

40 Queen's Grove

Noise Emissions from Building Services

Summary

Arup Acoustics (AAc) has been commissioned to set noise emission limits for new mechanical plant in the refurbishment of 40 Queen's Grove in order to meet the environmental noise requirements specified by the London Borough of Camden.

Limiting noise levels, in terms of sound power and sound pressure levels at 1m, have been set for the main plant: rooftop chillers; an emergency generator and plant in the basement plant room, which comply with the London Borough of Camden's requirements.

In addition, the louvres enclosing the rooftop chillers should be at least equal in height to the chillers and minimum insertion losses are given for the south west louvre, facing 41 Queen's Grove.

Sufficient space should be allowed for within the generator enclosure for attenuation measures which enable the generator sound power limits to be met. The door to the generator enclosure should be a proprietary unit and provide a minimum weighted sound reduction index of R_{w35} when measured in a laboratory in accordance with BS EN ISO 140-3 1995.

Based upon the above conditions and our calculations we are satisfied that individually and cumulatively the proposed plant will conform to the London Borough of Camden's noise limit thresholds.

1 Introduction

A residential property at 40 Queen's Grove is to undergo refurbishment which includes the installation of new mechanical services. Arup Acoustics (AAc) has been commissioned to set noise emission limits for the new mechanical plant in order to meet the environmental noise requirements specified by the London Borough of Camden.

The acoustic terminology used in this report is explained in Appendix A.

2 Local Planning Authority Requirements

The property lies within the boundary of the London Borough of Camden. The London Borough of Camden Unitary Development Plan (UDP) was revised in June 2006. The relevant requirements regarding plant noise emissions are outlined in Table 1.

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <L _{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10dB(A) <L _{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10dB(A) <L _{A90}
Noise at 1 metre external to sensitive façade where LA90 >60dB	Day, evening and night	0000-2400	55dB L _{Aeq}

Table 1: Noise levels from plant and machinery at which planning permission will not be granted

3 Noise Survey

Manned measurements were taken in order to determine the existing noise levels at the nearest noise sensitive façades.

3.1 Closest sensitive

The nearest noise sensitive façades to 40 Queen's Grove are those of adjoining neighbouring residential properties at 41 and 39 Queen's Grove. The residential properties on Queensmead have also been considered since these may be the closest sensitive receivers to mechanical plant located at the back of 40 Queen's Grove.

The property at 41 Queen's Grove is currently undergoing refurbishment. The proposed refurbishment has therefore been considered in this assessment.

Measurements were made in two locations, at the front and back of 40 Queen's Grove (see Figure 1 and Section 3.2 below for details).

3.2 Survey Details

Procedure:	Noise measurements were carried out throughout the day and night in order to capture the quietest periods
Date/time:	Monday 21 January 2008 from 1430 to 1630 and 2030 to 2359 Tuesday 22 January 2008 from 0000 to 0230
Personnel:	Luke Robertson
Measurement duration:	Daytime (0700 to 2300) 10 minute samples Night time (2300 to 0700) 5 minute samples
Measurement locations:	Measurements were carried out at two locations, shown in Figure 1. Location 1 was 2m from the front façade of 40 Queen's Grove, at a height of 1.5m from the ground. Noise levels incident at this location were considered to be representative of those at the closest residential façades overlooking Queen's Grove. Location 2 was in the back garden of 40 Queen's Grove, at a height of 1.5m from the ground. Noise levels incident at this location were considered to be representative of those at the closest residential façades shielded from noise from Queen's Grove.
Weather:	Dry with a light wind of less than 5m/s.
Equipment:	1 x B&K 2260 Precision Integrated Sound Level Analyser 1 x B&K 4231 Type 1 Sound Level Calibrator Calibration was checked before and after use. A drift of less than 0.5dB was observed.

4 Limiting Plant Noise Levels

4.1 Environmental Criteria

The lowest background noise levels (dBL_{A90}) measured at each location are shown in Table 2.

Full survey results are presented in Appendix B.

	Lowest Measured Background Level, dBL_{A90}
Location 1	47
Location 2	45

Table 2: Lowest measured background noise levels, dBL_{A90}

4.2 Limiting Plant Noise Levels

On the basis of the minimum background noise levels and the London Borough of Camden's requirements, the cumulative plant noise limits at the nearest neighbouring façades are outlined in Table 3.

