PENPLAS LANDFILL SITE

MONITORING SUMMARY AND SURRENDER REPORT

SEPTEMBER 2019

Prepared for:

BJ Land Holdings Limited
County House
Beauford Road
Plasmarl Industrial Estate
Morriston
Swansea
SA6 8JG

ExCAL House, Capel Hendre Industrial Estate,
Ammanford, Carmarthenshire. SA18 3SJ
Tel: 01269 831606
Fax: 01269 841867

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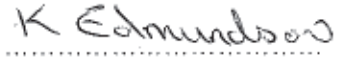
PREPARED BY:

D Simons: 

APPROVED BY:

S Whitehouse: 

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Version	Date	Amendments
Original	July 2019	
Rev 1	August 2019	Amended with comments received from NRW
Rev 2	September 2019	Amended with further NRW comments

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1.0 INTRODUCTION

Penllergaer Estates (Penllergaer) owns the land on which the closed Penplas inert landfill is located. An agreement was reached between Penllergaer Estates and BJ Land Holdings Limited to create the landfill on their land.

The landfill was created to allow predominantly inert waste to be moved from a proposed development site within the Swansea catchment, following which the landfill was immediately capped. No further materials were deposited. The material moved, which was mainly demolition rubble, was removed from a location where it had already been deposited for a number of years.

The Landfill was designed as an engineered clay cell with the walls base and cap comprised of a minimum 1m thickness of clay, which was compacted to a minimum permeability of 10^{-9} m/s.

Suitable clay to form the cell was present on site, which was validated through a series of insitu falling head permeability tests and laboratory tests to assess the mass permeability values.

The natural sloping topography was utilised to allow the collection of leachate into a HDPE drainage system.

The drains were surrounded by granular material which was wrapped in a geotextile membrane.

A plan showing the boundary of the site is shown in drawing 04-01-11.D02 included in Appendix A.

A plan showing the monitoring locations is presented in Appendix A as drawing 04-01-11.D01.

1.1 Monitoring

Monitoring has been undertaken in accordance with the Waste Management License. The results of monitoring are summarised in this report.

1.2 NRW Waste Management License (WML)

A stream runs adjacent to the site.

The WML for the facility stipulates that one location upstream of the site and one location downstream of the site should be monitored every 6 months together with external groundwater monitoring boreholes. The test suite was: -

- Total Organic Carbon (TOC), Total Oxidised Nitrogen (TON), Iron, Calcium, Magnesium, Sodium, Chloride and Sulphate.

1.3 GIBB Supporting Report – Working Plan

A copy of a GIBB working plan report which describes the design and installation of the landfill has been obtained from NRW and is included in Appendix D.

The report states that the Leachate Monitoring Well should be monitored quarterly for the following determinands: -

- pH, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Ammoniacal Nitrogen, Particulate Solids.

Gas vents and boreholes were monitored weekly for the first 6 months and thereafter at a frequency determined by the initial monitoring.

Surface water was monitored for particulate solids during the construction phase. Particulate solids within leachate were measured during the initial operational phase where leachate level increases may have required a tanker to be utilised to remove leachate from site.

Following stabilisation, as leachate is not required to be removed from the site, the requirement to test for particulate solids was removed from the ongoing quarterly testing suite.

Surface water samples were then to be collected from a designated monitoring location to the north of the site and analysed for the following determinands: -

- pH, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Ammoniacal Nitrogen, Particulate Solids.

The working plan advocated that the long term monitoring and site aftercare would be detailed in a Section 106 Agreement to be drawn up between Lliw Borough Council and the landowner. At the time of writing, we have been unable to obtain a copy or record of any such agreement.

1.3.1 Landfill Construction

Following granting of the waste license to construct the landfill, the cell was constructed, waste material placed and landfill capped and closed within a period of 1-2 months. The site immediately went into a period of aftercare.

The methodology utilised in the construction of the landfill is set out in section 1.2 of the working plan, with Construction Quality Assurance (CQA) methods detailed in section 1.3.

The working plan states that a minimum number of test positions shall be 25 per hectare for horizontally placed material, with one test per 500 cubic meters of material placed elsewhere.

The site was a land – raise construction on top of an existing clay aquaclude and so, subject to competent clay cap, was not anticipated to produce any leachate, especially as the material had been moved to the site from a previous tip site and had to a great extent already stabilised.

Pollution control measures are detailed in sections 3 and 4 of the working plan. The clay cell containment of the waste eliminates water ingress into the waste mass, which also significantly reduces the likelihood and volume of leachate being produce. Leachate drains were nonetheless installed to a sump as detailed in the working plan and the sump level and composition has been monitored periodically in accordance with the requirements of the permit. The monitoring data for the sump is discussed later in this report.

The landfill was completed in accordance with the permit conditions.

With the exception of the information provided in the working plan, there are no surviving additional records such as borehole logs, records or inspection or construction details etc.

1.3.2 Landfill Aftercare

Following completion of the filling works, which were undertaken in a two month period, the landfill was capped, covered with topsoil and grassed with locally occurring species as agreed with regulators.

Boreholes and surface water have been routinely monitored in accordance with the licence, with the site being strimmed/cut periodically and large bushes/trees establishing on the site removed, to retain the integrity of the landfill clay cap/liner.

The proposals set out in the working plan were to return the site to agricultural grazing use following completion of works. This has been done.

At the time of writing, we are unaware of any changes to performance or pollution control measures.

1.4 Limits

No environmental limits were specified within the waste management license. Representative Environmental Quality Standard (EQS) limits have been included where possible for illustrative purposes in this report to aid interpretation of the results.

1.5 Data

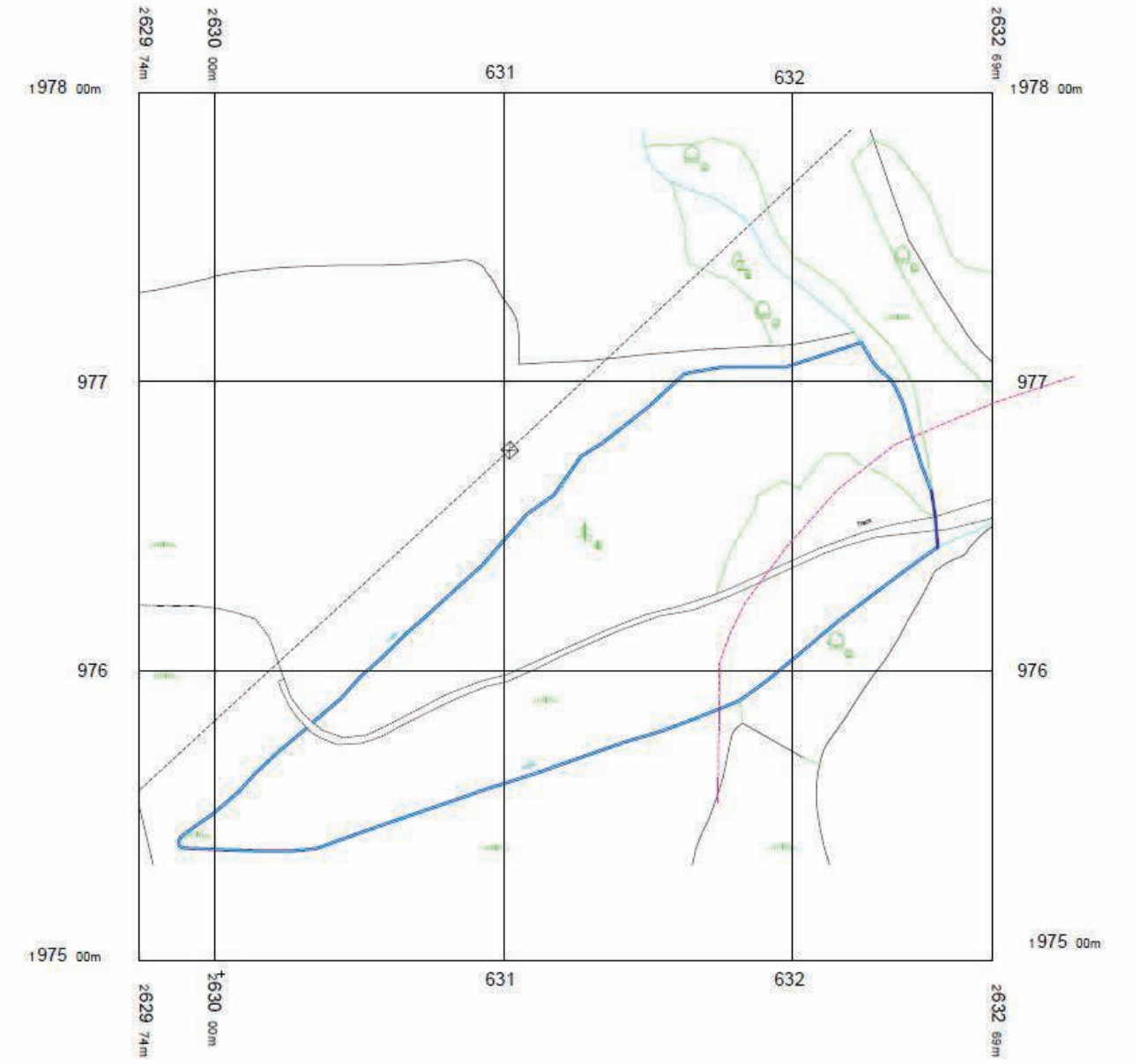
The data used to form this report has been summarised from the available records of historical monitoring undertaken at the site.

2.0 SITE DESCRIPTION

2.1 Site Location

The approximate boundary of the site is shown on Figure 1 below, marked by a blue line.

Figure 1 – Site Boundary



The site address is: -

Land at Penplas Farm
Llangyfelach
Field Parcel number 0366 & part of 1254
SA5 7LA.

The grid reference for the approximate centre of the site is SS 63130 97644.

2.2 Current Site Use

The site has remained closed since completion and is used for grazing.

The site is bounded to the northeast by dense trees, with intermittent treelines located to the south and north of the site. The predominant site surroundings comprise agricultural land.

Figure 2 below shows an aerial photograph of the site, displaying the immediate surroundings.

Figure 2 – Aerial Photograph

2.3 Site Description

The site is grassed having been restored following completion of the filling works.

The topography of the site is relatively flat in the central section which is the highest area of the landfill. A slope along the northern boundary of the site leads down to the original ground level with a gradual slope on the southern boundary down to original ground level.

A copy of a topographical survey drawings prepared in 2008 following a survey is included in Appendix A.

2.4 Leachate Generation over the site lifespan

Available data relating to leachate generation over the lifespan of the site has been obtained and summarised in the table below: -

Table 1 – Leachate Generation Data

Available data relating to leachate generation over the lifespan of the site has been presented in Appendix B and summarised in table 1 below: -

Year	Average Leachate Depth
2002	2.57
2003	2.67
2004	2.52
2005	2.65
2006	2.71
2007	1.74
2008	2.98
2009	2.61
2010	2.04
2011	2.81
2012	1.43
2013	1.46
2014	1.40

The data highlights that for the 12 years tested, leachate levels have trended down, with the final three years of dip data showing consistency with levels below 1.5m.

The leachate has been analysed during the lifetime of the landfill and a review of the results obtained is included in section 4.0. The results show that all results remain within environmental compliance standards; and therefore that any leachate produced poses a low risk of contamination to surroundings receptors.

The Penplas landfill site also comprises over 75% inert material, with a proportion of the residual material potentially being biodegradable. This split in material composition can provide additional confidence in the lower potential for the landfill to generate leachate.

Furthermore, the material deposited at the Penplas site was initially part of a historic landfill, which was subsequently moved to the Penplas site.

Given that the material was deposited and left in situ at the original landfill site for over 10 years, the leachate generating potential of the material will have significantly reduced during the period it was located at the previous site, prior to its relocation to the Penplas landfill.

The surrounding ground is underlain with clay, which was excavated and recompacted to form the actual landfill cell. The presence of clay encourages and aids overland flow.
Cut off ditches containing stone were installed all around the landfill off-site to divert overland flow of water around the landfill cell. The levels of leachate have consistently dropped following installation of the ditches between 2011 and 2012.

2.5 Gas Generation over the site lifespan

Available data relating to gas generation over the lifespan of the site has been presented in Appendix B and are summarised in table 2 on the following page.

The data highlights that for the 12 years covered, no or negligible (<0.1%/vol) levels of methane have been recorded for four of the five boreholes monitored, with correspondingly low levels of carbon dioxide and oxygen within normal levels.

The fifth borehole monitored has exhibited some methane generation, which has decreased in intensity and volume over the monitoring period. During the last 5 years of monitoring data between 2009 and 2014, only 6 elevated results over 2% were recorded with the remaining monitoring results recorded being 0% or 0.1%.

The Landfill Directive guidance on Landfill Gas Management identifies that there are no capping or lining requirements for inert landfills.

The guidance also identifies that “if the waste within the site contains 75 per cent or more inorganic wastes, then landfill gas production from biodegradation will be minimal”.

The Penplas landfill site contains less than 200,000 cubic meters of material and in excess of 75% inert material. Based on the guidance, the site therefore poses a limited potential of gas generation.

Furthermore, the material deposited at the Penplas site was initially part of a historic landfill, which was subsequently moved to the Penplas site.

Given that the material was deposited and left in situ at the original landfill site for over 10 years, the gas generating potential of the material will have significantly reduced prior to relocation of the material to the Penplas site.

Table 2 – Gas Generation Data

Year	Sampling Point G1			Sampling Point G2			Sampling Point G4			Sampling Point G5			Sampling Point G6		
	C02 (% vol)	CH4 (% vol)	O2 (% vol)	C02 (% vol)	CH4 (% vol)	O2 (% vol)	C02 (% vol)	CH4 (% vol)	O2 (% vol)	C02 (% vol)	CH4 (% vol)	O2 (% vol)	C02 (% vol)	CH4 (% vol)	O2 (% vol)
2002	0.9	0.0	20.8	0.6	5.0	19.3	0.1	0.0	19.0	1.8	0.1	16.8	0.1	0.0	20.8
2003	0.1	0.0	20.8	3.3	13.6	17.3	0.1	0.0	20.8	1.9	0.0	18.7	1.0	0.1	19.7
2004	0.2	0.1	20.5	2.9	7.8	17.4	0.3	0.0	20.5	1.9	0.0	18.7	0.4	0.0	20.0
2005	0.1	0.0	20.9	2.9	12.4	17.2	0.1	0.0	20.8	4.2	0.0	18.2	1.0	0.0	20.6
2006	0.0	0.0	20.8	0.9	4.2	20.3	0.5	0.0	20.8	0.6	0.0	20.3	0.1	0.0	20.8
2007	0.0	0.0	20.9	0.2	1.4	20.9	0.3	0.0	20.9	0.2	0.0	20.9	0.5	0.0	20.9
2008	0.3	0.1	20.6	1.1	1.9	20.5	0.4	0.0	20.9	0.7	0.0	20.7	1.0	0.0	20.7
2009	0.0	0.0	20.9	0.4	1.2	20.5	0.1	0.0	20.9	0.9	0.0	20.3	0.4	0.0	20.8
2010	0.0	0.0	20.9	0.1	0.0	20.9	0.1	0.0	20.9	1.1	0.0	19.9	1.3	0.1	20.8
2011	0.0	0.0	20.9	0.0	0.0	20.8	0.0	0.0	20.9	0.3	0.0	20.8	0.3	0.0	20.9
2012	0.0	0.1	20.9	2.3	13.4	17.4	0.3	0.0	20.5	0.6	0.2	19.1	1.4	0.0	18.1
2013	0.1	0.1	20.7	0.5	2.1	16.7	1.0	0.1	19.5	1.5	0.1	18.5	1.0	0.0	19.6
2014	N/A	N/A	N/A	0.2	0.8	15.5	0.1	0.0	20.7	0.1	0.1	20.3	2.3	0.0	13.6

2.6 Leachate outbreaks

Date obtained from NRW indicates that there have been historical leachate outbreaks at the site during 2006 and potentially around 2009.

We have researched the breaches, based on the limited information available and these appear to have been caused by the following events:

1. Established vegetation growing on the land causing a small breach of the capping layer

2. Ingress of water via overland flow/sub surface groundwater flow facilitated by the underlying clay deposits, recharging the landfill leachate levels.

A plan to remove vegetation at the site was implemented with bushes and trees being removed from the surface.

A deeper cut of ditch was constructed around 2011 in an arc, trending north-south around the eastern elevation of the landfill, to collect and divert water around the landfill, reducing the potential for recharge.

Following completion of the above works, there have been no further breaches to the knowledge of the client or recorded in the information obtained for the site, the leachate dip levels presented in this report were consistently lower and the quality of the leachate itself remained compliant with the permit parameters, as discussed later in this report.

3.0 SURRENDER TYPE

The NRW guidance on landfill surrender has been reviewed in the preparation of this report.

Based on the data available, we have assessed the waste deposited in line with section 4.2.1 of the guidance.

The Waste License for the site, included in Appendix D, states on page 2 that the materials placed within the landfill were:

1 – Inert building material with clay fill and a specific quantity of biodegradable material (refer Gibb Environmental Sciences Report dated April 1992)

2 – Excavated natural materials

The working plan also states in correspondence appended to it that the section of waste that could contain biodegradable fractions, totalled 8000 cubic meters. The remaining material was all inert. The waste license allowed for a total of 93,000 cubic meters.

The material meets the criteria for Type B waste.

Monitoring records, discussed later in this report, also support the conclusion that waste acceptance procedures were followed.

The sensitivity of the site surroundings have been assessed in line with section 4.2.2 of the guidance.

Based on environmental data obtained from Groundsure, the site is underlain and surrounded on all sides by a minor aquifer with low leaching potential. The nearest alternative designation is a minor aquifer – with intermediate leaching potential, located around 130m to the east of the site.

As all of the water from the site falls / runs north / northeast and given the clay construction of the landfill itself, the risk posed to aquifers is not considered to be significant.

There is a surface water body located immediately to the north of the site and this has a sensitivity of grade 1 or 2 based on data provided by NRW. This surface water body has been periodically monitored in line with the environmental permit for the site. Environmental monitoring data, which is discussed later in this report shows that the water quality has not been adversely impacted and therefore the risk to the surface water receptor is not considered to be significant.

The Penplas Grasslands SSSI surrounds the site to the North, East and West.

The SSSI comprises a series of low-lying pastures. These pastures represent one of the largest and most diverse examples of agriculturally unimproved land within the lowland part of West Glamorgan. Eight different grassland types have been identified on the site, including three types of purple moor-grass pasture, two of rush pasture, fen meadow, acid grassland and damp heath (CCW, 1992).

The nearest human occupation to the site lies over 250m upstream of the site to the south. Given the construction method of the landfill, the site age and the fact that there has been no deterioration of water quality detected by monitoring, it is unlikely that the site poses an adverse risk to the nearby residential receptors and this receptor can therefore be discounted.

As described within section 1.3, and the Report contained within Appendix D, the site was constructed in accordance with a strict and approved methodology utilising low permeability clays. Monitoring has demonstrated that the liner remains competent and that there has been no adverse impact on surface water bodies located adjacent and downstream of the site.

The waste was well characterised as detailed in a report submitted in support of the original waste license.

Based on the data presented above, the site would be Type B waste located over a minor aquifer, with low gassing potential and leaching potential as discussed in section 2. Following a review of Table 5 contained in the guidance, we believe that the site would be classified as a class 3 low risk surrender.

4.0 LEACHATE MONITORING LOCATION L1

The Waste License for the site requires that the Leachate Monitoring Well is tested every 6 months in accordance with the working plan. The working plan, included in Appendix D, suggested that monitoring should be undertaken for the following determinands: -

- pH;
- COD;
- BOD;
- Ammoniacal Nitrogen.

Historical data including measurements of leachate levels has been obtained from NRW.

Review of the most recent 3 years of data shows that the level of leachate within the monitoring sump typically lies around 1.5m.

These levels are lower than those identified during the previous 10 years of monitoring, which show that the levels of leachate within the well were typically around 2.5 - 3m.

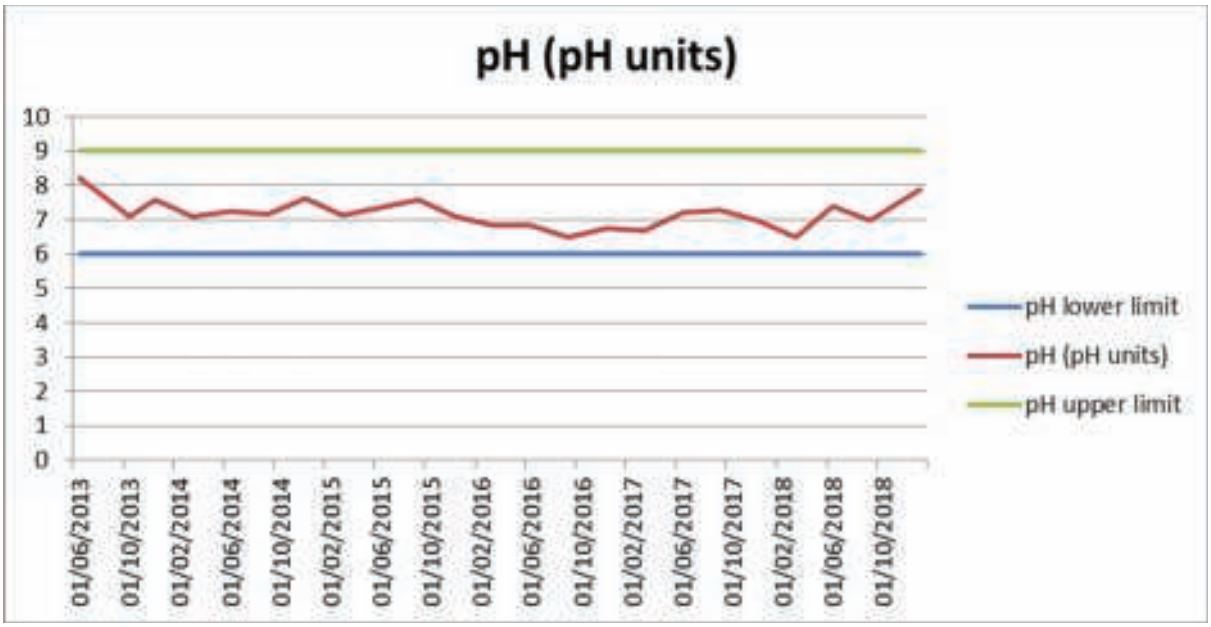
The operator has chosen to undertake sampling for the determinands every 3 months to provide supplemental data of leachate quality.

Historical monitoring data for the site between 2002 and 2014 has been reviewed and is presented in Appendix B, with the leachate below compliance limits throughout this period for pH and BOD. Occasional elevations in ammonia and COD were observed.

Trend graphs for each determinand for the more recent period of 2014 to 2019 are presented below.

The analysis shows that the quality of leachate has remained relatively constant for the last 5 years of monitoring with the exception of one marginally elevated BOD result in 2014 and one marginally elevated ammonia result in 2018. These minor excursions are likely to be related to the agricultural use.

pH

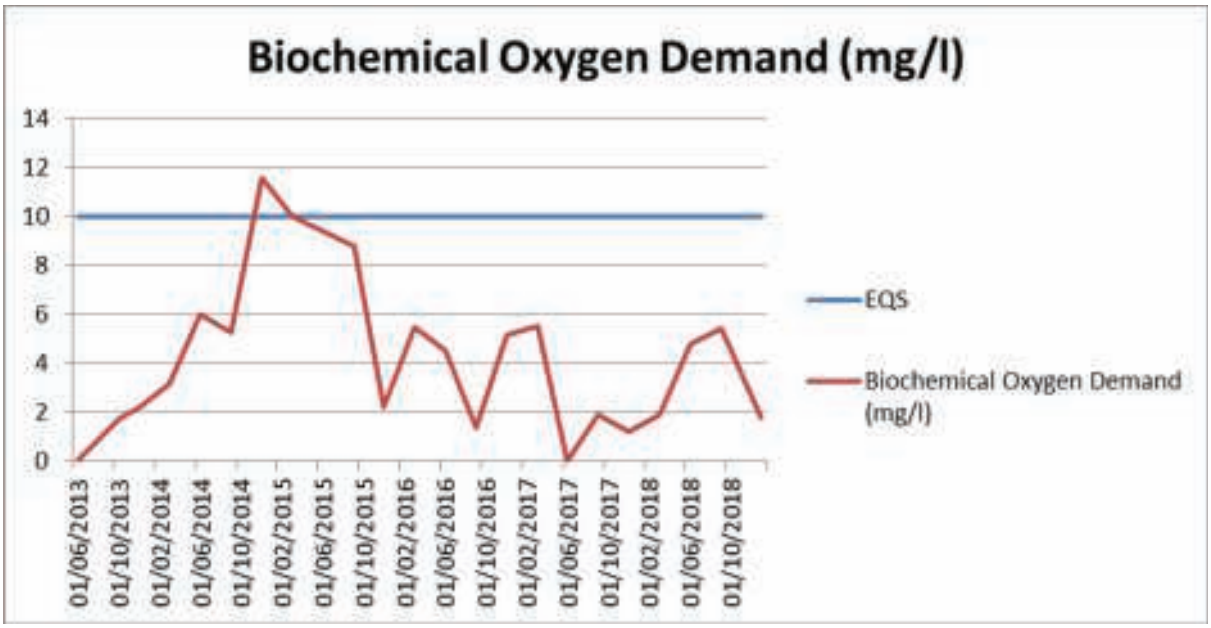


The graph above shows that pH has consistently remained between 6 and 9 for all samples obtained since June 2013 and consequently no further analysis is required.

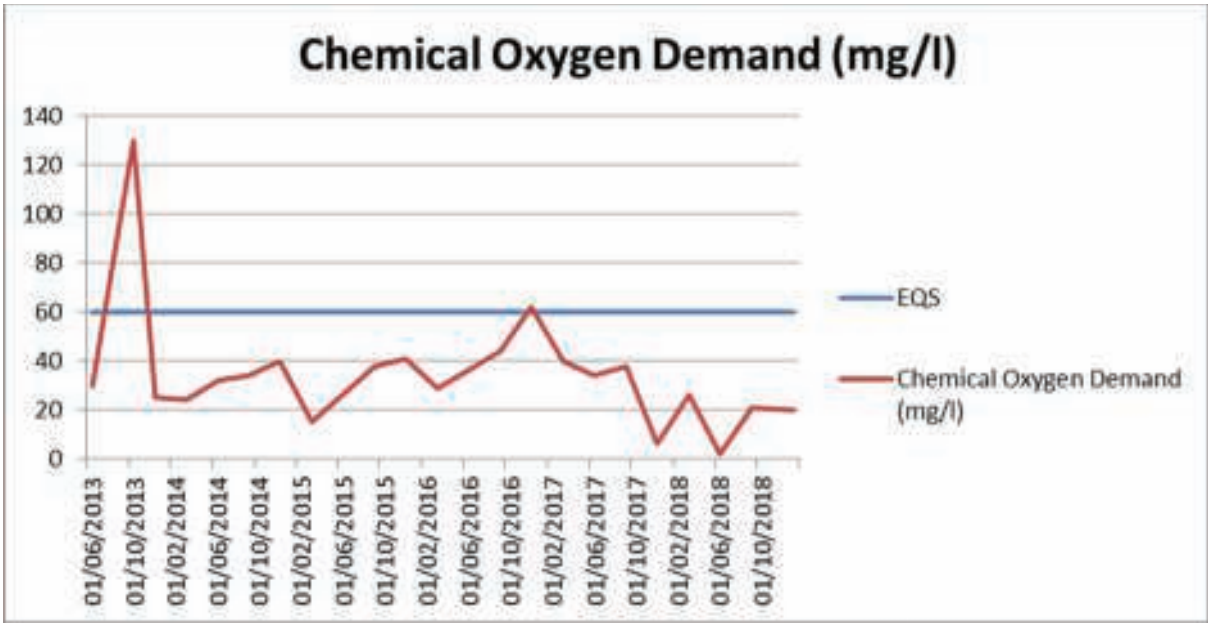
BOD

Based on the Water Framework Directive UK ENVIRONMENTAL STANDARDS AND CONDITIONS (PHASE 1) Report, values below 4-5 mg/l can be considered good or high quality.

