The London Resort Development Consent Order

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Environmental Statement
Volume 2: Appendices

Appendix 18.10 – Bamber Quarry Landfill Report

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Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
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The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
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LRCH

BAMBER QUARRY LANDFILL ANNUAL REPORT 2019

MARCH 2020

CONFIDENTIAL

LRCH

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BAMBER QUARRY LANDFILL ANNUAL REPORT 2019

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1 INTRODUCTION

1.1 OVERVIEW

1.1.1 This report presents a summary of the landfill gas and groundwater monitoring undertaken by WSP UK Ltd on behalf of London Resort Company Holdings Limited (LRCH) at the Bamber Quarry Landfill Site in Swanscombe, Kent ("the site") during 2019 and early 2020.

1.1.2 All monitoring was undertaken in accordance with the Environmental Permit for the site (reference EPR/KP3598HT, dated 12 December 2011) and included the following:

- Fortnightly monitoring of landfill gas;
- Periodic (annual) monitoring of trace gases;
- Periodic (annual) monitoring of surface emissions; and
- Periodic (6 monthly) monitoring of surface water and groundwater.

1.2 BACKGROUND

1.2.1 Bamber Quarry Landfill is centred on National Grid Reference 560810, 174670 within a former Chalk quarry. The western margin of the landfill backs on to residential properties on Swanscombe High Street. The Dartford to Gravesend railway line and the High Speed 1 line form the northern and eastern margins respectively. The land to the south was originally also part of the quarry but was never landfilled and remains open ground, restored to low level.

1.2.2 The landfill was designed as a disperse and attenuate facility and was operational from the mid 1970's to 1986. The waste deposits are covered with a soil layer, which supports mature vegetation.

1.2.3 The landfill is situated in an area of the Chalk (Principal Aquifer) that is harnessed for public water supply (PWS) and the site lies within the Source Protection Zone III (total catchment) of groundwater sources operated by Thames Water plc. Leachate generated within the site disperses readily within the Chalk aquifer.

1.2.4 The potential migration of landfill gas across the western boundary of the site is controlled by means of a gas management system. This system was replaced in early 2012 with the installation of five new gas extraction wells, pipework and condensate soakaway.

1.2.5 A site location plan, showing the gas extraction and monitoring infrastructure, is shown in Figure 1.

1.3 STRUCTURE OF THE REPORT

1.3.1 Sections 2 and 3 of the report provide a summary of the water and gas monitoring, respectively, undertaken during 2019 and set this in the context of previous years' monitoring. The principal findings are summarised in Section 4.

2 WATER MONITORING

2.1 MONITORING DATES

2.1.1 The two scheduled 2019 water monitoring rounds were undertaken on the following dates:

- 10th July 2019; and,
- 4th March 2020.

2.1.2 The Q4 2019 water monitoring was deferred until March 2020, in agreement with the EA, whilst vegetation clearance was completed to allow safe access to groundwater and surface water monitoring locations.

2.2 MONITORING LOCATIONS AND METHODS

2.2.1 Groundwater samples were collected in accordance with the Environmental Monitoring and Management Plan (EMMP) using a petrol-operated inertial pump at the five groundwater monitoring wells (PBGW1 - PBGW5 inclusive) shown on Figure 1. All of these installations are finished within the saturated zone of the Chalk aquifer. Monitoring wells PBGW1 - PBGW3 were constructed outside the area covered by the Environmental Permit (EP), on land to the north of the Dartford-Gravesend railway line.

2.2.2 At each monitoring well location, the depth to water was measured using an electronic dip meter. A minimum of three borehole volumes of water was subsequently purged before sampling.

2.2.3 Surface water monitoring was undertaken from the pond situated to the southeast of the EP boundary. During the July 2019 round, samples were taken from PBSW1 and PBSW2 locations (depicted in Figure 1). However, during the March 2020 round these locations were not safely accessible and a single surface water sample was taken as a replacement from a safely accessible location (PBSW3) located between PBSW1 and PBSW2.

2.2.4 All samples were dispatched to the analytical laboratory, ALS (formerly ALcontrol) of Chester, in cool boxes on the day after sampling, under full chain of custody procedures.

2.3 LABORATORY ANALYSIS

2.3.1 All water samples from both sampling rounds were analysed in accordance with the requirements of the Environmental Permit for the following parameters:

- pH;
- Electrical conductivity;
- Chloride;
- Ammoniacal nitrogen;
- Nitrate;
- Nitrite;
- Sulphate;
- Chemical Oxygen Demand (COD); and
- Biochemical Oxygen Demand (BOD).

2.3.2 The 'annual' sampling conducted in 4 March 2020 analysed for the following additional parameters:

- Potassium;

- Transition metals: cadmium, chromium, copper, iron, lead, nickel, zinc;
- Cyanide (total, free and ionised);
- Polyaromatic Hydrocarbons (PAHs);
- Total petroleum hydrocarbons (TPH CWG);
- Volatile organic compounds (VOCs); and
- Semi-volatile organic compounds (SVOCs).

2.3.3 All groundwater samples were filtered through a 0.45µm filter prior to analysis, however the surface waters were unfiltered.

2.4 GROUNDWATER ELEVATIONS

2.4.1 The depths to standing water levels measured from ground level in July 2019 and March 2020 are summarised in Table 1, together with the measurements as reduced levels relative to Ordnance Datum (m AOD). The historic maxima and minima at each location are also shown. The elevations recorded in 4th March 2020 are shown on Figure 1, whilst the hydrographs showing recorded groundwater elevations since 2005 are presented in Figure 2.

Table 1 - Summary of Groundwater Levels, 2019/20

Location	Ground Level Elevation (m AOD)	10/7/2019		04/03/2020		Historic max	Historic min
		Depth (m bgl)	m AOD	Depth (m bgl)	m AOD	m AOD	m AOD
Groundwater Monitoring Boreholes							
PBGW1	9.16	8.41	0.75	7.25	1.91	2.25	-0.07
PBGW2	8.42	7.68	0.74	6.66	1.76	2.078	-0.102
PBGW3	9.04	8.12	0.92	7.75	1.29	2.536	0.153
PBGW4	5.66	4.9	0.76	4.30	1.36	2.484	-3.326
PBGW5	7.18	6.57	0.61	6.00	1.18	2.349	-1.211
Gas/Groundwater Boreholes							
PBG/L1	Inaccessible due to headworks for gas extraction						
PBG/L2	20.63	All Dry		All Dry			
PBG/L3	21.37						
PBG/L4	12.63						
PBG/L5	20.46						
PBG/L6	11.73						
PBG7	27.16						
PBG8	28.09						
PBG9	28.20						
PBG10	27.65						

2.4.2 The monitoring data indicate groundwater elevations within the Chalk outside the site were between 0.61 and 1.91m AOD. Groundwater elevations in March 2020 were higher than those recorded in July 2019 consistent with the high precipitation levels in Winter 2019. The groundwater elevations recorded in 2019/2020 are within the ranges detected at each location in previous monitoring events (Figure 2).

2.4.3 Measurements taken within the gas and leachate wells confirmed the absence of leachate levels consistent with previous observations.

2.5 ANALYTICAL RESULTS

2.5.1 The laboratory results for the groundwater and surface water monitoring in 2019/2020 are presented in the laboratory certificates in Appendix A. As the Chalk is utilised for the Public Water Supply, results are compared against the requirements of the Water Quality (Water Supply) Regulations 2000 (as amended), hereafter referred to as the UK Drinking Water Standards (DWS).

2.6 GROUNDWATER CHEMISTRY

2.6.1 The following summarises the analytical results of the groundwater sampling undertaken July 2019 and March 2020. Comment on any obvious trends apparent within the data is made by reference to the time-series charts presented as Figures 3 - 7.

PH

2.6.2 The recorded pH of the groundwater was between pH 7.38 – pH 11.10 with the highest pH recorded in PBGW1 in both July 2019 and March 2020 rounds. pH values at all boreholes were consistent with the historic readings at each location.

CONDUCTIVITY

2.6.3 The recorded conductivity in the monitoring wells was between 0.918 mS/cm at PBGW5 in March 2020 and 5.48 mS/cm in PBGW2 in July 2019. These data were consistent with previous monitoring rounds. Recorded conductivity was within historic ranges in all boreholes.

CHLORIDE

2.6.4 The time series data representing chloride concentrations recorded at the site since 2005 are shown in Figure 3. Chloride concentrations in all monitoring wells were within previously detected ranges during 2019/2020.

2.6.5 Recorded chloride concentrations were between 59.8 mg/l in PBGW5 (March 2020) and 1,320 mg/l in PBGW2 (July 2019) to the north of the site. Chloride concentrations in boreholes PBGW1 – PBGW3 remained consistently above the UK DWS of 250mg/l.

2.6.6 Recorded concentrations in PBGW4 and PBGW5, to the south of the site, were below the DWS throughout in July 2019 and March 2020.

AMMONIACAL NITROGEN

2.6.7 The time series data of ammoniacal nitrogen concentrations recorded at the site since 2005 are shown in Figure 4.

2.6.8 Recorded concentrations of ammoniacal nitrogen were between <0.2 mgN/l, in PBGW5 and 8.46 mgN/l in PBGW3, both recorded in July 2019. As in previous years, the highest concentrations were found in boreholes PBGW1 - PBGW3 inclusive, to the north of the landfill. Concentrations at these locations were within historically detected ranges, and in excess of the DWS.

2.6.9 Concentrations in wells PBGW4 and PBGW5, to the south of the site, were consistently lower than those from wells to the north, consistent with the previous years. Concentrations were below DWS at PBGW4 and PBGW5 in both the July 2019 and March 2020 monitoring rounds.

NITRITE

2.6.10 The time series data of nitrite concentrations recorded at the site since 2005 are shown in Figure 5.

2.6.11 Recorded nitrite concentrations were below the limit of detection (0.05 mg NO2/l) in all boreholes with the exception of PBGW1 (15.7 mgN/l (July 2020) and 7.71 mgN/l (March 2020)) and PBGW4 (0.491 mgN/l (July 2019) and 0.319 mgN/l (March 2020)).

2.6.12 Overall concentrations of nitrite in PBGW1 continue to show an apparent rising trend, despite the reduction recorded in 2016. Following an anomalously high concentration in PBGW2 in June 2016, concentrations of nitrite have returned to levels consistent with 2017 and 2018.

NITRATE

2.6.13 The time series data of nitrate concentrations recorded at the site since 2005 are shown in Figure 6.

2.6.14 Recorded concentrations of nitrate (as NO_3) were between 0.091 mg/l (PBGW2 March 2020) and 53.7 mg/l (PBGW5, July 2019). The DWS of 50 mg/l was exceeded at PBGW5 in July 2019. There was a notable drop in nitrate concentrations at PBGW4 and PBGW5 in March 2020, compared to the previous round. Reductions in concentration of a similar magnitude have been recorded previously (June 2010).

SULPHATE

2.6.15 The time series sulphate concentration data recorded at the site since 2005 are shown in Figure 7.

2.6.16 The highest sulphate concentration (322 mg/l) was recorded in PBGW1 in March 2020. Concentrations detected at PBGW1, PBGW2, PBGW3 and PBGW4 in March 2020 exceeded the DWS (250 mgSO_4/l).

METALS

2.6.17 Transition metals were analysed as part of the annual monitoring suite conducted in March 2020 and the concentrations are presented in Appendix A.

2.6.18 In general, the recorded concentrations of metals were low and below the relevant standards, consistent with the buffering effect that would be expected within the Chalk aquifer.

2.6.19 The exceptions to this conclusion were concentrations of dissolved arsenic, nickel, sodium and iron recorded within the samples obtained from PBGW1, PBGW2 and PBGW3 to the north of the landfill, consistent with data collected in previous years. Detected concentrations of arsenic were between 0.537 µg/l – 748 µg/l, highest in PBGW3, whilst nickel concentrations were between 3.7 µg/l – 27.6 µg/l, highest in PBGW1.

HAZARDOUS SUBSTANCES INCLUDING HYDROCARBONS

2.6.20 Concentrations of cyanide species were below laboratory detection limits at all locations in March 2020.

2.6.21 Concentrations of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were all below laboratory detection limits.

2.6.22 Concentrations of PAH (USEPA 16) species were below laboratory detection limits in samples taken from PBGW3, PBGW4 and PBGW5. However, all but two PAH compounds were detected above LOD at PBGW2 and trace concentrations of four PAH compounds were detected at PBGW1.

Benzo(a)pyrene (0.08 µg/l) and PAH sum of 4 (0.25 µg/l) concentrations detected at PBGW2 exceeded the DWS.

2.6.23 PAH detections were confined to those monitoring wells to the north of the landfill, consistent with monitoring data collected in previous years.

2.7 SURFACE WATER CHEMISTRY

2.7.1 Analytical data from surface water monitoring locations PBSW1, PBSW2 and PBSW3 are presented in Appendix A.

2.7.2 Concentrations of PAHs, VOCs and SVOCs were below laboratory detection limits in the sample taken in March 2020.

2.7.3 Trace concentrations of metals were detected in surface water samples during both sampling rounds consistent with data collected in previous years. None of those concentrations exceeded their respective DWS.

3 GAS MONITORING

3.1 OVERVIEW

3.1.1 During 2019, the gas extraction system operated continuously, with the exception of electric failure and system blower failure in March 2019 and pump bearing / belt failure in July and August 2019.

3.1.2 Details of all periods of plant outage and reduced suction were communicated by Section 5 reports, in accordance with the Environmental Permit (EP) for the site and are also summarised in the relevant quarterly gas monitoring report. Following correction of the blower failure in March, gas concentrations returned below permitted levels by early April 2019.

3.1.3 Monitoring of landfill gas was carried out at the following locations, shown on Figure 1:

- Boundary monitoring wells installed in Chalk;
  - BMG2 - BMG6 inclusive.
- Boundary monitoring wells installed through waste/made ground and Chalk;
  - PBG7 - PBG10 inclusive.
- Monitoring wells installed in waste;
  - PBG/L1 - PBG/L6 inclusive (combined gas and leachate monitoring wells).
- Gas Management System;
  - Wells A - E, the five new boreholes on the extraction system; and
  - Combined inflow to the vent, referred to as 'Line at Plant'.

3.1.4 In accordance with the EP and following agreement with Environment Agency, routine monitoring was carried out at fortnightly intervals in the boundary monitoring wells and at monthly intervals at the remaining locations. In addition, supplementary monitoring was carried out during periods of plant outage for the purpose of assessing risks associated with potential landfill gas migration.

3.1.5 All wells were monitored for bulk landfill gas composition, including methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), carbon monoxide (CO) and hydrogen sulphide (H_2S), using a portable analyser (GA2000). Atmospheric pressure and relative pressure in the wells were also monitored.

3.2 BOUNDARY BOREHOLES INSTALLED IN CHALK

3.2.1 Figures 8 – 12 show the recorded gas concentrations in the boundary boreholes installed in Chalk at the western boundary of the site, namely BMG2 to BMG6, for the six year period 2014 to 2019 inclusive. These boreholes were drilled at 45˚ through the western face of the Chalk quarry in the mid-1980s, during infilling with waste. Table 2 shows a summary of the landfill gas monitoring from these boreholes in 2019.

3.2.2 Methane was detected in the boreholes BMG4-BMG6 on the western boundary of the site but only sporadically, during and immediately following periods of plant outage.

3.2.3 Carbon dioxide was routinely detected in the boreholes, particularly during periods of outage. With the gas management system in operation, concentrations were consistently below 1.5%v/v in all boreholes (Figures 8 - 12).

3.2.4 Average carbon dioxide concentrations were highest in BMG5, consistent with 2017 and 2018, with a mean value of 5.5%v/v. The maximum concentration during 2019 however was detected at BMG2, on 22 August 2019 (20.5% v/v), following the pump bearing failure. This concentration decreased to 1.3%v/v in the following monitoring round.

3.2.5 No carbon monoxide or hydrogen sulphide was detected in the boundary boreholes installed in the Chalk.

Table 2 - Summary of Landfill Gas Monitoring in Boundary Boreholes installed in Chalk, 2019

	BMG2	BMG3	BMG4	BMG5	BMG6
Methane (%v/v)					
Min.	0.0	0.0	0.0	0.0	0.0
Mean	0.0	0.0	0.3	0.9	0.4
Median	0.0	0.0	0.0	0.0	0.0
90th %ile	0.0	0.0	0.5	3.7	0.4
95th %ile	0.0	0.0	1.0	7.1	1.7
Max.	0.0	0.0	5.1	8.5	6.7
Carbon Dioxide (%v/v)					
Min	0.0	0.0	0.1	0.1	0.1
Mean	1.8	1.4	1.8	5.5	2.5
Median	0.6	0.7	0.8	4.0	1.4
90th %ile	3.7	2.6	4.3	12.7	6.4
95th %ile	5.4	4.1	7.4	16.2	9.0
Max.	20.5	10.5	11.0	17.1	10.6
Carbon Monoxide (ppm)					
Min.	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0
Mean	0.0	0.0	0.0	0.0	0.0

	BMG2	BMG3	BMG4	BMG5	BMG6
Max.	0.0	0.0	0.0	0.0	0.0
Hydrogen Sulphide (ppm)					
Min.	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0
Mean	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0

3.3 BOREHOLES INSTALLED IN MADE GROUND / WASTE AND CHALK

3.3.1 Figures 13 - 16 show the recorded gas concentrations in the boundary boreholes installed partially in Made Ground or Waste at the western boundary of the site, namely PBG7 to PBG10, for the six year period 2014 and 2019 inclusive. Table 3 shows a summary of the monitoring of landfill gas in these boreholes during 2019.

3.3.2 During 2018, trace amounts of methane were detected in PBG9 (Figure 15), but not in PBG7, PBG8 or PBG10 (Figure 13, 14 and 16). Mean methane concentrations were < 0.5% at PBG9. The maximum methane concentration was detected in August 2019.

3.3.3 Recorded carbon dioxide concentrations were similarly very low throughout the year (mean concentrations <4% at all locations). The highest CO_2 concentrations were recorded in March and August 2019 during periods of system failure. At these times, boreholes PBG7, PBG8, PBG9 and PBG10 exceeded the 5% compliance limit, the highest concentration of 18.9%v/v was recorded on 26 March 2019 (PBG9).

3.3.4 No hydrogen sulphide or carbon monoxide was detected in these boundary boreholes with the exception of two detections of carbon monoxide at PBG9 in August 2019 (maximum, 4.0 ppm).

Table 3 - Summary of Landfill Gas Monitoring in Boundary Boreholes installed in Made Ground/Waste during 2019

	PBG7	PBG8	PBG9	PBG10
Methane (%v/v)				
Min.	0.0	0.0	0.0	0.0
Mean	0.0	0.0	0.4	0.0
Median	0.0	0.0	0.0	0.0
90th %ile	0.0	0.0	1.0	0.0
95th %ile	0.0	0.0	2.5	0.0
Max.	0.0	0.0	6.5	0.0
Carbon Dioxide (%v/v)				
Min.	0.0	0.0	0.1	0.0
Mean	1.0	2.9	3.4	2.1
Median	0.3	2.6	1.0	0.2
90th %ile	2.6	5.4	9.7	5.4
95th %ile	3.9	6.8	17.6	10.6
Max.	6.3	8.7	18.9	14.7
Carbon Monoxide (ppm)				
Min.	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.3	0.0
Mean	0.0	0.0	0.0	0.0
Max.	0.0	0.0	4.0	0.0
Hydrogen Sulphide (ppm)				
Min.	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0
Mean	0.0	0.0	0.0	0.0
Max.	0.0	0.0	0.0	0.0

3.4 BOREHOLES INSTALLED IN WASTE

3.4.1 Figures 17 to 22 show the recorded gas concentrations in the boreholes installed in waste at the site, namely PBG/L1 to PBG/L6, for the five year period 2014 to 2019 inclusive. Table 4 shows a summary of the monitoring of landfill gas in these boreholes in 2019.

Table 4 - Summary of Landfill Gas Monitoring in Internal Boreholes Installed in Waste 2019

	PBG/L1	PBG/L2	PBG/L3	PBG/L4	PBG/L5	PBG/L6
Methane (%v/v)						
Min.	0.0	0.0	0.0	0.0	0.0	0.0
Mean	5.3	0.0	7.7	0.0	17.2	0.9
Median	6.2	0.0	0.0	0.0	10.4	0.0
90th %ile	9.8	0.0	30.1	0.0	33.2	3.6
95th %ile	10.1	0.1	30.1	0.0	33.8	5.5
Max.	10.5	0.2	30.2	0.0	36.3	5.7
Carbon Dioxide (%v/v)						
Min.	0.5	1.7	4.9	3.9	16.1	10.0
Mean	12.8	7.2	13.2	7.9	21.1	13.9
Median	17.3	5.8	7.3	7.7	21.6	12.1
90th %ile	20.0	16.2	26.0	11.3	25.8	17.9
95th %ile	20.7	16.4	26.1	12.4	26.1	18.4
Max.	20.9	18.5	26.3	12.7	26.9	19.1
Carbon Monoxide (ppm)						
Min.	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.1	0.0	0.2	0.0	0.2	0.1
Mean	0.0	0.0	0.0	0.0	0.0	0.0
Max.	1.0	0.0	3.0	0.0	2.0	2.0
Hydrogen Sulphide (ppm)						
Min.	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.5	0.0	0.2	0.0	2.7	0.0
Mean	0.0	0.0	0.0	0.0	0.0	0.0
Max.	9.0	0.0	3.0	0.0	38.0	0.0

3.4.2 As in previous years, the highest concentrations of both carbon dioxide and methane were recorded in PBG/L5 (Figure 21). Mean recorded methane and carbon dioxide concentrations in PBG/L5 in 2019 were 17.2%v/v and 21.1%v/v respectively.

3.4.3 In the remaining boreholes, PBG/L1, PBG/L2, PBLG/3, PBG/L4 and PBG/L6, recorded methane concentrations were lower, with the highest average of 7.7% recorded at PBLG/3.

3.4.4 Carbon dioxide concentrations in PBG/L2 continued to demonstrate some seasonality, with concentrations lower in the summer period. Carbon dioxide concentrations in the other boreholes did not record any similar strong seasonality.

3.4.5 Recorded carbon monoxide and hydrogen sulphide concentrations were consistent with previous years.

3.5 GAS MANAGEMENT SYSTEM

3.5.1 Figures 23 to 28 show the recorded gas concentrations at the wellhead of extraction boreholes BHA - BHE inclusive, whilst the mean concentration of the extracted gas is shown in Figure 28. Table 5 shows a summary of the monitoring of landfill gas at these locations in 2019.

Table 5 - Summary of Landfill Gas Extracted from Waste, 2019

	A	B	C	D	E	Line
Methane (%v/v)						
Min.	0.0	1.7	0.7	0.1	0.0	0.0
Mean	0.0	10.6	3.1	0.8	0.0	0.1
Median	0.0	10.4	3.1	0.4	0.0	0.0
90th %ile	0.0	13.3	5.1	1.6	0.0	0.1
95th %ile	0.0	13.5	6.6	2.2	0.0	0.2
Max.	0.0	13.6	7.3	6.5	0.0	0.4
Carbon Dioxide (%v/v)						
Min.	2.8	17.1	7.30	2.7	2.1	1.7
Mean	6.2	19.6	14.7	12.2	5.7	2.6
Median	5.5	19.8	16.1	12.6	4.5	2.5
90th %ile	10.3	20.8	19.7	16.8	10.2	3.6
95th %ile	10.8	20.9	20.1	17.3	11.3	3.9
Max.	12.7	21.4	20.2	17.4	16.9	4.1

3.5.2 Recorded methane concentrations were relatively low with the exception of concentrations detected at Well B that registered an average of 10.6%. The next highest average concentration was detected at Well C with 3.1%. Maximum concentrations have been detected at Well B in previous years.

3.5.3 Carbon dioxide concentrations averaged between 5.7%v/v and 19.6%v/v, slightly higher than the previous year. The highest concentration of 19.6%v/v was recorded in Well B (Figure 24).

3.5.4 In the line at the gas management plant, methane concentrations averaged 0.1% and carbon dioxide concentrations averaged 2.6%v/v, both a slight decrease compared with 2018. Recorded concentrations of carbon dioxide oscillated throughout the year, in part due to manual variation of suction pressures to limit condensate generation.

3.6 SURFACE WALKOVER SURVEY

3.6.1 The annual surface emissions walkover survey was undertaken on 9th July 2019 between 12:00 and 16:00 using an Inficon IRwin SXT (portable laser methane / gas analyser).

3.6.2 During the survey the meteorological conditions were clear and dry. Atmospheric pressure ranged between 1020 – 1021 mb and the gas management system was operating.

3.6.3 The survey demonstrated the integrity of the surface of Bamber Quarry Landfill and that associated monitoring infrastructure was generally in good condition, with no significant emissions (>10ppmv) of hydrocarbons to air occurring through the surface, with the exception of an emission of 90 ppmv located 3m above the gas compound area, adjacent to the stack. A maximum of 22 ppmv was observed in the vicinity of the gas management compound, at ground level. These observations are consistent with the operation of the gas management system in which landfill gas with relatively low methane and carbon dioxide content is vented to air. This result is also consistent with data collected in previous years.

3.7 TRACE GAS MONITORING

3.7.1 Trace gas sampling of the landfill gas in the gas management system was undertaken on 18th December 2019. Samples were collected by pumping onto two-bed sorption tubes and reactive sorbent tubes following the methodology set out by Environment Agency guidance, LFTGN 04.

Several priority compounds were detected within the bulk extracted gas, at concentrations marginally above the recommended limit of detection. These comprised benzene, toluene and formaldehyde, at concentrations significantly below those which would pose a risk to surrounding occupants. The findings are consistent with monitoring previously undertaken.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

4.1.1 The monitoring undertaken at Bamber Quarry Landfill during 2019 continues to demonstrate that which has been previously reported, that the site poses little, if any, environmental risk.

LANDFILL GAS

4.1.2 Previous risk assessments for Bamber Quarry identified that the main potential risk associated with the site is for lateral migration of landfill gas across the western boundary towards residential properties.

4.1.3 Monitoring in 2019 demonstrated similar conditions to those recorded in 2018 with gas concentrations typically within previously detected ranges throughout 2018, except during periods of system failure.

4.1.4 Within the body of the landfill, methane and carbon dioxide concentrations are consistent with pockets of anaerobic activity within the waste. The 2019 surface walkover survey demonstrated that the integrity of the surface was good and that methane and carbon dioxide emissions to air from the surface of the site were predominantly imperceptible.

4.1.5 It is concluded that emissions of greenhouse gases from site are currently minimised, both from the western margin and the main waste mass within the centre and east of the site.

WATER ENVIRONMENT

4.1.6 The results of the monitoring undertaken are consistent with findings reported previously and demonstrate that groundwater and surface water chemistry is generally stable. The results confirm that the area covered by the Environmental Permit is having little (if any) deleterious impact on the quality of surrounding groundwater.

4.1.7 As in previous years, the poorest groundwater quality was observed to the north of the area covered by the Environmental Permit at boreholes PBGW1 - PBGW3 inclusive. These monitoring wells regularly recorded concentrations of ammoniacal nitrogen, nitrite, sulphate and chloride above the relevant screening criteria. The observed water quality at these locations is attributed to leaching from the Made Ground present to the north of the Dartford to Gravesend railway line, as well as anthropogenic inputs, in the vicinity of PBGW1 and PBGW2.

4.1.8 Better water quality was recorded to the south of the area covered by the Permit, and the Chalk aquifer shows relatively little impact from the key parameters most typically associated with leachates from putrescible wastes. Recorded concentrations of chloride and ammoniacal nitrogen within PBGW4 and PBGW5 remained noticeably lower than observed to the north of the site.

4.1.9 The monitored water quality within the pond to the south of the site was consistent with the previous year.

4.2 RECOMMENDATIONS

4.2.1 The following recommendations are made for implementation during 2020. We recommend that once agreed, each of these should be discussed with the Environment Agency and agreement reached.

