NSL
Noise Solutions Ltd

# Deliveroo

**115 to 121 Finchley Road**
**Swiss Cottage**
**London**
**NW3 6HY**

## Plant Noise Impact Assessment

On behalf of

deliveroo

Project Reference: 86967 | Revision: 03 | Date: 4 August 2017

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## Document Information

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| **For and on behalf of Noise Solutions Ltd** | | | | |

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| 1 | 1/12/2017 | Update reference to Camden London Borough policies | AM | NAC |
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# 1.0 Introduction

1.1. A Deliveroo kitchen is located within an existing building along Finchley Road in Swiss Cottage, London. Noise Solutions Ltd (NSL) has been commissioned to undertake a noise impact assessment in relation to the plant noise emissions from the building services plant serving the kitchen.

1.2. Noise emission levels for the installed plant have been predicted at the nearest noise sensitive receptors to the site and assessed against the relevant local and national guidance.

1.3. Appendix A contains a guide to common acoustic terminology.

# 2.0 Details of development proposals

2.1. A Deliveroo kitchen is located on the ground floor of an existing building located on the western side of Finchley Road in Swiss Cottage, London. There are currently eight kitchens on the site, with the potential to add a further kitchen in the future.

2.2. The installed ventilation plant comprises three supply Air Handling Units (AHU) and three kitchen extract fans. All plant is located inside the building with external intake and discharge vents. Appendix D contains the noise output data for the proposed plant.

2.3. Operating hours are 08:30 to midnight, with cooking and deliveries out 17:00 - 23:00 Monday to Wednesday and 12:00 – 23:00 Thursday to Saturday. The period between 23.00 and midnight is used for cooling off and cleaning up.

# 3.0 Nearest noise sensitive receptors

3.1. The area surrounding the site contains mixed residential and commercial properties. The nearest residential dwellings are above the shops adjoining the proposed kitchen (Reference R1) at a distance of approximately 2m from the closest ventilation grille. There are further residential properties (Reference R2) behind the kitchen along Dobson Close at a distance of approximately 20m from the closest proposed plant item.

3.2. Appendix B contains an aerial photograph showing the site and surrounding area.

# 4.0 Existing noise climate

4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the plant area, during the quietest times at which the plant will operate.

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) | | | |
|---|---|---|---|---|
| | $L_{Aeq(15min)}$ | $L_{Amax(15min)}$ | $L_{A10(15min)}$ | $L_{A90(15min)}$ |
| Daytime (07.00 - 23.00 hours) | 55-69 | 65-92 | 57-75 | 54-59 |
| Operating hours (08.30 – 24.00) | 55-69 | 65-92 | 56-75 | 54-59 |
| Night-time (23.00 - 07.00 hours) | 53-60 | 57-91 | 54-59 | 52-58 |

4.3. The noise climate at the nearest residential flat overlooking the site was dominated by noise from existing plant serving other premises in the area. In order to be robust, the lowest $L_{A90,15min}$ background levels are therefore deemed to be representative.

4.4. It should be noted that BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* states the following with regard to the measurement of background noise levels;

> *Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.*

# 5.0 Plant noise design criteria

## National Planning Policy Framework

5.1. The National Planning Policy Framework (NPPF) was introduced in March 2012. The document sets out the Government's planning policies for England and how these are expected to be applied.

5.2. *Paragraph 123* of the *NPPF* states that planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on quality of life arising from noise from new development, including through the use of conditions;*

- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established [subject to the provisions of the Environmental Protection Act 1990 and other relevant law]; and*

- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

5.3. Furthermore the NPPF gives weight to the requirements of the local authority as it states the following:

> *11. Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise.*
>
> *12. This National Planning Policy Framework does not change the statutory status of the development plan as the starting point for decision making. Proposed development that accords with an up-to-date Local Plan should be approved, and proposed development that conflicts should be refused unless other material considerations indicate otherwise. It is highly desirable that local planning authorities should have an up-to-date plan in place.*
>
> *13. The National Planning Policy Framework constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications.*

## Planning Practice Guidance – Noise

5.4. As of March 2014, a Planning Practice Guidance (PPG) for noise was issued which provides additional guidance and elaboration on the aims of Paragraph 123 in the NPPF. The PPG advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur;

- Whether or not an adverse effect is occurring or likely to occur; and

- Whether or not a good standard of amenity can be achieved.