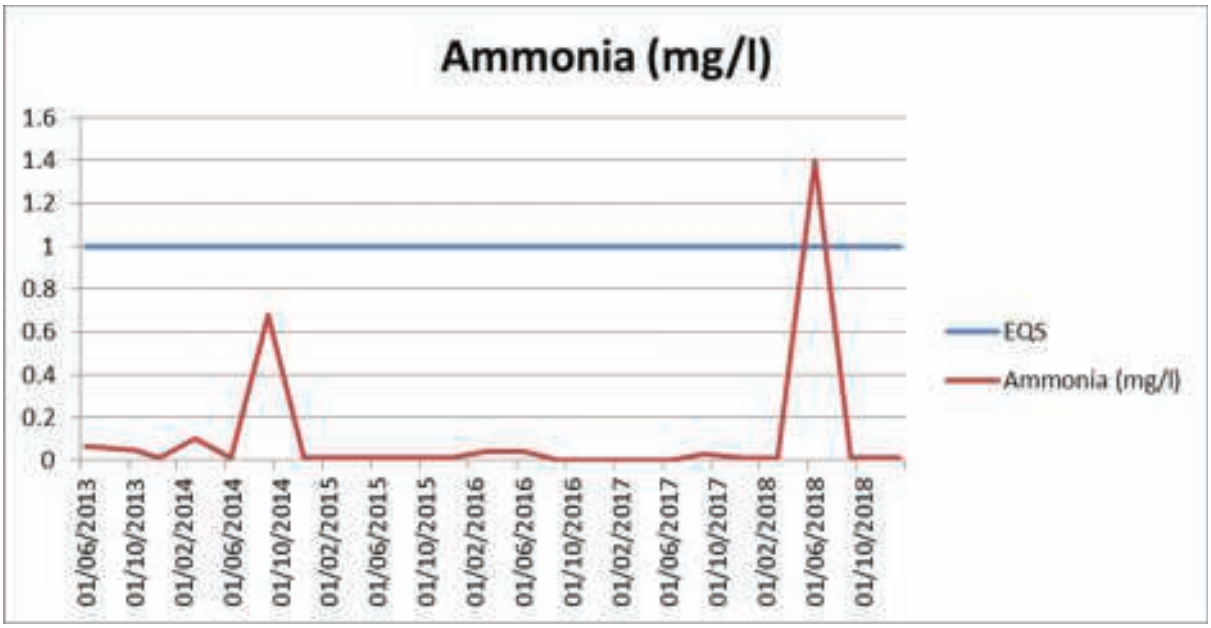
All BOD results for the last 12 months have fallen below 4 mg/l.



COD



Ammonia


Ammonia (mg/l)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
01/06/2013
01/10/2013
01/02/2014
01/06/2014
01/10/2014
01/02/2015
01/06/2015
01/10/2015
01/02/2016
01/06/2016
01/10/2016
01/02/2017
01/06/2017
01/10/2017
01/02/2018
01/06/2018
01/10/2018
EQS
Ammonia (mg/l)

5.0 SURFACE WATER

The surface water body was dry during the quarterly monitoring visit of June 2018. A follow up visit was carried out to attempt to obtain samples, however the surface water body was again dry. Samples were able to be obtained for the following 2 sampling rounds.

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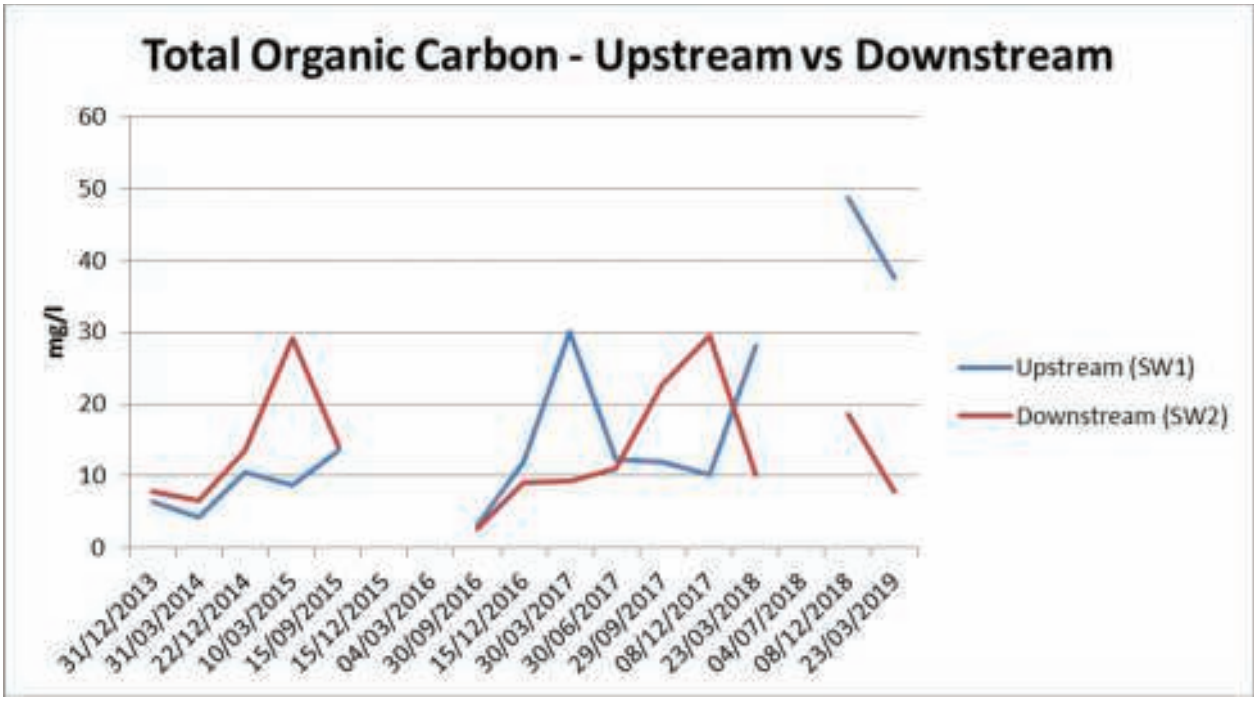

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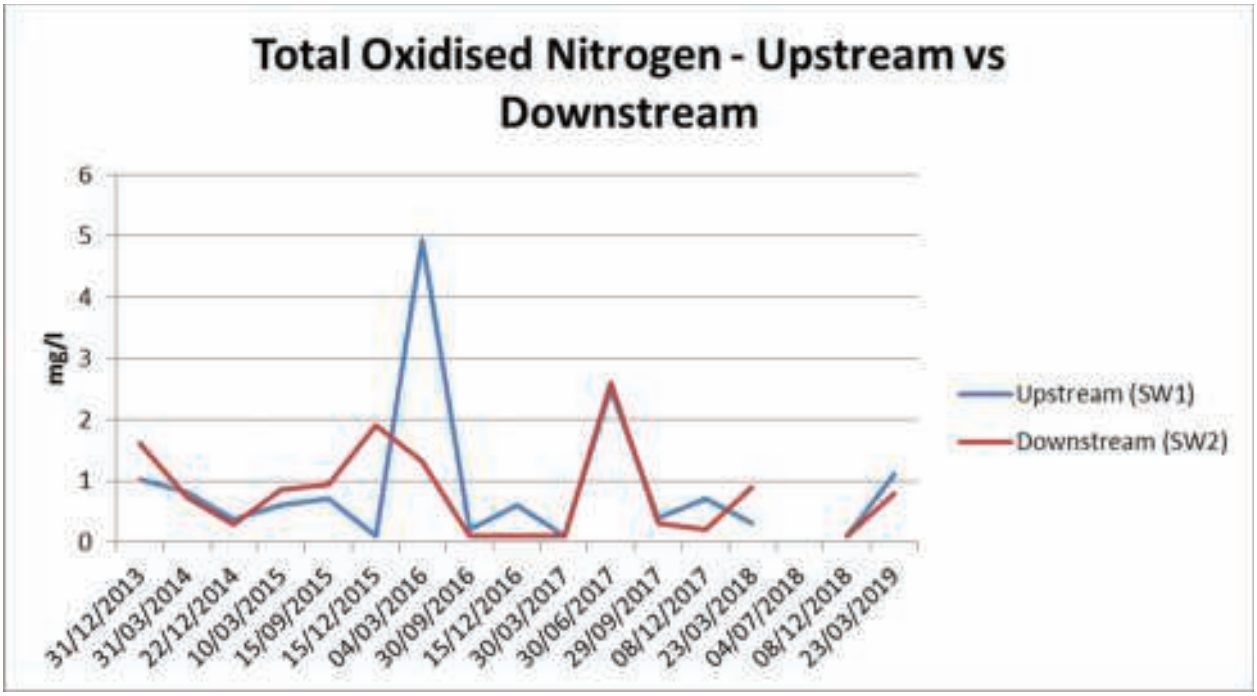
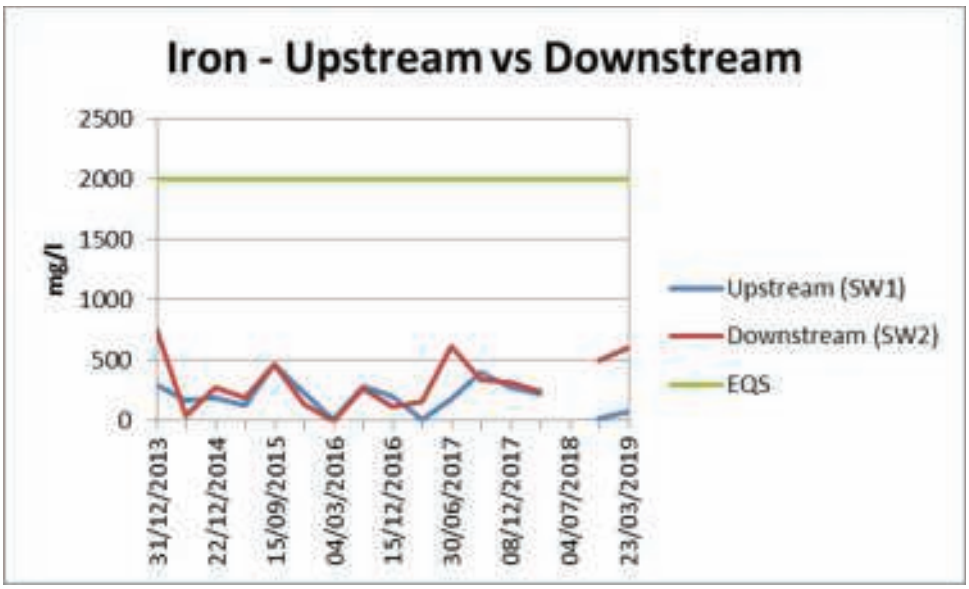
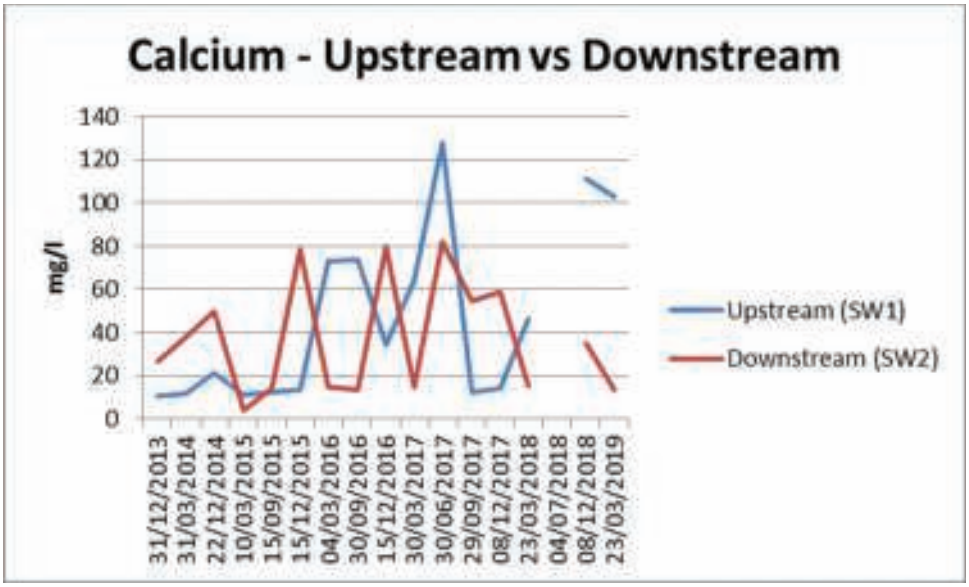


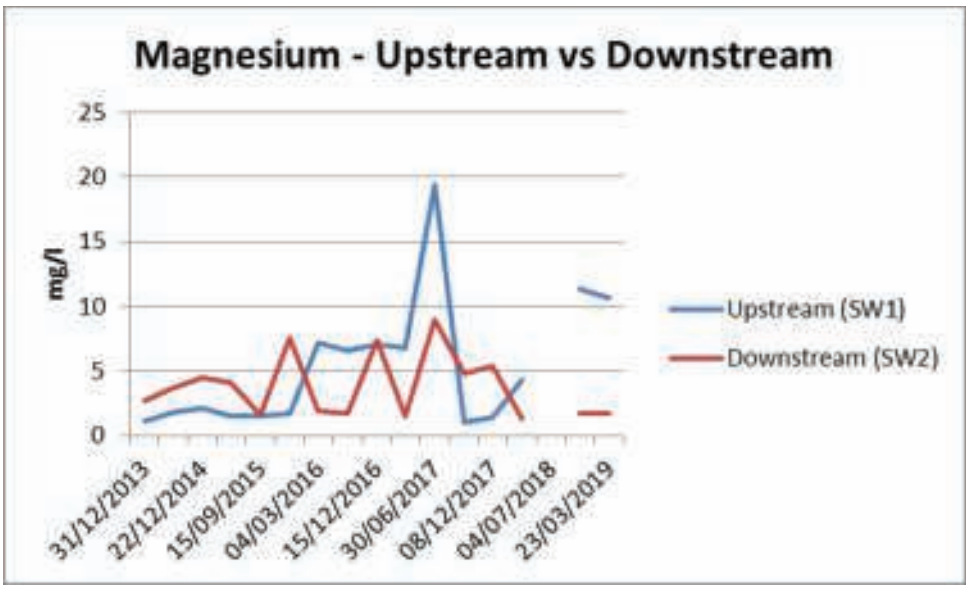
Iron



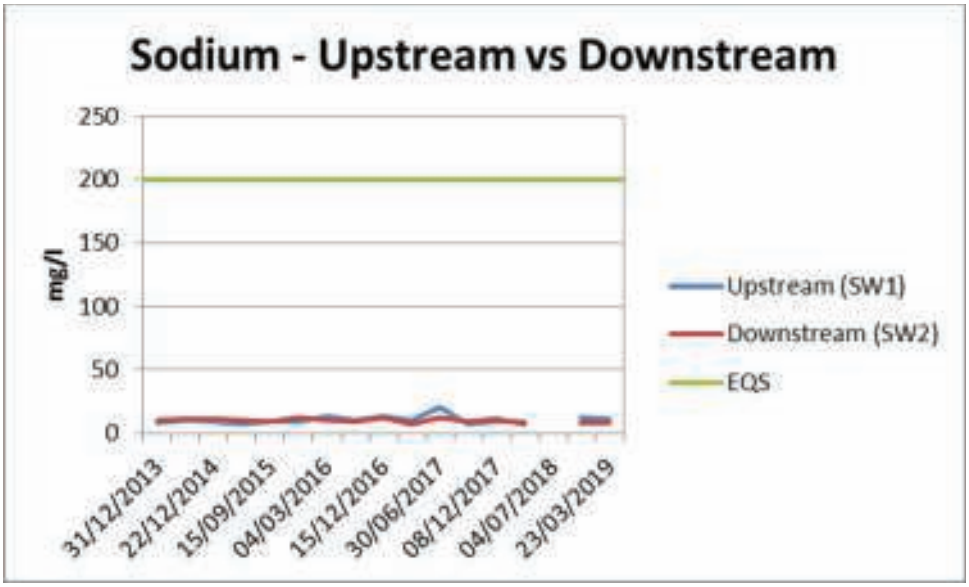
Calcium



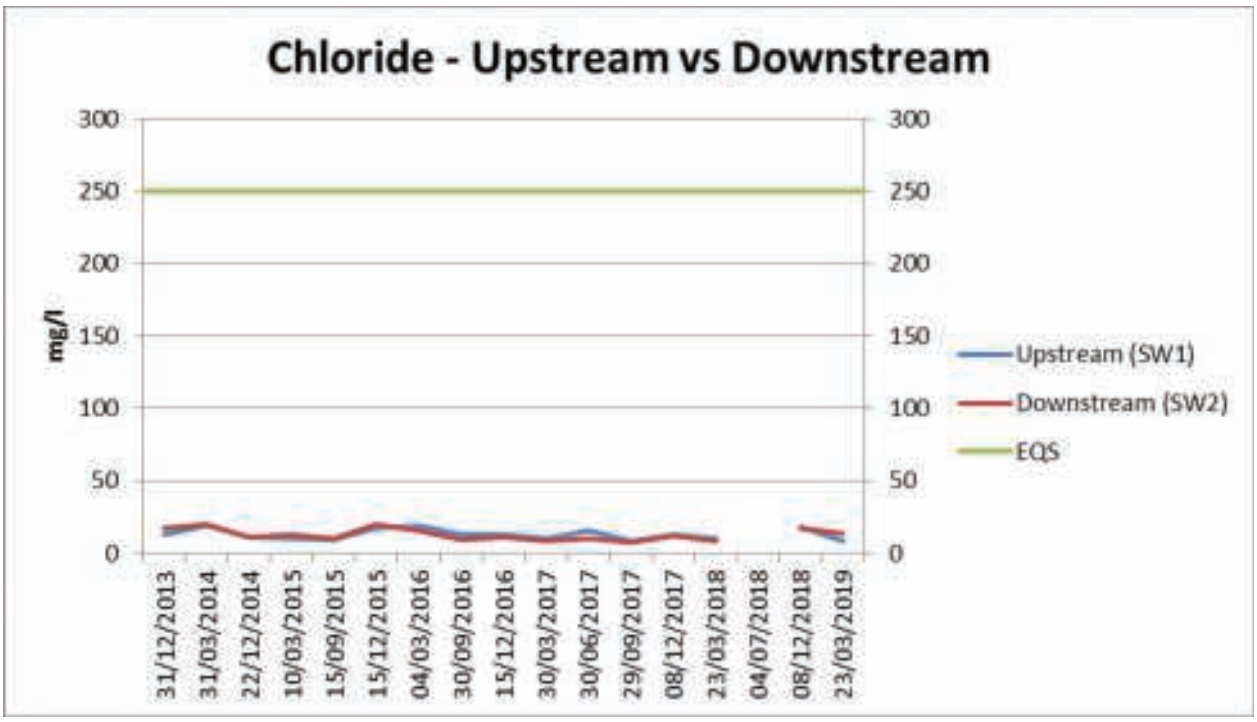
Magnesium



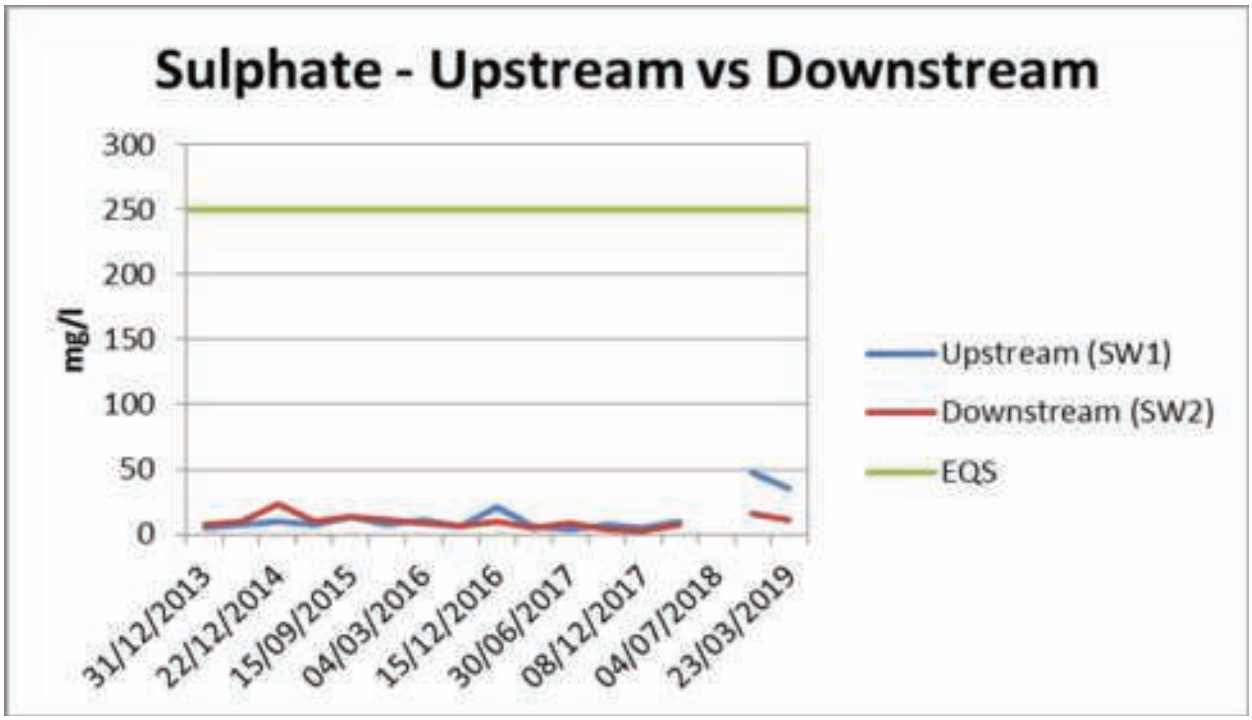
Sodium



Chloride



Sulphate



6.0 EXTERNAL GROUNDWATER MONITORING BOREHOLES

Historical monitoring data for the site between 2002 and 2014 has been reviewed and is presented in Appendix B, with the groundwater boreholes below compliance limits for iron and sodium since 2002.

Trend graphs for each determinand for the more recent period of 2014 to 2019 are presented below.

