Proposed Kitchen Extract

136 - 138 Long Acre
London
WC2E 9AA

Plant Noise Impact Assessment

On behalf of

Charles D. Smith & Associates Ltd

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T: 01252 519881
W: noisesolutions.co.uk
E: hello@noisesolutions.co.uk
Noise Solutions Ltd, 5 Oriel Court, Omega Park, Alton, GU34 2YT Reg no. 3483481

Document Information

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	Name	Qualifications	Initials	Date
Prepared by:	Dean Bowden	BSc(Hons), MIOA	DMB	23rd April 2021
Reviewed and approved by:	Nigel Chandler	BSc(Hons) MIOA	NAC	23rd April 2021
For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
01	26/04/2021	Amended plan/elevation drawing	DMB	NAC
02	19/01/2022	Amended plant selection	ACM	NAC
03	26/01/2022	Updated drawings	DMB	JS
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Reg no. 3483481 Trading office, 5 Oriel Court, Omega Park, Alton, GU34 2YT

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1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Charles D Smith and Associates Ltd to provide a noise impact assessment for a proposed kitchen extract system serving 136 – 138 Long Acre, London.

1.2. It should be noted that this assessment was originally undertaken in May 2020, at a time when the coronavirus pandemic was causing a disruption to working patterns and other activity. As a result, prevailing environmental noise levels affecting the site have been estimated based on historical noise surveys undertaken at the site and in the surrounding area.

1.3. Noise emissions from the kitchen extract system have been predicted at the nearest noise-sensitive receptors and assessed against Westminster City Council's standard requirements.

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 basement, ground and first floors of the building are to be redeveloped into a restaurant. New extract systems are proposed to serve the spaces.

2.2. A new kitchen extract fan is to be installed within an existing acoustic louvred enclosure at the rear of the site. The fan itself will be installed within a dedicated fan enclosure. A suitable attenuator will be fitted to the atmospheric-side of the fan. The fan and ductwork will be fitted with suitable anti-vibration mounts/fixings, as required, to isolate the system from the structure. Flexible connections will be installed either side of the fan to minimise vibration transfer.

2.3. A new soot abatement fan will be installed inside the unit, with an extract flue flowing the same duct as the kitchen extract fan.

2.4. A new extract fan for the adjacent unit at 138 Long Acre will also follow the same duct.

2.5. The plant will run only between 07:00 hours and 23:00 hours.

2.6. An aerial photograph showing the site and surrounding area is provided in **Appendix B**. Photographs of the existing plant are provided in **Appendix C**. Manufacturers' plant noise levels are given in **Appendix D.** Proposed layout drawings are given in **Appendix E.**

3.0 Nearest noise sensitive receptors

3.1. The area surrounding the site is a mix of commercial and residential in nature.

3.2. The nearest residential receptors (Receptor R1) to the plant area are flats on Long Acre. Commercial offices (Receptors R2 and R3) on Long Acre have also been assessed.

3.3. The locations of the nearest receptors are shown in **Appendix B**.

4.0 Existing noise climate

4.1. It should be noted that this assessment was undertaken in May 2020, at a time when the coronavirus pandemic was causing a disruption to working patterns and other activity.

4.2. Since Government advice at the time was to avoid any unnecessary travel, traffic noise levels were likely to be much lower than normal - and certainly not higher. Many potentially noise generating commercial premises in the area may also be closed. It is likely that any noise survey at the site would therefore measure lower background sound levels than would usually prevail, and give more onerous limits on plant noise than is necessary.

4.3. The Chief Planner at the Ministry of Housing Communities and Local Government wrote to all planning authorities in March 2020 encouraging them to be pragmatic in their approach during these abnormal times. It is therefore proposed to provide a noise impact assessment using historic noise survey data for the area (e.g. from the NSL database and previous planning submissions) and include commentary on the robustness of the survey data and the potential impact of any uncertainties within the methodology and results.

4.4. An unattended background noise survey was undertaken at the premises in 2006. The noise meter was located in the plant area. The lowest measured background noise levels were as follows

- Daytime: 52 dB
- Night-time 52 dB

4.5. In addition, NSL undertook an unattended noise survey at a nearby site located at WC2N 4JS in October 2018. The site was also in a courtyard at the rear of commercial premises.

4.6. Table 1 below shows a summary of the results:

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(15mins)}$	$L_{AFmax(15min)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
Daytime hours (07:00 – 23.00 hours)	46-75	54-101	48-67	45-58
Night-time hours (23.00 – 07.00 hours)	45-68	51-82	47-69	43-68

4.7. In order to be robust, the lowest value from these two surveys has been selected to be representative of the background noise level in this area.

5.0 Plant noise design criteria

Westminster City Council

5.1. Westminster City Council's Draft Noise Technical Guidance Note was published in November 2019 to accompany the City Plan 2019 – 2040.