5.5. This guidance introduced the concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). NOAEL differs from NOEL in that it represents a situation where the acoustic character of an area can be slightly affected (but not such that there is a perceived change in the quality of life). UAEL represents a situation where noise is 'noticeable',

'very disruptive' and should be 'prevented' (as opposed to SOAEL, which represents a situation where noise is 'noticeable' and 'disruptive', and should be 'avoided').

5.6. As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

5.7. The LOAEL is described in PPG as the level above which "noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life."

5.8. PPG identifies the SOAEL as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."

*5.9.* In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to the noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that: *"…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."*

5.10. The relevant guidance in the PPG in relation to the adverse effect levels is summarized in Table 2.

*Table 2: Summary of Effect Levels*

| Perception | Examples of Outcomes | Increasing Effect Level | Action |
|---|---|---|---|
| **Not Noticeable** | No Effect | No Observed Effect | No specific measures required |
| **Noticeable and not Intrusive** | Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life. | No Observed Adverse Effect | No specific measures required |
| **Lowest Observed Adverse Effect Level** | | | |
| **Noticeable and Intrusive** | Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life. | Observed Adverse Effect | Mitigate and reduce to a minimum |
| **Significant Observed Adverse Effect Level** | | | |
| **Noticeable and Disruptive** | The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area. | Significant Observed Adverse Effect | Avoid |
| **Noticeable and very Disruptive** | Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory | Unacceptable Adverse Effect | Prevent |

5.11. This assessment will assess the impact of scooter deliveries from the kitchen in line with the NPPF. As the NPPF does not provide explicit objective assessment methodologies, various guidance documents and standards will be taken into account as summarized in the following section.

## Camden London Borough Council

5.12. The Camden Local Policy document dated 2017 states in Policy A1 *'Managing the impact of development'* that for noise and vibration:

> *"Noise and vibration can have a major effect on amenity. The World Health Organisation (WHO) for example states that excessive noise can seriously harm human health, disturb sleep and have cardiovascular and behavioural effects. Camden's high density and mixed-use nature means that disturbance from noise and vibration is a particularly important issue in the borough.*
>
> *Where uses sensitive to noise are proposed close to an existing source of noise or when development that is likely to generate noise is proposed, the Council will require an acoustic report to accompany the application. Further detail can be found in Policy A4 -*

*Noise and Vibration and our supplementary planning document Camden Planning Guidance 6: Amenity."*

5.13. Policy A4 *'Noise and Vibration'* states under the section titled *'Plant and other noise generating equipment'* that:

*"Planning conditions will be imposed to require that plant and equipment which may be a source of noise is kept working efficiently and within the required noise limits and time restrictions. Air conditioning will only be permitted where it is demonstrated that there is a clear need for it after other measures have been considered (Policy CC2 Adapting to climate change). Conditions may also be imposed to ensure that attenuation measures are kept in place and are effective throughout the life of the development."*

5.14. The policy document goes on to describe noise thresholds in Appendix 2 and states in the *'Industrial and Commercial Noise Sources'* section:

*"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document 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)."*

5.15. Table C of the appendix states the criteria at which development related noise levels will be acceptable:

*Table C: Noise levels applicable to proposed industrial and commercial development (including plant and machinery)*

| Existing Noise sensitive receptor | Assessment Location | Design Period | LOAEL (green) | LOAEL to SOAEL (Amber) | SOAL (Red) |
|---|---|---|---|---|---|
| Dwellings** | Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade) | Day | 'Rating level' 10dB* below background | 'Rating level' between 9dB below and 5dB above background | 'Rating level' greater than 5dB above background |
| Dwellings** | Outside bedroom window (façade) | Night | 'Rating level' 10dB* below background and no events exceeding 57dB$L_{Amax}$ | 'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB$L_{Amax}$ | 'Rating level' greater than 5dB above background and/or events exceeding 88dB$L_{Amax}$ |

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

## BS 4142:2014

5.16. BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* 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 the loading and unloading of goods and materials and industrial and/or commercial premises"*. The standard has been referenced as appropriate for the assessment of noise from deliveries made to or from commercial premises.