The analysis shows that the water quality has remained relatively constant for the last 5 years

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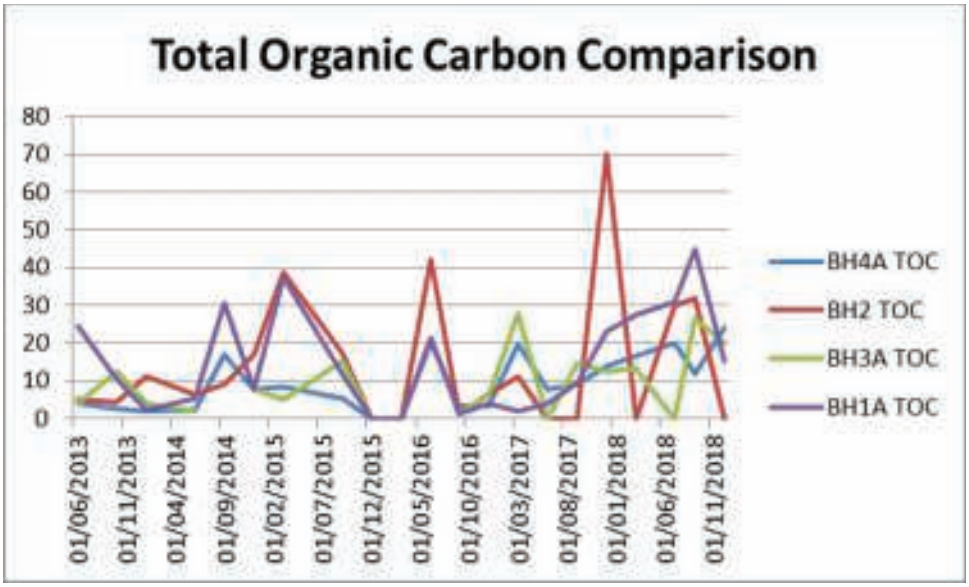

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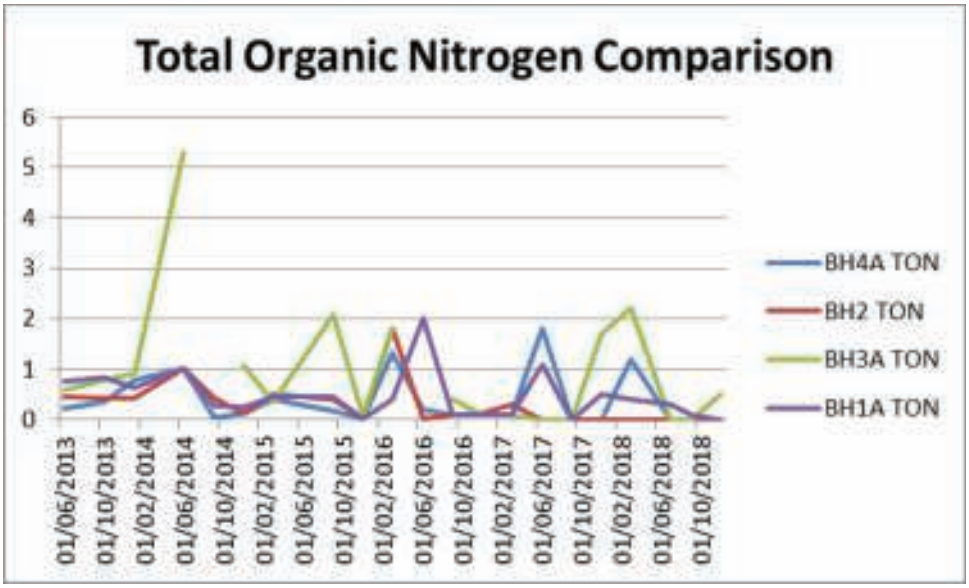
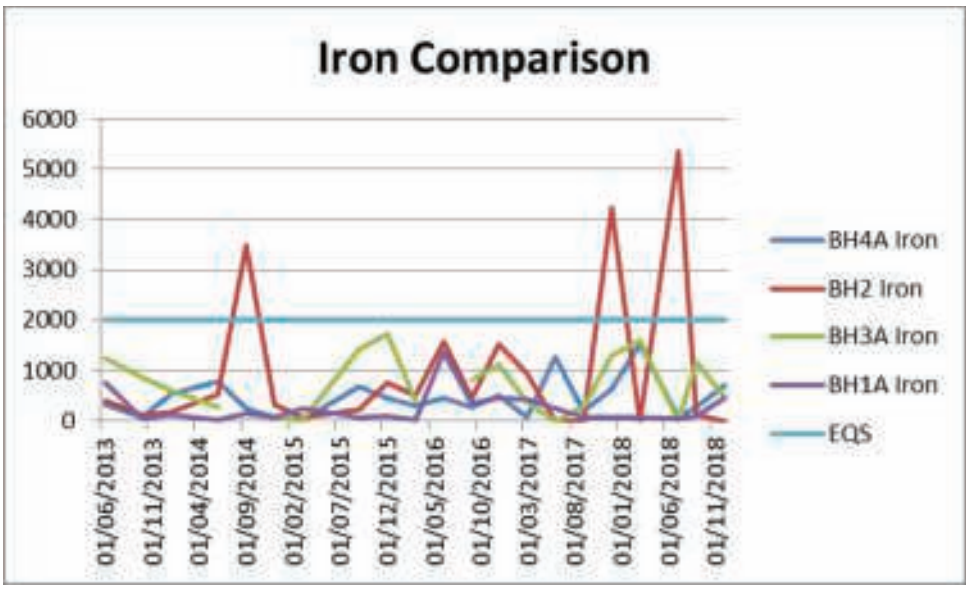
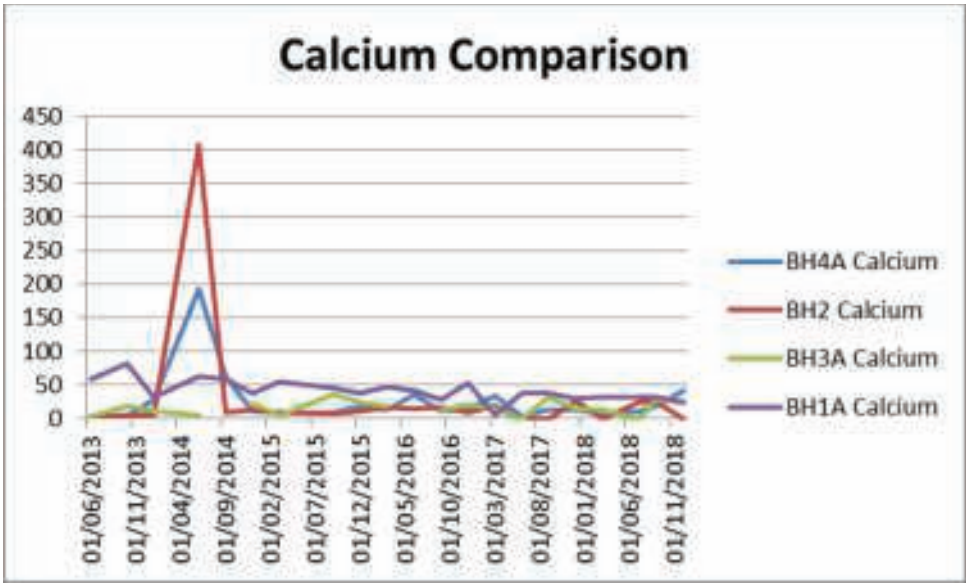


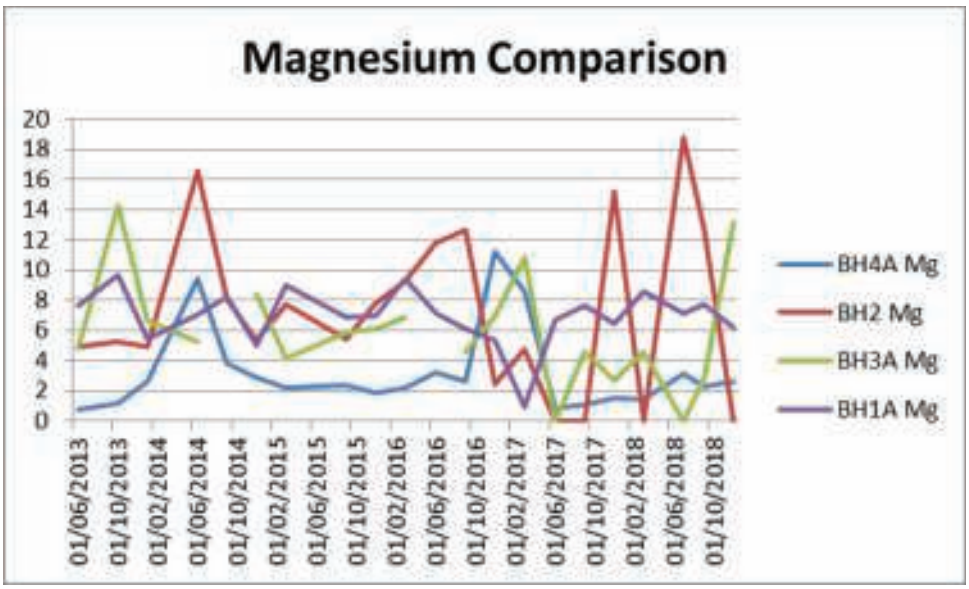
Iron



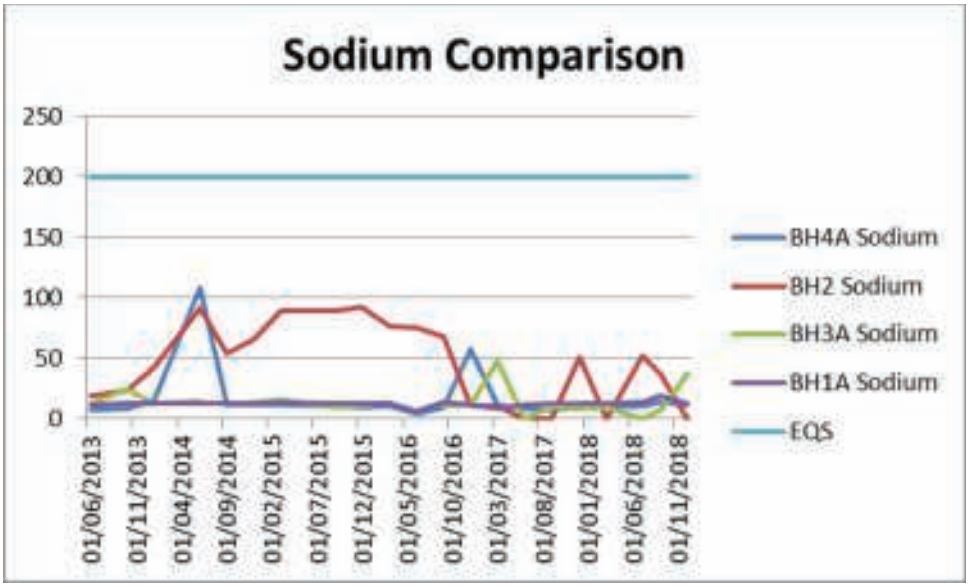
Calcium



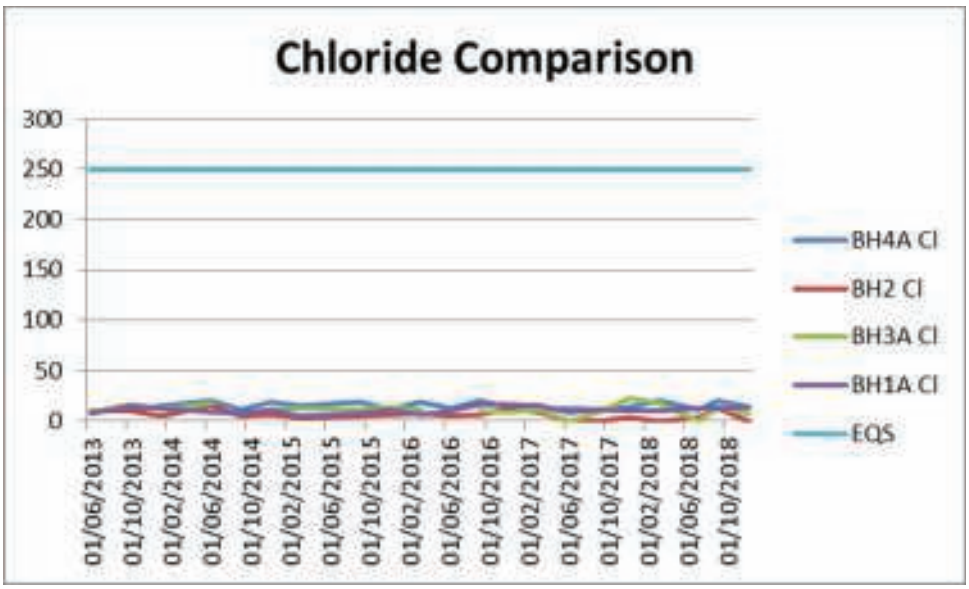
Magnesium



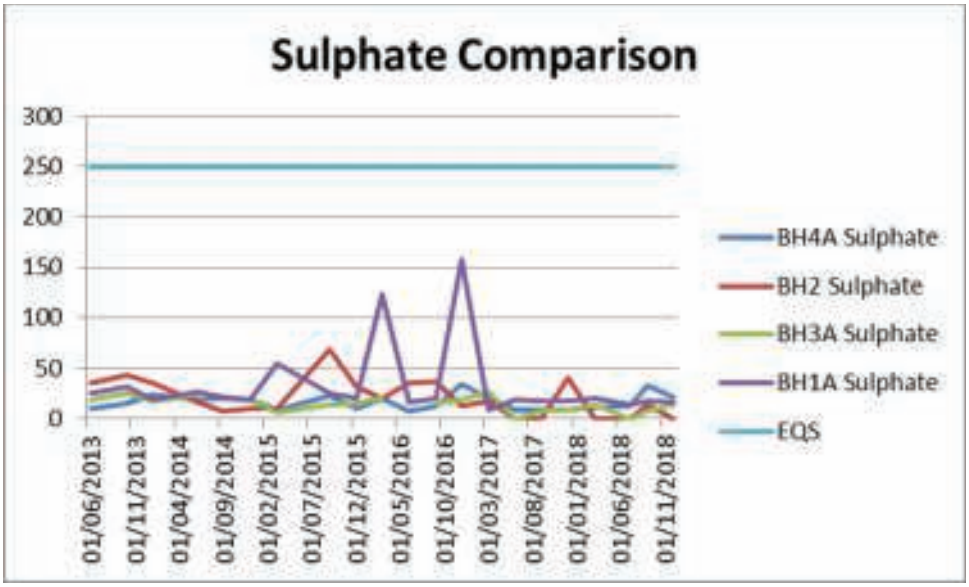
Sodium



Chloride



Sulphate



7.0 RISK ASSESSMENT FRAMEWORK

A conceptual model has been developed based on the available data to assess the residual risk of the landfill site.

7.1 Critical Sensitive Receptor – Human Health

The current use is ad - hoc grazing. The immediate use following surrender of the permit will be as agricultural land. The long term future use of the site is unknown.

7.2 Critical Sensitive Receptor – Controlled Waters and Environmental Designated Areas

As the site is located within private land, the critical sensitive receptors comprise the underlying groundwater and surface water bodies adjacent to the site.

7.3 Potential Contaminant Sources

The available historic data indicates that both inert and biodegradable materials were placed within the landfill.

Monitoring via boreholes on the site has been undertaken and provides robust chemical analysis data which has been utilised in characterisation of potential contamination which could be generated from the Landfill.

7.4 Gas Monitoring

Further to a meeting with NRW in February 2019, a Landfill Gas survey has been undertaken.

A GA5000 Landfill gas surveyor was utilised to survey each of the site borehole locations shown in drawing 04-01-11.d01 included in Appendix A.

The calibration certificate for the GA5000 is included in Appendix C.

No methane was detected in any of the site boreholes, Leachate sump, or during a walkover survey of the site surface.

Oxygen levels of 20.9 were recorded in all boreholes, with negligible levels of Carbon Dioxide detected (0-0.1%).

Historical gas data was obtained from NRW and reviewed in the preparation of this report. The results are discussed in section 2.5. The results showed that no gas was detected in 4 boreholes will gas trending down to 2.1% average for the final year of monitoring in the fifth boreholes.

Based on review of the historical data and the survey conducted prior to submission of the surrender application, and as advised by NRW during a meeting, the site does not appear to be producing any gas at levels which would preclude a low risk surrender.

Due to the negligible/very low level of generation, landfill gas is unlikely to cause the potential for an adverse effect to any sensitive receptors.

7.5 Potential Exposure Pathways

Potential exposure pathways are listed below: -

- Migration via groundwater;
- Migration via surface water.

The assessment has also considered the following: -

- Human dermal contact;
- Ingestion.

7.6 Degree of Confidence / Uncertainty

The assessment is based on minimal historical data of the landfill during its construction, supplemented with annual monitoring data which has been summarised in the preceding section and general data obtained from NRW under a freedom of information request.

It was confirmed during a meeting between NRW, Excal and the permit holder during February 2019, that this data was the best available and would be acceptable on which to base the assessment.

8.0 CONCEPTUAL MODEL AND RISK ASSESSMENT

The conceptual exposure model has been produced to reflect the findings of the annual monitoring results and the information available regarding the landfill, its construction methods and the details of materials placed within it

The conceptual model and risk assessment is summarised on the following pages.

Revised Conceptual Model Risk Assessment Matrices

Potential Source	Potential Pathway	Potential Receptor	Potential Probability & Consequence	Potential Risk	Comments	Pathway Confirmed?
Inert waste - contaminants included within the site monitoring profile dictated by the environmental permit.	Inhalation of fugitive dust	Site Workers	Low Likelihood /Moderate	Low	The materials deposited were inert and the landfill was enclosed within a clay lined cell, which was further capped and restored with grass. Monitoring results all show the site remains within compliance limits for the contaminants under assessment indicating no release or further mobilisation of any contaminants which may be present.	No – Pathway removed by construction and restoration methods used for the site
		End Users	Low Likelihood /Moderate	Low		
		Local Residents	Low Likelihood /Moderate	Low		
	Ingestion and absorption via direct contact	Site Workers	Low Likelihood /Moderate	Low		
		End Users	Low Likelihood /Moderate	Low		
	Migration in solution via groundwater flow	Surface Water	Low Likelihood /Moderate	Low		
		Aquifer	Low Likelihood /Moderate	Low		
	Migration in solution via surface water flow	Surface Water	Low Likelihood /Moderate	Low		
		Aquifer	Low Likelihood /Moderate	Low		
	Plant uptake	Local Flora	Low Likelihood /Moderate	Low		
General risks						
Toxic & phytotoxic metals and non-metals within shallow soil / groundwater	Inhalation of fugitive dust	Site Workers	Likely/Medium	Low	The materials deposited were inert and the landfill was enclosed within a clay lined cell, which was further capped and restored with grass. Monitoring results all show the site remains within compliance limits for the contaminants under assessment indicating	No – Pathway removed by construction and restoration methods used for the site
		End Users	Likely/Medium	Low		
		Local Residents	Likely/Medium	Low		
	Ingestion and absorption via direct contact	Site Workers	Likely/Medium	Low		
		End Users	Likely/Medium	Low		
	Migration in solution via groundwater flow	Surface Water	Likely/Medium	Low		
		Aquifer	Likely/Medium	Low		

Potential Source	Potential Pathway	Potential Receptor	Potential Probability & Consequence	Potential Risk	Comments	Pathway Confirmed?
	Migration in solution via surface water flow	Surface Water	Low Likelihood /Moderate	Low	no release or further mobilisation of any contaminants which may be present.	
		Aquifer	Low Likelihood /Moderate	Low		
	Plant uptake	Local Flora	Likely/Medium	Low		
Leachate – pH	Inhalation of fugitive dust	Site Workers	Likely/Medium	Low	Monitoring results all show the leachate well pH remains within compliance along with all other determinands. There have been no recorded leachate outbreaks since remedial works were undertaken	No.
		End Users	Likely/Medium	Low		
		Local Residents	Likely/Medium	Low		
	Ingestion and absorption via direct contact	Site Workers	Likely/Medium	Low		
		End Users	Likely/Medium	Low		
	Migration in solution via groundwater flow	Surface Water	Likely/Medium	Low		
		Aquifer	Likely/Medium	Low		
	Migration in solution via surface water flow	Surface Water	Low Likelihood /Moderate	Low		
		Aquifer	Low Likelihood /Moderate	Low		
	Plant uptake	Local Flora	Likely/Medium	Low		
Sulphates within soil / groundwater	Inhalation of fugitive dust	Site Workers	Likely/Medium	Low	No elevated sulphate concentrations encountered	No current precautions or adverse impacts to receptors or to buried concrete structures.
		End Users	Likely/Medium	Low		
		Local Residents	Likely/Medium	Low		
	Ingestion and absorption via direct contact	Site Workers	Likely/Medium	Low		
		End Users	Likely/Medium	Low		
	Migration in solution via groundwater flow	Surface Water	Likely/Medium	Moderate		
		Aquifer	Likely/Medium	Moderate		
	Plant uptake	Local Flora	Likely/Medium	Low		
Landfill Gas	Inhalation of	Site Workers	Low Likelihood	Low	Historical monitoring data	No/limited source of gas

Potential Source	Potential Pathway	Potential Receptor	Potential Probability & Consequence	Potential Risk	Comments	Pathway Confirmed?
	Landfill Gas		/Moderate		available does not indicate generation of gas at levels of concern. Final survey prior to submission did not identify and gas in any of the boreholes sampled on site.	identified based on gas monitoring, therefore no pathway.
		End Users	Low Likelihood /Moderate	Low		
		Local Residents	Low Likelihood /Moderate	Low		
	Plant uptake	Local Flora				

9.0 DISCUSSION

9.1 Surface water

The levels of determinands measured within surface water samples both upstream and downstream of the site are comparable with each other and no significant elevations downstream of the site could be identified.

All levels of determinands fall below the indicative EQS values that were obtainable at the time of writing for the determinands analysed.

There is no evidence of any adverse effect from the landfill on the surface water.

9.2 Leachate Monitoring Well

pH fell within the upper and lower EQS limit for the full duration of the site monitoring undertaken.

COD and BOD concentrations were below the representative EQS value for most of the 5 year monitoring period and for over the last 12 months of monitoring.

Ammonia has been consistently below the EQS value of 1mg/l, predominantly falling between 0 and 0.2 mg/l. An elevated result was recorded in June 2018 at 1.4mg/l which is slightly over the EQS value utilised, but the following two results two visit over the next 6 month period. The elevated result is therefore not thought to be significant given the historical and later data available and is probably attributable to agricultural processes.

9.3 Groundwater Boreholes

During the monitoring period TOC and TON have fluctuated. However, the levels during the last 12 months of monitoring have been low and are comparable to the levels found within the surface water body adjacent to the site.

Sodium, Chloride and Sulphate have remained low and significantly below the representative EQS values for a number of years.

No EQS values for Calcium and Magnesium were identified. However, the levels which average 25ug/l and 10 ug/l respectively across the site are not considered significant. Peaks of 15ug/l in Oct 2017 and 2019 ug/l in June 2018 were recorded for one borehole. However, corresponding increases within the surface water around the site was not identified during these periods. These values are not thought to be significant and can be discounted.

Iron levels have fluctuated during the monitoring period, but have remained predominantly below 1000ug/l, with occasional rises to around 1500 ug/l. Three results exceeding 2000 ug/l (3500, 4200 and 5350) have been recorded within Borehole 2; However, on each occasion the corresponding surface water sample taken during the same sampling period did not show any elevation.

10.0 CONCLUSION

The inert landfill material is located within a clay lined cell. No baseline contamination data is available.

Periodic monitoring has been undertaken of both boreholes within the cell and surface water adjacent to the site over several years. The monitoring has not identified any contaminant migration into the surface water body which lies adjacent to the site.

Ground boreholes into the waste material highlighted some elevated readings of Iron. However, the material is encapsulated within the clay lined cell and there were no corresponding elevated readings of Iron within the groundwater results.

It can be concluded that the landfill clay liner remains intact and functional.

Gas monitoring has been conducted and did not identify any methane within the boreholes. Historical records stated that a small volume of materials placed within the landfill were potentially bio-degradable. However historical gas monitoring has not identified generation of gas at levels of concern.

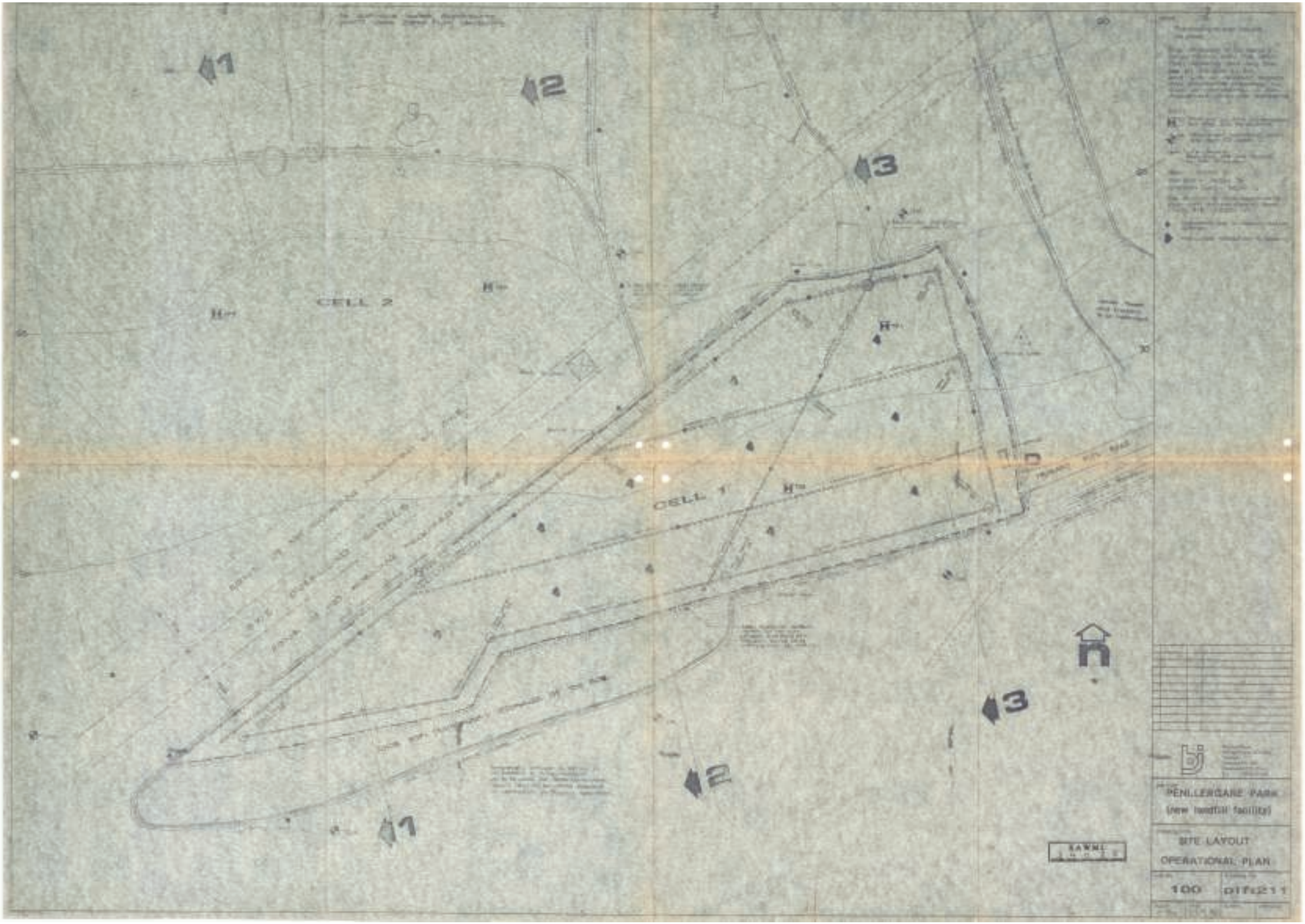
A risk assessment has been completed to identify potential contamination pathways or linkages from the site to potential sensitive receptors. The assessment concluded that, based on the information available, the site does not present a risk to any of the sensitive receptors identified as each contamination pathway is broken either by lack of a source or lack of a pathway.

The applicant has revised this report in line with the guidance received from NRW at a meeting held in February 2019.

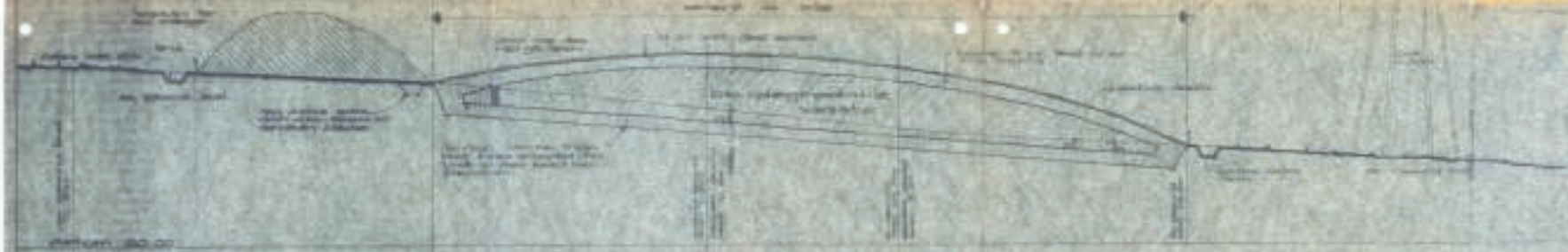
Consequently based on the analysis results and risk assessment provided in this report, we believe that sufficient information has been provided to enable the permit for the site to be surrendered.

