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NOISE IMPACT ASSESSMENT FOR PROPOSED SUSTAINABLE MIXED-USE SCHEME INCLUDING NEW COMMUNITY STADIUM FOR BOSTON UNITED FOOTBALL CLUB, HOUSING, RETAIL, COMMERCIAL AND LEISURE USES, QUADRANT 1: LAND EITHER SIDE OF THE A16, SOUTH OF TYTTON LANE EAST, BOSTON

1.00 INTRODUCTION

1.01 Environmental Noise Solutions Limited (ENS) has been commissioned by Chestnut Homes Ltd to carry out a noise assessment for a proposed sustainable mixed-use scheme including new community stadium for Boston United Football Club, housing, retail, commercial and leisure uses at land either side of the A16, south of Tytton Lane East, Boston (hereafter referred to as the application site).

1.02 The objectives of the assessment were to:

- Measure the ambient noise climate at the application site during representative periods of the daytime and at night;
- Determine the ambient noise climate at the application site over the entire 16-hour daytime and 8-hour night time periods with reference to pertinent calculation methods;
- Assess the potential impact of noise on the proposed development (with reference to the National Planning Policy Framework and other pertinent guidance);
- Assess the potential impact of the proposed retail/commercial uses in the eastern and south eastern parts of the application site on both existing and proposed residential development;
- Assess the potential impact of the Boston United Football Club's relocation to the land to the east of the A16; and
- Provide recommendations for a scheme of noise attenuation works, as necessary, to ensure that the future occupants of the proposed development do not experience any unacceptable loss of amenity due to noise.

1.03 This report details the methodology and results of the assessment and provides recommendations for the layout (location and orientation of residential dwellings), in addition to building envelope design (fenestration and ventilation) and boundary screening. The report also contains recommendations for mitigating noise associated with the proposed stadium, where required. It has been prepared to accompany a hybrid planning application to be submitted to Boston Borough Council (BBC) for the proposed mixed use development of the application site (outline permission is to be sought for the residential, retail and commercial aspects of the development, whilst full permission is sought for the stadium, the distributor road and points of vehicular access for all the developments.

1.04 This report has been prepared for Chestnut Homes Ltd for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Chestnut Homes Ltd and ENS as to the extent to which the findings may be appropriate for their use.

1.05 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

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2.00 SITE SETTING AND PROPOSED DEVELOPMENT

2.01 For reference, the application site is located approximately 2 kilometres to the south of Boston town centre and is set in a predominantly residential area. The western section of the application is bound by:

- The A16 to the east:
- The rear of residential properties along Tytton Lane East to the north;
- The rear of residential properties along London Road to the west; and
- A residential estate to the south.

2.02 The section of the application site to the east of the A16 is bound by:

- The A16 to the west:
- The rear of residential properties along Tytton Lane East to the north; and
- Open fields to the south and east with further residential dwellings beyond.

2.03 Current proposals are for a community stadium to be constructed in the eastern half of the application site. This stadium will be home to Boston United Football Club and also provide a number of community facilities.

2.03 The western section of the development is to consist of approximately 500 residential dwellings in addition to a food store (approximately 7000 m^2 gross) and a commercial use area (potentially to include retail units a restaurant and a hotel).

2.04 The current concept plan indicates that the foodstore and retail/commercial units will provide a degree of screening and a buffer zone to protect the proposed residential dwellings from road traffic noise along the A16.

3.00 BASELINE NOISE MONITORING

3.01 In order to determine the ambient noise levels at the application site, baseline noise surveys were undertaken on Wednesday 6th and Thursday 7th November 2013.

3.02 For the purpose of the noise impact assessment, the following noise monitoring positions were adopted (approximate location of the noise monitoring positions is contained in Appendix 2):

- MP1 was located in the south eastern corner of the application site, at a distance of approximately 20 metres from the nearside kerb of the A16;

- MP2 was located in the north eastern corner of the application site, at a distance of approximately 20 metres from the nearside kerb of the A16;

- MP3 was located near to the northern boundary of the application site at a distance of circa 80 metres to the nearside kerb of the A16 (this position is representative of noise levels at the nearest proposed residential dwellings to the A16);

- MP4 was also located near to the northern boundary of the application site at a distance of approximately 280 metres from the A16;

- MP5 was located near to the western boundary of the application site;

- MP6 was located in the centre of the application site, at a distance of circa 230 metres to the A16;

- MP7 was located on southern boundary of the application site, at a distance of circa 170 metres to the A16;

- MP8 was located in the south western corner of the application site;

- MP9 was located on the northern boundary of the community stadium site; and

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3.03 During the course of the daytime and night time noise surveys the dominant noise source was noted to be local road traffic along the A16.