GAS MONITORING AND RISK ASSESSMENT

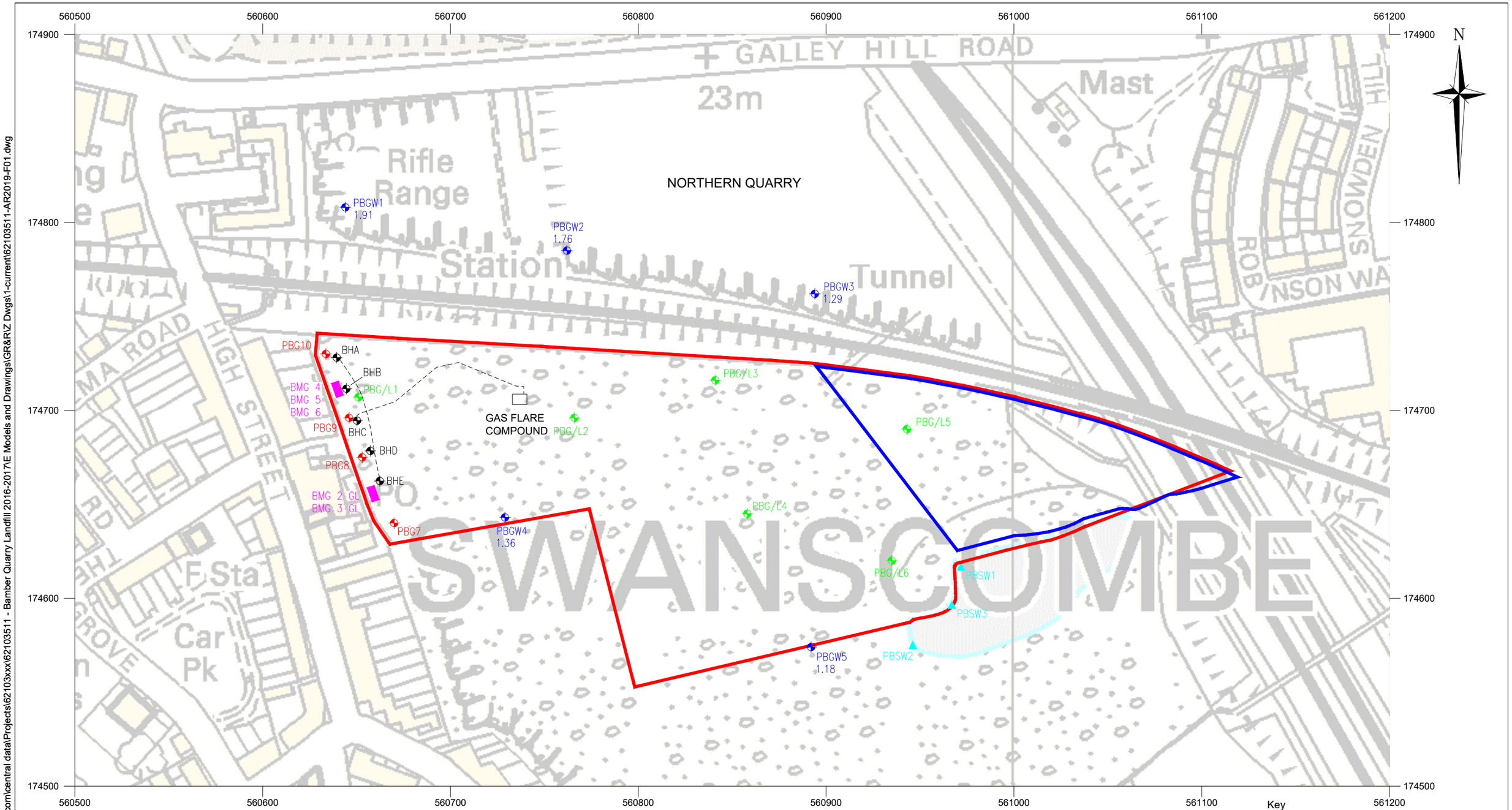
4.2.2 A large amount of routine monitoring data has been obtained since installation of the new gas extraction wells and pipework in April 2012, initially at a weekly frequency and, since early 2013, at a fortnightly frequency. This has demonstrated that, providing the extraction system remains operational, the risk to neighbouring properties and any environmental receptors is negligible. Further, monitoring of the trace gases highlights that both composition and concentrations are relatively stable and presents a negligible risk to human health receptors. The following recommendations are provided for the coming year:

- A formal update to the Gas Risk Assessment is not considered to be required due to the stability of the CSM and site specific data; and
- Surface emissions survey should continue to be undertaken during 2020 to demonstrate continued absence of risk.

WATER MONITORING

4.2.3 Review of groundwater and surface water monitoring data obtained over the last fourteen years has indicated very little change in the chemical composition of waters within the vicinity of the site and these data continue to provide a clear appreciation of the specific parameters representing the principal indicators of water quality.

4.2.4 The proposed scope of monitoring in 2020 is consistent with the scope undertaken in 2019.



Key

- PBSW — Surface Water Monitoring Point
- PBGW — Groundwater Monitoring Borehole
- PBA-E — PB Gas Extraction Well (2012)
- PBC — PB Gas Monitoring Well (2007)
- PBG/L — PB Gas & Leachate Monitoring Well (2002)
- BMG — Gas Monitoring Well (pre 2000)
- Gas Line (2012)
- 2.54 — Groundwater Elevation (mAOD)

Rev	Date	Description	By	Chk	App

Notes:
- Original Landfill Licence Boundary
- Areas Subject to Compulsory Purchase

Kings Orchard
1 Queen Street
Bristol BS2 0HQ
Tel: 44-(0)1179-306200

Client: LRCH

Project: Bamber Quarry Landfill Annual Report 2019

Title: Site Location Showing Monitoring Infrastructure and Water Elevations March 2020

Drawn: CEW		Checked: DD	
Designed: EV		Approved:	
Date: 17/03/2020	Scale: 1:2000	A3	Sheet:
Project Number: 62103511		Drawing Number: Figure 1	Revision:

File Name: \\uk.wspgroup.com\central data\Projects\62103xxx\62103511 - Bamber Quarry Landfill 2016-2017\E Models and Drawings\GR&R\Z Dwgs\1-current\62103511-AR2019-F01.dwg
Login: Bharti, Neha
Plot Date: 3/25/2020 3:11:39 PM

