Weston, Spalding

Noise Impact Assessment

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Issued to
Persimmon - Charles Church

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1. INTRODUCTION

Persimmon – Charles Church (Persimmon) are seeking planning permission for a new residential development on land between the A151 and High Road in Weston, near Spalding in Lincolnshire. The site is currently a farmland site and the proposal is for 150 new dwellings. Persimmon are seeking planning permission for the proposal from South Holland District Council.

Spectrum Acoustic Consultants have been engaged by Persimmon to carry out an investigation of the noise environment at the site and to provide a Noise Impact Assessment report for submission with the planning application. The primary intention of this report is to assess the potential for adverse effects as a result of noise on a proposed residential development at the site and to determine whether the proposals are conducive to dwellings with an acceptable level of acoustic amenity.

2. SITE DESCRIPTION AND PROPOSALS

The development site is located between the A151 and High Road in Weston. The A151 bypasses the village of Weston to the north. The northwest corner of the proposal site is the closest point to the A151 and is around 25m from the edge of the carriageway. The High Road runs along the length of the southern site boundary. The site boundary directly adjoins the pavement of the High Road.

To the north of the site (aside from the A151) is open farmland. There is also farmland to the east and west of the site. To the south, on the opposite side of the High Road is an area of residential properties. Some distance to the west are a number of commercial properties including a garden centre and some distance to the northeast beyond the A151 is a commercial/industrial area which appears to be used primarily for distribution.

A site location plan is included in Appendix A. Site layout plans have been developed and include 150 dwellings in the form of primarily 2-storey houses. A site plan is included in Appendix B.

3. GUIDELINES FOR ACCEPTABILITY

3.1 NOISE POLICY GUIDELINES - NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The **National Planning Policy Framework** (NPPF) sets out the government's guidance for local planning authorities and planning application decision-takers.

It says that the planning system should contribute to and enhance the environment by (among other things) preventing development from contributing to, being put at risk from, or being adversely affected by unacceptable levels of noise pollution. (Para. 109)

Paragraph 123 states that 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; 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."

The NPPF refers to the **Noise Policy Statement for England** (NPSE) which sets out the long term vision of Government noise policy as follows: *Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.*

The NPSE aims to clarify the principles and aims in existing policy documents, legislation and guidance that relate to noise. Its noise policy aims are to:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

through the effective management and control of environmental, neighbour and neighbourhood noise.

These aims are developed by reference to the concepts NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level). NPSE also refers to SOAEL (Significant Observed Adverse Effect Level).

It recognises that there is no universally applicable threshold for these concepts. Consequently, the SOAEL is likely to be different for different noise sources and receptors and at different times. Even so, significant effects should be avoided, taking account of sustainability aims.

Where noise impact is between LOAEL and SOAEL, the NPSE requires that all reasonable steps should be taken to mitigate adverse effects while taking account sustainable development aims. It notes (para. 2.7) that *the NPSE should consider noise alongside other relevant issues and noise should not to be considered in isolation.*

The **Planning Practice Guide** (PPG) refers to the NPPF and provides further guidance on the interpretation of no, lowest and significant observed adverse effect level described in the NPSE.

The PPG provides a commentary on the noise exposure hierarchy, based on the 'likely average response'.

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect Lowest Observed Adverse Effect Level	No specific measures required
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect Significant Observed Adverse Effect Level	Mitigate and reduce to a minimum
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1: PPG noise exposure heirarchy

The PPG recognises a broad range of factors which can influence the relationship between noise level and the impact on those affected. Accordingly, the examples in the above table may not be relevant to a specific development and which should be considered on its merits within the specific context under consideration.

3.2 BS 8233:2014 AND WHO

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings gives absolute noise limits for steady state noise without a specific character (such as that from road traffic) inside residential properties as follows:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 2: Indoor ambient noise levels for dwellings

BS 8233 also provides guidelines for noise levels in residential gardens. It says:

> *For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*

These guidelines are in keeping with "Guidelines for Community Noise" published by the World Health Organization, 1999.

Area	Critical health effect	Noise level
Outdoor living area	Serious annoyance, daytime and evening	$L_{Aeq,16hr}$ 55 dB
	Moderate annoyance, daytime and evening	$L_{Aeq,16hr}$ 50 dB
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	$L_{Aeq,16hr}$ 35 dB
	Sleep disturbance, night-time	$L_{Aeq,8hr}$ 30 dB
		L_{Amax} 45 dB

Table 3: WHO guideline values for community noise

The values in Table 3 need further elaboration. There is a variability in individual response to environmental noise, with some people being more noise-sensitive than others. The levels given for outdoor living areas are the noise level below which *few* people will be moderately/seriously annoyed; they do not represent an onset of moderate/serious annoyance for the general population. In effect, the levels protect the more sensitive section of the population. Likewise, the L_{Amax} value is not the highest single noisy event that occurs during the night, but rather the WHO guidelines note *For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10 to 15 times per night.*

Also, the scope of the WHO document is wider than that of BS8233. Whereas BS8233 advises the guidelines are primarily intended for consideration of "anonymous noise" (which is not defined), WHO state that the guidelines relate to community noise, which is defined as all noise, including neighbourhood noise, and that …*typical neighbourhood noise comes from a range of noise sources including from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music, etc*.

$L_{Aeq,T}$ is the average noise level, measured over the time period T. BS8233 and WHO advise that the time period for the daytime should be a 16-hour average (07:00-23:00). The night period is defined as 23:00-07:00.

4. AMBIENT NOISE SURVEY

In order to support the assessment of the effect of noise on the proposed development, existing ambient noise levels at the site have been measured. Details of the measurement and analysis of noise across the site is described in following sections.

4.1 SURVEY DATE, LOCATION AND EQUIPMENT

Ambient noise measurements were carried out during a site survey on Tuesday 18th and Wednesday 19th February 2020. This survey consisted of a series of attended, short-term measurements at two locations on the subject site. Measurements were recorded in a series of 15-minute periods, each broken up into 3 contiguous 5-minute periods.

Position 1 was at the northern-most point of the site boundary, approximately 25m from the edge of the A151 carriageway. The microphone was at a height of 1.5m above ground level. The location was not screened from noise on A151, except by the strip of vegetation along the roadside. Due to the time of year, this vegetation was dormant and leafless, so provided little-to-no attenuation.

Position 2 was on the southern site boundary approximately 5m from the edge of High Road. The microphone was raised to a height of 1.5m above ground level. At this location, the microphone was more distant from the A151 but with a direct line-of-sight to the major road.

Both these measurement locations are shown on the site location plan in Appendix A.

The following equipment was used during the survey:

- Bruel & Kjaer Type 2250 Sound Level Meter s/n 3010857
- Bruel & Kjaer Type 4189 Microphone s/n 3060877
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 2291483

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer's guidelines, and no significant drift was observed. The meter, microphone and field calibrator are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

4.2 RESULTS

The results of the individual 5-minute measurements have been collated and are displayed in tabular form in the Environmental Noise Record Sheets included in Appendix C. Noise parameters recorded consisted of equivalent continuous (L_{Aeq}) noise levels and statistical noise levels (termed L_n, where n is the percentage of time the level is exceeded during the measurement period). In addition, maximum (L_{Amax}) noise levels were recorded in contiguous 5-minute periods. Octave band measurements were also recorded for each of these parameters. The results of the measurements are summarised as representative daytime and night-time levels below in Table 1.