APPENDIX A

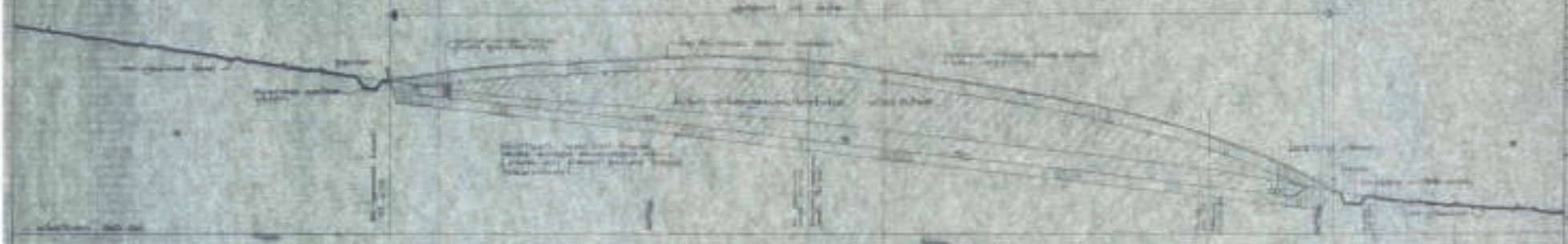
Drawings


1
2
3
CELL 2
CELL 1
3
2
1
PENLLERGARE PARK
(new landfill facility)
SITE LAYOUT
OPERATIONAL PLAN
100
01/211

SECTION 1 - 1



SECTION 2 - 2



SECTION 3 - 3

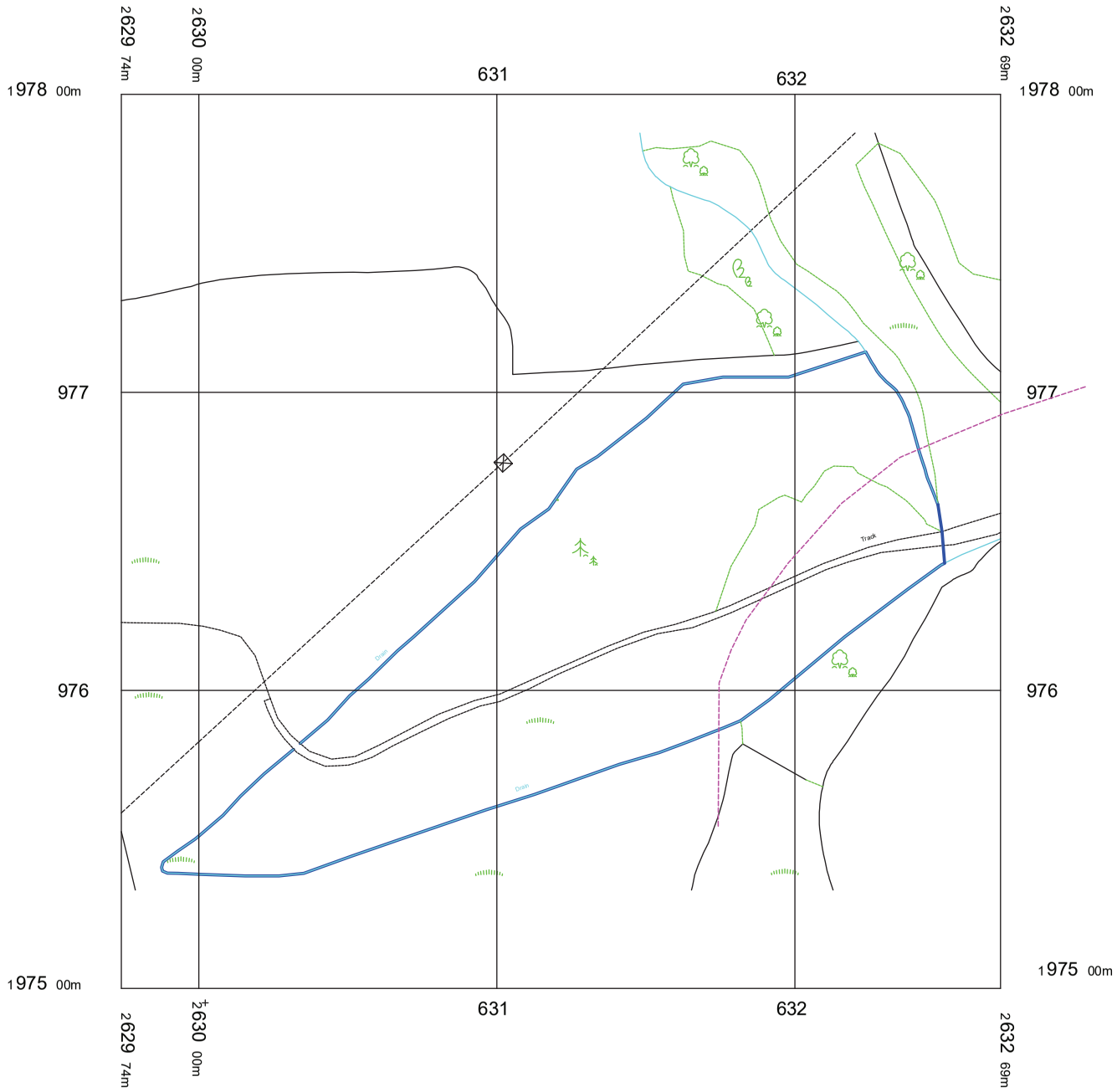
TRIAL PIT SECTIONS

PENLLERGARE PARK
(new landfill facility)

CROSS SECTIONS

100

PIT:212



Notes:	A3

Approximate landfill boundary

Job:
BJ Landholdings Limited
Penplas Landfill Site

Title:
Site Boundary

Date: June 2019

Scale: 1:150@A3

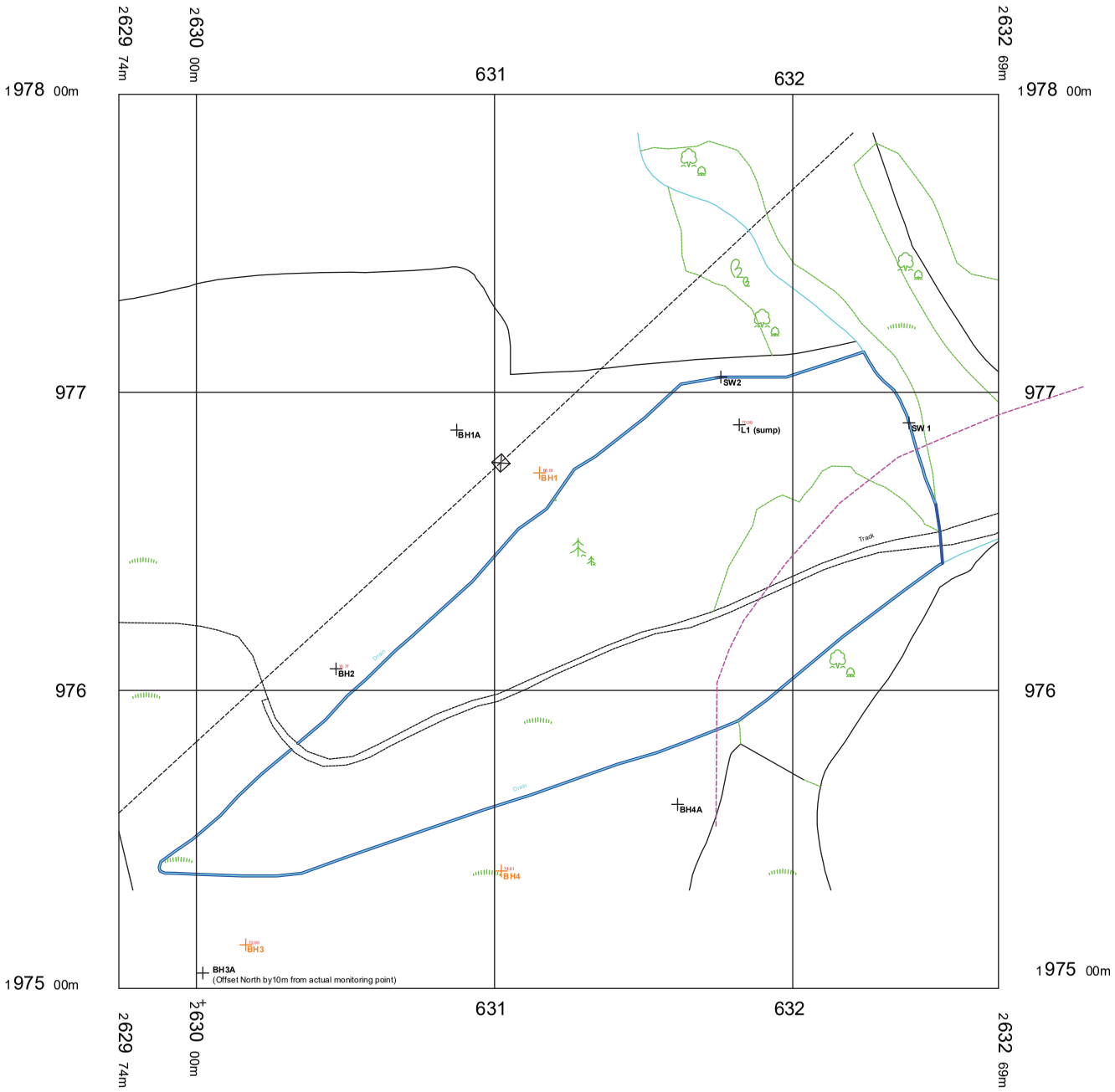
Drawn by: AJD

Checked by: DS

ExCAL House,
Capel Hendre Ind. Est.
Ammanford
Carmarthenshire
SA18 3SJ
Tel: 01269 831606
Fax: 01269 841867
Website: www.excaluk.com
E-mail: info@excaluk.com

Drawing No: 04-01-11.D02

Revision No:	Date: 18/06/2019



Notes: A3

- Approximate landfill boundary
- BH2/BH1A Groundwater Monitoring Point
- SW1 Surface Water Monitoring Point
- L1 sump Leachate Monitoring Point
- BH1 Damaged Groundwater Monitoring Point

Job:
BJ Landholdings Limited
Penplas Landfill Site

Title:
Monitoring Installations Locations

Date: June 2019

Scale: 1:150@A3

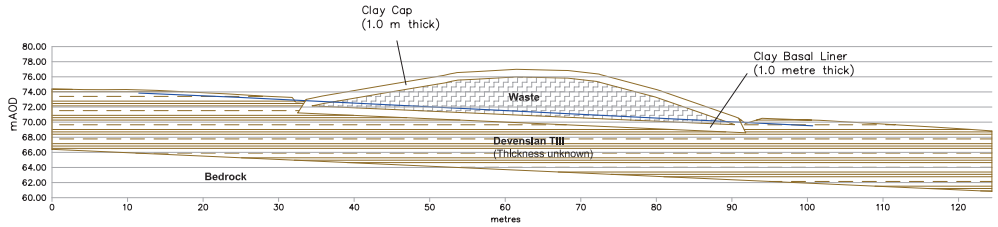
Drawn by: AJD

Checked by: DS

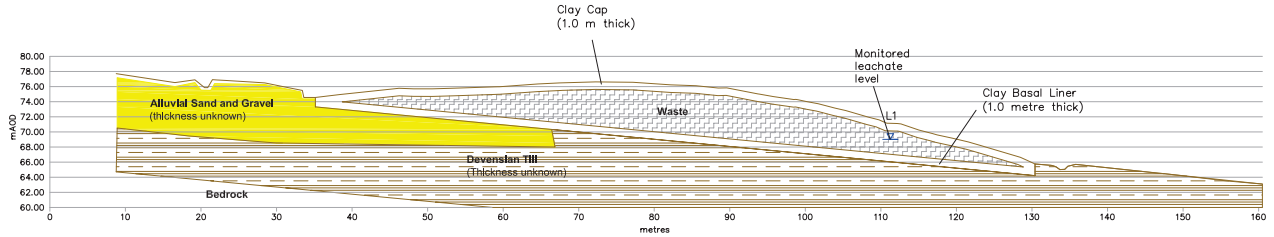
ExCAL House,
Capel Hendre Ind. Est.
Ammanford
Carmarthenshire
SA18 3SJ
Tel: 01269 831606
Fax: 01269 841867
Website: www.excaluk.com
E-mail: info@excaluk.com

Drawing No: 04-01-11.D01

Revision No: | **Date: 18/06/2019**



Section B-B1 *(Scale 1:1000)*



Section B-B1 *(Scale 1:1000)*

Notes:	A2

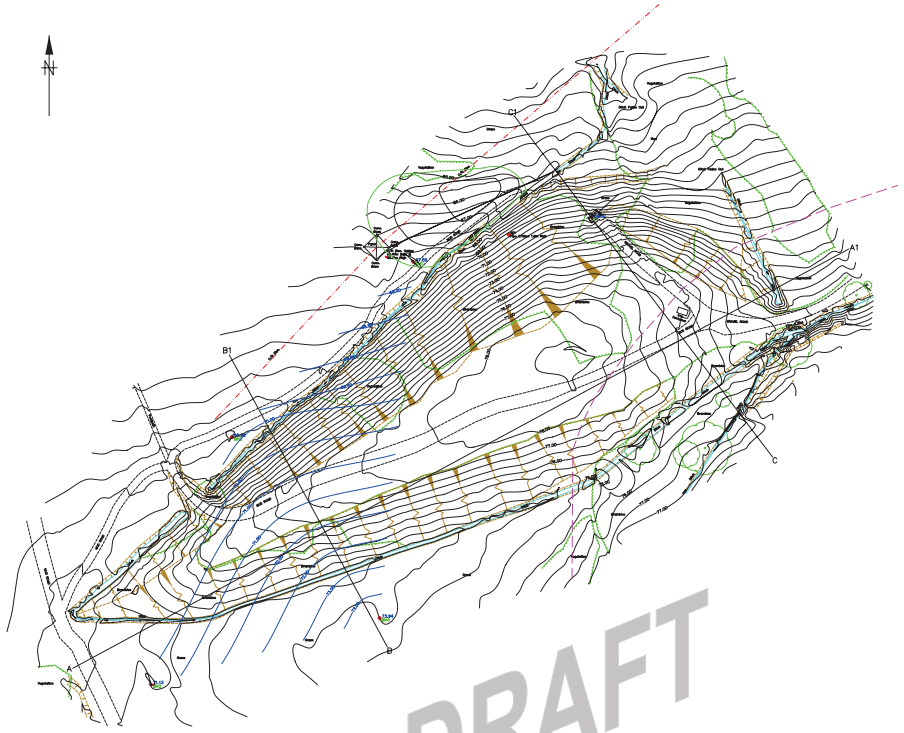
Job:
BJ Landholdings Limited
Penplas landfill Site
Swansea

Title.
Landfill sections

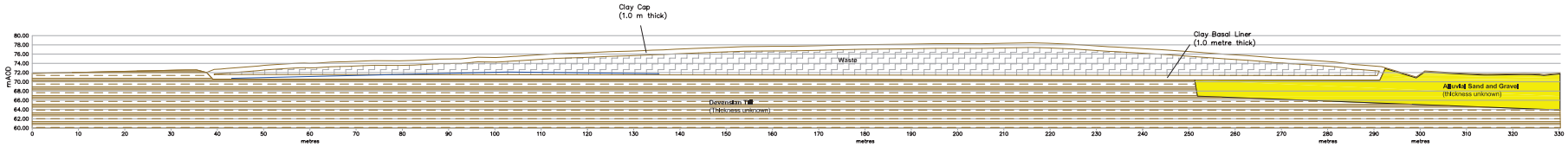
Date:	April 2008
Scale:	as shown
Drawn by:	DT
Checked by:	SR

EXCAL LIMITED
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ
Tel: 01269 831606 Fax: 01269 841867
Website: www.excaluk.com E-mail: reception@excaluk.com

Drawing No:	04-01-06-07.D002
Revision No:	**Date:**



Scale 1:1000



Section A-A1 *(Scale 1:500)*

Notes: A1

76.00 Groundlevel contours (mAOD)

76.00 Groundwater level contours (mAOD)

73.94 BH4 Monitoring Borehole (GW Level and Reference)

Assumed extend of alluvial sand and gravels

Job:
BJ Landholdings Limited
Penplas Landfill Site
Swansea

Title:
Landfill Plan and Sections

Date:	April 2008
Scale:	as shown
Drawn by:	DT
Checked by:	SR

EXCAL LIMITED
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ
Tel: 01269 831606 Fax: 01269 841867
Website: www.excaluk.com E-mail: reception@excaluk.com

Drawing No:	04-01-06-07.D001
Revision No:	**Date:**

APPENDIX B

Analysis Results

Sampling Point BH1

Date dd/mm/yyyy	TOC mg/l sign	result	Sodium mg/l sign	result	Magnesium mg/l sign	result	Calcium mg/l sign	result	Iron mg/l sign	result	TON mg/l sign	result	Chloride mg/l sign	result	Sulphate mg/l sign	result
18/04/2000		16		15.7		28.8		102		21.2		0.17		27		69
07/07/2000	<	2		247		40.2		81.2		64.1		0.31		27		51
15/11/2000		3.9		34		21		61		17.6		0.5		33		48
29/01/2001		1.4		13		18		49		13.8		1.1		27		46
04/07/2001		2.4		19		21		60				0.4		15		20
12/10/2001		0.8		13		14		41		0.28		1.3		15		24
20/12/2001		2.4		13		15		43		6.53	<	0.3		12		19
19/03/2002		1.3		13		15		35		11.6	<	0.3		14		18
19/06/2002		1.2		11		11		30		1.79		0.5		16		26
24/09/2002		1.1		11		9		28		0.19	<	0.3		15		46
16/01/2003		0.6		14		11		28		2.5	<	0.3		15		34
17/04/2003		0.7		11		9.9		27		0.2		1		10		20
14/08/2003		0.7		14		14		34		12.5		0.7		16		24
17/12/2003		1.4		13		10		26		1.45		0.6		13		26
18/05/2004		1.7		25		13		37		29.2		0.4		28		34
30/11/2004		1.3		27		10		28		6.58		1.1		15		31
23/02/2005		1.1		23		12		28		8.81	<	0.3		36		53
11/05/2005		1.4		13		9.4		23		2.38	<	0.3		14		25
02/08/2005		1.7		18		9.9		24		8.1	<	0.3		21		35
25/11/2005		1.7		17		8		20		1.17		0.8		13		24
23/02/2006		1		13		11		25		8.31		2.8		28		26
30/05/2006		2.7		14		9.9		25		20.5	<	0.3		11		22
06/12/2006		2.3		33		10		33		10.9		1.2		12		37
29/03/2007		5.2		30		17		43		23.4	<	0.3		25		100
30/06/2010		1.96												9.67		

Sampling Point BH2

Date dd/mm/yyyy	TOC mg/l sign	result	Sodium mg/l sign	result	Magnesium mg/l sign	result	Calcium mg/l sign	result	Iron mg/l sign	result	TON mg/l sign	result	Chloride mg/l sign	result	Sulphate mg/l sign	result
07/08/2000		2.4		30.9		82.8		97.6		102		0.57		21		79
15/11/2000		2.7		74		37		60		28.4		2.6		31		163
29/01/2001		2.4		42		36		47		29.9		2		28		158
04/07/2001		2.4		50		25		33				0.7		21		102
12/10/2001		1.2		31		16		21		0.54	<	0.3		24		104
20/12/2001		3.5		43		20		25		5.86	<	0.3		13		108
19/03/2002		1.8		36		18		18		10.2	<	0.3		14		104
19/06/2002		1.9		40		12		16		1.94		0.5		14		95
24/09/2002		1.2		31		13		15		0.39	<	0.3		15		96
16/01/2003		2.9		36		13		14		5.1	<	0.3		10		64
17/04/2003		0.9		48		13		14		7.7		0.8		10		84
14/08/2003		1.4		39		11		10		9.01		0.5		17		85
17/12/2003		0.8		35		9.9		12		6.12	<	0.3		27		78
18/05/2004		1.9		41		13		14		18.6	<	0.3		16		42
30/11/2004		2.3		44		11		13		22		1		14		14
23/02/2005		1.6		43		13		14		41.7	<	0.3		15		12
11/05/2005		2.6		29		8.9		8.5		4.06	<	0.3		9		8
02/08/2005		2.1		28		12		9.2		6.91	<	0.3		16		21
25/11/2005		2.7		34		12		10		3.05	<	0.3		12		7
23/02/2006		2.7		37		9.3		9.8		14.1		3.8		57		15

30/05/2006		4.9		32		9.7		12		11.2		0.3		9	<	5
06/12/2006		2.7		34		8.4		11		5.54		0.8		9		64
29/03/2007		3.5		40		7		10		15.2		0.3		9		62
30/06/2010		2.46														9.48

Sampling Point BH3

Date dd/mm/yyyy	TOC mg/l sign	result	Sodium mg/l sign	result	Magnesium mg/l sign	result	Calcium mg/l sign	result	Iron mg/l sign	result	TON mg/l sign	result	Chloride mg/l sign	result	Sulphate mg/l sign	result
07/08/2000	<	2		23		63		86.8		77.1		0.29		23		40
15/11/2000		2		49		33		55		42.2		1.6		33		112
29/01/2001		1.4		33		27		44		7.83		1.6		31		111
04/07/2001		1.5		35		16		29				0.5		26		61
12/10/2001		0.5		29		15		27		0.38	<	0.3		22		55
20/12/2001		2.1		27		14		22		10.9	<	0.3		17		55
19/03/2002		2.2		27		19		19		34.6	<	0.3		22		62
19/06/2002		1.1		30		11		17		4.8		0.3		37		81
24/09/2002		1.7		26		14		28		0.05	<	0.3		12		84
16/01/2003		1.9		23		8.3		12		1.22		0.3		15		9
17/04/2003		0.3		22		8.2		11		1.65		0.8		17		37
14/08/2003		0.6		21		9.8		13		10.2		0.5		39		49
30/11/2004		0.5		26		6.5		10		8.14		1		34		67
23/02/2005		0.5		27		10		12		13	<	0.3		24		44
11/05/2005		0.9		19		6.2		7.3		3.14	<	0.3		17		31
02/08/2005		1.1		21		7.5		8.1		5.49	<	0.3		24		30
25/11/2005		0.9		20		5.8		6.2		3.35	<	0.3		18		32
23/02/2006		0.9		19		7.6		7.3		10.5	<	0.3		21		45
30/05/2006		2.5		22		7.2		7.6		6.77	<	0.3		17		27
24/08/2006		1.6		23		19		21		42		0.7		115		81
06/12/2006		1.8		29		9.2		13		21.8		0.8		26		43
29/03/2007		2.2		18		6.9		6.5		11.6	<	0.3		18		48
30/07/2010		17.4												5.33		

Sampling Point BH4

Date dd/mm/yyyy	TOC mg/l sign	result	Sodium mg/l sign	result	Magnesium mg/l sign	result	Calcium mg/l sign	result	Iron mg/l sign	result	TON mg/l sign	result	Chloride mg/l sign	result	Sulphate mg/l sign	result
07/08/2000	<	2		246		53.1		81.1		66.7	<	0.05		20		52
15/11/2000		2.7		37		25		63		15.4	<	0.3		24		79
29/01/2001		2		59		1		20		0.4		0.3		20		75
04/07/2001		2.1		30		17		44			<	0.3		17		60
12/10/2001		1		28		17		38		0.19	<	0.3		17		76
20/12/2001		2.3		28		24		55		2.53	<	0.3		13		62
19/03/2002		2.4		29		20		37		3.24	<	0.3		16		73
19/06/2002		2.1		39		18		35		0.49		0.8		14		80
16/01/2003		2		26		14		27		0.78	<	0.3		9		5
14/08/2003		1.2		41		15		28		4.59		0.5		12		71
17/12/2003		1.5		29		12		22		0.69		0.8		10		78
18/05/2004		2		40		13		26		6.57	<	0.3		12		69
11/08/2004		1.6		26		14		25			<	0.3		11		61
30/11/2004		1.5		31		11		23		7.11		1		12		65
23/02/2005		0.9		31		12		22		5.49	<	0.3		12		65
11/05/2005		1.6		23		8.3		14		0.47		0.4		9		68
02/08/2005		1.6		33		11		21		6.08	<	0.3		12		67

25/11/2005		1		21		8.8		15	0.38	<	0.3	10	55
23/02/2006		1.4		22		11		20	8.54	<	0.3	14	69
30/05/2006		2.7		23		9.5		16	2.77		4.4	11	60
24/08/2006		1.5		22		13		21	11.7		1	15	61
06/12/2006		1.5		22		7.6		16	1		0.8	7	57
29/03/2007		2.6		42		5.9		11	2.59	<	0.3	10	48
30/07/2010		2.31										13.87	

Sampling Point L1

Date	pH Value		Ammoniacal Nitrogen		BOD (5 day)		COD	
dd/mm/yyyy	pH Units		mg/l		mg/l		mg/l	
	sign	result	sign	result	sign	result	sign	result
18/04/2000		6.85		1.4		3.3		54
01/09/2000		7.19	<	0.3		4.1		53
15/11/2000		6.6		1		2		100
29/01/2001		6.5		1.7		1		34
04/07/2001		7.2	<	0.3		5		77
12/10/2001		7.1	<	0.3		1		46
20/12/2001		7.5		0.6		3		44
19/03/2002		7.3		0.8		1		20
19/06/2002		7.3		0.6		1		55
24/09/2002		7.7		0.5		2		36
16/01/2003		5.7		17.7		3		60
17/04/2003		7.2	<	0.3		1		125
14/08/2003		6.8		0.4		1		55
17/12/2003		6.9		0.6		2		57
18/05/2004		6.6		0.4		3		77
11/08/2004		7.2		0.8		4		57
30/11/2004		6.7		10.6		3		124
24/02/2005		7.5	<	0.3		2		74
11/05/2005		7.1	<	0.3		1		61
02/08/2005		7.3	<	0.3		3		74
25/11/2005		7.9	<	0.3		2		74
23/02/2006		7.6	<	0.3		1		50
30/05/2006		7.1	<	0.3		2		47
24/08/2006		7.5	<	0.3		6		79
06/12/2006		8.2	<	0.3	<	1		92
29/03/2007		7.5				1		65
30/07/2010		7.08		8.45				53

Sampling Point L1

date	Leachate Depth			
dd/mm/yyyy	m		average	
	sign	result		
08/03/2002		1.90	2.57	
19/03/2002		2.20		
04/04/2002		2.20		
19/04/2002		2.30		
10/05/2002		2.50		
23/05/2002		2.60		
10/06/2002		2.50		
19/06/2002		2.50		
12/07/2002		2.50		
25/07/2002		2.60		
06/08/2002		2.60		
22/08/2002		2.60		
05/09/2002		2.80		
25/09/2002		2.80		
15/10/2002		2.10		
31/10/2002		2.10		
14/11/2002		3.00		
25/11/2002		3.00		
06/12/2002		3.20		
18/12/2002		3.30		
13/01/2003		3.20	2.67	
27/01/2003		3.20		
11/02/2003		2.60		
25/02/2003		2.60		
14/03/2003		2.70		
28/03/2003		2.80		
17/04/2003		2.70		
28/04/2003		2.80		
14/05/2003		2.80		
30/05/2003		2.80		
10/06/2003		2.82		
27/06/2003		2.85		
10/07/2003		2.70		
24/07/2003		2.70		
14/08/2003		2.70		
26/08/2003		2.60		
10/09/2003		2.60		
24/09/2003		2.60		
01/10/2003		2.60		
17/10/2003		2.60		
08/11/2003		2.90		
25/11/2003		0.00		
02/12/2003		2.90		
17/12/2003		3.25		
09/01/2004		3.55	2.52	
30/01/2004		3.05		
04/02/2003		3.15		
18/02/2003		3.00		
12/03/2004		2.75		
25/03/2004		0.00		
07/04/2004		2.40		
27/04/2004		2.60		
07/05/2004		2.60		
18/05/2004		2.60		
03/06/2004		2.60		
23/06/2004		2.60		
02/07/2004		2.60		
22/07/2004		2.60		
11/08/2004		2.60		
27/08/2004		2.60		
13/09/2004		2.90		
28/09/2004		2.90		
12/10/2004		2.90		
28/10/2004		2.90		
15/11/2004		2.90		
30/11/2004		0.40		
10/12/2004		2.50		
22/12/2004		1.82		
07/01/2005		2.60	2.65	
14/01/2005		2.80		
01/02/2005		2.40		
23/02/2005		2.80		
03/03/2005		2.50		
21/03/2005		2.50		
13/04/2005		3.00		
26/04/2005		2.90		
11/05/2005		2.70		
21/03/2005		2.80		
10/06/2005		2.80		

