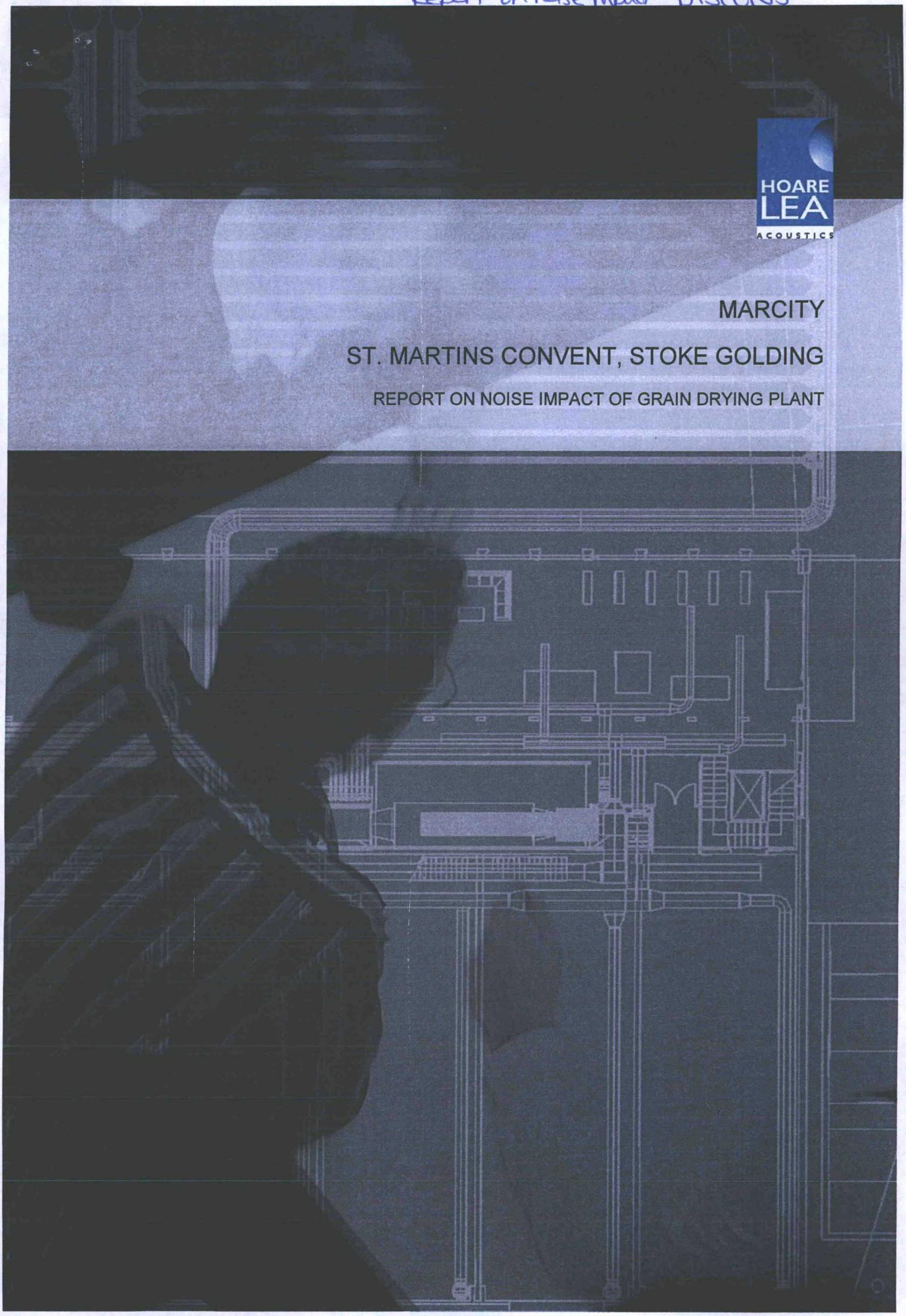
"Report on noise impact" DISCONS



HOARE LEA ACOUSTICS

MARCITY

ST. MARTINS CONVENT, STOKE GOLDING

REPORT ON NOISE IMPACT OF GRAIN DRYING PLANT

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REVISION	DESCRIPTION	DATE	ISSUED BY	REVIEWED BY
R0 DFC	Noise report	13/02/12	MJG	
R1	reviewed	20/02/12	MJG	DM
R2	Updated with plans of proposed noise control measures	12/03/12	MW	DM

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1. INTRODUCTION

Assessment has been made of the noise impact of a grain dryer upon a proposed residential development at St Martin's Convent, Stoke Golding. The grain dryer is located on the farm directly to the north of the site.

