Castle Buildings LLP

CASTLE BUILDINGS

Hull

Noise Assessment

March 2019

Prepared on behalf of WYG Environment Planning Transport Limited.

Executive Park, Avalon Way, Anstey, Leicester, LE7 7GR

Tel: +44 (0)116 234 8000

Email: nigel.mann@wyg.com

Document Control

Project:	Castle Buildings – Noise Assessment
Client:	Castle Buildings LLP
Job Number:	A112718
File Origin:	O:\Acoustics Air Quality and Noise\Active Projects\A112718

Document Checking:

Prepared by:	Mark Smith MIOA *Senior Consultant*	Initialled:	MS

Reviewed by:	Sam Moran MIOA *Associate*	Initialled:	SM

Verified by:	Sam Moran MIOA *Associate*	Initialled:	SM

Issue	Date	Status
1	11th March 2019	First Issue
2	20th March 2019	Second Issue
3		
4		

Contents Page

Appendix Contents

1.0 Introduction

This noise assessment has been prepared by WYG on behalf of the Castle Buildings LLP to inform a full planning application and associated listed building consent for the Castle Buildings development. The proposed development comprises:

- Demolition and (partial) relocation of the Earl de Grey building, subsequent use for A3/A4 uses and/or B1 use;
- Conversion and extension of Castle Buildings, subsequent use for A3/A4 uses and/or B1 use;
- Erection of a 9-storey hotel building; and
- Associated hard/soft landscape works, access and infrastructure.

A description of the existing noise environment in and around the site is provided. A Noise survey has been undertaken and the results used to verify predictions of the effects of noise. The noise levels across the site have been predicted at proposed receptors using CADNA noise modelling software, which incorporates ISO 9613 and CRTN methodologies and calculations.

A list of acoustic terminology and abbreviations used in this report is provided in Appendix A and a set of location plans and noise contour plots relevant to the assessment are presented in Appendix B. Statistical analysis of long term noise monitoring data is presented in Appendix C and a breakdown of predicted noise levels and required noise mitigation strategy is presented in Appendix D. Report Conditions are presented in Appendix E.

1.1 Legislative Context (England)

This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in the National Planning Policy Framework (NPPF), published on 24th July 2018. With regard to noise and planning, NPPF contains the following statement at paragraph 170:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions

such as air and water quality, taking into account relevant information such as river basin management plans

A further 2 short statements are presented at paragraph 180, which state:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *"mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*
b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational an amenity value for this reason."*

Furthermore, paragraphs 182 and 183 state:

> *"182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*
>
> *183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, is to, *'identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated as follows:

Table 1.1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No Specific Measures Required
Noticeable and 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 (NOEL)	No Specific Measures Required
Lowest Observed Adverse Effect Level (LOAEL)			
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; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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 Observed Adverse Effect	Prevent

The NPPF, NSPE and NPPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, national planning policy and appropriate guidance documents, including the 'BS 8233 (2014) Guidance on sound Insulation and Noise Reduction for Buildings', Section 2.0 presents the noise level criteria used as a basis of this assessment.

The NPPG also states that *neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.*

2.0 Assessment Criteria

2.1 LOAEL and SOAEL Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified.

Table 2.1 Noise Level Criteria and Actions

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect	Building Services Plant	Source noise levels below background L_{A90} noise levels	No Action Required Source noise levels below the background noise is an indication of the sound source having a low impact and that complaints would be unlikely
	Proposed Hotel Residents	Noise levels are below: Bedrooms (Night-time): 30 $dBL_{Aeq,8hours}$ Bedrooms (Daytime): 35 $dBL_{Aeq,16hours}$	Within BS8233 / WHO guideline criteria
Lowest Observed Adverse Effect Level (LOAEL)	Building Services Plant	Difference between source noise levels and existing background levels of zero to 5 dB	Action: None Justification: + 5 dB above background is considered an indication of an impact of marginal significance.
	Noise Breakout from A3 / A4 uses	Entertainment Noise below (Inside existing residential receptor locations with windows open) Daytime: NR25 Night-time: NR 20	None Within relevant Criteria
	Proposed Hotel Residents	Noise levels are below: Bedrooms (Night-time): 30 $dBL_{Aeq,8hours}$ Bedrooms (Daytime): 35 $dBL_{Aeq,16hours}$	Within BS8233 / WHO guideline criteria
Significant Observed Adverse Effect Level (SOAEL)	Building Services Plant	Noise Rating Level ($L_{Aeq,T}$) 10 dB above the background noise level ($L_{A90,T}$)	Action: Mitigate as far as practicable: Justification: Depending on context, a difference of +10dB to be an indication of a significant adverse impact.
	Noise Breakout from A3 / A4 uses	Entertainment Noise above (Inside existing residential receptor locations with windows closed) Daytime: NR25 Night-time: NR 20	Action: Mitigate to achieve (with windows open): Daytime: NR25 Night-time: NR 20

Effect Level	Assessment	Noise Level Criteria	Action / Justification
	Proposed Hotel Residents	Noise levels are exceeded (With windows closed): Bedrooms (Night-time): 35 $dBL_{Aeq,8hours}$ Bedrooms (Daytime): 40 $dBL_{Aeq,16hours}$	Mitigate and reduce to achieve with windows closed: Bedrooms: 30 / 35 $dBL_{Aeq,8hours}$
Unacceptable Observed Adverse Effect Level (UOAEL)	Building Services Plant	Difference between source noise levels and existing background levels of greater than 15 dB	Action: Reduce as far as practicable depending on context Justification: +10dB above existing background is an indication of a likely significant adverse impact
	Proposed Hotel Residents	Internal noise levels exceed: Bedrooms: 51 $dBL_{Aeq,8hours}$, 67 dBL_{Amax}	Mitigate and reduce to achieve with windows closed: Bedrooms (Night-time): 30 $dBL_{Aeq,8hours}$ Bedrooms (Daytime): 35 $dBL_{Aeq,16hours}$

NR noise values are presented in Table 2.2 below.

Table 2.2 NR Noise Values

Noise Rating	Octave-Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
NR 25	55.2	43.7	35.2	29.2	25	21.9	19.5	17.7
NR 20	51.3	39.4	30.6	24.3	20.0	16.8	14.4	12.6

3.0 Assessment Methodology

3.1 Noise Modelling Methodology

Three-dimensional noise modelling has been undertaken based on the monitoring data to predict L_{Aeq} and L_{Amax} noise levels at a large number of locations both horizontally and vertically. CADNA noise modelling software has been used which is based on the Department of Transport Calculation of Road Traffic Noise (CRTN) and ISO 9613 noise propagation methodology.

The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in the table below have been used.

Table 3.1 Modelling Parameters Sources and Assumptions

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels	Environment Agency Open Data	LIDAR Composite DTM
Traffic data surrounding roads	WYGE	WYGE observations and validated noise levels.
Building heights – around site	WYGE Observations	Properties measured from Google Earth using polygon ruler function
Receptor positions	WYGE	As detailed in Table 3.7
Absorbent Ground	CADNA	Frequency dependant ground absorption has been applied based on values specified in VDI 2714/16 clause 6.3.
Site Layout	DLA Design	Proposed Site Plan 2016-223 0012 Elevations 2016-223 0015 Hotel Floor Plans 0016-223 0021 - 0029

It is acknowledged that a number of these assumptions will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are worst case.

3.2 Model Input Data

3.2.1 Commercial Noise Sources

Building Services Plant Noise Data

With the exception of the hotel building (as detailed on HA Eight Floor Plan Hotel ref: 2016-223), the proposed layout does not include plant locations. Additionally, plant specifications for all units at this stage have not been confirmed and so a detailed plant noise assessment cannot be undertaken. Therefore, point sources have been defined in the model to represent potential plant associated with the proposed development. The maximum sound pressure levels of the point sources at 3 and 10 metres were estimated in the model as a conditional maximum level that the noise levels at nearby receptors were predicted to meet the assessment criteria of not exceeding the background noise level.

Noise Breakout

Vertical area sources have been defined within the noise model to account for the noise breakout from the A3/A4 uses including the 8th floor hotel sky bar of the proposed development. Source noise data has been based on published data from the Little Red Book of Acoustics, A Practical Guide, 2007.

Table 3.2 Internal Noise Level

Description	Frequency (Hz)							Total L_{Aeq} dB(A)
	63	125	250	500	1k	2k	4k	
Busy Pub/Bar	80	85	85	85	85	80	70	88

Error! Reference source not found. details the assumed sound reduction performance of the façade. In order to present a reasonable worst-case, the sound reduction performance of standard double glazing 4 (12) 4 has been assumed. All entrance doors to the premises have been assumed to be open for the duration of the 15-minute assessment period which is likely to result in an over-estimate of the noise breakout.

Table 3.3 Assumed Glazing Specification

Description	Octave band centre frequency (R)							Single Figure R_w
	63	125	250	500	1000	2000	4000	
Saint Gobain 4 (12) 4	21	24	18	25	36	39	31	29
Entrance doors	0	0	0	0	0	0	0	0

3.2.2 Existing Noise Sources

Multi Storey Car Park (MSCP)

Road traffic noise from the A63 is the dominant noise source at the site and the surrounding area. Therefore, noise levels from the adjacent MSCP at Princess Quay have been modelled on measurements undertaken by WYG within an existing car park. L_{Aeq} noise levels, as follows, are modelled as area sources across each car parking area.

- $L_{Aeq,1hr}$ *Noise Level* = 54 dB at 1.5m height
- L_{Amax} used is as 76 dB at 3 m distance [L_w = 93.5 dB]

AN additional +6 dB(A) correction has been applied to account for the reverberant sound pressure level within the MSCP as a worst-case.

Road Traffic Noise Model Verification

The model has been verified against noise monitoring locations for the 'existing' scenario based on noise data obtained over the duration of the survey, further details of which are presented in Section 4.0. The comparison between the monitoring and modelling results are shown in the tables below. The greatest weight has been given to the long term measurements locations and appropriate short-term locations located adjacent to local roads further away from the A63.

Table 3.4 Daytime Modelled vs. Monitored Results $L_{Aeq,T}$

Monitoring Position	Monitored L_{Aeq} (dB)	Modelled L_{Aeq} (dB)	Difference between modelled and measured noise level (dB)
LT1	74.1	74.1	0.0
LT2	66.4	65.9	-0.5
ST1	59.2	59.9	0.7
ST3	62.0	63.0	1.0

All values are sound pressure levels in dB re: 2x 10-5 Pa

Within the daytime noise model all verification points show a divergence between monitored and modelled results of no more than 3 dB(A), the models are therefore considered to be suitably verified.

Table 3.5 Night-time Modelled vs. Monitored Results $L_{Aeq,T}$

Monitoring Position	Monitored L_{Aeq} (dB)	Modelled L_{Aeq} (dB)	Difference between modelled and measured noise level (dB)
LT1	71.5	71.6	0.1

Monitoring Position	Monitored L_{Aeq} (dB)	Modelled L_{Aeq} (dB)	Difference between modelled and measured noise level (dB)
LT2	63.7	63.4	-0.3
ST1	53.7	56.1	2.4
ST3	62.4	62.3	-0.1

All values are sound pressure levels in dB re: 2x 10-5 Pa

Within the night-time noise model all verification points show a divergence between monitored and modelled results of no more than 3 dB(A), the models are therefore considered to be suitably verified.

