RBA ACOUSTICS

THE CONSTITUTION, CAMDEN

Plant Noise Assessment

Reference: 10428.RP01.PNA.0
Prepared: 15 October 2020
Revision Number: 0

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Plant Noise Assessment

THE CONSTITUTION, CAMDEN

Reference: 10428.RP01.PNA.0
Prepared: 15 October 2020

Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	1 October 2020	Robert Harris-Marshall	David Johnston
1	Minor plant design amendments	15 October 2020	Robert Harris-Marshall	David Johnston

Terms of contract:

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

In line with our Environmental Policy, up to two hard copies of the report will be provided upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.

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1.0 INTRODUCTION

The Constitution, Camden is set to undergo a refurbishment which includes the installation of external plant units such as condensers, extract fans and supply fans, mostly located atop the roof of the premises. As part of the planning application, Camden Council requires consideration be given to atmospheric noise emissions from the proposed equipment at the nearest noise-sensitive property.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with Camden's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

In accordance with the requirements of the Local Authority, monitoring of the prevailing background noise was undertaken between 12:00 on Thursday 27 August 2020 to 11:00 on Friday 28 August 2020.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during installation and removal of the equipment and weather reports for the area, weather conditions were generally dry with little wind for the most part. There were some showers of heavy rainfall during the measurement period, however these were both sporadic and occurred during the busier periods of the day (i.e. evening), where typically noise levels are relatively louder than other periods of the day. It is not considered that these events would have affected the reliability of the results.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15-minutes duration.

2.2 Measurement Location

Measurement Position (MP) – Rear Garden

Measurements were undertaken at the rear garden of The Constitution with the microphone positioned approximately 4m above ground level. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the proposed plant to the rear of the property. The prevailing noise climate was noted to mainly consist of road traffic noise from St Pancras Way and, on occasion, slight noise emissions from a nearby condenser. This existing plant noise is not considered to have affected the reliability of the results.

This measurement position is also illustrated on the site plan in Figure 1 in Appendix E.

2.3 Instrumentation

Details of the instrumentation used to undertake the survey are provided in Appendix B.

The sound level meter was calibrated both prior to and on completion of the survey with no significant calibration drift observed.

3.0 RESULTS

The noise levels at the measurement positions are shown as time-histories on the attached Graphs 1-2.

In order to ensure a worst-case assessment, the lowest background L_{A90} noise levels measured have been used in our analyses. The lowest L_{A90} and the period averaged L_{Aeq} dB noise levels measured are summarised below.

Table 1 – Measured Levels

Measurement Period	L_{90} (dBA)	L_{eq} (dBA)
Daytime (07:00 – 23:00)	41	51
Night-time (23:00 – 07:00)	36	46
Kitchen opening hours (08:00 – 22:00)	42	52
Premises opening hours (09:00 – 00:00)	40	51
24-hour operation (00:00 – 00:00)	36	50

4.0 CRITERIA

The requirements of Camden Council Environmental Health Department regarding new building services plant are outlined in the Camden Local Plan (2017) as follows:

> *"[...] it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases, a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."*

Based on the measured noise levels provided in Section 3.0 the following noise limits are therefore proposed at the nearest noise-sensitive receptors to the proposed plant:

Kitchen opening hours (08:00 – 22:00) 32dBA
Premises opening hours (09:00 – 00:00) 30dBA
24-hour operation (00:00 – 00:00) 26dBA

In line with the Camden Local Plan, should the proposed plant be identified as having intermittent or tonal characteristics, a further 5dB penalty should be subtracted from any of the above proposed noise emission limits.

5.0 ASSESSMENT

Our assessment has been based upon the following information:

5.1 Proposed Plant Items

Table 2 – Plant Information

Ref.	Manufacturer/Model/Duty	Plant Type
AC.1-2	2No. Mitsubishi PUZ-ZM100YKAR1	Air-conditioning external condenser
AC.3	1No. Mitsubishi PUHZ-ZRP250YKA3	Air-conditioning external condenser
CC.1	1No. Beermaster BMO-300 1/3	Cellar cooling condenser
CR.1	1No. DUET+ 1-1H ST	Cold room condenser
KSF.1	1No. MUB 62-630D4 IE2 Multibox	Kitchen supply fan
KEF.1	1No. MUB 62-630D4 IE2 Multibox	Kitchen extract fan

5.2 Operating Periods

The air-conditioning plant (AC.1-3) will be in operation during the premises opening hours (09:00 – 00:00), the kitchen extract and supply fans will be operating during the kitchen opening hours (08:00 – 22:00) and the cellar cooling (CC.1) and cold room (CR.1) condensers will be in 24-hour operation.

