CONABEARE ACOUSTICS

ACOUSTIC REPORT

Ref No: CS 7115-1

Royal Free Hospital
CAAP NAC Project
(West Roof)

30th November 2011

Prepared By:

.....

John E Redknap MBA, MIOA, MCMI

Checked By:

.....

David Whymark - Director

Client:

Royal Free Hampstead NHS Trust
Pond Street
Hampstead
London NW3 2QG

Conabeare Acoustics Limited
10 Chiltern Enterprise Centre, Station Road, Theale, Berkshire. RG7 4AA
Telephone 0118 930 3650 Facsimile 0118 930 3912
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FORWARD

As part of the CAPP NAC Project, new external plant is being proposed on the roof of the site. A pre-installation acoustic survey and report is therefore required to establish compliance or otherwise with the planning requirements of the local council for this area.

Conabeare Acoustics Limited has been commissioned to undertake an Environmental Sound Survey at the proposed roof location. The results of the survey will establish the Background Sound Level to enable checks to be made on the new mechanical services plant in order that they comply with planning requirements.

SUMMARY

The lowest measured Background Sound Levels $L_{A90.15MIN}$ were as follows:

$L_{A90\text{-}15min}$	57.5dB(A) between 07:00 hours to 19:00 hours (Day Time)
$L_{A90\text{-}15min}$	58.0dB(A) between 19:00 hours to 23:00 hours (Evening)
$L_{A90\text{-}15min}$	57.0dB(A) between 23:00 hours to 07:00 hours (Night Time)

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CONABEARE ACOUSTICS

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1. Author

John E Redknap MBA, MIOA, MCMI

The author has been practising in noise control engineering since 1985. He has gained a wide range of experience over this period and is employed as a Sales Engineer for **Conabeare Acoustics Ltd.**

2. Client

The survey and report has been undertaken on behalf of:

Royal Free Hospital
Pond Street
Hampstead
London NW3 2QG

3. Introduction

As part of the CAPP NAC Project, new external plant is being proposed on the roof of the site. A pre-installation acoustic survey and report is therefore required to establish compliance or otherwise with the planning requirements of the local council for this area. Conabeare Acoustics Limited has therefore been commissioned to undertake an Environmental Sound Survey of the area.

The Environmental Sound Survey has now been carried out to establish the existing Background Sound Levels. The results of the Environmental Sound Survey are used as a datum so that acoustic calculations can be undertaken to determine the likely impact of the proposed plant on the nearest sound sensitive locations.

4. Noise Principles

The Environmental Sound Survey has been carried out in accordance with the principles of BS7445-1 (2003) to establish the existing Background Sound Levels. The Background Sound Level measured is in terms of A-weighted sound pressure level L_{A90} with a time interval of 15 minutes.

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5. The Site

The main entrance to the hospital is off Pond Street, London, NW3. The proposed new plant is to be located on a roof to the rear of the site. The proposed plant location is detailed on the attached Schofield Lothian drawing number M/009 dated July 2011. This drawing also contains our notes relating to the microphone location and residential properties. Other plant was clearly visible on the roof – some of which is also indicated on the attached drawing.

Residential properties were evident at some distance from the roof, as indicated towards the bottom of the drawing, with what we were advised was a Convent located to the left of the drawing and a school positioned between the two.

The general ambient noise level in the area is expected to be a combination of noise from the mechanical services plant and the local traffic.

6. Measurement Methodology

A CEL490 (Precision) Environmental Sound Level Analyser, fitted with an Electret Microphone was set up on the corner of the proposed roof, with the tripod secured to an existing safety hand rail – see the attached location photograph.

The survey was carried out from 11:17 hours on Thursday 3rd November 2011, until 10:47 hours on Friday 4th November 2011.

The Analyser was programmed to produce the following indices:

$L_{AEQ\text{-}15min}$, $L_{A90\text{-}15min}$, $L_{A10\text{-}15min}$

Attached for your reference is a Glossary of these terms.

The analyser was checked for calibration before the survey commenced and at the end of survey with a CEL 284/2 Class 1 calibrator with no measurable deviation.

The weather during the survey period was generally dry with partly cloudy skies.

Having reviewed the results of our survey, it is our opinion that the weather experienced over the survey period has not had any detrimental effect on the recorded readings and therefore on our recommendations.

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7. Planning Noise Requirements

The Planning noise requirement of this area usually states, that any proposed plant should be at least 10dBA below the Background Sound level (L_{A90}) measured at 1 metre from the nearest effected residential property. Allowance should also be made for any tonal noise emanating from the proposed units.

8. Assessment

The objective of any specification limiting sound should be to ensure that sound emissions from the proposed plant should not materially add to the existing ambient noise climate when measured 1m from the nearest effected property window.

The level at which the target should be set is normally specified by the planning authority in their planning consent conditions.

In the absence of any such specification, we would recommend setting a limit on the proposed plant sound level as follows, with the proviso that any sound produced by this plant must be quite free of any audibly evident, tonality or similar characteristics.