A63 Improvement Work

Highway improvements are proposed along the A63 adjacent to the site for which a Development Consent Order has been applied for and is yet to be determined. A review of the A63 Castle Street Improvement, Hull Transport Assessment Report (Document Ref: TR010016/APP/7.4, dated September 2018) has been undertaken which includes details on changes in traffic along the A63. A comparison with the 2015 Base and 2025 Do Something (With improvements) scheme traffic flows as presented within Table 4.3 of the document has been undertaken which result in an increase in noise level of 1.2 dB as a result of the scheme.

Therefore, to account for the potential impact as a result of the A63 improvement works a correction of 1.2 dB(A) has been included into the noise model, for both A63 east and west bound links adjacent to the proposed development. This presents a reasonable worst-case as the current general arrangement scheme plan (Drawing ref: A63 (Castle Street Improvement, Hull) TR010016/APP/2.2(DA) Revision 0), shows the main carriageway of the A63 being relocated further away from the development boundary. Table 3.6 below details the AADT flows stated from the report.

Table 3.6 AADT Traffic Flows (Document Ref: TR010016/APP/7.4)

Road Section	Direction	AADT Traffic Flows		Predicted Change in Noise Level
		Base (2015)	2525 With Scheme	
A63 Castle street (Humber Dock Street to Mytongate)	West Bound	22462	29632	1.2 dB(A)
A63 Castle Street (Myton Street to Princess Dock Street)	East Bound	24949	32756	1.2 dB(A)

3.2.3 Sensitive Receptors

The nearest residential receptors are located on Princess Dock Street, approximately 185m from the development boundary, and are screened from the development by Princess Quay, Princess Quay MSCP and

Ask Italian restaurant. On this basis it is assumed that noise contributions from the development at the residential receptors will be negligible and the Holiday Inn Hotel which is approximately 50m from the development boundary has been identified as the nearest receptor.

Table 3.7 below summarises receptor locations that have been selected to represent worst-case existing sensitive receptor (the Holiday Inn Hotel) with respect to direct noise from the proposed development. Upper floor facades (adjacent and facing the proposed development) have been represented.

The locations of existing receptors are shown on SK02a and proposed receptor locations are shown on SK02b in Appendix B.

Table 3.7 Receptor Locations

Ref.	Description	Assessed Height (m)
ER – GF	The Holiday Inn Hotel	1.5
ER – F1		4.5
ER – F2		7.0
ER – F3		9.5

3.3 Tranquillity Rating

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most).

4.0 Noise Survey

4.1 Noise Survey Methodology

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Rion NL-52	Environmental Noise Analyser (WYG16)	s/n	1221576
Rion NL-52	Environmental Noise Analyser (WYG21)	s/n	1021331
Rion NL-52	Environmental Noise Analyser (WYG23)	s/n	732146
Rion NL-52+X	Environmental Noise Analyser (WYG5)	s/n	342866
Rion NC-74	Sound Calibrator	s/n	35046823

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice, and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at ten locations (as specified in the following table and shown in SK01 of Appendix B) from Friday 22nd February 2019 to Wednesday 27th February 2019. Attended short term measurements were undertaken at eight locations during day, evening periods and 4 during night-time periods with two additional locations being measured unattended over a 119-hour period. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*. Weather conditions during the survey period were observed as being dry. Anemometer readings confirmed that wind speeds were less than 5 ms^{-1} at all times during the survey, with a predominant south-westerly wind direction, during the survey.

Table 4.1 Noise Monitoring Locations

Ref	Description
LT1	On Castle Buildings facing Waterhouse Lane.
LT2	On Castle Buildings facing A63/Castle Street.
ST1	Myton Lane, opposite Bonus Arena
ST2	Waterhouse Lane, in front of Castle Buildings car park.
ST3	Waterhouse Lane, opposite Bonus Arena service yard.
ST4	Castle Street/A63.

Ref	Description
ST5	On Princes Quay car park facing west.
ST6	On Princes Quay car park facing south.
ST7	Princes Dock Street.
ST8	On Level 2A of Princes Quay Car Park.

4.2 Noise Survey Results

The dominant noise sources found in the area include road traffic noise from Myton street and A63/Castle street.

During the attended measurement at ST2 during an event at the Bonus Arena no noise breakout from the event or from fixed plant were audible. Noise from activities within the servicing yard were observed, associated with load-in / load-out activities, however in the context of noise emanating from the road network these contributions were considered to be of negligible significance and not assessed further within this report.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period). For the long-term (LT) locations, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Table 4.2 Meteorological Conditions during the Survey

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Day ST1	27/02/2019 11:40	11.0	0-1	SW	1	Traffic along Myton Street and A63/Castle Street.
Day ST2	27/02/2019 11:24	11.0	0-1	SW	1	Traffic along Waterhouse Lane, A63/Castle Street and Myton Street.
Day ST3	27/02/2019 12:56	13.0	1-2	SW	1	Traffic along Waterhouse Lane and A63/Castle Street.
Day ST4	27/02/2019 11:08	11.0	1-2	SW	1	Traffic along A63/Castle Street.
Day ST5	27/02/2019 12:21	13.0	1-2	SW	1	Traffic along A63/Castle Street and Waterhouse Lane.
Day ST6	27/02/2019 12:38	13.0	1-2	SW	1	Traffic along A63/Castle Street.
Day ST7	27/02/2019 10:50	11.0	0-1	SW	1	Traffic along A63/Castle Street.
Day ST8	27/02/2019 12:05	13.0	0-1	SW	1	Traffic along A63/Castle Street and noise from cars moving within Princes Quay car park.

Survey Location	Date & Time	Temperature (ºC)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Evening ST1	26/02/2019 22:09	8.0	1-2	SE	1	Traffic along Myton Street and A63/Castle Street and people coming out of Bonus Arena.
Evening ST2	26/02/2019 19:28	10.0	1-2	SE	1	Traffic along Waterhouse Lane, A63/Castle Street and Myton Street.
Evening ST3	26/02/2019 21:51	8.0	1-2	SE	1	Traffic along Waterhouse Lane and A63/Castle Street and noise from Bonus Arena service yard.
Evening ST4	26/02/2019 21:35	9.0	1-2	SE	1	Traffic along A63/Castle Street.
Evening ST5	26/02/2019 18:50	10.0	1-2	SE	1	Traffic along A63/Castle Street and Waterhouse Lane.
Evening ST6	26/02/2019 18:33	11.0	1-2	SE	1	Traffic along A63/Castle Street.
Evening ST7	26/02/2019 21:17	9.0	1-2	SE	1	Traffic along A63/Castle Street.
Evening ST8	26/02/2019 19:08	10.0	1-2	SE	1	Traffic along A63/Castle Street and noise from cars moving within Princes Quay car park.
Night ST1	26/02/2019 23:51	6.0	0-1	S	1	Traffic along Myton Street and A63/Castle Street.
Night ST3	26/02/2019 23:34	6.0	0-1	S	1	Traffic along Waterhouse Lane and A63/Castle Street and noise from Bonus Arena service yard.
Night ST4	26/02/2019 23:17	6.0	0-1	S	1	Traffic along A63/Castle Street.
Night ST7	26/02/2019 23:00	6.0	0-1	S	1	Traffic along A63/Castle Street.

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2 x 10^{-5} Pa). For the LT locations, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Table 4.3 Results of Baseline Noise Monitoring Survey (Average Levels)

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekday Daytime 07:00 - 23:00	47 Hours	22/02/2019 - 27/02/2019 15:17 - 13:47	LT1	74.1	99.0	47.5	76.6	68
Weekday Night-time 23:00 – 07:00	24 Hours	22/02/2019 - 27/02/2019 23:00 - 07:00		71.5	96.4	42.8	73.1	46
Weekend Daytime 07:00 - 23:00	32 Hours	23/02/2019 - 24/02/2019 07:00 - 23:00		73.8	101.1	46.0	76.6	67
Weekend Night-time 23:00 – 07:00	16 hours	23/02/2019 - 24/02/2019 23:00 - 07:00		69.5	91.7	42.0	73.4	52

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekday Daytime 07:00 - 23:00	47 Hours	22/02/2019 - 27/02/2019 15:13 - 13:43	LT2	66.4	93.2	47.9	68.6	62
Weekday Night-time 23:00 – 07:00	24 Hours	22/02/2019 - 27/02/2019 23:00 - 07:00		63.7	87.9	40.8	65.1	48
Weekend Daytime 07:00 - 23:00	32 Hours	23/02/2019 - 24/02/2019 07:00 - 23:00		66.5	94.6	43.5	69.0	62
Weekend Night-time 23:00 – 07:00	16 hours	23/02/2019 - 24/02/2019 23:00 - 07:00		62.5	88.0	39.0	65.3	52
Daytime 07:00 - 18:30	15 Mins	27/02/2019 11:40	ST1	59.2	77.0	50.7	60.5	55.3
	15 Mins	27/02/2019 11:24	ST2	61.0	77.9	54.2	61.8	58.5
	15 Mins	27/02/2019 12:56	ST3	62.0	75.0	54.6	62.8	58.6
	15 Mins	27/02/2019 11:08	ST4	75.5	91.4	60.4	76.7	70.5
	15 Mins	27/02/2019 12:21	ST5	62.3	69.2	55.4	63.0	59.5
	15 Mins	27/02/2019 12:38	ST6	68.1	79.1	58.5	68.9	64.9
	15 Mins	27/02/2019 10:50	ST7	61.1	82.1	54.9	62.4	58.1
	15 Mins	27/02/2019 12:05	ST8	62.3	77.3	53.2	63.6	58.2
Evening 18:30 - 23:00	15 Mins	26/02/2019 22:09	ST1	60.9	87.0	51.2	62.8	57.6
	60 Mins	26/02/2019 19:28	ST2	60.4	75.5	51.7	61.1	57.6
	15 Mins	26/02/2019 21:51	ST3	64.4	81.5	52.5	66.3	59.2
	15 Mins	26/02/2019 21:35	ST4	74.5	88.1	52.8	75.9	66.2
	15 Mins	26/02/2019 18:50	ST5	62.6	76.1	54.9	63.6	59.8
	15 Mins	26/02/2019 18:33	ST6	69.7	81.9	60.6	70.3	66.8
	15 Mins	26/02/2019 21:17	ST7	58.2	72.5	50.1	59.3	54.1
	15 Mins	26/02/2019 19:08	ST8	62.4	74.5	55.9	63.0	60.1
Night-time 23:00 - 07:00	15 Mins	26/02/2019 23:51	ST1	53.7	82.6	45.2	56.2	48.9
	15 Mins	26/02/2019 23:34	ST3	62.4	80.9	58.0	64.5	59.0
	15 Mins	26/02/2019 23:17	ST4	71.1	95.3	51.5	73.2	62.0
	15 Mins	26/02/2019 23:00	ST7	56.5	72.1	50.4	57.9	53.0
Plant or Sources								
P1	30 Secs	27/02/2019 14:12	1m	83.8	84.7	82.8	84.1	83.4
P2	30 Secs	27/02/2019 14:12	3m	79.4	80.4	78.6	79.8	79.0
P3	30 Secs	27/02/2019 14:14	1m	67.0	70.1	66.2	67.4	66.6
P4	30 Secs	27/02/2019 14:16	1m	64.0	65.0	62.9	64.3	63.4
P5	30 Secs	27/02/2019 14:17	1m	63.3	63.9	62.6	63.5	62.9
P6	30 Secs	27/02/2019 14:19	1m	67.6	70.8	65.3	68.4	66.3
P7	30 Secs	27/02/2019 14:21	1m	69.8	71.2	68.5	70.2	69.1
P8	30 Secs	27/02/2019 14:22	1m	65.1	66.1	64.2	65.4	64.7

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

5.0 Assessment of Key Effects on Proposed Hotel

5.1 Noise Intrusion Assessment

Internal noise levels at the proposed development, based on the existing ambient noise climate and contributions from the proposed commercial units, have been assessed both with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of standard double glazing (4mm / 16mm / 6mm) with a sound reduction of 29 dB R_{tr} has been used. The predicted noise levels at the assessed receptors locations are presented in Table 1 and Table 2 in Appendix D. Following a review of the long-term noise data, by addressing the L_{Aeq} in bedrooms, the required glazing and ventilation specification is sufficient to address the majority of peak (L_{Amax}) noise levels from road traffic noise.