5.3 Position of Units

The air-conditioning plant (AC.1-3), along with the cellar cooling (CC.1) and cold room (CR.1) condensers, will be situated on the rooftop of the premises. The kitchen extract and supply fans will be located internally where KSF.1 will be located within the roof cavity and KEF.2 will be situated within a 2nd floor plant room. The 2nd floor plant room is proposed to be ventilated through the use of 2No. slate roof vent grilles which will allow noise breakout from the plant room and roof cavity via the openings within the above ceiling and roof. The kitchen fans will be ducted to high level and terminate above the rooftop.

The equipment positions are indicated on the site plan in Figures 2 and 3 in Appendix E.

5.4 Noise Levels

Information regarding the noise levels of the proposed plant has been provided by both the M&E consultants (Elemental) and the manufacturer of the unit. The associated plant noise levels are detailed as follows:

Table 3 – Plant Noise Levels

Unit	Function	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
			63	125	250	500	1k	2k	4k	8k
AC.1-2	Heating	L_p at 1m	54	54	53	49	46	41	36	29
AC.3	Heating	L_p at 1m	66	63	61	60	58	53	48	42
CC.1	-	L_p at 10m	47dBA (no octave band data available)							

Unit	Function	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
			63	125	250	500	1k	2k	4k	8k
CR.1	-	L_p at 10m	33dBA (no octave band data available)							
KSF.1 & KEF.1	Outlet	L_w	101	93	90	86	82	78	73	68
	Inlet	L_w	99	91	88	84	88	76	71	66
	Casing	L_w	88	80	77	73	59	65	60	55

Review of the available octave band data provides no indication of any tonal characteristics associated with the proposed plant.

5.5 Locations of Nearest Residential Windows

Receptor 1 (R1) – Rear of 7 Barker Drive

The closest residential windows to the plant were advised as being those to the rear of 7 Barker Drive approximately 20m away from the nearest plant unit and screened from the rooftop plant by the roof parapet.

Receptor 2 (R2) – Star Wharf Apartments

Other noise-sensitive windows close to the plant were advised as being those to the rear of Star Wharf Apartments approximately 32m away from the nearest plant unit and partially screened from the rooftop plant by the roof parapet.

5.6 Mitigation

In-Duct Attenuation

We recommend that the KSF.1 and KEF.1 are fitted with atmosphere-side in-duct attenuators. The attenuators should be capable of achieving the performance levels detailed in the specification below. Our database shows that attenuators of a 30% free area and 600mm length should be capable of achieving this performance level, however other configurations would be acoustically acceptable provided they achieve the insertion losses provided in Table 4.

Table 4 – In-Duct Attenuation Specification

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
4	8	12	17	29	28	23	16

The attenuators above should mitigate noise within the ductwork on the atmospheric side of the fans which, in turn, will reduce the noise levels at the nearest receptors.

Adoption of the above would ensure that noise levels to the rear of the property are within the criteria required by Camden Council, as detailed within the following section.

5.7 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting cumulative noise levels from the proposed plant at the nearest residential windows, based on the information stated above, is summarised below.

- Source Term L_p / L_w
- In-Duct Losses (Ducted plant only)
- Roof Cavity Resonance Corrections
- Radiation Corrections (L_w to L_p)
- 20LogR Distance Attenuation
- Screening
- Directivity
- Mitigation (Specified in Section 5.6)

Calculation sheets are attached for further information in Appendix C.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 5 – Predicted Noise Levels

Operating Period	Prediction (dBA)		Criterion (dBA)
	R1 – Rear of 7 Barker Dr	R2 – Star Wharf Apartments	
Kitchen opening hours (08:00 – 22:00)	29	29	32
Premises opening hours (09:00 – 00:00)	25	26	30
24-hour operation (00:00 - 00:00)	24	23	26

Subject to mitigation being adopted as detailed in Section 5.6, noise from the proposed plant is within the target criteria and can be considered acceptable.