3.04 Noise measurements were undertaken using two Bruel & Kjaer 2260 Type 1 integrating sound level meters. Measurements were made in a free field environment at 1.5 metres above local ground level. A windshield was fitted for all measurements. The measurement systems calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring.

3.05 Measurements consisted of A–weighted broadband parameters, together with linear one-third octave band L_{eq} levels. The following table contains a summary of the measurement data for each measurement session, at each measurement position, rounded to the nearest decibel.

Table 3.1 – Summary of Noise Measurement Data

Position	Date	Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{A1} (dB)	Comment
MP1	06/11/2013	10:00-10:15	71	62	74	77	Road traffic on A16 approximately 1200 vehicles per hour
MP1	06/11/2013	11:45-12:00	71	64	73	77	
MP1	06/11/2013	12:15-12:30	71	63	74	76	
MP1	07/11/2013	01:17-01:32	58	30	58	72	Road traffic on A16 (typically <77 dB L_{AFMax})
MP1a	06/11/2013	12:04-12:09	64	60	67	69	Road traffic on A16, (typically <70 dB L_{AFmax}), approximately 1200 vehicles per hour
MP2	06/11/2013	10:44-10:59	68	59	72	74	Road traffic on A16, approximately 1200 vehicles per hour
MP2	06/11/2013	11:25-11:40	67	59	70	73	
MP2	06/11/2013	12:40-12:55	69	61	71	74	
MP2	07/11/2013	00:49-01:04	59	35	63	72	Road traffic on A16 (typically 75 dB L_{AFMax})
MP2a	06/11/2013	11:02-11:17	64	58	66	68	Road traffic on A16
MP3	06/11/2013	11:09-11:24	61	57	63	65	Road traffic on A16
MP3	07/11/2013	13:30-14:00	61	57	64	65	
MP3	06/11/2013	20:37-21:07	58	51	61	65	
MP3	07/11/2013	00:32-00:47	46	30	50	56	Road traffic on A16 (typically <58 dB L_{AFMax})
MP4	06/11/2013	14:00-14:15	56	52	57	60	London Road, A16 and occasional traffic on Tytton Lane East
MP4	07/11/2013	11:03-11:33	53	50	55	59	
MP4	06/11/2013	23:43-23:58	39	33	43	48	Intermittent traffic on London Road and A16
MP5	06/11/2013	13:20-13:35	54	52	55	57	Distant road traffic on both London Road and the A16
MP5	07/11/2013	10:29-10:44	52	49	54	56	

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Position	Date	Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{A1} (dB)	Comment
MP5	07/11/2013	14:19-14:34	53	50	55	57	
MP5	06/11/2013	23:03-23:18	43	32	47	52	
MP6	06/11/2013	13:40-13:55	53	51	55	57	Distant road traffic on both London Road and the A16
MP6	06/11/2013	11:39-12:08	52	49	53	55	
MP6	07/11/2013	23:22-23:37	43	35	46	50	
MP7	06/11/2013	10:19-10:34	49	47	50	53	Distant road traffic on A16
MP7	07/11/2013	12:12-12:42	49	47	51	55	
MP7	06/11/2013	19:19-19:49	53	46	57	60	
MP7	07/11/2013	02:02-02:17	39	32	42	48	
MP8	06/11/2013	15:22-15:37	48	47	50	52	Road traffic on London Road
MP8	07/11/2013	10:03-10:18	47	46	49	51	
MP8	07/11/2013	14:40-14:55	50	48	51	56	
MP8	06/11/2013	18:58-19:13	53	48	56	59	
MP8	07/11/2013	01:42-01:57	38	30	42	47	
MP9	06/11/2013	14:29-14:44	59	55	61	63	Road traffic noise on A16
MP9	07/11/2013	12:54-13:24	60	55	63	66	
MP9	06/11/2013	20:02-20:32	57	50	60	63	
MP9	07/11/2013	00:10-00:25	48	32	53	58	

