Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	Report ID: PP3139GB/0192537

This form will report compliance with your permit as determined by an NRW officer

Site	Hafod Quarry Landfill			Permit Ref	PP3139GB		
Operator/ Permit holder	Cory Environmental (Central) Ltd						
Date	05/11/2013			Time in	00:00	Out	00:00
What parts of the permit were assessed	Cell 3 Western Upper Sidewall Construction CQA Plan Version 1						
Assessment	Report/data review	EPR Activity:	Installation X	Waste Op		Water Discharge	
Recipient's name/position	Ian Craven - Site Manager						
Officer's name	Ian Oakes			Date issued	05/11/2013		

Section 1 - Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations. A detailed explanation and any action you may need to take are given in the "Detailed Assessment of Compliance" (section 3). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS scores can be consolidated or suspended, where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit Conditions and Compliance Summary				Condition(s) breached
a) Permitted activities	1. Specified by permit	N		
b) Infrastructure	1. Engineering for prevention & control of pollution	A		
	2. Closure & decommissioning	N		
	3. Site drainage engineering (clean & foul)	N		
	4. Containment of stored materials	N		
	5. Plant and equipment	N		
c) General management	1. Staff competency/ training	N		
	2. Management system & operating procedures	N		
	3. Materials acceptance	N		
	4. Storage handling, labelling, segregation	N		
d) Incident management	1. Site security	N		
	2. Accident, emergency & incident planning	N		
e) Emissions	1. Air	N		
	2. Land & Groundwater	N		
	3. Surface water	N		
	4. Sewer	N		
	5. Waste	N		
f) Amenity	1. Odour	N		
	2. Noise	N		
	3. Dust/fibres/particulates	N		
	4. Pests, birds & scavengers	N		
	5. Deposits on road	N		
g) Monitoring and records, maintenance and reporting	1. Monitoring of emissions & environment	N		
	2. Records of activity, site diary, journal & events	N		
	3. Maintenance records	N		
	4. Reporting & notification	N		
h) Resource efficiency	1. Efficient use of raw materials	N		
	2. Energy	N		

KEY: C1, C2, C3, C4 = CCS breach category (* **suspended scores are marked with an asterisk),**
A = Assessed (no evidence of non-compliance), **N** = Not assessed, **NA** = Not Applicable, **O** = Ongoing non-compliance – not scored

Number of breaches recorded	0	**Total compliance score** (see section 5 for scoring scheme)	0

If the Total No Breaches is greater than zero, then please see Section 3 for details of our proposed enforcement response

	INITIALS	DATE
OK FOR PUBLIC REGISTER		2/12/13
COPIED TO PUBLIC REGISTER	JB	EDRM

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- the part(s) of the permit that were assessed (e.g. maintenance, training, combustion plant, etc)
- where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- any non-compliances identified
- any non-compliances with directly applicable legislation
- details of any multiple non-compliances
- information on the compliance score accrued inc. details of suspended or consolidated scores.
- details of advice given
- any other areas of concern
- all actions requested
- any examples of good practice.
- a reference to photos taken

This report should be clear, comprehensive, unambiguous and normally completed within 14 days of an assessment.

RE: Hafod Quarry Landfill – Cell 3 Western Upper Sidewall Construction CQA Plan Version 1

The submission has not been approved by Natural Resources Wales and Cory need to address the issues raised and submit the additional information. Detail as follows:

Geotechnology has examined the recent CQA Plan submitted by Cory Environmental Ltd. It comprises a written CQA Plan which follows the format of previous Cory submissions, as well as a series of drawings illustrating the proposed works. The report is supported by a short letter report provided by Stratus Environmental and a site visit note made by Geofabrics, the potential geocomposite material suppliers to the works.

Background

The upper sidewall of Cell 3 is a problematic area for engineering. The in-situ Ruabon Marl which comprises the formation for the Cell 3 lower sidewall is overlain by unconsolidated drift deposits which include interlayered sands, silts, clays and gravels. The more permeable horizons are saturated and support strong flows of groundwater. Geotechnology has been a regular visitor to this site since the proposals to landfill were first discussed and has noted that this particular area has always been making water. The groundwater in this area is associated with localised instability and there have been several minor slips and one quite significant slip in the area covered by the proposed works.

Soon after the site had started to operate as a landfill this part of the western batter was reprofiled. The reprofiled area soon showed signs of distress and discrete lines of instability were noted along the two prominent lines of seepage. Matters were soon complicated by internal erosion, whereby fines were being washed out from the soils forming an extremely soft silt deposit. The previous site operator's intention had been to collect any seepages escaping from the trimmed formation slopes into a groundwater collection trench and to cover the surface with a geocomposite collection layer. However, the presence of these unexpectedly significant issues resulted in the engineering of the area being deferred to a later date.