6.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that condensing units and fans be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7.0 CONCLUSION

Measurements of the existing background noise levels at The Constitution, Camden have been undertaken. The results of the measurements have been used in order to determine the required criteria for atmospheric noise emissions from the future plant installations.

The results of the assessment indicate atmospheric noise emissions from the plant are within the criteria required by Camden Council providing suitable mitigation measures are employed. As such, the proposed plant installations should be considered acceptable.

Appendix A – Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Instrumentation

The following equipment was used for the measurements

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1406116	U30290	5 December 2020
Norsonic Pre Amplifier	1209	20295		
Norsonic ½“ Microphone	1225	305325	33945	5 December 2020
Norsonic Sound Calibrator	1251	34307	U30288	5 December 2020

Appendix C – Plant calculations

A summary of the noise levels at each receiver from each proposed plant item is provided below, together with the overall predicted level. Note that all values are given as integers and are therefore subject to rounding errors.

Unit	Operating Times	Predicted Receive Levels at Receptor 1 (dBA)	Predicted Receive Levels at Receptor 2 (dBA)
AC.1-3	09:00 – 00:00	19	22
CC.1	00:00 – 00:00	24	23
CR.1	00:00 – 00:00	11	11
KSF.1	08:00 – 22:00	23	25
KEF.1	08:00 – 22:00	23	19
Total Received Level (dBA)		29	29

A summary of the cumulative noise levels at each receiver during each operating period is provided below.

Op Period	AC.1-3	CC.1 / CR.1	KSF.1 / KEF.1	Cumulative Received Level		Target
				R1	R2	
Kitchen opening hours (08:00 - 22:00)	x	x	x	29	29	32
Premises opening hours (09:00 - 00:00)*	x	x		25	26	30
24-hour operation (00:00 - 00:00)*		x		24	23	26

* Please note that whilst the KSF.1 and KEF.1 will be in operation partially during this period, the target criterion for this operating period has been taken from the lowest L_{A90} which occurred outside of the kitchen opening hours.

Calculation examples are provided below.

AC.1-3 to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
AC.1-3	Cumulative L_p at 1m	66	64	62	61	58	54	49	42	63
Screening	Roof parapet	-8	-10	-12	-15	-18	-20	-20	-20	-
Distance loss	25m	-28	-28	-28	-28	-28	-28	-28	-28	-
Total Received Level at R1		**30**	**26**	**22**	**18**	**12**	**6**	**1**	**0**	**19**

CC.1 to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
CC.1 *	L_p at 10m	66	64	62	61	58	54	49	42	47
CC.1	L_p at 1m	75	69	65	64	63	58	52	47	67
Screening	Roof parapet	-8	-10	-12	-15	-18	-20	-20	-20	-
Distance loss	23.5m	-27	-27	-27	-27	-27	-27	-27	-27	-
Total Received Level at R1		**40**	**32**	**26**	**22**	**18**	**11**	**5**	**0**	**24**

* Assumed spectrum to allow for detailed calculation based on similar-sized unit

CR.1 to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
CR.1 *	L_p at 10m	41	35	31	30	29	24	18	13	33
CR.1	L_p at 1m	61	55	51	50	49	44	38	33	53
Screening	Roof parapet	-8	-10	-12	-15	-18	-20	-20	-20	-
Distance loss	23.5m	-27	-27	-27	-27	-27	-27	-27	-27	-
Total Received Level at R1		**26**	**18**	**11**	**7**	**3**	**0**	**0**	**0**	**11**

* Assumed spectrum to allow for detailed calculation based on similar-sized unit

KSF.1 Supply Grille to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
KSF.1	Inlet L_w	99	91	88	84	88	76	71	66	90
In-Duct Losses (bends / duct radiation)		-3	-2	-1	-1	-1	-1	-1	-1	-
In-Duct Attenuator		-4	-8	-12	-17	-29	-28	-23	-16	-
Grille End Reflection		-5	-2	0	0	0	0	0	0	-
Hemi-Spherical Radiation (L_w to L_p)		-8	-8	-8	-8	-8	-8	-8	-8	-
Directivity Losses	150^0 Horizontal	-1	-2	-3	-7	-9	-8	-8	-8	-
Distance loss	23.5m	-27	-27	-27	-27	-27	-27	-27	-27	-
Screening	Roof parapet	-9	-11	-13	-16	-19	-20	-20	-20	-
Total Received Level at R1		**42**	**31**	**24**	**8**	**0**	**0**	**0**	**0**	**20**

