

Starbucks
St Mary's Gate
Rochdale

Noise Impact Assessment

On behalf of

Glenbrook Investments

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1	17 May 23	Site layout / delivery route amended	JS	NAC
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Executive summary

Noise Solutions Limited has been appointed to provide a noise impact assessment of plant serving the proposed Starbucks coffee shop at St Mary's Gate, Rochdale.

Although precise plant selections are unavailable at this stage, an assessment of typical equipment for similar Starbucks stores shows that, with the attenuation specified, noise from the proposed plant will comply with the typical requirements of the local authority and should therefore be acceptable.

Noise from delivery activity has been assessed and found to be of low impact for both daytime and night-time periods.

Noise from customers using the drive-thru facility has been assessed, inclusive of an acoustic barrier to the west of the access road and found to be of low impact during the daytime and night-time periods. It is noted however that during the less busy parts of the night usage levels will be lower such that noise levels will reduce.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment of a proposed drive-thru Starbucks to be located at St Mary's Gate, Rochdale. The assessment includes noise from mechanical services plant, deliveries, and customer drive-thru activity.
- 1.2. This report contains recommendations based on project information available at the time of the assessment and the results of a baseline noise survey.
- 1.3. Noise levels have been predicted at the nearest noise-sensitive receptors and assessed against the requirements of appropriate guidance.
- 1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in [Appendix A](#). An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

- 2.1. The Starbucks coffee shop is to be located toward the northern extent of a customer car park at the St Mary's Gate retail park in Rochdale.
- 2.2. Customers using the drive-thru facility will drive up to an order point intercom to the west of the building and collect orders from a pickup point window on the north elevation. An acoustic barrier is proposed alongside the west of the drive-thru access road, to reduce noise from the intercom at the nearest noise sensitive receptors.
- 2.3. Deliveries will be made to an enclosed service yard at the west of the building, with vehicles parking alongside the store to the east and goods manoeuvred into the store.
- 2.4. Precise plant details are unknown at this stage. This report therefore includes an assessment of typical plant used at similar Starbucks locations.
- 2.5. Three air conditioning (AC) condensers are to be located externally. Two Back of House extract fans and a WC extract fan are located within the building, with discharge louvres on external elevations.
- 2.6. For a robust assessment at this stage, it is assumed that all plant will be on the side of the building closest to the nearest noise sensitive receptor, with no screening provided by the building structure.
- 2.7. The plant will operate only when the shop is open. At this stage, it is proposed that the opening hours will be unrestricted (i.e. 24hr, seven days per week).

2.8. Typical plant noise data is given in [Appendix D](#).

3.0 Nearest noise sensitive receptors

- 3.1. The area around the site contains a mixture of residential and commercial property.
- 3.2. The nearest noise-sensitive properties to the site are on Whitehall Street to the west of the site. The nearest house on Whitehall Street will be around 29m from the drive-thru lane at the west of the site and 56m from the service yard, although line of sight of the yards will be prevented by the store building.
- 3.3. A site plan showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is presented in [Appendix B](#).

4.0 Existing noise climate

- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at locations representative of the noise climate outside the façades of the nearest noise sensitive receptors to the east and west of the premises.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{AFmax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	51-68	58-92	53-71	44-63
Night-time (23.00 – 07.00 hours)	45-65	56-93	48-62	37-51

Figure 1 Histogram of L_{A90} background sound pressure levels during daytime (07.00 – 23.00 hours)