The lowest measured Background Sound Levels $L_{A90.15MIN}$ were as follows:

$L_{A90\text{-}15min}$ 57.5dB(A) between 07:00 hours to 19:00 hours (Day Time)
$L_{A90\text{-}15min}$ 58.0dB(A) between 19:00 hours to 23:00 hours (Evening)
$L_{A90\text{-}15min}$ 57.0dB(A) between 23:00 hours to 07:00 hours (Night Time)

Whilst the Sound Level Analyser was positioned as remote as possible from any existing mechanical plant, the readings in our opinion, have been influenced by some of the surrounding mechanical services plant.

We have therefore investigated other survey's we have carried out at the hospital. We have found a survey undertaken at the end of August 2010, under report reference CS6884-1, on an adjacent lower roof (nom. two floors lower than the current roof). See the location photographs and also the marked drawing attached

Using data from this survey we would propose that the 24hour design target be reduced from 47dB(A) to 42dB(A). We would consider this level as a more representative figure on this particular project.

The above limits should be achieved with all plant operating normally, any plant exhibiting characteristics which are tonal or intermittent in nature should be designed to criteria 5dB(A) more stringent than those levels shown above. Allowances should also be made for the additional effect of multiple noise sources if applicable.

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From the frequency analysis the plant does not exhibit any distinct tonal characteristics and so the additional 5dB(A) penalty is not required.

We have assumed for the purposes of this report that the proposed new plant may operate 24hours a day and so we would recommend that the equipment is designed to achieve a level of 42dB(A) at the nearest noise sensitive windows.

Following our site survey we have established that there are two locations to be considered as the nearest noise sensitive windows. The first is the Convent immediately opposite the plant and the second is the residential properties diagonally opposite. Both of these locations are estimated to be 45m from the proposed plant location.

The top floor Convent windows would be level with the proposed plant, whilst the top floor residential windows are two floors lower than the roof level. The Convent windows are referenced as Assessment Location "A" in our acoustic calculations and the residential windows are referenced as Assessment Location "B".

The attached Calculation Sheet One is for Assessment Location A. This sheet illustrates that at 1 metre from the façade the Specific Sound Level would be 37dB(A) without the introduction of any acoustic treatment. This figure is below the proposed design target of 42dB(A) and should therefore meet the planning requirements of the local authority.

The attached Calculation Sheet Two is for Assessment Location B. This sheet illustrates that at 1 metre from the façade the Specific Sound Level would be 31dB(A) without the introduction of any acoustic treatment. This figure is below the proposed design target of 42dB(A) and should therefore meet the planning requirements of the local authority.

In our opinion all of the above would generally be acceptable to the local authority for this area, but all design targets should as a matter of course should be verified with the local Environmental Health or Planning Departments.

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9. Sound Level Measurements

The statistical readings obtained during the survey are attached to this report and are presented in both graphical and tabular form.

10. Glossary of Terms

L_{A90}	The sound pressure level in dB(A) which is exceeded for 90% of the time and is taken to be the effective lowest background sound level for the period by such methods of sound rating as that recommended in British Standard 4142. It will also be used as a basis for selecting limiting sound levels from new plant by Local Planning Authorities when setting Planning Consent Conditions.
L_{eq}	The "equivalent continuous sound level" for the measuring period, defined as the level in dB(A) which, if held constant over the measuring period, would produce the same amount of sound energy as does the actual varying ambient sound level. It is a measure of the amount of sound energy affecting the site from sources other than new plant or operations.
L_{A10}	The sound level exceeded for 10% of the time over the sample period. Originally used as a measure of subjective reaction to traffic noise in particular, it can also be taken as an indication of the practical maximum sound level that the building envelope will have to protect against.
dB(A)	Describes 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 3dB(A) is the minimum perceptible under normal conditions, and a change of 10dB(A) corresponds roughly to halving or doubling the loudness of a sound.