The Stability Risk Assessment for the site was prepared by Encia Consulting (which has now become Stratus Environmental) in support of the PPC Permit application. In it, the stability of the side-slopes around the site was considered before the true magnitudes of the seepages along the western batter were appreciated. The SRA screening concluded that the stability and integrity of the sidewall lining system needed to be assessed in detail and therefore it was considered further. The western batter was subjected to limit equilibrium modelling in order to evaluate whether the proposed 1 in 3 slopes could be expected to have the required factor of safety (of 1.3). Numerous models were run and the assessment concluded that whilst the slopes were generally stable "the limiting factor in the short and long-term was shown to be from any rogue cohesion-less bands within the perimeter embankment." Since this factor was identified, the side-slopes have been reprofiled, the cohesion-less bands have been uncovered and instability has been seen. As the extent of this area had not been determined at the time the SRA was drafted the SRA does not offer a scheme of remedial works to address the issue in a manner that assures acceptable factors of safety.

During the initial engineering of Cell 3, the upper sidewall was exposed and reprofiled, uncovering the extent of the seepages and precipitating localised instability. The phasing of engineering works was amended to avoid this area until a suitable scheme of stabilisation could be found. Geotechnology attended a site meeting with Encia (the Designers), Egniol (the CQA Engineers) and the operator on 15 August 2007 to look at the upper sidewall of Cell 3. In the meeting it was decided to stop the ongoing lining works in the area and place a series of counterfort drains into the slope before covering with geocomposite. This was to be the first step in developing a design to be proven by site observation. This area of remedial works remains visible today.

The Current CQA Plan Submission

The CQA Plan for the works in this rather difficult area commences with a conventional CQA Plan based upon previous approved plans. The conventional works comprising the placement of geocomposite interlayered beneath and between re-compacted site-won clay is described adequately in the submission. The frequency and type of

CQA testing follows previous submissions and therefore these aspects of the submission are acceptable in their current form. However, the requirement to provide elements that are able to control groundwater build-up by drainage (hence improving stability) means that certain aspects covered by the Plan are new to the site. It is the design and the CQA procedures for these elements that needs close attention.

The Design of Groundwater Control

There is no separate design document that Geotechnology has seen that pulls together issues of drainage, stability and construction. The CQA Plan includes a number of drawings to communicate the elements that are proposed and the CQA Appendices contain supporting information prepared by the design engineers and geocomposite suppliers. Geotechnology conclude that the letter to Cory on 3 July 2013 from Stratus is to be considered the design report for the works not already approved by the Permit application process.

The proposals for groundwater control are rooted in a site inspection carried out by Stratus on 13 June, 2013. The inspection reveals that groundwater seepage from the drift yield significant flow despite recent dry weather, though the flow is not quantified. It is noted that the seepages emerge from the lower 3 to 4 metres of drift not just the contact with the underlying relatively impermeable Marl. The Stratus inspection suggests that the groundwater emerges as single line of seepage, though Geotechnology recall that there are two seepage lines in this area. In fact Geotechnology's recollection is supported by the inspection carried out by an engineer from Geofabrics who notes on 14 June 2013 that "the sidewall subgrade is displaying groundwater seepage at two distinct horizons within the face, both of which are approximately 3 to 4m in height". It appears that there is a conflict in the conclusions drawn from the walkover inspections which is not satisfactory as these underpin the design proposals.

Geofabrics note that "seepage rates were not confirmed but are sufficient to warrant remedial measures....as the risk of porewater pressure build-up behind the lining system could cause a potential failure/breech of containment if unaddressed". This seems to be a sensible conclusion to draw, but leaves open the question of the capacity of the system to accommodate flow. Stratus likewise provides no measure of the flowrate from the design area other than to note it is "significant". The design of the drainage system is not therefore based on a justifiable measure of the required capacity.

In the absence of directly measured discharges from the works area, Stratus has approached the question of flow capacity in the system by referring back to data provided in the original PPC Permit application. The total groundwater yield into the site calculated in the original HRA is 2600m3 per day and this has been divided by the site perimeter of 1642m to give an average flowrate per metre of 0.018 l/s. This calculation makes two unsubstantiated assumptions: firstly that the HRA calculation was correct and secondly that the flow is uniformly distributed around the perimeter. Geotechnology cannot see any dispute in the observation that flow is actually concentrated into this problematic zone and therefore even if the unsubstantiated flow-rate was accepted the validity of the flow capacity calculation is questionable.

