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Ty Garreg, Church Village Bypass
Ty Garreg Landfill Permit Surrender Report

December 2014

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1. The Site

1.1 Background

This report refers to the Ty Garreg landfill 'the Site' an 'Active' but 'closed' landfill. The ground level at the site is above that of the surrounding area, elevated by the deposited made ground. The slopes of the site fall away to the surrounding areas, the southern and eastern slopes being particularly steep.

As part of the construction of the Church Village bypass, a road cutting was excavated through the landfill. A duel carriageway now passes through this cutting orientated east to west.

Prior to this development, the site comprised of a number of fields used for grazing. Prior to the use of the site as a landfill the site consisted of disused air shafts and mineshafts.

1.2 Location

Ty Garreg Landfill 'the Site' is located approximately 6km northwest of Cardiff. The town of Llantwit Fardre is approximately 500m to the north. Immediately south of the Site is the closed municipal landfill of Rhiwsaeson, which received waste between the late 1960's and early 1980's and is now used as a field for grazing.

East of the Ty Garreg Landfill is the closed Ystrad Barwig landfill. This was recorded as receiving construction, demolition and dredging materials. To the west of the site is the Ty Garreg phase II historic landfill.

The location of the Site and the surrounding areas of landfill are shown on Figure 1 sourced from the EA Website.

1.3 Site Conceptual Model

1.3.1 Made Ground

Investigations have proven the ground conditions present beneath the site consist of Made Ground (to a depth of up to 14mbgl). The fill is underlain by thin and intermittent peat that overlies the superficial deposits. The nature of the Made ground is discussed in Section 4, Waste Characterisation

1.3.2 Superficial Deposits

The 1:50,000 scale British Geological Survey (BGS) map sheet 248 (Ref. 1), indicates that the superficial deposits beneath the Site comprise glacial till overlain by alluvial sands and gravels. Investigations have shown the glacial till to range in thickness from 7m to 12m.

1.3.3 Solid Geology

The 1:10,560 scale sheet (ST08SE) (Ref. 2) indicates that the site is underlain by beds of the Grovesend Formation of the Warwickshire Group (Upper Carboniferous). The Grovesend Formation in the area generally comprises mudstones with sandstone horizons. Two coal seams cross the site, the No.1 and No. 2 Llantwit, with the former seam totalling 2.4m in two

leaves and the latter approximately 2m. A thick (15m) bed of sandstone is known to lie just above the No 1 Llantwit seam. These seams are known to have been productive in the past. During site investigations the bedrock geology was encountered as mudstone at depths ranging from 15m to 19.8mbgl

1.3.4 Hydrogeology

During ground investigations water strikes have been recorded in the fill and the sands and gravels deposits at between 1m and 6mbgl with a lateral flow in a north easterly direction following the topography.

Occasional groundwater strikes have been recorded in the glacial till. The glacial deposits which separates the shallow groundwater from that in the Coal Measures does not appear to be continuous and as a result is unlikely to act as an aquitard between the two horizons. This may, however, have little impact on the hydrogeological regime given the generally low permeability of the bedrock.

Groundwater was encountered in the Coal Measures at approximately 27mbgl with a lateral flow to the west. The Environment Agency classifies the bedrock as a Secondary (A) Aquifer, and it is has been given a Low vulnerability rating. The superficial deposits are unclassified.

1.3.5 Hydrology

A drainage ditch runs along the southern boundary. This ditch collects surface water runoff from the southern half of the site and that from the former Rhiwsaeson landfill to the immediate south, currently in use as fields for grazing livestock.

It is anticipated that the drainage channel intercepts the shallow groundwater that flows towards the north east The northern part of the fields immediately south of the site are known to become waterlogged following periods of heavy rainfall - indicative of a shallow water table.

This drainage ditch flows along the southern site boundary and follows the eastern boundary northwards before changing direction and flowing towards the Nant Myddlyn approximately 250m east of the site.

Surface water from the road is collected and diverted through a reed bed treatment pond prior to feeding into the channel that eventually reaches the Nant Myddlyn.

The Nant Myddlyn flows north to south and feeds into the Afon Clun approximately 1km south of the site. From this point the Afon Clun flows towards the west.

1.4 Pollutant Linkages

The risk that the landfill poses on the surrounding environment has been assessed using the source pathway receptor approach. The possible pollutant linkages are identified in Table 1.1.

Table 1.1. Summary of Potential Pollutant Linkages at the Site

Source	Pathway	Receptor
Contamination within landfill	Leachate produced by water percolation through waste material	Perched waters within waste material
Perched waters within waste material	Vertical migration of leachate through the waste material	Shallow groundwater in the superficial fluvio-glacial sands and gravels
Leachate produced in the landfill.	Shallow groundwater in fluvio-glacial sands and gravels.	Deep groundwater in the Coal Measures
Contaminated groundwater	Natural issues	Nearby surface water feeding to the Nant Myddlin
Gasses produced by the breakdown of waste material	Cracks and natural fissures in the ground	Nearby residential properties. Approximately 25m to the North

1.5 Pollution Control Measures

The glacial till beneath the landfill and superficial deposits may provide some protection to the groundwater in the underlying coal measures. Previous ground investigations have suggested that these glacial deposits are not continuous. As a result, the protection offered by this geological barrier is limited. This may, however, have little impact on the hydrogeological regime given the generally low permeability of the bedrock.

The majority of the site has been capped with clean sub soils and top soils. It is understood that the subsoil and topsoil capping for the embankment land cutting was 0.5m thick. Elsewhere on the Landfill the slopes were covered with subsoil/topsoil capping 0.5 or more. The capping layer is shown on the Atkins construction drawings, Figure 2.

The construction of the road over the landfill material will have some benefits in terms of pollution control. Several aspects of road design and construction will present pathway barriers by construction of relatively impermeable surfaces and through the diversion of surface water flows that would otherwise percolate into landfill material. Therefore the potential for leachate production is reduced. Surface water runoff from the carriageway is diverted to an offsite attenuation pond prior to discharge.

2. Permit History

2.1 Licence

Site License Number 2/90/17 was granted under the Control of Pollution Act 1974 to dispose of waste to Mr. David W Thomas on the 14th of March 1990. The site was granted a non bio-degradable wastes landfill category (not construction).

2.2 Modifications

The licence, now referenced EAWML/30031, was transferred to the Environment Agency on the 1st April 1996 from Taff Ely Borough Council and registered under Section 2 of the Environment Act 1995 and the site became a waste management facility.

The licence was modified on the 30th March 1999 and 27th March 2003 in accordance with Section 37(1) (a) Environmental Protection Act 1990.

Rhondda Cynon Taf CBC on behalf of Mr David W. Thomas, modified the licence to accommodate the bypass on the 3rd June 2008 in accordance with Section 37(1) (a) and (b) of the Environmental Protection Act 1990.

In June 2008, the licence was modified by Rhondda Cynon Taff County Borough Council on behalf of Mr David W. Thomas, to accommodate the Church Village bypass. The bypass was placed in a cutting through the landfill containing non-hazardous material, to a maximum depth of 6m. Construction of the road began in 2009 and was completed by the end of 2010.

2.3 Closure

Tipping continued until closure on 1st July 2001. A review of the post closure inspection reports show that unauthorised tipping continued for some time after this date.

According to the Environment Agency website, the Ty Garreg landfill is confirmed as an 'Active' but 'closed' landfill.

3. Waste Characterisation

3.1 Type of Waste

In accordance with the Waste Management Licence granted in 1990, only inert waste was to be accepted consisting of soil, subsoil and hardcore. The following types of wastes were excluded by this licence:

- "Special waste" (as defined by the Control of Pollution (Special Waste) Regulations 1980 and any subsequent amendments);
- Radioactive substances (listed in the Control of Radioactive Substances Act 1960 and subsequent amendments),percussions or explosives;
- Flammable liquids (listed in the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972); or
- Any dangerous substances (listed by the EC Directive on Pollution Caused by Certain Dangerous Substances Discharged to the Aquatic Environment (76/464/EC) and listed in Annex A of the Ministerial Declaration on the Second International Conference on the Protection of the North Sea 1987).

3.2 Site Investigations

Site investigations were carried out by Halcrow in 2006 in order to characterise the waste at Ty Garreg landfill prior to any earthworks associated with the bypass development.

Borehole and trial pit logs from these investigations describe the waste as construction waste comprising, firm black to grey-brown gravelly CLAY with bricks, paving slabs, kerbing slabs, sheet metal, lead flashings and pipe, plastics, timber and reinforced concrete. Reinforced concrete kerbstones and slabs of brickwork were the main cause of obstruction within the boreholes. Some boreholes were noted to contain pulverised fly ash (PFA). These Logs are presented in the Halcrow Geo-Environmental Report. March 2006. (Ref 4).