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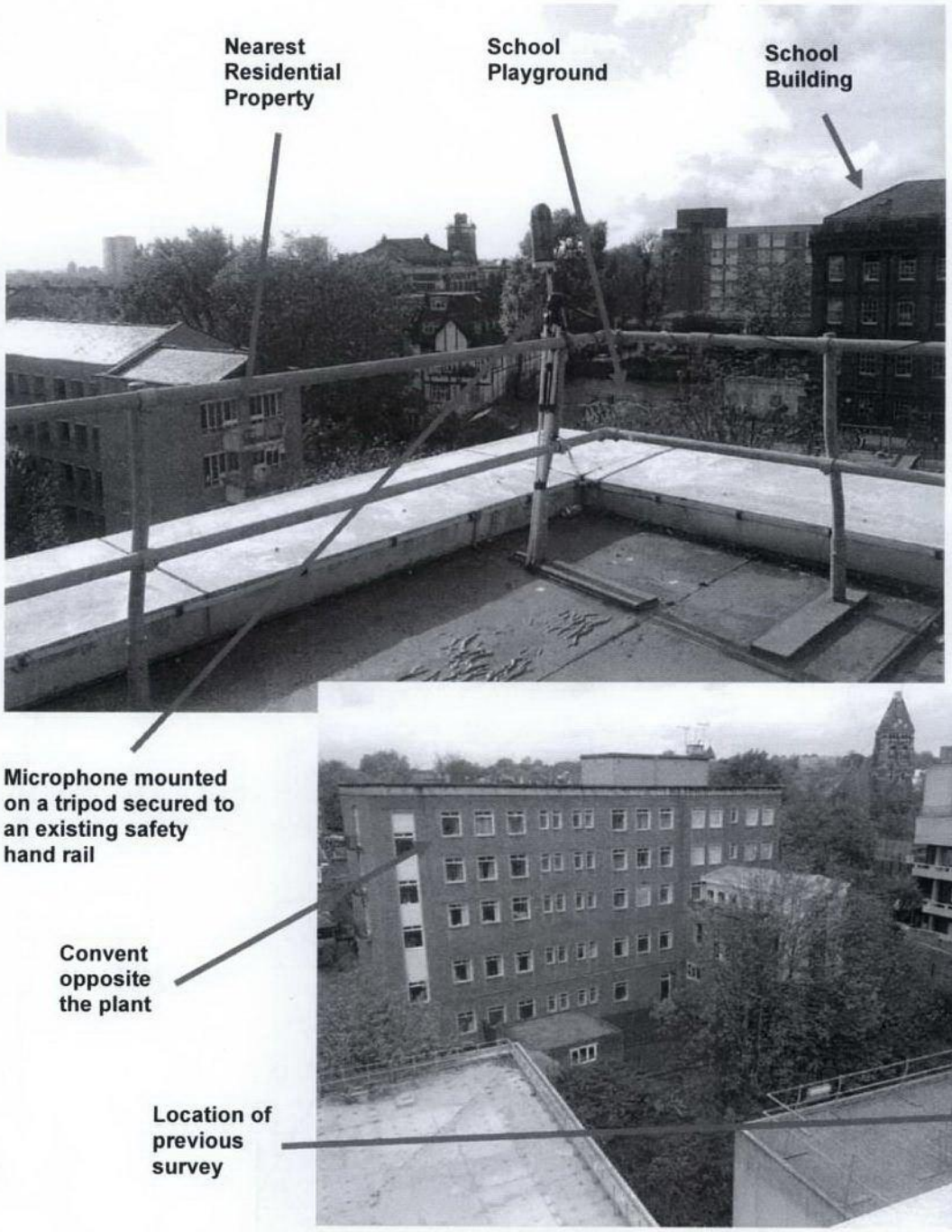
11. Location Photographs



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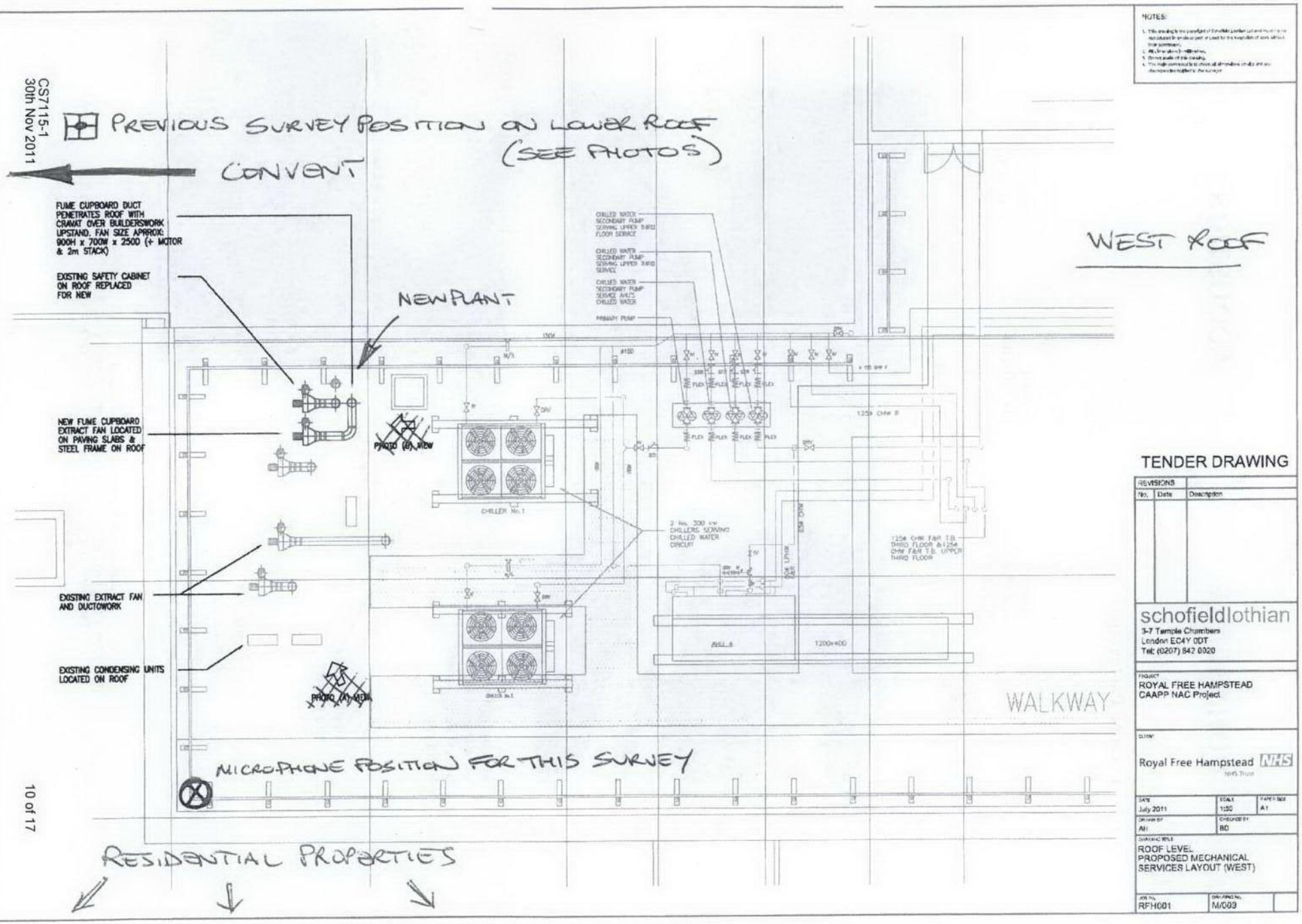
CS7115-1
30th Nov 2011