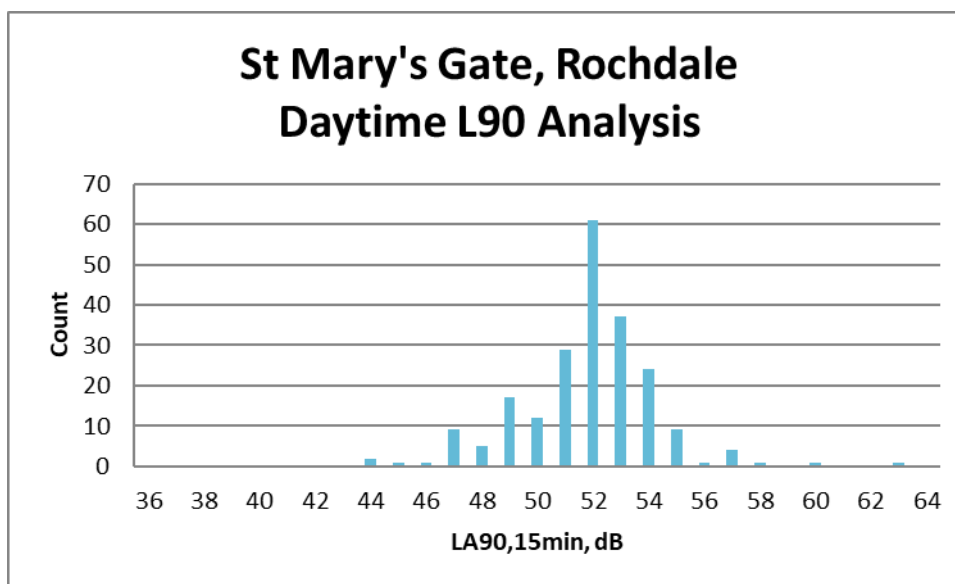
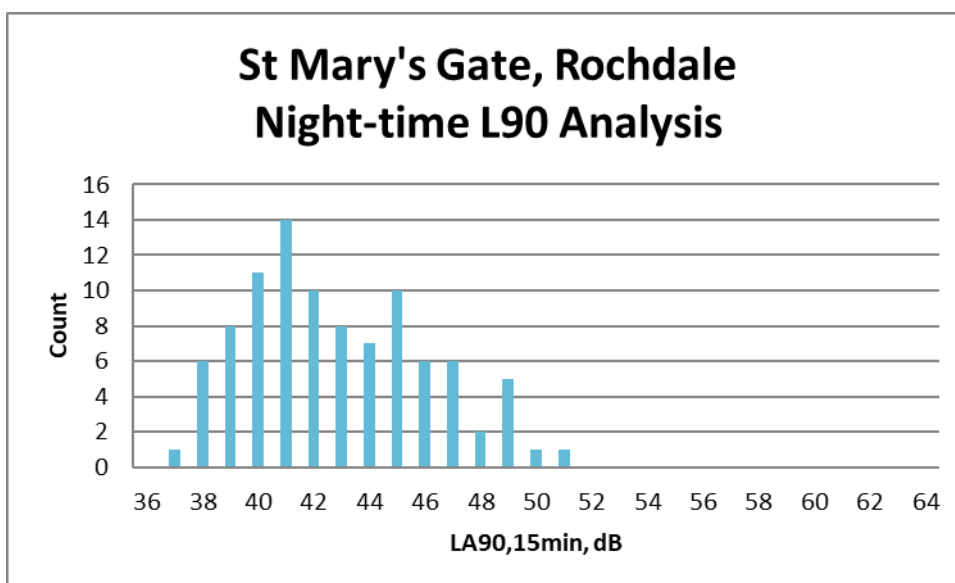


Figure 2 Histogram of L_{A90} background sound pressure levels at night (23.00 – 07.00 hours)



- 4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels

	dB, L_{A90}	
	Daytime	Night-time
mean	52	43
modal	52	41
median	52	42

- 4.4. The following background sound levels have been selected to be robustly representative of the background noise levels:

- 50dB $L_{A90\ 15min}$ during daytime hours
- 40dB $L_{A90\ 15min}$ at night

5.0 Acoustic standards and guidance

Rochdale Metropolitan Borough Council

- 5.1. Rochdale Metropolitan Borough Council's Unitary Development Plan 2001-2016 (which is still in place) contains policy S/10 for food and drink outlets, which states:

The development of, or change of use to, a café, restaurant pub, wine bar, snack bar or hot food or fast food takeaway will be permitted provided that ... b) it will not unduly affect the amenity of nearby residents or businesses by reason of noise, smell, litter and hours of opening.

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.

- 5.2. This Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999¹). These guideline noise levels are shown in Table 3, below:

Table 3 BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

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

- 5.3. BS 8233:2014 advises that: *"regular individual noise events...can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values."*
- 5.4. The standard also provides advice in relation to design criteria for external noise. It states that:

¹ World Health Organisation Guidelines for Community Noise, 1999

"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.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.

Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.

In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

5.5. The World Health Organisation (WHO) Guidelines for Community Noise (1999) recommends suitable internal and external noise levels based on dose response research. The levels recommended in this guidance could be correlated to the LOAEL. Relevant guidance from this document is presented below.

- Sleep Disturbance (Night-time internal LOAEL): If negative effects on sleep are to be avoided, the equivalent sound pressure level should not exceed 30dBA indoors for continuous noise.
- Interference with Communication (Daytime internal LOAEL): Noise tends to interfere with auditory communication, in which speech is a most important signal. However, it is also vital to be able to hear alarming and informative signals such as door bells, telephone signals,

alarm clocks, fire alarms etc., as well as sounds and signals involved in occupational tasks. The effects of noise on speech discrimination have been studied extensively and deal with this problem in lexical terms (mostly words but also sentences). For communication distances beyond a few metres, speech interference starts at sound pressure levels below 50 dB for octave bands centred on the main speech frequencies at 500, 1 000 and 2 000 Hz. It is usually possible to express the relationship between noise levels and speech intelligibility in a single diagram, based on the following assumptions and empirical observations, and for speaker-to-listener distance of about 1 metre:

- a) Speech in relaxed conversation is 100% intelligible in background noise levels of about 35dBA, and can be understood fairly well in background levels of 45dBA.
- b) Speech with more vocal effort can be understood when the background sound pressure level is about 65dBA.