The noise climate for this site has previously been assessed and the findings are detailed in the HLA report dated July 2010. At the time of this earlier report, the grain dryer was not operational and, consequently, assessment of noise impact could not be determined.

The grain drying plant has now been repaired and this report details the results of site measurements made during dryer operation. This data has been reviewed with respect to applicable guidance and standards to determine the potential noise impact upon the proposed residential development. The report contains recommendations for control measures to achieve acceptable noise levels at the nearest proposed dwellings.

2. SITE DESCRIPTION

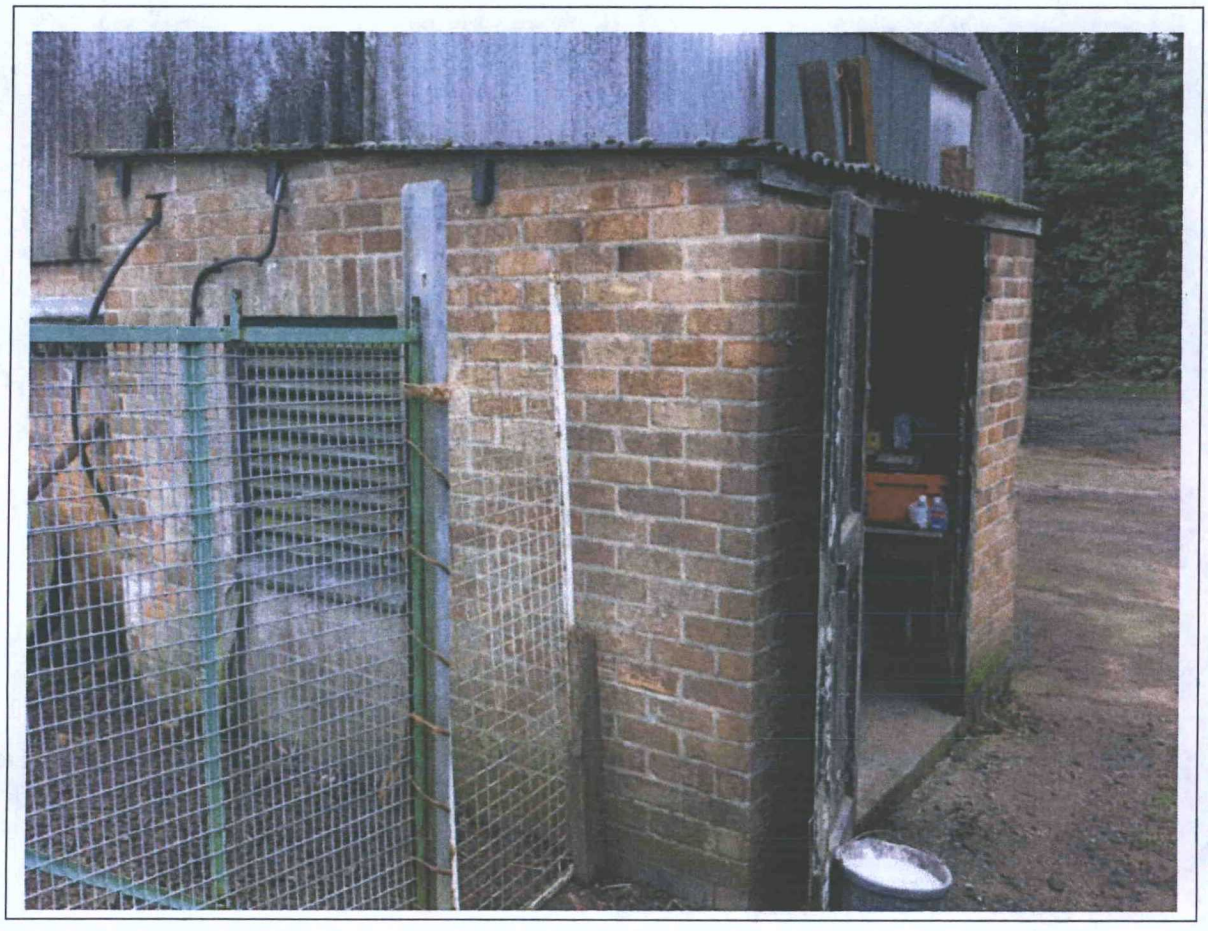
St. Martins Convent is located on the outskirts of the village of Stoke Golding, Leicestershire. Stoke Golding lies approximately 3 km north of the town of Hinckley, and 3 km north of the MIRA (Motor Industries Research Association) testing facility.