NOTES:

TENDER DRAWING

REVISIONS		
No.	Date	Description

schofieldlothian
3-7 Temple Chambers
London EC4Y 0DT
Tel: (0207) 842 0920

PROJECT
ROYAL FREE HAMPSTEAD
CAAPP NAC Project

CLIENT
Royal Free Hampstead NHS
NHS Trust

DATE	SCALE	PAPER SIZE
July 2011	1:50	A1
DRAWN BY: AH	CHECKED BY: BD	

DRAWING TITLE
ROOF LEVEL
PROPOSED MECHANICAL SERVICES LAYOUT (WEST)

JOB NO.	DRAWING NO.
RFH001	M/009

CONABEARE ACOUSTICS LTD CALCULATION SHEET - ONE

CLIENT: **Royal Free Hampstead NHS Trust**		PROJECT: **CAAPP NAC Project**							
		DATE: **30th Nov 2011**							
Roof Top Plant		Conabeare Acoustics ref: **CS7115**							
		Octave Band Centre Frequency (Hz)							
Description		**63**	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**	**dB(A)**
LOCATION 'A' ASSESSMENT										
Fan Type CMV 200	Lw	**52**	**59**	**61**	**60**	**66**	**66**	**56**	**44**	
Fan Type CMV 315	Lw	**73**	**74**	**76**	**70**	**69**	**65**	**59**	**49**	
Combined Total		**73**	**74**	**76**	**70**	**71**	**69**	**61**	**50**	**75**
Additional Surface Reflections	One	3	3	3	3	3	3	3	3	
Screening via building	None	0	0	0	0	0	0	0	0	
Distance 45m to nearest window		-44	-44	-44	-44	-44	-44	-44	-44	
Façade Correction		3	3	3	3	3	3	3	3	
Lp @1m from receivers façade		**35**	**36**	**38**	**32**	**33**	**31**	**23**	**12**	**37**

24hour design target = 42

Additional screening required	No	0	0	0	0	0	0	0	0	
Lp @1m from receivers façade		**35**	**36**	**38**	**32**	**33**	**31**	**23**	**12**	**37**

24hour design target = 42

Notes

Calculations are to the nearest top floor windows of the Convent level with the roof top plant
No allowance has been made for any noise/vibration transfer through floor/structure in the above calculations
Vibration isolation will be required for the new plant

CONABEARE ACOUSTICS LTD CALCULATION SHEET - TWO

CLIENT: **Royal Free Hampstead NHS Trust**		PROJECT: **CAAPP NAC Project**							
		DATE: **30th Nov 2011**							
Roof Top Plant		Conabeare Acoustics ref: **CS7115**							
		Octave Band Centre Frequency (Hz)							
Description		**63**	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**	**dB(A)**
LOCATION 'B' ASSESSMENT										
Fan Type CMV 200	Lw	**52**	**59**	**61**	**60**	**66**	**66**	**56**	**44**	
Fan Type CMV 315	Lw	**73**	**74**	**76**	**70**	**69**	**65**	**59**	**49**	
Combined Total		**73**	**74**	**76**	**70**	**71**	**69**	**61**	**50**	**75**
Additional Surface Reflections	One	3	3	3	3	3	3	3	3	
Screening via building		-5	-5	-5	-6	-6	-6	-6	-7	
Distance 45m to nearest window		-44	-44	-44	-44	-44	-44	-44	-44	
Façade Correction		3	3	3	3	3	3	3	3	
Lp @1m from receivers façade		**30**	**31**	**33**	**26**	**27**	**25**	**17**	**5**	**31**

24hour design target = 42

Additional screening required	No	0	0	0	0	0	0	0	0	
Lp @1m from receivers façade		**30**	**31**	**33**	**26**	**27**	**25**	**17**	**5**	**31**

24hour design target = 42

Notes

Calculations are to the nearest top floor windows of the residential properties two levels down from the roof
No allowance has been made for any noise/vibration transfer through floor/structure in the above calculations
Vibration isolation will be required for the new plant

