90.07	0.4	89.98
BH7	1.27	88.95	0.6	89.62	0.49	89.73	0.52	89.70
BH8	1.19	89.47	0.91	89.75	0.86	89.80	0.74	89.92
BH9	0.52	90.02	1.02	89.52	1.195	89.34	1.26	89.28
BH10			0.56	90.08	0.61	90.03	0.455	90.19

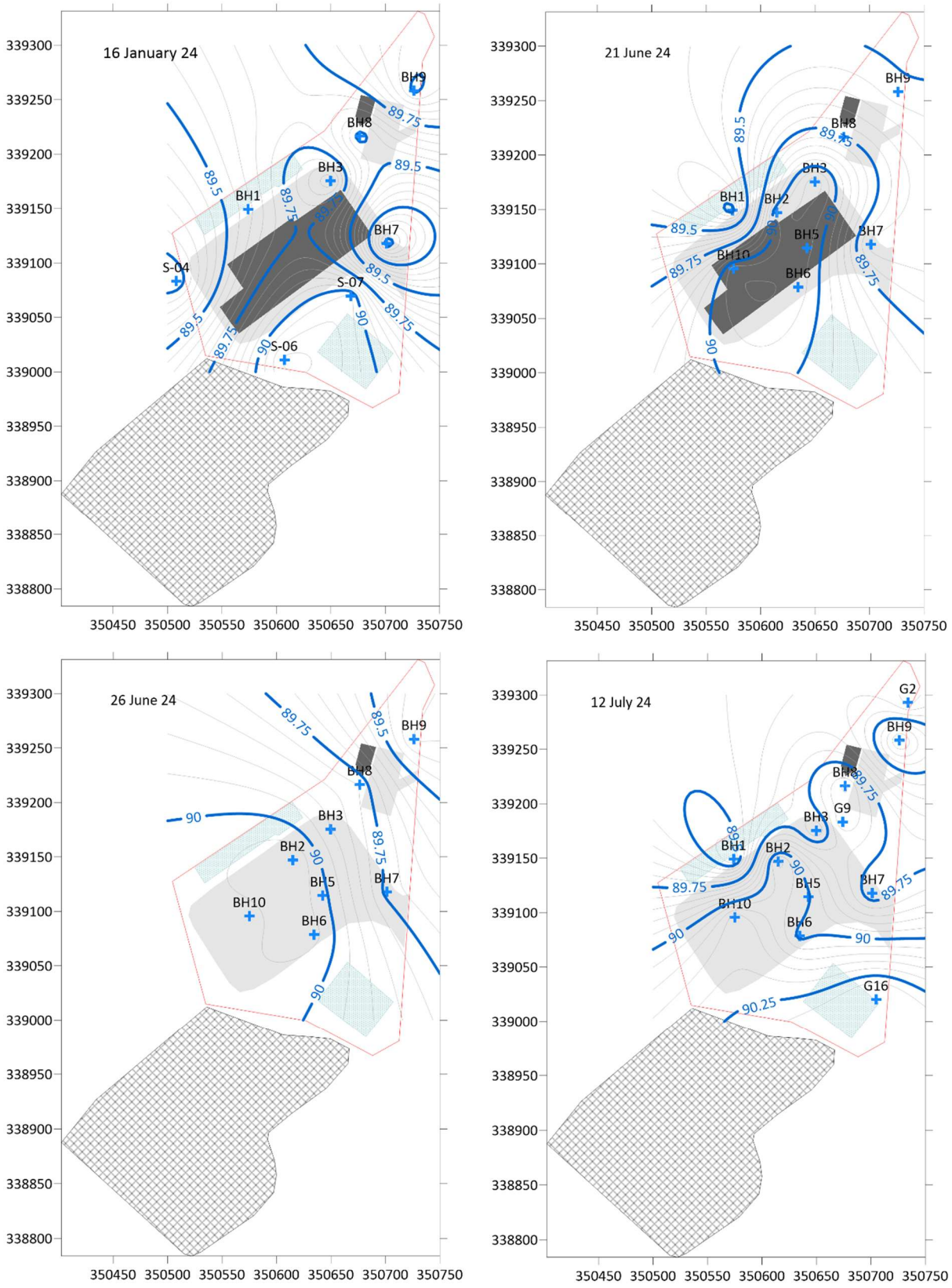

Figure 3.6 Groundwater contours (dates)

3.4 Gas Monitoring and sampling

Gas monitoring was proposed at the site, to determine the potential for the presence of ground gases associated with the historic site activities.

Two rounds of ground gas monitoring were undertaken on the 17th and 18th January 2024 and 26th June 2024. Gas monitoring was undertaken at 18 locations including boreholes and gas spikes using GFM436 and GA5000 gas monitors. These gas monitors detect carbon dioxide (CO_2), carbon monoxide (CO), oxygen (O_2), hydrogen sulphide (H_2S), and methane (CH_4). The flow of the gas is also measured.

Due to the gas monitors being unable to measure for hydrogen (H_2), gas canisters were used to sample bulk gases, which included carbon dioxide (CO_2), carbon monoxide (CO), oxygen (O_2), hydrogen sulphide (H_2S), (H_2), nitrogen (N_2) and methane (CH_4) from 14 locations. Gas sampling was undertaken on the 12 July 2024 to assess the presence of hydrogen; all monitoring was carried out by Xenia Boyes in general accordance with BS8576 and CIRCI C665 Guidance.

Monitoring and sampling methodologies are provided in Appendix B, and calibration certificates for the gas meters, are provided in Appendix C.

A summary of the gas monitoring data is provided in Section 4.3; all sample data and laboratory results are provided in Appendices D and E respectively.

4 CHEMICAL ANALYSIS RESULTS

All soil and water samples were sent to i2 laboratories under chain of custody and gas canister samples were sent to ALS laboratory under chain of custody.

A summary of the soil, water and gas analyses are presented in Sections 4.1, 4.2 and 4.3 respectively

4.1 Soil sample results

A summary of the soil sample results is shown in Table 4.1. The average is calculated using the half the limit of detection for any non-detects. Full results with laboratory certificates are included in Appendix F.

Table 4.1 Soil sample results summary

Analyte	Unit	No of samples	Non detects	Min	Average	Max
Analytical Parameter (Soil Analysis)						
Stone Content	%	45	44	0.05	1.38	60
Moisture Content	%	45	0	5.4	21.8	52
Total mass of sample received	kg	45	0	0.8	1.3	1
Asbestos in Soil	Type	45	45	Not detected		
General Inorganics						
pH - Automated	pH Units	45	0	5.4	8.09	12.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	45	0	0.0054	0.15	2.46
Total Chloride	mg/kg	45	0	35	383	2400
Water Soluble Fluoride (2:1)	mg/kg	45	2	1	11.5	47
Ammoniacal Nitrogen as NH3	mg/kg	45	26	<0.5	20.7	460
PAHs						
Naphthalene	mg/kg	45	44	<0.05	0.03	0.14
Acenaphthylene	mg/kg	45	44	<0.05	0.03	0.06
Acenaphthene	mg/kg	45	44	<0.05	0.06	1.5
Fluorene	mg/kg	45	44	<0.05	0.06	1.6
Phenanthrene	mg/kg	45	39	<0.05	0.36	14
Anthracene	mg/kg	45	42	<0.05	0.10	3.4
Fluoranthene	mg/kg	45	30	<0.05	0.59	22
Pyrene	mg/kg	45	33	<0.05	0.49	18
Benzo(a)anthracene	mg/kg	45	37	<0.05	0.23	7.7
Chrysene	mg/kg	45	34	<0.05	0.22	6.9
Benzo(b)fluoranthene	mg/kg	45	33	<0.05	0.24	7.2
Benzo(k)fluoranthene	mg/kg	45	39	<0.05	0.10	2.9
Benzo(a)pyrene	mg/kg	45	34	<0.05	0.20	5.9
Indeno(1,2,3-cd)pyrene	mg/kg	45	39	<0.05	0.10	2.7
Dibenz(a,h)anthracene	mg/kg	45	43	<0.05	0.04	0.69
Benzo(ghi)perylene	mg/kg	45	39	<0.05	0.11	2.9

Analyte	Unit	No of samples	Non detects	Min	Average	Max
Speciated Total EPA-16 PAHs	mg/kg	45	38	<0.8	2.87	96.5
Heavy Metals / Metalloids						
Aluminium (aqua regia extractable)	mg/kg	45	0	1500	13180	25000
Arsenic (aqua regia extractable)	mg/kg	45	0	2.7	6.02	11
Barium (aqua regia extractable)	mg/kg	45	0	12	273	1100
Beryllium (aqua regia extractable)	mg/kg	45	0	0.12	0.62	1.2
Boron (water soluble)	mg/kg	45	9	<0.2	1.02	6.1
Cadmium (aqua regia extractable)	mg/kg	45	23	<0.2	0.21	0.7
Chromium (aqua regia extractable)	mg/kg	45	0	3.9	19.8	33
Copper (aqua regia extractable)	mg/kg	45	0	7.6	46.2	170
Lead (aqua regia extractable)	mg/kg	45	0	1.8	17.2	56
Manganese (aqua regia extractable)	mg/kg	45	0	97	387	2300
Mercury (aqua regia extractable)	mg/kg	45	45	<0.3	<0.3	<0.3
Nickel (aqua regia extractable)	mg/kg	45	0	3.5	18.4	32
Selenium (aqua regia extractable)	mg/kg	45	44	<1	0.52	1.5
Vanadium (aqua regia extractable)	mg/kg	45	0	3.6	20.1	34
Zinc (aqua regia extractable)	mg/kg	45	0	13	78	880
Petroleum Hydrocarbons						
TPH C10 - C40 $_{EH\_CU\_1D\_TOTAL}$	mg/kg	45	24	<10	26	220

4.2 Water sampling results

A summary of all the water sample results is shown in Table 4.2. The average is calculated including the half value of non-detects. Full sampling data and results with laboratory certificates are included in Appendices G and H respectively.

Table 4.2 Summary of water sampling results

Analyte	Units	No. Samples	Non detects	Min	Average	Max
General Inorganics						
pH	pH Units	26	0	6.7	8.16	12
Electrical Conductivity at 20 °C	µS/cm	26	0	200	5980	44000
Sulphate as SO4	mg/l	26	0	3.93	145	652
Chloride	mg/l	26	0	30	1760	15000
Total Phosphate as P	µg/l	26	14	10	79.7	440
Ammonia as NH3	mg/l	26	0	0.029	124	1200
Nitrate as NO3	mg/l	26	0	0.005	7.29	47.4
Nitrite as NO2	µg/l	22	0	1.6	8300	65691
Alkalinity	mgCaCO3/l	26	0	57	533	2600
Fluoride	µg/l	26	0	230	2230	8900
Heavy Metals / Metalloids						

Analyte	Units	No. Samples	Non detects	Min	Average	Max
Boron (dissolved)	µg/l	26	0	15	1780	9900
Calcium (dissolved)	mg/l	26	0	12	96.7	340
Iron (dissolved)	mg/l	26	0	0.011	0.996	5
Magnesium (dissolved)	mg/l	26	0	0.074	23.6	120
Potassium (dissolved)	mg/l	26	0	2.4	380	2600
Sodium (dissolved)	mg/l	26	0	15	737	5700
Aluminium (dissolved)	mg/l	26	0	0.001	0.598	2.8
Arsenic (dissolved)	µg/l	26	0	0.52	6	29
Barium (dissolved)	µg/l	26	0	48	238	1200
Beryllium (dissolved)	µg/l	26	24	0.05	0.0731	0.1
Cadmium (dissolved)	µg/l	26	17	0.01	0.132	1.1
Chromium (dissolved)	µg/l	26	2	0.1	2.11	5.8
Copper (dissolved)	µg/l	26	0	1.6	73.7	770
Lead (dissolved)	µg/l	26	14	0.1	1.95	9.9
Manganese (dissolved)	µg/l	26	0	0.79	984	8800
Mercury (dissolved)	µg/l	26	23	0.025	0.132	0.31
Nickel (dissolved)	µg/l	26	0	1.1	7.78	33
Selenium (dissolved)	µg/l	26	9	0.3	18	150
Vanadium (dissolved)	µg/l	26	5	0.1	5.48	32
Zinc (dissolved)	µg/l	26	0	2.3	16.2	57
Speciated PAHs						
Naphthalene	µg/l	9	9	0.005	0.005	0.005
Acenaphthylene	µg/l	9	9	0.005	0.005	0.005
Acenaphthene	µg/l	9	9	0.005	0.005	0.005
Fluorene	µg/l	9	9	0.005	0.005	0.005
Phenanthrene	µg/l	9	9	0.005	0.005	0.005
Anthracene	µg/l	9	9	0.005	0.005	0.005
Fluoranthene	µg/l	9	9	0.005	0.005	0.005
Pyrene	µg/l	9	9	0.005	0.005	0.005
Benzo(a)anthracene	µg/l	9	9	0.005	0.005	0.005
Chrysene	µg/l	9	9	0.005	0.005	0.005
Benzo(b)fluoranthene	µg/l	9	9	0.005	0.005	0.005
Benzo(k)fluoranthene	µg/l	9	9	0.005	0.005	0.005
Benzo(a)pyrene	µg/l	9	9	0.005	0.005	0.005
Indeno(1,2,3cd)pyrene	µg/l	9	9	0.005	0.005	0.005
Dibenz(a,h)anthracene	µg/l	9	9	0.005	0.005	0.005
Benzo(ghi)perylene	µg/l	9	9	0.005	0.005	0.005
Total PAH						
Total EPA16 PAHs	µg/l	9	9	0.08	0.08	0.08

Analyte	Units	No. Samples	Non detects	Min	Average	Max
Monoaromatics & Oxygenates						
Benzene	µg/l	9	9	1.5	1.5	1.5
Toluene	µg/l	9	9	1.5	1.5	1.5
Ethylbenzene	µg/l	9	9	1.5	1.5	1.5
p & m xylene	µg/l	9	9	1.5	1.5	1.5
Oxylene	µg/l	9	9	1.5	1.5	1.5
MTBE (Methyl Tertiary Butyl Ether)	µg/l	9	9	1.5	1.5	1.5
Petroleum Hydrocarbons						
TPHCWG Aliphatic >C5 C6 HS_1D_AL	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aliphatic >C6 C8 HS_1D_AL	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aliphatic >C8 C10 HS_1D_AL	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aliphatic >C10 C12 EH_1D_AL_MS	µg/l	9	9	5	5	5
TPHCWG Aliphatic >C12 C16 EH_1D_AL_MS	µg/l	9	9	5	5	5
TPHCWG Aliphatic >C16 C21 EH_1D_AL_MS	µg/l	9	9	5	5	5
TPHCWG Aliphatic >C21 C35 EH_1D_AL_MS	µg/l	9	9	5	5	5
TPHCWG Aliphatic (C5 C35) HS+EH_1D_AL_MS	µg/l	9	9	5	5	5
TPHCWG Aromatic >C5 C7 HS_1D_AR	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aromatic >C7 C8 HS_1D_AR	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aromatic >C8 C10 HS_1D_AR	µg/l	9	9	0.5	0.5	0.5
TPHCWG Aromatic >C10 C12 EH_1D_AR_MS	µg/l	9	9	5	5	5
TPHCWG Aromatic >C12 C16 EH_1D_AR_MS	µg/l	9	9	5	5	5
TPHCWG Aromatic >C16 C21 EH_1D_AR_MS	µg/l	9	9	5	5	5
TPHCWG Aromatic >C21 C35 EH_1D_AR_MS	µg/l	9	9	5	5	5
TPHCWG Aromatic (C5 C35) HS+EH_1D_AR_MS	µg/l	9	9	5	5	5
TPH (EC12 EC35) EH+1D_TOTAL_MS	µg/l	5	5	5	5	5

4.3 Soil gas results

Soil gas sampling results taken during July 2024 are provided in Table 4.3. A summary of all gas monitoring and sampling data (January to July 20204) is provided in Table 4.4: below. Full results of the monitoring rounds undertaken during January and June 2024 are provided in Appendix D and laboratory certificates are provided in Appendix E.

Table 4.3: Gas sampling results

ID	H_2S (ppm)	H_2 (%)	O_2 %)	N_2 (%)	CO (%)	CH_4 (%)	CO_2 (%)	Total Bulk Gas (%)
BH1	<1	<0.5	12.8	80.5	<0.05	0.173	6.59	100
BH2	<1	<0.5	20.2	79.3	<0.05	<0.05	0.54	100
BH3	<1	<0.5	19.8	77.7	<0.05	1.13	1.33	100
BH5	<1	<0.5	20.9	79.1	<0.05	<0.05	<0.05	100
BH6	<1	<0.5	21.1	78.9	<0.05	<0.05	<0.05	100
BH7	<1	<0.5	20.4	79.6	<0.05	<0.05	<0.05	100
BH8	<1	<0.5	20.6	78.7	<0.05	<0.05	0.72	100
BH9	<1	<0.5	20.1	78.3	<0.05	<0.05	1.52	100
BH10	<1	<0.5	21.0	79.0	<0.05	<0.05	<0.05	100
GS9	<1	<0.5	20.8	79.2	<0.05	<0.05	<0.05	100
GS13	<1	<0.5	20.8	79.3	<0.05	<0.05	<0.05	100
GS16	<1	<0.5	20.7	79.3	<0.05	<0.05	<0.05	100
GS22	<1	<0.5	21.1	78.9	<0.05	<0.05	<0.05	100

Results from the gas sampling show concentrations of oxygen between 12.8% and 21.2%, with the lowest concentration in BH1. Nitrogen was reported to be between 77.7% and 80.5% and was highest in BH1.

Methane was detected only in BH1 and BH3 with concentrations of 0.173% and 1.13% respectively. Cardon dioxide ranged between 0.54% and 6.59% in the five locations in which it was detected; the highest concentration was in BH1.

No concentrations of hydrogen sulphide, hydrogen or carbon monoxide were detected in any of the sampled locations.

Not enough sample was available for the canister for gas spike 2

The gas concentrations for carbon dioxide (CO_2), carbon monoxide (CO) and hydrogen sulphide (H_2S) during the two monitoring rounds in January and June was taken as the maximum however, the initial concentration when the gas tap was opened was discounted. Data for methane lower explosive limit (LEL) was not included as all recorded values were 0%. Concentrations of oxygen (O_2) are the minimum values monitored. Atmospheric oxygen is approximately 20%, therefore any concentrations below can indicate the presence of other gases.

A summary of all the gas monitoring and sampling is provided in Table 4.4:

Table 4.4: Summary of gas monitoring data (monitored and sampled)

Location ID	Response zone/Strata (m bgl)	Water level range (m bgl)	No. of monitoring occasions	Max CH_4 (%)	Max CO_2 (%)	Max CO (%)	Max H_2S (%)	Max H2 (%)	Max N_2 (%)	Min O_2 (%)	Max steady state Flow (l/hr)**	Atmospheric pressure (mbar)	Comment
BH1	2.0 - 3.0 Clay	0.90 - 1.09	1	0.173	6.59	0.004	0	0	80.5	12.8	-0.8	1018	
BH2	2.0 - 3.0 Clay	0.34 - 0.305	2	0	0.54	4	0	N/A	79.3	19.4	3.4	1018	Water in pipe after 90 seconds.
BH3	0.6 - 0.8 MG	0.37 - 0.57	3	1.13	1.33	0.0004	0	0	77.7	19.6	0.9	984 - 1019	Water in pipe after 120 seconds
BH5	0.6 - 0.8 Silt	0.10 - 0.16	2	0	0	0.0001	0	0	79.1	20.7	0.1	1018	
BH6	0.6 - 0.8 Clay	0.305 - 0.40	3	0	0.1	0.0002	0	0	78.9	20.3	0.2	983-1017	
BH7	2.0 - 3.0 Sand	0.49 - 1.27	2	0.1	0	0.0005	0	0	79.6	18.9	0.1	1017	
BH8	2.0 - 3.0 Clay/ Sand	0.74 - 1.19	2	0	0.72	0.0002	0	0	78.7	20.1	0.1	1017	
BH9	1.0 - 3.0 Clay/Sand	0.52 - 1.26	2	0.1	6.2	0.0003	0	0	78.3	16.9	3.4	1016	
BH10	0.2 - 0.6 MG	0.455 - 0.56	2	0	0	0.0002	0	0	79	19.9	0.2	1017	
GS2	0.05 - 0.40	0.09	3	0	1.6	0.0001	0	N/A	N/A	19.1	0.9	999-1008	Not accessible due to demolition activities
GS6	0.05 - 0.40	Dry	1	0	0	-	0	N/A	N/A	19.6	1	984	Too overgrown for monitoring

Location ID	Response zone/Strata (m bgl)	Water level range (m bgl)	No. of monitoring occasions	Max						Min	Max steady state Flow (l/hr)**	Atmospheric pressure (mbar)	Comment
				CH_4 (%)	CO_2 (%)	CO (%)	H_2S (%)	H2 (%)	N_2 (%)	O_2 (%)			
GS9	0.05 - 0.40	0.18	3	0	0.9	0.021	0	0	79.2	18.5	0.1	999-1016	
GS13	0.05 - 0.40	Dry	3	0	0.1	0.0024	0	0	79.3	19.8	0.4	984-1018	
GS16	0.05 - 0.40	0.295	3	0	0.1	0.0138	0	0	79.3	20	0.3	984-1016	
GS18	0.05 - 0.40	Dry	1	0	0	-	0	N/A	N/A	20	0.3	983	Too overgrown for monitoring
GS21	0.05 - 0.40	Dry	3	0	0.2	0.0005	0	N/A	N/A	19.9	0.1	985-1016	
GS22	0.05 - 0.40	Dry	1	0	0	-	0	0	78.9	19.9	0.3	983	Couldn't find in June/July sampling
GS23	0.05 - 0.40	Dry	1	0	0	-	0	N/A	N/A	19	-0.3	984	Destroyed by June/July - area had been cleared

**This does not include the flow from the gas canister which was 220ml/min which equates to 12l/hr
MG = made ground.

- Methane was recorded in boreholes 1, 3, 7 and 9 with concentrations ranging between 0.1% and 1.13%, the highest in BH3.
- Carbon dioxide was recorded in boreholes 1, 2, 3, 6, 8 and 9 and gas spikes 2, 9, 13, 16 and 21 at concentrations between 0.1% to 6.59% with the highest concentration recorded in BH1.
- Carbon monoxide was recorded in all boreholes and gas spikes 2, 9, 13 and 21 at concentrations ranging from 0.0001% to 4%; the highest recorded in location BH2.
- No hydrogen sulphide was recorded in any location.
- The lowest oxygen level at a concentration of 12.8% was recorded in BH1.
- Nitrogen was recorded between 78.3 % and 80.5 %, with the lowest concentration in BH9.
- The water levels in the boreholes were all above the response zone, therefore potentially affecting the concentration of gas in the boreholes; the majority of the gas spikes were dry.
- Flow rates for locations BH1 and gas spike 23 were recorded as negative.
- The atmospheric pressure was recorded at an average of 998 mbar in January and an average of 1017 mb in June.

5 CONCEPTUAL MODEL

For a risk to exist due to land contamination, there needs to be one or more contaminant source-pathway- receptor linkages – "contaminant linkage" – by which a relevant receptor might be affected by the contaminants in question. In other words, there must be contaminants present in, on or under the land in a form and quantity that pose a hazard and one or more pathways by which they might impact one or more receptors. Defra (2012)[20] provides the following definitions:

(a) A contaminant source is "*a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters*";

(b) A receptor is "*something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body*"; and

(c) A pathway is "*a route or means by which a receptor can be exposed to, or affected by, a contaminant*".

The term "contaminant linkage" means the relationship between a contaminant source, a pathway, and a receptor. All three elements of a contaminant linkage must exist for there to be a risk to the identified receptor.

The conceptual site model summarises what is known about the ground conditions at the site, then goes on to describe potential sources, pathways, and receptors.

5.1 Ground model

The site is underlain by glacial deposits comprising alternating layers of glacial till and sand and gravels. These are mapped as Till in the south of the site and Glacial Sands and Gravels in the north of the site and have been proven to depths of up to 25 m bgl. The bedrock underlying the area are Triassic strata comprising the Branscombe Mudstone Formation (mudstones with partings veined by halite).

Entec (2008)[6] report the superficial geology at the Wardle site as follows:

- Topsoil or re-worked fill Typically 0.1m to 1.7m thick;
- Upper sand up to 4.5m thick;
- Glacial clay (Till) between 0.5 and 12.3 m thick; and
- Lower sand between up to 12.3 m thick at elevations c. 80 – 85 m aOD and below.

However, Glacial Clay between the sand layers is not always continuous and is sometimes present at surface. Geological logs from drilling at the Befesa site (Amec Foster Wheeler, 2017) and recent drilling undertaken by HFCL, show the upper 3 m of the soil profile to variably comprise sand, silt, and/or clay.

The target strata for the brick pits are thought to be the Till, and it is likely that the underlying sand was exposed in some locations due to clay extraction.

The sand and gravel deposits are classified by the Environment Agency as a Secondary A aquifer, and the Till is a secondary (undifferentiated) aquifer. Groundwater levels are very close to ground level in the winter months to the south of the site, and groundwater flow is towards the north or northwest. Anecdotally, the brick pits that pre-dated the Wardle site are thought to have been

[20] Defra and Environment Agency, 2008. Model Procedures for the Management of Land Contamination. CLR11.

abandoned when inflowing groundwater could no longer be controlled, suggesting that the excavations extended beyond the clay into the underlying sand and gravel.

The Bull's Head Pool lies c. 190 m to the southwest of the site, and the Wheatsheaf Pool lies c. 175 m to the south. A ditch runs northwest from the Bull's head pool, to join a brook running northeast approximately 70 m northwest of the site. A smaller ditch (the field ditch) runs from a large pool at the base of the landfill along the western site boundary to join this brook, which continues to run northeast, under Fenn's Bank Road. This is known locally as the Red Brook (note that mapping shows this to be a tributary of the Red Brook, which it joins c. 675 m northeast of Fenn's Bank Road however, this report refers to the more local watercourse as the Red Brook). The general direction of drainage is to the north.

There is a storm water lagoon in the south of the site, and a storm ditch and reedbed in the north of the site. The overflow from the storm ditch is to the site drainage system, which is linked via a pipe to an outfall into the Red Brook.

The main portion of the site is covered in hardstanding comprising concrete, tarmac and gravels. The infilled lagoon to the north is infilled with gravely clay. The area around the office and lagoon are grassed.

5.2 Potential contaminant sources

A number of potentially polluting substances are present on site from historical works and the adjacent landfill. These are summarised into contaminant groups and include the following:

- S1: Potential contaminants of concern in soils, including: metals and metalloids (aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium and zinc); Inorganics (pH, sulphate, chloride, fluoride, phosphate, ammonia, nitrate and nitrite); Organic compounds (polyaromatic hydrocarbons (PAH), Total petroleum hydrocarbons (TPH)); monoaromatics and oxygenates (benzene, toluene, ethylbenzene, p&m xylene and o xylene (BTEX) and methyl tertiary butyl ether (MTBE)).
- S2: Ground gases including methane (CH_4), carbon dioxide (CO_2) and hydrogen sulphide (H_2S) from Made Ground, infilled locations and underlying natural strata with the off-site landfill presenting an additional gas source including methane (CH_4), hydrogen (H_2) and ammonia (NH_3).
- S3: Surface water and groundwater impacted by leachate from adjacent landfill;
- S4: Asbestos fibres/fragments in soils

5.3 Potential exposure routes

Possible exposure routes may include:

- P1: direct dermal contact (e.g. skin exposure) with CoCs
- P2: ingestion of CoCs
- P3: inhalation of dust, gas and vapours

Possible migration pathways may include:

- P4: vertical leaching of leachable CoCs in unsaturated zone and lateral migration in saturated zone

- P5: migration of groundwater to surface water via groundwater flooding and baseflow
- P6: surface water runoff
- P7: permeation through pipework into water supply network
- P8: volatilisation from soil and/or groundwater to air (indoor and outdoor)
- P9: gas migration through unsaturated zone and permeable strata and ingress and accumulation within confined spaces

5.4 Potential receptors

Human receptors

- R1: current or future site users such as workers and visitors.
- R2: current or future users of surrounding properties; and
- R3: current or future users of groundwater or surface water abstracted for human use
- R4: current or future water supply users, where water supply pipes are impacted by contaminants

Environmental receptors

- R5: groundwater beneath, or in the vicinity of the site (secondary A aquifer);
- R6: current or future groundwater abstractions;
- R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee;
- R8: current or future surface water abstractions; and
- R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC)
- R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI

Table 5.1: CSM and qualitative risk assessment

Source	Pathway	Receptor
S1: Chemicals potentially present in soils on site	P1: direct dermal contact (e.g. skin exposure) with chemicals of concern	R1: current or future site users such as workers and visitors.
	P2: ingestion of chemicals of concern	
	P3: inhalation of dust, gas and vapours	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties
	P4: vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone	R3: current or future users of groundwater abstracted for human use R4: current or future water supply users, where water supply pipes are impacted by contaminants R5: groundwater beneath, or in the vicinity of the site (secondary A aquifer); R6: current or future groundwater abstractions
	P5: migration of groundwater to surface water via groundwater flooding and baseflow	R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee; R8: current or future potential surface water abstractions R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI
	P6: surface water run-off	R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee; R8: current or future potential surface water abstractions R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI
	P7: permeation through pipework into water supply network	R4: current or future water supply users, where water supply pipes are impacted by contaminants

Source	Pathway	Receptor
	P8: volatilisation from soil and/or groundwater to air (indoor and outdoor)	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties
S2: Ground gases including methane (CH_4), carbon dioxide (CO_2), hydrogen sulphide (H_2S) and hydrogen (H_2) and ammonia from made ground, infilled locations, underlying natural strata and off-site landfill.	P9: gas migration through unsaturated zone and accumulation within confined spaces P3: inhalation of gas and vapours	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties
S3: Groundwater and surface waters impacted by leachate from adjacent landfill;	P5: migration of groundwater to surface water via groundwater flooding and baseflow P6: surface water run-off	R3: current or future users of groundwater or surface water abstracted for human use R5: groundwater beneath, or in the vicinity of the site (secondary A aquifer); R6: current or future groundwater abstractions; R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee; R8: current or future surface water abstractions; and R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI
	P7: permeation through pipework into water supply network	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties; and R4: current or future water supply users, where water supply pipes are impacted by contaminants
S4: asbestos fibres/fragments in soils	P3: inhalation of dust	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties.

6 HUMAN HEALTH RISK ASSESSMENT

A Human Health risk assessment has been undertaken in accordance with the Environment Agency's (2009) CLEA Framework, having due regard to the relevant statutory guidance regarding land affected by contamination (Defra, 2012). This approach is consistent with Defra and the Environment Agency's (2011) Model Procedures and more recent Land Contamination Risk Management guidance on gov.uk[21].

Current best practice advocates the following approach to risk assessment:

- Development of the conceptual site model;
- Selection of appropriate generic screening criteria (GACs), taking into consideration the Site specific pollutant linkages that may be operating;
- Screening of soil (and other media, if relevant) concentrations against GACs;
- Further assessment and development of Site-specific screening levels (SSSLs) if soil concentrations exceed GACs.

The contaminants analysed are compared against Generic Assessment Criteria (GACs); soil concentrations below the GAC are considered to present an acceptable level of risk to human health. The GACs used are Land Quality Management (LQM) / Chartered Institute for Environmental Health (CIEH) 'suitable for use levels' (S4ULs) for commercial use, residential land use with home grown veg and residential land use without home grown veg for 1% soil organic matter (SOM). An S4UL is a soil concentration that represents a minimal risk to long term human health and is derived using an iterative approach based on a modified version of the Environmental Agencies CLEA model.[22] The 1% SOM S4UL was chosen as the most conservative concentrations in the soil samples in the absence of SOM data.

6.1 Critical receptor and selection of GACs

The site is a commercial site; under the CLEA framework the critical receptor for a commercial land use is an adult worker aged 16 – 65. The exposure parameters used to derive Generic Assessment Criteria (GACs) for commercial land use are considered to be highly conservative for this land use, but have been adopted as an appropriate screening tool. GACs for residential use have been included in order to assess future land use as it is possible that the site may be sold for future development. Under the CLEA framework the critical receptor for a residential land use is a female child (aged 1-6), and use of residential GACs is protective of this receptor and less sensitive older child and adult receptors.

Table 6.1 presents a summary of the soil concentrations, and also provides the Commercial and Residential Land Use GACs for comparison. Exceedances are highlighted and the specific GAC which has been exceeded is presented in bold type. A summary of all contaminants of concern is presented in Sections 6.1.1 and 6.1.5.

[21] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

[22] https://www.envchemgroup.com/human-health-exposure-from-contaminated-land-a-lqmcieh-report.html

Table 6.1: Summary of contaminants of concern against screening values

Analyte	Unit	Commercial HH value 1% SOM	Residential land use		No of samples	Non detects	Min	Average	Max	No. exceedances	Locations
			with home grown veg 1%SOM	without home grown veg 1% SOM							
Analytical Parameter (Soil Analysis)											
Stone Content	%	N/A	N/A	N/A	45	44	0.05	1.38	60	0	
Moisture Content	%	N/A	N/A	N/A	45	0	5.4	21.8	52	0	
Total mass of sample received	kg	N/A	N/A	N/A	45	0	0.8	1.3	1	0	
Asbestos in Soil	Type	N/A	N/A	N/A	45	45	Not detected			0	
General Inorganics											
pH - Automated	pH Units	N/A	N/A	N/A	45	0	5.4	8.09	12.3	0	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	N/A	N/A	N/A	45	0	0.0054	0.15	2.46	0	
Total Chloride	mg/kg	N/A	N/A	N/A	45	0	35	382.56	2400	0	
Water Soluble Fluoride (2:1)	mg/kg	N/A	N/A	N/A	45	2	1	11.54	47	0	
Ammoniacal Nitrogen as NH3	mg/kg	N/A	N/A	N/A	45	26	<0.5	20.67	460	0	
Speciated PAHs											
Naphthalene	mg/kg	190	2.3	2.3	45	44	<0.05	0.03	0.14	0	
Acenaphthylene	mg/kg	83000	170	2900	45	44	<0.05	0.03	0.06	0	
Acenaphthene	mg/kg	84000	210	3000	45	44	<0.05	0.06	1.5	0	
Fluorene	mg/kg	63000	170	2800	45	44	<0.05	0.06	1.6	0	
Phenanthrene	mg/kg	22000	95	1300	45	39	<0.05	0.36	14	0	
Anthracene	mg/kg	520000	2400	31000	45	42	<0.05	0.10	3.4	0	

Analyte	Unit	Commercial HH value 1% SOM	Residential land use		No of samples	Non detects	Min	Average	Max	No. exceedances	Locations
			with home grown veg 1%SOM	without home grown veg 1% SOM							
Fluoranthene	mg/kg	23000	280	1500	45	30	<0.05	0.59	22	0	
Pyrene	mg/kg	54000	620	3700	45	33	<0.05	0.49	18	0	
Benzo(a)anthracene	mg/kg	170	**7.2**	11	45	37	<0.05	0.23	**7.7**	1	BH1 1.2 m
Chrysene	mg/kg	350	15	30	45	34	<0.05	0.22	6.9	0	
Benzo(b)fluoranthene	mg/kg	44	**2.6**	**3.9**	45	33	<0.05	0.24	**7.2**	1	BH1 1.2 m
Benzo(k)fluoranthene	mg/kg	1200	77	110	45	39	<0.05	0.10	2.9	0	
Benzo(a)pyrene	mg/kg	35	**2.2**	**3.2**	45	34	<0.05	0.20	**5.9**	1	BH1 1.2 m
Indeno(1,2,3-cd)pyrene	mg/kg	500	27	45	45	39	<0.05	0.10	2.7	0	
Dibenz(a,h)anthracene	mg/kg	3.5	**0.24**	**0.31**	45	43	<0.05	0.04	**0.69**	1	BH1 1.2 m
Benzo(ghi)perylene	mg/kg	3900	320	360	45	39	<0.05	0.11	2.9	0	
Total PAH											
Speciated Total EPA-16 PAHs	mg/kg	N/A	N/A	N/A	45	38	<0.8	2.87	96.5	0	
Heavy Metals / Metalloids											
Aluminium (aqua regia extractable)	mg/kg	N/A	N/A	N/A	45	0	1500	13177.78	25000	0	
Arsenic (aqua regia extractable)	mg/kg	640c	37	40	45	0	2.7	6.02	11	0	
Barium (aqua regia extractable)	mg/kg	22000	N/A	N/A	45	0	12	272.51	1100	0	
Beryllium (aqua regia extractable)	mg/kg	12	1.7	1.7	45	0	0.12	0.62	1.2	0	
Boron (water soluble)	mg/kg	240000	290	11000	45	9	<0.2	1.02	6.1	0	
Cadmium (aqua regia extractable)	mg/kg	410	11	85	45	23	<0.2	0.21	0.7	0	
Chromium (aqua regia extractable)	mg/kg	**33**	**6**	**6**	45	0	3.9	19.83	**33**	44	All except BH5 0.7m
Copper (aqua regia extractable)	mg/kg	68000	2400	7100	45	0	7.6	46.15	170	0	
Lead (aqua regia extractable)	mg/kg	2330	200	310	45	0	1.8	17.21	56	0	

Analyte	Unit	Commercial HH value 1% SOM	Residential land use		No of samples	Non detects	Min	Average	Max	No. exceedances	Locations
			with home grown veg 1%SOM	without home grown veg 1% SOM							
Manganese (aqua regia extractable)	mg/kg	N/A	N/A	N/A	45	0	97	387.04	2300	0	
Mercury (aqua regia extractable)	mg/kg	1100	40	56	45	45	<0.3	<0.3	<0.3	0	
Nickel (aqua regia extractable)	mg/kg	980	130	180	45	0	3.5	18.38	32	0	
Selenium (aqua regia extractable)	mg/kg	12000	250	430	45	44	<1	0.52	1.5	0	
Vanadium (aqua regia extractable)	mg/kg	9000	410	1200	45	0	3.6	20.05	34	0	
Zinc (aqua regia extractable)	mg/kg	730000	3700	40000	45	0	13	78.09	880	0	
Petroleum Hydrocarbons											
TPH C10 - C40 $_{EH\_CU\_1D\_TOTAL}$	mg/kg	28000	1600	1900	45	24	<10	26.02	220	0	

6.1.1 General inorganics

The soil pH ranged from 5.4 reported in location S23 at a depth of 0-0.1m to 12.3 and 12.2, reported in location BH10 at depths of 0 m and 0.8 m respectively. The pH for the remainder of the sample locations ranged between 6.6 and 10.4.

6.1.2 Asbestos

No asbestos was detected in any of the soil samples

6.1.3 Speciated PAHs

The majority of concentrations of speciated PAHs were below the laboratory limit of detection (LOD) of 0.05 mg/kg. Locations in which PAHs were detected included the following:

BH1 (1.2 m and 1.5 m), S1 (0.0-0.1 m), S4 (0.0-0.1 m), S5 (0.0-0.1 m), S7 (0.0-0.1 m), S12 (0.0-0.1 m), S14 (0.0-0.1 m), S15 (0.0-0.1 m) and locations S17 to S22 inclusive, all at depths of 0.0-0.1 m. No PAHS were identified in the deeper samples with the exception of BH1.

No exceedances of the commercial screening values were reported. Exceedances of the residential land use with and without homegrown vegetables was reported for Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(a,h)anthracene in location BH1 (1.2 m). An exceedance of the residential land use with homegrown vegetables for Benzo(a)anthracene was also reported in BH1 (1.2 m).

6.1.4 Heavy metals / metalloids

Concentrations of all metals and metalloids with the exception of mercury were detected in each location; selenium was only detected in one location (BH3, 0.60-0.70 m). All concentrations were below the S4ULs for commercial and residential values with the exception of chromium which is reported as total chromium. The value for chromium VI (hexavalent chromium) has been used for screening to be conservative. It is reasonable to assume, based on historical works, that the presence of chromium VI is possible however, it is likely also that chromium III is present which would result in a lower concentration of chromium VI. The maximum concentration for total chromium of 33 mg/kg located in BH10, is the same as the commercial S4ULs; with all other soil sample concentrations being below the screening value. Residential S4UL for chromium VI is 6 mg/kg, therefore this is exceeded in all but one sample location. The S4ULs for CrIII are 910 mg/kg and 8600 mg/kg for residential and commercial land uses respectively; there were no exceedances of the S4ULs for Cr III.

Aluminium is the most abundant metal on the planet and no screening values exist for this metal. However, the concentrations of aluminium across the site range between 1500 mg/kg and 25000 mg/kg. Information provided from the UK soil observatory[23] show that aluminium concentrations in the area to range between 4.76% to 4.84% which equates to 47600 mg/kg to 48400 mg/kg.

6.1.5 TPH

TPH was reported in 21 samples ranging from concentrations of 12 mg/kg to 220 mg/kg and generally within the shallower samples (0.0 m to 0.4 m), with the exception of three locations; BH1, BH2 and BH4 where TPH was identified between 1.2 m and 3.0 m. Thes concentrations are all well below the screening values for both commercial and residential land use.

[23] UK Soil Observatory (bgs.ac.uk)

It can be concluded that the observed soil concentrations do not present a significant risk to the identified critical receptor, an adult worker, under the current land use.

There are a limited number of exceedances of S4ULs for residential land use, however mean concentrations are below the S4ULs. Further assessment would be required to ascertain whether risks to human health for residential land use would be acceptable.

Off-site workers have also been identified as potential receptors. These are less sensitive than the commercial receptors identified above, due to a greater distance from the site and lower exposure to potential soil contaminants. As the risks to the critical receptors are considered to be low, the risks to off-site commercial receptors are also considered to be low.

7 CONTROLLED WATERS RISK ASSESSMENT

A controlled waters risk assessment has been carried out to assess the risk of potential contaminants to the closest watercourse, the Red Brook, which lies c.80 m from the site boundary at its closest point. For the purposes of this assessment the groundwater and surface water have been considered together, for the following reasons:

- Site investigation has shown that the groundwater and surface water are closely linked across the site, with groundwater flooding common in the wetter months across low lying parts of the site.
- Field drains discharge shallow groundwater into the site drainage system, which is designed to discharge to the Red Brook via the site discharge point (not operational under the site's permit).
- Shallow groundwater flow direction underlying the site is northwest towards the Red Brook.
- Surface water also drains from the site towards the Red Brook, either via the field ditch to the southwest of the site, or via the road to the northeast of the site.

An initial generic quantitative risk assessment has been carried out, where contaminant concentrations across the site are compared to screening levels. Where concentrations exceeded screening levels an assessment of the impact on surface water quality in the Red Brook has been carried out.

7.1 Generic quantitative risk assessment

The water sampling results have been compared to the relevant Environmental Quality Standard (EQS) and Drinking Water Standard (DWS) to assess which contaminants exceeds these screening levels. Results from the 2024 investigation are shown in Table 7.1 (on site samples) and Table 7.2 (off-site samples) while results across all 23 sampling rounds are shown in Table 7.3.

Organic contaminants (PAHs, TPH) are not considered further as all sample results were below the laboratory detection limits.

A number of general inorganics, and heavy metals were detected across the site at concentrations elevated above the EQS or the DWS, shown highlighted in orange in Table 7.1 and Table 7.3. These are therefore considered Contaminants of Concern (CoCs).

7.1.1 Contaminants of concern

For the recent sampling round:

pH ranged from 7 mg/l to 12 mg/l in onsite samples, and 6.7 mg/l to 9.4 mg/l in offsite samples, compared with an EQS of 6-9 mg/l. The highest concentration was at BH7, June 2024 (onsite).

Sulphate ranged from 3.93 mg/l to 645 mg/l in onsite samples, and 14.6 mg/l to 652 mg/l in offsite samples, compared with an EQS of 400 mg/l. The highest concentration was at BH1, 2 June 2024 (offsite).

Chloride ranged from 30 mg/l to 2200 mg/l in onsite samples, and 94 mg/l to 15000 mg/l in offsite samples, compared with an EQS of 250 mg/l. The highest concentration was at location FD1, January 2024 (offsite).

Total phosphate ranged from 10 mg/l to 130 ug/l in onsite samples, and 10 ug/l to 440 ug/l in offsite samples, compared with an EQS of 28 ug/l. The highest concentration was at FD1, January 2024 (offsite).

Ammonia ranged from 0.029 mg/l to 78 mg/l in onsite samples, and 0.05 mg/l to 1200 mg/l in offsite samples, compared with an EQS of 2.5 mg/l. The highest concentration was at FD1, January 2024 (offsite).

Nitrate ranged from 1.6 ug/l to 4598 ug/l in onsite samples, and 6.9 ug/l to 65691 ug/l in offsite samples, compared with an DWS of 500 ug/l. The highest concentration was at WD2, January 2024 (offsite).

Fluoride ranged from 230 ug/l to 8900 ug/l in onsite samples, and 470 ug/l to 5000 ug/l in offsite samples, compared with an EQS of 1000 ug/l. The highest concentration was at SW1, January 2024 (onsite).

Boron ranged from 15 ug/l to 1400 ug/l in onsite samples, and 61 ug/l to 9900 ug/l in offsite samples, compared with an EQS of 2000 ug/l which is only exceeded offsite. The highest concentration was at WD2, January 2024 (offsite).

Iron ranged from 0.011 mg/l to 2.8 mg/l in onsite samples, and 0.077 mg/l to 5 mg/l in offsite samples, compared with an EQS of 1 mg/l. The highest concentration was at WD1, January 2024 (offsite).

Sodium ranged from 15 mg/l to 950 mg/l in onsite samples, and 51 mg/l to 5700 mg/l in offsite samples, compared with an WDS of 200 mg/l. The highest concentration was at FD1, January 2024 (offsite).

Cadmium ranged from 0.01 ug/l to 1.1 ug/l in onsite samples, and 0.4 ug/l to 0.59 ug/l in offsite samples, compared with an EQS of 0.08 ug/l. The highest concentration was at BH1, 2 June 2024 (offsite).

Chromium ranged from 0.1 ug/l to 4.8 ug/l in onsite samples, and 1.5 ug/l to 5.8 ug/l in offsite samples, compared with an EQS of 4.7 ug/l. The highest concentration was at FD1, January 2024 (offsite).

Copper ranged from 1.6 ug/l to 45 ug/l in onsite samples, and 6.5 ug/l to 770 ug/l in offsite samples, compared with an EQS of 1 ug/l. The highest concentration was at WD2, January 2024 (offsite).

Lead ranged from 0.1 ug/l to 2.7 ug/l in onsite samples, and 0.3 ug/l to 9.9 ug/l in offsite samples, compared with an EQS of 1.2 ug/l. The highest concentration was at RB1, January 2024 (offsite).

Manganese ranged from 0.79 ug/l to 3600 ug/l in onsite samples, and 48 ug/l to 8800 ug/l in offsite samples, compared with an EQS of 123 ug/l. The highest concentration was at WD1, January 2024 (offsite).

Mercury ranged from 0.025 ug/l to 0.31 ug/l in onsite samples, and 0.025 ug/l to 0.25 ug/l in offsite samples, compared with an EQS of 0.07 ug/l. The highest concentration was at BF8, January 2024 (onsite).

Nickel ranged from 1.1 ug/l to 33 ug/l in onsite samples, and 3.1 ug/l to 25 ug/l in offsite samples, compared with an EQS of 4 ug/l. The highest concentration was at BH7, June 2024 (onsite).

Vanadium ranged from 0.1 ug/l to 32 ug/l in onsite samples, and 0.8 ug/l to 24 ug/l in offsite samples, compared with an EQS of 20 ug/l. The highest concentration was at BH7, June 2024 (onsite).

Zinc ranged from 2.3 ug/l to 33 ug/l in onsite samples, and 12 ug/l to 57 ug/l in offsite samples, compared with an EQS of 10.9 ug/l. The highest concentration was at RB2, January 2024 (offsite).

To summarise the recent site investigation data, there were 20 CoCs that exceeded screening criteria; the highest concentration of 12 of these was detected off-site (sulphate, chloride, lead, ammonia, nitrite, iron, chromium, copper, lead, boron, manganese, zinc). It is considered that the source of these contaminants is the landfill upstream of the site. Of the remaining 8 potential CoCs, concentrations of 7 CoCs (pH sodium, aluminium, cadmium, mercury, nickel, vanadium), in on- and off-site samples were sufficiently similar to consider that they are also part of the same suite of potential contaminants affected by landfill leachate. For the one remaining CoC, fluoride, the highest concentration was detected on site in the north of the site, and it is possible that this potential CoC is not solely related to landfill leachate.

Table 7.1 Screening table for 2024 water sampling – on site

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
General Inorganics										
pH	pH Units	9		14	0	7	8.3	12	1	BH7 June 2024
Electrical Conductivity at 20 °C	µS/cm			14	0	200	2620	7300	0	S-07 January 2024
Sulphate as SO4	mg/l	400		14	0	3.93	120	645	1	BH1 January 2024
Chloride	mg/l	250		14	0	30	634	2200	9	S-07 January 2024
Total Phosphate as P	µg/l	28		14	12	10	19.7	130	1	S-07 January 2024
Ammonia as NH3	mg/l	2.5		14	0	0.029	12.4	78	5	BH1 January 2024
Nitrate as NO3	mg/l		50	14	0	0.005	2.51	18	0	BF8 January 2024
Nitrite as NO2	µg/l		500	14	0	1.6	723	4598	3	BF8 January 2024
Alkalinity	mgCaCO3/l			14	0	57	292	580	0	S-07 January 2024
Fluoride	µg/l	1000	1500	14	0	230	2680	8900	11	SW1 January 2024
Heavy Metals / Metalloids										
Boron (dissolved)	µg/l	2000		14	0	15	351	1400	0	BF8 January 2024
Calcium (dissolved)	mg/l			14	0	13	139	340	0	BH1 January 2024
Iron (dissolved)	mg/l	1	0.2	14	0	0.011	0.253	2.8	1	S-06 January 2024
Magnesium (dissolved)	mg/l			14	0	0.074	33.6	120	0	S-07 January 2024
Potassium (dissolved)	mg/l			14	0	2.4	138	420	0	BF2 January 2024
Sodium (dissolved)	mg/l		200	14	0	15	305	950	8	S-07 January 2024
Aluminium (dissolved)[24]	mg/l	10		14	0	0.001	0.351	2.8	0	BH7 June 2024

[24] https://www.gov.uk/government/publications/water-companies-water-treatment-works-discharge-limits-for-environmental-permits/water-companies-water-treatment-works-discharge-limits-for-environmental-permits#:~:text=Aluminium%20discharge%20limits%20to%20sur.

