

Parrys Quarry Environmental Permit Application

Schedule 5 Questions and Responses

Response to Schedule 5 information provided 18/02/2014

Hydrological Risk Assessment

1 **Question 21**

Thank you for clarifying the proposed height of the groundwater drainage blanket. We accept that it will be at 97mAOD and locally higher depending on further pre-operational monitoring from additional boreholes. Please see our response to attachments 4 and 5 for comments on the number and spacing of these additional boreholes.

***Response:** The number and spacing of the proposed new boreholes are discussed in our response to NRW Comment 7 below. We have no further comments.*

2 **Question 22 & 24 – leachate monitoring points and leachate levels**

Revised drawing 30030/ESID/13A shows the location of proposed leachate monitoring points. We are satisfied that this provides good coverage of the central part of the landfill to address our previous comment about a lack of monitoring in this area.

We note that it is intended to maintain leachate heads at 2m below adjacent natural groundwater levels during the period of hydraulic containment. We have no objection to this approach but do have some concerns over how this will be managed given that several of the proposed leachate monitoring wells are quite remote from the nearest groundwater level monitoring boreholes. For example RMW3.1 is around 150m from borehole PQGW1 and this is replicated at several of the other proposed leachate monitoring wells.

In addition, the water level information collected to date shows that around the landfill there is variability of several metres in groundwater levels between the existing boreholes, and there will be also be seasonal variations to account for. The implication of this variability is that leachate heads will need to change from month to month and will need to be maintained at different levels in different monitoring points.

As an alternative, consideration may be given to maintaining the leachate levels at a fixed elevation relative to the lowest groundwater level around the site. Whilst this will in part lead to an increase of groundwater entering the landfill it would provide for a simpler monitoring regime to ensure compliance. **Can leachate heads be effectively managed to ensure compliance and leachate levels maintained below external groundwater levels at all times to ensure hydraulic containment? Given the variability from one borehole to the next, what measures are proposed to ensure that leachate levels are being maintained at 2m below adjacent water level at all points around the perimeter of the landfill?**

Response: *It is proposed to determine the leachate compliance limits as follows:*

- As detailed in our response to the NRW Comment on Attachment 4 below, it is proposed to drill and monitor monthly for 6 months 7 no. new boreholes (PQGW1A, PQGW2, PQGW3, PQGW5, PQGW8, PQGW9 and PQGW10,) around the perimeter of the site. The new boreholes will target the more permeable horizons (sandstone bands) below the water table. The proposed location of the new boreholes is shown on enclosed Drawing ESID/13A rev 4. The monitoring data collected from each individual permeable horizon will be compared with the long-term monitoring data from the existing boreholes (see updated hydrograph in Annex A), which reflect average conditions across a number of permeable horizons. The additional data will also be used to refine the current understanding of groundwater levels across the site and determine seasonal variation;*
- Given that the Coal Measures underlying the site contain a number of permeable horizons (sandstone bands), and as explained in our response to the NRW Comment to Question 37 below, the minimum groundwater levels recorded within the sandstone horizons located above or closest to the base of the site (assumed at 82 m AOD) will be used to define the leachate compliance limits; and*
- The minimum groundwater levels recorded over the 6-month period at the new boreholes closest to each leachate monitoring well will be used to set a compliance limit in m AOD as 2 m below minimum groundwater levels.*

3 **Question 29 – Borehole PQ15/01**

Whilst we acknowledge that this borehole is not being retained, if the landfill is developed we do not agree that this means the data collected should not be used as part of the assessment of groundwater levels.

Techniques to determine where slotted casing is present would provide some information on the likely response zone of this installation.

Works should be undertaken to determine why this borehole is providing water level information which does not tally with the other sites being monitored. This should then be reported back to Natural Resources Wales.

Response: *Review of the groundwater level data (hydrograph in Appendix A) indicates that borehole PQ15 has higher water levels but a similar response to the other boreholes at the site. This suggests that borehole PQ15 is monitoring similar permeable horizons within the Coal Measures but the datum is incorrect. RJS Engineering has confirmed that groundwater elevations are around 103m AOD but it is proposed to re-survey the borehole datum and, if it is incorrect, re-calculate groundwater elevations. If the borehole datum is correct, it is proposed to check the construction details by the use of a downhole camera and caliper log.*

4

Question 30

We support the decision to install a replacement borehole at this location as PQGW01 is not suitable for use as a compliance point. We suggest that existing borehole PQGW01 is retained to allow a comparison of water level and water quality information with the new installation. The water quality comparison may also assist in determining the likely source of the poorer quality water which affects this borehole at present. **Please retain PQGW01 for comparison purposes. Please confirm that this will be retained.**

Response: *We agree with NRW comment that continuing the monitoring of borehole PQGW01 in addition to the replacement borehole PQGW01A may assist in determining the likely local source of the poorer water quality that currently affects this borehole. The proposed location of the replacement borehole PQGW01A is shown on r Drawing ESID/13A Rev4. As discussed in the Schedule 5 response (P025 dated 18 February 2014) runoff following the application of road salt at the A494 road, the site entrance and the council depot (which may be used for storage of road salt) is a potential contaminant source of this borehole. If additional monitoring data continues to show contamination at the borehole and if the pollution source is confirmed it is proposed to decommission the borehole to prevent the borehole acting as a conduit for contamination of groundwater.*

5

Question 33

We accepted the justification for using a 2m leachate head below the adjacent groundwater levels during hydraulic containment but please see comments made in response to Questions 22 & 24.

Response: *Please see response to comment 2 above.*

6

Question 37

Detailed response provided under 'comment on attachment 4'. One point that requires further clarification, the response states that '*proposed groundwater drainage layer will equalise any potential stratified groundwater levels acting on the sidewall liner*'. **How does the presence of stratified groundwater levels correlate with the landfill being hydraulically contained?**

Response: *The geological information collected during the various site investigations was presented in Tables 1.3 and 1.4 of the HRA report (dated September 2012). This was further discussed in the Schedule 5 response (P025 dated 18 February 2014). In summary:*

- *The Coal Measures are saturated beneath the water table. However, the head in different layers is variable.*
- *The Coal Measures underlying the site are dominated by low permeability strata (siltstones and mudstones) with some more permeable horizons (sandstone bands). The sandstone horizons have an average thickness of 5 m (range 0.9-10.5 m);*
- *The shallowest sandstone horizons (at elevations between 93.4 and 111 m AOD) were recorded along the eastern and southern boundary of the site (PQW4-00, PQGW01, PQ4/96, SHBH4-06 and SBH6-06).*

Other sandstone horizons were recorded across the site at elevations between ~77 and 88 m AOD and ~50 and 60 m AOD. A deeper sandstone horizon was recorded at PQW1-00 at an elevation of 31 m AOD (78 m bgl); and

- Although some of the boreholes have long response zones the more permeable strata, where present, will dominate the water level response of these boreholes. The limited information on pressure gradients with depth for paired boreholes indicate the presence of both downward and upward gradients although the downward gradient shows a higher head difference (0.5-0.6 m upward and 4.2-6.4 m upward);and*
- Some of the sandstone horizons lie above the water table and are, therefore, of limited interest.*

On this basis it is proposed that the leachate compliance levels are defined as 2 m below the minimum groundwater levels recorded in sandstone horizons above or closest to the base of the site (assumed at 82 m AOD) as these represent the fastest pathway for contaminant diffusion out of the site and the head in these layers is the head that will bear on the landfill. The deeper permeable horizons are separated from shallow permeable zones by a substantial thickness of low permeability mudstone/siltstone and therefore the groundwater levels in these deeper strata are not relevant for defining hydraulic containment at the site.

7 Comment on Attachment 4

The attachment and response to question 31 both state that groundwater levels are close to recovered following the cessation of pumping. It also states that water levels 'will be higher in the southern (up-gradient) part of the site'. The current water level information provided does not support this. The up-gradient borehole PQGW01 has recorded groundwater levels lower than the water levels being recorded at the northern (down-gradient) part of the site in borehole PQGW04 and PQGW06.

Having reviewed the water level information collected from the various boreholes drilled at the site hydraulic containment appears to be technically feasible at this location. Further investigation works are planned including the installation of three new boreholes, which are to be completed as proposed pre-operational condition. This information will refine the current geological understanding of the site and provide additional information on water levels and its seasonal variability.

We support the installation of additional boreholes and are satisfied that these can be undertaken as a pre-operational condition. We are however concerned that the three additional boreholes proposed do not provide sufficient coverage of the site. As the site will, in future, be reliant on hydraulic containment and being able to relate leachate heads within the landfill to adjacent groundwater levels, it is vital to have sufficient monitoring in place. Based on revised drawing ESID/13A which shows the proposed location of new boreholes there is a lack of groundwater monitoring along the

western side (between current boreholes PQGW1 and PQGW6) and the eastern side between the proposed new boreholes PQGW2 and PQGW3, and between PQGW3 and PQGW4. Note that Environment Agency's 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water (2003)' states that boreholes should be spaced a maximum of 100m apart on the down-gradient landfill site margin.

Please propose locations for additional boreholes (in addition to the three already planned) to address these gaps in coverage. A selection of these new boreholes should also be completed as multi-level installations (double or triple installation) to ensure representative measurement of groundwater levels and quality. Most of the existing boreholes being retained have long response zones which makes them unsuitable for water quality monitoring. Having a long response zone through different horizons allow any poorer quality water to be diluted in the water column. The new boreholes which are installed should be completed as multi-level installations with shorter response zones to ensure water quality is representative of the adjacent strata. This will be required to determine whether the landfill meets the compliance limits set for groundwater.

Response: We agree with NRW comments that the understanding of groundwater levels across the site could be improved by the installation of additional boreholes around the site boundary completed with multi-level installations. The groundwater level data available was discussed on the previous Schedule 5 response (P025 dated 18 February 2014) and indicate that:

- *Groundwater levels recorded at the site prior to early 2012 reflect artificially lowered conditions due to dewatering operations (hydrograph in Appendix A);*
- *Since groundwater pumping ceased at the start of 2012 groundwater levels have gradually increased throughout 2012 and appear to have stabilised based on 2013-Jan 2015 monitoring data (hydrograph in Appendix A);*
- *Some of the existing boreholes have long response zones covering more than one permeable horizon (e.g. borehole DBHB/06) indicating that the water level recorded corresponds to the average level across the screened permeable horizons. The limited information on pressure gradients with depth for paired boreholes indicate the presence of both downward and upward gradients although the downward gradient shows a higher head difference (0.5-0.6 m upward and 4.2-6.4 m upward);*
- *There is uncertainty regarding the fully recovered maximum natural groundwater level across the site and the likely amplitude of seasonal variation as there is an insufficient set of data unaffected by pumping or which pre-date quarrying;*
- *The highest groundwater levels (~97-108 m AOD) have been recorded at boreholes PQW1-00 (southeast) and PQ15 (centre) and the lowest*

levels (~91-93 m AOD) at boreholes PQGW1 (southwest) and PQGW6 (northwest). As discussed on our response to EA Comment 3 above there is uncertainty on the groundwater levels measured at borehole PQ15 (no borehole log available) and additional works are proposed to investigate this. The groundwater levels recorded at the site are several metres higher than the proposed landfill base at 82 m AOD indicating that operation of the site at a hydraulic containment head difference of 2 m is achievable.

Although the available groundwater level data and HRA (dated September 2012) indicate that hydraulic containment can be achieved at the site, it is proposed to undertake additional works as a Pre-Operational Condition to refine the current understanding of groundwater levels across the site and assist in the assessment of hydraulic containment:

1. Drilling of new boreholes

It is proposed to drill 7 no. new boreholes (PQGW1A, PQGW2, PQGW3, PQGW5, PQGW08, PQGW9 and PQGW10) around the periphery of the site. These boreholes will target the more permeable horizons (sandstone bands) below the water table. The proposed locations are shown on revised Drawing ESID/13A rev 4 attached.

2. Collection and review of groundwater monitoring data

The new boreholes will be monitored monthly for water levels and quality for 6 months prior to dewatering re-commencing. This will assist in confirming groundwater flow direction, determining seasonal variation in groundwater levels, establish baseline water quality and derive appropriate groundwater compliance limits. The water quality monitoring suite will be consistent with the proposals in Table 3.4 of the HRA (Dated September 2012) and will also include nitrate and dissolved oxygen as requested by NRW on the Comment 9 below.

4. Installation of a groundwater drainage layer up the landfill sidewalls to an elevation of 1 m above the fully recovered maximum natural groundwater levels:

Groundwater levels acting on the liner will be equalised by the proposed drainage layer sidewall liner and the average groundwater levels acting on the liner will be monitored. This information will be used, together with the perimeter borehole water level data, to assess hydraulic containment at the site.

8 **Comment on Attachment 5**

Further monitoring boreholes are planned as a pre-operational condition to refine the current geological understanding. We support the installation of additional boreholes but the three proposed are not sufficient to provide coverage around the perimeter of the landfill. The current proposal shown on ESID/13A includes one up-gradient boreholes and two down/cross-gradient based on the current assumptions around groundwater flow directions.

However, this leaves sections unmonitored, particularly along the western and eastern margins of the landfill. When the site is operating under hydraulic containment there will be a hydraulic gradient towards the waste mass and it is vital to have a good understanding of water levels on all sides of the landfill to ensure leachate heads are maintained at least 2m below adjacent water levels. Without boreholes in place to measure water levels, how will this compliance be achieved?

We also note that these boreholes will be monitored for a period of 3 months following installation. We would expect any new boreholes to be monitored for a period of at least 12 months prior to dewatering re-commencing on site. Attachment 5 acknowledges that there is uncertainty regarding the fully recovered maximum groundwater level and the likely amplitude of seasonal variation. In order to address this uncertainty, monitoring is required to take place over the course of a year (as a minimum) to assess the seasonal highs and lows in water level. This will also assist in determining the seasonally highest water level for the design of the groundwater drainage blanket.

This period of monitoring should also include collecting water quality samples to establish the baseline quality from the monitoring points. Having this information will allow the inclusion of finalised control levels and compliance limits in the permit prior to the landfilling of wastes and negate the requirement to set interim limits as suggested in permit application (section 3.3.1 of the Hydrogeological Risk Assessment). **Please submit proposals for the installation of monitoring boreholes to measure water levels. Please submit proposals for monitoring to account for seasonal variations in groundwater levels.**

Response: We accept NRW comments. Please see our response to Comment 7 above.

9 **Additional comment on monitoring plans**

We do have some additional points to raise on the proposed groundwater and leachate monitoring determinants and frequency. We agree with the proposed frequencies for monitoring leachate and groundwater once the site is operational as set out in Tables 3.2 and 3.4 of the HRA. **Please include the following determinants in the analysis suite:**

- Nitrate
- Dissolved Oxygen (in the groundwater analysis suite)

It was also not clear from the organic screen whether this includes analysis for hydrocarbons – please provide clarification.

Response: The groundwater monitoring suite proposed in Table 3.4 of the HRA (dated September 2012) will be amended to include nitrate and dissolved oxygen as requested. The annual organic screen refers to a GCMS scan for volatile and semi-volatile compounds which will include hydrocarbons.

Response to Schedule 5 information provided 4th June 2014

Environmental Setting Installation Design (ESID)

- 10 **Questions 1 – 3.** No further comment regarding question 1. However with regards to Question 2, we cannot agree that this 100 meter buffer zone will provide adequate mitigation against odour release. Furthermore, Mineral TAN 1 concerns aggregates extraction, therefore its relevance as an appropriate distance for landfill activities is unsuitable.

***Response:** The 100m buffer zone was applied at the planning stage and is a requirement of the planning permission. The Planning Authority provides its justification for its inclusion and use of guidance in applying it. We acknowledge that NRW do not consider that the inert waste buffer zone alone is not adequate mitigation against odour release and that operational controls will be required within the non-hazardous waste disposal area.*

Question 3 of the Schedule 5 Response provided June 2014 states that “full details will be agreed as part of the CQA programme”. This places an over reliance on the CQA programme. CQA is to provide assurances that actual construction and engineering is carried out appropriately. **Justification is required for deviation from Regulatory guidance and detailed design is needed prior to implementation.**

***Response:** Leachate monitoring boreholes will be constructed in accordance with EPR guidance and agreed with NRW prior to installation.*

- 11 **Question 4.** We accept revised ESID 06 rev 4 drawing as confirmation that 1 meter of soil cover will be used over the low permeability cap.

No response required

- 12 **Question 5.** Due to the proximity of receptors the site is very sensitive from a gas migration perspective. Gas is proven to migrate through such clays by observation of clay lining systems in other landfill quarry systems in North Wales. Therefore we need to agree landfill gas monitoring infrastructure prior to granting any permit. **Please provide appropriate details of gas monitoring boreholes.**

***Response:** See response to Question 41 below.*

- 13 **Question 6.** We accept the response to question 6.

No response required

Odour Management Plan

- 14 **Question 7.** Please see responses to the section on Air Modelling Dispersion Assessment.

- 15 **Question 8.** We cannot find the revised Odour Risk Assessment referenced in the revised Odour Management Plan. **Please re-submit this document.**

Response: *The OMP (AMEC report ref: 30030/rr033i1) identifies that there are sensitive receptors relatively close to the site boundary in the prevailing downwind directions, which upgrades the risk rating to medium risk, thus requiring a high degree of competent site management in respect of odour control. The OMP identifies sources, releases and impacts of Odour (Section 3) and control measures to reduce the potential impact (Section 4) rather than a tabulated risk assessment. The Amenity Risk Assessment (AMEC report ref: 30030/rr031i1) will be amended to change the risk from low to medium given the sensitivity of the site.*

Habitats Management Plan

- 16 **Questions 9 & 10.** No further comments. Note that we have no problem with specific measures cross referencing other documents, however such cross references should be clearly signposted.

Noted.

During the meeting between NRW, the Applicant and AMEC on January 30th 2015, the issue of newt fencing around each working area was discussed. It was confirmed that newt exclusion fencing for each working area was a requirement of the planning permission and will be put in place.

Amenity Risk Assessment

- 17 **Question 11.** Please note the response to question 8 regarding the Odour Management Plan. Furthermore The OMP states that daily cover will be sourced from the site. If the material is heavily clay based then this can cause discrete impermeable layers to form across the site resulting in perching at many different levels in the site causing the landfill gas system to become filled with water due to horizontal drainage into gas wells. Clay based cover can result in fine suspensions entering gas and leachate wells which can cause rapid silting and cause excessive wear and clogging in pumps fitted to dewater gas wells and basal leachate head. **Please clarify if these potential issues have been considered and the decision process in deciding on this method. If any of the above were to occur, what mitigation measures will be applied? Has an alternative source of cover been considered as an alternative should problems arise? Please detail what this cover consist of and how much will be required.**

Response: *As part of the operational management of the site selected materials will be assessed and any found containing high clay content will not be used as cover to minimise the risk of perched leachate occurring. There are granular materials on site which can be used for temporary cover, or otherwise imported to the site.*

Section 3 of the odour management plan still contains the following statement; "air quality impacts are likely to be minimal. On this basis the site could possibly be regarded as being of low risk in relation to the potential for odour release" This is caveated by "the proximity of sensitive receptors which upgrades the rating to medium risk thus requiring a high degree of competent management in respect to odour control."- This does not in any way answer the original concerns that we have in terms of the odour effects on local receptors. Therefore the following comment stands;

The proximity of the site to the A55 and the services which are within 100m of the site boundary means that these receptors will be particularly vulnerable to any odours which may emanate from the site. Where perched leachate is encountered (which occurs at all of the landfills in Wales) issues can arise due to the increased production of hydrogen sulphide, which contributes to the odiferous nature of the waste. NRW must be sure that the detrimental effects of such wastes so close to these receptors can be mitigated by the Landfill gas extraction and control system.

These odour problems have been encountered on other sites in North Wales during cool still air conditions with light drainage winds where there is little chance for wind dispersion and the gas from the site drains to the surrounding areas with little dilution. It is critical that best practice and the highest standards of plant and infrastructure maintenance are applied to this site in the event that a permit to operate is granted.

What contingencies are in place in case of mains power failure or other plant breakdown? This is critical to maintaining odour control in such a sensitive area.

***Response:** As stated in response to question 37 below, Modern landfill gas utilisation plants incorporate telemetry to warn operators of plant failures/outages. The Applicants gas manager would ensure alarms are rapidly responded to.*

The detailed design of the landfill gas plant would be agreed in advance with NRW prior to construction and may well include standby and/or variable speed boosters.

Plant breakdown - There will be routine maintenance of equipment to reduce the likelihood of breakdown. A supply of critical spares (e.g. for the loading shovel) will be maintained on site. Any replacement equipment will be supplied within 48 hours.

Olfactory monitoring will be increased to ensure the breakdown does not have an adverse effect. If necessary, the site will close to further deliveries of waste until any backlog is cleared.

- 18 Questions 12, 13 & 14. Responses accepted, with the exception of table 5.3 on contamination of surrounding surface water, land and groundwater. The risk management still refers to the SWMP. **As this is a measure to take in**

the event of an incident, specific measures should be specified in this risk assessment. Please revise and resubmit.

Response: Table 7.6 of the SWMP sets out Risk Management measures to prevent contamination of sw. These can be listed in the risk assessment:

For oils and other organic contaminants:

- Proper maintenance of plant
- Storage of fuels and chemicals in secure areas with hardstanding and adequate bunding
- Grit traps and oil separators in site drainage and before discharge

For suspended solids introduced to surface waters

- Provision of sumps and ponds to allow settlement of solids prior to discharge
- Provision of storage and water management to control discharge regime during sensitive periods

For Landfill leachate contaminating waters/land

- Engineered design in accordance with Landfill Regulations (supported by risk assessment)
- CQA of construction process
- Proactive leachate management system
- Leakage monitoring
- Interception of any leakage before it can reach the surface water system
- Appropriate disposal and/or treatment of any contaminated leakages
- Minimisation of time before capping and restoration of landfill cells to restrict water ingress

Accident Management Plan

- 19 **Questions 15 – 20.** Responses accepted and we agree that should a permit be granted, a pre-operational condition will be included for the location of emergency equipment.

No response required.

Surface Water Management Plan

- 20 **Questions 21 – 22.** We accept the responses to questions 21 – 22 and agree that a pre-operational condition may be included for the collection and review of monitoring data for the Alltami Brook and subsequent setting of compliance limits.

No response required.

Closure and Aftercare Plan

- 21 **Questions 23 – 26** – responses accepted. However we note that under section 2.2 – decommissioning, it states “asbestos or other potentially harmful materials are removed unless agreed that it is reasonable to leave such liabilities to future owners”. **Please clarify where asbestos or other potential harmful materials could be used.**

***Response:** Reference to asbestos will be removed in the next revision of the closure and aftercare plan.*

GASSIM Modelling

- 22 **Questions 27 – 29.** Responses noted and accepted.

No response required.

Air Dispersion Modelling

The following queries relate to Questions 30 – 32.

- 23 Page 6 of AMEC’s Final Revised Air Dispersion Modelling report says “This assessment considers one emission scenario, namely peak emission year (2026) for the surface flux of landfill gas, as derived from GasSim simulations.” However, the emission rates shown in Table 2.2 of the same page were not consistent with the GasSim simulations, especially for the odour surface emissions. **Please revise and resubmit.**

***Response:** Table 2.2 has been revised and is included below as Table 2.1. The model has been re-run, incorporating these revised odour emission rates and the revised modelled 98th percentile odour concentrations at the sensitive receptors are included in Table 2.2. Revised results for hydrogen sulphide (H₂S) and carbon disulphide (CS₂) are contained in Tables 2.3 to 2.5 including the WHO odour criterion for hydrogen sulphide of 7 µ/m³ as a maximum half-hourly average.*

It can be seen that the emission rates from the landfill cells for odour, extracted from the GASSIM model output files, are approximately one-third of those used in the June 2014 report, which were calculated from measured data contained in SNIFFER Report ER31. The GASSIM results for Cell 4 were taken from the average of the tabulated emissions for the year 2026, which were the highest predicted emissions. The odour emissions from the other three cells were similarly taken from the average of the same year, 2026.

An identical approach was taken for hydrogen sulphide and carbon disulphide to derive the revised surface emission rates contained in Table 2.1.

Table 2.1 Revised odour, hydrogen sulphide and carbon disulphide surface emission rates

Emission Source	Area (m ²)	H ₂ S, g/s/m ²	CS ₂ , g/s/m ²	Odour, ou _E /s/m ²
Cell 1	14958	0.00000005 (0.00000004)	0.00000003 (0.00000002)	0.06 (0.0067)
Cell 2	17808	0.00000002 (0.00000002)	0.000000008 (0.00000001)	0.02 (0.0067)
Cell 3	26309	0.00000003 (0.00000004)	0.00000002 (0.00000002)	0.04 (0.0067)
Cell 4	19732	0.00000033 (0.00000028)	0.00000017 (0.00000014)	0.344 (1.051)

Numbers in brackets are the emission rates contained in the June 2014 report.