KSF.1 Casing to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
KSF.1	Casing L_w	88	80	77	73	59	65	60	55	74
Hemi-Spherical Radiation (L_w to L_p)		-8	-8	-8	-8	-8	-8	-8	-8	-
Cavity Resonance		+6	+6	+6	+6	+6	+6	+6	+6	-
Roof losses	SRI 18mm plywood + vent gaps	-16	-17	-17	-18	-18	-18	-18	-16	-
Screening	Roof parapet	-6	-6	-8	-9	-12	-15	-18	-20	-
Distance loss	22m	-26	-26	-26	-26	-26	-26	-26	-26	-
Total Received Level at R1		**38**	**29**	**24**	**18**	**1**	**4**	**0**	**0**	**20**

KEF.1 Discharge Flue to Receptor 1

Calculation	Detail	Noise Levels (dB) at Octave Band Centre Frequency								dBA
		63	125	250	500	1000	2000	4000	8000	
KSF.1	Inlet L_w	101	93	90	86	82	78	73	68	88
In-Duct Losses (bends / duct radiation)		-6	-5	-4	-3	-4	-4	-4	-4	-
In-Duct Attenuator		-4	-8	-12	-17	-29	-28	-23	-16	-
Grille End Reflection		-9	-5	-2	0	0	0	0	0	-
Hemi-Spherical Radiation (L_w to L_p)		-8	-8	-8	-8	-8	-8	-8	-8	-
Directivity Losses	90^0 Vertical	0	0	0	0	-4	-7	-7	-7	-
Distance loss	21m	-26	-26	-26	-26	-26	-26	-26	-26	-
Screening	Roof parapet	-7	-8	-10	-12	-15	-18	-20	-20	-
Total Received Level at R1		**41**	**33**	**28**	**20**	**0**	**0**	**0**	**0**	**23**

Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiplying the two scores and is then used to determine the course of action.

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Attenuators/ Acoustic Lagging	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging	Skin & respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Site Plans