Daytime ambient noise level ≈ 71 dB $L_{Aeq\ (07:00–23:00)}$ at MP1, 68 dB $L_{Aeq\ (07:00–23:00)}$ at MP2, 61 dB $L_{Aeq\ (07:00–23:00)}$ at MP3, 53 dB $L_{Aeq\ (07:00–23:00)}$ at MP4, 52 dB $L_{Aeq\ (07:00–23:00)}$ at MP5, 51 dB $L_{Aeq\ (07:00–23:00)}$ at MP6, 50 dB $L_{Aeq\ (07:00–23:00)}$ at MP7, 51 dB $L_{Aeq\ (07:00–23:00)}$ at MP8 and 59 dB $L_{Aeq\ (07:00–23:00)}$ at MP9 based on CRTN methodology

Night time ambient noise level of ≈ 62 dB $L_{Aeq,(23:00–07:00)}$ at MP1, 59 dB $L_{Aeq,\ ,(23:00–07:00)}$ at MP2 and < 55 dB $L_{Aeq(0700-2300)}$ throughout the remainder of the site based on TRL methodology

3.06 For the prediction of daytime road traffic noise, the Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used. Measurements of L_{A10} are made over any three consecutive hours between 10:00 and 17:00 hours. Using $L_{A10\ (3\ hour)}$ as the arithmetic mean of the three consecutive values of hourly L_{A10}, the $L_{A10\ (18\ hour)}$ can be calculated from the equation:

(i) $L_{A10\ (18\ hour)} = L_{A10\ (3\ hour)} - 1$ dB

3.07 PPG24 further states that for road traffic noise:

(ii) $L_{Aeq\ (0700–2300)} \approx L_{A10\ (0600–0000))} - 2$ dB

3.08 Substituting (ii) into (i) gives the following approximation:

(iii) $L_{Aeq\ (0700–2300)} \approx L_{A10,\ 3\ hour} - 3$ dB

3.09 Although the above measurement procedure has not been strictly followed, it is evident that road traffic noise levels (L_{A10}) were consistent throughout the survey period. Therefore, the measurements taken are considered appropriate for establishing the daytime ambient noise level.

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3.10 The daytime ambient noise level near to the eastern boundary of the application site (20 metres to nearside kerb of the A16) is calculated at 68-71 dB $L_{Aeq(0700-2300)}$. Levels further to the west dropped significantly, with a calculated noise level of 61 dB $L_{Aeq(0700-2300)}$ at MP3 (80 metres to the nearside kerb of the A16).

3.11 A study prepared by TRL Limited on behalf of the Department for Environment, Food and Rural Affairs (DEFRA) entitled 'Converting the UK Traffic Noise Index $L_{A10\ (18\ hour)}$ to EU Noise Indices for Noise Mapping' presents a methodology for calculating night time road traffic noise levels based on daytime road traffic noise level based on the following formulae:

(iv) $L_{Aeq\ (23:00–07:00)} \approx 0.90 * L_{A10,\ 18\ hour} – 3.77$ (for non-motorways)

and

(v) $L_{Aeq\ (23:00–07:00)} \approx 0.87 * L_{A10,\ 18\ hour} + 4.24$ (for motorways)

3.12 Based on the formula above, a predicted noise level of 59-62 dB $L_{Aeq\ (2300-0700)}$ is calculated at positions MP1 and MP2, with night time noise levels of <55 dB $L_{Aeq(2300-0700)}$ at a distance of > 80 metres from this highway.

3.13 Background noise levels at across the application site during the daytime were measured at approximately 47 dB $L_{A90,T}$, with night time background noise levels falling to approximately 30 dB $L_{A90,T}$. These levels are considered representative of worst case (lowest) existing background noise levels at the existing (and proposed) residential dwellings.

4.00 NOISE IMPACT ASSESSMENT CRITERIA

4.01 The National Planning Policy Framework (NPPF), came into force on 27 March 2012 and is a material consideration in planning decisions. At the heart of the NPPF is a presumption in favour of sustainable development, and the policies in Paragraphs 18 to 219 of the NPPF, taken as a whole, constitute the Government's view on what sustainable development in England means in practice for the planning system.

4.02 The NPPF states that there are three dimensions to sustainable development, which include an economic role (contributing to building a strong, responsive and competitive economy), a social role (providing the supply of housing required to meet the needs of present and future generations) and an environmental role (which includes minimising waste and pollution).

4.03 The NPPF supersedes Planning Policy Guidance Note 24 (PPG 24). The main policy statement in relation to noise is Paragraph 123 of the NPPF, which states:

Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established (note: subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and*

- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

4.04 In relation to 'adverse impacts', the NPPF refers to the Explanatory Note to the Noise Policy Statement for England (NPSE) for guidance.