	Plant noise limits at nearest residential façade, dBL _{Aeq}
At façades overlooking Queen's Grove	42
At façades shielded from Queen's Grove	40

Table 3: Cumulative plant noise limits at nearest residential façades, dBL_{Aeq}

Should the plant exhibit a distinguishable discrete continuous note or distinct impulses the noise limits should be reduced by 5dB in accordance with the London Borough of Camden's requirements.

4.3 Plant Noise Assessment

In the following section we have estimated the likely noise levels from plant to assess the possible requirements for noise control.

The calculation has been based assuming the simultaneous use of all units.

4.3.1 Rooftop Plant

Three Daikin Type EWAQ-007ACV3P chillers are proposed for the rooftop of 40 Queen's Grove. The chiller manufacturer has provided the noise emission data given in Table 4 for this model.

The chillers will be enclosed on all sides by louvres at least equal in height to the chiller units. The south west louvre, facing 41 Queen's Grove, shall achieve at least the minimum insertion losses given in Table 5.

Daikin Type EWAQ-007ACV3P chiller	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Sound pressure level at 1m (single chiller)	46	49	49	48	46	39	34	28

Table 4: Maximum sound pressure level per chiller, dB re 2 x 10⁻⁵Pa

	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Insertion Losses	6	6	8	10	14	18	16	15

Table 5: Minimum acoustic louvre insertion losses, dB

The closest noise sensitive receiver to the rooftop chillers will be a northeast facing window at second floor level in 41 Queen's Grove. This location is not considered to be directly exposed to noise from Queen's Grove therefore the plant noise limit of 40dBL_{Aeq} applies.

The rooftop layout and elevations shown in Eric Parry Architects Drawings EPA-QGR-02-114-P5 and EPA-QGR-02-111-P1 have been used in the calculations.

Based on the above conditions, the calculation results in estimated levels of 36dB_{L_{Aeq}} at 1m from the nearest window in 41 Queen's Grove. This is below the plant noise limit of 40dB_{L_{Aeq}} at 1m from the façade of the nearest noise sensitive receiver.

4.3.2 Emergency Generator

A generator is proposed at 40 Queen's Grove for backup electrical power in the event of a network power failure. The generator is to be located in a full enclosure at basement level towards the back of 40 Queen's Grove.

The engine exhaust will be routed to the roof of the generator enclosure. Louvres to the air intakes and outlet will be located on the northeast wall of the enclosure.

The closest noise sensitive receivers to the emergency generator enclosure will be northwest facing windows in the proposed residential developments at 39 and 41 Queen's Grove. These locations are not exposed to noise from Queen's Grove therefore the plant noise limit of 40dB_{L_{Aeq}} applies.

The door to the generator enclosure should be a proprietary unit and provide a minimum weighted sound reduction index of Rw35 when measured in a laboratory in accordance with BS EN ISO 140-3 1995.

Maximum sound power levels at the air intake, air outlet and engine exhaust are given in Table 6 in order for noise emission limits to be met.

Sufficient space should be allowed for within the generator enclosure for attenuation measures which enable the sound power limits in Table 6 to be met.

	Maximum sound power level, dB(A)
Engine exhaust	62
Air intake	59
Air Outlet	59

Table 6: Maximum generator sound power levels, dB(A) re 1 x 10⁻¹²W

Eric Parry Architects Drawings EPA-QGR-02-114-P5, EPA-QGR-01-099-P7 and EPA-QGR-01-100-P7 have been used in the calculations.

Based on the above conditions, calculations result in estimated levels of 39dB_{L_{Aeq}} at 1m from the nearest windows in 39 and 41 Queen's Grove. This is below the plant noise limit of 40dB_{L_{Aeq}} at 1m from the façade of the nearest noise sensitive receiver.

Based on the above conditions, operation of the emergency generator would result in estimated levels of 42dB_{L_{Aeq}} in the nearest area of garden of 39 or 41 Queen's Grove. This is 8dB below the noise limit of 50dB_{L_{Aeq}} proposed for gardens in BS 8233:1999 *Sound insulation and noise reduction for buildings – Code of Practice* and 3dB below the lowest background noise level measured in the garden of 40 Queen's Grove.

4.3.3 Basement Plant

Two heat pumps and an air handling unit are proposed for the basement plant room located at the front of 40 Queen's Grove.

