



**Farrer & Co.**

**Imperial Buildings, Lincoln's Inn Fields,  
Holborn**

**Plant Noise Assessment  
February 2019**

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2		
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## 1.0 Introduction

### 1.1 Purpose of this Report

This report presents the findings of a noise assessment undertaken for the proposed installation of 7 air conditioning units, on the roof of Imperial Buildings, Lincoln's Inn Fields, which are proposed to replace existing building services plant.

A description of the existing noise environment in and around the site is provided. The noise levels from the proposed development have been predicted at local representative receptors using CADNA noise modelling software which incorporates ISO 9613 methodologies and calculations. Report Conditions are presented in Appendix C.

### 1.2 Legislative Context

This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in the NPPF, published on 24<sup>th</sup> July 2018. With regard to noise and planning, NPPF contains the following statement at paragraph 170:

*"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:*

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"*

A further 2 short statements are presented at paragraph 180, which state:

*"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- a) "mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*



- b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*"

Furthermore, paragraphs 182 and 183 state:

*"182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

*183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

Planning Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, is to, *'identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated as follows:



**Table 1.1 NPPG Noise Exposure Hierarchy**

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 Observed Adverse Effect	Prevent

The NPPF, NPSE and NPPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, national planning policy and appropriate guidance documents including 'BS 4142: 2014 Methods for Rating and Assessing Industrial and Commercial Sound'. Section 2.0 presents the noise level criteria used as a basis of this assessment.

The PPG: Noise also states that *neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.*



## 2.0 Assessment Criteria

### 2.1 Local Guidance (Camden London Borough Council) – Assessment Criteria

The effects of the new plant noise have been assessed in accordance with the noise thresholds set out in Appendix 3 of the Camden Local Plan which states:

*"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)."*

Table 2.2 presents equivalent noise levels presented within Appendix 3 of the Camden Local Plan.

**Table 2.2 Noise Levels Applicable to Proposed Industrial and Commercial Developments (Including Plant and Machinery) – Camden Local Plan**

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (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' 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 event exceeding 57 dB L <sub>Amax</sub>	'Rating level' 9dB below and 5dB above background or noise events between 57dB and 88dB L <sub>Amax</sub>	'Rating level' greater than 5dB above background and/or events exceeding 88dB L <sub>Amax</sub>

Therefore, the effects of operational noise associated with the project have been assessed in accordance with BS 4142:2014. This standard sets down the following guidelines for assessing the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes, based upon difference between the measured background noise level and the rating level of the source under consideration. In particular, the standard states:

- a) Typically, the greater the difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.



- c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) 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."

In addition to noise levels the significance of the impact depends on the individuals affected and to the acoustic features present which may be assessed subjectively or objectively as appropriate. Section 9 of BS 4142:2014 recommends that correction factors be applied to the specific noise level if the noise contains certain acoustic features such as:

- tonality
- impulsivity
- other sound characteristics which are readily distinctive
- intermittency

It should be noted that the significance of an industrial sound source depends upon both the margin by which the rating level exceeds the background sound level and the overall context in which the sound occurs.



## 3.0 Assessment Methodology

### 3.1 Noise Modelling Methodology

Three-dimensional noise modelling has been undertaken based on the monitoring data to predict noise levels at a number of locations. The model is based on ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for several receptor points and different noise emission scenarios both horizontally and vertically.

The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in Table 3.1 below have been used.

**Table 3.1 Modelling Parameters Sources and Input Data**

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	Ordnance Survey	Ordnance Survey
Building heights – around site	WYG Observations	8 m height for two storey residential properties, and 3m per storey thereafter.
Barriers	WYG	All existing barriers inputted from site visit data.
Proposed Plans	Glynn Williams Architects Limited	Drawing Number: 1HK/RP07PR Dated: January 2019

It is acknowledged that a number of these parameters will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are considered to be representative of a reasonable worst-case.