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
Arsenic (dissolved)	µg/l	50		14	0	0.52	2.23	5.86	0	S-07 January 2024
Barium (dissolved)	µg/l			14	0	48	290	1200	0	BH9 June 2024
Beryllium (dissolved)	µg/l			14	13	0.05	0.0536	0.1	0	BH1 January 2024
Cadmium (dissolved)	µg/l	0.08		14	7	0.01	0.156	1.1	2	BH1 January 2024
Chromium (dissolved)	µg/l	4.7	50	14	2	0.1	1.3	4.8	1	BF2 January 2024
Copper (dissolved)	µg/l	1	2000	14	0	1.6	14.9	45	14	BF2 January 2024
Lead (dissolved)	µg/l	1.2	10	14	12	0.1	0.35	2.7	1	S-06 January 2024
Manganese (dissolved)	µg/l	123	50	14	0	0.79	917	3600	6	S-07 January 2024
Mercury (dissolved)	µg/l	0.07	1	14	12	0.025	0.0564	0.31	2	BF8 January 2024
Nickel (dissolved)	µg/l	4	20	14	0	1.1	6.89	33	5	BH7 June 2024
Selenium (dissolved)	µg/l		10	14	4	0.3	3.32	9.7	0	BF2 January 2024
Vanadium (dissolved)	µg/l	20		14	2	0.1	3.42	32	1	BH7 June 2024
Zinc (dissolved)	µg/l	10.9		14	0	2.3	7.52	33	2	BH1 January 2024

Table 7.2 Screening table for 2024 water sampling – off site

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
General Inorganics										
pH	pH Units	9		12	0	6.7	8	9.4	5	WD2 January 2024
Electrical Conductivity at 20 °C	µS/cm			12	0	380	9910	44000	0	FD1 January 2024
Sulphate as SO4	mg/l	400		12	0	14.6	175	652	2	BH1_2 June 2024
Chloride	mg/l	250		12	0	94	3070	15000	8	FD1 January 2024
Total Phosphate as P	µg/l	28		12	2	10	150	440	9	FD1 January 2024

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
Ammonia as NH3	mg/l	2.5		12	0	0.05	255	1200	9	FD1 January 2024
Nitrate as NO3	mg/l		50	12	0	0.07	12.9	47.4	0	WD2 January 2024
Nitrite as NO2	µg/l		500	8	0	6.9	21600	65691	5	WD2 January 2024
Alkalinity	mgCaCO3/l			12	0	99	956	2600	0	FD1 January 2024
Fluoride	µg/l	1000	1500	12	0	470	1700	5000	8	FD4 January 2024
Heavy Metals / Metalloids										
Boron (dissolved)	µg/l	2000		12	0	61	3460	9900	5	WD2 January 2024
Calcium (dissolved)	mg/l			12	0	12	47.2	230	0	BH1_2 June 2024
Iron (dissolved)	mg/l	1	0.2	12	0	0.077	1.86	5	6	WD1 January 2024
Magnesium (dissolved)	mg/l			12	0	4.3	11.9	20	0	WD2 January 2024
Potassium (dissolved)	mg/l			12	0	27	663	2600	0	FD1 January 2024
Sodium (dissolved)	mg/l		200	12	0	51	1240	5700	7	FD1 January 2024
Aluminium (dissolved)	mg/l	10		12	0	0.18	0.886	1.4	0	FD1 January 2024
Arsenic (dissolved)	µg/l	50		12	0	1.28	10.4	29	0	WD2 January 2024
Barium (dissolved)	µg/l			12	0	73	178	480	0	WD1 January 2024
Beryllium (dissolved)	µg/l			12	11	0.05	0.0958	0.1	0	WD1 January 2024
Cadmium (dissolved)	µg/l	0.08		12	10	0.04	0.102	0.59	2	BH1_2 June 2024
Chromium (dissolved)	µg/l	4.7	50	12	0	1.5	3.06	5.8	1	FD1 January 2024
Copper (dissolved)	µg/l	1	2000	12	0	6.5	142	770	12	WD2 January 2024
Lead (dissolved)	µg/l	1.2	10	12	2	0.3	3.81	9.9	8	RB1 January 2024
Manganese (dissolved)	µg/l	123	50	12	0	48	1060	8800	9	WD1 January 2024
Mercury (dissolved)	µg/l	0.07	1	12	11	0.025	0.22	0.25	11	WD1 January 2024
Nickel (dissolved)	µg/l	4	20	12	0	3.1	8.82	25	8	FD1 January 2024
Selenium (dissolved)	µg/l		10	12	5	2	35.2	150	5	WD2 January 2024

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
Vanadium (dissolved)	µg/l	20		12	3	0.8	7.87	24	1	WD2 January 2024
Zinc (dissolved)	µg/l	10.9		12	0	12	26.2	57	12	RB2 January 2024

Table 7.3 Screening table for all water samples

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
General Inorganics										
pH	pH Units	9		648	0	4	7.64	12	26	BH7 June 2024
Electrical Conductivity at 20 °C	µS/cm			648	0	34	6220	180000	0	FD1 July 2022
Sulphate as SO4	mg/l	400		648	0	0.767	140	1720	61	FD1 July 2022
Chloride	mg/l	250		648	0	1.6	1780	54000	493	FD1 July 2022
Total Phosphate as P	µg/l	28		344	210	0	66	3000	112	MH7 July 2022
Ammonia as NH3	mg/l	2.5		648	4	0.0075	55.9	1500	407	FD1 November 2021
Nitrate as NO3	mg/l		50	136	0	0.005	24.2	128	22	FD4 December 2020
Nitrite as NO2	µg/l		500	132	8	1.6	3780	72000	53	FD1 May 2021
Alkalinity	mgCaCO3/l			101	8	1.5	260	2600	0	FD1 January 2024
Fluoride	µg/l	1000	1500	26	0	230	2230	8900	19	SW1 January 2024
Heavy Metals / Metalloids										
Boron (dissolved)	µg/l	2000		136	0	11	751	9900	9	WD2 January 2024
Calcium (dissolved)	mg/l			136	0	2	75.3	680	0	S-07 February 2022
Iron (dissolved)	mg/l	1	0.2	136	0	0.008	0.561	5	24	WD1 January 2024
Magnesium (dissolved)	mg/l			136	0	0.074	20.8	200	0	S-07 February 2022
Potassium (dissolved)	mg/l			648	0	1.4	510	13000	0	FD1 June 2021

Test	Units	EQS	DWS	No. Samples	Non detects	Min	Average	Max	No. exceedances	Highest conc. place & date
Sodium (dissolved)	mg/l		200	648	0	2.8	1030	23000	470	FD1 July 2022
Aluminium (dissolved)	mg/l	10		436	4	0	0.47	6.52	0	BF2 May 2021
Arsenic (dissolved)	µg/l	50		136	0	0.33	7.04	43.1	0	FD1 February 2022
Barium (dissolved)	µg/l			136	0	6.1	238	4100	0	S-05 January 2021
Beryllium (dissolved)	µg/l			136	125	0.05	0.0592	0.3	0	RB0 May 2021
Cadmium (dissolved)	µg/l	0.08		136	26	0.01	0.149	1.7	58	WD2 February 2022
Chromium (dissolved)	µg/l	4.7	50	136	2	0.1	2.76	11	15	FD1 February 2022
Copper (dissolved)	µg/l	1	2000	630	3	0.25	49.3	1500	624	FD1 April 2021
Lead (dissolved)	µg/l	1.2	10	592	187	0.1	1.13	16	99	S-08 April 2022
Manganese (dissolved)	µg/l	123	50	136	0	0.79	541	8800	66	WD1 January 2024
Mercury (dissolved)	µg/l	0.07	1	136	92	0.025	0.092	0.68	52	BF2 May 2021
Nickel (dissolved)	µg/l	4	20	136	4	0.25	5.34	34	46	S-07 February 2022
Selenium (dissolved)	µg/l		10	136	12	0.3	10.1	150	44	WD2 January 2024
Vanadium (dissolved)	µg/l	20		136	5	0.1	6.1	32	2	BH7 June 2024
Zinc (dissolved)	µg/l	10.9		592	3	0.25	15.7	220	267	WD2 October 2022

7.2 Assessment of impact on surface water quality in the Red Brook

The methodology outlined in the latest Environment Agency guidance for assessing surface water pollution risk (updated 25 February 2022)[25] has been used to calculate the potential impacts of the site discharge on water quality in the Red Brook. The assessment assumes that there is a discharge of surface water through the site drainage system, with concentrations of potential CoCs at the average of the concentrations measured in on-site samples. The discharge enters the Red Brook at the site outfall, where it mixes with the water in the Red Brook. Note that the methodology refers to an 'effluent' concentration, as it is designed to calculate the impact of industrial effluent on receiving water quality. We use the same terminology, but the 'effluent' refers to discharge of rainfall run-off and groundwater derived site drainage, with no contribution from any industrial process.

For each contaminant of concern, an average site concentration is calculated as a time series, for each site monitoring round. A time series graph is shown for each contaminant of concern in Appendix I. The site average concentration is the proxy used to estimate the likely effluent concentration.

To calculate the Process Contribution (PC) the effluent flow and receiving water flow are required. HFCL Technical Note '30496TN6.1 Dilution Calculations' (Appendix J) details the method used to calculate the effluent flow and receiving water flow at the site.

The Process Contribution (PC) is calculated as follows:

PC = (Effluent flow * Effluent concentration) / (effluent flow + receiving water flow)

As the receiving water flow is 65 times the effluent flow, this equation reduces to

PC = Effluent concentration/66

EA guidance advises that contaminants where the PC is less than 4% of the EQS can be disregarded, as it is highly unlikely that there will be a significant impact on the quality of the receiving water (Test 2 in the guidance). The EQS and 4% of the EQS are shown as a solid line and a dashed line respectively on the time series graphs in Appendix I.

Having calculated the Process Contribution, the Predicted Environmental concentration (PEC) is calculated as the process contribution (PC) plus the background concentration (BC).

PEC = PC + BC

For the background concentration (BC) data from sampling location RB3 is used, located just upstream of the site outfall. The data from RB3 for each sampling round is shown on the time series graphs in Appendix I. Also shown for context is the data from RB4, just downstream of the site outfall, as well as the calculated PEC.

The difference between BC and PEC is calculated, if this is greater than 10% of the EQS then further assessment is required (Test 3 in the guidance).

Finally, the PEC is compared to the EQS, if PEC is greater than EQS then further assessment is required (Test 4 in the guidance).

[25] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit#screening-tests-freshwaters

Table 7.4 shows the contaminants of concern identified and the results of the dilution screening test.

Table 7.4 Contaminants of concern

Contaminant of concern	PC > 4% of EQS (Test 2)	PEC minus BC > 10% EQS? (Test 3)	PEC > EQS (Test 4)	Further assessment required
Sulphate as SO_4	PC < 4% of EQS			No
Chloride	PC > 4% of EQS (in 15/23 sample rounds, average 5% of EQS)	<10% EQS in all sample rounds	PEC > EQS (in 9/15 rounds)	Yes
Phosphate as P	PC > 4% of EQS (in 2/12 sample rounds)	>10% EQS (in 1/2 rounds) but on average <10% EQS	PEC > EQS (in 2/2 rounds)	Yes
Ammonia as NH_3	PC > 4% of EQS (in 21/23 sample rounds)	>10% EQS (in 7/20 rounds) but on average <10% EQS	PEC > EQS (in 8/20 rounds)	Yes
Nitrate as NO_3*	PC < 4% of EQS			No
Nitrite as NO_2*	PC > 4% of EQS (in 1/5 sample rounds)	<10% EQS in all sample rounds	PEC < EQS in all sample rounds	No
Fluoride	PC > 4% of EQS (in 1/1 sample rounds)	<10% EQS in all sample rounds	PEC < EQS in all sample rounds	No
Boron	PC < 4% of EQS			No
Iron	PC < 4% of EQS			No
Sodium*	PC > 4% of EQS (in 9/23 sample rounds)	<10% EQS in all sample rounds	PEC > EQS (in 6/9 rounds)	Yes
Cadmium	PC < 4% of EQS			No
Chromium	PC < 4% of EQS			No
Copper	PC > 4% of EQS (in 23/23 sample rounds)	>10% EQS (in 20/20 rounds)	PEC > EQS (in 19/20 rounds)	Yes
Lead	PC < 4% of EQS			No

Contaminant of concern	PC > 4% of EQS (Test 2)	PEC minus BC > 10% EQS? (Test 3)	PEC > EQS (Test 4)	Further assessment required
Manganese	PC > 4% of EQS (in 4/5 sample rounds)	>10% EQS (in 1/4 rounds)	PEC > EQS (in 2/4 rounds) but on average PEC < EQS	Yes
Mercury	PC > 4% of EQS (in 1/5 sample rounds)	<10% EQS in all sample rounds	PEC < EQS in all sample rounds	No
Nickel	PC < 4% of EQS			No
Selenium*	PC < 4% of EQS			No
Vanadium	PC < 4% of EQS			No
Zinc	PC < 4% of EQS			No

*or DWS where there is no EQS

The process contribution was above 4% of the EQS for the following potential CoCs:

Chloride, phosphate, ammonia, nitrite, fluoride, sodium, copper, manganese, mercury.

Of these potential CoCs, the Predicted Environmental Contribution (PEC) minus the background concentration was less than 10% of the EQS for chloride, phosphate, ammonia, nitrite, fluoride, sodium, and mercury (Test 3). The PEC was less than the EQS (Test 4) for nitrite, fluoride, manganese, and mercury. Where both of these tests were satisfied the potential CoC was screened out, leaving only the below potential CoCs:

Chloride, ammonia, phosphate, sodium, manganese, copper.

Of these six contaminants ammonia is listed as a non-hazardous pollutant[26], while chloride, phosphate, sodium, copper, and manganese are not listed as a hazardous substance or a non-hazardous pollutant in groundwater. A summary of the average results for these six contaminants is shown in Table 7.5.

Table 7.5 Average dilution results across all sampling rounds

Potential CoC	Units	EQS	Average site concentration	Average PC	Average BC at RB3	Average PEC	FD1
Chloride	mg/l	250	807	12	360	370	15740
Phosphate as P	µg/l	28	52	0.8	48	49	430
Ammonia as NH3	mg/l	2.5	16	0.2	5.1	5.4	620
Sodium	mg/l	200	500	7.5	230	230	8550
Copper	µg/l	1	50	0.8	9.9	11	140
Manganese	µg/l	123	540	8.1	85	93	150

The average background concentration in the Red Brook across all the sample round exceeds the EQS for all the potential contaminants of concern with the exception of manganese. The concentration at the top of the field ditch, off-site and adjacent to the landfill, exceeds the site concentration for all potential contaminants apart from manganese.

Given high background concentrations, and high concentrations adjacent to the site, the site discharge is not considered to be having a significant impact on the quality in the Red Brook for chloride, phosphate, ammonia, sodium, and copper.

The high average concentration of manganese on site is elevated by the groundwater samples. For the 2024 samples the on-site average is 920 µg/l including groundwater underlying the site, and only 37 µg/l when groundwater samples are excluded. This suggests the elevated concentrations are restricted to the groundwater and are likely to be a naturally occurring. Oxidisation in surface water will precipitate out the manganese leading to the lower elevations seen in the surface water.

[26] https://wfduk.org/resources/groundwater-hazardous-substances-standards

Spatial plots showing the distribution of chloride, phosphate, ammonia, sodium, copper, and manganese on the site and surrounding area are shown in Appendix K. The spatial distribution of chloride, and ammonia in particular, clearly show that the highest concentrations are consistently found in the Field Ditch adjacent to the site, in particular FD1 which is upstream of the majority of the site and thought to be fed by landfill leachate. This suggests that the landfill is a highly polluting source, which is likely a source of high concentrations of contaminants to the site, given the site is downgradient of surface and groundwater flow from the landfill

7.3 Controlled waters risk assessment summary

High concentrations of chloride, phosphate, ammonia, sodium and copper are derived from landfill leachate, as seen from samples at FD1, and result in concentrations that are elevated above EQS in waters at the site. Concentrations in the Red Brook are also elevated above the EQS, as a result of landfill leachate.

Manganese is elevated in site samples compared with the EQS; this is due to high concentrations in groundwater, thought to be naturally occurring; manganese oxidises to an insoluble form when oxidised in surface water and is not considered to present a risk to surface water quality in this setting.

The predicted impact of allowing the site to drain freely on the quality in the Red Brook is considered to be insignificant.

This assessment is considered to be conservative, as the average site concentration includes a range of sample locations that include standing water. The site discharge, once the drainage system is functioning as it was designed, will derive from rainfall run-off and be more dilute than the concentrations used in the assessment.

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8 SOIL GAS RISK ASSESSMENT

Soil gas monitoring and assessment has been undertaken in general accordance with CIRIA Guidance[27] and BS8576[28].

Based on information provided in BS8576 and the potential for gas generation, the number of rounds and frequency of gas monitoring should be undertaken over a period of between 2 months and 6 months with up to fortnightly readings. This intensity of gas monitoring was not part of the scope of works, however up to three rounds of monitoring have been taken over a 6 month period, giving sufficient data for a preliminary risk assessment to be undertaken. Further monitoring is recommended to confirm the results.

8.1 Gas screening values and characteristic situation

Gas screening values (GSV) and associated characteristic situation (CS), have been determined to provide a semi-quantitative risk assessment of the gas regime at the site. These are discussed below and presented in Table 8.1.

The CS is calculated for methane and carbon dioxide using the maximum recordable concentration and the maximum recordable gas flow rate in order to represent a worst-case scenario.

For other gases, in the absence of GSVs, workplace exposure limits (WELs) provided by the Health and Safety Executive (HSE) are used as screening data; WEL limits are published in EH 40[29].

The WELs are listed as follows:

- H_2S – Long term: 5 ppm (0.0005%) and short term 7 ppm (0.0007%)[29];
- H_2 – no levels exist;
- CO - Long term: 30 ppm (0.003%) and short term 200 ppm (0.02%)[29];

Table 8.1: Gas screening values and characteristic situation criteria

Characteristic Situation (CIRIA R149)	Risk Classification	Gas Screening Value (GSV) (CH_4 or CO_2) (l/hr)[1] Threshold	Additional Factors	Typical Source of Generation
1	Very low risk	<0.07	Typically methane <1% and / or carbon dioxide <5%. Otherwise consider increase to situation 2.	Natural soils with low organic content. "Typical" made ground.

[27] • CIRIA report C665, 2007

[28] British Standard BS8576, 2013

[29] https://www.hse.gov.uk/

Characteristic Situation (CIRIA R149)	Risk Classification	Gas Screening Value (GSV) (CH_4 or CO_2) (l/hr)[1] Threshold	Additional Factors	Typical Source of Generation
2	Low risk	<0.7	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider increase to characteristic situation 3.	Natural soil high peat / organic content.
3	Moderate risk	<3.5		Old landfill, inert waste, old mineworking flooded.
4	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26b criteria)
5	High risk	<70		Mineworking unflooded inactive with shallow workings near surface.
6	Very high risk	>70		Recent landfill site.

8.2 Gas sampling results and assessment

Based on the small data set, the maximum steady flow rate and maximum concentrations for methane and carbon dioxide data were used from each monitoring round rather than the maximum flow and concentration overall. This was undertaken in order to compare results and identify any correlation with atmospheric pressure changes and other influencing factors such as groundwater levels. The corresponding CS for each location for the January and June gas monitoring rounds are presented in Table 8.2 and Table 8.3.

Negative flow rates were recorded in Gas spike 23 during January and BH1 during the June sampling round; these usually occur when the ground is effectively sealed or has only limited permeability resulting in atmospheric air being inhibited from entering the ground[4]; these are therefore not included in the assessment.

The laboratory sample results are also not included in the calculation of the characteristic situation as the flow was set during the canister sampling at 12l/hr and does not represent the normal flow of gas from the borehole.

8.2.1 Methane

Maximum steady state flow rates and maximum concentrations for the two monitoring rounds for methane are presented in Table 8.2 below, with the worst-case resulting CS presented in Figure 8.1.

Table 8.2: Characteristic situation of each sample location for methane

Date	Location	Flow (l/hr)	Max Conc.%	GSV	CS
17/01/24	BH3	0.9	0	0	CS1
17/01/24	BH6	0	0	0	CS1
17/01/24	Gas Spike 2	0.9	0	0	CS1
17/01/24	Gas Spike 6	1	0	0	CS1
17/01/24	Gas Spike 9	0	0	0	CS1
17/01/24	Gas Spike 13	0.4	0	0	CS1
17/01/24	Gas Spike 16	0.3	0	0	CS1
17/01/24	Gas Spike 18	0.3	0	0	CS1
17/01/24	Gas Spike 21	0	0	0	CS1
17/01/24	Gas Spike 22	0.3	0	0	CS1
17/01/24	Gas Spike 23	-0.3	0	0	CS1
26/06/24	BH1	-0.8	0	0	CS1
26/06/24	BH2	3.4	0	0	CS1
26/06/24	BH3	0.2	0.5	0.1	CS1
26/06/24	BH5	0.1	0	0	CS1
26/06/24	BH6	0.2	0	0	CS1
26/06/24	BH7	0.1	0.1	0.01	CS1
26/06/24	BH8	0.1	0	0	CS1
26/06/24	BH9	3.4	0.1	0.55	CS2
26/06/24	BH10	0.2	0	0	CS1
26/06/24	Gas Spike 2	0	0	0	CS1
26/06/24	Gas Spike 9	0.1	0	0	CS1
26/06/24	Gas Spike 13	0	0	0	CS1
26/06/24	Gas Spike 16	0.1	0	0	CS1
26/06/24	Gas Spike 21	0.1	0	0	CS1

Figure 8.1: Worst case characteristic situation results for methane

The initial results show all locations to be CS1 (very low risk) for methane with the exception of BH9 during the June monitoring round, which was calculated as CS2 (low risk). Groundwater levels were above the borehole screen at each of the borehole locations; water data was not available for the gas spikes.

8.2.2 Carbon dioxide

Maximum steady state flow rates and maximum concentrations for the two monitoring rounds for carbon dioxide are presented in Table 8.3 below, with the worst-case resulting CS presented in Figure 8.2.

Table 8.3: Characteristic situation of each sample location for carbon dioxide

Date	Location	Flow (l/hr)	Max Conc.%	GSV	CS
17/01/24	BH3	3	0.5	1.5	CS3
17/01/24	BH6	0	0	0	CS1
17/01/24	Gas Spike 2	0.9	0	0	CS1
17/01/24	Gas Spike 6	1	0	0	CS1
17/01/24	Gas Spike 9	0	0	0	CS1
17/01/24	Gas Spike 13	0.4	0	0	CS1

Date	Location	Flow (l/hr)	Max Conc.%	GSV	CS
17/01/24	Gas Spike 16	0.3	0	0	CS1
17/01/24	Gas Spike 18	0.3	0	0	CS1
17/01/24	Gas Spike 21	0	0	0	CS1
17/01/24	Gas Spike 22	0.3	0	0	CS1
17/01/24	Gas Spike 23	-0.3	0	0	CS1
26/06/24	BH1	-0.8	1.4	-1.12	N/A
26/06/24	BH2	2.6	0.3	0.78	CS3
26/06/24	BH3	0.2	0.8	0.16	CS2
26/06/24	BH5	0.1	0	0	CS1
26/06/24	BH6	0.2	0.1	0.02	CS1
26/06/24	BH7	0.1	0	0	CS1
26/06/24	BH8	0.1	0.7	0.07	CS2
26/06/24	BH9	3.4	6.2	21.08	CS5
26/06/24	BH10	0.2	0	0	CS1
26/06/24	Gas Spike 2	0	1.6	0	CS1
26/06/24	Gas Spike 9	0.1	0.9	0.09	CS2
26/06/24	Gas Spike 13	0	0.1	0	CS1
26/06/24	Gas Spike 16	0.1	0.1	0.01	CS1
26/06/24	Gas Spike 21	0.1	0.2	0.02	CS1

Figure 8.2: Worst case characteristic situation for carbon dioxide

A summary of the results is as follows:

- The initial results show the majority of locations to be CS1 (very low risk) for carbon dioxide
- BH2, monitored during June was reported as CS3 (moderate risk)
- BH3 was reported as CS2 during January and June (low risk)
- BH8 was reported as CS2 during June (low risk)
- BH9 and gas spike 9, during June, were reported as CS5 (High risk) and CS2 (low risk) respectively.

The locations of the boreholes and gas spikes assessed to be above CS1 (CS2 - low risk to CS5 – high risk) are located in the northern portion of the main site adjacent to the building (BH2 and BH3), near the office block (G9 and BH8) and BH9 with the highest risk (CS5) located near to the site entrance.

It is expected that the higher risk results derive from artificially high flow rates induced from a high water table, and further monitoring is recommended to confirm that the risks to buildings are likely to be low.

8.2.3 Hydrogen

Hydrogen gas was not present above the limit of detection in the bulk gas samples collected from the site.

8.2.4 Hydrogen sulphide

Hydrogen sulphide gas was not present above the limit of detection in the bulk gas samples collected from the site.

8.2.5 Carbon monoxide

Locations where concentrations of carbon monoxide were recorded above the long term WEL of 0.003% include BH1 (0.004%), BH2 (4%), gas spike 9 (0.021%) and gas spike 16 (0.0138%). The short term WEL (0.02%) was also exceeded at BH2 and gas spike 9. These are located in the northern part of the main site, by the office building.

8.2.6 Ammonia

Ammonia gas has not been monitored or measured in the bulk gas samples due to the constraints of the meters and the laboratory services available. The bulk gas concentrations in the gas samples taken sum to 100%, indicating that if ammonia is present in soil gas it is at trace concentrations.

9 UPDATED CONCEPTUAL MODEL AND RISK ASSESSMENT

The results of the site investigation have been used to inform a Generic Quantitative Risk Assessment (GQRA) to include:

- a review of soil data against CIEH/S4UL levels (human health risk assessment),
- a review of groundwater and surface water data against Environmental Quality Standards
- dilution calculations to assess the likely effect of discharge of site run-off on local receiving waters
- a preliminary assessment of risks to human health and infrastructure arising from ground gases.

The results of the risk assessments are summarised within the Source-Pathway- receptor site conceptual model, in Table 9.1 below.

Table 9.1: Updated CSM and risk assessment

Source	Pathway	Receptor	
S1: Chemicals potentially present in soils on site	P1: direct dermal contact (e.g. skin exposure) with chemicals of concern	R1: current or future site users such as workers and visitors.	Concentrations of potential CoCs in soil did not exceed screening values for commercial land use. Additionally, the majority of the site is covered in hardstanding. However, four potential contaminants of concern exceeded screening values for residential use, therefore reassessment would be required for any future change of land use. Potential contaminants of concern that create vapours, such as solvents and fuels, were not detected in the recent site investigations, indicating low risks arising from vapours Asbestos was not detected in soil samples. **Current or similar commercial land use: low risk** **Change in land use: reassessment required to confirm a likely low risk**
	P2: ingestion of chemicals of concern		
	P3: inhalation of dust, gas and vapours	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties	
	P4: vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone	R3: current or future users of groundwater abstracted for human use	Concentrations of potential CoCs in soil are not thought to be making a significant contribution to variable surface water and groundwater quality at the site; additionally, much of the site is covered in hard standing further

Source	Pathway	Receptor	
		R4: current or future water supply users, where water supply pipes are impacted by contaminants R5: groundwater beneath, or in the vicinity of the site (secondary A aquifer) R6: current or future groundwater abstractions	reducing the risk that potential CoCs in soil have a significant effect on the identified receptors. There are no current surface or groundwater abstractions downstream of the site that might be significantly affected by potential CoCs **Current or similar commercial land use: low risk** **Change in land use: low risk**
	P5: migration of groundwater to surface water via groundwater flooding and baseflow	R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee R8: current or future potential surface water abstractions R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI	
	P6: surface water run-off	R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee R8: current or future potential surface water abstractions R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC)	

Source	Pathway	Receptor	
		R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI	
	P7: permeation through pipework into water supply network	R4: current or future water supply users, where water supply pipes are impacted by contaminants	Permeation of contaminants into water supply networks is associated with organic chemicals permeating plastic water supply pipes. There is no evidence of significant concentrations of organic contaminants in soil or groundwater. **Current or similar commercial land use: low risk** **Change in land use: further assessment focussing on a particular location is advised if water supply pipes are to be lain in the future**
	P8: volatilisation from soil and/or groundwater to air (indoor and outdoor)	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties	Potential CoCs that are volatile and associated with risks arising from soil vapour were not present above the limit of detection at the site **Current or similar commercial land use: low risk** **Change in land use: likely low risk but a reassessment would be required to target the location of receptors**
S2: Ground gases including methane (CH_4), carbon dioxide (CO_2), hydrogen sulphide (H_2S) and hydrogen (H_2) and ammonia from made ground, infilled locations, underlying natural strata and off-site landfill.	P3: inhalation of gas and vapours P9: gas migration through unsaturated zone and accumulation within confined spaces	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties	Preliminary results indicate that hydrogen was not present in soil gas samples obtained from the site, and that the gas regime for methane and carbon dioxide is predominantly low risk, but high gas flows at a small number of locations indicate high risk. The highest flows and concentrations were at locations away from buildings, reducing the significance of these findings. **Current or similar commercial land use: Further gas monitoring and assessment of a larger data set is required to confirm that risks are likely to be low under the current site use. In the absence of additional data, gas protection measures may be required for new buildings.** **Change in land use: Given the hazardous nature of the gases that may be associated with the neighbouring landfill, a robust data set would be required to assess potential risks for a residential land-use.**

Source	Pathway	Receptor	
S3: Groundwater and surface waters impacted by leachate from adjacent landfill	P5: migration of groundwater to surface water via groundwater flooding and baseflow P6: surface water run-off	R3: current or future users of groundwater or surface water abstracted for human use R5: groundwater beneath, or in the vicinity of the site (secondary A aquifer); R6: current or future groundwater abstractions; R7: surface water bodies including the Red Brook, Wych Upper water body and the River Dee; R8: current or future surface water abstractions; and R9: Midland meres and mosses RAMSAR site and Special Area of Conservation (SAC) R10: River Dee and Bala Lake Special Area of Conservation, RAMSAR and SSSI	20 CoCs exceeded screening criteria and are considered to be associated with the landfill upstream of the site; with the possible exception of fluoride (the highest concentrations were on-site, however there is only one set of monitoring data hence no indication of variability in on- and off-site concentrations). The measured fluoride concentrations are not considered to present a significant risk to controlled waters. **Current or similar commercial land use: Low risk. Site investigation and assessment indicates risks to controlled waters arising from the site (current and historic land use) are low, given the site setting and background concentrations deriving from the adjacent landfill.** **Change in land use: As above**
	P7: permeation through pipework into water supply network	R1: current or future site users such as workers and visitors. R2: current or future users of surrounding properties; and R4: current or future water supply users, where water supply pipes are impacted by contaminants	Permeation of contaminants into water supply networks is associated with organic chemicals permeating plastic water supply pipes. There is no evidence of significant concentrations of organic contaminants in soil or groundwater. **Current or similar commercial land use: low risk** **Change in land use: further assessment focussing on a particular location is advised if water supply pipes are to be lain**
S4: asbestos fibres/fragments in soils	P3: inhalation of dust	R1: current or future site users such as workers and visitors.	Asbestos was not detected in soil samples

Source	Pathway	Receptor	
		R2: current or future users of surrounding properties.	Demolition and asbestos removal works should be undertaken in accordance with current guidance and legislation under controlled conditions by licenced contractors to prevent spread of asbestos fibres and fragments. **Current or similar commercial land use: low risk (with the proviso set out above)** **Change in land use: low risk (with the proviso set out above, further sampling recommended post demolition).**

10 SITE CONDITION AND PERMITTING

Regulations 24 and 25, and Clause 14 of Schedule 5, of the Environmental Permitting (England and Wales) Regulations 2016 (EPR) deal with surrender of Environmental Permits. Regulation 25 allows that an operator may surrender an Environmental Permit by application to the regulator, and Clause 14 1) b) requires that:

'the regulator must accept an application for the surrender of an environmental permit ... if it is satisfied that the necessary measures have been taken—

(a) to avoid a pollution risk resulting from the operation of the regulated facility,

(b) to return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation.

10.1 Site condition

The original permit application did not include an intrusive investigation, and the original condition of the site, including pollution impacts arising from the operation of the adjacent aluminium foundry and landfill , is not known. However, recent site investigation data indicate that soil quality is satisfactory. Impacts to surface water, groundwater and soil gas deriving from the adjacent landfill would occur whether or not the site were in operation and are not relevant to the consideration of the application to surrender the environmental permit.

10.2 Permit surrender

Appendix L presents correspondence between Befesa Salt Slags regarding the surrender of the environmental permit. NRW's letter of 1 July 2022 to Befesa states that the contents of the surface water lagoon need to be cleared from site prior to surrender of the permit.

NRW advised that they consider there are two options available to Befesa in relation to this.

1) to tanker off the liquid content (to a suitably permitted site). This option could commence as soon as a suitably permitted site has been located to accept the waste water.

2) to apply for a permit variation to allow the discharge of the liquid to the controlled water. Discharge would not be able to commence until the variation had been determined and the impact fully considered. There is no guarantee that permission would be granted for this and pre-treatment of the effluent may be required. Once the effluent has been removed the lagoon would need to be de-sludged (and the material sent to a suitably permitted site) and liner removed before it is backfilled with suitable material.

Table 10.1 compares the water quality in the lagoon, compared with the average of water quality from samples at the site. It can be seen that all determinands in the lagoon are lower than the maximum site concentrations, and that all determinands in the lagoon are below the site average, with the exception of fluoride, copper and lead.

Table 10.1 Lagoon water quality

Test	Units	EQS	DWS	Min	Average	Max	BF5 17/01/2024
General Inorganics							
pH	pH Units	9		7	8.3	12	8.5
Electrical Conductivity at 20 °C	µS/cm			200	2620	7300	1700
Sulphate as SO4	mg/l	400		3.93	120	645	67

Test	Units	EQS	DWS	Min	Average	Max	BF5 17/01/2024
Chloride	mg/l	250		30	634	2200	440
Total Phosphate as P	µg/l	13		10	19.7	130	< 20
Ammonia as NH3	mg/l	2.5		0.029	12.4	78	0.18
Nitrate as NO3	mg/l		50	0.005	2.51	18	1.79
Nitrite as NO2	µg/l		500	1.6	723	4598	43
Alkalinity	mgCaCO3/l			57	292	580	200
Fluoride	µg/l	1000	1500	230	2680	8900	3700
Heavy Metals / Metalloids							
Boron (dissolved)	µg/l	2000		15	351	1400	690
Calcium (dissolved)	mg/l			13	139	340	20
Iron (dissolved)	mg/l	1	0.2	0.011	0.253	2.8	0.14
Magnesium (dissolved)	mg/l			0.074	33.6	120	7.3
Potassium (dissolved)	mg/l			2.4	138	420	130
Sodium (dissolved)	mg/l		200	15	305	950	240
Aluminium (dissolved)	mg/l		0.2	0.001	0.351	2.8	0.234
Arsenic (dissolved)	µg/l	50		0.52	2.23	5.86	1.89
Barium (dissolved)	µg/l			48	290	1200	71
Beryllium (dissolved)	µg/l			0.05	0.0536	0.1	< 0.1
Cadmium (dissolved)	µg/l	0.08		0.01	0.156	1.1	< 0.02
Chromium (dissolved)	µg/l	4.7	50	0.1	1.3	4.8	1.1
Copper (dissolved)	µg/l	1	2000	1.6	14.9	45	18
Lead (dissolved)	µg/l	1.2	10	0.1	0.35	2.7	1
Manganese (dissolved)	µg/l	123	50	0.79	917	3600	12
Mercury (dissolved)	µg/l	0.07	1	0.025	0.0564	0.31	< 0.05
Nickel (dissolved)	µg/l	4	20	1.1	6.89	33	2.2
Selenium (dissolved)	µg/l		10	0.3	3.32	9.7	3.3
Vanadium (dissolved)	µg/l	20		0.1	3.42	32	1.2
Zinc (dissolved)	µg/l	10.9		2.3	7.52	33	6.1

10.3 Site discharge

Further to decommissioning of the lagoon, NRW confirmed that the drainage system could be opened to allow direct discharge of surface water, as set out in their email of Friday, August 5, 2022 10:11 AM

> *'To follow up as discussed previously at the meeting, you stated that once the lagoon had been fully decommissioned (by either of the mechanisms described in our letter) and all other pollution sources had been removed from site, that the drainage system could be opened to allow direct discharge of surface water. I can confirm that this is our position'*

11 CONCLUSIONS

H Fraser Consulting Ltd (HFCL) was instructed by Mark Wakefield Demolition Ltd (MWD) to undertake site investigations at a site in Fenn's Bank which was formerly operated by Befesa as an aluminium slag reprocessing plant. The site operated under an environmental permit (EP), which is still in force (ref EPR-VP3030BX).

The site is adjacent to, and downgradient of, a landfill formed of waste aluminium slag, which has been remediated by the Environment Agency. Leachate from the landfill is known to have formed a plume below the site, and to discharge into local surface water courses. Recent data indicates that emission of leachate from the landfill is ongoing. Furthermore, the landfill has emitted or is emitting gas: there is a large on-site surface water lagoon, whose lining has risen to form an 'island' in the lagoon, due to an underlying gas bubble. The landfill materials may generate methane, ammonia and hydrogen, and the gas bubble could comprise one or all of these of these gases.

Under the site's environmental permit, no discharge of water is permitted from the site. While the site was operational, surface water was collected in the lagoon and used in the process. When site operations ceased, surface water was no longer consumed by the process; and in the absence of a formal discharge arrangement, rainfall falling on the site discharged informally via the road system to the nearby Red Brook, and to a field ditch along the south-western site boundary.

MWD has recently purchased the site, and wishes to understand the current site condition, to support sale and/or development of the site. This report has been prepared to provide further information on the site conditions, and to accompany a permit surrender application.

A site investigation (SI) undertaken between January and July 2024 by HFCL, included soil sampling, installation of gas spikes and boreholes, gas and groundwater monitoring, and surface water sampling.

A GQRA was undertaken to assess potential risks to human health and controlled waters receptors.

It is concluded that:

11.1 Constraints to land use

- Risks to human health under the current site use, arising from concentrations of potential contaminants of concern in soils, are considered to be low
- Preliminary indications are that risks arising from soil gas, under the current site use, are low; it is recommended that further monitoring of soil gases is undertaken to confirm this.
- Appropriate health and safety measures with regards to soil and water quality should be implemented for construction work, or maintenance works involving contact with soils and groundwater, or entry into confined spaces.
- Further targeted investigations would be required to confirm whether the site is suitable for residential land use, particularly with regard to soil gas. Preliminary indications are that on-site soil and water concentrations may not pose a risk to future site users under a change of land use, however further investigation would be required to confirm this. A significantly more robust monitoring data set would be required with regard to soil gas to confirm whether the landfill might present an ongoing risk to a future residential land use. In any event, the proximity of the landfill may preclude change of land use in planning terms, and further advice should be sought in this regard.

11.2 Permit surrender

- Site data indicate that the operation of the reprocessing plant has not had an impact on soil and groundwater quality that can be distinguished from impacts arising from landfill leachate, deriving from the adjacent landfill.
- Groundwater and surface water in and around the site are impacted by landfill leachate, with the highest concentrations found off-site close to the landfill (with the exception of fluoride where the highest concentration is measured on site, but at concentrations that are not considered to present a significant risk to controlled waters quality). The likely impact of drainage from the site on receiving surface waters is not considered to be significant, owing to high background concentrations.
- NRW has indicated that the on-site lagoon must be emptied and decommissioned, in line with appropriate waste management regulations, before the environmental permit can be surrendered.

12 RECOMMENDATIONS

It is recommended that:

- Further soil gas monitoring is undertaken to confirm that risks arising from soil gases are low
- The lagoon is emptied and decommissioned under appropriate waste management procedures, given due consideration to management of the gas bubble below the lagoon lining.
- There may be an option to empty the lagoon into a receiving water course, rather than off-site disposal to a waste facility. Note that this would require a permit variation prior to surrender of the permit, and there is no certainty that a permit variation would be approved
- The permit for the site is surrendered

13 REFERENCES

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APPENDIX A

Borehole Logs

H Fraser Consulting
Contaminated Land and Hydrogeology

BOREHOLE LOG BH1

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 11/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350574.174, 339149.155
SURFACE ELEVATION 90.480 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments The borehole was drilled with a cable percussion rig. The drillers added water constantly to clean the drilling string, which made the logged material appear muddier than it would be in natural conditions.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0.2					Soft, dark brown sandy, gravelly clay. Sand is fie to coarse and gravel is fine to coarse and includes quartz, brick and concrete. Metal and plastic fragment present. MADE GROUND.		0.2
0.4							0.4
0.6							0.6
0.8							0.8
1	Sample 1					Bentonite and plain pipe	1
1.2					Soft, dark grey-brown sandy, gravelly clay. Sand si fine to coarse and gravel is coarse to cobble and incldues brick and concrete fragments. MADE GROUND.		1.2
1.4	Sample 2						1.4
1.6					Very soft, red-brown silty, sandy CLAY. Sand is fine.		1.6
1.8							1.8
2							2
2.2							2.2
2.4						Gravel in slotted pipe	2.4
2.6							2.6
2.8							2.8

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H Fraser Consulting
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BOREHOLE LOG BH2

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 11/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350614.915 339147.111
SURFACE ELEVATION 90.471 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments The borehole was drilled with a cable percussion rig. The drillers constantly added water to clean the drilling string, making the logged material appear muddier than in natural conditions.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0.2					Light brown and red sandy gravelly silt. Sand is fine to coarse and gravel is medium to cobble and includes quartz and flint fragments and abundant brick, concrete and plastic fragments. MADE GROUND		0.2
0.4							0.4
0.6							0.6
0.8							0.8
1						Bentonite and plain pipe	1
1.2							1.2
1.4	Sample 1				Stiff, light brown, reddish sandy, CLAY with light grey bands containing sand and gravel.		1.4
1.6							1.6
1.8							1.8
2	Sample 2						2
2.2							2.2
2.4						Gravel in slotted pipe	2.4
2.6					Firm, light brown, reddish sandy CLAY with light grey bands containing sand and gravel with sand content increasing.		2.6
2.8							2.8

produced by ESlog.ESdat.net on 24 Jan 2024

H Fraser Consulting
Contaminated Land and Hydrogeology

BOREHOLE LOG BH3

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 11/12/2023
TOTAL DEPTH 1 m
DIAMETER 52 mm

COORDINATES 350649.802 339175.473
SURFACE ELEVATION 90.520 m aOD
HOLE TYPE Hand drilled pit
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram (BH3)	Elevation (m)
0.1					Soft, dark brown, red sandy, gravelly silt. Gravel is medium to cobble and includes quartz and flint and abundant brick, concrete and plastic fragments. MADE GROUND.		0.1
0.2							0.2
0.3						Bentonite and plain pipe	0.3
0.4							0.4
0.5	Sample 1						0.5
0.6							0.6
0.7						Gravel in slotted pipe	0.7
0.8							0.8
0.9	Sample 2					Bentonite	0.9
1							1
1.1							1.1
1.2							1.2
1.3							1.3
1.4							1.4
1.5							1.5
1.6							1.6
1.7							1.7
1.8							1.8
1.9							1.9

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BOREHOLE LOG BH4

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 12/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350561.988 339035.933
SURFACE ELEVATION 90.374 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments The drillers constantly added water to clean the drilling string, making the logged material appear muddier than in natural conditions.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0					Coarse to cobble Gravels consisting of brick and concrete and including plastic fragments. MADE GROUND.		0
0.2							0.2
0.4							0.4
0.6							0.6
0.8					Firm, dark brown to black sandy SILT with light grey gravel bands. Sand is fine to coarse and organic matter is present.		0.8
1						Bentonite and plain pipe	1
1.2							1.2
1.4	Sample 1				Firm, red-brown CLAY with white layers of sand and gravel.		1.4
1.6							1.6
1.8							1.8
2					Firm, red-brown CLAY with white layers of gravel with some sand.		2
2.2							2.2
2.4	Sample 2					Gravel in slotted pipe	2.4
2.6							2.6
2.8							2.8

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BOREHOLE LOG BH5

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 12/12/2023
TOTAL DEPTH 1 m
DIAMETER 52 mm

COORDINATES 350642.481 339114.392
SURFACE ELEVATION 90.169 m aOD
HOLE TYPE Hand drilled pit
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0.1					Coarse to cobble Gravels consisting of brick and concrete and including plastic fragments . Geomembrane is located at the base of the layer. MADE GROUND.		0.1
0.2							0.2
0.3						Bentonite and plain pipe	0.3
0.4							0.4
0.5	Sample 1				Soft, red-brown gravelly SILT. Gravel is coarse to cobble and rounded.		0.5
0.6							0.6
0.7						Gravel in slotted pipe	0.7
0.8							0.8
0.9						Bentonite	0.9
1			▽				1
1.1							1.1
1.2							1.2
1.3							1.3
1.4							1.4
1.5							1.5
1.6							1.6
1.7							1.7
1.8							1.8
1.9							1.9

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BOREHOLE LOG BH6

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 12/12/2023
TOTAL DEPTH 1 m
DIAMETER 52 mm

COORDINATES 350634.566 339078.783
SURFACE ELEVATION 90.383 m aOD
HOLE TYPE Hand drilled pit
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments Water constantly coming in from Made Ground. The gravel in the Made Ground is fully saturated with water. A similar situation happened while drilling BH5.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0.1					Coarse to cobble Gravels consisting of brick and concrete and including plastic fragments .MADE GROUND.		0.1
0.2							0.2
0.3	Sample 1				Firm red CLAY with undulating sand bands. Sand is fine to coarse.	Bentonite and plain pipe	0.3
0.4							0.4
0.5							0.5
0.6							0.6
0.7						Gravel in slotted pipe	0.7
0.8							0.8
0.9					Very soft, red and light brown slightly silty, clayey SAND. Sand is fine to coarse grained.	Bentonite	0.9
1			▽				1
1.1							1.1
1.2							1.2
1.3							1.3
1.4							1.4
1.5							1.5
1.6							1.6
1.7							1.7
1.8							1.8
1.9							1.9

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BOREHOLE LOG BH7

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 12/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350701.286 339117.775
SURFACE ELEVATION 90.221 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments Borehole drilled underwater. The Made Ground flooded the borehole. Ammonia smell in the air, oil sheen in superficial water in surrounding area of the borehole coming from vehicles in car park.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram (BH7)	Elevation (m)
0.2					Coarse to cobble Gravels consisting of brick and concrete and including plastic fragments. MADE GROUND.		0.2
0.4							0.4
0.6					Firm, red to light brown CLAY with white silt and grey sand laminae. Sand is fine to coarse. Abundant rootlets are presente near the top and some organic matter is present.		0.6
0.8							0.8
1						Bentonite and plain pipe	1
1.2							1.2
1.4							1.4
1.6	Sample 1						1.6
1.8							1.8
2	Sample 2				Soft, red to light brown SAND with abundant grey layers of silt and clay with some gravel.		2
2.2							2.2
2.4						Gravel in slotted pipe	2.4
2.6							2.6
2.8			▽				2.8

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BOREHOLE LOG BH8

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 13/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350676.470 339216.469
SURFACE ELEVATION 90.657 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments There is a lot of water in the silty sand, but it's difficult to tell where it comes from since the drillers added buckets of water to the drilling string to clean the pipe.

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram	Elevation (m)
0.2					Soft, dark grey to dark brown sandy, slightly gravelly SILT with abundant rootlets, grass and organic matter. Sand is fine to coarse. TOPSOIL.		0.2
0.4							0.4
0.6							0.6
0.8							0.8
1						Bentonite and plain pipe	1
1.2					Firm, light red to brown CLAY with light grey bands of silt and fine white to light grey bands of silt and fine to coarse sand. Some organic material present.		1.2
1.4							1.4
1.6							1.6
1.8							1.8
2	Sample 1						2
2.2			▽		Soft, red to light brown silty SAND.		2.2
2.4						Gravel in slotted pipe	2.4
2.6							2.6
2.8							2.8
	Sample 2						

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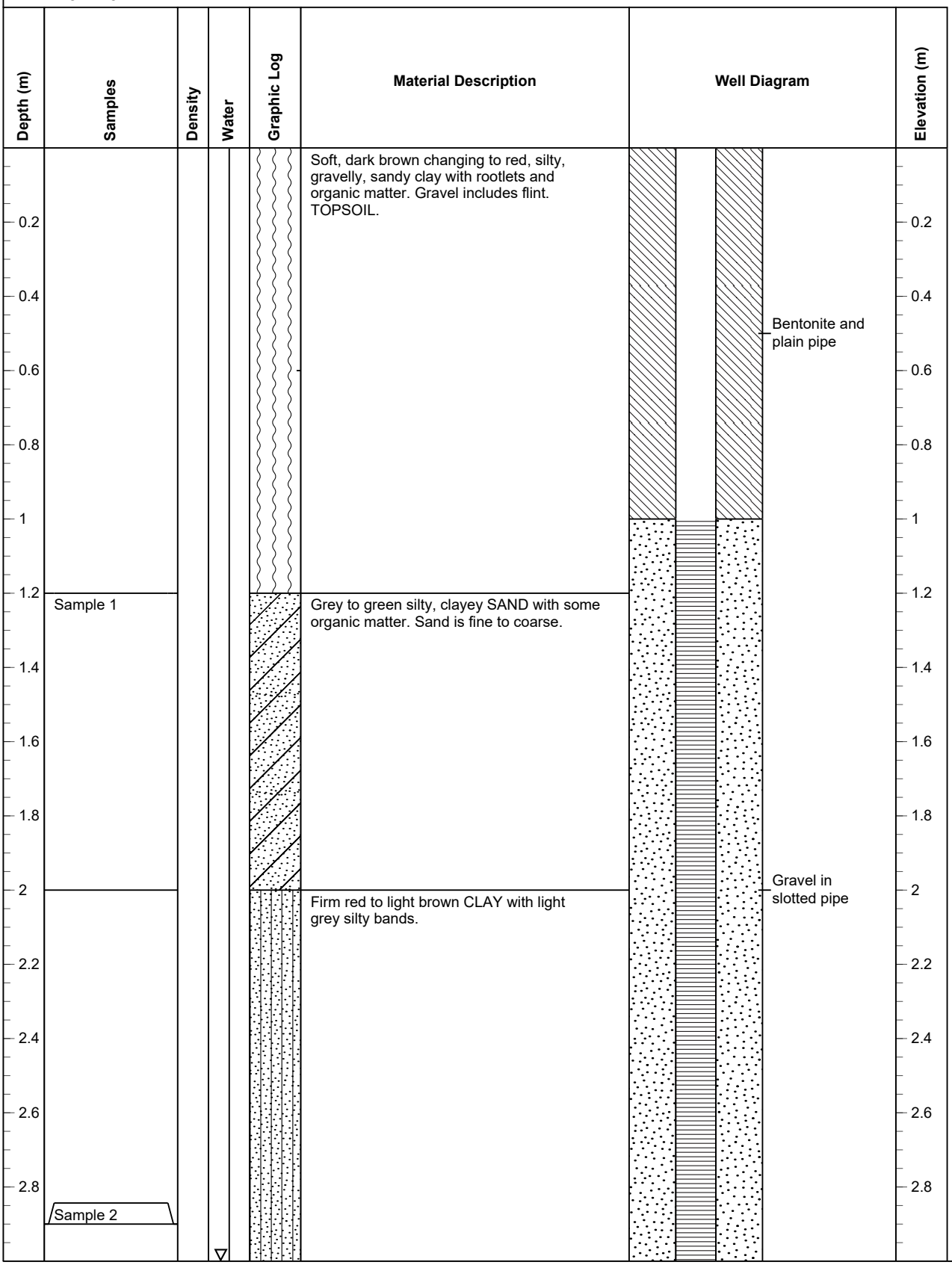
BOREHOLE LOG BH9

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank
DRILLING COMPANY VC Drilling

DRILLING DATE 13/12/2023
TOTAL DEPTH 3 m
DIAMETER 52 mm

COORDINATES 350726.313 339258.187
SURFACE ELEVATION 90.538 maOD
HOLE TYPE Cable Percussion Drilling
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments The area is flooded before drilling started. This borehole displays more sand than any other borehole in the area in this campaign. The drillers added abundant water to the pipe to clean the drilling string.



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BOREHOLE LOG BH10

PROJECT NUMBER 30756
CLIENT Mark Wakefield Demolition Ltd
PROJECT NAME Mark Wakefield Fenn's Bank

DRILLING DATE 14/12/2023
TOTAL DEPTH 1 m
DIAMETER 52 mm

COORDINATES 52.826636 0.871364
SURFACE ELEVATION To be surveyed later
HOLE TYPE Hand drilled pit
LOGGED BY: JPC
CHECKED BY: RC, XB

Comments The borehole was drilled by hand in a location with unfavourable conditions due to made ground and reinforcing bar on the ground. Abundant water flooded the hole from start to end

Depth (m)	Samples	Density	Water	Graphic Log	Material Description	Well Diagram (TP-1)	Elevation (m)
0	Sample 1				Reinforced concrete underlain by coarse gravel and geomembrane. MADE GROUND.		0
0.1						Bentonite	0.1
0.2							0.2
0.3							0.3
0.4						Gravel in slotted pipe	0.4
0.5							0.5
0.6							0.6
0.7							0.7
0.8	Sample 2				Dark grey, green and drak brown sandy SILT with some clay. Sand is fien to coarse.	Bentonite in plain pipe	0.8
0.9							0.9
1							1
1.1							1.1
1.2							1.2
1.3							1.3
1.4							1.4
1.5							1.5
1.6							1.6
1.7							1.7
1.8							1.8
1.9							1.9

APPENDIX B

Gas Monitoring and Sampling Methodologies

1. GAS MONITORING METHODOLOGY

The following methodology, in accordance with the CIRIA guidance, was used for gas monitoring:

- Recording of the atmospheric pressure readings during the period before the monitoring visit;
- Calibration of the instruments before the monitoring period;
- Clean air was run through the equipment prior to any sampling to zero the methane levels;
- Monitoring equipment was kept switched on between boreholes to prevent having to zero the methane each time; this also ensured any residual gases were purged;
- Recording of the atmospheric pressure reading from the monitoring equipment. Also recording of the weather, air temperature and ground conditions at each location;
- Recording of the range of pressures and flow readings from each sample location, noting whether the flow was "positive" or "negative";
- Closing of the gas tap and removal of the gas flow meter;
- Attaching the monitoring equipment tubing to the gas tap and opening the tab. Switching on the pump and recording the peak and steady reading for methane (% v/v), methane (% LEL), carbon dioxide (% v/v) and oxygen (& v/v), whilst also recording the time lapsed taken to reach the steady reading;
- If the gas recordings had not reached a steady value after three minutes, recording of the concentrations and the direction and rate of change in concentration and continuation of monitoring was undertaken for up to 10 minutes;
- Once data was recorded, the tubing was removed from the gas tap and the tap closed. Purging of the monitoring equipment was undertaken in a clean area (away from the borehole / and other sources of gas) until the methane and carbon dioxide concentrations returned to zero and the oxygen reading atmospheric concentrations;
- Recording of the water level in the borehole using a dip meter prior to securing the borehole.

2. GAS SAMPLING METHODOLOGY

The following methodology provided by ALS laboratories, was used for the canister gas sampling:

Pre-sampling checks of the canisters were undertaken to confirm the following:

- Sufficient canisters and flow controllers required for the sampling;
- The vacuum of each canisters was checked by following the steps below:
    - Using the vacuum gauge with quick-connect mechanism for the checks of complete connection and confirmation that the gauge registered between 25 to just pass 30 inches of vacuum; and
- Checks of each sample location to ensure it was not flooded; no sampling was undertaken in these locations.