Year	Average Leachate Depth
2002	2.57
2003	2.67
2004	2.52
2005	2.65
2006	2.71
2007	1.74
2008	2.98
2009	2.61
2010	2.04
2011	2.81
2012	1.43
2013	1.46
2014	1.40

23/06/2005	2.80	
13/07/2005	2.70	
25/07/2005	2.80	
02/08/2005	3.00	
22/08/2005	3.00	
31/08/2005	0.00	
19/09/2005	2.00	
02/10/2005	2.70	
26/10/2005	3.00	
10/11/2005	3.30	
25/11/2005	3.00	
06/12/2005	2.80	
21/12/2005	2.60	
01/02/2006	0.80	2.71
22/02/2006	2.60	
09/03/2006	2.70	
22/03/2006	2.80	
05/04/2006	2.80	
21/04/2006	2.80	
05/05/2006	2.75	
18/05/2006	2.80	
02/06/2006	2.80	
29/06/2006	2.55	
14/07/2006	2.50	
28/07/2006	2.50	
13/09/2006	2.50	
26/09/2006	2.45	
04/10/2006	2.80	
19/10/2006	2.60	
10/11/2006	2.88	
24/11/2006	3.63	
06/12/2006	3.58	
15/12/2006	3.40	
03/01/2007	2.78	1.74
11/01/2007	1.40	
01/02/2007	1.83	
14/02/2007	2.98	
21/02/2007	2.59	
29/03/2007	1.70	
10/04/2007	1.60	
27/04/2007	1.20	
11/05/2007	1.00	
23/05/2007	0.80	
11/06/2007	2.70	
19/06/2007	0.70	
13/07/2007	1.00	
26/07/2007	2.20	
17/08/2007	2.25	
21/08/2007	2.25	
06/09/2007	1.30	
21/08/2007	1.60	
04/10/2007	0.10	
31/10/2007	0.50	
19/11/2007	2.60	
30/11/2007	1.75	
10/12/2007	3.15	
17/12/2007	1.70	
02/01/2008	3.3	2.98
23/01/2008	2.9	
11/02/2008	3.45	
29/02/2008	-	
06/03/2008	-	
31/03/2008	3.5	
08/04/2008	2.9	
17/04/2008	3.5	
16/05/2008	2.9	
29/05/2008	2.8	
25/06/2008	1.14	
30/06/2008	1.18	
11/07/2008	2.3	
31/07/2008	2.3	
08/08/2008	3.15	
28/08/2008	3.6	
10/09/2008	3.6	
30/09/2008	2.95	
13/10/2008	3.5	
31/10/2008	3.1	
14/11/2008	3.6	
26/11/2008	3.3	
02/12/2008	3.3	
16/12/2008	3.3	
05/01/2009	3.3	2.61
29/01/2009	3.7	
13/02/2009	3.5	
23/02/2009	3.2	

04/03/2009	3.6	
18/03/2009	3	
09/04/2009	2.1	
30/04/2009	-	
05/05/2009	2.2	
26/05/2009	3.4	
02/06/2009	2.2	
30/06/2009	1.2	
13/07/2009	1.7	
29/07/2009	3.2	
10/08/2009	2.6	
24/08/2009	2.6	
04/09/2009	3.1	
28/09/2009	2.5	
14/10/2009	2.5	
21/10/2009	3.2	
04/11/2009	2.2	
17/11/2009	1.8	
03/12/2009	1.5	
16/12/2009	1.7	
19/01/2010	1.6	2.04
27/01/2010	1.6	
10/02/2010	1.7	
26/02/2010	2	
05/03/2010	3.1	
22/03/2010	1.7	
08/04/2010	2.2	
20/04/2010	2.1	
14/05/2010	1.8	
27/05/2010	1.2	
17/06/2010	0.9	
30/06/2010	1.2	
12/07/2010	1	
19/07/2010	1.5	
16/08/2010	1.5	
26/08/2010	1.5	
09/09/2010	2.9	
29/09/2010	3.2	
11/11/2010	3.3	
22/11/2010	3	
10/12/2010	2.9	
23/12/2010	3	
14/01/2011	3.2	2.81
20/01/2011	3.1	
04/02/2011	3.2	
23/02/2011	3	
10/03/2011	3.3	
30/03/2011	3.1	
20/04/2011	2.6	
27/04/2011	2.4	
12/05/2011	2.8	
23/05/2011	2.3	
15/06/2011	2.1	
30/06/2011	1.9	
19/07/2011	2.76	
29/07/2011	3.02	
05/08/2011	3.1	
26/08/2011	3.96	
13/09/2011	3.44	
29/09/2011	3.18	
28/10/2011	3.31	
14/11/2011	2.31	
30/11/2011	2.08	
07/12/2011	2.24	
22/12/2011	2.25	
05/01/2012	2.05	1.43
30/01/2012	1.6	
14/02/2012	2.2	
28/02/2012	1.6	
13/03/2012	1.45	
27/03/2012	1.4	
11/04/2012	1.35	
24/04/2012	1.16	
16/05/2012	1.24	
31/05/2012	1.45	
12/06/2012	1.35	
25/06/2012	1.3	
10/07/2012	1.32	
31/07/2012	1.35	
21/08/2012	1.49	
31/08/2012	1.45	
12/09/2012	1.38	
28/09/2012	1.35	
16/10/2012	1.36	
30/10/2012	1.26	

14/11/2012	1.3	
28/11/2012	1.32	
12/12/2012	1.26	
17/12/2012	1.32	
11/01/2013	1.3	1.46
30/01/2013	1.29	
15/02/2013	1.35	
28/02/2013	1.43	
14/03/2013	1.56	
27/03/2013	1.38	
11/04/2013	1.57	
30/04/2013	1.6	
13/05/2013	1.65	
28/05/2013	1.6	
12/06/2013	1.6	
27/06/2013	1.7	
18/07/2013	1.8	
31/07/2013	1.9	
30/08/2013	1.45	
20/09/2013	1.54	
01/10/2013	1.58	
22/10/2013	1	
31/10/2013	1.25	
13/11/2013	1.24	
06/12/2013	1.46	
16/12/2013	1.24	
31/12/2013	1.2	
17/01/2014	1.24	1.40
31/01/2014	1.28	
20/02/2014	1.21	
28/02/2014	1.28	
13/03/2014	1.46	
31/03/2014	1.6	
15/04/2014	1.52	
30/04/2014	1.45	
16/05/2014	1.52	

Alex Prigmore
Excal Ltd
Excal House
Capel Hendre Industrial Estate
Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 1946

Project/Site name:	Penplas		Samples Taken:	30-06-2017
Job Number:	01-11-02		Samples Received:	04-07-2017
Order Number:	EC 3156		Date Instructed:	04-07-2017
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	19-07-2017
			Report Issued:	20-07-2017
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

UKAS TESTING
4303

Client: Excal Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 1946

Results of analysis of 5 samples received on the 04/07/17

Report Date
20th July 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**040717028**	-	-	**040717029**
Client Sample Reference:				BH1	BH2	BH3	BH4
Sample Date:				30/06/17	-	-	30/06/17
Sample Matrix:				Groundwater	Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.2	*[I/S]*	*[I/S]*	5.7
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	0.30	*[I/S]*	*[I/S]*	0.04
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	8.9	*[I/S]*	*[I/S]*	12.8
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	4.0	*[I/S]*	*[I/S]*	7.7
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	212	*[I/S]*	*[I/S]*	183
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	1.1	*[I/S]*	*[I/S]*	1.8
-	Total Nitrogen	$mg.l^{-1}$ N	N	1.4	*[I/S]*	*[I/S]*	1.8
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O2	A	7.8	*[I/S]*	*[I/S]*	6.7
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	<0.21	-	-	<0.21
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	*[I/S]*	*[I/S]*	8.8
METALS-L	Iron	$\mu g.l^{-1}$	A	256	*[I/S]*	*[I/S]*	1,280
METALS-L	Copper	$\mu g.l^{-1}$	A	<0.8	*[I/S]*	*[I/S]*	<0.8
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.3	*[I/S]*	*[I/S]*	3.2
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	*[I/S]*	*[I/S]*	<4.1
1450	Arsenic	$\mu g.l^{-1}$	S-A	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	288	*[I/S]*	*[I/S]*	311
METALS-L	Boron	$\mu g.l^{-1}$	A	6.9	-	-	17.0
METALS-L	Potassium	$mg.l^{-1}$	A	0.56	*[I/S]*	*[I/S]*	<0.12
METALS-L	Sodium	$mg.l^{-1}$	A	11.0	*[I/S]*	*[I/S]*	7.7
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.86	*[I/S]*	*[I/S]*	<0.86
METALS-L	Magnesium	$mg.l^{-1}$	A	6.7	*[I/S]*	*[I/S]*	0.84
1450	Mercury	$\mu g.l^{-1}$	S-A	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	36.8	*[I/S]*	*[I/S]*	4.1
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	*[I/S]*	*[I/S]*	34.3
METALS-L	Sulphate	$mg.l^{-1}$	A	18.9	*[I/S]*	*[I/S]*	9.1

* Accreditation Status
Tests marked 'A' hold UKAS accreditation
Tests marked 'N' do not hold UKAS accreditation
Tests marked 'S - A' were sub-contracted to an approved laboratory with accreditation on the specific method
Tests marked 'S - N' were sub-contracted to an approved laboratory without accreditation on the specific method
Any comments or interpretations are beyond the scope of UKAS accreditation

UKAS TESTING
4303

Decus RESEARCH

Client: Excal Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 1946

Results of analysis of 5 samples received on the 04/07/17

Report Date
20th July 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**040717030**	**040717031**	**040717032**	-
Client Sample Reference:				SW1	SW2	L1	-
Sample Date:				30/06/17	30/06/17	30/06/17	-
Sample Matrix:				Surface Water	Surface Water	Leachate Water	-
INORG-L01	pH	pH units	A	7.7	7.8	7.2	-
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	0.20	1.8	<0.01	-
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	15.8	10.0	2.8	-
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	34	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	12.3	11.1	20.4	-
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	<0.4	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	515	340	176	-
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	2.5	2.6	1.7	-
-	Total Nitrogen	$mg.l^{-1}$ N	N	2.7	4.4	1.7	-
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O2	A	7.0	6.1	8.0	-
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	0.04	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	<0.21	<0.21	<0.21	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	2.5	2.6	-
METALS-L	Iron	$\mu g.l^{-1}$	A	175	616	647	-
METALS-L	Copper	$\mu g.l^{-1}$	A	<0.8	1.7	14.3	-
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.8	2.6	2.1	-
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	<4.1	-
1450	Arsenic	$\mu g.l^{-1}$	S-A	-	-	1.4	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	217	20.5	32.4	-
METALS-L	Boron	$\mu g.l^{-1}$	A	189.0	42.5	16.3	-
METALS-L	Potassium	$mg.l^{-1}$	A	12.5	7.2	0.73	-
METALS-L	Sodium	$mg.l^{-1}$	A	20.0	12.6	5.7	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.86	<0.86	<0.86	-
METALS-L	Magnesium	$mg.l^{-1}$	A	19.4	9.0	1.5	-
1450	Mercury	$\mu g.l^{-1}$	S-A	-	-	<0.50	-
METALS-L	Calcium	$mg.l^{-1}$	A	128	81.9	37.8	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	<1.1	<1.1	-
METALS-L	Sulphate	$mg.l^{-1}$	A	3.7	8.3	7.4	-

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UKAS TESTING
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Client: Excal Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 1946

Results of analysis of 5 samples received on the 04/07/17

Report Date
20th July 2017

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	ISO 17025
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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CERTIFICATE OF ANALYSIS 1946

Results of analysis of 5 samples received on the 04/07/17

Report Date
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All results only relate to the items tested.
This report supersedes any previous versions issued by the laboratory.
A full list of determinants relating to abbreviations such as PAHs, VOCs, SVOCs, PCBs etc. is available upon request.
Where results have been labelled as deviating for any reason, the data may not be representative of the sample at the point of sampling:

[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

Where any sub-contracted results have been noted as deviating by the laboratory in question, their deviations codes will be applied and detailed.
Accreditation statements are correct at the time of issue.

**********END OF REPORT**********

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Alex Prigmore
Excal Ltd
Excal House
Capel Hendre Industrial Estate
Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2048

Project/Site name:	Penplas		Samples Taken:	29-09-2017
Job Number:	01-11-02		Samples Received:	04-10-2017
Order Number:	EC 3206		Date Instructed:	04-10-2017
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	03-11-2017
			Report Issued:	03-11-2017
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2048

Results of analysis of 6 samples received on the 04/10/17

Report Date
03rd November 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**041017001**	**041017002**	**041017003**	**041017004**
Client Sample Reference:				BH1	BH3	BH4	SW1
Sample Date:				29/09/17	29/09/17	29/09/17	29/09/17
Sample Matrix:				Groundwater	Groundwater	Groundwater	Surface Water
INORG-L01	pH	pH units	A	7.3	7.2	6.7	6.9
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	0.07	<0.01	<0.01
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	10.7	8.3	10.7	8.4
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	9.3	14.6	9.0	11.9
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	163	165	60	56
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	<0.1	<0.1	<0.1	0.4
-	Total Nitrogen	$mg.l^{-1}$ N	N	<0.1	<0.1	<0.1	0.4
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	8.9	8.0	7.1	8.2
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	<0.21	<0.21	<0.21	<0.21
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	6.8	4.0	2.7
METALS-L	Iron	$\mu g.l^{-1}$	A	64.1	283	208	398
METALS-L	Copper	$\mu g.l^{-1}$	A	1.7	11.7	4.8	38.5
METALS-L	Chromium	$\mu g.l^{-1}$	A	<1.0	1.4	<1.0	1.0
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	<4.1	<4.1
1450	Arsenic	$\mu g.l^{-1}$	S-A	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	27.9	45.9	254	7.8
METALS-L	Boron	$\mu g.l^{-1}$	A	12.2	10.9	10.2	13.8
METALS-L	Potassium	$mg.l^{-1}$	A	<0.12	<0.12	<0.12	<0.12
METALS-L	Sodium	$mg.l^{-1}$	A	12.7	8.7	7.5	7.3
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9	<0.9	<0.9	1.0
METALS-L	Magnesium	$mg.l^{-1}$	A	7.6	4.6	1.1	1.0
1450	Mercury	$\mu g.l^{-1}$	S-A	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	38.1	31.1	12.9	12.4
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	11.9	29.8	44.9
METALS-L	Sulphate	$mg.l^{-1}$	A	17.1	7.6	7.9	7.4

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4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2048

Results of analysis of 6 samples received on the 04/10/17

Report Date
03rd November 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**041017005**	**041017006**	-	-
Client Sample Reference:				SW2	L1	-	-
Sample Date:				29/09/17	29/09/17	-	-
Sample Matrix:				Surface Water	Leachate Water	-	-
INORG-L01	pH	pH units	A	7.1	7.3	-	-
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	0.03	-	-
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	7.3	2.0	-	-
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	38	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	22.7	21.5	-	-
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	1.9	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	195	139	-	-
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.3	0.2	-	-
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.3	0.2	-	-
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	8.7	8.7	-	-
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	0.10	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	<0.21	<0.21	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	<1.5	-	-
METALS-L	Iron	$\mu g.l^{-1}$	A	332	319	-	-
METALS-L	Copper	$\mu g.l^{-1}$	A	22.1	37.4	-	-
METALS-L	Chromium	$\mu g.l^{-1}$	A	1.1	1.3	-	-
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	-	-
1450	Arsenic	$\mu g.l^{-1}$	S-A	-	2.4	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	23.2	17.3	-	-
METALS-L	Boron	$\mu g.l^{-1}$	A	28.6	12.9	-	-
METALS-L	Potassium	$mg.l^{-1}$	A	<0.12	<0.12	-	-
METALS-L	Sodium	$mg.l^{-1}$	A	8.9	5.3	-	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	2.2	1.0	-	-
METALS-L	Magnesium	$mg.l^{-1}$	A	4.8	1.9	-	-
1450	Mercury	$\mu g.l^{-1}$	S-A	-	<0.50	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	54.9	37.6	-	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	2.5	9.7	-	-
METALS-L	Sulphate	$mg.l^{-1}$	A	4.3	2.6	-	-

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CERTIFICATE OF ANALYSIS 2048

Results of analysis of 6 samples received on the 04/10/17

Report Date
03rd November 2017

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	ISO 17025
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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CERTIFICATE OF ANALYSIS 2048

Results of analysis of 6 samples received on the 04/10/17

Report Date
03rd November 2017

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[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
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[C]: Samples not received in appropriate containers
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< "Less Than"
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Excal Ltd
Excal House
Capel Hendre Industrial Estate
Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2136

Project/Site name:	Penplas		Samples Taken:	08-12-2017
Job Number:	01-11-02		Samples Received:	08-12-2017
Order Number:	EC 3263		Date Instructed:	08-12-2017
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	19-12-2017
			Report Issued:	20-12-2017
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2136

Results of analysis of 7 samples received on the 08/12/17

Report Date
20th December 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**081217035**	**081217036**	**081217037**	**081217038**
Client Sample Reference:				BH1	BH2	BH3	BH4
Sample Date:				08/12/17	08/12/17	08/12/17	08/12/17
Sample Matrix:				Groundwater	Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.8	6.9	7.2	6.8
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	0.01	1.8	1.1	0.09
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	10.0	3.8	22.3	14.2
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	22.9	70.0	12.6	13.9
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	154	333	691	93
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.5	<0.1	1.7	<0.1
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.5	1.4	1.8	<0.1
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	10.5	3.0	4.1	9.5
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	2.1	12.4	27.8	10.1
METALS-L	Iron	$\mu g.l^{-1}$	A	64.8	4,229	1,306	635
METALS-L	Copper	$\mu g.l^{-1}$	A	4.8	1.8	35.4	6.3
METALS-L	Chromium	$\mu g.l^{-1}$	A	1.6	3.4	6.7	1.0
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	4.4	9.9	<4.1
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	9.7	3,673	195	293
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5	<6.5	<6.5	<6.5
METALS-L	Potassium	$mg.l^{-1}$	A	0.8	1.1	0.7	0.3
METALS-L	Sodium	$mg.l^{-1}$	A	12.0	50.7	8.3	9.7
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9	<0.9	<0.9	<0.9
METALS-L	Magnesium	$mg.l^{-1}$	A	6.4	15.2	2.7	1.5
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	30.2	26.1	13.9	11.8
METALS-L	Zinc	$\mu g.l^{-1}$	A	7.8	11.8	89.4	48.2
METALS-L	Sulphate	$mg.l^{-1}$	A	17.6	40.6	8.8	8.3

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CERTIFICATE OF ANALYSIS 2136

Results of analysis of 7 samples received on the 08/12/17

Report Date
20th December 2017

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**081217039**	**081217040**	**081217041**	-
Client Sample Reference:				SW1	SW2	L1	-
Sample Date:				08/12/17	08/12/17	08/12/17	-
Sample Matrix:				Surface Water	Surface Water	Leachate Water	-
INORG-L01	pH	pH units	A	6.9	7.1	7.0	-
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	<0.01	0.01	-
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	13.0	12.4	7.3	-
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	6	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	10.2	29.5	29.1	-
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	1.2	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	52	179	144	-
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.7	0.2	0.3	-
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.7	0.2	0.3	-
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	10.6	10.7	10.4	-
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	0.08	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	<0.21	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	3.4	3.9	6.6	-
METALS-L	Iron	$\mu g.l^{-1}$	A	270	319	470	-
METALS-L	Copper	$\mu g.l^{-1}$	A	12.0	6.3	14.1	-
METALS-L	Chromium	$\mu g.l^{-1}$	A	1.0	1.2	1.2	-
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	<4.1	-
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	1.1	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	9.7	75.0	40.4	-
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5	<6.5	<6.5	-
METALS-L	Potassium	$mg.l^{-1}$	A	1.3	1.9	1.7	-
METALS-L	Sodium	$mg.l^{-1}$	A	8.9	11.2	7.4	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9	<0.9	<0.9	-
METALS-L	Magnesium	$mg.l^{-1}$	A	1.4	5.4	2.6	-
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	0.56	-
METALS-L	Calcium	$mg.l^{-1}$	A	13.9	59.0	39.8	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	6.2	<1.1	<1.1	-
METALS-L	Sulphate	$mg.l^{-1}$	A	5.1	3.0	2.1	-

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CERTIFICATE OF ANALYSIS 2136

Results of analysis of 7 samples received on the 08/12/17

Report Date
20th December 2017

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	None
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2136

Results of analysis of 7 samples received on the 08/12/17

Report Date
20th December 2017

All results only relate to the items tested.
This report supersedes any previous versions issued by the laboratory.
A full list of determinants relating to abbreviations such as PAHs, VOCs, SVOCs, PCBs etc. is available upon request.
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[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

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**********END OF REPORT**********

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UKAS TESTING
4303

Alex Prigmore
Excal Ltd
Excal House
Capel Hendre Industrial Estate
Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2326

Project/Site name:	Penplas		Samples Taken:	23-03-2018
Quote Number:	DS120307		Samples Received:	26-03-2018
Order Number:	EC 3361		Date Instructed:	27-03-2018
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	19-04-2018
			Report Issued:	23-04-2018
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

UKAS TESTING
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Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2326

Results of analysis of 6 samples received on the 26/03/18

Report Date
23rd April 2018

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**270318039**	**270318040**	**270318041**	**270318042**
Client Sample Reference:				BH1	BH3	BH4	SW1
Sample Date:				26/03/18	26/03/18	26/03/18	26/03/18
Sample Matrix:				Groundwater	Groundwater	Groundwater	Surface water
INORG-L01	pH	pH units	A	5.9	6.3	6.0	6.3
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	0.65	0.03	<0.01
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	9.7	17.7	19.6	10.6
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	27.6	13.1	16.5	28.0
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	250	622	378	220
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.4	2.2	1.2	0.3
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.4	2.9	1.2	0.3
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	9.0	8.1	9.3	10.0
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	3.3	5.6	9.4	<1.5
METALS-L	Iron	$\mu g.l^{-1}$	A	60.4	1,589	1,514	223
METALS-L	Copper	$\mu g.l^{-1}$	A	3.8	8.1	10.0	6.4
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.3	4.6	4.6	1.7
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	4.4	<4.1	13.0
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	3.5	79.8	300	11.5
METALS-L	Boron	$\mu g.l^{-1}$	A	14.9	19.2	17.9	19.8
METALS-L	Potassium	$mg.l^{-1}$	A	1.4	1.6	0.9	1.7
METALS-L	Sodium	$mg.l^{-1}$	A	11.9	8.8	8.7	8.9
METALS-L	Cadmium	$\mu g.l^{-1}$	A	1.2	<0.9	<0.9	<0.9
METALS-L	Magnesium	$mg.l^{-1}$	A	8.6	4.6	1.4	4.3
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	31.2	12.8	7.6	46.4
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	5.8	30.8	<1.1
METALS-L	Sulphate	$mg.l^{-1}$	A	20.5	13.4	11.5	9.4

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UKAS TESTING
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Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2326

Results of analysis of 6 samples received on the 26/03/18

Report Date
23rd April 2018

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**270318043**	**270318044**	-	-
Client Sample Reference:				SW2	L1	-	-
Sample Date:				26/03/18	26/03/18	-	-
Sample Matrix:				Surface Water	Leachate Water	-	-
INORG-L01	pH	pH units	A	6.6	6.5	-	-
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	0.01	-	-
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	8.5	4.0	-	-
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	26	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	10.1	24.4	-	-
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	1.9	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	79	378	-	-
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.9	1.5	-	-
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.9	1.5	-	-
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	10.3	9.2	-	-
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	0.06	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	<0.21	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	2.7	-	-
METALS-L	Iron	$\mu g.l^{-1}$	A	236	285	-	-
METALS-L	Copper	$\mu g.l^{-1}$	A	9.9	10.4	-	-
METALS-L	Chromium	$\mu g.l^{-1}$	A	1.4	1.8	-	-
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	12.8	-	-
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	1.1	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	5.1	6.3	-	-
METALS-L	Boron	$\mu g.l^{-1}$	A	10.0	10.2	-	-
METALS-L	Potassium	$mg.l^{-1}$	A	1.2	1.3	-	-
METALS-L	Sodium	$mg.l^{-1}$	A	7.4	5.4	-	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9	0.9	-	-
METALS-L	Magnesium	$mg.l^{-1}$	A	1.3	1.9	-	-
1450	Mercury	$\mu g.l^{-1}$	S-N	-	<0.50	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	15.3	30.1	-	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	2.2	<1.1	-	-
METALS-L	Sulphate	$mg.l^{-1}$	A	7.4	3.8	-	-

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Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2326

Results of analysis of 6 samples received on the 26/03/18

Report Date
23rd April 2018

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	None
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

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Excal House
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Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2487

Project/Site name:	Penplas		Samples Taken:	04-07-2018
Job Number:	01-11-02		Samples Received:	20-07-2018
Order Number:	EC 3467		Date Instructed:	20-07-2018
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	15-08-2018
			Report Issued:	20-08-2018
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