5.17. The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains *"a tone, impulse or other characteristic"* then various corrections can be added to the specific (source) noise level to obtain the *"rating level"*. Specifically, "Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

5.18. The likely effects of sound on people are assessed by subtracting the background noise level from the rating level. BS 4142:2014 states the following:

- *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. 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.*

### Plant noise criteria

5.19. The lowest background sound level measured during the kitchen operating hours was 54dB $L_{A90,15min}$. Based on the guidance above and given that noise from plant serving adjacent units is presently influencing the prevailing background, it is recommended that the cumulative noise level for the proposed plant should not exceed a level 10dB lower than the representative $L_{A90}$ background level at the nearest noise sensitive receptors. The following noise limit therefore applies:

*Table 3: Plant noise emissions limits at nearest receptors*

| Period | Cumulative plant noise rating level, dB(A) |
|---|---|
| Operating hours (08.30 – midnight) | 44 |

## 6.0 Noise assessment

6.1. The London Borough of Camden plant noise criterion requires that noise from the plant must be significantly below the existing background sound levels, at the nearest noise-sensitive receptors. This precludes the demonstration of compliance with the criterion by measurement of plant noise on site. It is therefore necessary to show, by calculation, that the plant noise emissions meet the criterion.

6.2. Cumulative noise emissions from the installed plant have been predicted at the nearest properties to the site based on the manufacturer noise data presented in Appendix D.

6.3. Noise levels for the proposed extract and supply systems have been predicted taking into account ductwork system losses, aperture size, directivity of sound propagation and distance attenuation. Predictions are inclusive of the following atmospheric-side attenuation fitted to the ventilation systems.

*Table 4: Proposed atmospheric-side attenuator selections*

| Attenuator | Insertion loss (dB) at Octave Band Centre Frequencies (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| Kitchen extract 1 | 4 | 6 | 9 | 17 | 22 | 20 | 16 | 10 |
| Kitchen extract 2 | 4 | 6 | 9 | 17 | 22 | 20 | 16 | 10 |
| Kitchen extract 3 | 4 | 6 | 9 | 17 | 22 | 20 | 16 | 10 |
| AHU 1 | 5 | 7 | 11 | 19 | 25 | 22 | 18 | 12 |
| AHU 2 | 6 | 13 | 26 | 36 | 40 | 36 | 30 | 21 |
| AHU 3 | 5 | 7 | 11 | 19 | 25 | 22 | 18 | 12 |

6.4. It should be noted that the plant is high-quality, inverter driven equipment which will minimise the presence of any specific acoustic characteristics (i.e. bangs, clicks, tonal components, impulsive nature, etc.). In order to be robust, however, Camden Council's most stringent plant noise emissions criteria have been applied.

6.5. Predicted noise levels during the operating hours (08.30 to midnight) are based upon all plant operating simultaneously at maximum capacity (i.e with the existing eight kitchens and the potential future ninth kitchen operating). All the plant will be switched off outside those hours.

6.6. Table 5, below, summarises the assessment of predicted noise levels. The full set of calculations are presented in Appendix E.

*Table 5 Assessment of predicted noise levels at the nearest noise sensitive receptors*

| Receptor | Period | Predicted noise level at receptor, $L_{Aeq}$ (dB) | Design criterion (dB) | Difference (dB) |
|---|---|---|---|---|
| Receptor R1 | All plant operating (08.30 - midnight) | 44 | 44 | 0 |
| Receptor R2 | | 41 | 44 | -3 |

6.7. The plant noise impact assessment has demonstrated that cumulative noise emissions from the plant comply with appropriate design criteria (as established in Table 3) at the nearest residential premises, inclusive of suitable atmospheric-side attenuation fitted to the kitchen

extract and supply systems. In addition, plant noise will be in the "No Observed Effect" category in the PPG table given above.

6.8. In addition, all plant and associated ductwork/pipework is fitted with suitable anti-vibration isolation in order to ensure structure-borne transmission to the adjoined residential properties is appropriately mitigated.

## 7.0 Summary

7.1. Noise Solutions Ltd (NSL) has been commissioned by Chapman Ventilation Ltd to undertake a noise assessment for new plant at a proposed Deliveroo kitchen along Finchley Road in Swiss Cottage.

7.2. The noise impact from the proposed plant has been predicted at the nearest noise sensitive receptors to the site and assessed against the typical requirements of the local authority (and in accordance with national policy on noise).

7.3. The predictions demonstrate that cumulative noise from the proposed plant should be acceptable to Camden Council at all nearby receptors and all times, inclusive of the atmospheric-side attenuators detailed in Table 4 being fitted to the fresh air supply and kitchen extract systems.