5.2. Section 2.4 of the Guidance Note gives noise thresholds for "Development including plant or machinery, or contains activities that cause noise from amplified and unamplified music or human voices both internally and externally" as set out in Table 2 below (Table 3 in the Guidance Note).

Table 2. Noise criteria for plant machinery and internal/external activities

Existing External Ambient Noise Level	Tonal or Intermittent Noise / Noise Source	Sound Emission Level that should not be exceeded at the nearest Noise Sensitive Receptor[1]
Exceed WHO Guideline Levels L_{Aeq} 55dB over periods of daytime (07.00-23.00 hours) and L_{Aeq} 45 dB at night-time (23.00-07.00 hours	Does not contain tones or intermittent noise sufficient to attract attention	10dB below the minimum external background noise level
	Contains tones or be intermittent noise sufficient to attract attention	15dB below the minimum external background noise level
	Noise emitted from emergency plant or an emergency life supporting generator(s)[2]	10dB above the lowest background noise level within a 24-hour period
Does not exceed WHO Guideline Levels L_{Aeq} 55dB over periods of daytime (07.00-23.00 hours) and L_{Aeq} 45 dB at night-time (23.00-07.00 hours	Does not contain tones or intermittent noise sufficient to attract attention	5dB below the minimum external background noise level
	Contains tones or be intermittent noise sufficient to attract attention	10dB below the minimum external background noise level

	Noise emitted from emergency plant or an emergency life supporting generator(s)[2]	10dB above the lowest background noise level within a 24-hour period
Below 30 dB $L_{A90,15min}$ at the nearest noise sensitive receptors Both daytime (07.00-23.00hrs) and night-time (23.00-07.00hrs).	Noise contains and/or does not contain tones or intermittent noise	Site specific standards that avoid noise disturbance to nearest noise sensitive receptors may be considered

Notes:

Measured at the nearest noise sensitive receptors 1m from the most affected façade, relative to the existing external background noise level in this location and including assessment at the quietest time during which the plant operates or when there is internal activity at the development site. The background noise level should be expressed in terms of the lowest $L_{A90,15min}$ during daytime or night time (depending on the hours of use being applied for).

Where emergency plant or a generator is installed testing times will be regulated

Criterion at offices

5.3. Typically, local authorities do not consider offices premises to be as sensitive to noise as residential properties and, therefore, emissions criteria are generally relaxed at these locations.

5.4. However, it is considered appropriate to control plant noise levels within offices to meet the recommended internal noise levels provided in BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*. The standard states a range of noise levels for various spaces used for 'study and work requiring concentration' between 35 and 50dB L_{Aeq}.

5.5. In addition, BS 8233 provides general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

> *If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB.*

5.6. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15dB is expected for non-openable standard double-glazed windows. However, in order to assess the worst-case scenario, this report assumes that windows may be opened if desired.

5.7. Based on the above and assuming a worst-case internal criterion of 35dB L_{Aeq}, cumulative plant noise levels at the façade of the nearest office premises should not exceed 50dB L_{Aeq}.

5.8. As the criteria at the residents is 15dB more stringent than at the commercial receptor, and the residential receptor has direct line of sight to all the plant items, it is expected that the limits will be set by compliance with the residential receptor.

Summary of criteria

5.9. Due to the pandemic situation, it was not possible to measure the average background noise level at the premises, therefore it is assumed that Westminster's more stringent emissions criteria should apply for the assessment of plant noise affecting nearby residential premises.

5.10. It is proposed that the cumulative noise emission level of new plant, at the nearest noise-sensitive residential receptor, does not exceed a level 10dB below the existing background sound level.

Table 3 Plant noise emissions limits at nearest receptors

Period	Receptor	Cumulative plant noise emission level, dB(A)
Daytime (07.00 -23.00 hours)	Residential (R1)	35
	Commercial (R2 and R3)	50

6.0 Noise Impact Assessment

6.1. Noise from the proposed kitchen extract system has been predicted at the most affected noise sensitive receptors. The assessment has taken into consideration ductwork system losses, distance attenuation and directivity corrections. Predictions are inclusive of the following atmospheric-side attenuator fitted to the extract systems:

Table 4 Proposed atmospheric-side attenuators to ventilation systems

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Kitchen Extract (136 Long Acre)	9	19	34	45	45	45	45	44
Kitchen Extract (138 Long Acre)	6	13	26	41	45	45	43	36

6.2. The calculation assumes that the acoustic louvres surrounding the kitchen extract fan has the minimum insertion losses specified in Table 5.

Table 5 Assumed acoustic louvre performance

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Typical acoustic louvre	5	7	10	13	18	20	14	13

6.3. The calculations assume the fan will be installed within an enclosure providing an overall noise reduction of 10dB.

6.4. It should be noted that the proposed kitchen extract system is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. The system will run continuously during operational hours (07.00 – 23.00) and will not run at night (23.00 – 07.00 hours).