The flowrate calculation has been used to specify an appropriate grade of cuspated geocomposite product, yet much of the flow is expected to be captured in the proposed counterfort drains. Their objective is "to intersect the saturated areas....so as to dewater the upper surface" and they have been specified as being 450mm wide by 500mm deep (below final formation). The counterfort drains are not piped but are to be filled with high permeability coarse drainage stone. The counterfort drains discharge into a deeper piped groundwater collection trench fitted with a 150mm diameter structured-wall perforated plastic pipe laid to a 1:500 fall. There are no calculations to show that the drain has sufficient capacity to accommodate maximum flowrates.

The counterfort drains are an essential element of this design as their purpose is to reduce the moisture content of the saturated silt and fine sand to a degree that the strata gain sufficient strength to form a firm, unyielding surface for lining works. Prior to placing the geocomposite the formation will be inspected to confirm it is firm and suitable for deployment, but after placing the geocomposite the formation will remain unseen.

The lining works will commence with spreading a 250mm thick layer of clay before subjecting it to compaction with heavy vibrating rollers. Silt is notoriously unstable when subjected to moisture and vibration and therefore the "buildability" of the proposed works has to be considered carefully.

The design does not consider the spacing of the drains, instead deferring this to a site decision to be made by the CQA Engineer, the Quality Engineer and the Site Manager. However, the use of relatively simple drain spacing calculations could lead to an understanding of the required depth and spacing required to maintain water levels below the design level. The design level has to be understood as part of this calculation and the capability of the drained strata to support heavy vibrating earthmoving plant should be part of that assessment.

There is a significant problem in specifying drain spacing by visual assessment alone. Geotechnology has recent experience of a failed mineral lining system where the designer required drainage based on visual assessment. As the inspector only sees what is exposed when the decision is being made, this system is not tolerant of changes in seepage. Furthermore, whilst it may be possible to form a firm surface suitable for geocomposite placement, the critical moment for integrity is likely to be when the first mineral layer is compacted above the geocomposite. By this stage the drains are in place and the formation is unseen. Observational design is best carried out when the

performance of the design can be observed. The proposed design has not offered any assurance that the system will be able to achieve the required degree of groundwater control to allow placement onto a firm unyielding surface.

Stability

The consideration of stability in the report is limited to one sentence: "The existing stability risk assessment has shown that a gradient of 1:3 will provide an adequate factor of safety for this material". Geotechnology do not share this opinion.
The original SRA does not consider the strata geometry and groundwater conditions uncovered during the development of the site. A general consideration of this part of the side-wall concluded that water bearing cohesionless bands would have a controlling influence on side-wall stability and this has indeed proven to be the case. Unacceptably low factors of safety have been revealed in the SRA when such conditions are simulated and therefore further work is required in order to provide convincing evidence that the side-wall formation and lining system will be stable.

The essential first step in evaluating stability is to produce a conceptual model which accurately reflects the groundwater and strata geometry. There seems to be a difference between the conceptual understandings of the site between the two inspectors that visited the site on successive days in June of this year. This needs to be resolved and then an appropriate stability assessment can be carried out so that the influence of the chosen drainage system can be evaluated. The design of the groundwater control may be amended if the results of the modelling dictate.

Design Change

The CQA Plan indicates that the approved design for the lining system over the area of the proposed works comprises a groundwater drainage geocomposite overlain by two mineral barrier layers separated by a geocomposite layer. The submission proposes however that the geocomposite separating the two mineral barriers is omitted from the design. Any modifications to the approved design need to be justified with reference to the original design justification. The justification outlined in the CQA Plan is that gas pressure does not have the capacity to migrate behind the mineral ASL, though Geotechnology note that the geocomposite to be omitted is not referred to as a gas control layer or gas pressure relief layer but as an under-liner drainage layer (see extract of SRA below)

- In-situ Middle / Upper Ruabon Marl / Glacial overburden formation (cleaned face and graded);
- 6mm Non-woven needle punched geo-textile fabric with a heat bonded cuspated HDPE core geo-composite groundwater drainage layer with minimum in plane water flow of 3.1 x10-3m/s into groundwater collection drain at base of middle and upper sections;
- 1000mm Minimum groundwater separation zone (Artificially established geological barrier) of engineered Ruabon Marl compacted to a maximum permeability of 1 x 10-9 m/s placed to an angle of 1 in 3;
- 6mm Non-woven needle punched geo-textile fabric with a heat bonded cuspated HDPE core geo-composite under-liner drainage layer with minimum in plane water flow of 3.1 x10-3m/s;
- 1000mm Compacted Clay Liner (Artificial Sealing Layer)

Geotechnology would prefer to see a review of the original design objectives placed alongside a performance comparison with the proposed design changes, so that it is easier to come to a view on the acceptability of the proposal.

