

Sundorne Products (LLanidloes) Limited

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SY21 7BE

Our ref: 3824.CAU.XX.XX.CO.Y.03

Date: 9th April 2018

By e-mail

F.A.O. Mr David Williams

Dear David,

Re: NRW Regulation 61(1) Information Notice – Bryn Posteg Landfill (Notice No.2)

Further to your instruction on the 26th and of March 2018 and our subsequent discussions, we hereby present our selected comments in connection with the NRW email dated 26th March 2018 pertaining to our response on the 26th January 2018 to the Schedule 1 requirements for Notice No.2 (as documented by NRW in their correspondence dated 27th November 2017).

Please note that because there were subsequent submissions to NRW, our comments herein do not address every comment in the NRW email nor all of the points raised in the accompanying Geotechnology Limited report ('Review of Caulmert Report Dated 26th January 2018 concerning NRW Regulation 61(1)Information Notice – Bryn Posteg landfill (Notice No. 2).

1 Survey and Waste Landform Comparison

The waste volumes documented in our January 2018 submission were calculated using the following survey and drawing information.

- Survey; NRG dated 6th March 2017 as shown on Drawing No. 3428.CAU.XX.XX.DR.S.1801 P1
- Pre-settlement restoration profile; Drawing Reference DRWG9 as shown on Drawing No. 3428.CAU.XX.XX.DR.S.1802 P1

The waste volumes have subsequently been recalculated using the survey of the January 2018.

For ease of reference the variance in levels between the January 2018 and the March 2017 surveys is presented on isopachyte Drawing No. 3456.CAU.XX.XX.DR.G.1814. The drawing shows that the profile of the site has increased marginally on the top of the site as a consequence of the 2017 capping works as well as in the operational Phase 9 area.



Certificate Number 9113
ISO 9001, ISO 14001

Caulmert Limited

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG

Company Registered No. 06716319

Company Registered in Cardiff

2 Waste Deposited at the Site

On the basis of the January 2018 survey and the DRWG9 pre-settlement restoration profile an isopachyte representation of the difference in levels between these two profiles has been prepared and is presented as Drawing No. 3456.CAU.XX.XX.DR.G.1806.

The areas where the levels exceed the pre-settlement profile are shown on Drawing No. 3428.CAU.XX.XX.DR.S.1803 as red contours. As identified in our January submission the majority of the over-tip occupies the central part of the site; though there are minor areas where the ground profile exceeds the pre-settlement profile to the north of the site in phases 1 and 2, to the western boundary of the site and in Phase 9 to the southern boundary of the site.

We note that the exceeded levels to the north of the site are predominantly associated with capping, a peat stockpile and fill materials to the leachate lagoon embankment and as such are not waste related over-tip.

A summary of the over-tip volumes and their locations are presented below.

Waste Related Overtip and Volumes Pertaining to the DRWG9 Profile for the Whole of the Site				
Variance Between DRWG9 and Jan 2018 Profiles				Comments
Area Ref'	Location	Over DRWG9 Overtip (m3)	Under DRWG9 to be Filled (m3)	
1	Central	268,227	-	Central mass increased volume as a result of capping and restoration works between the 2017 and 2018 surveys.
2	Southern	63,648	57,278	Phase 9: Overtipped to steep flanks to the east (lower section capped) and south (temporary capped) with a remaining central waste void.
3	Western	1,427	47,268	Capped and restored: Minimal overtip to steep flank with no intention to strip the capped area and raise waste levels to the west.
4	North Eastern	-	17,383	Phases 1 and 2; Overtip / fill of materials (none waste) in proximity to the leachate lagoons and the underfilled NE hollow which is not proposed to be filled.
Total		333,302	121,929	<i>Balance; 211,373 m3 of overtip</i>

The main area of over-tip is located in the central part of the site and overlays parts of phases 3, 4, 5, 7 and 9.

We do not agree with the limited approach adopted by Geotechnology Limited in their assessment of the over-tip and the density of the waste within the site.