CEL SoundTrack - dB23 1.05 © Casella CEL Ltd 2004
s:_cal quotation & order data\cs - survey\cs7115 royal free hospital\cel490 results\rfhcel.dta

- Run Summary -

Logging times:		
	dd/mm/yyyy	hh:mm:ss
Start of run	03/11/2011	11:17:38
End of run	04/11/2011	11:02:45

Overload occurred	No
Total overload time	00:00.0
Under-range occurred	No
Low battery occurred	No

Cumulative peak value	124.7 dB

User calibration information:

Calibrated before run on	03/11/2011	11:12:25	at	114	dB
Calibrated after run on	04/11/2011	11:06:15	at	114	dB
Input	Microphone				
Frequency weighting for RMS	Z				
Frequency weighting for Peak	Z				
Time weighting	Fast				
Measurement range	0 - 140 dB				
Exchange rate (Q)	3				
Period time	00:15:00				
FSI mode:	Off				

s:_cal quotation & order data\cs - survey\cs7115 royal free hospital\cel490 results\rfhcel.dta

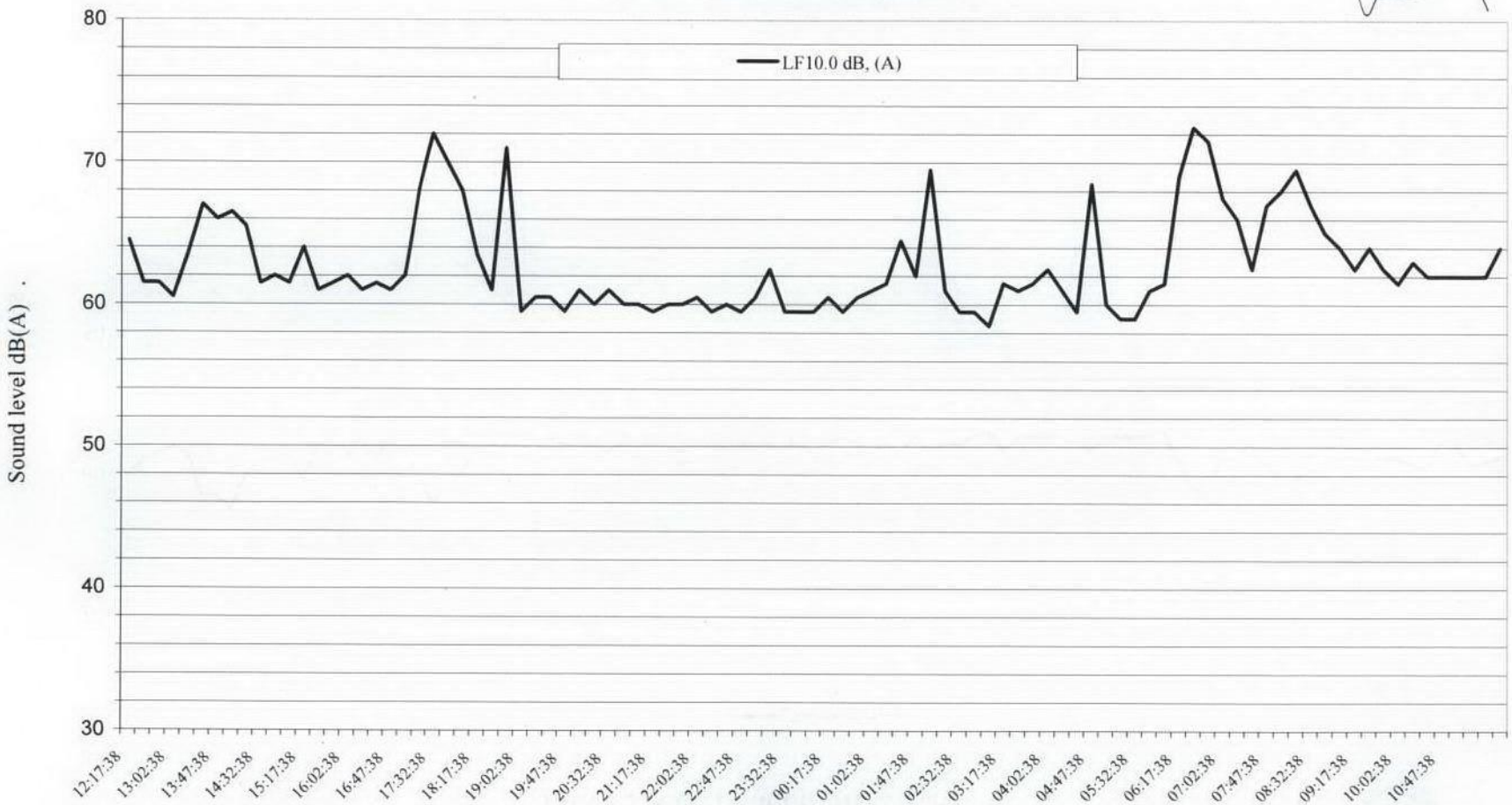
- Period Profile -

Period number	Flags	Date	Time	LF90.0	LF10.0	Leq
	(OBPZ)			dB, (A)	dB, (A)	dB, (A)
1	-----	03/11/2011	11:17:38	60.0	64.5	62.5
2	-----	03/11/2011	11:32:38	59.0	61.5	60.8
3	-----	03/11/2011	11:47:38	58.5	61.5	60.7
4	-----	03/11/2011	12:02:38	58.0	60.5	60.1
5	-----	03/11/2011	12:17:38	58.5	63.5	62.6
6	-----	03/11/2011	12:32:38	61.5	67.0	65.0
7	-----	03/11/2011	12:47:38	61.5	66.0	64.1
8	-----	03/11/2011	13:02:38	62.5	66.5	64.9
9	-----	03/11/2011	13:17:38	60.0	65.5	63.2
10	-----	03/11/2011	13:32:38	59.0	61.5	60.7
11	-----	03/11/2011	13:47:38	59.0	62.0	61.8