Directly adjacent to the northern site boundary is Lodge Farm. Lodge Farm houses approximately 2000 sows, on a straw based bedding system.

The grain storage barn for the farm is located approximately 10m from the northern boundary of the development site. During wet harvesting, it is necessary for the grain to be dried by blowing air into the barn. The fan used for this purpose is located in a small enclosure at the western end of the barn. Air is blown into a large masonry duct that runs the length of the barn and into the stored grain via low level vents.

The fan enclosure is located approximately 20m from the site boundary and is of masonry construction with an access door and light weight roof as indicated in the following images





In order to ensure adequate air supply to the fan, it is necessary for the access doors to be left fully open. Some additional air supply is provided by a small louvre mounted within the northern wall of the enclosure. The inlet louvre is approximately 1000mm x 1000mm in size whilst the doorway is approximately 1500mm x 2000mm in size.

An aerial view of the site is given at Figure 1 indicating the position of the barn and fan relative to the development site.

The current proposed site layout for the development site is given at Figure 2. This indicates that the nearest dwelling to the fan enclosure (plot 59) will be at a distance of approximately 45m. All other dwellings on the development will be further from the fan and screened from it by the barn building.

3. BASIS OF ASSESSMENT

3.1 BS4142: 1997

BS4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas' is the current British Standard providing guidance for assessment of noise impact from industrial and commercial sites, and details a procedure for determining if noise is likely to give rise to complaints at residential property. In general, the likelihood of complaint in response to a particular noise is dependent upon factors including the margin by which it exceeds the background noise level, the character of the noise and its occurrence. The Standard recommends the determination of the Rating Level of the specific source, by the addition of a +5 dB correction if it contains any of the following features:

- discreet distinguishable continuous note
- distinct impulses
- the noise is intermittent or irregular enough to attract attention

The potential for complaint is assessed by comparing the measured background level with the Rating Level (specific noise level plus any tonal corrections). The likelihood of complaint increases as the Rating level exceeds the background, as shown below:

+10 dB or greater above measured background	Complaints Likely
+ 5 dB	Marginal Significance
- 10 dB or more below measured background	Complaints unlikely

It is noted that BS 4142 is intended for situations where new noise sources will impact upon established residential property. As a consequence of this, it is not necessarily appropriate for situations where noise sensitive property encroaches upon an existing noise source since there is no established perception of the noise climate by residents.

3.2 BS8233: 1999

BS8233:1999 'Sound insulation and noise reduction for buildings – Code of Practice' is the current British Standard providing guidance for appropriate noise criteria and limits for differing building types including dwellings. PPG 24 lists this document for reference purposes. BS8233 provides guidance regarding suitable internal noise level criteria but does not form any statutory requirement to achieve the guidance values provided therein.

The BS8233 minimum internal criteria for dwellings are as follows:

- Living rooms during the daytime - $L_{Aeq,T}$ 40 dB.
- Bedrooms during the night-time - $L_{Aeq,T}$ 35 dB / L_{Amax} 45 dB.

The Standard states also that 'good' internal conditions can be achieved for a level of $L_{Aeq,T}$ 30 dB daytime and night time.

BS 8233 Table 10 advises that the sound reduction across an open window will be limited to 10-15dB. On this basis, it is possible to extrapolate external limits values for an open window that would enable the internal criteria to be achieved.

In the case of gardens, BS 8233 advises that a level of L_{Aeq} 50dB is desirable and that a level of L_{Aeq} 55dB should be considered to be an upper limit value.

4. MEASUREMENTS

Measurement of sound levels for operation of the dryer fan was undertaken on 31 January 2012 at five positions as detailed below:

- Position 1 – located 1m in front of the open door to the existing fan enclosure
- Position 2 – located to the side of the existing fan enclosure at the site boundary
- Position 3 – located on the proposed building line adjacent to position 2
- Position 4 – located to the rear of the barn at the site boundary
- Position 5 – located to the rear of the barn at the building line

The measurement positions are as indicated in Figure 1. All measurements were made with the enclosure doors open.