6.5. Table 6, below, summarises the results of the assessment at the nearest noise sensitive windows. All other receptors benefit from increased distance/screening to the plant. The full set of calculations can be found in **Appendix F**.

Table 6 Assessment of predicted noise levels at nearest receptors

Receptor	Period	Predicted noise level at receptor, L_{Aeq} (dB)	Proposed design criterion (dB)	Difference (dB)
R1	07:00 – 23:00 hours	35	35	0
R2	07:00 – 23:00 hours	43	50	-7
R3	07:00 – 23:00 hours	33	50	-17

6.6. The above assessment demonstrates that noise from the proposed kitchen extract system will comply with the proposed design criteria at all nearby receptors.

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

- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.
- Although the coronavirus pandemic has prohibited a noise survey from being undertaken at this time, reasonable steps have been taken within this assessment to establish appropriate background noise levels.

7.0 Summary

7.1. Noise Solutions Ltd (NSL) has been commissioned by Charles D Smith and Associates Ltd to provide a noise impact assessment for a proposed kitchen extract system serving 136 – 138 Long Acre, London.

7.2. It should be noted that this assessment was originally undertaken in May 2020, at a time when the coronavirus pandemic was causing a disruption to working patterns and other activity. As a result, prevailing environmental noise levels affecting the site have been estimated based on historical noise surveys undertaken at the site and in the surrounding area.

7.3. Noise emissions from the kitchen extract system have been predicted at the nearest noise-sensitive receptors and assessed against Westminster City Council's standard requirements.

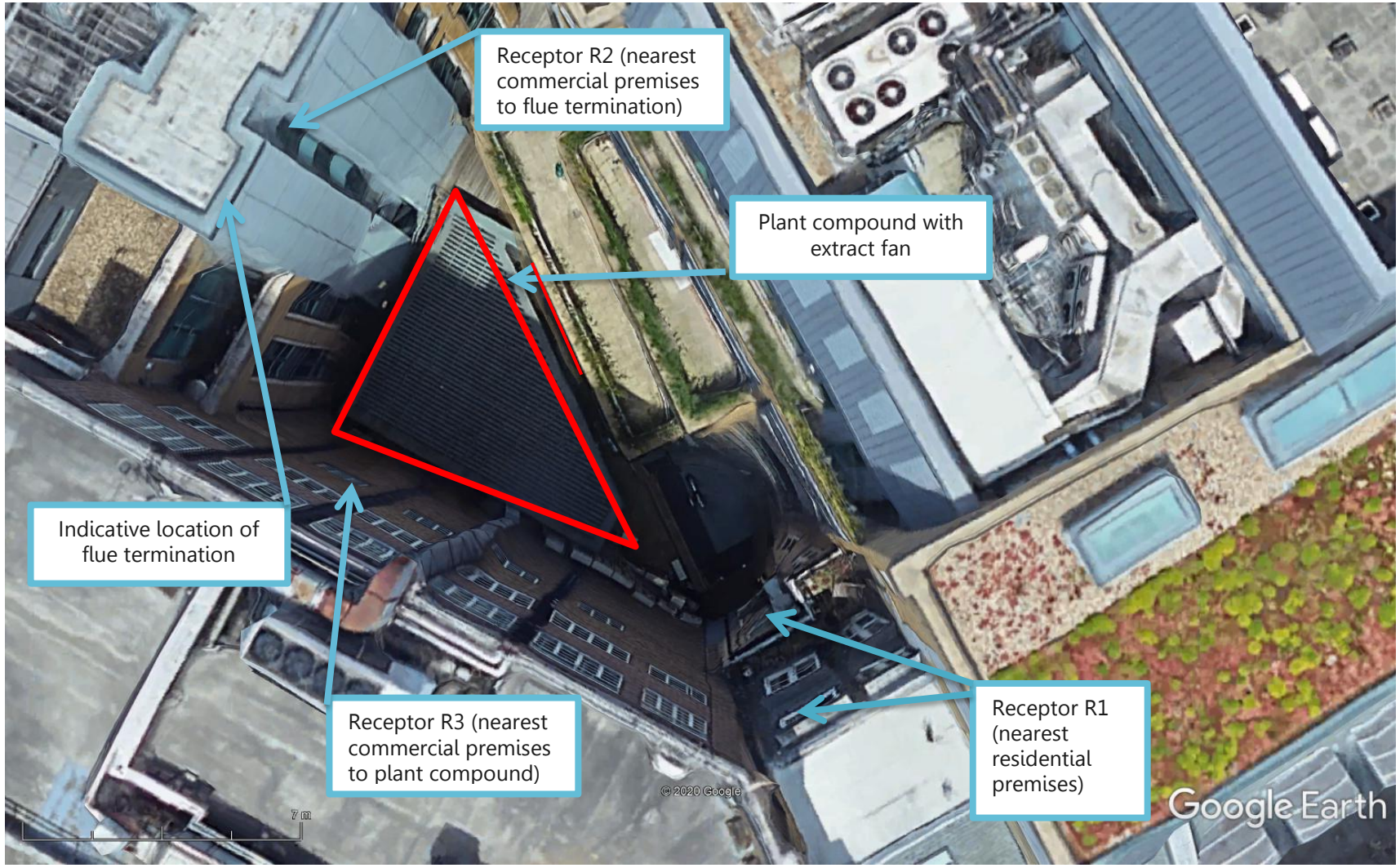
7.4. The assessment has demonstrated that the requirements of Westminster City Council will be met, inclusive of the following mitigation measures fitted to the kitchen extract systems;