The waste has been characterised as predominantly non-degradable with generally low levels of contamination. Contamination was reported to consist of ammoniacal nitrogen and slightly elevated concentrations of heavy metals. Under current classification, Landfill Regulations (England & Wales 2002), the waste is considered as non-hazardous.

3.3 Quantities of Waste

Licence No 2/90/17 schedule B types of waste to be accepted with maximum accepted quantities per day : Soil 200 tonnes, Subsoil 200 tonnes, Hardcore 500 tonnes, total maximum per day 500 tonnes.

It is estimated that 52,000m3 was moved during the creation of the road cutting for the construction of Ystrad Barwig Isaf embankment.

3.4 Waste Acceptance Procedures

There are no records of the waste acceptance procedures during the operational lifetime of the landfill.

3.5 Inspection Records

Inspection records held by Natural Resources Wales (NRW) have been reviewed for the production of this report. Records of non compliant activities are listed below.

3.6 Non-compliance

Table 3.1: Summary of Non compliant Site Inspection Reports

Site Inspection Reference	Non Compliant Activities
0322166: 19/11/2004	Waste accepted after closure. Waste Included large quantities of rubble and metal
0322167: 2/12/2004	Waste accepted after closure. 4 No. trucks delivering waste at the time of inspection.
0322168: 16/12/2004	Waste accepted after closure. No waste accepted at time of visit but evidence of recent activity was noted. Waste was reported as not always 'clean' and excessive quantities
0322173: 16/6/2005	Load carrying inappropriate material was refused disposal by environmental officer during site visit

Historic aerial photographs from 1991 show advance disposal activities at the Ty Garreg site and indicate that vegetation was not cleared before tipping. It is known that filling activities occurred in the area as early as 1967

4. Leachate and Ground Gasses

4.1 Leaching Potential

The leaching potential of the site is anticipated to be low, based on the nature of the waste deposited and the construction of the capping layer covering a large area of the site. Previous reports also suggest a low leaching potential at the site.

In 2006, the surface waters around Ty Garreg were sampled and analysed by Halcrow (Ref. 4) to determine if leachate generated in the landfill was migrating offsite and contaminating nearby surface waters. It was anticipated that this would be the case when what appeared to be leachate breakouts were observed entering streams on the eastern site boundary.

However test results revealed that no contamination of the surface water courses around the site had occurred with the exception of one location where elevated levels of ammoniacal nitrogen were detected. This was downstream of land with grazing livestock, which was suggested to be the likely source.

Sampling of the water in the drainage ditch on the eastern site boundary has since been carried out. The results of laboratory analysis of these samples are discussed in the following section.

4.2 Gassing Potential

Based on the nature of the waste material it is anticipated that the landfill site has a low gassing potential. In 2008 Arup reported that off-site gas migration could be considered insignificant due to low gas generation rates, the raised nature of the landfill and the nature of the underlying ground (Ref. 3).

Gas monitoring at the site was set up in 2004 and reported by Halcrow in a report titled: "Rhiwsaeson Lane Landfill - initial assessment of gas monitoring - November 2004" (Ref. 5). This report revealed significant quantities of methane and carbon dioxide (between 50 and 90%) were present in the eastern side of the landfill. In 2005, following an intrusive site investigation at the site, Halcrow reported high concentrations of methane and carbon dioxide and reduced concentrations of oxygen at half of sampling locations on site. However, it was also reported that the maximum flow rates were lower than previous monitoring rounds (max of 9.1l/hr in 2005 from >20l/hr in 2004). It was suggested in 2005 that the elevated levels of methane and carbon dioxide were produced by the decomposition of organic materials within the waste. The report concluded that the evidence suggested that the concentration and flow rate of the methane and carbon dioxide was diminishing overtime.

5. Landform

The modified landfill License/ Permit stipulated details for sub-soiling, top-soiling, landscaping and final landform gradients. The landfill was to be capped to a minimum depth of 0.5m and have slopes with gradients between a maximum of 1 in 2.5 and minimum of 1 in 25.

A walkover survey of the site was undertaken by Capita Symonds on the 28th of February 2012 during a period of dry weather. The purpose was to visually assess the condition of the cut slopes, plateau and embankment areas with regard to overall stability.

During the walkover survey it was noted that mature trees line the site perimeter the along the north, east and south boundaries. Trees growing around the site perimeter show no evidence of disturbance. Timber fencing around the perimeter appeared in good condition and showed no evidence of ground movement. The tarmac surfaced cycleway present along the northern boundary appeared in good condition.

Within the highway boundary south of the bypass (denoted by 4 rail and post timber fencing) top soil capping layer appeared to be present. Grass and other minor vegetation have become established other the entirety of the site with other vegetation including brambles and small trees mainly along slope areas. Tree planting has been implemented with saplings in protective plastic tubes evident across localised areas. Tree planting will further aid embankment stability.

Fencing across the top of the embankment section south of the bypass was in good condition. Stock proof fencing around the site north of the bypass also appears in good order and un affected by ground movements.

Following the site walkover survey the slopes inspected comply generally with the recommended slope gradients of 1V : 2.5H and appear stable and well vegetated. No evidence of instability was found during the walkover. However, areas beyond the highway boundary south of the bypass could not be visually inspected due to the large extent of vegetation (brambles, gorse, trees etc). Fence lines and mature trees around the site perimeter appeared in good order with no instability issues evident.

There was no visible evidence of the formation of slips; scour drainage runs or settlement occurring across the site. In general, slopes appear in good order and stable with gradients of approximately 1V:2.5H.

A topographic map of the Site is presented on Figure 3.

6. Monitoring

6.1 Groundwater Monitoring

6.1.1 Locations

The site has been subjected to intensive investigation for the bypass development.The majority of groundwater monitoring installations were installed by Halcrow and Soil Mechanics during a fifth stage of investigation in 2005.

During the construction of the bypass, a number of boreholes were lost or damaged during the earthworks; subsequently the most recent data has been limited to four locations. Between 2010 and 2012, following completion of the Church Village bypass, the groundwater was monitored by Capita Symonds from these four remaining locations. Table 6.1 identifies the boreholes monitored up to June 2012 and those lost during the bypass development.

Table 6.1: Groundwater Monitoring Boreholes

Boreholes Monitored up to July 2012	BH5/5, BH5/11, BH5/12, BHA(1225)
Boreholes Not monitored	BH5/6, BH5/7, BH1a/17, BH1a/15
Boreholes Lost (construction / abandoned)	BH5/10, BH1a/22A, BH5/14, BH5/4, BH1225, BH5/1, BH2/X03, BH5/2

In order to determine the influence of the landfill on the groundwater the data The boreholes used to collect groundwater information have been grouped as those up gradient of the landfill and those within the land fill material. The location of the boreholes is provided on Figure 4.and summarised in the Table 6.2.

Table 6.2: Location of Groundwater Monitoring Boreholes

Boreholes installed up gradient of the site	Boreholes installed within the site
BH5/1*	BH5/14
BH5/5	BH5/10
BH5/6	BH5/12
	BH1225
	BH5/11

With the exception of BH5/1, the response zones of the monitoring wells were installed within superficial deposits of the Ty Garreg landfill or in the neighbouring historical landfill to the south west.

Borehole BH5/1 was installed outside the extent of the landfill material with a response zone in the bedrock aquifer.

6.1.2 Methodology

Groundwater samples have been tested for a range of determinands to assess groundwater quality. Samples were collected between July 2008 and July 2012.

During each monitoring visit, samples were collected using a TROLL 9500 low flow sampling system. The TROLL 9500 is a multi-parameter water quality monitoring instrument that provides 'read out' analysis of water quality parameters during sampling.

The low flow sampling technique was used to collect representative samples of the groundwater without the need to purge and dispose of significant quantities of waste water. When groundwater sampling was carried out field parameters: pH, ORP, RDO, conductivity and temperature were continually monitored until the parameter values stabilised before a sample was taken.

Concentrations of the following determinands have been screened using Environmental Quality Standard (EQS) values for groundwater in line with the Water Framework Directive 2010.

- Metals: Arsenic, Boron, Cadmium, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Manganese, Iron, Calcium, Magnesium, Sodium, Potassium, Aluminium, Vanadium, Molybdenum
- Inorganic Cyanide
- Total Sulphur as SO4
- Sulphide (Free) as S
- Ammoniacal Nitrogen as N
- Chloride as Cl
- Cresols
- Semi Volatile Organic Compounds: Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[ghi]perylene, Benzo[a]pyrene, Indeno[123-cd]pyrene, Naphthalene & Phenol

6.1.3 Results

The following contaminants were detected at concentrations that exceed EQS values: Selenium, Manganese, Iron, Sodium, Aluminium and Chloride.