World Health Organisation (WHO) 2009

- 5.6. The introduction of the Directive on Environmental Noise, obliges Member States to assess and manage noise levels. With the support of the European Commission, the WHO Regional Office for Europe has developed night noise guidelines for Europe to help Member States develop legislation to control noise exposure.
- 5.7. The guidelines are based on scientific evidence on the effects of noise and the thresholds above which these effects appear to harm human health.
- 5.8. There is limited evidence that night noise is related to hypertension, heart attacks, depression, changes in hormone levels, fatigue and accidents.
- 5.9. The WHO report summarises the threshold levels of night noise above which a negative effect starts to occur or above which the impact becomes dependent on the level of exposure. For example, the threshold level for waking in the night and/or too early in the morning was 42 dB.
- 5.10. It also establishes that there are differences in the intensity and frequency of noise depending on the source, which lead to different impacts. Road traffic is characterised by low levels of noise per event, but as there are a high number of events, on average it has a greater effect on awakenings than air traffic, which has high levels of noise per event but fewer events.
- 5.11. Integrating these findings, the report proposed a guideline target limit of outdoor night noise of 40 dB (annual average defined as 'L_{night}' in the Environmental Noise Directive). There is not sufficient evidence that the biological effects observed below this level are harmful to health but adverse effects are observed above 40dB.

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 5.12. BS 4142:2014+A1:2019² is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment" and "*sound from the loading and unloading of goods and materials at industrial and/or commercial premises*".
- 5.13. The procedure contained in BS 4142:2014 is to quantify the "specific sound level", which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 5.14. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.
- 5.15. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."
- 5.16. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."
- 5.17. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:
- *Typically, the greater this difference, the greater the magnitude of the impact.*
 - *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
 - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
 - *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.*

² For the purposes of brevity, references in this report to "BS 4142:2014" or "BS 4142" should be read as BS 4142:2014 + A1:2019

Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

- 5.18. The standard does state that "adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."
- 5.19. The standard goes on to note that: "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."
- 5.20. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

- 5.21. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Proposed criteria

- 5.22. Based on the above criteria the noise level for the proposed plant at the nearest residential windows should be at or below the background sound level. This would ensure noise is of no more than 'low impact' when assessed in accordance with BS 4142:2014.
- 5.23. The following criteria therefore apply:

Table 4 Plant noise emissions limits at the nearest noise sensitive receptor

Period	Cumulative plant noise sound level, dB(A)
Daytime (07.00 – 23.00 hours)	50
Night-time (23.00 – 0700 hours)	40

6.0 Plant noise assessment

- 6.1. Plant noise levels have been predicted at the nearest noise-sensitive receptor, taking account of the distance between the plant and the closest windows. Attenuation to the extract systems as specified in [Appendix D](#) is also included in the assessment.
- 6.2. The proposed plant will operate only while the store is open, although current proposals are for unrestricted operating hours.
- 6.3. A summary of the predicted noise levels is given in Table 5. Full calculations are shown in [Appendix E](#).

Table 5 Plant noise assessment

Receptor	Period	Predicted rating level, dB L_{Aeq}	Proposed criterion, dB L_{Aeq}	Excess, dBA
R1	Daytime (07.00 – 23.00 hours)	40	50	-10
	Night-time (23.00 – 07.00 hours)	40	40	0

- 6.4. The assessment shows that plant noise levels will comply with the proposed criteria and therefore meet the local authority's usual requirements.

7.0 Store delivery assessment

- 7.1. It is understood that the coffee shop will be serviced by vehicles up to 26t box van in size. An assessment has been made of the possible noise impact of vehicles servicing the premises during the night-time period, as proposals are for unrestricted delivery operations.

Sound pressure levels of activities associated with store deliveries

- 7.2. The sound pressure levels associated with a typical delivery by a similar vehicle was established by reference measurements. The measurements included all aspects of the delivery including, but not limited to, the arrival, unloading, movement of trolleys and cages and the departure of the vehicle. The sound pressure levels were normalised to a distance of 10m from the delivery area and have been converted to Sound Exposure Levels (SEL) for ease of comparison/calculation. Typical L_{Amax} levels were also established.
- 7.3. To account for the size of the proposed delivery vehicle (up to 26t) and ensure a robust assessment, vehicle movement noise levels have been based on measurements of articulated HGV activity.

- 7.4. Table 6 details typical source noise levels, used within the assessment, with the data presented in terms of SEL and maximum individual noise event levels ($L_{A_{Fmax}}$).