- Atmospheric-side attenuator as per the specification provided in Table 4;
- Suitable spring anti-vibration mounts and flexible connections fitted to extract fan.

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 s1 and s2 is given by 20 $\log_{10}$ (s1/s2). 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 20μPa. 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 Leq 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 Photographs of existing plant compound

C.1 Photograph of existing acoustic louvred enclosure

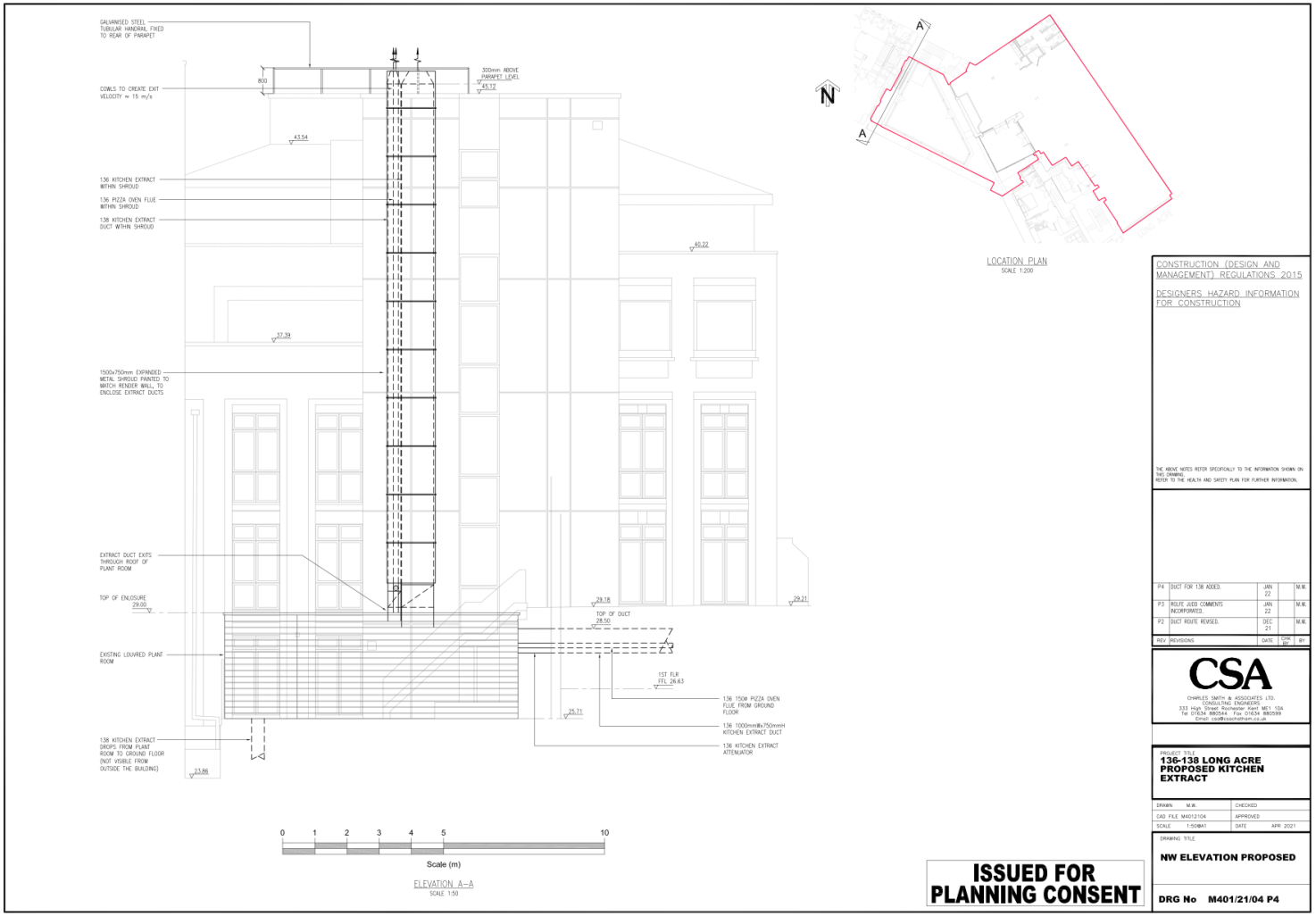
C.2 Photograph of existing acoustic louvred enclosure (existing plant to be removed)