Table.2.2 Re-modelled 98th percentile odour concentrations at sensitive receptors

Receptor	AQS, ou _E /m ³	PC, ou _E /m ³	%PC of AQS
Parry's Cottages	3	0.7	23
Holiday Inn	3	0.6	20
Shell Service Station	3	0.9	30
The Box	3	1.4	47
Alltami House	3	1.4	47
Pinfold Cottage	3	1.4	47
Ewloe Wood House	3	1.2	40
Costa & Subway Outdoor Eating Areas	3	1.1	37
Ewloe Barns Industrial Estate	3	0.3	10
SCANIA and other business/industrial units (to north of site)	3	6.1	203
FCC and other office/ business units (to south-west of site)	3	0.3	10
OK Diner Restaurant	3	1.1	37
Permitted Development (to south-east of site)	3	1.1	37

Table 2..3 Re-modelled 1-hour hydrogen sulphide concentrations at sensitive receptors

Receptor	AQS, µg/m ³	PC, µg/m ³	% PC of AQS
Parry's Cottages	150	4.8	3
Holiday Inn	150	6.8	5
Shell Service Station	150	8.4	6

Receptor	AQS, $\mu\text{g}/\text{m}^3$	PC, $\mu\text{g}/\text{m}^3$	% PC of AQS
The Box	150	7.4	5
Alltami House	150	7.6	5
Pinfold Cottage	150	7.2	5
Ewloe Wood House	150	6.3	4
Costa & Subway Outdoor Eating Areas	150	8.8	6
Ewloe Barns Industrial Estate	150	4.2	3
SCANIA and other business/industrial units (to north of site)	150	15.8	11
FCC and other office/ business units (to south-west of site)	150	7.3	5
OK Diner Restaurant	150	8.6	6
Permitted Development (to south-east of site)	150	6.0	4

Table 2.4 Re-modelled half-hourly maximum hydrogen sulphide concentrations at sensitive receptors

Receptor	AQS, $\mu\text{g}/\text{m}^3$	PC, $\mu\text{g}/\text{m}^3$	% PC of AQS
Parry's Cottages	7	5.3	76
Holiday Inn	7	7.6	109
Shell Service Station	7	9.0	129
The Box	7	8.4	120
Alltami House	7	8.1	116
Pinfold Cottage	7	7.8	111
Ewloe Wood House	7	7.0	100
Costa & Subway Outdoor Eating Areas	7	9.6	137
Ewloe Barns Industrial Estate	7	4.8	69
SCANIA and other business/industrial units (to north of site)	7	16.1	230
FCC and other office/ business units (to south-west of site)	7	8.2	117
OK Diner Restaurant	7	8.7	124
Permitted Development (to south-east of site)	7	6.6	94

Table 2.5 Re-modelled short term concentrations of carbon disulphide at sensitive receptors

Receptor	AQS, $\mu\text{g}/\text{m}^3$	PC, $\mu\text{g}/\text{m}^3$	% PC of AQS
Parry's Cottages	100	2.5	2.5
Holiday Inn	100	3.6	3.6
Shell Service Station	100	4.4	4.4
The Box	100	3.9	3.9
Alltami House	100	4.0	4.0
Pinfold Cottage	100	3.8	3.8
Ewloe Wood House	100	3.3	3.3
Costa & Subway Outdoor Eating Areas	100	4.6	4.6
Ewloe Barns Industrial Estate	100	2.1	2.1
SCANIA and other business/industrial units (to north of site)	100	8.2	8.2
FCC and other office/ business units (to south-west of site)	100	3.9	3.9
OK Diner Restaurant	100	4.5	4.5
Permitted Development (to south-east of site)	100	3.2	3.2

- 24 Based on our check modelling, we agree with the AMEC's conclusion that it is unlikely the predicted emissions from the proposed installation will have a significant impact on NO₂ air quality at the selected receptors and on the relevant habitats sites in terms of the relevant Critical Levels and Critical Loads. We agree with the AMEC's conclusion that it is unlikely the predicted emissions from the proposed installation will have a significant impact on health in terms of H₂S EAL and CS₂ EAL. Both AMEC and our check modelling (with GasSim simulations) predicted that the maximum 98th percentile hourly concentration is likely to exceed the 3 OUE/m³ indicative odour threshold at several selected locations. Our check modelling also indicated that the WHO¹ H₂S odour annoyance guideline value of 7 $\mu\text{g}/\text{m}^3$ (30 minutes averaging time) is likely to be exceeded at some selected locations. **This needs to be considered in both the modelling assessment and the Odour Management Plan.**

Response: In comparison to the modelled odour concentrations contained in the June 2014 report, these revised odour concentrations are lower – the comparative modelled concentration at SCANIA was 11.1 ouE/m³. With the exception of Parry's Cottages, Ewloe Barns Industrial Estate and the permitted development to the south east of the site, the WHO half-hourly average guideline value for hydrogen sulphide is exceeded at the receptors.

¹ WHO Air Quality Guidelines for Europe, second edition.

Additional measures to control odour from landfilling activities are addressed in the Odour Management Plan for the site.

Revised ADMS model files are provided at Appendix B (CD File only). The revised Odour Management is provided to Appendix C.

- 25 Regarding the last paragraph on page 5 of the Final Revised Air Dispersion Modelling report - Please **clarify if cell 4 is the active cell. How was the SNIFFER ER31 report used in the odour emission calculation?**

Response: *The emission rate for cell 4 in an active state was calculated as detailed in section 2.2 of the Final Revised Air dispersion modelling report, as a worst case assumption. Cell 4 was assigned as the Active working cell in the modelling, this being closest to the nearby receptor locations. The odour emission rates from the capped cells 1, 2 and 3 were assigned using the data in SNIFFER Report ER31 values in Table 8. However, the odour emission rates have now been harmonised with those used in the GASSIM model and the results are presented in Table 2.2 above.*

- 26 With regards to Table 2.1 of the Final Revised Air Dispersion Modelling report: **What were the oxygen and water vapour contents in the engine exhaust and flare exhaust? How was the flare efflux velocity estimated? The flare diameter was 1.2 m in Table 2.1 but 1.0 m in GasSim file, please explain this discrepancy.**

Response: *The volume flow rates of flue gas for the engine are calculated from the inlet gas quality, the electrical generation, engine efficiency and exhaust temperature. These calculations are based on information given in the EA Guidance on monitoring protocols from spark ignition landfill gas engines (LFTGN 08) and are summarised below.*

The electrical output (kWe) is divided by the generation efficiency (%) to calculate the thermal input required by the engine (kWth). Using the percentage of methane in the incoming landfill gas, and the calorific value of methane (MJ m⁻³), the amount of methane required per second to provide the thermal input can be calculated (m³ s⁻¹). The non-combustible element of the incoming gas is then added to the methane to calculate the total landfill gas (m³ s⁻¹) required by the engine to generate the electrical output.

To calculate the exhaust gas flow rate, the stoichiometric theoretical waste gas volume (m³ m⁻³) for methane is multiplied by the methane gas feed rate (m³ s⁻¹) and the non-combustible element (m³ s⁻¹) is subsequently added resulting in the total exhaust gas volume (Nm³ s⁻¹) at 0% oxygen content, dry gas and 288K. Using the equations given in Environment Agency technical guidance note M2 this exhaust gas volume is corrected to reference conditions (m³ s⁻¹) then multiplied by the emission limit value (mg m⁻³) to produce a pollutant mass emission release rate (g/s) required by the model.

The exhaust gas volume flow rate (Nm³ s⁻¹) is then corrected using the same equations to actual exhaust conditions (Am³ s⁻¹). Dividing this parameter by

the cross-sectional area of the discharge point (m²) provides the actual efflux velocity (m s⁻¹). The reference conditions quoted in the table are 273 K, 101.3 kPa, 5% oxygen content for the engine. The emission rates for the landfill gas engine have been calculated based on the Environment Agency benchmark ELVs, for an engine installed after 31 December 2005 and the specifications of the engines, such as the capacity, efflux temperature and efficiency. A similar approach was used for calculating the flue gas flows from the landfill gas flare, other than the oxygen reference condition was 3%.

With regard to the differences in the assumed diameter of the flare between the GASSIM and ADMS 5.1 model, the slightly larger diameter (1.2 m) assumed in the ADMS 5.1 model would result in slightly higher ground level concentrations of nitrogen dioxide than would be the case if the diameter was 1.0 m. This is because the emission velocity of the exhaust gases would be lower, thus generating a smaller degree of plume rise. We are therefore of the opinion that the results of the assessment contained in the June 2014 report are conservative and the change in assumed diameter of the flare stack would not change the conclusions of the report with regard to nitrogen dioxide ambient air quality.

- 27 With regards to Table 2.2 of the report. H₂S and CS₂ emission rates from Cells 1 and 4 were smaller than GasSim simulations; Odour emission rates from Cells 1, 2 and 3 were smaller than GasSim simulations but bigger for Cell 4. **Please explain these discrepancies.**

Response: The emission rates have been harmonised with those contained in the GASSIM model and the revised modelling results are contained in Tables 2.3 to 2.5 above.

- 28 The surface roughness has been adjusted from 0.75 m to 0.5 m in their submitted ADMS modelling files for NO_x and odour, but not for H₂S and CS₂. We would consider that even 0.5 m is probably too high. Furthermore no sensitivity analysis has been carried out on this. **Please carry out sensitivity analysis and explain why H₂S and CS₂ have been omitted.**

Response: We remain of the opinion that the originally selected surface roughness figures for the modelling are appropriate for this model domain, given the topography around the landfill site itself, which will be "rougher" than the surrounding area, which consists of rough pastureland, hedges, hedgerow trees and belts of trees. We are, therefore, of the opinion that surface roughness values of 0.5 to 0.75 are appropriate for this location and do not consider that a sensitivity analysis is required, as smaller surface roughness values are clearly not appropriate for this location and small differences in surface roughness categories do not have significant effects upon the model results. However, the model results for hydrogen sulphide and carbon disulphide, reported above in Tables 2.2 to 2.5, have been obtained using a model domain surface roughness value of 0.5.

- 29 Table 2.6 of the report cites Buckley Clay Pits as a SSSI. The site is also a SAC site (SAC Deeside and Buckley Newt sites, UK 0030132). Furthermore, the

closest site of the Dee Estuary is about 4 km, not 7 km. There is also an Ancient and Semi Natural Woodland site, about 400 m from the proposed installation, which should have been included in the modelling assessment. **Please revise accordingly.**

***Response:** The position of the closest part of the Dee Estuary has been checked and the model has been re-run. In addition, the Ancient and Semi natural Woodland site some 400 metres distant has been located using the Forestry Commission mapping web site (http://maps.forestry.gov.uk/imf/imf.jsp?site=fcwales_ext&) and the model has been re-run for this location. The results for nitrogen oxides concentrations and nitrogen deposition are included in Table 2.6 below.*

Table 2.6 Nitrogen oxides concentrations at Ancient Woodland site

Parameter	AQS/CL	Background	PC	PEC	PEC % of AQS
Annual Average NO _x , µg/m ³	30	20	0.1	20.1	67
Max Daily Average NO _x , µg/m ³	75	40	8.0	48.0	64
Nitrogen Deposition, kg/ha/y	10-20	38.08	0.03	38.11	381

For annual average NO_x, the PC of 0.1 µg/m³ adds only a very small amount to the existing background concentration and the PEC complies with the AQS. Similarly, the PEC for the maximum 24-hour NO_x concentration also complies with the AQS. For nitrogen deposition, the very small increase of 0.03 kgN/ha/year is dwarfed by the existing background deposition rate of ~38 kgN/ha/year.

- 30 In the second paragraph of page 19 it states “Data from the FRAME model can be extracted via the Air Pollution Information Service (APIS) website. The APIS website no longer uses FRAME outputs. **Please revise accordingly.**

***Response:** We note that the use of the FRAME model has been discontinued and that the EMEP4UK unified model is now used for providing information to the APIS web site.*

Landfill Gas Risk Assessment

- 31 **Question 33 - 34. Please confirm the depth of each lift. We presume this depth to be 10 metres? Once each lift then reaches 10m will drilled sacrificial wells be installed? What routine monitoring would be performed to establish when gas could be extracted?**

***Response:** The depth of each lift will be a maximum of 2m (see response to question 18 in previous Schedule 5 notice 4/6/14).*

Horizontal pipework (rather than drilled i.e. vertical wells) has been proposed as a 'sacrificial' system that will allow gas to be collected from the entire waste mass as soon as practicable during landfilling as the thickness of waste in each cell increases. This will be achieved by installation of a minimum of three 'levels' of horizontal pipework in each cell (i.e. one level in the lower, middle and upper ~10m of waste as shown on drawings 30030ESID/08 and 30030/GRA/01 as well as new drawing ESID/SK001). The lowest level horizontal trenches (i.e. those in the bottom level) should be installed at least 6m above the base to avoid potential flooding by mounded leachate.

As stated in the ESID Report, typically landfill gas extraction will commence when approximately 10m of waste have been deposited, although this varies on a site specific basis (only 4-6m may be sufficient in this case as discussed in the Landfill Gas Risk Assessment).

Routine monitoring will identify if there is sufficient gas volume generated that would require management controls to be implemented at an earlier date. This will include surface emissions monitoring via FID surveys as identified by supporting subjective odour monitoring as well as monitoring of the leachate monitoring wells installed within each cell during construction.

- 32 **Question 35.** Horizontal pipework is prone to collapse and bending, clogging and poor application of pressure gradients at any distance from the source of suction. They are prone to air ingress and can promote fires and cross interference. NRW cannot support the use of horizontal wells unless it was as an early addition to the installation of vertical wells at the requisite depth. Three layers of horizontal pipework with no defined time for the installation of vertical wells may result in gas system failure, oxygen ingress and cross interference along with high pressure losses along the length of the pipe. Horizontal pipework balancing is different to vertical balancing as pressure is applied over a large distance and area horizontally requiring a much greater extraction pressure to be applied to the pipe to create the vacuum over the whole pipe which would cover the same waste area as several targeted drilled wells. Finally pressure and gas flow is applied to a much greater extent in the horizontal plane due to the nature of horizontal compaction in a modern landfill. This means it is even more difficult to apply suction from the horizontal plane to the vertical as opposed to the other way around. NRW does not accept that the horizontal extraction system design will meet the benchmark extraction efficiency of 85% due to the reasons stated above and practical evidence gleaned from such trials at other landfills in Wales. **Please clarify whether or not horizontal wells are proposed as a permanent means of gas extraction. If they are not proposed as a permanent fixture, please clarify how long these are proposed to be in operation for and what system will replace them.**

Response: *As per our response to point 31 from this latest Schedule 5, the horizontal wells are proposed as an early 'sacrificial' system that will allow gas to be collected from the entire waste mass as soon as practicable during landfilling as the thickness of waste in each cell increases. Our definition of 'sacrificial' is that of the management of landfill gas ICoP, i.e. an indefinable,*

but limited life expectancy. The horizontal wells will be supplemented by vertical extraction wells that will be added over finished surfaces of the site (i.e. after capping) to enhance landfill gas capture. The vertical extraction wells will be installed between the horizontal trenches within the 127m AOD contour area at 40m spacing as shown on drawing ESID 8.

The intention is to continue extracting landfill gas from the horizontal wells for as long as it is feasible to do so, i.e. at least for the duration of landfilling, although it should be noted that these horizontal wells will no longer form the only means of extracting landfill gas from the site once the vertical wells are installed. We have put forward our justification of the use of horizontal wells in previous Schedule 5 responses, notably the responses to Q34-36 in the previous Schedule 5 dated 3rd March 2014. However, given NRW's concerns and if it should become evident that the sacrificial horizontal wells are not performing adequately to extract landfill gas from the site prior to the installation of the permanent vertical gas extraction wells, then proposals will be submitted for NRW's approval to install vertical gas extraction wells (i.e. retro drilled pin wells) within the waste mass at a suitable spacing as soon as practicable after approval, along with decommissioning of the horizontal gas collection system to prevent air ingress into the waste mass. Should parts, or all, of the horizontal collection system start to fail after the site has been capped and the vertical wells installed, then proposals will be submitted for NRW's approval to install supplementary vertical retro-drilled gas extraction wells in the affected area(s) of the landfill.

- 33 **Question 36.** Representative in-waste gas monitoring cannot be provided by monitoring at gas manifolds. Where suction has been applied, the influence of the vacuum and drop out of moisture as well as the introduction of air does not provide a representative sample. The only way to provide a representative sample is to sample from a well that is not under extraction. However the monitoring of gas at wells and in gas mains is a useful tool in gauging the state of the active system.

The Global Methane Initiative citation highlights the disadvantages of horizontal wells. NRW would expect the best practice option to be taken to fulfil the stated aim of reducing emissions to acceptable levels based on evidence garnered from sites across the UK. **Please revise the proposed gas extraction system accordingly and submit.**

Response: *The Global Methane Initiative citation does indeed highlight the disadvantages of horizontal wells but it also highlights the disadvantages of vertical wells. As per our response to points 31 and 32 in this latest Schedule 5, the horizontal wells have been specified as a sacrificial system that will allow gas to be collected from the entire waste mass as soon as practicable during landfilling as the thickness of waste in each cell increases. Note that potential delay in gas extraction is cited as a disadvantage of conventional vertical wells.*

The landfill gas ICoP on the management of landfill gas from March 2012 does include discussion and description of horizontal wells (Section 7.2.4)

citing their main advantage as being able to be placed in active tipping areas to allow landfill gas extraction whilst tipping continues. This is exactly the reason why the sacrificial horizontal well system has been proposed for this site. Because horizontal wells are discussed positively within the ICoP, we contend that their use in a sacrificial system is the best practice option to fulfil the stated aim of reducing emissions to acceptable levels.

With regard to representative in waste gas monitoring, NRW's point regarding representative the use of gas manifolds for in-waste gas monitoring is noted and accepted. However, Section 2.4.5 of the ESID, as well as Table ESID 10, do state that in waste gas monitoring will also be achieved using gas sampling valves fixed to the leachate wells.

- 34 **Question 37:** Responding to an outage of extraction and combustion plant the next working day at this site would not be acceptable as gas control is vital due to the nature of the location and sensitivity of the site. **Please explain how the severity of an out of hours incident can be gauged if it is not attended. Do you propose to install a standby booster to ensure as little plant downtime as possible? If so, will the system include a variable speed booster to allow a range of delivery pressure?**

***Response:** Modern landfill gas utilisation plants incorporate telemetry to warn operators of plant failures/outages and it is anticipated that such a system would be installed at the plant that would allow the operator to gauge the severity of the out of hours incident. The technician on duty would be notified of the outage and would response within the agreed response time. Details of the response times would be agreed with NRW as part of the detailed landfill gas management plan (see response to point 38).*

Design details of the booster(s) has not been provided at the application stage because the detailed design of the landfill gas plant has yet to be carried out. The detailed design of the landfill gas plant would be agreed in advance with NRW prior to construction and may well include standby and/or variable speed boosters.

- 35 **Question 38.** We note and accept your proposals.

No response required.

- 36 **Question 39.** The decreased depth over which sub surface migration can occur does not in the opinion of NRW decrease the risk of migration. It can in some circumstances cause the gas to move further out from the site. The evidence from many sites with clay lining systems is that they suffer from lateral migration both of the advective and diffusive kind. Please refer to previous comments on the control of leachate perching as this is critical in the build-up of pressurised gas at depth under the perching causing increased likelihood of lateral migration. In the opinion of NRW the containment system proposed at this site does not represent a barrier to lateral migration. Furthermore the measures and standards applied to the whole extraction system, the type of extraction system and the maintenance of the system

would be the most critical aspects of preventing migration at this site based on previous experience. **Will there be provision in the landfill gas extraction system for the installation of pumps at depth?** Please Note: such pumps could not be installed in horizontal pipework.

Response: *We maintain that the combination of passive, engineered and hydraulic containment as well as landfill gas collection, abstraction, flaring and utilisation infrastructure proposed in the ESID and Landfill Gas Risk Assessment will present a significant barrier to lateral migration. If lateral migration were to occur, then we expect that this would be dominated by slower advective flows, which are driven by concentration differentials, and would be detected by the network of perimeter monitoring boreholes that would be installed (refer to our response to point 38 in this latest Schedule 5 regarding borehole spacing). Faster advective flows, which are driven by pressure differentials, would be even less likely (i.e. as a result of a sudden containment breach) and the pressure differential induced by the active gas extraction system would likely draw gas into, rather than allow migration from, the waste mass in such an unlikely scenario.*

Leachate management is described in Section 2.3 of the ESID report and includes justification for the use of sidewall risers for leachate pumping purposes. This section also notes that at the base of the side wall, the side wall and basal liners will be locally thickened to take account of the leachate. The side wall will be constructed with a 3.0m thickness (measured perpendicular to the slope) of liner, and the basal liner thickened to 1.0m. The leachate collection blanket installed up the side walls of the landfill should also serve to equalise landfill gas pressure build-up against the sidewall further reducing the likelihood of sub surface migration during landfilling (refer to new drawing ESID/SK001) although these may need some form of temporary capping if there was to be significant migration of landfill gas detected through this layer.

Notwithstanding the above, and to accommodate possible redundancy within the proposed leachate management infrastructure, reinforced concrete target pads will be constructed for any retro drilling of vertical leachate extraction wells if this becomes necessary. Furthermore, the vertical landfill gas extraction wells installed after capping will be installed at an appropriate diameter to accommodate leachate pumps, where necessary.

37 **Question 40.** No further comments.

38 **Question 41.** As previously stated, due to the sensitivity of this site and the distance to sensitive receptors, we do not accept the proposal of perimeter monitoring boreholes being spaced every 50 metres. **Please revise your perimeter monitoring proposals in line with Table 8.1 of LFTGN 03 and provide detailed proposals for the gas extraction system as mentioned previously.**

Response: *Detailed proposal for the gas extraction system are provided within the ESID and Landfill Gas Risk Assessment and are further discussed in our responses to points 31-33 within this latest Schedule 5. NRW have*

expressed a number of concerns with the landfill gas extraction system (including the need to manage perched leachate and pump basal leachate as part of the operational gas management of the site, along with regular gas field balancing by technically competent personnel). It has been agreed with NRW at a meeting on 30 January 2015 that these issues will be considered by developing a detailed landfill gas management plan for the site which would be required either before determination of the permit or as a pre-operational condition.

The spacing of the monitoring boreholes will be in accordance with the guidance provided in LFTGN03 and based on the ground conditions at the site we anticipate that a 50m borehole spacing will be sufficient for perimeters of the site where there are no sensitive receptors. The boreholes will be spaced more closely in areas on the basis of risk assessment where there are sensitive receptors, identified on drawing ESID/13A rev4. In these areas, and subject to agreement with NRW, the boreholes may be at 10-25m spacing. Detail on the borehole spacing including a plan will be provided in the detailed landfill gas management plan for the site mentioned above.

- 39 **Question 42.** NRW would prefer to see some baseline readings from drilled gas monitoring boreholes at relevant points around the site. However we note the difficulties you encounter. Discussion is needed regarding alternatives.

***Response:** Note from the revised ESID13A drawing and commentary in Section 3.6.1 of the ESID that four of the monitored boreholes (PQGW1, PQGW4, PQGW6 and PQW1-00) are actually located outside the proposed landfill footprint, approximately with one of these boreholes each on the northern, eastern, southern and western perimeters. Therefore our response to Question 42 in the previous Schedule 5 notice is partially incorrect. We agree that it would be beneficial to continue collecting baseline data and this will be collected initially on a monthly basis as described in section 3.6.3 of the ESID for a period of at least 6 months with regular review of the results.*

The number/spacing of perimeter boreholes is further discussed in our response to point 38 from this latest Schedule 5 notice.

- 40 **Question 43.** No further comments.

- 41 **Question 44.** Although the proposals appear to satisfy some of the requirements for the control of landfill gas at this site, the borehole spacing is not agreed. Background gas levels have not been established, in NRW's opinion the extraction system is not of robust enough design for reasons stated above and there is no provision made for perched leachate. This means that the proposed horizontal system is likely to flood and settle, have poor applied suction across its length, introduce excess air into the system turning part of the waste aerobic eliciting potential thermal events; therefore NRW cannot be confident that the system as designed will meet the stated aims. **As previously stated in point 46, please revise your perimeter monitoring proposals in line with Table 8.1 of LFTGN 03 and provide**

detailed proposals for the gas extraction system as previously mentioned.

Response: *Refer to our responses to points 31-33 and 38 within this latest Schedule 5.*

42 **Question 45.** No further comments.

43 **Question 46.** Please see our response to question 39.

Response: *Refer to our responses to point 36 within this latest Schedule 5.*

44 **Question 47.** Again we refer you to our response to question 39. All liners are subject to small tears and cracks especially as mass is drawn from the site and settlement occurs. Almost all capped sites in Wales have had some emission from capped areas. The critical element as you rightly point out is the efficacy of the collection system. This is predicated on the installation, maintenance and dewatering of the system on a rolling basis. The applicant should include provision to deal with perched water in the site as this is a continuous problem for all landfill sites in Wales. **The collection and utilisation of gas, ensuring gas pressure does not build up is predicated on keeping the system de-watered. Please detail how you propose to ensure this will take place? Please see point 39 above with regard to restricting the depth of sub-surface migration.**

Response: *Leachate management (i.e. 'de-watering' of the waste mass) and sub-surface migration are discussed in our response to point 36 within this latest Schedule 5. The leachate management infrastructure is described in detail in Section 2.3.4 of the ESID and shown on drawings ESID06 and ESID07. Also refer to new drawing ESID/SK001 which shows in a simplified manner what we anticipate would likely occur to landfill gas trapped below perched leachate during landfilling and after permanent capping. Also refer to our response to point 38 regarding production of a detailed landfill gas management plan.*

45 **Question 48.** The key starting point for a fire is the introduction of air pulled through the waste mass, turning parts of the site partially aerobic and causing a heating effect. As discussed in previous points, NRW believes that horizontal pipe-work is likely to exacerbate this effect. Further, if valves are switched off on a horizontal system then a large area of extraction is lost. Please detail how would this be compensated for. With vertical systems this would not be the case. A balance must be struck between capturing greenhouse gas as soon as possible and reducing the risk of fires. NRW does not consider that the current proposals are adequate to achieve this. Please see previous points for comments on gas balancing in horizontal pipe-work. The network of vertical wells will not be installed until the operations reach final levels, thus relying on a purely horizontal system for many years. Such a system has not been applied successfully in any modern landfill in Wales, therefore this design is not acceptable to NRW in its current

form. **Please re-design the landfill gas extraction system using a more conventional vertical well system.**

Response: Refer to our responses to points 31-33 and 38 within this latest Schedule 5.

Part B Noise Assessment

46 We do not support your view that because the noise assessment submitted with the EPR application has already been examined at Public Inquiry in 2008 and the proposed site has been through the planning system, a review of the noise assessment is not required for the permit application. This does not constitute a suitable response to our request for further information.

Planning and environmental regulation are two separate areas, and the noise assessments that accompany each application are used for different purposes. The proposed site will be regulated by NRW under the EPRs. NRW need to ensure that the site is managed appropriately and adheres to the relevant standards and controls in order to prevent noise pollution. Based on the information supporting the permit application it is not possible to verify the predictions and conclusions in the noise assessment for operational noise from the site.

In order to do this and to evaluate the environmental risk from operations at the site we require the Applicant to submit an appropriate noise impact assessment for EPR application. The supplied Environment Agency (EA) document gives the general information requirements that should be included in a noise impact assessment supporting an EPR application. The following issues should also be addressed by the applicant in their noise impact assessment:

- **Noise source sound power data and how they were derived (e.g. from measurement, manufacturer information or from a particular standard).**
- **Noise modelling files or calculations (e.g. spreadsheet calculations) should be submitted with the assessment.**
- **Worst-case operational scenario with any noise sources that operate concurrently combined into the assessment.**
- **Monitoring locations and weather conditions during the baseline monitoring survey should be included with the assessment (Appendices 9.1 to 9.2 were not included with the current submitted noise assessment).**

Response: Attached is the Noise Management Plan dated October 2013 submitted to the Planning Authority to discharge planning conditions 10 & 11 (Appendix D) which sets out the baseline conditions, mitigating measures and a monitoring programme to protect local noise sensitive receptors. We consider any further information can be dealt with by a pre operational condition.