Table 6 Reference noise data for delivery activities (at 10m)

Noise Source	SEL, dB(A)	$L_{A_{Fmax}}$, dB(A)
Lorry arrives in loading bay	69	68
Door open and close	63	68
Crates loaded (each)	62	67
Lorry departs	69	68

Delivery noise predictions

- 7.5. The information contained in Table 6 was used to calculate the equivalent source noise level based on the number of activity events over the required assessment period using the following equation:

7.6.
$$L_{Aeq,T} = SEL + 10 \cdot \log\left(\frac{1}{T}\right) + 10 \cdot \log(N) \quad (\text{Equation 1})$$

Where:

SEL is the L_{Aeq} over a one second period, and represents the noise energy from an event (e.g. cage movement) compressed into one second;

T is the reference time period in seconds; and

N is the number of movements in the time period, T.

- 7.7. It is assumed that the delivery vehicle may park on the east side of the coffee shop, approximately 61m from the nearest houses. Full calculations are shown in [Appendix F](#) and are summarised in Table 7. It can be seen from the calculations that, due to the site layout, the overall delivery noise level at the receptor is dominated by the handling of goods, rather than vehicle movements even allowing for HGV movements in the assessment.

Table 7 Predicted delivery noise levels

Receptor	Period	Predicted noise levels at upper window of most affected residential dwelling	
		$L_{Aeq,T}$, dB	Range of $L_{A_{Fmax}}$ (dB)
R1	23.00 – 07.00 hours	36 $L_{Aeq, 15min}$	52-56

BS 4142:2014 delivery noise assessment

- 7.8. Table 8 presents the assessment of the likely impact at Receptor R1 during the early morning delivery period, in accordance with the BS 4142:2014 methodology. As noted in Paragraph 4.4 the representative background sound level during the night time period is considered to be 40dB L_{A90} .

Table 8 R1 Assessment of predicted external delivery noise levels using BS 4142:2014 during the night-time period

Results	Mon-Fri 06.00 – 07.00hrs	Relevant Clauses of BS4142:2014	Commentary
Background Sound level	$L_{A90} = 40\text{dB}$	8.1, 8.2	Representative typical background sound level determined from a range of measurements (Friday to Monday)
Assessment made during the night-time, so the reference interval is fifteen minutes		7.2	
Rating Level	$L_{A_{r,Tr}} = 36\text{dB}$	7.3.6	Calculations presented in Appendix F
Acoustic Feature Correction	0	9.2	Impulsivity (bangs and clatters) could be perceptible: included in calculation.
Rating Level	36 dB		
Excess of Rating Level over background sound level	$(36-40) \text{ dB} = -4\text{dB}$		
Assessment of impact: No impact		11	

8.0 Drive-thru assessment

- 8.1. The proposed vehicle movement in and out of the site will consist of customers;
- driving in, parking their cars in the main car park and eating inside the coffee shop
 - using the drive-thru and eating off site
 - walk in customers
- 8.2. The sound pressure levels associated with vehicle movements and the use of a drive-thru intercom system have been measured previously at similar premises. The sound pressure levels were normalised to a distance of 10m from the area of movement and have been converted to Sound Exposure Levels (SEL) for ease of comparison/ calculation. Typical $L_{A_{max}}$ levels were also established.
- 8.3. It should be noted that the example of vehicle arrival, engine noise and door slam is typical of a standard vehicle and is shown in Table 9 below.

Table 9 Reference noise data for vehicle movement and drive-thru (at 10m)

Noise Source	SEL, dB(A)	L _{Afmax} , dB(A)
Vehicle Pass-through	55	53
Intercom Speaker	74	81

Predicted impact

- 8.4. The information contained in Table 9 was used to establish a source noise level based on the number of activity events over the required assessment period using the following equation:

$$L_{Aeq,T} = SEL + 10 \cdot \log\left(\frac{1}{T}\right) + 10 \cdot \log(n) \quad (\text{Equation 1})$$

Where:

SEL is the L_{Aeq} over a one second period, and represents the noise energy from an event (e.g. cage movement) compressed into one second;

T is the reference time period in seconds; and

N is the number of movements in the time period, T.

- 8.5. At worst, the vehicles passing through the drive-thru lane run past the nearest residential house (R1) and the intercom speakers are approximately 29m and 31m from the property façade, respectively. The proposed acoustic barrier to the west of the lane, indicated on Appendix B, will provide 8dB of screening of the intercom unit to receptor R1. Other receptors not benefitting from the screening will be at sufficiently increased distances that similar losses occur.
- 8.6. It is understood that there are predicted to be approximately 430 vehicle movements per day associated with the coffee shop. For a robust assessment it is assumed that there may be 43 movements in the busiest hour (i.e. approximately 10% of the total). It is assumed that during an early morning (06.00 to 07.00 hours) there may be up to 12 vehicle movements in the busiest 15-minute period.
- 8.7. The cumulative customer vehicle movement and drive-thru noise levels at the most affected noise sensitive receptor have been predicted based on these predicted flows and takes into consideration distance attenuation and directivity corrections.
- 8.8. The resultant sound pressure levels are summarised in Table 10.