Figure 2 - Bamber Quarry Landfill: Groundwater Elevations 2005 - 2020

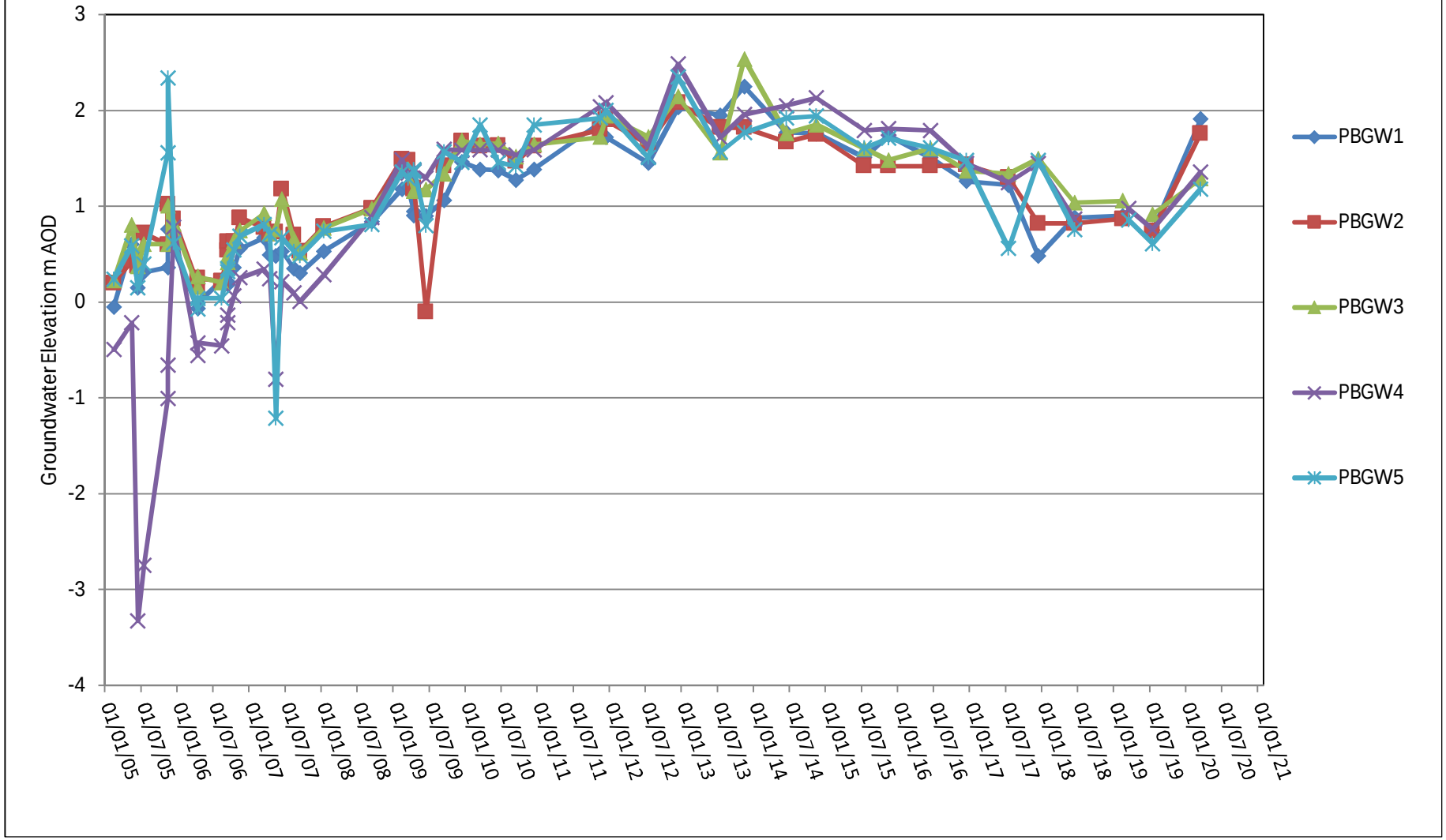


Figure 3 - Recorded Chloride Concentrations in Groundwater 2005-2020

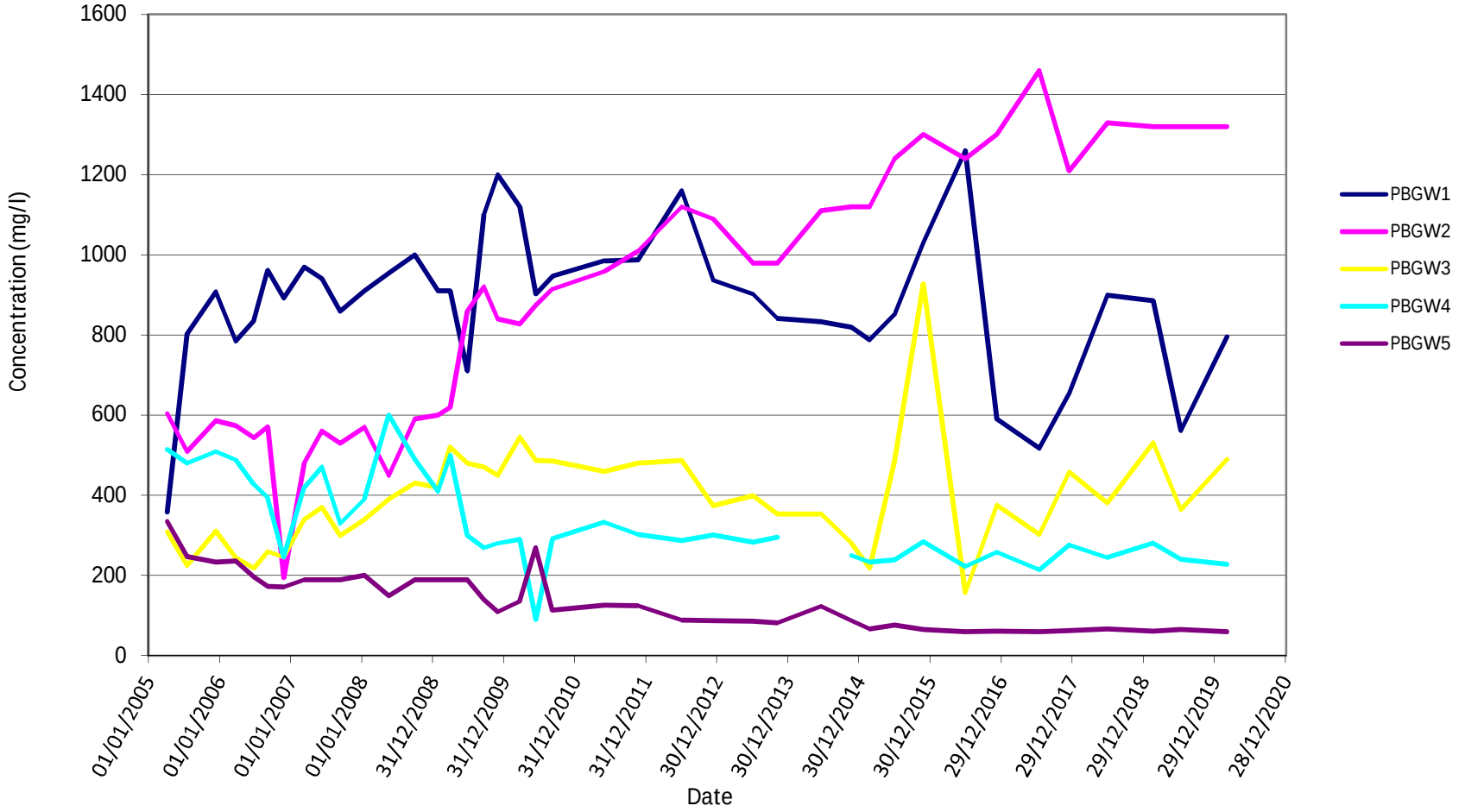


Figure 4 - Recorded Ammoniacal Nitrogen Concentrations in Groundwater 2005-2020

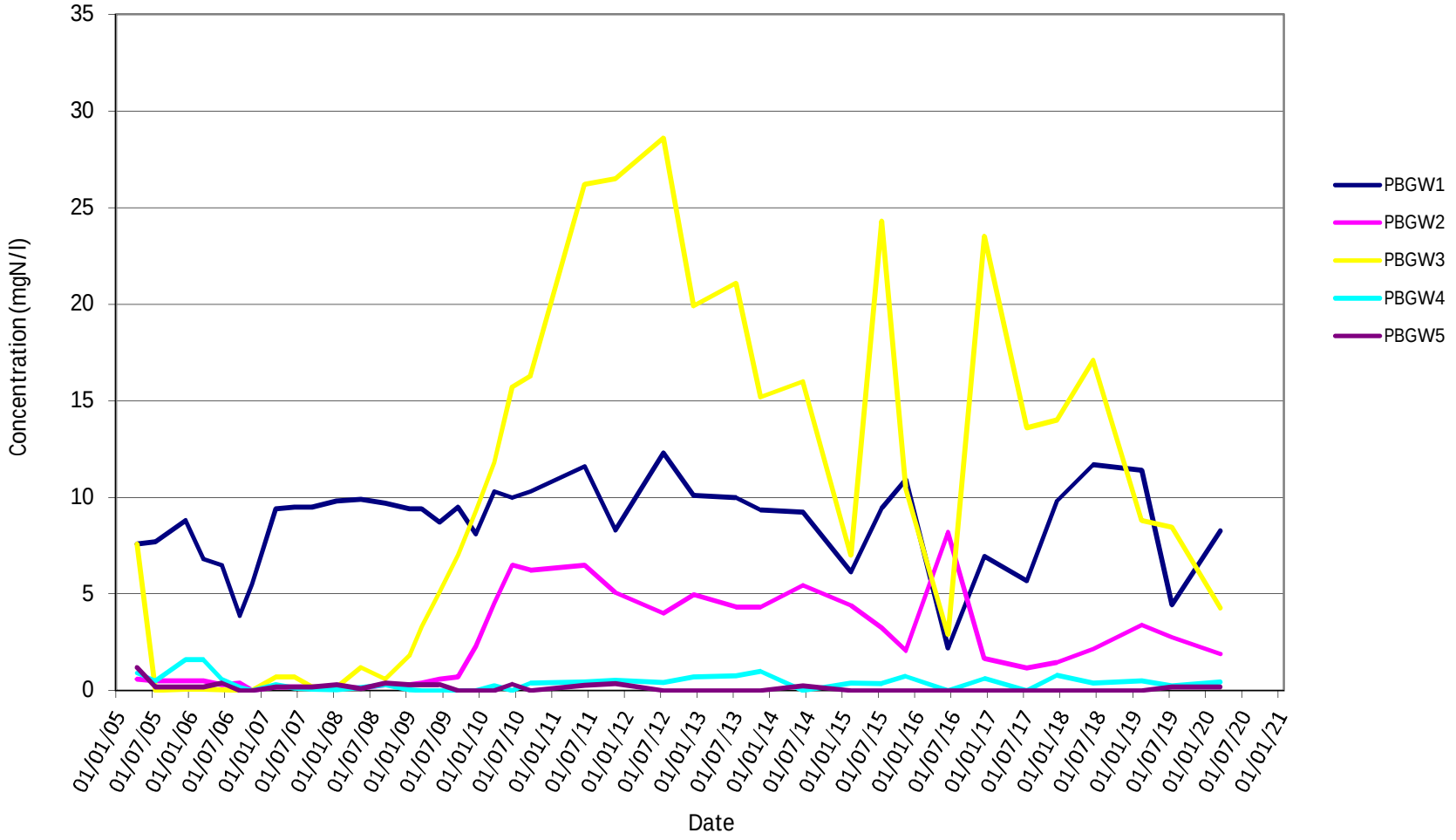


Figure 5 - Recorded Nitrite Concentrations in Groundwater 2005-2020

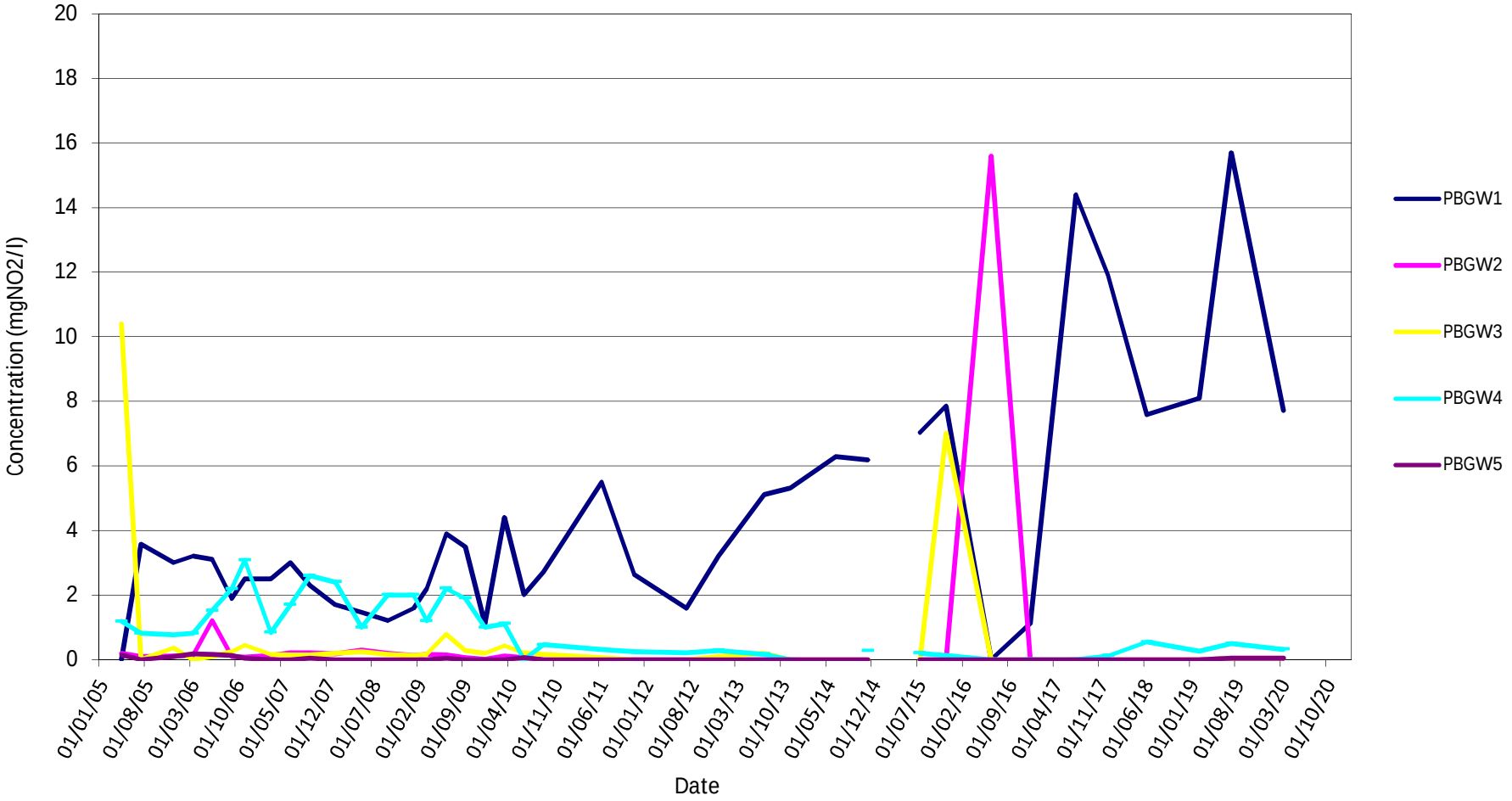


Figure 6 - Recorded Nitrate Concentrations in Groundwater 2005-2020

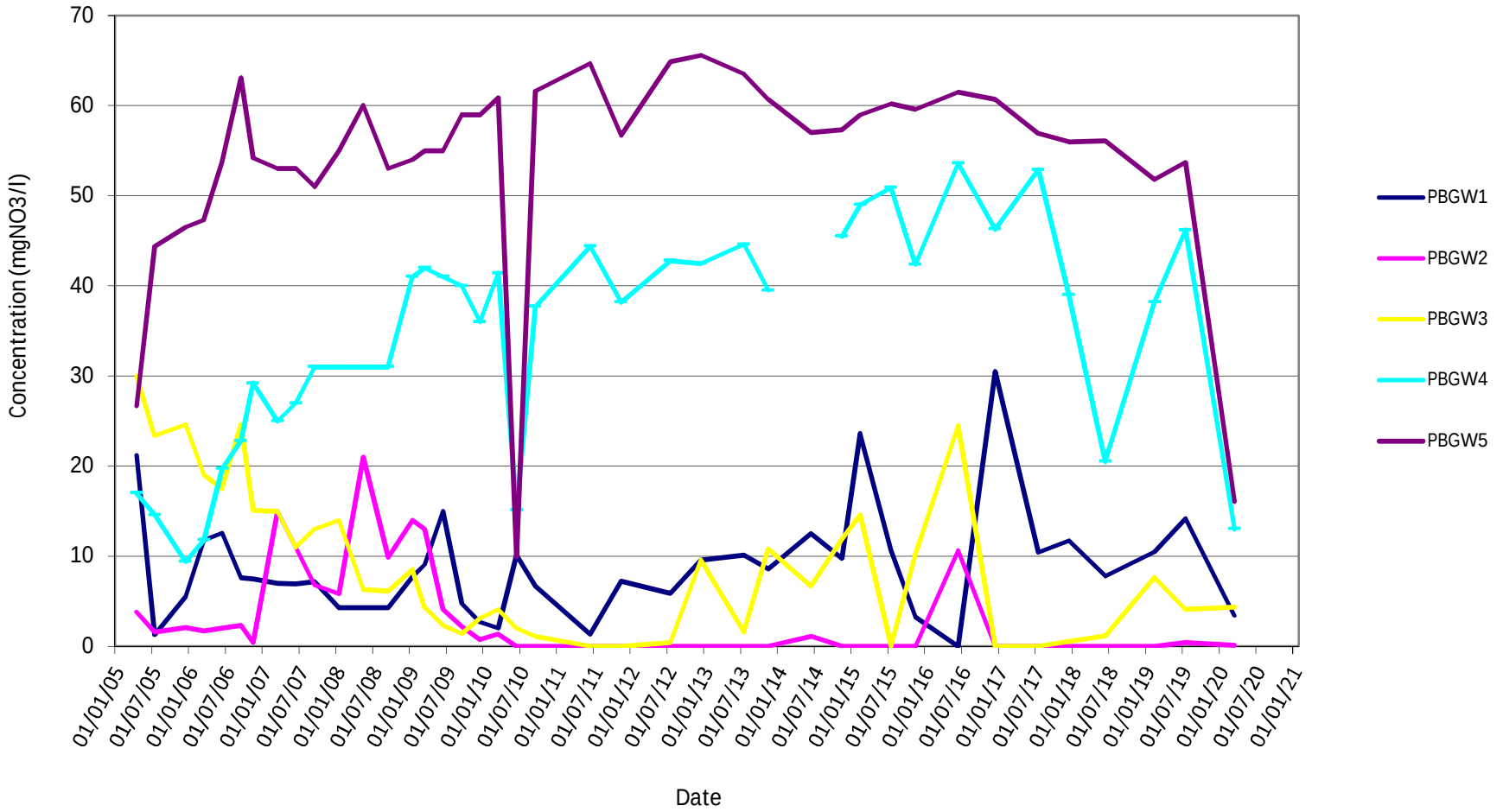


Figure 7 - Recorded Sulphate Concentrations in Groundwater 2005-2020

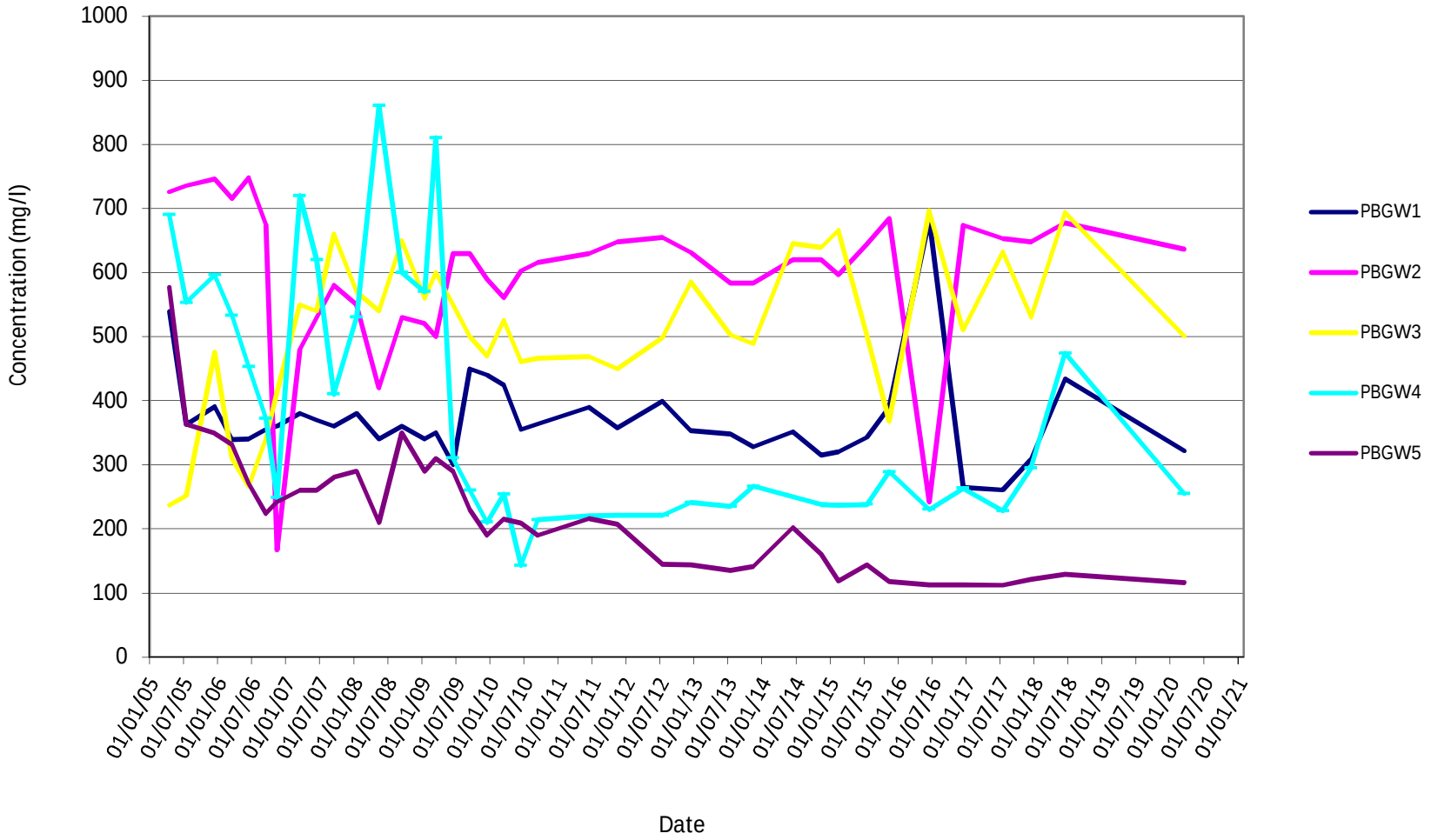


Figure 8: Gas concentration in BMG2, 2014 - 2019

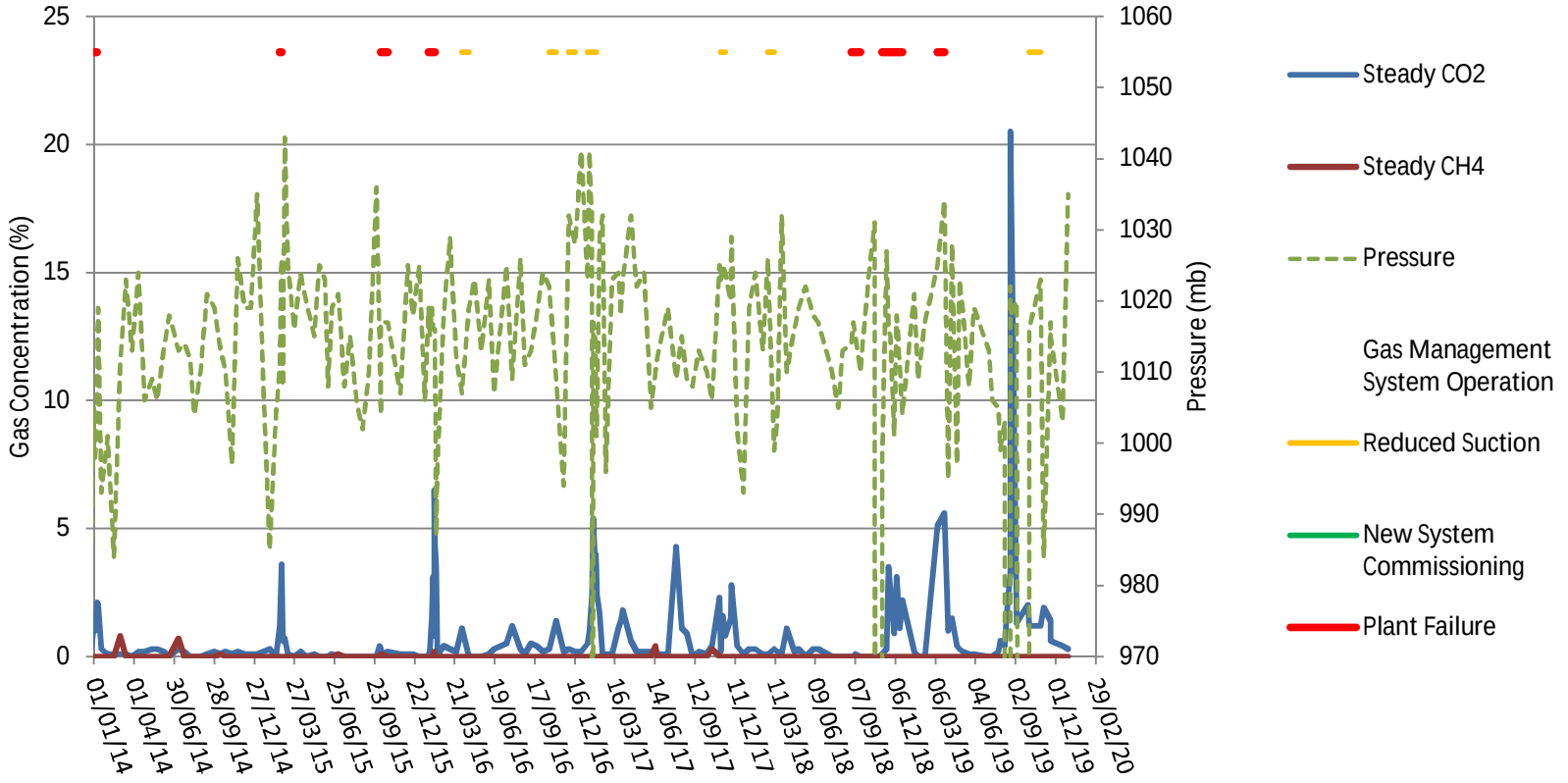
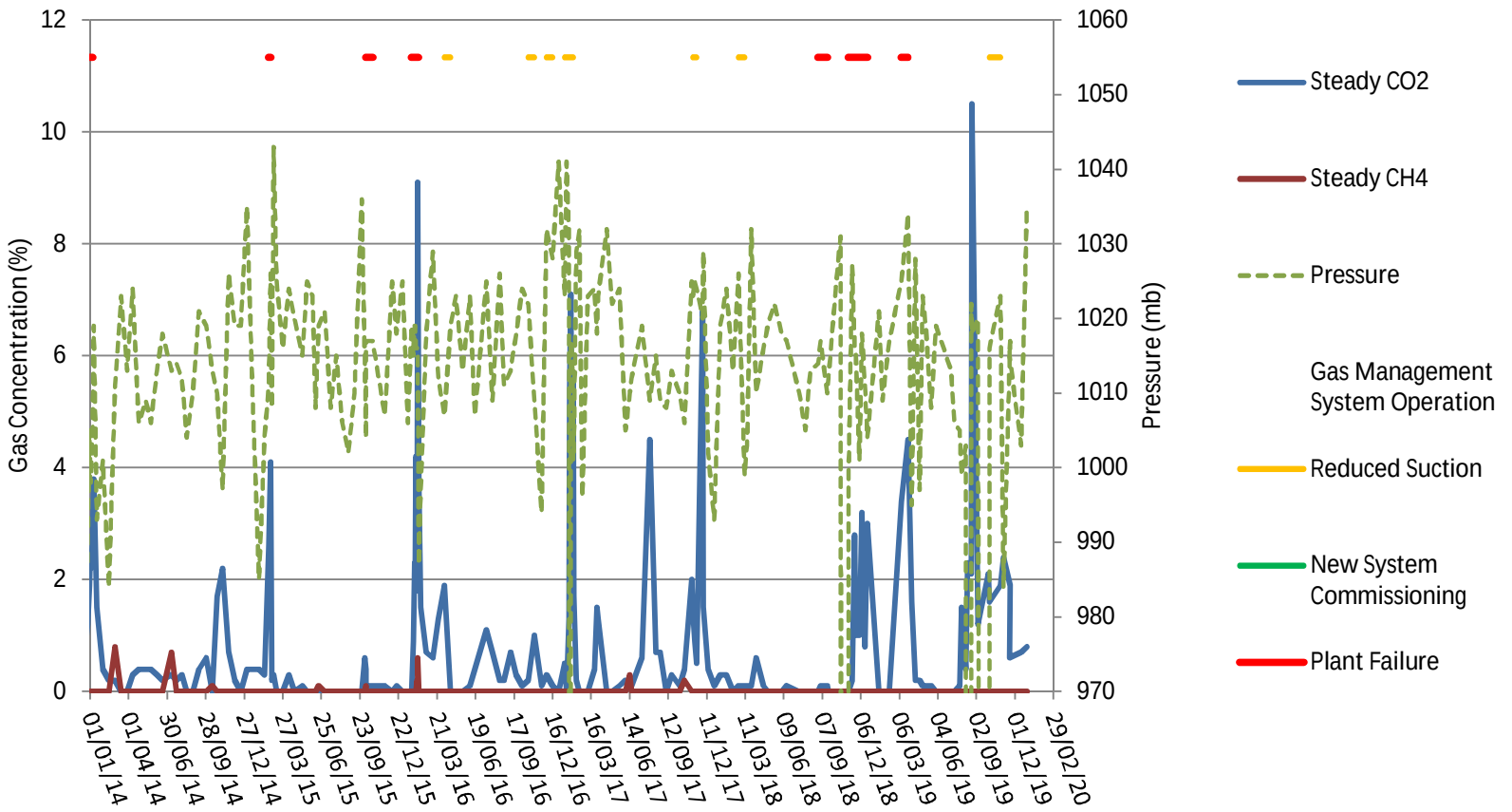


Figure 9: Gas concentration in BMG3, 2014 - 2019



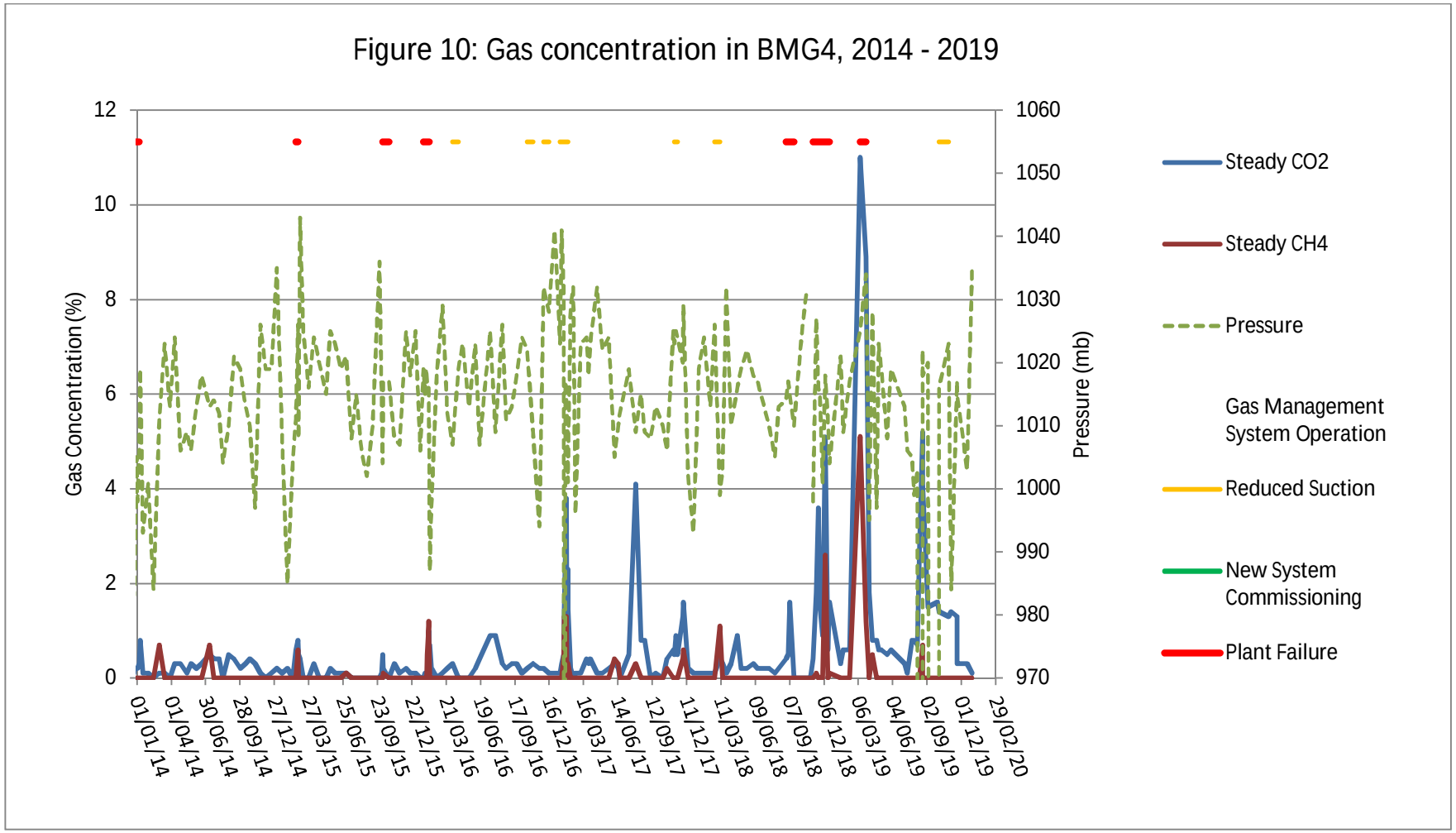


Figure 10: Gas concentration in BMG4, 2014 - 2019
Gas Concentration (%)
Pressure (mb)
0
2
4
6
8
10
12
970
980
990
1000
1010
1020
1030
1040
1050
1060
01/01/14
01/04/14
30/06/14
28/09/14
27/12/14
27/03/15
25/06/15
23/09/15
22/12/15
21/03/16
19/06/16
17/09/16
16/12/16
16/03/17
14/06/17
12/09/17
11/12/17
11/03/18
09/06/18
07/09/18
06/12/18
06/03/19
04/06/19
02/09/19
01/12/19
29/02/20
Steady CO2
Steady CH4
Pressure
Gas Management System Operation
Reduced Suction
New System Commissioning
Plant Failure