Attachments Accompanying the Schedule 5 Response

Appendix A
Groundwater Levels 2011-2014

Appendix B
Air Quality Model Files (CD only)

Appendix C
Revised Odour Management Plan
(AMEC Report Ref 30030rr033i2 dated 3 February 2015)

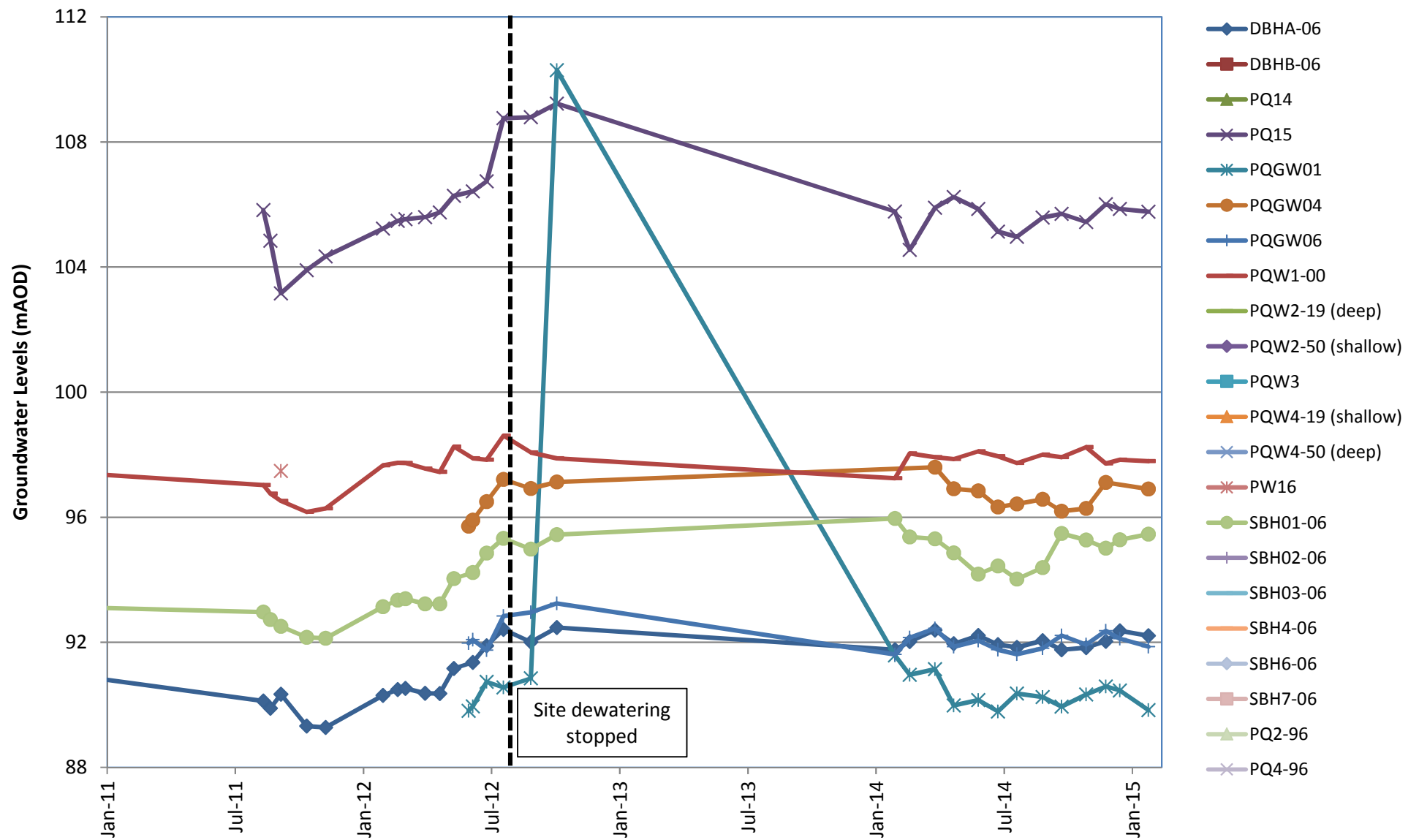
Appendix D
Noise Management Plan October 2013

Drawings
Drawing SK001
Drawing ESID/13A (Rev 4)

Appendix A

Groundwater Levels 2011-2014

Parry's Quarry Landfill - Groundwater Levels (2011-2015)



Appendix B

Air Quality Model Files (CD only)

Appendix C
Revised Odour Management Plan
(AMEC Report Ref 30030rr033i2 dated 3 February 2015)



RJS Civil Engineering Ltd

Parrys Quarry Environmental Permit Application

Odour Management Plan



3 February 2015

AMEC Environment & Infrastructure UK Limited

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Document Revisions

No.	Details	Date
1	Final Issue	June 2014
2	Revised Version	3 February 2015

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RJS Civil Engineering Ltd

Parrys Quarry Environmental Permit Application

Odour Management Plan

3 February 2015

AMEC Environment & Infrastructure
UK Limited



ISO 9001 – FS 13881
ISO 14001 – EMS 69090

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1. Introduction

1.1 Background

In 2011 Robin Jones and Sons Limited has commissioned AMEC Environment and Infrastructure (UK) Limited (AMEC) to provide, inter alia, an odour management plan (OMP) for the proposed landfilling activities a Parry's Quarry, to support the permit Application process.

Following a review of the report by the Environment Agency Wales, now Natural Resources Wales (NRW), a Schedule 5 Notice was issued by NRW which contained several identified issues with the odour management plan. Detailed responses have been made to these Schedule 5 issues and these are contained in a separate document but a summary of the main points and responses to them are included below.

This report contains an updated impact assessment of emissions of NO_x from the landfill gas electricity generation plant and flare that will be operational on the site and also an evaluation of the fugitive emissions of hydrogen sulphide (H₂S), carbon disulphide (CS₂) and odour from the landfill operations.

1.2 Purpose of this Odour Management Plan

The purpose of this odour management plan (OMP) is to provide a framework within which the proposed Parry's Quarry landfill site can be operated and managed so that the risk of odour annoyance or nuisance arising for the local community is prevented or minimised as far as is practicable. It details appropriate operational and control measures for the management and control of odour on the site, in addition to providing details such as contact names and methods for direct communication with neighbouring local communities. It is also a requirement that the OMP must be compliant with the requirements of Environment Agency Horizontal Guidance document H4¹.

1.2.1 OMP Objectives

OMPs should be developed with three pollution prevention objectives clearly in mind:

- to employ all appropriate methods to minimise the emissions of odorous substances and subsequent exposure/ impact;
- to prevent exposure of people outside the site to levels of odour which would result in annoyance (unacceptable pollution); and
- to minimise the risk of unplanned odour release incidents or accidents which would result in annoyance.

¹ Environment Agency (2011) H4 Odour management. How to Comply with your Environmental permit

This OMP will serve to aid the decision-making process on the choice of controls, general site design, and operational practice in line with current industry best practice. The OMP is a working document with the specific aims of ensuring:

- odour impact is considered as part of routine inspections;
- to minimise the risk of unplanned odour releasing incidents or accidents that could result in annoyance;
- odour is primarily controlled at source by good operational practices, the correct use and maintenance of plant, and operator training; and
- all appropriate measures are taken to prevent or, where that is not reasonably practicable, to minimise odorous emissions to air from the landfill.

1.2.2 OMP Methods

The methodologies presented take full account of Environment Agency (EA) guidance documentation, as detailed below:

- LFTGN 03: Guidance on the management of landfill gas, dated September 2004;
- LFTGN 04: Guidance for monitoring trace components in landfill gas version 3.0, dated 2010;
- LFTGN 07: Guidance for monitoring landfill gas surface emissions version 2.0, dated 2010;
- Internal Guidance for the Regulation of Odour at Waste Management Facilities;
- Environment Agency Technical Guidance Note H4 – Odour Management 2011;
- Environment Agency Guidance for the Landfill Sector EPR S5.02, dated March 2009; and
- Appendix 10, How to apply for an environmental permit Part B: New permit guidance notes.

All OMPs, including this document, contain a number of basic elements:

- sources, releases and impacts;
- controls;
- monitoring;
- contingencies;
- emergency plans.
- Community Interaction; and

- Responsible Persons.

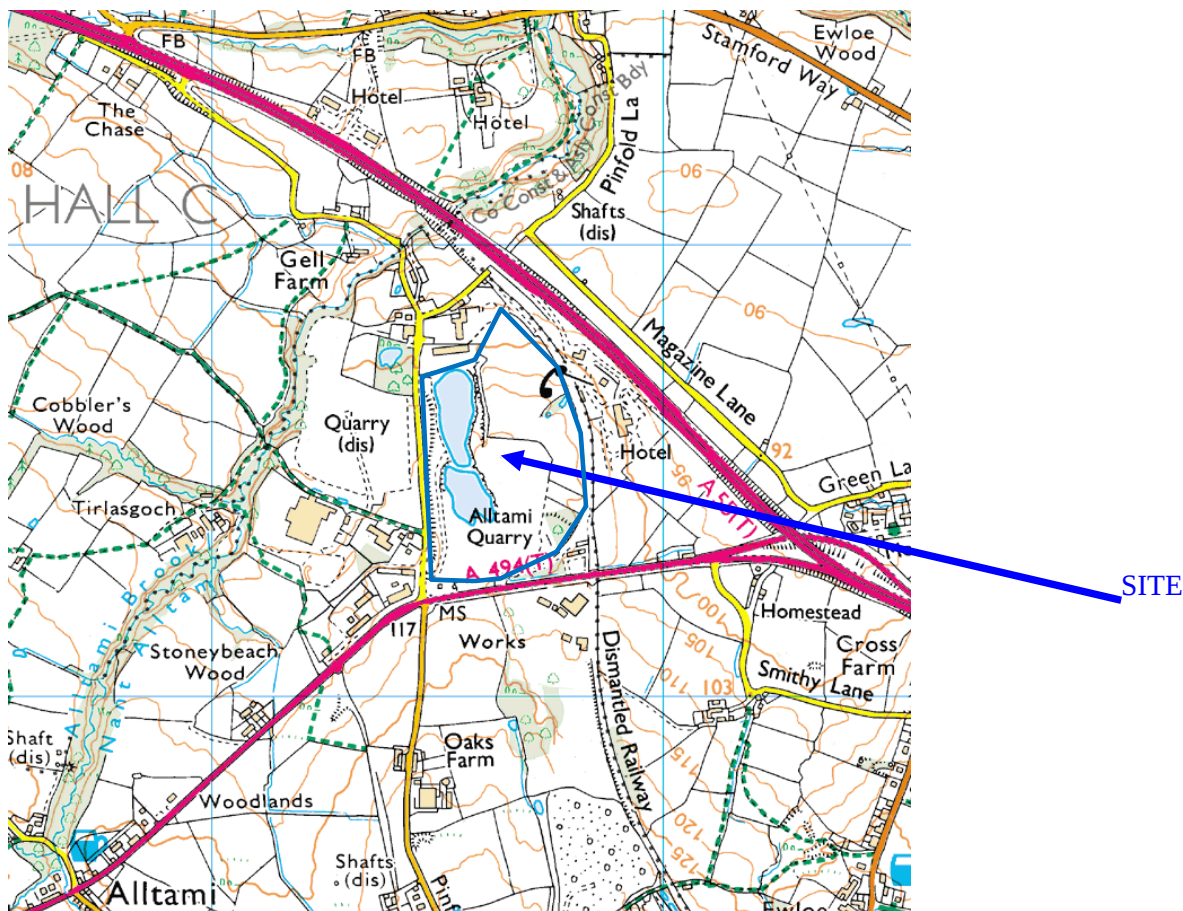
Appendix A contains examples of standard forms that are used for site inspections, daily assessment reports, odour complaint record forms and OMP review records.

2. Site Description

2.1 Site Location and Nearby Receptors

Robin Jones and Sons Ltd currently operates a waste transfer station and conducts mineral extraction activities at the Parry's Quarry site. This site is located 1km to the northeast of the village of Alltami, Flintshire, north-east Wales, lying to the west of the junction of the A55(T) with the A494h. The location of the site is shown in Figure 2.1.

Figure 2.1 Location Map



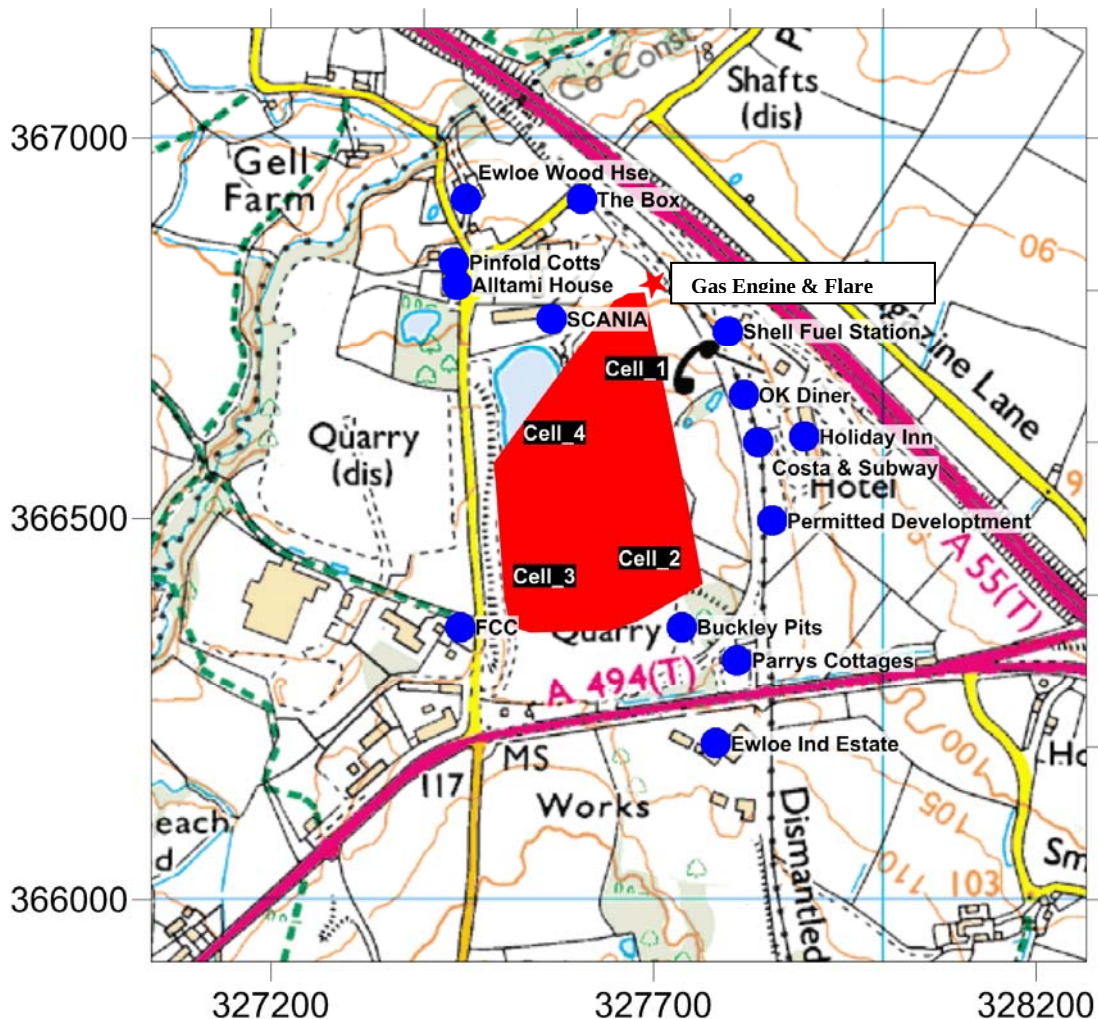
Note: Based on Ordnance Survey Maps with the permission of the controller of Her Majesty's Stationery Office ©.
AMEC UK Limited AL100001776.

There are a number of industrial, commercial and residential properties within relatively close proximity to the proposed landfill site, to the south, south-west, east and north. These are identified in Table 2.1 and Figure 2.2 below.

Table 2.1 Details of Sensitive Receptors

Receptor Name		Easting (m)	Northing (m)
1	Parry's Cottages	327808	366314
2	Holiday Inn	327897	366607
3	Shell Service Station	327799	366746
4	The Box	327606	366919
5	Alltami House	327443	366807
6	Pinfold Cottage	327439	366837
7	Ewloe Wood House	327455	366919
8	Costa & Subway Outdoor Eating Areas	327836	366600
9	Ewloe Barns Industrial Estate	327781	366204
10	SCANIA and other business/industrial units (to north of site)	327567	366762
11	FCC and other office/ business units (to south-west of site)	327447	366357
12	OK Diner Restaurant	327817	366661
13	Permitted Development (to south-east of site)	327855	366497

Figure 2.2 Locations of Sensitive Receptors Relative to Landfill Site

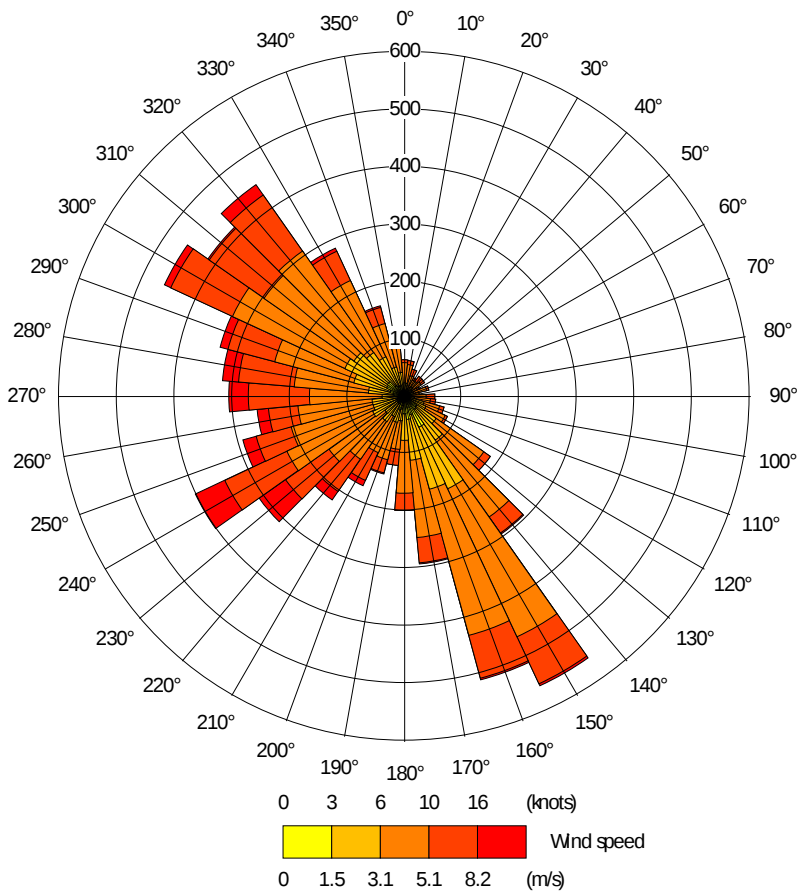


2.2 Local Meteorology

There is a Meteorological Office synoptic recording station at Hawarden some 7 km to the east of the site and a wind rose, showing the typical distribution and frequency of occurrence of different wind speeds and directions, in this case for 2007, is contained below in Figure 2.3. The wind rose depicts a prevailing south-easterly component over the modelled area, with lesser westerly and north-westerly components.

From this it would appear that locations to the north-west, south-east and east of the landfill site would be most at risk of any odour impacts arising from emissions from the landfill site.

Figure 2.3 2007 Hawarden Wind Rose



2.3 Current and Planned Site Activities

2.3.1 Current Activities

The site is currently operated by the applicant for the quarrying of materials for civil engineering purposes. Quarrying of the economic brick-making material at the site, especially the unit known as the Buckley Fireclay or Buckley Blue (the lower mudstones of the Ruabon Marl (Buckley) Formation), will continue in parallel with the proposed site restoration by landfilling with site-derived materials being utilised for engineering purposes as far as possible. The company currently operates under planning permission and Environmental Permit No. .

2.3.2 Planned Activities

The site was granted planning permission at appeal in 2009 and is to be permitted and operated as a non-hazardous landfill site accepting domestic, commercial and industrial wastes, i.e. municipal solid waste (MSW). The site will

be landfilled at a rate of 105,000 tonnes per annum over a 15 year period. The expected wastes will contain a significant putrescible content which historically requires active landfill gas management to prevent unacceptable emissions to the environment. The site will be divided into four cells of areas as shown in Table 2.2 below (these can also be seen in Figure 2.2 above). The operational hours for the site will be 07.30h – 18.00h Mondays to Fridays and 08.00h – 13.00h Saturdays, with no operation on Sundays.

Daily and intermediate cover material will be sourced largely from within the site's existing resources and the final cap for each component of the four main cells will be at least 1 metre of low permeability native clay cover over finished surfaces, overlain by vegetated topsoil.

Table 2.2 Landfill Cell Areas

Landfill Cell	Area (m ²)
Cell 1	14,958
Cell 2	17,808
Cell 3	26,309
Cell 4	19,732

2.3.3 Landfill Gas Management

Landfill gas will be actively extracted and collected from the decomposing deposited wastes as soon as is practicable after deposition and daily/ intermediate covering. The gas will be conveyed by pipeline to a gas utilisation and flaring compound on the north-east section of the site, where it will be combusted in a spark ignition engine to generate electricity for export to the Grid. When there is insufficient gas to run the engine and when the engine is undergoing planned maintenance, the gas will be combusted in an efficient enclosed flare. Further details can be found in the landfill gas management plan.

2.3.4 Leachate Management

The site will effectively operate as two hydraulic cells draining towards the perimeter at the interface of Cells 1 & 2 (east) and Cells 3 & 4 (west) at leachate heights of less than 84m AOD or as a single hydraulic unit at higher leachate heights, when the site is operated under hydraulic containment principals. The leachate collection system will consist of a continuous drainage blanket, lateral collection pipes, perimeter header pipes, cleanouts, leachate pump stations and a leachate rising main to the public foul sewer.

3. Sources, Releases and Impacts of Odour

This document has been compiled with specific regard to the non hazardous landfilling operations at the site. There are three primary potential odour sources associated with landfill sites accepting non hazardous (potentially putrescible) wastes:

- landfill gas (LFG);
- leachate; and
- incoming wastes.

A Landfill Gas Risk Assessment (LFGRA) and an air quality impact assessment have been produced in support of the Environmental Permit application for the site. The results of the air quality impact assessment have indicated that there is a potential risk of noticeable odour being detected off-site at one of the sensitive receptors (SCANIA and other business/industrial units to north of site. In addition, it has also identified that the WHO Guideline for hydrogen sulphide (H₂S) concentrations in air, averaged over a 30-minute period, could also potentially be infringed at 9 of the 13 receptors. This assessment was carried out using theoretical landfill surface emissions of odour and H₂S, generated by the GaSSim model and, as such, actual surface emissions would need to be validated for any specific landfill site.

Notwithstanding the potential uncertainties in the actual level of surface odour and H₂S emissions that will be generated from the landfill site, it is therefore prudent to put in place, via this odour management plan, competent management measures that the site Operator can apply to guard against the risk of detectable odour annoyance off-site.

3.1 Potential Odour Sources

This section provides an inventory of all potential odour sources under the full range of usual operating conditions.

The measures to control odour have been considered in the context of the installation setting and the operations that will be carried out. A summary of the operations are as follows:

- Engineering of cells;
- Deposition of new waste to the required waste fill level;
- Installation of landfill gas and leachate management systems; and
- Recapping and restoration of cells.

This OMP has been developed for the installation to ensure that any potential odour release is managed to an acceptable level.

3.2 Activities that Produce Odour and Points of Release

Potential sources of odour at Parry's Quarry landfill site that may arise from specific engineering operations associated with the landfill operations are considered below.

3.2.1 Engineering Operations

Engineering operations considered to represent a potential risk of odour release are as follows:

- Temporary partial shut-down of landfill gas extraction system;
- Damage caused by other site operations;
- Gas management – draining of condensate;
- Leachate management – collection, ponding and disposal; and
- Old waste, which is partially degraded, and is disturbed by digging or drilling.

3.2.2 Landfilling Operations

Potential odour sources from landfilling operations will be associated with the deposit of fresh waste and the degradation of already filled waste, therefore possible odour sources may be as follows:

- Biodegradable waste that has been stored for significant periods prior to delivery;
- Any potentially malodorous waste; and
- Landfill gas and leachate, containing compounds with low odour thresholds e.g. organo-sulphur compounds, aromatic hydrocarbons, esters and carboxylic acids.

4. Control Measures

This OMP describes the specific techniques and measures that will be adopted at Parry's Quarry Landfill to minimise any potential release of odours as a result of the landfilling and associated activities. The following sections detail the management techniques and procedures, and odour control measures that will be employed for each aspect of the scheme.

4.1 Waste Transport, Acceptance and Deposition

The operational control techniques employed to minimise the potential for odour generation at Parry's Quarry during transport, acceptance and deposition of waste are as follows:

- The site management will liaise with the waste producers and transport contractors, with a view to minimising the storage and transport periods for the waste being delivered to the site;
- Waste identified as being difficult due to their odorous nature will be required to book at site one day in advance. In particular, any waste suspected of containing gypsum (calcium sulphate) should be excluded, for the purpose of minimising H₂S and odour generation;
- Waste producers and carriers will be required to demonstrate that any potentially odorous waste has been treated prior to delivery at site;
- Waste carriers will be required to deliver loads consisting of, or containing, malodorous wastes, in enclosed vehicles. The use of open tipper, open skip vehicles or vehicles contained only by nets for such wastes will not be permitted;
- Any malodorous waste shall be recorded as to composition, date and time received at site;
- Any malodorous waste received will be tipped at the bottom of the working face and immediately covered by a minimum thickness of 1 m of other non-malodorous waste;
- Malodorous waste will not be accepted at the site when unfavourable weather conditions would hinder effective dispersion of residual odours. Unfavourable weather conditions would be times of low wind speeds (less than Force 3 on the Beaufort Scale (see Appendix A)) with the wind blowing directly towards the nearest sensitive receptors;
- The process of progressively compacting waste using mobile compaction equipment will assist in the prevention of odours.

4.2 Provision of Cover Materials

The Landfill Manager will ensure there are adequate supplies of daily and intermediate cover material available at the installation. A layer of suitable cover material will be applied to deposited waste at the end of each working day. This will assist in controlling odour from recently deposited and any disturbed waste; in addition to the

provision of daily cover, flanks likely to be exposed for a long duration will have an intermediate cap applied to ensure potential emissions are kept to a minimum. Active areas of the site close to the boundary with sensitive receptors should not be exposed, as far as is operationally feasible, and sufficient quantities of daily cover will be necessary to prevent fugitive emissions from the deposited waste.