All measurements were made with calibrated, precision grade sound level meters in accordance with BS EN 60651 and BS 7445:1993. All equipment was calibration-checked before and after the survey; no significant drift was observed, as detailed below:

	Before	After
B&K 2260 Handheld SLM	94.0	94.0

5. RESULTS

The following Table shows the measured levels at site for the five measurement positions:

Position	L_{Aeq}	63	125	250	500	1K	2K	4K	8K
1	86.7	86	88	94	83	79	74	69	62
2	63.7	70	67	70	61	56	53	48	39
3	48.9	67	56	50	45	43	40	39	<20
4*	68.6	73	75	78	55	45	42	38	<20
5*	51.8	74	59	60	43	41	39	38	<20

* these levels were measured with the rear access door to the vent duct open - this door will not be open when in use so fan noise levels for these positions are expected to be approximately 20 dB lower than shown

The ambient noise climate for the site has previously been assessed and is detailed in the report dated July 2010. It is considered that the levels which were obtained over a five day period are still representative of the existing noise climate. The levels are shown in the Table below:

Day	Period	Average measured $L_{Aeq,5mins}$	Average measured $L_{A90,5mins}$
Thursday	Daytime	49.7	39.1
	Night-time	46.6	27.2
Friday	Daytime	48.4	40.5
	Night-time	43.3	28.8
Saturday	Daytime	46.8	38.6
	Night-time	46.0	32.0
Sunday	Daytime	49.6	37.7
	Night-time	46.4	29.1
Monday	Daytime	47.9	35.7

	Night-time	48.9	23.1
Tuesday	Daytime	43.0	34.6

The overall averaged levels for the monitoring period are shown in the Table below:

Period	Average measured $L_{Aeq,5mins}$	Average measured $L_{A90,5mins}$
Daytime	48.4	38.1
Night-time	46.6	28.1

6. DISCUSSION

6.1 Noise from the Grain Dryer

Noise from operation of the dryer fan is clearly noticeable at the site boundary due to the need for enclosure doors to be open and the relatively low ambient noise levels around the site. From this it is evident that it will be necessary to implement control measures to reduce noise levels at the development site.

Noise is generated within the enclosure by breakout through the fan casing and open inlet with secondary noise generated by the motor assembly. Successful noise control will require a reduction in breakout from the enclosure and, where practicable, a reduction of noise levels transferred to the enclosure from the open air inlet.

It is considered that the doors to the enclosure need to remain open during fan operation due to the undersized air inlet louvre on the north facing wall of the enclosure. The current louvre is approximately 1000mm square and has a free area no greater than 50%. Replacement of the existing inlet louvre with a more efficient detail would enable the use of solid doors to the front of the enclosure.

Noise breakout from the rear of the storage barn occurs via the masonry duct. Levels are much lower than those attributable to the fan enclosure but will still require attenuation to minimise noise impact during the quieter night time period.

6.2 BS 4142 assessment

It is understood from previous site visits, that the grain dryer operates only when required and is not a regular day to day operation. When it does run, however, it can be operational on a 24hr basis over several days. On this basis, assessment of noise impact will have to assume continuous night time operation.

Measurement data for the current fan enclosure and operating conditions indicates an overall level of L_{Aeq} 48.9dB at the closest residential plot (59). This compares with a typical daytime background level of L_{A90} 38dB and a typical night time background of L_{A90} 28dB. From this it may be extrapolated that it would be necessary to achieve a sound reduction of the order of 20dB(A) to achieve BS 4142 'marginal significance' conditions at the nearest dwelling during night time.

Any control measures adopted for the dryer enclosure should, therefore, achieve a minimum insertion loss of 20dB(A) at the development site.

For the masonry duct that supplies air to the barn, the measurement data with the duct door open indicates a sound reduction requirement of 24dB(A) to enable 'marginal significance' conditions. After allowance for the closed door, it is considered that a minimum insertion loss of 10dB(A) would be acceptable.

6.3 Control measures

The current masonry walls of the fan enclosure can be expected to provide a sound reduction of the order of 50dB and will not provide a significant pathway for noise breakout. Principal noise breakout occurs via the doorway, louvre and roof and it will be necessary to treat each of these items to achieve the sound reduction requirement.