Manganese and Iron exceedances were detected in samples collected up gradient of the site; as well as in samples collected from within the site boundary. Concentrations of these contaminants were regularly detected above EQS values.

Two isolated exceedances of selenium were recorded in BH5/14. These were marginal exceedances recorded in 2008 and 2009.

Two isolated exceedances of aluminium were detected in BH5/10 in 2008 and 2009.

Elevated concentration of Sodium and Chloride were detected exclusively and relatively consistently in BH5/12.

Exceedances of EQS values are summarised in Table 6.3.

Table 6.3: Exceedances of EQS Values

Determinand	EQS	Max recorded Concentration	Monitoring Location	Dates
Selenium	10	11	BH5/14 (within landfill)	23/07/2008 24/09/2009
Manganese	400	11000	BH5/1* (up gradient) BH5/5 (up gradient) BH5/6 (up gradient) BH5/14 (within landfill) BH5/10 (within landfill) BH5/12 (within landfill) BH1225 (within landfill) BH5/11 (within landfill)	Frequent exceedances between: 09/2009 & 07/2012
Iron	1000	16500	BH5/5 (up gradient) BH5/14 (within landfill) BH5/10 (within landfill) BH5/12 (within landfill) BH1225 (within landfill) BH5/11 (within landfill)	Frequent exceedances between: 09/2009 & 07/2012
Sodium	133000	225000	BH5/12 (within landfill)	24/07/2008 03/06/2009 24/09/2009 04/12/2009
Chloride	187500	341000	BH5/12 (within landfill)	24/07/2008 03/06/2009 24/09/2009 04/12/2009
Aluminium	150	180	BH5/10 (within landfill)	23/07/2008 12/02/2009

** screened section within bedrock aquifer*

6.1.4 *Interpretation*

High concentrations of Iron and Manganese up gradient of the site suggest that the shallow groundwater in the superficial deposits is affected by Acid Mine Drainage contamination. High concentration of these AMD contaminants are detected in boreholes up gradient of the landfill as well as those boreholes located within the landfill. This suggests that these high concentrations are caused by the waste material deposited in the neighbouring historic landfill to the south and west. Lower concentrations of these contaminants inside the lands fill compared to those outside show that site is not adding to this contamination.

There are EQS exceedances of selenium, aluminium, sodium and chloride concentrations from within the site. These exceedances are marginal and restricted to individual boreholes suggesting the contaminants are not mobile and do not represent a significant risk to the surrounding environmental receptors. It is likely that the variability of the groundwater chemistry is a result of the heterogeneous nature of the waste material within the site.

6.2 Surface Water Monitoring

Analysis has been carried out on the laboratory testing results from two separate surface water sampling regimes. Surface water sampling was carried out by carried out around the site by Costain in 2008. These locations are shown on marked as CV 1 and CV1A on the Monitoring Location Plan.

A second surface water sampling regime was established by Capita in 2012. This focused on the engineered drainage network immediately east of the site and captures the area that was reported to be affected by leachate breakouts in 2006. Sampling points from this sampling regime have been carried out to provide a 'profile' of the surface water chemistry along the length of the engineered drainage system to the east of the site.

6.2.1 Locations

SW7 is located in the drainage channel between the site and the neighbouring landfill, Rhiwsaeson to the immediate south. This drainage channel collects surface water runoff from steep slope in the southern half of the site and the surface water from the fields to the south that slope towards the north. The groundwater within the superficial deposits in this area flows towards the north east. This drainage ditch is likely to be significantly influenced by the groundwater flowing through the Rhiwsaeson landfill.

SW1 is located on the eastern boundary of the site, downstream of SW 7. Immediately after this SW1 a second channel feeds into the main drainage channel with surface water runoff from the site.

The drainage channel flows north, along the site boundary, passing under the main road; SW2 is located on the northern side of the main road. The drainage channel then flows towards the east and the discharge is mixed with surface water runoff from the bypass.

SW6 is located following this mixing and represents the quality of the surface water that will eventually feed to the Nant Myddlyn to the east of the site.

The surface water runoff from the carriageway was sampled at SW5 prior to mixing with the discharge from the previously mentioned drainage channel.

The Costain sampling locations CV1 and CV1A are located on the southern and northern boundaries of the site. These have been analysed to determine / provide a comparison of the surface water chemistry from the northern side of the site with that from the southern side, in line with the flow of the regional groundwater in the superficial deposits.

6.2.2 Methodology

Sampling undertaken by Capita in 2012 was carried out using a TROLL 9500 low flow sampling system. Field parameters including pH, ORP, RDO, conductivity and temperature were monitored until they had stabilized before samples were taken. Samples were collected and sent within 24 hours via a courier to the UKAS accredited Servern Trent Laboratory for analysis.

Samples were scheduled for the following determinands to assess the general water quality:

- Calcium , Total as Ca
- Iron , Total as Fe
- Magnesium, Total as Mg
- Manganese , Total as Mn
- Potassium , Total as K
- Sodium , Total as Na
- pH
- Conductivity- Electrical 20C
- Alkalinity as CaCO3
- Ammoniacal Nitrogen as N
- Chloride as Cl
- Nitrogen, Total as N
- Sulphate as SO4
- Suspended Solids
- Dissolved Oxygen
- BOD + ATU (5 day)
- COD (Total)
- TOC (Filtered)

Results from the analysis of the surface water samples have been screened against EQS values for a surface water receptor based on values published in the Water Framework Directive 2010.

The results from the two sampling regimes are discussed below. The data from these sampling locations are presented in the appendix.

6.2.3 Results

Contaminants indicative of AMD conditions, Iron and Manganese have been found at concentrations exceeding EQS. High concentrations of these contaminants were found at sampling locations SW7 and SW1.

Samples collected downstream of SW7 & SW1 were found to have lower concentrations of the metals with only occasional and marginal exceedances of EQS values.

Samples collected from SW5, within the treatment pond for the carriageway water runoff were found to be uncontaminated when compared with EQS.

Ammoniacal nitrogen was also detected at concentrations exceeding EQS values. The occurrence of the exceedances of this contamination is similar to that of iron and manganese.

Frequent exceedances were detected in SW7 and SW1. A single exceedances was noted at SW2. There were no exceedances of Ammonical nitrogen in SW5 and SW6 has revealed occasional exceedances.

6.2.4 *Interpretation*

The high concentrations of iron and manganese are likely to be due to the groundwater influence of the drainage ditch following the southern site boundary. This groundwater flows from the south west to the north east indicating the source of the contamination is south of the site. The concentrations of iron and manganese are lower further downstream in the drainage ditch. This is possibly due to precipitation of metals out of the water within the drainage channel or a dilution of the water with the addition of surface water along the length of the channel.

Frequent exceedances of the EQS for ammoniacal nitrogen are likely to be caused by the grazing of livestock on the surrounding land. The fields to the south of the site, the historic Rhiwsaeson landfill are frequently occupied by cattle. Surface water draining into the drainage ditch from this field is likely to contain high concentrations of ammoniacal nitrogen.

6.3 Ground Gas

6.3.1 *Locations*

Ground gas monitoring was carried out after completion of the bypass in 2009 and 2010 due to access restraints during construction. Ground gas monitoring was continued following the completion of the road until July 2012 at the request of the Environment Agency.

The nearest sensitive receptor to the site has been identified as an individual residential property approximately 25m from the northwest boundary. There are no details on this property relating to the possibility of a basement or ground gas protection. The next nearest sensitive receptor concerning ground gas is a residential estate approximately 200m north of the site.

No offsite monitoring wells have ever been installed for the Ty Garreg Site. Boreholes BH5/10, BH1326, BH1226 and BH1225 are the nearest onsite gas monitoring locations to the residential receptor, BH1225 being the closest (see Monitoring Location Plan Figure 4).

Due to the construction of the Church Village Bypass, boreholes BH1326, BH1226 and BH5/10 were lost overtime, and the most recent data from the highlighted boreholes is only available from BH1225.

Boreholes from other areas of the landfill, BH5/5a, BH5/11 and BH5/12 have been monitored up to July 2012. The results of these monitoring points have been plotted with those from BH1225 to show the ground gas conditions across the site (Appendix A).

6.3.2 *Methodology*

The monitoring for CH_4, CO_2 and O_2 was carried out at locations presented on the monitoring location plan (figure 4). Gas concentrations were obtained using a Gas Analyser 2000 instrument. Barometric pressure was also recorded.