Table 10 Assessment of predicted daily and peak-hour vehicle movement and drive-thru Rating Levels at NSR

Receptor	Period	Predicted Rating levels at window of most affected residential dwelling
		$L_{A,T,r}$ dB
R1	Daytime 1-hr	40
	Early morning 15-min	40

BS 4142:2014 restaurant vehicle movement assessment

- 8.9. Table 11 and Table 12 present the assessment of the likely impact that the vehicle movement relating to the restaurant will have on the nearest noise sensitive receptor during the daytime peak hour and night-time peak 15-minute period, in accordance with the BS 4142:2014 methodology.
- 8.10. Acoustic feature corrections have been applied to specific noise sources where appropriate (for example, door slams); details can be seen in [Appendix G](#).

Table 11 Assessment of predicted coffee shop activity noise levels using BS 4142:2014 – Peak hour daytime

Results		Relevant Clauses of BS4142:2014	Commentary
Background Sound level	$L_{A90} = 50\text{dB}$	8.1, 8.2	Representative typical background sound level determined from a range of measurements
Assessment made during the daytime, so the reference interval is one hour		7.2	
Rating Level	$L_{A,T,r} = 40\text{dB}$	7.3.6	Calculations presented in Appendix G
Excess of Rating Level over background sound level	$(40-50) \text{ dB} = -10\text{dB}$		
Assessment of impact: No impact		11	

Table 12 Assessment of predicted coffee shop activity noise levels using BS 4142:2014 – Peak 15-minute 06.00 to 07.00 hours

Results		Relevant Clauses of BS4142:2014	Commentary
Background Sound level	$L_{A90} = 40\text{dB}$	8.1, 8.2	Representative typical background sound level determined from a range of measurements
Assessment made before 07.00 hours, so the reference interval is fifteen minutes		7.2	
Rating Level	$L_{A,r,Tr} = 40\text{dB}$	7.3.6	Calculations presented in Appendix G
Excess of Rating Level over background sound level	$(40-40) \text{ dB} = 0\text{dB}$		
Assessment of impact: Low impact, depending on context		11	

- 8.11. It is noted that there will be fewer vehicles using the drive-thru at the quietest parts of the night, such that noise levels and corresponding impact will be lower.

9.0 Context and uncertainties

- 9.1. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:

- The assessment is undertaken at the nearest residential windows. The impact on all other nearby residential windows will be lower due to screening and distance attenuation.
- It is to be appreciated that the BS 4142:2014 assessment relates to external noise levels only.
- The number of expected deliveries during the early morning period is low (no more than one per morning).
- Deliveries during daytime hours, when background noise levels are higher, would be of even less impact.
- It is noted that there will be fewer vehicles using the drive-thru during the less busy parts of the night, such that noise levels and corresponding impact will be lower.

- 9.2. Where possible uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.
- Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.