Sampling was undertaken as follows:

- Check for leaks and purging as required;
- Confirmation that the tap on the sampling train was closed;
- Approximately 30 cm pf PTFE tube was attached to the train to check for water ingress as sampling proceeded;
- On placement of the sampling train to the canister, sampling commenced once the gas tap was opened;
- Sampling time was recorded and the sampling duration was based on the following:
    - Gradual decrease of the gauge reading, which took approximately 10 minutes to sample 1400 ml at flow rate 200 ml/min, taking into account that flow decreased as the vacuum in the canister approached atmospheric pressure. Where there is low soil permeability, the time taken to sample 1400 ml will be increased.
    - The sampling was completed when the gauge read between 3 and 5" Hg. The pressure was recorded on the chain of custody form.
- To finish, the tap was closed and the canister disconnected. Removal of the flow controller resulted in the canister automatically re- sealing when it was removed.
- The time the sampling stopped was recorded on the chain of custody.
- All canisters were sent to ALS Laboratories, under chain of custody for analysis of bulk gases.

APPENDIX C

Gas Meter Calibration Certificates

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Life-saving solutions

CERTIFICATE OF CALIBRATION
MultiRAE

CALIBRATION CERTIFICATE NO: 80046

ISSUED BY: SHAWCITY LIMITED
DATE: 19.06.24

APPROVED SIGNATORY:

NAME: William Franklin

CUSTOMER: Shawcity Ltd
INSTRUMENT: MultiRAE
SERIAL NUMBER: M01C015194

CALIBRATION METHOD: CM03
AMBIENT CONDITIONS: 20°C ± 2°C and 50% (± 20%) RH

Prior to calibration the instrument was allowed to stabilise in the laboratory for at least 30 minutes.
The instrument was calibrated by exposing the sensor to known values of gas concentrations.
All gases were sampled through the complete probe and in line filter, where applicable.
The reference values are those generated by the certified sources and the indicated values are those measured by the instrument.

CALIBRATION RESULTS

GAS	LOT No	REF. VALUE	INDICATED VALUE
CH4/LEL (zero)	Fresh air	0	0
H2S (zero)	Fresh air	0	0
N2 99.99% CO2 (zero)	WO377496-1	99.99%	99.99%
H2S (span)	WO403389-9	10 ppm	10 ppm
CH4/LEL (span)	WO403389-9	2.2% (50% LEL)	2.2% (50% LEL)

COMMENTS:
The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$.
This provides a level of confidence of uncertainty of approximately 95%.
The uncertainty of measurement is ±2% of range.
The results indicate that the instrument conforms to the applicable parts of the published specification.

Tel: 01793 780622
www.shawcity.co.uk
Instrument House, 91-92 Shrivenham Hundred Business Park
Watchfield, Oxfordshire, SN6 8TY

shawcity
Life-saving solutions

CERTIFICATE OF CALIBRATION
MultiRAE

CALIBRATION CERTIFICATE NO: 80047

ISSUED BY: SHAWCITY LIMITED
DATE: 19.06.24

APPROVED SIGNATORY:

NAME: William Franklin

CUSTOMER: Shawcity Ltd
INSTRUMENT: MultiRAE - diffusive
SERIAL NUMBER: M01D002503

CALIBRATION METHOD: CM03
AMBIENT CONDITIONS: 20°C ± 2°C and 50% (± 20%) RH

Prior to calibration the instrument was allowed to stabilise in the laboratory for at least 30 minutes.
The instrument was calibrated by exposing the sensor to known values of gas concentrations.
All gases were sampled through the complete probe and in line filter, where applicable.
The reference values are those generated by the certified sources and the indicated values are those measured by the instrument.

CALIBRATION RESULTS

GAS	LOT No	REF. VALUE	INDICATED VALUE
LEL/NH3/H2 zero	Fresh air	0.0%	0.0%
O2 zero	Fresh air	20.9%	20.9%
LEL span	WO403389-9	2.2% (50% LEL)	2.2% (50% LEL)
O2 span	WO403389-9	18%	18%
NH3	WO412449-2	50 ppm	50 ppm
H2	WO386030-1	1000 ppm	1000 ppm

COMMENTS:
The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$.
This provides a level of confidence of uncertainty of approximately 95%.
The uncertainty of measurement is ±2% of range.
The results indicate that the instrument conforms to the applicable parts of the published specification.

Tel: 01793 780622
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Instrument House, 91-92 Shrivenham Hundred Business Park
Watchfield, Oxfordshire, SN6 8TY

APPENDIX D

Gas Sample Data

January 2024

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB, JPC		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
Gas Spike 6		1.0 l/hr Peak: 1.2 l/hr	DP: 5 (Pa) AP: 999 mb SP: 1011 mb	0	0	0	0	0	19.7	19.5	0	0	0	0	Atmospheric Pressure:
				15		0		0		19.7		0		0	
				30		0		0		19.7		0		0	Ambient Temp:
				60		0		0		19.7		0		0	
				90		0		0		19.6		0		0	PID:
				120		0		0		19.6		0		0	1
				180		0		0		19.6		0		0	
Time and Date:															
Gas Spike 13		0.4 l/hr Peak: 0.4 l/hr	DP: 2 (Pa) AP: 1001 mb SP: 1013 mb	0	0	0	0	0	20.2	20.4	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.2		0		0	
				30		0		0		20.2		0		0	Ambient Temp:
				60		0		0		20.2		0		0	
				90		0		0		20.2		0		0	PID:
				120		0		0		20.2		0		0	1
				180		0		0		20.2		0		0	
Time and Date:															

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
BH3	0.57 first dip; 0.72 free water level	0.9 l/hr Peak: 3 l/hr	DP: 4 (Pa) AP: 984 mb SP: 996 mb	0	0	0	0	0.2	20.1	20.1	0	0	0	0	Atmospheric Pressure:
				15		0		0.5		19.8		0		0	984
				30		0		0.5		19.8		0		0	Ambient Temp:
				60		0		0.4		19.8		0		0	
				90		0		0.4		19.8		0		0	PID:
				120		0		0.4		19.8		0		0	
				180		0		0.4		19.8		0		0	
Time and Date: 12:10 pm 17/01/2024															
Gas Spike 16		0.3 l/hr Peak: 0.6 l/hr	DP: 1 (Pa) AP: 983 mb SP: 995 mb	0	0	0	0	0	20.2	20	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.1		0		0	
				30		0		0		20.1		0		0	Ambient Temp:
				60		0		0		20.1		0		0	
				90		0		0		20		0		0	PID:
				120		0		0		20		0		0	1
				180		0		0		20		0		0	
Time and Date: 14:58 pm 17/01/2024															

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
Gas Spike 23		"-0.3 l/hr Peak: -0.3 l/hr"	DP: 1 (Pa) AP: 984 mb SP: 11 mb	0	0	0	0	0	19.8	19.7	0	0	0	0	Atmospheric Pressure:
				15		0		0		19		0		0	984
				30		0		0		19.6		0		0	Ambient Temp:
				60		0		0		19.7		0		0	
				90		0		0		19.8		0		0	PID:
				120		0		0		19.8		0		0	1
				180		0		0		19.9		0		0	
Time and Date: 14:30 pm 17/01/2024															
Gas Spike 18		0.3 l/hr Peak: 0.4 l/hr	DP: 2 (Pa) AP: 983 mb SP: 995 mb	0	0	0	0	0	20.2	20	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.1		0		0	983
				30		0		0		20.1		0		0	Ambient Temp:
				60		0		0		20		0		0	
				90		0		0		20		0		0	PID:
				120		0		0		20		0		0	1
				180		0		0		20		0		0	
Time and Date: 14:45 pm 17/01/2024															

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB, JPC		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
BH6		0 l/hr Peak: 0 l/hr	DP: 0 (Pa) AP: 983 mb SP: 995 mb	0	0	0	0	0	20.4	20.5	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.3		0		0	983
				30		0		0		20.3		0		0	Ambient Temp:
				60		0		0		20.3		0		0	
				90		0		0		20.3		0		0	PID:
				120		0		0		20.3		0		0	1
				180		0		0		20.3		0		0	
Time and Date: 18/01/2024															
Gas Spike 2		0.9 l/hr Peak: 1 l/hr	DP: 4 (Pa) AP: 999 mb SP: 1011 mb	0	0	0	0	0	19.7	19.6	0	0	0	0	Atmospheric Pressure:
				15		0		0		19.6		0		0	999
				30		0		0		19.6		0		0	Ambient Temp:
				60		0		0		19.6		0		0	
				90		0		0		19.5		0		0	PID:
				120		0		0		19.5		0		0	1
				180		0		0		19.4		0		0	
Time and Date: 9:00 am 18/01/2024															

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB, JPC		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
Gas Spike 22		0.3 l/hr Peak: 0.4 l/hr	DP: 1 (Pa) AP: 983 mb SP: 995 mb	0	0	0	0	0	20.2	19.6	0	0	0	0	Atmospheric Pressure:
				15		0		0		19.9		0		0	983
				30		0		0		20.1		0		0	Ambient Temp:
				60		0		0		20.2		0		0	
				90		0		0		20.2		0		0	PID:
				120		0		0		20.2		0		0	1
				180		0		0		20.2		0		0	
Time and Date: 17/01/24															
Gas Spike 21		0 l/hr Peak: 0.3 l/hr	DP: 0 (Pa) AP: 985 mb SP: 997 mb	0	0	0	0	0	20.4	20.5	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.5		0		0	985
				30		0		0		20.4		0		0	Ambient Temp:
				60		0		0		21.6		0		0	
				90		0		0		20.3		0		0	PID:
				120		0		0		20.3		0		0	1
				180		0		0		20.3		0		0	
Time and Date: 17/01/24															

Project Number	30756		Project Name	Fenn's Bank							Sampler Name		XB, JPC		
Location	Depth to water (m bgl)	Flow (l/hr)	Differential Pressure (Pa)	Time (seconds)	% by volume in air						Hydrogen Sulphide (ppm)		LEL (%)		Water samples/observations
					Methane		Carbon Dioxide		Oxygen						
Gas Spike 9		0 l/hr Peak: 0.1 l/hr	DP: 1 (Pa) AP: 999 mb SP: 1011 mb	0	0	0	0	0	20.4	21.5	0	0	0	0	Atmospheric Pressure:
				15		0		0		20.4		0		0	999
				30		0		0		20.4		0		0	Ambient Temp:
				60		0		0		20.4		0		0	
				90		0		0		20.4		0		0	PID:
				120		0		0		20.4		0		0	1
				180		0		0		20.4		0		0	
Time and Date: 17/01/24															
				0											
				15											
				30											
				60											
				90											
				120											
				180											
Time and Date:															

June 2024

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	All temperatures are from the weather forecast
					Methane	Carbon Dioxide	Oxygen				
BH10	0.61 m bd	0.2 l/hr	-0.05mb	Ambient	0	0	20.2	0	1	Atmospheric Pressure: 1017 mb Ambient Temp: 24 PID:	
				0	0	0	20.1	0	1		
				15	0	0	19.9	0	2		
				30	0	0	19.9	0	1		
				60	0	0	19.9	0	1		
				90	0	0	19.9	0	1		
				120	0	0	19.9	0	1		
				180	0	0	19.9	0	1		
Time and Date:		13:30 pm	26/06/24								
BH1		-0.8 l/hr	-3.62 mb	Ambient	0	0	20.3	0	1	Atmospheric Pressure: 1018 mb Ambient Temp: 25 PID:	
				0	0	0	20.2	0	1		
				15	0	1.1	19.4	0	4		
				30	0	1.1	19.3	0	3		
				60	0	1.2	19.3	0	3		
				90	0	1.2	19.3	0	3		
				120	0	1.2	19.3	0	2		
				180	0	1.4	18.7	0	2		
Time and Date:		13:42 pm	26/06/24								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	About 30 cm mud coated pipe after pumping
					Methane	Carbon Dioxide	Oxygen				
Gas Spike 2		0 l/hr	-1.35mb	Ambient	0	0.1	20.3	0	0	Atmospheric Pressure: 1018 mb Ambient Temp: 17 PID:	
				0							
				15	0	1.6	19.1	0	1		
				30							
				60	0	1.5	19.3	0	1		
				90	0	1.4	19.3	0	0		
				120	0	1.4	19.4	0	0		
				180	0	1.3	19.5	0	0		
Time and Date:		26/06/2024 08:50									
Gas Spike 13		0 l/hr	-2.34 mb	Ambient	0	0	19.8	0	1	Atmospheric Pressure: 1018 mb Ambient Temp: 20 PID:	
				0	0	0	19.8	0	1		
				15	0	0.1	19.9	0	24		
				30	0	0.1	19.9	0	2		
				60	0	0.1	19.9	0	1		
				90	0	0.1	19.9	0	1		
				120	0	0.1	19.9	0	1		
				180	0	0.1	19.9	0	1		
Time and Date:		10:41 am	26/06/24								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	About 40cm of condensation in the pipe after pumping
					Methane	Carbon Dioxide	Oxygen				
BH9	1.195 m bd	**Max:** 5.5 l/hr **After 2 mins:** 3.4 l/hr **After pumping:-** 12 l/hr	14.76 mb	**Ambient**	0	0.1	20.2	0	1	Atmospheric Pressure: 1016 mb	
				0	0	6.2	18.1	0	3	Ambient Temp: 18	
				15						PID:	
				30	0.1	6.2	16.9	0	3		
				60	0.1	6.2	16.9	0	2		
				90	0.1	6.2	16.9	0	2		
				120	0.1	6.2	16.9	0	2		
				180							
Time and Date:		9:10 am	26/06/2024								
BH7	0.49 m bd	0.1 l/hr	0.07 mb	**Ambient**	0	0	20.6	0	1	Atmospheric Pressure: 1017 mb	Borehole gas spike open upon arrival.
				0	0	0	20.6	0	1	Ambient Temp: 20	
				15	0.1	0	19.1	0	4	PID:	
				30	0.1	0	19	0	5		
				60	0.1	0	18.9	0	5		
				90	0.1	0	18.9	0	5		
				120	0.1	0	18.9	0	5		
				180							
Time and Date:		11:02 am	26/06/2024								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	
					Methane	Carbon Dioxide	Oxygen				
Gas Spike 16		0.1 l/hr	-3.50 mb	**Ambient**	0	0	20.8	0	1	Atmospheric Pressure: 1016 mb	
				0	0	0	20.8	0	1	Ambient Temp: 23	
				15	0	0.1	20.5	0	138	PID:	
				30	0	0.1	20.5	0	12		
				60	0	0.1	20.5	0	0		
				90	0	0.1	20.5	0	0		
				120	0	0.1	20.5	0	1		
				180	0	0.1	20.5	0	1		
Time and Date:		11:49 am	26/06/24								
Gas Spike 21		0.1 l/hr	-3.18 mb	**Ambient**	0	0	20.3	0	1	Atmospheric Pressure: 1016 mb	
				0	0	0	20.3	0	1	Ambient Temp: 24	
				15	0	0.1	20.1	0	5	PID:	
				30	0	0.1	20	0	4		
				60	0	0.1	20	0	3		
				90	0	0.2	19.9	0	3		
				120	0	0.1	19.9	0	3		
				180	0	0.1	19.9	0	2		
Time and Date:		13:42 pm	26/06/24								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	
					Methane	Carbon Dioxide	Oxygen				
BH8	0.86 m bd	0.1 l/hr	0.02 mb	Ambient	0	0	20.3	0	0	Atmospheric Pressure:	
				0	0	0.7	20.2	0	0	1017 mb	
				15	0	0.2	20.2	0	2	Ambient Temp:	
				30	0	0.2	20.1	0	1	20	
				60	0	0.2	20.1	0	1	PID:	
				90	0	0.2	20.1	0	1		
				120	0	0.2	20.1	0	1		
				180	0	0.2	20.1	0	1		
Time and Date:		9:57 am	26/06/24								
Gas Spike 9		0.1 l/hr	-2.5 mb	Ambient	0	0	19.8	0	1	Atmospheric Pressure:	
				0	0	0	19.8	0	0	1010 mb	
				15	0	0.7	19	0	210	Ambient Temp:	
				30	0	0.7	19	0	27	20	
				60	0	0.9	18.6	0	4	PID:	
				90	0	1	18.5	0	1		
				120	0	1	18.5	0	1		
				180	0	1	18.5	0	1		
Time and Date:		10:18 am	26/06/2024								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	
					Methane	Carbon Dioxide	Oxygen				
BH5	0.15 m bd	0.1 l/hr	-0.007 mb	Ambient	0	0	20.6	0	1	Atmospheric Pressure:	
				0	0	0	20.5	0	1	1018 mb	
				15	0	0	20.7	0	1	Ambient Temp:	
				30	0	0	20.7	0	1	22	
				60	0	0	20.7	0	1	PID:	
				90	0	0	20.7	0	1		
				120	0	0	20.7	0	1		
				180	0	0	20.7	0	1		
Time and Date:		11:22 am	26/06/24								
BH6	0.315 m bd	0.2 l/hr	-0.09 mb	Ambient	0	0	20.9	0	1	Atmospheric Pressure:	
				0	0	0	20.8	0	2	1017 mb	
				15	0	0.1	20.6	0	1	Ambient Temp:	
				30	0	0.1	20.5	0	1	22	
				60	0	0	20.6	0	1	PID:	
				90	0	0	20.6	0	1		
				120	0	0	20.6	0	1		
				180	0	0	20.6	0	1		
Time and Date:		11:36 am	26/06/24								

Project Number	30756		Project Name	Fenn's Bank				Sampler Name	XB		Comments
Location	Depth to water (m bd)	Flow (l/hr)	Differential Pressure (mb)	Time (seconds)	% by volume in air			Hydrogen Sulphide (ppm)	Carbon Monoxide(ppm)	Water samples/ observations	Water in pipe at 90 seconds
					Methane	Carbon Dioxide	Oxygen				
BH2	0.37 m bd	Max: 4.2 l/hr Average: 3.4 l/hr Min: 2.6 l/hr	16.9 mb	Ambient	0	0	20.2	0	1	Atmospheric Pressure: 1017 mb Ambient Temp: 25 PID:	
				0	0	0.2	20	0	4		
				15	0	0.3	19.5	0	3		
				30	0	0.3	19.5	0	3		
				60	0	0.3	19.4	0	3		
				90	Water in Pipe						
				120							
				180							
Time and Date:		14:01 pm	26/06/24								
BH3	0.62 m bd	0.2 l/hr	-2.02 mb	Ambient	0	0	20.4	0	2	Atmospheric Pressure: 1019 mb Ambient Temp: 25 PID:	Water in pipe at 120 seconds
				0	0	0	20.3	0	2		
				15	0.5	0.8	19.7	0	4		
				30	0.4	0.7	19.6	0	3		
				60	0.4	0.6	19.6	0	2		
				90	0.4	0.6	19.6	0	2		
				120	Water in Pipe						
				180							
Time and Date:		14:22 pm	26/06/24								

APPENDIX E

Gas Laboratory Certificates

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

H Fraser Consulting
The Pump House
Coton Hill
Shrewsbury
SY1 2DP

Attention: Xenia Boyes

CERTIFICATE OF ANALYSIS

Date of report Generation:	31 July 2024
Customer:	H Fraser Consulting
Sample Delivery Group (SDG):	240713-71
Your Reference:	
Location:	Fenns Bank
Report No:	736385
Order Number:	

This report has been revised and directly supersedes 736139 in its entirety.

We received 14 samples on Saturday July 13, 2024 and 14 of these samples were scheduled for analysis which was completed on Monday July 29, 2024. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:

Lauren Ellis
General Manager Western Europe Environmental

CERTIFICATE OF ANALYSIS

SDG: 240713-71 Report Number: 736385 Superseded Report: 736139
Client Ref.: Location: Fenns Bank

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
30074213	BH1			12/07/2024
30074211	BH2			12/07/2024
30074210	BH3			12/07/2024
30074220	BH5			12/07/2024
30074221	BH6			12/07/2024
30074209	BH7			12/07/2024
30074216	BH8			12/07/2024
30074218	BH9			12/07/2024
30074214	BH10			12/07/2024
30074217	G2			12/07/2024
30074215	G9			12/07/2024
30074219	G13			12/07/2024
30074223	G16			12/07/2024
30074222	G22			12/07/2024

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139
Client Ref.: **Location:** Fenns Bank

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			30074213	30074211	30074210	30074220	30074221	30074209	30074216	30074218	30074214	30074217	30074215	30074219	30074223	30074222
Customer Sample Reference			BH1	BH2	BH3	BH5	BH6	BH7	BH8	BH9	BH10	G2	G9	G13	G16	G22
AGS Reference																
Depth (m)																
Container			Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister	Gas Canister
Sample Type			G	G	G	G	G	G	G	G	G	G	G	G	G	G
Bulk Gas	All	NDPs: 1 Tests: 13										N				
			X	X	X	X	X	X	X	X	X		X	X	X	X

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139

Client Ref.: **Location:** Fenns Bank

Bulk Gas

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH1	BH2	BH3	BH5	BH6	BH7
			Depth (m)	.	.	.	.	.	.
			Sample Type	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)
			Date Sampled	12/07/2024	12/07/2024	12/07/2024	12/07/2024	12/07/2024	12/07/2024
			Sample Time	11:11:00	10:52:00	10:35:00	12:25:00	12:40:00	10:20:00
			Date Received	13/07/2024	13/07/2024	13/07/2024	13/07/2024	13/07/2024	13/07/2024
			SDG Ref	240713-71	240713-71	240713-71	240713-71	240713-71	240713-71
			Lab Sample No.(s)	30074213	30074211	30074210	30074220	30074221	30074209
			AGS Reference						
Hydrogen sulphide	<1 ppm	TM053		<1	<1	<1	<1	<1	<1
Hydrogen	<0.5 %	TM053		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Oxygen	<0.5 %	TM053		12.8	20.2	19.8	20.9	21.1	20.4
Nitrogen	<1 %	TM053		80.5	79.3	77.7	79.1	78.9	79.6
Carbon monoxide	<0.05 %	TM053		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methane	<0.05 %	TM053		0.173	<0.05	1.13	<0.05	<0.05	<0.05
Carbon dioxide	<0.05 %	TM053		6.59	0.54	1.33	<0.05	<0.05	<0.05
Bulk gas, Total	%	TM053		100	100	100	100	100	100

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139

Client Ref.: **Location:** Fenns Bank

Bulk Gas

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH8	BH9	BH10	G9	G13	G16
			Depth (m)	.	.	.	.	.	.
			Sample Type	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)
			Date Sampled	12/07/2024	12/07/2024	12/07/2024	12/07/2024	12/07/2024	12/07/2024
			Sample Time	09:01:00	09:30:00	11:25:00	08:38:00	09:50:00	13:12:00
			Date Received	13/07/2024	13/07/2024	13/07/2024	13/07/2024	13/07/2024	13/07/2024
			SDG Ref	240713-71	240713-71	240713-71	240713-71	240713-71	240713-71
			Lab Sample No.(s)	30074216	30074218	30074214	30074215	30074219	30074223
			AGS Reference						
Hydrogen sulphide	<1 ppm	TM053		<1	<1	<1	<1	<1	<1
Hydrogen	<0.5 %	TM053		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Oxygen	<0.5 %	TM053		20.6	20.1	21	20.8	20.8	20.7
Nitrogen	<1 %	TM053		78.7	78.3	79	79.2	79.3	79.3
Carbon monoxide	<0.05 %	TM053		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methane	<0.05 %	TM053		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon dioxide	<0.05 %	TM053		0.72	1.52	<0.05	<0.05	<0.05	<0.05
Bulk gas, Total	%	TM053		100	100	100	100	100	100

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139

Client Ref.: **Location:** Fenns Bank

Bulk Gas

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+$@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	
			G22	
			Depth (m)	.
			Sample Type	Gas (G)
			Date Sampled	12/07/2024
			Sample Time	12:55:00
			Date Received	13/07/2024
			SDG Ref	240713-71
			Lab Sample No.(s)	30074222
			AGS Reference	
Hydrogen sulphide	<1 ppm	TM053	<1	
Hydrogen	<0.5 %	TM053	<0.5	
Oxygen	<0.5 %	TM053	21.1	
Nitrogen	<1 %	TM053	78.9	
Carbon monoxide	<0.05 %	TM053	<0.05	
Methane	<0.05 %	TM053	<0.05	
Carbon dioxide	<0.05 %	TM053	<0.05	
Bulk gas, Total	%	TM053	100	

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139
Client Ref.: **Location:** Fenns Bank

Notification of NDPs (No determination possible)

Date Received : 13/07/2024 11:46:17

Sample No	Customer Sample Ref.	Depth (m)	Test	Comment
30074217	G2		Bulk Gas	Insufficient Sample

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139
Client Ref.: **Location:** Fenns Bank

Data Amendment

Sample No. : 30074211 **Date of Amendment :** 31/07/2024

Sample Ref.	Reason	Previous	Amended
BH2	Sample ID Change	BHG2	BH2

Table of Results - Appendix

Method No	Description
TM053	Determination of Bulk Gas Composition

NA = not applicable.
Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).

CERTIFICATE OF ANALYSIS

SDG: 240713-71 **Report Number:** 736385 **Superseded Report:** 736139
Client Ref.: **Location:** Fenns Bank

Test Completion Dates

Lab Sample No(s)	30074213	30074211	30074210	30074220	30074221	30074209	30074216	30074218	30074214	30074215
Customer Sample Ref.	BH1	BH2	BH3	BH5	BH6	BH7	BH8	BH9	BH10	G9
AGS Ref.										
Depth										
Type	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)	Gas (G)
Bulk Gas	29-Jul-2024	29-Jul-2024	29-Jul-2024	18-Jul-2024	29-Jul-2024	29-Jul-2024	29-Jul-2024	29-Jul-2024	29-Jul-2024	29-Jul-2024

Lab Sample No(s)	30074219	30074223	30074222
Customer Sample Ref.	G13	G16	G22
AGS Ref.			
Depth			
Type	Gas (G)	Gas (G)	Gas (G)
Bulk Gas	29-Jul-2024	18-Jul-2024	29-Jul-2024

Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX F

Soil Laboratory Certificates

Roz Cox
H Fraser Consulting Ltd
The Pump House
Coton Hill
Shrewsbury
SY1 2DP

e: rcox@hfraserconsulting.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
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e: reception@i2analytical.com

Analytical Report Number : 23-75187

Project / Site name:	Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch	**Samples received on:**	14/12/2023
Your job number:		**Samples instructed on/ Analysis started on:**	15/12/2023
Your order number:		**Analysis completed by:**	27/12/2023
Report Issue Number:	1	**Report issued on:**	27/12/2023
Samples Analysed:	12 soil samples		

Signed:

Dominika Liana
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-75187

Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912474	2912475	2912476	2912477	2912478
Sample Reference				BH1-1	BH1-2	BH2-1	BH2-2	BH3-1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	1.50	1.40	2.00	0.60-0.70
Date Sampled				11/12/2023	11/12/2023	11/12/2023	11/12/2023	11/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	16	16	17	5.4
Total mass of sample received	kg	0.001	NONE	1.1	1.1	0.9	1.1	1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JBH	JBH	JBH	JBH	JBH

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	7.8	8.3	8.4	8.4
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.186	0.939	0.0214	0.026	0.0189
Total Chloride	mg/kg	5	NONE	350	560	320	280	280
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	8.7	4.2	2.5	2.6	5.6
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	250	< 0.5	< 0.5	11

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	1.5	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	1.6	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	14	0.19	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	3.4	0.06	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	22	0.34	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	18	0.3	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	7.7	0.14	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	6.9	0.13	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	7.2	0.13	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.9	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5.9	0.08	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.7	0.06	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.69	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.9	0.06	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	96.5	1.49	< 0.80	< 0.80	< 0.80

Analytical Report Number: 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912474	2912475	2912476	2912477	2912478
Sample Reference				BH1-1	BH1-2	BH2-1	BH2-2	BH3-1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	1.50	1.40	2.00	0.60-0.70
Date Sampled				11/12/2023	11/12/2023	11/12/2023	11/12/2023	11/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	7600	15000	17000	15000	5400
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.3	7.2	9.3	7.4	11
Barium (aqua regia extractable)	mg/kg	1	MCERTS	160	440	230	220	140
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.38	0.96	1.2	1.1	0.37
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	1.4	< 0.2	< 0.2	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2	< 0.2	0.3
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	25	30	27	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	39	16	17	15	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	10	19	16	10
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	260	910	480	440	610
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	27	31	28	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1.5
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	18	28	31	27	13
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	38	49	45	43
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	220	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912479	2912480	2912481	2912482	2912483
Sample Reference				BH3-2	BH4-1	BH4-2	BH5	BH6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90-1.00	1.50	2.50	0.70	0.90
Date Sampled				11/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	9.9	12	13	15	18
Total mass of sample received	kg	0.001	NONE	1.2	1.2	1.1	1.2	1.2
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JBH	JBH	JBH	JBH	JBH

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	7.6	8.1	10.4	8.9
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0237	0.0096	0.0111	0.0342	0.0297
Total Chloride	mg/kg	5	NONE	210	1500	1300	710	710
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	4.3	1.4	1.2	5.7	3.3
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	19	1	12	9.1	2.8

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80

Analytical Report Number: 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912479	2912480	2912481	2912482	2912483
Sample Reference				BH3-2	BH4-1	BH4-2	BH5	BH6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90-1.00	1.50	2.50	0.70	0.90
Date Sampled				11/12/2023	12/12/2023	12/12/2023	12/12/2023	12/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	6700	14000	18000	1500	6600
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.8	4.1	7.7	2.9	4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	49	530	400	12	610
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.29	0.79	0.96	0.12	0.5
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.2	0.5	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	23	28	3.9	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	15	14	16	8.2	21
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.2	9.2	8	1.8	6.4
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	180	160	910	240	210
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	10	21	26	3.5	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	14	26	29	3.6	15
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	31	29	41	13	26
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	14	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912484	2912485
Sample Reference				BH7-1	BH7-2
Sample Number				None Supplied	None Supplied
Depth (m)				1.70	2.00
Date Sampled				12/12/2023	12/12/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	15
Total mass of sample received	kg	0.001	NONE	1.1	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DBU	DBU

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.4	8.4
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.105	0.0371
Total Chloride	mg/kg	5	NONE	1200	850
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	2.9	2.6
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	< 0.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80

Analytical Report Number: 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Lab Sample Number				2912484	2912485
Sample Reference				BH7-1	BH7-2
Sample Number				None Supplied	None Supplied
Depth (m)				1.70	2.00
Date Sampled				12/12/2023	12/12/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Heavy Metals / Metalloids					
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	21000	18000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.4	7.8
Barium (aqua regia extractable)	mg/kg	1	MCERTS	830	720
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1	1
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	29
Copper (aqua regia extractable)	mg/kg	1	MCERTS	25	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	9.7	9.4
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	830	670
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	27
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	34	29
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	51	46
Petroleum Hydrocarbons					
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2912474	BH1-1	None Supplied	1.2	Brown loam and clay with gravel.
2912475	BH1-2	None Supplied	1.5	Brown sandy clay.
2912476	BH2-1	None Supplied	1.4	Brown clay.
2912477	BH2-2	None Supplied	2	Brown clay.
2912478	BH3-1	None Supplied	0.60-0.70	Brown sand with gravel.
2912479	BH3-2	None Supplied	0.90-1.00	Brown clay and sand with gravel.
2912480	BH4-1	None Supplied	1.5	Brown clay and sand.
2912481	BH4-2	None Supplied	2.5	Brown clay.
2912482	BH5	None Supplied	0.7	Brown sand.
2912483	BH6	None Supplied	0.9	Brown clay and sand.
2912484	BH7-1	None Supplied	1.7	Brown clay.
2912485	BH7-2	None Supplied	2	Brown clay.

Analytical Report Number : 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Chloride in soil	Determination of acid soluble chloride in soil by extraction with nitric acid, addition of silver nitrate followed by titration against thiocyanate.	In-house method	L075-PL	D	NONE
Fluoride, water soluble, in soil	Determination of fluoride in soil by water extraction followed by 1:1 ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Ammonia as NH3 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS

Analytical Report Number : 23-75187
Project / Site name: Mark Wakefield Demolition LTD -Fenns Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 23-76350

Replaces Analytical Report Number: 23-76350, issue no. 1
Additional analysis undertaken.
Asbestos screen added to all samples by laboratory

Project / Site name:	Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch	**Samples received on:**	19/12/2023
Your job number:		**Samples instructed on/ Analysis started on:**	21/12/2023
Your order number:		**Analysis completed by:**	11/01/2024
Report Issue Number:	2	**Report issued on:**	25/01/2024
Samples Analysed:	6 soil samples		

Signed:

Claire Brown-Crociquia
Group Customer Services Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-76350

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918945	2918946	2918947	2918948	2918949
Sample Reference				BH8-1	BH8-2	BH9-1	BH9-2	BH10-1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				13/12/2023	13/12/2023	13/12/2023	13/12/2023	13/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	16	13	21	13
Total mass of sample received	kg	0.001	NONE	0.9	0.9	0.9	1.1	0.8
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM	WEM	WEM	WEM

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	8.9	7	8.7	12.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0208	0.0164	0.0158	0.0177	0.0054
Total Chloride	mg/kg	5	NONE	110	71	250	140	1900
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	1.3	1.1	1.3	1.6	< 1.0
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	< 0.5	0.8	< 0.5	6.3

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80

Analytical Report Number: 23-76350

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918945	2918946	2918947	2918948	2918949
Sample Reference				BH8-1	BH8-2	BH9-1	BH9-2	BH10-1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				13/12/2023	13/12/2023	13/12/2023	13/12/2023	13/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	22000	4800	5300	5600	14000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.4	2.7	3.3	3.3	7
Barium (aqua regia extractable)	mg/kg	1	MCERTS	1100	430	170	460	72
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1	0.33	0.32	0.46	0.41
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	0.2	0.2	< 0.2	1.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	9.1	9.5	11	33
Copper (aqua regia extractable)	mg/kg	1	MCERTS	48	11	7.6	16	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	8.5	3.4	4.4	7.4	16
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	2300	100	120	110	410
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	32	9	7.6	11	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	31	9.6	10	11	24
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	45	15	17	47	880
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	12	< 10	< 10	54

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-76350

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918950
Sample Reference				BH10-2
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				13/12/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Stone Content	%	0.1	NONE	60
Moisture Content	%	0.01	NONE	10
Total mass of sample received	kg	0.001	NONE	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	12.2
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.139
Total Chloride	mg/kg	5	NONE	2400
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	3.4
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	130

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80

Analytical Report Number: 23-76350

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918950
Sample Reference				BH10-2
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				13/12/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Heavy Metals / Metalloids				
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	5600
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.1
Barium (aqua regia extractable)	mg/kg	1	MCERTS	70
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.33
Boron (water soluble)	mg/kg	0.2	MCERTS	2.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	6
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	460
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.1
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	12
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	27
Petroleum Hydrocarbons				
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-76350

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2918945	BH8-1	None Supplied	None Supplied	Brown clay.
2918946	BH8-2	None Supplied	None Supplied	Brown sandy clay.
2918947	BH9-1	None Supplied	None Supplied	Brown clay and sand with gravel.
2918948	BH9-2	None Supplied	None Supplied	Brown sandy clay.
2918949	BH10-1	None Supplied	None Supplied	Brown gravelly clay.
2918950	BH10-2	None Supplied	None Supplied	Brown clay and loam with stones and gravel

Analytical Report Number : 23-76350
Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Chloride in soil	Determination of acid soluble chloride in soil by extraction with nitric acid, addition of silver nitrate followed by titration against thiocyanate.	In-house method	L075-PL	D	NONE
Fluoride, water soluble, in soil	Determination of fluoride in soil by water extraction followed by 1:1 ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Ammonia as NH3 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Analytical Report Number : 23-76350
Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 23-76311

Project / Site name:	Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch	**Samples received on:**	21/12/2023
Your job number:		**Samples instructed on/ Analysis started on:**	21/12/2023
Your order number:		**Analysis completed by:**	04/01/2024
Report Issue Number:	1	**Report issued on:**	04/01/2024
Samples Analysed:	27 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918773	2918774	2918775	2918776	2918777
Sample Reference				S1	S2	S3	S4	S4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.30-0.40
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	20	27	36	27	15
Total mass of sample received	kg	0.001	NONE	0.9	1.2	0.9	1	1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	KSZ	KSZ	KSZ	KSZ	KSZ
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8	7.8	7.7	7.7	8.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0092	0.042	0.0198	0.0172	0.0416
Total Chloride	mg/kg	5	NONE	71	110	110	71	250
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	2.9	19	9.8	5.9	4.1
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	< 0.5	1.7	< 0.5	< 0.5
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.24	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.26	< 0.05	0.06	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.15	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.16	< 0.05	< 0.05	0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.27	< 0.05	< 0.05	0.07	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.09	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.19	< 0.05	< 0.05	0.06	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.12	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.68	< 0.80	< 0.80	< 0.80	< 0.80
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	16000	15000	9700	7600	21000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.3	6.8	5.5	4.5	6.5
Barium (aqua regia extractable)	mg/kg	1	MCERTS	390	230	190	190	480
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.77	0.76	0.49	0.45	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9	1.5	1.1	0.4	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	0.3	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	23	15	14	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	25	45	63	32	20
Lead (aqua regia extractable)	mg/kg	1	MCERTS	14	17	23	11	8.1
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	450	660	180	270	470
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	22	15	13	29
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	25	24	17	15	31
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	47	57	63	38	46

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918773	2918774	2918775	2918776	2918777
Sample Reference				S1	S2	S3	S4	S4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.30-0.40
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918778	2918779	2918780	2918781	2918782
Sample Reference				S5	S6	S6	S7	S8
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.30-0.40	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	30	22	19	28	25
Total mass of sample received	kg	0.001	NONE	1	1	1	1	0.9
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	KSZ	KSZ	KSZ	KSZ	KSZ
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.4	7.8	8.2	7.6	7.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0209	0.0121	0.0168	0.0153	0.0115
Total Chloride	mg/kg	5	NONE	140	71	110	71	71
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	7.2	10	7.3	9	12
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	1.7	< 0.5	< 0.5	< 0.5
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05	0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	0.07	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	14000	12000	8400	12000	9900
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	6.6	5.2	6.1	5.2	5
Barium (aqua regia extractable)	mg/kg	1	MCERTS	200	180	210	170	180
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.62	0.54	0.51	0.5	0.51
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.6	0.5	0.4	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	0.3	0.2	0.2	0.3
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	16	25	15	15
Copper (aqua regia extractable)	mg/kg	1	MCERTS	51	59	37	41	49
Lead (aqua regia extractable)	mg/kg	1	MCERTS	16	21	16	18	19
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	350	240	290	200	230
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18	16	20	14	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21	18	16	17	16
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	53	60	46	50	53

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918778	2918779	2918780	2918781	2918782
Sample Reference				S5	S6	S6	S7	S8
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.30-0.40	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	< 10	14	50	130

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918783	2918784	2918785	2918786	2918787
Sample Reference				S9	S9	S10	S12	S13
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.40	0.00-0.15	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	22	32	23	38	26
Total mass of sample received	kg	0.001	NONE	0.9	0.9	1.3	1	1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	EWS	EWS	EWS	EWS	EWS
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8	7	7.9	7.8	7.7
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0233	0.0126	0.0199	0.0347	0.0142
Total Chloride	mg/kg	5	NONE	180	35	110	110	110
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	10	18	17	32	33
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	< 0.5	0.7	3.6	< 0.5
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.34	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.38	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.3	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.18	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.21	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	0.2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.14	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.09	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	1.96	< 0.80
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	17000	13000	22000	19000	18000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.4	4.7	7	6.1	5.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	270	160	260	190	140
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.86	0.53	0.84	0.65	0.48
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	0.9	0.6	1.9	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	0.4	0.3	0.3
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	17	27	23	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	31	63	87	76	130
Lead (aqua regia extractable)	mg/kg	1	MCERTS	13	19	28	23	28
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	440	210	440	210	290
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	16	26	19	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	26	16	27	22	15
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	90	64	92	79	100

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Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918783	2918784	2918785	2918786	2918787
Sample Reference				S9	S9	S10	S12	S13
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.40	0.00-0.15	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	91	26	49	26	63

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918788	2918789	2918790	2918791	2918792
Sample Reference				S14	S15	S16	S17	S18
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	25	26	32	27	33
Total mass of sample received	kg	0.001	NONE	0.8	1	0.9	0.9	0.9
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	EWS	EWS	EWS	EWS	EWS
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8	7.7	7.7	7.7	6.6
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0584	0.0963	0.0472	0.0126	0.0207
Total Chloride	mg/kg	5	NONE	110	110	71	71	71
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	43	35	18	8.2	5.6
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	0.5	0.7	< 0.5	< 0.5
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.43	0.1	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.15	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	1.9	0.22	0.05	0.22	0.05
Pyrene	mg/kg	0.05	MCERTS	1.7	0.15	< 0.05	0.19	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.95	0.09	< 0.05	0.09	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.91	0.12	< 0.05	0.15	0.06
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.2	0.19	< 0.05	0.16	0.09
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.41	0.05	< 0.05	0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.1	0.15	< 0.05	0.11	0.07
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.56	0.09	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.16	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.64	0.12	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	10	1.28	< 0.80	0.97	< 0.80
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	16000	7200	17000	15000	15000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.3	4.4	6.6	7.2	4.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	370	120	190	340	140
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.66	0.41	0.6	0.63	0.43
Boron (water soluble)	mg/kg	0.2	MCERTS	1.5	2.7	2.3	1.2	0.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	0.2	0.4	0.4	0.7
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	13	22	20	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	40	29	100	63	170
Lead (aqua regia extractable)	mg/kg	1	MCERTS	26	19	31	43	56
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	500	180	280	320	220
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	12	19	19	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	27	14	20	23	15
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	96	62	100	95	150

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Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918788	2918789	2918790	2918791	2918792
Sample Reference				S14	S15	S16	S17	S18
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	35	46	27	23	40

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-76311

Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918793	2918794	2918795	2918796	2918797
Sample Reference				S19	S20	S21	S22	S22
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.30-0.40
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	34	22	52	33	16
Total mass of sample received	kg	0.001	NONE	0.9	0.8	0.8	1	1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO	PDO	PDO	PDO
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.7	7.7	7.5	7.1	7.9
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0478	0.02	0.0439	0.156	0.35
Total Chloride	mg/kg	5	NONE	110	110	110	140	1200
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	47	18	34	42	12
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	< 0.5	< 0.5	2.7	< 0.5	< 0.5
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.07	0.13	0.07	0.1	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.1	< 0.05	0.06	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.08	< 0.05	0.08	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.1	< 0.05	0.12	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.06	< 0.05	0.07	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
Heavy Metals / Metalloids								
Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	21000	21000	25000	9500	13000
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	6.5	6.3	3.3	4.4	5.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	140	100	130	150	190
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.73	0.77	0.46	0.52	0.6
Boron (water soluble)	mg/kg	0.2	MCERTS	2.8	1.2	3.2	6.1	3.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.2	0.3	0.4
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	27	30	15	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	93	71	160	54	68
Lead (aqua regia extractable)	mg/kg	1	MCERTS	32	19	24	29	26
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	270	340	210	150	260
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	25	16	15	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	23	24	19	18	19
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	69	110	88	74

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Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918793	2918794	2918795	2918796	2918797
Sample Reference				S19	S20	S21	S22	S22
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.30-0.40
Date Sampled				18/12/2023	18/12/2023	18/12/2023	18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	31	30	52	18	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918798	2918799
Sample Reference				S23	S23
Sample Number				None Supplied	None Supplied
Depth (m)				0.00-0.10	0.25-0.35
Date Sampled				18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	21	15
Total mass of sample received	kg	0.001	NONE	1	0.9
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.4	7.5
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.52	2.46
Total Chloride	mg/kg	5	NONE	71	280
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	< 1.0	3.4
Ammoniacal Nitrogen as NH3	mg/kg	0.5	MCERTS	16	460

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80

Heavy Metals / Metalloids

Aluminium (aqua regia extractable)	mg/kg	30	ISO 17025	7100	8500
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.1	5.4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	140	170
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.39	0.51
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19	23
Lead (aqua regia extractable)	mg/kg	1	MCERTS	12	13
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	97	260
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	14	15
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	33	36

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Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Lab Sample Number				2918798	2918799
Sample Reference				S23	S23
Sample Number				None Supplied	None Supplied
Depth (m)				0.00-0.10	0.25-0.35
Date Sampled				18/12/2023	18/12/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Petroleum Hydrocarbons					
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-76311
Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2918773	S1	None Supplied	0.00-0.10	Brown loam and clay with gravel and vegetation.
2918774	S2	None Supplied	0.00-0.10	Brown loam and clay with gravel and vegetation.
2918775	S3	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918776	S4	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918777	S4	None Supplied	0.30-0.40	Brown clay and sand with gravel and vegetation.
2918778	S5	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918779	S6	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918780	S6	None Supplied	0.30-0.40	Brown clay and loam with gravel and vegetation.
2918781	S7	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918782	S8	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918783	S9	None Supplied	0.30-0.40	Brown clay and loam with gravel and vegetation.
2918784	S9	None Supplied	0.00-0.15	Brown clay and loam with gravel and vegetation.
2918785	S10	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918786	S12	None Supplied	0.00-0.10	Brown clay and loam with peat and vegetation.
2918787	S13	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918788	S14	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918789	S15	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918790	S16	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918791	S17	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918792	S18	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918793	S19	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918794	S20	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918795	S21	None Supplied	0.00-0.10	Brown clay and loam with peat and vegetation.
2918796	S22	None Supplied	0.00-0.10	Brown clay and loam with gravel and vegetation.
2918797	S22	None Supplied	0.30-0.40	Brown clay and sand with gravel and vegetation.
2918798	S23	None Supplied	0.00-0.10	Brown clay and sand with gravel and vegetation.
2918799	S23	None Supplied	0.25-0.35	Brown clay and sand with gravel and vegetation.