### 3.2 Model Input Data

The proposals include the introduction of 7 x Mitsubishi PURY-P450YSNW-A condenser units situated on the roof. Noise level data from the manufacturer is presented in Table 3.2 below, the sound pressure level has been used within the model. It is understood these units will serve office spaces only, therefore will only run during daytime hours (07:00-23:00).

**Table 3.2 Manufacturer Noise Level Data**

Plant	Sound Pressure Level at 1m Distance (L <sub>p</sub> )
7 x Mitsubishi PURY-P450YSNW-A	63.5 dB(A)

The proposed scheme retains the existing 3.1m louvred screen, however, for the purposes of this worst-case assessment the effects of the barrier have not been included within the model.

### 3.3 Sensitive Receptors

The table below summarises receptor locations that have been selected to represent worst-case residential receptors with respect to direct noise from the new plant. The locations of the receptors are shown on SK02 in Appendix B.

**Table 3.3 Receptor Locations**

Ref.	Description	Height (m) Above Local Ground Level
R01	Flats, 64 Lincoln's Inn Fields	14.5
R02	Flats, 42 Kingsway	19.5
R03	Flats, 36 Kingsway	24.5
R04	Flats, 44-46 Kingsway	17.5
R05	Flats, 91-95 Kingsway	24.5



## 4.0 Noise Survey

### 4.1 Noise Survey Methodology

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Norsonic 140	Environmental Noise Analyser	s/n	1402987
Norsonic 1251	Sound Calibrator	s/n	31291
Rion NL-52	Environmental Noise Analyser (WYG11)	s/n	1021257
Rion NC-74	Sound Calibrator	s/n	35046823

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice, a drift of 0.1 dB was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at five locations (as specified in the following table and shown in SK01 of Appendix B) from Wednesday 6<sup>th</sup> February 2019 to Tuesday 12<sup>th</sup> February 2019. Attended short term measurements were undertaken at four locations during day, evening and night-time periods with one additional location measured unattended over a 143-hour period. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*. Weather conditions during the survey period were observed as being dry with scattered showers. Anemometer readings confirmed that wind speeds were less than 5 ms<sup>-1</sup> at all times during the survey, with a predominant south-westerly wind direction, during the survey.

**Table 4.1 Noise Monitoring Locations**

Ref	Description
LT1	On Imperial Building Roof, facing east
ST1	Remnant Street
ST2	Kingsway, in front of Leon/Café Rouge
ST3	Gate Street
ST4	Lincoln's Inn Fields



## 4.2 Noise Survey Results

The ambient noise climate found in the area includes: road traffic noise from Kingsway, Lincoln's Inn Fields, Gate Street and Remnant Street as well as contributions from existing plant noise at roof level from surrounding buildings.

Ambient and background noise levels are usually described using the  $L_{Aeq}$  index (a form of energy average) and the  $L_{A90}$  index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the  $L_{A10}$  index (i.e. the level exceeded for 10% of the measurement period). For the long-term (LT) location, the presented  $L_{Aeq,T}$  and  $L_{A10,T}$  are average noise levels whilst the  $L_{A90}$  is the modal noise level of each 5 minute measurement over the stated survey period.

**Table 4.2 Meteorological Conditions during the Survey**

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Day ST1	12/02/2019 10:11	7.0	0-1	SW	8	Traffic along Kingsway and Remnant Street
Day ST2	12/02/2019 10:28	7.0	0-1	SW	8	Traffic along Kingsway
Day ST3	12/02/2019 09:37	7.0	0-1	SW	7	Traffic along Lincoln's Inn Fields and Remnant Street
Day ST4	12/02/2019 09:54	7.0	0-1	SW	8	Traffic along Lincoln's Inn Field and Kingsway
Evening ST1	11/02/2019 19:32	7.0	0-1	SW	8	Traffic along Kingsway and Remnant Street
Evening ST2	11/02/2019 19:49	7.0	0-1	SW	8	Traffic along Kingsway
Evening ST3	11/02/2019 19:00	7.0	0-1	SW	8	Traffic along Lincoln's Inn Fields and Remnant Street
Evening ST4	11/02/2019 19:16	7.0	0-1	SW	8	Traffic along Lincoln's Inn Field and Kingsway
Night ST1	11/02/2019 23:17	6.0	0-1	SW	8	Traffic along Kingsway and Remnant Street
Night ST2	11/02/2019 23:00	6.0	0-1	SW	8	Traffic along Kingsway
Night ST3	11/02/2019 23:39	6.0	0-1	SW	8	Traffic along Lincoln's Inn Fields and Remnant Street
Night ST4	11/02/2019 23:33	6.0	0-1	SW	8	Traffic along Lincoln's Inn Field and Kingsway