Figure 11: Gas concentration in BMG5, 2014 - 2019

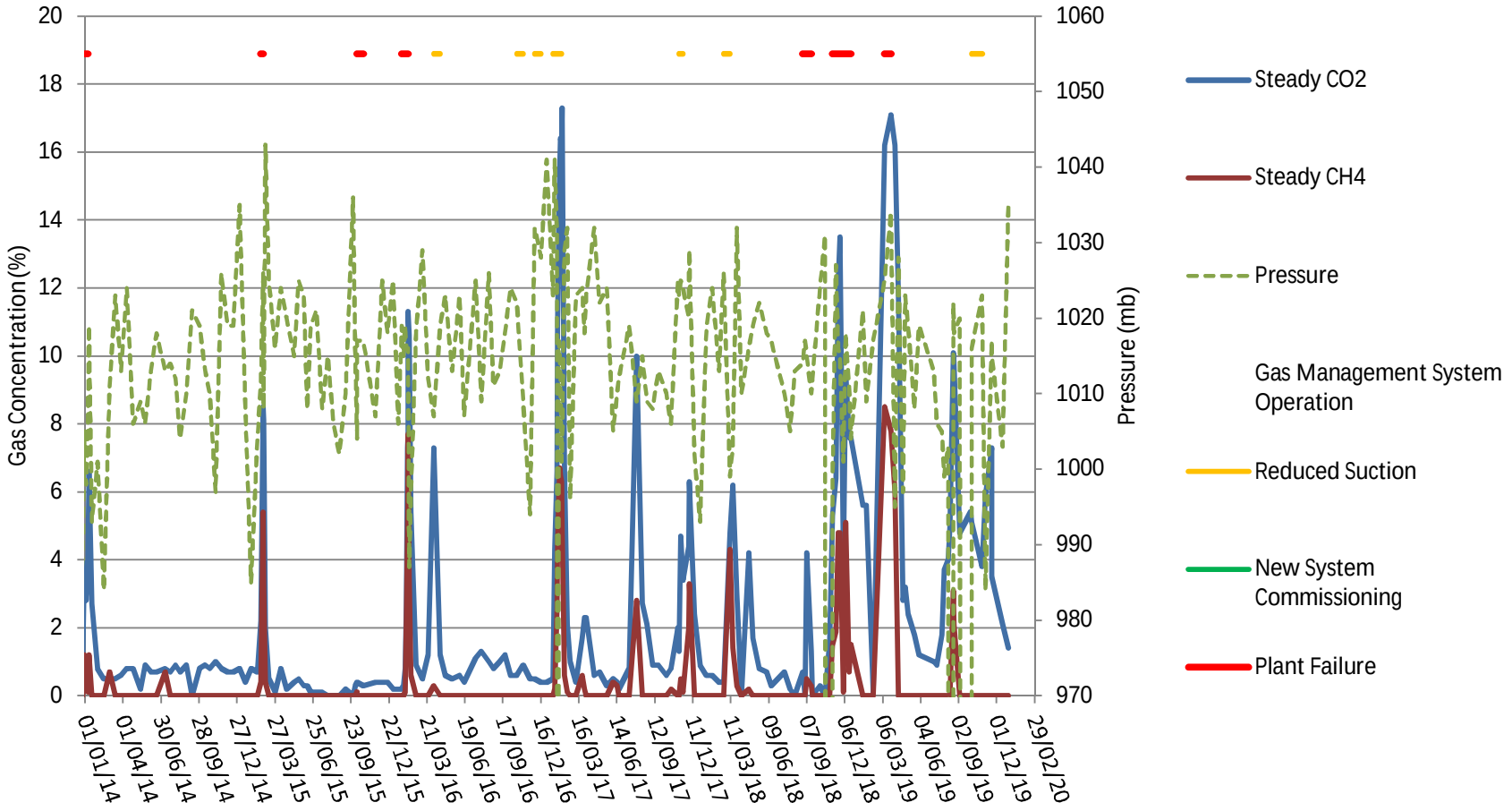


Figure 12: Gas concentration in BMG6, 2014 - 2019

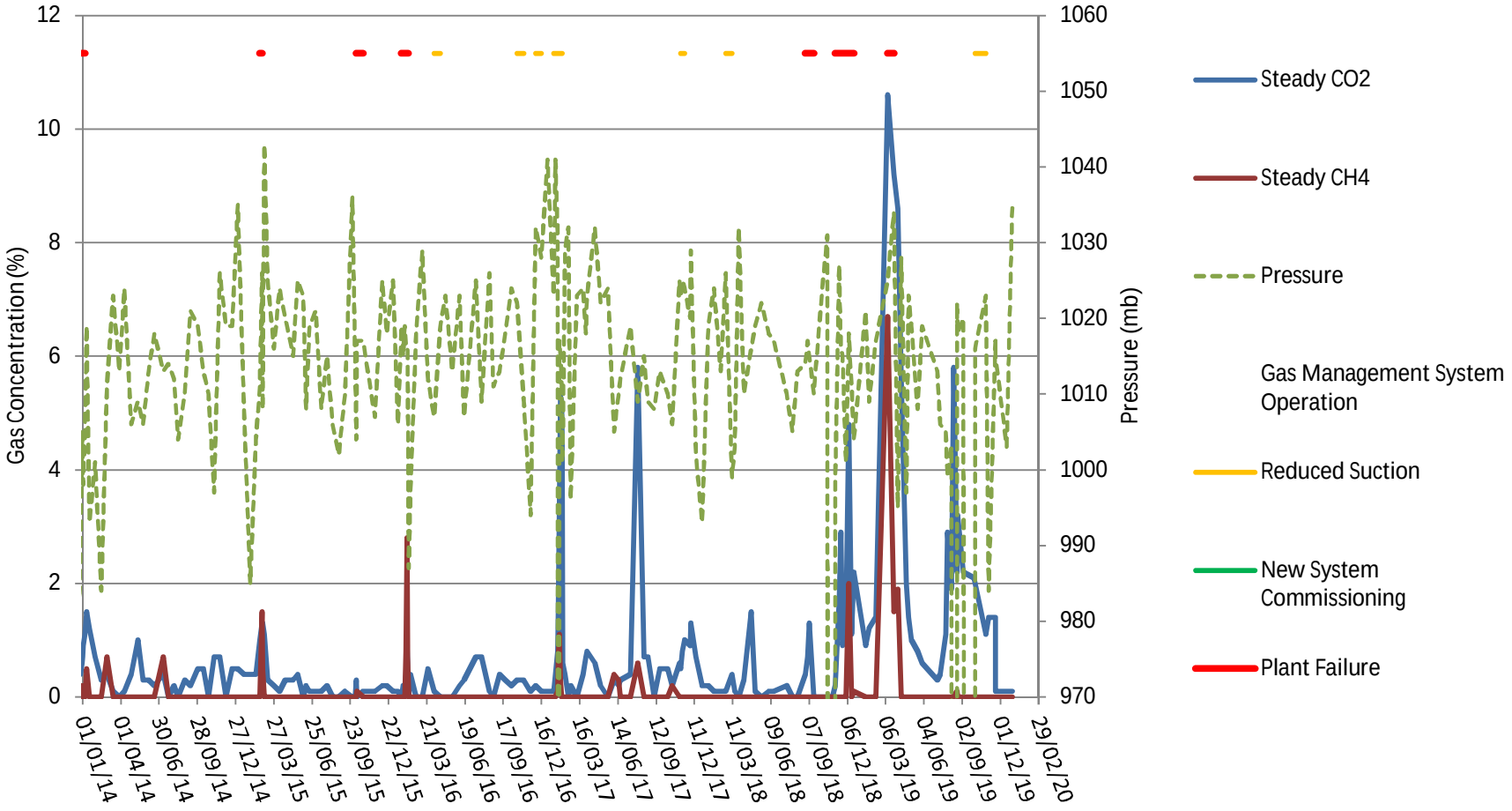


Figure 13: Gas concentration in PBG7, 2014 - 2019

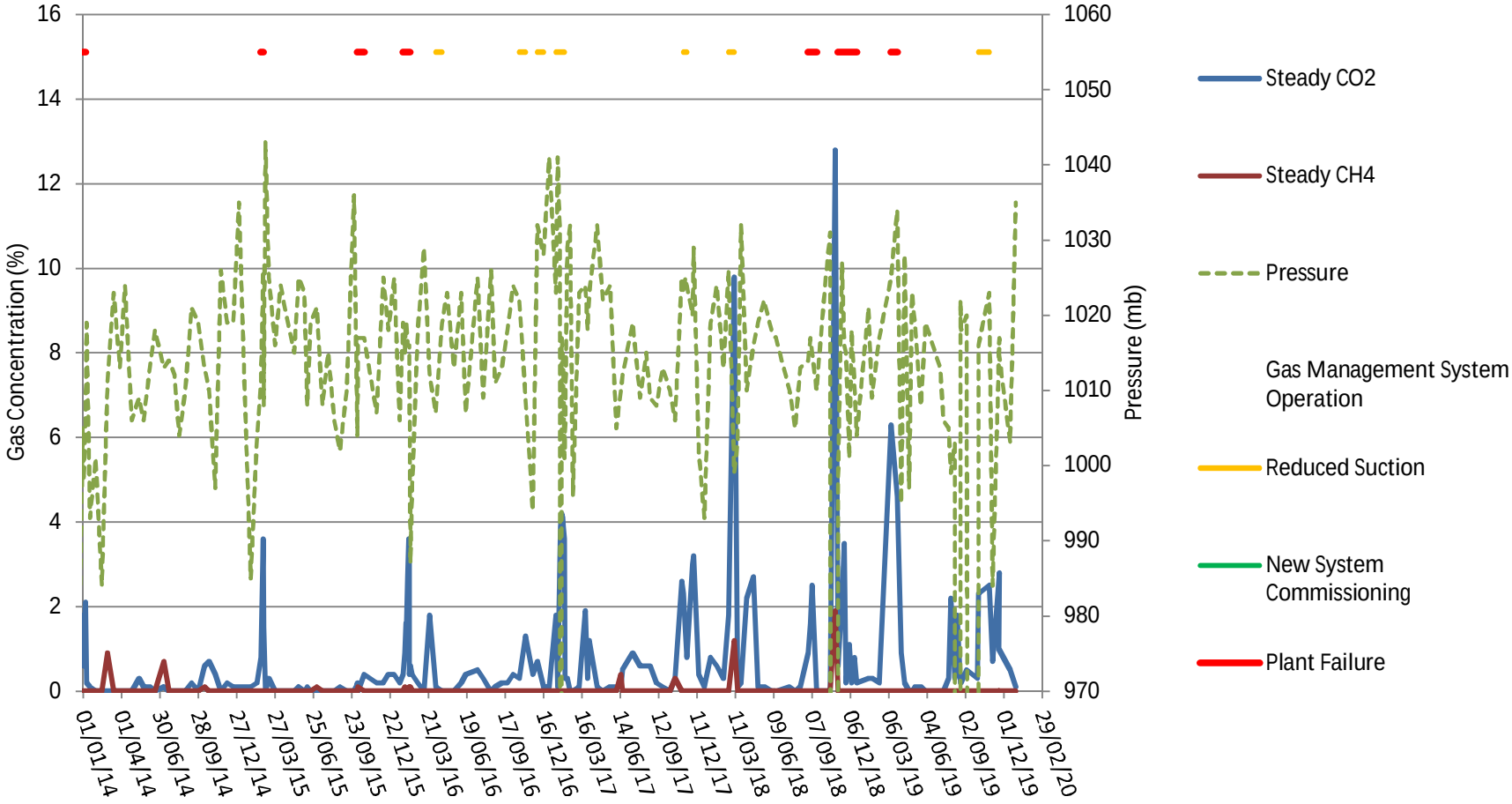


Figure 14: Gas concentration in PBG8, 2014 - 2019

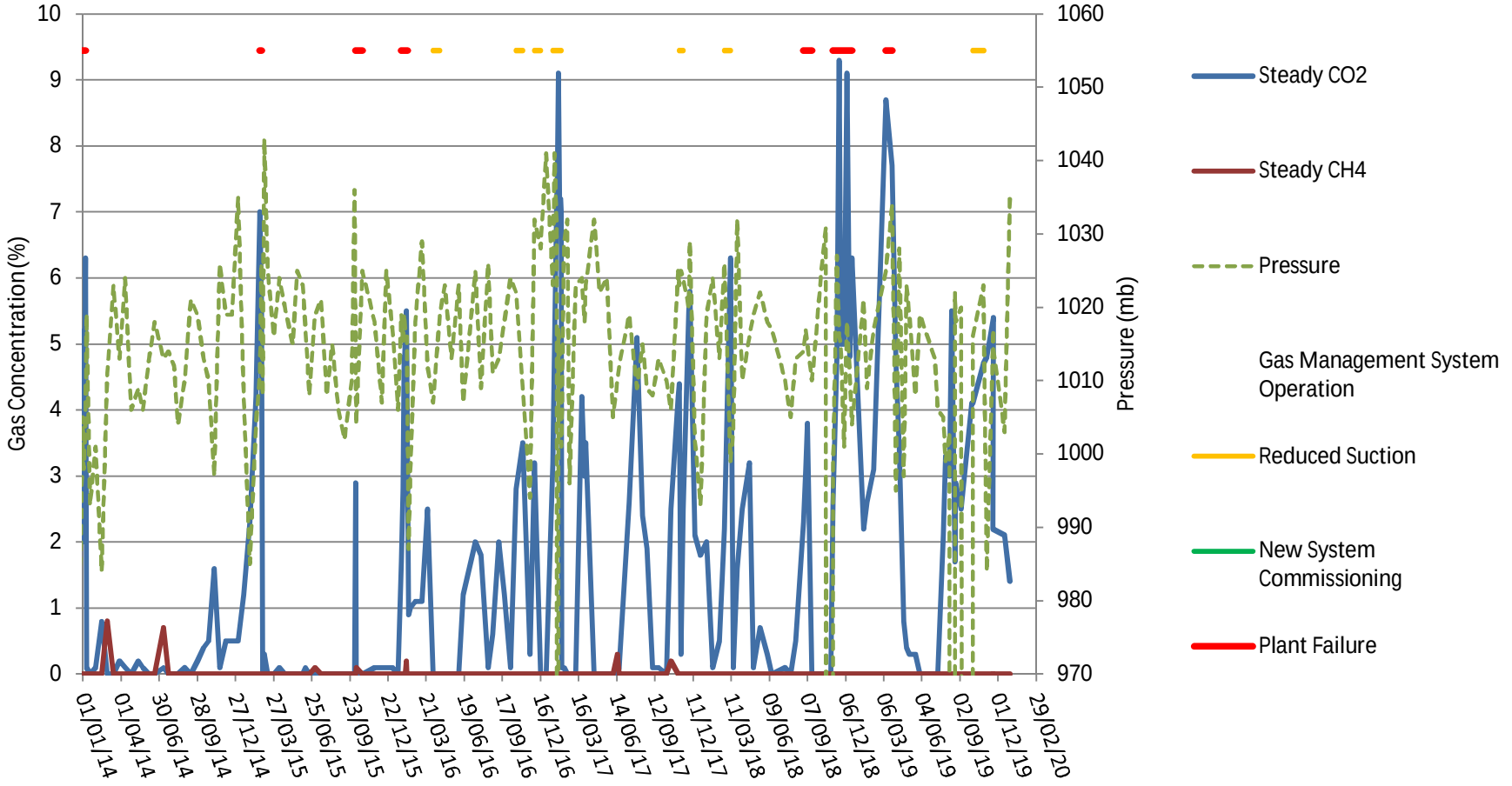


Figure 15: Gas concentration in PBG9, 2014 - 2019

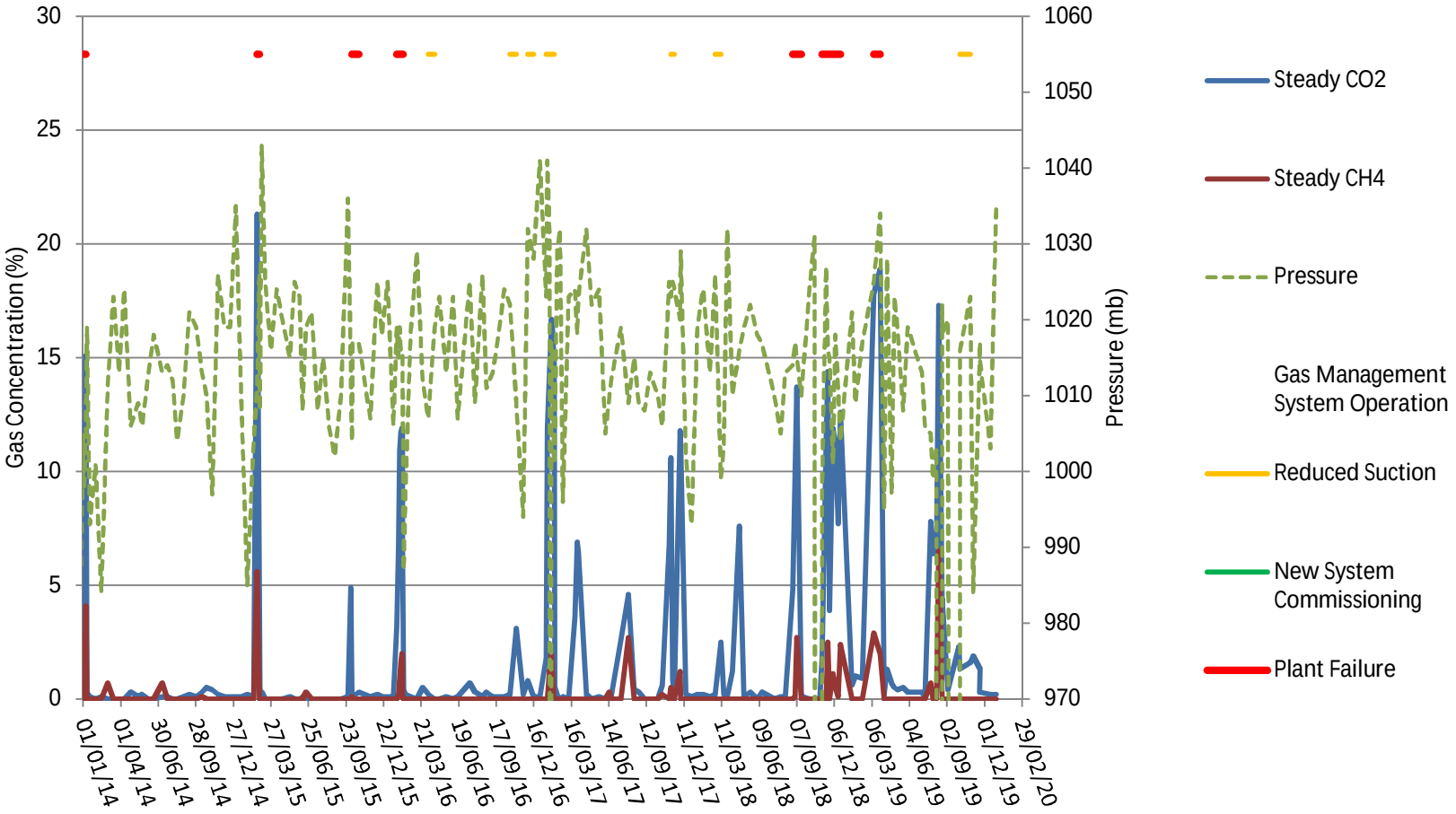


Figure 16: Gas concentration in PBG10, 2014 - 2019

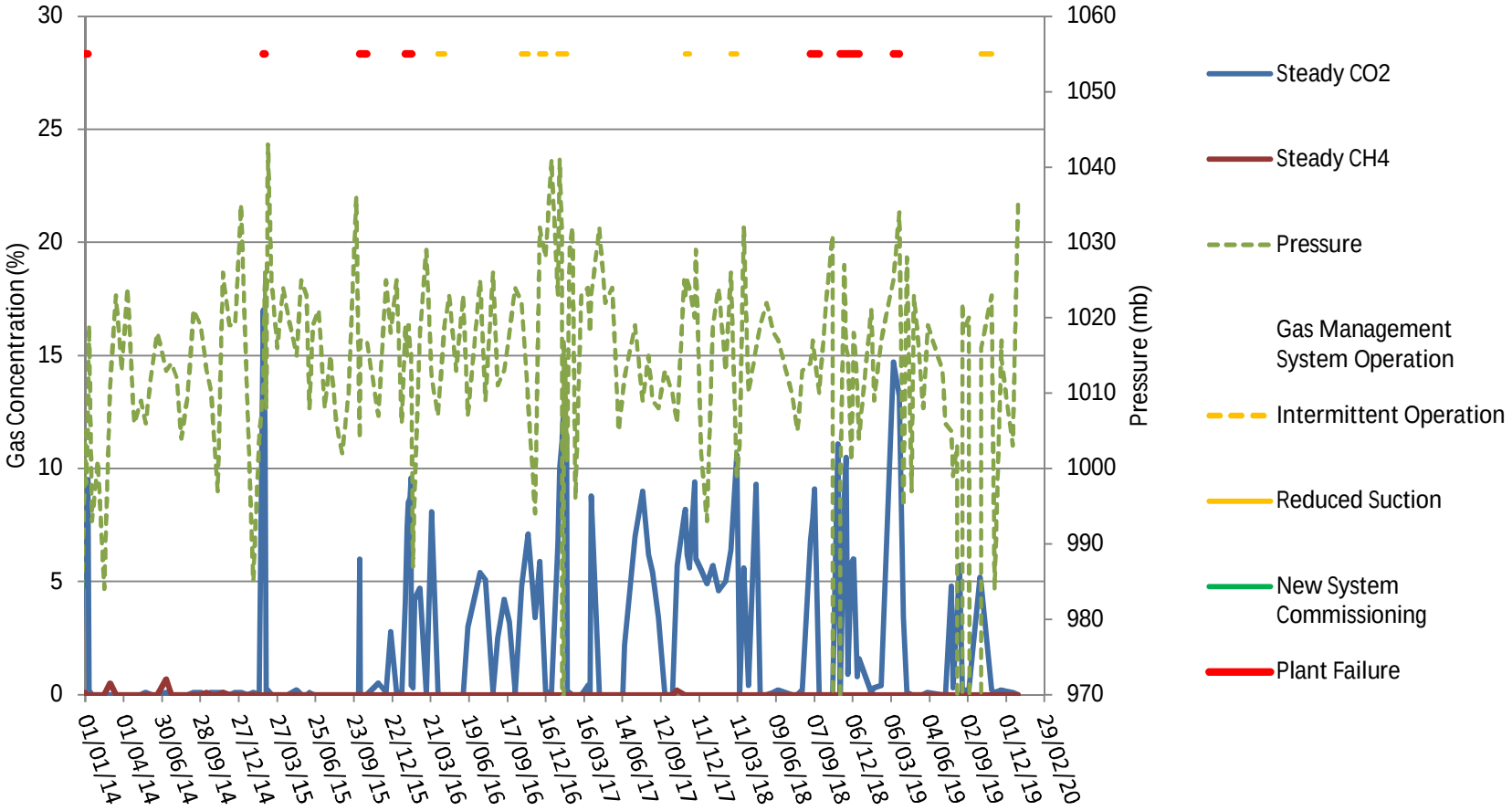


Figure 17: Gas concentration in PBG L1, 2014 - 2019

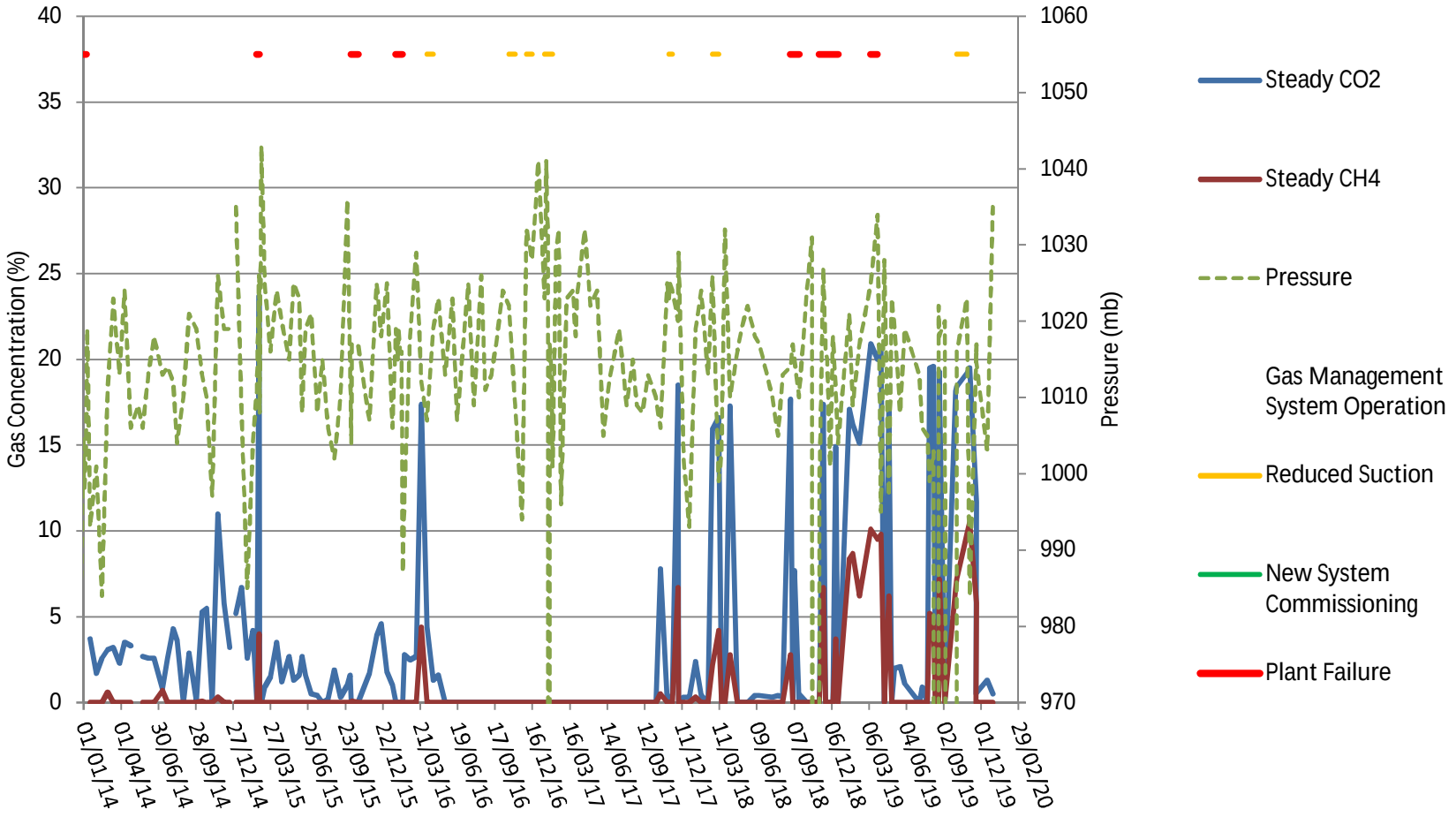


Figure 18: Gas concentration in PBGL2, 2014 - 2019

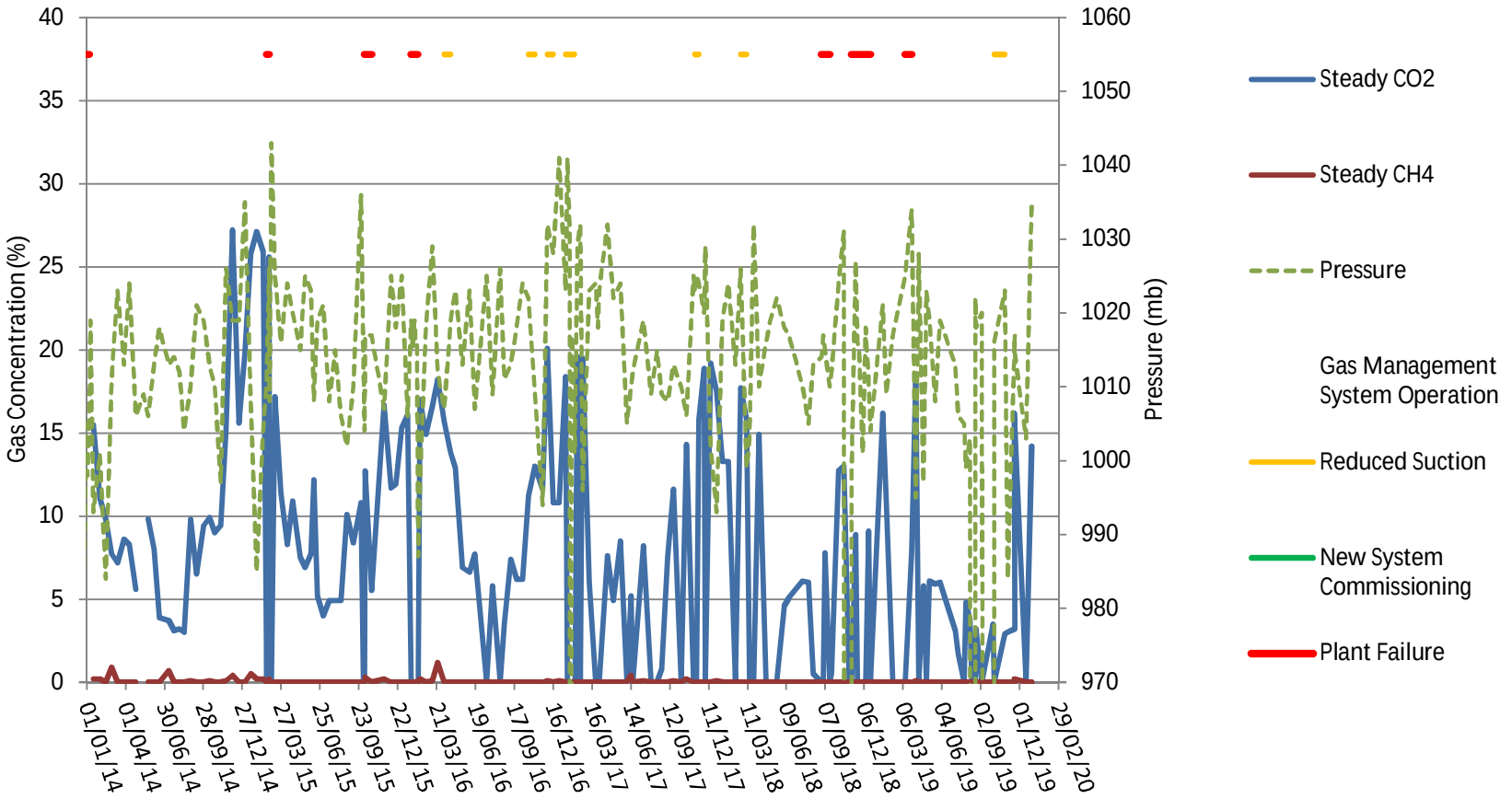


Figure 19: Gas concentration in PBGL3, 2014 - 2019

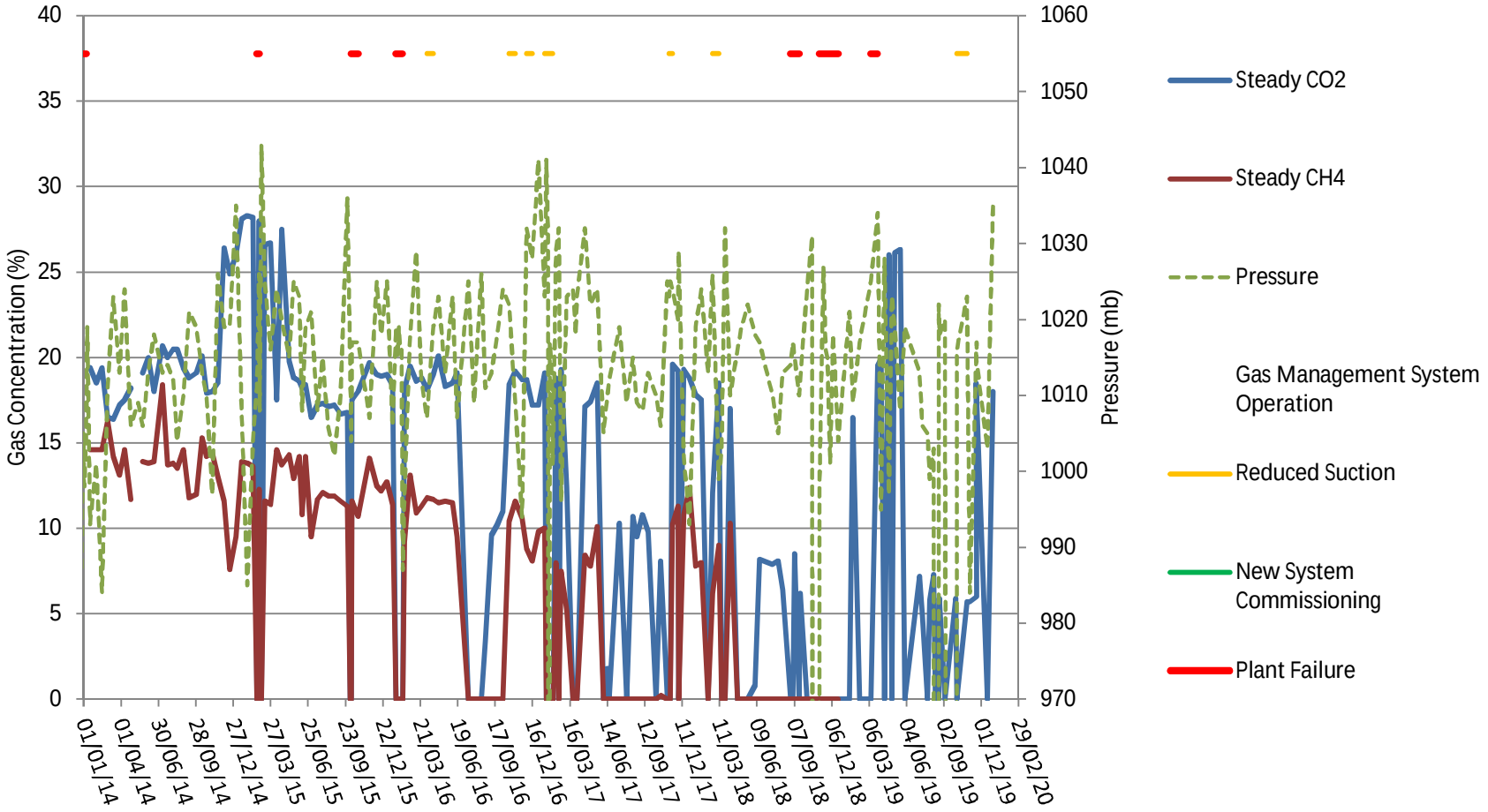


Figure 20: Gas concentration in PBGL4, 2014 - 2019

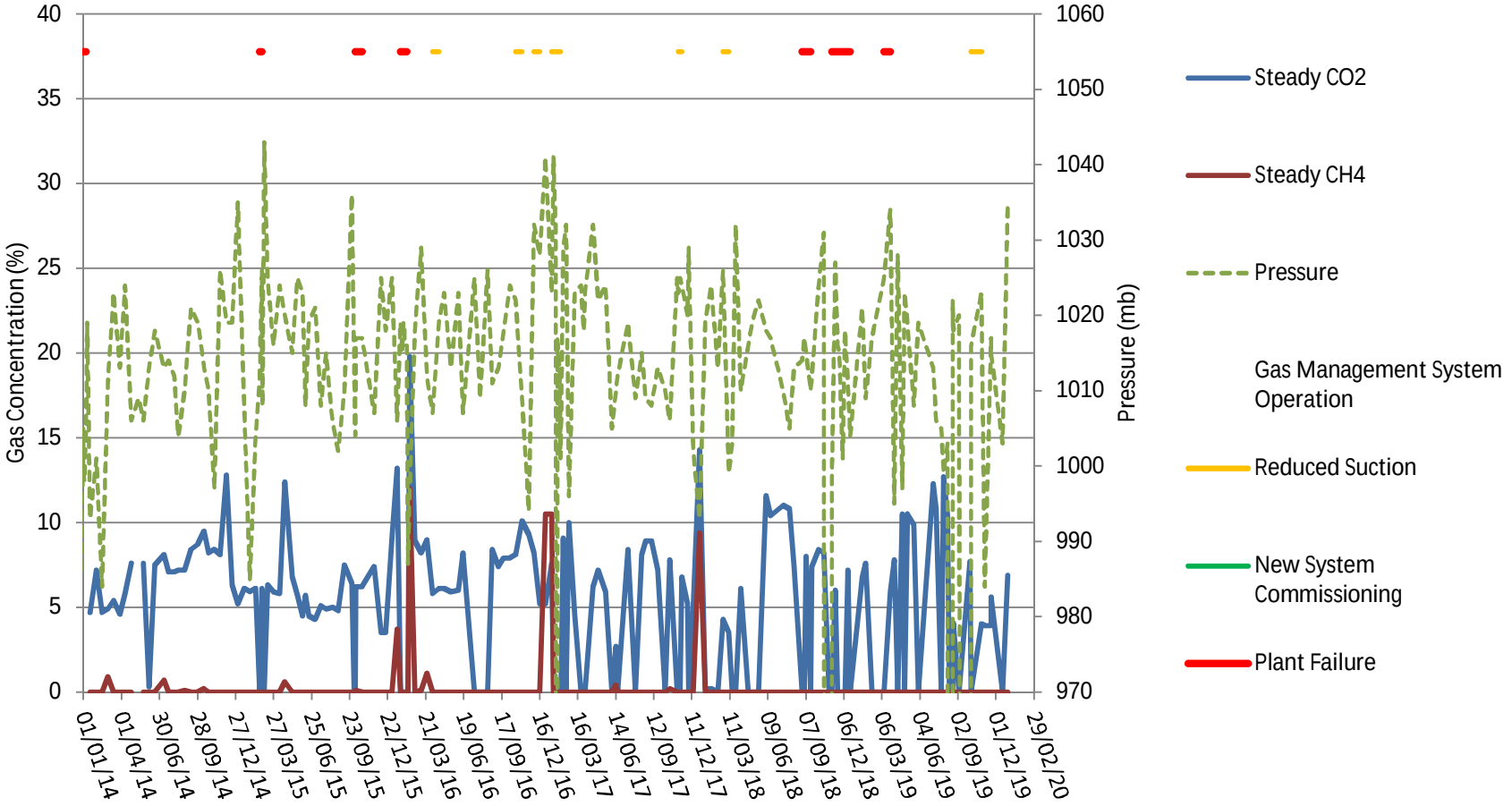


Figure 21: Gas concentration in PBGL5, 2014 - 2019

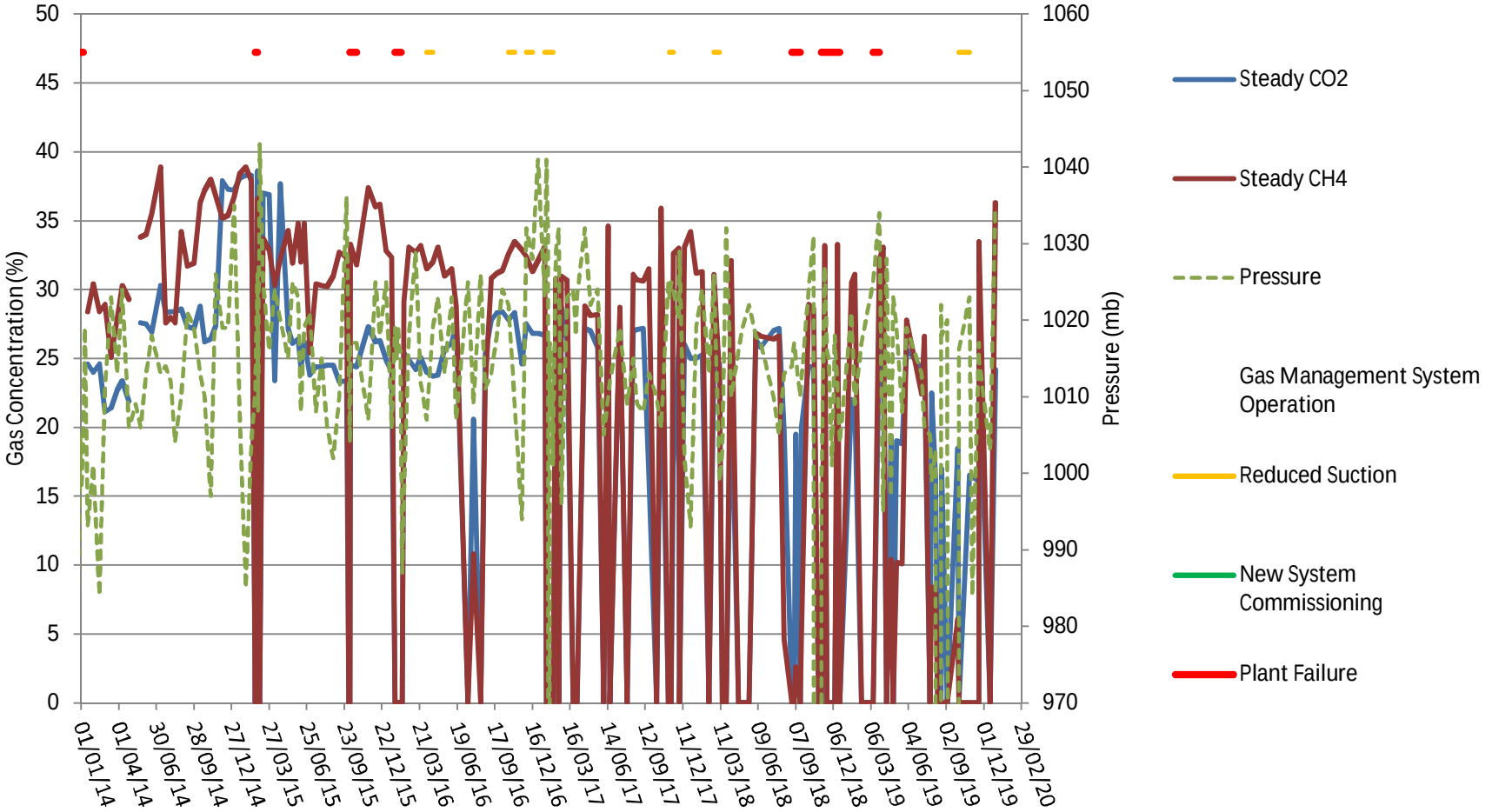


Figure 22: Gas concentration in PBGL6, 2014 - 2019

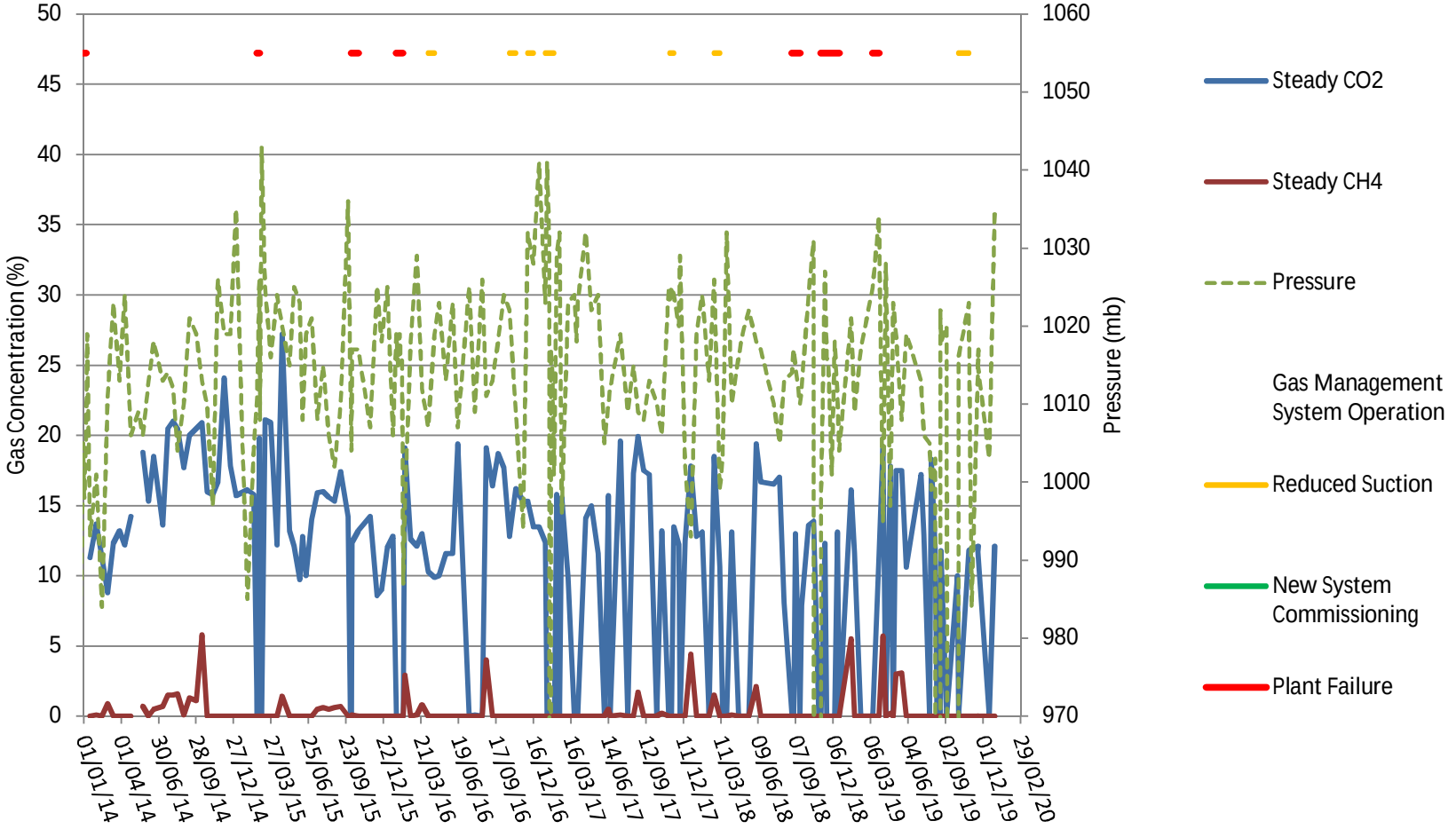


Figure 23: Gas concentration in WELL A, 2014 - 2019

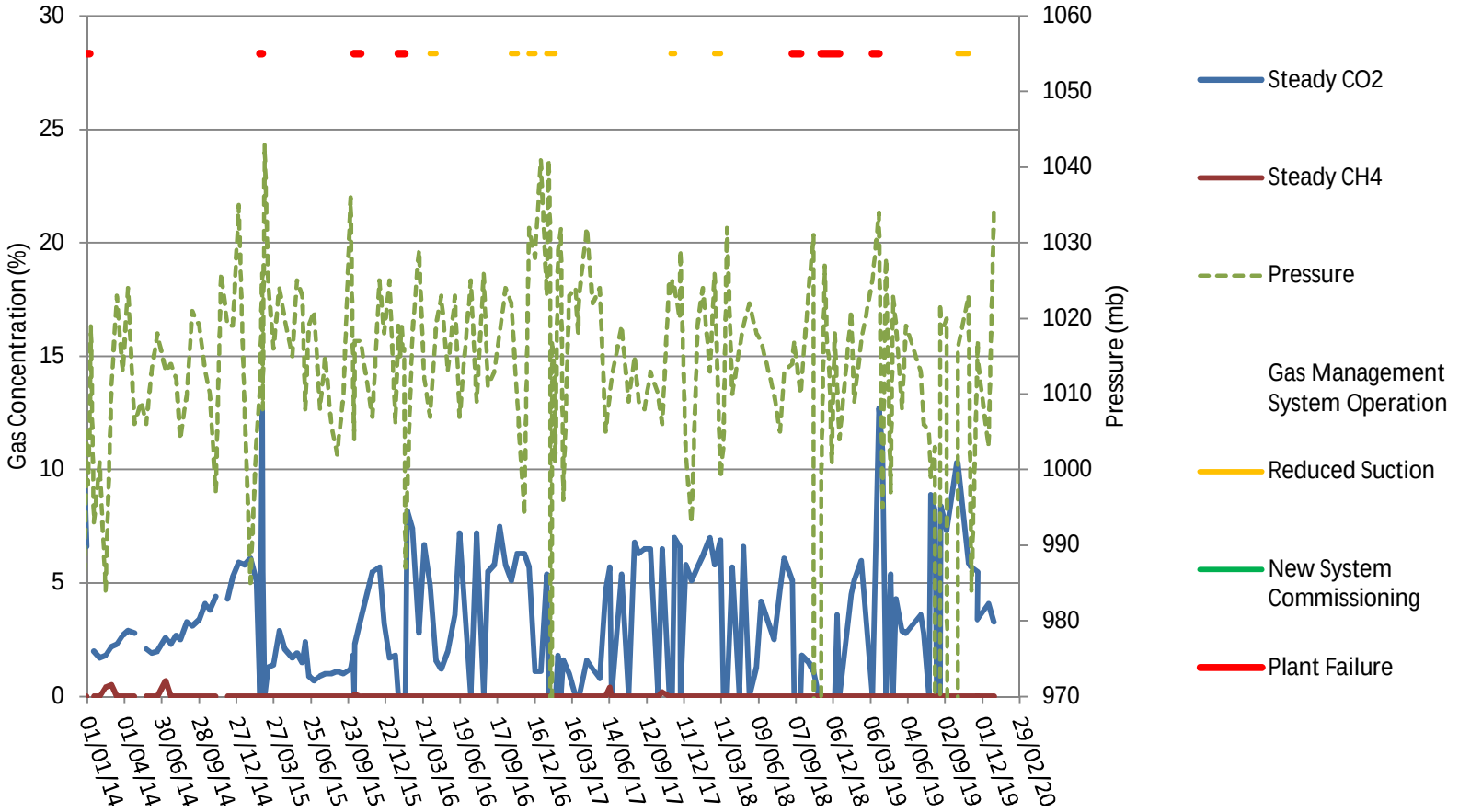


Figure 24: Gas concentration in WELL B, 2014 - 2019

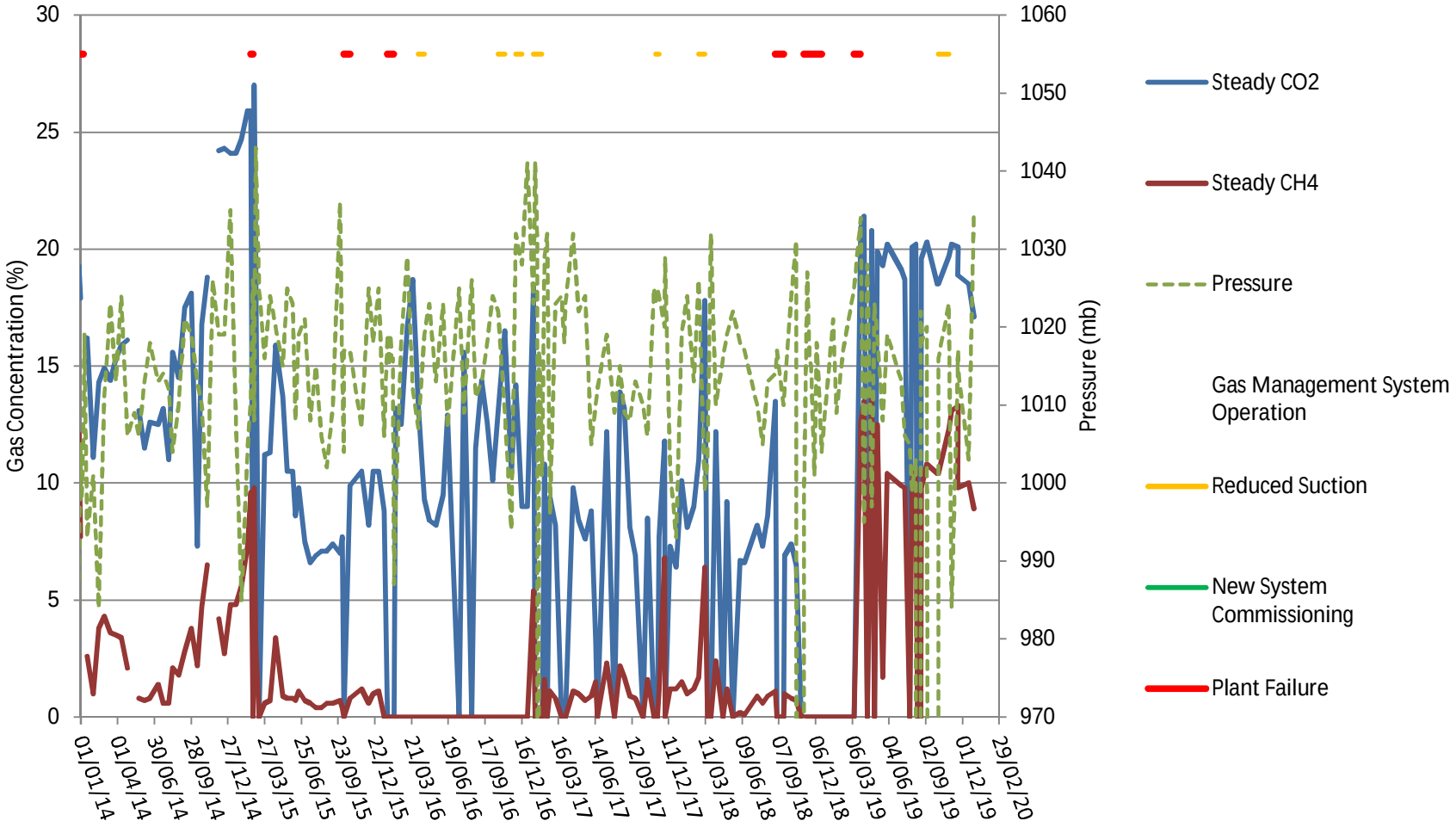


Figure 25: Gas concentration in WELL C, 2014 - 2019

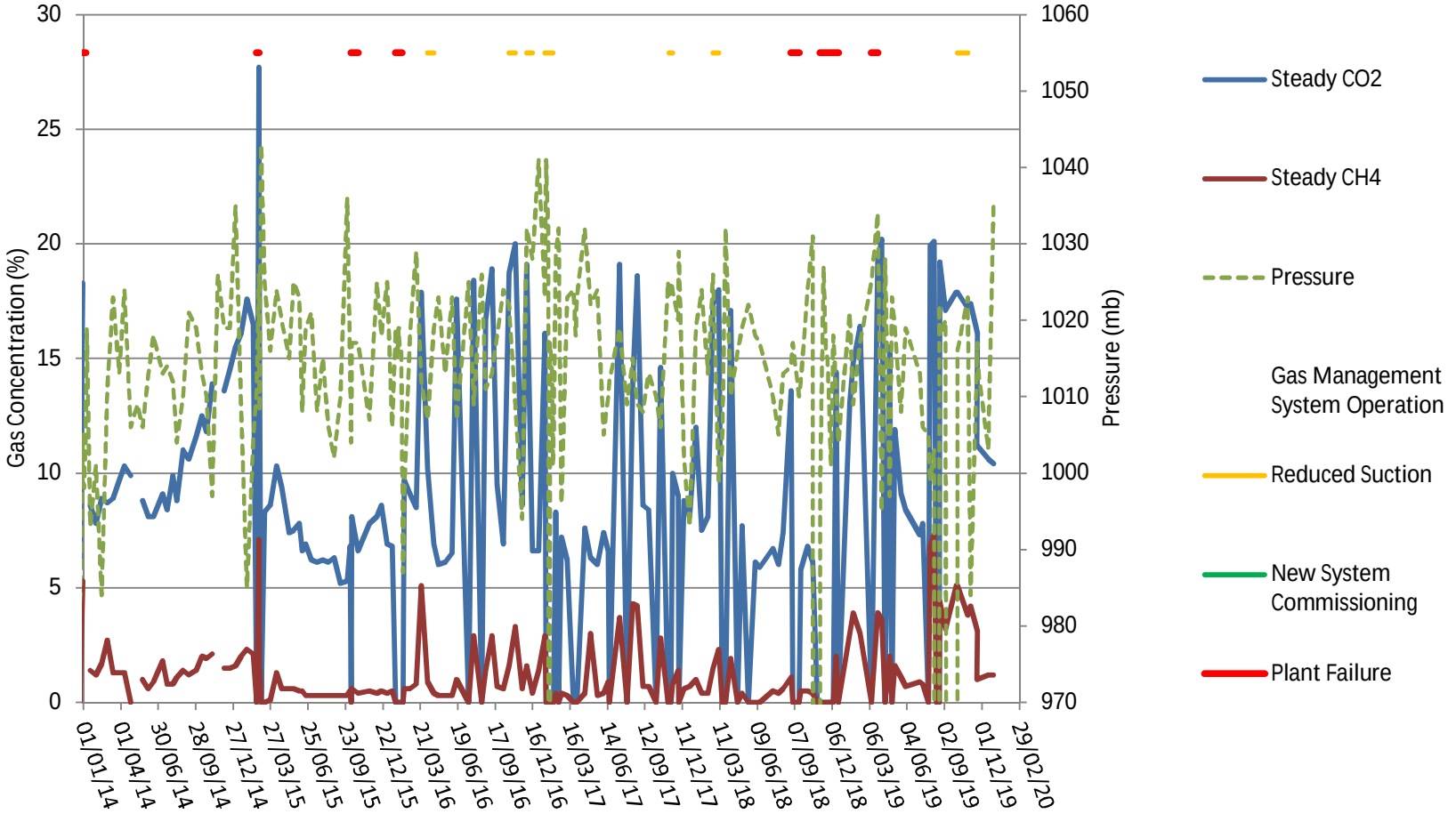


Figure 26: Gas concentration in WELL D 2014 - 2019

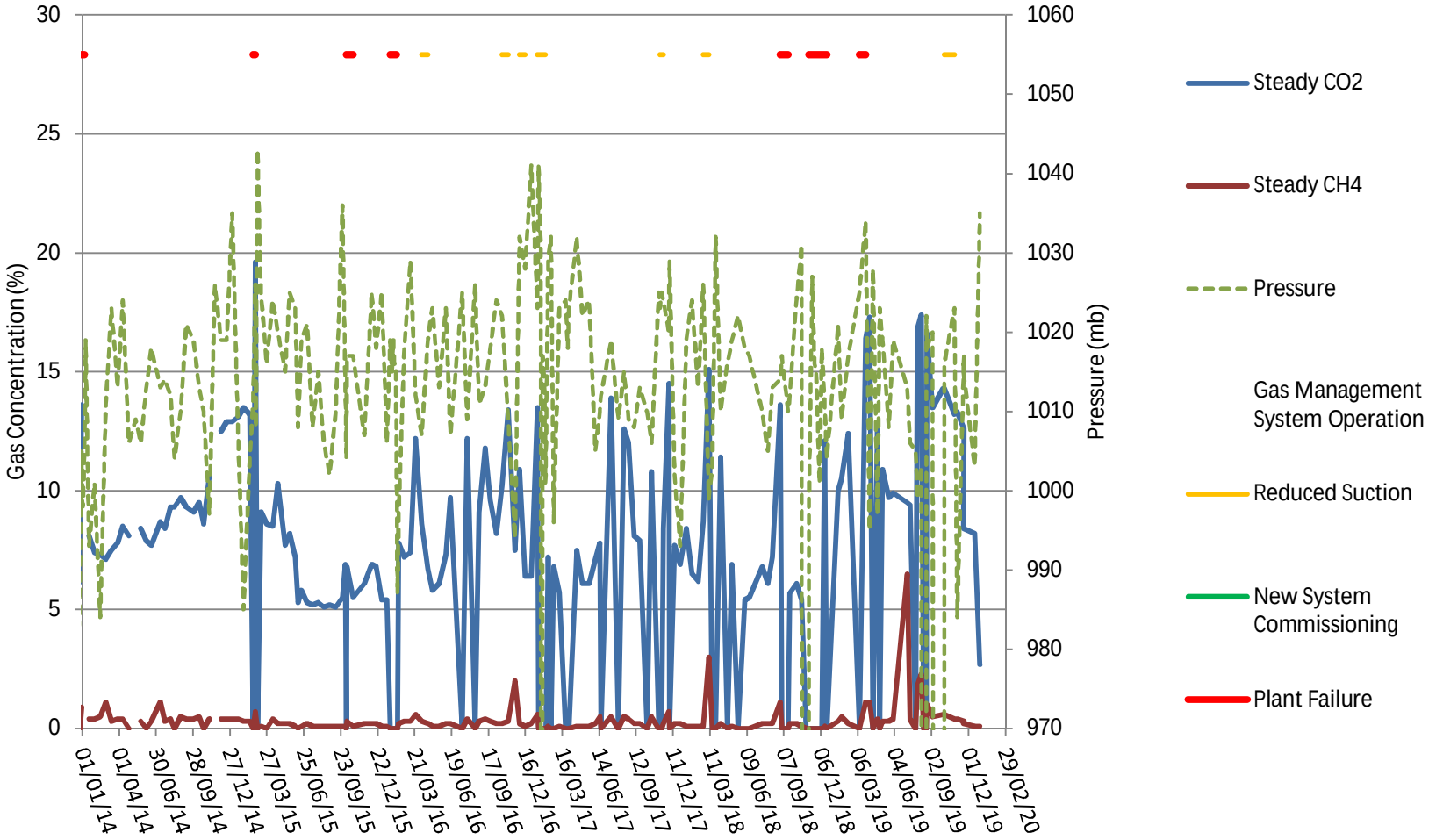


Figure 27: Gas concentration in WELL E, 2014 - 2019

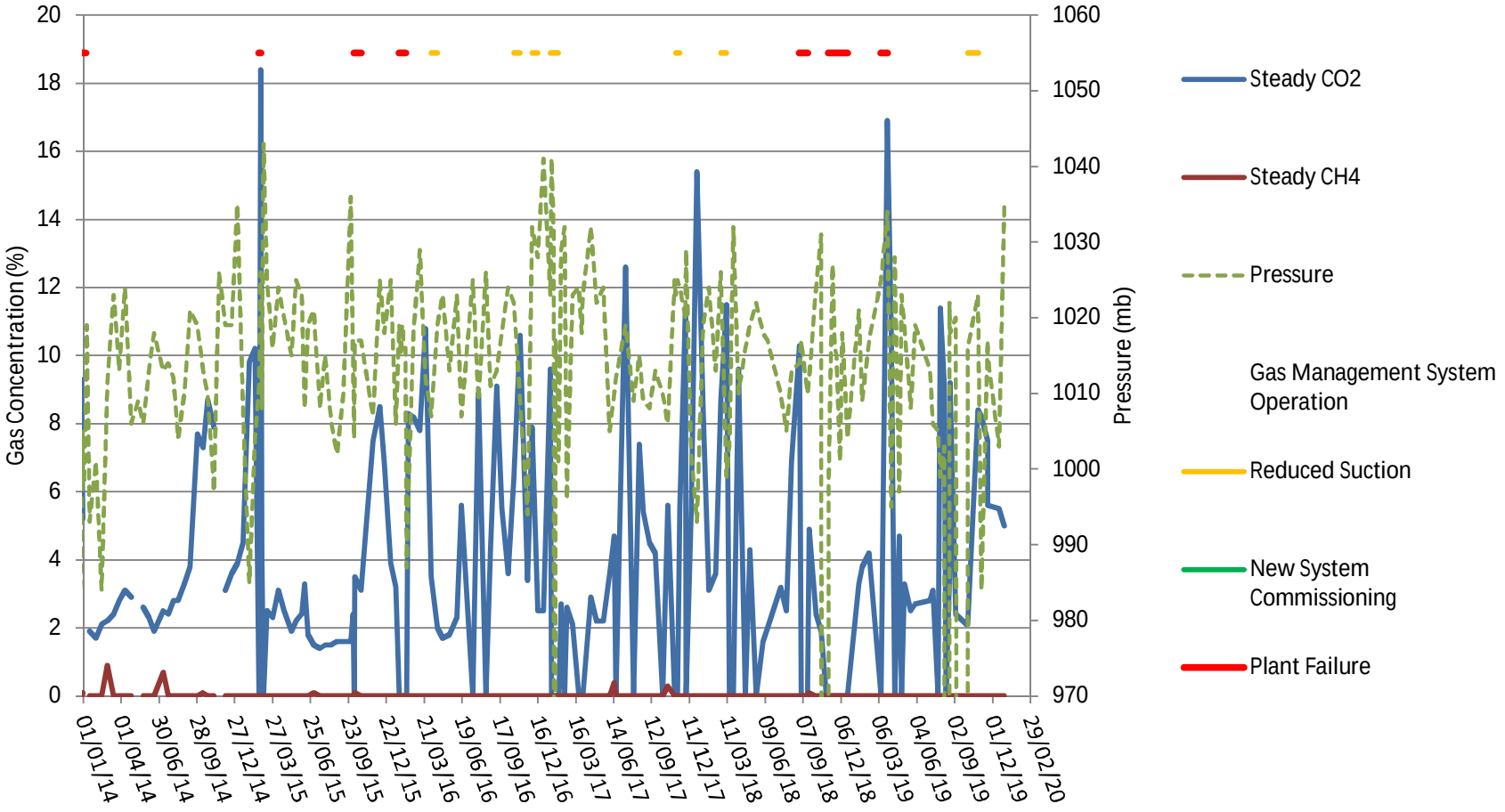
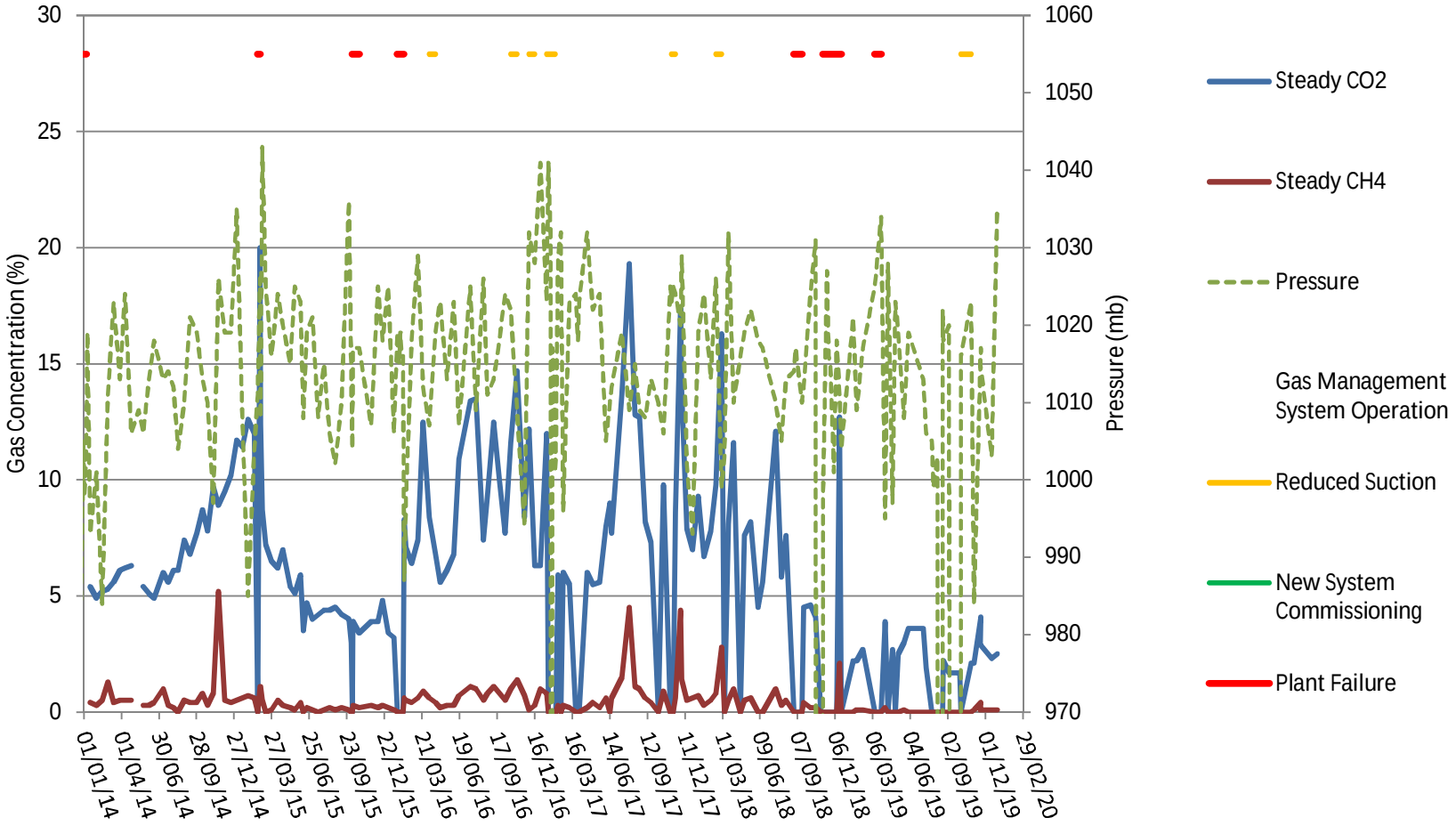


Figure 28: Gas concentration in Line at Plant 2014 - 2019



Appendix A

LABORATORY CERTIFICATES

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
[redacted]

WSP PB BBC
3rd Floor, Kings Orchard,
1 Queen Street
Bristol
Gloucestershire
BS2 0HQ

Attention: Jonathan Tanner

CERTIFICATE OF ANALYSIS

Date of report Generation:	17 July 2019
Customer:	WSP PB BBC
Sample Delivery Group (SDG):	190711-8
Your Reference:	62103511-031
Location:	BAMBER
Report No:	514617

We received 7 samples on Thursday July 11, 2019 and 7 of these samples were scheduled for analysis which was completed on Wednesday July 17, 2019. 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 Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

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.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

[redacted]

Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
20307257	PBGW1	EW	0.00 - 0.00	10/07/2019
20307266	PBGW2	EW	0.00 - 0.00	10/07/2019
20307272	PBGW3	EW	0.00 - 0.00	10/07/2019
20307233	PBGW4	EW	0.00 - 0.00	10/07/2019
20307228	PBGW5	EW	0.00 - 0.00	10/07/2019
20307239	PBSW1	EW	0.00 - 0.00	10/07/2019
20307244	PBSW2	EW	0.00 - 0.00	10/07/2019

Maximum Sample/Coolbox Temperature (°C) : **8.2**

ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

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

Validated

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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)					20307257				20307266				20307272				20307233				20307228	
Customer Sample Reference					PBGW1				PBGW2				PBGW3				PBGW4				PBGW5	
AGS Reference					EW				EW				EW				EW				EW	
Depth (m)					0.00 - 0.00				0.00 - 0.00				0.00 - 0.00				0.00 - 0.00				0.00 - 0.00	
Container					250ml BOD (ALE212)	500ml Plastic (ALE208)	H2SO4 (ALE244)	NaOH (ALE245)	250ml BOD (ALE212)	500ml Plastic (ALE208)	H2SO4 (ALE244)	NaOH (ALE245)	250ml BOD (ALE212)	500ml Plastic (ALE208)	H2SO4 (ALE244)	NaOH (ALE245)	250ml BOD (ALE212)	500ml Plastic (ALE208)	H2SO4 (ALE244)	NaOH (ALE245)	250ml BOD (ALE212)	500ml Plastic (ALE208)	H2SO4 (ALE244)
Sample Type					GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 7					X				X				X				X				X
Anions by ion Chromatography	All	NDPs: 0 Tests: 7				X				X				X				X				X	
Anions by Kone (w)	All	NDPs: 0 Tests: 7				X				X				X				X				X	
BOD True Total	All	NDPs: 0 Tests: 7	X						X				X				X				X		
COD Unfiltered	All	NDPs: 0 Tests: 7	X						X				X				X				X		
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 7		X						X				X				X				X	
Nitrite by Kone (w)	All	NDPs: 0 Tests: 7					X					X				X				X			
pH Value	All	NDPs: 0 Tests: 7		X						X				X				X				X	
pH Value of Filtered Water	All	NDPs: 0 Tests: 7		X						X				X				X				X	

20307244	PBSW2	EW	0.00 - 0.00	NaOH (ALE245)	SW		
				H2SO4 (ALE244)	SW	X	
				500ml Plastic (ALE208)	SW		X
				250ml BOD (ALE212)	SW		X