As shown in the Table 1 and Table 2 within Appendix D, for the majority of rooms, based on detailed BS 8233 calculations, the standard double glazing and natural ventilation via openable windows will not be sufficient to meet target internal noise criteria. Therefore, alternative ventilation and, for some rooms, enhanced glazing will be required. For the purpose of this assessment it has been assumed mechanical ventilation would be installed.

Table 6.1 details example glazing specifications that are predicted to meet the internal noise level criteria of 30 dB $L_{Aeq,16hours}$ with the locations where noise mitigation is required presented in SK05 -SK08. The noise criteria is based on achieving the criteria stated within BS 8233. When an operator is known, confirmation should be sought regarding any bespoke noise criteria that may be applicable.

In addition, consideration has been given to potential noise breakout associated with amplified music from the proposed commercial uses including the sky bar on 8th floor of the proposed hotel. The proposed hotel is the closest receptor and a noise criteria of NR 20 is considered appropriate at this stage of the project design. The glazing specification takes into account potential noise from amplified music based on the source data presented in Section 3.2. Therefore, at this stage two glazing systems are recommended, however, depending on any future confirmation of the glazing specification and the proposed usage in relation to internal source noise levels, a standard double glazing specification (29 dB R_{tr}) could be acceptable for some bedrooms on the north eastern façade of the proposed hotel.

Table 5.1 Example Required Glazing Specifications

Reference	Description	Octave-band Sound Reduction Index (Hz)						Predicted Sound Reduction (dB)
		125	250	500	1000	2000	4000	
1	Saint Gobain Glass 10 (12) 12	30	32	38	36	40	49	33
2	Saint Gobain Glass 8 (16) 16.8A	28	36	39	45	46	58	39

6.0 Assessment of Key Effects (Commercial Development)

Details of the future occupiers of the commercial units (A3, A4 and B1) are currently unknown. However, the site is located within a high noise area with the nearest sensitive receptor being the Holiday Inn hotel at Hull Marina on the opposite side of the A63. The nearest residential receptors are approximately 200m away from the development boundary on Princess Dock Street and are partially screened from the site by the Princess Quay multi-storey car park and shopping centre. Therefore, it is considered that noise from occasional delivery events would have a low impact.

Further to the above, to enable design limits to be set with regard noise from potential building service plant (BSP) associated with the A3, A4, B1 and hotel uses, an assessment has been undertaken in accordance with BS 4142 with the findings presented in Section 5.1 below.

Section 5.0 provides an assessment with regard to the suitability of the site for hotel end-use within the context of existing noise sources.

6.1 Building Services Plant BS 4142 Noise Assessment

For the purpose of assessing impacts in accordance with BS 4142, the representative existing measured background noise level has been established from a statistical analysis of the long-term noise survey data. The statistical analysis of long term measured noise data is presented in Appendix C.

As details relating to proposed BSP are currently unknown, noise from a series of predictions were made by defining different sound power levels (assuming hemi-spherical propagation) at the point sources shown in SK02a. In terms of establishing indicative permissible plant noise levels (as shown in Table 5.1), consideration has been given to the noise from plant being around -10dB below the predicted external noise levels at the proposed hotel associated with existing noise sources (as detailed in Appendix D).

Table 6.1 BSP Noise Emissions as Modelled

BSP Location	Noise Emission - Sound Pressure Level	
	Daytime	Night-time
Assessed plant locations shown on SK02a (1 m above roof)	62.6 dBA at 3 m *OR* 52.1 dB(A) at 10 m	60.1 dB(A) at 3 m *OR* 49.6 dB(A) at 10 m

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

Table 5.2 presents the difference between the background noise level and noise rating level associated with the proposed plant. To present a worst-case scenario and take into account any assessment uncertainty, as noise contributions from BSP are predicted to be significantly below background at the Holiday Inn, specific

characteristics will be imperceptible therefore no character correction has been applied to determine the rating level in accordance with BS 4142.

Table 6.2 BS4142 Assessment for Proposed Plant

Ref	Existing Measured Background L_{A90}		Rating level from plant ($L_{A,Tr}$)		BS 4142 Score	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
ER – GF	62	46	34	32	-28	-14
ER – F1	62	46	31	28	-31	-18
ER – F2	62	46	32	29	-30	-17
ER – F3	62	46	32	30	-30	-17

All values are sound pressure levels in dB re: 2x 10^{-5} Pa.

All calculations used to derive the above table (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 Para 8.6, the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

Based on worst case assumptions that all plant would be operating simultaneously, noise contributions from BSP are predicted to be below significantly background noise levels and therefore below the LOAEL.

6.2 Noise Breakout Assessment

Based on the source data presented in Section **Error! Reference source not found.**, the following internal noise levels at nearby receptors have been assessed with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of standard double glazing (4mm / 16mm / 4mm) with a sound reduction of 29 dB R_w has been used.

The results of the modelling exercise are presented in Table 5.3 and Table 5.4.

Table 6.3 Predicted Internal Noise Levels at existing receptors from Noise Breakout (Windows Open)

Ref.	Octave Band Centre Frequency (Hz) Sound Pressure Level (dB)							NR
	63	125	250	500	1000	2000	4000	
ER – GF	27.2	30.5	33.6	29.9	27.5	21.5	9.6	***28***
ER – F1	20.4	23.4	27.0	23.1	20.2	14.1	2.2	***21***
ER – F2	21.8	25.4	29.0	25.4	24.0	19.2	7.5	***24***
ER – F3	22.6	26.8	30.4	27.4	25.5	19.7	7.6	***26***

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

Table 6.4 Predicted Internal Noise Levels at existing receptors from Noise Breakout (Windows Closed)

Ref.	Octave Band Centre Frequency (Hz) Sound Pressure Level (dB)							NR
	63	125	250	500	1000	2000	4000	
ER – GF	21.2	21.5	30.6	19.9	6.5	-2.5	-6.4	***20***
ER – F1	14.4	14.4	24.0	13.1	-0.8	-9.9	-13.8	***13***
ER – F1	15.8	16.4	26.0	15.4	3.0	-4.8	-8.5	***16***
ER – F2	16.6	17.8	27.4	17.4	4.5	-4.3	-8.4	***17***

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

It can be seen from the assessment above that potential noise breakout associated with amplified music within the site is NR20 or less when windows are closed. When windows are open the highest predicted internal noise level is NR28 with an external noise level at the façade of 47 dB $L_{Aeq,T}$. However, the assessment is based on all doors within the proposed development being open and a high level of internal noise from commercial unit and the sky bar. In addition, existing noise levels at the hotel are high. Using the verified night-time noise model, noise levels at the hotel are around 69 dB $L_{Aeq,8hours}$ which is 22 dB higher than the predicted noise breakout levels which are based on reasonable worst-case assumptions. Therefore, it is considered that there will not be an unacceptable impact at the closest existing receptor.

6.3 Tranquillity Assessment

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). By reference to these maps the development is assessed as falling into Zone 1 and of low tranquillity value. No footpaths, bridleways or national routes exist within the study area and it is therefore considered that the proposed scheme will not affect local access to areas of greater tranquillity.

7.0 Conclusions

This report presents the findings of a noise assessment to inform a full planning application and associated listed building consent for the Castle Buildings development. The proposed development comprises:

- Demolition and (partial) relocation of the Earl de Grey building, subsequent use for A3/A4 uses and/or B1 use;
- Conversion and extension of Castle Buildings, subsequent use for A3/A4 uses and/or B1 use;
- Erection of a 9-storey hotel building; and
- Associated hard/soft landscape works, access and infrastructure.

The NPPF gives a number of test points relating to noise which are referenced as bullet points below. Considering each of these points, the following conclusions can be drawn in relation to the proposed development:

NPPF 170 (e) and 180 (a)

Through the use of appropriate mitigation, which is summarised below, it is considered that the proposed development will avoid noise giving rise to significant adverse impacts on health and the quality of life.

For the proposed hotel receptors there is the requirement for enhanced glazing throughout the development and, with regard to compliance with Part F of the Building Regulations, alternative ventilation will also be required. It has been assumed at this stage that the hotel will be mechanically ventilated.

Noise rating levels from proposed building services plant have been predicted and indicative design noise limits established in order to the noise rating level associated with the noise from plant being insignificant at the proposed hotel façade in relation to road traffic noise sources. Based on these indicative design limits noise levels at existing receptor location are predicted to be significantly below existing background noise levels.

Noise breakout from A3 / A4 uses has been assessed based on typical noise levels within a busy bar. The assessment concludes that there will not be an adverse impact at the closest sensitive receptor during either daytime or night-time periods whilst acceptable internal noise levels are predicted to be achieved in the proposed hotel bedrooms.

Given the high noise levels that exist at the site due to the proximity to the A63 and no existing sensitive receptors being located with close proximity to the site, it is considered that noise from occasional deliveries would have a low impact.

NPPF 180 (b), 182 and 183

Based on the assessments undertaken it is not considered that any existing businesses wanting to develop would be restricted by the proposals. An assessment of the existing tranquillity level of the site undertaken and identified that the site is not highly prized for its tranquillity and recreational value in terms of noise. There will be no disruption to public rights of way which are located within or adjacent to the site. Therefore, the proposed development is considered to have a negligible effect on local access to any areas of tranquillity.

Planning Practice Guidance: Noise

The noise mitigation measures recommended within this report is sufficient to reduce the effects of identified sources of noise both existing and proposed to prevent the adopted thresholds (within the context of BS 8233 and BS 4142) of where the Significant Observed Adverse Effect Level (SOAEL) would be exceeded for future patrons of the hotel.