On the basis of disposal area specific surveys and the imported tonnages for the period of January 2014 to January 2018 the waste density in the site has been calculated at 0.83 T/m³ which is in line with our previously stated density of 0.8T/m³ but is significantly less than the density value quoted and utilised by Geotechnology Limited.

Waste Tonnages, Void Consumption and Density				
Period		Void Consumption	Landfilled Tonnage	Waste Density
To	From	(m3)	(Tonnes)	(T/m3)
18-Jan	14-Jan	406047	60102.92	0.83
18-Jan	14-Nov	346416	103650.76	
18-Jan	16-Jan	213920	76628.30	
18-Jan	17-Feb	126274	96240.90	
Total		336622.88		

On the basis of the above information and referenced profiles the volume of the over-tip is 333,302m³ (with an over-tip balance of 211,373 m³). Using a conversion factor of 0.83 T/m³ this equates to an over-tip of 276,640 Tonnes.

We note that the none-representative density value of 1.2 T/m³ has been used by Geotechnology Limited throughout their report. Whilst we appreciate that the calculated density of 0.83 T/m³ is marginally higher than the 0.8 T/m³ estimated and used in our previous submissions the impact of this variance is likely to be insignificant. We therefore consider our conclusions which were initially reported based on the density of 0.8 T/m³ density to be valid and the comments of Geotechnology Limited invalid in the light of their use of a none-representative density value.

3 Investigation into the Impact of the Over-tipped Waste

a) Landfill Liner

As previously concluded, the over-tip is unlikely to adversely affect the integrity of the liner system and consequently will not result in an increased potential for pollution of the environment.

b) Leachate Systems

i. Leachate Collection Infrastructure

As previously reported: the over-tip the collection system is functioning in accordance with the requirements of the operator and leachate is being managed via abstraction and on-site treatment. No detrimental impact on the performance of the leachate collection system has been identified by the operator either during the over-tipping activities or subsequent to them in the capped-off phases.

As previously reported; taking into consideration the small amount of additional loading that will be applied to the collection system as a result of the over-tip; it is unlikely to have had a significant impact on the components of the leachate collection system.

As previously reported; it is noted that the chambers to the collection sumps remain functional at the site with the over-tip in place.

ii. Hydraulic Properties of the Waste Mass and the Impact on Leachate Abstraction Infrastructure

As previously reported; in conclusion, the over-tip is unlikely to adversely affect the capability of the leachate collection and abstraction infrastructure and consequently will not result in an increased potential for pollution of the environment.

c) Landfill Gas Extraction Systems

i. Assessed waste tonnages

We confirm that the 2010 GasSim model (the original base model) had not been altered as part of the work completed in 2018, or any previous work after 2010 and all justifications remain as they were in the 'original model'. Justifications within this model relate to amendments made up to the finalisation of the model as part of the work completed in 2010 (and refer to data obtained from the client prior to this date).

As stated previously, the 2018 model has been updated using waste returns. These detail the actual tonnage of waste accepted at the site, rather than estimates based on volume of remaining void, or on averaged weight to volume ratio. As such, they are considered to be the most accurate measure of the tonnage of waste having been accepted at the site and were used on this basis.

For ease of comparison, Geotechnology's figures for the tonnages assessed in each model are reproduced in table below:

	2010 base model	2018 updated model	Difference
Minimum	1,918,400 tonnes	2,123,500 tonnes	205,100 tonnes
Likely	2,071,900 tonnes	2,257,000 tonnes	185,100 tonnes
Maximum	2,229,400 tonnes	2,394,500 tonnes	165,100 tonnes

Our assessment was based on the 2010 base model and the additional impact that the currently-accepted additional waste would have (the 2018 model).

The 2010 base model estimated forward the amount of waste that would be accepted at the site after 2010. The tonnages accepted in reality differed to this, and were updated with actual tonnes (as detailed in the January 2018 letter, and described above).