12	-----	03/11/2011	14:02:38	58.5	61.5	60.4
13	-----	03/11/2011	14:17:38	60.5	64.0	62.5
14	-----	03/11/2011	14:32:38	58.0	61.0	59.9
15	-----	03/11/2011	14:47:38	58.5	61.5	60.2
16	-----	03/11/2011	15:02:38	59.0	62.0	60.6
17	-----	03/11/2011	15:17:38	57.5	61.0	59.5
18	-----	03/11/2011	15:32:38	59.0	61.5	61.0
19	-----	03/11/2011	15:47:38	57.5	61.0	62.4
20	-----	03/11/2011	16:02:38	58.5	62.0	60.5
21	-----	03/11/2011	16:17:38	60.0	68.0	65.2
22	-----	03/11/2011	16:32:38	62.0	72.0	68.9
23	-----	03/11/2011	16:47:38	61.0	70.0	67.2
24	-----	03/11/2011	17:02:38	60.0	68.0	65.0
25	-----	03/11/2011	17:17:38	58.5	63.5	62.4
26	-----	03/11/2011	17:32:38	58.0	61.0	60.5
27	-----	03/11/2011	17:47:38	58.0	71.0	71.1
28	-----	03/11/2011	18:02:38	58.0	59.5	58.7
29	-----	03/11/2011	18:17:38	58.5	60.5	60.3
30	-----	03/11/2011	18:32:38	57.5	60.5	61.7
31	-----	03/11/2011	18:47:38	58.0	59.5	59.0
32	-----	03/11/2011	19:02:38	58.0	61.0	60.2
33	-----	03/11/2011	19:17:38	58.0	60.0	59.1
34	-----	03/11/2011	19:32:38	58.5	61.0	60.3
35	-----	03/11/2011	19:47:38	58.0	60.0	59.2
36	-----	03/11/2011	20:02:38	58.0	60.0	59.6
37	-----	03/11/2011	20:17:38	58.0	59.5	59.2
38	-----	03/11/2011	20:32:38	58.0	60.0	59.4
39	-----	03/11/2011	20:47:38	58.5	60.0	59.3
40	-----	03/11/2011	21:02:38	58.0	60.5	60.1
41	-----	03/11/2011	21:17:38	58.0	59.5	59.0
42	-----	03/11/2011	21:32:38	58.0	60.0	59.4
43	-----	03/11/2011	21:47:38	58.0	59.5	58.9
44	-----	03/11/2011	22:02:38	58.0	60.5	59.6
45	-----	03/11/2011	22:17:38	58.0	62.5	62.7