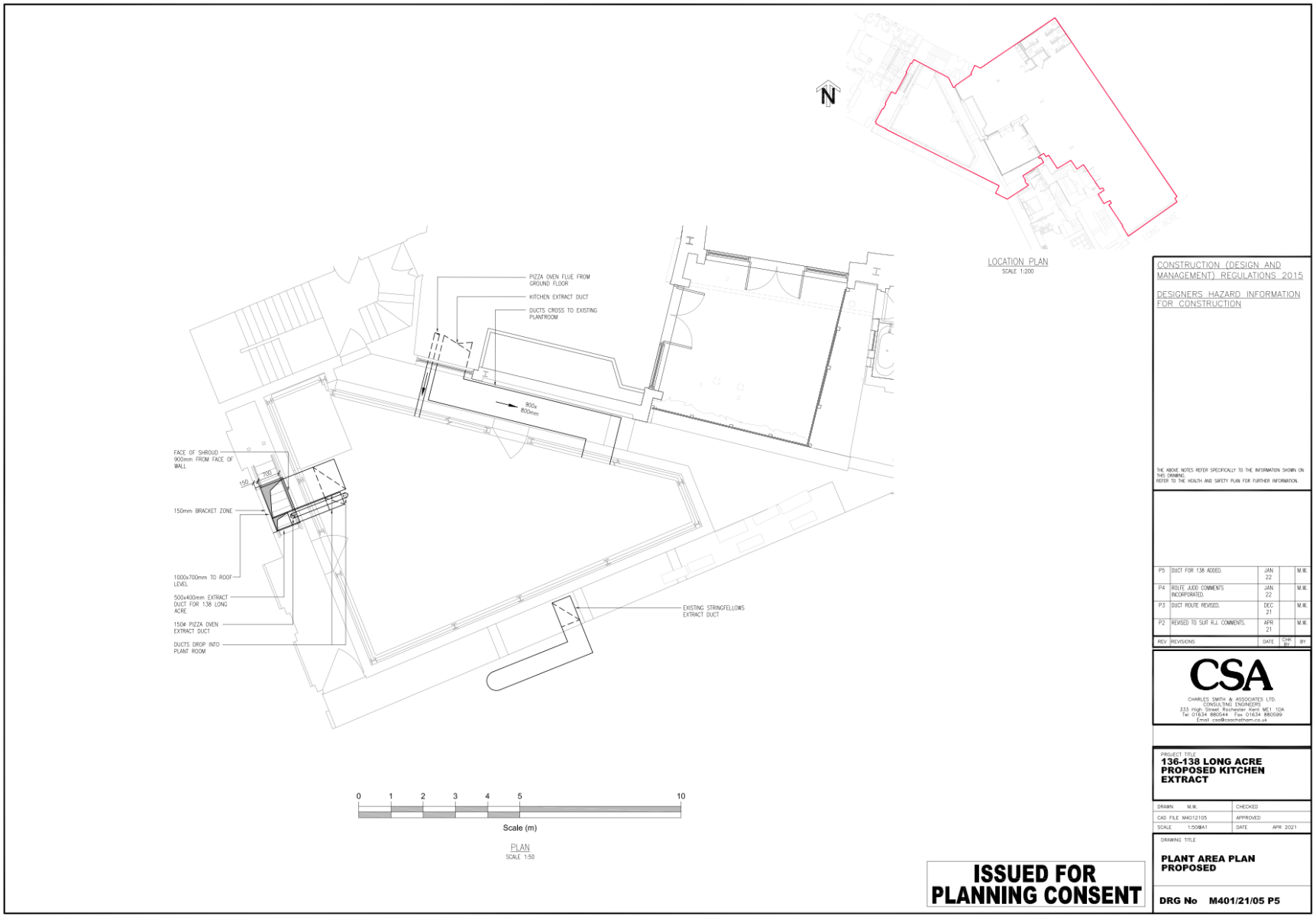
Appendix D Manufacturer's plant noise details

	Plant item (make/model)	Notes	Sound levels, dB, at octave band frequencies (Hz)								dBA
			63	125	250	500	1K	2K	4K	8K	
Kitchen Extract (136 Long Acre)	Fläkt Woods / 80JM.BIF/20/4/6/22	Inlet L_w	87	97	96	99	92	86	82	77	98
		Outlet L_w	89	100	95	97	93	87	83	80	98
		Breakout L_w*	83	83	93	90	89	86	80	72	93
Kitchen Extract (138 Long Acre)	Fläkt Woods / 40JM.BIF/20/2/6/24	Inlet L_w	92	91	92	94	89	88	83	80	95
		Outlet L_w	89	93	95	93	90	89	83	81	96
Soot abatement fan	Smoki/200	Outlet L_w	82	72	60	56	53	55	50	52	64