Appendices

Appendix A – Acoustic Terminology and Abbreviations

Acoustic Terminology

dB — Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.

dB(A) — Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.

L_{Aeq} — Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,\ 07:00 - 23:00}$ for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower that the $L_{Aeq,\ 07:00 - 23:00}$.

L_{Amin} — The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.

L_{Amax} — The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.

L_n — Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the $L_{A10,\ 1\ hr}$ = x dB.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.

R_w — The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

Abbreviations

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

PPG24 – Planning Policy Guidance

PRoW – Public Rights of Way

UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

WYGE – WYG Environment

Appendix B – Sketches

SK01 Noise Monitoring Location Plan

SK02a Existing Receptor Location Plan

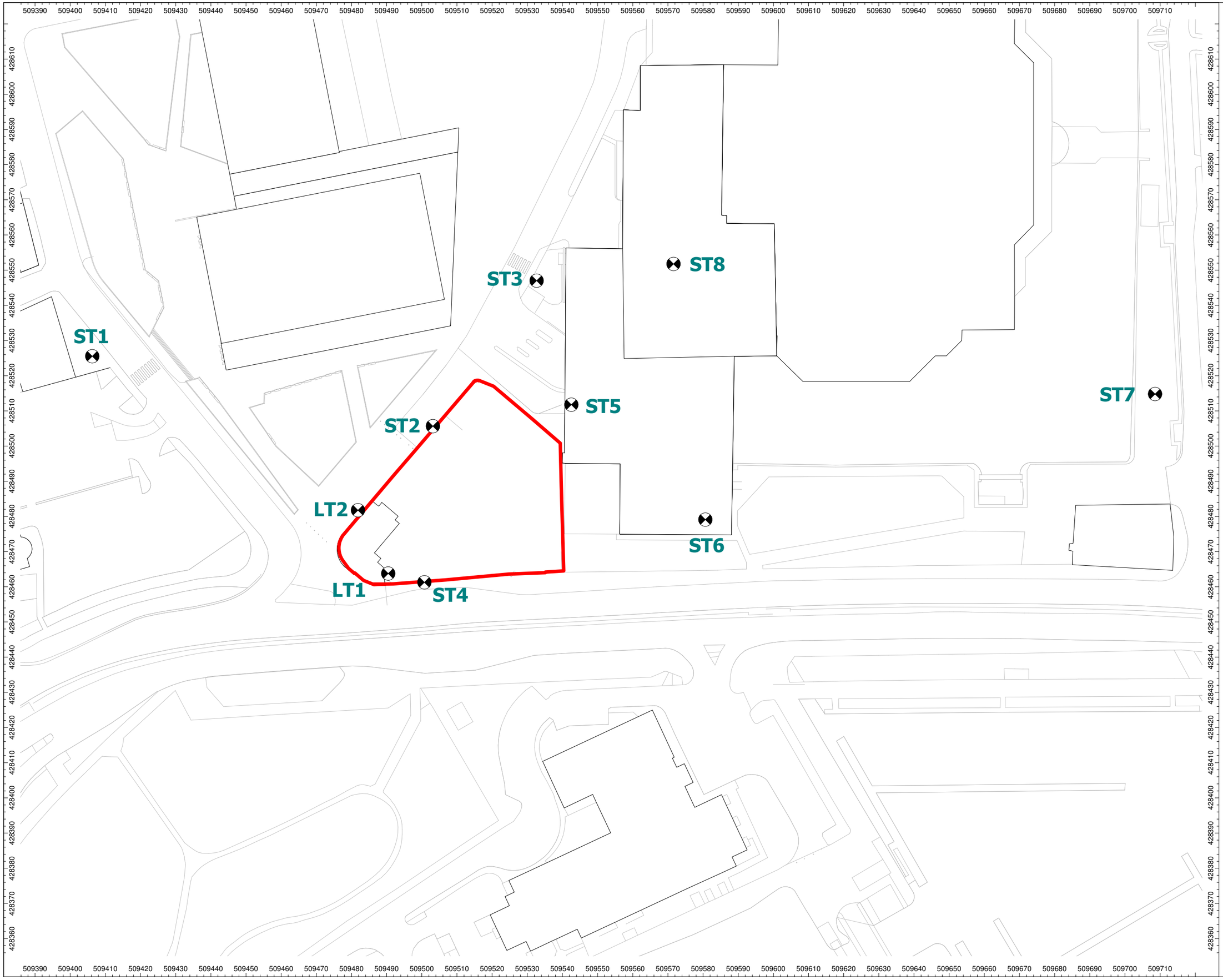
SK02b Proposed Receptor Location Plan

SK03 Noise Contour Plot Daytime (Proposed Receptors) $L_{Aeq, 16hr}$

SK04 Noise Contour Plot Night-time (Proposed Receptors) $L_{Aeq, 8hr}$

SK05 Noise Mitigation Strategy (F1 – F5)

SK06 Noise Mitigation Strategy (F6 – F7)



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Noise Monitoring
Location Plan

Drawing Number:
SK01

Key:

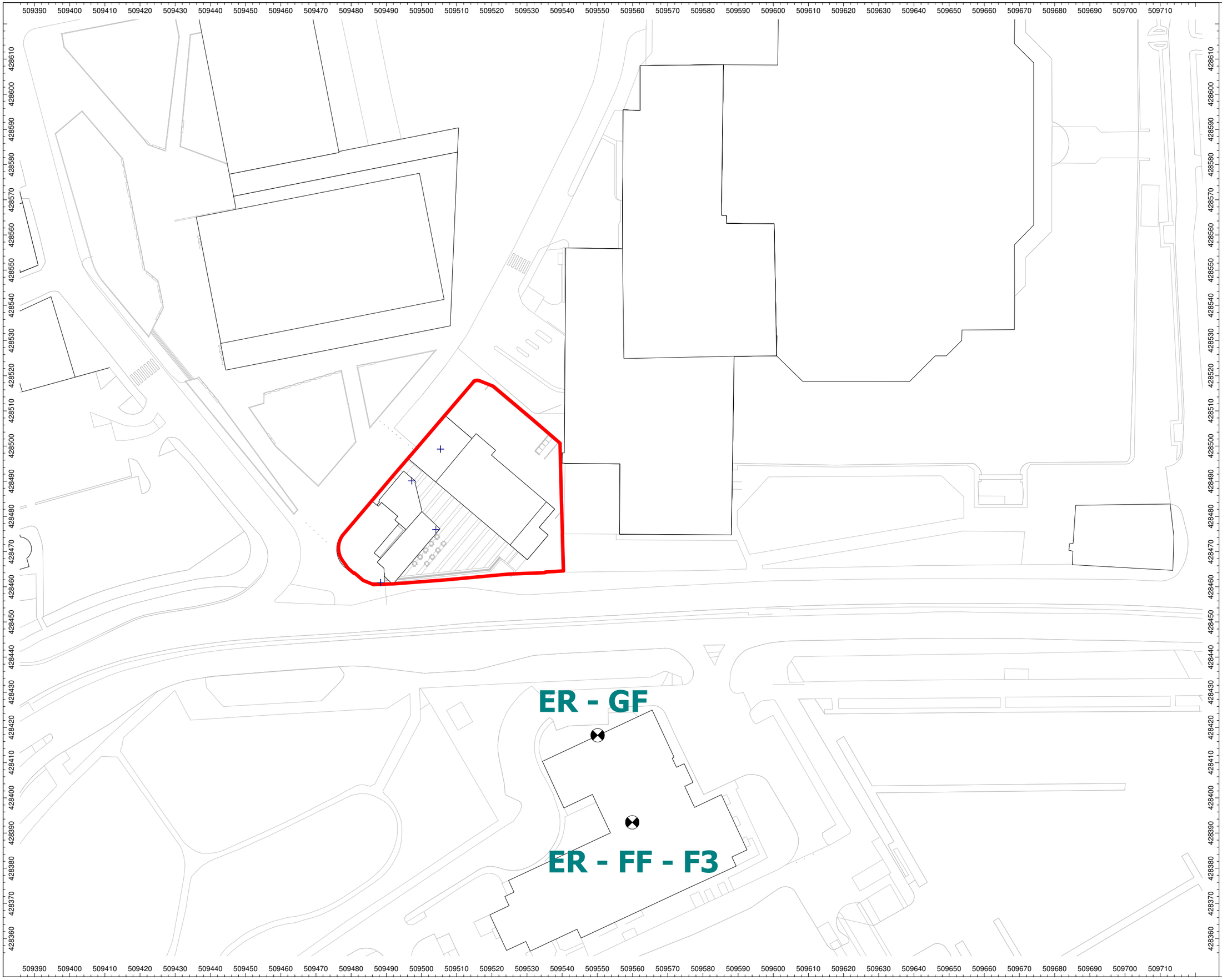
Site Boundary:

Noise Monitoring
Location:

Scale : Not to scale

WYGE Leicester 08.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Proposed Receptor
Location Plan

Drawing Number:
SK02b

Key:

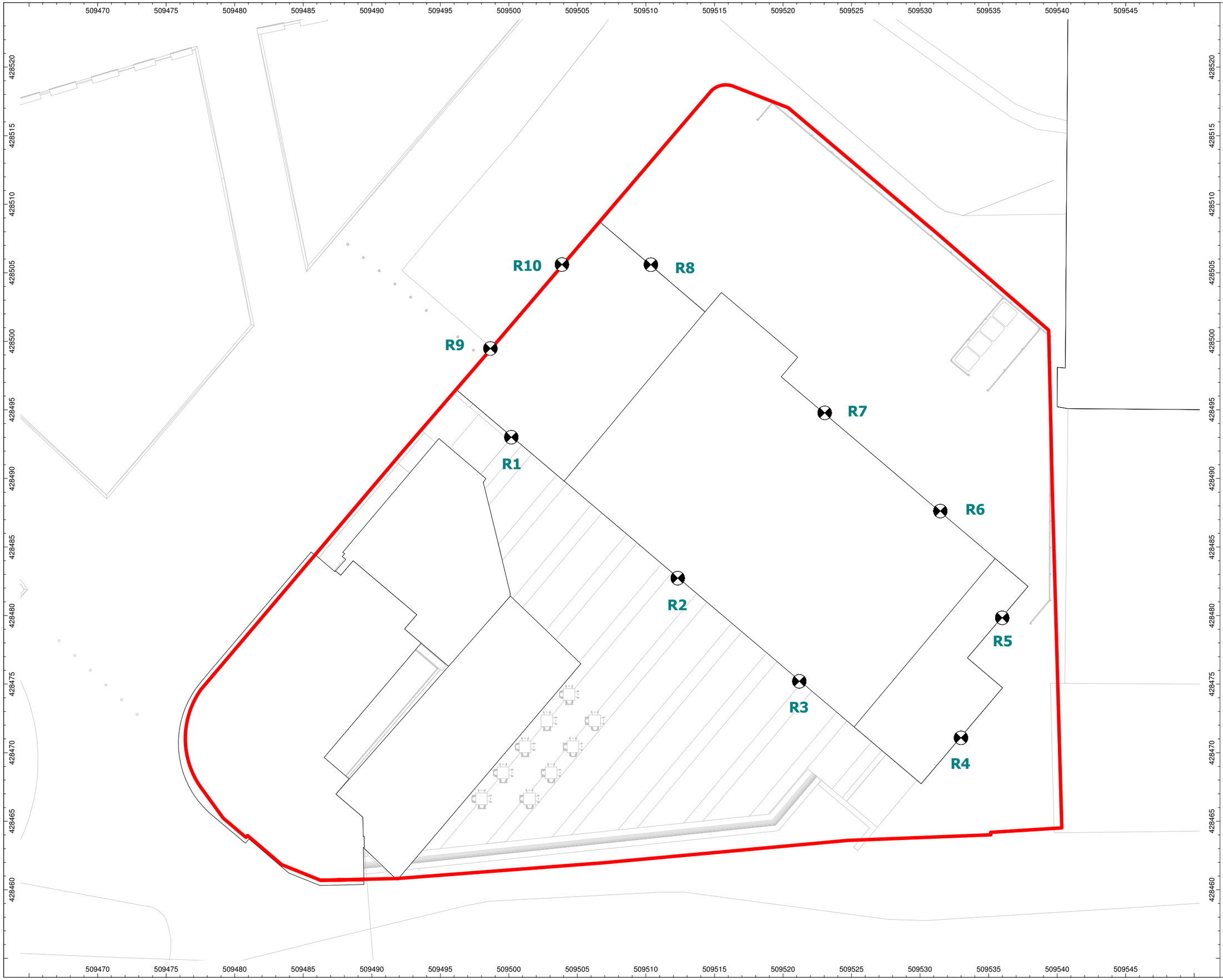
Site Boundary:

Receptor Location:

Scale : Not to scale

WYGE Leicester 20.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Proposed Receptor Location Plan

Drawing Number:
SK02b

Key:

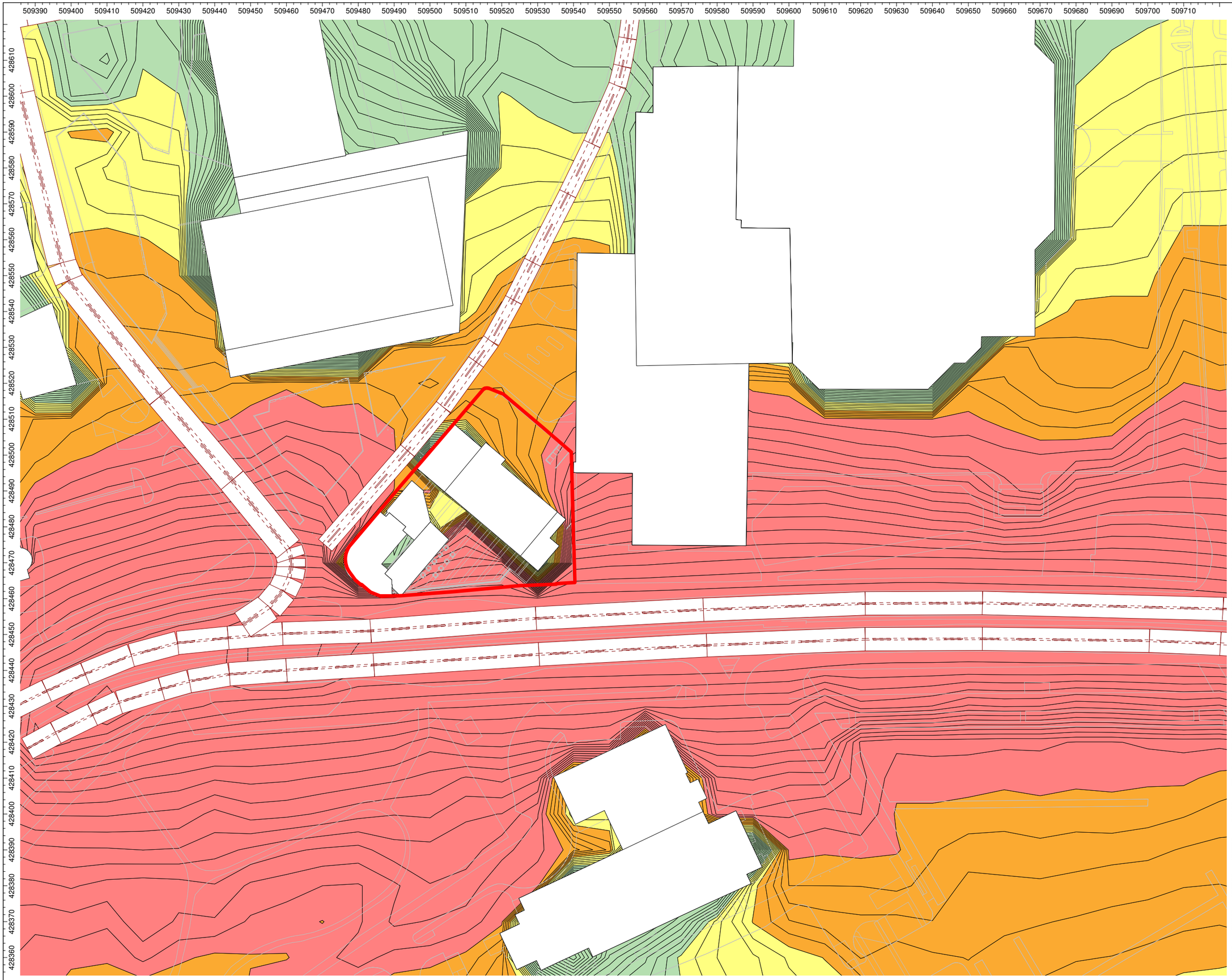
Site Boundary:

Receptor Location:

Scale : Not to scale

WYGE Leicester 08.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Noise Contour Plot
Daytime LAeq, 16hr

Drawing Number:
SK03

Key:

Site Boundary:

- 0 - 55 dB(A)
- 55 - 60 dB(A)
- 60 - 65 dB(A)
- >65 dB(A)

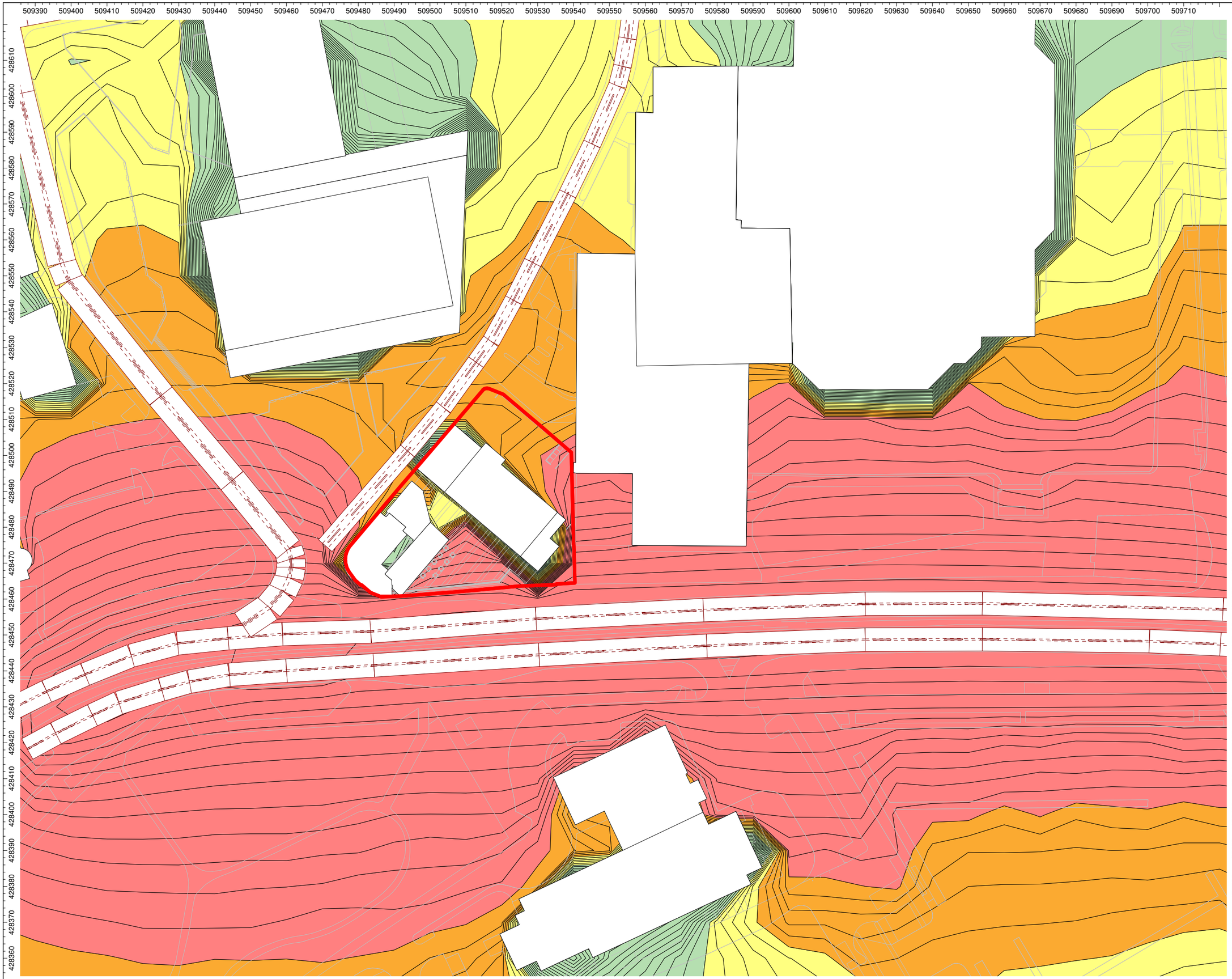
Contour plot for indicative purposes only.