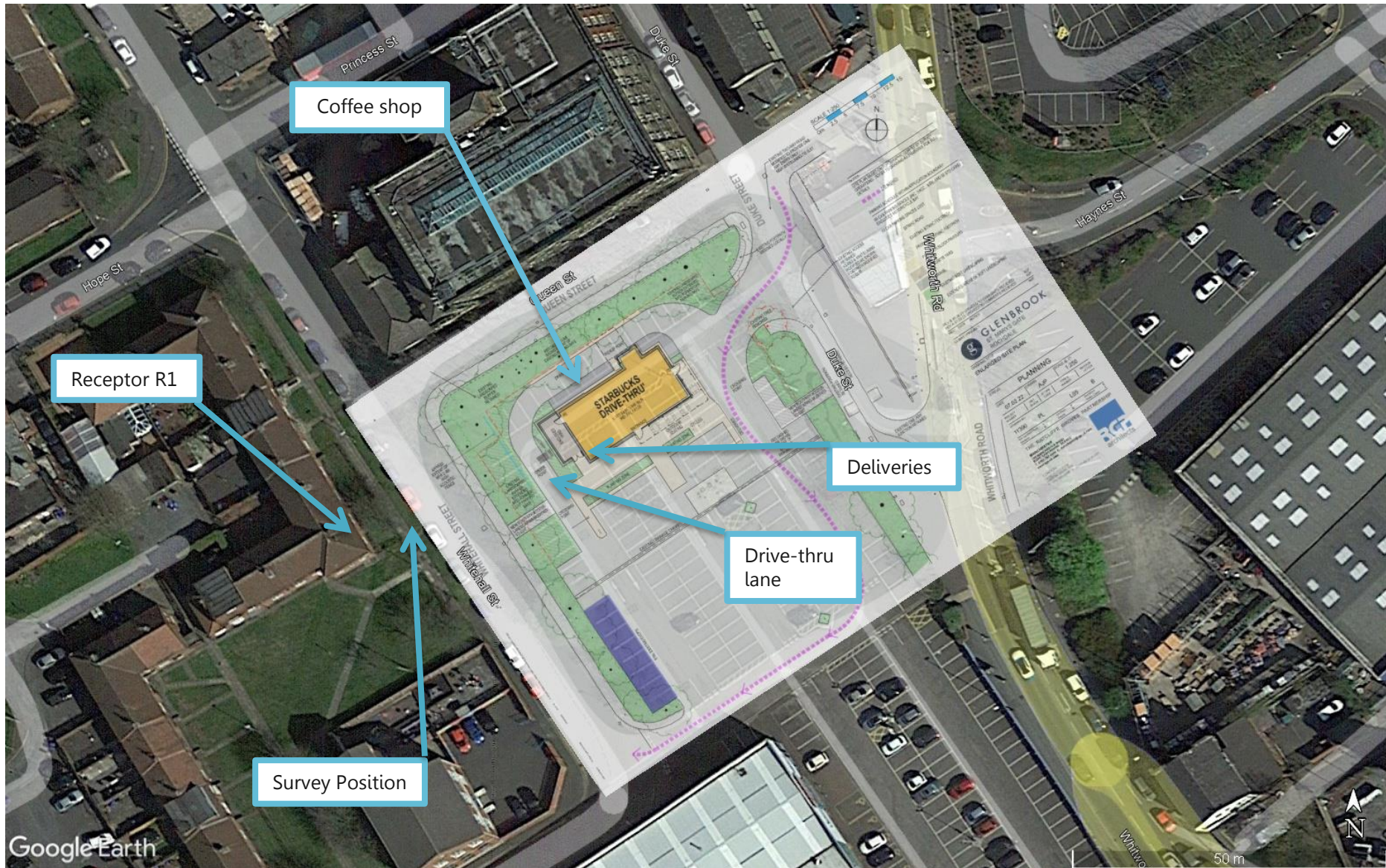
10.0 Summary

- 10.1. Noise Solutions Ltd has been commissioned to provide a noise impact assessment of internal plant serving the proposed Starbucks coffee shop St Mary's Gate, Rochdale.
- 10.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at locations representative of the noise climate outside the nearest noise sensitive receptors to the proposed Starbucks premises.
- 10.3. The assessment shows that, when attenuated as described in this report, noise from the proposed plant complies with suitable guidance and criteria and should be acceptable to the local authority.
- 10.4. Noise from deliveries has been assessed at the nearest and most affected noise sensitive receptors and been found to be of low impact.
- 10.5. Noise from vehicles using the drive-thru has been assessed, inclusive of the proposed acoustic barrier to the west of the drive-thru lane and found to be of low impact during the daytime and night-time periods. It is also noted that there will be fewer vehicles using the drive-thru during the less busy parts of the night, such that noise levels and corresponding impact will be lower.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial photograph site showing areas of interest



Appendix C Environmental sound survey

Details of sound survey

- C.1 Measurements of the existing background sound levels were undertaken between 09.00 hours on Friday 27th January and 14.45 hours on Monday 30th January 2023.
- C.2 The sound level meters were programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement position

- C.3 The meters were located on lighting columns on Whitehall Street (location indicated on the site plan in [Appendix B](#)). The survey locations were chosen to be representative of ambient noise levels at the houses nearest to the site.
- C.4 In accordance with BS 7445-2:1991 'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use', the measurements were undertaken under free-field conditions.

Equipment

- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (± 0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971A / 124655	26/07/2022	Factory conformation certificate
Condenser microphone	ACO Pacific 7152 / 84710		
Preamplifier	Svantek SV18A / 126200		
Calibrator	Svantek SV33B / 125706	09/09/2022	Factory conformation certificate