4.05 The Noise Policy Statement for England (NPSE) and associated Explanatory Note were published by DEFRA in 2010 and set out the Government's noise management strategy to

enable noise management decisions to be made within the wider context (i.e. guiding principles of sustainable development), in a cost-effective manner and in a timely fashion.

4.06 Fundamental to this approach is '*there is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors'*.

4.07 The noise policy aims of NPSE are to (i) avoid significant adverse impact on health and quality of life, (ii) mitigate and minimise adverse impacts on health and quality of life, and (iii) where possible, contribute to the improvement of health and quality of life. The policy aims are always to be considered within the context of the Government's policy on sustainable development.

4.08 In relation to the mitigation and minimisation of adverse impacts, NPSE considers that '*in reality, although not always stated, the aim has tended to be to minimise noise 'as far as is reasonably practical'*. This is reinforced in Paragraph 2.24 of the Explanatory Note, which requires that '*all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur'*.

4.09 In relation to explaining the 'significant adverse' and 'adverse' effects quoted in the NPPF, NPSE uses the two established concepts from toxicology that are currently being applied to noise impacts, for example by the World Health Organisation (WHO), these are:

- NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.

- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

4.10 The NPSE then extends these concepts to lead to a SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

4.11 No specific criteria are presented in the NPSE, to provide the necessary policy flexibility until further evidence and suitable guidance is available. In lieu of specific criteria, for residential development, ENS makes reference to existing guideline documents, which are summarised in the following paragraph(s).

<u>Impact of Ambient Noise on Proposed Dwellings</u>

4.12 BS 8233:1999 'Sound Insulation and Noise Reduction for Buildings – Code of Practice' (BS 8233) defines a range of ambient noise levels for design criteria, in order that good or reasonable conditions are achieved in certain internal and external environments. The following table shows a summary of the levels recommended in BS 8233 for habitable rooms in the proposed development. Additionally, the World Health Organisation (WHO) Guidelines on Community Noise (1999) considers that for speech intelligibility during the daytime and evening periods, internal living room levels should not exceed 35 dB $L_{Aeq\ (0700\text{-}2300)}$

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Table 4.1 – Indoor Ambient Noise Levels as Recommended in BS 8233 (Residential)

Criterion	Typical Situation	Design Range dB $L_{Aeq, T}$	
		GOOD	REASONABLE
Reasonable resting / sleeping conditions	Living rooms	30	40
	Bedrooms*	30	35

* For a reasonable standard in bedrooms at night, individual noise events should not normally exceed 45 dB $L_{AF\ max}$.

4.13 With reference to the BS 8233 guideline levels, by definition, the 'reasonable' design criteria cannot represent a significant adverse impact (the prevention of which is the 1st aim of NPSE). With cognisance to the 2nd aim of NPSE (to minimise noise impact), the WHO criterion of 35 dB $L_{Aeq,T}$ during the daytime and BS 8233 'good' design criterion of 30 dB $L_{Aeq,T}$ during the night time are considered appropriate.

4.14 As well as the protection afforded by the new building for occupiers of the internal area, BS 8233 states that barriers or bunds should be considered to protect the gardens. In gardens and balconies etc. it is considered desirable that the steady noise level does not exceed 50 dB $L_{Aeq\ (0700–2300)}$ and 55 dB $L_{Aeq\ (2300–0700)}$ should be regarded as the upper limit (i.e. the upper limit of acceptability).

4.15 Furthermore the WHO Guidelines considers that few people are seriously annoyed (a significant effect) by activity with levels below 55 dB L_{Aeq} in the daytime. On this basis, the SOAEL is an unknown value in excess of 55 dB L_{Aeq}. Therefore, utilising 55 dB L_{Aeq} as the target garden criterion achieves the 1st aim of NPSE (avoiding significant impact).

Impact of Environmental Noise on Proposed Commercial Land Uses

4.16 In addition to providing internal ambient noise level criteria for residential dwellings, BS 8233 recommends internal noise level criteria for a range of commercial and business uses, as detailed in Table 4.2 below:

Table 4.2 – Indoor Ambient Noise Levels as Recommended in BS 8233 (Employment)

Criterion	Typical Situation	Design Range dB $L_{Aeq, T}$	
		GOOD	REASONABLE
Reasonable conditions for study and work requiring concentration	Cellular office	40	50
	Meeting Room, executive office	35	40
Reasonable acoustic privacy in shared spaces	Open Plan Office	Design Range of 45-50 dB	
Reasonable industrial working conditions	Heavy Engineering	70	80
	Light Engineering	65	75

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Impact of Proposed Employment Uses on Existing and Proposed Residential Dwellings

4.17 British Standard 4142:1997 'Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas' (BS 4142:1997) is commonly used for assessing the impact of noise sources of an industrial nature on residential dwellings. Although ENS does not consider a BS 4142 assessment, when used in isolation, to be a suitable assessment tool, it is a commonly used tool for assessing the potential impact of an item of plant introduced into a residential area.