Position	Period	Time period (T)	Representative ambient noise level $L_{Aeq,T}$ dB	Typical measured maximum noise event $L_{AFmax,5min}$ dB
A – Close to A151	Daytime	07:00-23:00	66	n/a
	Night-time	23:00-07:00	62	78
B – Close to High Road	Daytime	07:00-23:00	63	n/a
	Night-time	23:00-07:00	55	75

Table 4: Summary of representative measured noise levels

The representative $L_{Aeq,T}$ levels in Table 4 are determined from the log average of all measured $L_{Aeq,5min}$ values during the relevant period.

The representative L_{AFmax} level is the 10-15th highest measured $L_{AFmax,5min}$ between 23:00 and 07:00 each night, in accordance with guidance in the WHO[1]. In this case, measurements were short-term attended samples so levels throughout the entire night-time were not captured. However, measurements were recorded during the loudest periods of the night i.e. 23:00-00:00 and 06:00-07:00, the periods when road traffic was busiest. Accordingly, the representative L_{AFmax} is taken as the first or second highest measured $L_{AFmax,5min}$. For Position A there were consistent high-level individual events as HGVs passed. For Position B, vehicles on High Road were much less frequent and levels exceeding $L_{AFmax,5min}$ 75 dB were only measured once. Therefore 75 dB is used as a conservative representation of the typical 10th-15th highest noise event.

Weather conditions were cold and mostly dry. There was a period of rain prior to the start of the measurements, however there was no rainfall during the measurements. Wind speeds were sampled using a hand-held anemometer and varied between 1 and 5 meters-per-second throughout the majority of the survey. These speeds are sufficient high to potentially affect noise levels, however the speeds are within typical measurement guidelines. Additionally, noise levels were recorded close to the primary noise source at Position A. At this distance, windspeed would have had a negligible effect on the measured levels, particularly since there was no noticeable wind noise in vegetation.

5. ASSESSMENT OF NOISE AT PROPOSED RESIDENCES

5.1 NOISE PREDICTION MODEL

In order to assess noise at the proposed properties, it is necessary to extrapolate measured noise levels across the site and then to use these extrapolated levels to predict noise levels at the proposed dwellings.

5.1.1 Noise prediction methodology

Noise levels across the site are predicted using proprietary numerical noise modelling software (Predictor[2]). This software package meets the requirements of ISO 9613 Part 2:1996[3]. The noise model takes account of the following in its calculation procedures:

[1] *The WHO "Guidelines for community noise" document states that, for a good nights' sleep, the L_{Amax} level should not exceed 45 dB more than 10 to 15 times.*

[2] *Bruel and Kjaer – Predictor (Predictor-LimA) v2019 Environmental Noise Calculation Software Package, Type 7810*

[3] *ISO 9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation to determine Noise Levels*

- Source sound power level (for point, line and area sources)
- Reflection from nearby structures and source directivity
- Distance from noise source (geometric spreading)
- Atmospheric absorption
- Acoustic screening of intervening structures and topography
- Ground absorption
- Ground effects (which includes the height of ground relative to the noise source)

The accuracy of the predictions is maximised by validating predicted levels using the long-term measured levels at the two noise logger locations. Predicted levels were shown to be equal to measured levels (within measurement/modelling tolerances). This gives a high level of confidence in the accuracy of the predicted levels.

5.1.2 Results

The results of the noise prediction model show that noise levels across the site, particularly closer to the A151, are relatively high as a result of road traffic on the A151. Before the development, noise levels are above L_{Aeq} 55 dB everywhere on-site during the daytime and above L_{Aeq} 45 everywhere on-site during the night-time.

5.2 NOTES ON ACOUSTIC DESIGN

The IoA document ProPG gives information on the principles of 'good acoustic design'. It notes that acoustics should and cannot be considered in isolation of other factors but highlights the need for the potential effects of noise to, at least in part, guide the design.

ProPG highlights a number of key areas of design which should be considered in any assessment, so each of these are discussed with reference to the proposed development.

5.2.1 Reducing noise level at source

In general, mitigating noise at its source rather than at the sensitive receptor is an effective and favourable means of noise control. However, in many circumstances, changes at source are not feasible. This site is one such case, since the noise environment is dominated by noise from the A151 and relocating or reducing noise from this source is outside the scope of this development.

Without relocating the road or affecting the amount or speed of traffic on the road, installation of a noise barrier as close to the road as possible is the next best option for reducing noise levels across the whole site, and this is addressed below.

5.2.2 Noise barriers

As noted above in Section 5.2.1, a noise barrier can be an effective mitigation measure. Barriers close to a source can very effectively reduce noise levels across an entire site, particularly where the receptors are 1 or 2-storey buildings, however the further from the source the less effective barriers can be, particularly in rooms above ground floor level.

At this site, the closest point of the site is 20m from the main noise source (the A151) and this is only one corner of the site. Furthermore, it is not possible to construct a barrier on the site boundary due to the positioning of drainage ditches close to the site boundary. These ditches will remain in place after development and will be managed by the Internal Drainage Board, so a barrier outside these ditches is not permitted. Therefore, a boundary barrier would not be an effective means of source mitigation at this site.

However, noise barriers at this site could be beneficial in a more minor way by reducing noise levels in gardens at the most noise-exposed properties. Accordingly, barriers around the boundary of gardens at the most noise-exposed properties are proposed. The site layout has developed since the initial version, and the extent of barriers has been reduced accordingly. The recommendations now include two sections of barrier, both of which are 2.5m tall at the northern end of the site. These heights are selected to be optimally effective without being unnecessarily high. A material specification for the acoustic barrier is provided in Section 6.1 and Appendix D. The effects of the proposed barriers are shown in Appendix E.

5.2.3 Site layout

When developing the design of a site such as this, which incorporates multiple dwellings, there are a number of ways in which the layout can be optimised to improve acoustic amenity. ProPG discusses a number of these, which are addressed here:

Maximising separation

The position of the site relative to the A151 means that there is a set-back zone of at least 20m from the edge of the carriageway to the site boundary. The proposals further increase the set back distance by incorporating an attenuation pond in the northernmost portion of the site. As a result, the closest residential façade is around 110m from the edge of the carriageway. This is an increase of 20m on previous layout proposals. This is a significant distance and effectively minimises the number of properties exposed to higher noise levels closer to the northern boundary.

Barrier blocks or non-sensitive elements as screens

ProPG states that:

> "*On larger developments, a "barrier block" can be used to protect the residential development from noisy roads or railways… A continuous frontage is one way to lower noise levels in the rest of the property."*
>
> *"The block should run along the edge of the site closest to and parallel to the noise source and wrap around the sides of the property to protect the sides".*
>
> *"The block should preferably be used for non noise-sensitive purposes such as parking cars or refuse storage."*

In order for a barrier block to be effective, it must provide functional screening to the remainder of the site. This means that a barrier block at this site would have to be broadly continuous along the northern and potentially the western boundary, over a large distance.