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re:  $2 \times 10^{-5}$  Pa).



**Table 4.3 Results of Baseline Noise Monitoring Survey (Average Levels)**

Period	Duration (T)	Monitoring Date and Times	Location	L <sub>Aeq,T</sub> (dB)	L <sub>Amax,T</sub> (dB)	L <sub>Amin,T</sub> (dB)	L <sub>A10,T</sub> (dB)	L <sub>A90,T</sub> (dB)
Weekday Daytime 07:00 - 23:00	63 Hours	06/02/2019 - 12/02/2019 12:55 - 11:05	LT1	60.3	82.2	57.4	61.7	61
Weekday Night-time 23:00 - 07:00	32 Hours	06/02/2019 - 12/02/2019 23:00 - 07:00		59.0	78.0	56.5	59.4	58
Weekend Daytime 07:00 - 23:00	32 Hours	09/02/2019 - 10/02/2019 07:00 - 23:00		60.1	79.3	57.4	60.5	59
Weekend Night-time 23:00 - 07:00	16 hours	09/02/2019 - 10/02/2019 23:00 - 07:00		58.4	67.4	56.3	58.9	58
Daytime 07:00 - 19:00	15 Mins	12/02/2019 10:11	ST1	69.7	87.4	40.1	73.3	59.5
		12/02/2019 10:28	ST2	75.8	100.6	61.1	74.0	65.2
		12/02/2019 09:37	ST3	63.6	80.6	53.1	66.5	56.5
		12/02/2019 09:54	ST4	61.0	76.2	55.0	63.1	57.5
Evening 19:00 - 23:00	15 Mins	11/02/2019 19:32	ST1	69.7	101.1	51.5	69.2	55.1
		11/02/2019 19:49	ST2	69.7	85.4	60.0	72.3	63.8
		11/02/2019 19:00	ST3	58.0	71.7	50.2	61.6	52.5
		11/02/2019 19:16	ST4	63.8	86.4	52.6	62.6	54.9
Night-time 23:00 - 07:00	15 Mins	11/02/2019 23:17	ST1	70.6	92.7	38.6	71.3	58.4
		11/02/2019 23:00	ST2	68.1	82.1	58.9	71.0	62.2
		11/02/2019 23:39	ST3	55.8	79.6	43.0	55.2	44.7
		11/02/2019 23:33	ST4	58.7	80.3	48.3	60.5	51.1

All values are sound pressure levels in dB re: 2x 10<sup>-5</sup> Pa



## 5.0 Noise Assessment

### 5.1 BS 4142 Assessment of Background Noise Comparison Assessment

The assessment compares the predicted noise rating levels from proposed plant noise with the lowest measured background noise levels  $L_{A90}$ , (taken from the lowest representative short-term monitoring location which was not influenced by the existing rooftop plant within the vicinity of the site), at the nearest residential dwellings during the daytime period (07:00 – 23:00). The noise monitoring results presented in section 4 above demonstrate that background noise levels during the daytime are typically higher and therefore the assessment below is considered to represent a worst-case scenario.

The assessment compares the predicted average noise levels from proposed plant with the measured pre-installation daytime background noise  $L_{A90}$  at the nearest noise sensitive properties; all plant is considered to be operating simultaneously and at full capacity. The proposed plant is not expected to be tonal or impulsive, and will be similar to the plant that will be replaced and as such is not expected to be readily distinguishable against the existing ambient noise climate, therefore no acoustic feature correction has been applied.