20307239	PBSW1	EW	0.00 - 0.00	NaOH (ALE245)	SW		X
				H2SO4 (ALE244)	SW	X	
				500ml Plastic (ALE208)	SW		X
				250ml BOD (ALE212)	SW	X	
20307228	PBGW5	EW	0.00 - 0.00	NaOH (ALE245)	GW	X	

Validated

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	PBGW1	PBGW2	PBGW3	PBGW4	PBGW5	PBSW1
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Surface Water (SW)
			Date Sampled	10/07/2019	10/07/2019	10/07/2019	10/07/2019	10/07/2019	10/07/2019
			Sample Time	.	.	.	.	.	.
			Date Received	11/07/2019	11/07/2019	11/07/2019	11/07/2019	11/07/2019	11/07/2019
			SDG Ref	190711-8	190711-8	190711-8	190711-8	190711-8	190711-8
			Lab Sample No.(s)	20307257	20307266	20307272	20307233	20307228	20307239
			AGS Reference	EW	EW	EW	EW	EW	EW
BOD, unfiltered	<1 mg/l	TM045		2.1 #	<1 #	<1 #	<1 #	<1 #	3.32 #
Ammoniacal Nitrogen as N	<200 µg/l	TM099		4450 #	2760 #	8460 #	258 #	<200 #	<200 #
Free Ammonia as N	<200 µg/l	TM099		4360	<200	<200	<200	<200	<200
COD, unfiltered	<7000 µg/l	TM107		53800 #	40200 #	39700 #	17700 #	<7000 #	21800 #
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120		3.47 #	5.48 #	3.16 #	1.82 #	0.992 #	0.731 #
Nitrite as NO2	<50 µg/l	TM184		15700 #	<50 #	<50 #	491 #	<50 #	<50 #
Chloride	<2000 µg/l	TM184		562000 #	1320000 #	365000 #	240000 #	65900 #	66600 #
Nitrate as NO3	<300 µg/l	TM184		14200	418	4100	46200	53700	3310
Sulphate as S	<40 µg/l	TM226		80000 #	224000 #	223000 #	78000 #	42000 #	32200 #
pH	<1 pH Units	TM256		11.1 #	7.95 #	7.38 #	7.7 #	7.89 #	8.19 #
pH (diss.filt)	1 pH Units	TM256		11	8.23	7.72	7.92	7.76	8.24

Validated

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	
			Depth (m)	0.00 - 0.00
			Sample Type	Surface Water (SW)
			Date Sampled	10/07/2019
			Sample Time	.
			Date Received	11/07/2019
			SDG Ref	190711-8
			Lab Sample No.(s)	20307244
			AGS Reference	EW
BOD, unfiltered	<1 mg/l	TM045	3.68	#
Ammoniacal Nitrogen as N	<200 µg/l	TM099	<200	#
Free Ammonia as N	<200 µg/l	TM099	<200	
COD, unfiltered	<7000 µg/l	TM107	11800	#
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120	0.74	#
Nitrite as NO2	<50 µg/l	TM184	51	#
Chloride	<2000 µg/l	TM184	67100	#
Nitrate as NO3	<300 µg/l	TM184	3340	
Sulphate as S	<40 µg/l	TM226	32400	#
pH	<1 pH Units	TM256	7.93	#
pH (diss.filt)	1 pH Units	TM256	8.4	

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM226	In-House Method	Determination of Anions in Waters using Ion Chromatography
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Validated

CERTIFICATE OF ANALYSIS

SDG:	190711-8	**Client Reference:**	62103511-031	**Report Number:**	514617
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	20307257	20307266	20307272	20307233	20307228	20307239	20307244
Customer Sample Ref.	PBGW1	PBGW2	PBGW3	PBGW4	PBGW5	PBSW1	PBSW2
AGS Ref.	EW	EW	EW	EW	EW	EW	EW
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water
Ammoniacal Nitrogen	17-Jul-2019	17-Jul-2019	17-Jul-2019	17-Jul-2019	17-Jul-2019	17-Jul-2019	17-Jul-2019
Anions by ion Chromatography	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019
Anions by Kone (w)	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019
BOD True Total	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019	16-Jul-2019
COD Unfiltered	11-Jul-2019	11-Jul-2019	11-Jul-2019	11-Jul-2019	11-Jul-2019	11-Jul-2019	11-Jul-2019
Conductivity (at 20 deg.C)	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019
Nitrite by Kone (w)	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019
pH Value	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019
pH Value of Filtered Water	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019	12-Jul-2019

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 30 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 one month 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. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

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. **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.

18. **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**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**

19. **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 (2005), 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

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials 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 (2005).

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, based on HSG 248 (2005).

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.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2107).*

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.