Contour Plot at 1.5m Height

Scale : Not to scale

WYGE Leicester 11.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Noise Contour Plot
Night-time LAeq, 8hr

Drawing Number:
SK04

Key:

Site Boundary:

- 0 - 55 dB(A)
- 55 - 60 dB(A)
- 60 - 65 dB(A)
- >65 dB(A)

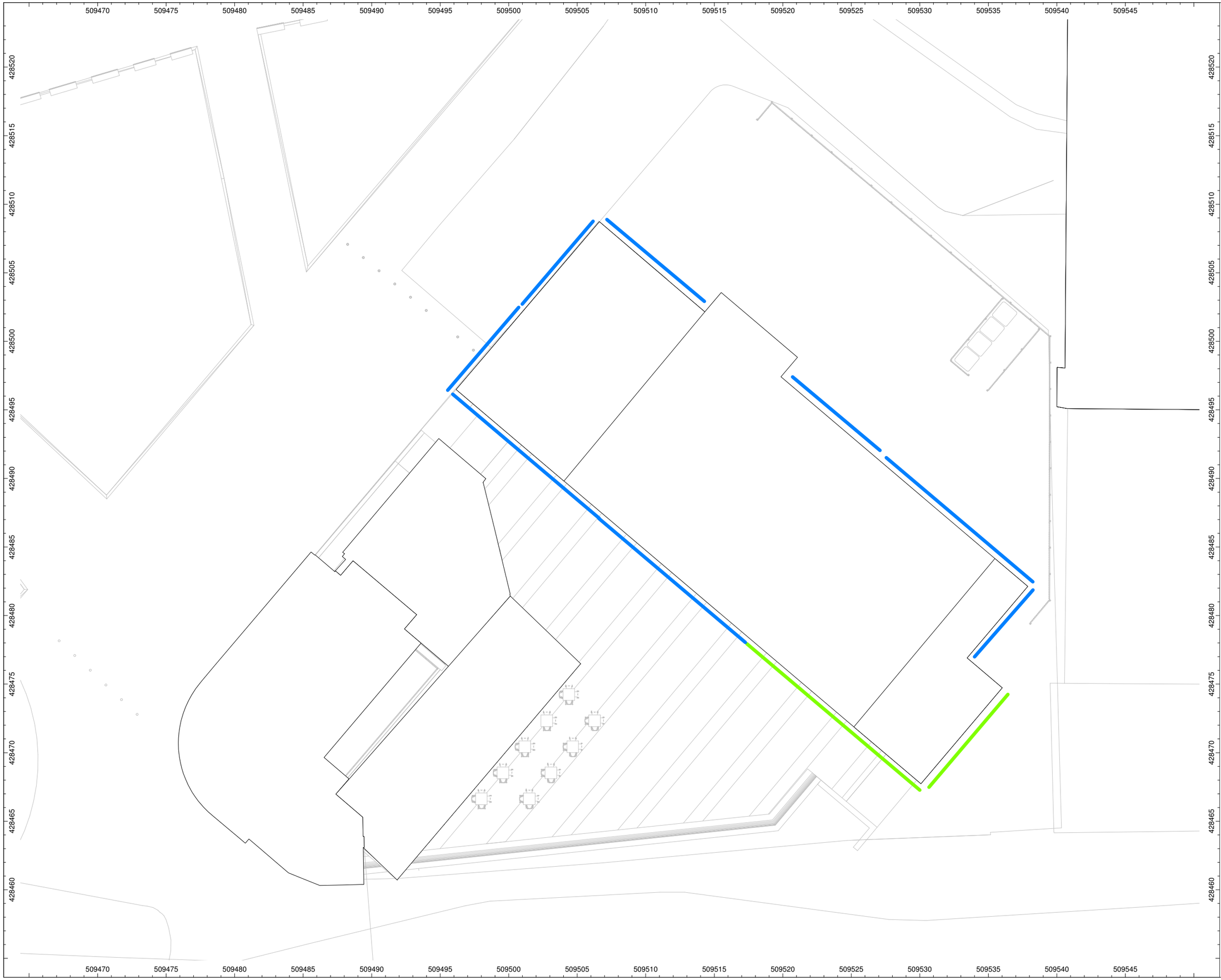
Contour plot for indicative purposes only.

Contour Plot at 4.0m Height

Scale : Not to scale

WYGE Leicester 11.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Noise Mitigation Strategy

1st - 5th Floor

Drawing Number:
SK05

Key:

Specification 1:

Specification 2:

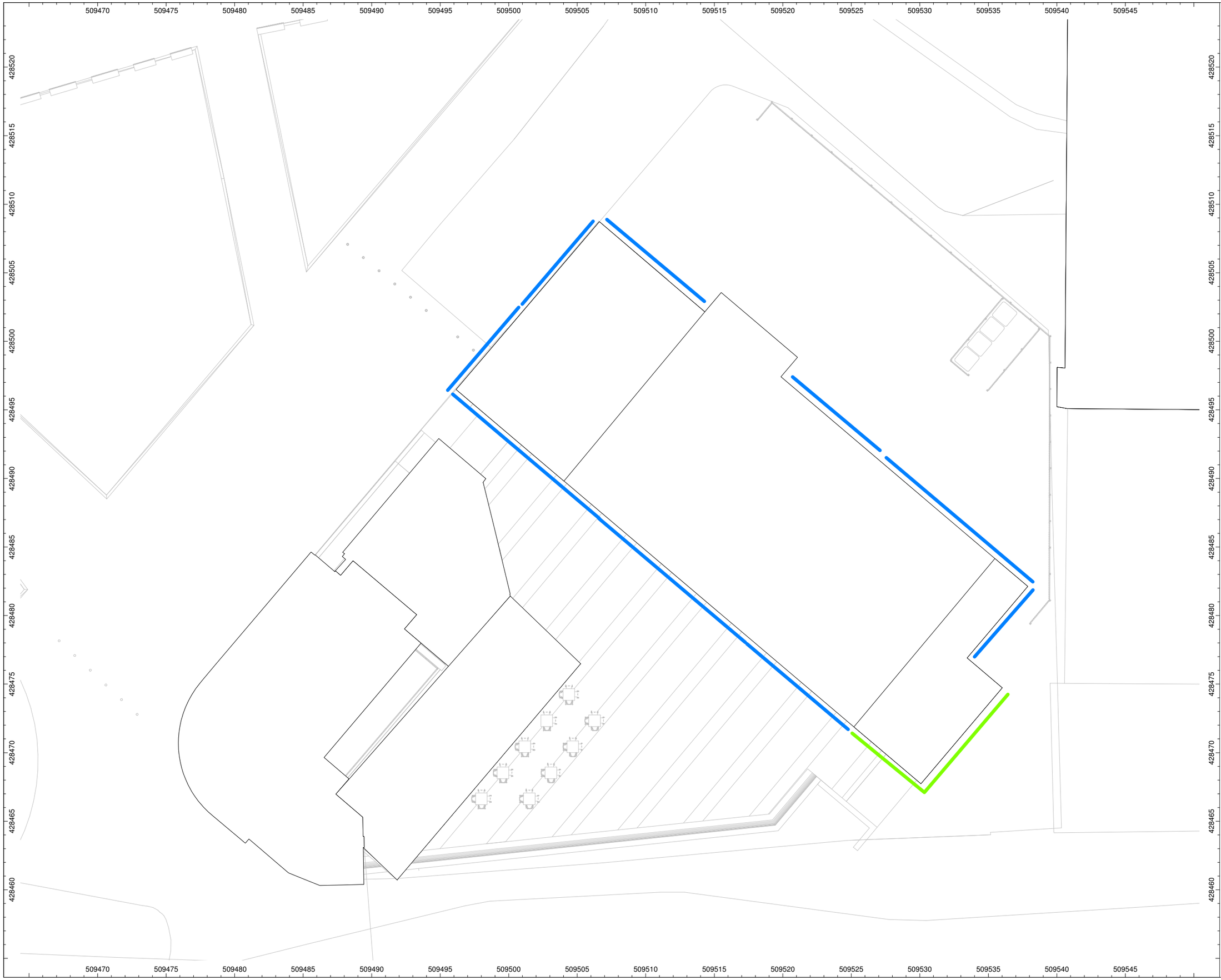
Note:

All bedrooms assumed to be mechanically ventilatied.
Glazing specifications as per noise report.

Scale : Not to scale

WYGE Leicester 20.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Castle Buildings LLP

Project:
Castle Buildings,
Hull

Project Number:
A112718

Drawing Title / Scenario:
Noise Mitigation Strategy

6th - 7th Floor

Drawing Number:
SK06

Key:

Specification 1:

Specification 2:

Note:

All bedrooms assumed to be mechanically ventilatied.
Glazing specifications as per noise report.