4.3 Progressive Capping of Completed Areas

The landfill will be progressively capped and restored in a series of discreet phase as soon as practicable once infilling activities are complete. This will be particularly important for recently temporarily capped areas of the site, close to the boundary with any of the sensitive receptors identified above in Table 2.1 and Figure 2.2.

4.4 Disturbance of Previously Emplaced Waste

Wherever possible, measures will be taken to ensure that previously emplaced waste is not disturbed, exposed or moved. Landfill operators should follow procedures to prevent any over-tipping that would require the deposited waste to be disturbed at a later date. In the event that any waste must be excavated (e.g. during the installation of gas and leachate wells, or re-grading of profiles), it will be removed and buried at the tipping face at the earliest opportunity.

4.5 Landfill Gas Extraction System

Based upon the outputs of the air quality impact assessment, to minimise the risk of fugitive releases of landfill gas the following measures will be employed:

- The gas extraction system will be operated in accordance to the site Permit;
- A sacrificial gas extraction system will be introduced to the future filling area as soon as practicable;
- Gas field balancing will be undertaken to prevent fugitive emissions of landfill gas and to restrict oxygen ingress;
- Following completion of each area the permanent gas extraction infrastructure (wells, spurs and pipe work) will be developed as soon as is practicable;
- The integrity of the gas system will be monitored on a regular basis;
- Side slopes must be adequately covered to exclude air and prevent odour release;
- As far as possible, infrastructure will not be located in close proximity to sensitive receptors; and
- Shut-down/isolation for maintenance to gas extraction system will be planned to avoid unfavourable meteorological conditions.

4.6 Leachate Management

To minimise the risk of fugitive emission of odour from leachate the following measures will be employed:

- Leachate wells will be covered;
- Holding tanks are kept closed;
- The site is regularly inspected for evidence of fugitive leachate emissions;
- As far as possible, infrastructure will not be located in close proximity to sensitive receptors. Where this is not possible, appropriate measures will be taken (i.e., covering/enclosure, extraction and discharge of treated air);
- Leachate head will be maintained in accordance with the site's Permit and Hydrogeological Risk Assessment; and
- Prevailing meteorological conditions will be taken into consideration when planning leachate collection, recirculation, and disposal activities.

4.7 Odour Management Misting Sprays

If considered necessary, odour management sprays containing a masking or neutralising agent may be utilised around sensitive areas of the installation. These can be mixed in the bowser to treat larger areas in emergency situations. In addition, pumped knapsack sprays containing odour masking agents will be maintained on site for use in emergency situations to prevent any potential odour nuisance arising off-site. Their use will be monitored closely to ensure their effectiveness and the use of compounds that are considered more offensive than the odour then are being used to mask will be avoided.

4.8 Liaison with Neighbours

If at any time an action that is likely to cause temporary odour is being considered (e.g. the drilling of gas wells), then before such action is taken the area manager or operations manager will be informed. Neighbours who may be affected will be contacted in advance to advise them of the operation being undertaken and that any odour will be of a temporary nature. The same provisions would apply in advance of any other work activities that could give rise to excessive odour emissions, such as re-excavation of deposited wastes or work on the leachate collection and pre-treatment system.

5. Failure and Abnormal Event Scenarios

In accordance with the requirements of Environment Agency's draft Technical Guidance Note H4, types of failure or abnormal events considered to have the potential to result in an odour impact have been considered. These have been identified as abnormal meteorological conditions and failures of certain control measures detailed above. Failure and abnormal event scenarios are presented in Appendix B.

5.1 Abnormal Meteorological Conditions

Extreme meteorological conditions that promote the generation of odour and inhibit its effective dispersion (i.e. high temperatures, low wind speeds and/or stable atmospheric conditions) may result in impact at receptor locations. Even with the application of control measures, such as using meteorological forecasts, in-filling operations away from receptors and immediate covering of the waste, an impact could still occur under extreme conditions.

5.2 Failure of Control Measures

Failures in the control measures employed have the potential to result in impacts at receptor locations. Failures also have the potential to result in an increase in the magnitude of odour emissions and consequentially potentially higher odour concentration at receptors.

Potential failures in control measures include:

- Damage to or material failure of the gas extraction network, requiring shut-off and replacement of infrastructure, may result in short term passive venting of landfill gas. The magnitude of impact will be dependent on wind direction but could potentially result in elevated odour concentrations at receptor locations;
- Failure of the engines and subsequent failure of the flare resulting in landfill gas emissions to atmosphere. The magnitude of impact will be dependent on wind direction but could potentially result in elevated odour concentrations at receptor locations.

Responses to failure and abnormal events are addressed in Section 7 and Appendix B.

6. Monitoring Measures

To ensure that the control measures in Section 4 are effective, the landfill site operator will employ monitoring techniques as outlined in this section of the document. The company operates a Corporate Management System that encompasses the requirements of ISO 9001 Quality Management Systems and ISO 14001 Environmental Management Systems. The following monitoring activities will be regularly undertaken to ensure continuous improvement:

- Site inspections by the site manager or deputy (as outlined below);
- Site audits conducted by the company's management;
- Site audits and inspections by the Environment Agency;
- Site Inspections by the Planning Authority;
- Inspections by specialist contractors (e.g. landfill gas energy conversion companies);
- Third party audits.

6.1 Meteorological Monitoring

Meteorological forecasts and conditions are and will continue to be monitored routinely to enable potential odour problems to be predicted and necessary remedial actions, such as modifications to the method of working or the use of deodorising sprays, to be implemented. Meteorological data will be recorded as per LFTGN035, as derived from the Landfill Directive. Details are presented in Table 6.1.

Table 6.1 Meteorological Monitoring

Landfill Directive Requirements	Operational and Restored Phases
Rainfall volumes	Recorded daily
Minimum & maximum temperatures	Recorded daily
Wind speed & direction	Recorded continuously, reported yearly as a wind rose
Evaporation	Recorded daily
Barometric pressure	Recorded daily
Atmospheric humidity	Recorded daily

The meteorological data will form part of the monthly/ quarterly records submitted to the Environment Agency as a requirement of the operating Permit.

6.2 Site Walk-Over Surveys

The site manager (or deputy) will be responsible for ensuring that monthly site walkover surveys will be carried out on all capped, temporarily capped and covered areas in order to identify any imperfections in the caps or cover that could be sources of emissions to atmosphere. In the event that any imperfections are identified, they shall be rectified as soon as is practicable. The use of a hand-held portable flame ionization detector (FID) or methane monitoring device is often helpful in identifying areas where emissions to atmosphere from the landfill surface occur. Such a walkover survey could also be usefully conducted in response to an off-site complaint.

6.3 Olfactory Monitoring Procedure

All site personnel will be responsible for reporting any odour problems immediately to the site manager (or deputy). The Site Manager will ensure that regular inspections are made of the installation and its perimeter in order to identify any sources of odour and to establish whether any odours are discernible at the perimeter of the installation. The survey will be carried out in accordance with the monitoring protocol contained within the Environment Agency's Technical Guidance Note H4: Horizontal Guidance for Odour. Particular attention will be paid to the active operational parts of the installation.

In the event that odour is detected at the installation boundary, additional monitoring will be undertaken at the sensitive receptors in accordance with Appendix B. Further olfactory monitoring will be undertaken in response to complaints. The procedure has been adapted from the Environment Agency guidance document Internal Guidance for the Regulation of Odour at Waste Management Facilities for application to Parry's Quarry Landfill.

The assessor will ensure that he/she has not been subject to landfill odours in the 30 minutes prior to the assessment and are compliant with the requirements laid down in the Olfactory Survey procedure (detailed in Appendix B) in order to ensure that they are not suffering from odour fatigue and will be sensitive to landfill odours.

The assessor will undertake the olfactory survey at the location of the complaint and at potentially sensitive receptor locations in the vicinity downwind from the site. At each location observations will be made concerning the intensity of the odour, its persistence and character (these details will be logged following the instruction provided in the pro forma, see Appendix B).

If odour is detected at the assessment location and is judged to be a moderate odour then the Landfill Manager (or Deputy) will be notified immediately and the olfactory survey will continue to attempt to determine the extent of the odour plume, as follows:

- A suitable location downwind of the landfill and potentially sensitive receptor at which the odour plume is unlikely to extend will be selected for assessment;
- The survey will then continue toward the landfill until landfill odour is perceived; and
- Assessment points perpendicular to the plume axis and equidistant from the landfill site will then be monitored, subject to access requirements.

6.4 Complaint Monitoring

Complaints will be monitored and actioned in accordance with the site's Working Plan. The complaint shall be recorded in accordance with the Permit and shall include: the date and nature of complaint, time of complaint, name of complainant (if given), a summary of any investigation undertaken in response to the complaint and the results of the investigation and any actions taken.

6.5 Monitoring Frequency

Monitoring frequencies are as detailed in Table 6.2 below.

Table 6.2 Monitoring Frequencies

Parameter	Monitoring Technique	Frequency
Meteorology	Recording conditions at 15:00 GMT	Daily
	Wind speed and direction	Continuous
Odour	Olfactory monitoring	Weekly installation and perimeter checks.
		Boundary odour detection will induce receptor monitoring.
		Increased frequency in response to complaints
	Complaint	Continuous (24 hours) via telephone reporting system

6.6 Responsible Persons

Responsible persons are detailed within Appendix C.

6.7 Records

A daily record relating to the management and monitoring of odour will be maintained. It will include the following details:

- The results of inspections and olfactory monitoring carried out by site personnel;
- Weather conditions including atmospheric pressure, wind speed and wind direction;
- Problems including date, time, duration, prevailing weather conditions and cause of problem;
- Complaints received including address of complainant;
- Details of corrective action taken, and any subsequent changes to operational procedures; and
- An evaluation of the effectiveness of the techniques used.

7. Compliance Action Plans

7.1 Control and Trigger Levels

The control trigger levels are presented below in Table 7.1.

Table 7.1 Control and Trigger Levels

Parameter	Monitoring Technique	Control Level
Odour	Olfactory monitoring	Moderate odour recorded at sensitive receptor. (Persistent / transient nature noted and considered)
	Complaint monitoring	Complaint received

7.2 Compliance Actions

Exceedence of the control & trigger level will necessitate further investigation into the causes and determine whether further monitoring is required. The actions to be taken in the event of an exceedence will be dictated by the nature and extent of the exceedence(s) (e.g. by considering the magnitude of exceedence and whether it was event driven or on-going).

7.3 Response to Complaints

The receipt of a complaint relating to odour during in-filling is treated as an exceedence of a control level. The primary response will be as detailed in accordance with the site's complaints procedure. An investigation will then be initiated into the cause of the complaint, this will involve as necessary:

- An olfactory survey following the procedure detailed in Section 5.2;
- Perimeter and receptor methane monitoring;
- An examination of the site activities at the time of the complaint;
- An examination of the meteorological conditions at the time of the complaint;
- A review of the effectiveness of gas collection containment; and
- A review of the effectiveness of the landfill cap.

If the complaint is verified it will be treated as an exceedence of the control level. The outcome of the investigation will determine the corrective actions to be implemented (see Section 7.2.3 below).

7.3.1 Detection of Moderate Odour during Olfactory Survey

The detection of a moderate odour, (i.e. ‘odour easily detected while walking and breathing normally, possibly offensive’), will initiate a more extensive olfactory survey to determine the extent of the odour plume (as described in Section 6.2). An investigation will then be initiated into the cause of the odour.

7.3.2 Corrective Actions

The outcome of an investigation will determine the corrective actions to be implemented, they will consider, but not be limited to:

- Re-locating the deposition area to a more favourable position with regard to potentially sensitive receptors e.g. disposing wastes in a different part of the active cell as far as practicable;
- Implementing procedures to prevent in-filling in particular locations under the meteorological conditions prevalent at the time of the complaint;
- Changes to application of daily cover i.e. depth or more immediate covering;
- Increasing gas extraction rate;
- Installing additional pin wells to increase gas extraction efficiency;
- Remediation to the landfill cap;
- Acceptance of a specific waste type can be placed on hold pending further investigations; and
- Update of OMP if new procedures are created.

7.4 Reporting

An exceedence of a control level will be investigated (as described above) and recorded in accordance with current operating procedures. This includes recording the following:

- The nature of the incident;
- The date of occurrence/s;
- The results of the investigation;
- The details of responses/ action plans implemented; and
- The event will be marked within the site’s incident log.

The report will be made available to the Environment Agency on request.

Appendix A

Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	On Land
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	
12	64+	Hurricane	

Appendix B

Failure and Abnormal Event Summary Table

Odour Generating Process	Release Points	Abnormal Situation/ Failure	Potential Outcome	Control Measure	Action (Responsible Person)
Decomposition of waste in transit and in active cell.	Active cell and deposition area	Extended duration of stable meteorological conditions	Elevated odour concentrations at receptors.	Meteorological forecasts, re-locate infill operation, suspension of operations. Olfactory surveys and complaint monitoring.	Progressive initiation of control measures as necessary, and complaint investigation in accordance with Section 7.3. (Landfill Manager)
Decomposition of waste within cells.	Fugitive release through un-capped areas.	Failure of gas extraction in cells.	Elevated odour concentrations at receptors.	Additional / full time monitoring and maintenance of gas system. Routine maintenance and monitoring of gas extraction system, olfactory surveys and complaint monitoring.	Rapid maintenance of gas extraction system, surface testing using methane as an indicator, appropriate remediation and monitor meteorological conditions (Landfill Manager)

Appendix C

Olfactory Survey Pro-formas

Assessor Name	
Signature if requirements of Reference Table 1 (see below) have been met	
Date	
Start time	
Finish time	
Complaint location	
Wind direction	
Wind speed (m/s)	
Atmospheric pressure (mBar)-falling/rising/stable	
Cloud cover (oktas)	
Temperature (C)	

Location ¹	Odour Intensity ²	Odour Extent ³	Odour Description ⁴

1 Begin at complaint location

2 Refer to Reference Table 2

3 Refer to Reference Table 3

4 Describe the character of the odour (e.g. rotten eggs, musty, drains, waste, landfill gas, sewage, agricultural, etc)

If odour intensity is judged as “moderate” at any sensitive receptor location the Landfill Manager must be immediately notified, then the extent of the plume should be investigated using the Table that follows overleaf:

Location ¹	Odour Intensity ²	Odour Extent ³	Odour Description ⁴

1 Describe location e.g. street name, house number etc

2 Refer to Reference Table 2

3 Refer to Reference Table 3

4 Describe the character of the odour (e.g. rotten eggs, musty, drains, waste, landfill gas, sewage, agricultural, etc)

Choose a suitable location downwind of the landfill and sensitive receptor at which the odour plume is unlikely to extend, continue toward the site until a faint odour is detectable.

Select further assessment points perpendicular to the plume axis and equidistant from the landfill site to determine extent of plume.

Reference Tables

Reference Table 1: Assessor Rules and Preparation

Requirements of Assessors
Assessor has not been exposed to Landfill odours for previous 30 minutes Assessor has not smoked or consumed strongly flavoured food or drink in previous 30 minutes Scented toiletries should not be applied immediately before or during assessment. Vehicle used for assessment should not contain deodoriser and care should be taken concerning odour in windscreen wash.

Reference Table 2: Odour Intensity

Odour Intensity	Description
1	No detectable odour
2	Faint odour (barely detectable, need to stand still and inhale facing into wind)
3	Moderate odour (odour easily detectable while walking and breathing normally, possibly offensive)
4	Strong odour (bearable, but offensive odour – makes clothes hair/smell)
5	Very strong odour (encourages one to move well away from the locality)

Reference Table 3: Odour Extent

Odour Extent	Description
1	Localised and not persistent (only detected during brief periods when wind drops or blows)
2	Not persistent, as above, but detected away from site boundary
3	Persistent but fairly localised
4	Persistent and pervasive up to 50m from site boundary
5	Persistent and widespread (odour detected >50m from site boundary)

Appendix D

Responsible Persons

The site manager, his/ her appointed deputy and environmental monitoring technicians will carry out odour monitoring. The role of the technicians will be essential to confirm the findings of the inspections carried out by the installation personnel and thereby minimise the potential impacts of odour fatigue.

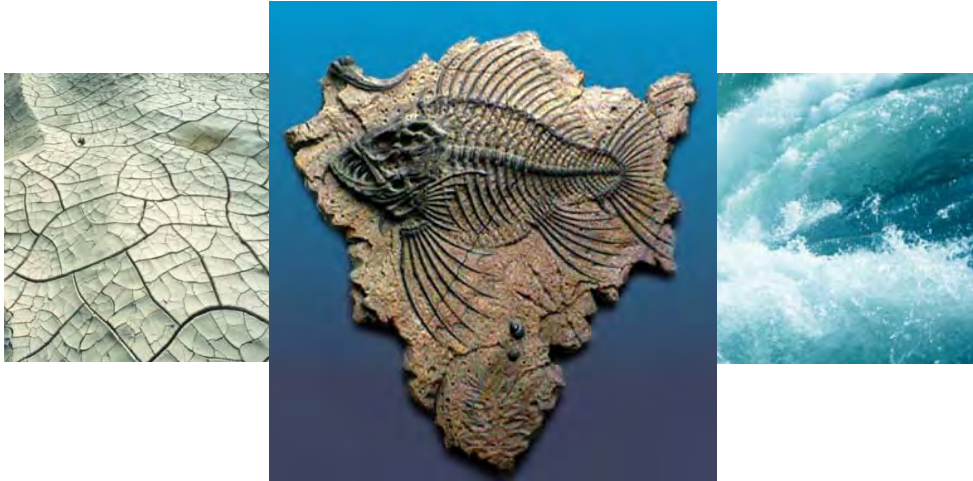
Control Measure	Responsible Person	
	Implementation on Site	Overall Manager
Waste storage and infilling operations In accordance with Section 4	Landfill Site Manager	Operations Director
Provision of Cover material in accordance with Section 4.2		
Progressive capping of completed areas in accordance with Section 4.3		
Maintenance of gas extraction in accordance with Section 4.5		
Gas collection and treatment in accordance with Section 4.5		
Covering of Leachate wells in accordance with Section 4.6		
Meteorological monitoring in accordance with Section 6.1		
Olfactory Surveys in accordance with Section 6.2		
Complaint monitoring in accordance with Section 6.3		

Appendix D

Noise Management Plan October 2013

McLorinan Consulting Ltd

Hydrogeological & Environmental Consultants



Report No. P630-11

**NOISE MANAGEMENT PLAN
DISCHARGE OF PLANNING CONDITIONS**

**PARRY'S QUARRY
MOLD**

OCTOBER 2013

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Table 1 - Baseline Monitoring Results of Environmental Statement.

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Appendix 1 – Baseline Noise Monitoring Summary

Appendix 2 – Examples of Alternative Reversing Alarms & Noise Attenuation Barriers

1.0 INTRODUCTION

McLorinan Consulting Ltd were appointed to develop a noise management plan for Parry's Quarry, Alltami, in order to effectively mitigate against elevated noise levels at local noise sensitive receptors. This report outlines a noise management plan as required under the conditions of planning for the site.

2.0 BACKGROUND

2.1 Site Description

The site is located approximately 1km north east of the village of Alltami in Flintshire (Figure 1), North East Wales (National Grid Reference SJ 2755 6652), and has been granted planning permission for infilling of waste into the existing quarried void space.



Figure 1. Site Location Map, Parrys Quarry, Alltami.

The potential for noise impact on local sensitive receptors has previously been considered as part of the Environmental Statement prepared for the site (*Environmental Statement for Landfill Operations Volume 1 & 2, Amec Earth & Environmental UK Ltd, 2006*), and as such the assessment indicates that local dwellings and services may be impacted upon as a direct result of the intended landfilling activities. Subsequently a series of conditions of planning were imposed upon the site to control elevated noise levels and include the provision of a noise management plan for the site.

2.2 Conditions of Planning

The following outlines the conditions of planning imposed on the site with relevance to the control of noise:

- 10) *Prior to the commencement of development a written scheme for the control of noise, including a timetable for its implementation, shall be submitted to and approved in writing by the local planning authority. The scheme shall include measures to mitigate the impact of noise on neighbouring land uses, including the A55 service area and all facilities included therein. The scheme shall provide details of the location, height, extent and construction of acoustic barriers and details of reversing alarms to be used on site plant. The scheme shall be implemented, retained and operated in accordance with the approved details.*

11) Notwithstanding the requirements of condition 10 above, the noise levels at any neighbouring noise sensitive properties or land uses shall not exceed:

- 55dB LAeq (1 hour) free field measurement in the periods 0730-1800 Mondays to Fridays and 0800-1300 Saturdays other than during the construction of screen mounds and acoustic barriers designed to reduce the impact of the development and approved under condition 6 above;
- 50dB LAeq (1 hour) free field at the A55 service area and 40dB LAeq (1 hour) free field elsewhere where night time, Saturday afternoon after 1300, Sunday, Public or Bank holiday working is authorised under condition 9 above;
- 70dB LAeq (1 hour) free field measurement in the periods 0730-1800 Mondays to Fridays and 0800-1300 Saturdays during the construction of the screen mounds and other earthwork barriers designed to reduce the impact of the development and approved under condition 6 above.

2.3 Baseline Noise

Baseline noise levels were recorded in and around the site (see Appendix 1 for baseline noise monitoring locations) as part of the original noise impact assessment, and the results of average monitored background noise levels for the site are presented in Table 1.

Table 1. Baseline Monitoring Results for ES.

Monitoring Locations	Period	L _{Aeq,T} dB	L _{A90,T} dB	L _{Amax,F} dB
ML1	Day	61	58	78
	Night	48	41	69
ML2	Day	55	51	75
	Night	48	39	71
ML3	Day	71	62	90
ML4	Day	55	51	73
	Night	44	36	65

Noise levels were checked at the site during 22nd - 23rd October 2013 in order to determine if the baseline monitoring assessment prepared for the Environmental Statement remained valid. Observed noise levels at the site were considered similar to those of the baseline assessment, and as such are considered realistic to develop the noise management plan.

2.4 Consultations

The development of a noise management plan for the site was discussed with Mr Dave Jones, Pollution Control Officer, at Flintshire County Council on 21st October 2013 in order to design a robust noise monitoring program and suitable mitigating measures to protect local noise sensitive receptors.

Mr Jones accepted that the conditions of planning imposed unachievable noise levels for the site and surrounding receptors, given that background noise levels at these receptors already exceed the imposed threshold value of 55dB L_{Aeq, 1hour}. Therefore it was considered appropriate to employ a more robust method of assessing nuisance noise generated by on-site activities.

British Standard BS4142 provides the most appropriate means of setting and managing noise thresholds levels for noise at local sensitive receptors, in conjunction with a robust noise monitoring program, and as such this noise management plan incorporates the noise criteria outlined in BS4142.

3.0 NOISE STANDARDS

This noise management plan incorporates the following guidance documents:-

- BS 4142 'Method for rating industrial noise affecting mixed residential and industrial areas';
- BS 5228 'Noise and Vibration Control on Construction and Open Sites';
- BS8223 'Sound Insulation and noise reduction for Buildings – Code of Practice';
- ISO 9613 'Acoustics – Attenuation of Sound during propagation outdoors';
- World Health Organisation (WHO) 'Guidelines for Community Noise, 1999';
- Welsh Office – Technical Advice Note (TAN) (Wales) 11 (1997).

3.1 Noise Criteria

British Standard (BS) 4142: 1997 – *Methods for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas* provides guidance on assessing the significance of a noise source. It describes a method, whereby measured or predicted noise levels from a noise source(s) are compared to existing background noise conditions in order to determine the likelihood of complaints from residents within the vicinity of the source. The title of the document implies that the guidance is strictly for industrial developments; however the assessment methodology it recommends is also often used for a wider range of noise sources.

The likelihood of complaints is assessed by subtracting the background noise level ($L_{A90,T}$) from the rating level ($L_{Aeq,T}$). The rating level is based upon the specific noise level, and includes a correction of +5 dB if the noise source features any tonal or impulse noise. BS4142 states that a difference of +10dB or more between the predicted/measured (with development) and background (without development) noise levels is likely to result in complaints. A difference of around +5dB is of marginal significance, with a difference of -10dB being a positive indication that complaints are unlikely.

Therefore the noise management plan for the site incorporates periodic monitoring of background noise levels and assessing operational noise levels against background levels in order to determine the likelihood of complaints being generated as a result of site activities. For the purpose of providing a reporting and action threshold it is considered that the site should not cause noise levels to exceed +10dB over monitored background levels.

4.0 CONSTRUCTION & OPERATIONAL MITIGATION MEASURES

The following outlines a range of mitigation measures which should be implemented in order to provide some noise attenuation measures and to reduce the likelihood of noise related complaints from local receptors:

- All plant should not be left idling unnecessarily and should have their engines switched off when not in use;
- Where practical, all plant should be fitted with sound suppression units, silencers fitted to exhausts, engine covers fitted securely and should be routinely maintained in order to achieve efficiency;
- Efforts should be made to improve working relations between the site operators and neighbouring residents by having an appointed liaison person to investigate any complaints made regarding noise generated by the site;
- a hard metallised surfaced internal haul road, which will be maintained to allow efficient use and minimise vehicle noise;
- restriction of the vehicle speed along the haul road to avoid body slap from empty lorries;

- a landfill maintenance programme, with particular attention being given to maintaining improving the noise muffling system on landfill construction and waste/cover soil placement equipment;
- a closed board fence along the northern boundary of the site, which should attenuate noise propagation to Ewloe Wood House and the Box.

4.1 Reversing Alarms

Typical reversing alarms employed on constructions sites generally exhibit a tonal frequency characteristic at a high level intermittent pitch, and commonly gives rise to complaints. Therefore, in order to reduce noise levels, particularly those of a single frequency or tonal characteristic, it is intended to employ the following noise management techniques:

- All vehicles will have a smart alarm system installed or retro-fitted to the vehicle, which will automatically adjust a broad band frequency noise to no more than 10 decibels above the background noise levels;
- All plant vehicles will be installed or retro-fitted with a wide angle reversing camera in order for the plant operator to visually detect obstacles;
- All plant vehicles will be installed or retro-fitted with an ultrasonic obstacle detection unit in order to sense obstructions and to provide the plant operator with an audible sensor in the vehicle cab;
- All plant vehicles will be installed or retro-fitted with a high visibility reversing indicator (i.e. LED message flasher unit) to indicate to personnel when a vehicle is engaged in a reversing manoeuvre;

Broadband alarms typically operate at a much lower noise level than standard single frequency reversing alarms while at the same time providing a similar level of safety to site personnel in the vicinity of plant machinery. This effectively means that rather than alerting the entire site of a vehicle movement, the reversing alarm is designed to alert only personnel within a closer vicinity to the moving plant thus preventing noise propagation beyond the site boundary.