6.3.3 *Results*

Assessment of the data from BH1225 indicates that the overall trend in concentration of both methane and carbon dioxide show a general reduction over time. This trend is also apparent in the data collected from other boreholes around the site.

With the exception of one reading in 2005, carbon dioxide concentrations have permanently been below 5%. Although peaks in methane concentration have been relatively high in the past, the data shows a continuing decline in the methane concentration overtime. Since 2009, methane concentrations have been recorded to be below 1.5%.

6.3.4 *Interpretation*

A review of the gas monitoring data indicates that across the site the production of methane and carbon dioxide has diminished overtime to near atmospheric concentrations. The earthworks, as part of the Church Village Bypass scheme, may have assisted in speeding up the dispersion of the ground gas.

7. Conclusions

Based on the nature of the waste deposited and the construction of the capping layer covering a large area of the site the leaching potential of the materials within the landfill is considered low.

The waste has been characterised as predominantly non-degradable with generally low levels of contamination. Contamination was reported to consist of ammoniacal nitrogen and slightly elevated concentrations of heavy metals.

Latest laboratory testing on groundwater samples has revealed that the following contaminants were detected at concentrations that exceed EQS values: Selenium, Manganese, Iron, Sodium, Aluminium and Chloride.

Analysis on these results has shown that exceedances of Iron and Manganese EQS were detected up gradient of the site. This shows that this contamination is not due to the materials within the Site. It has been suggested that these exceedances are caused by colliery spoil waste deposited in the neighbouring landfill directly south of the Site.

Isolated exceedances of EQS for aluminium, selenium sodium and chloride concentrations have been limited to selected boreholes. The data shows that this contaminants are relatively immobile within the waste, and are considered to be 'hotspots' within the heterogeneous waste material.

Recent surface water analysis have revealed concentrations of ammoniacal nitrogen, iron and manganese exceeding EQS standards for a surface water receptor. The high concentrations of iron and manganese are likely to be due to the groundwater influence of the drainage ditch following the southern site boundary. High concentrations of ammoniacal nitrogen are likely to be caused by the grazing of livestock on the surrounding land.

The groundwater and surface water analysis carried out as part of this report support the conclusion that the landfill has a low leaching potential.

The gassing potential of the materials within the site is considered to be low. A review of the gas monitoring data indicates that initially ground gas concentrations were irregular but have settled, and have been steady since 2011. The production of methane and carbon dioxide has diminished overtime to near atmospheric concentrations. The earthworks, as part of the Church Village Bypass scheme, may have assisted in speeding up the dispersion of the ground gas.

8. References

1. (Ref. 1) 1:50,000 scale British Geological Survey (BGS) map (sheet 248)

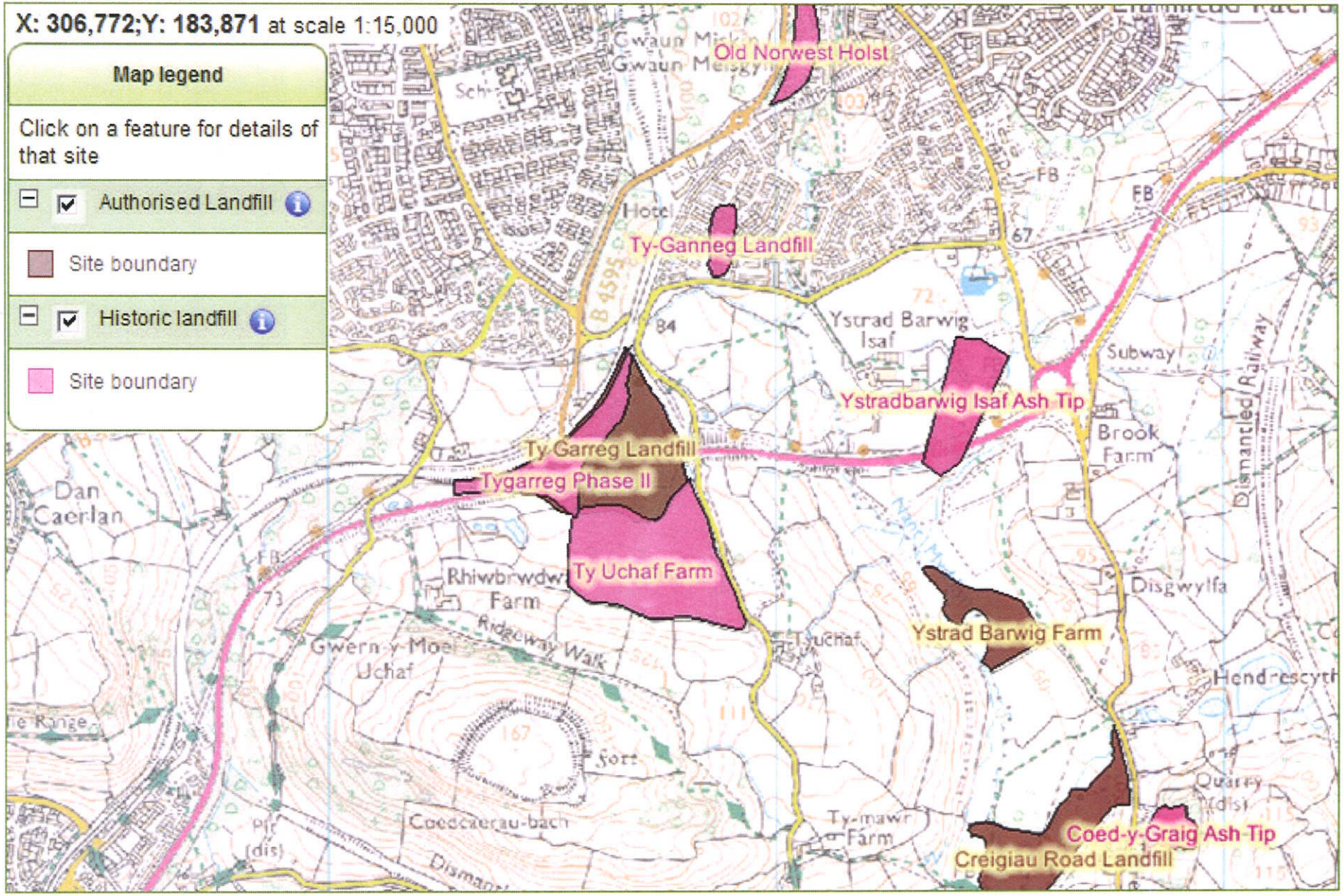
2. (Ref .2) 1:10,560 scale British Geological Survey (BGS) map sheet (ST08SE)

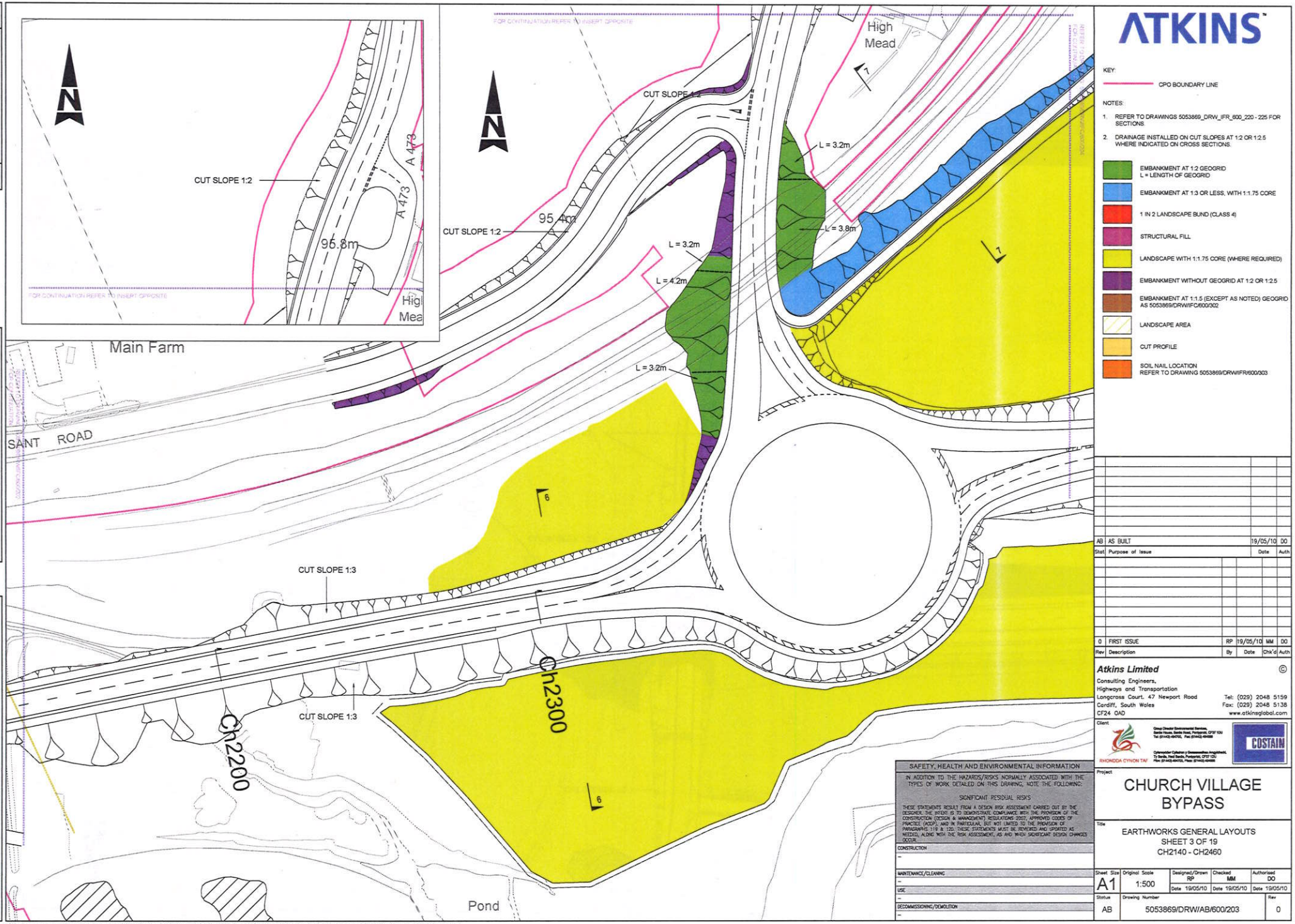
3. (Ref. 3) Arup. Church Village Bypass. Risk Assessment. January 2008