Analytical Report Number : 23-76311
Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	ISO 17025
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Chloride in soil	Determination of acid soluble chloride in soil by extraction with nitric acid, addition of silver nitrate followed by titration against thiocyanate.	In-house method	L075-PL	D	NONE
Fluoride, water soluble, in soil	Determination of fluoride in soil by water extraction followed by 1:1 ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Ammonia as NH3 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS

Analytical Report Number : 23-76311
Project / Site name: Mark Wakefield Demolition Ltd - Fenn's Bank, Whitchurch

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX G

Water Sample Data

Sample Location Number	BH1		**Screened Interval**		(mbd)	**Purging Information**	
Site / Facility Name	Fenns Bank		Top (mbgl)	2	2.27	Purging device (pump type)	Peristatic
Date	17/01/2024		Bottom (mbgl)	3	3.27	Pump intake depth (mbd)	2.1
Sampling Organisation	HFCL		Length (m)	1		Flow Cell Volume (litres)	
Field personnel	XB, JPC		Dia (mm)	50		Total system volume (litres)	
Datum point description	Top of steel casing		Screen Vol (litres)	2.0		Total volume purged (litres)	
Height of datum point relative to GL(m)	0.27	mbgl - metres below groung level				No of screen volumes purged	0.0
Depth to water level (mbd)	0.9	mbd - meters below datum				Drawdown in water level (m)	0.495
Depth to base of well (mbd)	2.02		**Stabilisation indicators**				
Time of Test	10:21 AM		**Operational**			**Chemical**	

Time (mins)	Time (secs) to fill a … L container	Purge rate (mL/min) or (L/min)	Cum. Volume Purged (litres)	Depth to water (mbd)	Temp (oC)	Turbidity (NTU)	EC (µS/cm)	pH	ORP (mV)	DO (mg/l)	Comments
5		0.25	0.8	1.15	6.33	1238	7570	6.47	146.8	1.34	
10			1.9	1.18	6.74	1229	7497	6.45	141.8	0.84	Failed on DO, Temp
15			3.1	1.25	6.97	643	7493	6.45	136	0.56	Failed on Temp, Tur, DO
20			4.3	1.27	7.1	3304	7551	6.48	133	0.42	Failed on Temp, Tur
25		0.25	5.5	1.31	7.17	1149	7548	6.47	130	0.42	Failed on Tur
30			6.8	1.33	7.23	578	7649	6.49	127	0.35	
											Sample Taken at 10:55 am
Stabilisation Criteria					*3%*	*10%*	*3%*	*± 0.1*	*± 10mV*	*10%*	
Alternative if greater						*< 5 NTU*			*< 0.5 mV*	*< 0.5 mg/L*	

EC-Electrical conductivity
ORP-Oxidation-Reduction potential
DO-Dissolved Oxygen

Sample Location Number	BH2		**Screened Interval**		(mbd)		**Purging Information**				
Site / Facility Name	Fenns Bank		Top (mbgl)	2	2.27		Purging device (pump type)	Peristatic			
Date	17/01/2024		Bottom (mbgl)	3	3.27		Pump intake depth (mbd)	2.4			
Sampling Organisation	HFCL		Length (m)	1			Flow Cell Volume (litres)				
Field personnel	XB, JPC		Dia (mm)	50			Total system volume (litres)				
Datum point description	Top of steel casing		Screen Vol (litres)	2.0			Total volume purged (litres)				
Height of datum point relative to GL(m)	0.27	mbgl - metres below groung level					No of screen volumes purged	0.0			
Depth to water level (mbd)	1.175	mbd - meters below datum					Drawdown in water level (m)	0.22			
Depth to base of well (mbd)	3.12		**Stabilisation indicators**								
Time of Test	10:45 AM		**Operational**			**Chemical**					

Time (mins)	Time (secs) to fill a … L container	Purge rate (mL/min) or (L/min)	Cum. Volume Purged (litres)	Depth to water (mbd)	Temp (oC)	Turbidity (NTU)	EC (µS/cm)	pH	ORP (mV)	DO (mg/l)	Comments
5			0.7	0.8	6.26	12383164	2813	7.65	25.6	0.38	
10		0.3	2.2	1	6.22	150.76	256.3	7.64	-6.6	0.08	Failed on ORP, Tur, EC
15		0.3	3.6	1.03	6.49	142.11	247	7.67	-18.8	0.03	Failed on Temp, ORP
20			5.1	1.03	7.19	6456.6	254.48	7.66	-28.3	0.02	Failed on Tur, Temp
25			6.9	1.03	7.44	6063.8	241.1	7.67	34.3	0.01	Failed on EC, Temp
30			8.5	1.03	7.54	5268	245	7.7	38.1	0.01	Failed on Tur, Temp
35			1.4	1.02	7.76	5274	244.7	7.7	-40.4	0.01	Passed
40			2.5	1.95	7.21	4731	228	7.66	42.3	0.01	Failed on Temp, Tur
Stabilisation Criteria					*3%*	*10%*	*3%*	*± 0.1*	*± 10mV*	*10%*	
Alternative if greater						*< 5 NTU*			*< 0.5 mV*	*< 0.5 mg/L*	

EC-Electrical conductivity
ORP-Oxidation-Reduction potential
DO-Dissolved Oxygen

Sample Location Number			S-04		**Screened Interval**			(mbd)	**Purging Information**			
Site / Facility Name			Fenns Bank		Top (mbgl)				Purging device (pump type)		Peristatic	
Date			16/01/2023		Bottom (mbgl)				Pump intake depth (mbd)		1.6	
Sampling Organisation			HFCL		Length (m)				Flow Cell Volume (litres)		0.5	
Field personnel			XB, JPC		Dia (mm)		50		Total system volume (litres)		0.5	
Datum point description			Top of steel casing		Screen Vol (litres)		0.0		Total volume purged (litres)			
Height of datum point relative to GL(m)			0.3	mbgl - metres below groung level					No of screen volumes purged			
Depth to water level (mbd)			0.45	mbd - meters below datum					Drawdown in water level (m)		0.945	
Depth to base of well (mbd)			1.94		**Stabilisation indicators**							
Time of Test			9:55 AM		**Operational**				**Chemical**			

Time (mins)	Time (secs) to fill a … L container	Purge rate (mL/min) or (L/min)	Cum. Volume Purged (litres)	Depth to water (mbd)	Temp (oC)	Turbidity (NTU)	EC (µS/cm)	pH	ORP (mV)	DO (mg/l)	Comments
2		0.154		0.53	6.74	13.27	1382.5	6.46	69.2	2.641.34	
5		0.18		0.57	6.94	12.44	1376	6.2	79.4	1.89	
10			1.5	0.61	7.16	14.29	1363.5	6.17	86.6	1.04	Failed on DO, Tur, Temp
15		0.18	2.3	0.63	7.43	11.76	1355	6.15	88.4	0.71	Failed on Temp, Tur, DO
20			3	0.65	7.63	8.72	1367	6.14	90.1	0.46	Failed on Tur, DO
25			4.25	0.665	7.63	8.53	1386	6.14	92.3	0.38	Failed on DO
30			5.1	0.65	7.64	7.67	1387	6.13	93.6	0.31	Passed
											Sample at 10:28 am Final Dip=0.69m
Stabilisation Criteria					*3%*	*10%*	*3%*	*± 0.1*	*± 10mV*	*10%*	
Alternative if greater						*< 5 NTU*			*< 0.5 mV*	*< 0.5 mg/L*	

EC-Electrical conductivity
ORP-Oxidation-Reduction potential
DO-Dissolved Oxygen

Sample Location Number	S-06		**Screened Interval**		(mbd)	**Purging Information**					
Site / Facility Name	Fenns Bank		Top (mbgl)			Purging device (pump type)				Peristatic	
Date	16/01/2024		Bottom (mbgl)			Pump intake depth (mbd)				2	
Sampling Organisation	HFCL		Length (m)			Flow Cell Volume (litres)					
Field personnel	XB, JPC		Dia (mm)	50		Total system volume (litres)					
Datum point description	Top of steel casing		Screen Vol (litres)			Total volume purged (litres)					
Height of datum point relative to GL(m)	0.32	mbgl - metres below groung level				No of screen volumes purged					
Depth to water level (mbd)	0.415	mbd - meters below datum				Drawdown in water level (m)				0.98	
Depth to base of well (mbd)	3.25		**Stabilisation indicators**								
Time of Test	12:40 PM		**Operational**			**Chemical**					

Time (mins)	Time (secs) to fill a … L container	Purge rate (mL/min) or (L/min)	Cum. Volume Purged (litres)	Depth to water (mbd)	Temp (oC)	Turbidity (NTU)	EC (µS/cm)	pH	ORP (mV)	DO (mg/l)	Comments
0				0.405							
2		0.21		0.53	8.05	36.89	3939	6.83	140.841.8	1.63	
5		0.21		0.63	8.19	29.73	3923	6.84	-65.3	0.47	Failed on ORP, Tur
10			1.75	0.68	8.18	26.19	382	6	-79.4	0.27	Failed on ORP, Tur
15			2.9	0.7	7.93	20.34	3430	6.85	-90.7	0.21	Failed on ORP, Tur, EC
20			4	0.72	7.76	31.9	2724	6.88	-97.7	0.18	Failed on Tur, EC
25			5.1	0.73	7.58	44.04	2218	6.97	-101.7	0.15	Failed on Tur, EC
30			6.5	0.74	7.47	59.38	1977	7	-103	0.13	Failed on Tur, EC
35			8	0.745	7.31	63.59	1829.7	7.03	-103	0.11	
40			9	0.755	7.18	68.09	1773	7.02	-103	0.1	
45			1	0.76	7.09	67.57	1711	7.04	-104	0.1	Failed on EC
50			11.5	0.77	6.98	55.53	1682	7.05	-105.1	0.09	Failed on EC, Tur not stabilised perfectly
55											Sample taken at 13:33
Stabilisation Criteria					*3%*	*10%*	*3%*	*± 0.1*	*± 10mV*	*10%*	
Alternative if greater						*< 5 NTU*			*< 0.5 mV*	*< 0.5 mg/L*	

EC-Electrical conductivity
ORP-Oxidation-Reduction potential
DO-Dissolved Oxygen

Sample Location Number	S-07		**Screened Interval**		(mbd)	**Purging Information**					
Site / Facility Name	Fenns Bank		Top (mbgl)			Purging device (pump type)				Peristatic	
Date	16/01/2024		Bottom (mbgl)			Pump intake depth (mbd)				1.8	
Sampling Organisation	HFCL		Length (m)			Flow Cell Volume (litres)					
Field personnel	XB, JPC		Dia (mm)	50		Total system volume (litres)					
Datum point description	Top of steel casing		Screen Vol (litres)			Total volume purged (litres)					
Height of datum point relative to GL(m)	0.315	mbgl - metres below groung level				No of screen volumes purged					
Depth to water level (mbd)	0.54	mbd - meters below datum				Drawdown in water level (m)				0.855	
Depth to base of well (mbd)	2.78		**Stabilisation indicators**								
Time of Test	14:55 pm		**Operational**			**Chemical**					

Time (mins)	Time (secs) to fill a … L container	Purge rate (mL/min) or (L/min)	Cum. Volume Purged (litres)	Depth to water (mbd)	Temp (oC)	Turbidity (NTU)	EC (µS/cm)	pH	ORP (mV)	DO (mg/l)	Comments
5		0.2		0.54							
10		0.21		0.56	7.28	132	3671	7.1	41.9	0.51	
15			1.2	0.58	7.93	104.43	6222	7.04	-16	0.3	Failed on Temp, Tur, EC, ORP
20			2.2	0.6	8.06	66.62	7153	7.03	-50.4	0.24	Failed on Tur, ORP, EC
25			3.4	0.6	8.15	19.62	7603	7.04	-72.2	0.2	Failed on Tur, ORP, EC
30			4.5	0.605	8.18	8.81	7919	7.04	-89.3	0.17	Failed on Tur, ORP, EC
35			5.5	0.62	8.19	4.82	8030	7.02	-101.8	0.15	Failed on ORP
40			6.5	0.625	8.24	0	8182	7.04	-115.4	0.14	Failed on ORP
45			7.5	0.63	8.24	0	8248	7.03	-125	0.13	Passed
50			9	0.635	8.23	0	8255	7.05	-133.8	0.12	Passed and sample taken
Stabilisation Criteria					*3%*	*10%*	*3%*	*± 0.1*	*± 10mV*	*10%*	
Alternative if greater						*< 5 NTU*			*< 0.5 mV*	*< 0.5 mg/L*	

EC-Electrical conductivity
ORP-Oxidation-Reduction potential
DO-Dissolved Oxygen

APPENDIX H

Water Laboratory Certificates

Roz Cox
H Fraser Consulting Ltd
The Pump House
Coton Hill
Shrewsbury
SY1 2DP

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Analytical Report Number : 24-78949

Project / Site name:		**Samples received on:**	19/01/2024
Your job number:		**Samples instructed on/ Analysis started on:**	19/01/2024
Your order number:		**Analysis completed by:**	29/01/2024
Report Issue Number:	1	**Report issued on:**	29/01/2024
Samples Analysed:	21 water samples		

Signed:

Joanna Szwagrzak
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-78949

Lab Sample Number				2932311	2932312	2932313	2932314	2932315
Sample Reference				WD1	WD2	FD1	FD2	FD3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (L099)	pH Units	N/A	ISO 17025	7.8	9.4	9.4	9.3	9.2
Electrical Conductivity at 20 °C (L031B)	µS/cm	10	ISO 17025	8200	8300	44000	18000	18000
Sulphate as SO4	mg/l	0.045	ISO 17025	26.7	184	473	221	227
Chloride	mg/l	0.15	ISO 17025	2800$$	1700$$	15000$$	5700$$	5400$$
Total Phosphate as P	µg/l	20	ISO 17025	23	390	440	160	200
Fluoride	µg/l	50	ISO 17025	2000	2600	1300	1300	1100
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	91000	390000$$	1200000$$	500000$$	470000$$
Nitrate as N	mg/l	0.01	ISO 17025	0.72	47.4	2.51	32	32.3
Nitrite as N	µg/l	1	ISO 17025	15	20000	13000	7500	7600
Alkalinity as CaCO3	mg/l	3	ISO 17025	230	370	2600	1600	1400
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	-	-	-	-	-
Acenaphthylene	µg/l	0.01	ISO 17025	-	-	-	-	-
Acenaphthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Fluorene	µg/l	0.01	ISO 17025	-	-	-	-	-
Phenanthrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Chrysene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	-	-	-	-	-
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	-	-	-	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932311	2932312	2932313	2932314	2932315
Sample Reference				WD1	WD2	FD1	FD2	FD3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (dissolved)	mg/l	0.012	ISO 17025	0.18	1.2	1.4	1.2	1.2
Arsenic (dissolved)	µg/l	1	ISO 17025	5	29	20	21	22
Barium (dissolved)	µg/l	0.05	ISO 17025	480	73	230	180	180
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Boron (dissolved)	µg/l	10	ISO 17025	150	9900	9600	7500	7400
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Calcium (dissolved)	mg/l	0.012	ISO 17025	88	12	39	32	32
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.8	1.7	5.8	3.6	4
Copper (dissolved)	µg/l	0.7	ISO 17025	29	770	64	280	280
Iron (dissolved)	mg/l	0.004	ISO 17025	5	0.077	0.19	0.8	0.79
Lead (dissolved)	µg/l	1	ISO 17025	2.2	4.6	< 1.0	2.2	3.7
Magnesium (dissolved)	mg/l	0.005	ISO 17025	14	20	12	15	16
Manganese (dissolved)	µg/l	0.06	ISO 17025	8800	72	48	400	430
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	5.8	7	25	12	11
Potassium (dissolved)	mg/l	0.025	ISO 17025	600	570$$	2600$$	1400$$	1300$$
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	150	43	74	74
Sodium (dissolved)	mg/l	0.01	ISO 17025	1200	950$$	5700$$	2100$$	2000$$
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	24	17	18	15
Zinc (dissolved)	µg/l	0.4	ISO 17025	28	13	50	15	13

Aluminium (dissolved)	mg/l	0.001	ISO 17025	-	-	-	-	-
Arsenic (dissolved)	µg/l	0.15	ISO 17025	-	-	-	-	-
Barium (dissolved)	µg/l	0.06	ISO 17025	-	-	-	-	-
Beryllium (dissolved)	µg/l	0.1	ISO 17025	-	-	-	-	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	-	-	-	-	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Copper (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Lead (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Manganese (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Mercury (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	-	-	-	-	-
Vanadium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	-	-	-	-	-
Toluene	µg/l	3	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/l	3	ISO 17025	-	-	-	-	-
p & m-xylene	µg/l	3	ISO 17025	-	-	-	-	-
o-xylene	µg/l	3	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-	-	-	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C6 - C8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C8 - C10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932311	2932312	2932313	2932314	2932315
Sample Reference				WD1	WD2	FD1	FD2	FD3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-78949

Lab Sample Number				2932316	2932317	2932318	2932319	2932320
Sample Reference				FD4	RB1	RB2	RB3	RB5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (L099)	pH Units	N/A	ISO 17025	9.1	7	7	6.8	6.8
Electrical Conductivity at 20 °C (L031B)	µS/cm	10	ISO 17025	13000	380	550	490	450
Sulphate as SO4	mg/l	0.045	ISO 17025	210	14.6	17.7	16.4	16.3
Chloride	mg/l	0.15	ISO 17025	3800$$	94	130	110	110
Total Phosphate as P	µg/l	20	ISO 17025	150	120	100	92	100
Fluoride	µg/l	50	ISO 17025	5000	470	1400	850	730
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	310000$$	1300	8600	3800	910
Nitrate as N	mg/l	0.01	ISO 17025	32.2	0.48	1.56	2.16	1.68
Nitrite as N	µg/l	1	ISO 17025	4400	U/S**	U/S**	U/S**	U/S**
Alkalinity as CaCO3	mg/l	3	ISO 17025	1000	U/S**	U/S**	U/S**	U/S**
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	-	-	-	-	-
Acenaphthylene	µg/l	0.01	ISO 17025	-	-	-	-	-
Acenaphthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Fluorene	µg/l	0.01	ISO 17025	-	-	-	-	-
Phenanthrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Chrysene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	-	-	-	-	-
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	-	-	-	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932316	2932317	2932318	2932319	2932320
Sample Reference				FD4	RB1	RB2	RB3	RB5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (dissolved)	mg/l	0.012	ISO 17025	1.1	0.83	0.81	0.7	0.73
Arsenic (dissolved)	µg/l	1	ISO 17025	13	3.3	1.3	3	4.2
Barium (dissolved)	µg/l	0.05	ISO 17025	180	150	150	140	150
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Boron (dissolved)	µg/l	10	ISO 17025	5500	61	120	75	68
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Calcium (dissolved)	mg/l	0.012	ISO 17025	39	18	19	19	20
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.8	3.2	3.1	2.7	2.8
Copper (dissolved)	µg/l	0.7	ISO 17025	210	6.5	10	7.7	7.6
Iron (dissolved)	mg/l	0.004	ISO 17025	1.1	3.7	3.7	3.2	3.4
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	9.9	7.8	7.1	5.9
Magnesium (dissolved)	mg/l	0.005	ISO 17025	18	5.8	5.9	5.6	6.2
Manganese (dissolved)	µg/l	0.06	ISO 17025	760	130	140	130	140
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	9.4	3.9	3.1	3.1	3.5
Potassium (dissolved)	mg/l	0.025	ISO 17025	830	28	35	29	27
Selenium (dissolved)	µg/l	4	ISO 17025	61	< 4.0	< 4.0	< 4.0	< 4.0
Sodium (dissolved)	mg/l	0.01	ISO 17025	1700	51	70	55	55
Vanadium (dissolved)	µg/l	1.7	ISO 17025	9.2	1.8	< 1.7	< 1.7	4.5
Zinc (dissolved)	µg/l	0.4	ISO 17025	12	36	57	33	31
Aluminium (dissolved)	mg/l	0.001	ISO 17025	-	-	-	-	-
Arsenic (dissolved)	µg/l	0.15	ISO 17025	-	-	-	-	-
Barium (dissolved)	µg/l	0.06	ISO 17025	-	-	-	-	-
Beryllium (dissolved)	µg/l	0.1	ISO 17025	-	-	-	-	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	-	-	-	-	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Copper (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Lead (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Manganese (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Mercury (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	-	-	-	-	-
Vanadium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	-	-	-	-	-
Toluene	µg/l	3	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/l	3	ISO 17025	-	-	-	-	-
p & m-xylene	µg/l	3	ISO 17025	-	-	-	-	-
o-xylene	µg/l	3	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-	-	-	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C6 - C8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C8 - C10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932316	2932317	2932318	2932319	2932320
Sample Reference				FD4	RB1	RB2	RB3	RB5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	-
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-78949

Lab Sample Number				2932321	2932322	2932323	2932324	2932325
Sample Reference				BF1	BF2	BF5	BF8	S-04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	2.00-2.10
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (L099)	pH Units	N/A	ISO 17025	7.8	8.5	8.5	8.7	7.5
Electrical Conductivity at 20 °C (L031B)	µS/cm	10	ISO 17025	200	4200	1700	2400	1400
Sulphate as SO4	mg/l	0.045	ISO 17025	3.93	285	67	111	39.6
Chloride	mg/l	0.15	ISO 17025	30	1300	440	480	350
Total Phosphate as P	µg/l	20	ISO 17025	< 20	< 20	< 20	< 20	< 20
Fluoride	µg/l	50	ISO 17025	1500	1300	3700	2800	820
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	390	18000	180	20000	50
Nitrate as N	mg/l	0.01	ISO 17025	0.3	3.43	1.79	18	0.07
Nitrite as N	µg/l	1	ISO 17025	9.6	1200	43	1400	2.1
Alkalinity as CaCO3	mg/l	3	ISO 17025	57	160	200	310	99
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Fluorene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Anthracene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Pyrene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Chrysene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	-	-	-	-	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	-	-	-	-	< 0.16

Analytical Report Number: 24-78949

Lab Sample Number				2932321	2932322	2932323	2932324	2932325
Sample Reference				BF1	BF2	BF5	BF8	S-04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	2.00-2.10
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (dissolved)	mg/l	0.012	ISO 17025	-	-	-	-	-
Arsenic (dissolved)	µg/l	1	ISO 17025	-	-	-	-	-
Barium (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Beryllium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Boron (dissolved)	µg/l	10	ISO 17025	15	250	690	1400	150
Cadmium (dissolved)	µg/l	0.08	ISO 17025	-	-	-	-	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	13	65	20	41	19
Chromium (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-	-
Copper (dissolved)	µg/l	0.7	ISO 17025	-	-	-	-	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.049	0.012	0.14	0.043	0.2
Lead (dissolved)	µg/l	1	ISO 17025	-	-	-	-	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	3.4	7	7.3	15	4.3
Manganese (dissolved)	µg/l	0.06	ISO 17025	-	-	-	-	-
Mercury (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	-	-	-	-	-
Potassium (dissolved)	mg/l	0.025	ISO 17025	9.6	420	130	200	85
Selenium (dissolved)	µg/l	4	ISO 17025	-	9.7	-	-	-
Sodium (dissolved)	mg/l	0.01	ISO 17025	15	570	240	310	180
Vanadium (dissolved)	µg/l	1.7	ISO 17025	-	-	-	-	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-	-

Aluminium (dissolved)	mg/l	0.001	ISO 17025	0.0445	0.47	0.234	0.152	0.858
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.52	3.38	1.89	1.49	1.77
Barium (dissolved)	µg/l	0.06	ISO 17025	56	77	71	48	110
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	0.03	< 0.02	0.04	0.24
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.8	4.8	1.1	4.1	3.7
Copper (dissolved)	µg/l	0.5	ISO 17025	10	45	18	32	25
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	1	< 0.2	1
Manganese (dissolved)	µg/l	0.05	ISO 17025	39	96	12	71	93
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	0.18	< 0.05	0.31	0.11
Nickel (dissolved)	µg/l	0.5	ISO 17025	1.2	3.4	2.2	1.5	11
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	-	3.3	9.5	3.2
Vanadium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	4.8	1.2	4.3	1.6
Zinc (dissolved)	µg/l	0.5	ISO 17025	5.2	4.4	6.1	2.3	13
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	-	-	-	-	< 3.0
Toluene	µg/l	3	ISO 17025	-	-	-	-	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	-	-	-	-	< 3.0
p & m-xylene	µg/l	3	ISO 17025	-	-	-	-	< 3.0
o-xylene	µg/l	3	ISO 17025	-	-	-	-	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-	-	-	-	< 3.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >C6 - C8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >C8 - C10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	< 10

Analytical Report Number: 24-78949

Lab Sample Number				2932321	2932322	2932323	2932324	2932325
Sample Reference				BF1	BF2	BF5	BF8	S-04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	2.00-2.10
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-	-	-	-	< 1.0
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	-	-	-	-	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-78949

Lab Sample Number				2932326	2932327	2932328	2932329	2932330
Sample Reference				BH1	S-06	S-07	SW1	SW2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.10	2.00-2.10	2.00-2.10	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (L099)	pH Units	N/A	ISO 17025	7.7	8	8	8.4	8.3
Electrical Conductivity at 20 °C (L031B)	µS/cm	10	ISO 17025	6900	1500	7300	1700	540
Sulphate as SO4	mg/l	0.045	ISO 17025	645	4.53	304	95.2	8.02
Chloride	mg/l	0.15	ISO 17025	1800$$	320	2200$$	350	66
Total Phosphate as P	µg/l	20	ISO 17025	< 20	26	130	< 20	< 20
Fluoride	µg/l	50	ISO 17025	2600	3200	4300	8900	2200
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	78000	710	39000	91	31
Nitrate as N	mg/l	0.01	ISO 17025	3.85	< 0.01	< 0.01	2.9	< 0.01
Nitrite as N	µg/l	1	ISO 17025	81	< 1.0	16	5.6	< 1.0
Alkalinity as CaCO3	mg/l	3	ISO 17025	320	320	580	260	200
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	-	-
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932326	2932327	2932328	2932329	2932330
Sample Reference				BH1	S-06	S-07	SW1	SW2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.10	2.00-2.10	2.00-2.10	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (dissolved)	mg/l	0.012	ISO 17025	-	-	-	-	-
Arsenic (dissolved)	µg/l	1	ISO 17025	-	-	-	-	-
Barium (dissolved)	µg/l	0.05	ISO 17025	-	-	-	-	-
Beryllium (dissolved)	µg/l	0.2	ISO 17025	-	-	-	-	-
Boron (dissolved)	µg/l	10	ISO 17025	770	330	580	500	88
Cadmium (dissolved)	µg/l	0.08	ISO 17025	-	-	-	-	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	340	79	330	87	42
Chromium (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-	-
Copper (dissolved)	µg/l	0.7	ISO 17025	-	-	-	-	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.061	2.8	0.21	0.026	0.04
Lead (dissolved)	µg/l	1	ISO 17025	-	-	-	-	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	40	18	120	20	16
Manganese (dissolved)	µg/l	0.06	ISO 17025	-	-	-	-	-
Mercury (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	-	-	-	-	-
Potassium (dissolved)	mg/l	0.025	ISO 17025	380	71	360	110	29
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	-	< 4.0	-	-
Sodium (dissolved)	mg/l	0.01	ISO 17025	890	200	950	210	47
Vanadium (dissolved)	µg/l	1.7	ISO 17025	-	-	-	-	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-	-

Aluminium (dissolved)	mg/l	0.001	ISO 17025	0.907	0.163	0.0139	0.043	0.0341
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.34	3.82	5.86	1.12	0.84
Barium (dissolved)	µg/l	0.06	ISO 17025	140	310	130	150	160
Beryllium (dissolved)	µg/l	0.1	ISO 17025	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	1.1	0.05	0.03	< 0.02	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	1.7	1.1	0.6	1.3	1.1
Copper (dissolved)	µg/l	0.5	ISO 17025	19	14	3	18	12
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	2.7	< 0.2	< 0.2	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	2000	2900	3600	3.6	1.9
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	18	4.2	18	2.2	1.4
Selenium (dissolved)	µg/l	0.6	ISO 17025	-	2.6	-	3.1	0.8
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.9	1.2	0.6	0.6	0.2
Zinc (dissolved)	µg/l	0.5	ISO 17025	33	5.9	4.3	11	5.4
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aliphatic >C6 - C8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aliphatic >C8 - C10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-

Analytical Report Number: 24-78949

Lab Sample Number				2932326	2932327	2932328	2932329	2932330
Sample Reference				BH1	S-06	S-07	SW1	SW2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.10	2.00-2.10	2.00-2.10	None Supplied	None Supplied
Date Sampled				17/01/2024	17/01/2024	17/01/2024	17/01/2024	17/01/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	-	-
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-78949

Lab Sample Number	2932331
Sample Reference	SW3
Sample Number	None Supplied
Depth (m)	None Supplied
Date Sampled	17/01/2024
Time Taken	None Supplied

Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
General Inorganics				
pH (L099)	pH Units	N/A	ISO 17025	8.5
Electrical Conductivity at 20 °C (L031B)	µS/cm	10	ISO 17025	730
Sulphate as SO4	mg/l	0.045	ISO 17025	19.4
Chloride	mg/l	0.15	ISO 17025	110
Total Phosphate as P	µg/l	20	ISO 17025	< 20
Fluoride	µg/l	50	ISO 17025	3700
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	110
Nitrate as N	mg/l	0.01	ISO 17025	0.99
Nitrite as N	µg/l	1	ISO 17025	10
Alkalinity as CaCO3	mg/l	3	ISO 17025	220
Speciated PAHs				
Naphthalene	µg/l	0.01	ISO 17025	-
Acenaphthylene	µg/l	0.01	ISO 17025	-
Acenaphthene	µg/l	0.01	ISO 17025	-
Fluorene	µg/l	0.01	ISO 17025	-
Phenanthrene	µg/l	0.01	ISO 17025	-
Anthracene	µg/l	0.01	ISO 17025	-
Fluoranthene	µg/l	0.01	ISO 17025	-
Pyrene	µg/l	0.01	ISO 17025	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-
Chrysene	µg/l	0.01	ISO 17025	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	-
Total PAH				
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	-

Analytical Report Number: 24-78949

Lab Sample Number				2932331
Sample Reference				SW3
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				17/01/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Heavy Metals / Metalloids				
Aluminium (dissolved)	mg/l	0.012	ISO 17025	-
Arsenic (dissolved)	µg/l	1	ISO 17025	-
Barium (dissolved)	µg/l	0.05	ISO 17025	-
Beryllium (dissolved)	µg/l	0.2	ISO 17025	-
Boron (dissolved)	µg/l	10	ISO 17025	150
Cadmium (dissolved)	µg/l	0.08	ISO 17025	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	50
Chromium (dissolved)	µg/l	0.4	ISO 17025	-
Copper (dissolved)	µg/l	0.7	ISO 17025	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.092
Lead (dissolved)	µg/l	1	ISO 17025	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	16
Manganese (dissolved)	µg/l	0.06	ISO 17025	-
Mercury (dissolved)	µg/l	0.5	ISO 17025	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	-
Potassium (dissolved)	mg/l	0.025	ISO 17025	43
Selenium (dissolved)	µg/l	4	ISO 17025	-
Sodium (dissolved)	mg/l	0.01	ISO 17025	71
Vanadium (dissolved)	µg/l	1.7	ISO 17025	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	-

Aluminium (dissolved)	mg/l	0.001	ISO 17025	0.0362
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.26
Barium (dissolved)	µg/l	0.06	ISO 17025	160
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.3
Copper (dissolved)	µg/l	0.5	ISO 17025	12
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	36
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	1.9
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.4
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.3
Zinc (dissolved)	µg/l	0.5	ISO 17025	4.5

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	-
Toluene	µg/l	3	ISO 17025	-
Ethylbenzene	µg/l	3	ISO 17025	-
p & m-xylene	µg/l	3	ISO 17025	-
o-xylene	µg/l	3	ISO 17025	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-
TPH-CWG - Aliphatic >C6 - C8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-
TPH-CWG - Aliphatic >C8 - C10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	-
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-

Analytical Report Number: 24-78949

Lab Sample Number				2932331
Sample Reference				SW3
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				17/01/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	-
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	-
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-78949
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Electrical conductivity at 20oC of water	Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW	In-house method	L031-PL	W	ISO 17025
Fluoride in water	Determination of fluoride in water by 1:1 ratio with a buffer solution followed by Ion Selective Electrode. Accredited matrices: SW, PW, GW.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	ISO 17025
Ammonia as NH3 in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW, FSE, LL.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Total Phosphate as P in water	Determination of ortho phosphate in water by addition of ammonium molybdate, potassium antimonyl tartrate and ascorbic acid followed by colorimetry.Accredited matrices: SW, PW, GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton, analysis by discreet analyser.	L082-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025

Analytical Report Number : 24-78949
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride in water	Determination of Chloride (diissolved) colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025
Alkalinity in Water (by discreet analyser)	Determination of Alkalinity by discreet analyser (colorimetry). Accredited matrices: SW, PW, GW.	In house method based on MEWAM & USEPA Method 310.2.	L082-PL	W	ISO 17025

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

**U/S - Unsuitable for analysis due to high colour intensity
$$ - Result was reported from high dilution. The result should be interpreted with caution

UKAS TESTING
4041

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Analytical Report Number : 24-027892

Project / Site name:		**Samples received on:**	28.06.2024
Your job number:	FENNS BANTI	**Samples instructed on/ Analysis started on:**	28.06.2024
Your order number:		**Analysis completed by:**	05.07.2024
Report Issue Number:	1	**Report issued on:**	05.07.2024
Samples Analysed:	5 water samples		

Signed:

Rafał Szczepańczyk
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-027892

Lab Sample Number				242047	242048	242049	242050	242051
Sample Reference				BH1	BH2	BH7	BH8	BH9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				26/06/2024	26/06/2024	26/06/2024	26/06/2024	26/06/2024
Time Taken				1342	1401	1102	0957	0910
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (L099)	pH Units	N/A	ISO 17025	6.7	7.5	12	7	7.3
Electrical Conductivity at 20°C	µS/cm	10	ISO 17025	6100	710	4400	1000	3400
Sulphate as SO_4	mg/l	0.045	ISO 17025	652	31.4	16.4	24.2	64.4
Chloride	mg/l	0.15	ISO 17025	1600 $^{\$\$}$	77	830	57	810
Total Phosphate as P	µg/l	20	ISO 17025	< 20	< 20	< 20	< 20	< 20
Fluoride	µg/l	50	ISO 17025	2800	320	2500	260	230
Ammoniacal Nitrogen as NH_3	µg/l	15	ISO 17025	82000	40	17000	29	420
Nitrate as N	mg/l	0.01	ISO 17025	1.31	0.03	0.03	3.76	0.03
Nitrite as N	µg/l	1	ISO 17025	17	< 1.0	270	42	2.3
Alkalinity as $CaCO_3$	mgCaCO3/l	3	ISO 17025	350	250	250	440	520
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16

Analytical Report Number: 24-027892

Lab Sample Number				242047	242048	242049	242050	242051
Sample Reference				BH1	BH2	BH7	BH8	BH9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				26/06/2024	26/06/2024	26/06/2024	26/06/2024	26/06/2024
Time Taken				1342	1401	1102	0957	0910
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Aluminium (dissolved)	µg/l	1	ISO 17025	420	1	2800	9.2	8.2
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.28	3.68	3.73	0.67	1.61
Barium (dissolved)	µg/l	0.06	ISO 17025	110	580	390	590	1200
Beryllium (dissolved)	µg/l	0.1	ISO 17025	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.59	< 0.02	< 0.02	0.05	0.82
Chromium (dissolved)	µg/l	0.2	ISO 17025	1.5	< 0.2	< 0.2	0.5	0.6
Copper (dissolved)	µg/l	0.5	ISO 17025	19	2.1	1.6	7.7	14
Lead (dissolved)	µg/l	0.2	ISO 17025	0.3	< 0.2	< 0.2	< 0.2	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	1600	850	0.79	130	3100
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	11	1.1	33	1.5	6.8
Selenium (dissolved)	µg/l	0.6	ISO 17025	6.7	< 0.6	6.7	1	3.8
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.8	< 0.2	32	0.5	1.1
Zinc (dissolved)	µg/l	0.5	ISO 17025	14	7.8	2.7	7.8	4.9
Boron (dissolved)	µg/l	10	ISO 17025	940	30	28	45	32
Calcium (dissolved)	mg/l	0.012	ISO 17025	230	100	320	140	320
Iron (dissolved)	mg/l	0.004	ISO 17025	0.19	0.019	0.011	0.011	0.023
Magnesium (dissolved)	mg/l	0.005	ISO 17025	20	38	0.074	50	120
Potassium (dissolved)	mg/l	0.025	ISO 17025	450	2.4	160	3.6	7.2
Sodium (dissolved)	mg/l	0.01	ISO 17025	830	15	420	57	280
Petroleum Hydrocarbons								
TPH - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC12 - EC16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC16 - EC21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC21 - EC35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC5 - EC35 $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC12 - EC16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC16 - EC21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC21 - EC35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC5 - EC35 $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH (EC12 - EC35) $_{EH+1D\_TOTAL\_MS}$	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10

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Analytical Report Number: 24-027892

Lab Sample Number				242047	242048	242049	242050	242051
Sample Reference				BH1	BH2	BH7	BH8	BH9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				26/06/2024	26/06/2024	26/06/2024	26/06/2024	26/06/2024
Time Taken				1342	1401	1102	0957	0910
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-027892
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Electrical conductivity at 20°C of water	Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW	In-house method	L031B	W	ISO 17025
Fluoride in water	Determination of fluoride in water by 1:1 ratio with a buffer solution followed by Ion Selective Electrode. Accredited matrices: SW PW, GW	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination	L033B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices: SW, GW, PW, PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total petroleum hydrocarbons with carbon banding by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total petroleum hydrocarbons by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS	In-house method	L070B	W	ISO 17025
BTEX and/or Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08	L078	W	ISO 17025
Alkalinity in water (by discreet analyser)	Determination of Alkalinity by discrete analyser (colorimetry). Accredited matrices: SW,PW, GW,FSE,LL	In-house method based on MEWAM & USEPA Method 310.2	L082B	W	ISO 17025
Chloride in water	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW,PW, GW,FSE,LL	L082B	W	ISO 17025
Ammonia as NH3 in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Phosphate as P in water	Determination of ortho phosphate in water by addition of ammonium molybdate, potassium antimonyl tartrate and ascorbic acid followed by colorimetry. Accredited matrices: SW, PW, GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton, analysis by discreet analyser	L082B	W	ISO 17025
Total petroleum hydrocarbons by GC-MS HS in water	Determination of total petroleum hydrocarbons in water by GC-MS HS	In-house method	L088B	W	ISO 17025
pH at 20°C in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method	L099	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAH) in leachate by extraction in dichloromethane followed by GC-MS	In-house method based on USEPA 8270	L102B	W	ISO 17025

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Analytical Report Number : 24-027892
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

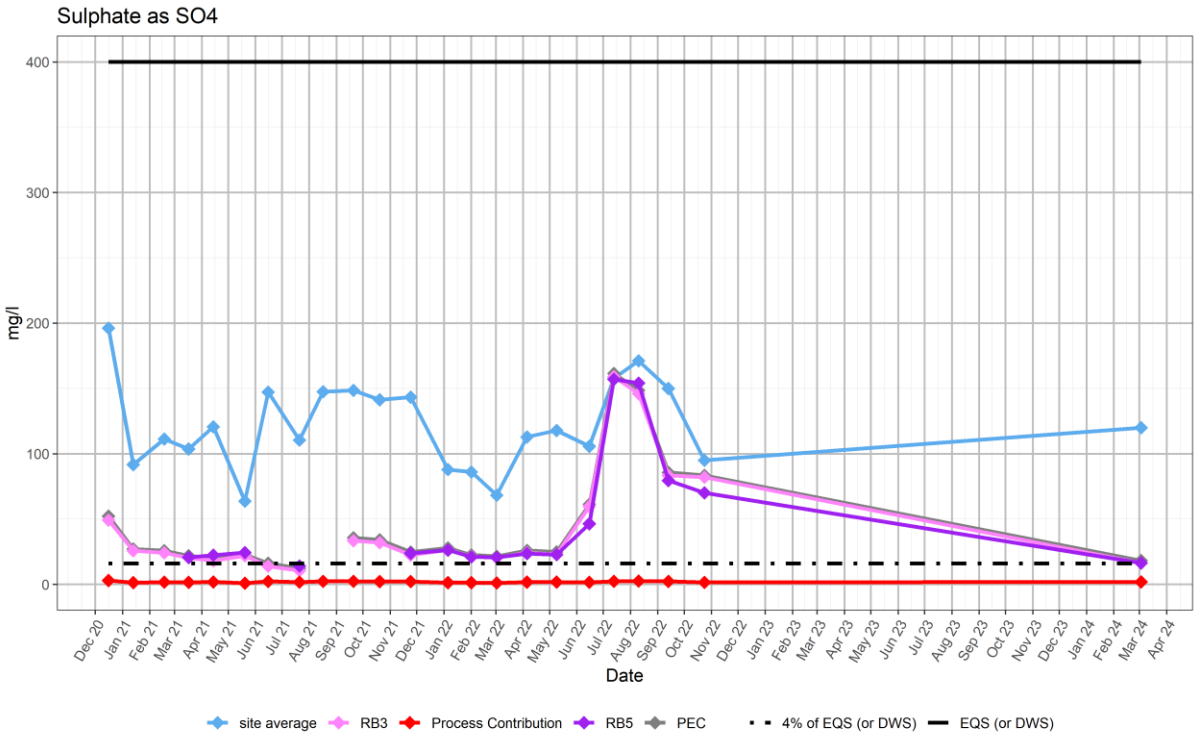
$$ - Result was reported from high dilution. The result should be interpreted with caution.

APPENDIX I

Controlled Water Risk Assessment
Dilution Screening Table and Graphs

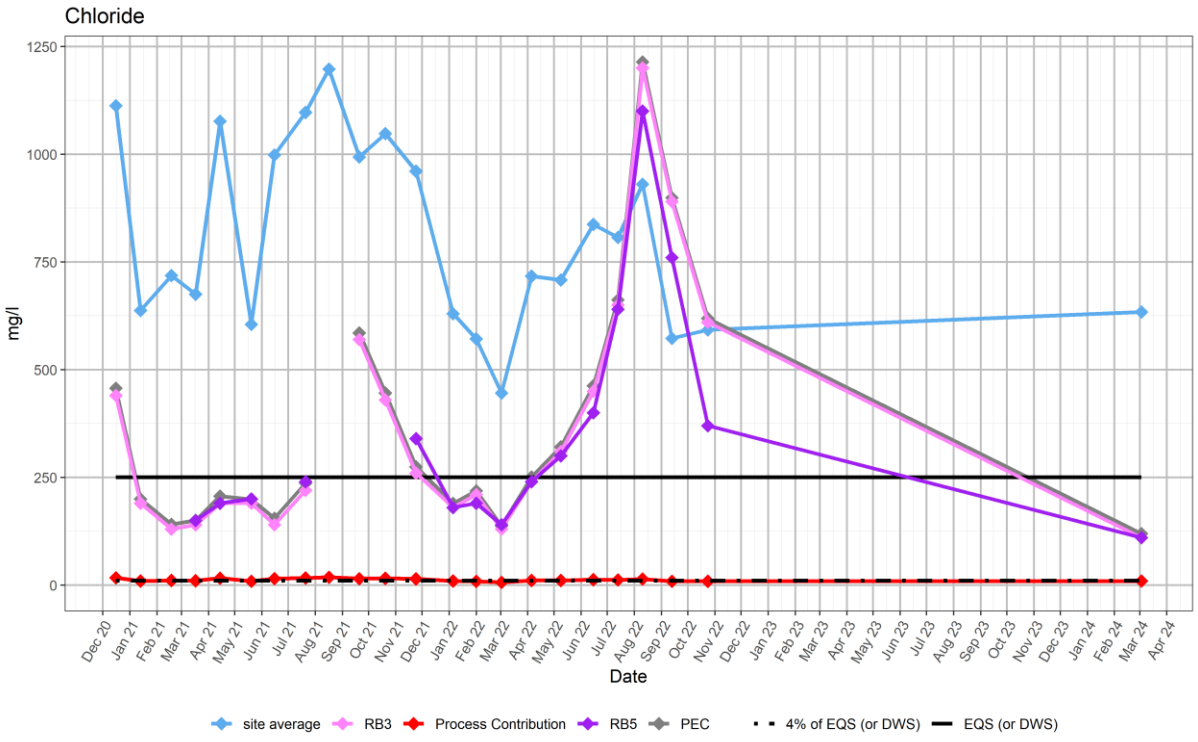
Sulphate as SO4

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	400	196.17000	2.9722727	49.2	52.17227	NO	YES	-	-	NO
2	SR2	400	91.68984	1.3892400	25.7	27.08924	NO	YES	-	-	NO
3	SR3	400	111.21429	1.6850649	24.2	25.88506	NO	YES	-	-	NO
4	SR4	400	103.61737	1.5699601	20.3	21.86996	NO	YES	-	-	NO
5	SR5	400	120.65000	1.8280303	18.2	20.02803	NO	YES	-	-	NO
6	SR6	400	63.71300	0.9653485	21.8	22.76535	NO	YES	-	-	NO
7	SR7	400	147.18667	2.2301010	13.9	16.13010	NO	YES	-	-	NO
8	SR8	400	110.46154	1.6736597	10.5	12.17366	NO	YES	-	-	NO
9	SR9	400	147.52632	2.2352472	NA	NA	NO	YES	-	-	NO
10	SR10	400	148.49889	2.2499832	33.4	35.64998	NO	YES	-	-	NO
11	SR11	400	141.30714	2.1410173	31.9	34.04102	NO	YES	-	-	NO
12	SR12	400	143.28667	2.1710101	22.5	24.67101	NO	YES	-	-	NO
13	SR13	400	87.83955	1.3309022	26.5	27.83090	NO	YES	-	-	NO
14	SR14	400	86.03500	1.3035606	21.3	22.60356	NO	YES	-	-	NO
15	SR15	400	68.15550	1.0326591	20.4	21.43266	NO	YES	-	-	NO
16	SR16	400	112.82778	1.7095118	24.2	25.90951	NO	YES	-	-	NO
17	SR17	400	117.79412	1.7847594	23.0	24.78476	NO	YES	-	-	NO
18	SR18	400	105.69529	1.6014439	59.7	61.30144	NO	YES	-	-	NO
19	SR19	400	157.84000	2.3915152	159.0	161.39152	NO	YES	-	-	NO
20	SR20	400	171.08412	2.5921836	146.0	148.59218	NO	YES	-	-	NO
21	SR21	400	149.93850	2.2717955	83.4	85.67180	NO	YES	-	-	NO
22	SR22	400	94.94500	1.4385606	82.0	83.43856	NO	YES	-	-	NO
23	SR23	400	119.96286	1.8176190	16.4	18.21762	NO	YES	-	-	NO



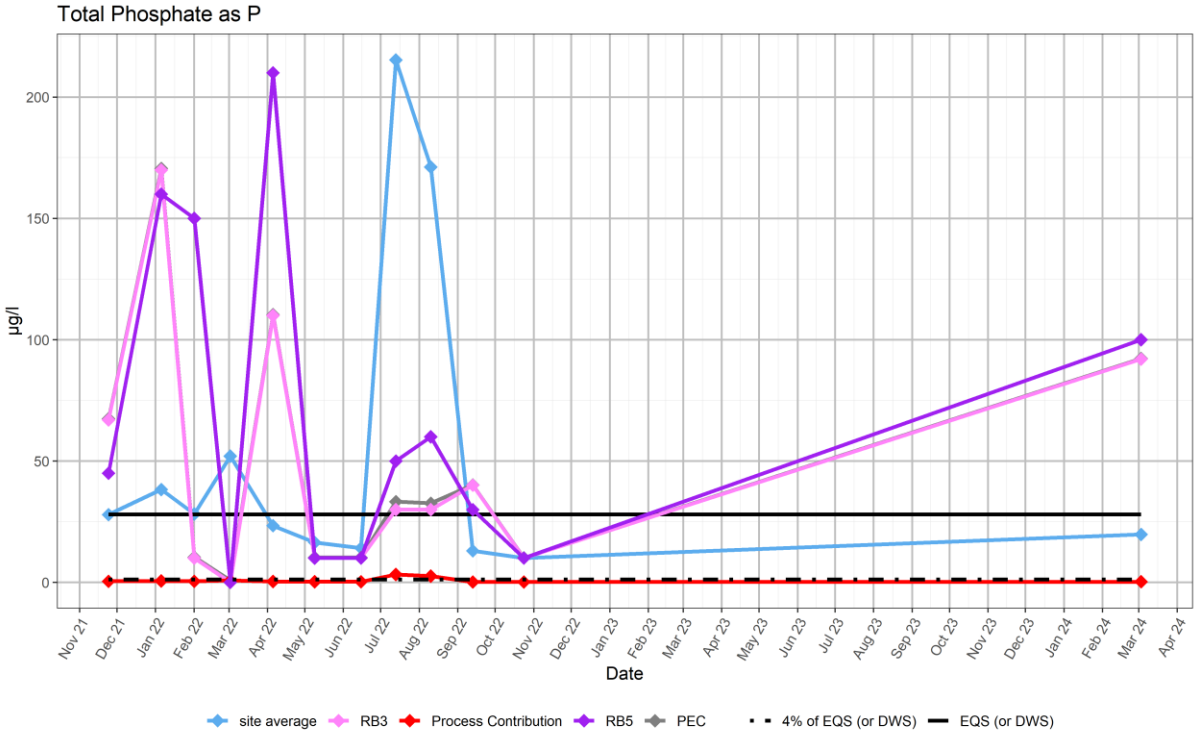
Chloride

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	250	1112.7842	16.860367	440	456.8604	NO	NO	YES	NO	YES
2	SR2	250	637.4895	9.658931	190	199.6589	NO	YES	-	-	NO
3	SR3	250	718.3571	10.884199	130	140.8842	NO	NO	YES	YES	NO
4	SR4	250	675.2105	10.230463	140	150.2305	NO	NO	YES	YES	NO
5	SR5	250	1076.5625	16.311553	190	206.3116	NO	NO	YES	YES	NO
6	SR6	250	605.3350	9.171742	190	199.1717	NO	YES	-	-	NO
7	SR7	250	998.0000	15.121212	140	155.1212	NO	NO	YES	YES	NO
8	SR8	250	1096.9231	16.620047	220	236.6200	NO	NO	YES	YES	NO
9	SR9	250	1197.3684	18.141946	NA	NA	NO	NO	?	?	?
10	SR10	250	993.6667	15.055556	570	585.0556	NO	NO	YES	NO	YES
11	SR11	250	1047.8571	15.876623	430	445.8766	NO	NO	YES	NO	YES
12	SR12	250	960.6667	14.555556	260	274.5556	NO	NO	YES	NO	YES
13	SR13	250	629.8182	9.542700	180	189.5427	NO	YES	-	-	NO
14	SR14	250	571.6364	8.661157	210	218.6612	NO	YES	-	-	NO
15	SR15	250	445.7500	6.753788	130	136.7538	NO	YES	-	-	NO
16	SR16	250	717.2222	10.867003	240	250.8670	NO	NO	YES	NO	YES
17	SR17	250	707.9647	10.726738	310	320.7267	NO	NO	YES	NO	YES
18	SR18	250	837.2353	12.685383	450	462.6854	NO	NO	YES	NO	YES
19	SR19	250	806.8667	12.225253	650	662.2253	NO	NO	YES	NO	YES
20	SR20	250	930.5353	14.099020	1200	1214.0990	NO	NO	YES	NO	YES
21	SR21	250	572.3800	8.672424	890	898.6724	NO	YES	-	-	NO
22	SR22	250	592.4500	8.976515	610	618.9765	NO	YES	-	-	NO
23	SR23	250	633.5714	9.599567	110	119.5996	NO	YES	-	-	NO



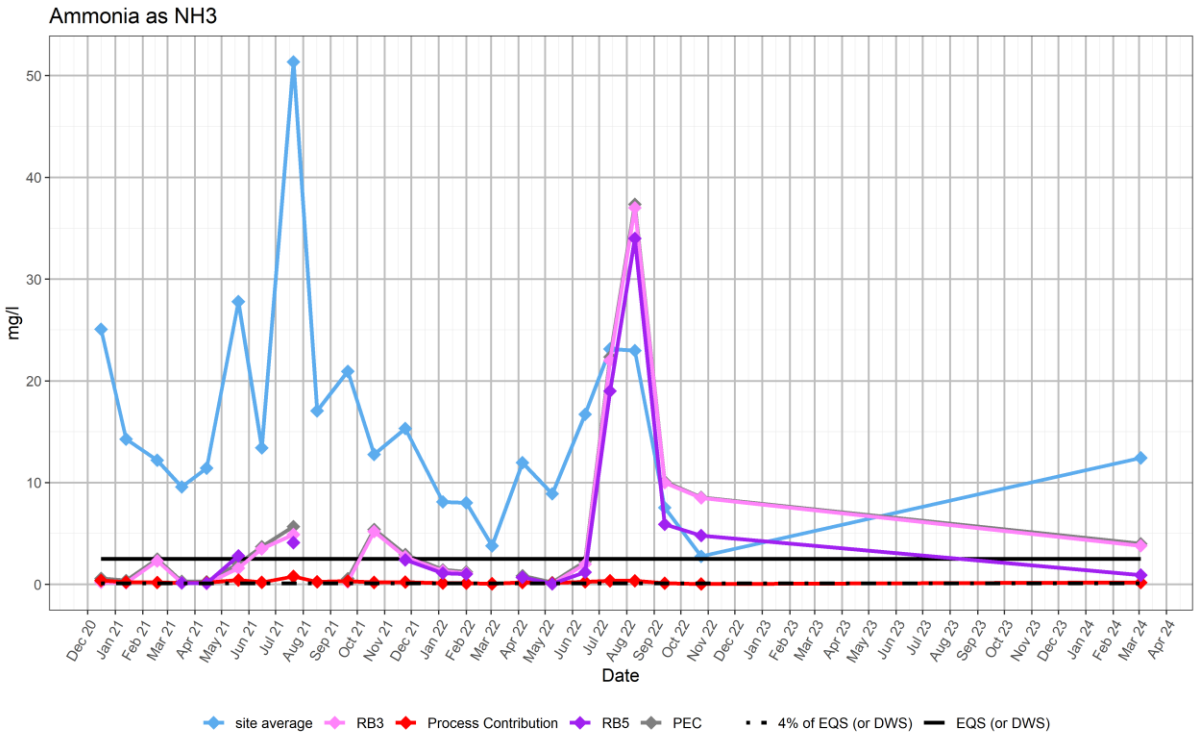
Phosphate as P

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR12	28	27.93333	0.4232323	67	67.4232323	NO	YES	-	-	NO
2	SR13	28	38.22727	0.5792011	170	170.5792011	NO	YES	-	-	NO
3	SR14	28	28.18182	0.4269972	10	10.4269972	NO	YES	-	-	NO
4	SR15	28	52.00000	0.7878788	0	0.7878788	NO	YES	-	-	NO
5	SR16	28	23.33333	0.3535354	110	110.3535354	NO	YES	-	-	NO
6	SR17	28	16.47059	0.2495544	10	10.2495544	NO	YES	-	-	NO
7	SR18	28	14.11765	0.2139037	10	10.2139037	NO	YES	-	-	NO
8	SR19	28	215.33333	3.2626263	30	33.2626263	NO	NO	NO	NO	YES
9	SR20	28	171.17647	2.5935829	30	32.5935829	NO	NO	YES	NO	YES
10	SR21	28	13.00000	0.1969697	40	40.1969697	NO	YES	-	-	NO
11	SR22	28	10.00000	0.1515152	10	10.1515152	NO	YES	-	-	NO
12	SR23	28	19.71429	0.2987013	92	92.2987013	NO	YES	-	-	NO



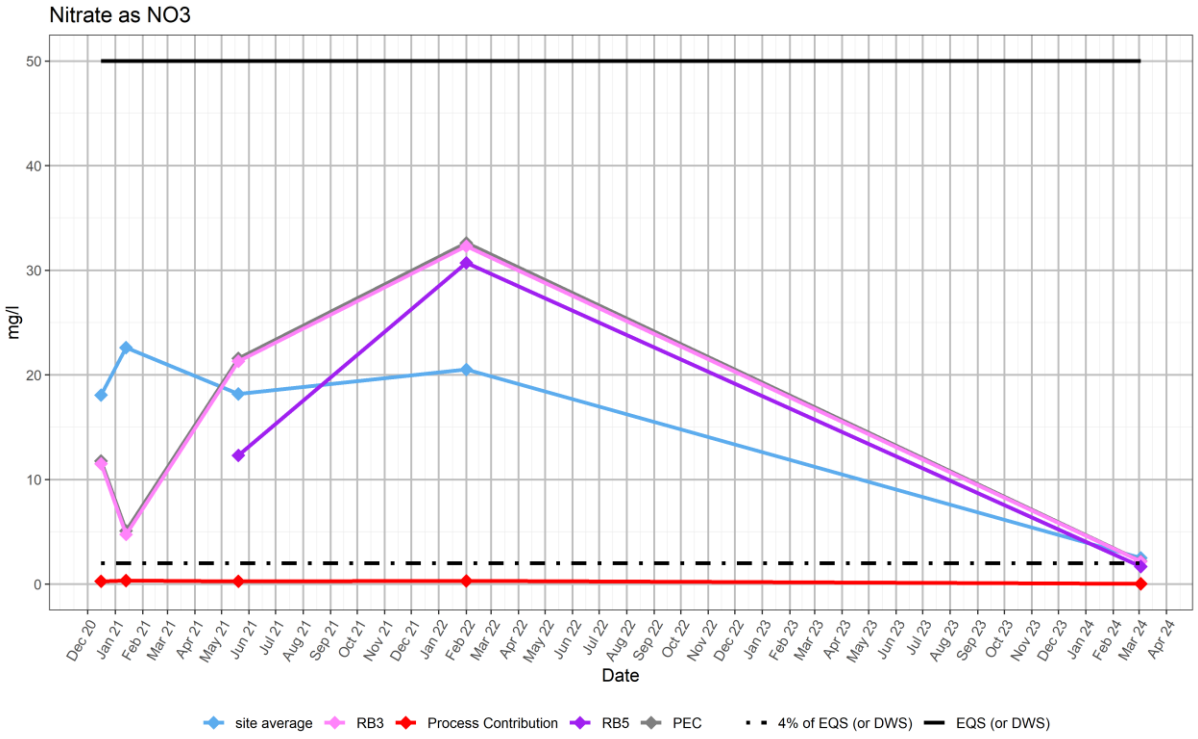
Ammonia as NH_3

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	2.5	25.067368	0.37980861	0.200	0.5798086	NO	NO	NO	YES	YES
2	SR2	2.5	14.271053	0.21622807	0.150	0.3662281	NO	NO	YES	YES	NO
3	SR3	2.5	12.200714	0.18485931	2.300	2.4848593	NO	NO	YES	YES	NO
4	SR4	2.5	9.571579	0.14502392	0.160	0.3050239	NO	NO	YES	YES	NO
5	SR5	2.5	11.423875	0.17308902	0.090	0.2630890	NO	NO	YES	YES	NO
6	SR6	2.5	27.788000	0.42103030	1.600	2.0210303	NO	NO	NO	YES	YES
7	SR7	2.5	13.415333	0.20326263	3.500	3.7032626	NO	NO	YES	NO	YES
8	SR8	2.5	51.343077	0.77792541	4.900	5.6779254	NO	NO	NO	NO	YES
9	SR9	2.5	17.055789	0.25842105	NA	NA	NO	NO	?	?	?
10	SR10	2.5	20.928333	0.31709596	0.240	0.5570960	NO	NO	NO	YES	YES
11	SR11	2.5	12.765000	0.19340909	5.200	5.3934091	NO	NO	YES	NO	YES
12	SR12	2.5	15.320133	0.23212323	2.700	2.9321232	NO	NO	YES	NO	YES
13	SR13	2.5	8.108136	0.12285055	1.300	1.4228506	NO	NO	YES	YES	NO
14	SR14	2.5	8.019091	0.12150138	1.100	1.2215014	NO	NO	YES	YES	NO
15	SR15	2.5	3.788300	0.05739848	NA	NA	NO	YES	-	-	NO
16	SR16	2.5	11.959444	0.18120370	0.660	0.8412037	NO	NO	YES	YES	NO
17	SR17	2.5	8.900765	0.13486007	0.049	0.1838601	NO	NO	YES	YES	NO
18	SR18	2.5	16.706118	0.25312299	2.000	2.2531230	NO	NO	NO	YES	YES
19	SR19	2.5	23.134000	0.35051515	22.000	22.3505152	NO	NO	NO	NO	YES
20	SR20	2.5	22.971176	0.34804813	37.000	37.3480481	NO	NO	NO	NO	YES
21	SR21	2.5	7.537025	0.11419735	10.000	10.1141973	NO	NO	YES	NO	YES
22	SR22	2.5	2.746700	0.04161667	8.500	8.5416167	NO	YES	-	-	NO
23	SR23	2.5	12.428643	0.18831277	3.800	3.9883128	NO	NO	YES	NO	YES