Scale : Not to scale

WYGE Leicester 20.03.19

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000

Appendix C – Long Term Noise Data Statistical Analysis

Figure 1 LT1 Statistical Analysis – Week Day

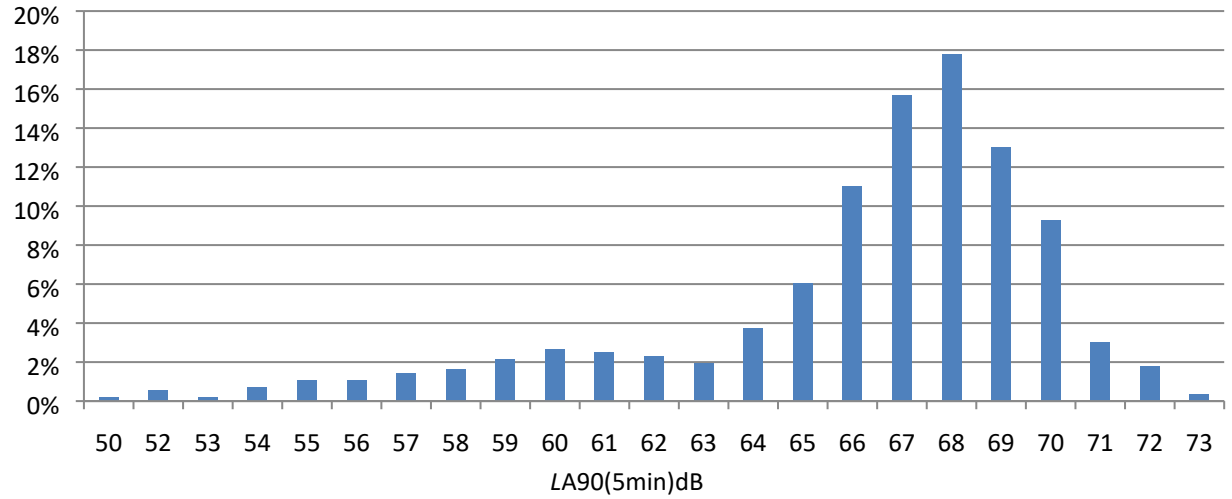


Figure 2 LT1 Statistical Analysis – Week Night

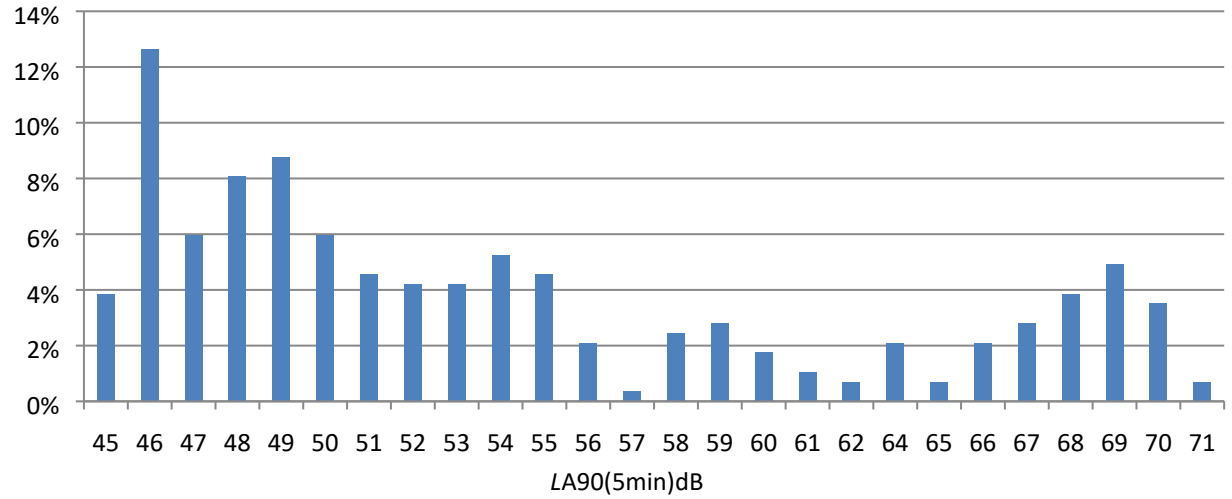


Figure 3 LT1 Statistical Analysis – Weekend Day

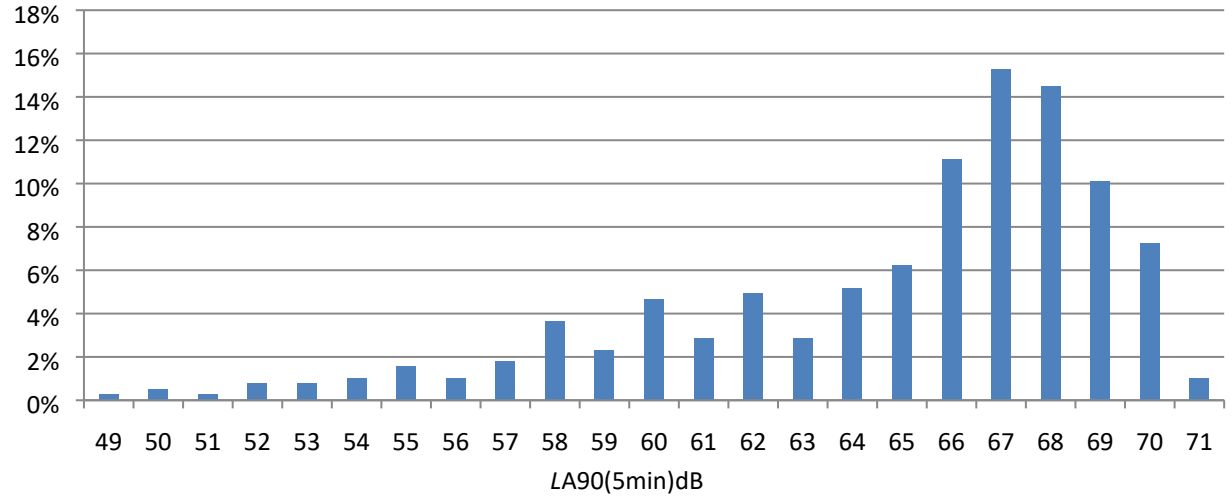


Figure 4 LT1 Statistical Analysis – Weekend Night

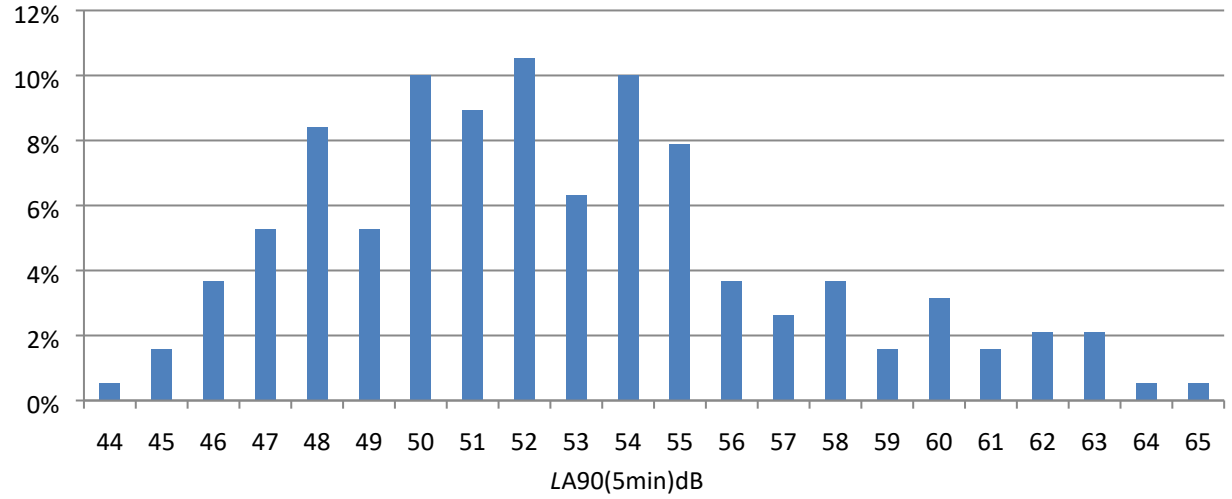


Figure 5 LT2 Statistical Analysis – Week Day

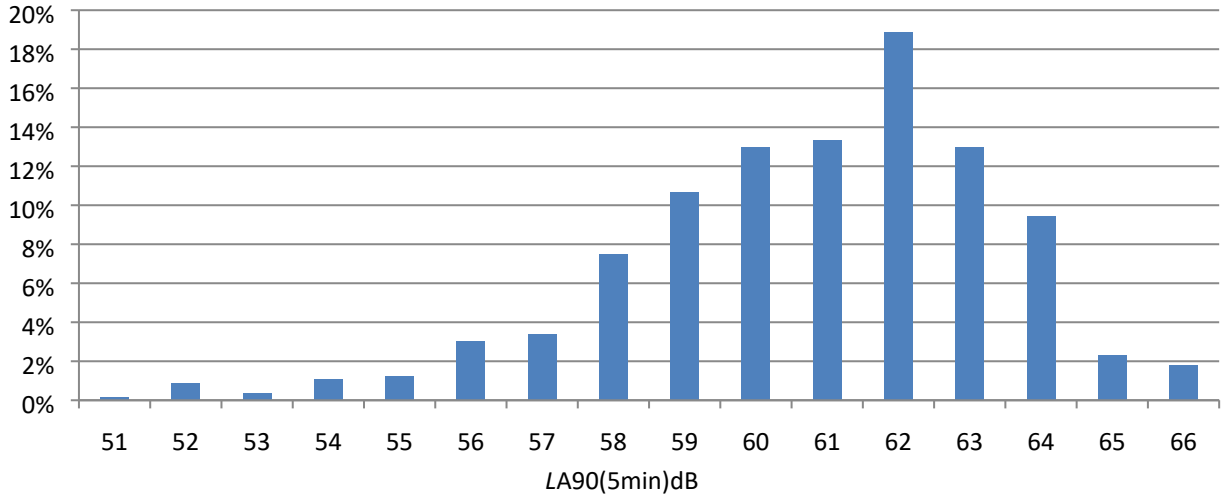


Figure 6 LT2 Statistical Analysis – Week Night

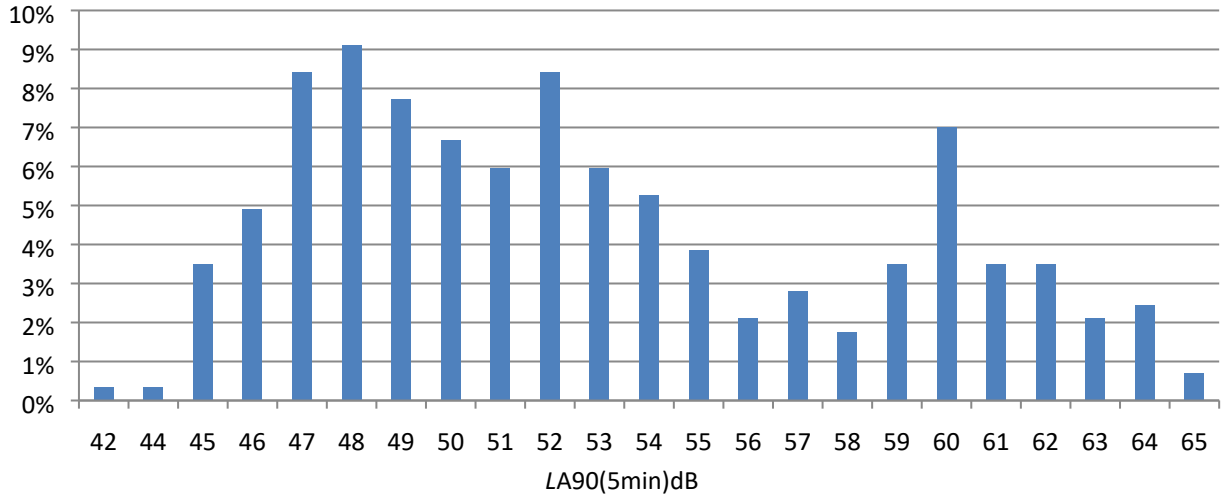


Figure 7 LT2 Statistical Analysis – Weekend Day

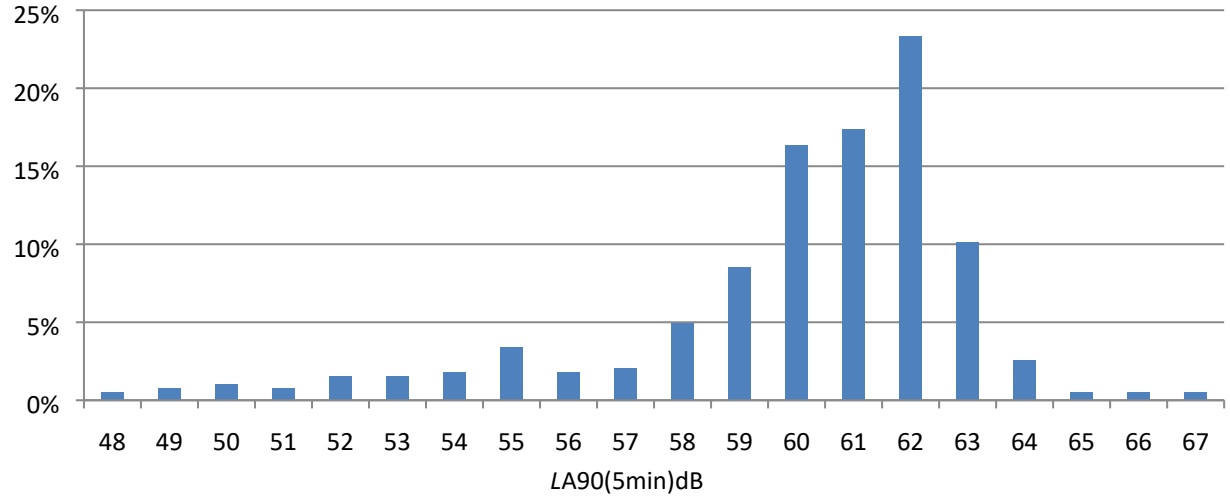
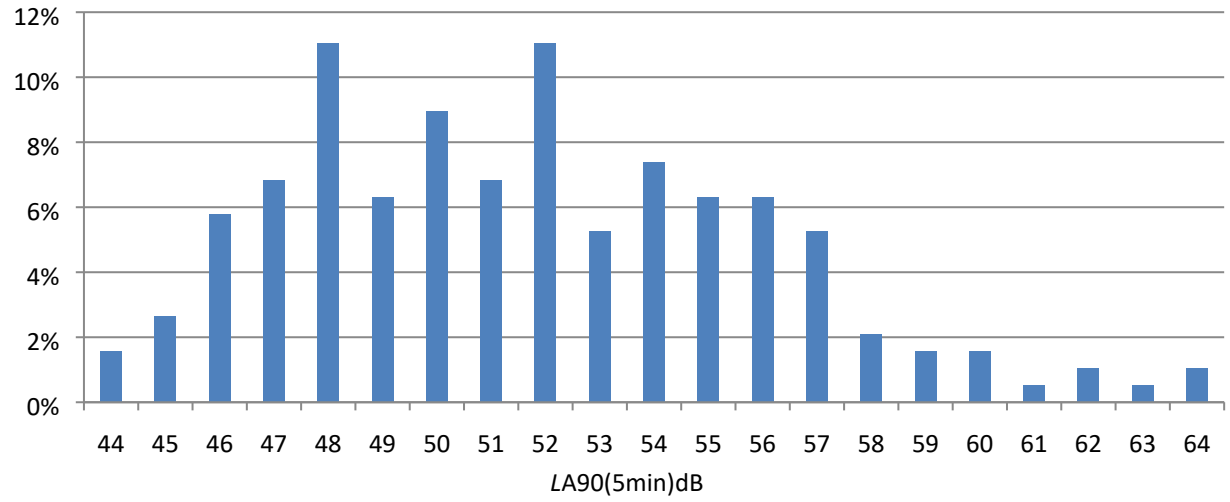