It is not considered that there is any scope at this site to include such a block. Primarily, this due to the proposal intending to remain respectful to the density and character of the surrounding area. There would also be no requirement for a non-sensitive block since parking will take the form of external spaces outside properties and individual garages and refuse storage would be localised to the houses.

Similarly, whilst in theory a continuous row of terraces along might provide an effective barrier; this would involve a high density of properties on the eastern boundary, which would be very inconsistent with the surrounding environment. It would also likely be counter-productive in terms of creating favourable acoustic amenity since it would likely mean that at least half of the habitable rooms in each terraced property would have to face the noise source directly and would require high performance glazing and mechanical ventilation.

Site topography

ProPG points out the good acoustic design can involve either taking advantage of existing topography or by changing the site levels. In this case, the site is flat and incorporates externally managed drainage systems, so there are no opportunities to take advantage of the topography or change the site levels.

Building layout/orientation

Another means of minimising the impact of noise on amenity is to put windows or doors of habitable rooms on less noise-exposed facades away from the key noise source. This principle minimises intrusive noise into habitable rooms in properties close to the noise sources, whilst allowing these properties to provide screening for more distant sources across the site.

At this site, as the properties are located more than 100m from the primary noise source at the north, it is difficult to orientate properties in a beneficial way. This is because at least two facades are typically exposed to equivalent noise levels. Fortunately, as the set back distance is significant, noise levels at the facades of dwellings are not particularly high, so this is not a critical issue.

5.2.4 Intrusive noise and façade sound insulation

In accordance with BS8233 and WHO, a key factor in determining whether a development is acceptable is the predicted level of internal noise in the proposed dwellings. Based on the measured and predicted external noise levels, indicative calculations of intrusive noise into typical dwellings have been carried out. These calculations show expected internal noise levels in typical living rooms and bedrooms.

These calculations make assumptions about the size and construction of the building façade elements, as well as acoustic properties of the receiving room, such as the volume and reverberation time based on common dwellings. It is then possible to provide an indication of the level of mitigation (in terms of glazing and ventilation to habitable rooms) that will be required at this site to ensure that acceptable internal ambient levels are achieved.

Sound insulation data for façade elements has been taken from sources such as standard data provided by BRE and DETR, Spectrum's library of measurement data, calculations using Marshall Day's Insul software as well as manufacturer's data and the BRE/CIRIA publication 'Sound Control for Homes'. Information regarding typical internal finishes for the type of rooms considered is based on acoustic properties Spectrum have measured in a range of occupied dwellings.

In the most noise-exposed areas of the site, for internal ambient noise levels inside habitable rooms to meet the BS8233 and WHO "desirable" criteria with open windows, the external noise level has to exceed the internal noise limit by no more than 10-15 dB. This is equivalent to an upper guideline level of $L_{Aeq,T}$ 50 dB during the daytime and $L_{Aeq,T}$ 45 dB during the night-time. Predicted levels at the most noise-exposed properties are $L_{Aeq,16hr}$ 59 dB during the daytime and $L_{Aeq,8hr}$ 54 dB during the night-time, so desirable levels won't be achieved in the most noise-exposed properties with open windows.

This means that additional mitigation is required to achieve the desirable level of internal acoustic amenity. Therefore, the necessary mitigation will be provided through the specification of glazing and ventilation where appropriate. Calculations of intrusive noise into key habitable rooms in the most noise-exposed properties are included in Appendix E. These calculations show that, with the mitigation measures recommended below in Section 6 incorporated, internal ambient noise levels are predicted to be below internal ambient noise level limits (taken from the BS8233 and WHO criteria) in the most noise-exposed properties. Where these standards are met, this is a good indication that any potential for adverse effect has been effectively mitigated and reduced.

5.2.5 Noise in outdoor amenity areas

The proposed scheme will also provide external amenity space for each property. Noise levels across site are not extraordinarily high however there are a small number of gardens where levels exceed the upper guideline level in BS 8233 prior to any mitigation. It is important to note that BS8233 makes clear that development ought not to be prohibited solely on the grounds of noise levels in external amenity areas. However, at this site, noise barriers can be incorporated into scheme (as described in Section 5.2.2) to reduce noise levels in these most noise-exposed gardens.

As shown on the contour plots in Appendix E, with the proposed noise barrier in place, all properties have access to external amenity areas with levels below L_{Aeq} 55 dB and most have access to gardens with levels below L_{Aeq} 50 dB. This means that noise levels in external amenity areas will be either below the lower WHO guideline level (which is also cited by BS8233 as a desirable level) or between the lower and upper WHO guideline levels (cited by BS8233 as acceptable).

In summary then, guideline levels for external amenity areas will be achieved in all properties, which provides a further indication that the potential for adverse effect will be low.

6. PROPOSED ACOUSTIC MITIGATION MEASURES

6.1 ACOUSTIC BARRIER

In order to ensure that noise levels are reduced as far as possible in external amenity areas and to minimise noise exposure at the facades of dwellings, Spectrum recommend that some acoustic fencing is installed in specific areas. This acoustic fence should have the following properties:

- 2.5m (or greater) in height
- No holes or penetrations
- A surface density of at least 10 kg/m^2

These requirements can readily be met with common approaches to fencing, for example a close-boarded timber fence. The fencing should be installed in the location, and to the extents, shown on the marked-up drawing included in Appendix D.

6.2 FAÇADE ACOUSTIC SPECIFICATION

As the calculations in Appendix F demonstrate, double glazing with a minimum performance of $R_w(C_{tr})$ 29(-4) dB coupled with standard hit-and-miss trickle vents with a minimum performance of $D_{n,e,w}(C_{tr})$ 33(-1) dB will provide sufficient sound insulation to ensure the guideline levels for internal ambient noise in habitable rooms (in line with BS8233 and WHO) are achieved in almost all houses across the development, including those on the northern boundary closest to the A151.

Typically, to meet an acoustic performance standard of $R_w(C_{tr})$ 29(-4) dB, glazing with a build-up of 4/12/4 or similar will suffice. Similarly, there are a number of common window-frame mounted hit-and-miss trickle vent products which will achieve $D_{n,e,w}(C_{tr})$ 33(-1) dB.

The only exception to this is in bedrooms in properties very close to the High Road, where noise from individual vehicles passing during the night-time will necessitate the use acoustically rated trickle vents. These will only be required in bedrooms with windows overlooking the High Road to ensure acceptable internal ambient noise levels are achieved. These acoustic trickle vents must achieve and acoustic performance of at least $D_{n,e,w}(C_{tr})$ 39(-2) dB. Acoustic window frame-mounted trickle vents are available which meet this standard.

Glazing and trickle ventilation systems must be selected to meet the performance requirements set out above. It is also important to note that the standard for glazing applies to the whole window or, if applicable, sliding or hinging door, including frames and seals.