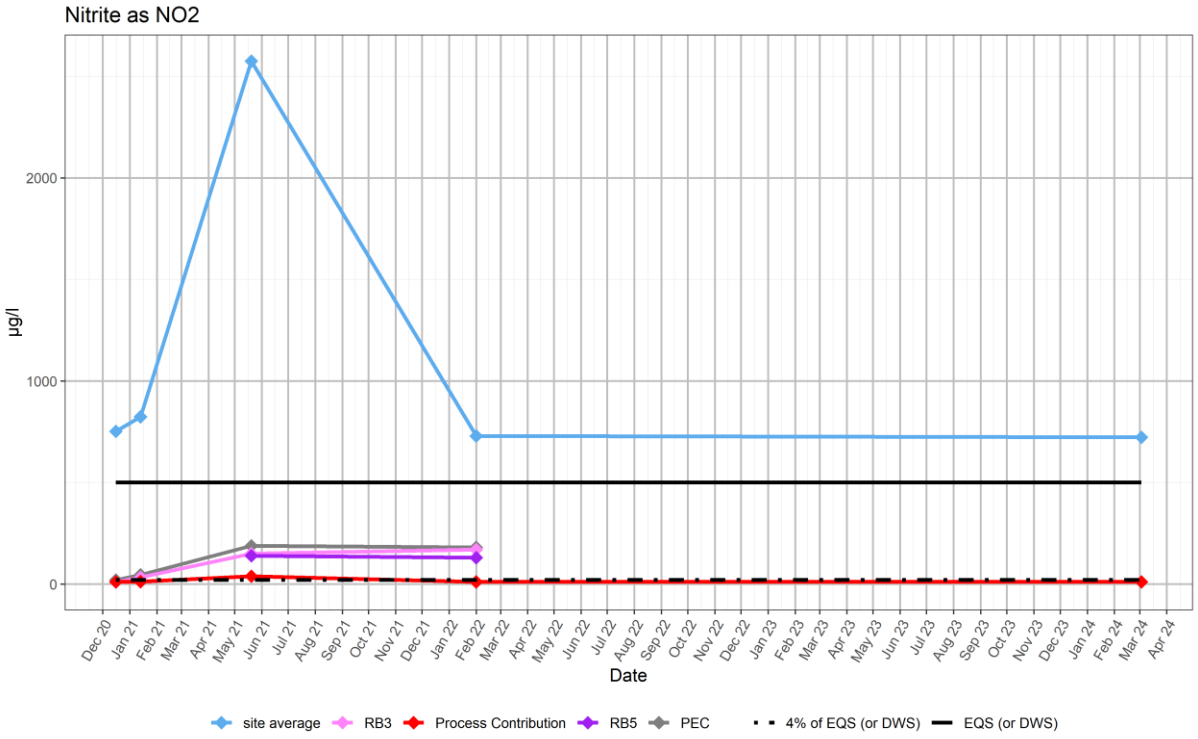
Nitrate as NO_3

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	50	18.067895	0.27375598	11.50	11.773756	NO	YES	-	-	NO
2	SR2	50	22.604211	0.34248804	4.75	5.092488	NO	YES	-	-	NO
3	SR6	50	18.180000	0.27545455	21.30	21.575455	NO	YES	-	-	NO
4	SR14	50	20.508182	0.31073003	32.30	32.610730	NO	YES	-	-	NO
5	SR23	50	2.508929	0.03801407	2.16	2.198014	YES	-	-	-	NO



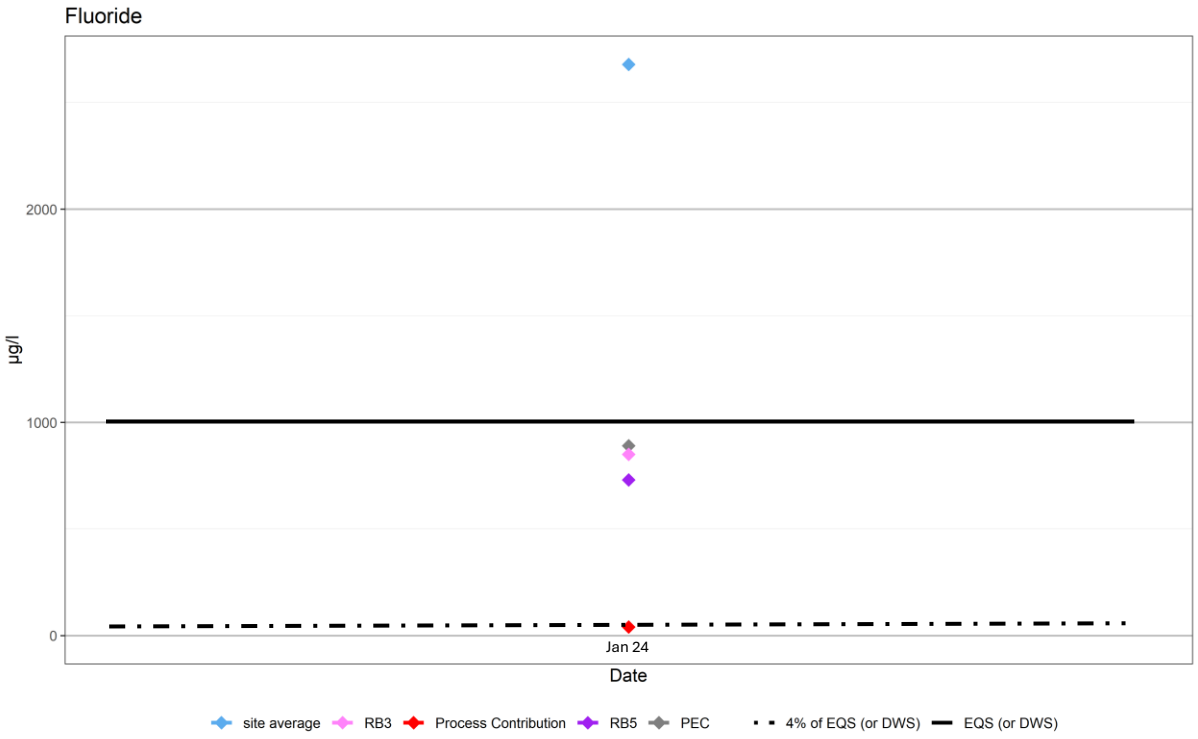
Nitrate as NO_2

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	500	752.2105	11.39713	9.1	20.49713	NO	YES	-	-	NO
2	SR2	500	823.9474	12.48405	33.0	45.48405	NO	YES	-	-	NO
3	SR6	500	2575.7143	39.02597	150.0	189.02597	NO	NO	YES	YES	NO
4	SR14	500	729.2318	11.04897	170.0	181.04897	NO	YES	-	-	NO
5	SR23	500	722.8324	10.95201	NA	NA	NO	YES	-	-	NO



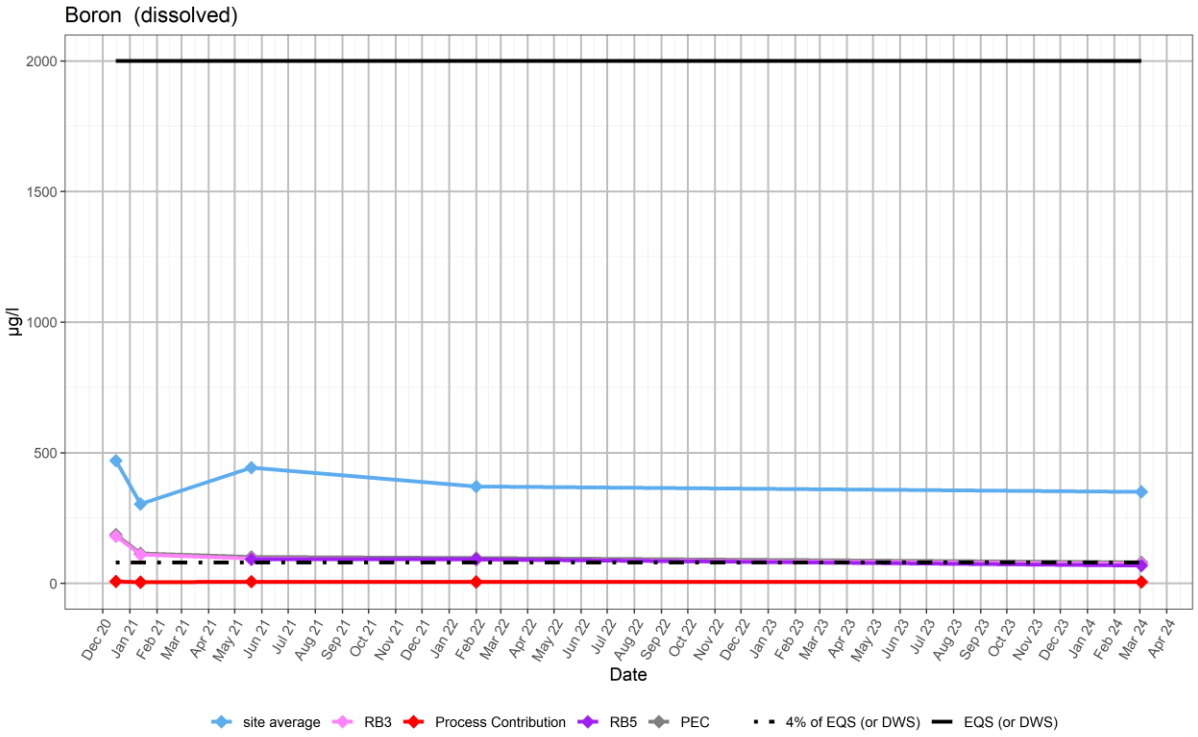
Fluoride

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR23	1000	2679.286	40.59524	850	890.5952	NO	NO	YES	YES	NO



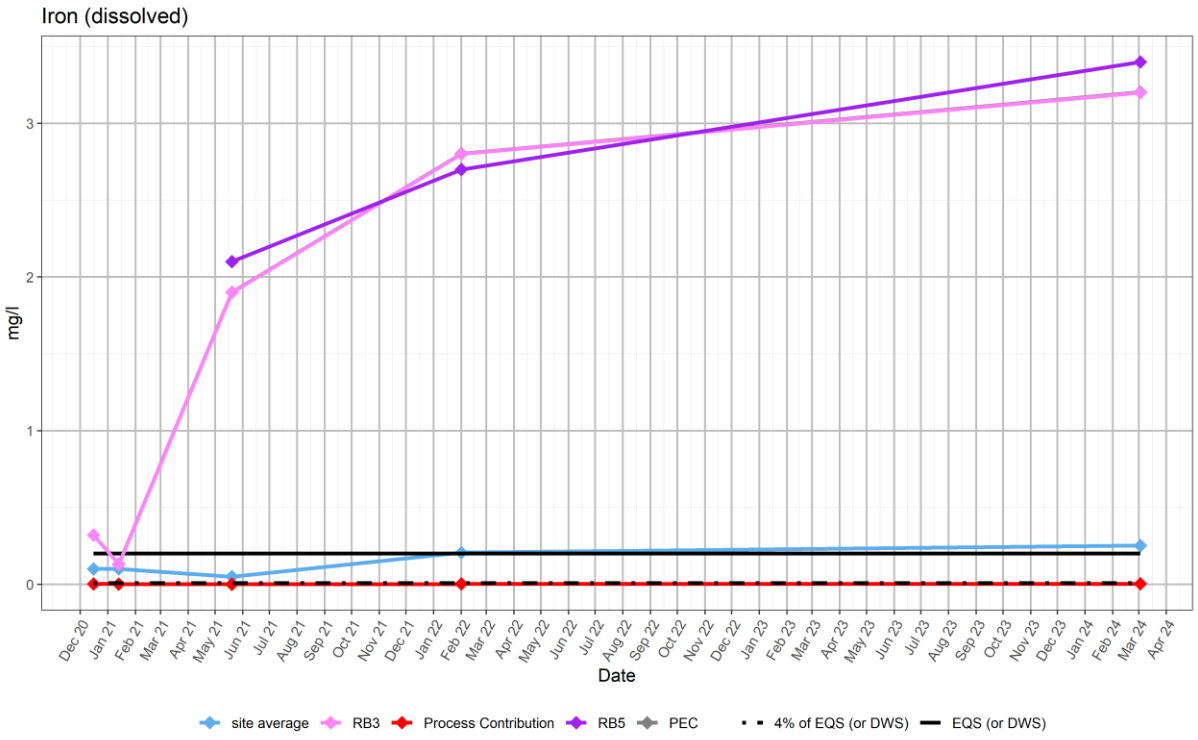
Boron

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	2000	469.6842	7.116427	180	187.11643	NO	YES	-	-	NO
2	SR2	2000	303.7368	4.602073	110	114.60207	NO	YES	-	-	NO
3	SR6	2000	442.8571	6.709957	95	101.70996	NO	YES	-	-	NO
4	SR14	2000	370.6818	5.616391	91	96.61639	NO	YES	-	-	NO
5	SR23	2000	350.5714	5.311688	75	80.31169	NO	YES	-	-	NO



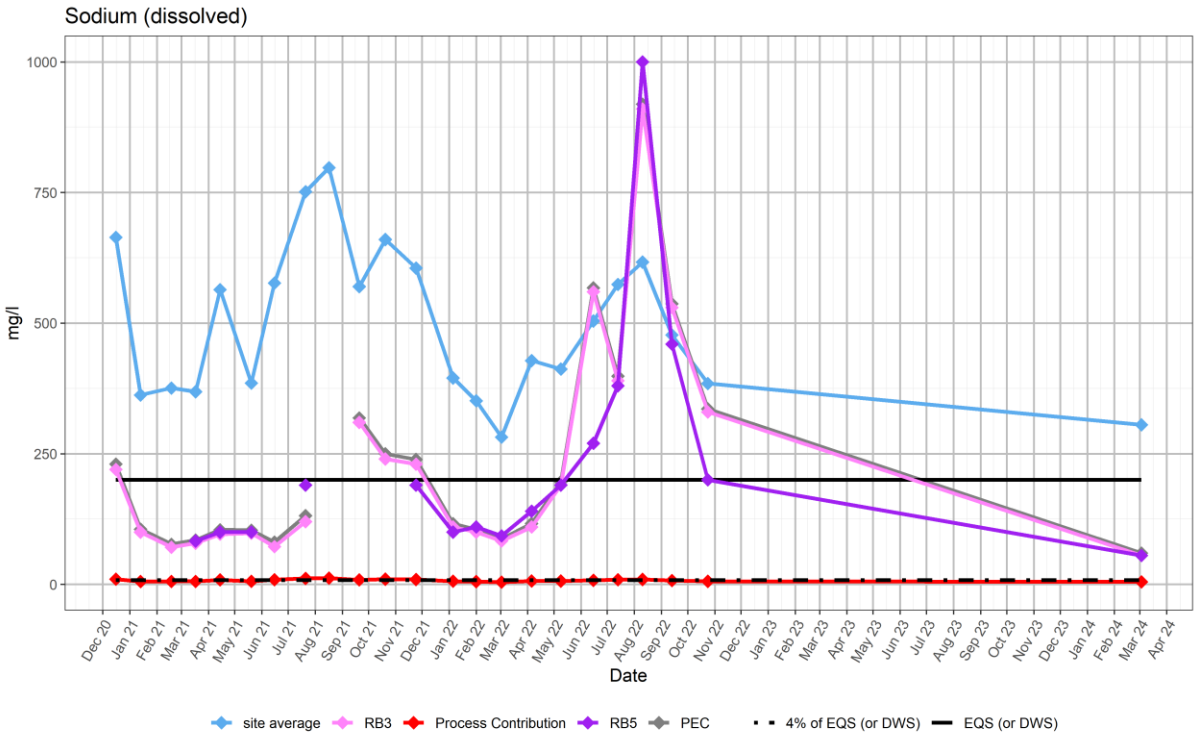
Iron

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.2	0.09968421	0.0015103668	0.32	0.3215104	NO	YES	-	-	NO
2	SR2	0.2	0.10110526	0.0015318979	0.13	0.1315319	NO	YES	-	-	NO
3	SR6	0.2	0.05014286	0.0007597403	1.90	1.9007597	NO	YES	-	-	NO
4	SR14	0.2	0.20640909	0.0031274105	2.80	2.8031274	NO	YES	-	-	NO
5	SR23	0.2	0.25264286	0.0038279221	3.20	3.2038279	NO	YES	-	-	NO



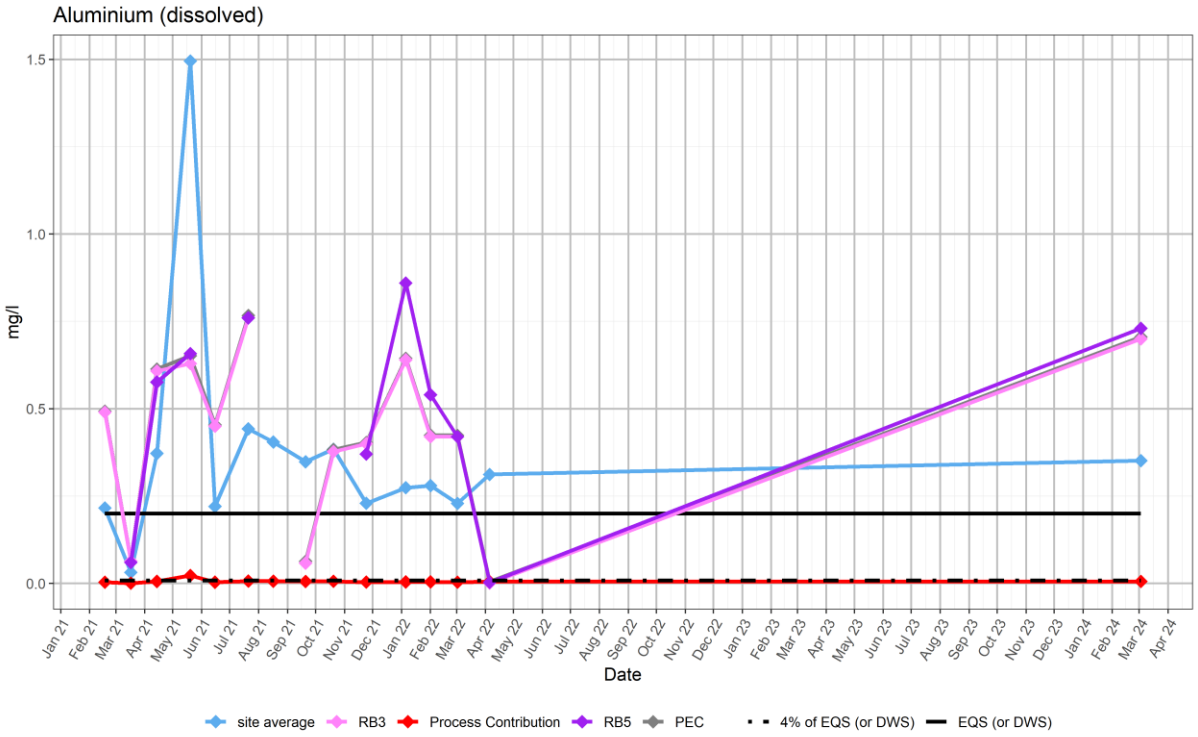
Sodium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	200	664.3526	10.065949	220	230.06595	NO	NO	YES	NO	YES
2	SR2	200	362.3579	5.490271	100	105.49027	NO	YES	-	-	NO
3	SR3	200	375.7857	5.693723	71	76.69372	NO	YES	-	-	NO
4	SR4	200	368.6842	5.586124	79	84.58612	NO	YES	-	-	NO
5	SR5	200	564.1875	8.548295	96	104.54830	NO	NO	YES	YES	NO
6	SR6	200	385.0700	5.834394	98	103.83439	NO	YES	-	-	NO
7	SR7	200	576.6667	8.737374	72	80.73737	NO	NO	YES	YES	NO
8	SR8	200	751.5385	11.386946	120	131.38695	NO	NO	YES	YES	NO
9	SR9	200	797.3158	12.080542	NA	NA	NO	NO	?	?	?
10	SR10	200	569.8889	8.634680	310	318.63468	NO	NO	YES	NO	YES
11	SR11	200	660.0000	10.000000	240	250.00000	NO	NO	YES	NO	YES
12	SR12	200	605.3333	9.171717	230	239.17172	NO	NO	YES	NO	YES
13	SR13	200	395.0000	5.984848	110	115.98485	NO	YES	-	-	NO
14	SR14	200	351.3182	5.323003	100	105.32300	NO	YES	-	-	NO
15	SR15	200	281.7500	4.268939	83	87.26894	NO	YES	-	-	NO
16	SR16	200	428.1667	6.487374	110	116.48737	NO	YES	-	-	NO
17	SR17	200	412.1588	6.244831	190	196.24483	NO	YES	-	-	NO
18	SR18	200	504.1176	7.638146	560	567.63815	NO	YES	-	-	NO
19	SR19	200	573.9333	8.695960	390	398.69596	NO	NO	YES	NO	YES
20	SR20	200	616.8588	9.346346	910	919.34635	NO	NO	YES	NO	YES
21	SR21	200	477.2100	7.230455	530	537.23045	NO	YES	-	-	NO
22	SR22	200	384.5500	5.826515	330	335.82652	NO	YES	-	-	NO
23	SR23	200	305.3571	4.626623	55	59.62662	NO	YES	-	-	NO



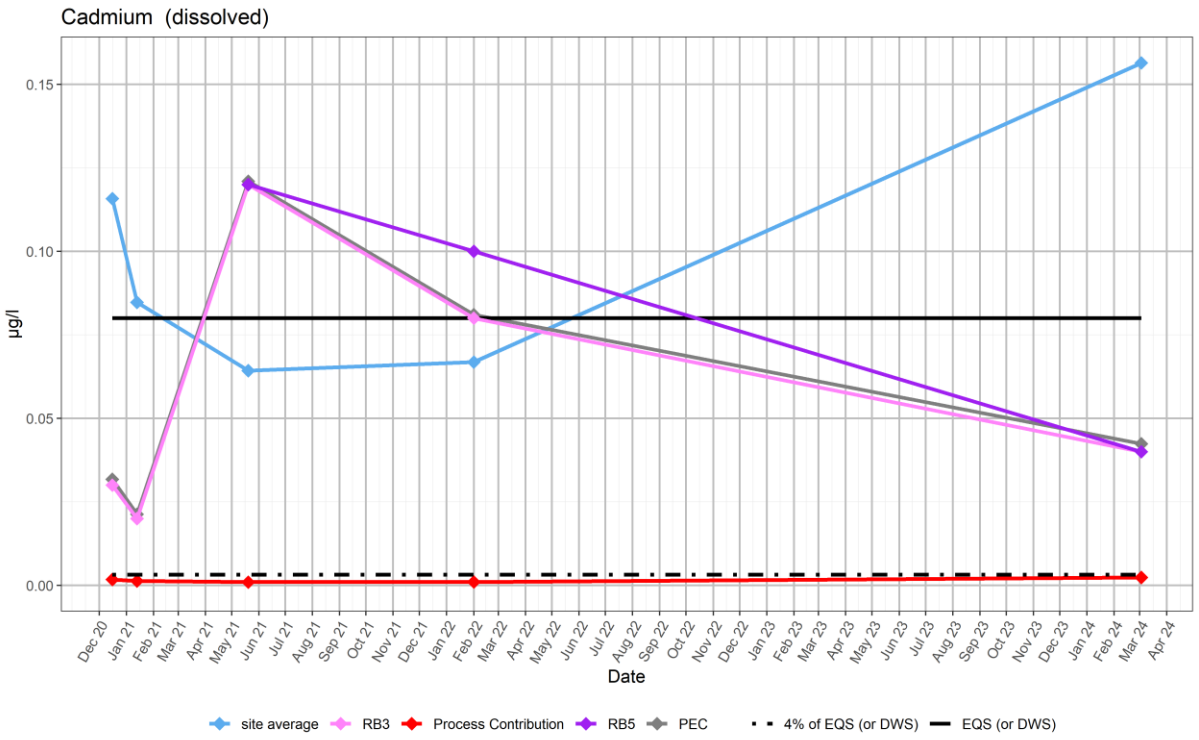
Aluminium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modellin
1	SR3	0.2	0.21592857	0.0032716450	0.4900	0.493271645	NO	YES	-	-	NO
2	SR4	0.2	0.03159053	0.0004786443	0.0633	0.063778644	NO	YES	-	-	NO
3	SR5	0.2	0.37220625	0.0056394886	0.6080	0.613639489	NO	YES	-	-	NO
4	SR6	0.2	1.49571500	0.0226623485	0.6290	0.651662348	NO	NO	NO	NO	YES
5	SR7	0.2	0.22018000	0.0033360606	0.4500	0.453336061	NO	YES	-	-	NO
6	SR8	0.2	0.44243077	0.0067034965	0.7600	0.766703497	NO	YES	-	-	NO
7	SR9	0.2	0.40480000	0.0061333333	NA	NA	NO	YES	-	-	NO
8	SR10	0.2	0.34793333	0.0052717172	0.0579	0.063171717	NO	YES	-	-	NO
9	SR11	0.2	0.38426429	0.0058221861	0.3770	0.382822186	NO	YES	-	-	NO
10	SR12	0.2	0.22926667	0.0034737374	0.4000	0.403473737	NO	YES	-	-	NO
11	SR13	0.2	0.27390909	0.0041501377	0.6400	0.644150138	NO	YES	-	-	NO
12	SR14	0.2	0.28000000	0.0042424242	0.4200	0.424242424	NO	YES	-	-	NO
13	SR15	0.2	0.22875000	0.0034659091	0.4200	0.423465909	NO	YES	-	-	NO
14	SR16	0.2	0.31172222	0.0047230640	0.0005	0.005223064	NO	YES	-	-	NO
15	SR23	0.2	0.35115000	0.0053204545	0.7000	0.705320455	NO	YES	-	-	NO



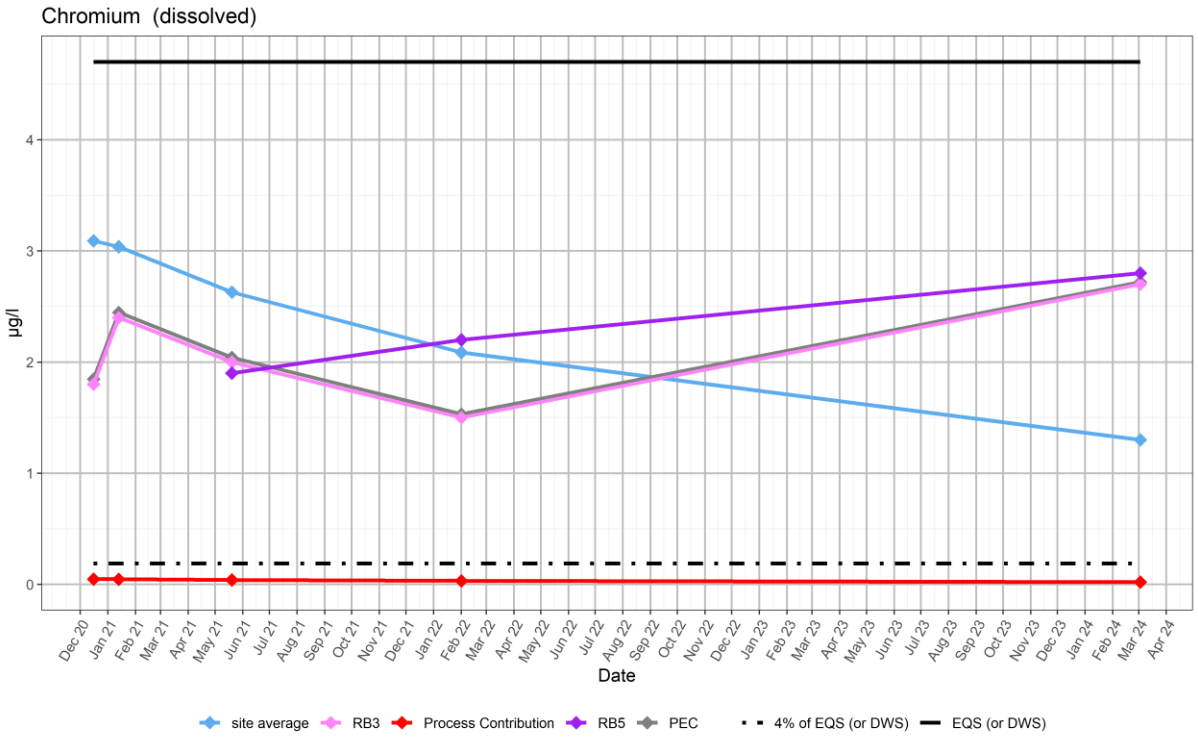
Cadmium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.08	0.11578947	0.001754386	0.03	0.03175439	NO	YES	-	-	NO
2	SR2	0.08	0.08473684	0.001283892	0.02	0.02128389	NO	YES	-	-	NO
3	SR6	0.08	0.06428571	0.000974026	0.12	0.12097403	NO	YES	-	-	NO
4	SR14	0.08	0.06681818	0.001012397	0.08	0.08101240	NO	YES	-	-	NO
5	SR23	0.08	0.15642857	0.002370130	0.04	0.04237013	NO	YES	-	-	NO



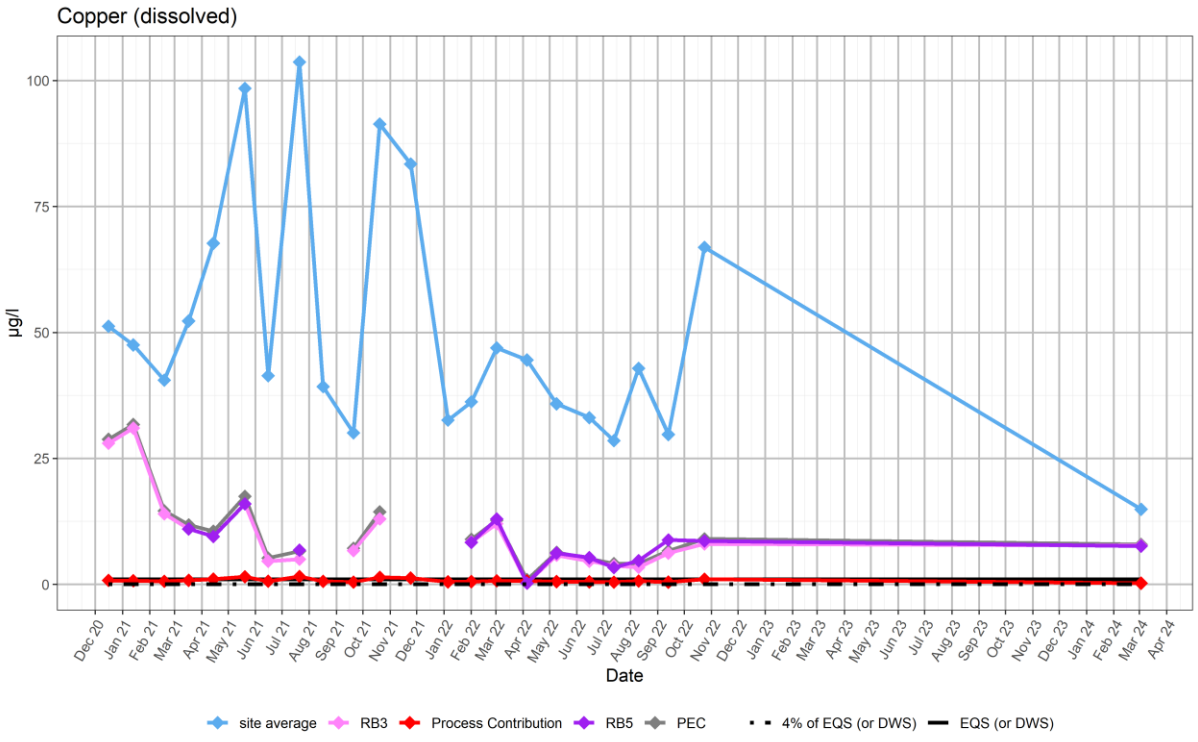
Chromium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	4.7	3.089474	0.04681021	1.8	1.846810	NO	YES	-	-	NO
2	SR2	4.7	3.036842	0.04601276	2.4	2.446013	NO	YES	-	-	NO
3	SR6	4.7	2.628571	0.03982684	2.0	2.039827	NO	YES	-	-	NO
4	SR14	4.7	2.086364	0.03161157	1.5	1.531612	NO	YES	-	-	NO
5	SR23	4.7	1.300000	0.01969697	2.7	2.719697	NO	YES	-	-	NO



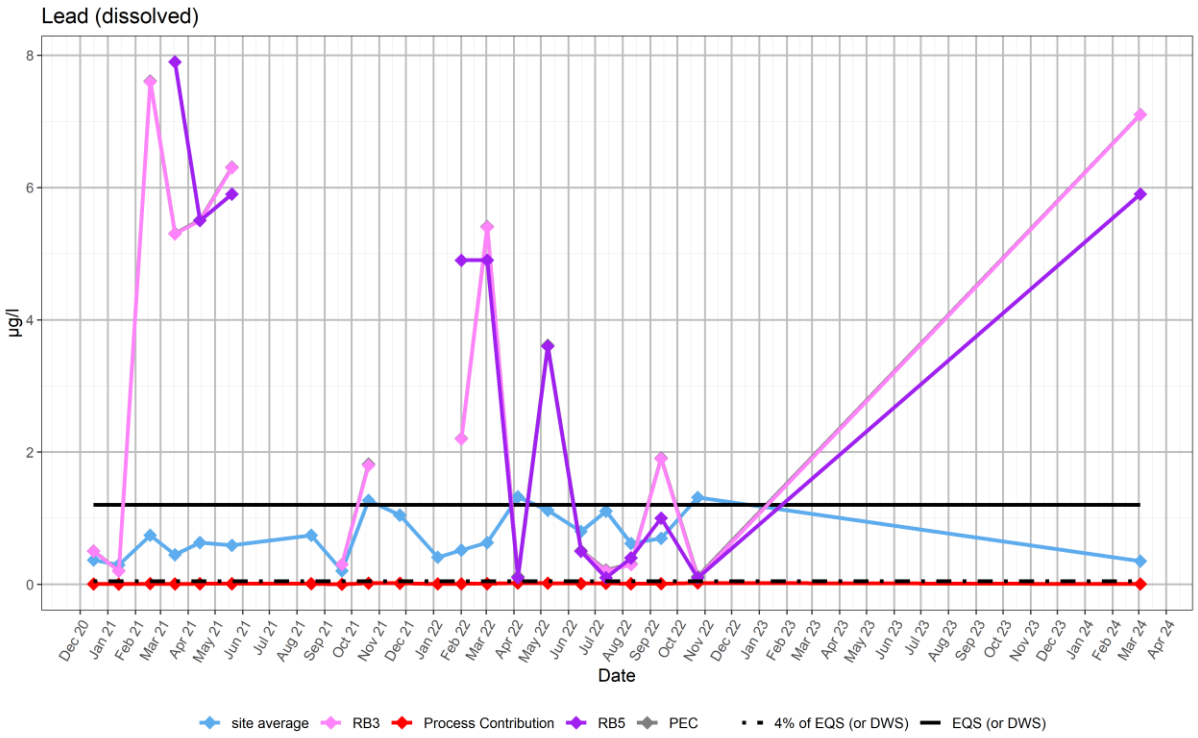
Copper

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	1	51.21579	0.7759968	28.00	28.7759968	NO	NO	NO	NO	YES
2	SR2	1	47.52632	0.7200957	31.00	31.7200957	NO	NO	NO	NO	YES
3	SR3	1	40.50000	0.6136364	14.00	14.6136364	NO	NO	NO	NO	YES
4	SR4	1	52.26316	0.7918660	11.00	11.7918660	NO	NO	NO	NO	YES
5	SR5	1	67.68750	1.0255682	9.50	10.5255682	NO	NO	NO	NO	YES
6	SR6	1	98.45000	1.4916667	16.00	17.4916667	NO	NO	NO	NO	YES
7	SR7	1	41.40000	0.6272727	4.60	5.2272727	NO	NO	NO	NO	YES
8	SR8	1	103.69231	1.5710956	5.00	6.5710956	NO	NO	NO	NO	YES
9	SR9	1	39.25263	0.5947368	NA	NA	NO	NO	?	?	?
10	SR10	1	30.05556	0.4553872	6.70	7.1553872	NO	NO	NO	NO	YES
11	SR11	1	91.35714	1.3841991	13.00	14.3841991	NO	NO	NO	NO	YES
12	SR12	1	83.42857	1.2640693	NA	NA	NO	NO	?	?	?
13	SR13	1	32.58636	0.4937328	NA	NA	NO	NO	?	?	?
14	SR14	1	36.22727	0.5488981	8.40	8.9488981	NO	NO	NO	NO	YES
15	SR15	1	46.95000	0.7113636	12.00	12.7113636	NO	NO	NO	NO	YES
16	SR16	1	44.53889	0.6748316	0.25	0.9248316	NO	NO	NO	YES	YES
17	SR17	1	35.82353	0.5427807	5.80	6.3427807	NO	NO	NO	NO	YES
18	SR18	1	33.08824	0.5013369	4.60	5.1013369	NO	NO	NO	NO	YES
19	SR19	1	28.54000	0.4324242	3.70	4.1324242	NO	NO	NO	NO	YES
20	SR20	1	42.87647	0.6496435	3.40	4.0496435	NO	NO	NO	NO	YES
21	SR21	1	29.75000	0.4507576	6.20	6.6507576	NO	NO	NO	NO	YES
22	SR22	1	66.87000	1.0131818	8.00	9.0131818	NO	NO	NO	NO	YES
23	SR23	1	14.88571	0.2255411	7.70	7.9255411	NO	NO	NO	NO	YES



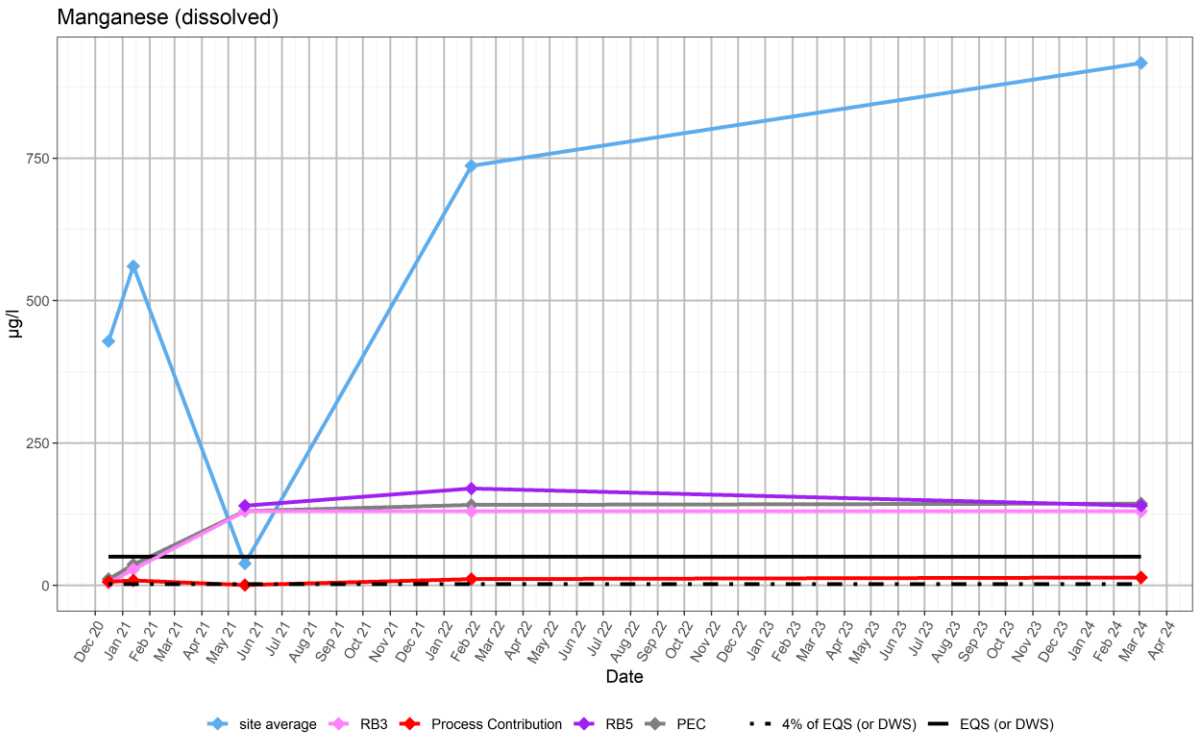
Lead

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	1.2	0.3684211	0.005582137	0.5	0.5055821	NO	YES	-	-	NO
2	SR2	1.2	0.2947368	0.004465710	0.2	0.2044657	NO	YES	-	-	NO
3	SR3	1.2	0.7428571	0.011255411	7.6	7.6112554	NO	YES	-	-	NO
4	SR4	1.2	0.4473684	0.006778309	5.3	5.3067783	NO	YES	-	-	NO
5	SR5	1.2	0.6312500	0.009564394	5.5	5.5095644	NO	YES	-	-	NO
6	SR6	1.2	0.5900000	0.008939394	6.3	6.3089394	NO	YES	-	-	NO
7	SR9	1.2	0.7421053	0.011244019	NA	NA	NO	YES	-	-	NO
8	SR10	1.2	0.2055556	0.003114478	0.3	0.3031145	NO	YES	-	-	NO
9	SR11	1.2	1.2714286	0.019264069	1.8	1.8192641	NO	YES	-	-	NO
10	SR12	1.2	1.0466667	0.015858586	NA	NA	NO	YES	-	-	NO
11	SR13	1.2	0.4090909	0.006198347	NA	NA	NO	YES	-	-	NO
12	SR14	1.2	0.5181818	0.007851240	2.2	2.2078512	NO	YES	-	-	NO
13	SR15	1.2	0.6300000	0.009545455	5.4	5.4095455	NO	YES	-	-	NO
14	SR16	1.2	1.3222222	0.020033670	0.1	0.1200337	NO	YES	-	-	NO
15	SR17	1.2	1.1176471	0.016934046	3.6	3.6169340	NO	YES	-	-	NO
16	SR18	1.2	0.8000000	0.012121212	0.5	0.5121212	NO	YES	-	-	NO
17	SR19	1.2	1.1066667	0.016767677	0.2	0.2167677	NO	YES	-	-	NO
18	SR20	1.2	0.6176471	0.009358289	0.3	0.3093583	NO	YES	-	-	NO
19	SR21	1.2	0.6950000	0.010530303	1.9	1.9105303	NO	YES	-	-	NO
20	SR22	1.2	1.3150000	0.019924242	0.1	0.1199242	NO	YES	-	-	NO
21	SR23	1.2	0.3500000	0.005303030	7.1	7.1053030	NO	YES	-	-	NO



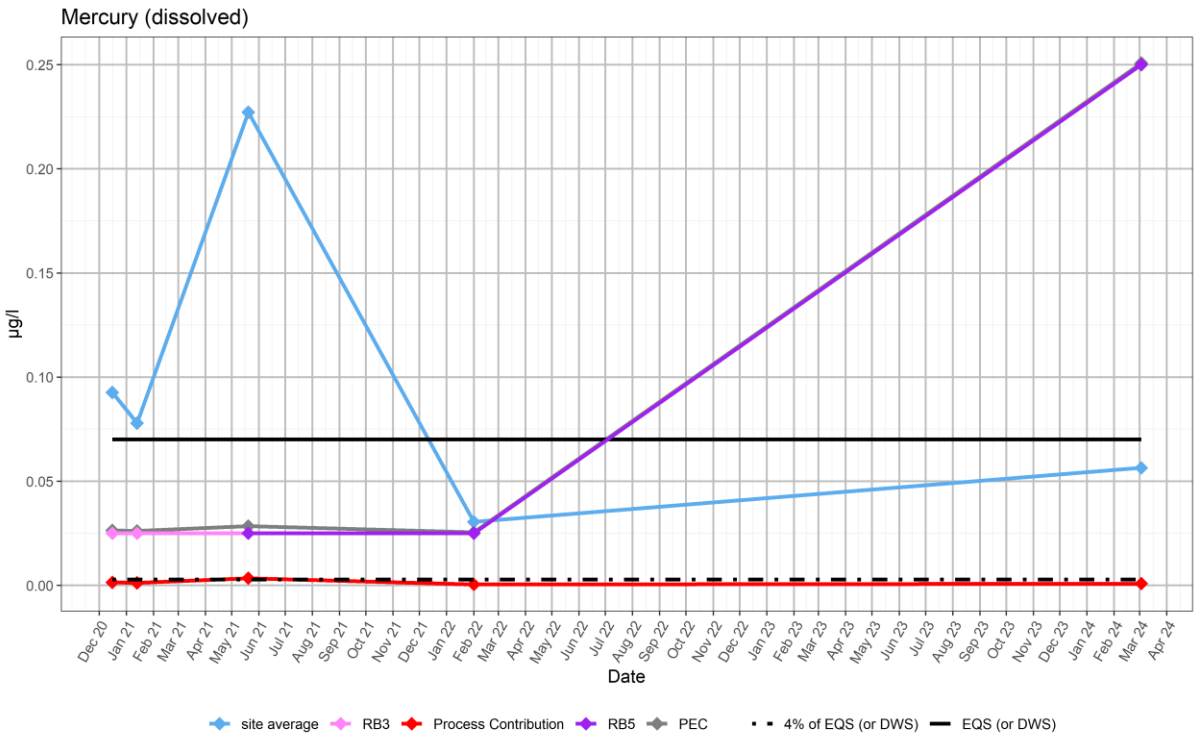
Manganese

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	50	428.62105	6.4942584	4.6	11.09426	NO	NO	NO	YES	YES
2	SR2	50	560.27895	8.4890750	28.0	36.48907	NO	NO	NO	YES	YES
3	SR6	50	38.55714	0.5841991	130.0	130.58420	NO	YES	-	-	NO
4	SR14	50	736.62273	11.1609504	130.0	141.16095	NO	NO	NO	NO	YES
5	SR23	50	917.16357	13.8964177	130.0	143.89642	NO	NO	NO	NO	YES



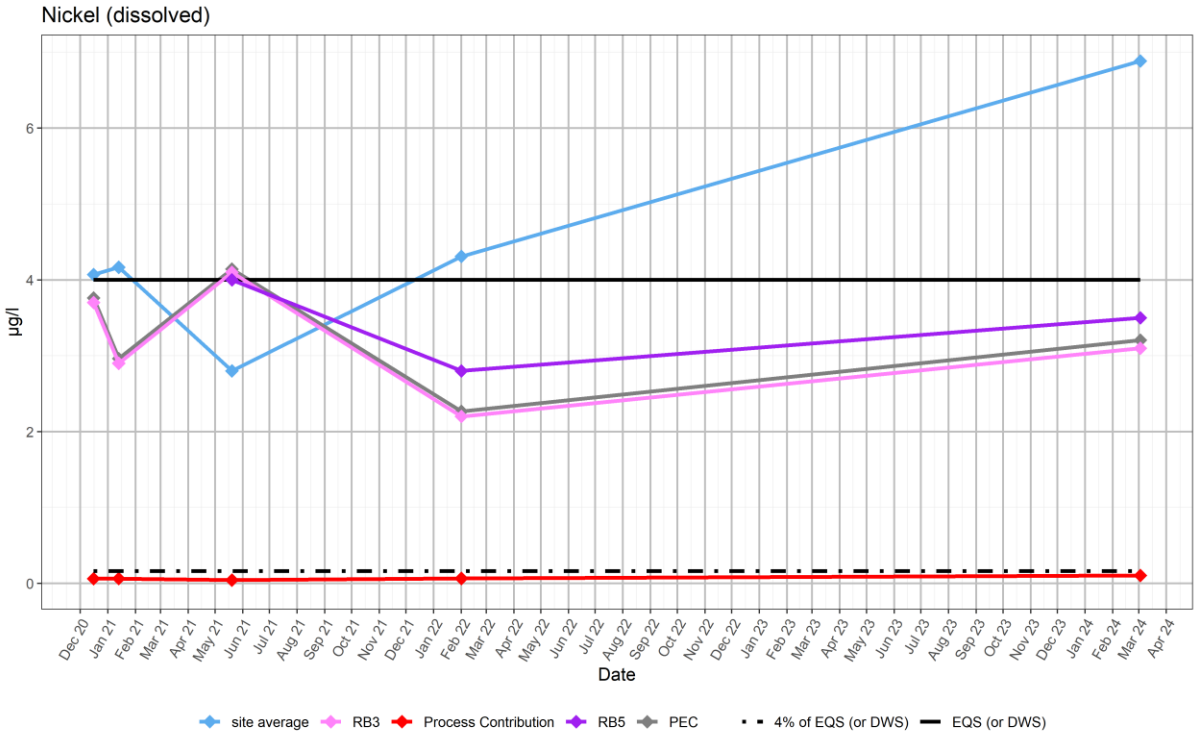
Mercury

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.07	0.09263158	0.0014035088	0.025	0.02640351	NO	YES	-	-	NO
2	SR2	0.07	0.07789474	0.0011802233	0.025	0.02618022	NO	YES	-	-	NO
3	SR6	0.07	0.22714286	0.0034415584	0.025	0.02844156	NO	NO	YES	YES	NO
4	SR14	0.07	0.03045455	0.0004614325	0.025	0.02546143	NO	YES	-	-	NO
5	SR23	0.07	0.05642857	0.0008549784	0.250	0.25085498	NO	YES	-	-	NO



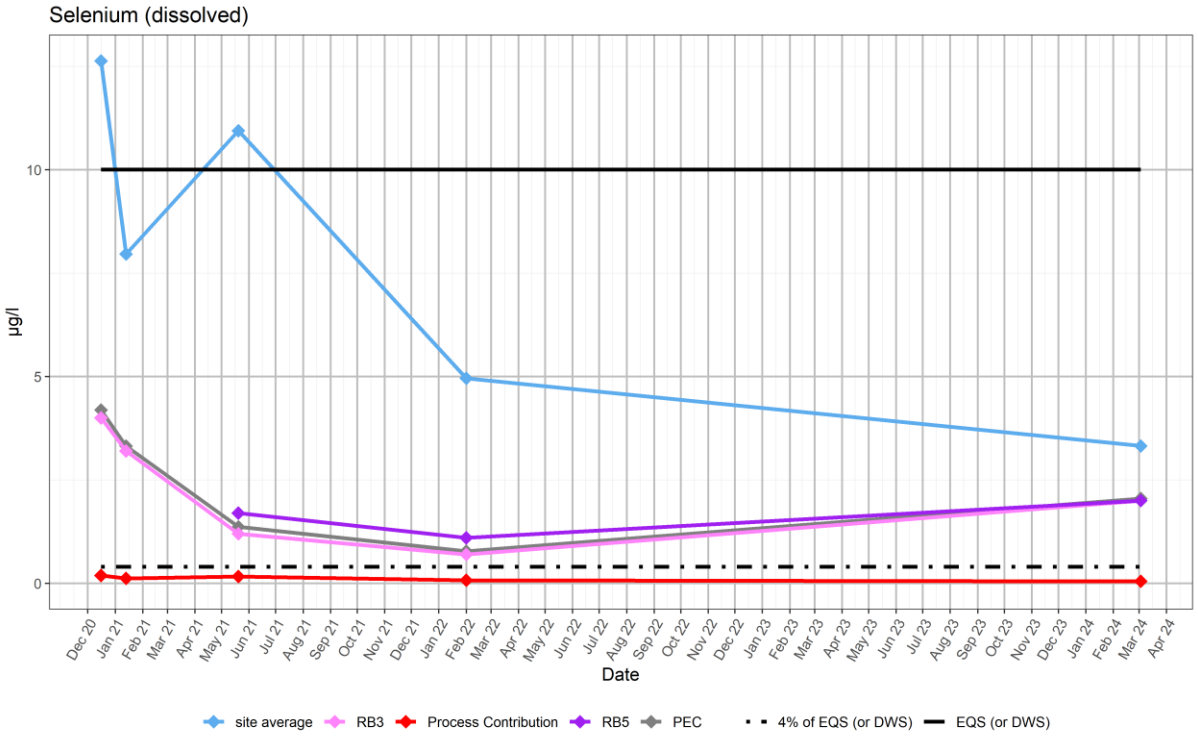
Nickel

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	4	4.071053	0.06168262	3.7	3.761683	NO	YES	-	-	NO
2	SR2	4	4.165789	0.06311802	2.9	2.963118	NO	YES	-	-	NO
3	SR6	4	2.800000	0.04242424	4.1	4.142424	NO	YES	-	-	NO
4	SR14	4	4.309091	0.06528926	2.2	2.265289	NO	YES	-	-	NO
5	SR23	4	6.885714	0.10432900	3.1	3.204329	NO	YES	-	-	NO