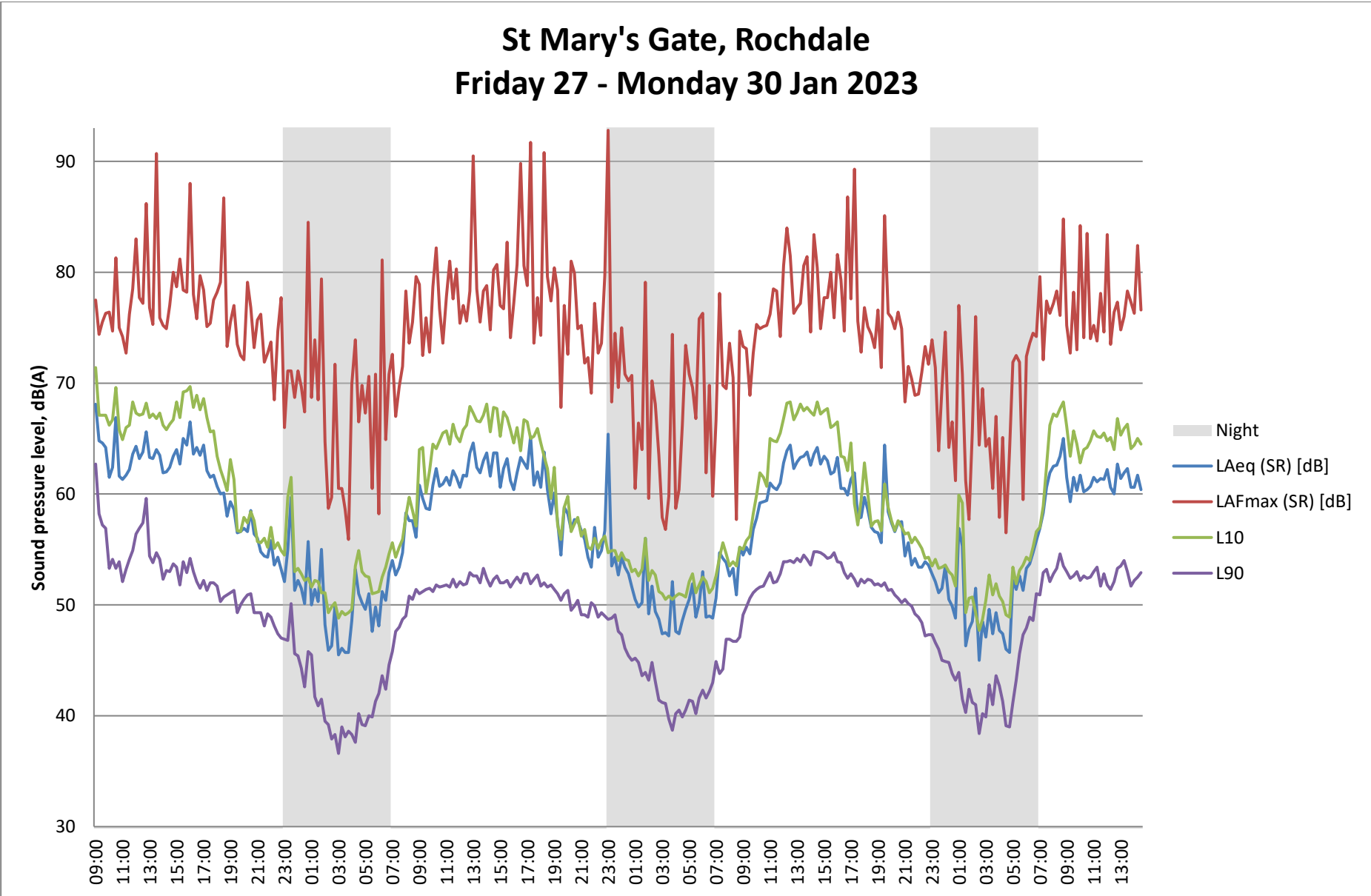
Weather Conditions

- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	09.00 27 Jan - 14.45 30 Jan 2023	Temperature (°C)	-1	8
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	Yes	No
		Cloud cover (oktas - see guide)	8	7
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	No
		Wind Speed (m/s)	1-2	3
		Wind Direction	ENE	W
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The noise climate during the survey period was dominated by local traffic noise. The results of the survey are presented in time history graph overleaf.



Appendix D Plant noise data

Item	Note	Sound power level (dB re 1 pW) at Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Back of House Extract EF1 Solar & Palau TD-2000/315N 315mm dia mixed-flow fan	Outlet	61	68	76	70	72	68	61	56
Back of House Extract EF2 Solar & Palau TH-2000/315 315mm dia roof-mounted fan	Outlet	71	80	81	77	76	72	64	60
WC Extract EF2 Solar & Palau TH-800/200 200mm dia roof-mounted fan	Outlet	69	67	73	74	70	66	61	53
CU1 Daikin AZAS100MV1		Sound pressure level 57dBA at 1m							
CU2 Daikin AZAS71MV1		Sound pressure level 47dBA at 1m							
CU3 Daikin AZAS125MV1		Sound pressure level 57dBA at 1m							

Attenuation required

Item	Note	Sound power level (dB re 1 pW) at Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Back of House Extract EF1	likely 315mm i/dia x 315 mm long	1	2	4	9	11	10	9	7
Back of House Extract EF2	likely 315mm i/dia x 630 mm long	2	2	5	13	18	12	11	10
WC Extract EF3	likely 200mm i/dia x 625 mm long	2	2	4	15	26	19	19	13

Appendix E Plant noise calculations



NSL Ref: **90876**
Project **Starbucks St Marys Gate, Rochdale**

Compiled by: JS 02/02/2023

Plant Ref **EF1 exhaust**
Plant Description **Solar & Palau 315mm dia mixed-flow fan**

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Grille Face Area grille dimensions mm	400	wide	400	high	10	6	2	0	0	0	0
SYSTEM LOSSES				10	6	2	0	0	0	0	0