The acoustic requirements for each window or glazed door are specified in terms of both the R_w and the R_w+C_{tr} performance standards. R_w is the standard weighted sound reduction of a façade element. R_w+C_{tr} (which is sometimes written as R_{tra}) is the weighted sound reduction of a façade element with respect to road traffic noise. Both performance requirements listed here are required to be met or exceeded by the selected glazing system. Similarly, with the ventilation requirement the value in parentheses is the $D_{n,e,w}+C_{tr}$ performance standard. The selected ventilation system must meet both performance values.

7. CONCLUSIONS

Persimmon Homes have commissioned Spectrum Acoustic Consultants to complete a noise impact assessment to accompany an application for planning permission for a proposed residential development at land between High Road and the A151 in Weston.

Road traffic is the dominant noise source at the proposed development site. This report discusses the way in which acoustic conditions are affected by the site layout, building layout and site topography. Possible different approaches to mitigation are also considered, including at-source mitigation and barrier blocks.

Using measured noise levels on site noise levels as a basis, noise levels across the site have been extrapolated using computer noise modelling software. Internal ambient noise levels inside the most noise-exposed dwellings have been calculated based on the extrapolated external noise levels.

The assessment demonstrates that it will be possible for internal ambient noise levels to meet the guideline levels in BS8233 and WHO Guidelines for Community Noise through a series of noise mitigation measures in the form of glazing systems and passive trickle vents. Some noise barriers are also proposed to reduce noise levels in external amenity areas.

Overall, this report demonstrates that, with appropriate noise mitigation measures in place, a significant adverse noise impact on the proposed development is unlikely and any potential adverse impacts will be able to be mitigated and minimised with standard glazing, ventilation and barriers.

APPENDIX A

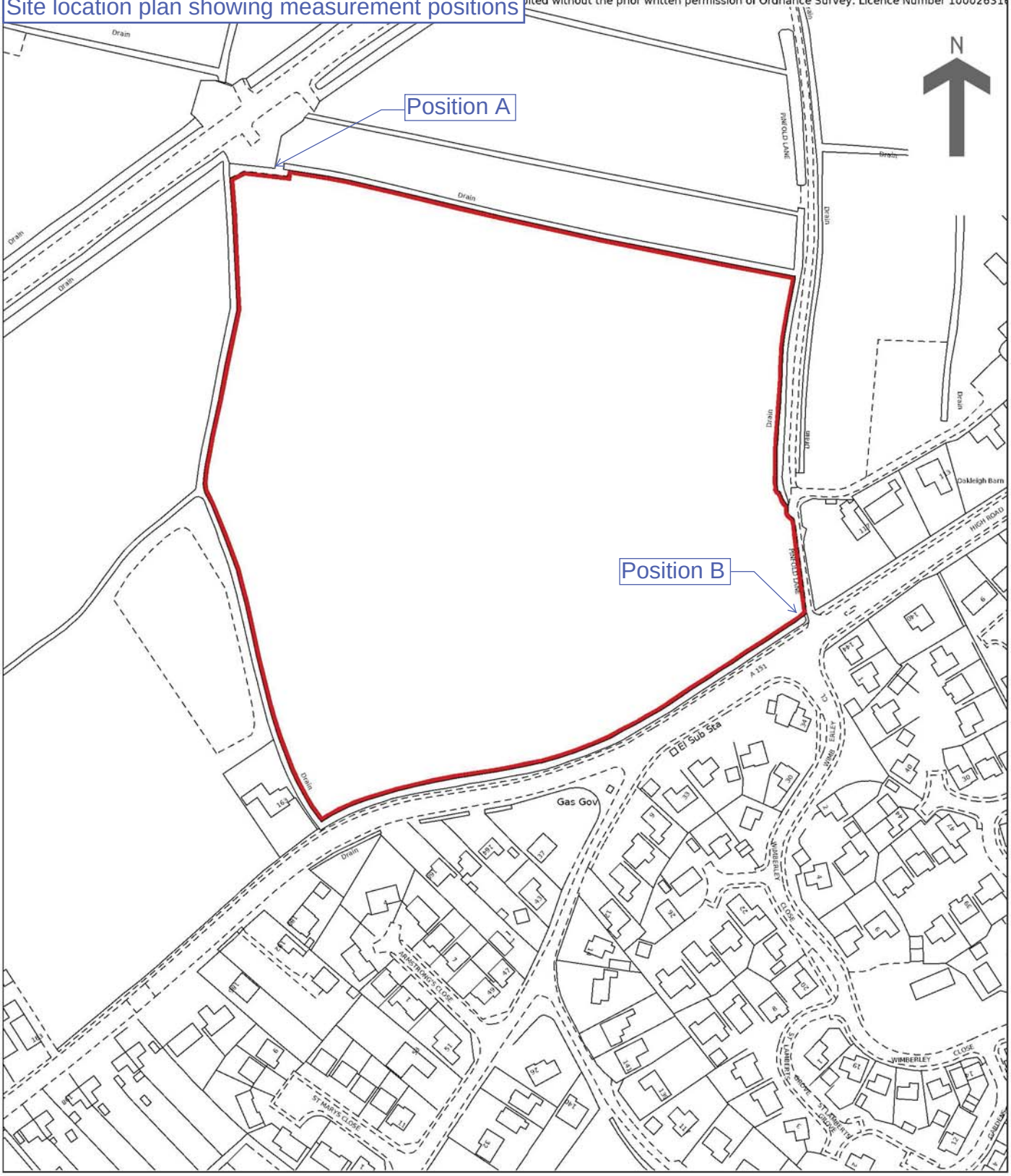
Site location plan showing measurement positions

HM Land Registry
Official copy of title plan

Title number **LL308422**
Ordnance Survey map reference **TF2824NE**
Scale **1:2500**
Administrative area **Lincolnshire : South Holland**

Site location plan showing measurement positions

ibited without the prior written permission of Ordnance Survey. Licence Number 100026316



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APPENDIX B

Site layout plan



Rev		Date	By
I	Parking space added to plot 147	30.09.20	AT
H	Bin collection points moved	04.09.20	AT
G	Road adjacent to Pinfold Lane amended	03.09.20	AT
F	Layout amended in line with planning comments	25.08.20	AT
E	House types amended	17.08.20	AT
D	Swales and footpaths updated	17.08.20	AT
C	Layout amended	12.08.20	AT
B	Integral units updated	24.04.20	BP
A	Pond & swales updated. pumping station added	01.04.20	BP

PERSIMMON
Persimmon Homes Ltd.
Persimmon House
19 Commerce Road
Lynchwood Business Park
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PE2 6LR
Tel : 01733 397200

Site Name:
Weston
Spalding

Drawing:
Proposed Planning Layout

Scale@A0:	Drawn By:	Date:
1:500	AT	17/08/2020
Version: --	Drawing No: SPAL/WEST/PPL/100	Rev: I