An example of the reversing alarms that are to be considered within this document are presented in Appendix 2.

4.2 Acoustic Barriers & Screening

The noise impact assessment previously prepared for the site indicates that residential dwellings along the southern boundary known as Parry's Cottages may be adversely impacted upon as a result of day to day operations. The services area along the north eastern boundary may be adversely impacted upon during the construction periods of phase 6 – 9.

Therefore, in addition to the mitigating measures outlined in Section 4.1, acoustic modelling was undertaken using CadnaA 3D noise modelling software to assess the effectiveness of barrier attenuation for the site.

Based on the results of modelling, it is proposed to construct a clay bund to a height of 3m along the portions of the site boundary adjacent to noise sensitive receptors (see Figure 2). Modelling indicates that noise impacts from Phases 1 – 5 are likely to be negligible on local receptors as these phases are to be developed below or at normalised ground level and can effectively be screened out by the clay bund and reduced topographic floor height of the quarried void (see Figure 3).

Further modelling was undertaken for the above normalised ground height of phases 6 – 9, as these phases are intended to be infilled to a level of ~128mOD and approximately 15m above the receiver level of noise sensitive receptors. The results of modelling indicate that noise levels can effectively be

reduced when a noise attenuation screen or barrier with a high absorption is installed. Figures 4 and 5 demonstrate reduced noise levels from the impact assessment predicted levels of 61dB at Parry's Cottages (using worst case scenarios of combined plant operating levels of 113dB), resulting in receiver levels of 48dB when combining a 3m clay bund with an addition 2m wood screen or polyplank barrier.

Therefore it is proposed to construct a clay bund to the height of 3 metres with a top width of 1m along the boundary sections adjacent to noise sensitive receptors, and to install a 2 metre high wood or polyplank noise screening barrier on the ridge of the clay bund.

It is proposed to construct clay bunding prior to the emplacement of waste or development of haulage routes, and it is intended that the construction of bunding will take place over a minimum period of time. Local noise sensitive receptors that may be adversely impacted upon during the construction of the bunds will be contacted prior to beginning construction, and will be informed of intended construction noise both in terms of likely intensity and period of time the construction process is likely to take. In addition, Flintshire County Council will also be informed of when construction processes are to begin and will be provided regular updating of the progress of constructions works.

5.0 NOISE MONITORING

Given that noise management plan within the site is to adopt the BS4142 methodology, it is essential that the site does not generate noise levels to be in excess of 10dB over background levels at local noise sensitive receptors.

Therefore it is proposed to implement a noise monitoring program that assesses background noise levels and subsequently monitors operations noise levels in order to determine if threshold levels have been exceeded. The following outlines the proposed monitoring program to be undertaken:

- Monitoring of background noise levels at the four selected noise sensitive receptors to include: The monitoring locations (ML1-ML4) as per the ES and as described below:
 - Grass verge adjacent to OK Dinner and Holiday Inn Hotel at A55 services
 - Grass verge adjacent to Ewloe Wood House located to the north west of the site along Pinfold Lane
 - Grass verge adjacent to the Flintshire County Council Corporate Training Centre and offices opposite the existing site entrance along Pinfold Lane
 - Adjacent to the garden areas of Parry's Cottages (Nos. 1,2,3,5 and 6) located to the south east of the site along Mold Road (A494)
- Background monitoring will be undertaken for $L_{Aeq,1hour}$ and $L_{A90,1hour}$ during periods when site activity is minimal or prior to the commencement of site activity, and shall be undertaken each month for the first three months of infilling activity, reducing to every three months (quarterly) thereafter for a minimum of 1 year and to be reviewed by the County Council;
- Continuous monitoring of $L_{Aeq,1hour}$ and $L_{A90,1hour}$ for one week following background monitoring, and collation of results to determine any exceedences in threshold values (i.e. +10dB or greater);
- Operational noise is to be monitored on the same frequency basis as background noise level monitoring, and all results to be submitted to the Environmental Health or Pollution Control department of Flintshire County Council for review;
- Exceedences are to be reported to the site supervisor or operator immediately, with additional mitigating measures to be submitted for approval and implementation;

-
- In the event of exceeding threshold levels, further monitoring should be undertaken in order to validate any new implemented mitigating measure, and results submitted for review;
 - Monitoring should be undertaken for a minimum of one year, and collation of annual results submitted and reviewed by the case EHO. Thereafter and provided noise levels have demonstrated an overall compliance with conditions of planning, it is proposed to undertake further noise monitoring on a bi-annual or annual basis, whichever is approved.

6.0 CONCLUSIONS

Modelling indicates that noise levels generated onsite can effectively be reduced to within conditioned levels at noise sensitive receptors, provided that this Noise Management Plan is implemented from the commencement of site preparation and infilling processes.

As background levels are elevated prior to development, it is intended to adopt the BS4142 approach to likelihood of noise complaints. Therefore the site operator should not generate noise levels at or above 10dB above the relevant background levels

Given the potential to impact upon noise sensitive receptors, good communication will be encouraged between the site operator and Flintshire County Council, and reporting of monitoring results will be undertaken and discussed with the council on a routine basis.

Provided that these mitigating measures and monitoring programs are implemented from commencement of construction works and prior to infilling then noise impacts and associated complaints should effectively be negated.

Report Prepared By:-



John Lavery BSc MEnv Sc
Senior Environmental Scientist

Reviewed By:-



David McLorinan BSc, MSc, CGeol, FGS, EurGeol
Managing Director/Chartered Geologist/European Geologist

FIGURES



Figure 2. Noise Monitoring Location Map

FIGURE 3
Modelled Noise Source at 0m Normalised Height

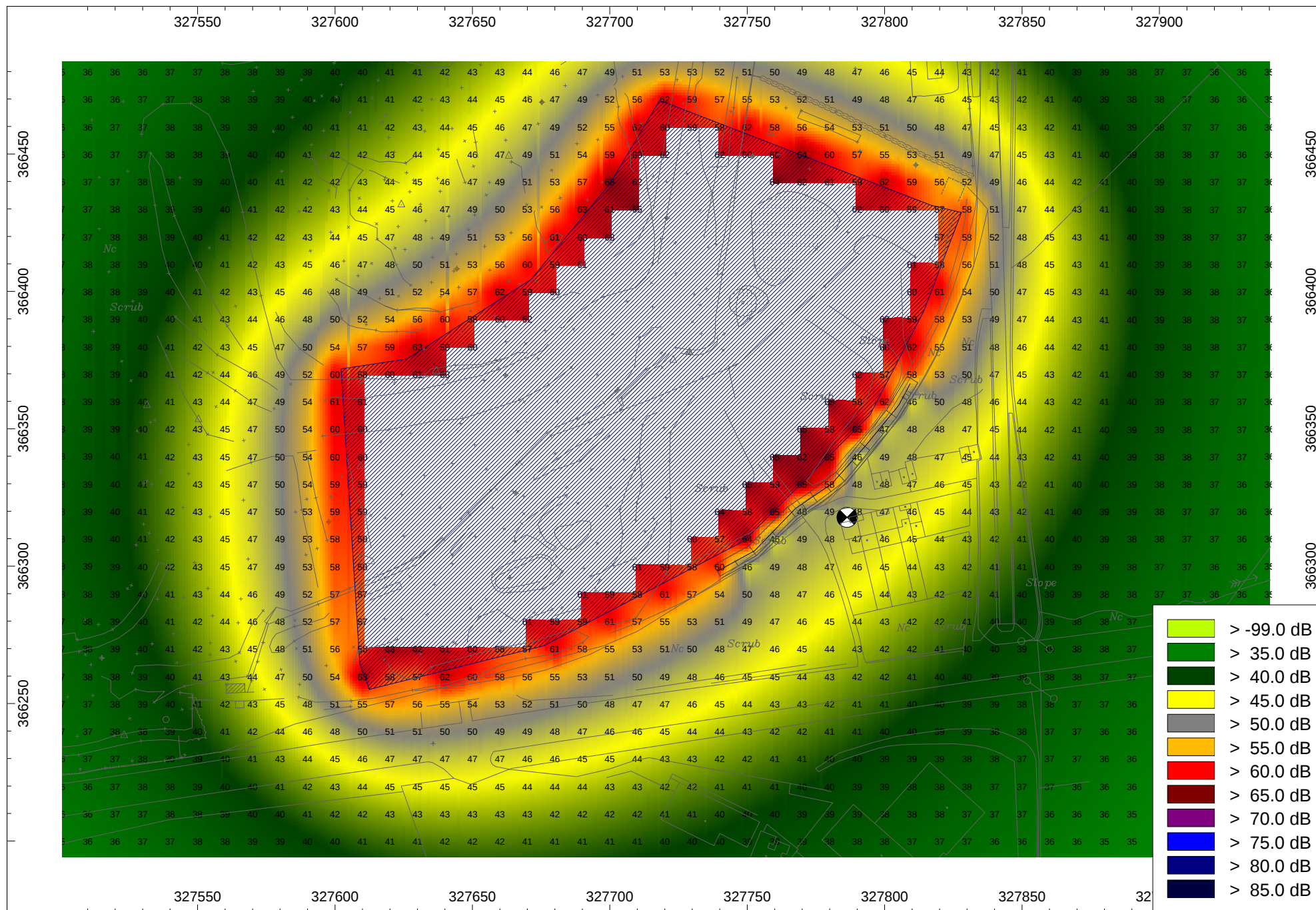


FIGURE 4
Modelled Noise Source at 0m Normalised Height & Setback

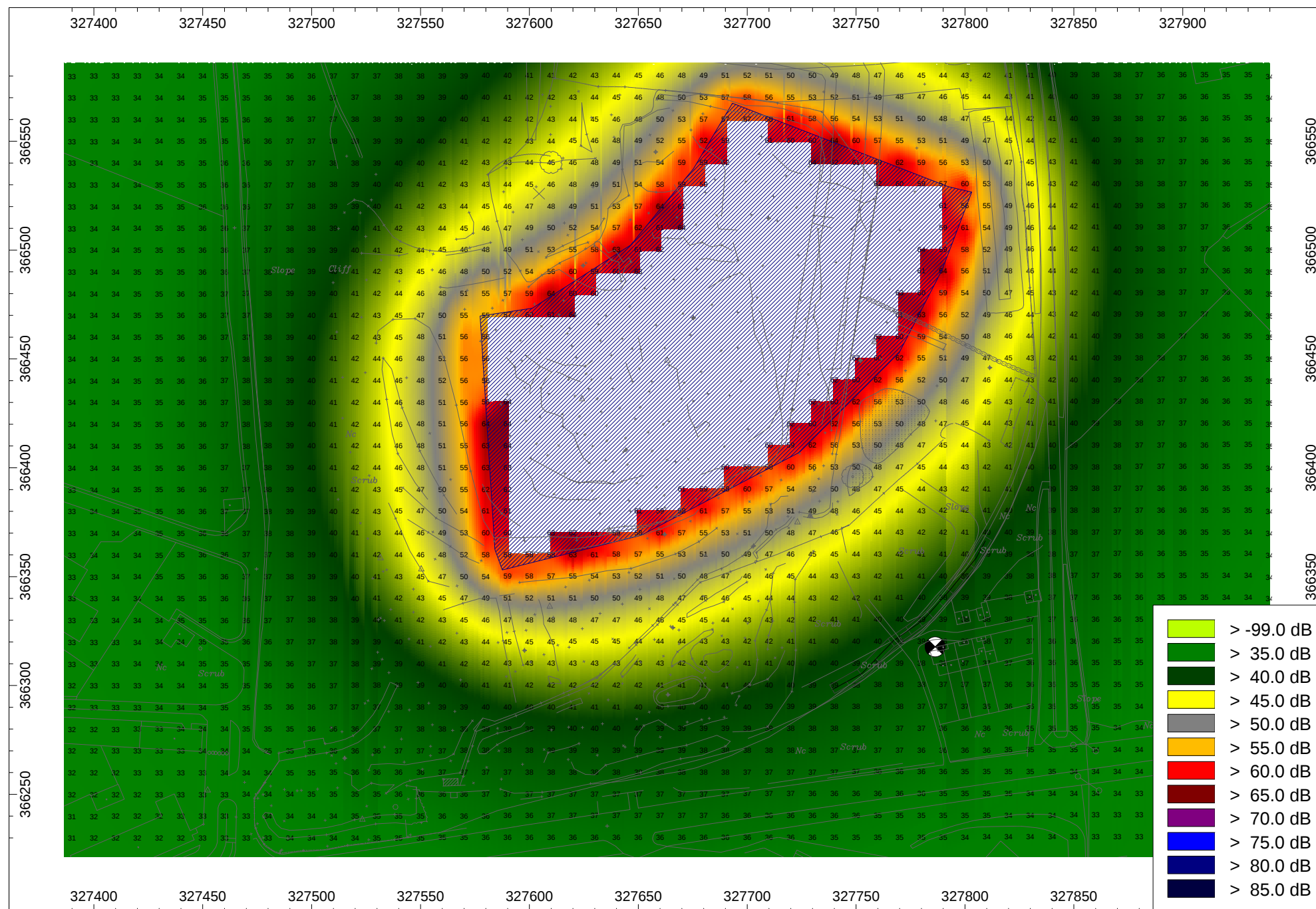
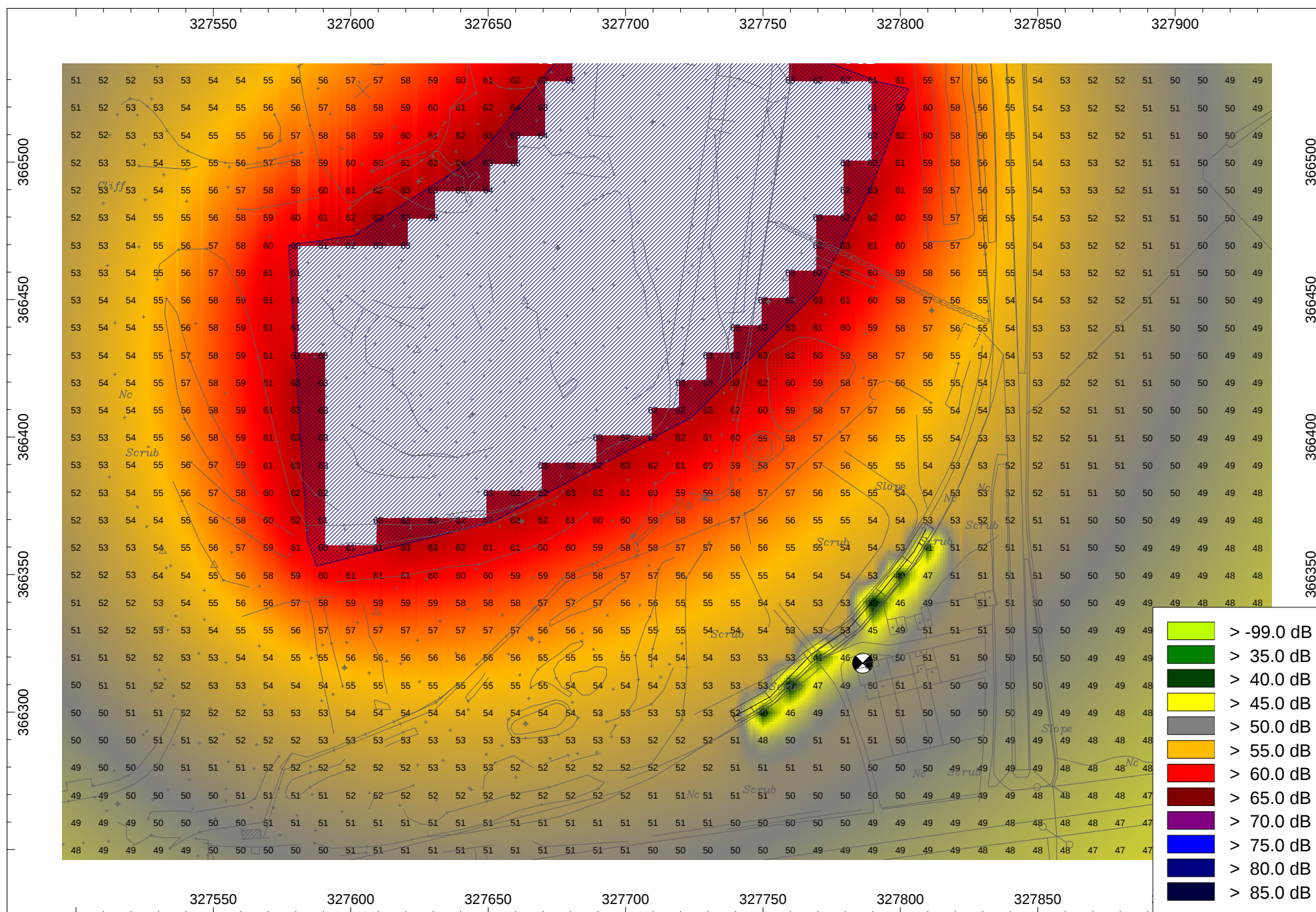
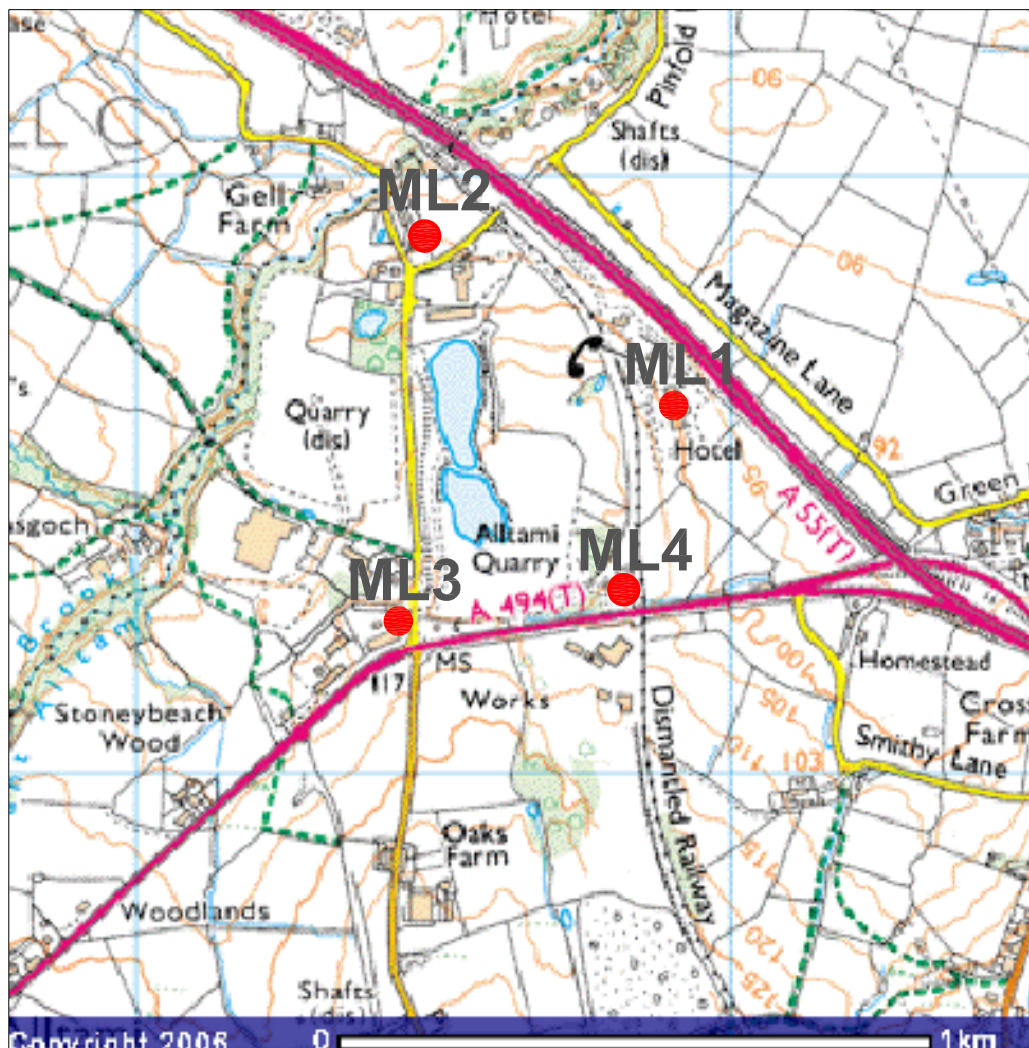


FIGURE 5
Modelled Noise Source at 15m Normalised Height



APPENDIX 1

Environmental Statement – Baseline Noise Summary



Earth and Environmental UK Ltd
 Unit 1, Long Barn, Pitsill Farm, Village Road, Nercwys, Mold, Flintshire CH7 4EW
 Tel: 01352 751761 Fax: 01352 751451 www.amec.com

Drawing Title: Figure 9.1 Monitoring Location Plan	
Client: Robin Jones and Son Ltd	
Date: 13 Sep 06	By: L.B
Job No. J1071	Scale(s): NTS

The following criteria (Table 9.3) have been developed for assessing the magnitude of impact due to the development at nearby noise-sensitive receptors. This is based on the guideline levels stated in BS4142 and recommendations within MTAN1.

Table 9.3 – Criteria Adopted for Interpreting Magnitude of Impact at Sensitive Receptor Locations

Magnitude of Impact	Noise level difference between predicted noise level ($L_{Aeq,T}$) and baseline level ($L_{A90,T}$)*
No impact	Less than -5 dB
Negligible/Insignificant impact	Between -5 and equal to baseline noise levels
Minor impact	Between 0 and +5 dB
Moderate impact	Between +5 and +10 dB
Major impact	Greater than +10 dB

* Note that for the purpose of the construction impact assessment the predicted noise levels have been compared to the ambient noise levels at each receptor ($L_{Aeq,T}$)

Note that this assessment has considered the potential impacts to noise-sensitive receptors within close proximity to the site only. This is considered to represent the worst-case potential impacts associated with the proposed landfill. Residential receptors and the Hotel close to the site are assumed to have a high sensitivity, with the council offices having a medium sensitivity.

The predicted impact on local residents due to changes in the traffic flow has been predicted, with reference to the Design Manual for Road and Bridges: Volume 11 - Environmental Assessment.

The DMRB11 document states that people may find benefits or disbenefits when noise changes are as small as 1 dB(A). This is equivalent to an increase in traffic flow of 25% or a decrease in traffic flow of 20%. Note that for gradual changes in traffic flow over a longer period of time, a change in noise level of around 3 dB is generally required for a perceivable change in noise level.

9.3 Baseline Noise Conditions

9.3.1 Site Location

The site is within Alltami, Flintshire. The site is bordered by Pinfold Lane (unclassified Road) to the west, and A494 Mold Trunk road to the south. The Buckley Clay Pits and Commons SSSI can be found along the south-eastern border of the site. A dismantled railway runs in a north – south direction along the eastern boundary of the site.

The closest residential properties to the site are Parry's Cottages, which are located adjacent to the south-eastern corner of the site. A number of scattered residential properties can also be found further along Pinfold Lane to the north of the site. The closest of which are Ewloe Wood House and the Box.

In addition to these residential properties, there are also several commercial properties which may be impacted upon as a result of the proposed landfill. These include the Flintshire Council offices and depot, which are located immediately opposite the current site entrance to the quarry across Pinfold Lane and the Holiday Inn Hotel, which is located to the north-east of the site.

The site is currently used as a quarry and waste transfer station. The site was granted planning permission to operate as a waste transfer station in October 2004. As part of the planning permission a number of planning conditions relating to noise were placed at the site. These are as follows:

- Restricted operation hours to 07.00 to 18.00 Mondays to Friday, 07.00 to 16.00 on a Saturday and no workings on either a Sunday or Bank or Public Holidays, except for repair, maintenance and testing which should be carried at between 09.00 and 17.00 hours.
- The site access and access route shall be hard surfaced and maintained in a good state of repair – to minimise noise that would otherwise be generated from vehicles travelling over a broken surface.
- The noise levels arising from the development shall not exceed the following levels at any neighbouring noise sensitive properties or land uses:
 - i) In the periods 07.00-19.00 hours Mondays to Fridays and 07.00-16.00 hours on Saturdays 55 dB L_{Aeq} (1 hour) free field measurement;
 - ii) Where evening, Saturday after 16.00 hours, Sundays or Public Holiday working is authorised, 45 dB L_{Aeq} (1 hour) (free field)
- All plant and machinery operative on the site shall be maintained and silenced in accordance with the manufacturer's guidance.
- Where vibration from the site's plant and equipment is identified to be causing loss of amenity off-site, a scheme will be submitted for written approval to the Local Authority to control ground vibration.

9.3.2 Baseline Survey

In order to determine the influence of existing noise sources upon the local noise environment, representative noise measurements have been taken at four positions, which correspond to the locations of residential and commercial properties nearest to the site.

The monitoring locations were chosen to correspond with those used within the Noise Addendum in the previous Parry's Quarry Environmental Statement for the waste transfer station (carried out by the Environmental Advice Centre Ltd, now Amec Earth & Environmental). A copy of the baseline survey results from this previous survey can be found in Appendix 9.1. The monitoring locations (ML1-ML4) are shown in Figure 9.1 and are described below:

1. Grass verge adjacent to OK Dinner and Holiday Inn Hotel at A55 services
2. Grass verge adjacent to Ewloe Wood House located to the north west of the site along Pinfold Lane
3. Grass verge adjacent to the Flintshire County Council Corporate Training Centre and offices opposite the existing site entrance along Pinfold Lane

4. Adjacent to the garden areas of Parry's Cottages (Nos. 1,2,3,5 and 6) located to the south east of the site along Mold Road (A494)

All locations were agreed in writing with Flintshire County Council prior to the baseline survey being undertaken.

Noise monitoring was carried out on the 16th, 17th and 21st August 2006. Given that there is the potential for the gas flare and engines to be used during the night it was considered appropriate to undertake monitoring over a 24 hour period during a typical weekday. Note that monitoring was only undertaken during the working day at ML3, as this location represents a commercial receptor which does not operate during the night.

The sound level meter (SLM) was calibrated at the start and end of each monitoring period. No significant drift was identified.

All noise measurements were taken by mounting the SLM approximately 1.2m above the ground. Measurement positions were located at least 3.5m away from buildings or other potentially reflective surface other than the ground, providing a representative free field outdoor measurement at each receptor location.

Details relating to the calibration history of the equipment and weather conditions at the time of the survey can be seen in Appendix 9.2.

The results of the monitoring are summarised in Table 9.4 below.