Period number	Flags	Date	Time	LF90.0	LF10.0	Leq
	(OBPZ)			dB, (A)	dB, (A)	dB, (A)
46	-----	03/11/2011	22:32:38	58.0	59.5	59.5
47	-----	03/11/2011	22:47:38	58.0	59.5	60.6
48	-----	04/11/2011	23:02:38	58.5	59.5	59.0
49	-----	04/11/2011	23:17:38	58.0	60.5	59.6
50	-----	04/11/2011	23:32:38	57.5	59.5	58.6
51	-----	04/11/2011	23:47:38	58.0	60.5	59.5
52	-----	04/11/2011	00:02:38	58.5	61.0	59.8
53	-----	04/11/2011	00:17:38	58.0	61.5	60.1
54	-----	04/11/2011	00:32:38	58.5	64.5	61.7
55	-----	04/11/2011	00:47:38	57.5	62.0	60.4
56	-----	04/11/2011	01:02:38	58.5	69.5	66.1
57	-----	04/11/2011	01:17:38	58.0	61.0	59.9
58	-----	04/11/2011	01:32:38	58.0	59.5	59.2
59	-----	04/11/2011	01:47:38	57.5	59.5	58.7
60	-----	04/11/2011	02:02:38	57.0	58.5	58.0
61	-----	04/11/2011	02:17:38	58.5	61.5	60.1
62	-----	04/11/2011	02:32:38	57.5	61.0	60.4
63	-----	04/11/2011	02:47:38	57.5	61.5	60.4
64	-----	04/11/2011	03:02:38	57.5	62.5	61.1
65	-----	04/11/2011	03:17:38	57.5	61.0	60.3
66	-----	04/11/2011	03:32:38	58.0	59.5	59.1
67	-----	04/11/2011	03:47:38	58.5	68.5	65.4
68	-----	04/11/2011	04:02:38	57.5	60.0	58.9
69	-----	04/11/2011	04:17:38	57.5	59.0	58.3
70	-----	04/11/2011	04:32:38	57.5	59.0	58.5
71	-----	04/11/2011	04:47:38	57.5	61.0	59.6
72	-----	04/11/2011	05:02:38	57.0	61.5	60.3
73	-----	04/11/2011	05:17:38	59.0	69.0	65.7
74	-----	04/11/2011	05:32:38	61.0	72.5	69.1
75	-----	04/11/2011	05:47:38	61.5	71.5	68.4
76	-----	04/11/2011	06:02:38	59.0	67.5	64.4
77	-----	04/11/2011	06:17:38	59.0	66.0	63.4
78	-----	04/11/2011	06:32:38	58.0	62.5	66.4
79	-----	04/11/2011	06:47:38	59.5	67.0	64.6
80	-----	04/11/2011	07:02:38	60.5	68.0	65.5
81	-----	04/11/2011	07:17:38	60.5	69.5	66.6
82	-----	04/11/2011	07:32:38	60.0	67.0	64.6
83	-----	04/11/2011	07:47:38	59.5	65.0	62.7
84	-----	04/11/2011	08:02:38	59.0	64.0	62.0
85	-----	04/11/2011	08:17:38	59.0	62.5	61.4
86	-----	04/11/2011	08:32:38	59.0	64.0	62.9
87	-----	04/11/2011	08:47:38	59.0	62.5	61.1
88	-----	04/11/2011	09:02:38	59.0	61.5	61.0
89	-----	04/11/2011	09:17:38	59.5	63.0	62.0
90	-----	04/11/2011	09:32:38	60.0	62.0	61.1
91	-----	04/11/2011	09:47:38	58.0	62.0	60.6
92	-----	04/11/2011	10:02:38	58.0	62.0	60.6
93	-----	04/11/2011	10:17:38	59.5	62.0	60.8
94	-----	04/11/2011	10:32:38	59.5	62.0	61.0
95	-----	04/11/2011	10:47:38	59.0	64.0	61.9