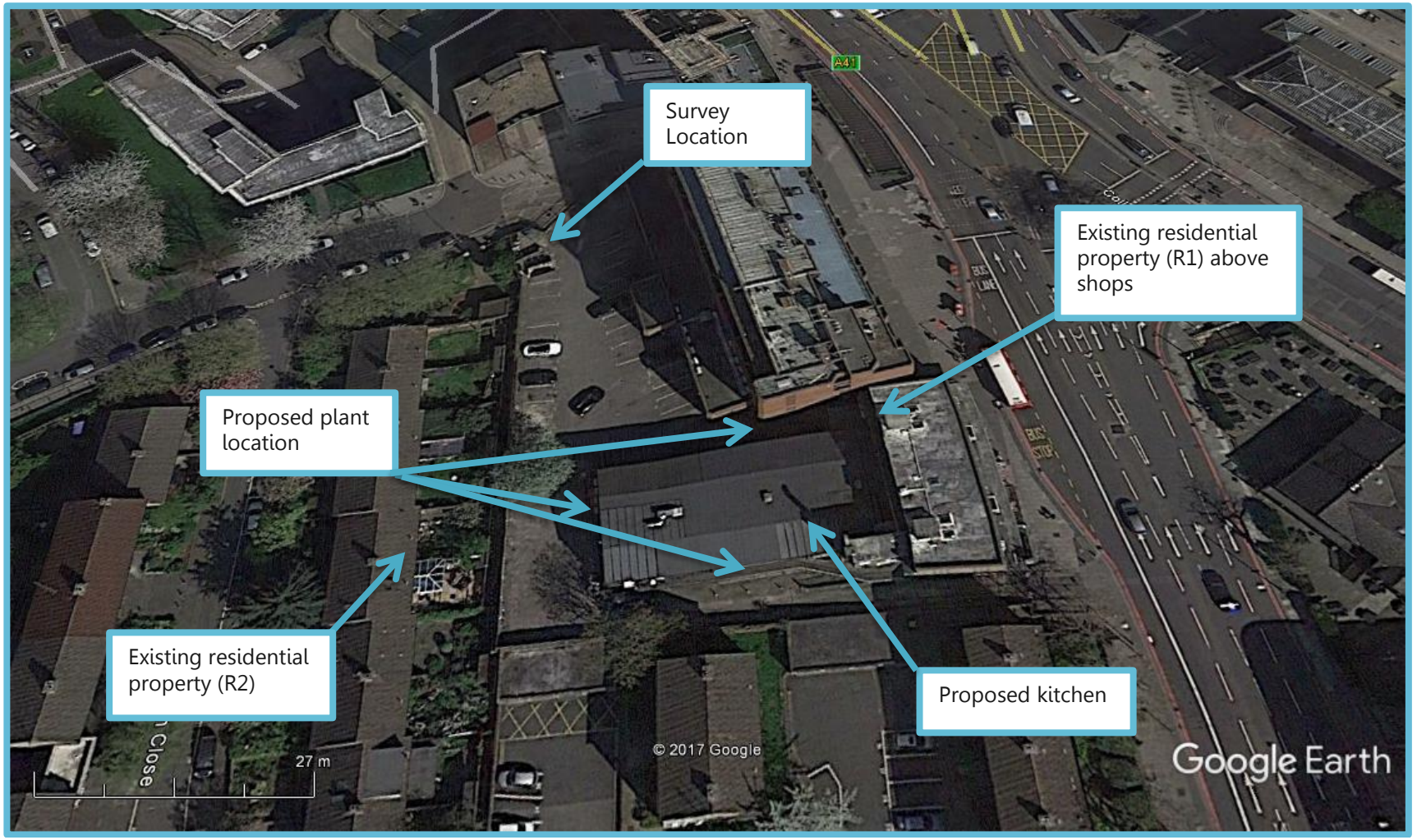
7.4. In addition, all plant and associated ductwork/pipework is fitted with suitable anti-vibration isolation in order to ensure structure-borne transmission to the adjoined residential properties is appropriately mitigated.

7.5. Therefore, noise from the plant proposals should not be a reason for refusal to issue a Certificate of Lawfulness.

# 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 log10 (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. Lmax 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 of site showing areas of interest



# Appendix C Environmental Sound Survey

## Details of environmental sound survey

C.1 Measurements of the existing background sound levels were undertaken from 12:00 hours on Wednesday 2 August 2017 and 10:00 hours on Thursday 3 August 2017.