APPENDIX C

Environmental Noise Record Sheets

Environmental Noise Record Sheet

Project:	Weston, Spalding
Project number:	20029
Date:	12/03/2020

Noise monitoring location:	A: On northern site boundary, 25m from near edge of A151
Plant operating condition:	n/a
Instrumentation:	Bruel & Kjaer 2250/6
Calibration times:	10:00, 03:00

Date/time			Weather			Noise Level (dB)						Comments
Date	Start time	Duration (min:sec)	Wind speed (m/s)	Wind direction	Cloud (%)	LAF10.0	LAF50.0	LAF90.0	LAFmax	LAFmin	LAeq	(Including description of noise (eg whine, hiss, rumble, impact, vehicle rain, vegetation, or animal noise)
18/02/20	21:12	05:00	3-5	W	0	69	59	49	78	45	65	Road traffic on A151
18/02/20	21:17	05:00	3-5	W	0	69	56	46	74	41	63	Road traffic on A151
18/02/20	21:22	05:00	3-5	W	0	69	56	45	76	42	64	Road traffic on A151
18/02/20	23:01	05:00	1-5	W	0	63	48	42	73	38	59	Road traffic on A151
18/02/20	23:06	05:00	1-5	W	0	64	49	41	77	37	61	Road traffic on A151
18/02/20	23:11	05:00	1-5	W	0	65	49	43	76	40	61	Road traffic on A151
18/02/20	23:47	05:00	1-5	W	0	59	42	40	76	38	57	Road traffic on A151
18/02/20	23:52	05:00	1-5	W	0	52	43	40	76	37	57	Road traffic on A151
18/02/20	23:57	05:00	1-5	W	0	61	42	40	76	37	59	Road traffic on A151
19/02/20	06:23	05:00	1-5	W	30	70	61	53	78	47	65	Road traffic on A151, occasional cars on High Road
19/02/20	06:28	05:00	1-5	W	30	70	62	52	77	48	65	Road traffic on A151, occasional cars on High Road
19/02/20	06:33	05:00	1-5	W	30	69	62	54	74	49	65	Road traffic on A151, occasional cars on High Road
19/02/20	09:53	05:00	1-5	W	60	70	66	56	77	47	67	Road traffic on A151
19/02/20	09:58	05:00	1-5	W	60	69	64	55	77	48	66	Road traffic on A151
19/02/20	10:03	05:00	1-5	W	60	70	64	57	74	52	66	Road traffic on A151
19/02/20	10:35	05:00	1-5	W	60	69	64	57	73	53	66	Road traffic on A151
19/02/20	10:40	05:00	1-5	W	60	69	64	53	75	47	65	Road traffic on A151
19/02/20	10:45	05:00	1-5	W	60	70	65	58	75	53	66	Road traffic on A151
19/02/20	11:17	05:00	1-5	W	60	69	64	56	77	51	66	Road traffic on A151, JCB moving on site
19/02/20	11:22	05:00	1-5	W	60	71	66	59	85	51	68	Road traffic on A151, JCB moving on site
19/02/20	11:27	05:00	1-5	W	60	69	63	53	74	48	65	Road traffic on A151, JCB moving on site

Date/time			Weather			Leq Octave Band Pressure Level (dB)										Comments
Date	Start time	Duration (min:sec)	Wind speed (m/s)	Wind direction	Cloud (%)	31.5	63	125	250	500	1k	2k	4k	8k	dB(A)	(Including description of noise (eg whine, hiss, rumble, impact, vehicle rain, vegetation, or animal noise)
18/02/20	21:12	05:00	3-5	W	0	65	65	66	59	57	63	58	49	40	65	Road traffic on A151
18/02/20	21:17	05:00	3-5	W	0	67	67	60	56	55	61	56	47	39	63	Road traffic on A151
18/02/20	21:22	05:00	3-5	W	0	66	63	60	56	56	61	57	48	40	64	Road traffic on A151
18/02/20	23:01	05:00	1-5	W	0	56	60	53	51	51	57	53	42	31	59	Road traffic on A151
18/02/20	23:06	05:00	1-5	W	0	59	66	63	56	55	58	54	44	34	61	Road traffic on A151
18/02/20	23:11	05:00	1-5	W	0	58	62	61	56	53	58	54	43	32	61	Road traffic on A151
18/02/20	23:47	05:00	1-5	W	0	55	56	52	49	48	54	50	39	29	57	Road traffic on A151
18/02/20	23:52	05:00	1-5	W	0	58	60	53	49	51	55	48	38	28	57	Road traffic on A151
18/02/20	23:57	05:00	1-5	W	0	64	63	59	54	54	56	50	43	37	59	Road traffic on A151
19/02/20	06:23	05:00	1-5	W	30	63	64	62	59	58	63	59	48	38	65	Road traffic on A151, occasional cars on High Road
19/02/20	06:28	05:00	1-5	W	30	64	65	61	58	58	63	59	48	38	65	Road traffic on A151, occasional cars on High Road
19/02/20	06:33	05:00	1-5	W	30	65	64	60	58	57	63	59	48	37	65	Road traffic on A151, occasional cars on High Road
19/02/20	09:53	05:00	1-5	W	60	66	68	65	62	62	64	60	49	39	67	Road traffic on A151
19/02/20	09:58	05:00	1-5	W	60	66	70	65	61	61	63	58	48	37	66	Road traffic on A151
19/02/20	10:03	05:00	1-5	W	60	65	67	63	61	60	64	59	48	38	66	Road traffic on A151
19/02/20	10:35	05:00	1-5	W	60	67	66	62	60	59	63	59	48	37	66	Road traffic on A151
19/02/20	10:40	05:00	1-5	W	60	68	71	64	61	60	63	58	47	37	65	Road traffic on A151
19/02/20	10:45	05:00	1-5	W	60	67	69	65	63	62	64	58	49	39	66	Road traffic on A151
19/02/20	11:17	05:00	1-5	W	60	66	67	63	60	59	63	58	47	37	66	Road traffic on A151, JCB moving on site
19/02/20	11:22	05:00	1-5	W	60	67	71	70	68	66	63	59	49	39	68	Road traffic on A151, JCB moving on site
19/02/20	11:27	05:00	1-5	W	60	69	70	66	62	60	62	57	48	37	65	Road traffic on A151, JCB moving on site

Environmental Noise Record Sheet

Project:	Weston, Spalding
Project number:	20029
Date:	12/03/2020

Noise monitoring location:	B: Corner of High Road and Pinfold Lane, 5m from edge of High Road
Plant operating condition:	n/a
Instrumentation:	Bruel & Kjaer 2250/6
Calibration times:	10:00, 03:00