The difference between the models is not a direct reflection of the over-tip volume. The 2010 base model included a range of values, covering some uncertainty over the forward-projected waste tonnages; which were best estimates available at the time. In addition, models are often constructed conservatively to reflect the worst case scenario (this includes assessing impacts from the site if the waste mass to volume ratio is different to that assumed at the modelling stage). The 2010 base model has therefore already assessed the impact of some additional waste.

The 2018 model was developed from the 2010 base model as a base and included for the actual waste tonnages accepted at the site. Therefore the difference between the waste amounts modelled in the two models can more accurately be described 'as the amount of additional waste that would have been accepted at the site until its closure, not previously assessed by the 2010 model', rather than 'the amount of waste that is considered 'over-tip' over and above the agreed restoration contours'.

Wet v's Average scenario considerations

We confirm that the assessment results detailed in our January 2018 submission were based on the average moisture content scenario (as can be seen in the attached printout of the 2018 model and output graphs; Attachments 1 and 2 respectively), and are therefore directly comparable to the results from the 2010 base model, in accordance with our approach.

Tier 2 modelling

We confirm that further assessment carried out as part of the gas risk assessment update work has similarly identified that surface emissions at the current site, will not cause exceedance of EAL's at any of the offsite discrete receptors. Justification and description of the results is included in the subsequent risk assessment submission.

Regarding hydrogen sulphide (H₂S) concentrations it is apparent from the reported sampling results that H₂S is present at the source but at low levels which are not likely to affect human health. There is a clear discrepancy between the results reported to NRW which includes the Exea Associates Limited report dated March 2017 (Attachment 3) and those reported in the Geotechnology Limited

report. Considering that a low concentration at the source is not consistent with high concentrations at the receptor, it is suspected that the units for the concentrations pertaining to the sampling reported in the Geotechnology Limited report are erroneous. Using ppm units instead of ppb units. For this reason the default range for H₂S concentrations for this gas within GasSim has not been altered.

Other issues pertaining to H₂S have been addressed in our subsequent submissions.

Gas infrastructure

A number of factors can impact on the efficiency of gas extraction at the site. This includes distribution of wells over the waste, active (uncapped) areas and aging waste where gas generation is sporadic. While decreased porosity of the waste could potentially decrease the zone of influence of gas extraction wells, this cannot be accurately quantified. Recent discussion included in the LFGRA update for the site estimated that extraction at present is >95 % efficient in extracting the gas generated in parts of the site where gas wells are installed (which includes the main over-tip area). This does not support an interpretation of decreased gas extraction efficiency due to increased waste depth at the site.

The performance of the extraction system in relation to the calculated gas generation rates will continue to be assessed/reviewed as additional wells are installed in the currently-active part of the site.

Perimeter gas wells quality

The Geotechnology Limited report states that Caulmert had historic knowledge of the site (e.g. through submission of quarterly and annual monitoring data reviews for the site), and that those reviews report exceedances of permit levels for gas at perimeter boreholes. The report queried why this had not been included in the quantitative assessment submitted in January 2018.

As previously detailed in the annual reviews, the site is underlain by boulder clay, which includes gravel lenses of sand and gravel which are limited in extent. Gas flux within the superficial deposits could occur through the unsaturated part of these sand and gravel lenses. The extent of migration being limited by the spatial distribution and interconnection of such lenses. The lateral migration module within GasSim calculates gas concentration along a 1-dimensional linear pathway. The strata surrounding the site are not homogeneous, and therefore do not satisfy the assumptions of the model, hence lateral migration was not assessed using the model.

The issue of elevated gas concentrations in the perimeter boreholes has been ongoing for a significant period of time, and cannot (as reported by Geotechnology Limited) be considered to be a direct result of the over-tip at the site.