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L_w	61	68	76	70	72	68	61	56	76
System losses		-10	-6	-2	0	0	0	0	0	
Atmospheric side attenuator	I.L.	-1	-2	-4	-9	-11	-10	-9	-7	
Sound power level leaving terminal		50	60	70	61	61	58	52	49	66

Receptor R1	V angle	H angle										
Directivity correction	0	0	400 x 400 (0,0)	1	2	3	4	5	6	6	6	
Distance correction	40	m	40 m	-40	-40	-40	-40	-40	-40	-40	-40	
Screening correction	Screened:		$\delta =$	-40	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R1			L_p	11	22	33	25	26	24	18	15	31



NSL Ref: **90876**
Project **Starbucks St Marys Gate, Rochdale**

Compiled by:	JS	02/02/2023
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Plant Ref **EF2 exhaust**
Plant Description **Solar & Palau 315mm dia roof-mounted fan**

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Grille Face Area grille dimensions mm	400	wide	400	high	10	6	2	0	0	0	0
SYSTEM LOSSES					10	6	2	0	0	0	0

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L _w	71	80	81	77	76	72	64	60	80
System losses		-10	-6	-2	0	0	0	0	0	
Atmospheric side attenuator	I.L.	-2	-2	-5	-13	-18	-12	-11	-10	
Sound power level leaving terminal		59	72	74	64	58	60	53	50	69

Receptor R1	V angle	H angle										
Directivity correction	0	0	400 x 400 (0,0)	1	2	3	4	5	6	6	6	
Distance correction	40	m	40 m	-40	-40	-40	-40	-40	-40	-40	-40	
Screening correction	Screened:		δ=	-40	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R1			L _p	20	34	37	28	23	26	19	16	33



NSL Ref: **90876**
Project **Starbucks St Marys Gate, Rochdale**

Compiled by: JS 02/02/2023

Plant Ref **EF3 exhaust**
Plant Description **Solar & Palau 200mm dia roof-mounted fan**

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Grille Face Area grille dimensions mm	250	wide	250	high	13	9	5	1	0	0	0
SYSTEM LOSSES					13	9	5	1	0	0	0

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L _w	69	67	73	74	70	66	61	53	75
System losses		-13	-9	-5	-1	0	0	0	0	
Atmospheric side attenuator	I.L.	-2	-2	-4	-15	-26	-19	-19	-13	
Sound power level leaving terminal		54	56	64	58	44	47	42	40	59

Receptor R1	V angle	H angle										
Directivity correction	0	0	250 x 250 (0,0)	1	2	3	4	5	6	6	6	
Distance correction	40	m	40 m	-40	-40	-40	-40	-40	-40	-40	-40	
Screening correction	Screened:		δ=	-40	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R1			L_p	15	18	27	22	9	13	8	6	23

AC Condensers – Noise to R1

Unit	Make / Model	Source Sound Level		Distance Correction		Directivity	Screening	Sound pressure level at Receptor, dBA
		L _{pA}	at / m	m	dB			
CU1	Daikin AZAS100MV1	57	1	37	-31	3	0	29
CU2	Daikin AZAS71MV1	47	1	37	-31	3	0	19
CU3	Daikin AZAS125MV1	57	1	37	-31	3	0	29

Summary

Plant	Resultant at Receptor (dBA)
	R1
EF1	31
EF2	33
EF3	23
CU1	29
CU2	19
CU3	29
Combined L_{Aeq}	37
BS 4142:2014 feature correction	+3
Rating level at receptor, L_{Ar,Tr}	40

Appendix F Delivery noise assessment

Activity	Measured noise levels		Correction for no. of occurrences		Distance correction		Screening (dB)	Feature correction (dB)	Resultant SEL at receptor (dB)	Resultant L _{Amax} at receptor (dB)
	SEL @ 10m	L _{Amax} @ 10m	No. of occurrences	Correction (dB)	Distance (m)	Correction (dB)				
Lorry arrives in loading bay	69	68	1	0	61	-16	0	0	53	52
Door open and close	63	68	1	0	61	-16	0	6	53	52
Crates loaded (each)	62	67	5	7	35	-11	0	6	64	56
Door open and close	63	68	1	0	61	-16	0	6	53	52
Lorry departs	69	68	1	0	61	-16	0	0	53	52
Cumulative SEL + feature correction:									65	
L _{Ar} (15min):									36	

Peak Hour, daytime

Peak 15 minutes, early morning

Activity	Source noise levels	Distance correction		BS 4142:2014 feature	Screening correction (dB)	No. of events	Total SEL at receptor (dB)	Resultant Rating level
	dB L _{AE} (at 10m)	Distance to receiver (m)	Correction (dB)					L _{Ar,Tr}
Drive-Through								
Vehicle Pass-Thru	55	29	-10	0	-10	12	47	17
Intercom Speaker	74	31	-10	3	-8	12	70	40
Combined								40