The closest noise sensitive receivers to the basement plant room will be the southeast facing windows in the proposed residential development at 41 Queen's Grove. This location is exposed to noise from Queen's Grove therefore the plant noise limit of 42dB_{L_{Aeq}} at 1m from the façade applies.

The air intake and discharge from the basement plant room should be attenuated within the plant room such that the noise level, when measured on axis at 1m from the outlet or inlet, does not exceed 39dB_{L_{Aeq}}. This will ensure noise emissions from the basement plant room comply with the requirements of the London Borough of Camden.

5 Conclusion

The proposed plant should therefore meet the conditions and be limited to the levels outlined in Section 4.3 to meet the London Borough of Camden's environmental noise criteria.

If subsequent plant selection results in an increase in noise levels mitigation measures must be improved accordingly.

Figures

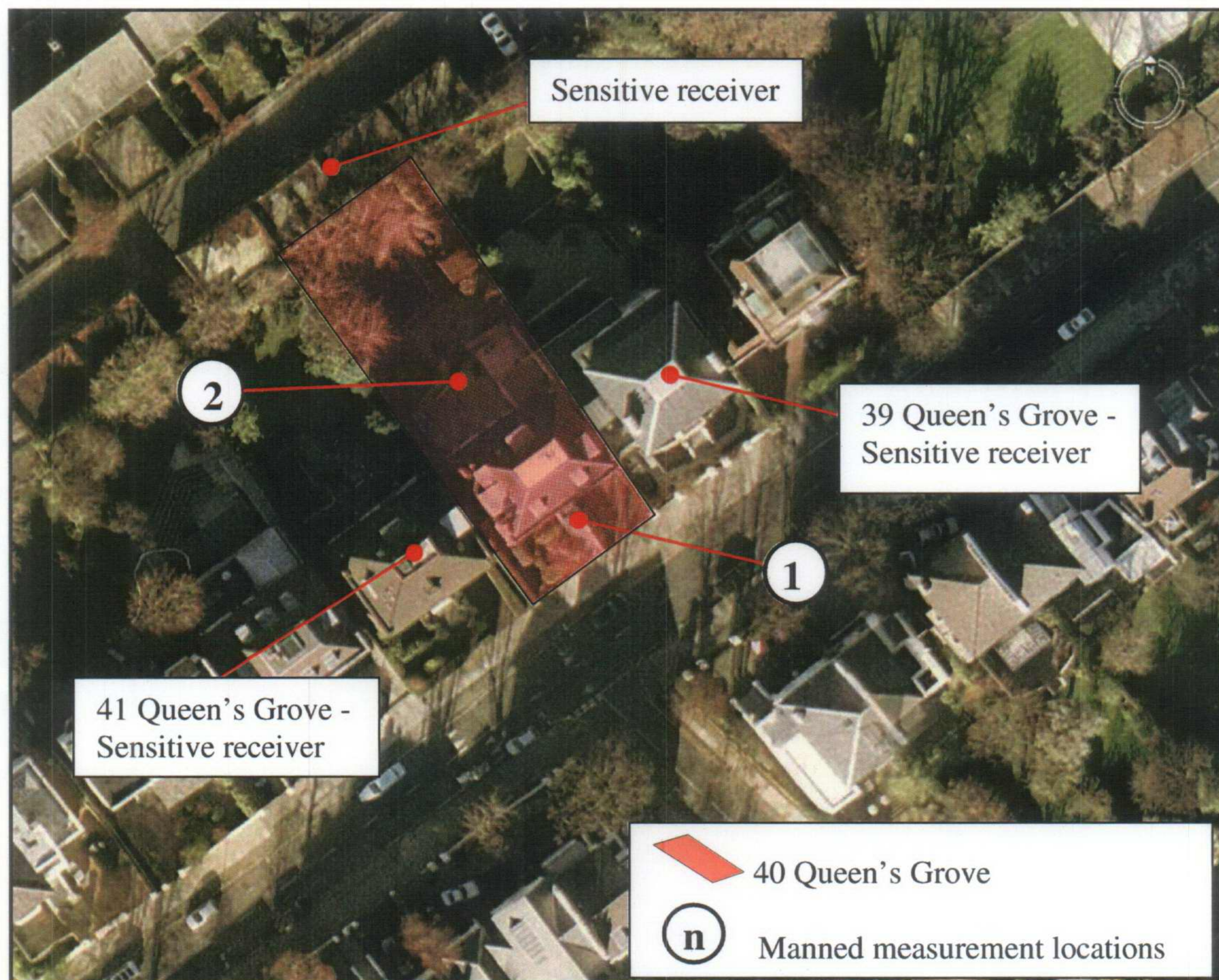


Figure 1: Measurement locations

Appendix A – Acoustic Terminology

dB(A)

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10} , L_{A90} , and L_{Aeq} for the 'A' weighted equivalent continuous noise level.