4.18 BS 4142 describes methods for determining, at the outside of a building, noise levels from factories or industrial premises and a method for assessing whether the noise is likely to give rise to complaints from people residing in the building.

4.19 BS 4142 considers that the likelihood of complaints is dependent on the difference between the rating level and background noise level; the greater this difference the greater the likelihood of complaints. Further, it suggests that a difference of around +10 dB or more indicates that complaints are likely, a difference of around +5 dB is of marginal significance and if the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

4.20 The rating level is described as the specific noise level (the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference period) plus any adjustment for the characteristic features of the noise. If the noise contains a distinguishable, discrete, continuous note, or if there are distinct impulses in the noise, or if the noise is irregular enough in character to attract attention, then a 5 dB penalty should be added to the specific noise level. Only a single 5 dB correction is made even if more than one of the above characteristics is present.

4.21 A BS 4142 assessment of +5 dB (i.e. marginal significance), by definition cannot represent a significant impact and therefore satisfies the first aim of NPSE.

Impact of Proposed Stadium on Existing Residential Dwellings

4.22 Due to the wider community use of the stadium, in addition to the restricted number of events that are to be held over the course of a year (the exact number of events is not known, however Boston United FC are unlikely to play more than one 'home game' per week at the stadium during the season, with no matches on consecutive days), it is not considered appropriate to assess the noise impact of the stadium under BS 4142. Furthermore, it is assumed that events will only take place in daytime hours (i.e. no later than 23:00 hours).

4.23 Although PPG 24 has been replaced by the NPPF guidelines, it is still considered to be a useful reference document. Paragraph 22 of Annex 3 of PPG 24 states that for sporting activities, the regularity of the noise should be taken into account. Furthermore, ENS also consider that any impact significance criteria for football match noise should also take account of the likely impact on resting conditions within the surrounding residential properties.

4.24 It is recommended that the noise impact of the stadium be assessed to absolute noise levels (as detailed in Table 4.1), within the residential dwellings. The recently published National Planning Practice Guidance states that a noise source that causes slight changes in behaviour (such as closing of windows for some of the time) does not represent a significant observed adverse effect, and that noise associated with this source should be mitigated and reduced to a minimum. It is therefore considered acceptable for residents to close windows during significant activity at the stadium (given the infrequent nature of such events), provided a reasonable level of internal amenity is then achieved.

4.25 It is therefore considered that designing the stadium to ensure that noise associated with its use is $\leq$ 40 dB $L_{Aeq,T}$ within dwellings with windows closed, satisfies the first aim of NPPF, whist designing to $\leq$ 35 dB $L_{Aeq,T}$ would satisfy the second aim.

4.26 Assuming approximately 30 dB of attenuation for a standard thermal double glazed window within a masonry facade, the maximum free field noise level at the surround residential facades should be 65 dB $L_{Aeq,T}$ (based on achieving a 'good' level of internal amenity).

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5.00 SOUND ATTENUATION SCHEME

5.01 As discussed in Section 2 above, a frozen layout was not available at the time of writing this report, however the indicative layout indicates that commercial and retail uses will provide a buffer zone between road traffic noise along the A16 and the proposed residential areas to the west. This section therefore contains recommendations for the provision of glazing and ventilation specifications, based on this indicative layout.

Proposed Residential Dwellings

5.02 The following glazing and ventilation specifications assume that the proposed commercial units are designed (through the use of barrier screening and suitably chosen items of fixed services plant) to ensure that the noise impact associated with their operation is minimal.

5.03 Measurements at MP3 (at circa 80 metres to the A16) are indicative of noise levels in the vicinity of the proposed residential dwellings nearest to the A16, and were measured/calculated at 61 dB $L_{Aeq,(0700-2300)}$ and 53 dB $L_{Aeq(2300-0700)}$ (with maximum noise levels of up to 58 dB L_{AFmax}). These levels do not take into account any screening that may be provided by the proposed retail/commercial units adjacent to the A16.