The Constitution, Camden

L_{Aeq} Time History

Rear Garden - Thursday 27 August to Friday 28 August 2020

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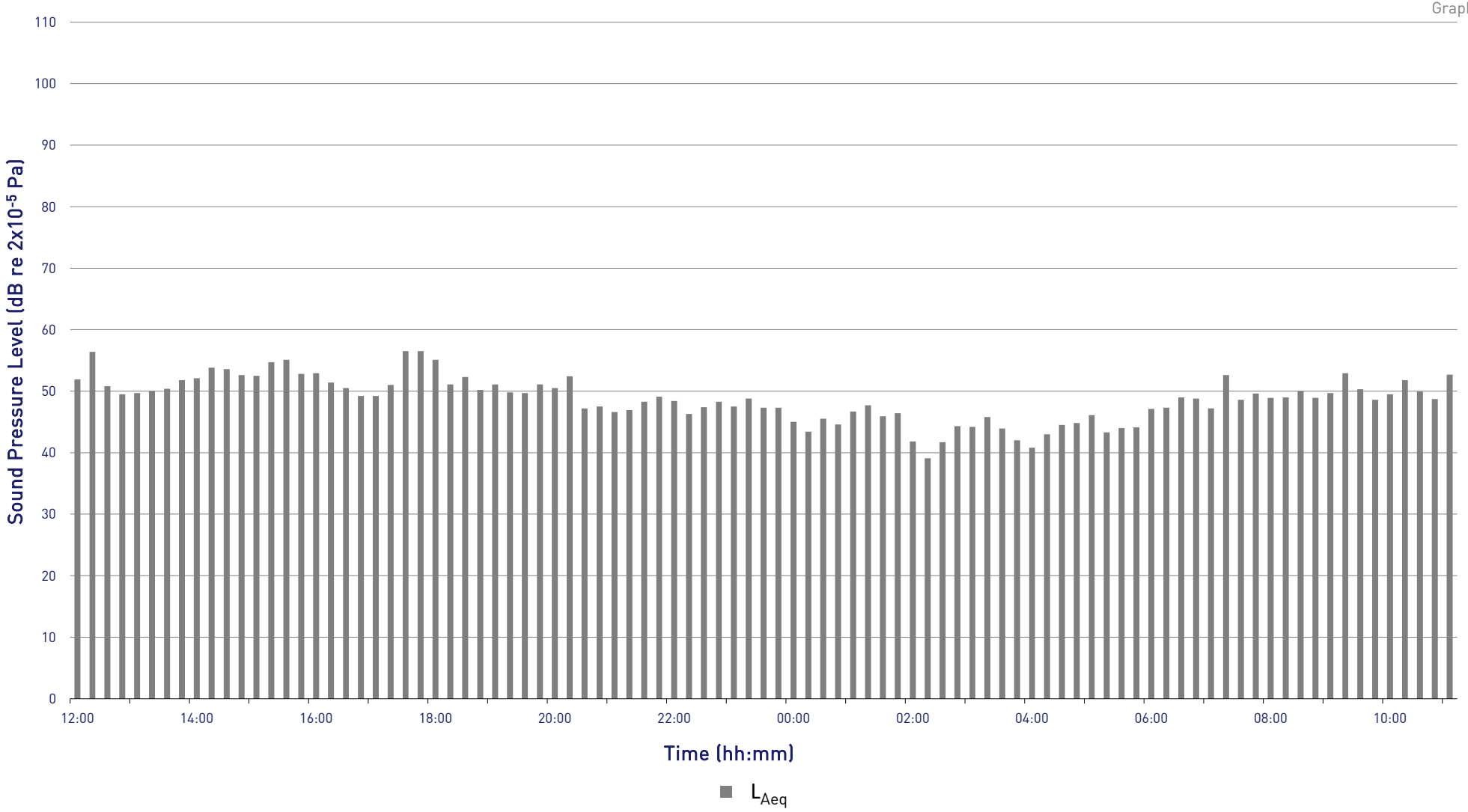
Project: 10428