To the rear of the barn, it will be necessary to reduce noise breakout from the masonry duct.

Doorway

The current door opening is required to allow adequate airflow to the fan and, as noted in 6.1 above, it is considered that this is the result of insufficient airflow across the inlet louvre.

On the basis that the inlet louvre is replaced with an alternative detail to achieve satisfactory airflow, the existing doors can be replaced with a new solid core door set within a rebated frame. A 50mm fire rated door will provide a typical sound reduction of 30dB in comparison with the open doorway.

Inlet louvre

It is considered that replacement of the existing louvre with a proprietary inlet attenuator will provide increased airflow to the enclosure whilst also achieving a significant reduction in noise breakout.

Available test data for an attenuator length of 1200mm indicates a sound reduction of 18dB which, when combined with the screening effect of the enclosure, would achieve the night time attenuation requirements derived above.

Given the enclosure arrangement, it will be feasible to oversize the attenuator section to provide increased airflow to the enclosure.

Where it is feasible to direct connect the fan inlet to the attenuator section, there will be a significant reduction of enclosure noise levels due to the loss of breakout noise from the fan inlet.

Enclosure roof

The existing corrugated roof section provides only a nominal sound reduction and is open at its edge.

Replacement of the existing roof with 25mm weatherproofed chipboard (or equivalent) underdrawn with mineral fibre insulation and internal lining board would be expected to provide an improvement of the order of 20-25dB to the existing roof detail.

Masonry duct

Some reduction of noise breakout from the duct might be realised by replacement of the existing timber door. However, it is considered that far more effective sound reduction can be achieved by installation of a proprietary duct attenuator at the fan discharge into the masonry duct.

This arrangement will achieve a higher sound reduction than replacement of the door and will also prevent noise breakout via the duct roof and via the drying vents into the barn.

In this instance, the sound reduction requirement would be expected to be achieved with an attenuator length of 600-900mm.

6.4 BS 8233 assessment

Based upon achievement of an operating sound level of L_{Aeq} 28dB or lower at the nearest dwelling, it may be extrapolated that the break-in to habitable rooms across an open window would be below 20dB. This level is more than 10dB below the BS 8233 'good' standard.

For all other plots, there would be significant further reductions due to distance attenuation and screening.

The target operating sound level is well within the BS 8233 preferred requirement for gardens.

7. RECOMMENDATIONS

It is recommended that the following control measures be provided to the existing fan enclosure and masonry air duct.

Enclosure roof

It is recommended that the entire roof area of the enclosure be replaced with 25mm weatherproofed chipboard or equivalent. This outer barrier layer should be underdrawn with 50mm medium density mineral fibre and lining board.

All board edges should be sealed to the surrounding masonry structure and there should be no gaps or openings within the barrier layer.

Air inlet

It is recommended that the existing louvre inlet be removed and replaced with a new proprietary duct attenuator. The attenuator should be sized to achieve a minimum insertion loss of 18dB(A) and to provide duty rated airflow to the fan and enclosure. The pressure drop across the attenuator unit should not exceed $50Nm^{-2}$ at the rated airflow.

Access door

It is recommended that the existing doors be removed and replaced with a solid timber half hour fire rated doorset with rebated frames.

Masonry air duct

It is recommended that the fan discharge opening into the masonry duct be fitted with a proprietary duct attenuator. The attenuator should be sized to achieve a minimum insertion loss of 10dB(A) and a maximum pressure drop of $50Nm^{-2}$ at the rated airflow.

It will be necessary to appoint a specialist contractor for specification, supply and installation of the inlet and discharge attenuators. Those treatments required to the enclosure roof and doorway are standard builderswork items.

The recommended control measures are indicated in the sketch proposals given at Appendix 1.

8. CONCLUSIONS

Measured sound levels for operation of the grain dryer exceed the existing daytime and night time ambient noise levels at the proposed development site. It will be necessary to introduce control measures to the fan enclosure to reduce noise breakout.

Assessment in accordance with BS 4142:1997 indicates that a minimum reduction of 20dB will be necessary to achieve 'marginal significance' conditions during night time at the new residential development.