5.04 Based on measurements taken at numerous sites, it is considered that a typical standard double glazed window with trickle vents in a building façade will provide of the order of 27 to 30 dB (A) sound insulation (from external to internal) to road traffic noise. Standard 'hit and miss' trickle vents along with standard double glazing is therefore likely be suitable throughout the application site.

5.05 Further to the above, it is likely that the commercial units will provide a significant degree of screening to road traffic noise, further reducing ambient noise levels at the majority of the proposed residential dwellings.

Gardens

5.06 As detailed in 5.03 above, noise levels at a distance of approximately 80 metres from the A16 were measured / calculated at 61 dB $L_{Aeq,(0700-2300)}$. It is considered that gardens are likely to benefit from a degree of screening to road traffic noise from the proposed commercial units.

5.07 Notwithstanding this, it is recommended that all gardens along the eastern boundary of the residential sections are provided with a circa 2 metre high close boarded fence to fully break the line of sight to the highway.

5.08 BS 5228:2009 Part 1 states *'In the absence of spectral data, as a working approximation, if there is a barrier or other topographic feature between the source and the receiving position, assume an approximate attenuation of 5 dB when the top of the plant is just visible to the receiver over the noise barrier, and of 10 dB when the noise screen completely hides the sources from the receiver. High topographical features and specifically designed and positioned noise barriers could provide greater attenuation.'*

5.09 It is therefore calculated that the provision of a circa 1.8-2 metre high barrier will reduce noise levels within gardens to approximately 51 dB $L_{Aeq,(0700-2300)}$.

Potential Noise Impact of Proposed Retail/Commerical Units

5.10 As detailed in Section 3.00, existing background (L_{A90}) noise levels are relatively high throughout the application site during the day and drop significantly into the night time period. The lowest measured background noise level at MP3 was measured at 57 dB $L_{A90,T}$ during the daytime and 30 dB $L_{A90,T}$ at night. The lowest measured background noise level at MP7 was measured at 46 dB $L_{A90,T}$ during the daytime and 32 dB $L_{A90,T}$ at night.

5.11 Consideration needs to be given to the layout of the proposed units (and associated service areas) and the screening of any proposed external items of plant at detailed design stage.

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5.12 It is therefore recommended that the cumulative total of any noise associated with fixed services plant does not exceed the background noise levels detailed in Section 5.10. Robustly assuming a +5 dB character penalty, this would give a BS 4142 rating of +5, i.e. marginal significance.

5.13 It is recommended that the commercial units are designed/orientated to provide screening to other significant noise generating activities (such as deliveries and customer car parking etc.).

Predicted impact of proposed stadium on existing and proposed residential dwellings to the north, east and west

5.14 As discussed in Section 2, current proposals are for a sports stadium to be constructed in the eastern portion of the application site (to the east of the A16). This stadium is to have a capacity of approximately 5000 people and include a number of community facilities such as conference spaces, meeting rooms, a café and an all weather sports pitch. The stadium will be the home of Boston United FC and will be designed to be easily upgradeable to increase capacity.

5.15 The main noise sources associated with sports stadiums are crowd noise and noise associated with the PA (including announcements and music played before and after the matches as well as at half time).

5.16 Noise measurements have previously been taken by ENS at the Prostar Stadium (home of Shrewsbury Town FC with a capacity of 9875) during a football match. Noise levels of up to 67 dB $L_{Aeq,T}$ were measured at a distance of approximately 30 metres to the stands, and approximately 115 metres to the centre of the pitch and a direct line of sight. The dominant noise sources were considered to be crowd noise and announcements.

5.17 The proposed stadium is a 'bowl' design. This type of stadium is considered to be the most effective in terms of reducing noise breakout as it significantly reduces sight lines to the crowd and pitch. In relation to the proposed development this design should fully break the line of sight from the existing residential dwellings to the pitch/crowd. This should provide circa 5-10 dB of attenuation to the levels detailed in Paragraph 5.16.

5.18 In order to calculate the predicted noise level at the nearest NSRs (the residential dwellings situated to the north on Tytton Lane East) point source propagation is assumed. Based on an increase in separation distance from 115 metres to 130 metres, an additional 1 dB of attenuation may be applied to the levels detailed in Section 5.16 above, resulting in a predicted free field noise level of 66 dB $L_{Aeq,T}$. Robustly assuming 5 dB of attenuation for the 'bowl' type stadium as discussed in Paragraph 5.17 gives a predicted noise level of 61 dB LAeq,T at the nearest residential dwellings, therefore satisfying the second aim of the NPPF guidelines (as discussed in Section 4.25).