Graph 1



The Constitution, Camden

$L_{Amax,f}$ and L_{A90} Time History

Rear Garden - Thursday 27 August to Friday 28 August 2020

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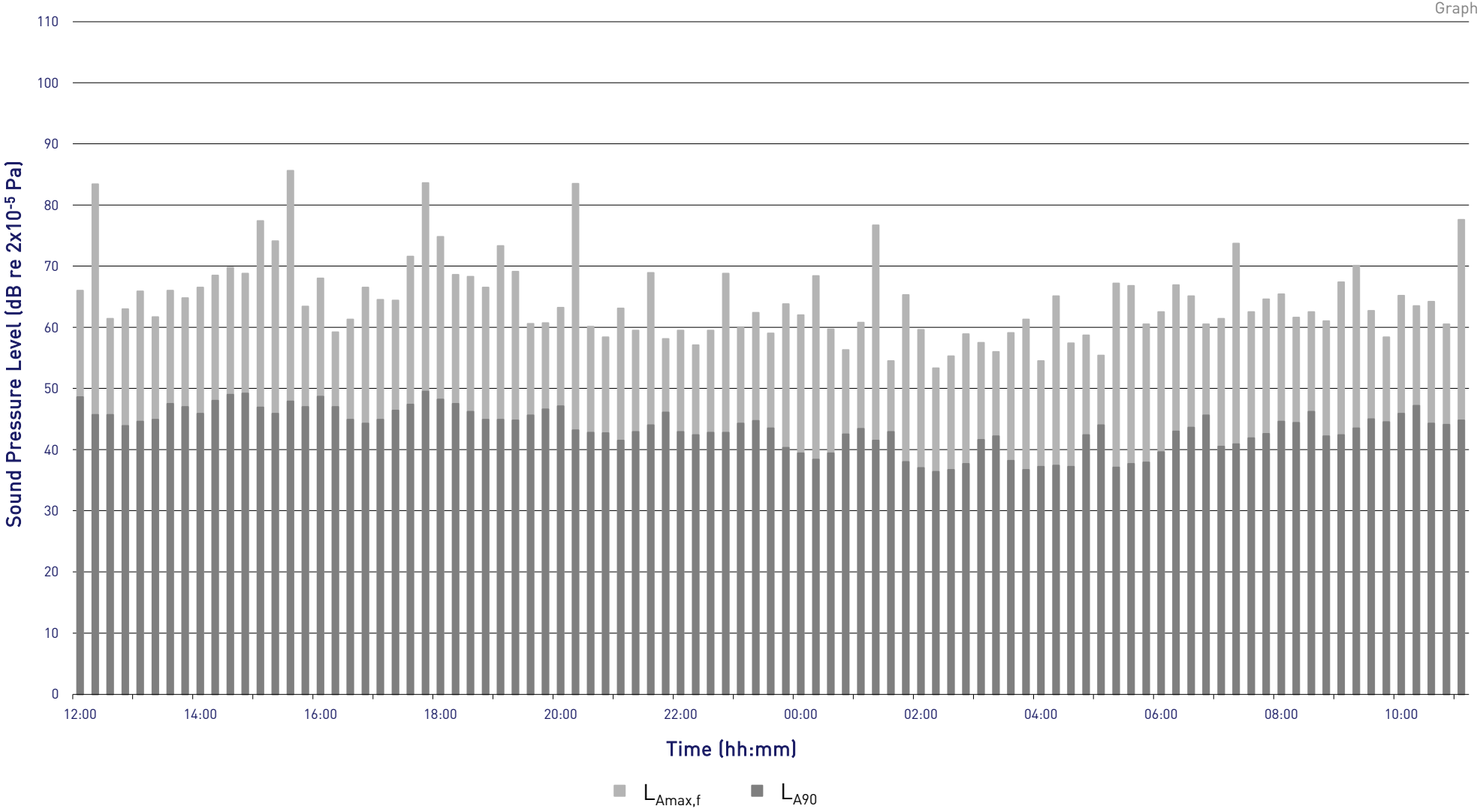
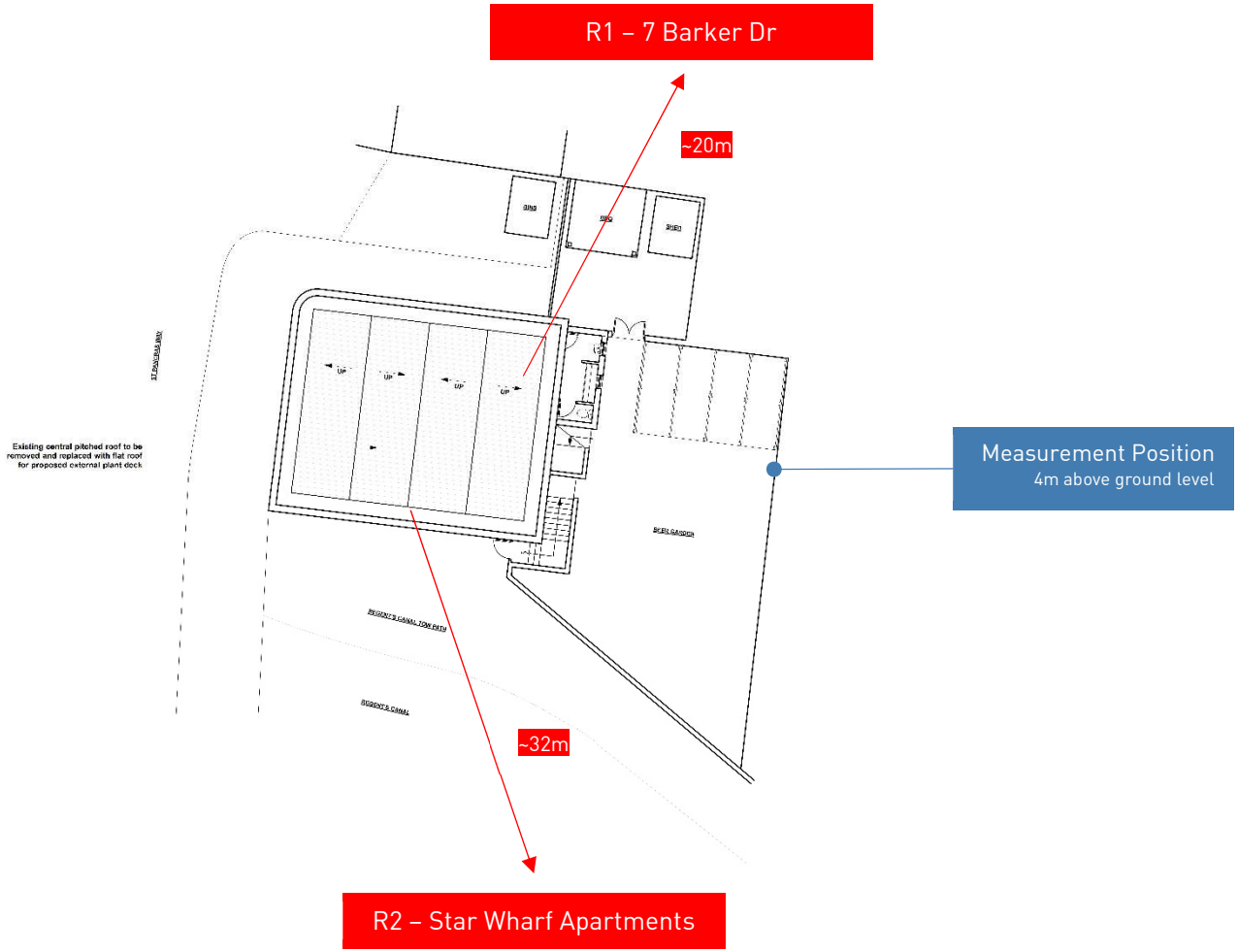
Project: 10428