Table 9.4 – Baseline Noise Monitoring Data

Monitoring Location	Start Time	Duration (mins:sec s)	L _{Aeq,T} dB	L _{A90,T} dB	L _{Amax,F} dB
ML1	08.51	20.00	58.7	56.2	69.1
	11.28	20.00	58.3	56.0	70.0
	14.43	20.00	55.9	53.5	67.1
	15.50	20.00	56.0	53.4	78.2
	20.39	20.00	56.0	52.8	65.7
	01.26	20.00	46.5	40.5	65.3
	01.46	20.00	48.9	41.6	70.8
ML2	09.15	20.00	54.7	48.0	76.2
	11.56	20.00	54.5	46.3	75.6
	15.08	20.00	56.6	52.4	74.8
	16.16	20.00	57.8	52.8	74.2
	21.07	20.00	54.3	41.8	72.5
	23.42	20.00	47.7	39.9	71.2

	00.33	20.00	49.1	38.9	71.4
ML3	07.43	20.00	69.0	61.7	85.8
	10.32	20.00	67.4	58.3	84.9
	14.11	20.00	64.4	55.2	74.9
	16.42	20.00	66.5	58.8	84.4
ML4	08.15	20.00	56.2	52.9	68.5
	10.59	20.00	55.9	52.5	65.1
	14.37	20.00	55.0	50.3	68.3
	17.11	20.00	55.5	52.1	74.1
	22.16	20.00	49.6	41.3	67.5
	00.07	20.00	45.2	37.7	66.5
	00.59	20.00	41.5	32.6	60.8

NB - Night-time measurements are shaded

The existing noise environment at the site generally comprises noise from plant and machinery associated with quarrying activities taking place at the site, noise from activities and heavy good vehicles movements taking place at the adjacent Scania site and traffic noise from the A55 and A494.

The dominant noise source throughout the noise survey at ML1 (adjacent to the Holiday Inn and OK Diner) was traffic noise from the A55. Noise from traffic within the services was also audible at this location. Noise from quarrying activities at the site was audible between 08.51 and 09.11 on the 16th August. In addition, noise from Pinfold Lane Quarry, operated by Brock Plc, was audible at this location between 14.43 and 16.10 on the 21st August. Additional noise sources at this location includes, talking from visitors and workers at the hotel and diner and bird song.

The daytime noise environment at ML2 (Ewloe Wood House) comprised continuous traffic noise from the A55 and occasional noise from passing traffic along Pinfold Lane and noise from activities and HGV movements within the adjacent Scania site. The dominant noise source at this location during the evening and night comprised traffic noise from the A55 and a low frequency hum from the Scania site. Noise from a pressure washer being used intermittently at Scania was also audible between 21.07 and 21.27. Impact noise from the Scania site was occasionally audible between 23.42 and 00.02. Noise from quarrying activities taking place at Pinfold Lane Quarry was also audible on the 21st August between 15.08 and 16.36.

The dominant noise source at ML3 (Council offices) comprised traffic noise from the A494 and occasional traffic movements along Pinfold Lane. Traffic noise from the A55 was also audible at this location during periods of low traffic flow along the A494. Noise from plant and equipment being used at the existing quarry was audible at this location during the day.

The daytime noise environment at ML4 (Parry's Cottages) was predominantly associated with constant traffic noise from the A494. A constant hum from traffic along the A55 and bird song was also audible at this location. Noise from quarrying activities was audible at this location between 14.37 and 14.57. The night-time noise environment was dominated by traffic noise from the A55 and occasional traffic along the A494.

Given that the baseline survey was carried out during the holiday period there is the potential for increased traffic noise from the A55. As a result, it was agreed with Flintshire County Council that the daytime noise levels from the previous monitoring survey (carried out on the 29th September 2004) would be utilised, along with the new data, to derive an average daytime noise level for each monitoring location for use within the assessment (see Table 9.5 below).

Table 9.5 – Average Noise Levels based on Amec's Monitoring Data

Monitoring Location	Period	L _{Aeq,T} dB	L _{A90,T} dB	L _{Amax,F} dB
ML1	Day	61	58	78
	Night	48	41	69
ML2	Day	55	51	75
	Night	48	39	71
ML3	Day	71	62	90
ML4	Day	55	51	73
	Night	44	36	65

NB - Night-time measurements are shaded

The average noise levels above indicate that the noise levels already experienced outside the Council offices are well in excess of the recommended levels stated within BS8233, assuming that the office does not have mechanical ventilation. In addition, existing noise levels adjacent to the hotel are already in excess of L_{Aeq} 55 dB, which is the WHO threshold for serious daytime annoyance.

9.4 Assessment of Potential Noise Impacts

The proposed landfill may have an impact upon the existing local noise environment during both the construction and operational phase. There is the potential for site preparation work to be undertaken simultaneously with operating activities. As a result, the combined impact of all noise sources which could be undertaken at the site time has also been assessed.

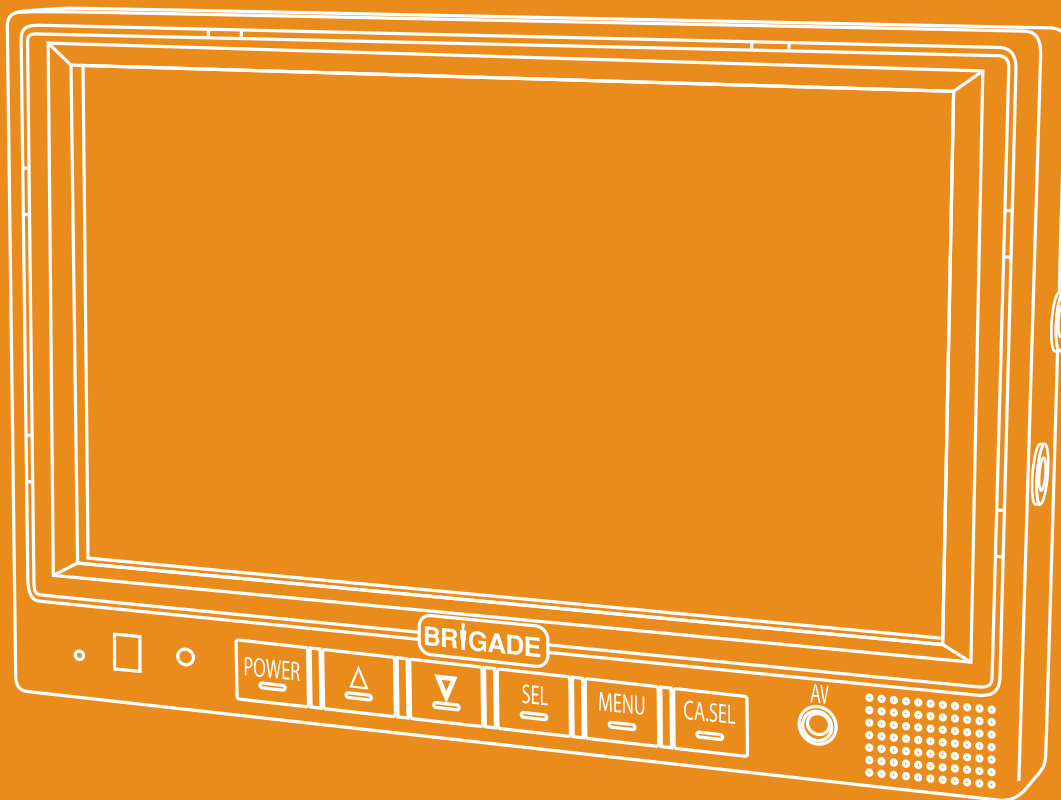
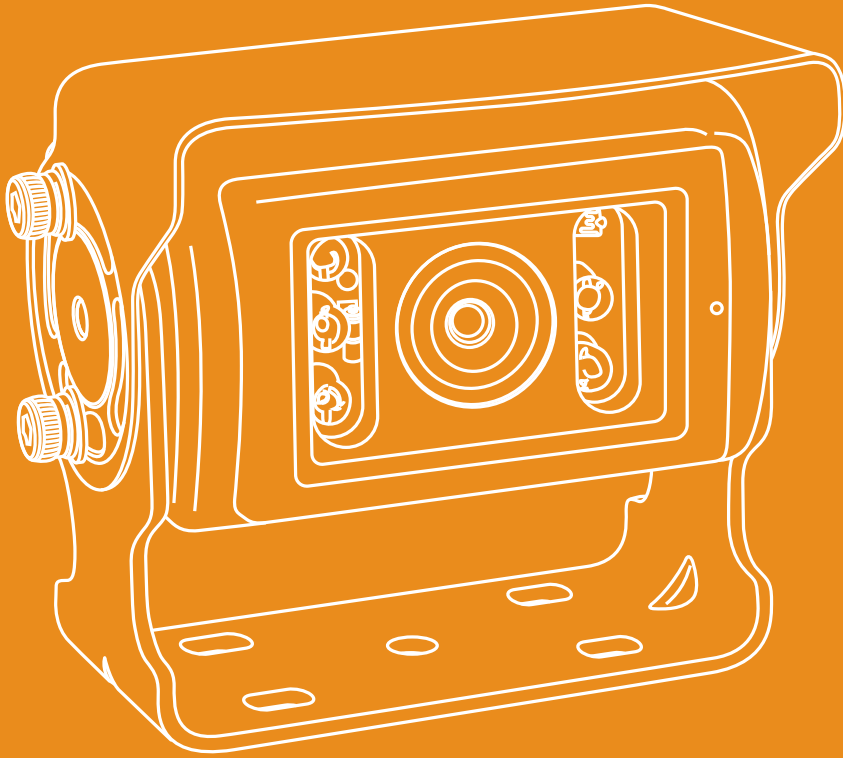
All impacts predicted within this assessment are considered to be localised and direct. However, unfavourable meteorological conditions, such as wind gradients and temperature inversions could transfer noise further away from the site making any potential impacts more widespread.

APPENDIX 2

EXAMPLES OF REVERSING ALARMS AND NOISE ATTENUATION BARRIERS



Vehicle Safety Solutions



Backeye™ Camera Monitor Systems



Camera Monitor Systems

Eliminating blind spots

Vehicle blind spots are a huge contributory factor in collisions in all industries. The substantial height and length of many vehicles and machines greatly limit driver visibility. Operator positions, bodywork panels, absent rear windows and bulkheads all create further restrictions.

There has been much debate about mirrors creating further blind spots and an 'information overload' for drivers who don't know where to look first. Knocked and broken mirrors have added to the question of suitability.

Camera monitor systems have brought driver vision into the twenty first century offering wider angles of view, clearer pictures and the ability to view multiple images on a single monitor.

The cost of limited visibility

The Health & Safety Executive (HSE) warned about the dangers of limited visibility after a banksman was killed when a motor grader reversed over him. He could not be seen by the driver due to a blind spot behind the machine. The company was fined £25,000.

HSE inspector David Jordan said, "the driver should have been more aware of the location of his banksman. The company could have done a lot more to prevent this death."

Every year 400 people are killed in EU countries when drivers fail to detect pedestrians, cyclists and other vehicles in their blind spots when manoeuvring.



How Brigade's camera monitor systems can help

Camera monitor systems are used in a wide range of on-road and off-road applications to meet a host of health and safety and legislative requirements. They can eliminate blind spots to prevent costly vehicle damage and ultimately save lives.

Operational and cost benefits

- ✓ Can cover multiple blind spots on a single monitor.
- ✓ Can reduce vehicle damage and downtime.
- ✓ Can help reduce insurance premiums.
- ✓ Improvement on mirrors:
 - Wider angle of view.
 - Clearer visibility in low light conditions.
 - Less likely to be damaged or broken.

Meet health and safety requirements

- ✓ Management of Health and Safety at Work Regulations (MHSWR) - requires all employees to identify risk and eliminate where possible.
- ✓ Provision & Use of Work Equipment Regulations (PUWER) - no person should be in a place where their health and safety is at risk as a result of operational control. (i.e. due to blind spots).

On-Road Applications

- ✓ EU directive 2007/38/EC - compulsory vision in class IV & V blind spots.
- ✓ EU directive 2003/97/EC - compulsory vision in class VI blind spot.

Off-Road Applications

- ✓ ISO 5006 – standard for earth-moving equipment which addresses the problem of blind spots around a vehicle.
- ✓ The Supply of Machinery (Safety) Regulations 1992 - appropriate devices must be provided to remedy hazards due to inadequate direct vision.



“Reversing of commercial vehicles is a major problem accounting for one claim in every six.”

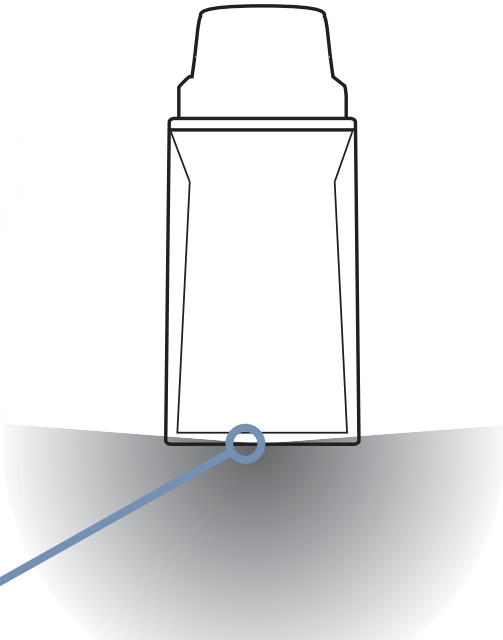
Association of British Insurers

Reverse in Safety

The rear blind spot is a huge problem regardless of vehicle/machine, and according to the Health and Safety Executive a quarter of all workplace accidents are caused by reversing. The University of Huddersfield highlighted in their report 'Reversing Accidents in UK Transport Fleets' found that a massive 90% of reversing accidents occur OFF the road (loading bays, lorry parks, private roads, quarry sites, warehouses etc).

Rear view camera benefits:

- ✓ Prevents reversing collisions with people, property or vehicles
- ✓ Reduces vehicle damage to the rear
- ✓ Reduced insurance premiums
- ✓ Assists safe and easier manoeuvring



Rear view cameras are available in the following ranges.
Elite, Select and Essential
Features include:

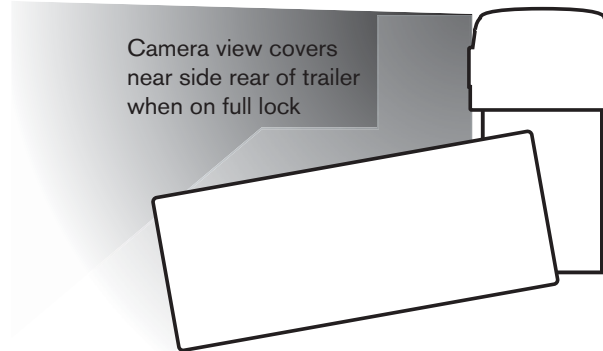
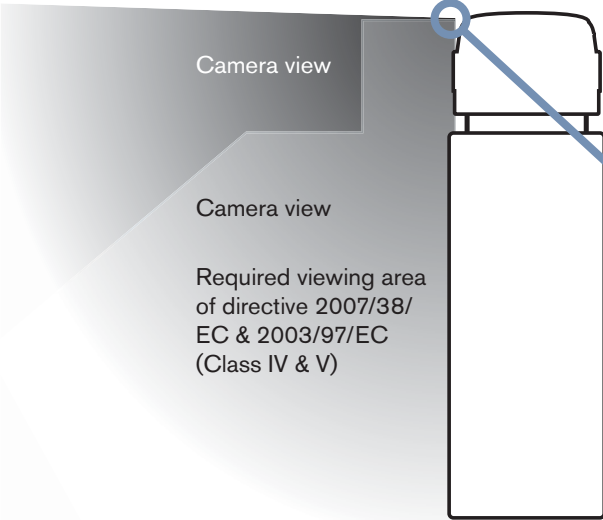
- IP69K
- Heated
- Shutter
- Compact and flush mount
- LED's for ultra-low light performance
- Up to 15m illumination distance

Please see the Brigade product catalogue for individual model specifications.

According to the Department for Transport, more than half of all cyclist deaths in London are caused by collisions with goods' vehicles due to the nearside blind spot.

Benefits:

- ✓ Meets side view requirements of EU blind spot directive 2007/38/EC & 2003/97/EC (Class IV & V)
- ✓ Removes the nearside blind spot
- ✓ Reduces risk of collisions with cyclists and pedestrians
- ✓ Reduces risk of sideswipe collisions with other vehicles
- ✓ Provides full side view of trailer when reversing on full lock, including near side rear corner
- ✓ Reduced nearside vehicle damage



Eliminating the Nearside Blind Spot

Most cyclist fatalities happen at low speeds, typically at road junctions and when moving off from a stationary position. A flush mount side view camera, triggered by the indicator solves this problem by giving a clear view of the nearside blind spot, where vulnerable cyclists and pedestrians are often hidden from the driver's view. Sideswipe collisions on motorways are another common result of poor visibility. This problem is especially acute for continental drivers in the UK, where the driver position is on the left hand side, and vice versa, when UK drivers are abroad.



Side view cameras are available in the following ranges:
Elite, Select
Features include:

- Flush mount
- Eyeball with adjustable lens position
- R46 approved for indirect vision

Please see the Brigade product catalogue for individual model specifications.

Front View

Forward Vision

Due to size of machinery and elevated operator positions, a blind spot often exists to the front. ISO 5006 states that 'a driver must be able to detect the presence of a standing person, of short stature [approx. 1.5m], 1m out from the perimeter of the machine.' A camera monitor system is the best solution for all round visibility.



Benefits:

- ✓ Meets front view requirements of EU blind spot directive 2003/97/EC (Class VI)
- ✓ Reduced front vehicle damage
- ✓ Prevents collisions with workers or pedestrians



Front view cameras are available in the following ranges.

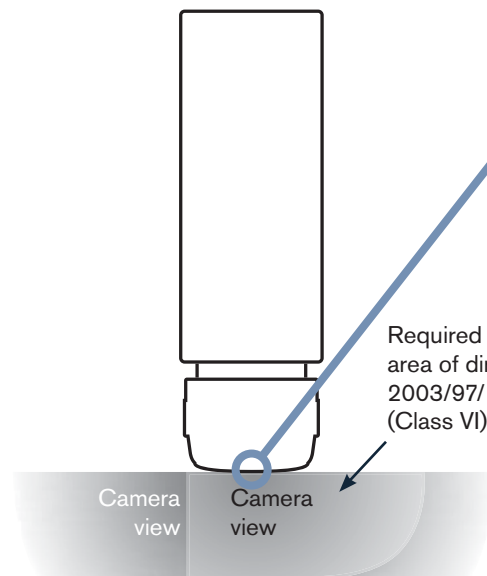
Elite, Select

Features include:

- IP69K
- Mini
- Flush mount
- Eyeball with adjustable lens position
- Infrared LED's for ultra-low light performance
- R46 approved for indirect vision

Please see the Brigade product catalogue for individual model specifications.

Additionally, trucks with tall cabs and/or high windscreens can lose sight of pedestrians in their front blind spot. Brigade's front view cameras meet the requirements of blind spot directive 2003/97/EC (Class VI), where front view is mandatory at forward speeds below 30kph.



Multiple View

All-round Visibility

Brigade's Select, Elite and Extreme camera monitor ranges are all suitable for multiple view applications. Up to four camera images can be displayed on a single monitor with in-built single, split, triple and quad screen function or in conjunction with Brigade's screen splitter.

On-road applications

All-round visibility is vital but mirrors can create further blind spots and drivers can only look in one direction at a time. By combining multiple cameras to view all blind spots on a single monitor, this problem is eradicated.

Camera 1: Front view

Camera 2: Side view

Camera 3: Rear view

The side view image can be shown permanently or triggered by the indicator circuit. At speeds of up to 30kph, the front view image can be simultaneously displayed using a multi-view monitor or a screen splitter. The rear view image is triggered by reverse gear.

If triggers are set up appropriately and the monitor has split screen functionality, this 3 camera configuration complies with all current blind spot legislation.



Off-road applications

It is essential for operators of agricultural machines to check produce is picked efficiently, whilst also ensuring safety. From the cab, visibility is limited, especially when the land is dry and dusty.

A bespoke, three-camera solution eliminates the problem.

Camera 1: Installed at the bottom of the pick-up element, viewing the level of the machine.

Camera 2: Positioned to look into the trailer of the adjacent collection vehicle.

Camera 3: Provides a panoramic rear view.

Images of the collection and transfer processes are shown on the monitor by default. The rear view is triggered by reverse gear.



Internal View

Ensuring passenger safety

Internal cameras are increasingly used as a deterrent against vandalism and violence. Attacks on passengers account for a quarter of all crime on London's buses. By using an in-cab monitor, drivers can observe activities in the vehicle and raise the alarm if necessary.

If a mobile digital recorder is installed, camera monitor systems can help reduce personal injury claims by deterring fraud. Evidence makes it easier for operators to refute any dubious claims that arise and prove whether a claimant was or was not on the bus concerned.

Internal cameras can be used to monitor driver behaviour by capturing footage of those who flout company regulations or are suspected of theft.



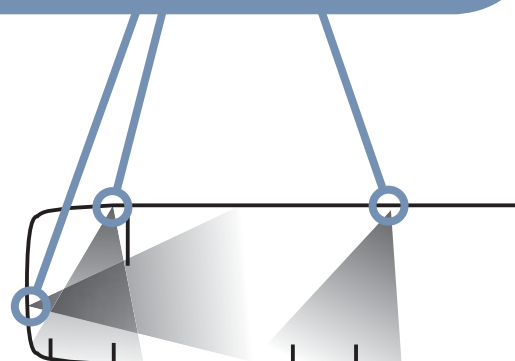
Internal cameras are available in the following range.

Elite

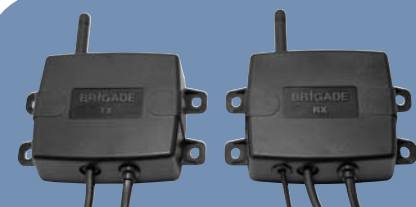
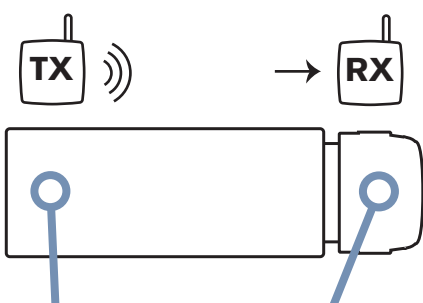
Features include:

- Mini
- Dome
- Flush

Please see the Brigade product catalogue for individual model specifications.



Wireless system



Features include:

- Digital technology
- Eliminates the need for additional suzie cables
- Vastly reduces installation time
- Allows for interchangeable trailers

Please see the Brigade product catalogue for specification.

Compatible with the following camera monitor ranges
Elite, Select

Cable free connection

Connecting a rear view camera system to a large vehicle or machine can be timely and awkward due to the amount of cable to install. Brigade's new wireless system eliminates excess cabling, saving up to two hours fitment time and removes the need for an additional suzie cable.

The camera image is sent to the monitor via a transmitter - installed on the trailer and a receiver - installed in the cab.

New digital wireless technology gives almost instantaneous pictures and is not affected by electrical interference from other vehicle equipment. Once paired, the transmitter and receiver link is secure, whilst a button on the receiver allows for re-pairing to a different transmitter making interchanging trailers easy on articulated vehicles.

Liability for vehicle related incidents is accepted on a daily basis by local authorities and large companies who have no way of disproving a false claim.

Protecting your driver. Providing your witness.

By recording footage from vehicle mounted cameras, mobile digital recording offers the solution. It provides an accurate witness, giving irrefutable evidence in the case of false claims, crash for cash incidents or vandalism. Refuting these claims means companies can make major cost savings, whilst importantly supporting their drivers, who are often the subject of increased scrutiny.



MDR-304 removable caddy and shock-proof mounting

Benefits:

- ✓ Prevent false insurance claims such as 'crash for cash' scams
- ✓ Protection for drivers who may be wrongly accused
- ✓ Provides irrefutable evidence in the case of accidents and legal proceedings
- ✓ Useful in reducing shrinkage and catching perpetrators
- ✓ Encourages driver best practice, so less vehicle damage and accidents
- ✓ Enables more effective driver training
- ✓ Vandalism deterrent
- ✓ All the above helps to lower insurance premiums
- ✓ Peace of mind for passengers and drivers

Mobile Digital Recording

Brigade's intuitive, affordable Mobile Digital Recorder captures real time footage from up to four vehicle mounted cameras.

Optional GPS and G-force sensor provides vital additional information such as vehicle location, speed, time and impact data. Recording can be activated or flagged by a trigger (such as a door opening, selecting reverse or indicating) or motion detection, useful for surveillance when the vehicle is unmanned. Offering selectable levels of image quality and recording between 2 to 30 frames per second, the hard disk can store up to 780 hours of footage.

Compatible with Brigade's wide range of camera monitor systems including rear, side, front and internal cameras, the MDR-304 is simple to install and data access is simple yet secure. The lockable hard drive is easily removed by authorised personnel for connection to PC or laptop for data download and interrogation.



Extreme

A robust range of camera monitor systems (CMS) especially suited to heavy duty applications, rugged terrain or where the cab is exposed to the elements.



- Features include:**
- Water and dust proof to IP69K
 - Single/split/triple/quad/picture in picture screen function
 - Certified to ISO 13766:2006 standard for earth moving equipment
 - Backlit touch screen button panel

3
YEAR
WARRANTY

Essential

A low cost, entry level reversing camera monitor kit. Ideally suited to light commercial vehicles and vans where only one camera is required.



1
YEAR
WARRANTY

Elite

A superior, high quality CMS range for comprehensive blind spot coverage. Suitable for large road going vehicles and specialist applications.



- Features include:**
- Single/split/triple/quad/picture in picture screen function
 - Certified to ISO 13766:2006 standard for earth moving equipment

3
YEAR
WARRANTY

Select

Our mid range CMS offer added choice, camera inputs and features at a cost effective price. Suitable for medium to large road going vehicles.