5.19 In line with the above calculations, it is recommended that the PA system is set to ensure that noise levels at the residential dwellings are no higher than 60 dB $L_{Aeq,T}$ (free field), including during times when music is being played. Careful positioning and direction of speakers should be used to ensure a suitable level is achieved within the stadium, whilst preventing an excessive level being experienced at the dwellings.

5.20 Current proposals show that car parking is to be provided to the north, west and south of the stadium. Although noise associated with car parks has the potential to create a significant noise impact, the car parks are likely to be used very sporadically outside of match times, with the matchday parking limited to two periods of heavy activity (immediately prior to and after the matches). It is therefore considered that the noise impact is likely to be negligible.

5.21 Notwithstanding the above, it is recommended that an acoustic barrier (such as a close boarded timber fence) is provided along the northern boundary of the car park, to provide additional screening to the dwellings. It is further recommended that the car parks to the west and south are prioritised over those to the north to further reduce the noise impact on local residents. This will require management controls to be put in place by the operator.

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Potential Impact of Road Traffic Noise on Proposed Retail/Commercial Units and Stadium

5.22 The internal ambient noise level criteria for the proposed retail/commercial units will depend on the intended use, as detailed in Table 4.2 above.

5.23 Although a detailed plan is not currently available, it is understood that proposals are for a number of restaurants, recreational uses and a hotel. The exact glazing and ventilation requirements will depend on the distances of each unit to the A16.

5.24 The proposed stadium includes a number of offices and classrooms, in addition to a number of ancillary spaces. In relation to the criteria outlined in Table 4.2, it is considered that providing a reasonable level of internal amenity should satisfy the requirements of NPPF.

5.25 The western façade of the stadium is situated at a distance of approximately 60 metres from the highway. Based on the measurements undertaken at MP1 & MP1A, the highway is acting as a point source (with 6dB per doubling of distance). The predicted noise level at the location of the proposed façade is therefore calculated to be 62 dB $L_{Aeq,T}$.

5.26 In order to calculate the sound insulation requirements of the building envelope for rooms along the western façade of the stadium, the Building Research Establishment (BRE) building envelope insulation calculation spreadsheet was used. This spreadsheet is based on the calculation methodology advocated in BS 8233. The spreadsheet allows input of external noise levels, room dimensions and reverberation time together with parameters for the various elements of the building envelope and calculates the internal noise level in terms of the external noise level metric (L_{Aeq} in this case).

5.27 For the calculations, room parameters were based on a standard classroom of 140 m^3 and a reverberation time of 0.8 second. Calculations were based on glazed curtain walling system. Based on an external noise level of 62 dB $L_{Aeq,T}$ and an internal ambient noise level criteria of 40 dB $L_{Aeq,T}$, standard thermal double glazing rated at 25 dB R_w+C_{tr} should be acceptable (such as two panes of 4 mm glass separated by a nominal cavity). The opening of windows for ventilation purposes will result in the internal noise criteria being exceeded, it is therefore recommended that a fully ducted mechanical ventilation scheme is provided throughout the development.

5.28 It is noted that the above glazing specification is based on achieving a reasonable internal noise level and does not necessarily comply with BB93. However, BB93 compliance is not considered necessary given the mixed use nature of the development. It is however recommended that any specific requirements the client has are confirmed prior to the specification of glazing and ventilation systems.

6.00 CONCLUSIONS

6.01 A noise impact assessment has been undertaken for a proposed mixed use development at land off Tytton Lane / the A16, Boston.

6.02 Recommendations for a scheme of sound insulation works have been developed to protect the proposed development from the ambient noise climate in accordance with the requirements of the National Planning Policy Framework. On this basis, the ambient noise climate is not considered to represent a constraint to the proposed development of the application site.

6.03 An assessment of the potential impact of the proposed stadium on the existing and proposed dwellings in the vicinity of the application site has been carried out with recommendations for limiting the noise level associated with the PA/tannoy system. On this basis, noise associated with the proposed stadium should not result in any unacceptable loss of amenity at existing dwellings.

6.04 Recommendations have also been provided to mitigate the noise impact of the proposed commercial uses on both the existing and proposed residential dwellings.

I trust that the above meets with your requirements. Should you have any queries please do not hesitate to contact me.