C.2 The sound level meter was 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 survey.

## Measurement position

C.3 The sound level meter was positioned on a lamppost at the rear of the building as shown in Appendix B. The microphone was positioned in free-field at a height of approximately 3.5m above ground level.

C.4 The adopted position is considered to be representative of the noise climate affecting the nearest noise sensitive premises to the site. The position was located at a similar distance and comparably screened from the dominant noise sources in the area, when compared to the nearest receptors assessed in this report.

## Equipment

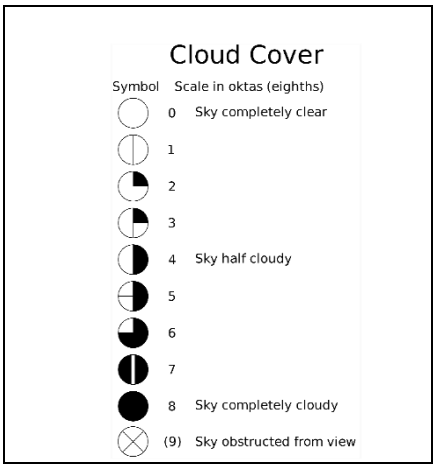
C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

| Description | Model / serial no. | Calibration date | Calibration certificate no. |
|---|---|---|---|
| Class 1 Sound level meter | Rion NL-52 / 00654035 | 21/09/2015 | CONF091517 |
| Condenser microphone | Rion UC-59 /08290 | | |
| Preamplifier | Rion NH-25 / 54080 | | |
| Calibrator | Rion NC-74 /34535932 | 21/09/2015 | 14746 |

## Weather Conditions

C.6 Weather conditions were determined both at the start and on completion of the surveys. It is considered that the meteorological conditions were appropriate for environmental noise

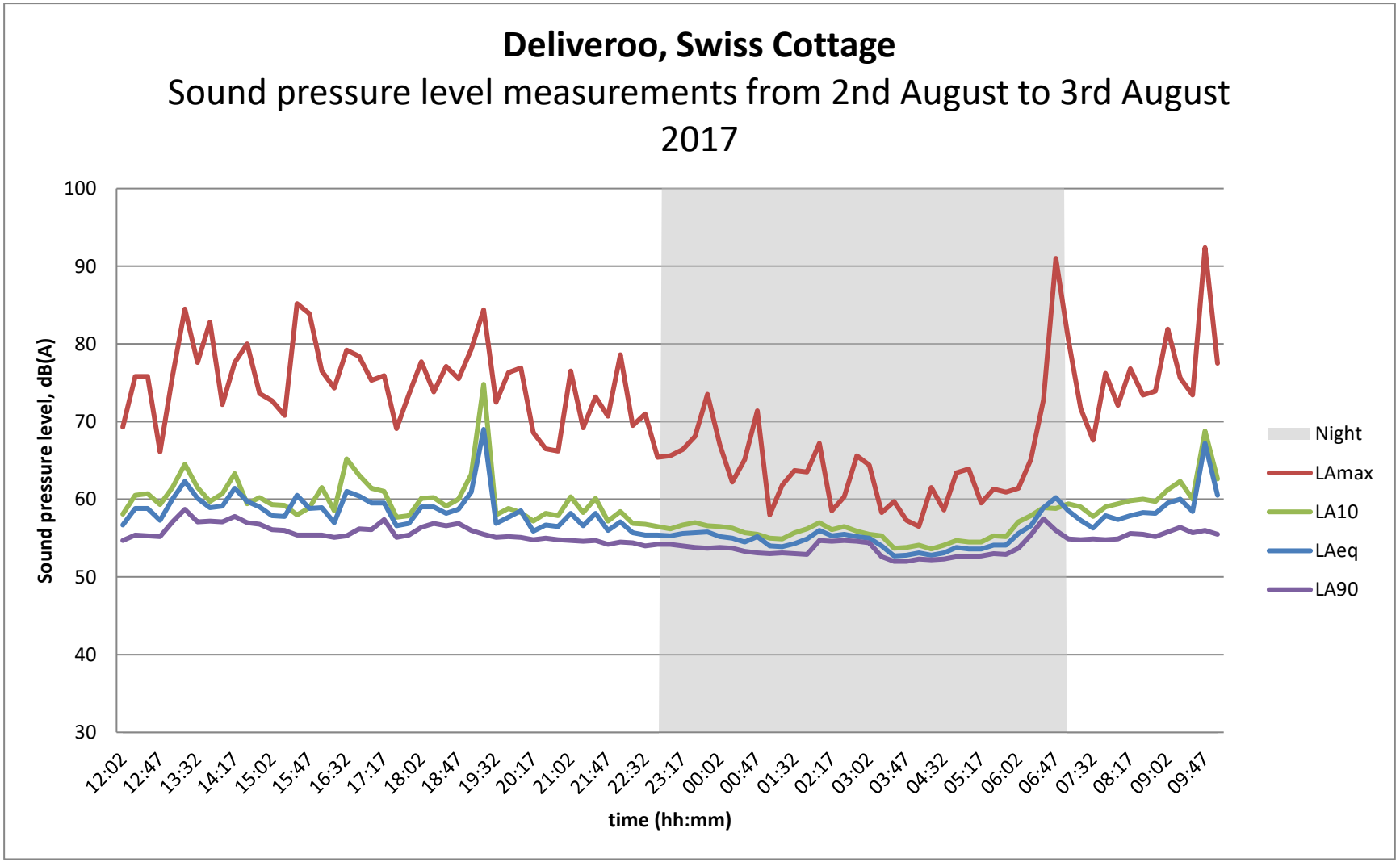
measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