2
YEAR
WARRANTY



**Camera Monitor
System Ranges
and
Suggested Vehicle
Compatibility**

To order or for more information on
Brigade's vehicle safety solutions;

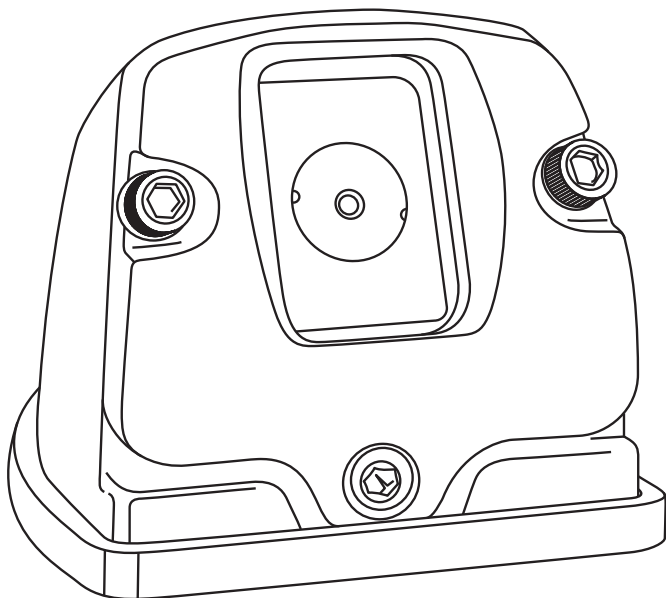
 **brigade-electronics.com**

 **+44 (0)1322 420300**

or visit your local stockist

Brigade's extensive portfolio of safety systems includes:

- **Smarteye™ 360° Camera monitor systems**
- **Camera monitor systems**
- **'White sound' reversing and warning alarms**
- **Pulsed radar obstacle detection systems**
- **Mobile digital recording**
- **Ultrasonic obstacle detection systems**



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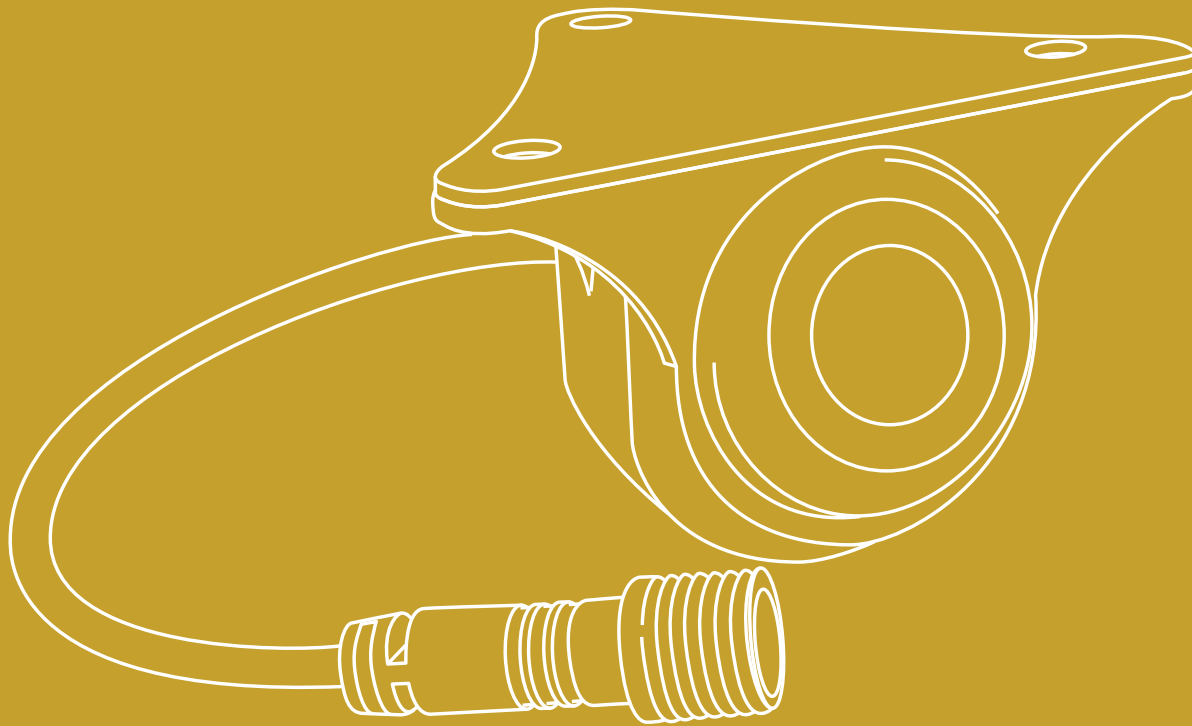
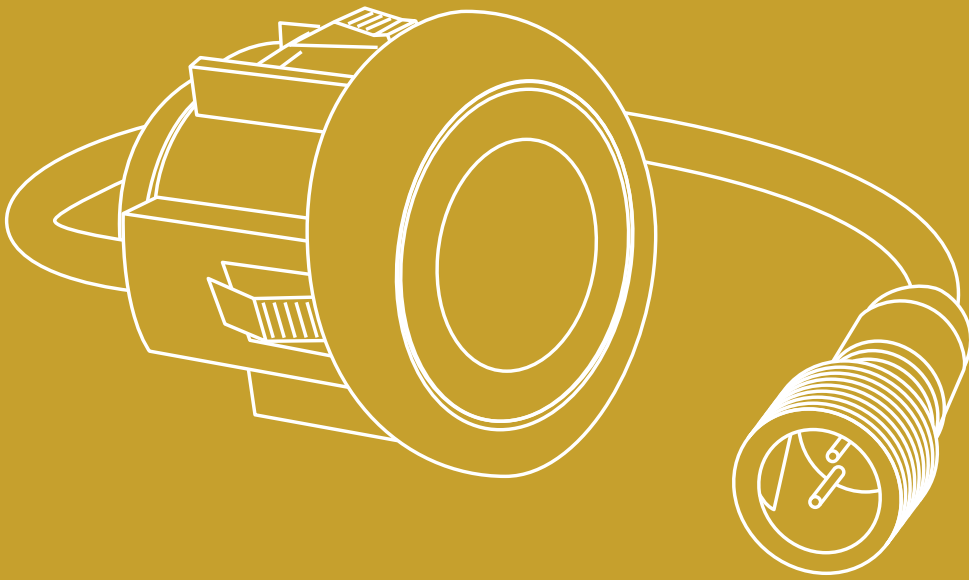
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Vehicle Safety Solutions



Ultrasonic Obstacle Detection



Sensing danger

Blind spot legislation is extremely topical. Over the last few years vehicle safety devices such as extra mirrors or camera monitor systems with wider viewing angles have become mandatory. However, despite an increase in all-round visibility, collisions with other vehicles, fixed objects, cyclists, workers and even pedestrians, remain high.

The issue of cyclist fatalities has been of particular concern, with more than half of all cyclist deaths in London attributed to collisions with HGVs. Fiona Hall MEP, who tabled a European written declaration on the matter, says: "Sensors and cameras should be compulsory on all lorries so that drivers are always aware when someone is close to their vehicle. This is everyday technology used to help car drivers with parking – on lorries it will save lives."

Ghost Bikes are becoming an increasingly common sight worldwide, a sombre memorial for a cyclist killed on the road. A bicycle is painted white and placed near the crash site, accompanied by a small plaque.

Ultrasonic Obstacle Detection

How Brigade can help

Brigade's ultrasonic detection and warning systems alert the driver of potential danger. An audible warning informs the driver of the distance between vehicle and obstacle, minimising both vehicle damage and collisions with pedestrians, cyclists or objects. Activation triggers (eg: reverse gear, left indicator) ensure the system is only operational when it is needed and an optional speaking alarm can be added to alert cyclists and pedestrians of the vehicle's path.

Brigade's range of ultrasonic sensor systems include Backscan®, Frontscan®, Sidescan®, Cornerscan™ and Stepscan™ and provide the following benefits.

- ✓ Gives peace of mind to the driver, greater protection to pedestrians, cyclists and workers
- ✓ Minimises damage to vehicle, property and other objects
- ✓ Can be used in conjunction with Brigade's camera monitor system for comprehensive all round blind spot coverage

The cost of turning a blind eye

Even a relatively small accident can be immensely costly to a fleet operator. Apart from repairs to the damaged vehicle, there is downtime and replacement vehicle hire costs to consider and this doesn't take into account any insurance or legal expenses.

Typical damage costs based on a Mercedes Actros:

Item	Cost of replacement
Step (bottom part moulded)	£295 - £585
Bumper - two corners and centre	£248
Under run bars (box section welded)	£385
Whole Front light cluster	£246
Rear light	£134

Yet the consequences can be even more severe.

A company was fined £105,000 in September 2009 after an employee was killed by a reversing lorry at the skip waste site where he worked. The man was in the lorry's mirror blind spot when he was struck by the rear of the lorry and run over.

"By fitting Brigade's Ultrasonic sensors, we are achieving a very high standard of health and safety on public highways both for Keltbray and other road users."

Adrian Scott, Haulage Operations Director, Keltbray



To view the Keltbray video case study on Sidescan, visit: brigade-electronics.com

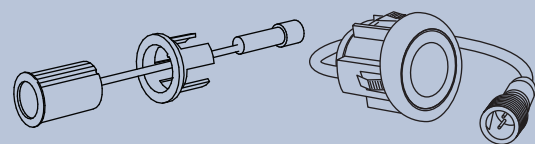


Ultrasonic Obstacle Detection

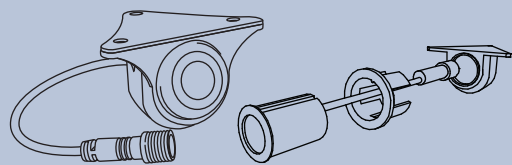
Two, three or four sensor ultrasonic sensor systems inform driver of distance between vehicle and any obstacles, whether moving or stationary. Perfect for road going commercial vehicles regularly operating in confined spaces or manoeuvring at low speed.

Features of all systems:

- Obstacles detected in under 200 milliseconds
- Environment Learning Mode prevents false alarms from permanent bodywork that intrude in the first 100cm of the detection zone
- Self diagnostic function
- Fixings included for all bodywork types
- Three stage audible distance warning to driver with adjustable volume
- 1 trigger output
- 2 year warranty



Assembly and housing for flush mount fixings



Housing and assembly for underslung fixings

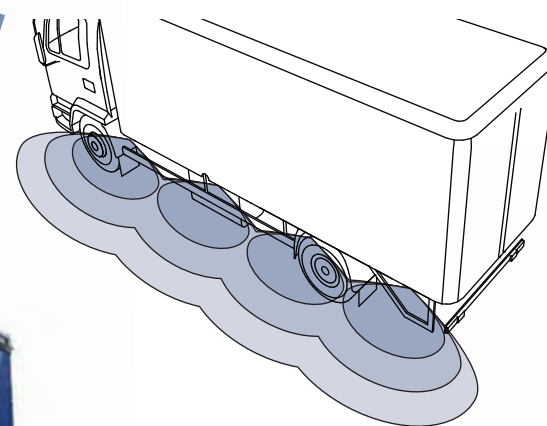
Sidescan®

Fitted to side of vehicle increasing safety when turning or low speed manoeuvring. Particularly relevant for near side blind spot where cyclists or pedestrians can otherwise go undetected.

- 4 sensor system
- Underslung or flush mount sensors
- 1.0 or 1.5m detection range
- Two levels of detection sensitivity

Options:

- System activated below designated speed
- System activated by turn indicator
- External speaking alarm with side turn warning for cyclists/pedestrians
- Can be fitted to articulated vehicles with additional suzie cables



BRIGADE®

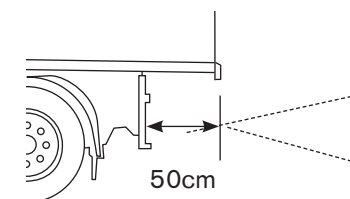
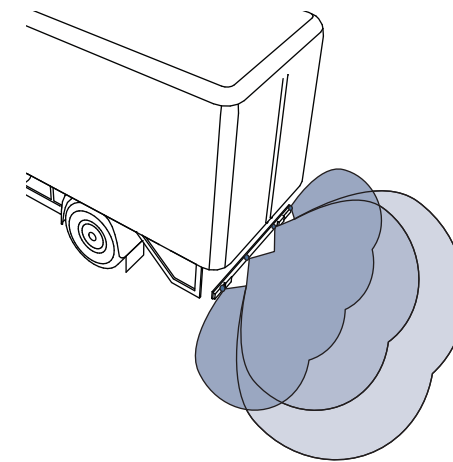
Backscan®

Fitted to rear of vehicle as an invaluable aid to safe reversing. Gives greater protection to pedestrians and workers, whilst minimising damage to vehicle and other objects.

- 4 sensor system
- Underslung or flush mount installation
- 2.5m detection range - outer sensors can be reduced to 0.6m
- System activated by reverse gear
- 50cm compensation range for sensors fitted inboard of vehicle rear

Options:

- Can be fitted to articulated vehicles with additional suzie cables
- 3 stage visual distance warning display



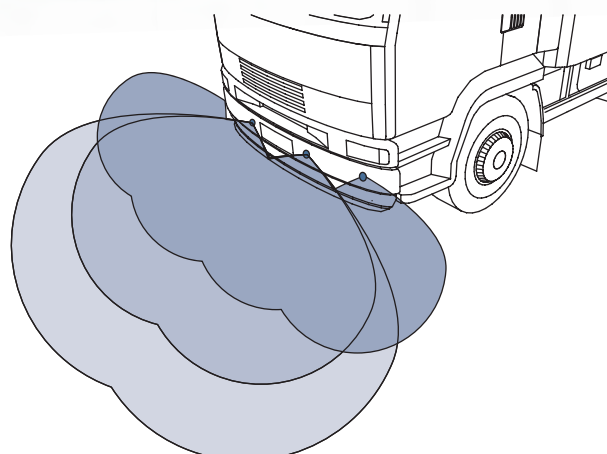
Frontscan®

Fitted to front of vehicle improving safety when manoeuvring at low speed. Particularly relevant for front blind spot on high cabs where low objects or pedestrians can be hidden.

- 4 sensor system
- Flush mount sensors
- 2.0 or 1.0m detection range - outer sensors can be reduced to 0.6m

Options

- System activated below designated speed



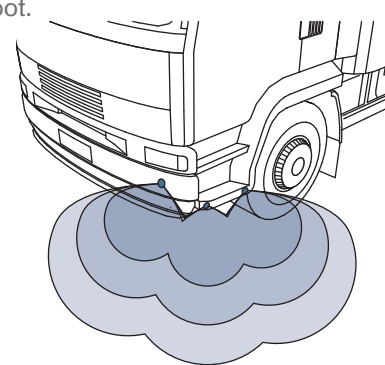
Cornerscan™

Fitted to near side corner of vehicle cab to detect objects in front near side blind spot. Minimises the risk of damage to the vehicle cab whilst manoeuvring and turning whilst reversing.

- 3 sensor system
- Flush mount sensors
- 0.6 or 1.0m detection range
- Two levels of sensitivity

Options

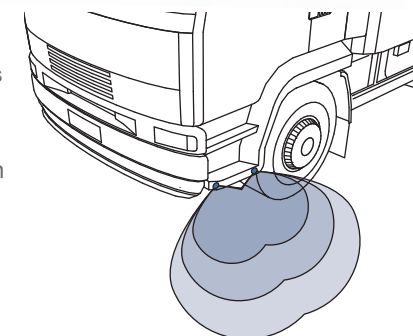
- System activated below designated speed



Stepscan™

Fitted to nearside cab step giving awareness to the driver of objects when turning and reversing. Minimises the risk of damage to the vehicle from otherwise unseen objects.

- 2 sensor system
- Flush mount sensors
- 0.6 or 1.0m detection range
- Two levels of detection sensitivity
- System activated by reverse gear



Sidescan® Case Study

Safety on the side



Cemex, a leading supplier of cement, ready mixed concrete and aggregates adopted a range of safety measures to resolve the issue of cyclist and HGV collisions.

Cemex fitted a range of Brigade's safety systems to its tippers and mixers to improve the driver's field of vision and make their vehicles more visible to pedestrians and cyclists. The combination systems include Brigade's movement sensors (Sidescan) and talking alarms (Backchat) to alert both parties to potential danger.

During an FTA Seminar, Paul Clarke, Logistics Fleet Engineering Manager at Cemex said "Between 2000 and 2004 vehicles operating on our behalf were involved in 6 road

traffic accidents involving cyclists on the nearside, two of which sadly resulted in fatalities, however...

"...since fitting Brigade Sidescan as part of a wider programme of road safety initiatives, we have not experienced any blameworthy road traffic incidents involving cyclists on the nearside."

Paul Clarke
Logistics Fleet Engineering
Manager, Cemex

Endorsements



Transport For London trialled blind spot technologies including Sidescan. Respondents found it particularly helpful in slow manoeuvres, tight spaces and felt it performed well in the dark.



Lafarge have set a worldwide target standard to install Brigade safety equipment to their vehicles including Ultrasonic Detection Systems. To view the Lafarge video case study, visit: brigade-electronics.com



Crossrail has set minimum standards for safety equipment for their contractor vehicles including side sensors.



RoadPeace has prepared a briefing for coroners and collision investigators on how blind spots can be eliminated using life saving vehicle safety equipment, such as sensors.

Backscan® Case Study



Every little helps when it comes to safety

The convenience and popularity of internet shopping has led to a sharp growth in home delivery. However, the increase in number of large cars in small residential streets coupled with the rear blind spot has made reversing and parking manoeuvres very difficult.

Damage to property and parked cars is costly and many operators can ill afford vehicle downtime for repairs. More startling is the real threat of collisions with pedestrians. According to the Health and Safety Executive (HSE) 25% of all workplace fatalities are caused by reversing vehicles.

Tesco.com is the largest online grocery store in the world. Drivers were experiencing problems reversing due to the huge blind spot at the rear of the vehicle and were also reporting damage from overhanging trees, especially in rural areas.

Brigade solved the problem by fitting upper Backscan sensors to protect the Mercedes Sprinters from overhanging branches. In addition, lower Backscan sensors were fitted to the bottom of the delivery vans to detect people and objects in the blind spot when reversing.

"We are very pleased with the performance of Brigade's Backscan which enables home delivery drivers to reverse into tight spaces. This ensures the safety of pedestrians and property, thus reducing damage to the vehicle."

Duncan Vavangas. Fleet Engineer,
Tesco.



To order or for more information on
Brigade's vehicle safety solutions;

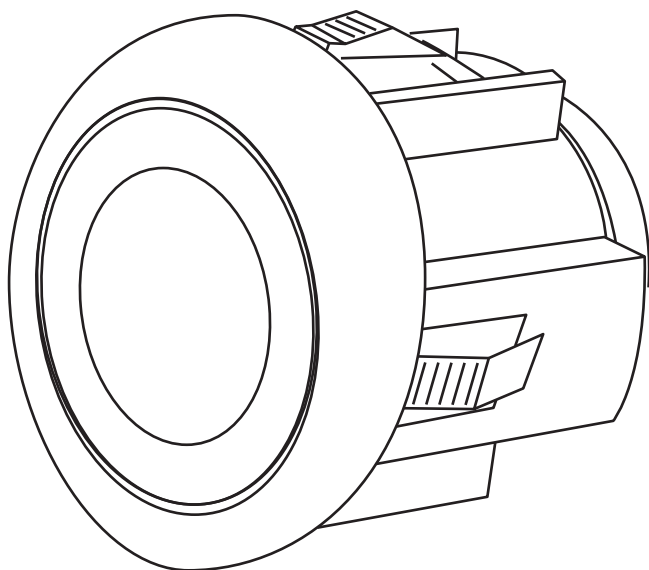
 **brigade-electronics.com**

 **+44 (0)1322 420300**

or visit your local stockist

Brigade's extensive portfolio of machine safety systems includes:

- **Camera monitor systems**
- **'White sound' reversing and warning alarms**
- **Pulsed radar obstacle detection systems**
- **Mobile digital recording**
- **Ultrasonic obstacle detection systems**



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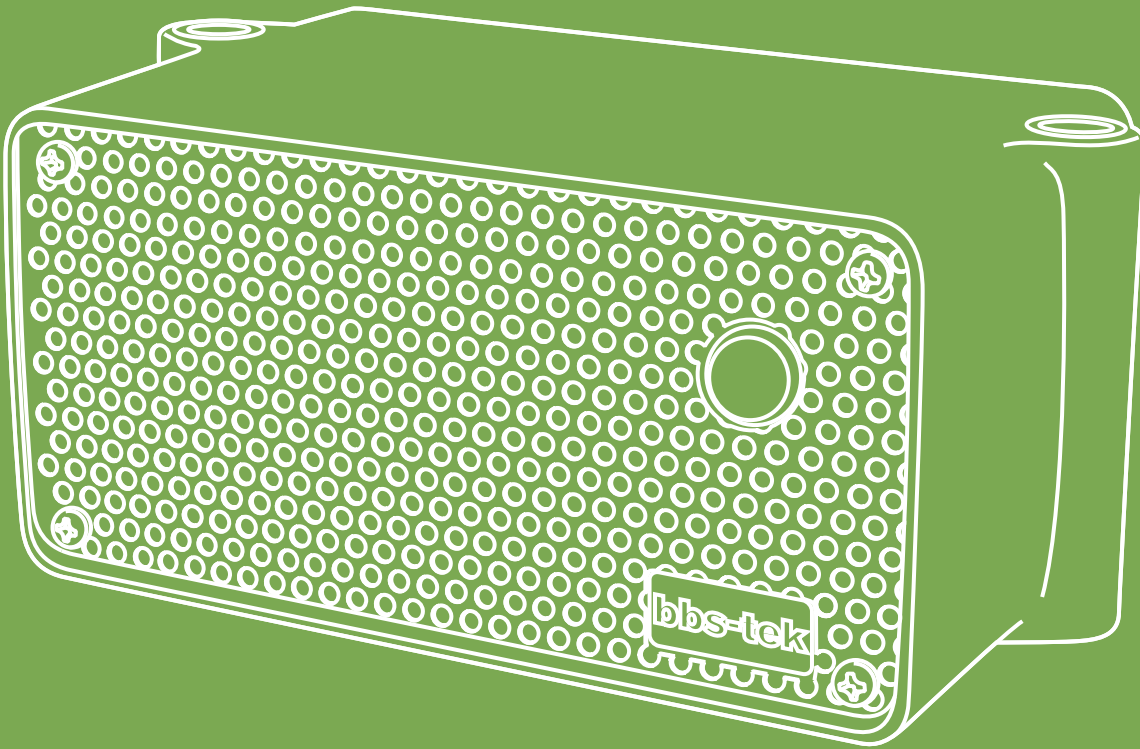
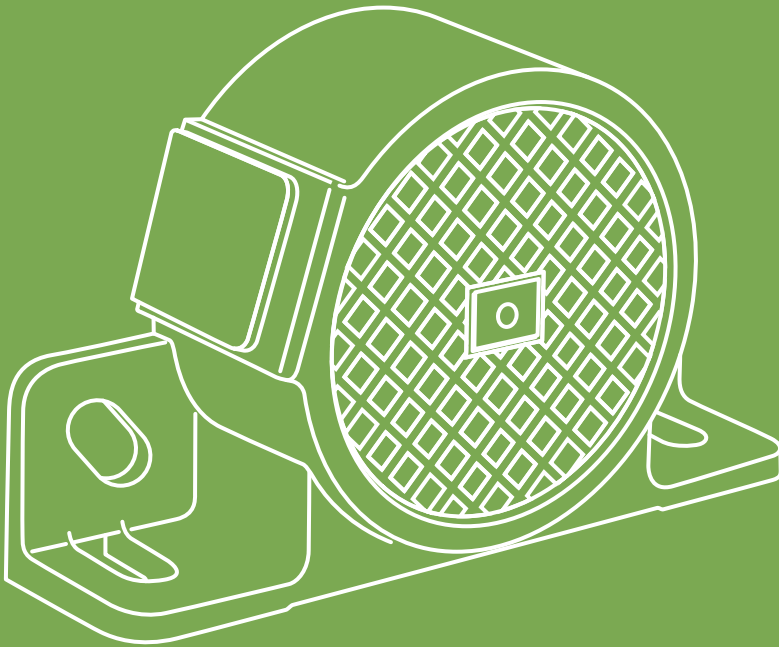
Belgium, The Netherlands & Luxembourg

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Vehicle Safety Solutions



bbs-tek[®] White Sound Warning Alarms



No need for alarm?

One quarter of all workplace deaths are caused by reversing vehicles according to the Health and Safety Executive (HSE). Many others result in injury and costly damage to vehicles, equipment and buildings. Despite this many operators still fail to fit simple and yet relatively inexpensive reversing alarms. With the advent of the Corporate Manslaughter Act, there has never been a greater legal necessity to carry out effective risk assessments of reversing processes.

Reversing 'beep beep' alarms were first introduced to Europe in the 1970s. They provided a vital step forward in safety, yet over time they have been shown to have a number of inherent problems; specifically concerning their environmental impact, but also in terms of safety – the exact reason they were introduced in the first place.

Advances in technology mean there is now a much better alternative.

Brigade Electronics has made a dramatic decision to phase out beeping tonal alarms for a safer alternative that does not cause a noise nuisance.

bbs-tek® White Sound Warning Alarms

White sound (bbs-tek®) alarms are a revolutionary new generation of warning alarm. They are the safest reversing alarms in the world and do not cause a noise nuisance. Already fitted across a range of industries from mobile plant machinery to airport luggage buggies, bbs-tek® is fast becoming the reversing alarm of choice. In fact, in New York City it is the only alarm permitted on construction vehicles. Brigade's vision is to ensure that every commercial vehicle is fitted with a white sound alarm to reduce reversing fatalities.

Why choose bbs-tek® over tonal alarms?

	bbs-tek® white sound alarms	Tonal 'beep beep' alarms
Safety		
Effective danger warning	Yes	Depends
Alarm sound quickly located	Yes – directional sound	Unreliable – confusing
Heard only where it matters	Yes – only in hazard zone	No – an area at least 30 times greater than hazard zone
Effect on workers	Treat warning with respect	More likely to become desensitised to sound or even disable alarm, increasing risk
Audible - heard by those wearing ear defenders or with a hearing impairment	Likely	Less likely
Environmental		
Eliminates noise complaints	Yes	No – sound too strident and piercing
Approved by the Noise Abatement Society	Yes	No
Certified by NAS/PIEK for night-time delivery	Yes – certain models	No
Health		
Risk of hearing damage and stress	Lower	Greater



Off-road bbs-tek®

Off-road working environments are commonly dominated by large mobile plant machinery, high noise levels and difficult terrains, making life extremely dangerous for workers. To improve safety, site operators must ensure the best possible warning is given to workers when machinery is reversing.

Heard only where it matters

White sound dissipates quickly meaning the alarm can only be heard in the hazard zone. It also creates a "ssh ssh" sound which is gentler on the ear. The combined effect ensures the warning is treated with respect and prevents workers from becoming desensitised to the alarm sound, tuning it out. It also reduces the likelihood of sabotage from workers disabling alarms.

Beeping tonal alarms can be heard up to thirty times the distance of the hazard zone causing workers to 'switch off' due to over-familiarity - putting them gravely at risk.

Instant locatability

White sound reversing alarms use broadband frequencies. These give greater directional information to the ear allowing the listener to instantly locate where the sound is coming from, and time to take evasive action.