4. (Ref. 4). Halcrow Group Limited. Church Village Bypass. Phase 5 Ground Investigation (Ty Garreg Landfill). Geo-Environmental Report. March 2006.

5. (Ref 5) Halcrow Group Limited. Rhiwsaeson Lane Landfill - initial assessment of gas monitoring. November 2004

Figures




CUT SLOPE 1:2
A 473
95.8m
FOR CONTINUATION REFER TO INSERT OPPOSITE
High Mead
CUT SLOPE 1:2
95.4m
L = 3.2m
L = 3.8m
L = 4.2m
L = 3.2m
L = 3.2m
Main Farm
SAINT ROAD
CUT SLOPE 1:3
CUT SLOPE 1:3
Ch2200
Ch2300
Pond
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:
SIGNIFICANT RESIDUAL RISKS
THESE STATEMENTS RESULT FROM A DESIGN RISK ASSESSMENT CARRIED OUT BY THE DESIGNER. THE INTENT IS TO DEMONSTRATE COMPLIANCE WITH THE PROVISION OF THE CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS 2007, APPROVED CODES OF PRACTICE (ACOP), AND IN PARTICULAR, BUT NOT LIMITED TO THE PROVISION OF PARAGRAPHS 119 & 120. THESE STATEMENTS MUST BE REVIEWED AND UPDATED AS NEEDED, ALONG WITH THE RISK ASSESSMENT, AS AND WHEN SIGNIFICANT DESIGN CHANGES OCCUR.
CONSTRUCTION
MAINTENANCE/CLEANING
USE
DECOMMISSIONING/DEMOLITION
ATKINS
KEY:
CPO BOUNDARY LINE
NOTES:
1. REFER TO DRAWINGS 5053869_DRW_IFR_600_220 - 225 FOR SECTIONS
2. DRAINAGE INSTALLED ON CUT SLOPES AT 1:2 OR 1:2.5 WHERE INDICATED ON CROSS SECTIONS.
EMBANKMENT AT 1:2 GEOGRID L = LENGTH OF GEOGRID
EMBANKMENT AT 1:3 OR LESS, WITH 1:1.75 CORE
1 IN 2 LANDSCAPE BUND (CLASS 4)
STRUCTURAL FILL
LANDSCAPE WITH 1:1.75 CORE (WHERE REQUIRED)
EMBANKMENT WITHOUT GEOGRID AT 1:2 OR 1:2.5
EMBANKMENT AT 1:1.5 (EXCEPT AS NOTED) GEOGRID AS 5053869/DRW/IFC/600/302
LANDSCAPE AREA
CUT PROFILE
SOIL NAIL LOCATION REFER TO DRAWING 5053869/DRW/IFR/600/303
AB AS BUILT 19/05/10 DO
Stat Purpose of Issue Date Auth
0 FIRST ISSUE RP 19/05/10 MM DO
Rev Description By Date Chk'd Auth
Atkins Limited ©
Consulting Engineers,
Highways and Transportation
Langcross Court, 47 Newport Road
Cardiff, South Wales
CF24 0AD
Tel: (029) 2048 5159
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www.atkinsglobal.com
Client
RHONDDA CYNON TAF
COSTAIN
Project
CHURCH VILLAGE BYPASS
Title
EARTHWORKS GENERAL LAYOUTS
SHEET 3 OF 19
CH2140 - CH2460
Sheet Size A1
Original Scale 1:500
Designed/Drawn RP Date 19/05/10
Checked MM Date 19/05/10
Authorised DO Date 19/05/10
Status AB
Drawing Number 5053869/DRW/AB/600/203
Rev 0
Rev 0
Status AB
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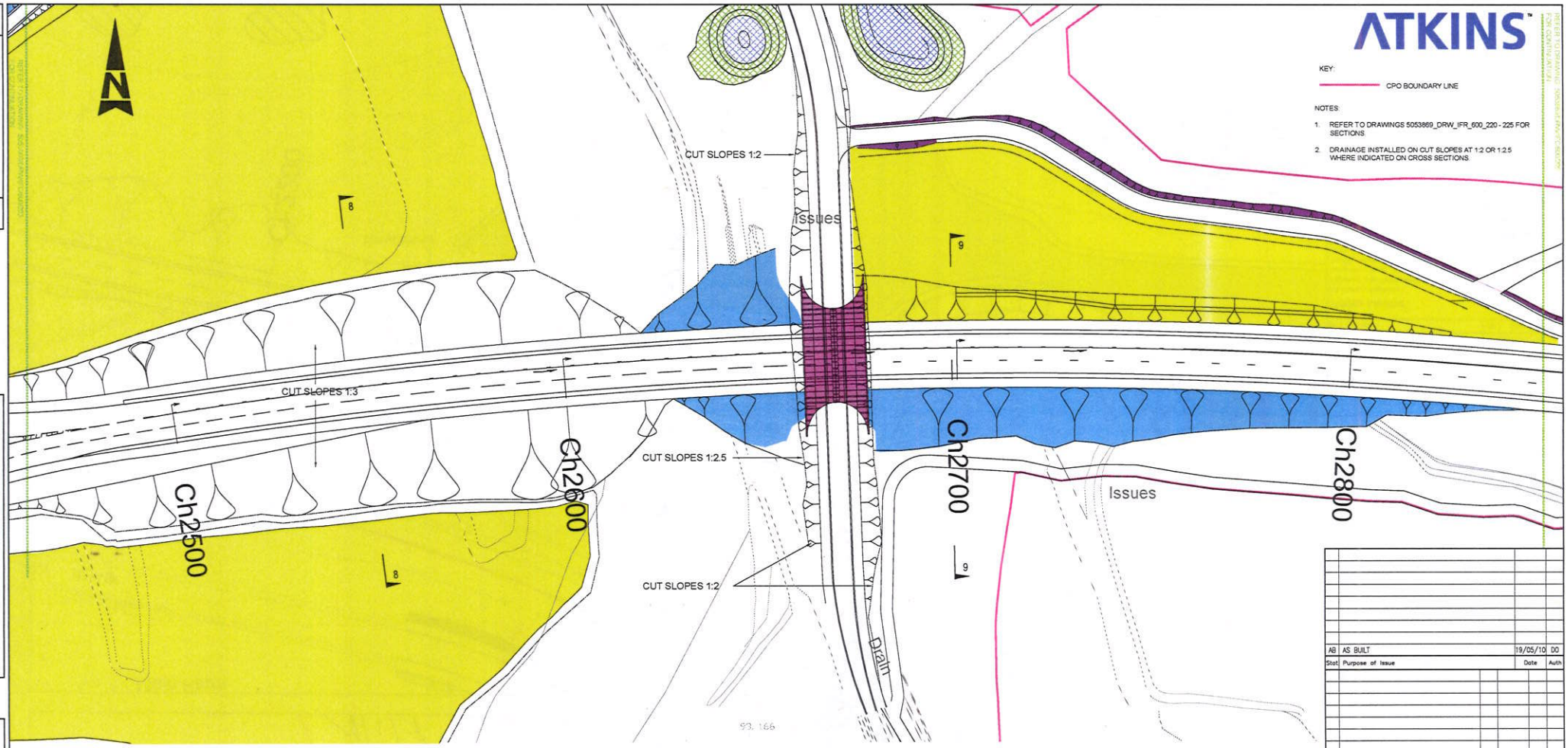

KEY:

CPO BOUNDARY LINE

NOTES:

1. REFER TO DRAWINGS 5053869_DRW_IFR_600_220 - 225 FOR SECTIONS.
2. DRAINAGE INSTALLED ON CUT SLOPES AT 1:2 OR 1:2.5 WHERE INDICATED ON CROSS SECTIONS.