| Weather Conditions | | | | |
|---|---|---|---|---|
| **Measurement Location** | **Date/Time** | **Description** | **Beginning of Survey** | **End of Survey** |
| As indicated on Appendix B | 12:00 2/8/2017-10:00 3/8/2017 | Temperature (°C) | 20 | 19 |
|  | | Precipitation: | Yes | Yes |
| | | Cloud cover (oktas - see guide) | 6 | 5 |
| | | Presence of fog/snow/ice | No | No |
| | | Presence of damp roads/wet ground | Yes | Yes |
| | | Wind Speed (m/s) | 8 | 5 |
| | | Wind Direction | North Easterly | South Westerly |
| | | Conditions that may cause temperature inversion (i.e. calm nights with no cloud) | No | No |



## Results

C.7 The results of the survey are considered to be representative of background sound pressure levels at the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate. The noise climate during the survey period was dominated by road traffic movements and plant noise emissions from neighbouring premises. The results of the survey are presented in a time history graph overleaf.


Deliveroo, Swiss Cottage
Sound pressure level measurements from 2nd August to 3rd August 2017
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
12:02
12:47
13:32
14:17
15:02
15:47
16:32
17:17
18:02
18:47
19:32
20:17
21:02
21:47
22:32
23:17
00:02
00:47
01:32
02:17
03:02
03:47
04:32
05:17
06:02
06:47
07:32
08:17
09:02
09:47
time (hh:mm)
Night
LAmax
LA10
LAeq
LA90

# Appendix D Manufacturer plant noise data

| Description | Model / Model | Quantity | Notes. | Sound power level(dB) at octave band centre frequencies (Hz) | | | | | | | | $L_{Aeq,T}$ (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| Kitchen Extract | Fläkt Woods | 3 | In-duct Lw Outlet | 82 | 82 | 84 | 87 | 86 | 81 | 79 | 75 | 90 |
| AHU | Fläkt Woods | 3 | In-duct Lw Inlet | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |

# Appendix E Plant noise level predictions at receptor

| Receptor | Plant | Resultant at Receptor (dBA) |
|---|---|---|
| R1 | Kitchen extract 1 | 31 |
| | Kitchen extract 2 | 31 |
| | Kitchen extract 3 | 31 |
| | AHU 1 | 31 |
| | AHU 2 | 42 |
| | AHU 3 | 36 |
| | Cumulative | 44 |
| R2 | Kitchen extract 1 | 35 |
| | Kitchen extract 2 | 35 |
| | Kitchen extract 3 | 35 |
| | AHU 1 | 30 |
| | AHU 2 | 16 |
| | AHU 3 | 33 |
| | Cumulative | 41 |