**noise breakout data unavailable from unit manufacturer. This assessment is based on emperical data for similar bifurcated fans.*

Appendix E Plant layout drawings




N
LOCATION PLAN
SCALE 1:200
PIZZA OVEN FLUE FROM GROUND FLOOR
KITCHEN EXTRACT DUCT
DUCTS CROSS TO EXISTING PLANTROOM
900x 600mm
FACE OF SHROUD 900mm FROM FACE OF WALL
150
700
150mm BRACKET ZONE
1000x700mm TO ROOF LEVEL
500x400mm EXTRACT DUCT FOR 138 LONG ACRE
150ø PIZZA OVEN EXTRACT DUCT
DUCTS DROP INTO PLANT ROOM
EXISTING STRINGFELLOWS EXTRACT DUCT
0 1 2 3 4 5 10
Scale (m)
PLAN
SCALE 1:50
CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015
DESIGNERS HAZARD INFORMATION FOR CONSTRUCTION
THE ABOVE NOTES REFER SPECIFICALLY TO THE INFORMATION SHOWN ON THIS DRAWING.
REFER TO THE HEALTH AND SAFETY PLAN FOR FURTHER INFORMATION.
P5 DUCT FOR 138 ADDED. JAN 22 M.W.
P4 ROLFE JUDD COMMENTS INCORPORATED. JAN 22 M.W.
P3 DUCT ROUTE REVISED. DEC 21 M.W.
P2 REVISED TO SUIT R.J. COMMENTS. APR 21 M.W.
REV REVISIONS DATE CHK BY
CSA
CHARLES SMITH & ASSOCIATES LTD.
CONSULTING ENGINEERS
333 High Street Rochester Kent ME1 1DA
Tel 01634 880344 Fax 01634 880399
Email csa@csachatham.co.uk
PROJECT TITLE
136-138 LONG ACRE
PROPOSED KITCHEN EXTRACT
DRAWN M.W. CHECKED
CAD FILE M4012105 APPROVED
SCALE 1:50@A1 DATE APR 2021
DRAWING TITLE
PLANT AREA PLAN PROPOSED
DRG No M401/21/05 P5
ISSUED FOR PLANNING CONSENT

Appendix F Plant noise calculations

Kitchen Extract (136 Long Acre)

NSL Ref: **89253**
Project **10-14 Upper St Martins Lane**

Compiled by:	ACM	18/01/2022

Plant Ref **Vent 1**
Plant Description **FlaktWoods/80JMBIF**

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	89	100	95	97	93	87	83	80	**98**
System losses		-7	-3	-1	-1	-1	-1	-1	-1	
Atmospheric side attenuator	I.L.	-9	-19	-34	-45	-45	-45	-45	-44	
Sound power level leaving terminal		**73**	**78**	**60**	**51**	**47**	**41**	**37**	**35**	**63**

Receptor R1	V angle	H angle									
Directivity correction	90	0	800 x 800 (90,0)	0	0	0	0	-4	-7	-7	-7	
Distance correction	18	m	18 m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening correction												
Surface corrections etc												
Resultant at Receptor R1			L_p	**40**	**45**	**27**	**18**	**10**	**1**	**-3**	**-5**	**30**

Receptor R2	V angle	H angle									
Directivity correction	135	0	800 x 800 (135,0)	-1	-1	-3	-6	-9	-8	-8	-8	
Distance correction	4	m	4 m	-20	-20	-20	-20	-20	-20	-20	-20	
Screening correction												
Surface corrections etc												
Resultant at Receptor R2			L_p	**52**	**57**	**37**	**25**	**18**	**13**	**9**	**7**	**41**

Receptor R3	V angle	H angle									
Directivity correction	135	45	800 x 800 (135,45)	-2	-2	-4	-7	-10	-10	-10	-10	
Distance correction	11	m	11 m	-29	-29	-29	-29	-29	-29	-29	-29	
Screening correction												
Surface corrections etc												
Resultant at Receptor R3			L_p	**42**	**47**	**27**	**15**	**8**	**2**	**-2**	**-4**	**31**

Kitchen Extract (138 Long Acre)