Summary

Cell 3 Western Upper Sidewall at Hafod is a complex and problematic area due to significant groundwater seepages leading to very soft saturated soils and instability. There have been numerous slope failures since the site was reprofiled as part of the initial development works at the site. The engineering of this area demands careful consideration, detailed design work and revisiting the stability risk assessment. The document that has been submitted provides largely acceptable CQA procedures for those aspects of the work that have been used elsewhere on the site. However, those aspects that have been developed specifically for engineering this particular area have not been considered in sufficient detail to offer a high degree of assurance that the works will be effective.

In order for the submission to be approved it should be modified and supplemented with additional information. It would be of benefit to separate out the design aspects from the CQA submission. The design document should commence with a robust conceptual model, developed from site observations, investigations, flow measurements etc so that the problem can be properly described. The data should be included as an appendix to the design report. Using the conceptual model, the design of the counterfort drains and the flow capacity of geocomposite elements can be developed. It is expected that the design will be strongly influenced by estimates of flow, gradient and the distance beneath the surface that the piezometric surface will need to be maintained. The design should consider the stability and integrity of the overlying liners. Practical difficulties during construction should also be considered so that unforeseen construction difficulties are avoided.

The design report should also consider any amendments proposed to the existing approved design so that it can be

adequately assessed. This should also include an assessment of the need to reprofile the slope to achieve the design grades of 1:3 and the tie-in between adjacent phases.

It would seem that there is a good prospect of achieving a workable design as the small area that has had drainage installed seems to be considerably improved when compared with its original condition. This bodes well for the scheme but Geotechnology is firmly of the opinion that the performance of the test area alone cannot give the required assurance that the proposed works will be acceptable. Similarly, deferring the detailed design decisions to the site supervisor during the works also fails to give a high degree of assurance that the scheme will succeed.

Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	Report ID: PP3139GB/0192537

This form will report compliance with your permit as determined by an NRW officer			
Site	Hafod Quarry Landfill	Permit	PP3139GB
Operator/ Permit	Cory Environmental (Central) Ltd	Date	05/11/2013

Section 3- Enforcement Response — Only one of the boxes below should be ticked	
You must take immediate action to rectify any non-compliance and prevent repetition. Non-compliance with your permit conditions constitutes an offence and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below.	
Other than the provision of advice and guidance, at present we do not intend to take further enforcement action in respect of the non-compliance identified above. This does not preclude us from taking enforcement action if further relevant information comes to light or advice isn't followed.	X
In respect of the above non-compliance you have been issued with a warning. At present we do not intend to take further enforcement action. This does not preclude us from taking additional enforcement action if further relevant information comes to light or offences continue.	
We will now consider what enforcement action is appropriate and notify you, referencing this form.	

Section 4- Action(s)

Where non-compliance has been detected and an enforcement response has been selected above, this section summarises the steps you need to take to return to compliance and also provides timescales for this to be done.

Criteria Ref.	CCS Category	Action Required/Advised	Due Date
See Section 1 above			

Section 5 - Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- advise on corrective actions verbally or in writing
- require you to take specific actions in writing
- issue a notice
- require you to review your procedures or management system
- change some of the conditions of your permit
- decide to undertake a full review of your permit

Any breach of a permit condition is an offence and we may take legal action against you.

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and or suspension or revocation of the permit.

See our Enforcement and Civil Sanctions guidance for further information

This report does not relieve the site operator of the responsibility to

- ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- ensure you comply with other legislative provisions which may apply.

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance which could have a **major** environmental effect	60
C2	A non-compliance which could have a **significant** environmental effect	31
C3	A non-compliance which could have a **minor** environmental effect	4
C4	A non-compliance which has **no** potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

Section 6 – General Information

Data protection notice

The information on this form will be processed by the Natural Resources Wales (NRW) to fulfill its regulatory and monitoring functions and to maintain the relevant public register(s). The NRW may also use and/or disclose it in connection with:

- offering/providing you with its literature/services relating to environmental matters
- consulting with the public, public bodies and other organisations (e.g. Health and Safety Executive, local authorities) on environmental issues
- carrying out statistical analysis, research and development on environmental issues
- providing public register information to enquirers
- investigating possible breaches of environmental law and taking any resulting action
- preventing breaches of environmental law
- assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Information Regulations request.

The NRW may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The NRW will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within twenty working days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with the officer's line managers. If you wish to raise your dispute further through our official Complaints and Commendations procedure, phone our general enquiry number 0300 065 3000 (Mon to Fri 08.00–18.00) and ask for the Customer Contact team or send an email to enquiries@naturalresourceswales.gov.uk. If you are still dissatisfied you can make a complaint to the Public Services Ombudsman for Wales. For advice on how to complain to the Ombudsman phone their helpline on 0845 607 0987.