It should be noted that the proposals will retain the existing 3.1m high louvered barrier around the boundary of building services plant area, however its effects have not been included within the assessment below to present a worst-case.

**Table 5.1 BS4142:2014 Assessment of Proposed Plant Noise**

Ref	Lowest Measured Representative Background Noise Level $L_{A90}$	Noise Rating Level $L_{Aeq,1hr}$	BS 4142 Score
R01	53	40	-13
R02	53	34	-19
R03	53	35	-18
R04	53	45	-8
R05	53	38	-15

All values are sound pressure levels in dB re:  $2 \times 10^{-5}$  Pa

The assessment shows that worst-case noise levels from the new building services plant are predicted to be below the lowest measured background  $L_{A90}$  noise levels by at least 8 dB during the daytime period. Therefore, in accordance with the guidance presented within BS 4142:2014, the proposed plant is expected to have a low impact. Furthermore, in accordance with the Camden London Borough Council local plan, plant noise rating levels are within the Lowest Observed Adverse Effect Level.



## 6.0 Conclusions

A noise assessment has been undertaken for the proposed instalment of 7 air conditioning units, on the roof of Imperial Buildings, Lincoln's Inn Fields, which are proposed to replace the existing air conditioning units. The assessment has been carried out in accordance with BS 4142:2014 and the noise thresholds detailed in Appendix 3 of the Camden Local Plan.

Noise rating levels from the new building services plant are predicted to be at least 8 dB below the lowest measured background  $L_{A90}$  noise levels during the daytime period. Therefore plant noise is expected to have a low impact and would be within the Lowest Observed Adverse Effect Level defined within the Camden Local Plan and is not expected to have an adverse impact on health or quality of life at nearby residential properties.

Noise Assessment



# Appendices



## Appendix A – Acoustic Terminology and Abbreviations

### Acoustic Terminology

- dB** Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
- dB(A)** Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.
- L<sub>Aeq</sub>** Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The L<sub>Aeq, 07:00 – 23:00</sub> for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the L<sub>pA</sub> at any particular time is likely to have been either greater or lower than the L<sub>Aeq, 07:00 – 23:00</sub>.
- L<sub>Amin</sub>** The L<sub>Amin</sub> is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.
- L<sub>Amax</sub>** The L<sub>Amax</sub> is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
- L<sub>n</sub>** Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the L<sub>A10, 1 hr</sub> = x dB.
- The L<sub>A10</sub> index is often used in the description of road traffic noise, whilst the L<sub>A90</sub>, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L<sub>A1</sub> and L<sub>Amax</sub> are common descriptors of construction noise.
- R<sub>w</sub>** The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.