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
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email: hawardencustomerservices@alsglobal.com
[redacted]

WSP PB BBC
3rd Floor, Kings Orchard,
1 Queen Street
Bristol
Gloucestershire
BS2 0HQ

Attention: Jonathan Tanner

CERTIFICATE OF ANALYSIS

Date of report Generation:	16 March 2020
Customer:	WSP PB BBC
Sample Delivery Group (SDG):	200306-150
Your Reference:	62103511-031
Location:	BAMBER
Report No:	546001

We received 6 samples on Friday March 06, 2020 and 6 of these samples were scheduled for analysis which was completed on Monday March 16, 2020. 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 Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

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:

[redacted]

Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
21836210	PBGW1	EW	0.00 - 0.00	04/03/2020
21836223	PBGW2	EW	0.00 - 0.00	04/03/2020
21836237	PBGW3	EW	0.00 - 0.00	04/03/2020
21836255	PBGW4	EW	0.00 - 0.00	04/03/2020
21836270	PBGW5	EW	0.00 - 0.00	04/03/2020
21836284	PBSW1	EW	0.00 - 0.00	04/03/2020

Maximum Sample/Coolbox Temperature (°C) : 5.2

ISO5667-3 Water quality - Sampling - Part3 -
During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

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

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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)			21836210							21836223							21836237					
Customer Sample Reference			PBGW1							PBGW2							PBGW3					
AGS Reference			EW							EW							EW					
Depth (m)			0.00 - 0.00							0.00 - 0.00							0.00 - 0.00					
Container			0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)
Sample Type			GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 6			X							X							X			
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 6				X							X							X		
Anions by Kone (w)	All	NDPs: 0 Tests: 6			X							X							X			
BOD True Total	All	NDPs: 0 Tests: 6			X							X							X			
COD Unfiltered	All	NDPs: 0 Tests: 6			X							X							X			
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 6			X							X							X			
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6						X							X							X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6					X							X							X	
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 6		X							X							X				
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 6		X							X							X				
GRO by GC-FID (W)	All	NDPs: 0 Tests: 6							X							X						
Mercury Dissolved	All	NDPs: 0 Tests: 6					X							X							X	
Nitrite by Kone (w)	All	NDPs: 0 Tests: 6						X							X							X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 6		X							X							X				
pH Value	All	NDPs: 0 Tests: 6			X							X							X			

21836284	PBSW1	EW	0.00 - 0.00	HNO3 Filtered (ALE204)	SW									X				X				
				H2SO4 (ALE244)	SW		X															
				500ml Plastic (ALE208)	SW	X		X	X	X	X											X
				250ml Amber Gl. PTFE/PE	SW										X	X					X	
				0.5l glass bottle (ALE227)	SW																	
21836270	PBGW5	EW	0.00 - 0.00	Vial (ALE297)	GW												X					
				NaOH (ALE245)	GW							X							X			
				HNO3 Filtered (ALE204)	GW									X				X				
				H2SO4 (ALE244)	GW		X															
				500ml Plastic (ALE208)	GW	X		X	X	X	X											X
				250ml Amber Gl. PTFE/PE	GW										X	X					X	
				0.5l glass bottle (ALE227)	GW																	
21836255	PBGW4	EW	0.00 - 0.00	Vial (ALE297)	GW												X					
				NaOH (ALE245)	GW							X							X			
				HNO3 Filtered (ALE204)	GW									X				X				
				H2SO4 (ALE244)	GW		X															
				500ml Plastic (ALE208)	GW	X		X	X	X	X											X
				250ml Amber Gl. PTFE/PE	GW										X	X					X	
				0.5l glass bottle (ALE227)	GW																	
21836237	PBGW3	EW	0.00 - 0.00	Vial (ALE297)	GW												X					

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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)			21836210							21836223								21836237						
Customer Sample Reference			PBGW1							PBGW2								PBGW3						
AGS Reference			EW							EW								EW						
Depth (m)			0.00 - 0.00							0.00 - 0.00								0.00 - 0.00						
Container			0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)	Vial (ALE297)	0.5l glass bottle (ALE227)	250ml Amber Gl. PTFE/PE	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	NaOH (ALE245)			
Sample Type			GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW			
Phosphate by Kone (w)	All	NDPs: 0 Tests: 6			X							X							X						
SVOC MS (W) - Aqueous	All	NDPs: 0 Tests: 6	X							X							X								
TPH CWG (W)	All	NDPs: 0 Tests: 6	X							X							X								
VOC MS (W)	All	NDPs: 0 Tests: 6							X							X									

21836284	PBSW1	EW	0.00 - 0.00	HNO3 Filtered (ALE204)	SW					
				H2SO4 (ALE244)	SW					
				500ml Plastic (ALE208)	SW	X				
				250ml Amber Gl. PTFE/PE	SW					
				0.5l glass bottle (ALE227)	SW		X	X		
21836270	PBGW5	EW	0.00 - 0.00	Vial (ALE297)	GW					X
				NaOH (ALE245)	GW					
				HNO3 Filtered (ALE204)	GW					
				H2SO4 (ALE244)	GW					
				500ml Plastic (ALE208)	GW	X				
				250ml Amber Gl. PTFE/PE	GW					
				0.5l glass bottle (ALE227)	GW		X	X		
21836255	PBGW4	EW	0.00 - 0.00	Vial (ALE297)	GW					X
				NaOH (ALE245)	GW					
				HNO3 Filtered (ALE204)	GW					
				H2SO4 (ALE244)	GW					
				500ml Plastic (ALE208)	GW	X				
				250ml Amber Gl. PTFE/PE	GW					
				0.5l glass bottle (ALE227)	GW		X	X		
21836237	PBGW3	EW	0.00 - 0.00	Vial (ALE297)	GW					X

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

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)			21836284		
Customer Sample Reference			PBSW1		
AGS Reference			EW		
Depth (m)			0.00 - 0.00		
Container			NaOH (ALE245)	Vial (ALE297)	
Sample Type			SW	SW	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6	X		
GRO by GC-FID (W)	All	NDPs: 0 Tests: 6		X	
Nitrite by Kone (w)	All	NDPs: 0 Tests: 6	X		
VOC MS (W)	All	NDPs: 0 Tests: 6		X	

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS 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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	Depth (m)	Sample Type	Date Sampled	Sampled Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
Alkalinity, Total as CaCO3	<2000 µg/l	TM043	989000 #	543000 #	416000 #	328000 #	296000 #
BOD, unfiltered	<1 mg/l	TM045	4.56 #	2.2 #	<1 #	<1 #	<1 #
Ammoniacal Nitrogen as N	<200 µg/l	TM099	8270 #	1880 #	4250 #	452 #	<200 #
COD, unfiltered	<7000 µg/l	TM107	117000 #	69300 #	26300 #	22700 #	12200 #
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120	4.28 #	5.34 #	2.87 #	1.81 #	0.918 #
Arsenic (diss.filt)	<0.5 µg/l	TM152	638 #	563 #	748 #	2.69 #	0.537 #
Cadmium (diss.filt)	<0.08 µg/l	TM152	<0.08 #	<0.08 #	<0.08 #	<0.08 #	<0.08 #
Chromium (diss.filt)	<1 µg/l	TM152	6.01 #	<1 #	<1 #	1.46 #	<1 #
Copper (diss.filt)	<0.3 µg/l	TM152	1.09 #	<0.3 #	7.3 #	3.04 #	1.52 #
Lead (diss.filt)	<0.2 µg/l	TM152	0.374 #	<0.2 #	0.416 #	0.322 #	0.795 #
Nickel (diss.filt)	<0.4 µg/l	TM152	27.6 #	6.78 #	14.8 #	4.06 #	3.7 #
Zinc (diss.filt)	<1 µg/l	TM152	1.78 #	4.6 #	126 #	146 #	3.34 #
Sodium (Dis.Filt)	<76 µg/l	TM152	1020000 #	1160000 #	361000 #	107000 #	37000 #
Magnesium (Dis.Filt)	<36 µg/l	TM152	38.4 #	34400 #	40700 #	9730 #	8150 #
Potassium (Dis.Filt)	<200 µg/l	TM152	30300 #	74400 #	131000 #	273000 #	67200 #
Calcium (Dis.Filt)	<200 µg/l	TM152	1420 #	53200 #	168000 #	104000 #	140000 #
Iron (Dis.Filt)	<19 µg/l	TM152	<19 #	535 #	24.2 #	<19 #	26.7 #
Mercury (diss.filt)	<0.01 µg/l	TM183	0.0642 #	<0.01 #	0.0141 #	<0.01 #	<0.01 #
Phosphate (Ortho as PO4)	<50 µg/l	TM184	1370 #	353 #	834 #	81 #	<50 #
Sulphate	<2000 µg/l	TM184	322000 #	637000 #	501000 #	255000 #	116000 #
Chloride	<2000 µg/l	TM184	796000 #	1320000 #	490000 #	228000 #	59800 #
Nitrite as N	<15.2 µg/l	TM184	2350 #	<15.2 #	<15.2 #	97.4 #	<15.2 #
Nitrate as N	<67.7 µg/l	TM184	2830	74.9	3560	10700	13200
Cyanide, Total	<50 µg/l	TM227	<50 #	<50 #	<50 #	<50 #	<50 #
pH	<1 pH Units	TM256	11.1 #	8 #	8.07 #	7.99 #	7.94 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
259000 #
2.35 #
<200 #
21200 #
0.795 #
0.769 #
<0.08 #
<1 #
0.759 #
<0.2 #
2.69 #
3.33 #
30300 #
8790 #
57300 #
110000 #
<19 #
<0.01
<50 #
107000 #
61700 #
16.4 #
4350
<50
8.33 #

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS 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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	Depth (m)	Sample Type	Date Sampled	Sampled Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
Naphthalene (aq)	<0.01 µg/l	TM178	0.05 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #
Acenaphthene (aq)	<0.005 µg/l	TM178	0.00902 #	0.00906 #	<0.005 #	<0.005 #	<0.005 #
Acenaphthylene (aq)	<0.005 µg/l	TM178	<0.005 #	<0.005 #	<0.005 #	<0.005 #	<0.005 #
Fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	0.157 #	<0.005 #	<0.005 #	<0.005 #
Anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0188 #	<0.005 #	<0.005 #	<0.005 #
Phenanthrene (aq)	<0.005 µg/l	TM178	0.0104 #	0.0557 #	<0.005 #	<0.005 #	<0.005 #
Fluorene (aq)	<0.005 µg/l	TM178	0.00785 #	0.00544 #	<0.005 #	<0.005 #	<0.005 #
Chrysene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0741 #	<0.005 #	<0.005 #	<0.005 #
Pyrene (aq)	<0.005 µg/l	TM178	<0.005 #	0.164 #	<0.005 #	<0.005 #	<0.005 #
Benzo(a)anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0828 #	<0.005 #	<0.005 #	<0.005 #
Benzo(b)fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	0.104 #	<0.005 #	<0.005 #	<0.005 #
Benzo(k)fluoranthene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0471 #	<0.005 #	<0.005 #	<0.005 #
Benzo(a)pyrene (aq)	<0.002 µg/l	TM178	<0.002 #	0.0819 #	<0.002 #	<0.002 #	<0.002 #
Dibenzo(a,h)anthracene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0132 #	<0.005 #	<0.005 #	<0.005 #
Benzo(g,h,i)perylene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0627 #	<0.005 #	<0.005 #	<0.005 #
Indeno(1,2,3-cd)pyrene (aq)	<0.005 µg/l	TM178	<0.005 #	0.0448 #	<0.005 #	<0.005 #	<0.005 #
PAH, Total Detected USEPA 16 (aq)	<0.082 µg/l	TM178	<0.082 #	0.921 #	<0.082 #	<0.082 #	<0.082 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
<0.01 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.005 #
<0.002 #
<0.005 #
<0.005 #
<0.005 #
<0.082 #

SVOC MS (W) - Aqueous

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

SVOC MS (W) - Aqueous

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS 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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	Depth (m)	Sample Type	Date Sampled	Sampled Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

SVOC MS (W) - Aqueous

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
1,2,4-Trichlorobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
1,2-Dichlorobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
1,3-Dichlorobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
1,4-Dichlorobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,4,5-Trichlorophenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,4,6-Trichlorophenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,4-Dichlorophenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,4-Dimethylphenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,4-Dinitrotoluene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2,6-Dinitrotoluene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Chloronaphthalene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Chlorophenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Methylnaphthalene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Methylphenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Nitroaniline (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
2-Nitrophenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
3-Nitroaniline (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Bromophenylphenylether (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Chloro-3-methylphenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Chloroaniline (aq)	<1 µg/l	TM176	<8	<1	<1	<1	<1
4-Chlorophenylphenylether (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Methylphenol (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Nitroaniline (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
4-Nitrophenol (aq)	<1 µg/l	TM176	<8	<1	<1	<1	<1
Azobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Acenaphthylene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Acenaphthene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Anthracene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
bis(2-Chloroethyl)ether (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
bis(2-Chloroethoxy)methane (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
bis(2-Ethylhexyl) phthalate (aq)	<2 µg/l	TM176	<16 #	<2 #	<2 #	<2 #	<2 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
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<1 #
<1 #
<1
<1 #
<1 #
<1 #
<1
<1 #
<1 #
<1 #
<1 #
<1 #
<2 #

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
Butylbenzyl phthalate (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Benzo(a)anthracene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Benzo(b)fluoranthene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Benzo(k)fluoranthene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Benzo(a)pyrene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Benzo(g,h,i)perylene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Carbazole (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Chrysene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Dibenzofuran (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
n-Dibutyl phthalate (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Diethyl phthalate (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Dibenzo(a,h)anthracene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Dimethyl phthalate (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
n-Dioctyl phthalate (aq)	<5 µg/l	TM176	<40 #	<5 #	<5 #	<5 #	<5 #
Fluoranthene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Fluorene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Hexachlorobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Hexachlorobutadiene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Pentachlorophenol (aq)	<1 µg/l	TM176	<8	<1	<1	<1	<1
Phenol (aq)	<1 µg/l	TM176	<8	<1	<1	<1	<1
n-Nitroso-n-dipropylamine (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Hexachloroethane (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Nitrobenzene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Naphthalene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Isophorone (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Hexachlorocyclopentadiene (aq)	<1 µg/l	TM176	<8	<1	<1	<1	<1
Phenanthrene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Indeno(1,2,3-cd)pyrene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #
Pyrene (aq)	<1 µg/l	TM176	<8 #	<1 #	<1 #	<1 #	<1 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<1 #
<5 #
<1 #
<1 #
<1 #
<1 #
<1
<1
<1 #
<1 #
<1 #
<1 #
<1 #
<1
<1 #
<1 #
<1 #

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

TPH CWG (W)

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

TPH CWG (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS 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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	Depth (m)	Sample Type	Date Sampled	Sampled Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

TPH CWG (W)

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
GRO Surrogate % recovery**	%	TM245	100	94	96	96	90
GRO >C5-C12	<50 µg/l	TM245	<50 #	<50 #	<50 #	<50 #	<50 #
Aliphatics >C5-C6	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aromatics >EC5-EC7	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aromatics >EC10-EC12	<10 µg/l	TM245	<10	<10	<10	<10	<10
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aliphatics >C16-C35 Aqueous	<10 µg/l	TM174	<10	<10	<10	<10	<10
Aromatics >EC16-EC35 (aq)	<10 µg/l	TM174	<10	<10	<10	<10	<10

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
94
<50 #
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10
<10

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

VOC MS (W)

Validated

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

VOC MS (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS 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
1-3+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	Depth (m)	Sample Type	Date Sampled	Sampled Time	Date Received	SDG Ref	Lab Sample No.(s)	AGS Reference

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

VOC MS (W)

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
Dibromofluoromethane**	%	TM208	18.6	112	117	115	114
Toluene-d8**	%	TM208	100	102	100	101	101
4-Bromofluorobenzene**	%	TM208	98.7	100	100	101	101
Dichlorodifluoromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Chloromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Vinyl chloride	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Bromomethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Chloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Trichlorofluoromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1-Dichloroethene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Carbon disulphide	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Dichloromethane	<3 µg/l	TM208	<3 #	<3 #	<3 #	<3 #	<3 #
Methyl tertiary butyl ether (MTBE)	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
trans-1,2-Dichloroethene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1-Dichloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
cis-1,2-Dichloroethene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
2,2-Dichloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1
Bromochloromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Chloroform	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1,1-Trichloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1-Dichloropropene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Carbontetrachloride	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2-Dichloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Benzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Trichloroethene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2-Dichloropropane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Dibromomethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Bromodichloromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
cis-1,3-Dichloropropene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Toluene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
trans-1,3-Dichloropropene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
112
101
101
<1 #
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<1 #
<3 #
<1 #
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CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
1,1,2-Trichloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,3-Dichloropropane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Tetrachloroethene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Dibromochloromethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2-Dibromoethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Chlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1,1,2-Tetrachloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Ethylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
m,p-Xylene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
o-Xylene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Styrene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Bromoform	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Isopropylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,1,2,2-Tetrachloroethane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2,3-Trichloropropane	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Bromobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Propylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
2-Chlorotoluene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,3,5-Trimethylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
4-Chlorotoluene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
tert-Butylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2,4-Trimethylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
sec-Butylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
4-iso-Propyltoluene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,3-Dichlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,4-Dichlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
n-Butylbenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2-Dichlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2-Dibromo-3-chloropropane	<1 µg/l	TM208	<1	<1	<1	<1	<1
1,2,4-Trichlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
Hexachlorobutadiene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
tert-Amyl methyl ether (TAME)	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
<1 #
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CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

			PBGW1 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836210 EW	PBGW2 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836223 EW	PBGW3 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836237 EW	PBGW4 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836255 EW	PBGW5 0.00 - 0.00 Ground Water (GW) 04/03/2020 . 06/03/2020 200306-150 21836270 EW
Naphthalene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,2,3-Trichlorobenzene	<1 µg/l	TM208	<1 #	<1 #	<1 #	<1 #	<1 #
1,3,5-Trichlorobenzene	<1 µg/l	TM208	<1	<1	<1	<1	<1
Sum of detected Xylenes	<2 µg/l	TM208	<2	<2	<2	<2	<2

PBSW1 0.00 - 0.00 Surface Water (SW) 04/03/2020 . 06/03/2020 200306-150 21836284 EW
<1 #
<1 #
<1
<2

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID
TM176	EPA 8270D Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Determination of SVOCs in Water by GCMS
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate
TM245	By GC-FID	Determination of GRO by Headspace in waters
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	21836210	21836223	21836237	21836255	21836270	21836284
Customer Sample Ref.	PBGW1	PBGW2	PBGW3	PBGW4	PBGW5	PBSW1
AGS Ref.	EW	EW	EW	EW	EW	EW
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water
Alkalinity as CaCO3	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020
Ammoniacal Nitrogen	10-Mar-2020	10-Mar-2020	10-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020
Anions by Kone (w)	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020
BOD True Total	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020
COD Unfiltered	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020
Conductivity (at 20 deg.C)	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020
Cyanide Comp/Free/Total/Thiocyanate	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020
Dissolved Metals by ICP-MS	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020
EPH CWG (Aliphatic) Aqueous GC (W)	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020
EPH CWG (Aromatic) Aqueous GC (W)	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020
GRO by GC-FID (W)	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020
Mercury Dissolved	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020
Nitrite by Kone (w)	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020	10-Mar-2020
PAH Spec MS - Aqueous (W)	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020
pH Value	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020	12-Mar-2020
Phosphate by Kone (w)	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020	09-Mar-2020
SVOC MS (W) - Aqueous	16-Mar-2020	16-Mar-2020	16-Mar-2020	16-Mar-2020	16-Mar-2020	13-Mar-2020
TPH CWG (W)	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020	14-Mar-2020
VOC MS (W)	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020	11-Mar-2020

CERTIFICATE OF ANALYSIS

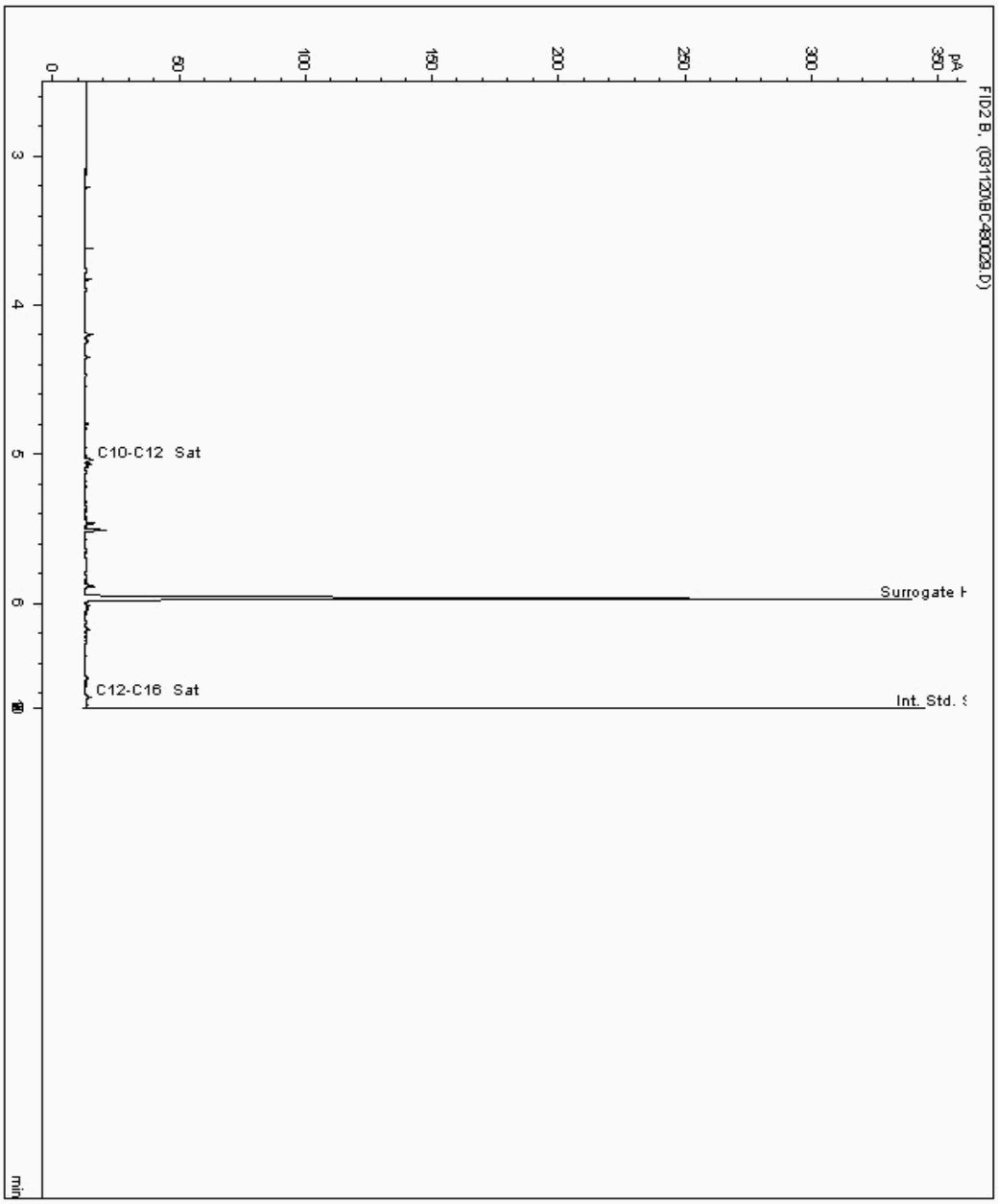
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837072 **Sample ID :** PBGW5 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506137-
Date Acquired : 12/03/2020 07:21:04 PM
Units : ppb
Dilution : SE PBGW5[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

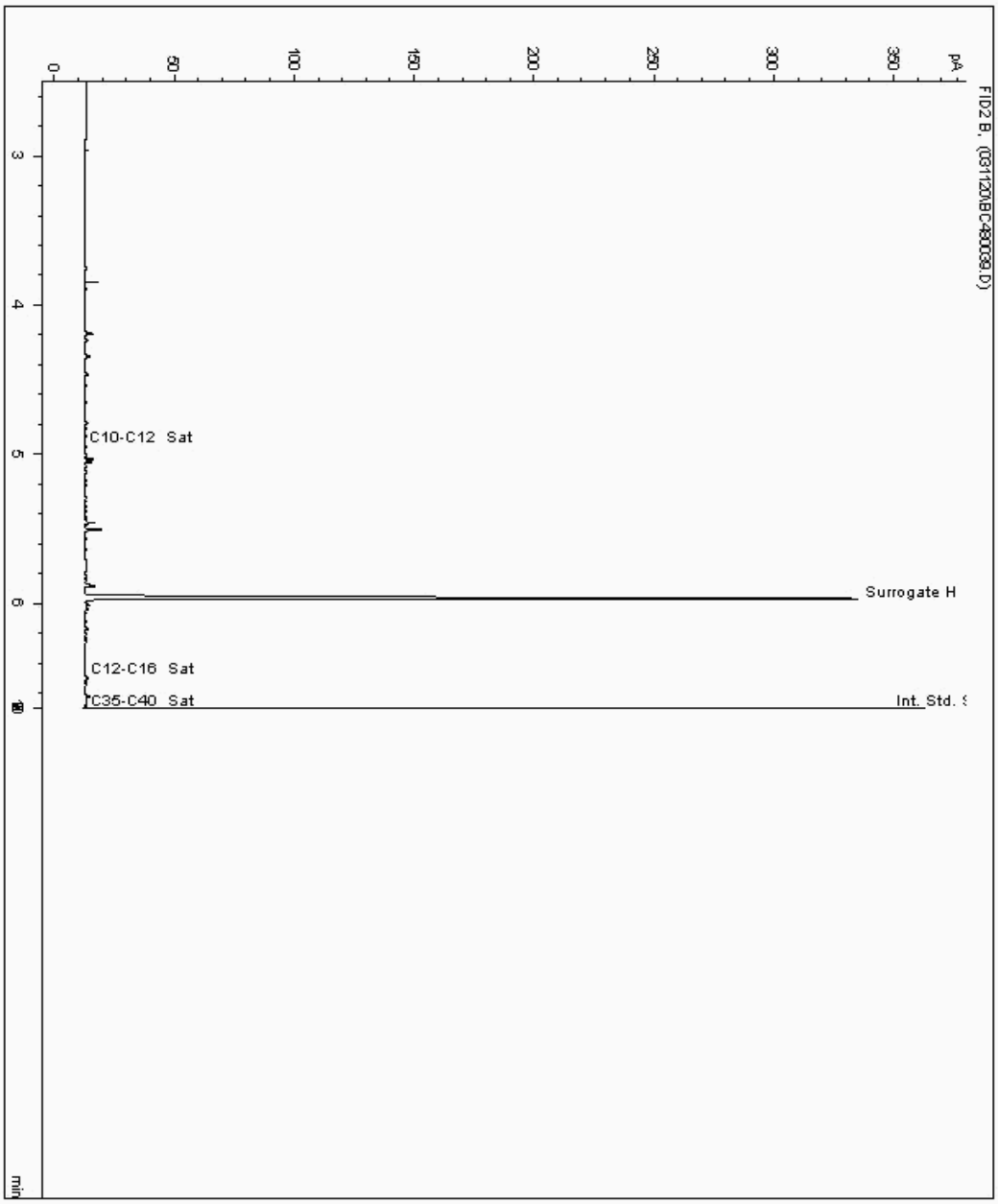
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837074 **Sample ID :** PBGW4 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506106-
Date Acquired : 12/03/2020 11:05:13 PM
Units : ppb
Dilution : SE PBGW4[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

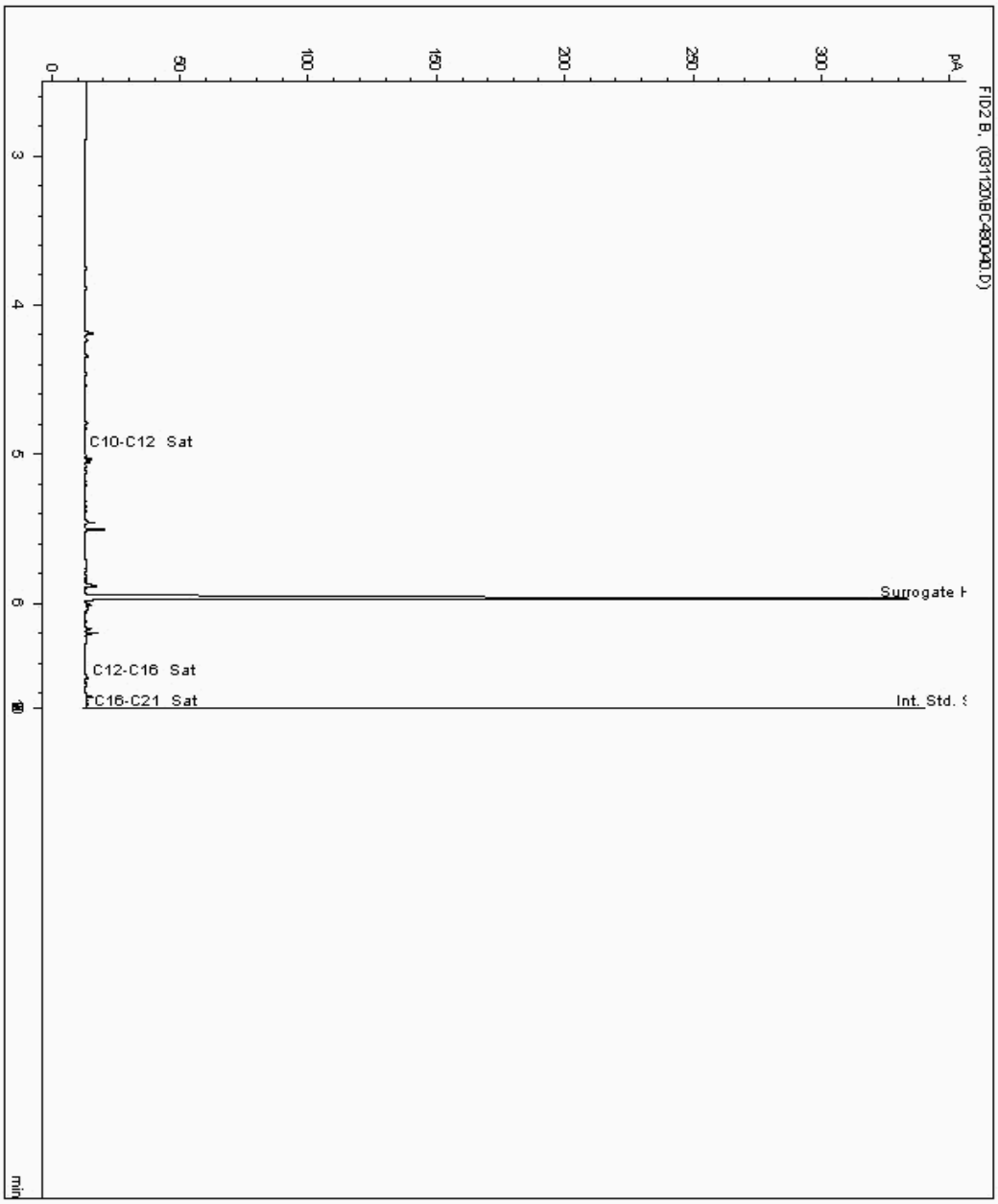
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837075 **Sample ID :** PBSW1 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506160-
Date Acquired : 12/03/2020 11:27:45 PM
Units : ppb
Dilution : SE PBSW1[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