UKAS TESTING
4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2487

Results of analysis of 4 samples received on the 20/07/18

Report Date
20th August 2018

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				200718002	200718003	200718004	200718005
Client Sample Reference:				BH1	BH2	BH4	L1
Sample Date:				04/07/18	04/07/18	04/07/18	04/07/18
Sample Matrix:				Groundwater	Groundwater	Groundwater	Leachate water
INORG-L01	pH	pH units	A	7.8	7.6	7.9	7.4
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01	2.9	0.04	1.4
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	12.8	3.2	10.9	2.6
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	<2
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	30.7	29.8	19.8	42.4
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	4.8
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	153	390	116	451
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.3	<0.1	<0.1	0.1
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.3	2.9	<0.1	2.7
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	10.2	9.9	10.3	10.6
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	0.11
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	-	0.2
METALS-L	Nickel	$\mu g.l^{-1}$	A	3.5	7.6	9.7	5.4
METALS-L	Iron	$\mu g.l^{-1}$	A	54.8	5,350	68.8	3,550
METALS-L	Copper	$\mu g.l^{-1}$	A	1.2	<0.8	1.9	6.7
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.4	3.4	3.0	2.0
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	5.4	6.5	7.7
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	-	1.2
METALS-L	Manganese	$\mu g.l^{-1}$	A	65.9	3,610	1,700	382
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5	9.1	<6.5	23.7
METALS-L	Potassium	$mg.l^{-1}$	A	1.3	1.4	0.3	3.1
METALS-L	Sodium	$mg.l^{-1}$	A	13.4	51.4	9.9	7.7
METALS-L	Cadmium	$\mu g.l^{-1}$	A	0.8	1.0	1.2	1.6
METALS-L	Magnesium	$mg.l^{-1}$	A	7.1	18.8	3.1	5.0
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	-	<0.50
METALS-L	Calcium	$mg.l^{-1}$	A	31.2	24.9	11.1	68.6
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	<1.1	13.5	3.9
METALS-L	Sulphate	$mg.l^{-1}$	A	13.4	<0.4	12.9	3.2

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UKAS TESTING
4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2487

Results of analysis of 4 samples received on the 20/07/18

Report Date
20th August 2018

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	None
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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UKAS TESTING
4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2487

Results of analysis of 4 samples received on the 20/07/18

Report Date
20th August 2018

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[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
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Excal Ltd
Excal House
Capel Hendre Industrial Estate
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Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2753

Project/Site name:	Penplas		Samples Taken:	25-09-2018
Job Number:	01-11-02		Samples Received:	06-12-2018
Order Number:	EC 3471		Date Instructed:	06-12-2018
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	18-12-2018
			Report Issued:	18-12-2018
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2753

Results of analysis of 7 samples received on the 06/12/18

Report Date
18th December 2018

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				061218002	061218003	061218004	061218005
Client Sample Reference:				BH1	BH2	BH3	BH4
Sample Date:				25/09/18	25/09/18	25/09/18	25/09/18
Sample Matrix:				Groundwater	Groundwater	Groundwater	Leachate water
INORG-L01	pH	pH units	A	6.8 *[B]*	7.1 *[B]*	6.9 *[B]*	7.0 *[B]*
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	0.01 *[B]*	<0.01 *[B]*	0.01 *[B]*	<0.01 *[B]*
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	11.9 *[B]*	12.6 *[B]*	14.0 *[B]*	20.0 *[B]*
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	44.8 *[B]*	32.0 *[B]*	26.5 *[B]*	11.8 *[B]*
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	140 *[B]*	183 *[B]*	116 *[B]*	43 *[B]*
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*
-	Total Nitrogen	$mg.l^{-1}$ N	N	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	10.1 *[B]*	9.7 *[B]*	9.8 *[B]*	9.9 *[B]*
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	1.5 *[B]*	1.6 *[B]*	11.6 *[B]*	5.8 *[B]*
METALS-L	Iron	$\mu g.l^{-1}$	A	94.8 *[B]*	111 *[B]*	1,160 *[B]*	277 *[B]*
METALS-L	Copper	$\mu g.l^{-1}$	A	2.3 *[B]*	2.8 *[B]*	18.9 *[B]*	9.4 *[B]*
METALS-L	Chromium	$\mu g.l^{-1}$	A	1.8 *[B]*	1.7 *[B]*	3.7 *[B]*	2.0 *[B]*
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1 *[B]*	<4.1 *[B]*	<4.1 *[B]*	<4.1 *[B]*
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	2.1 *[B]*	3.9 *[B]*	25.2 *[B]*	289 *[B]*
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5 *[B]*	<6.5 *[B]*	<6.5 *[B]*	<6.5 *[B]*
METALS-L	Potassium	$mg.l^{-1}$	A	1.0 *[B]*	0.9 *[B]*	1.3 *[B]*	0.8 *[B]*
METALS-L	Sodium	$mg.l^{-1}$	A	19.0 *[B]*	37.0 *[B]*	7.1 *[B]*	13.1 *[B]*
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9 *[B]*	<0.9 *[B]*	<0.9 *[B]*	<0.9 *[B]*
METALS-L	Magnesium	$mg.l^{-1}$	A	7.7 *[B]*	12.7 *[B]*	2.8 *[B]*	2.3 *[B]*
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	32.6 *[B]*	25.1 *[B]*	27.4 *[B]*	19.4 *[B]*
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1 *[B]*	<1.1 *[B]*	20.8 *[B]*	28.8 *[B]*
METALS-L	Sulphate	$mg.l^{-1}$	A	16.8 *[B]*	13.8 *[B]*	7.3 *[B]*	33.0 *[B]*

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4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2753

Results of analysis of 7 samples received on the 06/12/18

Report Date
18th December 2018

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				061218006	061218007	061218008	-
Client Sample Reference:				SW1	SW2	L1	-
Sample Date:				25/09/18	25/09/18	25/09/18	-
Sample Matrix:				Surface Water	Surface Water	Leachate water	-
INORG-L01	pH	pH units	A	6.7 *[B]*	7.0 *[B]*	7.0 *[B]*	-
INORG-L12	Ammonia	mg.l^{-1} NH_4	A	0.01 *[B]*	<0.01 *[B]*	<0.01 *[B]*	-
INORG-L13	Chloride	mg.l^{-1} Cl	A	18.7 *[B]*	17.6 *[B]*	10.7 *[B]*	-
INORG-L05	COD	mg.l^{-1} O_2	A	-	-	21 *[B]*	-
INORG-L18	Total Organic Carbon	mg.l^{-1} C	A	48.7 *[B]*	18.5 *[B]*	24.0 *[B]*	-
INORG-L6.1	BOD	mg.l^{-1} O_2	A	-	-	5.4 *[B]*	-
INORG-L09	Alkalinity	mg.l^{-1} HCO_3	A	287 *[B]*	85 *[B]*	73 *[B]*	-
-	Total Oxidised Nitrogen	mg.l^{-1} N	N	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*	-
-	Total Nitrogen	mg.l^{-1} N	N	<0.1 *[B]*	<0.1 *[B]*	<0.1 *[B]*	-
INORG-L10	Dissolved Oxygen	mg.l^{-1} O_2	A	9.9 *[B]*	10.0 *[B]*	10.1 *[B]*	-
INORG-L21.1	Ortho Phosphate	mg.l^{-1} P	A	-	-	0.04 *[B]*	-
METALS-L	Total Phosphorous	mg.l^{-1} P	A	-	-	<0.2 *[B]*	-
METALS-L	Nickel	µg.l^{-1}	A	<1.5 *[B]*	<1.5 *[B]*	<1.5 *[B]*	-
METALS-L	Iron	µg.l^{-1}	A	20.5 *[B]*	492 *[B]*	177 *[B]*	-
METALS-L	Copper	µg.l^{-1}	A	7.1 *[B]*	13.6 *[B]*	12.4 *[B]*	-
METALS-L	Chromium	µg.l^{-1}	A	2.1 *[B]*	1.9 *[B]*	1.5 *[B]*	-
METALS-L	Lead	µg.l^{-1}	A	6.2 *[B]*	<4.1 *[B]*	<4.1 *[B]*	-
1450	Arsenic	µg.l^{-1}	S-N	-	-	<1.0 *[B]*	-
METALS-L	Manganese	µg.l^{-1}	A	3.2 *[B]*	9.7 *[B]*	2.6 *[B]*	-
METALS-L	Boron	µg.l^{-1}	A	<6.5 *[B]*	<6.5 *[B]*	<6.5 *[B]*	-
METALS-L	Potassium	mg.l^{-1}	A	4.5 *[B]*	1.3 *[B]*	0.6 *[B]*	-
METALS-L	Sodium	mg.l^{-1}	A	12.6 *[B]*	8.2 *[B]*	5.7 *[B]*	-
METALS-L	Cadmium	µg.l^{-1}	A	<0.9 *[B]*	<0.9 *[B]*	<0.9 *[B]*	-
METALS-L	Magnesium	mg.l^{-1}	A	11.3 *[B]*	1.7 *[B]*	2.6 *[B]*	-
1450	Mercury	µg.l^{-1}	S-N	-	-	<0.50 *[B]*	-
METALS-L	Calcium	mg.l^{-1}	A	111 *[B]*	35.2 *[B]*	38.2 *[B]*	-
METALS-L	Zinc	µg.l^{-1}	A	<1.1 *[B]*	2.6 *[B]*	1.5 *[B]*	-
METALS-L	Sulphate	mg.l^{-1}	A	48.2 *[B]*	15.4 *[B]*	30.1 *[B]*	-

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4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2753

Results of analysis of 7 samples received on the 06/12/18

Report Date
18th December 2018

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	None
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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All results only relate to the items tested.
This report supersedes any previous versions issued by the laboratory.
A full list of determinants relating to abbreviations such as PAHs, VOCs, SVOCs, PCBs etc. is available upon request.
Where results have been labelled as deviating for any reason, the data may not be representative of the sample at the point of sampling:

[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

Where any sub-contracted results have been noted as deviating by the laboratory in question, their deviations codes will be applied and detailed.
Accreditation statements are correct at the time of issue.

**********END OF REPORT**********

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Alex Prigmore
Excal Ltd
Excal House
Capel Hendre Industrial Estate
Ammanford
SA18 3SJ

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 2849

Project/Site name:	Penplas		Samples Taken:	20-12-2018
Job Number:	01-11-02		Samples Received:	30-01-2019
Order Number:	EC 3670		Date Instructed:	30-01-2019
Sample Matrix:	Surface Water, Groundwater, Leachate water		Analysis Complete:	04-03-2019
			Report Issued:	04-03-2019
			Sampled By:	Client

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

Approved by: Adam Whitehouse
Signature:
Title: Quality Manager

4303

Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2849

Results of analysis of 6 samples received on the 30/01/19

Report Date
04th March 2019

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				**300119015**	**300119016**	**300119017**	**300119018**
Client Sample Reference:				BH1	BH3	BH4	SW1
Sample Date:				20/12/18	20/12/18	20/12/18	20/12/18
Sample Matrix:				Groundwater	Groundwater	Groundwater	Surface water
INORG-L01	pH	pH units	A	6.6 *[B]*	7.2 *[B]*	7.3 *[B]*	7.8 *[B]*
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01 *[B]*	<0.01 *[B]*	<0.01 *[B]*	<0.01 *[B]*
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	13.3 *[B]*	7.4 *[B]*	13.9 *[B]*	8.1 *[B]*
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	15.1 *[B]*	19.8 *[B]*	23.9 *[B]*	37.6 *[B]*
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	-	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	128 *[B]*	232 *[B]*	128 *[B]*	305 *[B]*
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	<0.1 *[B]*	0.5 *[B]*	<0.1 *[B]*	1.1 *[B]*
-	Total Nitrogen	$mg.l^{-1}$ N	N	<0.1 *[B]*	0.5 *[B]*	<0.1 *[B]*	1.1 *[B]*
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	9.8 *[B]*	9.6 *[B]*	9.7 *[B]*	9.4 *[B]*
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	-	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5 *[B]*	5.9 *[B]*	5.2 *[B]*	<1.5 *[B]*
METALS-L	Iron	$\mu g.l^{-1}$	A	438 *[B]*	475 *[B]*	714 *[B]*	73.0 *[B]*
METALS-L	Copper	$\mu g.l^{-1}$	A	1.8 *[B]*	3.8 *[B]*	12.0 *[B]*	4.4 *[B]*
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.2 *[B]*	2.0 *[B]*	2.3 *[B]*	1.9 *[B]*
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1 *[B]*	<4.1 *[B]*	4.6 *[B]*	5.5 *[B]*
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	24.1 *[B]*	739 *[B]*	483 *[B]*	7.8 *[B]*
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5 *[B]*	<6.5 *[B]*	<6.5 *[B]*	<6.5 *[B]*
METALS-L	Potassium	$mg.l^{-1}$	A	1.4 *[B]*	0.9 *[B]*	0.6 *[B]*	4.1 *[B]*
METALS-L	Sodium	$mg.l^{-1}$	A	12.4 *[B]*	36.5 *[B]*	11.6 *[B]*	11.5 *[B]*
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9 *[B]*	<0.9 *[B]*	1.4 *[B]*	<0.9 *[B]*
METALS-L	Magnesium	$mg.l^{-1}$	A	6.2 *[B]*	13.2 *[B]*	2.6 *[B]*	10.6 *[B]*
1450	Mercury	$\mu g.l^{-1}$	S-N	-	-	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	24.7 *[B]*	24.7 *[B]*	41.3 *[B]*	103 *[B]*
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1 *[B]*	14.4 *[B]*	25.8 *[B]*	<1.1 *[B]*
METALS-L	Sulphate	$mg.l^{-1}$	A	16.1 *[B]*	13.1 *[B]*	21.8 *[B]*	35.9 *[B]*

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Client: ExCAL Ltd
FAO: A Prigmore

CERTIFICATE OF ANALYSIS 2849

Results of analysis of 6 samples received on the 30/01/19

Report Date
04th March 2019

Code	Determinant	Units	*	Sample Identification			
Laboratory Sample Number:				300119019	300119020	-	-
Client Sample Reference:				SW2	L1	-	-
Sample Date:				20/12/18	20/12/18	-	-
Sample Matrix:				Surface Water	Leachate water	-	-
INORG-L01	pH	pH units	A	6.9 *[B]*	7.9 *[B]*	-	-
INORG-L12	Ammonia	$mg.l^{-1}$ NH_4	A	<0.01 *[B]*	<0.01 *[B]*	-	-
INORG-L13	Chloride	$mg.l^{-1}$ Cl	A	13.8 *[B]*	7.0 *[B]*	-	-
INORG-L05	COD	$mg.l^{-1}$ O_2	A	-	20 *[B]*	-	-
INORG-L18	Total Organic Carbon	$mg.l^{-1}$ C	A	7.9 *[B]*	31.9 *[B]*	-	-
INORG-L6.1	BOD	$mg.l^{-1}$ O_2	A	-	1.8 *[B]*	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ HCO_3	A	43 *[B]*	92 *[B]*	-	-
-	Total Oxidised Nitrogen	$mg.l^{-1}$ N	N	0.8 *[B]*	1.8 *[B]*	-	-
-	Total Nitrogen	$mg.l^{-1}$ N	N	0.8 *[B]*	1.8 *[B]*	-	-
INORG-L10	Dissolved Oxygen	$mg.l^{-1}$ O_2	A	9.0 *[B]*	9.3 *[B]*	-	-
INORG-L21.1	Ortho Phosphate	$mg.l^{-1}$ P	A	-	0.15 *[B]*	-	-
METALS-L	Total Phosphorous	$mg.l^{-1}$ P	A	-	<0.2 *[B]*	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	2.2 *[B]*	1.9 *[B]*	-	-
METALS-L	Iron	$\mu g.l^{-1}$	A	603 *[B]*	546 *[B]*	-	-
METALS-L	Copper	$\mu g.l^{-1}$	A	12.8 *[B]*	10.8 *[B]*	-	-
METALS-L	Chromium	$\mu g.l^{-1}$	A	2.5 *[B]*	2.0 *[B]*	-	-
METALS-L	Lead	$\mu g.l^{-1}$	A	8.9 *[B]*	4.7 *[B]*	-	-
1450	Arsenic	$\mu g.l^{-1}$	S-N	-	<1.0 *[B]*	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	5.6 *[B]*	11.8 *[B]*	-	-
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5 *[B]*	<6.5 *[B]*	-	-
METALS-L	Potassium	$mg.l^{-1}$	A	1.5 *[B]*	0.7 *[B]*	-	-
METALS-L	Sodium	$mg.l^{-1}$	A	8.1 *[B]*	6.6 *[B]*	-	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.9 *[B]*	<0.9 *[B]*	-	-
METALS-L	Magnesium	$mg.l^{-1}$	A	1.7 *[B]*	2.9 *[B]*	-	-
1450	Mercury	$\mu g.l^{-1}$	S-N	-	<0.50 *[B]*	-	-
METALS-L	Calcium	$mg.l^{-1}$	A	13.2 *[B]*	38.5 *[B]*	-	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	9.8 *[B]*	5.4 *[B]*	-	-
METALS-L	Sulphate	$mg.l^{-1}$	A	11.2 *[B]*	20.3 *[B]*	-	-

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CERTIFICATE OF ANALYSIS 2849

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Report Date
04th March 2019

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by electrode probe meter (In-house method)	INORG-L01	ISO 17025
Determination of Dissolved Oxygen in water by titration (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by colorimetric photometer (In-house method)	INORG-L12	ISO 17025
Determination of chloride by colorimetric photometer (In-house method)	INORG-L13	ISO 17025
Determination of COD in waters by colorimetric photometer (In-house method)	INORG-L05	ISO 17025
Determination of BOD in waters by titration (In-house method)	INORG-L06.1	ISO 17025
Determination of alkalinity of waters by colorimetric photometer (In-house method)	INORG-L09	ISO 17025
Determination of Total Oxidised Nitrogen as N in water by Calculation (In-house method)	-	None
Determination of Total Organic Carbon in water by photometer (In-house method)	INORG-L18	ISO 17025
Determination of ortho-phosphate in Water by colorimetric photometer (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (Cd, Cr, Cu, Ni, Pb, Zn, Fe, K, B, S, Mn, Ca, Mg, Na, P) (In-house method)	METALS-L	ISO 17025
Determination of metals in waters by ICP-OES (As, Hg) (Sub-contracted method)	1450	None
Determination of sulphate in waters by calculation (Sub-contracted method)	METALS-L	ISO 17025

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[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

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APPENDIX C

GA5000 Gas Monitor Calibration Certificate

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 25-Apr-2019

Certificate Number: G500702_2/23040

Issued by: QED Environmental Systems Ltd.

Customer: **Ashtead Technology Ltd**
Ashtead House Discovery Drive Arnhall Business Park
Westhill Aberdeenshire AB32 6FG UNITED KINGDOM

Description: Gas Analyser

Model: GA5000

Serial Number: G500702

UKAS Accredited results:

Results after adjustment :

Methane (CH_4)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	5.0	0.41
15.0	15.0	0.64
49.9	49.3	0.94

Carbon Dioxide (CO_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	5.0	0.43
15.0	15.0	0.70
50.1	50.2	1.1

Oxygen (O_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
21.3	21.4	0.31

The inwards assessment was carried out 18-Apr-2019.
The maximum adjustment is larger than the inwards assessment uncertainty.
Inwards assessment data is available if requested.

All concentrations are molar.

CH_4, CO_2 readings recorded at : 33.4 °C ± 2.5 °C

O2 readings recorded at : 24.5 °C ± 2.5 °C

Barometric Pressure : 0987 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Calibration Instance:101 IGC Instance:101

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 25-Apr-2019

Certificate Number: G500702_2/23040

Issued by: QED Environmental Systems Ltd.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	**Instrument Reading**
987	987

Additional Gas Cells		
Gas	**Certified Gas (ppm)**	**Instrument Reading (ppm)**
CO	507	513
H_2S	251	251

Internal Flow	
Applied (l/hr)	**Instrument Reading (l/hr)**
5.0	5.2
10.0	10.2

Date of Issue : 01-May-2019

Approved by Signatory

Graham Ingles

Laboratory Inspection

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

APPENDIX D

Copy of Working Plan

EAWML 34038

INCOMING – 1

L M APPLICATION T S

Ref. No. (for official use only)

CONTROL OF POLLUTION ACT 1974

DISPOSAL LICENCE APPLICATION

To the * LLIW VALLEY BOROUGH COUNCIL.

Note: Before providing the particulars required in Parts I, II and III and signing the Declaration at the end of this form, applicants should read the guidance notes in Appendix A of Department of the Environment Circular 55/76 (Welsh Office Circular 76/56).

PART I

1. Name and address of person or persons proposing to operate the facility (include post code	1. BJ Land Holdings Ltd./Jollypark Ltd., Beaufort House, Beaufort Road, Plasmarl, SWANSEA.
Telephone No.	0792 701414
2. Name and address of agents if application signed by agents (include post code)	2. N/A
Telephone No.	
3. Address or location of the facility in sufficient detail to enable it to be readily identified	3. Penplas Farm, Llangyfelach, SWANSEA.
Grid reference of the facility	
4. Nature of facility (please indicate by a tick)	4. /
A. LANDFILL SITE	☑
B. TRANSFER STATION	☐
Incorporating also	
(i) Static compaction	☐
(ii) Pulverisation	☐
(iii) Baling	☐
C. TREATMENT PLANT involving	
(i) Pulverisation	☐
(ii) Composting	☐
(iii) Incineration	☐
(iv) Chemical Treatment	☐
(v) Other Treatment (specify)	
(See Note 1, Appendix A)	

FORM-2

* Insert name of Waste Disposal Authority. LLIW VALLEY BOROUGH COUNCIL

Cat. No. W.D. 1. SHAW & SONS LTD., Shaway House, London, SE26 5AE S1158 (M)

Brief description of the types of general wastes accepted or to be accepted at the facility (*i.e.* excluding those wastes to which question 6 applies) (*See* Note ii, Appendix A)	5.1. Inert Building Material with clay fill and Quantified Bio-Degradable Material. (Refer Gibb Environmental Sciences Report Dated April 1992). 2. Excavated Natural Materials.
6. Are any of the categories of difficult waste listed in Appendix B accepted or likely to be accepted? (Please indicate by a tick) (*See* Note iii, Appendix A)	Yes ☐ No ☑
7. Hours of operation	

	Weekdays	Saturdays	Sundays
Time of opening	7.30 a.m.	7.30 a.m.	8.00 a.m.
Time of closing	4.30 p.m.	4.30 p.m.	4.00 p.m.
Total hours per week			

8. Capacity or remaining capacity of the facility. (Specify in cubic metres for landfill sites and tonnes per hour for treatment plants)	8. 93000 M^3
9. Estimate of useful life or remaining useful life of the facility	9. 1 years
10. Current status of the facility under planning law (indicate by a tick) (a) Planning permission applied for (b) Planning permission granted (c) GDO permission (d) No planning permission required (e) Planning permission for surface mineral extraction including restoration situations requiring the use of waste material Attach copy of any existing specific planning permission or reasons why none is required (Categories (c) and (d)	10. ☑ ☐ ☐ ☐ ☐
11. Date use of the facility commenced or is anticipated to commence	11. Required As Soon As Possible
12. Proposed final use of the site and likely commencement date for such use. (This applies to landfill sites only. Where no decision has been taken on the final use of the site this should be stated.)	12. Agriculture

13. Estimated maximum quantities of general waste of the following descriptions delivered or to be delivered daily at the facility (*i.e.* excluding those wastes to which question 6 applies).	13. LIQUIDS (tonnes)	SLUDGES (tonnes)	SOLIDS (tonnes)
(i) domestic and commercial waste			
(a) untreated			
(b) pulverised and/or composted			
(c) baled			
(d) incinerator residues			
(ii) medical surgical and veterinary wastes			
(iii) non hazardous industrial wastes			
(a) potentially combustible substances			
(b) inert and non flammable substances			
(iv) wastes from the construction industry			500
(v) old cars, vehicles and trailers			
(vi) sewage sludge and pail closet contents etc.			
(vii) mine and quarry waste*			
(viii) farm waste*			

(*See* Note iv, Appendix A)

14. Estimated maximum quantities of difficult wastes listed in Appendix B delivered or to be delivered daily at the facility	14. LIQUIDS (tonnes)	SLUDGES (tonnes)	SOLIDS (tonnes)
Type of Waste / *Code of Waste*			
NIL	NIL	NIL	NIL.

(*See* Note v, Appendix A)

15. Names and addresses of principal firms or organisations delivering or likely to deliver waste at the facility	15.
	BJ (Swansea) Ltd., Beaufort House, Beaufort Road, Plasmarl, SWANSEA.

16. Estimate of the percentage of waste originating or likely to originate from outside the boundary of the disposal authority (*i.e.* the county in England and the district in Scotland and Wales)	16. TOTAL %	LIQUID	SLUDGE	SOLID
	NIL			

(*See* Note vi, Appendix A)

17. Current or anticipated maximum rate of use of the facility. (Specify as tonnes per day for landfill sites and tonnes per hour for treatment plant.)	17.
	500 tonnes per day

* Particulars of these wastes are wanted for information purposes and only when they are being disposed of at sites accepting wastes listed in categories i-vi.

PART III

The application should be accompanied by the following documents:—

1. *A Site Location Plan*

This is required in every case and should be drawn on a scale appropriate to the facility (*e.g.* 1/2500 or 1/1000 showing the site of the facility to which the application relates coloured pink, any adjoining land in the same ownersh coloured blue and sufficient details readily to identify the site and the topography of its environs in comparison wi the Ordnance Survey Map of the same scale. The Waste Disposal Authority should be consulted in any cases doubt as to which scale is appropriate.

2. *An Outline Working/Operational Plan*

This is also required in every case but the content will vary according to the nature of the facility for which t licence is being sought. It should comprise of a detailed plan of the facility to a scale of not less than 1 500 accompani and backed up by a statement of intent regarding its operation.

(a) Landfill Sites

The detailed plan of the site should where relevant show:—

(i) gates and boundary fencing;
(ii) direction of working and phasing of filling and site restoration;
(iii) seasonal, bad weather and emergency tipping areas;
(iv) location of covering material stored on the site;
(v) location of the primary site road leading from the main gate;
(vi) location of site control office and any other buildings or fixed equipment on the site;
(vii) location of tanks or lagoons to be used for the storage or deposit of liquid wastes;
(viii) details of existing ground levels or contours;
(ix) details of proposed final contours;
(x) details of existing drainage facilities;
(xi) location of any existing watercourses, adits, shafts etc.

The accompanying statement should give an indication of applicant's intentions with regard to the followi matters, where these are relevant:—

(i) site preparation works;
(ii) drainage and outfalls;
(iii) provision being made for the recording of waste intake at the site;
(iv) the provision of litter screens;
(v) the provision of lighting equipment at the site;
(vi) maximum width of working face;
(vii) methods of dealing with hazardous or difficult to handle types of waste;
(viii) pest control measures;
(ix) water sampling and monitoring arrangements;
(x) site security arrangements;
(xi) final restoration of the site;
(xii) provision for waste sampling (*i.e.* if required in the case of hazardous wastes).

The statement should also indicate the number of people manning the site and include an inventory of the equ ment used or to be used there for spreading and compacting waste, for excavating, transporting and spreading cover materials, for maintaining roads and for washing or cleaning the wheels of vehicles using the site.

The statement should include available geological information about the site, particularly the results of a geological investigations and details of boreholes, sampling points and the water level.

(b) Other Facilities

The plan of each facility should show:—

(i) the layout and construction of the facility and its ancillary equipment including information on fenc and drainage where relevant;
(ii) the storage areas for solid and liquid wastes awaiting treatment and residues awaiting removal for dispo elsewhere;
(iii) the provision being made for the parking, loading and unloading of vehicles at the facility.