**Abbreviations**

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

NPPF – National Planning Policy Framework

PPG – Planning Practice Guidance

UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

WYGE – WYG Environment

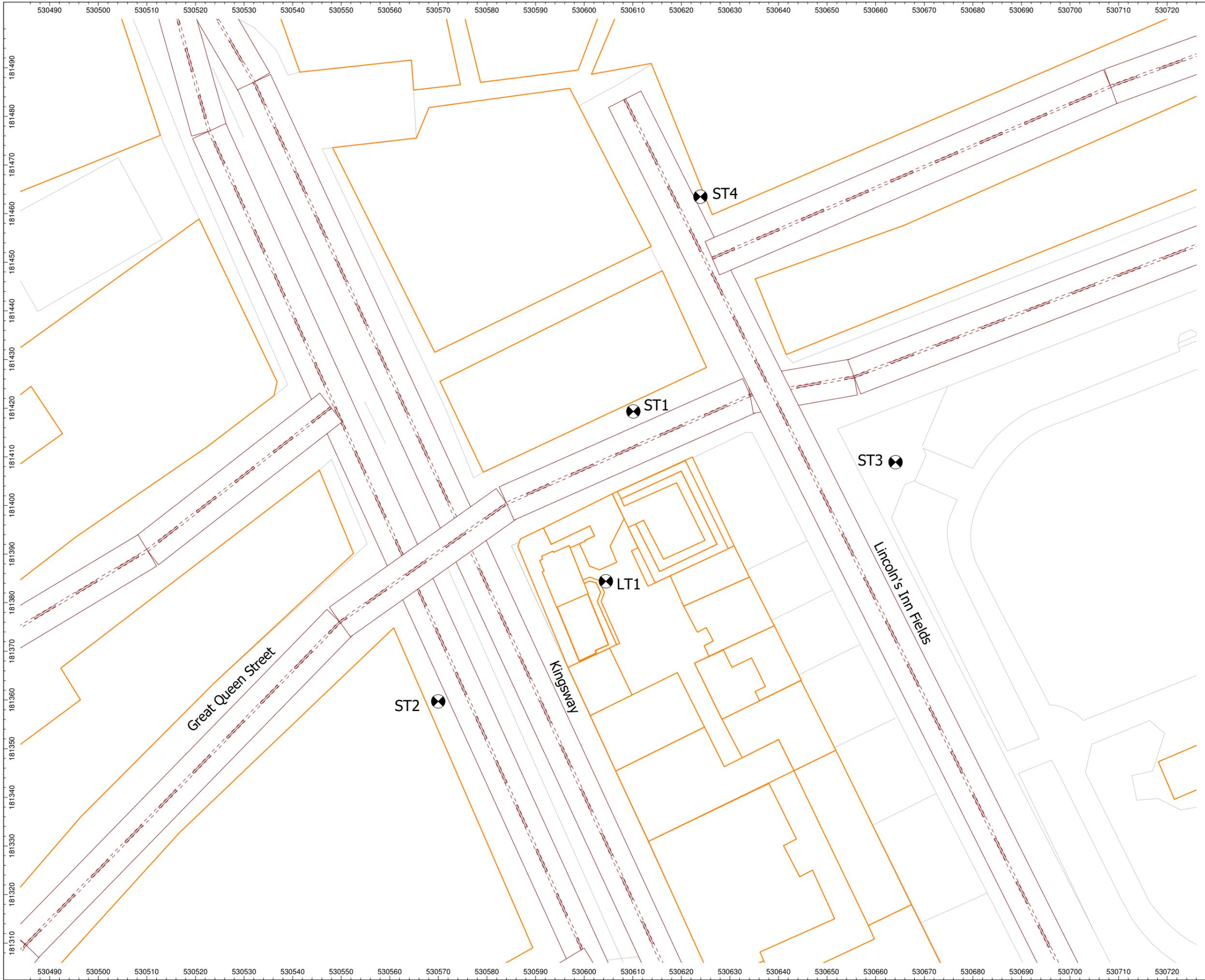


## **Appendix B – Sketches**

SK01 Noise Monitoring Locations

SK02 Sensitive Receptor Locations

SK03 Worst-case Daytime  $L_{Aeq}$  Contribution from New Building Services Plant



Client:  
Farrer & Co.