Figure 8 LT2 Statistical Analysis – Weekend Night



Appendix D – Predicted Noise Level Tables

Table 1 Daytime Noise Intrusion Levels $L_{Aeq,16hr}$

Ref	External $L_{Aeq,16hr}$ Daytime	Internal $L_{Aeq,16hr}$ Daytime (Windows Open)	Internal $L_{Aeq,16hr}$ Daytime (Windows Closed)	BS 8233 Target Criteria L_{Aeq}
R1 - F1	65.9	50.9	36.9	35
R1 - F2	66.1	51.1	37.1	35
R1 - F3	66.8	51.8	37.8	35
R1 - F4	68.1	53.1	39.1	35
R1 - F5	68.9	53.9	39.9	35
R1 - F6	69.2	54.2	40.2	35
R1 - F7	69.4	54.4	40.4	35
R2 - F1	71.5	56.5	42.5	35
R2 - F2	71.3	56.3	42.3	35
R2 - F3	71.2	56.2	42.2	35
R2 - F4	71.1	56.1	42.1	35
R2 - F5	71.0	56.0	42.0	35
R2 - F6	71.0	56.0	42.0	35
R2 - F7	71.0	56.0	42.0	35
R3 - F1	73.5	58.5	44.5	35
R3 - F2	73.3	58.3	44.3	35
R3 - F3	73.1	58.1	44.1	35
R3 - F4	72.8	57.8	43.8	35
R3 - F5	72.6	57.6	43.6	35
R3 - F6	72.4	57.4	43.4	35
R3 - F7	72.1	57.1	43.1	35
R4 - F1	75.0	60.0	46.0	35
R4 - F2	74.7	59.7	45.7	35
R4 - F3	74.4	59.4	45.4	35
R4 - F4	74.0	59.0	45.0	35
R4 - F5	73.6	58.6	44.6	35
R4 - F6	73.2	58.2	44.2	35
R4 - F7	72.8	57.8	43.8	35
R5 - F1	71.7	56.7	42.7	35
R5 - F2	71.6	56.6	42.6	35
R5 - F3	71.5	56.5	42.5	35
R5 - F4	71.3	56.3	42.3	35
R5 - F5	71.1	56.1	42.1	35
R5 - F6	70.9	55.9	41.9	35
R5 - F7	70.6	55.6	41.6	35
R6 - F1	65.8	50.8	36.8	35
R6 - F2	65.1	50.1	36.1	35
R6 - F3	65.5	50.5	36.5	35
R6 - F4	65.5	50.5	36.5	35
R6 - F5	64.8	49.8	35.8	35
R6 - F6	65.6	50.6	36.6	35
R6 - F7	66.5	51.5	37.5	35
R7 - F1	64.0	49.0	35.0	35
R7 - F2	64.4	49.4	35.4	35
R7 - F3	62.9	47.9	33.9	35
R7 - F4	64.1	49.1	35.1	35
R7 - F5	63.6	48.6	34.6	35
R7 - F6	63.9	48.9	34.9	35
R7 - F7	64.8	49.8	35.8	35
R8 - F1	56.3	41.3	27.3	35
R8 - F2	55.9	40.9	26.9	35
R8 - F3	56.0	41.0	27.0	35

Ref	External $L_{Aeq,16hr}$ Daytime	Internal $L_{Aeq,16hr}$ Daytime (Windows Open)	Internal $L_{Aeq,16hr}$ Daytime (Windows Closed)	BS 8233 Target Criteria L_{Aeq}
R8 - F4	56.0	41.0	27.0	35
R8 - F5	55.9	40.9	26.9	35
R8 - F6	56.1	41.1	27.1	35
R8 - F7	58.5	43.5	29.5	35
R9 - F1	63.4	48.4	34.4	35
R9 - F2	63.4	48.4	34.4	35
R9 - F3	63.4	48.4	34.4	35
R9 - F4	63.4	48.4	34.4	35
R9 - F5	63.3	48.3	34.3	35
R9 - F6	63.3	48.3	34.3	35
R9 - F7	63.4	48.4	34.4	35
R10 - F1	62.8	47.8	33.8	35
R10 - F2	62.8	47.8	33.8	35
R10 - F3	62.7	47.7	33.7	35
R10 - F4	62.7	47.7	33.7	35
R10 - F5	62.7	47.7	33.7	35
R10 - F6	62.7	47.7	33.7	35
R10 - F7	62.7	47.7	33.7	35

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa.

Table 2 Night-time Noise Intrusion Levels $L_{Aeq,8hr}$

Ref	External $L_{Aeq,16hr}$ Daytime	Internal $L_{Aeq,16hr}$ Daytime (Windows Open)	Internal $L_{Aeq,16hr}$ Daytime (Windows Closed)	BS 8233 Target Criteria L_{Aeq}
R1 - F1	63.4	48.4	34.4	30
R1 - F2	63.6	48.6	34.6	30
R1 - F3	64.3	49.3	35.3	30
R1 - F4	65.5	50.5	36.5	30
R1 - F5	66.4	51.4	37.4	30
R1 - F6	66.7	51.7	37.7	30
R1 - F7	66.9	51.9	37.9	30
R2 - F1	69.0	54.0	40.0	30
R2 - F2	68.8	53.8	39.8	30
R2 - F3	68.7	53.7	39.7	30
R2 - F4	68.6	53.6	39.6	30
R2 - F5	68.5	53.5	39.5	30
R2 - F6	68.5	53.5	39.5	30
R2 - F7	68.5	53.5	39.5	30
R3 - F1	71.0	56.0	42.0	30
R3 - F2	70.8	55.8	41.8	30
R3 - F3	70.6	55.6	41.6	30
R3 - F4	70.3	55.3	41.3	30
R3 - F5	70.1	55.1	41.1	30
R3 - F6	69.9	54.9	40.9	30
R3 - F7	69.6	54.6	40.6	30
R4 - F1	72.5	57.5	43.5	30
R4 - F2	72.2	57.2	43.2	30
R4 - F3	71.9	56.9	42.9	30
R4 - F4	71.5	56.5	42.5	30
R4 - F5	71.1	56.1	42.1	30
R4 - F6	70.7	55.7	41.7	30
R4 - F7	70.3	55.3	41.3	30
R5 - F1	69.2	54.2	40.2	30
R5 - F2	69.2	54.2	40.2	30
R5 - F3	69.0	54.0	40.0	30
R5 - F4	68.8	53.8	39.8	30

Ref	External $L_{Aeq,16hr}$ Daytime	Internal $L_{Aeq,16hr}$ Daytime (Windows Open)	Internal $L_{Aeq,16hr}$ Daytime (Windows Closed)	BS 8233 Target Criteria L_{Aeq}
R5 - F5	68.6	53.6	39.6	30
R5 - F6	68.4	53.4	39.4	30
R5 - F7	68.1	53.1	39.1	30
R6 - F1	63.5	48.5	34.5	30
R6 - F2	62.8	47.8	33.8	30
R6 - F3	63.3	48.3	34.3	30
R6 - F4	63.2	48.2	34.2	30
R6 - F5	62.5	47.5	33.5	30
R6 - F6	63.2	48.2	34.2	30
R6 - F7	64.2	49.2	35.2	30
R7 - F1	61.8	46.8	32.8	30
R7 - F2	62.2	47.2	33.2	30
R7 - F3	60.8	45.8	31.8	30
R7 - F4	61.9	46.9	32.9	30
R7 - F5	61.4	46.4	32.4	30
R7 - F6	61.6	46.6	32.6	30
R7 - F7	62.5	47.5	33.5	30
R8 - F1	55.2	40.2	26.2	30
R8 - F2	54.9	39.9	25.9	30
R8 - F3	55.1	40.1	26.1	30
R8 - F4	55.0	40.0	26.0	30
R8 - F5	54.9	39.9	25.9	30
R8 - F6	54.9	39.9	25.9	30
R8 - F7	56.8	41.8	27.8	30
R9 - F1	61.0	46.0	32.0	30
R9 - F2	61.0	46.0	32.0	30
R9 - F3	61.0	46.0	32.0	30
R9 - F4	60.9	45.9	31.9	30
R9 - F5	60.9	45.9	31.9	30
R9 - F6	60.9	45.9	31.9	30
R9 - F7	61.0	46.0	32.0	30
R10 - F1	60.4	45.4	31.4	30
R10 - F2	60.4	45.4	31.4	30
R10 - F3	60.4	45.4	31.4	30
R10 - F4	60.4	45.4	31.4	30
R10 - F5	60.3	45.3	31.3	30
R10 - F6	60.3	45.3	31.3	30
R10 - F7	60.3	45.3	31.3	30

All values are sound pressure levels in dB re: 2x 10^{-5} Pa.

Note:

Predicted internal noise level with windows closed based on a specification of 29 dB R_{tr}

Glazing Specifications presented in SK are predicted to be achieve the BS 8233 internal noise level criteria F1 (1st Floor) – F7 (7th Floor)

Appendix E – Report Conditions

This Report has been prepared using reasonable skill and care for the sole benefit of Castle Buildings LLP ("the Client") for the proposed uses stated in the report by WYG Environment Planning Transport Limited ("WYG"). WYG exclude all liability for any other uses and to any other party. The report must not be relied on or reproduced in whole or in part by any other party without the copyright holder's permission.

No liability is accepted or warranty given for; unconfirmed data, third party documents and information supplied to WYG or for the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report. WYG does not purport to provide specialist legal, tax or accounting advice.

The report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections'. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times. No investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions. The "shelf life" of the Report will be determined by a number of factors including; its original purpose, the Client's instructions, passage of time, advances in technology and techniques, changes in legislation etc. and therefore may require future re-assessment.

The whole of the report must be read as other sections of the report may contain information which puts into context the findings in any executive summary.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYG accept no liability for issues with performance arising from such factors.