Date/time			Weather			Noise Level (dB)						Comments
Date	Start time	Duration (min:sec)	Wind speed (m/s)	Wind direction	Cloud (%)	LAF10.0	LAF50.0	LAF90.0	LAFmax	LAFmin	LAeq	(Including description of noise (eg whine, hiss, rumble, impact, vehicle rain, vegetation, or animal noise)
18/02/20	21:37	05:00	3-5	W	0	56	50	43	72	40	54	Road traffic on A151, occasional cars on High Road
18/02/20	21:42	05:00	3-5	W	0	55	48	43	71	40	53	Road traffic on A151, occasional cars on High Road
18/02/20	21:47	05:00	3-5	W	0	52	43	41	67	39	51	Road traffic on A151, occasional cars on High Road
18/02/20	23:26	05:00	1-5	W	0	48	43	40	56	38	45	Road traffic on A151, occasional cars on High Road
18/02/20	23:31	05:00	1-5	W	0	49	43	41	56	39	46	Road traffic on A151, occasional cars on High Road
18/02/20	23:36	05:00	1-5	W	0	48	42	40	56	39	45	Road traffic on A151, occasional cars on High Road
19/02/20	00:08	05:00	1-5	W	0	47	42	40	52	38	44	Road traffic on A151
19/02/20	00:13	05:00	1-5	W	0	48	43	40	55	38	45	Road traffic on A151
19/02/20	00:18	05:00	1-5	W	0	50	44	40	56	38	46	Road traffic on A151
19/02/20	06:03	05:00	1-5	W	30	59	54	49	79	46	61	Road traffic on A151, occasional cars on High Road
19/02/20	06:08	05:00	1-5	W	30	58	52	49	75	45	57	Road traffic on A151, occasional cars on High Road
19/02/20	06:13	05:00	1-5	W	30	56	52	48	75	44	57	Road traffic on A151, occasional cars on High Road
19/02/20	09:28	05:00	1-5	W	60	67	57	53	75	50	63	Road traffic on A151, traffic on High Road, birdsong
19/02/20	09:33	05:00	1-5	W	60	63	55	51	74	47	60	Road traffic on A151, traffic on High Road, birdsong
19/02/20	09:38	05:00	1-5	W	60	63	55	52	77	49	61	Road traffic on A151, traffic on High Road, birdsong, JCB on site
19/02/20	10:14	05:00	1-5	W	60	64	54	50	77	48	60	Road traffic on A151, occasional traffic on High Road
19/02/20	10:19	05:00	1-5	W	60	64	55	52	78	48	62	Road traffic on A151, occasional traffic on High Road, intermittent bangs from ground investigations on site, aircraft overhead
19/02/20	10:24	05:00	1-5	W	60	65	55	52	75	49	61	Road traffic on A151, occasional traffic on High Road, intermittent bangs from ground investigations on site
19/02/20	10:56	05:00	1-5	W	60	66	54	51	76	48	62	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site
19/02/20	11:01	05:00	1-5	W	60	67	55	52	77	49	63	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site, bus idling at bus stop
19/02/20	11:06	05:00	1-5	W	60	68	55	51	77	48	63	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site

Date/time			Weather			Leq Octave Band Pressure Level (dB)										Comments
Date	Start time	Duration (min:sec)	Wind speed (m/s)	Wind direction	Cloud (%)	31.5	63	125	250	500	1k	2k	4k	8k	dB(A)	(Including description of noise (eg whine, hiss, rumble, impact, vehicle rain, vegetation, or animal noise)
18/02/20	21:37	05:00	3-5	W	0	62	58	52	46	47	52	45	33	25	54	Road traffic on A151, occasional cars on High Road
18/02/20	21:42	05:00	3-5	W	0	62	57	51	45	46	51	44	33	21	53	Road traffic on A151, occasional cars on High Road
18/02/20	21:47	05:00	3-5	W	0	63	56	50	43	44	49	41	30	22	51	Road traffic on A151, occasional cars on High Road
18/02/20	23:26	05:00	1-5	W	0	57	58	51	40	42	42	33	20	14	45	Road traffic on A151, occasional cars on High Road
18/02/20	23:31	05:00	1-5	W	0	60	56	50	40	42	43	35	22	17	46	Road traffic on A151, occasional cars on High Road
18/02/20	23:36	05:00	1-5	W	0	58	57	50	40	42	42	32	18	13	45	Road traffic on A151, occasional cars on High Road
19/02/20	00:08	05:00	1-5	W	0	67	60	52	43	41	39	32	26	21	44	Road traffic on A151
19/02/20	00:13	05:00	1-5	W	0	66	59	51	42	41	42	35	25	19	45	Road traffic on A151
19/02/20	00:18	05:00	1-5	W	0	66	61	52	43	42	43	35	24	19	46	Road traffic on A151
19/02/20	06:03	05:00	1-5	W	30	68	64	58	52	55	60	52	40	30	61	Road traffic on A151, occasional cars on High Road
19/02/20	06:08	05:00	1-5	W	30	69	62	59	49	51	55	48	38	29	57	Road traffic on A151, occasional cars on High Road
19/02/20	06:13	05:00	1-5	W	30	64	61	56	48	50	55	49	40	30	57	Road traffic on A151, occasional cars on High Road
19/02/20	09:28	05:00	1-5	W	60	69	66	62	58	58	61	53	45	35	63	Road traffic on A151, traffic on High Road, birdsong
19/02/20	09:33	05:00	1-5	W	60	67	64	59	55	56	58	51	43	33	60	Road traffic on A151, traffic on High Road, birdsong
19/02/20	09:38	05:00	1-5	W	60	67	65	59	54	56	59	51	42	31	61	Road traffic on A151, traffic on High Road, birdsong, JCB on site
19/02/20	10:14	05:00	1-5	W	60	64	63	61	61	56	57	51	46	34	60	Road traffic on A151, occasional traffic on High Road
19/02/20	10:19	05:00	1-5	W	60	68	65	60	57	57	60	53	45	34	62	Road traffic on A151, occasional traffic on High Road, intermittent bangs from ground investigations on site, aircraft overhead
19/02/20	10:24	05:00	1-5	W	60	69	67	60	56	56	59	52	44	35	61	Road traffic on A151, occasional traffic on High Road, intermittent bangs from ground investigations on site
19/02/20	10:56	05:00	1-5	W	60	64	64	60	57	57	60	51	42	33	62	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site
19/02/20	11:01	05:00	1-5	W	60	65	66	60	57	58	61	53	43	32	63	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site, bus idling at bus stop
19/02/20	11:06	05:00	1-5	W	60	65	65	60	57	58	61	53	42	30	63	Road traffic on A151, occasional cars on High Road, JCB on site, small motor on site