EMBANKMENT AT 1:2 GEOGRID
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1 IN 2 LANDSCAPE BUND (CLASS 4)

STRUCTURAL FILL

LANDSCAPE WITH 1:1.75 CORE (WHERE REQUIRED)

EMBANKMENT WITHOUT GEOGRID AT 1:2 OR 1:2.5

EMBANKMENT AT 1:1.5 (EXCEPT AS NOTED) GEOGRID
AS 5053869/DRW/IFC/600/302

LANDSCAPE AREA

CUT PROFILE

SOIL NAIL LOCATION
REFER TO DRAWING 5053869/DRW/IFR/600/303

Rev	Description	By	Date	Chk'd	Auth
AB	AS BUILT		19/05/10		DO
0	FIRST ISSUE	RP	19/05/10	MM	DO

Stat	Purpose of Issue	Date	Auth
AB	AS BUILT	19/05/10	DO

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

SIGNIFICANT RESIDUAL RISKS

THESE STATEMENTS RESULT FROM A DESIGN RISK ASSESSMENT CARRIED OUT BY THE DESIGNER. THE INTENT IS TO DEMONSTRATE COMPLIANCE WITH THE PROVISION OF THE CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS 2007, APPROVED CODES OF PRACTICE (ACOP), AND IN PARTICULAR, BUT NOT LIMITED TO THE PROVISION OF PARAGRAPHS 119 & 120. THESE STATEMENTS MUST BE REVIEWED AND UPDATED AS NEEDED, ALONG WITH THE RISK ASSESSMENT, AS AND WHEN SIGNIFICANT DESIGN CHANGES OCCUR.

CONSTRUCTION
–

MAINTENANCE/CLEANING
–

USE
–

DECOMMISSIONING/DEMOLITION
–

Atkins Limited

Consulting Engineers,
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Langcross Court, 47 Newport Road
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CF24 0AD

Tel: (029) 2048 5159
Fax: (029) 2048 5138
www.atkinsglobal.com

Client: RHONDDA CYNON TAF / COSTAIN

Project: CHURCH VILLAGE BYPASS

Title: EARTHWORKS GENERAL LAYOUTS
SHEET 4 OF 19
CH2470 - CH2850

Sheet Size	Original Scale	Designed/Drawn	Checked	Authorised
A1	1:500	RP Date 19/05/10	MM Date 19/05/10	DO Date 19/05/10

Status: AB

Drawing Number: 5053869/DRW/AB/600/204

Rev: 0

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Date: May 19, 2010 - 4:35pm Plotted by: rhyphi

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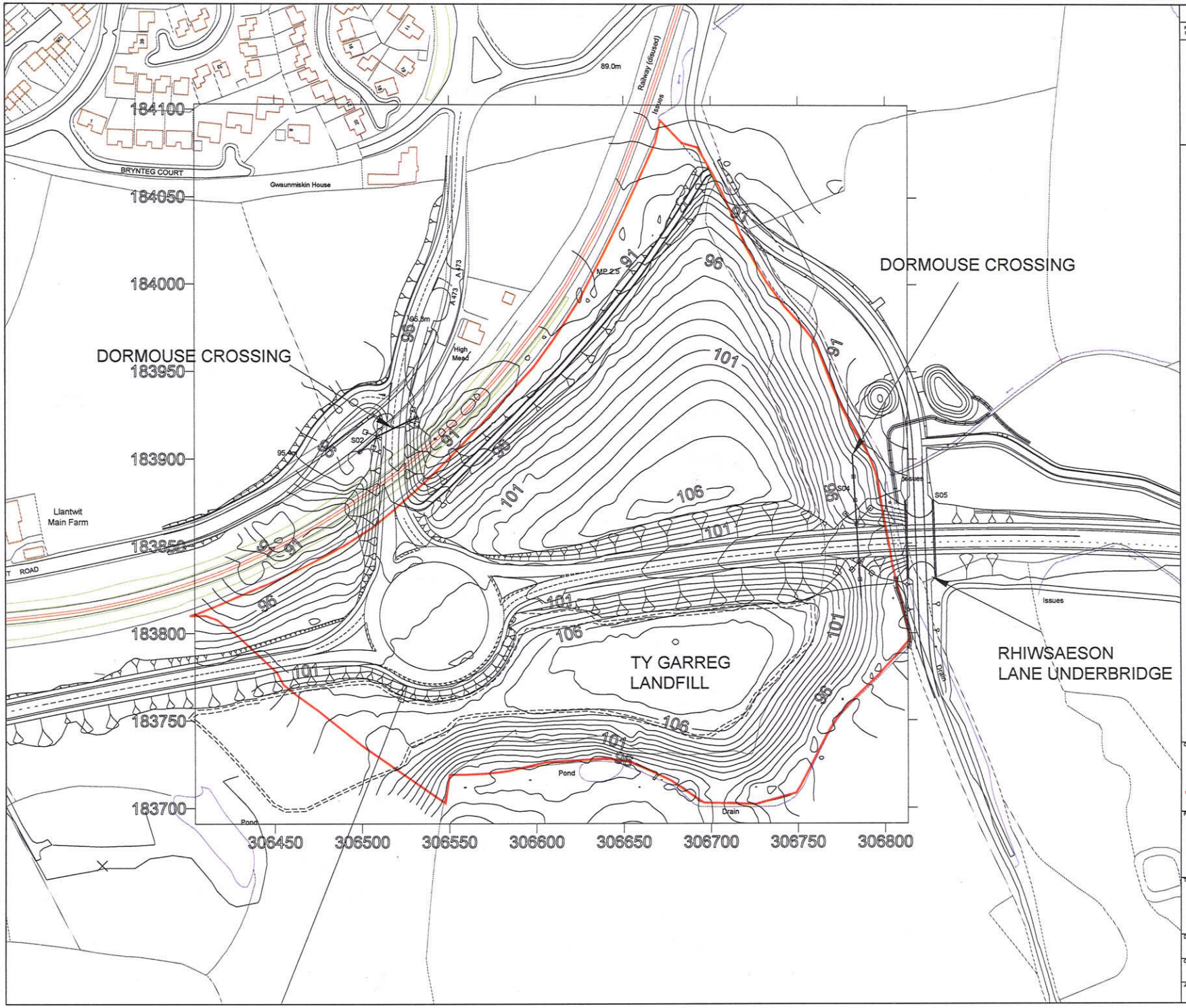


AMENDMENTS

Rev. Ref.	DETAILS	Date	Made By	Chk'd By

Key

Licence Boundary

DO NOT SCALE FROM THIS DRAWING

Client : RHONDDA CYNON TAF

Consultant :