Equivalent Continuous Sound Level

An index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq} . This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10} , the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that L_{Aeq} is used in BS 8233 for assessing traffic noise). The L_{90} , the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1 , the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10} , dBL_{A90} etc. The reference time period (T) is normally included, eg $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.

Sound Power

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

Appendix B – Survey Results

Location	Start	Elapsed	Index	Octave Band Centre Frequency (Hz)									dB(A)	Comments
				32	63	125	250	500	1k	2k	4k	8k		
1	14:46:47	00:10:00	L10	71	71	66	63	61	62	59	54	47	67	Passing traffic on Queen's Grove
1	14:46:47	00:10:00	L90	58	59	53	50	49	49	45	39	28	54	
1	14:46:47	00:10:00	LEQ	68	69	66	60	58	59	56	50	43	63	
1	14:46:47	00:10:00	LMAX	89	87	89	78	75	71	72	69	63	78	
1	15:09:56	00:10:00	L10	68	70	64	62	61	63	59	53	47	67	Passing traffic on Queen's Grove, bus revving engine
1	15:09:56	00:10:00	L90	57	58	52	48	47	48	43	36	27	52	
1	15:09:56	00:10:00	LEQ	66	68	61	59	58	60	56	51	44	63	
1	15:09:56	00:10:00	LMAX	84	85	81	80	84	81	79	77	69	86	
1	16:08:34	00:10:00	L10	70	71	65	63	63	64	59	53	46	67	Passing traffic on Queen's Grove
1	16:08:34	00:10:00	L90	59	59	53	49	48	48	43	36	27	52	
1	16:08:34	00:10:00	LEQ	69	69	62	60	59	60	56	50	43	64	
1	16:08:34	00:10:00	LMAX	91	86	82	77	75	76	72	70	62	79	
1	20:36:47	00:10:00	L10	66	64	69	58	56	59	54	43	35	62	Passing traffic on Queen's Grove
1	20:36:47	00:10:00	L90	55	55	52	47	45	44	39	29	25	49	
1	20:36:47	00:10:00	LEQ	64	62	65	56	54	56	51	43	35	59	
1	20:36:47	00:10:00	LMAX	83	79	75	73	69	72	68	61	58	74	
1	21:35:06	00:10:00	L10	67	62	68	54	52	54	50	40	35	58	Occasional passing traffic on Queen's Grove
1	21:35:06	00:10:00	L90	61	54	53	46	43	43	37	28	24	47	
1	21:35:06	00:10:00	LEQ	66	60	64	53	51	53	48	40	33	56	
1	21:35:06	00:10:00	LMAX	86	76	73	68	68	70	64	57	51	72	

Table B1: Noise survey results at Location 1

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Location	Start	Elapsed	Index	Octave Band Centre Frequency (Hz)									dB(A)	Comments
				32	63	125	250	500	1k	2k	4k	8k		
1	22:27:18	00:10:00	L10	68	66	75	56	55	55	50	42	36	60	Occasional passing traffic on Queen's Grove, some services noise
1	22:27:18	00:10:00	L90	62	56	55	47	45	44	38	30	26	50	
1	22:27:18	00:10:00	LEQ	67	67	72	55	53	53	49	43	35	58	
1	22:27:18	00:10:00	LMAX	86	90	82	73	68	68	67	62	54	73	
1	23:28:37	00:05:00	L10	68	64	60	55	53	54	49	42	37	58	Distant traffic
1	23:28:37	00:05:00	L90	58	54	53	47	45	45	39	30	22	49	
1	23:28:37	00:05:00	LEQ	67	62	61	55	52	52	48	42	36	56	
1	23:28:37	00:05:00	LMAX	86	79	80	75	69	69	66	62	55	74	
1	00:21:54	00:05:00	L10	67	59	58	51	48	48	42	37	34	52	Distant traffic
1	00:21:54	00:05:00	L90	61	54	55	46	43	43	37	28	24	48	
1	00:21:54	00:05:00	LEQ	66	58	57	49	46	47	41	35	31	50	
1	00:21:54	00:05:00	LMAX	82	74	64	60	57	65	53	51	45	65	
1	01:35:31	00:05:00	L10	66	58	57	49	47	48	42	37	33	52	Distant traffic, some services noise
1	01:35:31	00:05:00	L90	58	53	53	46	42	42	36	27	23	47	
1	01:35:31	00:05:00	LEQ	64	57	56	48	46	46	41	35	30	50	
1	01:35:31	00:05:00	LMAX	71	69	64	58	59	65	58	52	46	66	