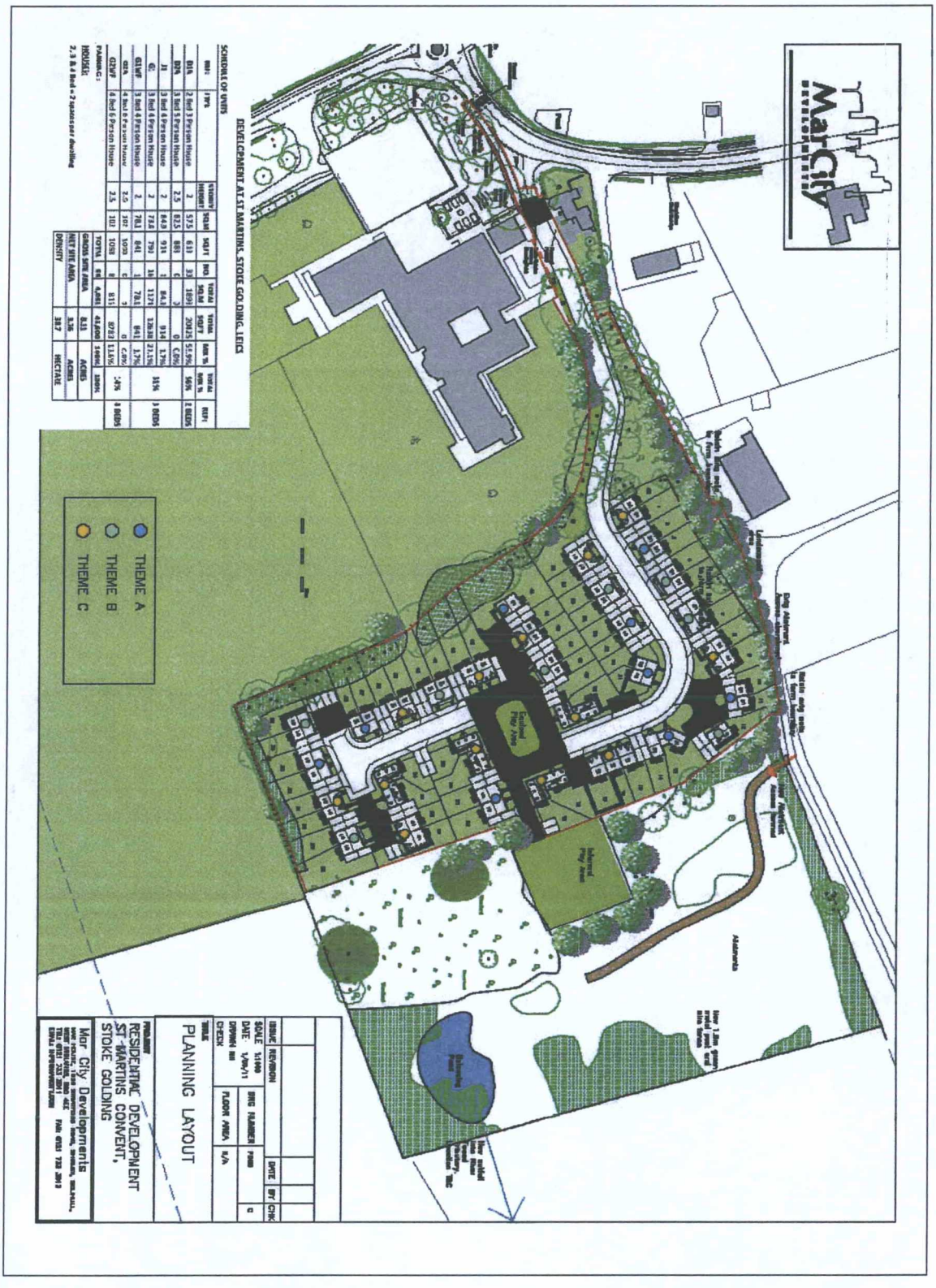
A reduction of this order would readily enable the BS 8233 internal 'good' standard to be achieved when windows are open and would also readily enable the BS 8233 preferred requirement for gardens to be achieved.

This report identifies the pathways of noise breakout from the fan enclosure and provides recommendations for remedial measures to each pathway to achieve the sound reduction requirement.

FIGURE 1 – SITE LOCATION



FIGURE 2 – PROPOSED RESIDENTIAL SITE LAYOUT



APPENDIX 1 – PROPOSED NOISE CONTROL MEASURES