Tonal alarms in contrast can cause a head-spinning effect, confusion and disorientation. Vital seconds can be lost resulting in fatal consequences.



An end to confusion

A worker on a road construction site in the Middle East was seriously injured by a road roller. He heard an alarm and saw a truck reversing. The worker was then hit by the roller from behind. The truck did not have an alarm, the roller did – a tonal alarm.

Following locatability trials, the company installed white sound alarms to all their road rollers worldwide.

Audible to all

Hearing protection devices (HPDs) protect workers from hearing damage, yet it is vital they can hear reversing vehicles to avoid fatality. HPDs mask the effect of some frequencies more than others. With a wide range of frequencies white sound alarms are much more likely to be heard. In the same way, those with hearing impairments stand a better chance of hearing white sound.

By contrast the sound of a narrowband, tonal alarm could easily be masked, dramatically increasing the chance of collision.



Heavy duty

For plant, quarry and construction machines or environments with high ambient noise.

BBS-107
BBS-102
SA-BBS-107 (SMART)



Medium duty

Ideal for smaller off road vehicles and environments with mid level ambient noise.

BBS-97
BBS-92
SA-BBS-97 (SMART)



Other

Electric forklift (high voltage) options

BBS-97HV
BBS-92HV

Constant tone ideal as a user operated forward horn or other warning.

CT-BBS-97
CT-BBS-92
CT-BBS-97HV
CT-BBS-92HV



All bbs-tek® white sound alarms come with a lifetime warranty

Stress free

British Airports Authority (BAA)

A health study by BAA involving noise exposure monitoring resulted in some very high noise readings. Originally thought to be due to faulty meters, a more detailed study identified that the tonal alarms on the passenger terminal electric buggies were being reflected so intensely they created a health problem.

Following further studies and a safety review BAA now specifies white sound alarms.

On-road bbs-tek®

Commercial vehicles working and delivering in tight urban areas need to make regular reversing manoeuvres. In local neighbourhoods and busy town centres they must safely warn pedestrians, whilst ensuring they do not cause a noise nuisance to local residents and businesses.

Quieter, yet safer

The safety benefits of white sound are the same whether off- or on-road. However, in urban areas, the environmental impact becomes much more important.

White sound meets the challenge by dissipating quickly outside the hazard zone, eliminating noise complaints. Furthermore, with its wide frequency range, white sound alarms can even operate 5-decibels quieter than a tonal alarm, yet still provide the same alerting effect.

Beeping tonal alarms can be heard up to thirty times the distance of the hazard zone, causing irritation, noise complaints and stress.

Adjusting to the ambient

In environments with varying ambient noise levels a fixed sound level alarm may be either too loud or too quiet.

As the ultimate in warning alarms, **SMART bbs®** models solve this problem. They continuously react to the surrounding noise level and self-adjust their warning sound to maintain it in the region of just 5dB louder. This ensures the alarm is loud enough to act as a warning, but not so loud that it startles workers or disturbs local residents.

Eliminating noise complaints

Asda opened a new supermarket near Skelmersdale in the UK. Part of the planning permission stipulated that any sound produced by reversing alarms should be inaudible to nearby residential properties, but initially there were complaints from local residents about tonal beepers. West Lancashire Borough Council confirmed that after Asda switched their fleet to white sound alarms the complaints stopped immediately.



Medium duty

Ideal for commercial road going vehicles and environments with mid level ambient noise.

BBS-92
BBS-87
BBS-82*



NEW low cost model



SMART bbs®

Continually adjust to 5-10 decibels above ambient so ideal in varying noise level environments

SA-BBS-97*



Other

Constant tone ideal as a user operated forward horn or other warning.

CT-BBS-97
CT-BBS-92
CT-BBS-97HV
CT-BBS-92HV

Petrol tanker (ADR)
BBS-92ADR - Petrol tanker



All bbs-tek® white sound alarms come with a lifetime warranty

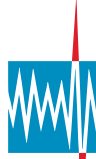
* Certified by PIEK for night-time delivery

Night time delivery

The environmental benefits of white sound alarms have resulted in them being endorsed by the Noise Abatement Society, with certain models certified by PIEK, the Dutch authority set up to regulate quiet night-time deliveries in Europe. By fitting white sound alarms, companies can now benefit from cost and time savings by operating at night on quiet roads, without compromising on safety.

Beeping tonal alarms are too strident to be used at night, whilst working without an alarm puts lives at risk.


noise abatement society

 **Piek**

To order or for more information on
Brigade's vehicle safety solutions;

 **brigade-electronics.com**

 **+44 (0)1322 420300**

or visit your local stockist

Awards:

- NAS John Connell Award for Innovation 2003
- Society of Automotive Engineers Noise Management Innovations Award 2003

Recognition:

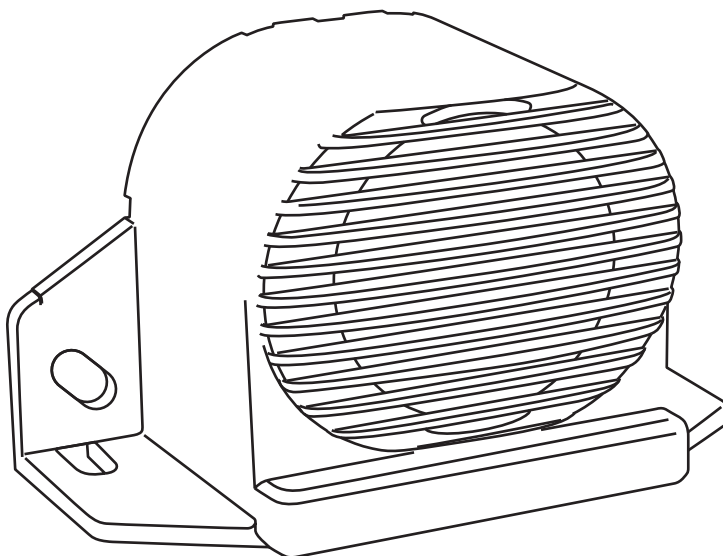
bbs-tek white sound alarms are specified worldwide by major supermarket chains; mining, quarry & construction conglomerates; distribution, bus & waste operators; and government and regulatory bodies.

For more information:

A white paper with detailed technical information on the benefits of white sound is also available – please enquire or visit www.brigade-electronics.com/product-focus/alarms

Brigade's extensive portfolio of machine safety systems includes:

- **Camera monitor systems**
- **'White sound' reversing and warning alarms**
- **Pulsed radar obstacle detection systems**
- **Mobile digital recording**
- **Ultrasonic obstacle detection systems**



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GRAMM BARRIER SYSTEMS LTD

ENVIRONMENTAL AND SECURITY BARRIER SPECIALIST

ALUMINIUM AND STEEL BARRIERS

High density mineral wool has good sound deadening properties and can be encased in either high specification pre-galvanised and painted steel or aluminium panels to produce a light weight sound absorbing barrier. These are used extensively throughout Europe within urban areas and on structures.

Each panel is made of corrosion-resistant aluminium steel, and perforated for acoustical absorption.

The size and pattern of the perforations are designed to protect and maintain the sound-absorptive capability of the acoustic fill inside the panels. The reverse side away from the road, is made of non-perforated galvanised steel, also corrosion-resistant.

Metal structures cut the build up of reverberant sound between parallel barriers, resulting in noise reduction higher than that provided by the hard-surface alternates.

A unique design feature of the aluminium and steel barrier construction is that individual panels can be removed and replaced. Panels are not bolted, welded, or otherwise permanently fastened to each other or to the support posts.

Should replacement be called for as a result of structural damage, no more than three workmen using ordinary hand tools will be able to do the job.

The light weight – 6lb/sq ft (29.3 kg/m²) of the noise shield panels also make them the prime choice for barrier construction atop existing bridges, overpasses, or other elevated transit structures which cannot support concrete panels of the same thickness – 4in. (102mm) weighing in at a heavy 37 lb/sq ft (180.6 kgm²).



Steel galvanised and painted absorptive noise barriers designed for heavy traffic on main roads and motorways.



Aluminium modular system designed for easy installations on roads and railways.



Lightweight aluminium panel system suitable for bridges and underpasses.



Combined aluminium absorptive and acrylic barrier system allowing bespoke architectural designs.



All components are maintenance-free and recyclable.



Octive Band, Hz	63	125	250	500	1K	2K	4K	8K	STC	NRC
Sound Transmission Loss, dB	-	-	-	-	-	-	-	-	-	-
Sound Absorbption Coefficients	-	-	-	-	-	-	-	-	-	-



Caption to come

Technical specification:**Acoustic Performance:**

The acoustic performance meets all the current UK and European regulations for roadside applications.

Random Incidence Sound Absorption:

- Tested to BS 3638 (BS EN 20345: 1993)
- Noise reduction coefficient (250-2000Hz): $\alpha=0.98$
- Tested to proposed CEN standard, pr EN 1793:1
- $DL_a=16$ dB, Class: A4

Sound Insulation:

- Tested to BS 2750: Part 3 (BS EN20140: Part 3) (ISO 140/111)
- Weighted Sound Reduction Index, $R_w=30$ dB (BS 5821: 1984)
- Tested to proposed CEN standard, pr EN 1793:2
- $DL_R=24.6$ dB, Class: B3

Panel Dimensions:

Post Spacing:	2.0m	3.0m	4.0m
Panel Length:	1.95m	2.95m	3.95m*
Effective Panel Height:	0.4m**	0.6m	0.8m**
Panel Width:		0.125m	Nominal

* Other dimensions to special order.

** Nominal dimensions and to special order only.

Posts:

Structural Steel Universal Columns from low carbon steel to BSEN 10025, 152mm x 152mm for standard systems.

Absorbant Infil:

75mm Thick mineral wool with black glass tissue face. Density 60kg/cubic meter.

Finish:

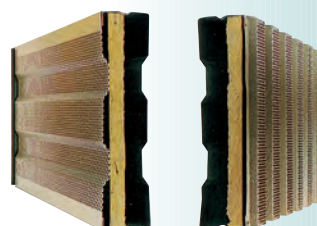
Top and bottom Aluminium profiles in natural finish.** Panels in a choice of Polyester powder coated, semi gloss (30%) colours

Posts in a hot dip galvanised finish to BS 729.**

* Can be powder coated to special order.

A Perfected System
Gramm noise protection elements meet all requirements:

- exceeding the noise values demanded
- guarantee a large measure of traffic safety
- are steady and dimensionally stable
- they are resistant to ageing and corrosion
- they are dimensionally accurate
- they are colourfast and resistant to fire
- they are resist impacts from stones and are largely maintenance-free



Contact

Stephen Whittle

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E-mail SteveWhitt@aol.com

www.grammbarriers.com

POLYPLANK

system SB 500 RA

Absorbing and reflecting noise barrier



GRAMM BARRIER SYSTEMS LTD
ENVIRONMENTAL AND SECURITY BARRIER SPECIALIST

POLYPLANK SYSTEM SB 500 RA IS A HIGH-EFFICIENT, ABSORBING AND REFLECTING NOISE BARRIER OF RECYCLABLE MATERIAL, SUITABLE FOR INSTALLATION OF HEIGHTS UP TO 6 METRES.

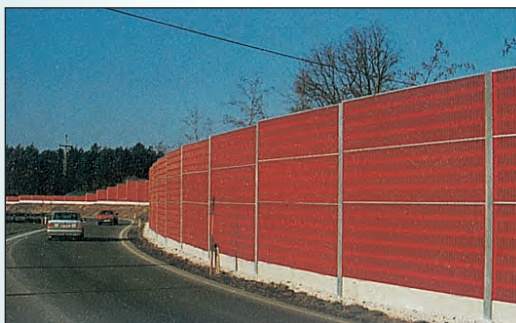
The PolyPlank system SB 500 RA is a unique, recycled product manufactured of mixed plastic waste.

The SB 500 RA system can be mounted to heights of up to 6m with a maximum c/c of 5m. Suitable for mounting on concrete walls etc.

Acoustic tests show a high absorption (9 dB) and a high airborne sound insulation (29 dB).

All components are of maintenance-free material. Easy mounting in galvanized HEA-steel posts minimises installation times, especially important on roads and railways with heavy traffic.

Over 70000 sq metres of PolyPlank SB 500 RA have been delivered in Europe.



PolyPlank SB 500 RA reflecting and absorbing noise barriers for installations of heights up to 6 metres.

Technical specification:

PolyPlank boards:

Composite material of mixed thermoplastics and organic fibre.

Mounting height:

Max. 6000mm

Length:

Max. 5000mm

Posts:

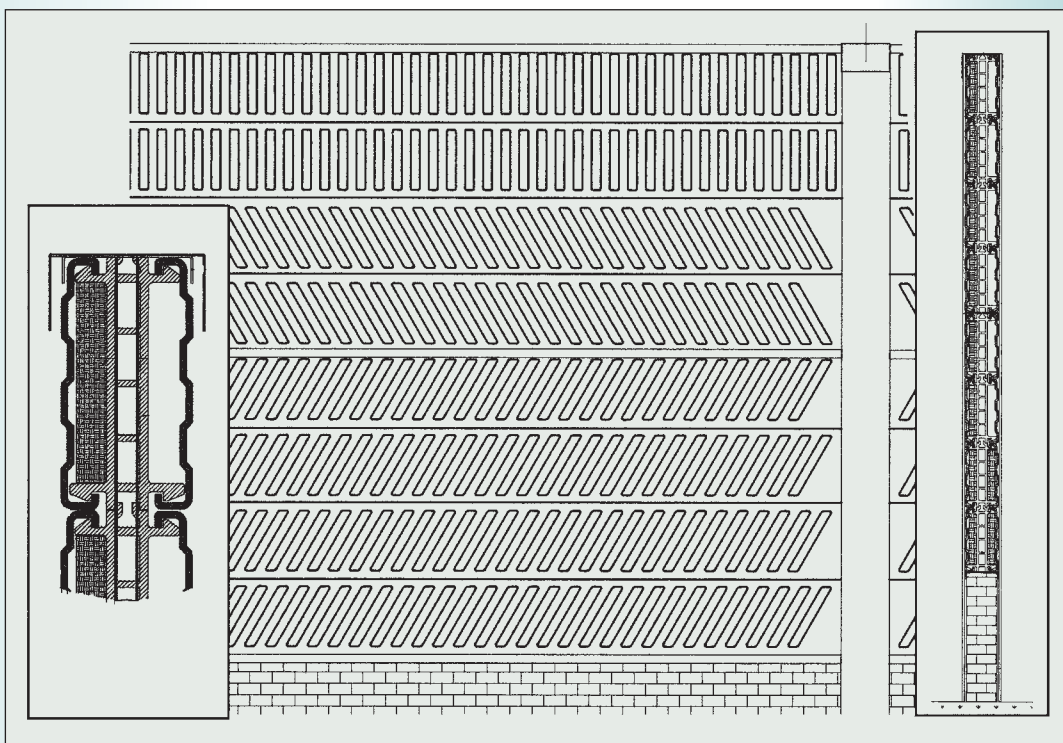
Galvanized HEA-steel posts 160-200.

Weight:

43kg per sq m (excl. HEA 160-200 and concrete foundation).

Absorbent:

Single or double-sided of 30mm recycled polyester or rockwool.



All components are maintenance-free and recyclable.



Contact
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CANOR BENELUX BV noisebarriers

SPECIFICATION SHEET OF THE NOISEBARRIER:

TECHNICAL DATA:

Material	: Hot dip galvanized steel+ mineral wool
Mesh	: 200 x 400 or 200 x 200
Wire thickness	: 6 or 8 mm
Element thickness	: maximum 230 mm
Element height	: maximum 2.000 mm
Element Length	: maximum 4,0 m
Weight (kg/m ²)	: maximum 45 kg/M2.
Windload	: 1,5 kN/m2



Covered with plants

Background:

The CANOR BENELUX BV NOISEBARRIER, is a mineral wool (Saint Gobain) based noisebarrier, that offers top absorption and insulation values. The standard consist out a metal mesh that is covered with a PE-net. This net can be supplied in different colours. At request all galvanized steel material can also be powder coated. The steelnets consist out of a rectangular mesh in order not to disturb the driving in his view and create longitudinal lines. After installation the barrier can easily be covered by different climbing plants. The nature of the barrier supports plantgrowth. The applied plants at this system creates a clean and healthy environment and will transfer polluted CO₂ towards O₂. The barrier itself is constructed out of fully recycable materials. Therefore this system is excellent alongside highways, railways and local roads due to it's nature of visual and environmental green aspects.



Impression at rail track with square net

SPECIFICATIONS:

GALVANISATION	: NEN1275 (DIN 17.100)
ISOLATION VALUE	: upto $R_w(C;Ctr) = 42(-2; -7)$ dB
According to	: ISO 717-1: 1996
ABSORPTION VALUE	: upto $\alpha_{fw} = 1,00$
According to	: ISO 11654

At request this modular elements can be executed with different configurations of noise absorption and isolation in order to fullfill the client requirements as much as possible. This regarding the needed requested absorption and isolation values



For further information please contact:

Ing. L.A. Pulleman

Tel: 0031 167 540405

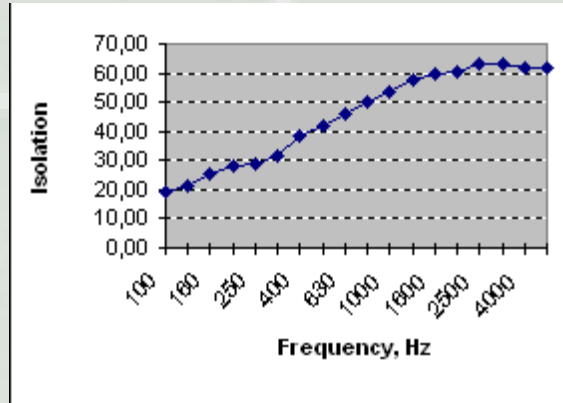
Fax 0031 167 540406

Mobile: 0031 6 51 235 948

ACOUSTIC PERFORMANCE:

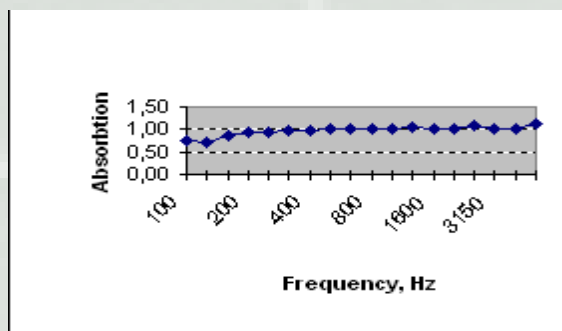
MAXIMUM ACHIEVED ISOLATION VALUE*.

Frequency	Isolation
100	19,50
125	21,40
160	25,70
200	28,30
250	28,60
315	31,90
400	38,20
500	41,60
630	45,90
800	50,00
1000	53,60
1250	57,40
1600	59,40
2000	60,20
2500	62,80
3150	63,00
4000	62,10
5000	61,90



MAXIMUM ACHIEVED ABSORPTION VALUE*

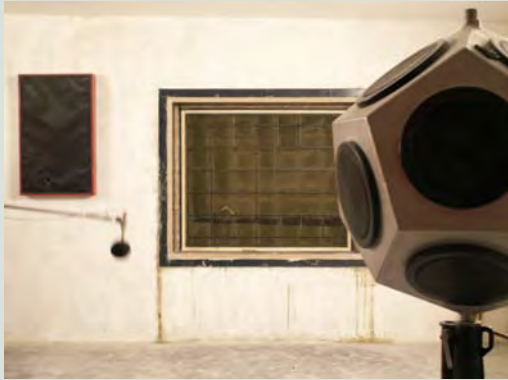
Frequency,Hz	Absorption Alfa
100	0,76
125	0,70
160	0,88
200	0,92
250	0,93
315	0,97
400	0,98
500	1,00
630	1,00
800	1,03
1000	1,03
1250	1,04
1600	1,02
2000	1,03
2500	1,08
3150	1,01
4000	1,03
5000	1,12



* Note all different isolation/absorption tests are officially executed by an independent laboratory

In both categories this element can be placed according to the EN-1793 ½ into the top class for absorption and isolation.

Some examples during manufacturing, tests and installation.



Acoustic tests in the Laboratory



Windload test for NS-Railway



Ready 2,0 x 4,0 mtr elements for transport



Ready elements for 2,5 km of 1,0 x 4,0 mtr



Installation of the supports from the railtrack side



Installation of the concrete bottom part



Transport of the elements to the building site



Installation of the pre assembled elements

The Canor Benelux BV noisebarrier is green in all his aspects:

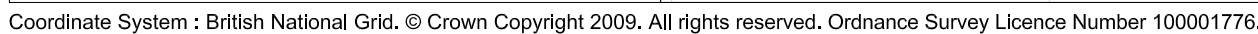
- 1) Green view.
- 2) Ecological green, noise absorber and –isolator.
- 3) The barrier can be planted.
- 4) Environmental-recycable.
- 5) Cleans air with plants by photosynthesis.

The end results shows already a clean, healthy, green and envrionmental noisebarrier



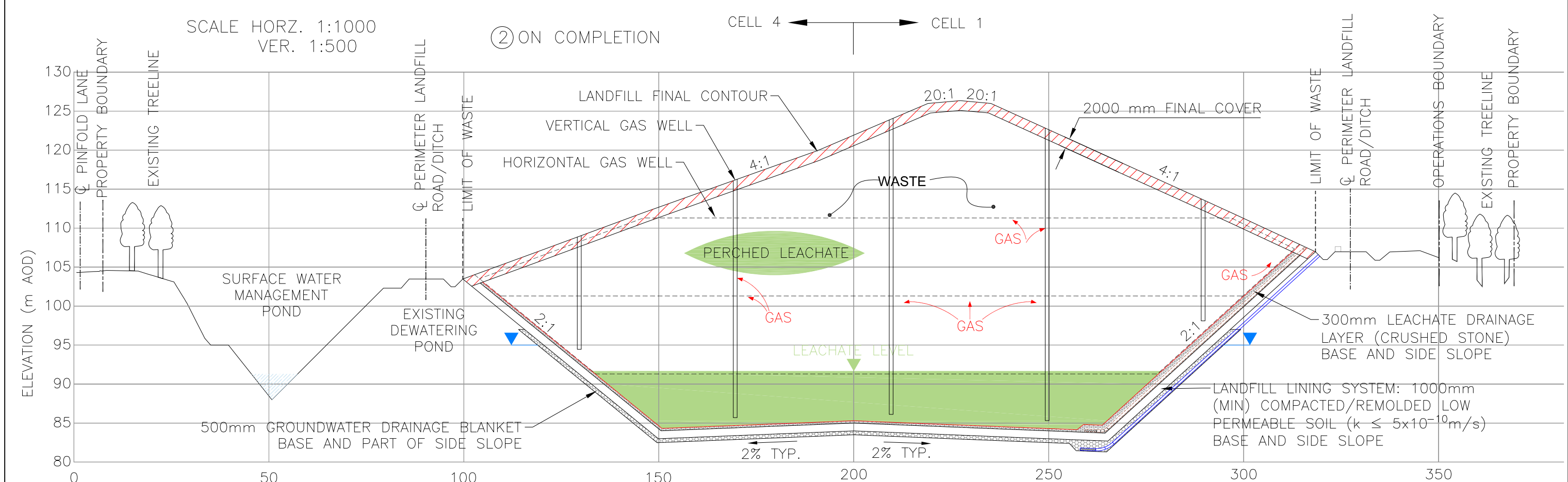
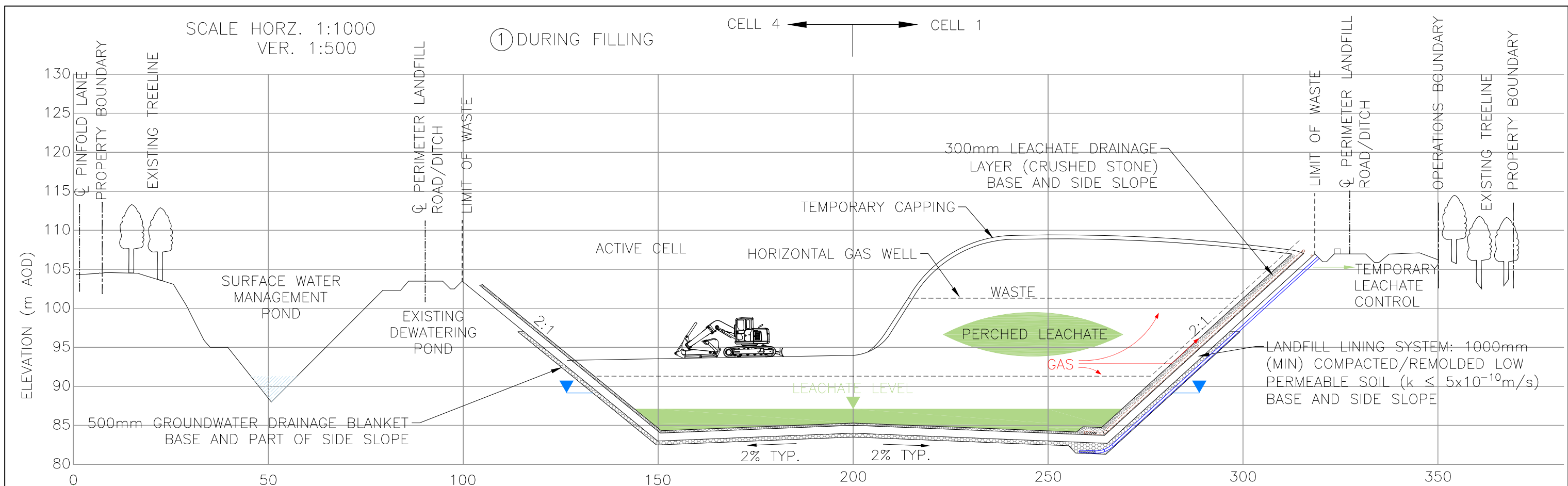
CANOR BENELUX BV noisebarriers

Drawings



amec 

DRAWING No. 30030/ESID/13A



REV 01	DATE 29/01/15	FIRST ISSUE	DWN AB	CHK SH	APP SH	PROJECT TITLE: PARRY'S QUARRY	CLIENT: ROBIN JONES & SONS LTS	CANON COURT, ABBEY LAWN, ABBEY FOREGATE, SHREWSBURY SY2 5DE. TEL: (01743) 342000 FAX: (01743) 342010 DRAWING No. 30030/ESID/SK001
REVISIONS						DRAWING TITLE: RESPONSE TO LANDFILL GAS RISK ASSESSMENT QUERIES FROM SCHEDULE 5 DATED SEPTEMBER 2014		
REV	DATE		DWN	CHK	APP	SCALES : AS SHOWN	Original Drawing Size – A3	