*Kitchen extract fans*

| 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 | 82 | 84 | 87 | 86 | 81 | 79 | 75 | 90 |
| System losses | | -6 | -2 | 0 | -1 | -2 | -3 | -3 | -3 | |
| Atmospheric side attenuator | I.L. | -4 | -6 | -9 | -17 | -22 | -20 | -16 | -10 | |
| Directivity correction | 90,0 | 0.25 | 0.25 | 0 | -4 | -7 | -7 | -7 | -7 | |
| Distance correction | 30m | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R1 | $L_p$ | 35 | 36 | 38 | 27 | 17 | 13 | 15 | 17 | 31 |
| | | | | | | | | | | |
| Source noise level (unattenuated) | In-duct $L_w$ | 82 | 82 | 84 | 87 | 86 | 81 | 79 | 75 | 90 |
| System losses | | -6 | -2 | 0 | -1 | -2 | -3 | -3 | -3 | |
| Atmospheric side attenuator | I.L. | -4 | -6 | -9 | -17 | -22 | -20 | -16 | -10 | |
| Directivity correction | 90,0 | 0.25 | 0.25 | 0 | -4 | -7 | -7 | -7 | -7 | |
| Distance correction | 20m | -34 | -34 | -34 | -34 | -34 | -34 | -34 | -34 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R2 | $L_p$ | 38 | 40 | 41 | 30 | 21 | 17 | 19 | 21 | 35 |

*AHU 1*

| 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 $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -5 | -7 | -11 | -19 | -25 | -22 | -18 | -12 | |
| Directivity correction | 0,135 | -0.5 | -2 | -5.5 | -8 | -8 | -8 | -8 | -8 | |
| Distance correction | 20m | -34 | -34 | -34 | -34 | -34 | -34 | -34 | -34 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R1 | $L_p$ | 32 | 33 | 38 | 20 | 13 | 11 | 16 | 19 | 31 |
| | | | | | | | | | | |
| Source noise level (unattenuated) | In-duct $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -5 | -7 | -11 | -19 | -25 | -22 | -18 | -12 | |
| Directivity correction | 0,90 | 0.75 | 0.75 | 0.5 | -3.5 | -7 | -7 | -7 | -7 | |
| Distance correction | 40m | -40 | -40 | -40 | -40 | -40 | -40 | -40 | -40 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R2 | $L_p$ | 27 | 30 | 38 | 18 | 8 | 6 | 10 | 14 | 30 |

*AHU 2*

| 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 $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -6 | -13 | -26 | -36 | -40 | -36 | -30 | -21 | |
| Directivity correction | 0,90 | 0.75 | 0.75 | 0.5 | -3.5 | -7 | -7 | -7 | -7 | |
| Distance correction | 2m | -14 | -14 | -14 | -14 | -14 | -14 | -14 | -14 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R1 | $L_p$ | 52 | 50 | 49 | 27 | 19 | 18 | 25 | 31 | 42 |
| | | | | | | | | | | |
| Source noise level (unattenuated) | In-duct $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -6 | -13 | -26 | -36 | -40 | -36 | -30 | -21 | |
| Directivity correction | 0,90 | 0.75 | 0.75 | 0.5 | -3.5 | -7 | -7 | -7 | -7 | |
| Distance correction | 42m | -40 | -40 | -40 | -40 | -40 | -40 | -40 | -40 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R2 | $L_p$ | 26 | 23 | 23 | 1 | -7 | -8 | -2 | 4 | 16 |

*AHU 3*

| 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 $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -5 | -7 | -11 | -19 | -25 | -22 | -18 | -12 | |
| Directivity correction | 0,90 | 0.75 | 0.75 | 0.5 | -3.5 | -7 | -7 | -7 | -7 | |
| Distance correction | 20m | -34 | -34 | -34 | -34 | -34 | -34 | -34 | -34 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R1 | $L_p$ | 33 | 36 | 44 | 24 | 14 | 12 | 17 | 20 | 36 |
| | | | | | | | | | | |
| Source noise level (unattenuated) | In-duct $L_w$ | 76 | 77 | 89 | 81 | 81 | 75 | 76 | 73 | 86 |
| System losses | | -4 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Atmospheric side attenuator | I.L. | -5 | -7 | -11 | -19 | -25 | -22 | -18 | -12 | |
| Directivity correction | 0,90 | 0.75 | 0.75 | 0.5 | -3.5 | -7 | -7 | -7 | -7 | |
| Distance correction | 30m | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | |
| Screening correction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Resultant at receptor R2 | $L_p$ | 29 | 32 | 41 | 21 | 11 | 9 | 13 | 16 | 33 |

# Appendix F Proposed plant layout