APPENDIX D

Site location plan showing recommended noise barrier locations



PERSIMMON

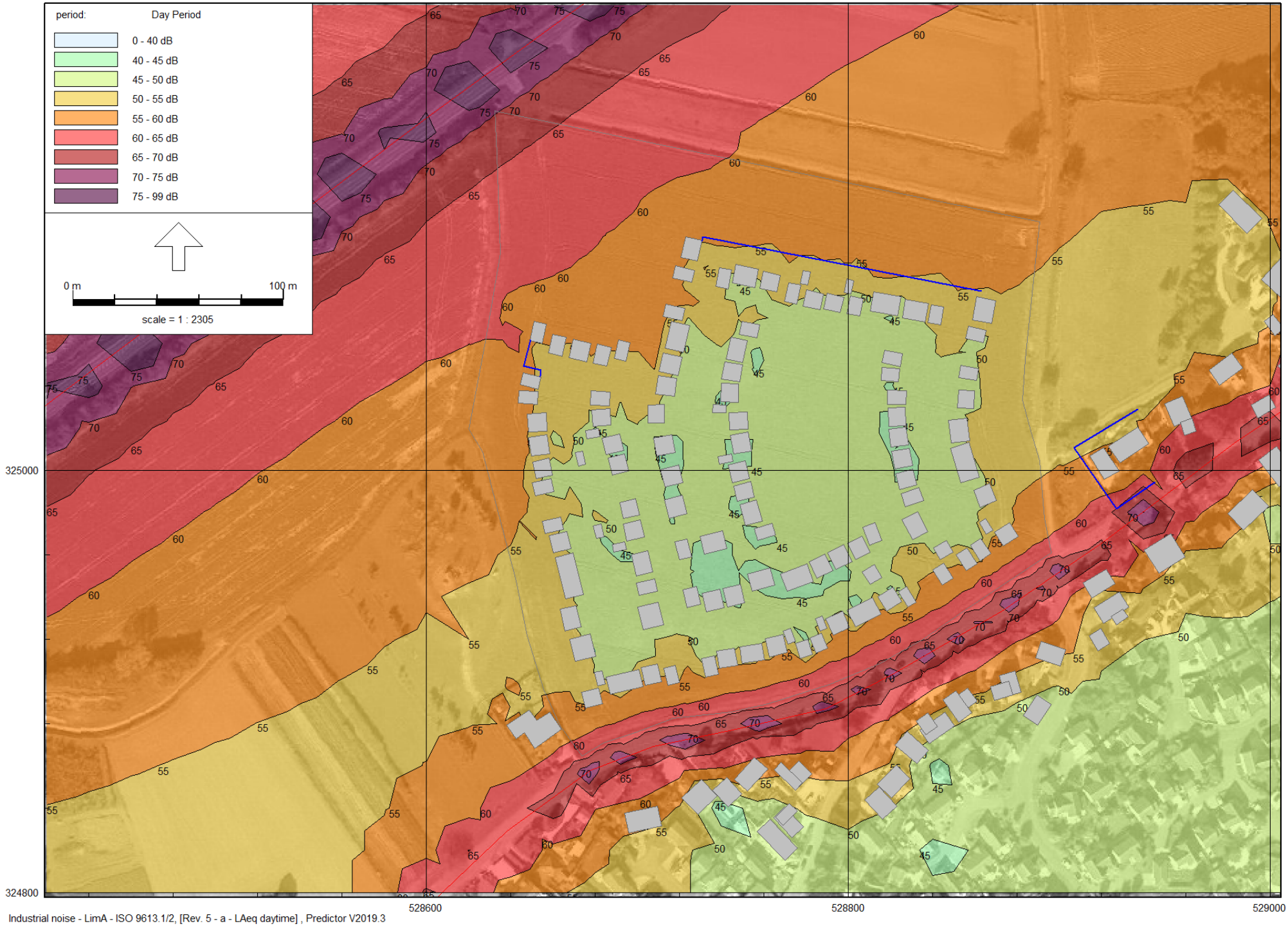
Site Name:
Weston
Spalding

Drawing:
Proposed Planning Layout

Scale@A0:	Drawn By:	Date:
1:500	AT	17/08/2020
Version:	Drawing No:	Rev:
--	SPAL/WEST/PPL/100	H

APPENDIX E

Contour plots showing noise levels across the site



20029 - Weston, Spalding

Predicted Daytime LAeq from road traffic

Contours at 1.5m

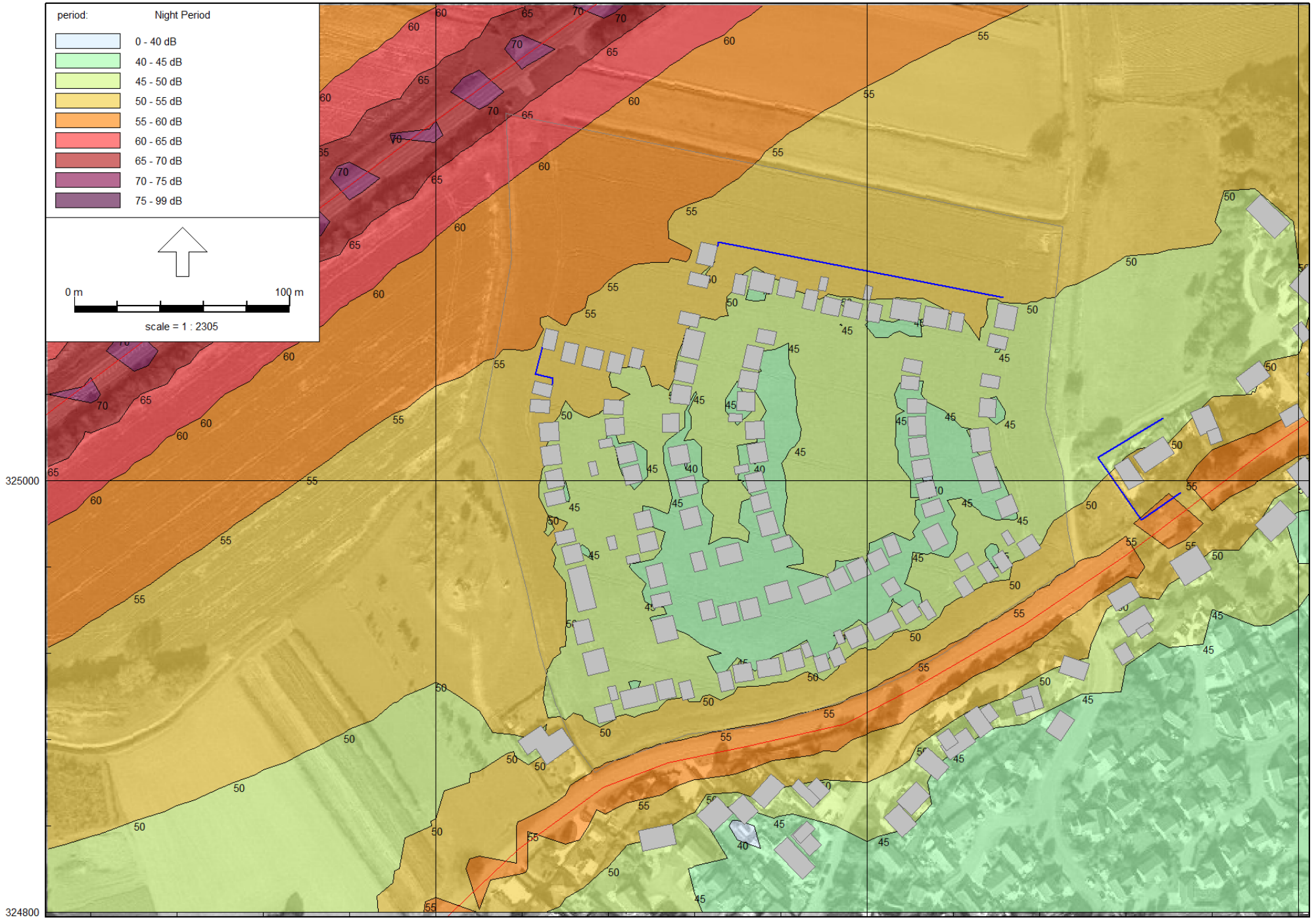
Spectrum Acoustic Consultants Ltd

Industrial noise - LimA - ISO 9613.1/2, [Rev. 5 - a - LAeq daytime] , Predictor V2019.3