Royal Free Hampstead NHS Trust

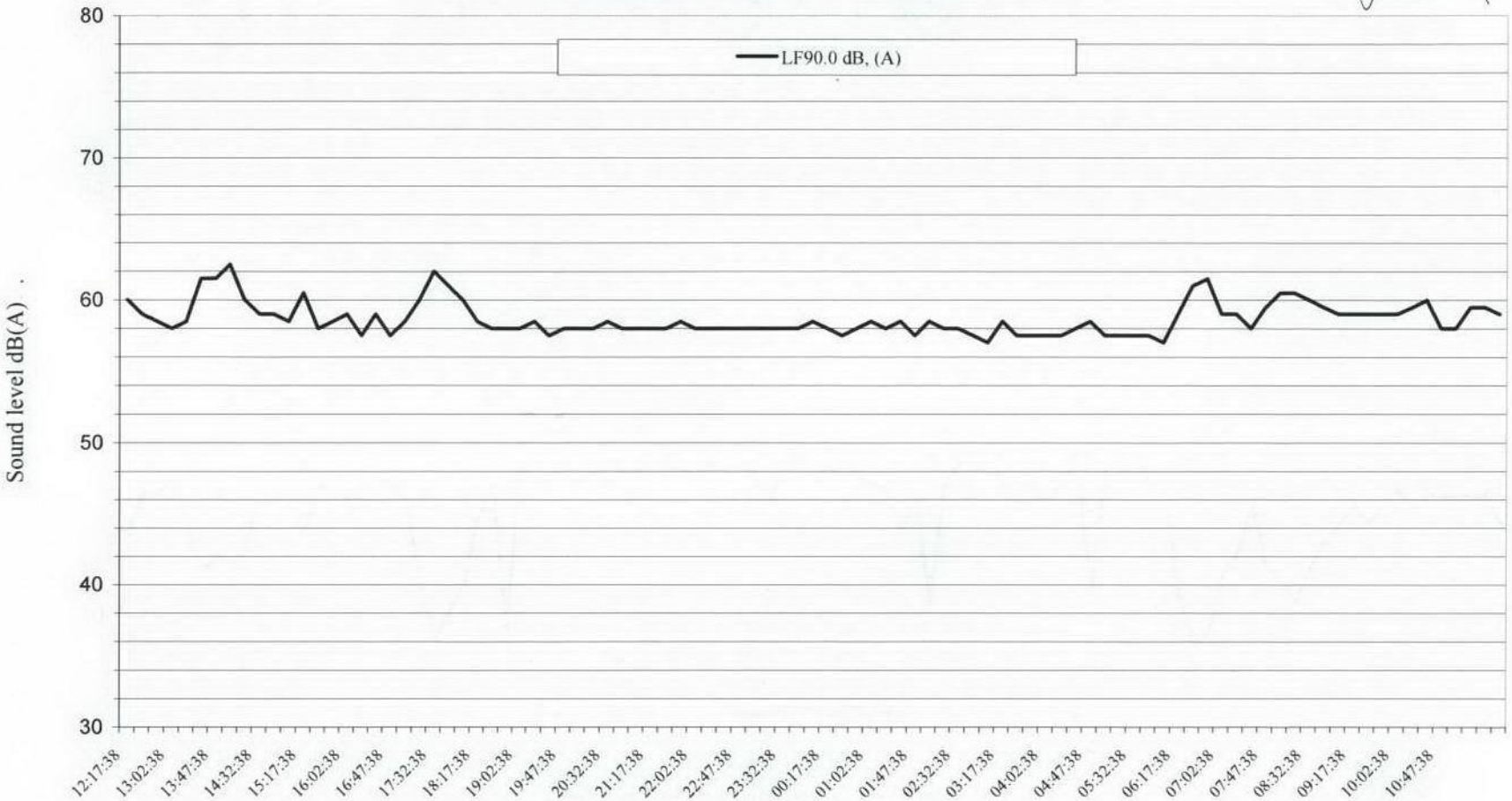
Pond Street, London. NW3 2QG



Start 03-11-2011 through to 04-11-2011

Royal Free Hampstead NHS Trust

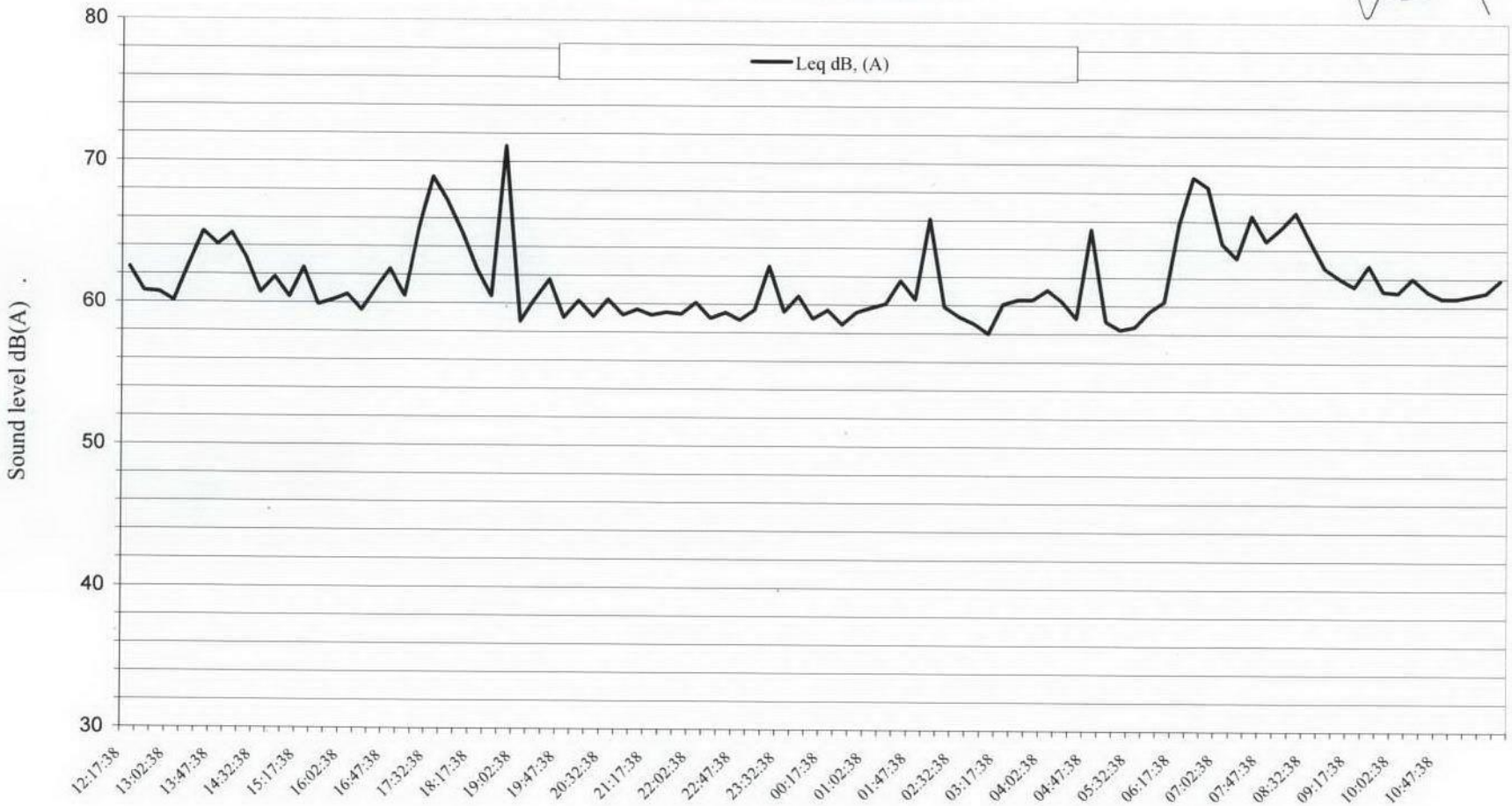
Pond Street, London. NW3 2QG



Start 03-11-2011 through to 04-11-2011

Royal Free Hampstead NHS Trust

Pond Street, London. NW3 2QG



Start 03-11-2011 through to 04-11-2011