Graph 2





The Constitution, Camden
Existing Site Plan (Receptor Distances & Survey Location)
Project 10428

Figure 1
15 October 2020
Not to Scale

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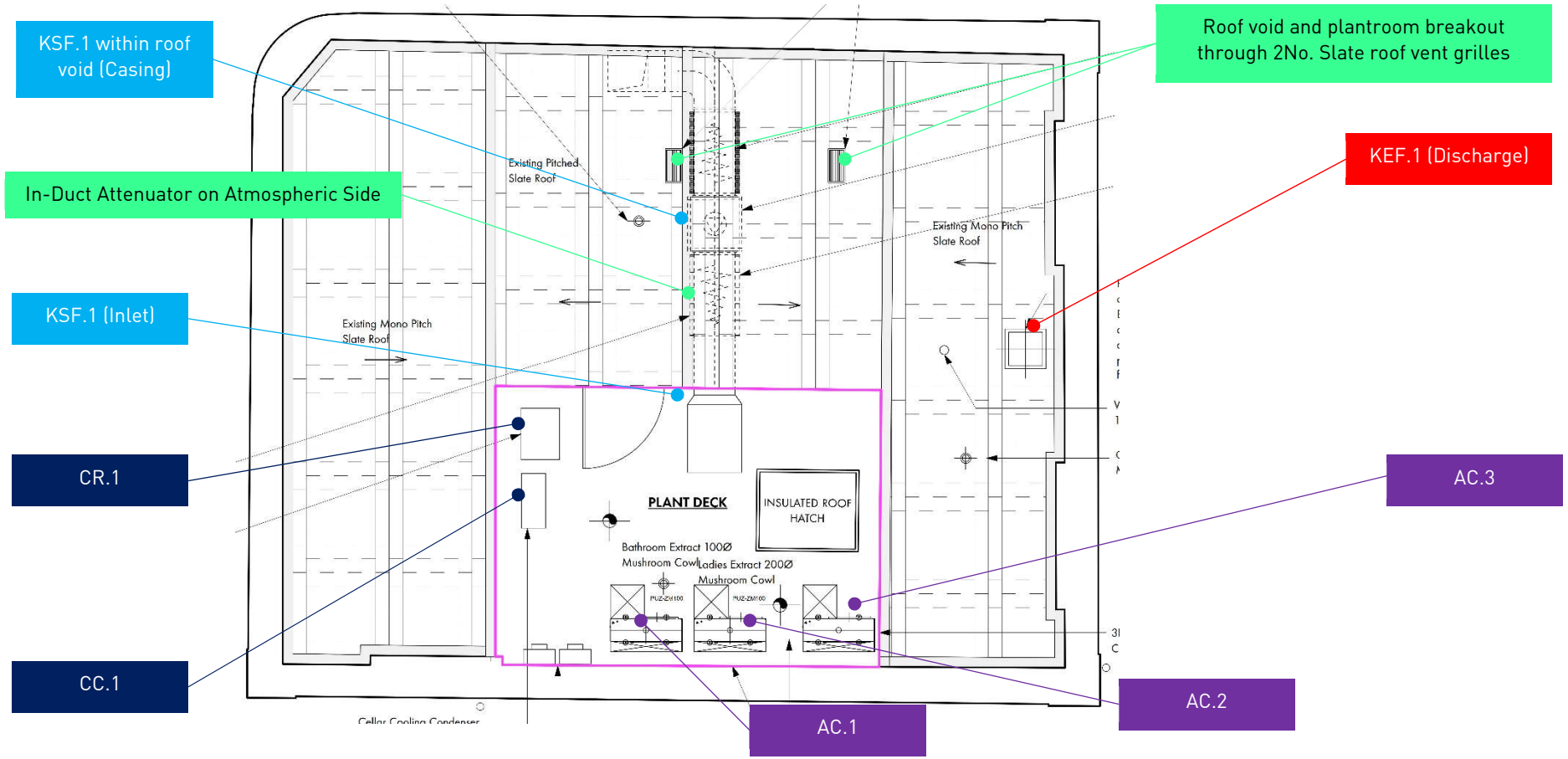