NSL Ref: **89253**
Project **10-14 Upper St Martins Lane**

Compiled by:	ACM	18/01/2022

Plant Ref **Vent 2**
Plant Description **FlaktWoods/40JMBIF**

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	89	93	95	93	90	89	83	81	**96**
System losses		-11	-7	-3	-2	-3	-3	-3	-3	
Atmospheric side attenuator	I.L.	-6	-13	-26	-41	-45	-45	-43	-36	
Sound power level leaving terminal		**72**	**73**	**66**	**50**	**42**	**41**	**37**	**42**	**61**
Receptor R1	V angle H angle									
Directivity correction	90 0 400 x 400 (90,0)	0	0	0	0	-4	-7	-7	-7	
Distance correction	18 m 18 m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening correction										
Surface corrections etc										
Resultant at Receptor R1	**L_p**	**39**	**40**	**33**	**17**	**5**	**1**	**-3**	**2**	**28**
Receptor R2	V angle H angle									
Directivity correction	135 0 400 x 400 (135,0)	-1	-1	-3	-6	-9	-8	-8	-8	
Distance correction	4 m 4 m	-20	-20	-20	-20	-20	-20	-20	-20	
Screening correction										
Surface corrections etc										
Resultant at Receptor R2	**L_p**	**51**	**52**	**43**	**24**	**13**	**13**	**9**	**14**	**39**
Receptor R3	V angle H angle									
Directivity correction	135 45 400 x 400 (135,45)	-2	-2	-4	-7	-10	-10	-10	-10	
Distance correction	11 m 11 m	-29	-29	-29	-29	-29	-29	-29	-29	
Screening correction										
Surface corrections etc										
Resultant at Receptor R3	**L_p**	**41**	**42**	**33**	**14**	**3**	**2**	**-2**	**3**	**29**

Soot abatement fan

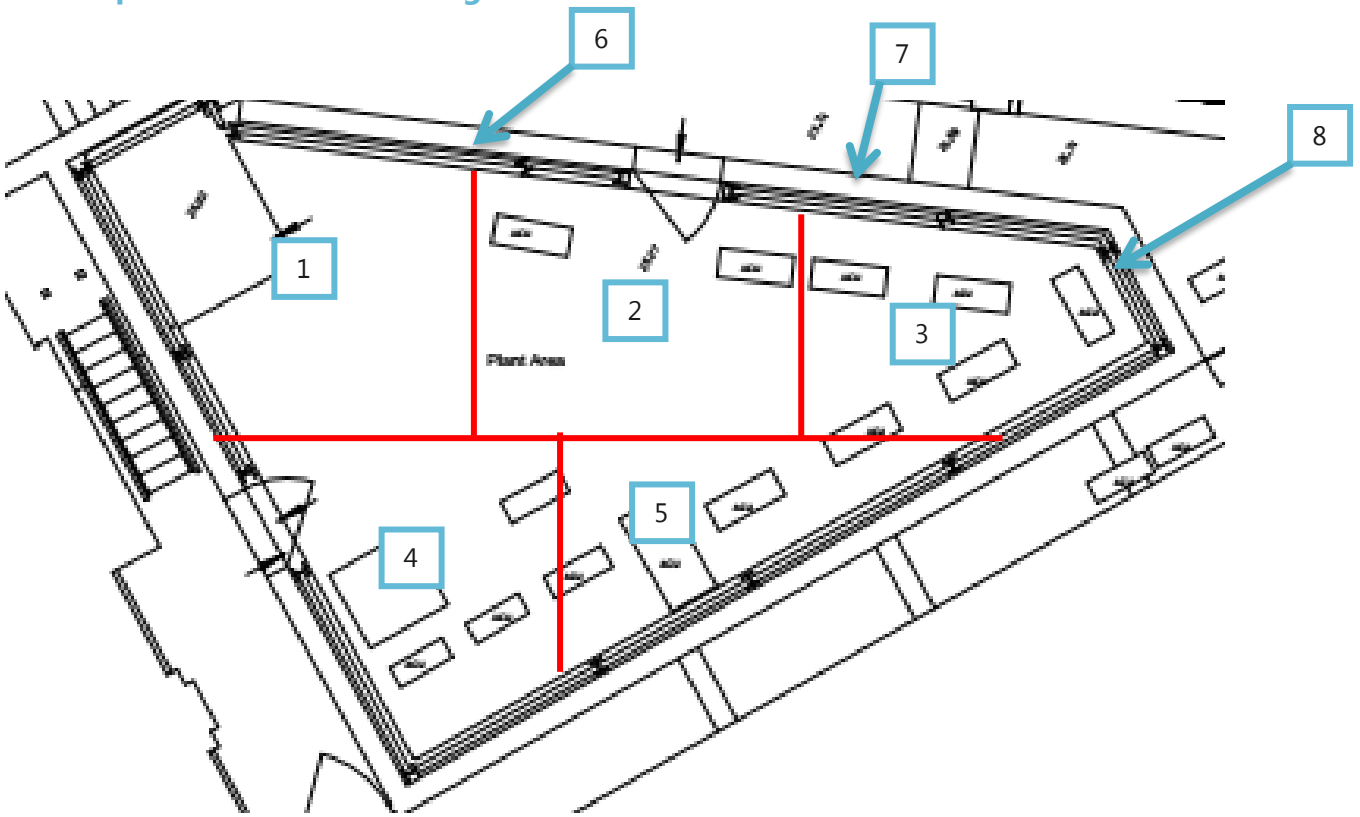
NSL Ref: **89253**
Project **10-14 Upper St Martins Lane**