The accompanying statement as well as giving details of the number and the status of people being employed operate the facility should, where relevant, give an indication of the following:—

(i) provision being made for recording intake and output at the facility including details of materials rest ases recovered, recycled or otherwise utilised *e.g.* generation and use of heat;
(ii) instrumentation being provided to ensure that a satisfactory method of treatment is maintained at facility and to warn of malfunctions;
(iii) methods of storage of wastes awaiting treatment at the facility and residues awaiting removal for disp elsewhere;
(iv) names and locations of sites where residues are being taken for final disposal;
(v) provision being made for dealing with unacceptable wastes delivered inadvertently or left at the fac and standby operating and disposal arrangements to be implemented in the case of a breakdown or o emergency situations developing at the facility;
(vi) maximum quantities of wastes and residues to be stored at the plant at any one time;
(vii) steps being taken to avoid spillages and such nuisances as noise, fumes, dust, grit and odours;
(viii) indication of any other steps being taken to ensure that the facility and its immediate environs are k clean and tidy and that both it and its operation are aesthetically compatible with the surrounding a

DECLARATION

I/We hereby apply for permission to carry out waste disposal operations as described in Parts I and II of application and in the attached plans, drawings and statement required by Part III.

Date 2nd June 1992 Signed [signature]

SCHEDULE G - OPERATIONAL PLAN

Attached:-

1. Waste Disposal Licence Application Form.

2. Information in Support of the Waste Disposal Licence Application.

3. Further Information dated 27th August 1992.

4. Method Statement For The Removal of The Cilfwnwr Tip To Penplas Farm.

5. Further Information dated 14th October 1992.

6. Plans:-

   i) PLF 211 - Site Layout : Operational PLan.

   ii) PLF 212 - Cross Sections.

   iii) PLF 213 - Construction Details.

   iv) Zonal Plan dated 13th January 1992.

Penplas Farm, Landfill Site

Information in Support
of the Waste Disposal
Licence Application

Prepared for:

B.J. Group
Beaufort House
Beaufort Road
Plasmarl
Swansea
SA6 8JG

July 1992

Gibb Environmental
Units 1 and 2
Cross Hands Business Centre
Cross Hands
Llanelli
Dyfed
SA14 6RB

Tel: 0269 831327
Fax: 0269 831328

ISSUED BY.....
Project Manager

APPROVED BY.....
Office Manager

INFORMATION IN SUPPORT OF THE WASTE DISPOSAL LICENCE APPLICATION

JULY 1992

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INFORMATION IN SUPPORT OF THE WASTE DISPOSAL

LICENCE APPLICATION

JULY 1992

LIST OF DRAWINGS

TITLE	DRAWING NO:
ZONAL PLAN	
SITE LAYOUT: OPERATIONAL PLAN	PLF 211
CROSS SECTIONS	PLF 212
CONSTRUCTION DETAILS	PLF 213

1. INTRODUCTION

The following report has been prepared in support of the Application for a Waste Disposal Licence in respect of land at Penplas Farm, Llangyfelach.

The proposed landfill site would occupy approximately 9 acres and is intended for the relocation of the existing Cilfwnwr Tip which will be removed to allow development of the Business Park adjacent to the A48.

2. DESIGN CONCEPT

The tip will be designed and constructed as a fully contained and sealed system to minimise the risk of leachate or landfill egress and migration. Systems will be implemented to ensure the safe collection and disposal of leachates and the safe venting of landfill gases to atmosphere. Particular attention will be paid to the quality of the containment system with respect to both design and construction. The importance of on-site quality control cannot be over-emphasised. The engineered repository will be suitable for subsequent agricultural grazing use.

3. CONTAINMENT SYSTEM

3.1 The containment system will comprise compacted clays to provide a low permeability barrier to prevent uncontrolled leachate egress.

3.2 The clay will be selected and placed in accordance with the recommendations made by the National Rivers Authority (North West Region), "Earthworks on Landfill Sites" revised July 1989 (See Appendix I). The basal clay seal will comprise clays at least 1 m thick which will be compacted with suitable plant prior to waste placement. The side seals and capping will be constructed of excavated clays such that 1 m of capping is provided. Rigorous quality control procedures will be adopted to ensure that the required level of containment is achieved. Investigations have revealed significant quantities of clay within the inert wastes and where possible these will be selected and used in the containment system.

4. LEACHATE DRAINAGE SYSTEM

4.1 The purpose of the leachate drainage system is to provide adequate control for any leachate produced by the wastes and to ensure that any leachate produced can be efficiently transported to a sump for subsequent extraction and disposal.

4.2 Preliminary calculations suggest that the volumes of leachate produced are likely to be low because:

- the wastes are largely inert;
- the timescale for waste deposition is very short (1-2 months);
- future rainfall infiltration will be minimised by the low permeability capping layer.

4.3 Nonetheless, installation of a leachate drainage system is still considered necessart.

4.4 The leachate collection system will comprise a series of piped drains surrounded by stone wrapped in a filter fabric. It is envisaged that pipework will comprise perforated 150 mm diameter MDPE or HDPE pipes leading to a sump at the northern boundary of the site. The lateral pipework spacing will be 30 m.

4.5 The sump will comprise reinforced concrete manhole rings constructed on a shallow foundation above the 1m clay base. The sump will have a nominal base diameter of 2.1m so as to provide a reasonable short term storage capacity.

4.6 While volumes of leachate anticipated are relatively small provision will be made for its removal and safe disposal. Removal from site by tanker to a licensed disposal point or for disposal to sewer is the preferred disposal route. Disposal to sewer will be subject to the approval of the drainage authority and the NRA.

4.7 The level of leachate within the sumps together with its composition will be monitored at regular intervals and be agreed with the Waste Regulation Authority (WRA). In no circumstances will the level of leachates be permitted to rise more than 1m above the base of each sump.

5. LANDFILL GAS

5.1 It is anticipated that the wastes will degrade to produce limited volumes of landfill gases. It is therefore proposed to construct gas vents within the waste. The vent pipes will be interconnected with a stone filled gas vent trench which will collect any gas generated by the wastes and safely transport it to the vent pipes. The gas vent layout is shown on Drawing No. PLF 211.

5.2 Four vent pipes will be interconnected with the basal leachate collection drains (see Drawing No. PLF 211).

5.3 It should be noted that there is no existing development within 250m of the proposed landfill site, nor is any future development planned. Nonetheless, a scheme of external gas monitoring will be undertaken to ensure and monitor the effectiveness of the containment system. The external monitoring will comprise 6 no. gas standpipes installed to a depth of around 5 m to intercept the groundwater table. The monitoring points will have a nominal 100m spacing and shall be located along the northern and southern boundaries of the site as shown in Drawing No. PLF 211.

5.4 All gas vents and monitoring points will be regularly monitored at intervals and for constituents agreed with the WRA. An initial monitoring scheme is given in Section 10. The monitoring strategy will be set out in an operational manual which will be kept under review. The following considerations will be taken into account:

- changes in gas composition and quantity;
- changes/modifications to control systems;
- changes in site use;
- climatic changes including barometric pressure, precipitation and temperature.

5.5 All monitoring shall be undertaken using standard instrumentation which will be subject to regular recalibration in accordance with the manufacturers recommendations. The monitoring shall routinely determine levels of methane, carbon dioxide and oxygen.

5.6 All records will be forwarded to the WRA at an agreed frequency. Any actions taken consequent upon monitoring results will be in accordance with Waste Management Paper No 27 and in consultation with the WRA.

6. ADVANCE ENGINEERING WORKS/OPERATIONAL MATTERS

6.1 Access Road

An access road will be constructed to the tip at the approximate location shown on the Penllergaer Park Zonal Plan (dated Jan 1992). All crossings of existing water courses and ditches will be culverted so as not to impede flows. The roadways to and on the site will be

maintained in a condition to allow safe and free movement of all site vehicles. Vehicles will not be permitted to use the public highway and therefore wheel washing facilities are not considered necessary. Any vehicles leaving the site on completion of the works will be cleaned prior to entering onto the public highway. In dry conditions site roadways will be sprayed with water to prevent any dust nuisance.

The main entrance to the site will be gated and will be locked when the site is not operational/being manned. The site will be entirely enclosed by boundary fencing which will be checked for integrity on a weekly basis.

6.2 Surface Water Drainage

Surface water cut-off drains will be installed around the perimeter of the site to intercept and redirect surface water flows around the site. The drains will normally comprise an open ditch excavated to an average depth of 1 m with side slopes of 45^0. Where it is necessary for the ditches to cross access roads appropriate protection of the ditch will be provided by culverting.

The ditches will egress to existing watercourses on the northern side of the site. Some slight improvements of existing ditches may be required to ensure sufficient flow capacity. However, care will be taken not to overdeepen ditches and change the nature of the surrounding marshy ground. Surface water quality will be assessed regularly as detailed in Section 10.

All surface watercourse diversion and culverting works will be undertaken with the approval of the NRA in accordance with the Land Drainage Act 1991. Particular emphasis will be placed upon the need to ensure that no significant change to the pattern of drainage is effected as a result of the proposed works.

It is considered that the long term impact of the proposed works on the surface water flows in the area will be minimal, since the site will be returned to agricultural use. Significantly increased water flows are unlikely and flow regulation measures are not proposed unless specifically requested by the NRA.

6.3 Groundwater

It is not anticipated that significant quantities of groundwater will be encountered during construction of the landfill site. If, however, seepages are encountered in the base or sides of excavations then drainage measures will be implemented.

These may include the construction of a deep (2-3m) cut-off drain upslope of the site. This would effectively redivert any groundwater flows around the site rather than beneath it.

The method of dealing with groundwater flows will be agreed with the NRA and shall be designed to minimise the impact of the tipping operations on the groundwater quality.

6.4 Surface Strip and Excavations

The topsoil and subsoil will be stripped from the site and stockpiled in amenity bunds along the southern boundary of the site.

Clay deposits will be excavated and stockpiled at locations shown on Drawing No. PLF 211 for subsequent reuse as lining and capping material.

6.5 Equipment and Manning

The following items of plant will be available for the placement and compaction of both wastes and the clay containment system:

1 - D6 Caterpillar Dozer with 5 Ton Vibrating Roller

1 - D4 Caterpillar Dozer with 5 Ton Vibrating Roller

Additional plant will be brought in as and when necessary to ensure the efficient and safe construction and operation of the site.

The manning levels will be:

1 - Site Supervisor

2 - Plant Operators

This manning level will vary from time to time depending on the waste input rate and other requirement. During construction works manning and plant levels will be in excess of that mentioned above. The work will be managed by an engineer from the B.J. Group who will be resident on the site. Where appropriate specialist sub-contractors may undertake various construction quality control and monitoring operations.

The B. J. Group engineer will be fully conversant with the proposals and shall have experience of waste handling and disposal. Gibb Environmental shall be retained by the B.J. Group to provide specialist environmental advice during all stages of the works. In addition, a short induction course will be run for B. J. Group staff by Gibb Environmental to ensure that all waste handling, sorting and deposition is carried out in a safe manner.

6.6 Site Facilities

The following facilities will be provided on site:

(a) Site Control Officer

(b) Employee's Welfare Facilities

(c) A suitable water supply for dust control

(d) Any derv storage tanks will be bunded and bunds to be capable of storing 110% of tank volume.

All site operations will be carried out in accordance with the requirements of the Health and Safety at Work Act 1974 and in conformity with the B.J. Group Safety Policy.

7. WASTE SORTING, HANDLING AND DEPOSITION

7.1 All waste arising will be from the excavation of the Cilfwnwr Tip, the Forest Tip or from the Upper Lake site. No additional wastes will be imported from outside the Penllergaer Park area.

7.2 The wastes from the Cilfwnwr Tip have been assessed by a study and subsequent report produced by Gibb Environmental. This report revealed the presence of some biodegradable material and confirmed that limited quantities of landfill gases were being generated in some areas of the tip. However, the bulk of the tip comprised inert materials.

7.3 All loads entering the site will be inspected to assess the material classification. The classifications will be as follows:

(i) Inert

(ii) Biodegradable

(iii) Hazardous

7.4 Only categories (i) and (ii) will be acceptable at the Penplas Farm Landfill site. Any hazardous materials encountered including drums and asbestos will be separated and stored in skips. These materials will be removed from site to a suitable licensed disposal facility. The maximum number of skips stored on site at any one time will be ten. Filled skips will be removed from site as quickly as possible subject to the relevant approvals.

7.5 It is not proposed to implement a formal system for the recording of waste intake, since all material will be from within the Penllergaer Park Estate. No material imported from elsewhere will be permitted. All hazardous wastes removed from site will be subject to recording procedures as dictated by the Duty of Care (1992).

7.6 The general method of working is shown on Drawing No. PLF 211 "Operational Plan". The materials will be placed and compacted in layers not exceeding 1.0m. No material will be placed below water.

7.7 Daily cover comprising inert wastes will be placed above the material at the end of each working day and as otherwise required. This daily cover will minimise environmental problems arising from odour and litter.

8. ENVIRONMENTAL CONTROLS

8.1 The site will be managed and operated to minimise environmental nuisance. Security fencing will be installed around the site. Monitoring of gases, leachates and surface water will be undertaken at regular intervals.

8.2 Litter

Although the nature of the waste is largely inert there is a proportion of material which may be susceptible to blowing, of particular concern is plastic and paper, although much of the paper is likely to be saturated by water. During sorting operations at the Cwilfwnwr Tip litter will be minimised by:

- careful control during excavation including minimising the area of waste exposed at any time
- construction of a 1.8m high 250m long chainlink fence along the northern boundary of the Cilfwnwr Tip adjacent to the A48 as shown on the zonal plan
- vehicles transporting wastes susceptible to wind blowing will either be sheeted or topped with inert material.

At the proposed landfill site problems of blown litter will be reduced by:

- rapid placement of appropriate cover material
- good compaction
- the perimeter fence which will capture any blown waste

In the unlikely event that the above measures do not prove totally effective mobile litter fencing would be utilized around sorting and landfilling areas as required.

8.3 Odours

Unpleasant odours generated by the decomposition of putrescible matter are generally a nuisance rather than a health hazard. However, odours will be minimised by good site management combined with the fact that only a small proportion of the wastes if any contain any putrescible matter. Measures will include:

- no deposition of waste into water
- controlled deposition of waste
- good compaction to minimise water ingress
- use of adequate daily cover
- rapid infilling and capping of the site

The site is a significant distance from nearest properties and odour is not expected to be a problem.

8.4 Pest Control

Pest control measures are unlikely to be extensive due to the inert nature of much of the waste. However, the risk of pest infestation will be minimised by:

- minimising time of exposure of any putrescible wastes
- high level of compaction
- use of daily cover

No pesticides or insecticides will be used without the approval of the Environmental Health Department and the Countryside Council for Wales.

The nature of the wastes is such that birds are unlikely to be attracted to the site. However, should birds become a problem bird scarers, distress calls or nets can be used to control them.

8.5 Fires

No fires will be permitted on or within the site. Site security will be maintained to prevent the occurrence of fires by unauthorized persons.

8.6 Noise

The effects of noise will be minimised by the construction of an amenity bund along the southern boundary of the site. This is the area closest to any residential properties. It is not anticipated that noise will be a problem. All operational machinery will be fitted with silencers which will be maintained to the design specification.

8.7 Dust

In dry weather equipment will be maintained on site for the damping down of site access roads and other areas as necessary.

8.8 Visual Impact

Any visual intrusion will largely be restricted to the housing development about 300m to the south of the site. This will be minimised by:

(a) The construction of an amenity bund along the southern boundary of the site.

(b) The existence of much natural vegetation including trees and hedges between the site and the housing estate.

9. CAPPING AND RESTORATION

9.1 The site will be capped with low permeability clays, minimum 1.0m thick.

9.2 The site will be shaped to encourage rainfall run-off and prevent infiltration.

9.3 The site will be returned to agricultural grazing use to final levels as shown on Drawing PLF211 and agreed with the Planning Authority. The following topsoil and subsoil provisions will be made subject to availability of materials on site:

(a) Topsoil - 150mm

(b) Subsoil - placed in 225mm layers

9.4 To protect the clay cap from erosion or desiccation the placement of subsoils and topsoil will be undertaken at the earliest opportunity following completion.

9.5 The restored area will be seeded with a natural mixture of grass seed to promote and established vegetative surface in as short a period as possible to minimise the risk of erosion damage.

9.6 The seeding specification will be to the satisfaction of the Welsh Office Agricultural Department and the Countryside Council for Wales. The seed used will be carefully selected to ensure compatibility with the existing natural vegetation and to ensure that no invasive species are introduced.

9.7 On completion of the restoration works the site offices and perimeter fencing will be removed. It is envisaged that the surface water cut-off ditch will remain in place and operational.

10. SITE MONITORING

10.1 Regular on site monitoring will be undertaken to ensure that the landfill site does not pose a risk to the environment, of particular importance is the possibility of ground or surface water pollution by leachates. These potential effects will be minimised the the proposed containment system, however, the need for longer term monitoring is recognised.

10.2 The following initial monitoring regime is recommended. Subsequent monitoring will be dependant upon the actual tests results and requirements of the relevant statutory authorities:

1. Gas Vents and Boreholes – to be monitored weekly for the first six months and thereafter every month for the first year. Monitoring to determine concentrations of methane, carbon dioxide and oxygen.

2. Leachate Sump – leachate level to be measured weekly for the first six months and thereafter at a frequency determined by results of initial monitoring.

– quality of leachate to be determined by laboratory testing at six month intervals and when required for leachate disposal. Samples of leachate will be analysed for the following minimum number of constituents:

pH
Chemical Oxygen Demand
Biological Oxygen Demand
Ammoniacal Nitrogen
Particulate Solids
And any other constituents required for off-site disposal purposes

3. Surface Water - surface water samples to be collected every six months from a designated monitoring point to the north of the site. Sampling shall be undertaken at the same time as for the leachate. The following constituents should be analysed for:

pH
Chemical Oxygen Demand
Biological Oxygen Demand
Ammoniacal Nitrogen
Particulate Solids

- the surface water quality should be determined prior to any landfilling to establish a background data level.

10.3 All monitoring results shall be forwarded to the Waste Regulation Authority at agreed frequencies.

10.4 The long term monitoring and site aftercare will be detailed in a Section 106 Agreement to be drawn up between Lliw Valley Borough Council and the landowner.

APPENDIX

1. PLACING AND COMPACTION OF CLAY FILLS

1.1 Selection of Clay Fills

The selection of clay fills shall be in accordance with the following specifications.

1.1.1 Representative samples of the material from each source to be used in any liner, final cap or specified bunds shall be tested by an approved soils laboratory to demonstrate that it is capable of being compacted (by the equipment to be used for its emplacement) to an extent which will achieve a permeability of not more than 1.0×10^{-9} m/sec.

The method of soils testing shall be in accordance with the following schedule:

1.1.2 Classification

The natural moisture content and Liquid Limit and Plastic Limit of each sample shall be measured in accordance with BS 1377 (1990): Part 2 Methods 3, 4 and 5 respectively. The Particle Size Distribution, and in particular the clay contents, shall be determined by BS 1377 (1990) Part 2 Method 9. Where "Boulder Clays" are involved these shall be tested using the procedures described in Head Vol 1 Sections 4.6.7 and 4.8.5.

1.1.3 Compaction

The density/moisture content relationship of the material shall be determined in accordance with BS 1377 (1990) Part 4 Method 3. The appropriate size of hammer (2.5 kg or 4.5 kg) shall be selected to reflect the actual compaction equipment it is proposed to use on site. Where there is any uncertainty regarding the type of plant the lighter hammer shall be used.

1.1.4 Permeability

Initially the permeability (k) of the recompacted sample shall be measured at field and optimum moisture contents. Should these approach the specified permeability, then additional permeability measurements shall be made dry of optimum and wet of field values. This will establish the range of permeabilities which may be achieved in the field at varying moisture contents (for either Standard or Modified Proctor densities).

When testing the recompacted clay, the permeability shall be measured directly by the falling head method, preferably using the BS compaction mould (Head, Vol 2, p457-459, 1982).

Alternatively, tests may be carried out using:

(i) Falling head cell)
) Head, Vol 2, p449-457
(ii) Oedometer cell*)

(iii) Triaxial cell under falling head or constant head - (Tavenas et al 1983)

Indirect evaluation of the permeability from consolidation tests will not be accepted as this method can lead to an underestimate of the k value.

***Note:** The oedometer cell used in method (ii) above is modified to allow direct measurement of k.

1.1.5 Specific Gravity

The specific gravity of the soil particles shall be determined using BS 1377 (1990): Part 2 Method 8.

1.1.6 Reporting Results

A report containing the results of all laboratory and field tests, along with a location plan showing the sampling locations at the material sources, shall be held in the office at the Site and a copy made available to the Waste Regulation Authority (WRA).

The report shall state the minimum moisture content to be achieved during its emplacement, the equipment to be used for its emplacement, the maximum thickness of each layer and the minimum number of passes per layer. These shall be selected to satisfy the requirements of 1.2.5, 1.2.6 and 1.2.7 and to ensure that the specified permeability and maximum of 5% air voids are not exceeded.

1.1.7 Acceptance Criteria

Clay fill material will only be accepted as suitable when the above testing programme proves that it is capable of achieving the specified permeability or less. The material shall have a minimum clay content (ie a particle size less than 0.002 mm) of 10%. The liquid limit shall not exceed 90 and the plasticity Index (Liquid Limit minus Plastic Limit) shall not exceed 65

and shall not be less than 12.

If certain tested samples from a proposed source do not meet these criteria, such sources of material shall be rejected and will carry out further sampling and tests of alternative sources until an adequate supply of suitable material available to complete each phase of construction has been demonstrated.

1.2 Stage 2: Construction of Clay Fill

1.2.1 Clay shall only be obtained from sources in accordance with 1.1.7.

1.2.2 The following unsuitable material shall be rigorously excluded from the seal:

(a) Peat, logs, stumps and perishable material.
(b) Material susceptible to spontaneous combustion.
(c) Material in a frozen condition.
(d) Any industrial, commercial or domestic waste.
(e) Rocks, concrete or boulders having a volume greater than $0.05m^3$.

1.2.3 The moisture content of the material, when placed, shall be at or above that specified in the report required by 1.1.6 but shall not be so high as to render it unworkable using the method and equipment agreed under 1.1.6.

1.2.4 If the material to be placed is in, or reaches a condition such that it cannot be compacted in accordance with 1.2.3, then the Contractor shall either:

(i) Make good by removing the material either to tip or elsewhere until it is in a suitable condition for re-use and replacing it with suitable material; or,

(ii) Make good the material by wetting or drying; or,

(iii) Cease work on the material until its physical condition is such that it can again be compacted in accordance with the stated procedure.

1.2.5 The material shall be placed in layers and tracked using agreed compaction equipment. The maximum thickness of each layer and the minimum number of passes should comply with or exceed the minimum requirements of Table 6/4 (Method 1) of the Department of Transport Specification for Highway Works Part 2, 1986 and its associated definitions and requirements.

The number of passes ultimately required shall be such that the compacted fill complies with the compaction standards of Clause 1.2.8 and may be in excess of the number of passes specified in Table 6/4.

1.2.6 Placing and compaction trials will be carried out using the intended compaction plant to determine the number of passes and loading of the rollers, the speed of the rollers, and the layer thickness required to achieve the specified permeability and level of compaction.

Trials shall be carried out for clay fill placement applicable to each of the proposed lining methods:

(a) Horizontal lining
(b) Inclined lining

The minimum size for each trial shall be:

horizontal	-	30 m long x 10 m wide x 1 m deep
inclined	-	20 m long x 2 m wide x 2 m deep

The degree of compaction will be assessed by insitu density measurement by the sand replacement method BS 1377 (1990): Part 9 Method 2 and laboratory compaction tests BS 1377 (1990): Part 4 Method 3. In addition, moisture content and classification testing shall be carried out. A minimum of three sets of tests shall be carried out for each trial. Holes shall be carefully backfilled and recompacted using suitable fills materials.

Providing the test results indicate that the required level of compaction has been achieved the trial areas can be incorporated into the permanent works. Should the tests prove the level of compaction to be unsatisfactory the material shall be removed and the trial repeated.

1.2.7 The Contractor shall only employ that plant which is suitable for the soils to be handled. At no time shall plant be used which damages the natural strength of the fill material, either in its in-situ state or during its handling and placing, or in its final compacted state.

1.2.8 All compaction plant shall be operated systematically and efficiently in parallel strips, with each strip overlapping with the previous one by an equal amount.

Compaction shall be continued until the whole depth of the layer throughout the area being compacted complies with the specified requirements.

No material shall be placed in or through water.

The clay fill shall be compacted to the requirements shown on the table below:

Proportion of Results	Compaction Standard
	Minimum Relative Compaction
80%	95%
100%	90%

The relative compaction of a soil is defined as:

$$\text{Relative Compaction \%} = \frac{\text{Field Dry Density} \times 100}{\text{Maximum Dry Density}}$$

The minimum moisture content shall be the optimum moisture content (OMC) + 1% and the maximum moisture content shall generally be not greater than OMC + 5%, but ultimately shall be determined by trafficability constraints.

The total thickness of clay at each location shall be as shown on the drawings and shall be at least 1 metre.

1.2.9 Specified bunds shall have a minimum crest width of 2 metres and shall be designed and constructed to provide a batter which will remain stable, both during and after the operational life of the landfill.

1.2.10 Trimming of Slopes

All inclined slopes shall be compacted oversize to allow for subsequent trimming. Trimming shall be carried out to produce a uniform and smooth profile. Trimming using a toothed excavator bucket shall not be permitted. Slopes shall be trimmed in stages to suit the construction plant as construction proceeds.

1.2.11 Inspection of Subgrade

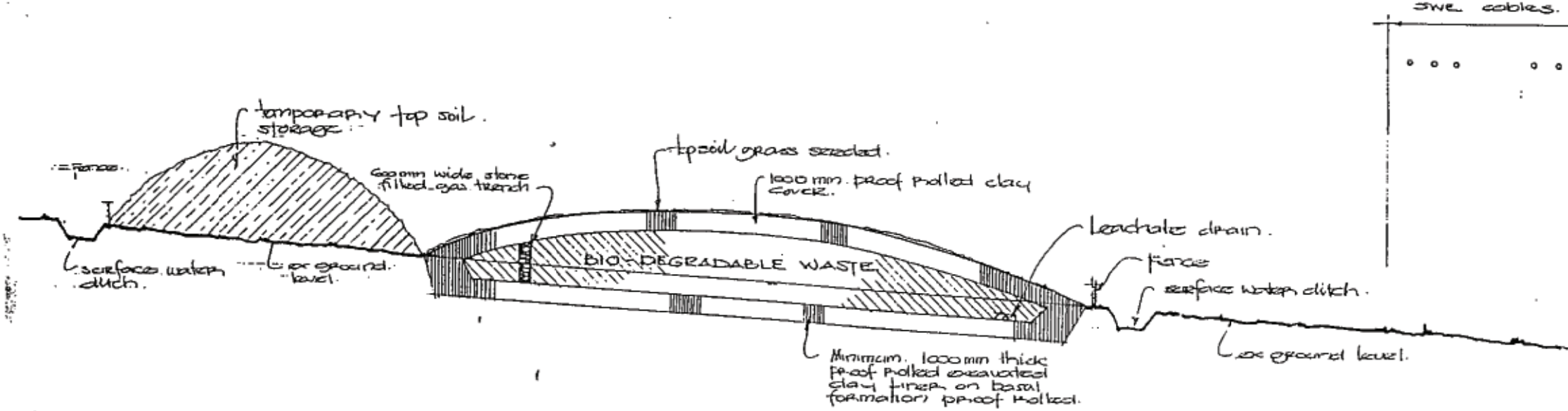
The compacted clay shall be protected as soon as is practicable and not more than one week after quality control testing to prevent it drying out and the formation of cracks in the placed material.