Table B2: Noise survey results at Location 1 continued

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Location	Start	Elapsed	Index	Octave Band Centre Frequency (Hz)									dB(A)	Comments
				32	63	125	250	500	1k	2k	4k	8k		
2	14:58:55	00:10:00	L10	64	61	52	49	48	46	42	36	30	50	Distant traffic, water fountain
2	14:58:55	00:10:00	L90	56	55	47	45	43	43	38	30	23	47	
2	14:58:55	00:10:00	LEQ	62	59	50	48	46	45	40	34	28	49	
2	14:58:55	00:10:00	LMAX	82	71	60	60	55	60	56	51	43	62	
2	15:41:41	00:10:00	L10	65	61	53	49	47	46	42	38	33	51	Distant traffic, water fountain
2	15:41:41	00:10:00	L90	56	54	47	45	43	43	38	31	24	47	
2	15:41:41	00:10:00	LEQ	65	61	52	49	46	46	41	36	31	50	
2	15:41:41	00:10:00	LMAX	89	86	73	69	60	56	58	59	51	63	
2	20:59:32	00:10:00	L10	61	57	51	47	46	44	39	36	32	49	Distant traffic, rustling leaves
2	20:59:32	00:10:00	L90	51	51	45	42	40	40	34	27	22	45	
2	20:59:32	00:10:00	LEQ	60	55	49	46	44	43	38	34	30	47	
2	20:59:32	00:10:00	LMAX	81	71	63	60	58	59	54	51	46	59	
2	21:54:51	00:10:00	L10	60	58	51	47	46	46	41	35	31	50	Distant traffic, rustling leaves
2	21:54:51	00:10:00	L90	52	51	45	42	40	40	35	27	22	45	
2	21:54:51	00:10:00	LEQ	58	56	53	52	52	48	41	34	31	53	
2	21:54:51	00:10:00	LMAX	78	68	73	71	70	64	55	56	57	68	
2	22:41:15	00:10:00	L10	61	58	53	50	48	47	42	38	32	52	Distant traffic, water fountain
2	22:41:15	00:10:00	L90	52	52	47	45	44	44	38	29	22	48	
2	22:41:15	00:10:00	LEQ	64	57	51	49	47	46	41	36	31	50	
2	22:41:15	00:10:00	LMAX	90	80	66	68	61	62	62	59	57	67	

Table B3: Noise survey results at Location 2

Location	Start	Elapsed	Index	Octave Band Centre Frequency (Hz)									dB(A)	Comments
				32	63	125	250	500	1k	2k	4k	8k		
2	23:41:34	00:05:00	L10	60	58	51	48	47	46	41	34	29	50	Distant traffic, rustling leaves
2	23:41:34	00:05:00	L90	52	52	46	44	42	43	37	27	22	47	
2	23:41:34	00:05:00	LEQ	59	56	50	47	46	45	39	33	27	49	
2	23:41:34	00:05:00	LMAX	80	69	58	53	52	52	52	51	44	57	
2	00:38:36	00:05:00	L10	58	56	50	46	45	45	40	35	30	49	Distant traffic, water fountain
2	00:38:36	00:05:00	L90	50	51	45	42	41	42	36	27	22	45	
2	00:38:36	00:05:00	LEQ	73	66	55	47	44	44	40	35	30	49	
2	00:38:36	00:05:00	LMAX	97	92	80	69	59	58	60	57	51	69	
2	02:02:39	00:05:00	L10	57	55	49	47	45	45	39	33	29	48	Distant traffic, water fountain
2	02:02:39	00:05:00	L90	49	49	45	42	41	41	35	27	22	45	
2	02:02:39	00:05:00	LEQ	59	54	48	46	44	44	38	31	27	47	
2	02:02:39	00:05:00	LMAX	82	75	62	55	49	49	46	46	39	54	

Table B4: Noise survey results at Location 2 continued