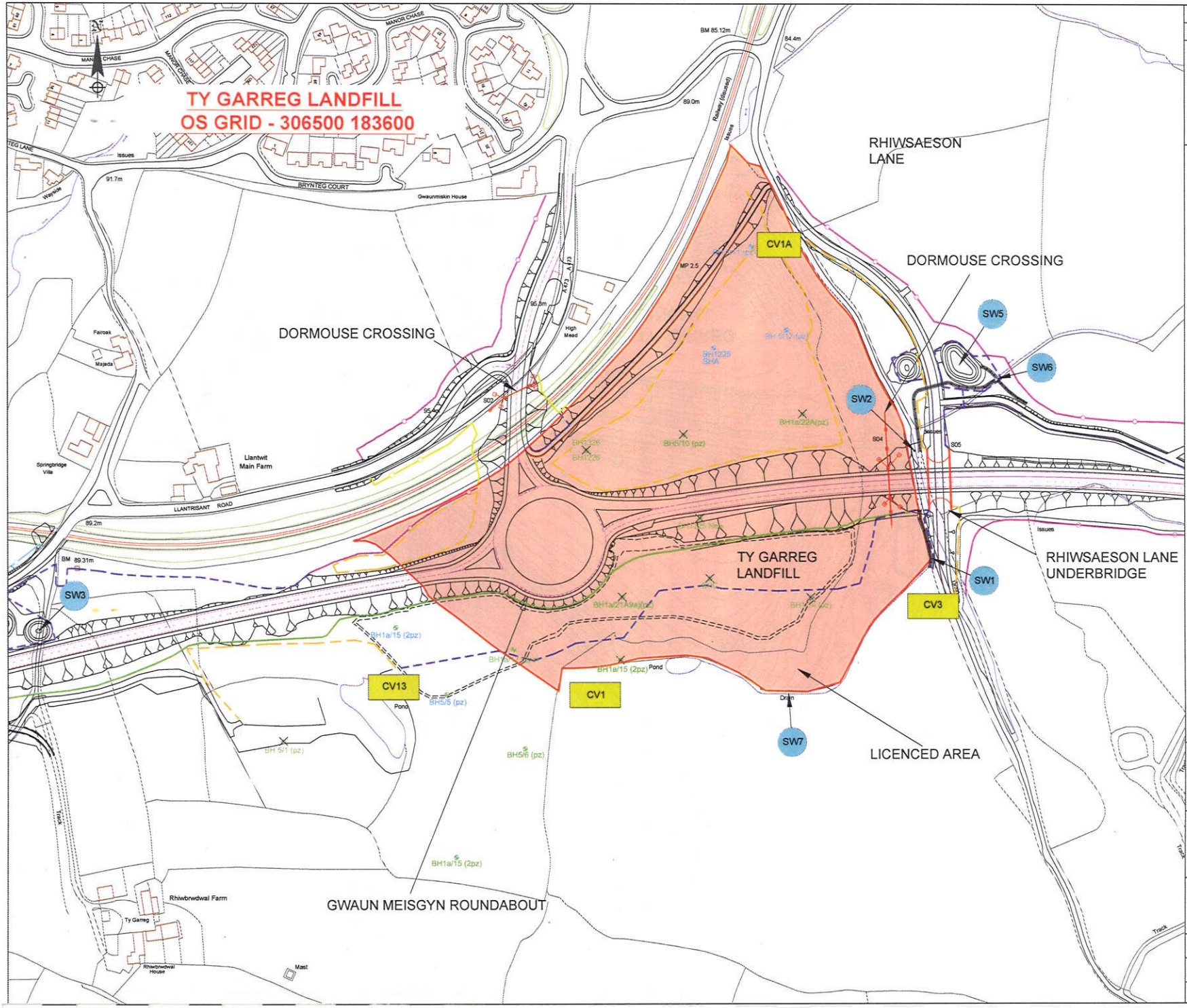
CAPITA SYMONDS
UNIT G1, THE WILLOWFORD,
TREFOREST INDUSTRIAL ESTATE,
PONTYPRIDD, CF37 5BF
Tel/Fon: (01443) 822200,
Fax/Flacs: (01443) 822201

BUILDING FOR A BETTER WORLD, INVESTOR IN PEOPLE

Project : Church Village Bypass

Title : Ty Garreg Landfill
Final Landform

Drawn	SID	Approved	WP
Checked	MS	Date	Apr '22
Scale	1:1000 (Original drawing: A1)		
Job No.	GC/000041	Drg No.	FL01
Rev.			



AMENDMENTS

Rev. Ref.	DETAILS	Date	Made By	Chkd By

Key

- Boreholes currently monitored
- Boreholes not currently monitored
- Abandoned Boreholes
- Licence Boundary
- Close Boarded Fence HCD Detail H14
- Newt Fence
- Post and 4 Rail Fence
- Stock Proof Post and 4 Rail Fence
- Stock Proof Post and Wire Fence
- Stock Proof Post and 4 Rail Fence with Barbed Wire
- SW1 — Surface Water Sampling Location
- CV1 — Previous Surface Water Sampling Location

Notes

SW2 is in reference to sampling chamber.

SW7 access permitting

Client: RHONDDA CYNON TAF

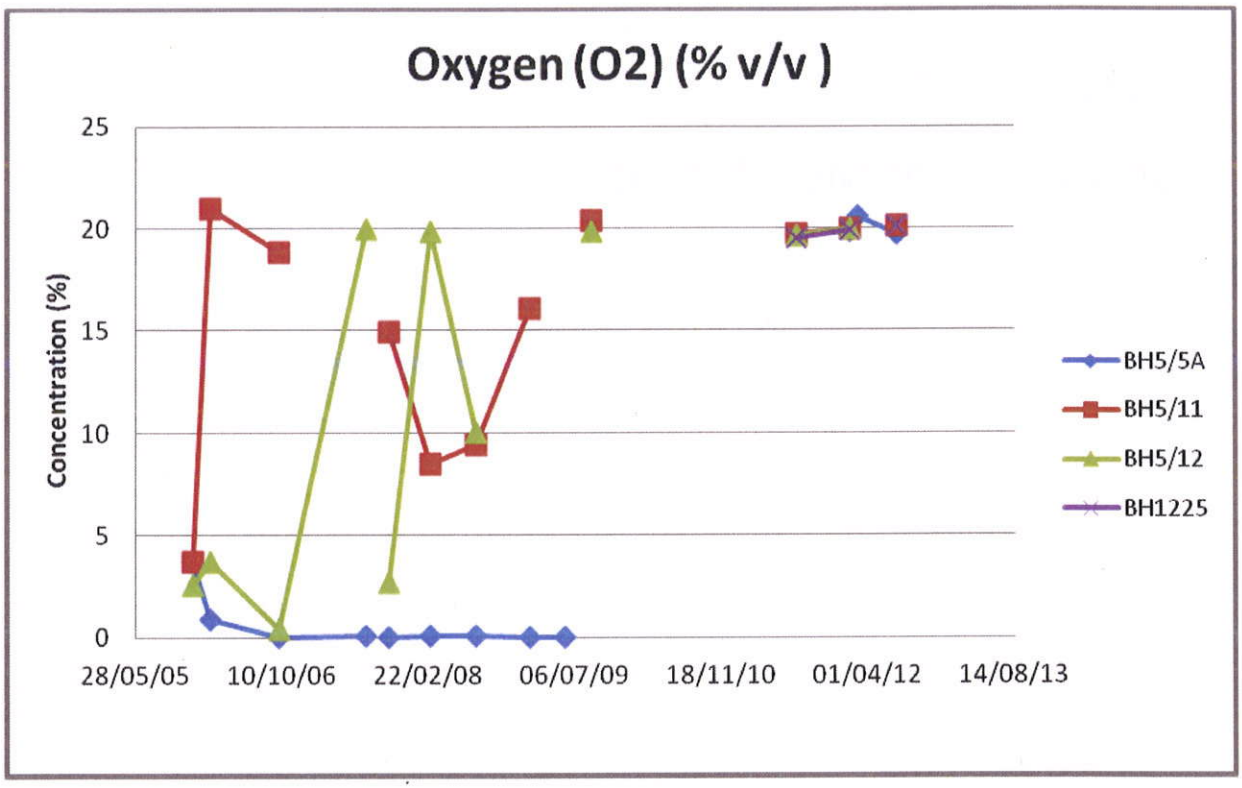
Consultant:
CAPITA SYMONDS
UNIT G1, THE WILLOWFORD,
TREFOREST INDUSTRIAL ESTATE,
PONTYPRIDD, CF37 5BF
Tel/Ffon: (01443) 823200,
Fax/Ffacs: (01443) 823201