20029 - Weston, Spalding

Predicted Night-time LAeq from road traffic

Contours at 4.5m



Industrial noise - LimA - ISO 9613.1/2, [Rev. 5 - b - LAeq night-time] , Predictor V2019.3

Spectrum Acoustic Consultants Ltd

APPENDIX F

Calculations of intrusive noise

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Northern boundary
Room:	LKD

Daytime ($L_{Aeq,16hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	61	55	56	54	57	52	40	26	$L_{Aeq,1}$	59 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	61	55	56	54	57	52	40	26	$L_{Aeq,ff}$	59 dB
ROOM DATA														
Room description and reverberation time	Volume	40	Living Room	RT_{60}	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	6.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	12.9	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 4000 SBW (Hit and miss)	Dn,e	38	38	37	34	30	34	37	46	Dn,e,w / Dn,e,w+Ctr	33 / 32 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	43	35	39	30	31	23	11	-	$L_{Aeq,2}$	35 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Northern boundary
Room:	Bedroom

Daytime ($L_{Aeq,16hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	61	55	56	54	57	52	40	26	$L_{Aeq,1}$	59 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	61	55	56	54	57	52	40	26	$L_{Aeq,ff}$	59 dB
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 4000 SBW (Hit and miss)	Dn,e	38	38	37	34	30	34	37	46	Dn,e,w / Dn,e,w+Ctr	33 / 32 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	37	30	34	28	32	23	9	-	$L_{Aeq,2}$	34 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Northern boundary
Room:	Bedroom

Night time ($L_{Aeq,8hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	60	55	51	48	51	47	36	22	$L_{Aeq,1}$	**54 dB**
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	60	55	51	48	51	47	36	22	$L_{Aeq,ff}$	**54 dB**
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		**s**
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	**Rw / Rw+Ctr**	**29 / 25 dB**
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	**Rw / Rw+Ctr**	**50 / 47 dB**
Vent	No. off.	2	Greenwood 4000 SBW (Hit and miss)	Dn,e	38	38	37	34	30	34	37	46	**Dn,e,w / Dn,e,w+Ctr**	**33 / 32 dB**
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	**36**	**31**	**29**	**22**	**26**	**18**	**5**	**-**	$L_{Aeq,2}$	**29 dB**

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Northern boundary
Room:	Bedroom

Night time (L_{AMax})					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{Max,1}$	65	62	60	59	63	61	50	36	$L_{AMax,1}$	66 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{Max,ff}$	65	62	60	59	63	61	50	36	$L_{AMax,ff}$	66 dB
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 4000 SBW (Hit and miss)	Dn,e	38	38	37	34	30	34	37	46	Dn,e,w / Dn,e,w+Ctr	33 / 32 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{Max,2}$	41	38	38	33	38	31	19	-	$L_{AMax,2}$	40 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Southern boundary
Room:	LKD

Daytime ($L_{Aeq,16hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	61	56	50	51	56	48	39	27	$L_{Aeq,1}$	58 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	61	56	50	51	56	48	39	27	$L_{Aeq,ff}$	58 dB
ROOM DATA														
Room description and reverberation time	Volume	40	Living Room	RT_{60}	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	6.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	12.9	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 4000 SBW (Hit and miss)	Dn,e	38	38	37	34	30	34	37	46	Dn,e,w / Dn,e,w+Ctr	33 / 32 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	42	36	33	27	31	19	9	-	$L_{Aeq,2}$	33 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Southern boundary
Room:	Bedroom

Daytime ($L_{Aeq,16hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	61	55	53	53	56	48	38	27	$L_{Aeq,1}$	58 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	61	55	53	53	56	48	38	27	$L_{Aeq,ff}$	58 dB
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 5000EAW.AC1 (Acoustic trickle)	Dn,e	32	38	37	31	43	43	40	40	Dn,e,w / Dn,e,w+Ctr	39 / 37 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	38	31	31	29	20	11	5	-	$L_{Aeq,2}$	29 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Southern boundary
Room:	Bedroom

Night time ($L_{Aeq,8hr}$)					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{eq,1}$	54	51	42	44	48	41	32	21	$L_{Aeq,1}$	50 dB
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{eq,ff}$	54	51	42	44	48	41	32	21	$L_{Aeq,ff}$	50 dB
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		s
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	Rw / Rw+Ctr	29 / 25 dB
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	Rw / Rw+Ctr	50 / 47 dB
Vent	No. off.	2	Greenwood 5000EAW.AC1 (Acoustic trickle)	Dn,e	32	38	37	31	43	43	40	40	Dn,e,w / Dn,e,w+Ctr	39 / 37 dB
None			--											
RESULTS														
Total calculated indoor noise level				$L_{eq,2}$	32	27	20	20	12	4	-	-	$L_{Aeq,2}$	20 dB

Calculated Indoor Ambient Noise Levels (as per BS 8233:2014 Annex G)

Project:	Weston, Spalding
Project number:	20029
Date:	13/03/2020
Plot:	Southern boundary
Room:	Bedroom

Night time (L_{AMax})					Octave band centre frequency									
	Unit	Value	Description	Term	63	125	250	500	1k	2k	4k	8k	Broadband term	
EXTERNAL NOISE LEVEL														
External noise level			Façade 1	$L_{Max,1}$	78	75	63	64	71	66	54	45	**$L_{AMax,1}$**	**73 dB**
Façade correction factor				C	0	0	0	0	0	0	0	0		
INCIDENT FAÇADE NOISE LEVEL														
Incident noise level			Façade 1	$L_{Max,ff}$	78	75	63	64	71	66	54	45	**$L_{AMax,ff}$**	**73 dB**
ROOM DATA														
Room description and reverberation time	Volume	25	Bedroom	RT_{60}	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.2		**s**
FAÇADE ELEMENTS (Façade 1)														
Glazing	Area	1.5	Pilkington 4/6-16/4	Rw	20	21	17	25	35	37	31	36	**Rw / Rw+Ctr**	**29 / 25 dB**
Wall	Area	5.22	Brick and block external wall	Rw	34	40	44	45	51	56	60	63	**Rw / Rw+Ctr**	**50 / 47 dB**
Vent	No. off.	2	Greenwood 5000EAW.AC1 (Acoustic trickle)	Dn,e	32	38	37	31	43	43	40	40	**Dn,e,w / Dn,e,w+Ctr**	**39 / 37 dB**
None			--											
RESULTS														
Total calculated indoor noise level				**$L_{Max,2}$**	**55**	**50**	**41**	**40**	**35**	**28**	**20**	**8**	**$L_{AMax,2}$**	**42 dB**

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