Project:  
Imperial Buildings,  
Lincoln's Inn Fields

Project Number:  
A1TBC

Drawing Title / Scenario:  
Noise Monitoring  
Locations

Drawing Number:  
SK01

Scale : Not to scale

WYGE Leicester 14.02.19

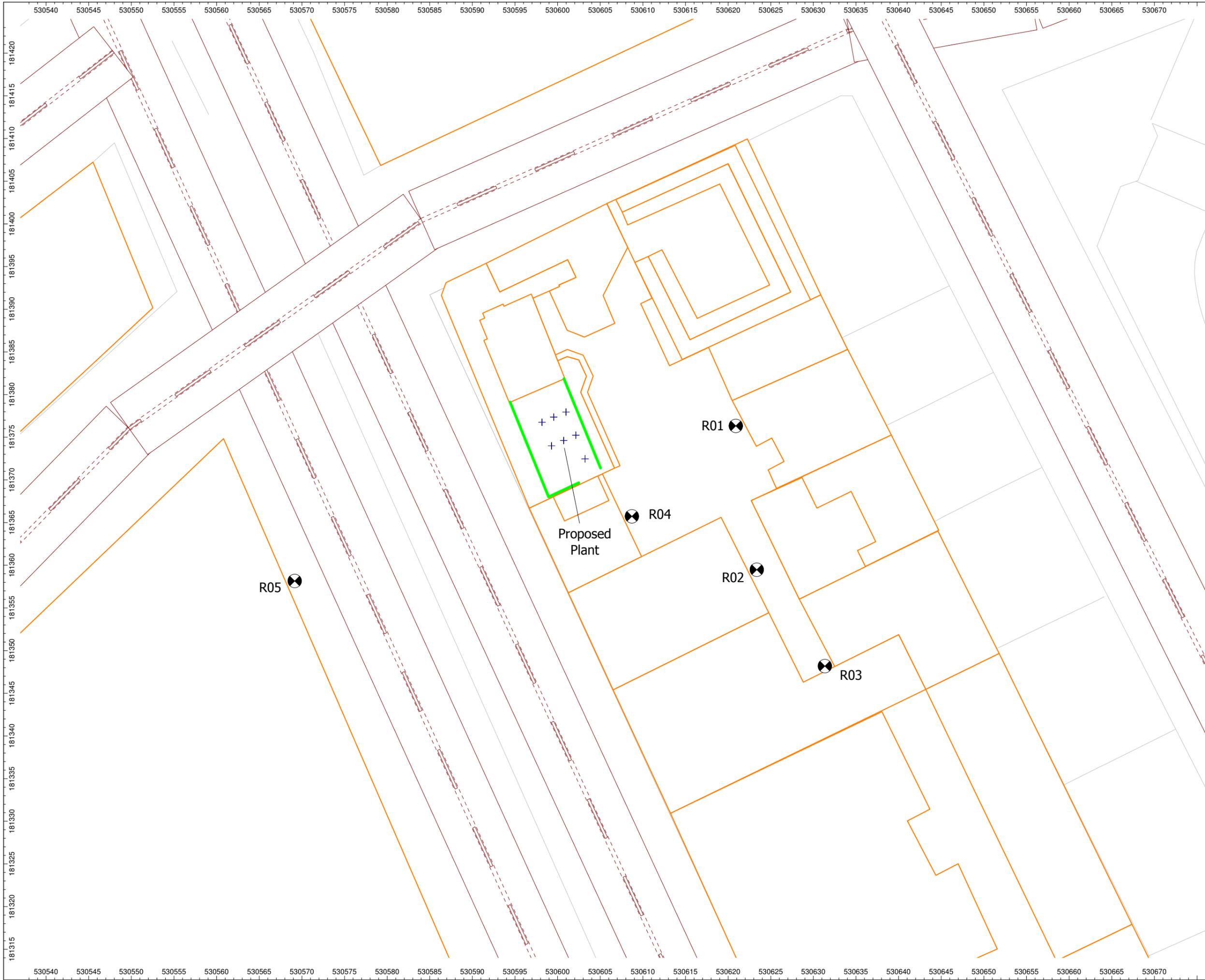
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Drawing Title / Scenario:  
**Sensitive Receptor  
 Locations**

Drawing Number:  
**SK02**

Key:  
 3.1m Acoustic  
 Louvre: 