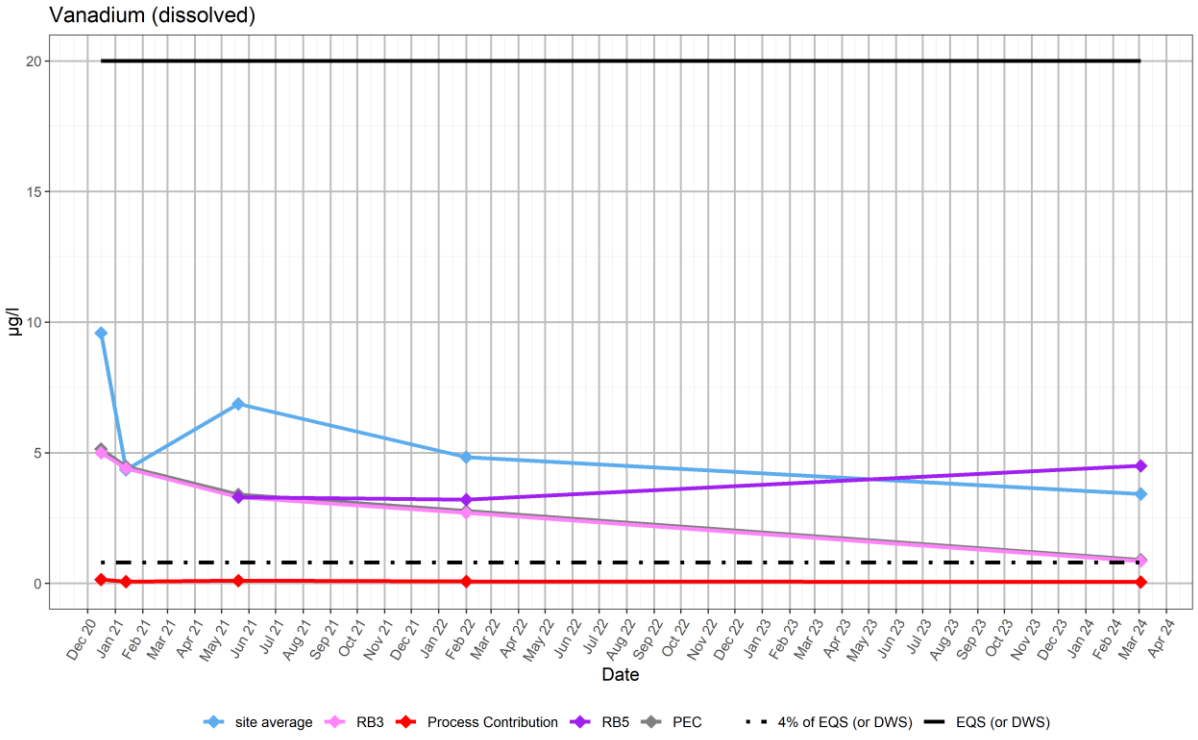
Selenium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	10	12.631579	0.19138756	4.0	4.1913876	NO	YES	-	-	NO
2	SR2	10	7.963158	0.12065391	3.2	3.3206539	NO	YES	-	-	NO
3	SR6	10	10.942857	0.16580087	1.2	1.3658009	NO	YES	-	-	NO
4	SR14	10	4.959091	0.07513774	0.7	0.7751377	NO	YES	-	-	NO
5	SR23	10	3.321429	0.05032468	2.0	2.0503247	NO	YES	-	-	NO



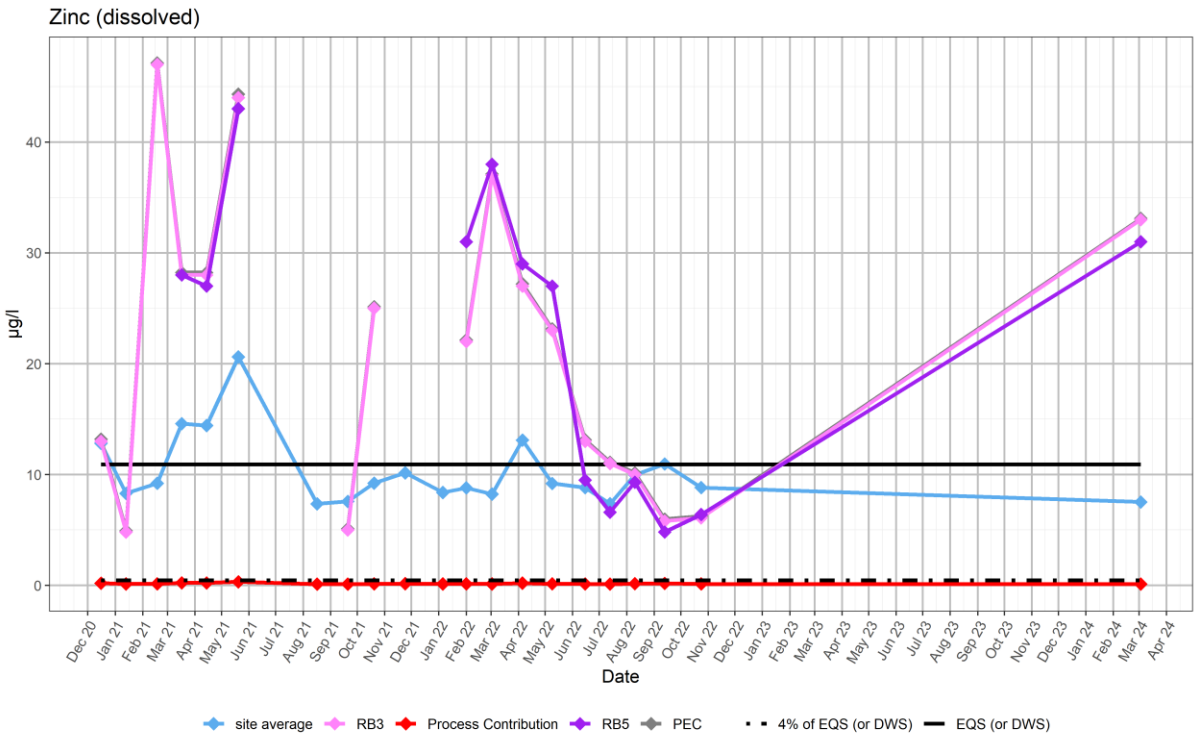
Vanadium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	20	9.584211	0.14521531	5.00	5.1452153	NO	YES	-	-	NO
2	SR2	20	4.347368	0.06586922	4.40	4.4658692	NO	YES	-	-	NO
3	SR6	20	6.871429	0.10411255	3.30	3.4041126	NO	YES	-	-	NO
4	SR14	20	4.831818	0.07320937	2.70	2.7732094	NO	YES	-	-	NO
5	SR23	20	3.421429	0.05183983	0.85	0.9018398	NO	YES	-	-	NO



Zinc

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	10.9	12.821053	0.1942584	13.0	13.194258	NO	YES	-	-	NO
2	SR2	10.9	8.300000	0.1257576	4.8	4.925758	NO	YES	-	-	NO
3	SR3	10.9	9.214286	0.1396104	47.0	47.139610	NO	YES	-	-	NO
4	SR4	10.9	14.578947	0.2208931	28.0	28.220893	NO	YES	-	-	NO
5	SR5	10.9	14.418750	0.2184659	28.0	28.218466	NO	YES	-	-	NO
6	SR6	10.9	20.615000	0.3123485	44.0	44.312348	NO	YES	-	-	NO
7	SR9	10.9	7.352632	0.1114035	NA	NA	NO	YES	-	-	NO
8	SR10	10.9	7.572222	0.1147306	5.0	5.114731	NO	YES	-	-	NO
9	SR11	10.9	9.221429	0.1397186	25.0	25.139719	NO	YES	-	-	NO
10	SR12	10.9	10.153333	0.1538384	NA	NA	NO	YES	-	-	NO
11	SR13	10.9	8.377273	0.1269284	NA	NA	NO	YES	-	-	NO
12	SR14	10.9	8.800000	0.1333333	22.0	22.133333	NO	YES	-	-	NO
13	SR15	10.9	8.235000	0.1247727	37.0	37.124773	NO	YES	-	-	NO
14	SR16	10.9	13.100000	0.1984848	27.0	27.198485	NO	YES	-	-	NO
15	SR17	10.9	9.194118	0.1393048	23.0	23.139305	NO	YES	-	-	NO
16	SR18	10.9	8.805882	0.1334225	13.0	13.133422	NO	YES	-	-	NO
17	SR19	10.9	7.366667	0.1116162	11.0	11.111616	NO	YES	-	-	NO
18	SR20	10.9	9.958824	0.1508913	10.0	10.150891	NO	YES	-	-	NO
19	SR21	10.9	10.960000	0.1660606	5.8	5.966061	NO	YES	-	-	NO
20	SR22	10.9	8.820000	0.1336364	6.1	6.233636	NO	YES	-	-	NO
21	SR23	10.9	7.521429	0.1139610	33.0	33.113961	NO	YES	-	-	NO



APPENDIX J

HFCL 2022; 30496TN6.1 Dilution Calculations

TECHNICAL NOTE 6.1 – FINAL

H Fraser Consulting
Contaminated Land and Hydrogeology

Project No:	**30496**
Project:	**Befesa surface water**
Document Ref:	**30496TN6.1 Dilution calculations New**
Version:	**2**
Date:	**11/01/2022**
Status	**FINAL**

1 INTRODUCTION

Befesa Salt Slags Ltd operate a salt slag processing operation at Fenn's Bank near Whitchurch. The site operates under an environmental permit, a condition of which is that there will be no discharge from the site to controlled waters. Whilst the site is operational, water received by the site is used in the process. However, the site is currently being decommissioned prior to closure, and the use of water in the site process has ceased. Unless a formal discharge arrangement can be agreed, rainfall falling on the site will discharge informally via the road system and to a field ditch on the western site boundary. This is compounded by the fact that the site drains are inundated with groundwater, with groundwater also discharging to surface under wet conditions (i.e. much of the winter).

The local environment is significantly impacted by a landfill to the south, with the field drain to the west of the site and shallow groundwater significantly impacted by a range of contaminants, with ammonia and chloride being of particular concern.

This technical note presents the results of dilution calculations undertaken to assess the likely impact of discharge of surface water from the site on the quality of the receiving water, the Redbrook.

2 RAINFALL

Onsite weather station data for Befesa is available from 1 February 2016 to 29 November 2020. This is augmented by weather station data for Erddig National Trust site, located c.19 km northwest of Befesa. Monthly rainfall is presented in Figure 2-1 and daily rainfall at Erddig since the start of the sampling period (December 2020 to May 2021) is shown in Figure 2-2. Sampling rounds are marked on Figure 2-2 as SR1 – SR6.

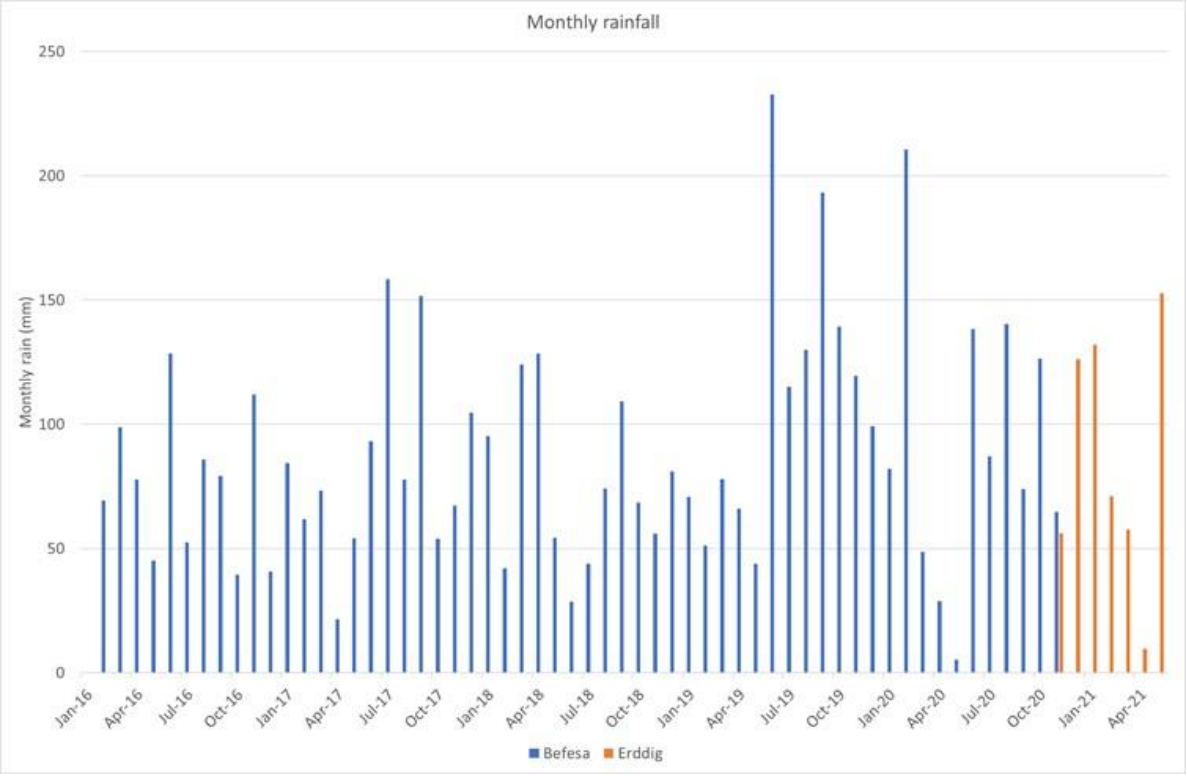


Figure 2-1 Monthly rainfall

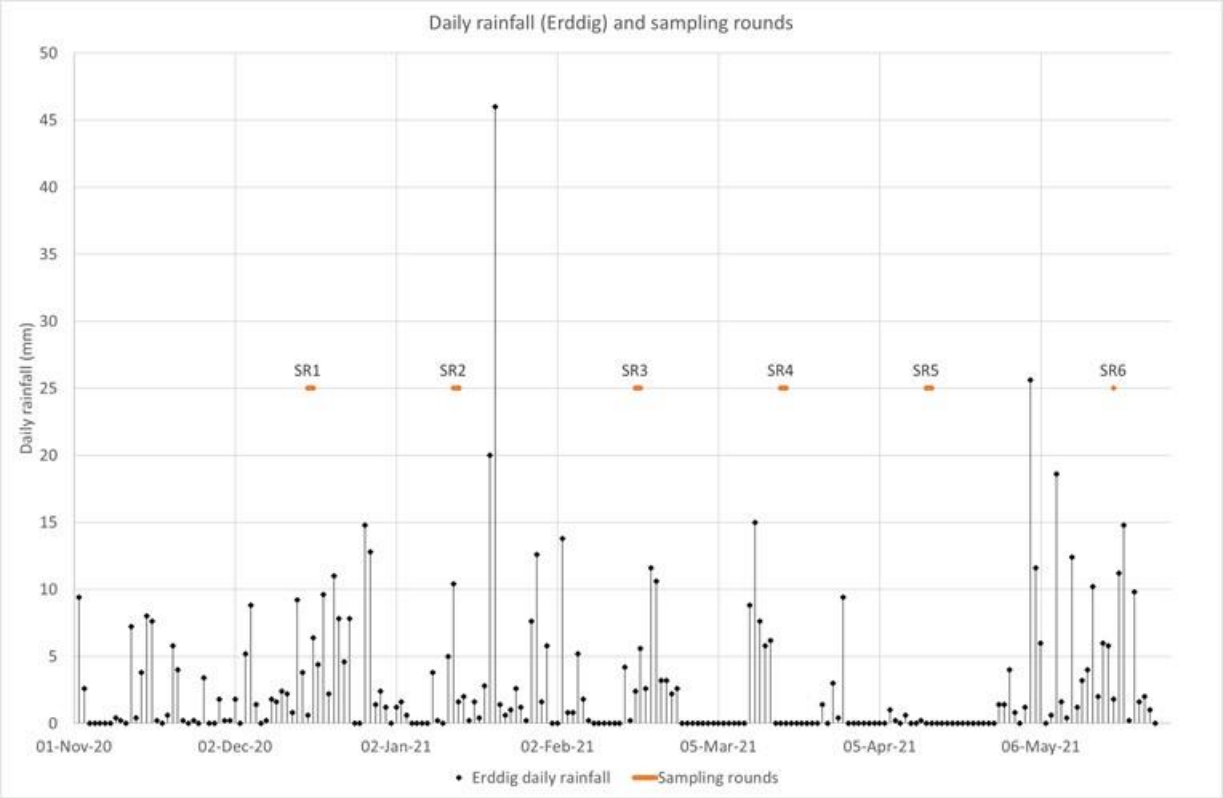


Figure 2-2 Daily rainfall (Erddig) during sampling period

Effective rainfall (ER) has been estimated based on monthly data, as reported in technical note '30496TN1.2 Befesa SW dilution calcs'. Average ER is estimated as 294 mm/a compared with an average total rainfall volume 659 mm/a. Average monthly rainfall, ER and ER as a percent of rainfall are shown in Table 2-1.

Table 2-1 Effective Rainfall (ER)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall	56	39	47	49	54	53	54	59	57	68	62	62	660
ER	55	32	20	0	0	0	0	0	14	53	59	62	294
ER %	98%	81%	42%	0%	0%	0%	0%	0%	24%	78%	96%	100%	45%

3 FLOW IN THE REDBROOK

Technical note 30496TN3.3 reports on methods of measuring and calculating stream flow in the Redbrook. Since March, Befesa have undertaken daily measurements of stream velocity, and flow rates have been calculated using those data, as shown in Figure 3-1. Measured flows are shown in orange; the grey data points are estimated for days when data were not available, usually coinciding with a weekend.

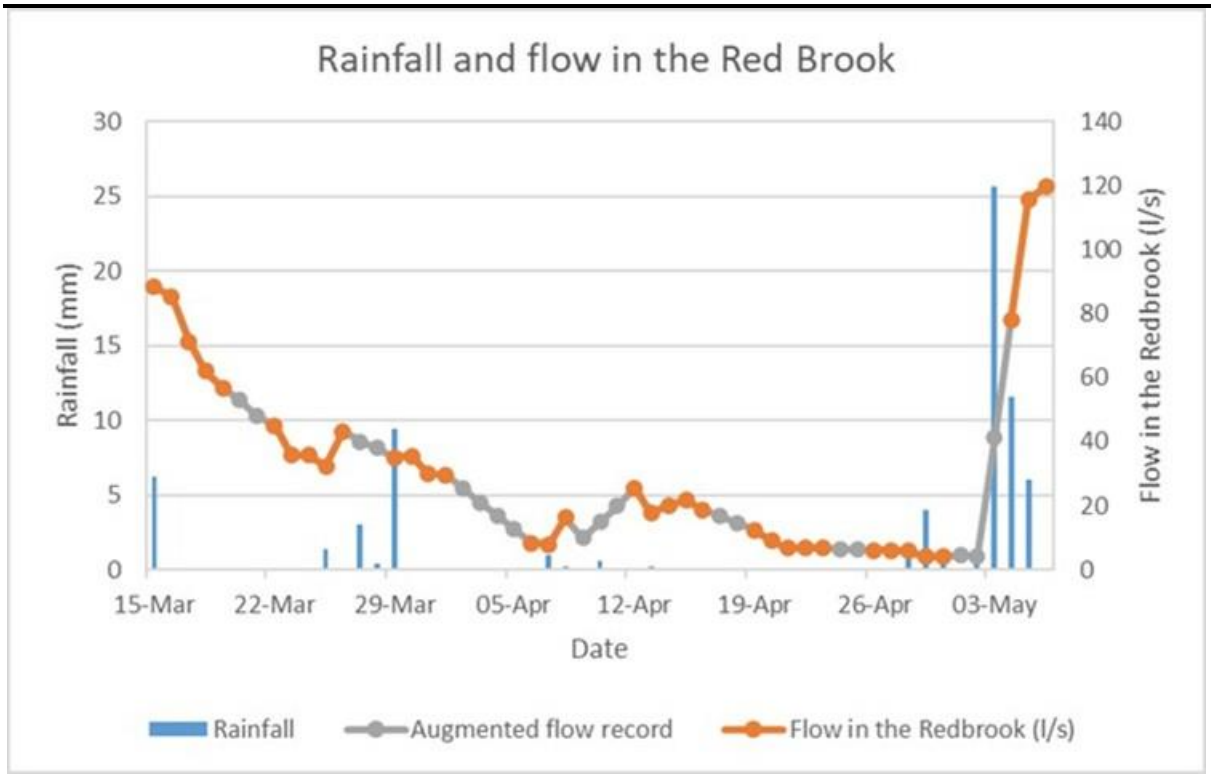


Figure 3-1 Flow measurement in the Redbrook

The catchment area of the Redbrook is estimated as 1.54 km^2, based on the FEH Web Service (Figure 3-2).

Figure 3-2 Catchment of the Redbrook

In order to estimate the likely range in flow in the Redbrook, the following steps have been taken to generate an artificial flow record:

Effective rainfall (ER) varies as a proportion of rainfall, depending on the temperature and amount of evapotranspiration. The estimates of monthly ER in Table 2-1 were used to inform predictions of daily effective rainfall. The rules used to generate a daily effective rainfall record are shown in Table 3-1.

Table 3-1 Calculating effective rainfall

Month	Effective Rainfall calculation
November, December January, February	ER= rainfall on that day
March, April, September, October	If daily rainfall > 10mm, ER = rainfall on that day, otherwise ER = 0.7*rainfall on that day
May, June, July, August	If the sum of the preceding 3 days rain is greater than 5 mm then ER = 0.5*daily rainfall, otherwise ER = 0 mm

The daily flow in the Redbrook was then calculated as

Q_{rb} = average of ER for previous 7 days x A_c x F

where

Q_{rb} = Flow in the Redbrook

ER = Effective Rainfall

A_c = Catchment area

F = adjustment factor

The flow record was calibrated against the measured flow record to set the adjustment factor, F. The resulting calculated daily flows are shown in Figure 3-3. The adjustment factor F was set to the value 2 to achieve the calibration shown.

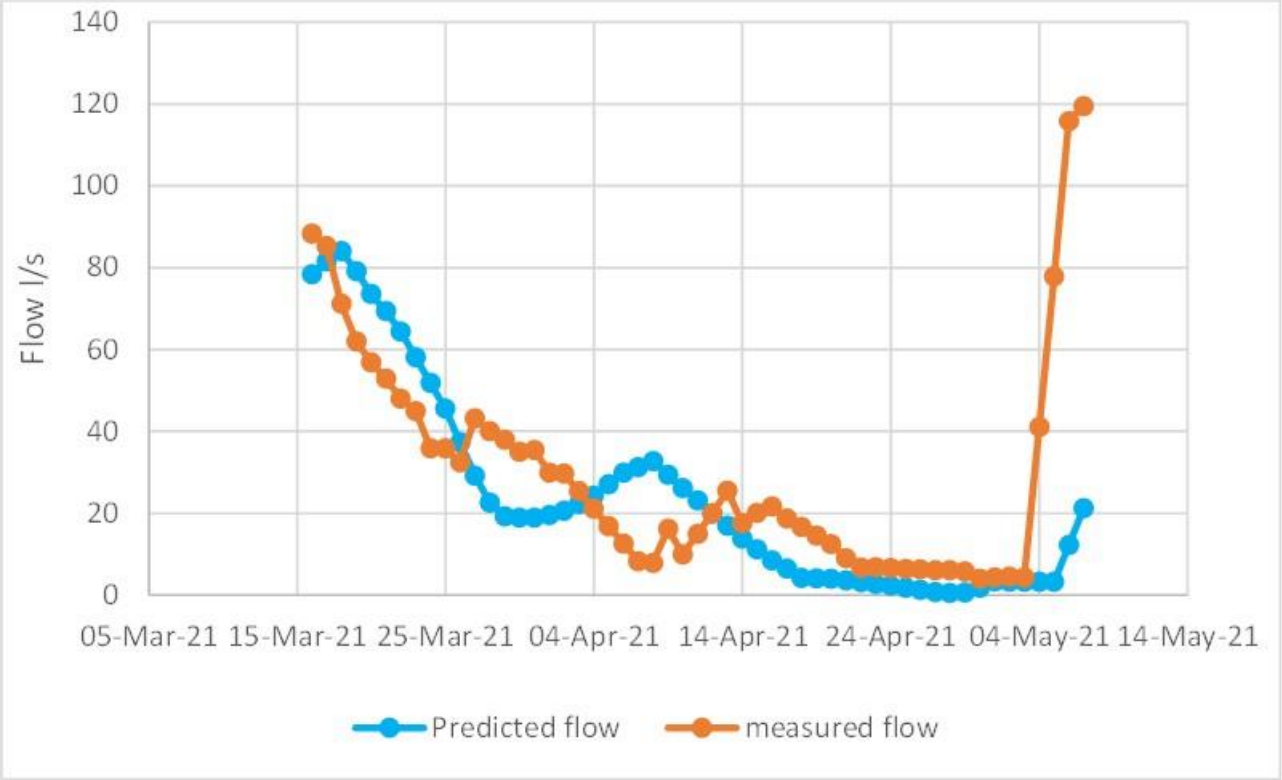


Figure 3-3 Measured and derived flow record

Having calibrated the flow equation to measured data, the same relationship was used to generate a flow record for the period of the rainfall data record, as shown on Figure 3-4. Also shown on Figure 3-4 is an estimate of the site discharge, calculated as the effective rainfall over the site multiplied by the site area of 47264 m^2.

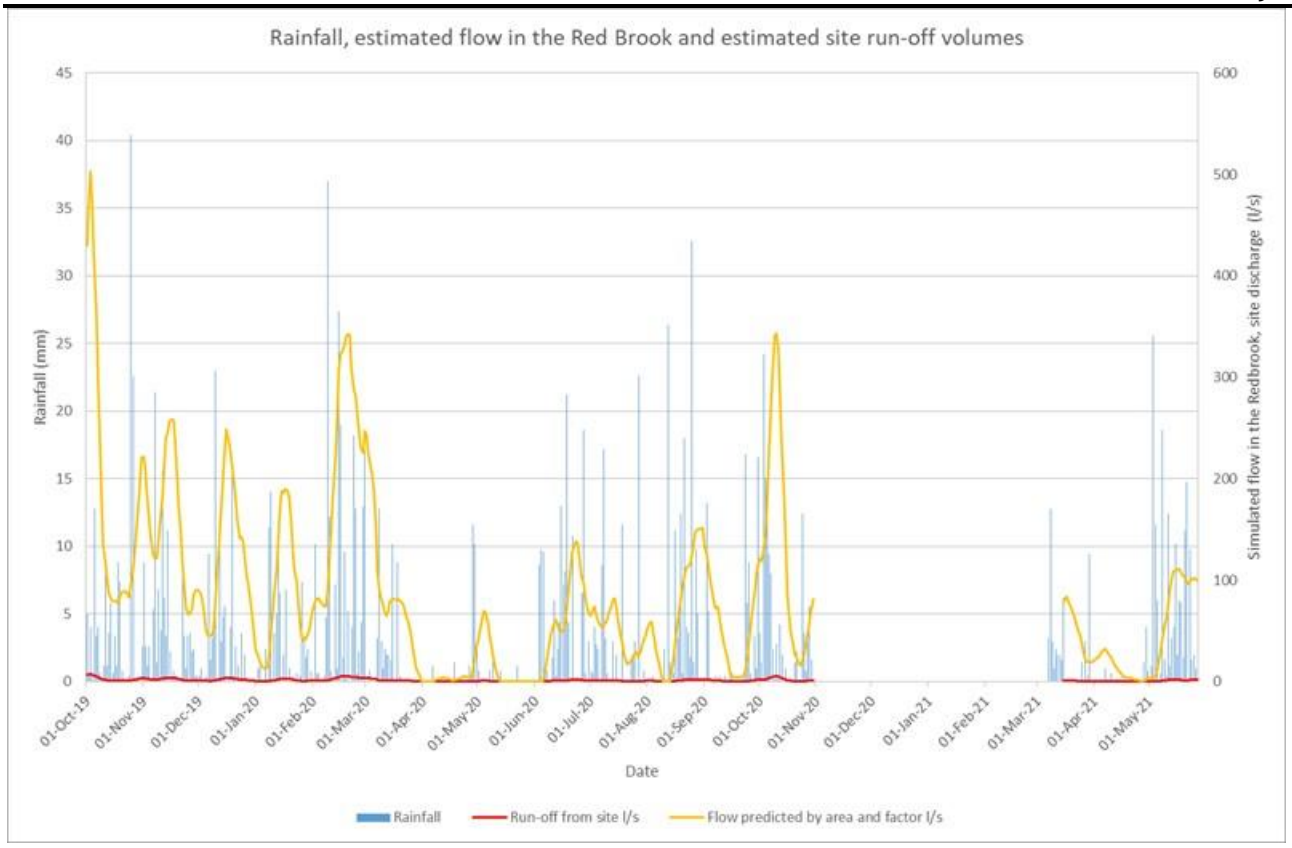


Figure 3-4 Generated flow record for the site and Redbrook.

The methods of estimating site run-off and streamflow are both based on and 'area multiplied by rainfall' basis; the flow in the Redbrook is 65 times greater than the estimated site run-off.

4 DILUTION CALCULATIONS

The methodology outlined in the latest Environment Agency guidance for assessing surface water pollution risk (updated 10 August 2021)[1] has been used to calculate the potential impacts of the site discharge on the Redbrook.

4.1 Methodology

4.1.1 Test 1

In the first instance, chemicals present above 10 % of the relevant Environment Quality Standard (EQS) (or drinking water standard (DWS) where EQS is not available) are identified as Contaminants of Concern.

4.1.2 Test 2

For each contaminant of concern, an average site concentration is calculated as a time series, based on the site monitoring data. A time series graph is shown for each contaminant of concern in Figure 5-1 to Figure 5-20. The site average concentration is the proxy used to estimate the likely effluent concentration.

The Process Contribution (PC) is calculated as follows:

PC = (Effluent flow * Effluent concentration[2]) / (effluent flow + receiving water flow)

As the receiving water flow is 65 times the effluent flow, this equation reduces to

PC = Effluent concentration/66

[1] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit#screening-tests-freshwaters

[2] The effluent concentration is the average site concentration

EA guidance advises that contaminants where the PC is less than 4% of the EQS can be disregarded, as it is highly unlikely that there will be a significant impact on the quality of the receiving water (Test 2 in the EA guidance). The EQS and 4% of the EQS are shown as a solid line and a dashed line respectively on Figure 5-1 to Figure 5-20.

EA guidance states that for contaminants where the PC is greater than 4% of the EQS two further tests should be carried out (Test 3 and Test 4).

4.1.3 Test 3

Having calculated the Process Contribution, the Predicted Environmental concentration (PEC) is calculated as the process contribution (PC) plus the background concentration (BC).

PEC = PC + BC

The difference between BC and PEC is calculated, if this is greater than 10% of the EQS the EA will need to carry out modelling.

The background concentration (BC) is shown as the data from sampling location RB3 (pink line), just upstream of the site outfall. Also shown for context is the data from RB4 (red line), just downstream of the site outfall. The PEC is shown as a purple line.

4.1.4 Test 4

The PEC is compared to the EQS, if PEC is greater than EQS then further assessment is required.

4.2 Results

Time series showing site average concentration (blue), EQS (black line), 4% of EQS (dot-dash line), the process contribution (PC, grey line), upstream concentrations (RB3, pink line), downstream concentrations (RB4, red line) and PEC (RB3 plus PC, purple line) are in the figures below. Also shown is the concentration in the surface water lagoon (BF5, green line).

The dilution calculations are presented in Appendix TN6A. Table 4-1 summarises the contaminants of concern identified.

Table 4-1 Contaminants of concern

Chemical (Pass ✔ or fail X)	Test 1: Contaminant of concern? (>10 % of EQS)	Test 2: Is PC > 4% of EQS ?	Test 3: Is difference between BC and PEC more than 10% of the EQS?	Test 4: Is PEC > EQS?	Further assessment needed? (i.e. failed test 3 and/or 4)
Sulphate as SO_4	**X**	✔	N/A	N/A	✔ No
Chloride	**X**	**X** PC up to 1.7 x 4%of EQS	✔	**X** In 4 of 9 measurements due to high BC	**X Further assessment required**
Ammonia as NH_3	**X**	**X** PC up to 7.8 x 4%of EQS	**X** In 4 of 11 measurements	**X** In 4 of 11 measurements due to high BC	**X Further assessment required**
Nitrate as NO_3	**X**	✔	N/A	N/A	✔ No
Nitrite as NO_2	**X**	**X** PC up to 2 x 4%of DWS	✔	✔	✔ No
Boron	**X**	✔	N/A	N/A	✔ No
Iron	**X**	✔	N/A	N/A	✔ No
Sodium	**X**	**X** PC up to 1.5 x 4%of DWS	✔	**X** In 4 of 7 measurements due to high BC	**X Further assessment required**
Aluminium*	**X**	**X** PC up to 3 x 4%of DWS	**X** In 1 of 10 measurements	**X** In 7 of 10 measurements, but only 1 of these measurements failed test 2.	**X Modelling required**
Arsenic	**X**	✔	N/A	N/A	✔ No
Cadmium	**X**	✔	N/A	N/A	✔ No
Chromium	**X**	✔	N/A	N/A	✔ No
Copper	**X**	**X** PC up to 39 x 4%of EQS	**X** In all measurements	**X** In all measurements due to endemically high Cu concentrations upstream of site	**X Further assessment required**
Lead	**X**	✔	N/A	N/A	✔ No
Manganese	**X**	**X** PC up to 1.7 x 4%of EQS	**X** In 2 of 3 measurements	**X** In 1 of 3 measurements due to high BC, but this measurement passed test 2.	**X Further assessment required**
Mercury	**X**	**X** PC up to 1.1 x 4%of EQS	✔	✔	✔ No
Nickel	**X**	✔	N/A	N/A	✔ No

Selenium	**X**	✔	N/A	N/A	✔ No
Vanadium	**X**	✔	N/A	N/A	✔ No
Zinc	**X**	✔	N/A	N/A	✔ No

*or DWS where applicable

Test 2: The process contribution was above 4% of the EQS for the following contaminants:

Chloride, ammonia, nitrite, sodium, aluminium, copper, manganese, mercury.

Test 3: The difference between the Background Concentration (BC) and the Predicted Environmental Concentration (PEC) was more than 10% of the EQS for the following contaminants:

Ammonia, aluminium, copper, manganese.

Test 4: The Predicted Environmental Concentration (PEC) was above the EQS for the following contaminants:

Chloride, ammonia, sodium, aluminium, copper, manganese.

The following contaminants failed test 3 and/or test 4 and therefore need further modelling to be carried out by the Environment Agency:

Chloride, ammonia, sodium, aluminium, copper, manganese.

For all the contaminants of concern where the PEC exceeded the EQS, the effect on the receiving water is predicted to be negligible as the background concentrations exceeded the EQS and the additional load from the site was insignificant.

- The chloride PEC (Figure 5-4) exceeded the EQS of 250 mg/l on four occasions (PEC = 456, 587, 446, and 275 mg/l compared with a background concentration of 440, 570, 430, and 260 mg/l respectively).
- The ammonia PEC (Figure 5-4) exceeded the EQS of 2.5 mg/l on four occasions (PEC = 3.7, 5.7, 5.4, and 2.9 mg/l compared with a background concentration of 3.5, 4.9, 5.2, and 2.7 mg/l respectively).
- The sodium PEC (Figure 5-8) exceeded the DWS of 200 mg/l on four occasions. The highest PEC of 319 mg/l compared with a background concentration of 310 mg/l.
- The aluminium PEC (Figure 5-9) exceeded the DWS of 200 mg/l on 7 occasions. The highest PEC of 767 mg/l was when the background concentration was 760 mg/l. On 7 out of 10 occasions, the aluminium concentration from site was less than that in the receiving water, indicating that site discharge would have reduced concentrations in the stream under these circumstances.
- The PEC for copper exceeded that EQS of 1 ug/l on all 10 occasions, due to the high background concentrations (Figure 5-13). The highest PEC of 31.7 mg/l was when the background concentration was 31 mg/l.
- The PEC for manganese exceeded the EQS of 123 mg/l on one occasion, due to high background concentrations (Figure 5-15). The PEC was 130.6 mg/l and the background concentration was 130 mg/l. At this time, the site concentration was lower than the background concentration, and this measurement passed test 2 of the EA guidance.

5 CONCLUSIONS

Dilution calculations indicate that discharge from the site at the average of measured site concentrations is unlikely to have a significant impact on concentrations in the Redbrook due to the amount of dilution in the Redbrook and/or the very high background concentrations.

Concentrations in the Redbrook (PEC) of chloride, ammonia, sodium, aluminium, copper, and manganese were predicted to occasionally exceed EQS (or DWS) when the background concentration exceeded the EQS. The concentration of copper was predicted to always exceed the EQS as the background concentration always exceeds the EQS. It was never the case that the site contribution caused the EQS to be breached. The contaminants of concern in the site discharge are considered to arise from the impacts to local groundwater and surface water quality from the landfill to the south of the site, and concentrations in the future discharge will depend on the relative quantities of clean rainfall, impacted groundwater and impacted surface water.

The above assessment has relied on estimates of flow, site discharge rates and site discharge concentrations. While these estimates are based on reasonable assumptions, there is some uncertainty due to the variability in the water quality and the length of the monitoring period which does not span a full hydrological cycle.

The work outlined here indicates that in the long term the site could be allowed to passively discharge without ongoing monitoring. However, it is recommended that the site be allowed to discharge in a controlled manner with a robust monitoring programme in the short term in order to confirm the effects on surface water quality.

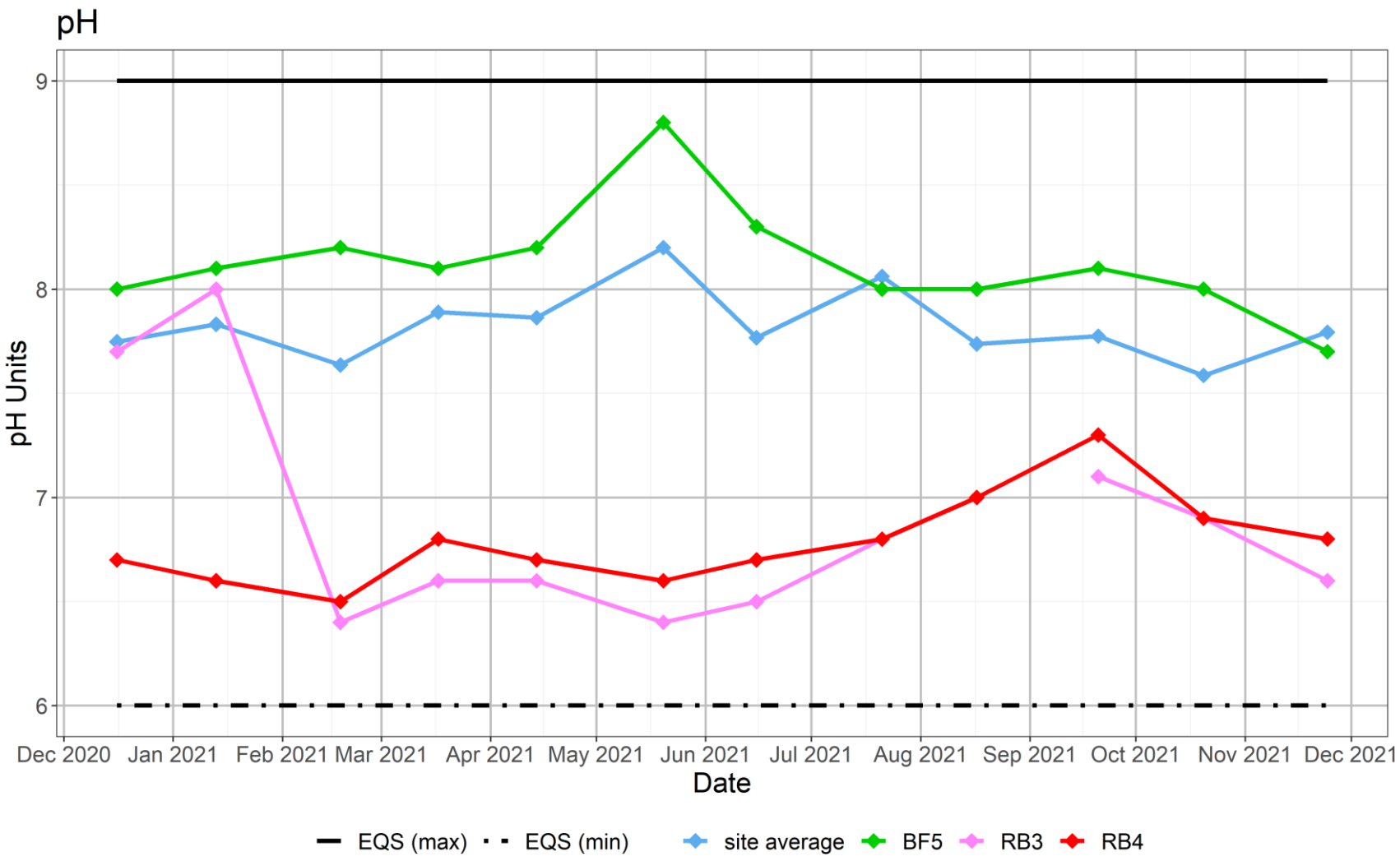

pH
9
8
7
6
pH Units
Dec 2020
Jan 2021
Feb 2021
Mar 2021
Apr 2021
May 2021
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021
Nov 2021
Dec 2021
Date
EQS (max)
EQS (min)
site average
BF5
RB3
RB4