The Constitution, Camden
Proposed Roof Plan
Project 10428

Figure 2
15 October 2020
Not to Scale

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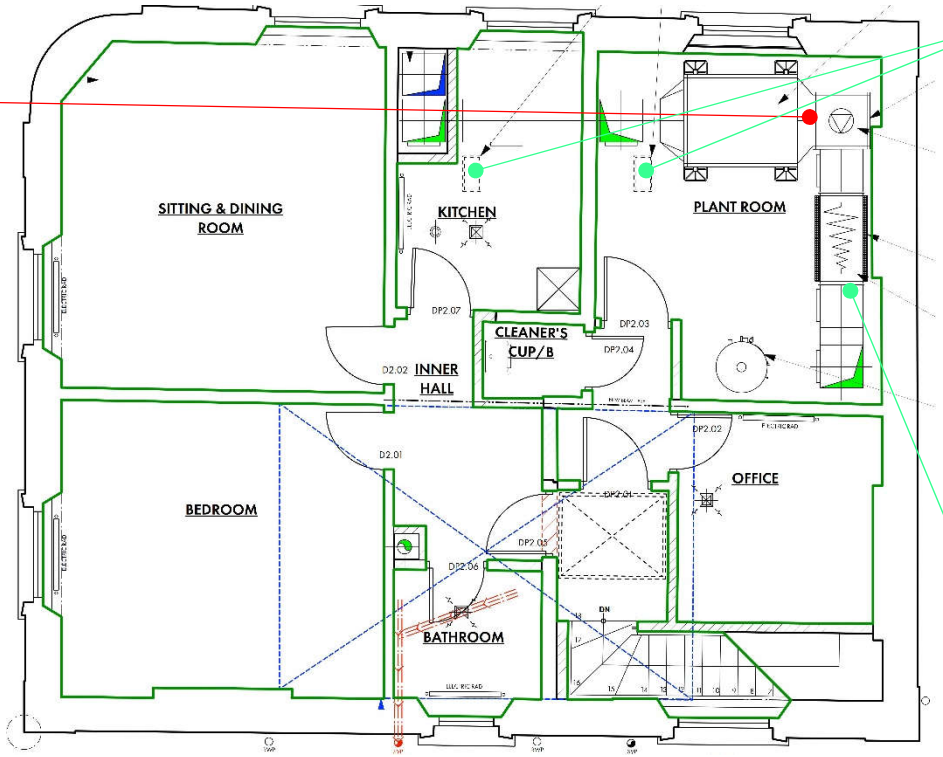
KEF.1 (Casing)



Roof void and plantroom breakout through 2No. Slate roof vent grilles

In-Duct Attenuator on Atmospheric Side

The Constitution, Camden
Proposed 2nd Floor Plan
Project 10428

Figure 3
15 October 2020
Not to Scale

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