Scale : Not to scale

**WYGE Leicester 14.02.19**

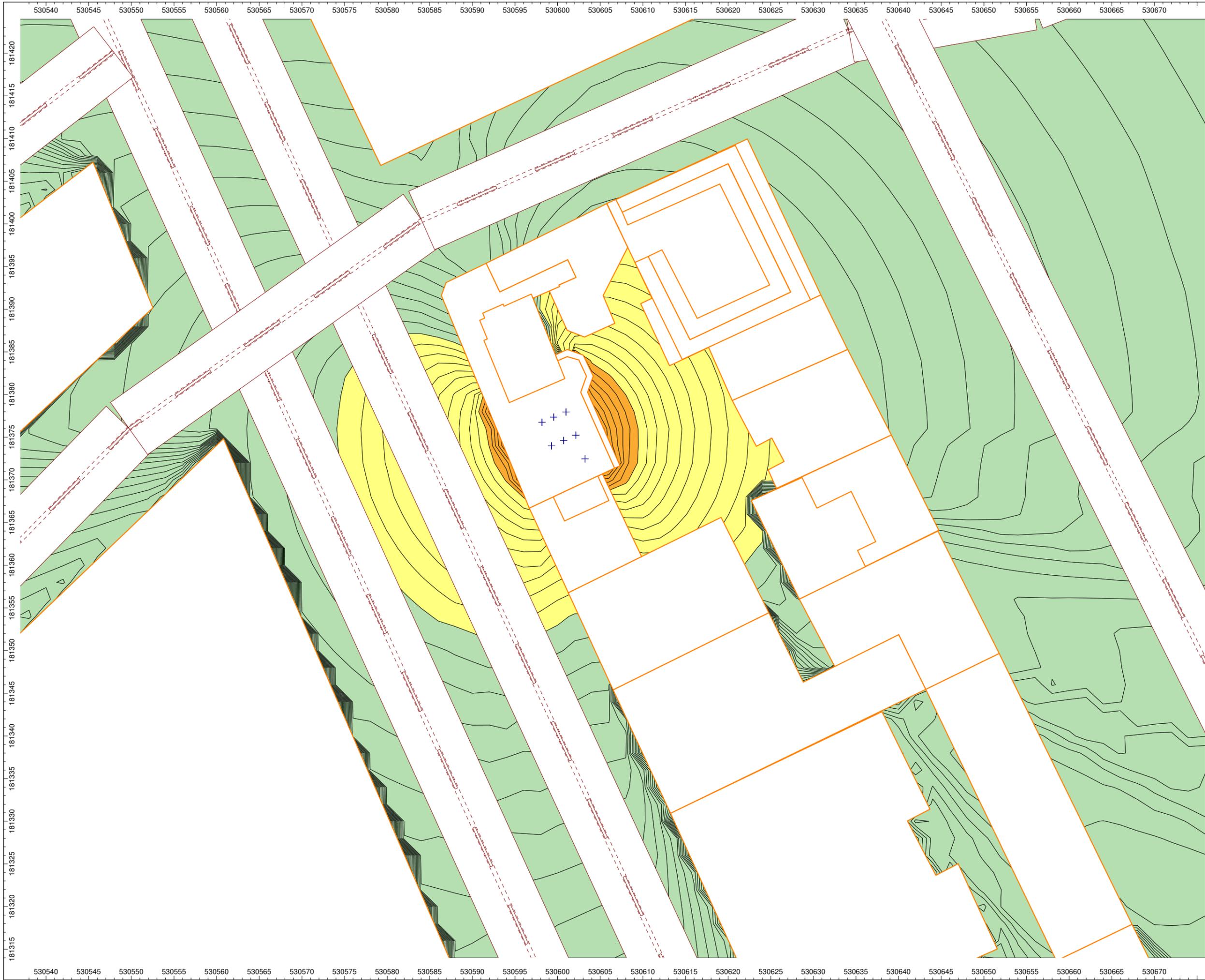
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Project:  
Imperial Buildings,  
Lincoln's Inn Fields

Project Number:  
A1TBC

Drawing Title / Scenario:  
Worst-case Daytime LAeq  
Contribution from New  
Building Services Plant

Drawing Number:  
SK03

Key:

- 0.0 - 40.0 dB
- 40.0 - 50.0 dB
- 50.0 - 60.0 dB
- > 60.0 dB

Scale : Not to scale

Grid Height: 22m above ground

WYGE Leicester 15.02.19

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