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Yours sincerely

Anthony Harper (BSc, MIOA)
Environmental Noise Solutions Limited

cc File

Appendix 1
Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$L_p = 20 \log_{10}(p/p_0)$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 µPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

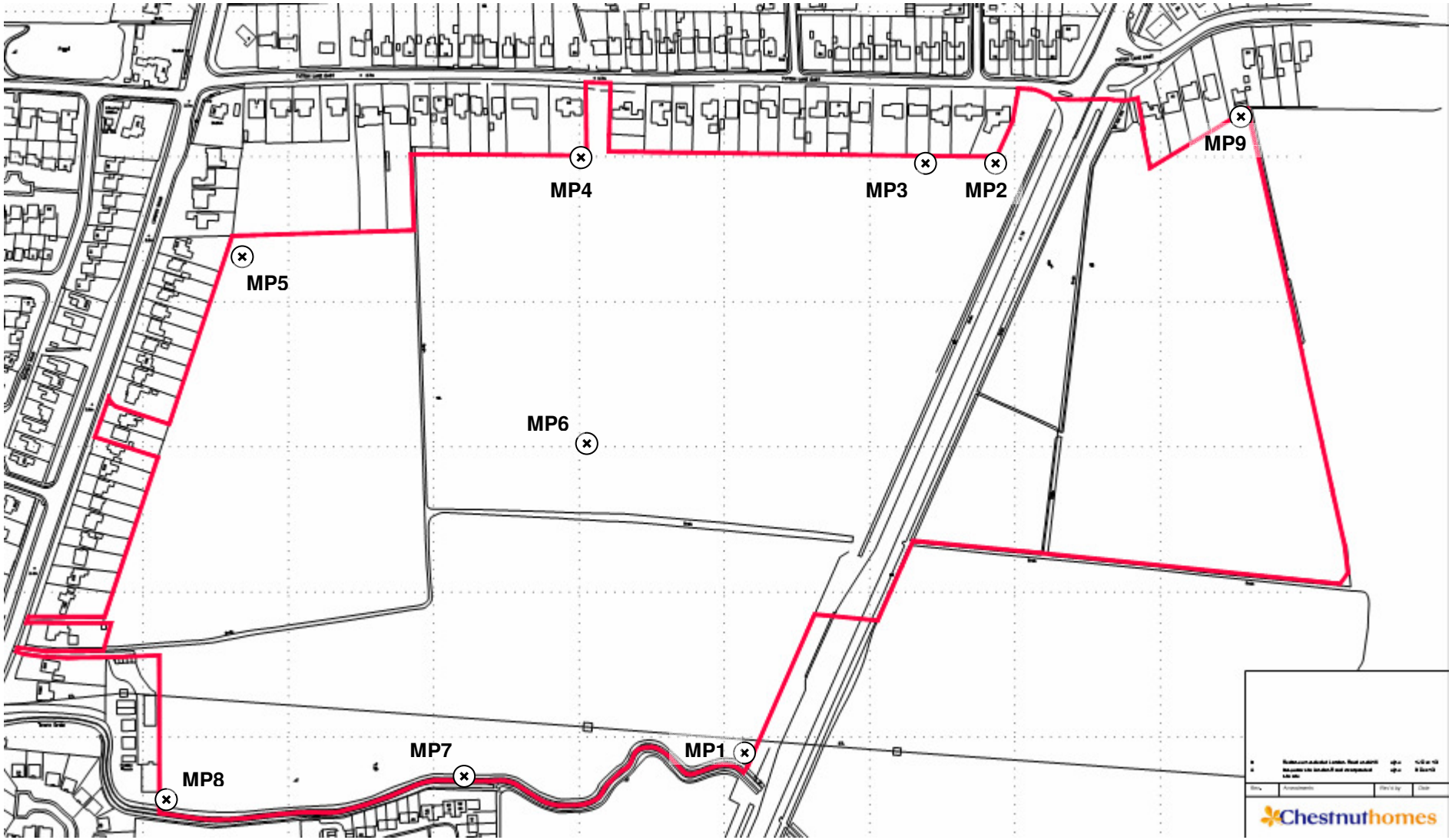
Weighted Sound Reduction Index (R_W)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Weighted Airborne Sound Insulation ($D_{nT,w}$)

Single number quantity which characterises the airborne sound insulation between rooms.

Appendix 2
Site Location Plan and Noise Monitoring Positions



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Appendix 2
Indicative Masterplan