Figure 5-1 pH

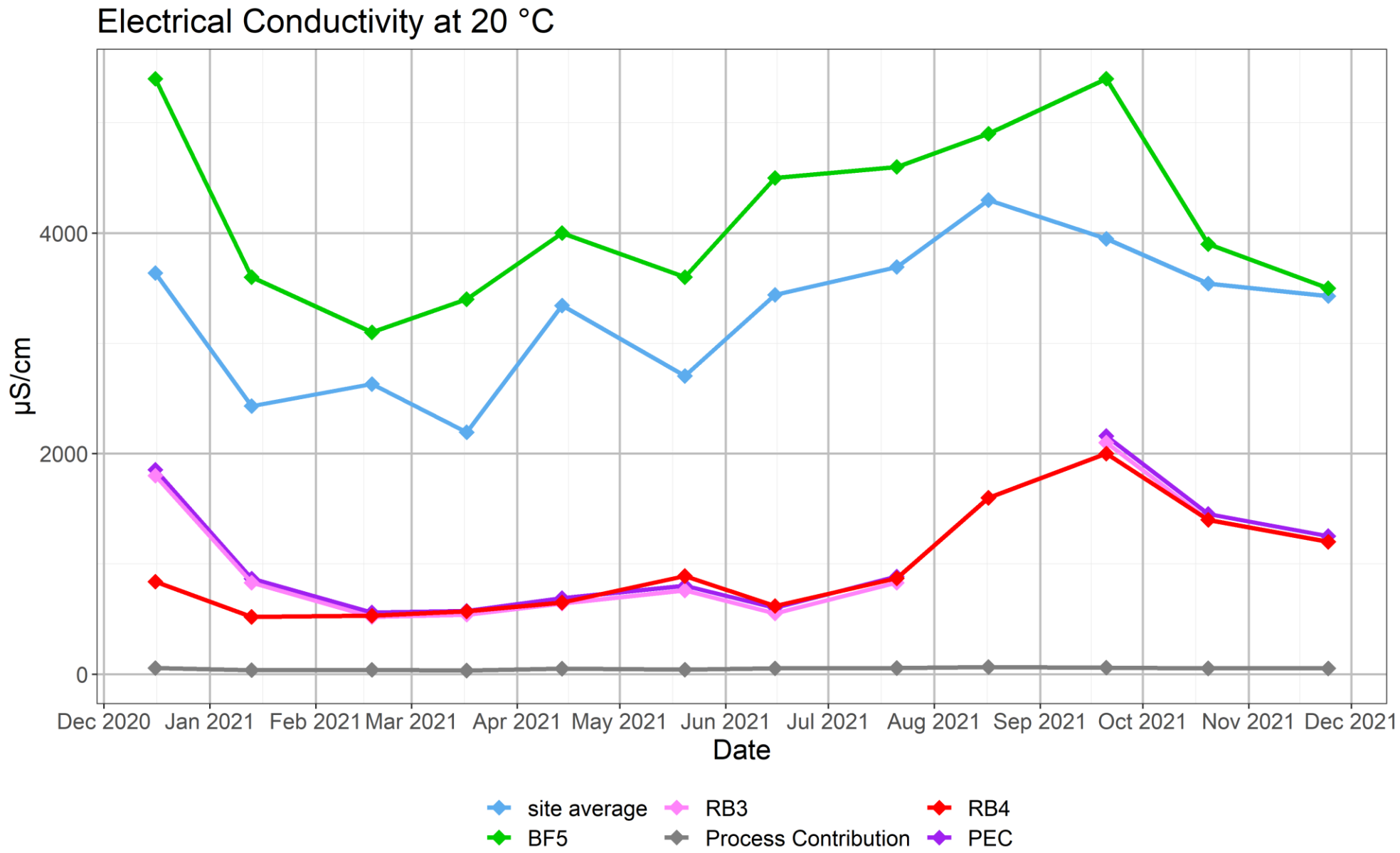


Figure 5-2 Electrical conductivity

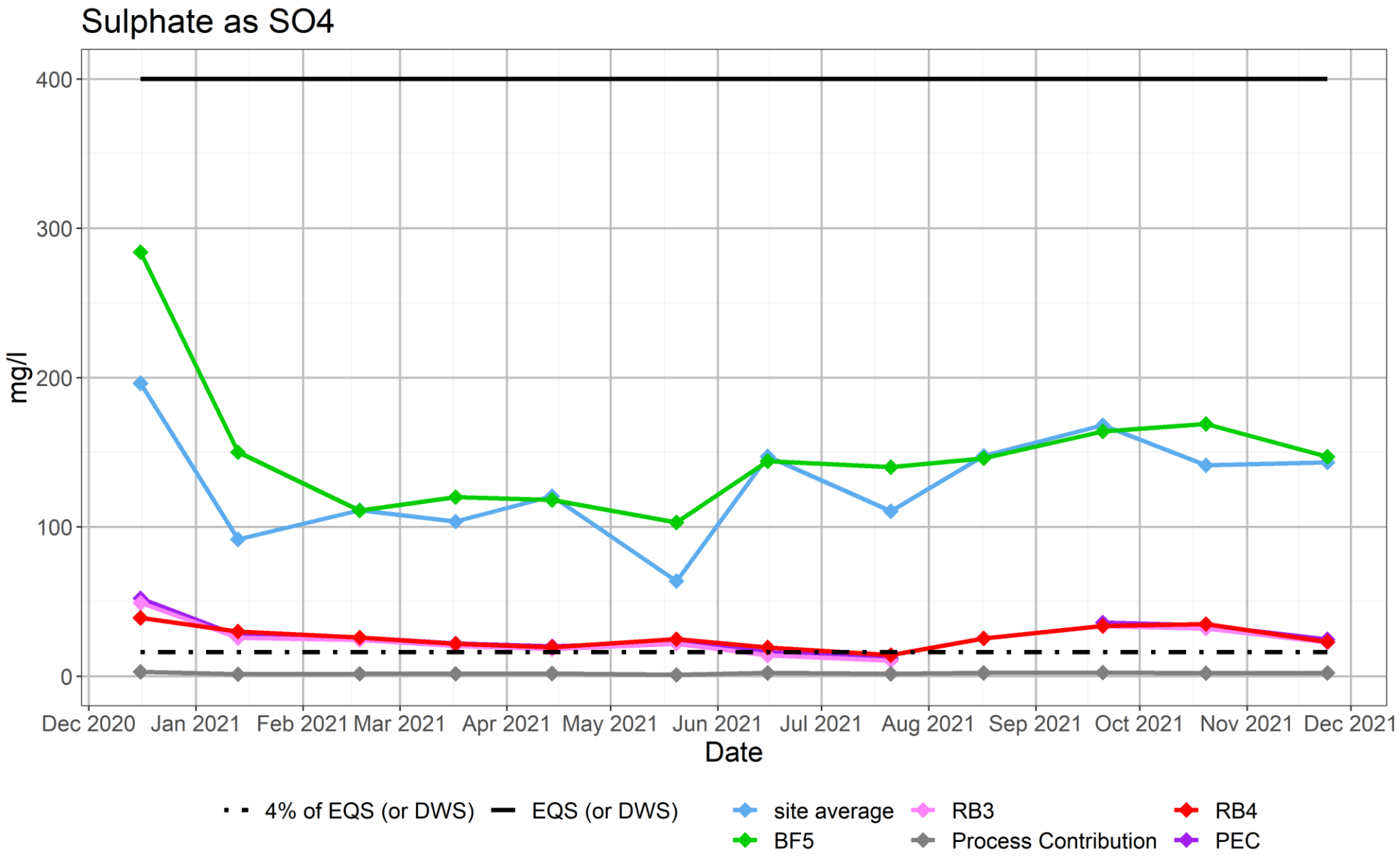


Figure 5-3 Sulphate

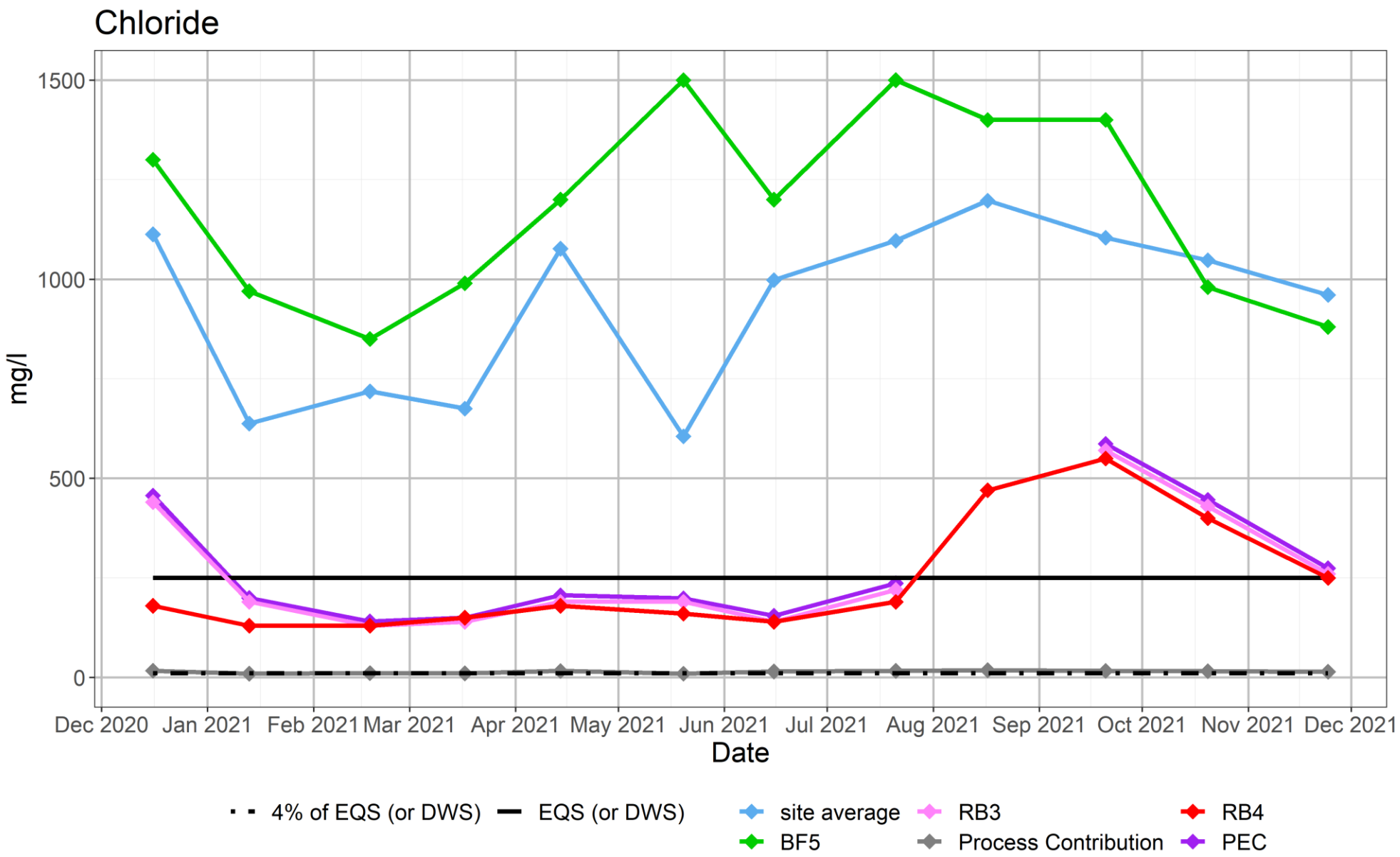


Figure 5-4 Chloride

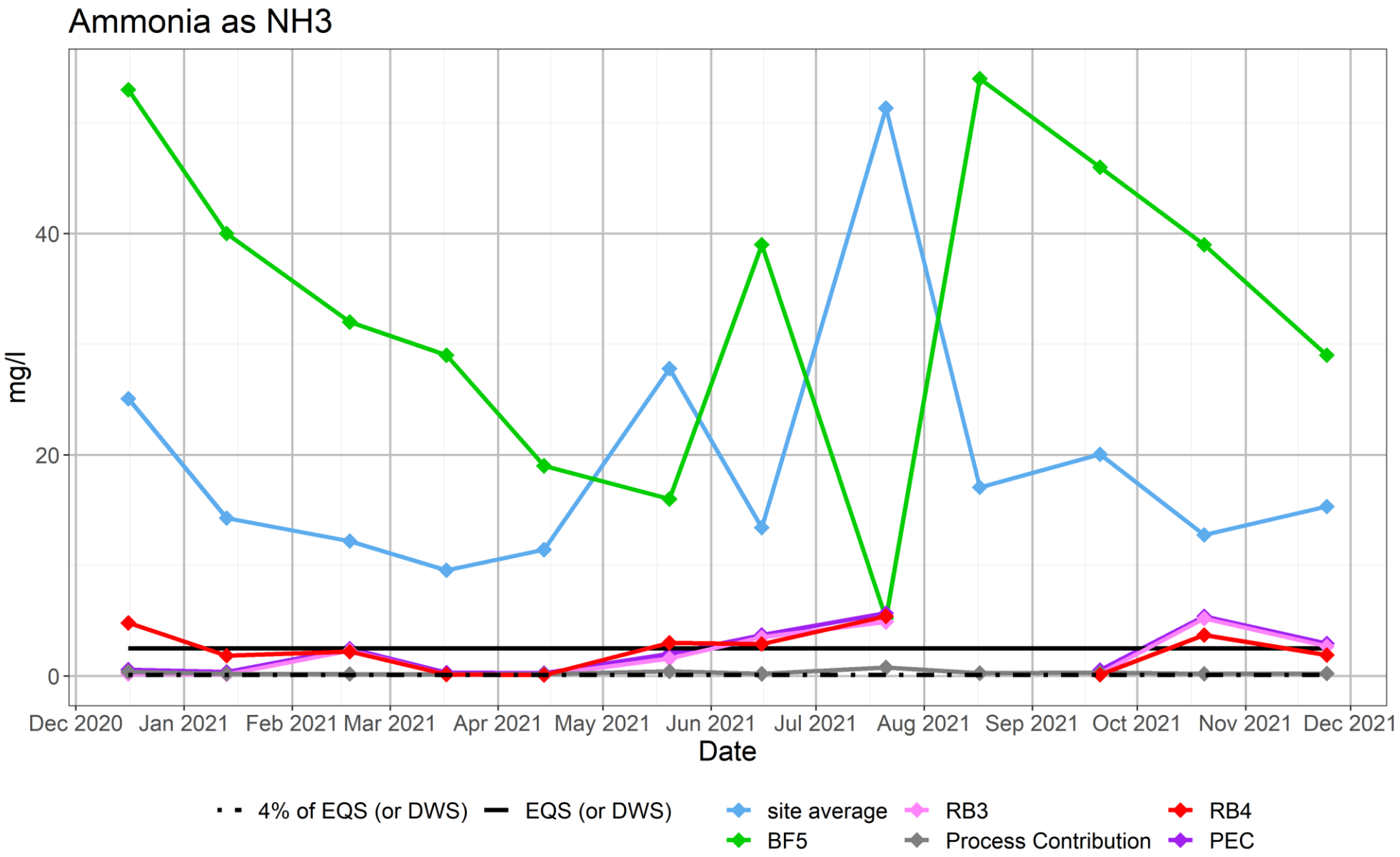


Figure 5-5 Ammonia

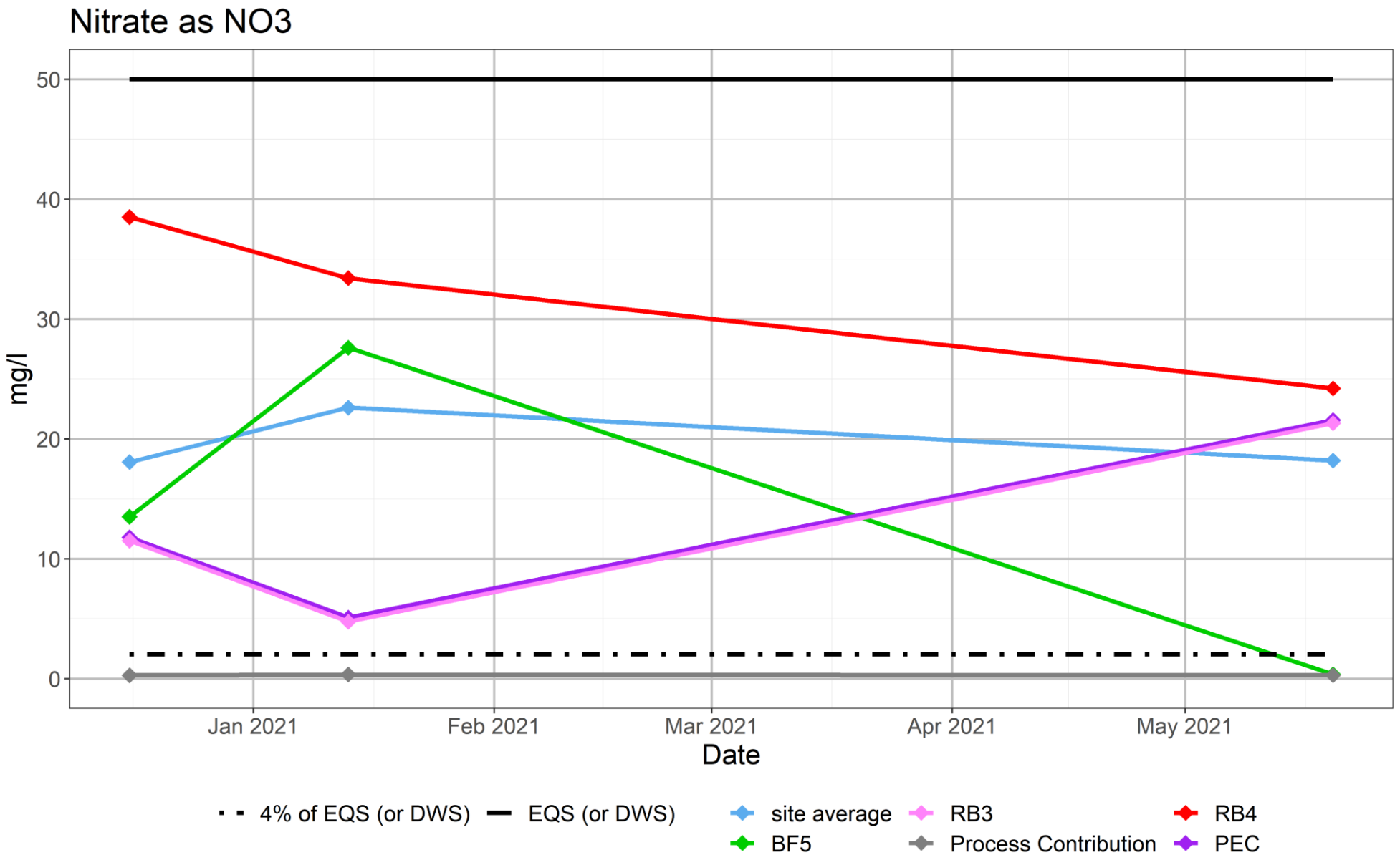


Figure 5-6 Nitrate

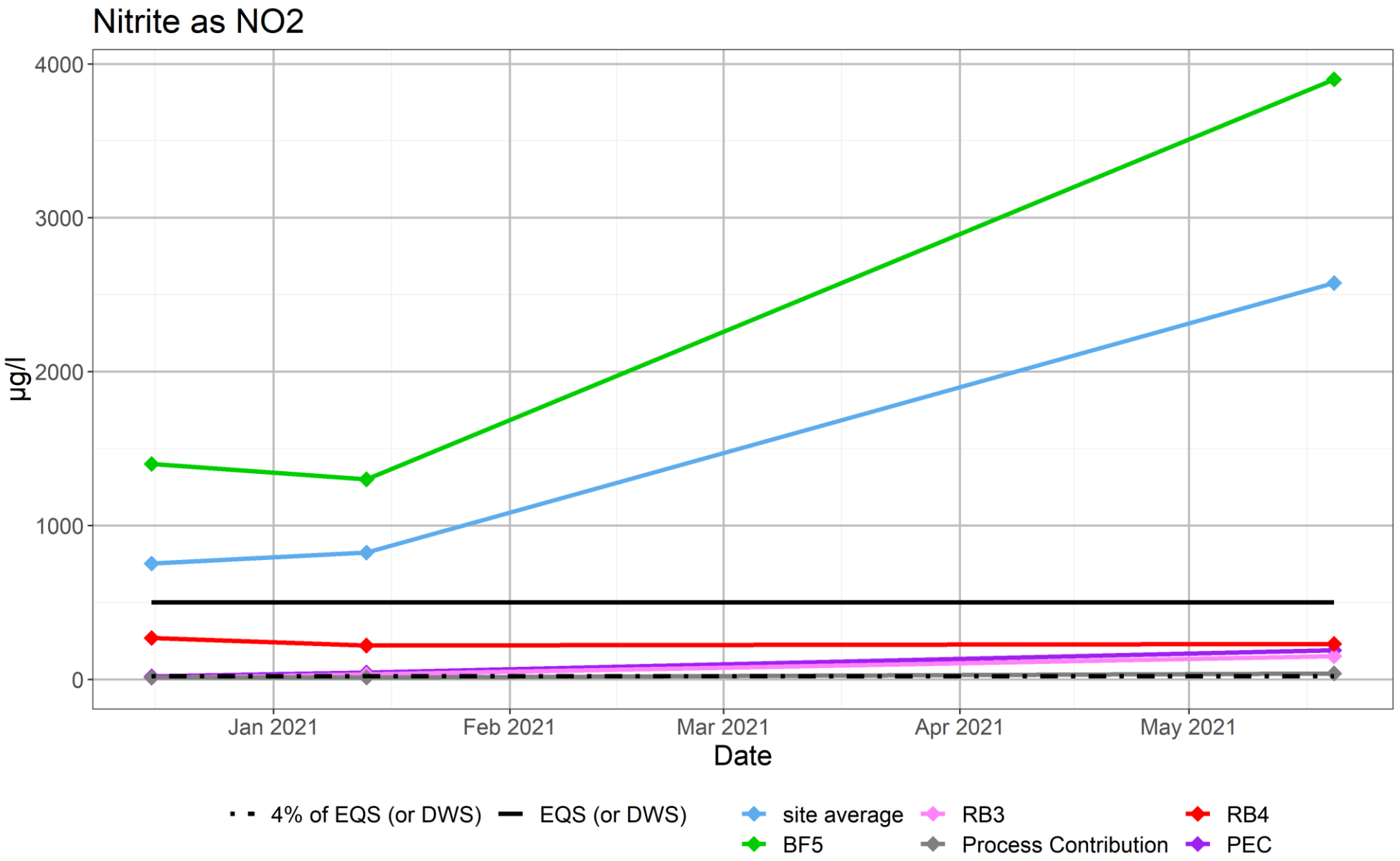


Figure 5-7 Nitrite

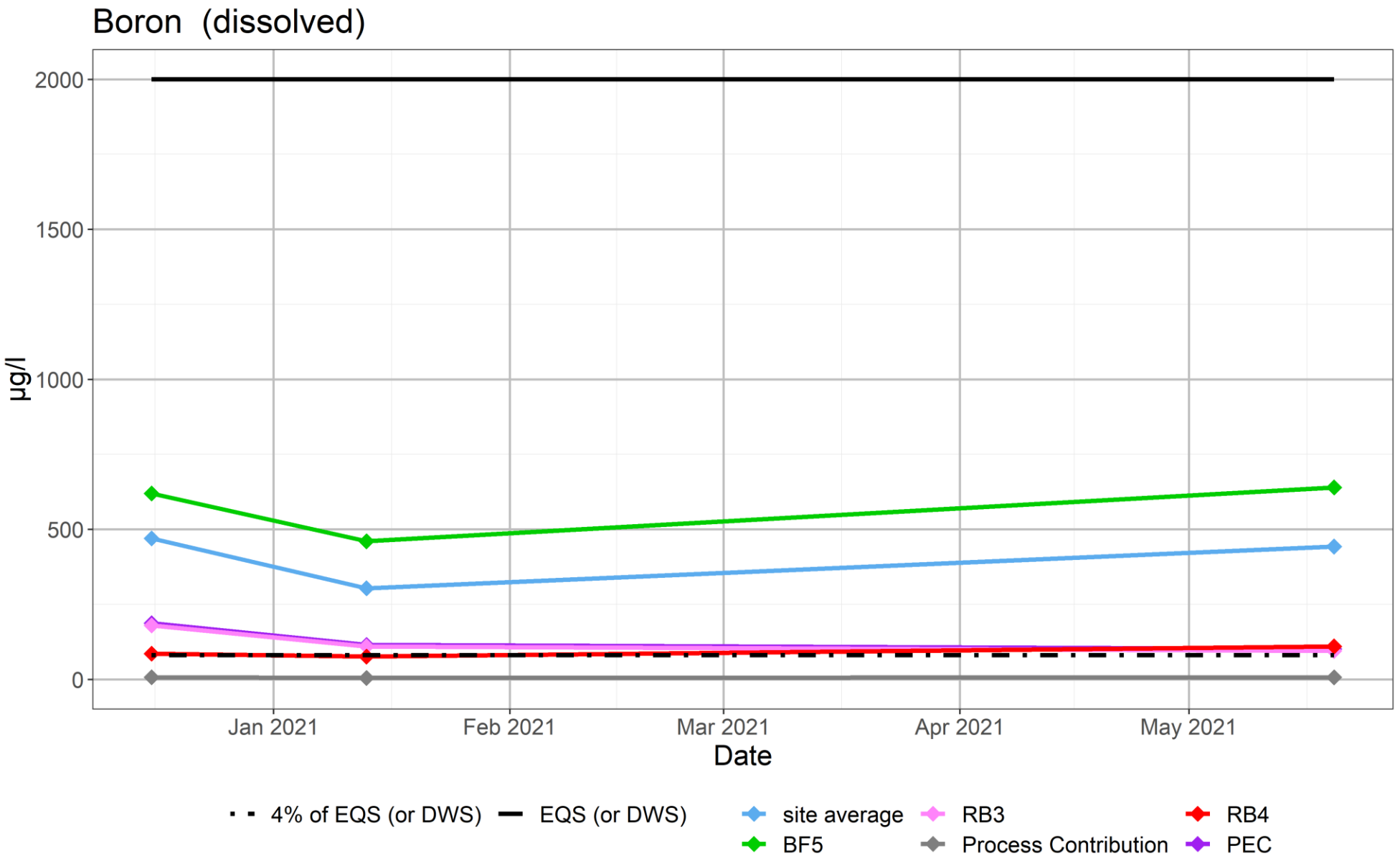


Figure 5-8 Boron

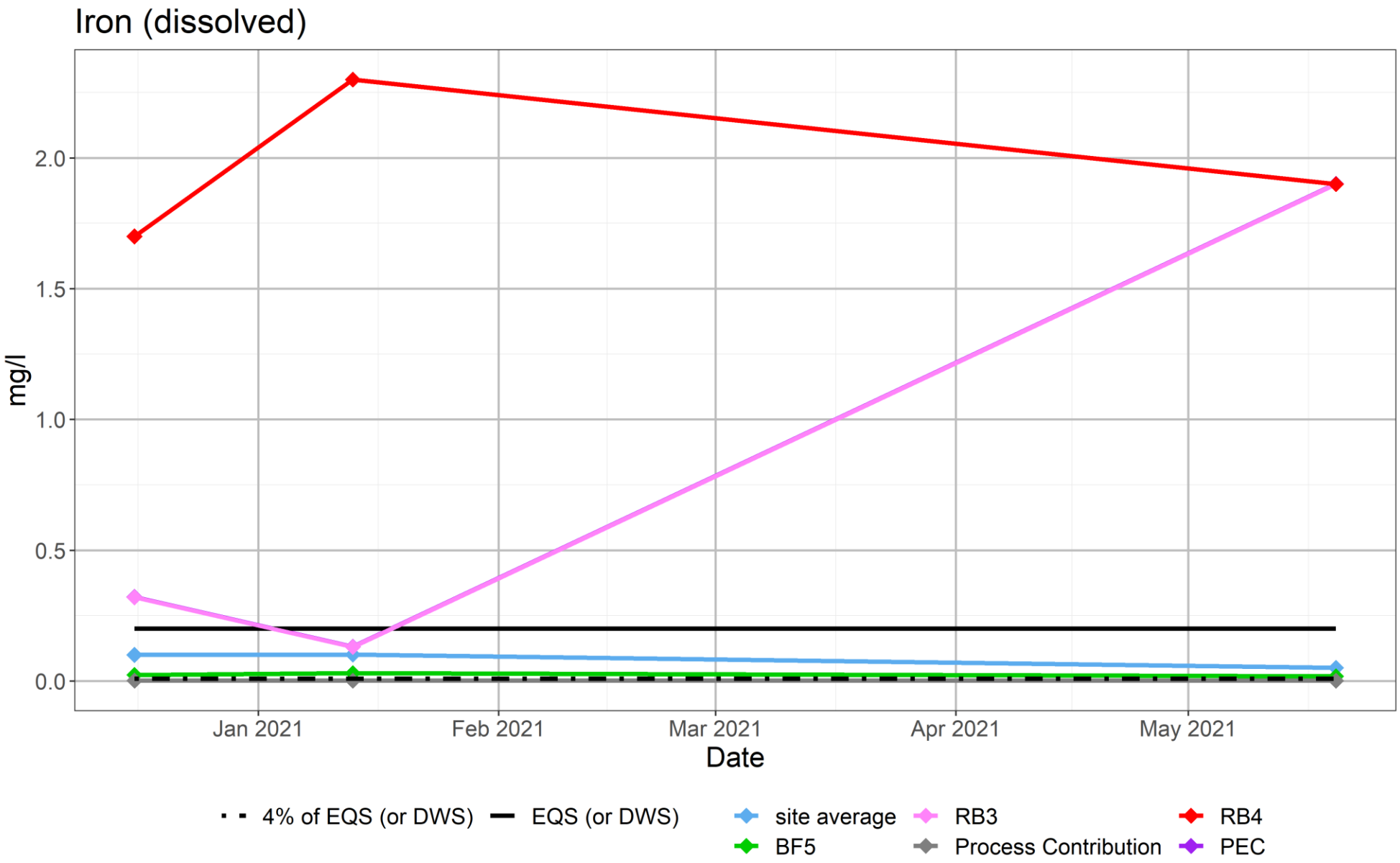


Figure 5-9 Iron

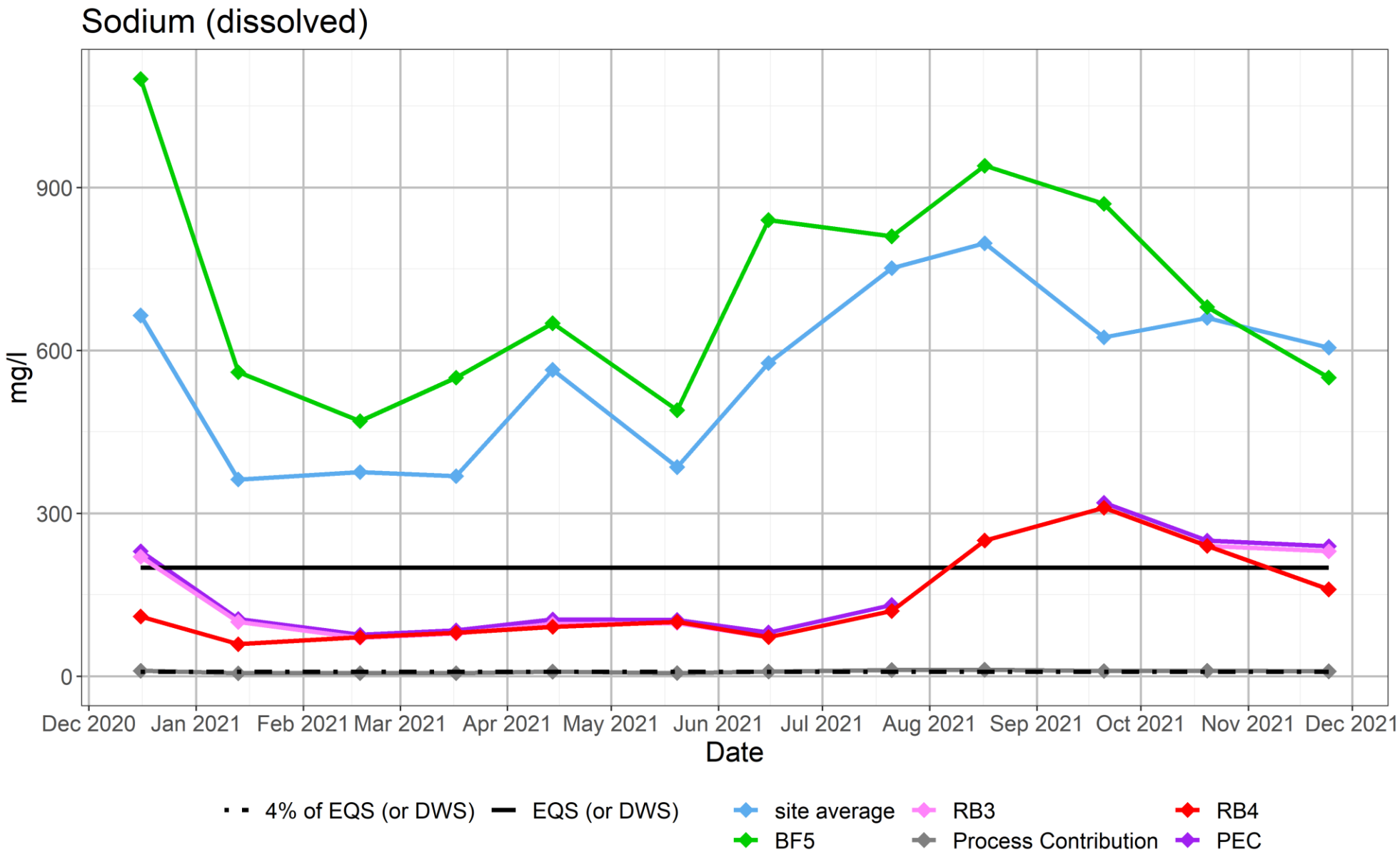


Figure 5-8 Sodium

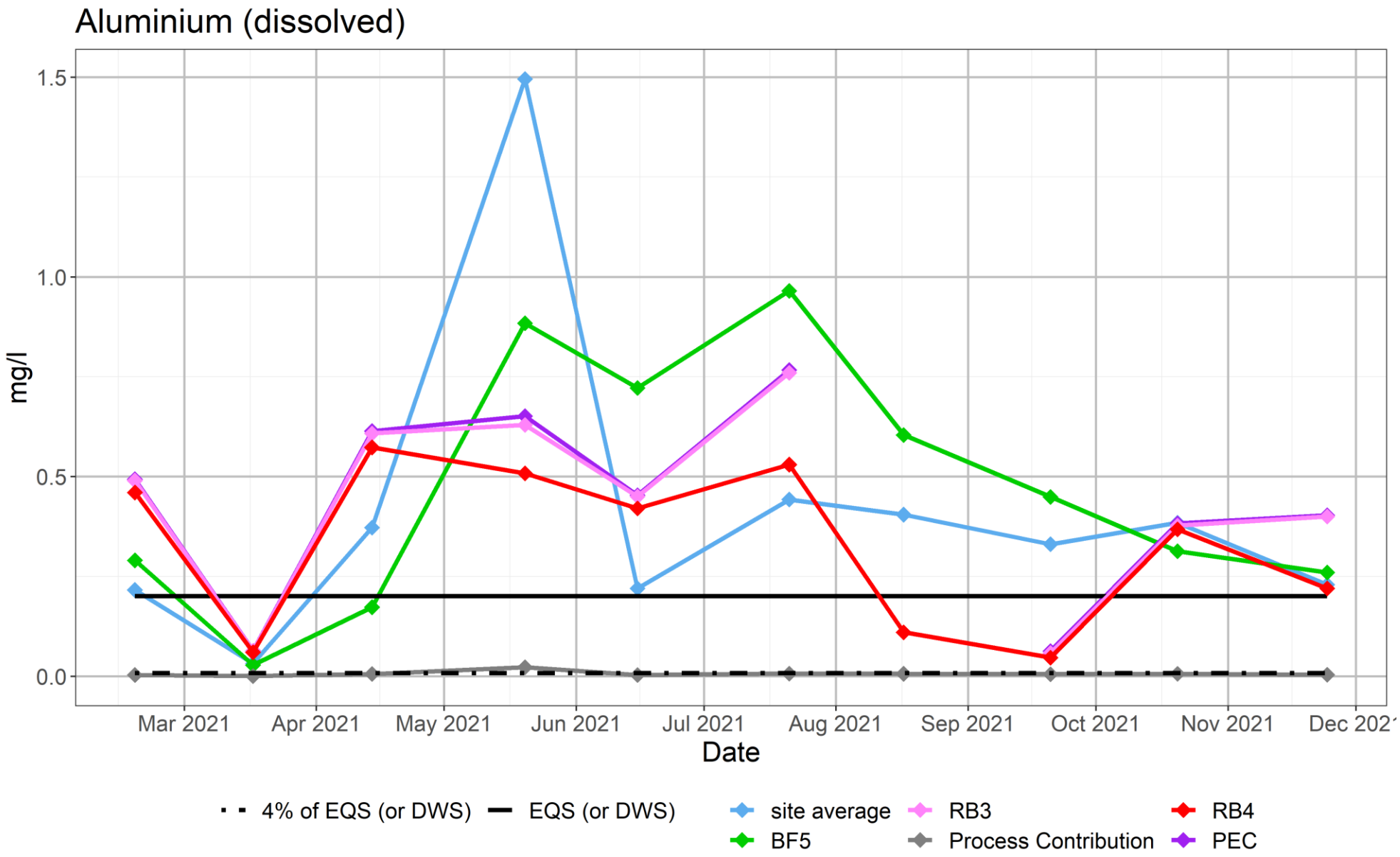


Figure 5-9 Aluminium

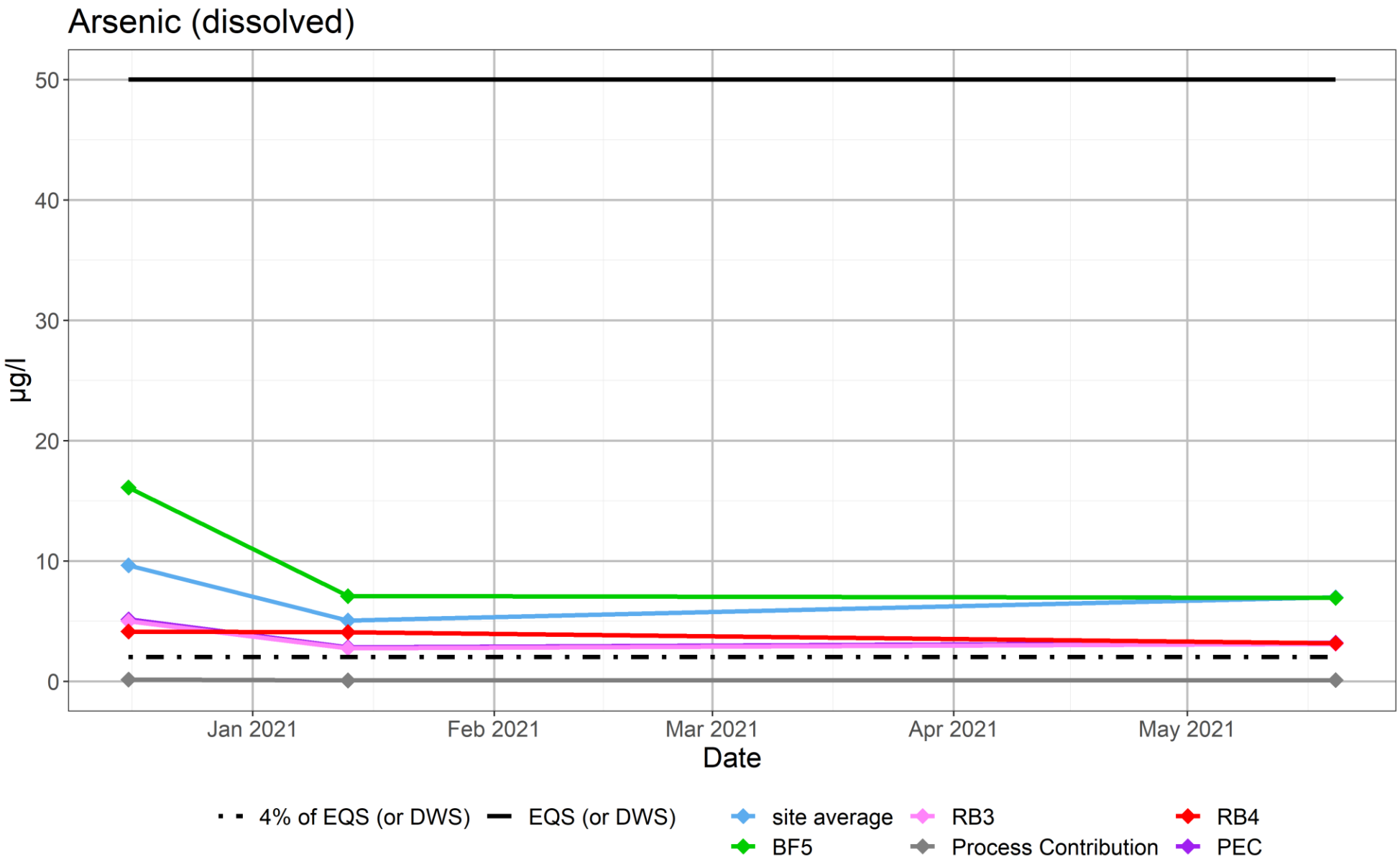


Figure 5-10 Arsenic

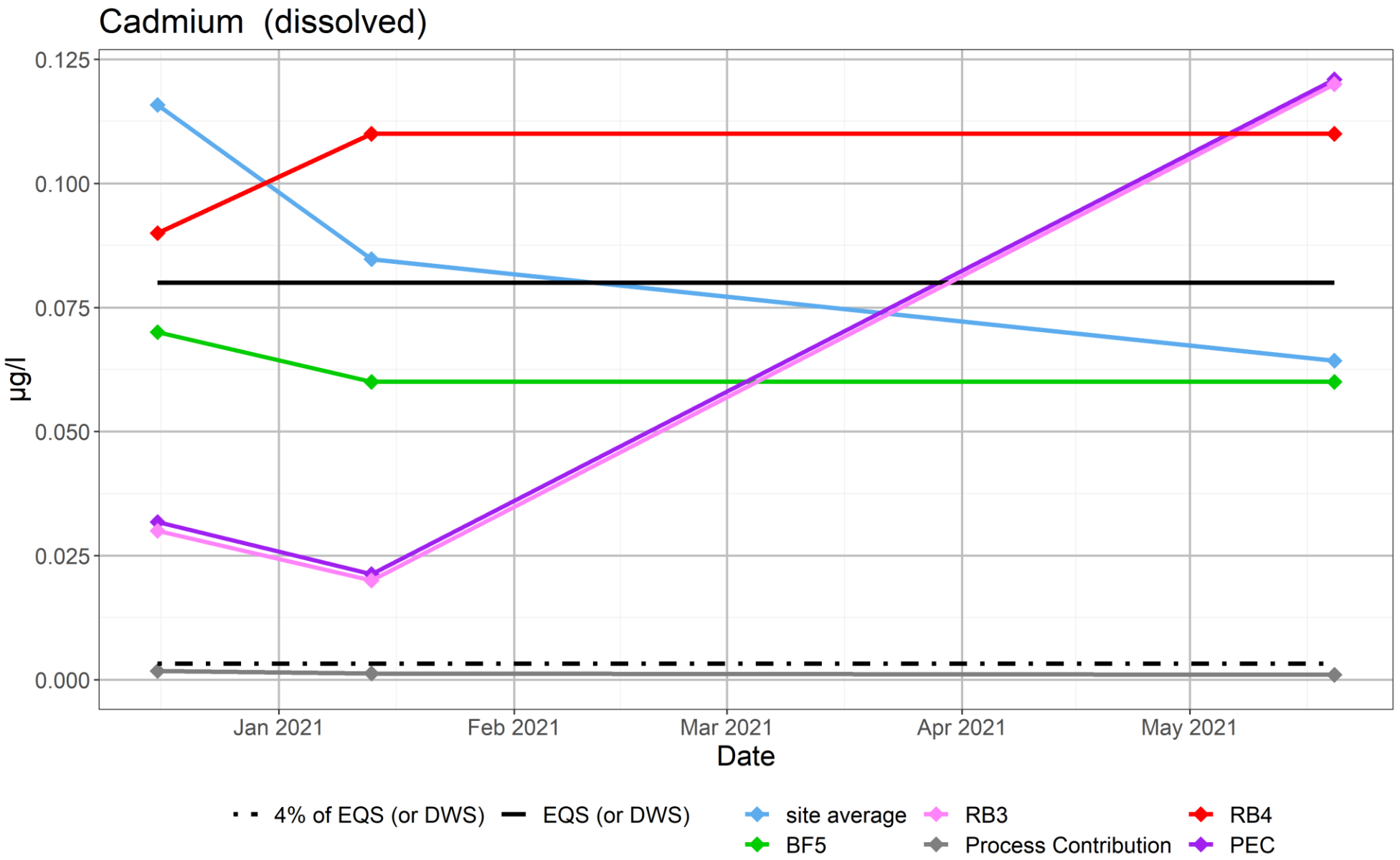


Figure 5-11 Cadmium

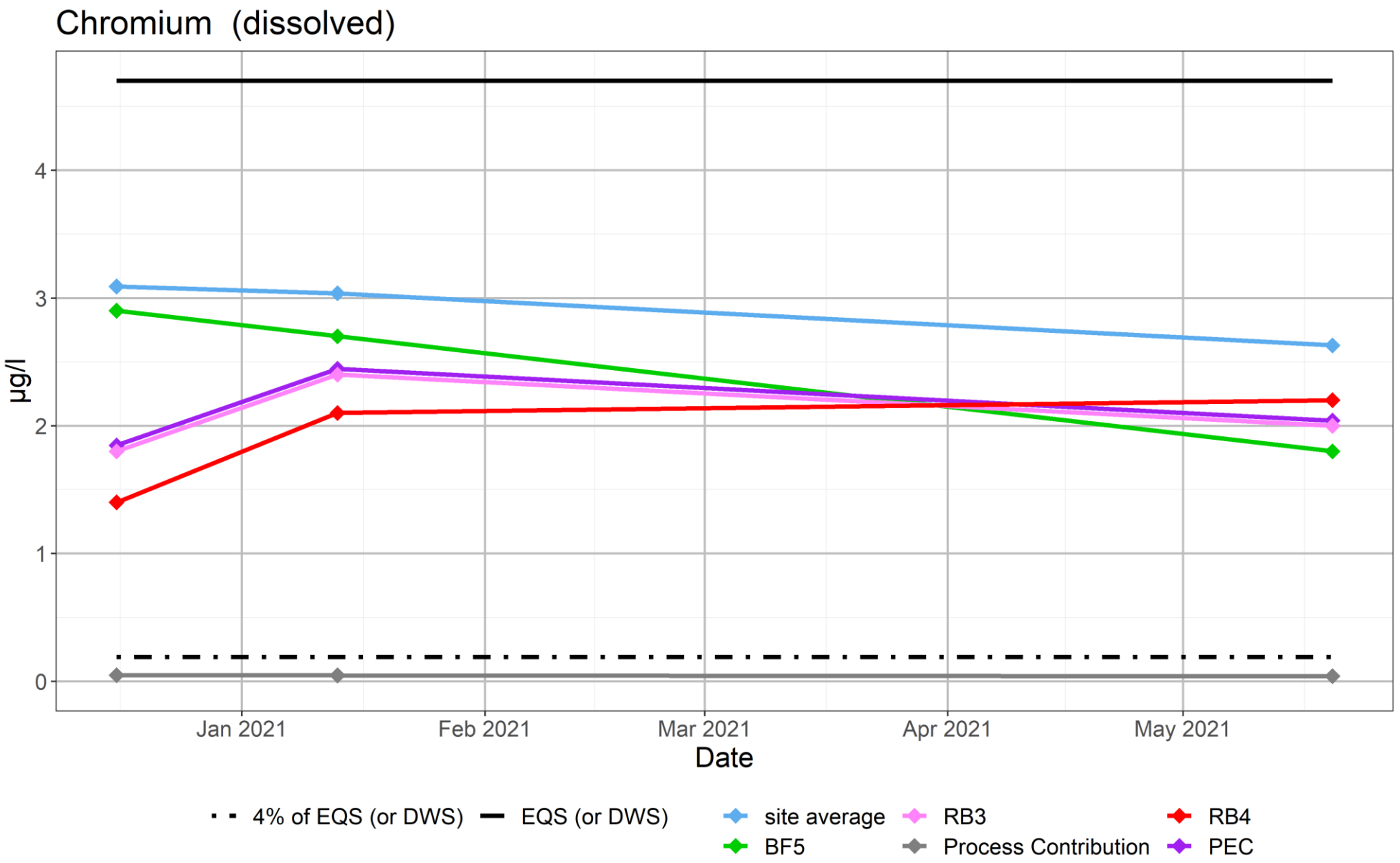


Figure 5-12 Chromium

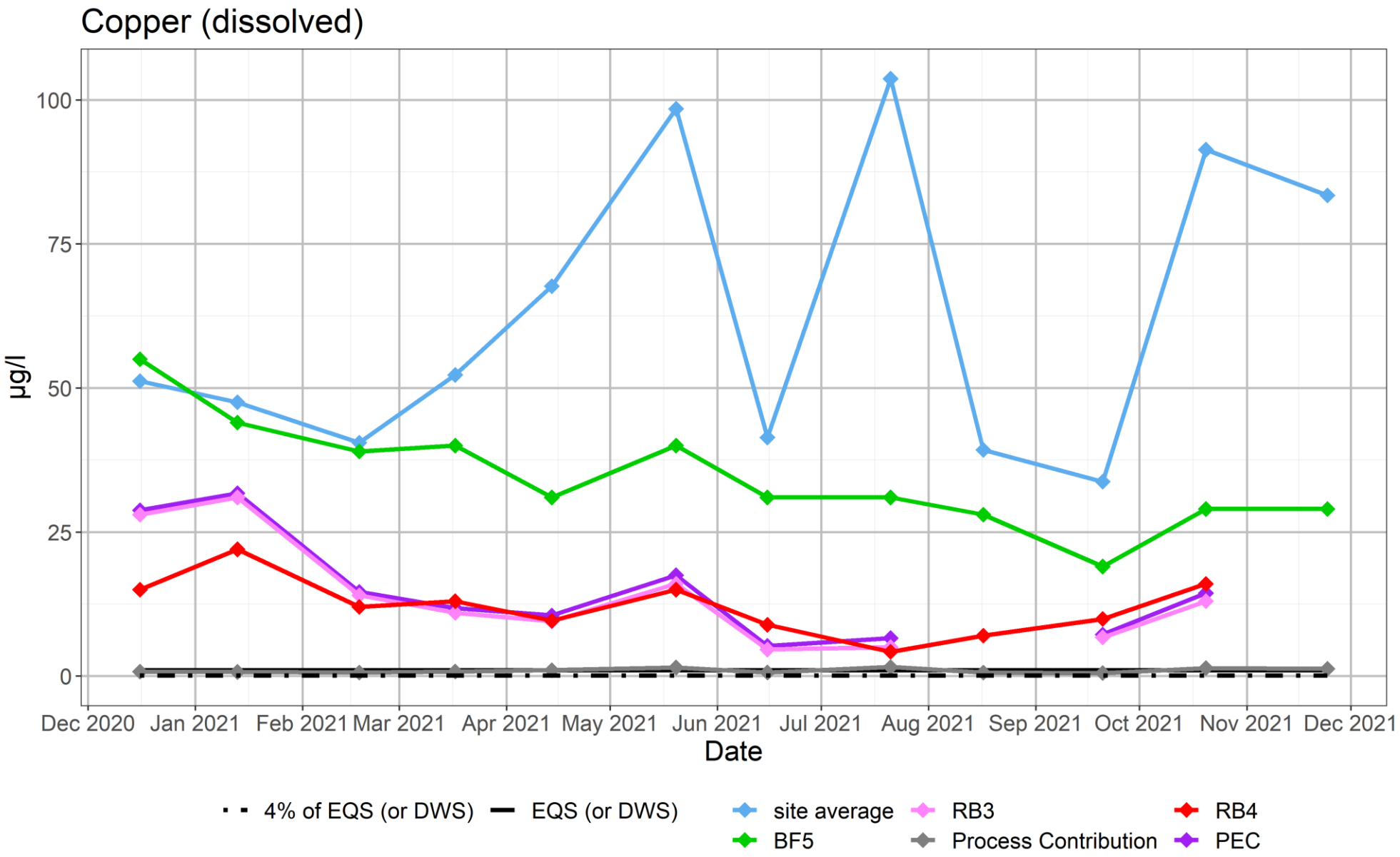


Figure 5-13 Copper

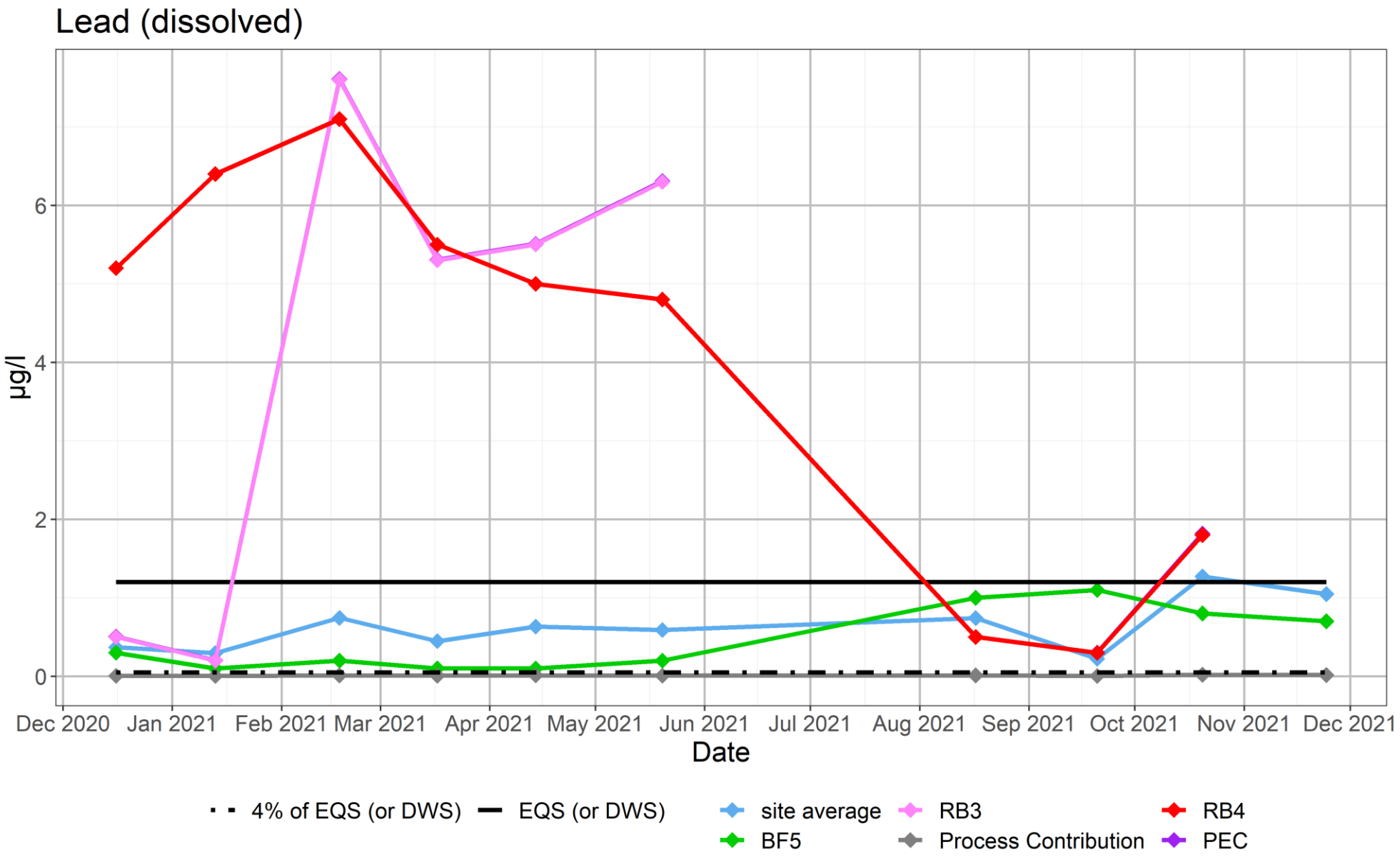


Figure 5-14 Lead

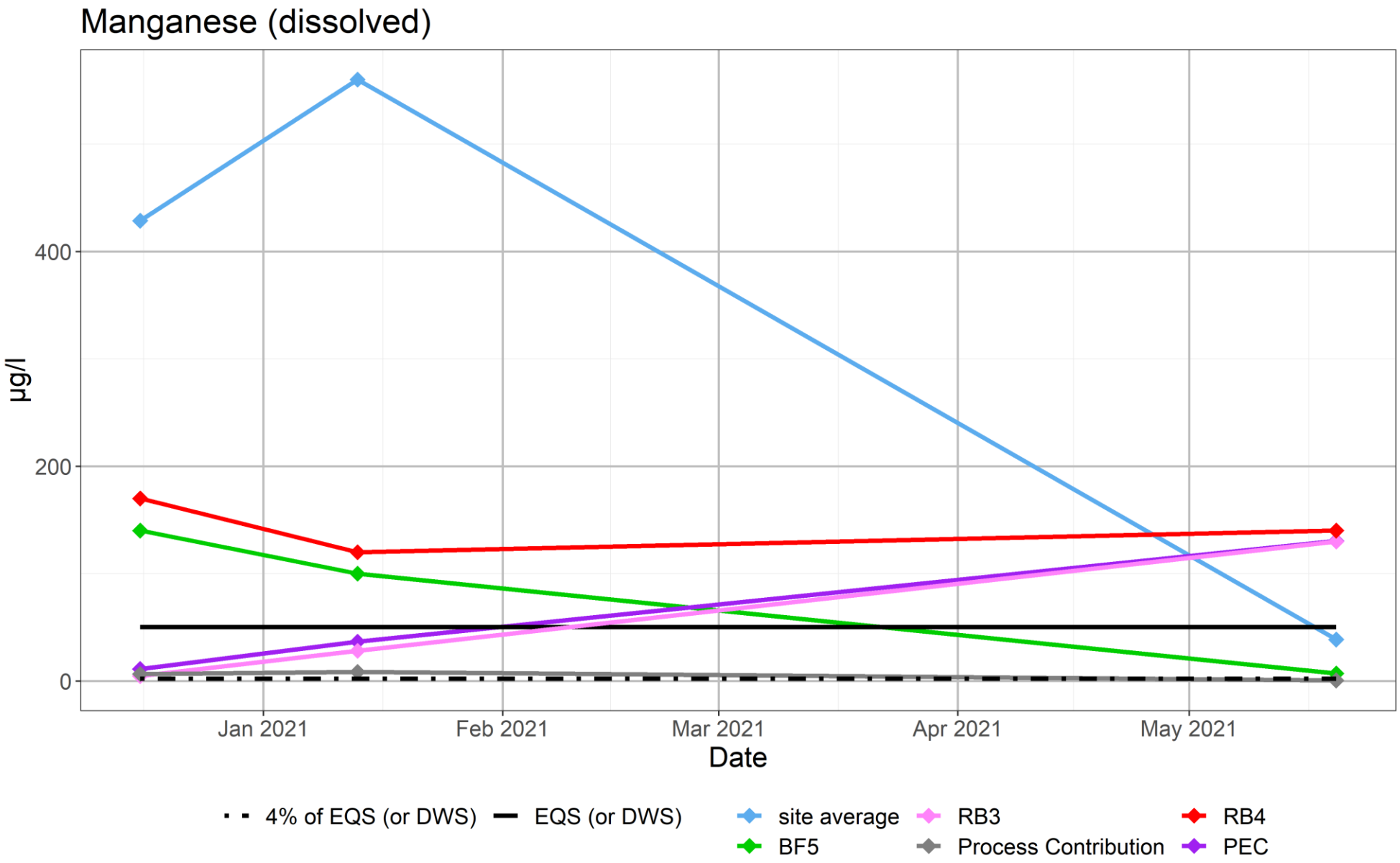


Figure 5-15 Manganese

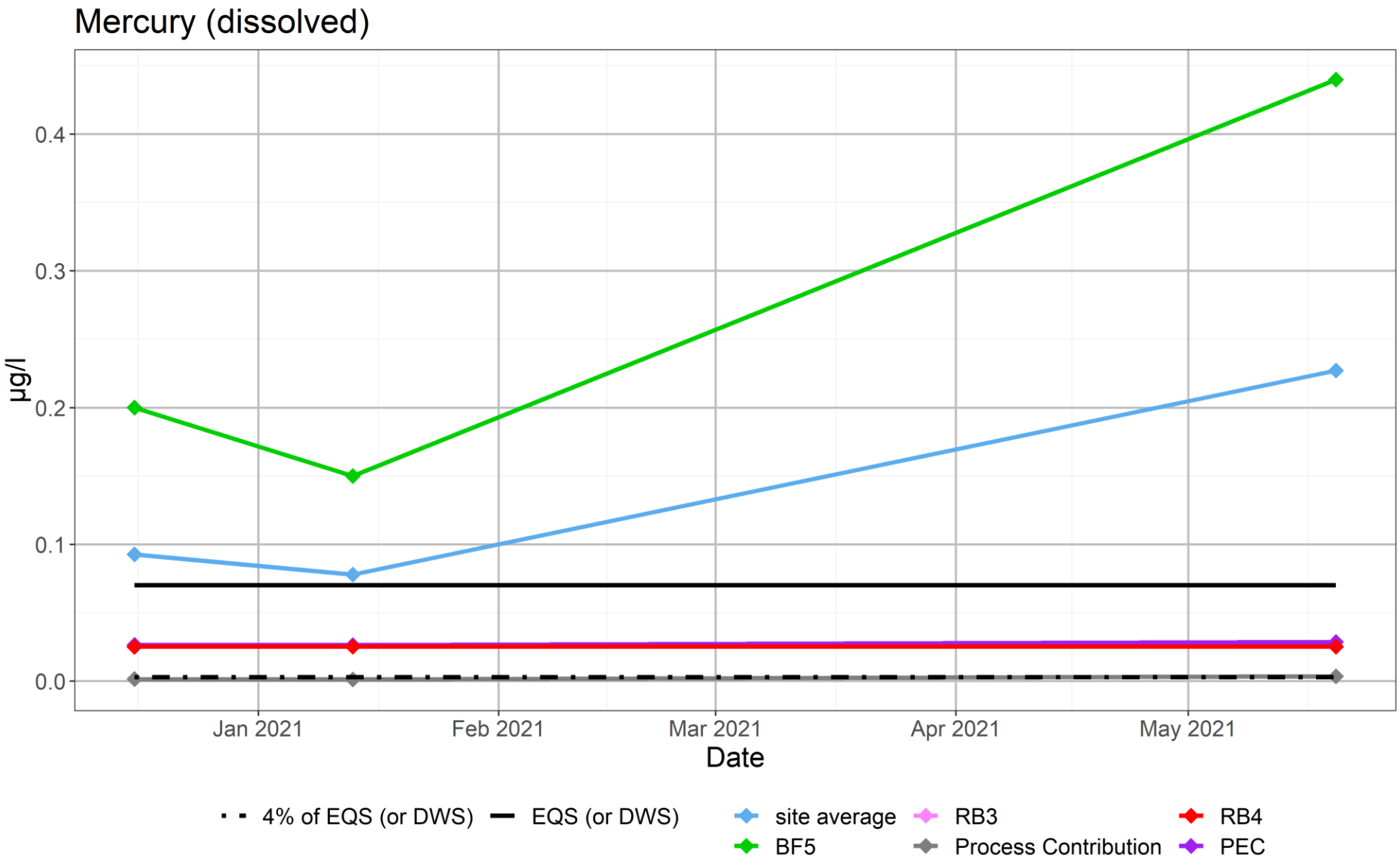


Figure 5-16 Mercury

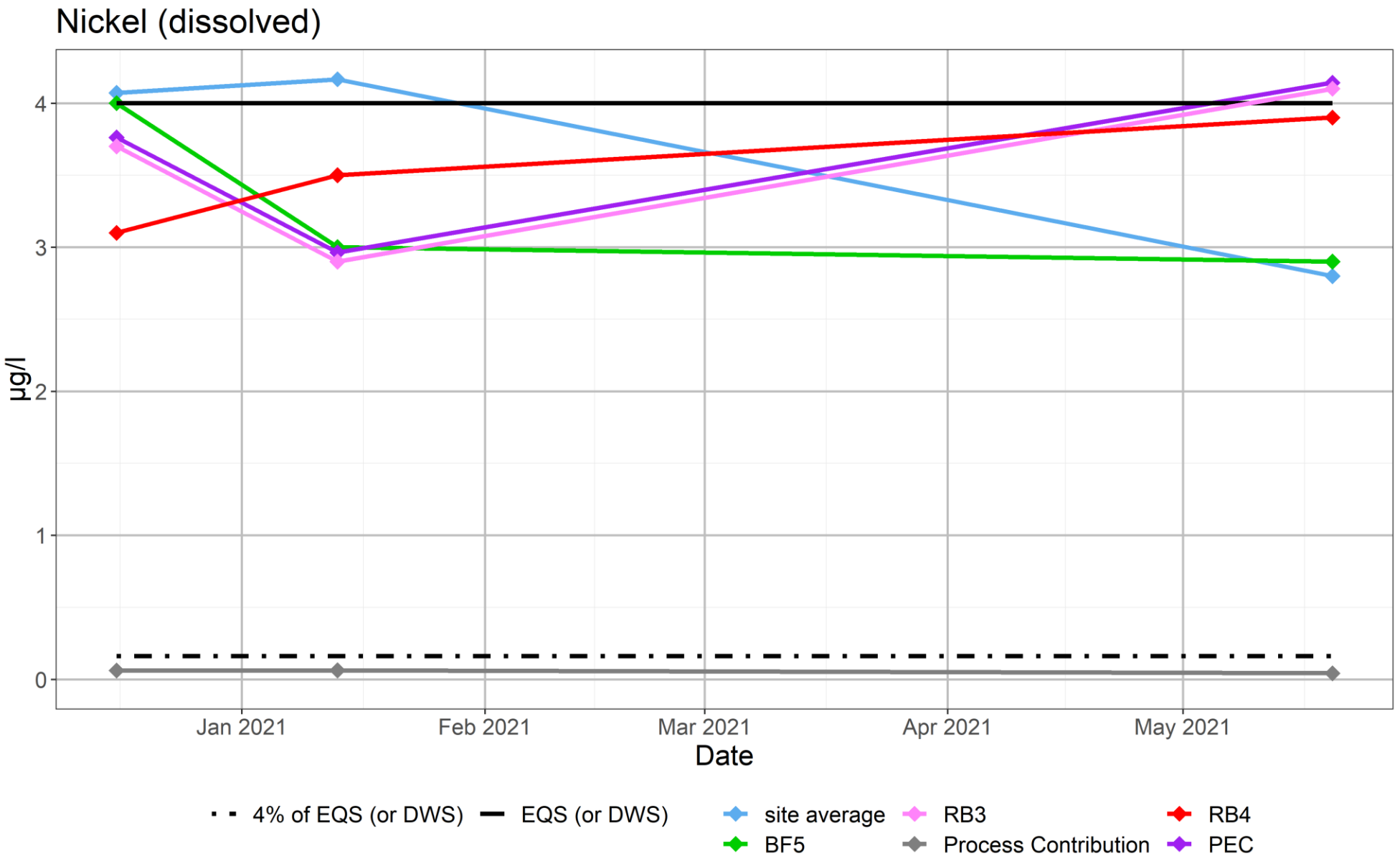


Figure 5-17 Nickel

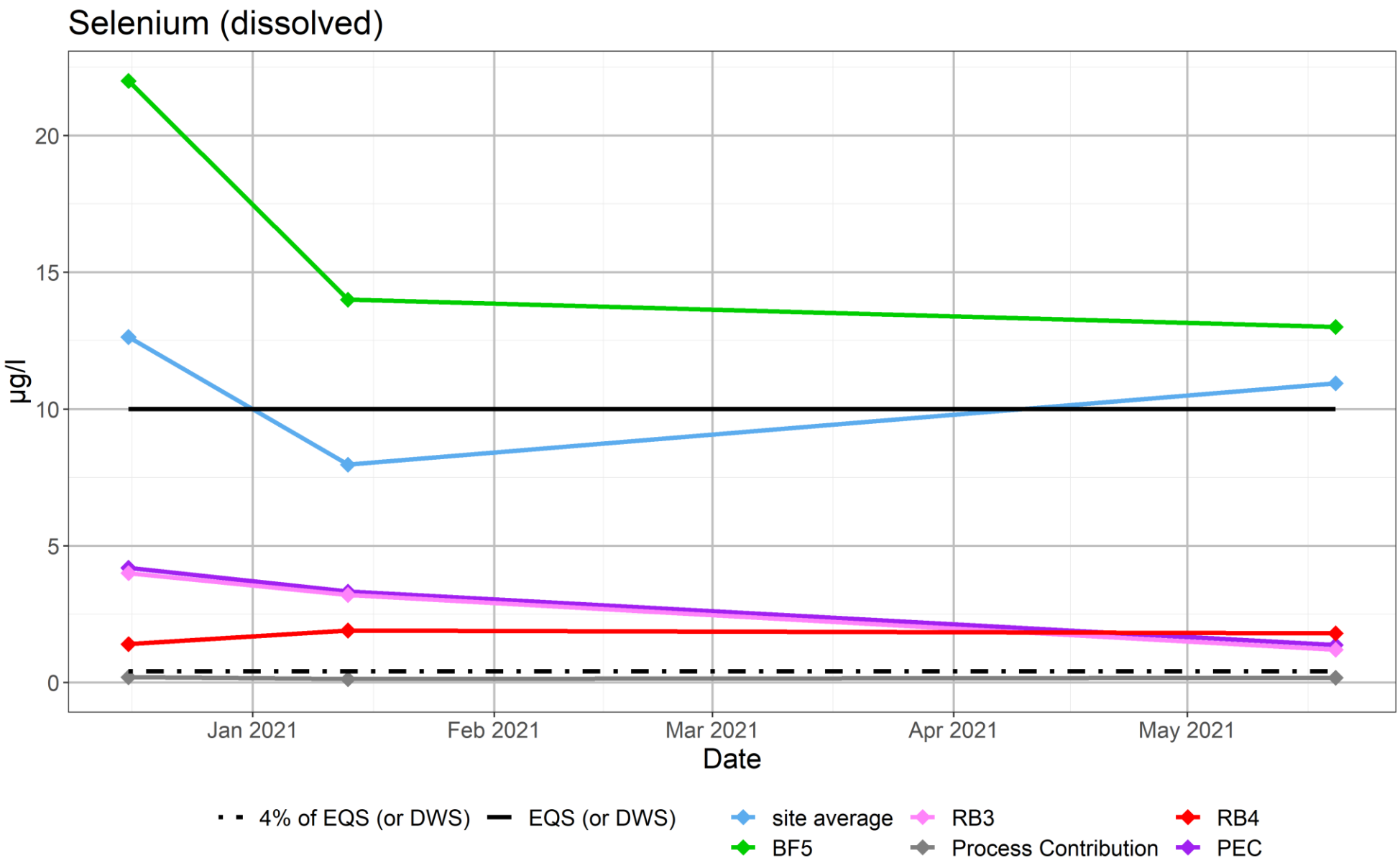


Figure 5-18 Selenium

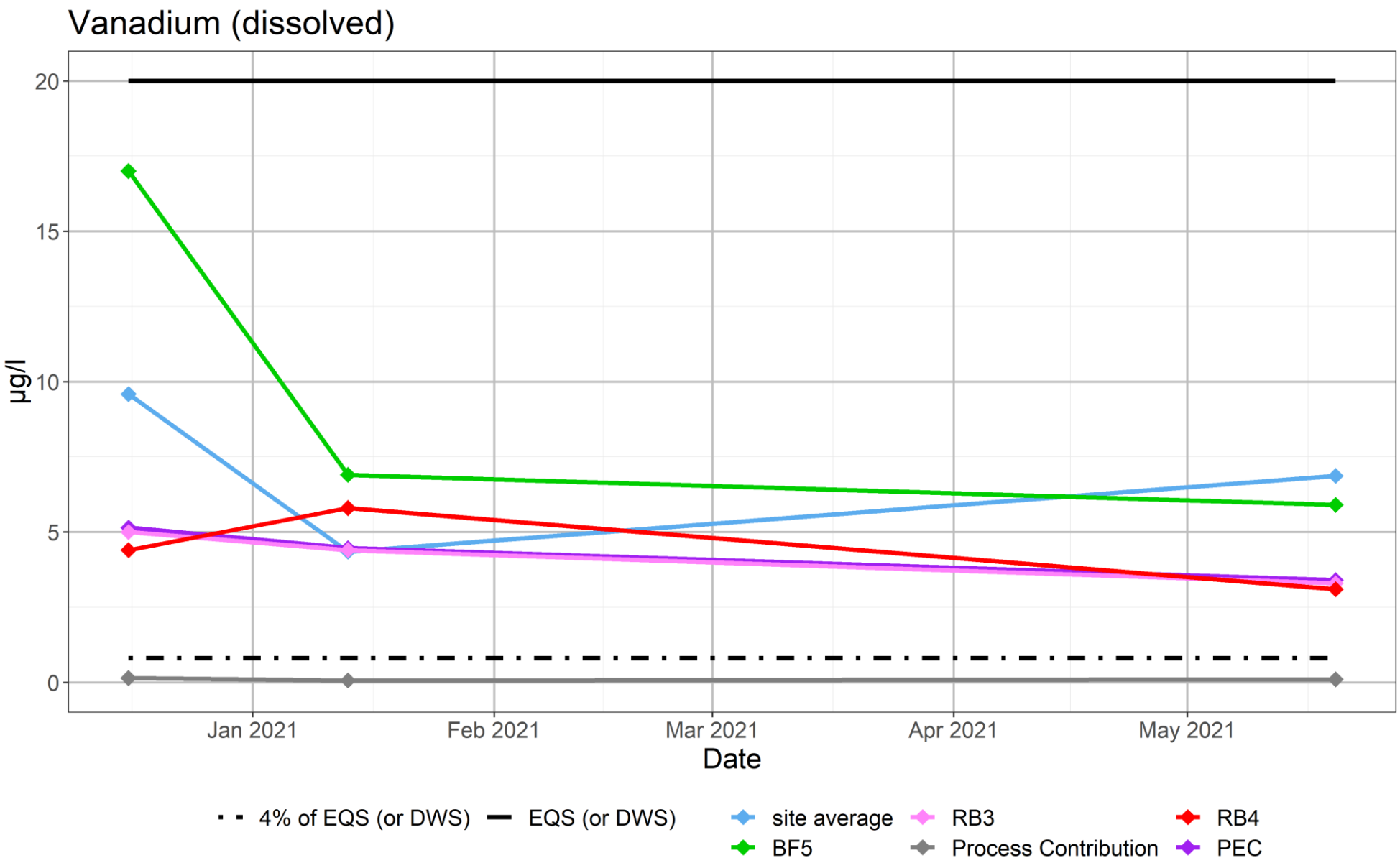


Figure 5-19 Vanadium

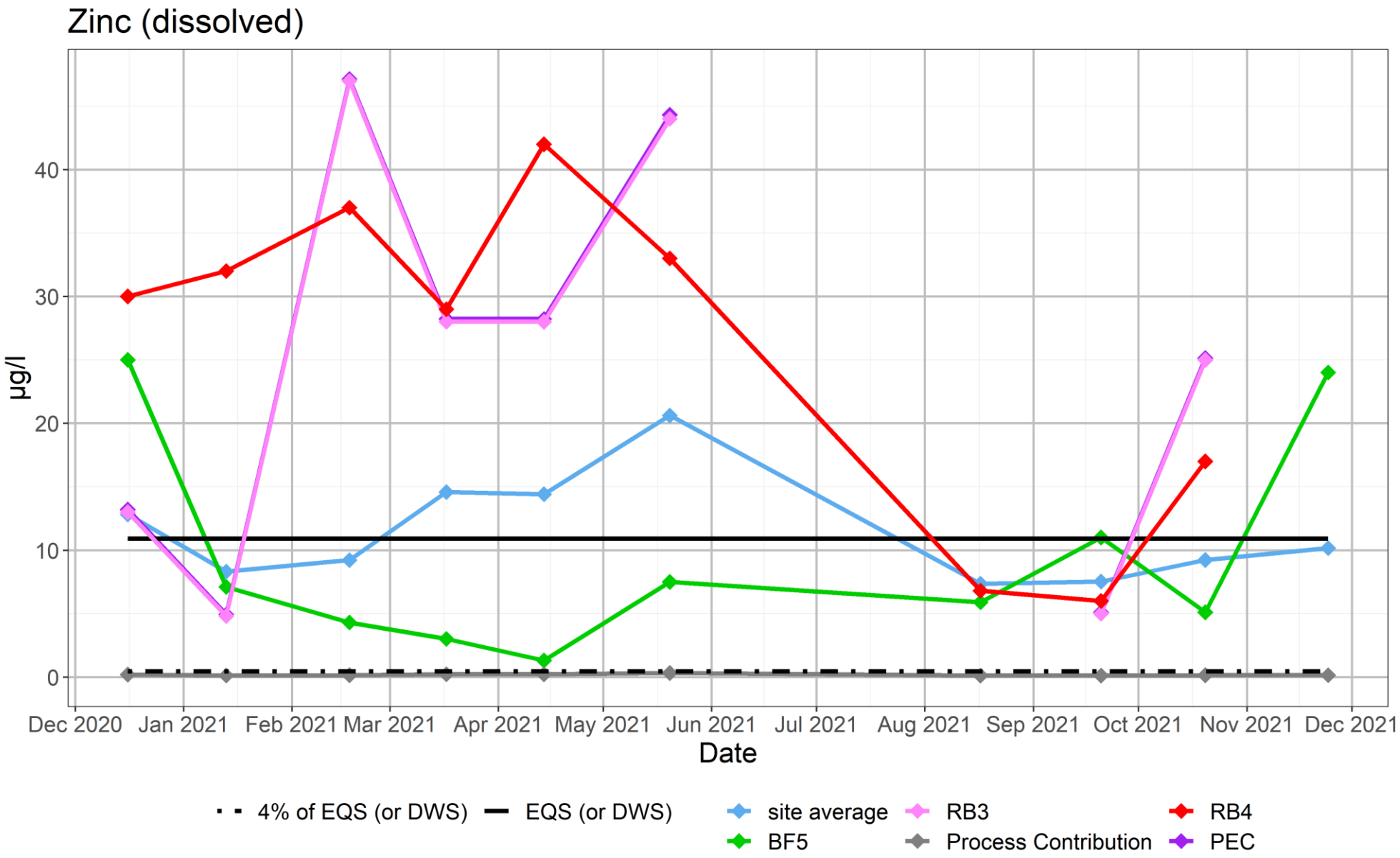


Figure 5-20 Zinc

6 LIMITATIONS AND RESTRICTIONS

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APPENDIX TN6A

Screening test tables

pH

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	9	7.747368	0.1173844	7.7	7.817384	NO	YES	-	-	NO
2	SR2	9	7.831579	0.1186603	8.0	8.118660	NO	YES	-	-	NO
3	SR3	9	7.635714	0.1156926	6.4	6.515693	NO	YES	-	-	NO
4	SR4	9	7.889474	0.1195375	6.6	6.719537	NO	YES	-	-	NO
5	SR5	9	7.862500	0.1191288	6.6	6.719129	NO	YES	-	-	NO
6	SR6	9	8.200000	0.1242424	6.4	6.524242	NO	YES	-	-	NO
7	SR7	9	7.766667	0.1176768	6.5	6.617677	NO	YES	-	-	NO
8	SR8	9	8.061538	0.1221445	6.8	6.922145	NO	YES	-	-	NO
9	SR9	9	7.736842	0.1172249	NA	NA	NO	YES	-	-	NO
10	SR10	9	7.805556	0.1182660	7.1	7.218266	NO	YES	-	-	NO
11	SR11	9	7.585714	0.1149351	6.9	7.014935	NO	YES	-	-	NO
12	SR12	9	7.793333	0.1180808	6.6	6.718081	NO	YES	-	-	NO

Electrical Conductivity

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	NA	3638.632	55.13078	1800	1855.1308	No Standard	-	-	-	NO
2	SR2	NA	2431.474	36.84051	830	866.8405	No Standard	-	-	-	NO
3	SR3	NA	2630.714	39.85931	520	559.8593	No Standard	-	-	-	NO
4	SR4	NA	2194.211	33.24561	540	573.2456	No Standard	-	-	-	NO
5	SR5	NA	3343.125	50.65341	640	690.6534	No Standard	-	-	-	NO
6	SR6	NA	2704.000	40.96970	760	800.9697	No Standard	-	-	-	NO
7	SR7	NA	3440.000	52.12121	550	602.1212	No Standard	-	-	-	NO
8	SR8	NA	3692.308	55.94406	830	885.9441	No Standard	-	-	-	NO
9	SR9	NA	4299.474	65.14354	NA	NA	No Standard	-	-	-	NO
10	SR10	NA	3611.667	54.72222	2100	2154.7222	No Standard	-	-	-	NO
11	SR11	NA	3542.857	53.67965	1400	1453.6797	No Standard	-	-	-	NO
12	SR12	NA	3429.333	51.95960	1200	1251.9596	No Standard	-	-	-	NO

Sulphate

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	400	196.17000	2.9722727	49.2	52.17227	NO	YES	-	-	NO
2	SR2	400	91.68984	1.3892400	25.7	27.08924	NO	YES	-	-	NO
3	SR3	400	111.21429	1.6850649	24.2	25.88506	NO	YES	-	-	NO
4	SR4	400	103.61737	1.5699601	20.3	21.86996	NO	YES	-	-	NO
5	SR5	400	120.65000	1.8280303	18.2	20.02803	NO	YES	-	-	NO
6	SR6	400	63.71300	0.9653485	21.8	22.76535	NO	YES	-	-	NO
7	SR7	400	147.18667	2.2301010	13.9	16.13010	NO	YES	-	-	NO
8	SR8	400	110.46154	1.6736597	10.5	12.17366	NO	YES	-	-	NO
9	SR9	400	147.52632	2.2352472	NA	NA	NO	YES	-	-	NO
10	SR10	400	148.49889	2.2499832	33.4	35.64998	NO	YES	-	-	NO
11	SR11	400	141.30714	2.1410173	31.9	34.04102	NO	YES	-	-	NO
12	SR12	400	143.28667	2.1710101	22.5	24.67101	NO	YES	-	-	NO

Chloride

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	250	1112.7842	16.860367	440	456.8604	NO	NO	YES	NO	YES
2	SR2	250	637.4895	9.658931	190	199.6589	NO	YES	-	-	NO
3	SR3	250	718.3571	10.884199	130	140.8842	NO	NO	YES	YES	NO
4	SR4	250	675.2105	10.230463	140	150.2305	NO	NO	YES	YES	NO
5	SR5	250	1076.5625	16.311553	190	206.3116	NO	NO	YES	YES	NO
6	SR6	250	605.3350	9.171742	190	199.1717	NO	YES	-	-	NO
7	SR7	250	998.0000	15.121212	140	155.1212	NO	NO	YES	YES	NO
8	SR8	250	1096.9231	16.620047	220	236.6200	NO	NO	YES	YES	NO
9	SR9	250	1197.3684	18.141946	NA	NA	NO	NO	?	?	?
10	SR10	250	993.6667	15.055556	570	585.0556	NO	NO	YES	NO	YES
11	SR11	250	1047.8571	15.876623	430	445.8766	NO	NO	YES	NO	YES
12	SR12	250	960.6667	14.555556	260	274.5556	NO	NO	YES	NO	YES

Ammonia

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	2.5	25.067368	0.3798086	0.20	0.5798086	NO	NO	NO	YES	YES
2	SR2	2.5	14.271053	0.2162281	0.15	0.3662281	NO	NO	YES	YES	NO
3	SR3	2.5	12.200714	0.1848593	2.30	2.4848593	NO	NO	YES	YES	NO
4	SR4	2.5	9.571579	0.1450239	0.16	0.3050239	NO	NO	YES	YES	NO
5	SR5	2.5	11.423875	0.1730890	0.09	0.2630890	NO	NO	YES	YES	NO
6	SR6	2.5	27.788000	0.4210303	1.60	2.0210303	NO	NO	NO	YES	YES
7	SR7	2.5	13.415333	0.2032626	3.50	3.7032626	NO	NO	YES	NO	YES
8	SR8	2.5	51.343077	0.7779254	4.90	5.6779254	NO	NO	NO	NO	YES
9	SR9	2.5	17.055789	0.2584211	NA	NA	NO	NO	?	?	?
10	SR10	2.5	20.928333	0.3170960	0.24	0.5570960	NO	NO	NO	YES	YES
11	SR11	2.5	12.765000	0.1934091	5.20	5.3934091	NO	NO	YES	NO	YES
12	SR12	2.5	15.320133	0.2321232	2.70	2.9321232	NO	NO	YES	NO	YES

Nitrate

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	50	18.06789	0.2737560	11.50	11.773756	NO	YES	-	-	NO
2	SR2	50	22.60421	0.3424880	4.75	5.092488	NO	YES	-	-	NO
3	SR6	50	18.18000	0.2754545	21.30	21.575455	NO	YES	-	-	NO

Nitrite

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	500	752.2105	11.39713	9.1	20.49713	NO	YES	-	-	NO
2	SR2	500	823.9474	12.48405	33.0	45.48405	NO	YES	-	-	NO
3	SR6	500	2575.7143	39.02597	150.0	189.02597	NO	NO	YES	YES	NO

Iron

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.2	0.09968421	0.0015103668	0.32	0.3215104	NO	YES	-	-	NO
2	SR2	0.2	0.10110526	0.0015318979	0.13	0.1315319	NO	YES	-	-	NO
3	SR6	0.2	0.05014286	0.0007597403	1.90	1.9007597	NO	YES	-	-	NO

Sodium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	200	664.3526	10.065949	220	230.06595	NO	NO	YES	NO	YES
2	SR2	200	362.3579	5.490271	100	105.49027	NO	YES	-	-	NO
3	SR3	200	375.7857	5.693723	71	76.69372	NO	YES	-	-	NO
4	SR4	200	368.6842	5.586124	79	84.58612	NO	YES	-	-	NO
5	SR5	200	564.1875	8.548295	96	104.54830	NO	NO	YES	YES	NO
6	SR6	200	385.0700	5.834394	98	103.83439	NO	YES	-	-	NO
7	SR7	200	576.6667	8.737374	72	80.73737	NO	NO	YES	YES	NO
8	SR8	200	751.5385	11.386946	120	131.38695	NO	NO	YES	YES	NO
9	SR9	200	797.3158	12.080542	NA	NA	NO	NO	?	?	?
10	SR10	200	569.8889	8.634680	310	318.63468	NO	NO	YES	NO	YES
11	SR11	200	660.0000	10.000000	240	250.00000	NO	NO	YES	NO	YES
12	SR12	200	605.3333	9.171717	230	239.17172	NO	NO	YES	NO	YES

Aluminium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR3	0.2	0.21592857	0.0032716450	0.4900	0.49327165	NO	YES	-	-	NO
2	SR4	0.2	0.03159053	0.0004786443	0.0633	0.06377864	NO	YES	-	-	NO
3	SR5	0.2	0.37220625	0.0056394886	0.6080	0.61363949	NO	YES	-	-	NO
4	SR6	0.2	1.49571500	0.0226623485	0.6290	0.65166235	NO	NO	NO	NO	YES
5	SR7	0.2	0.22018000	0.0033360606	0.4500	0.45333606	NO	YES	-	-	NO
6	SR8	0.2	0.44243077	0.0067034965	0.7600	0.76670350	NO	YES	-	-	NO
7	SR9	0.2	0.40480000	0.0061333333	NA	NA	NO	YES	-	-	NO
8	SR10	0.2	0.34793333	0.0052717172	0.0579	0.06317172	NO	YES	-	-	NO
9	SR11	0.2	0.38426429	0.0058221861	0.3770	0.38282219	NO	YES	-	-	NO
10	SR12	0.2	0.22926667	0.0034737374	0.4000	0.40347374	NO	YES	-	-	NO

Cadmium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.08	0.11578947	0.001754386	0.03	0.03175439	NO	YES	-	-	NO
2	SR2	0.08	0.08473684	0.001283892	0.02	0.02128389	NO	YES	-	-	NO
3	SR6	0.08	0.06428571	0.000974026	0.12	0.12097403	NO	YES	-	-	NO

Chromium

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	4.7	3.089474	0.04681021	1.8	1.846810	NO	YES	-	-	NO
2	SR2	4.7	3.036842	0.04601276	2.4	2.446013	NO	YES	-	-	NO
3	SR6	4.7	2.628571	0.03982684	2.0	2.039827	NO	YES	-	-	NO

Copper

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	1	51.21579	0.7759968	28.0	28.775997	NO	NO	NO	NO	YES
2	SR2	1	47.52632	0.7200957	31.0	31.720096	NO	NO	NO	NO	YES
3	SR3	1	40.50000	0.6136364	14.0	14.613636	NO	NO	NO	NO	YES
4	SR4	1	52.26316	0.7918660	11.0	11.791866	NO	NO	NO	NO	YES
5	SR5	1	67.68750	1.0255682	9.5	10.525568	NO	NO	NO	NO	YES
6	SR6	1	98.45000	1.4916667	16.0	17.491667	NO	NO	NO	NO	YES
7	SR7	1	41.40000	0.6272727	4.6	5.227273	NO	NO	NO	NO	YES
8	SR8	1	103.69231	1.5710956	5.0	6.571096	NO	NO	NO	NO	YES
9	SR9	1	39.25263	0.5947368	NA	NA	NO	NO	?	?	?
10	SR10	1	30.05556	0.4553872	6.7	7.155387	NO	NO	NO	NO	YES
11	SR11	1	91.35714	1.3841991	13.0	14.384199	NO	NO	NO	NO	YES
12	SR12	1	83.42857	1.2640693	NA	NA	NO	NO	?	?	?

Lead

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	1.2	0.3684211	0.005582137	0.5	0.5055821	NO	YES	-	-	NO
2	SR2	1.2	0.2947368	0.004465710	0.2	0.2044657	NO	YES	-	-	NO
3	SR3	1.2	0.7428571	0.011255411	7.6	7.6112554	NO	YES	-	-	NO