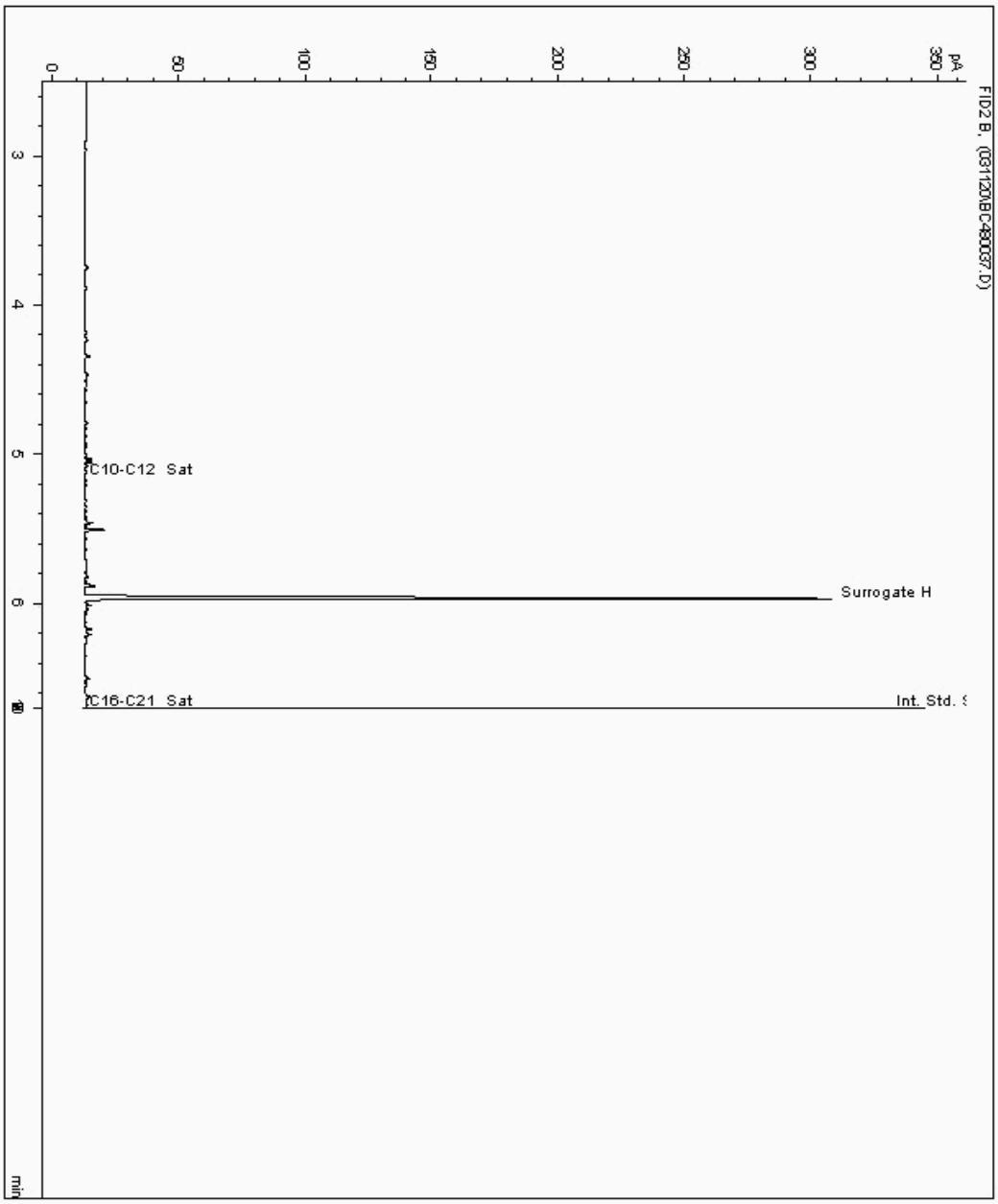
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837157 **Sample ID :** PBGW2 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506064-
Date Acquired : 12/03/2020 10:20:08 PM
Units : ppb
Dilution : SE PBGW2[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

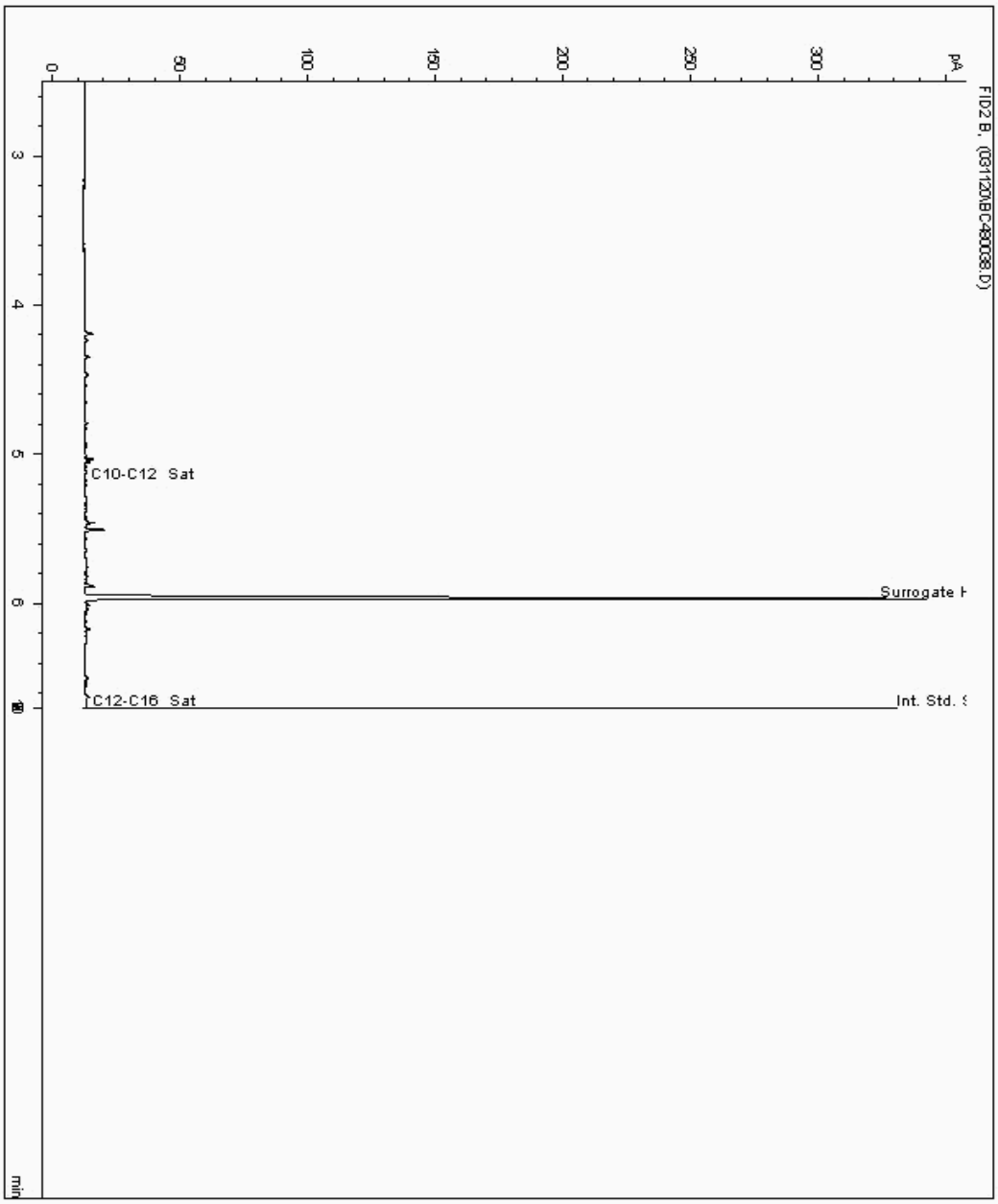
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837158 **Sample ID :** PBGW1 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506033-
Date Acquired : 12/03/2020 10:42:45 PM
Units : ppb
Dilution : SE PBGW1[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

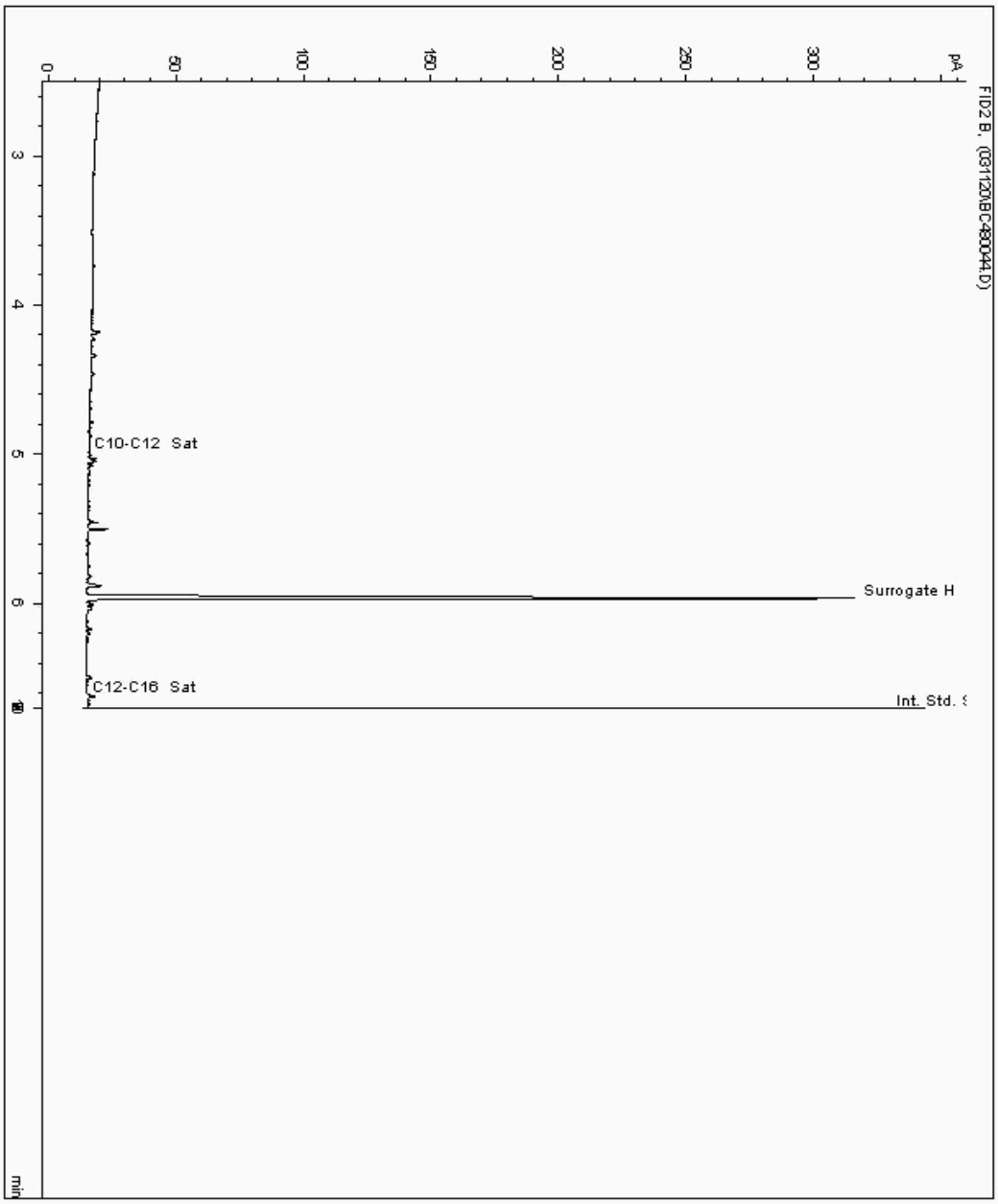
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aliphatic) Aqueous GC (W) **Sample No :** 21837159 **Sample ID :** PBGW3 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 20506085-
Date Acquired : 12/03/2020 12:58:24 PM
Units : ppb
Dilution : SE PBGW3[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

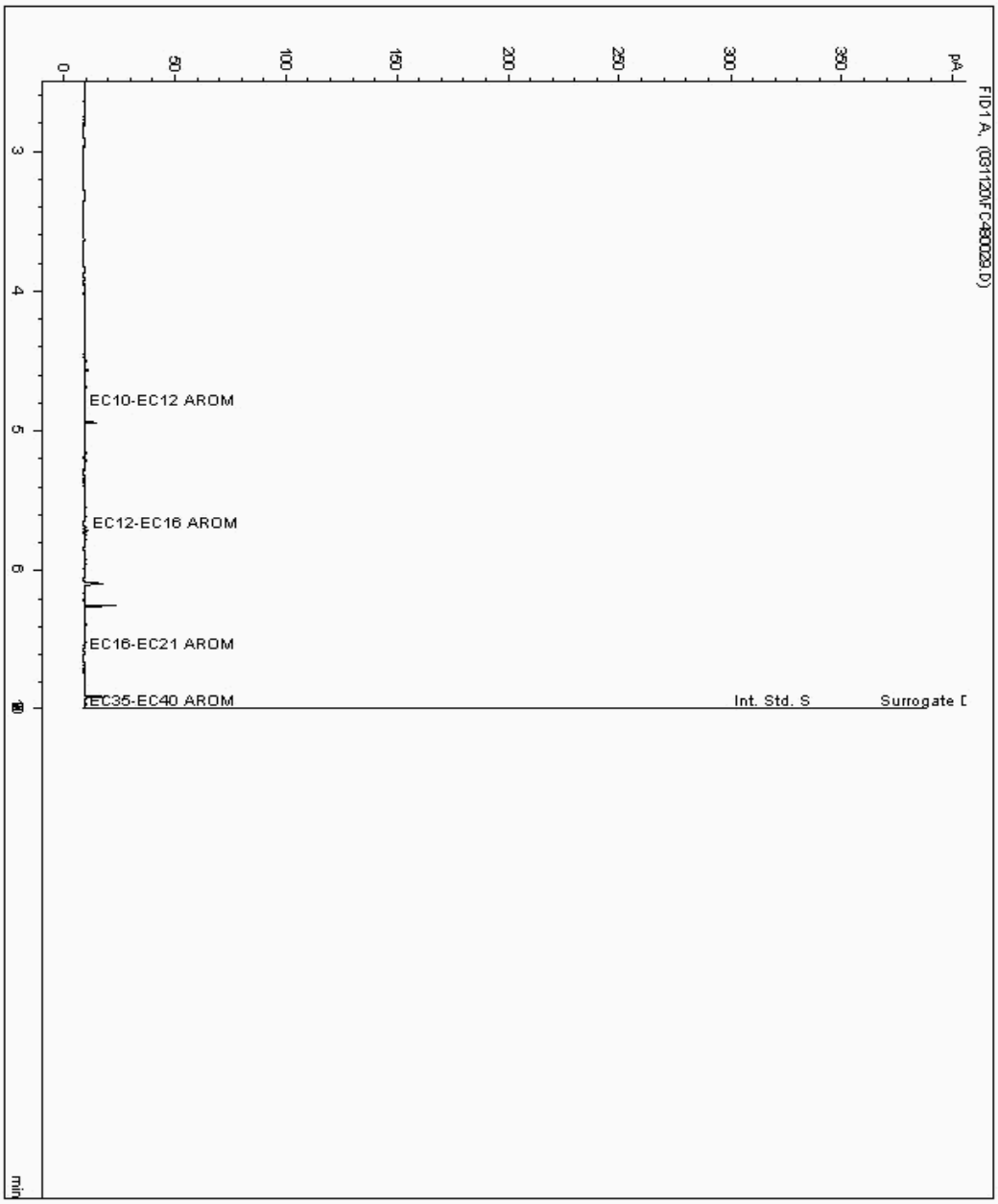
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837072 **Sample ID :** PBGW5 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506138-
Date Acquired : 12/03/2020 07:21:04 PM
Units : ppb
Dilution : SE PBGW5[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

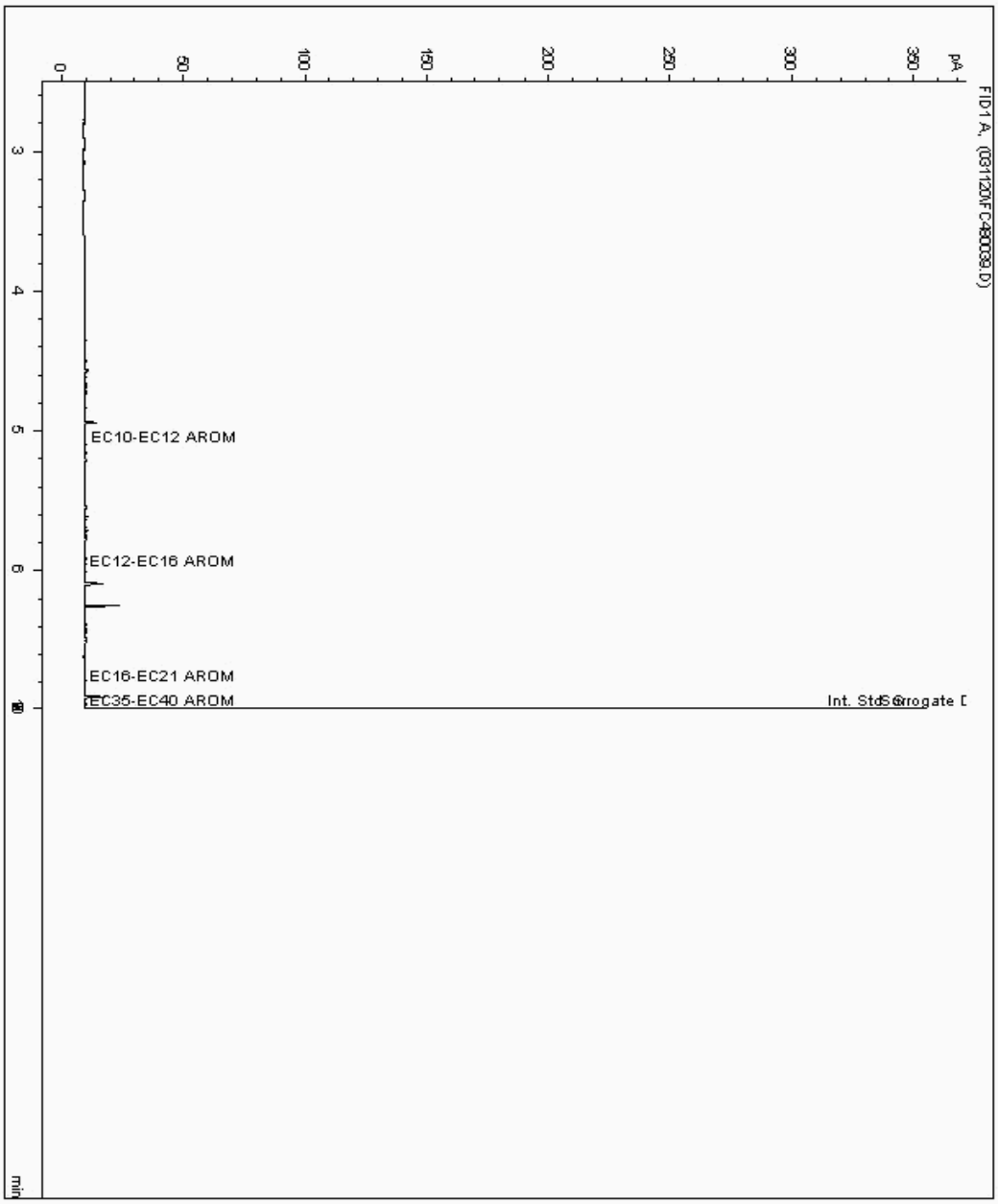
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837074 **Sample ID :** PBGW4 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506107-
Date Acquired : 12/03/2020 11:05:13 PM
Units : ppb
Dilution : SE PBGW4[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

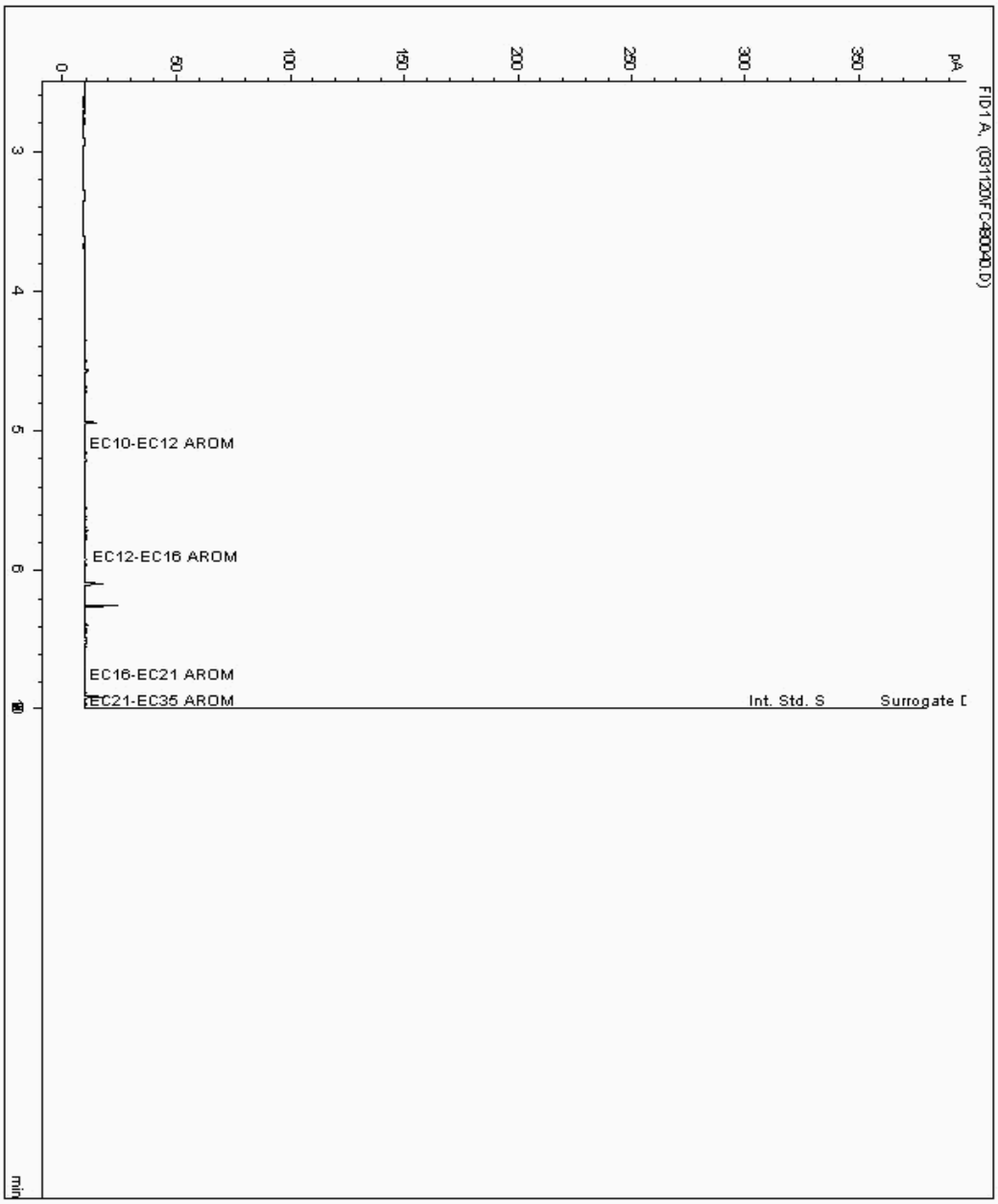
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837075 **Sample ID :** PBSW1 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506161-
Date Acquired : 12/03/2020 11:27:45 PM
Units : ppb
Dilution : SE PBSW1[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

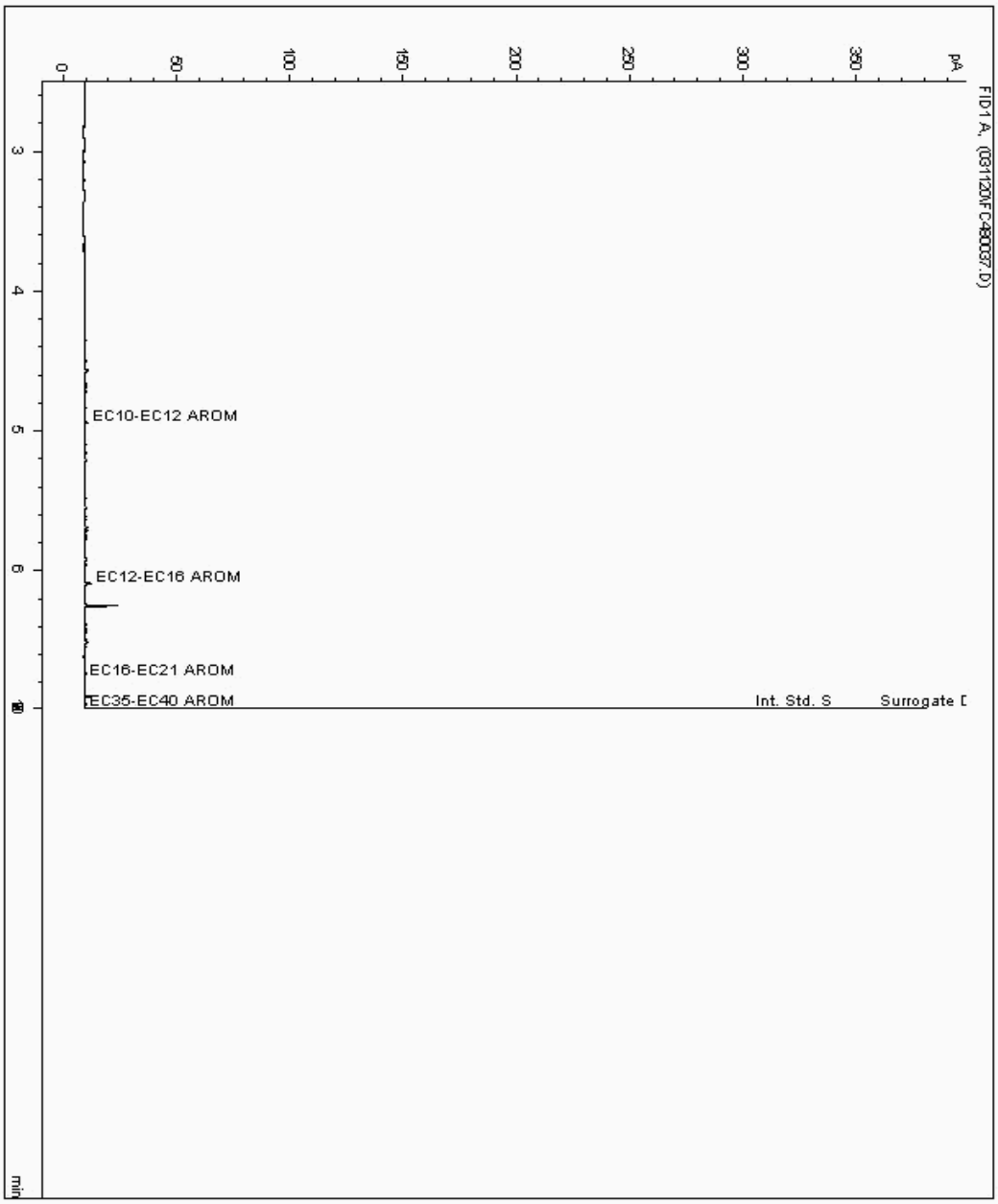
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837157 **Sample ID :** PBGW2 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506065-
Date Acquired : 12/03/2020 10:20:08 PM
Units : ppb
Dilution : SE PBGW2[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

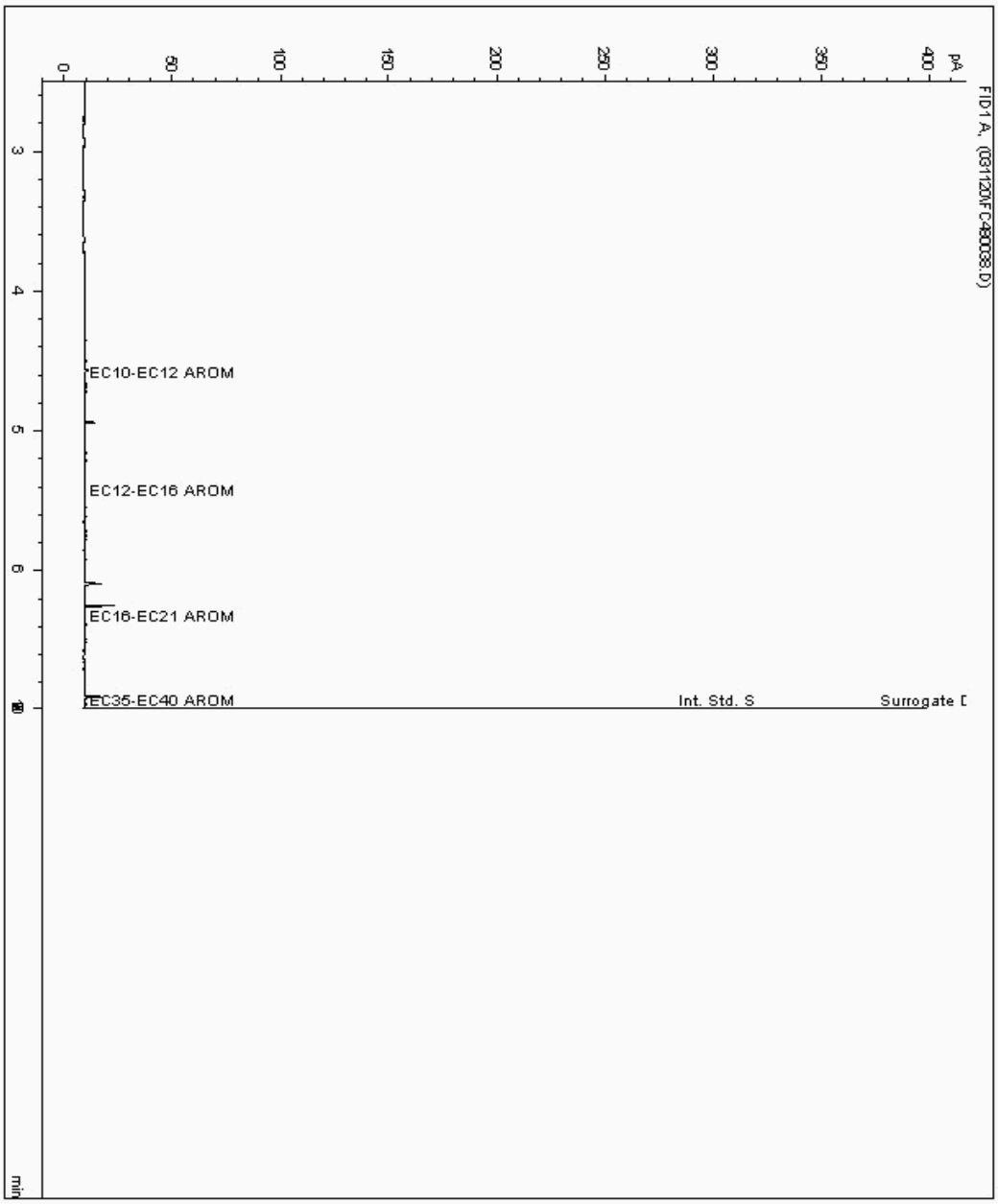
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837158 **Sample ID :** PBGW1 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506034-
Date Acquired : 12/03/2020 10:42:45 PM
Units : ppb
Dilution : SE PBGW1[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025