1.3 Construction Quality Control

1.3.1 The following quality control test shall be carried out on the placed material:

(i)	In-situ Density	-	BS 1377 (1990): Part 9 Method 2
(ii)	Moisture Content	-	BS 1377 (1990): Part 2 Method 3
(iii)	Classification Tests	-	BS 1377 (1990): Part 2 Methods 4, 5 & 9
(iv)	Compaction	-	BS 1377 (1990): Part 4 Method 3
(v)	Depth Profiling	-	Either by auguring or excavation (and backfilling with grout/clay/ bentonite), or by levelling surveys before and after the earthworks.

The above tests shall be carried out on compacted clay at locations and at depths as specified on site. The minimum number of test positions shall be 25 per hectare for horizontally placed material. Elsewhere testing shall be carried out at the rate of one test position per 500 m^3.



DETAIL SECTION - BIO-DEGRADABLE WASTE CONTAINMENT

up plc

Beaufort House
Beaufort Road
Plas-Marl
Swansea
SA6 8JG
Telephone (0792) 701414
Fax No 0792 796982

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W Glam.

attention of Ms. L. Williams
ental Health Officer

r

PENPLAS

er to my meetings with Mr. Hywel Lewis and Ms. Williams this ng and the specific queries raised regarding our Tip Licence he above, I would comment as follows.

Sorting of materials

The materials will be dealt with in the following manner:-

a) The area identified on the Gibb Environmental report, cross-hatched showing methane and CO^2, will be marked out on site. This area will be excavated initially and taken to the specially prepared pit at Penplas as shown on our drawings. We calculate that this area will yield some 8,000 cubic metres of materials and as such will be dealt with on a once and for all basis.

b) The remaining material at Cilfwnwr will then be excavated, carted to Penplas and deposited in the cells indicated on our plans. To this end, I enclose a copy of our Method Statement which has been prepared specifically for our engineers on site.

As additional precautions, we will have a qualified civil engineer, employed by BJ, on site full-time to direct operations plus specialist visits and advice from Gibb Environmental acting for BJ and W.S. Atkins acting for the W.D.A.

2. Pest control

Further to Clause 8(4) in our Application Licence, should pests become a problem then we will engage a specialist sub-contractor to deal with them in the appropriate manner. The specialist would be Rentokil or other equally qualified company.

3. Dust

If dust arises out of the operations then it is our intention to have on site adequate water bowsers and sprinklers to eradicate any nuisance.

4. Quantity of material moved per day

It is our intention to use between eight and twelve 14 cubic metre Volvos in our operation, the number being determined by the length and width of the haul road. It is anticipated that by using such equipment we will move 2,500 cubic metres per day.

5. Plan of final contours

I enclose a plan, prepared from the plans and cross-sections already in your possession, showing the eventual configuration of the site.

I trust that this information is satisfactory, but if you have any queries then please let me know.

Yours faithfully,
BJ GROUP PLC

D.M. HOWELLS
DEVELOPMENT DIRECTOR

METHOD STATEMENT FOR THE REMOVAL OF THE CILFWNWR TIP TO PENPLAS FARM

1. Treat area of knotweed at Cilfwnwr.

2. Strip all topsoil from Cell 1 at Penplas farm site and store in mounds at the southern boundary as shown on the attached drawing.

3. Erect post and chainlink fence to boundaries of Cell 1 shown on plan.

4. Construct road from C-D, including passing places, from arisings in brown tip area.

5. Construct 3 no. culverts on Road C-D.

6. Carry out test area as follows to ensure plant optimisation:-

   35M x 20M Test Area

   a. Take off soil.

   b. Carry out survey level at 5M grid.

   c. Take off 2M deep of reduced level and mound on site away from test area.

   d. **Put back 1M of clay by first proof rolling the bottom and rolling the fill material in 200MM layers to produce 1M of worked clay liner.

   e. Undertake quality control testing in accordance with NRA Specification for Earthworks.

7. Erect post and wire fence to clearly mark the route of road C-D and 250LM of 1.8M chain link north of Cilfwnwr tip in order to act as litter fence.

8. Erect gate at points C and D.

9. Clear and construct perimeter ditches as shown on drawing for Cell 1.

10. Set up site establishment at Penplas.

11. Construct land fill gas and leachate monitoring and control systems to details as shown and located on drawings.

Cell 1

12. Excavate area of Cell 1 to reduced level by approximately 2M and store on Cell 2 and carry out levels survey.

13. **Prepare clay liner in Cell 1 by proof rolling formation and relaying 1M of clay in 200MM layers. Compaction to be in accordance with Table 6/4 of Specification for Highway Works Part 2 and carry out further level survey to establish 1M thickness.

14. Undertake permeability testing in accordance with the National Rivers Authority Earthworks on Landfill Sites at a frequency of 25 tests per hectare.

15. Lay in leachate drainage and pump sump as detail and carefully backfill with material from Cilfwnwr tip.

16. Excavate at Cilfwnwr and cart to Cell 1. During the operation care should be taken to set aside any suitable materials for placing into planting area - this material to be approved by Mr. M. Earl of W.S. Atkins.

17. Works described in 12 13, 14 and 15 above to be carried out in an East to West direction concurrently across the site. Land fill gas control systems shall be installed as work proceeds and as detailed on the drawings.

18. On completion of Cell 1 tipping, cover with 1M of material stored in Cell 2. To be laid in 200MM layers and compacted as section 11 and test as NRA Earthworks on Landfill Sites document.

19. At the same time as commencing item 16 above, the excavation must commence at the Fforest tip followed by reinstatement of the Fforest tip as shown on approved drawings.

20. At the same time as commencing item 16 above, excavate brown land tip, cart to Penplas tip and reinstate if required by Lliw Valley Borough Council.

21. Should it be found that Cell 1 is not large enough to take all the fill material then the above procedure will be repeated in Cell 2.

22. Remove site establishment.

23. Cover tip with stored material from operation 1 above and "lake" topsoil as necessary including making good any disturbed areas.

24. Fill previously excavated ditch as required in Planning Conditions and marked X-Y on drawing.

25. Seed all disturbed areas as specification.

26. Secure both gates.

27. Perimeter fencing and gate D to be removed upon establishment of vegetation.

** Using Table 6/4 Part 1, it is anticipated four passes of a vibrating roller 2900kg - 3600kg in weight will be necessary to achieve the required compaction.

21.9.92

BJ Group
Construction Division

Beaufort House
Beaufort Road
Plas-Marl
Swansea
SA1 6JG
Telephone (0792) 701414
Fax No 0792 701438

FAX TRANSMISSION

FROM ...DAVE HARRIS.....

TO ..LYNDA WILLIAMS..... FAX NO. .....

.....

NO. PAGES (INC. TOP) ..... DATE .....

RE TIPPING LICENCE - PENPLAS (cont'd)

contained within the report and the results of the tests, carried out by Thyssen's at Bynea, will be forwarded by S. Whitehouse to both Llwr Valley and the N.R.A.

The format of the report is that contained in our "Information in Support of the Waste Disposal licence Application" prepared by Gibb Environmental.

Copy of table 6/4 is attached for your retention.

Schedule D - Operations.

The facility will be supervised by personnel from both Gibb Environmental and the BJ Group.

The personnel involved will be :-

MR R SCURFIELD B Eng MICE IWEM

and MR M. O'CONNOR Site Agent BJ Group.

(c) have a temperature not less than 10°C nor in excess of 25°C. The flow rate determined in the test shall be corrected to that applicable to a temperature of 15°C using published data on variation in viscosity of water with temperature.

(vi) The quantity of flow to be collected shall be not less than 2 litres or alternatively the flow shall be collected for a period of time in excess of 15 s.

(vii) The number of test pieces shall be a minimum of 4 and the number of flow runs per test piece shall be a minimum of 4.

(viii) The flow shall be quoted in litres/m²/s. The standard deviation of the flow results shall be stated together with the mean.

10 Pore size distribution and determination of O_w shall be as follows:–

(i) The pore size distribution shall be obtained by determining the percentages of each of a number of different designated sizes of glass spheres complying with BS 6088 chosen so as to cover the range of pore sizes which are retained on the geotextile when shaken through it employing the geotextile as a sieve.

(ii) A cumulative frequency graph of percentage of spheres retained against designated size shall be plotted and the size corresponding to 90% retained is the required O_w.

(iii) For each sieving at least 100 g of the glass spheres shall be shaken for 10 min on a test piece of geotextile supported and clamped in place on a BS sieve of frame diameter 300 mm and aperture size greater than 10 mm.

(iv) The sieve apparatus shall have a vibrational frequency of 50 Hz and a maximum vertical amplitude of 0.75 mm.

(v) 5 test pieces having dimensions exceeding the dimensions of the sieve shall be taken to provide a mean of O_w pore size.

610 Fill to Structures

1 This Clause shall apply to fill to structures other than:–

(i) fill for reinforced earth structures, including associated drainage layers;

(ii) fill for anchored earth structures including associated drainage layers;

(iii) fill for surrounds and bedding of corrugated steel buried structures;

(iv) fill above structural concrete foundations unless otherwise required in the Contract.

2 Materials, as required or permitted in Appendix 6/6 of Classes 6N, 6P, 7A or 7B and complying with Table 6/1 shall be used as fill to structures, in the locations described in the Contract.

3 The Contractor shall compact, in compliance with Clause 612, end-product compaction, Class 6N, 6P, 7A and 7B material to satisfy the compaction requirements for those Classes as listed in Table 6/1, but subject to the restrictions in sub-Clauses 4 and 5 of this Clause.

4 Where fill to structures is required to the same level on more than one side of a structural element it shall be maintained at heights not differing by more than 250 mm after compaction on opposing sides of the structural element as filling proceeds, unless otherwise permitted by the Engineer.

5 The Contractor shall restrict compaction plant used on fill to structures, within 2 m of a structure, to the following items as described in Clause 612.10 and listed in Table 6/4:–

(i) vibratory roller having a mass per metre width of roll, as determined by sub-Clause 612.10, not exceeding 1,300 kg with a total mass not exceeding 1,000 kg.

(ii) vibrating plate compactor having a mass not exceeding 1,000 kg.

(iii) vibro-tamper having a mass not exceeding 75 kg.

The compacted level of the fill within this zone shall not differ during construction from the compacted level of the remainder of the adjoining fill to structures by more than 250 mm.

6 Where required in Appendix 6/6, Classes 6N, 6P and 7B material shall be shown, by means of a test utilising not less than 20 m³ of the material, deposited and compacted in accordance with this Clause, that it is stable in the opinion of the Engineer, when it is trimmed to a slope of 1 vertical to 1½ horizontal, or other slope described in Appendix 6/6.

611 Fill above Structural Concrete Foundations

1 Fill deposited above structural concrete foundations shall be, as described in Appendix 6/6, either:–

(i) Class 6N, 6P, 7A or 7B selected fill material complying with Clause 610 including compaction requirements or

(ii) another class of selected fill or general fill complying with Table 6/1 deposited and compacted in compliance with Clauses 608 and 612 and in addition be subject to Clause 610.4 and 5.

612 Compaction of Fills

General

1 Except for dynamic compaction, which shall comply with Clause 630, and unless otherwise described in Appendix 6/3 or agreed by the Engineer, the Contractor

shall carry out compaction in compliance with this Clause, as soon as practicable after deposition, on all those Classes of fill in Table 6/1 which require to be compacted.

2 Compaction shall be either method or end-product as required for the Class of fill in Table 6/1 using plant appropriate to the Class of fill and the site conditions.

3 Subject and without prejudice to the provisions of Clause 45 of the Conditions of Contract and in order that the Engineer may make proper provision for the supervision of compaction in the Permanent Works, the Contractor shall, not less than 24 hours before he proposes to carry out compaction outside normal working hours, apply in writing to the Engineer for permission to do so.

Method Compaction

4 Where method compaction is required to be adopted it shall comply with sub-Clauses 5 to 10 of this Clause.

5 Except as stated in sub-Clause 6 of this Clause, method compaction shall be undertaken using the plant and methods in Table 6/4 appropriate to the compaction requirements as listed in Table 6/1 for the Class of material being compacted.

6 Plant and methods not included in Table 6/4 shall only be used providing the Contractor demonstrates at site trials that a state of compaction is achieved by the alternative method equivalent to that obtained using the specified method. The procedure to be adopted for these site trials shall first be submitted to the Engineer for approval.

7 Earthmoving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account when assessing the amount of compaction required for any layer.

8 If more than one Class of material is being used in such a way that it is not practicable to define the areas in which each Class occurs, the Contractor shall compact with plant operating as if only the material which requires the greater compactive effort is being compacted.

9 The Engineer may:–

(i) at any time carry out field dry density tests as described in sub-Clause 15 of this Clause on material compacted to method requirements.

(ii) If the results of the field tests in (i) above show densities which indicate, when compared with the results of similar tests made on approved work in similar materials carried out in accordance with this Clause and Table 6/4, the state of compaction to be inadequate, then if this is held to be due to failure of the Contractor to comply with the requirements of the Contract, the Contractor shall carry out such further work as the Engineer may decide is required to comply with the Contract.

10 For the purposes of Table 6/4 the following shall apply:-

(i) The minimum number of passes N is the minimum number of times that each point on the surface of the layer being compacted shall be traversed by the item of compaction plant in its operating mode, or struck by power rammers or falling weight compactors. D is the maximum depth of the compacted layer.

(ii) In column headed N ≠ the number of passes shown is to be doubled for material Classes 1A, 1B, 2A, 2B, 2C and 2D when such materials occur within 600 mm of sub-formation if a capping is required, or formation. Such extra compaction shall, unless otherwise described in Appendix 6/3, either be carried out for the full width of the embankment or, in other areas of fill which are to receive a pavement, between the outer extremities of the verges.

(iii) The compaction plant in Table 6/4 is categorised in terms of static mass. The mass per metre width of roll is the total mass on the roll divided by the total roll width. Where a roller has more than [illegible] axle the category of the machine shall be determined on the basis of the axle giving the highest value of mass per metre width.

(iv) A grid roller is a machine with a compacting roll or rolls constructed of heavy steel mesh of square pattern.

(v) A tamping roller is a machine with a roll or rolls from which 'feet' project and where the projected end area of each 'foot' exceeds 0.01 m² and the sum of the areas of the feet exceeds 15% of the area of the cylinder swept by the ends of the feet. The requirements for tamping rollers apply to machines that have 2 rolls in tandem. If only one tamping roll traverses each point on the surface of the layer on any one pass of the machine, the minimum number of passes shall be twice the number given in Table 6/4 plus any further doubling required to satisfy (ii) above.

(vi) For pneumatic-tyred rollers the mass per wheel is the total mass of the roller divided by the number of wheels.

(vii) For vibratory rollers the following shall apply:–

(a) Vibratory rollers are self-propelled or towed smooth-wheeled rollers having means of applying mechanical vibration to one or more rolls except that vibratory rollers employed for Method 5 compaction shall be single roll types.

(b) The requirements for vibratory rollers are based on the use of the lowest gear on a self-propelled machine with mechanical transmission and a speed of 1.5-2.5 km/h for a towed machine, or a self-propelled machine with hydrostatic transmission. If higher gears or speeds are used an increased number of passes shall be provided in proportion to the increase in speed of travel.

(c) Where the mechanical vibration is applied to two rolls in tandem, the minimum number of passes shall be half the number given in Table 6/4 for the

appropriate mass per metre width of one vibrating roll but if one roll differs in mass per metre width from the other the number of passes shall be calculated as for the roll with the smallest value. Alternatively the minimum number of passes may be determined by treating the machine as having a single vibrating roll with a mass per metre width equal to that of the roll with the higher value.

(d) Vibratory rollers operating without vibration will be classified as smooth-wheeled rollers.

(e) Vibratory rollers shall be operated with their vibratory mechanism operating at the frequency of vibration which produces the highest measurement of amplitude unless the manufacturers recommend otherwise for the material being compacted.

(f) Vibratory rollers shall be equipped or provided with devices indicating the frequency at which the mechanism is operating and the speed of travel. Both devices shall be capable of being read by an inspector alongside the machine.

(viii) Vibrating-plate compactors are machines having a base-plate to which is attached a source of vibration consisting of one or two eccentrically weighted shafts and:-

(a) the mass per square metre of the base plate of a vibrating-plate compactor is calculated by dividing the total mass of the machine in its working condition by its area in contact with the material to be compacted.

(b) vibrating-plate compactors shall be operated at the frequency of vibration recommended by the manufacturers. They shall normally be operated at travelling speeds of less than 1 km/h but if higher speeds are necessary the number of passes shall be increased in proportion to the increase in speed of travel.

(ix) Vibro-tampers are machines in which an engine-driven reciprocating mechanism acts on a spring system through which oscillations are set up in a base-plate.

(x) Power rammers are machines which are actuated by explosions in an internal combustion cylinder, each explosion being controlled manually by the operator.

(xi) Dropping weight compactors are machines in which a dead weight is dropped from a controlled height using a hoist mechanism and they include self-propelled machines with mechanical traversing mechanisms capable of compacting soil in trenches and close to structures

(xii) In the case of power rammers and dropping-weight compactors one pass will be considered as made when the compacting shoe has made one strike on the area in question.

(xiii) For items marked * in the Method 3 column the roller shall be towed by track-laying tractors. Self-propelled rollers are unsuitable.

(xiv) Where combinations of different types or categories of plant are used, the following shall apply:-

(a) the depth of layer shall be that for the type of plant requiring the least depth of layer, and

(b) the number of passes shall be that for the type of plant requiring the greatest number of passes

End-product Compaction

11 Where end-product compaction is required to be adopted it shall comply with sub-Clauses 12 to 15 of this Clause.

12 The Contractor shall at least 7 working days before commencement of end-product compaction submit the following to the Engineer for approval:-

(i) the values of maximum dry density and the optimum moisture content obtained in accordance with BS 1377 Test 12 or 14 as appropriate for each of the fills he intends to use which fall within the Contract limits of the permitted Class or Classes. Where within any Class of material the fill contains material having different maximum dry densities and optimum moisture contents the Class shall be further sub-divided, by extending the identification system, in order to monitor the compacted density.

(ii) a graph of density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined and, for Class 7A material, a plot of the 5% air voids curve for each sub-division.

13 Once the information contained in sub-Clause 12 of this Clause has been approved by the Engineer it shall form the basis for compaction.

14 Fill compacted to end-product requirements shall have a field dry density, measured in accordance with sub-Clause 15 of this Clause, equal to or greater than the percentage given in Table 6/1 of the maximum dry density for the relevant Class of fill previously submitted to and approved by the Engineer in accordance with sub-Clause 12 of this Clause.

15 The field dry density referred to in sub-Clause 14 of this Clause shall be measured in accordance with Test 15 of BS 1377 or, where required in Appendix 6/3, or permitted by the Engineer, measured by a nuclear moisture/density gauge used in accordance with an agreed procedure based on ASTM D2922 Methods A or B and ASTM D3017. The gauge shall be calibrated to provide a result identical to that obtained from Test 15 of BS 1377.

613 Sub-formation and Capping

1 Capping shall be provided only in those locations, and to the extent, particularly stated in the Contract to be constructed with capping. It shall comply with this Clause and in addition, for stabilised capping, Clauses 614 and 615 as appropriate.

2 Capping shall be constructed with Class 6F1, 6F2, 9A or 9B material as required or permitted in Appendix 6/7 and complying with Table 6/1.

TABLE 6/4: Method Compaction for Earthworks Material Plant and Methods
(This Table is to be read in conjunction with Clause 12.10)

Type of Compaction Plant	Ref No	Category	Method 1 D	Method 1 N	Method 2 D	Method 2 N	Method 3 D	Method 3 N	Method 4 D	Method 4 N	Method 5 D	Method 5 N	Method 6 N for D=110 mm	Method 6 N for D=150 mm	Method 6 N for D=250 mm	Ref No
Smooth wheeled roller for vibratory roller operating without vibration)		Mass per metre width of roll:—														
	1	over 2100 kg up to 2700 kg	125	6	125	10	125	10*	125	4	unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 2700 kg up to 5400 kg	125	6	125	8	125	8*	200	4	unsuitable		16	unsuitable	unsuitable	2
	3	over 5400 kg	150	4	150	8	unsuitable		300	4	unsuitable		8	16	unsuitable	3
Grid roller		Mass per metre width of roll:—														
	1	over 2700 kg up to 5400 kg	150	10	unsuitable		150	10	250	4	unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 5400 kg up to 8000 kg	150	8	125	12	unsuitable		325	4	unsuitable		20	unsuitable	unsuitable	2
	3	over 8000 kg	150	4	150	12	unsuitable		400	4	unsuitable		12	20	unsuitable	3
Tamping roller		Mass per metre width of roll:—														
	1	over 4000 kg	225	4	150	12	250	4	350	4	unsuitable		12	20	unsuitable	1
Pneumatic tyred roller		Mass per wheel:														
	1	over 1000 kg up to 1500 kg	125	6	unsuitable		150	10*	250	4	unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 1500 kg up to 2000 kg	150	6	unsuitable		unsuitable		300	4	unsuitable		unsuitable	unsuitable	unsuitable	2
	3	over 2000 kg up to 2500 kg	175	4	125	12	unsuitable		350	4	unsuitable		unsuitable	unsuitable	unsuitable	3
	4	over 2500 kg up to 4000 kg	225	6	125	10	unsuitable		400	4	unsuitable		unsuitable	unsuitable	unsuitable	4
	5	over 4000 kg up to 6000 kg	300	6	125	10	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable	5
	6	over 6000 kg up to 8000 kg	350	6	150	8	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable	6
	7	over 8000 kg up to 12000 kg	400	4	150	8	unsuitable		unsuitable		unsuitable		10	16	unsuitable	7
	8	over 12000 kg	450	4	175	6	unsuitable		unsuitable		unsuitable		8	12	unsuitable	8
Vibratory roller		Mass per metre width of a vibrating roll:—														
	1	over 270 kg up to 450 kg	unsuitable		75	16	150	16	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 450 kg up to 700 kg	unsuitable		75	12	150	12	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	2
	3	over 700 kg up to 1300 kg	100	12	125	10	150	6	125	10	unsuitable		16	unsuitable	unsuitable	3
	4	over 1300 kg up to 1800 kg	125	8	150	8	200	10*	175	4	unsuitable		8	16	unsuitable	4
	5	over 1800 kg up to 2300 kg	150	4	150	4	225	12*	unsuitable		unsuitable		4	6	12	5
	6	over 2300 kg up to 2900 kg	175	4	175	4	250	10*	unsuitable		400	5	3	5	11	6
	7	over 2900 kg up to 3600 kg	200	4	200	4	275	8*	unsuitable		500	5	3	5	10	7
	8	over 3600 kg up to 4300 kg	225	4	225	4	300	8*	unsuitable		600	5	2	4	8	8
	9	over 4300 kg up to 5000 kg	250	4	250	4	300	6*	unsuitable		700	5	2	4	7	9
	10	over 5000 kg	275	4	225	4	300	4*	unsuitable		800	5	2	3	6	10
Vibrating plate compactor		Mass per m² of base plate:—														
	1	over 880 kg up to 1100 kg	unsuitable		unsuitable		75	6	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 1100 kg up to 1200 kg	unsuitable		75	10	100	6	75	10	unsuitable		unsuitable	unsuitable	unsuitable	2
	3	over 1200 kg up to 1400 kg	unsuitable		75	6	150	6	150	8	unsuitable		unsuitable	unsuitable	unsuitable	3
	4	over 1400 kg up to 1800 kg	100	6	125	6	150	4	unsuitable		unsuitable		8	unsuitable	unsuitable	4
	5	over 1800 kg up to 2100 kg	150	6	150	5	200	4	unsuitable		unsuitable		5	8	unsuitable	5
	6	over 2100 kg	200	6	200	5	250	4	unsuitable		unsuitable		3	6	17	6
Vibro-tamper		Mass:—														
	1	over 60 kg up to 65 kg	100	3	100	3	150	3	125	3	unsuitable		4	8	unsuitable	1
	2	over 65 kg up to 75 kg	125	3	125	3	200	3	150	3	unsuitable		3	6	12	2
	3	over 75 kg up to 100 kg	150	3	150	3	225	3	175	3	unsuitable		2	4	10	3
	4	over 100 kg	225	3	200	3	225	3	250	3	unsuitable		2	4	10	4
Power rammer		Mass:—														
	1	100 kg up to 500 kg	150	4	150	6	unsuitable		200	4	unsuitable		5	8	unsuitable	1
	2	over 500 kg	275	8	225	12	unsuitable		400	4	unsuitable		5	8	14	2
Dropping-weight compactor		Mass of rammer over 500 kg height drop:—														
	1	over 1 m up to 2 m	400	6	600	8	450	8	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	1
	2	over 2 m	600	2	600	4	unsuitable		unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	2

BJ Group
Construction Division

Beaufort House
Beaufort Road
Plas-Marl
Swansea
SA1 6BJG
Telephone (0792) 701414
Fax No 0792 701438

FAX TRANSMISSION

FROM D. A. HARRIS

TO LINDA WILLIAMS
ENVIRONMENTAL HEALTH
L. W VALLEY

FAX NO. 0792 890588

NO. PAGES (INC. TOP) 6 DATE 14.10.92

RE TIPPING LICENCE - PENPLAS.

Thank you for your fax transmission dated the 12.10.92
In respect of the supplementary information requested the details are as follows -

Re Schedule B - 1
Preparatory works will be supervised by Sir Alexander Gibb & Partners named persons Mr R SCURFIELD B Eng MICE IWEM.

Schedule B - 7.
It is a condition that removal of the material to the landfill site will not be allowed along public highways. Wheel cleaning facilities in respect of this activity are, therefore, unnecessary however, plant has to be brought to site on suitable transport, and although this transport may load the plant at the entrance to the site where wash facilities are available by way of a water main hose facility at the Midway Cafe.

Schedule B - 11 - The report has already been submitted - this was prepared by S Whitehouse B. Eng (Hons) Civ Eng of Sir Alexander Gibb and Partners. Further tests are being carried out to confirm the integrity of the design concept