4	SR4	1.2	0.4473684	0.006778309	5.3	5.3067783	NO	YES	-	-	NO
5	SR5	1.2	0.6312500	0.009564394	5.5	5.5095644	NO	YES	-	-	NO
6	SR6	1.2	0.5900000	0.008939394	6.3	6.3089394	NO	YES	-	-	NO
7	SR9	1.2	0.7421053	0.011244019	NA	NA	NO	YES	-	-	NO
8	SR10	1.2	0.2055556	0.003114478	0.3	0.3031145	NO	YES	-	-	NO
9	SR11	1.2	1.2714286	0.019264069	1.8	1.8192641	NO	YES	-	-	NO
10	SR12	1.2	1.0466667	0.015858586	NA	NA	NO	YES	-	-	NO

Manganese

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	50	428.62105	6.4942584	4.6	11.09426	NO	NO	NO	YES	YES
2	SR2	50	560.27895	8.4890750	28.0	36.48907	NO	NO	NO	YES	YES
3	SR6	50	38.55714	0.5841991	130.0	130.58420	NO	YES	-	-	NO

Mercury

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	0.07	0.09263158	0.001403509	0.025	0.02640351	NO	YES	-	-	NO
2	SR2	0.07	0.07789474	0.001180223	0.025	0.02618022	NO	YES	-	-	NO
3	SR6	0.07	0.22714286	0.003441558	0.025	0.02844156	NO	NO	YES	YES	NO

Nickel

	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	4	4.071053	0.06168262	3.7	3.761683	NO	YES	-	-	NO
2	SR2	4	4.165789	0.06311802	2.9	2.963118	NO	YES	-	-	NO
3	SR6	4	2.800000	0.04242424	4.1	4.142424	NO	YES	-	-	NO

Selenium

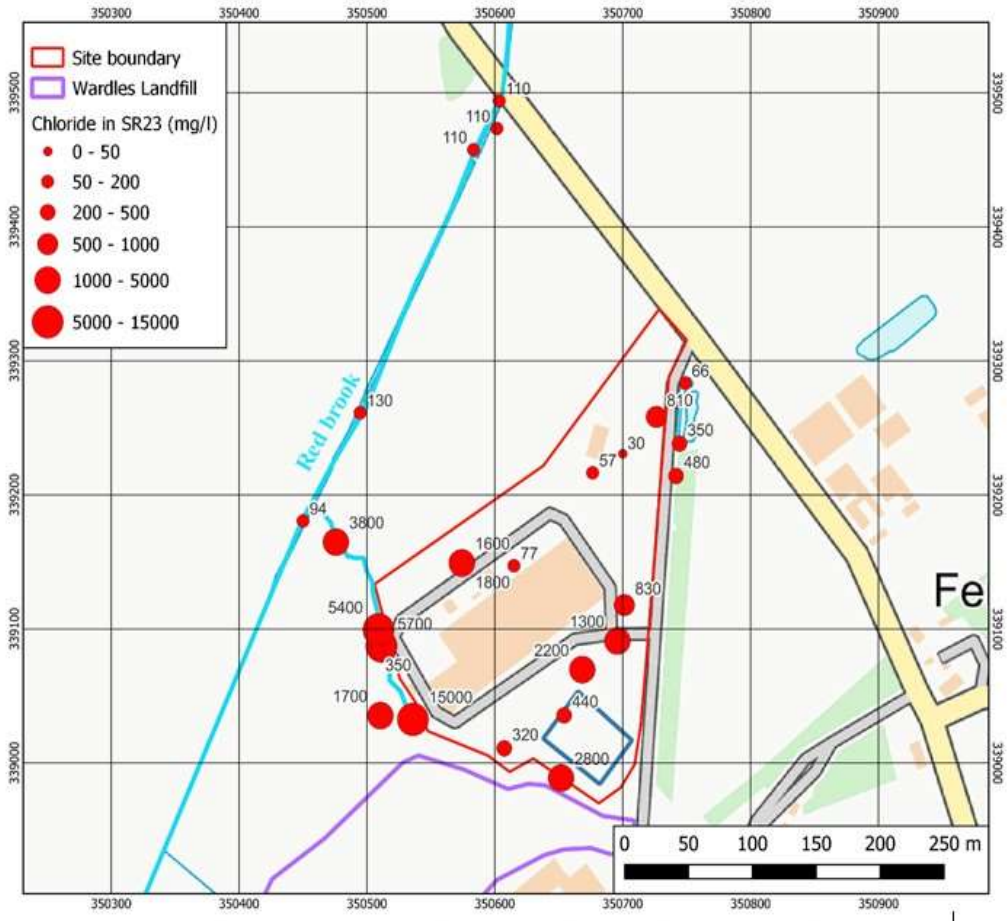
	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	10	12.631579	0.1913876	4.0	4.191388	NO	YES	-	-	NO
2	SR2	10	7.963158	0.1206539	3.2	3.320654	NO	YES	-	-	NO
3	SR6	10	10.942857	0.1658009	1.2	1.365801	NO	YES	-	-	NO

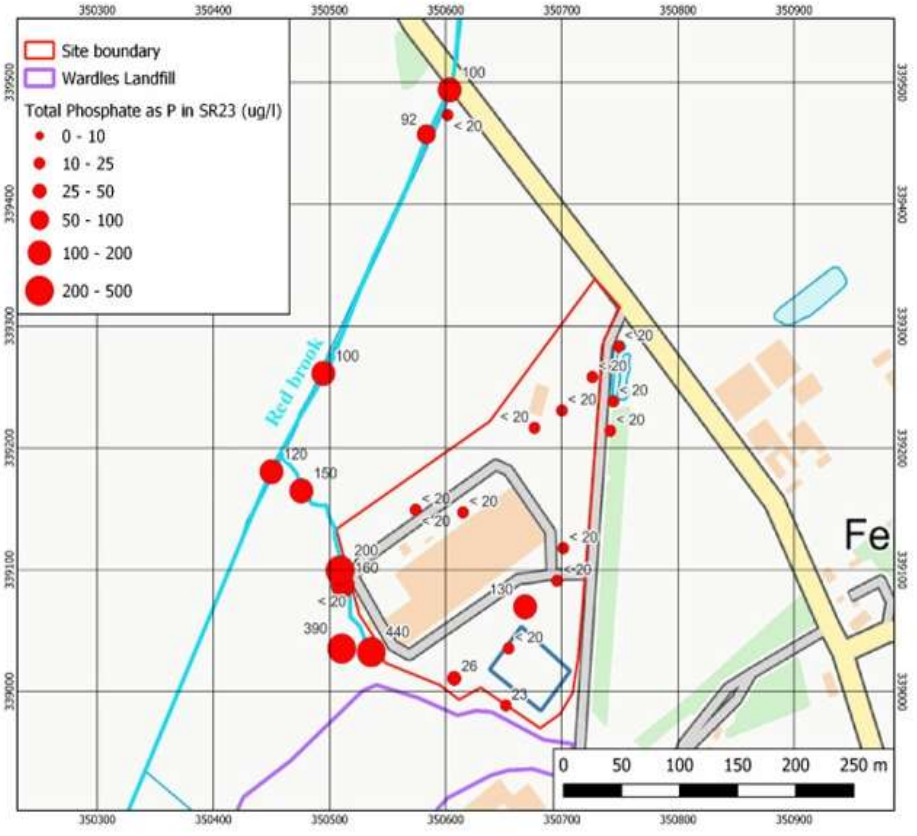
Zinc

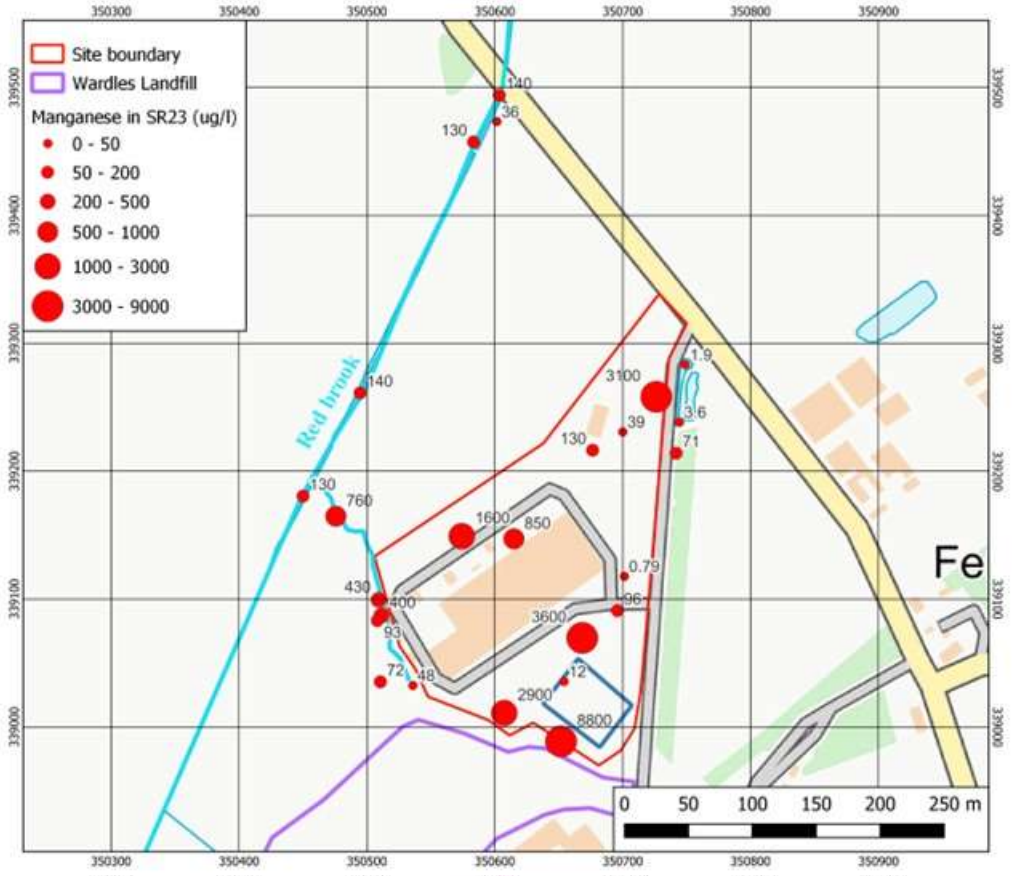
	Sampling Round	EQS/DWS	Site Average	PC	BC (RB3)	PEC	Pass Test 1	Pass Test 2	Pass Test 3	Pass Test 4	Needs modelling
1	SR1	10.9	12.821053	0.1942584	13.0	13.194258	NO	YES	-	-	NO
2	SR2	10.9	8.300000	0.1257576	4.8	4.925758	NO	YES	-	-	NO
3	SR3	10.9	9.214286	0.1396104	47.0	47.139610	NO	YES	-	-	NO
4	SR4	10.9	14.578947	0.2208931	28.0	28.220893	NO	YES	-	-	NO
5	SR5	10.9	14.418750	0.2184659	28.0	28.218466	NO	YES	-	-	NO
6	SR6	10.9	20.615000	0.3123485	44.0	44.312348	NO	YES	-	-	NO
7	SR9	10.9	7.352632	0.1114035	NA	NA	NO	YES	-	-	NO
8	SR10	10.9	7.572222	0.1147306	5.0	5.114731	NO	YES	-	-	NO
9	SR11	10.9	9.221429	0.1397186	25.0	25.139719	NO	YES	-	-	NO
10	SR12	10.9	10.153333	0.1538384	NA	NA	NO	YES	-	-	NO

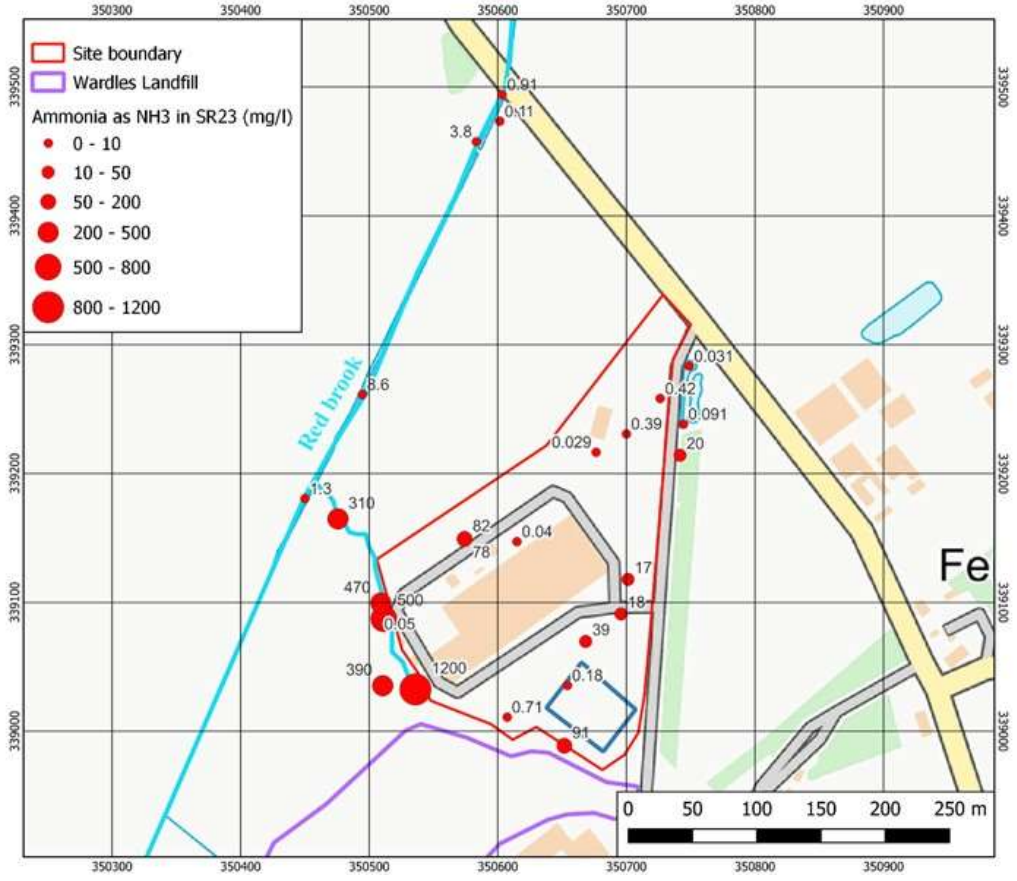
APPENDIX K

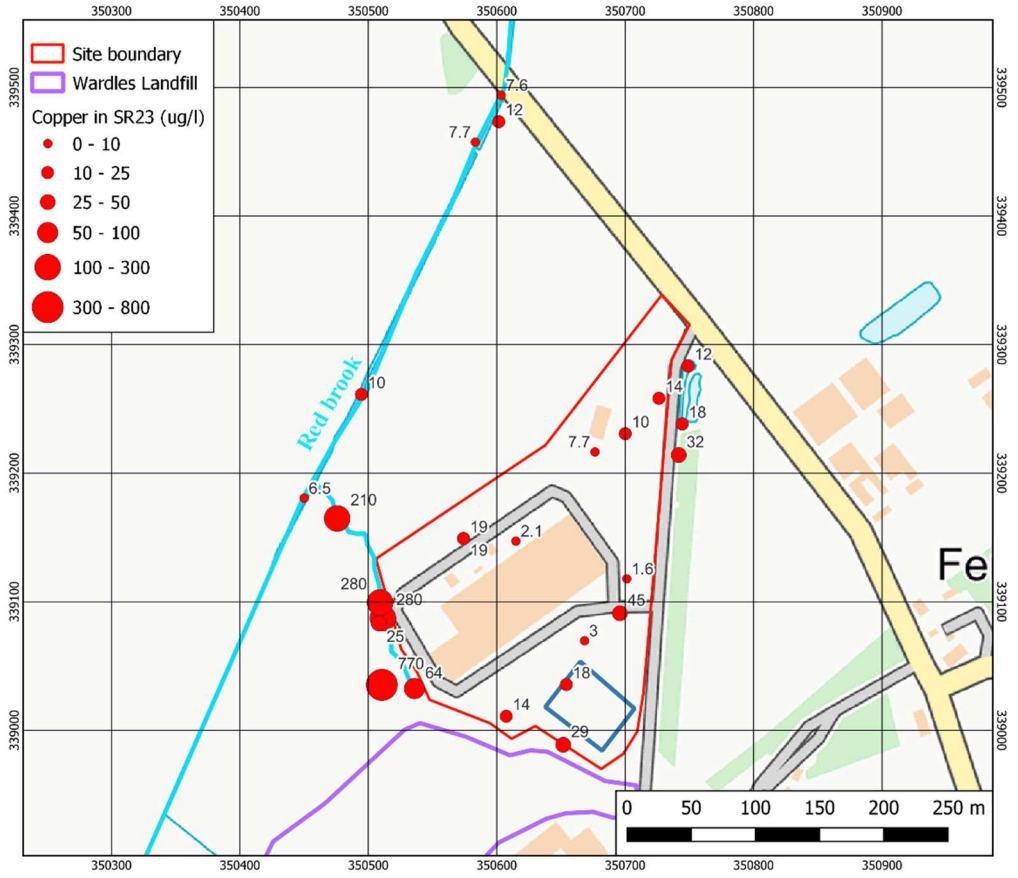
Spatial plots of water contamination

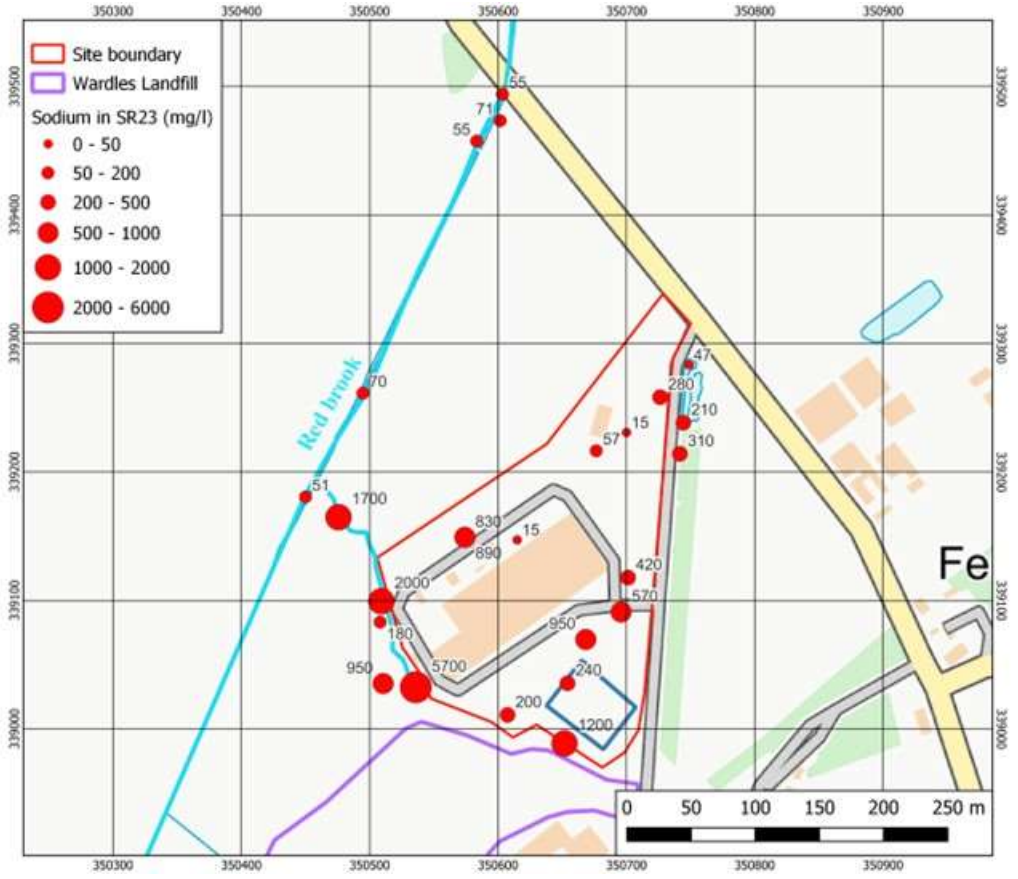

Site boundary
Wardles Landfill
Chloride in SR23 (mg/l)
0 - 50
50 - 200
200 - 500
500 - 1000
1000 - 5000
5000 - 15000
Red brook
Fe
0 50 100 150 200 250 m


Site boundary
Wardles Landfill
Total Phosphate as P in SR23 (ug/l)
0 - 10
10 - 25
25 - 50
50 - 100
100 - 200
200 - 500
Red brook
Fe
0 50 100 150 200 250 m


Site boundary
Wardles Landfill
Manganese in SR23 (ug/l)
0 - 50
50 - 200
200 - 500
500 - 1000
1000 - 3000
3000 - 9000
Red brook
Fe
0 50 100 150 200 250 m


Site boundary
Wardles Landfill
Ammonia as NH3 in SR23 (mg/l)
0 - 10
10 - 50
50 - 200
200 - 500
500 - 800
800 - 1200
Red brook
Fe
0 50 100 150 200 250 m


Site boundary
Wardles Landfill
Copper in SR23 (ug/l)
0 - 10
10 - 25
25 - 50
50 - 100
100 - 300
300 - 800
Red brook
Fe
0 50 100 150 200 250 m
350300 350400 350500 350600 350700 350800 350900
339500 339400 339300 339200 339100 339000


Site boundary
Wardles Landfill
Sodium in SR23 (mg/l)
0 - 50
50 - 200
200 - 500
500 - 1000
1000 - 2000
2000 - 6000
Red brook
Fe
0 50 100 150 200 250 m
350300 350400 350500 350600 350700 350800 350900
339500 339400 339300 339200 339100 339000

APPENDIX L

NRW Correspondence

Cyfoeth Naturiol Cymru
Natural Resources Wales

Befesa Salt Slags Ltd
Fenns Bank
Whitchurch
Shropshire
SY23 3PA

Ein/Our ref: EPR/VP3030BX

Dyddiad/Date: 1 July 2022

Dear Stuart

Site Meeting 14 June 2022

I would like to confirm the points discussed at our recent site meeting:

- Prior to the permit surrender all pollution sources on site must be removed.
- Befesa are currently progressing the removal of the waste within the buildings so that demolition can commence on these buildings.
- Removal of infrastructure and demolition has started in some parts of site.
- Two shipments of waste had been transported to Spain since you met with ourselves in March 2022.
- UK disposal routes are currently being trialed. Please provide an update on the outcome of these trials and whether this route will be utilized for the remaining waste, as well as an estimation for when all of the waste will be removed from site.
- Another potential pollution source that needs to be cleared from site is the contents of the surface water lagoon.
- NRW advised that they consider there are two options available to Befesa in relation to this.
  1) to tanker off the liquid content (to a suitably permitted site). This option could commence as soon as a suitably permitted site has been located to accept the waste water.
  2) apply for a permit variation to allow the discharge of the liquid to the controlled water. Discharge would not be able to commence until the variation had been determined and the impact fully considered. There is no guarantee that permission would be granted for this and pre-treatment of the effluent may be required.
- Once the effluent has been removed the lagoon would need to be de-sludged (and the material sent to a suitably permitted site) and liner removed before it is backfilled with suitable material.
- You were also advised to consider the Health and Safety implication prior to the removal of the liner

Ffôn/Tel 0300 065 3859
Ebost/Email Julia.Frost@naturalresourceswales.gov.uk
www.cyfoethnaturiolcymru.gov.uk www.naturalresourceswales.gov.uk

Chester Road, Buckley, Flintshire, CH7 3AJ.

- The type of information we would expect to see included in your permit surrender is detailed on our website https://cdn.cyfoethnaturiol.cymru/media/1213/site-condition-report-template.pdf
- Further information on how to apply to surrender your permit can be found at https://naturalresources.wales/permits-and-permissions/installations/apply-to-surrender-an-installations-permit/?lang=en

Please can you provide an update on progress on site since our meeting and confirm your intentions on which option you intend to follow with regards the emptying of the lagoon.

If you need any further information please give me a call on 03000 65 3859.

Yours faithfully

Julia Frost
Industry Regulation Team Leader - North East Wales

Ffôn/Tel 0300 065 3859
Ebost/Email Julia.Frost@naturalresourceswales.gov.uk
www.cyfoethnaturiolcymru.gov.uk www.naturalresourceswales.gov.uk

Chester Road, Buckley, Flintshire, CH7 3AJ.

From: Williams, Berwyn <berwyn.williams@cyfoethnaturiolcymru.gov.uk>
Sent: Friday, August 5, 2022 10:11 AM
To: Stuart Irvine <stuart.irvine@befesa.com>
Cc: Frost, Julia <Julia.Frost@cyfoethnaturiolcymru.gov.uk>; Chapman, Jane <Jane.Chapman@cyfoethnaturiolcymru.gov.uk>; North Wales PPC <north.wales.ppc@cyfoethnaturiolcymru.gov.uk>
Subject: RE: Response to Water Management issues

Good morning Stuart

To follow up as discussed previously at the meeting, you stated that once the lagoon had been fully decommissioned (by either of the mechanisms described in our letter) and all other pollution sources had been removed from site, that the drainage system could be opened to allow direct discharge of surface water. I can confirm that this is our position; however we also expect the other points covered by our letter to be addressed.

We are now aware that the TFS notification has expired, and believe you are now in discussion with Port Clarence, Augean for this to be the route to dispose of all remaining waste material on site, which will progress the site's clearance.

Following your trial loads to Augean, we expect to receive the Waste Transfer notes and Waste Characterisation as record of the trial results. You stated in our last meeting that the sample loads were Non-hazardous in characterisation, is this correct?

If you could confirm that this route is now the final disposal route, also confirm, which EWC codes the materials fall under and if these are accepted at Augean, plus the timeframe for clearance from Befesa's site at Whitchurch.

Look forward to your response.

Kind Regards,
Berwyn

Berwyn Williams (Fo/Fe - He/Him) **(ACPIP) - Level 7 Advanced Certificate in Professional Investigative Practices**

Arweinydd Tîm Rheoleiddio Gwastraff a Diwydiant (GG) / Industry & Waste Regulation Team Leader (NW)
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn Symudol /Mobile: 07815995293
Maes y Ffynnon, Bangor, Gwynedd LL57 2DW

Siaradwr Cymraeg Right-click or tap and hold here to

A Ffoniwch ni ar **03000 65 3000** (24-awr) i roi gwybod am ddigwyddiadau amgylcheddol
Call us on **03000 65 3000** (24-hour) to report environmental incidents

Neu cliciwch yma Cyfoeth Naturiol Cymru / Rhoi gwybod am ddigwyddiad amgylcheddol (naturalresources.wales)

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