CERTIFICATE OF ANALYSIS

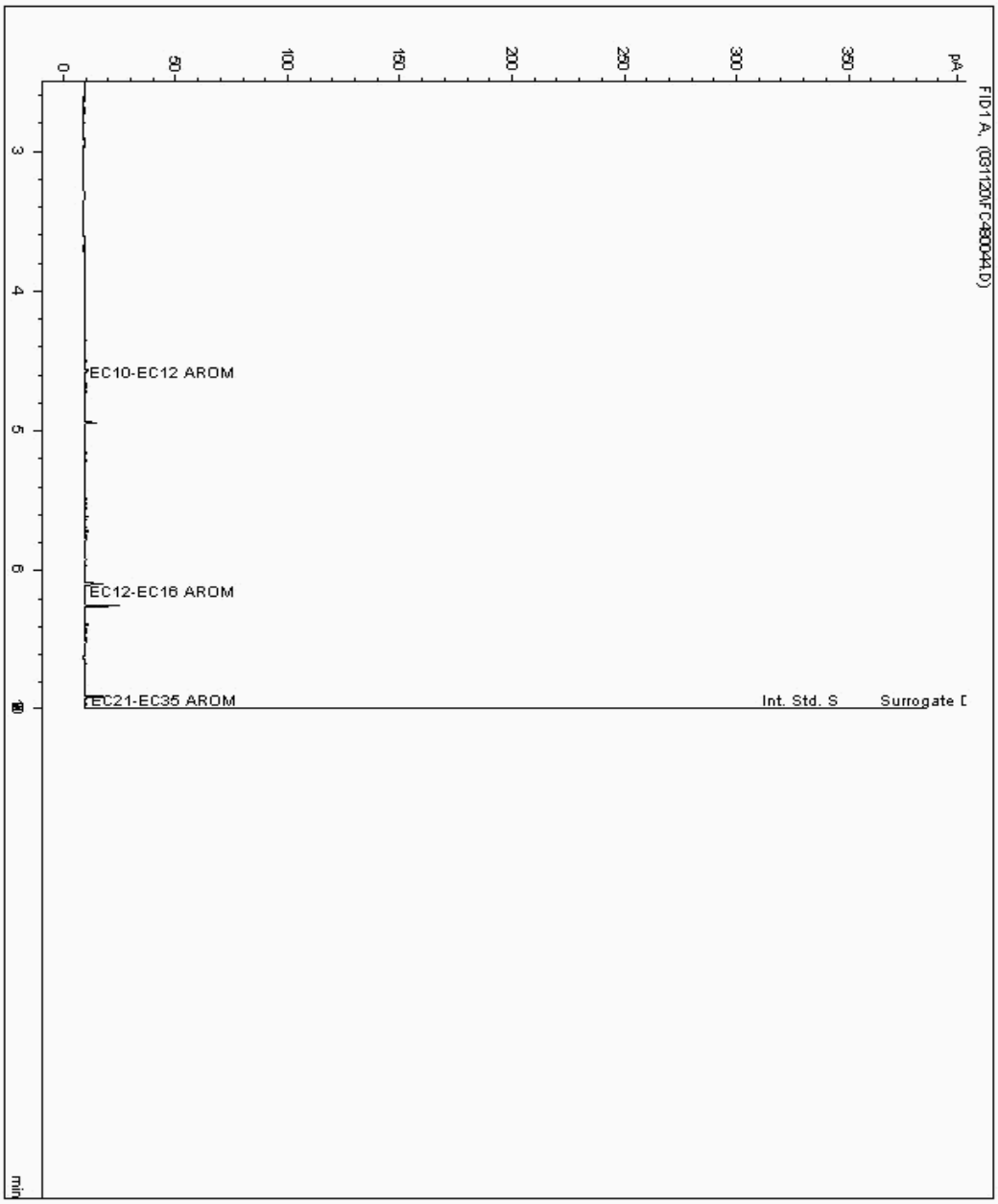
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: EPH CWG (Aromatic) Aqueous GC (W) **Sample No :** 21837159 **Sample ID :** PBGW3 **Depth :** 0.00 - 0.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 20506086-
Date Acquired : 12/03/2020 12:58:24 PM
Units : ppb
Dilution : SE PBGW3[0.00 - 0.00] ->
CF : 1
Multiplier : 0.025

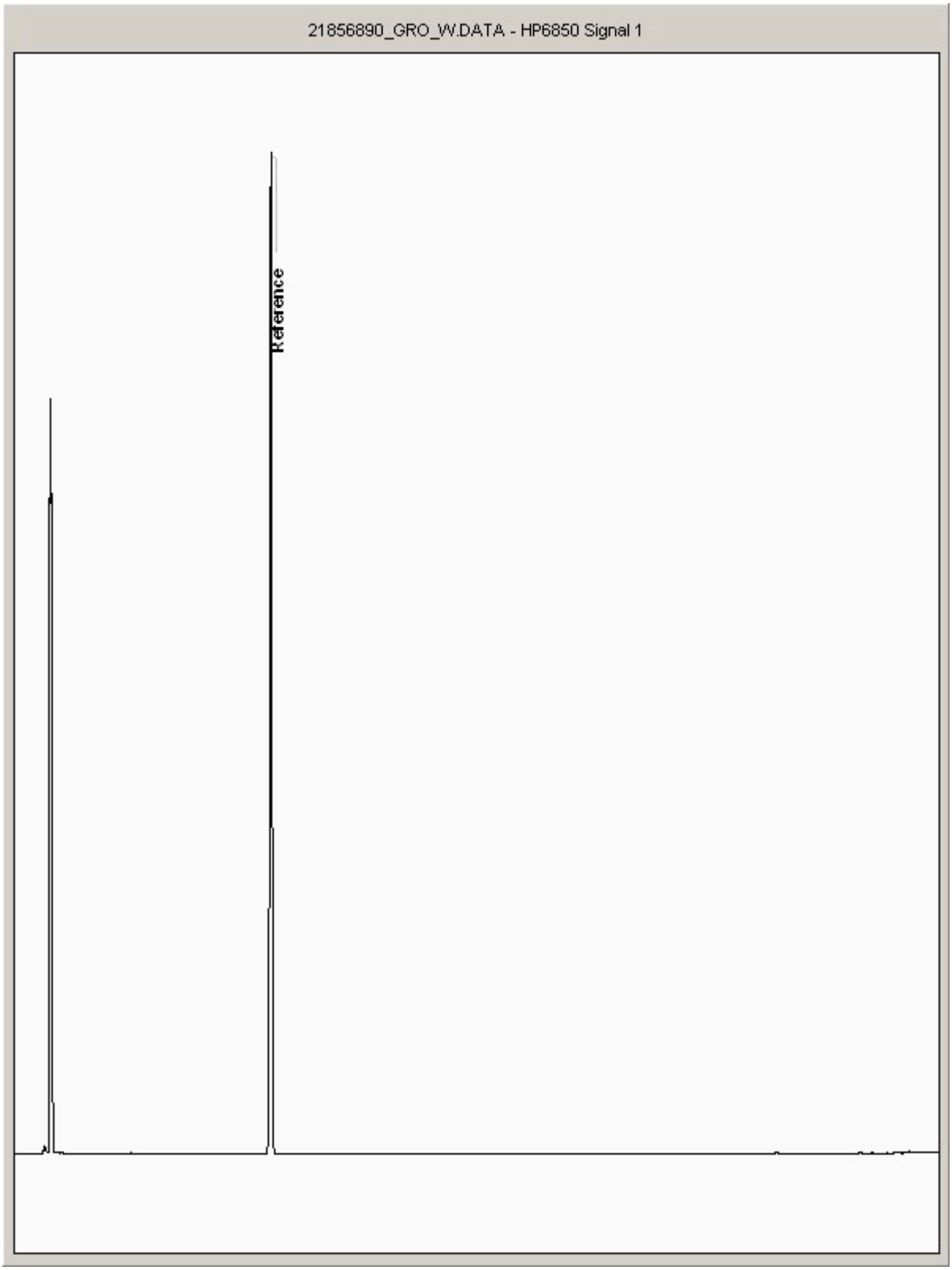


CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W) **Sample No :** 21856890 **Sample ID :** PBGW1 **Depth :** 0.00 - 0.00

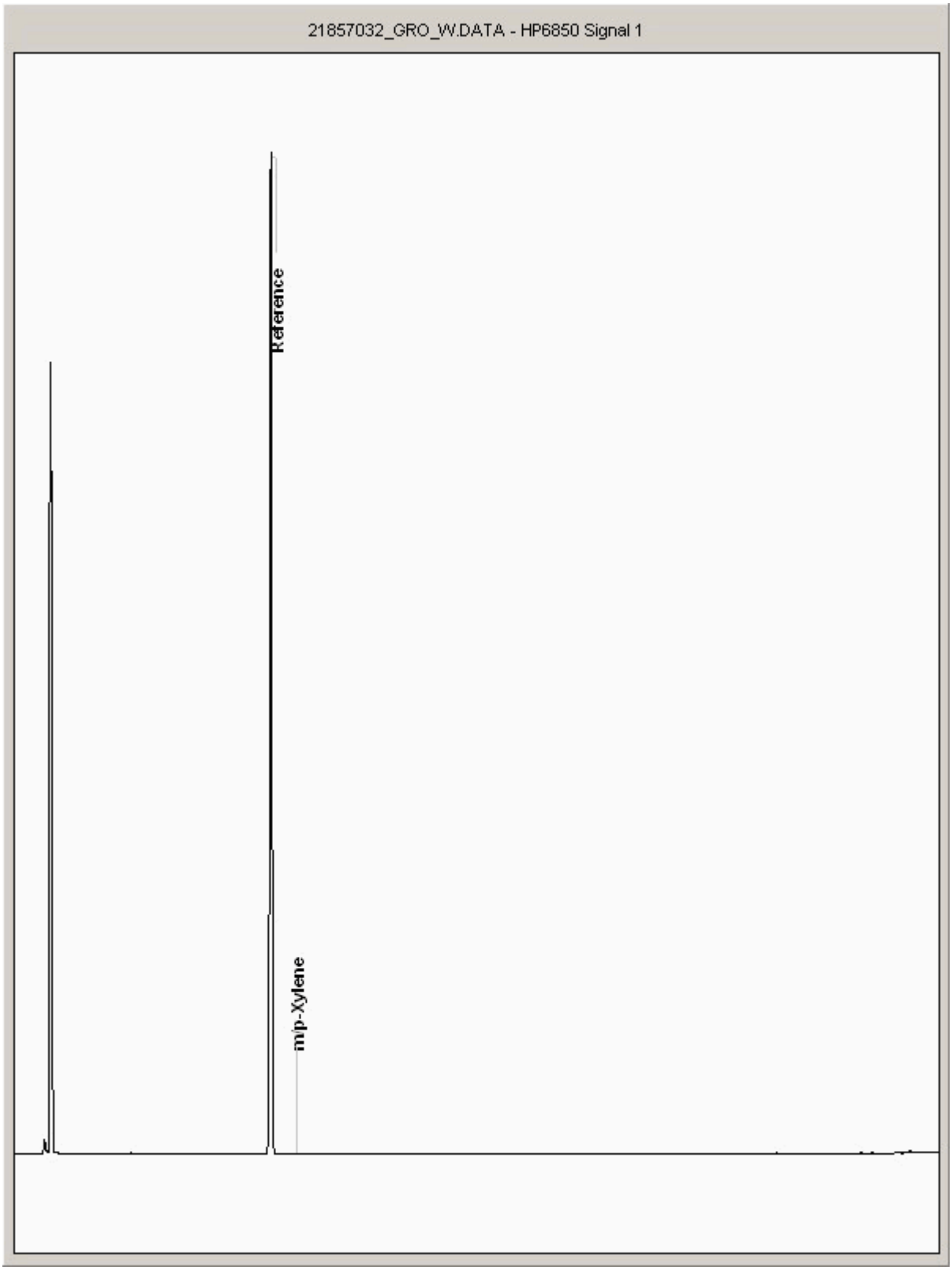


CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W) **Sample No :** 21857032 **Sample ID :** PBGW2 **Depth :** 0.00 - 0.00



CERTIFICATE OF ANALYSIS

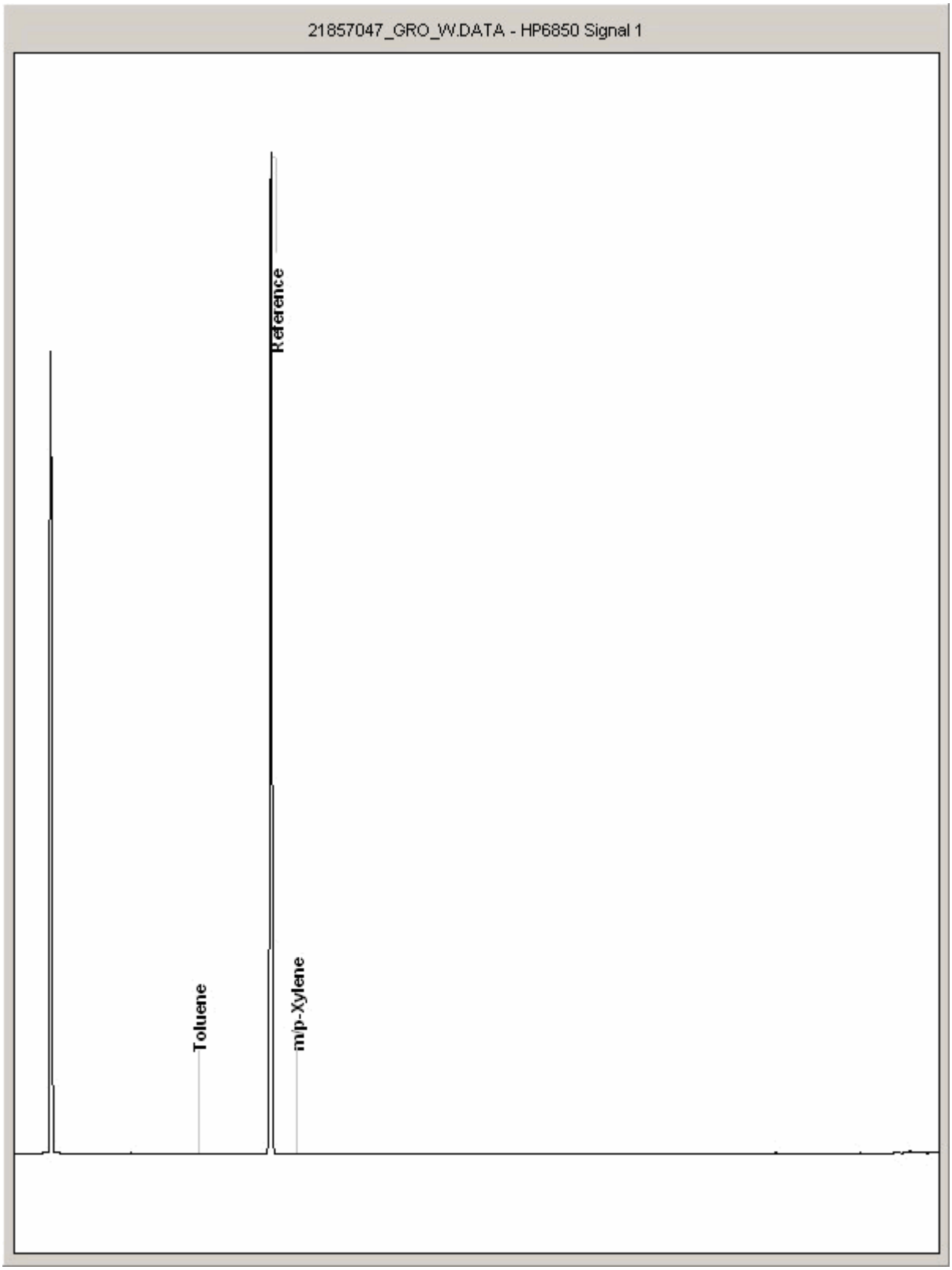
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 21857047
Sample ID : PBSW1

Depth : 0.00 - 0.00



CERTIFICATE OF ANALYSIS

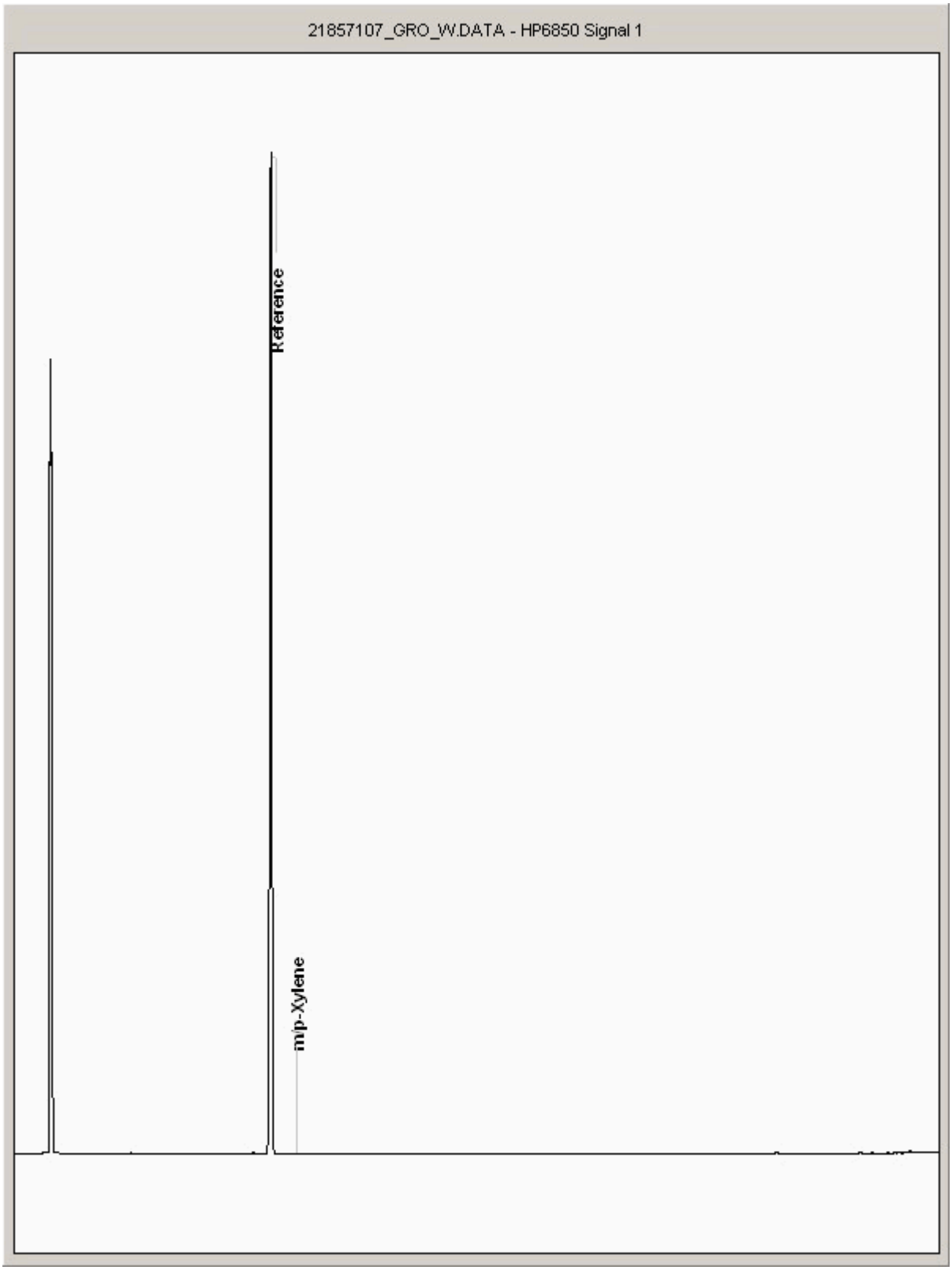
SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 21857107
Sample ID : PBGW4

Depth : 0.00 - 0.00

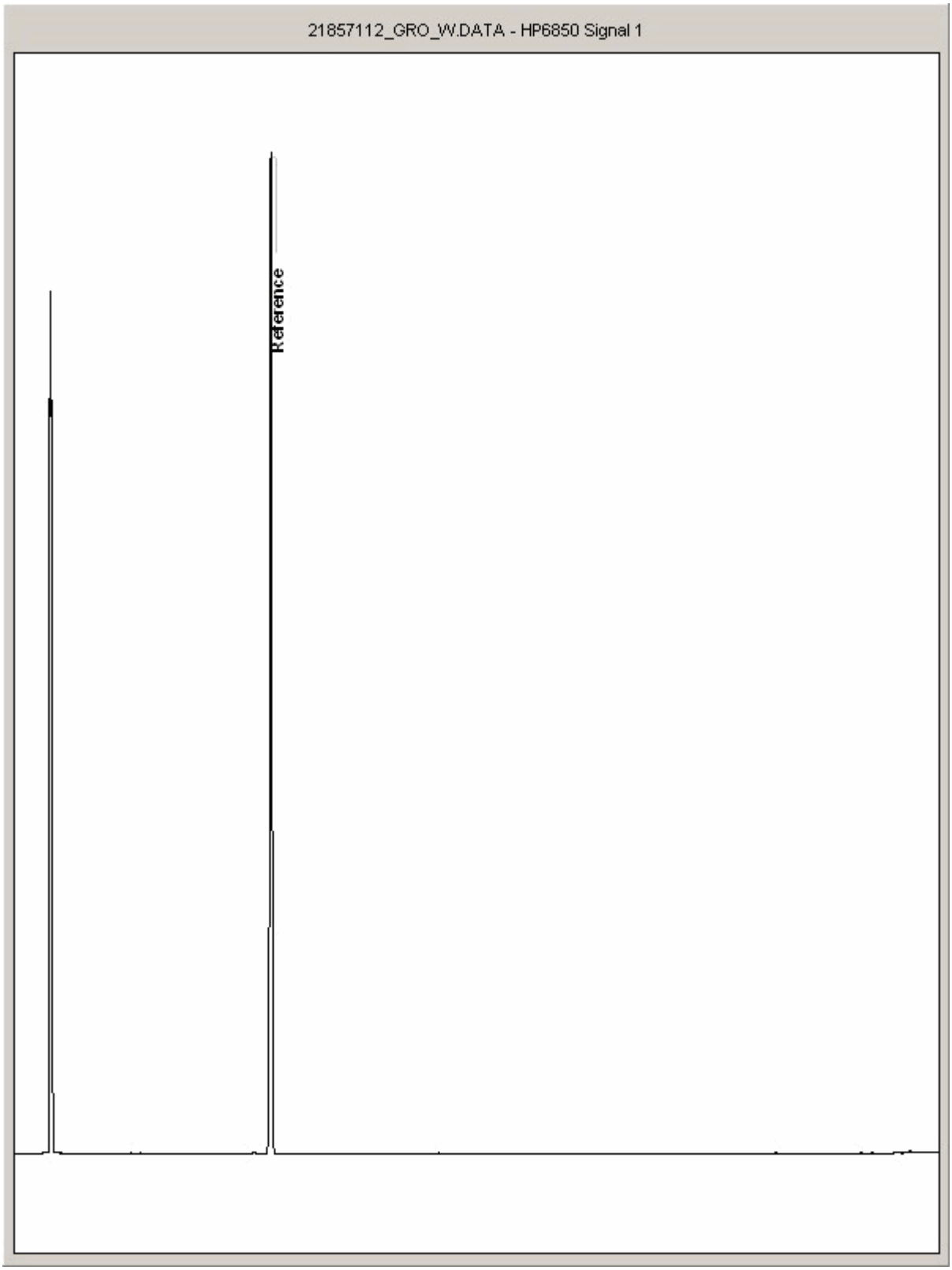


CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W) **Sample No :** 21857112 **Sample ID :** PBGW5 **Depth :** 0.00 - 0.00

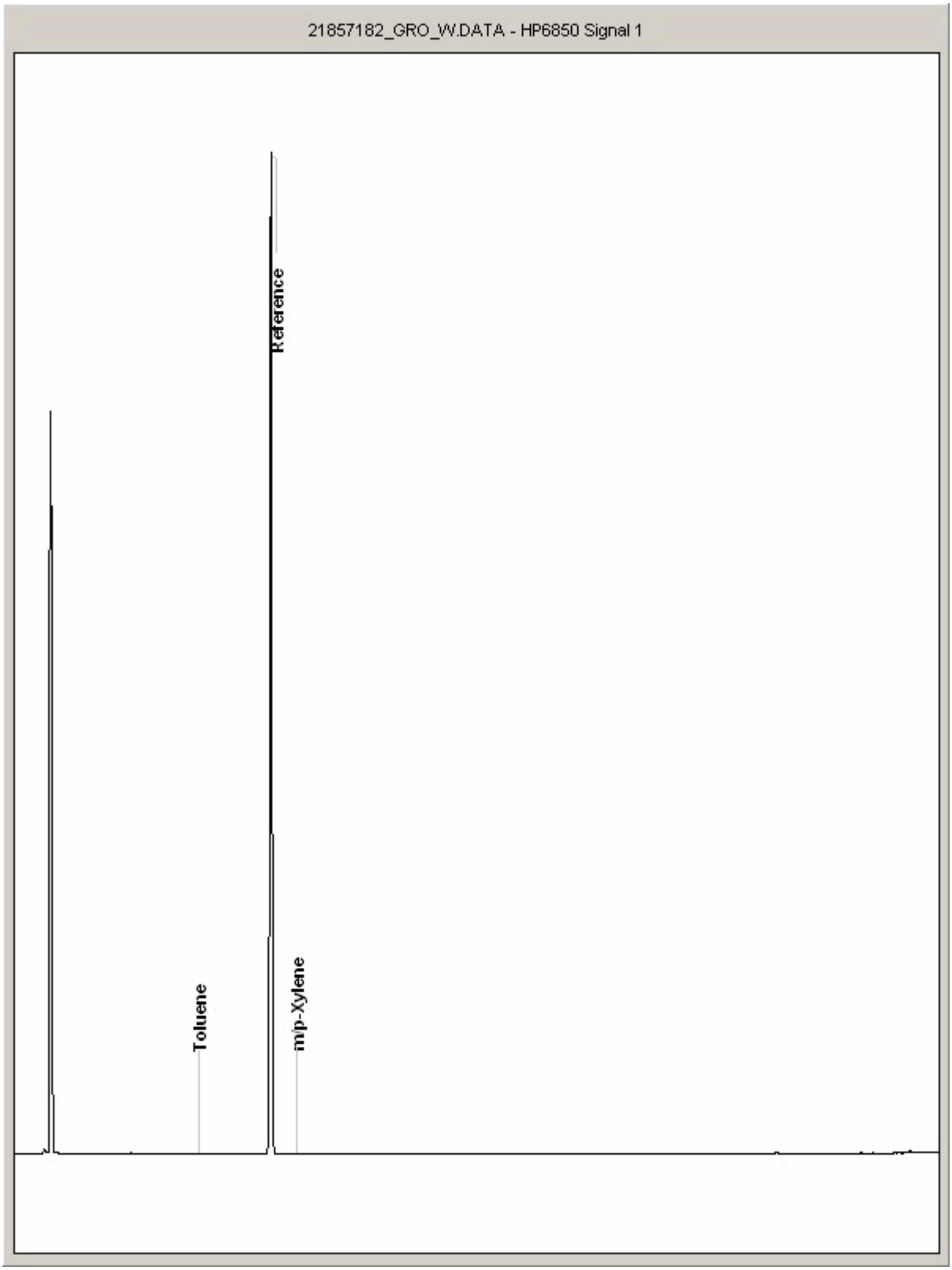


CERTIFICATE OF ANALYSIS

SDG:	200306-150	**Client Reference:**	62103511-031	**Report Number:**	546001
Location:	BAMBER	**Order Number:**	62103511-030	**Superseded Report:**	

Chromatogram

Analysis: GRO by GC-FID (W) **Sample No :** 21857182 **Sample ID :** PBGW3 **Depth :** 0.00 - 0.00



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 30 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 one month 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. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

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. **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.

18. **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**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**

19. **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 (2005), 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

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials 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 (2005).

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, based on HSG 248 (2005).

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.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2107).*

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.

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[redacted]

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