3d) Investigation into the impact of over-tipped waste: Slope Stability

Internal, short term waste slopes in Phase 9 in the south and south western parts of the Site, on the March 2017 survey are typically at gradients in the order of 1 in 2.5 or shallower in accordance with the SRA Addendum 4. Whilst some small slope sections are steeper on the more recent January 2018 survey. There have been no reported signs of instability in the waste slopes. We therefore agree with

Geotechnology Limited that the FoS will be between 1.0 and 1.3 but further assessment of these slopes which will need to be reduced by future infilling against them is not considered necessary.

It is agreed by all parties that the over-tip has resulted in slopes which are steeper than the criteria specified in SRA Addendum 4, specifically that the design slopes pertaining to the external slopes should be;

- no steeper than 1 in 5 and capped using an LLDPE geomembrane overlain by a drainage geocomposite layer (GDL); or
- no steeper than 1 in 6.5 and capped using an LLDPE geomembrane overlain by a protection geotextile.

Most of the external slopes to phases 3 and 9 were capped a number of years ago (from 2009 onwards) using an LLDPE geomembrane overlain by a drainage geocomposite and restoration soils, in accordance with the materials referenced in SRA Addendum 4, but on slopes steeper than the 1 in 5 detailed therein. As a result the overall FoS for these slopes will be between 1.01 and 1.3.

We consider that the primary issue in connection with these slopes is what should be done in connection with them and not what the specific FoS value may be estimated for them. A detailed assessment was carried out in 2006 in connection with the development of SRA Addendum 4. Further assessment is therefore not considered to be necessary.

Currently the sections of slope which are steeper than 1 in 5 are not showing signs of distress or instability.

On the basis of our assessment and those assessments carried out previously in the development of the site's SRA, the weakest interface and the potential critical plane of instability in the capping design is between the drainage geocomposite and the overlying restoration soils. Failure of the slope along the critical plane would therefore result in the sliding of the restoration soils on top of the drainage geocomposite. Such a failure mechanism would not affect the integrity of the capping liner or the integrity of the containment afforded by the liner. Remediation would also be a simple matter of placing soils back over the affected localised area.

Over time the waste profile will settle and the FoS increase as a consequence.

With regards to the current slopes which are greater than 1 in 5, we therefore consider that there are essentially two environmentally acceptable options.

- i. Leave the slopes as they currently are on the basis that over time the FoS will increase as the slope settles and regrades. If minor instability events occur, these will not compromise the integrity of the liner and can be readily remediated.
- ii. Regrade the affected steep slopes where practicable by buttressing the slope with fill materials.

We recognise that the capping and restoration materials could be removed and the waste profile regraded as proposed by NRW, but we do not consider that this option is environmentally acceptable. The overwhelming impact on public health and safety and the potentially significant risks to the environment are material factors in this case. The proposals of NRW to re-profile the site, by removing the existing cap and cutting into the degrading and actively gassing waste which has been in situ for up to some six years, will have a significant environmental impact.

Surface water running off the exposed degrading waste will carry contaminants to the perimeter surface water management features increasing the potential for migration of these contaminants off site through the surface water management system.

In addition to the significant impact on amenity and human health in respect of; greenhouse gas emissions, odour, dust, pests, vermin; the gas management infrastructure would need to be disconnected over a large proportion of the site. The resultant accumulation of landfill gasses and ingress of oxygen has the potential to cause widespread fire within the waste as well as a significant increase in the potential risk of a gas explosion.

Amenity Risk Assessment

Our Amenity Risk Assessment has been developed in accordance with the brief to reflect the current situation on site including the over-tip. It is apparent that Geotechnology Limited have assessed our submission on the basis of the impact of the site during previous phases of landfilling activities, which is not consistent with the scope of our document.

We consider that our submission is valid in terms of the scope.

We trust that the information presented above addresses our brief. Should you have any queries in connection with the information presented please do not hesitate in contacting us.

Yours sincerely



Jonathan Clark
Associate Director
On behalf of Caulmert Ltd

Encls. Drawings and Attachments 1 to 3 inclusive, as documented herein.