Project: Church Village Bypass

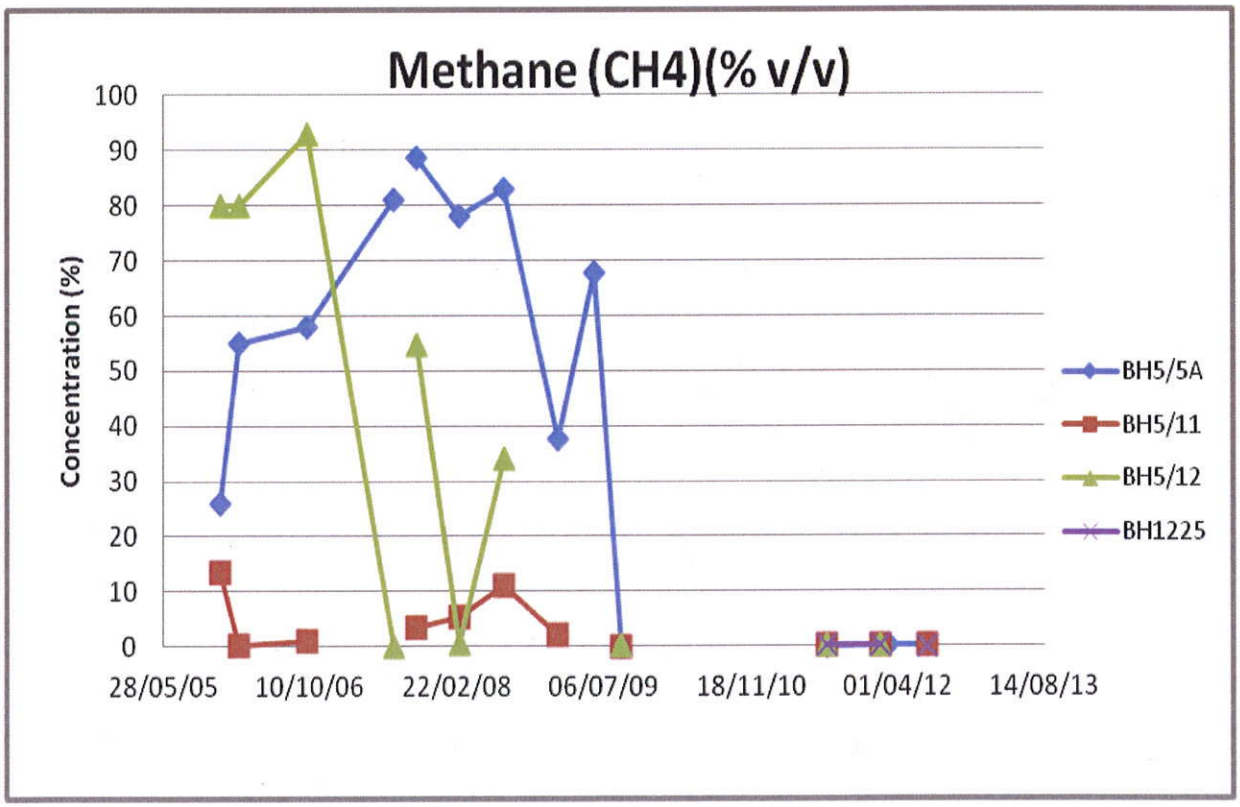
Title: Ty Garreg Landfill
Current Monitoring Locations

Drawn	SID	Approved	WP
Checked	MS	Date	Feb'12
Scale	1:1250		
Job No.	GC/000041	Drg No.	SW01
Rev.			

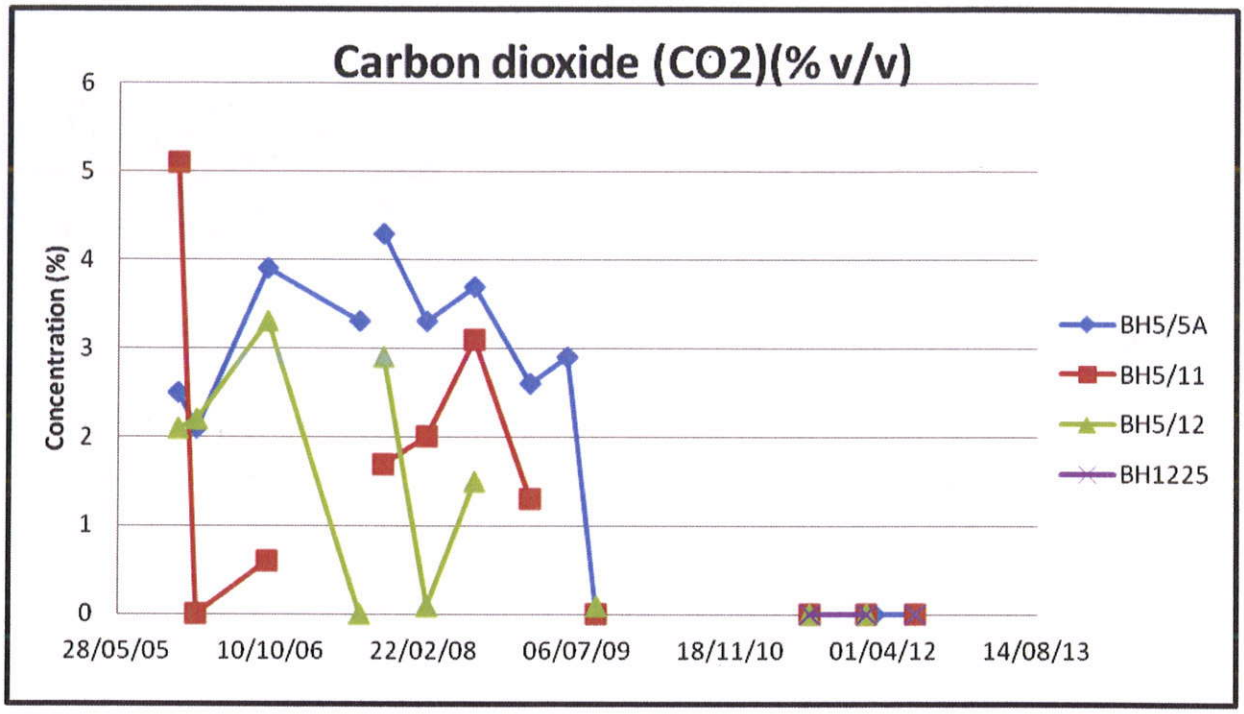
Appendix A
Ground Gas Monitoring



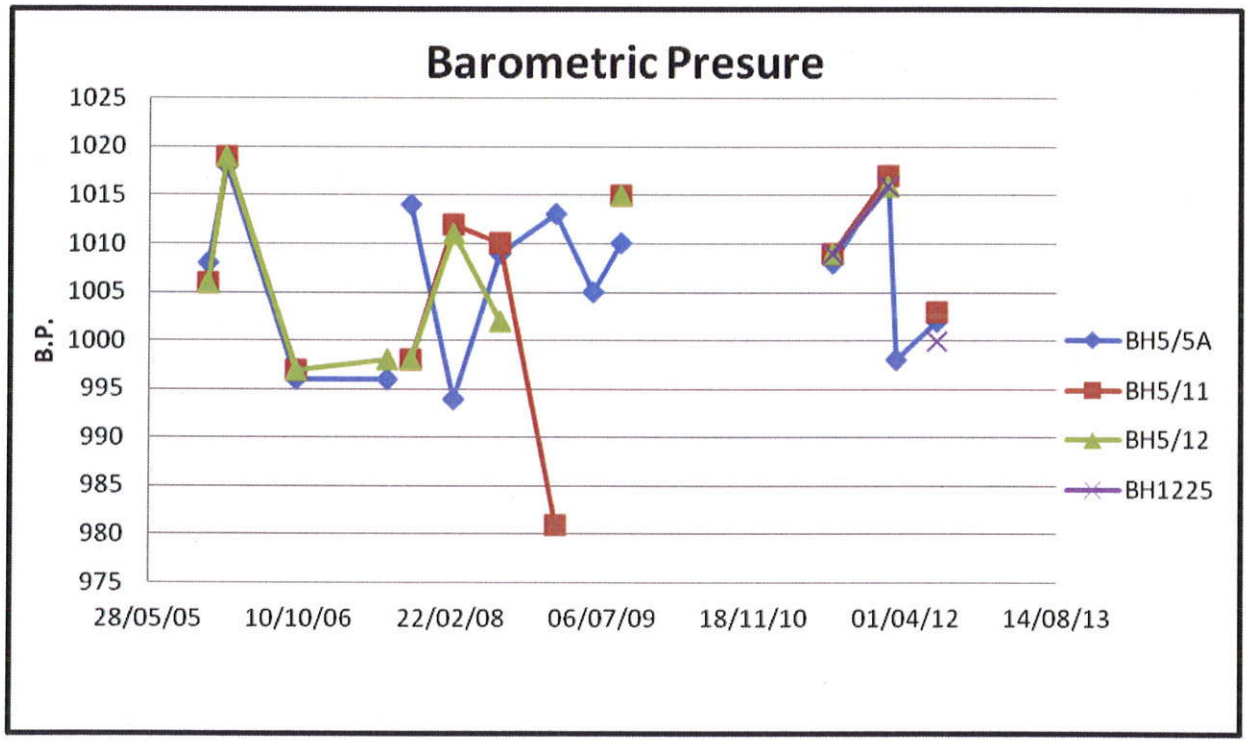
Ground Gas Monitoring: Oxygen Concentrations



Ground Gas monitoring: Methane Concentrations



Ground Gas Monitoring: Carbon Dioxide Concentrations



Ground Gas Monitoring: Barometric Pressure

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