Compiled by:	ACM	18/01/2022

Plant Ref **Vent 3**
Plant Description **Smoki/200**

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	82	72	60	56	53	55	50	52	**63**
System losses		-16	-12	-7	-5	-4	-4	-4	-4	
Atmospheric side attenuator	I.L.	0	0	0	0	0	0	0	0	
Sound power level leaving terminal		**66**	**60**	**53**	**51**	**49**	**51**	**46**	**48**	**57**
Receptor R1	V angle / H angle									
Directivity correction	90 / 0	200 x 200 (90,0)	0	0	0	0	-4	-7	-7	-7	
Distance correction	18 m	18 m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening correction											
Surface corrections etc											
Resultant at Receptor R1		**L_p**	**33**	**27**	**20**	**18**	**12**	**11**	**6**	**8**	**20**
Receptor R2	V angle / H angle									
Directivity correction	135 / 0	200 x 200 (135,0)	-1	-1	-3	-6	-9	-8	-8	-8	
Distance correction	4 m	4 m	-20	-20	-20	-20	-20	-20	-20	-20	
Screening correction											
Surface corrections etc											
Resultant at Receptor R2		**L_p**	**45**	**39**	**30**	**25**	**20**	**23**	**18**	**20**	**31**
Receptor R3	V angle / H angle									
Directivity correction	135 / 45	200 x 200 (135,45)	-2	-2	-4	-7	-10	-10	-10	-10	
Distance correction	11 m	11 m	-29	-29	-29	-29	-29	-29	-29	-29	
Screening correction											
Surface corrections etc											
Resultant at Receptor R3		**L_p**	**35**	**29**	**20**	**15**	**10**	**12**	**7**	**9**	**20**

Louvre plant enclosure area segments



The plant area was calculated as 8 approximately equal sections outlined above and each one calculated to the receptor, then combined.

Acoustic louvre enclosure to Receptor R1

	Sound levels, dB, at octave band frequencies (Hz)								dBA
	63	125	250	500	1K	2K	4K	8K	
Louvre SRI	5	7	10	13	18	20	14	13	
Radiating Sound power of each segment, based on calculated Reverberant L_p within enclosure	61	57	61	53	41	35	33	25	
Segment 1									
Distance to receptor	18	m							
Distance loss/divergence	-33	-33	-33	-33	-33	-33	-33	-33	
Lp at receptor	28	24	28	20	8	2	0	-8	**22**
Segment 2									
Distance to receptor	13	m							
Distance loss/divergence	-30	-30	-30	-30	-30	-30	-30	-30	
Lp at receptor	31	27	31	23	11	5	3	-5	**25**
Segment 3									
Distance to receptor	9	m							
Distance loss/divergence	-27	-27	-27	-27	-27	-27	-27	-27	
Lp at receptor	34	30	34	26	14	8	6	-2	**28**
Segment 4									
Distance to receptor	17	m							
Distance loss/divergence	-33	-33	-33	-33	-33	-33	-33	-33	
Lp at receptor	28	24	28	20	8	2	0	-8	**22**
Segment 5									
Distance to receptor	14	m							
Distance loss/divergence	-31	-31	-31	-31	-31	-31	-31	-31	
Lp at receptor	30	26	30	22	10	4	2	-6	**24**
Segment 6									
Distance to receptor	15	m							
Distance loss/divergence	-32	-32	-32	-32	-32	-32	-32	-32	
Screening	-10	-10	-10	-10	-10	-10	-10	-10	
Lp at receptor	19	15	19	11	-1	-7	-9	-17	**13**

	Sound levels, dB, at octave band frequencies (Hz)								dBA
	63	125	250	500	1K	2K	4K	8K	
Segment 7									
Distance to receptor	10	m							
Distance loss/divergence	-28	-28	-28	-28	-28	-28	-28	-28	
Screening	-10	-10	-10	-10	-10	-10	-10	-10	
Lp at receptor	23	19	23	15	3	-3	-5	-13	**17**
Segment 8									
Distance to receptor	7	m							
Distance loss/divergence	-25	-25	-25	-25	-25	-25	-25	-25	
Screening	-10	-10	-10	-10	-10	-10	-10	-10	
Lp at receptor	26	22	26	18	6	0	-2	-10	**20**
Total at receptor	38	34	39	30	18	13	10	2	**32**