



ACOUSTIC
CONSULTANTS LTD

Noise Impact Assessment

**Proposed Industrial Development
Dove Valley Park, Derby-Planning Conditions**

Reference: 8726/PR/BL

Client:

PGFI III Ltd

Document Control

Version	Revision Description	Date	Author:	Reviewed by:
1.0	Address of Planning Condition 17 – DMPA/2019/1205	08/11/21	Pedro Rodrigues, MIOA	Blake Lucas, MIOA

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

PGF III Ltd appointed Acoustic Consultants Limited to carry out a noise impact assessment from the proposed industrial development operations at Dove Valley Park, Derby in support of the following planning application (Ref. DMPA/2019/1205):

"The erection of part single, part two-storey facility for the extraction, processing, bottling and distribution of water based products (combined B2 and B8 use) along with associated ancillary office, infrastructure, access parking and landscaping at Plots 5 and P2-01, Dove Valley Park, Park Avenue, Foston, Derby, DE65 5BG"

A noise impact assessment report has been completed (8018 - Dove Valley Park, Derby V1.0' - 17th October 2019) and submitted in support of the above planning application which has been approved on the 21st October 2019, subject to the following 'noise' related planning conditions:

"17. The design and construction of the proposed building shall be capable of achieving sound insulation performance index R_w of 40dB which shall be maintained for the life of the approved development. Alternatively, prior to the construction of the main building in whole or in part, a noise mitigation scheme that specifies provisions for the control of noise emanating from noise sources within the proposed building shall be submitted to and approved in writing by the Local Planning Authority. The noise mitigation scheme shall be maintained as approved for the lifetime of the development.

Reason: In the interests of protecting the amenity of the area and adjoining occupiers."

"18. The level of noise emitted from the site shall not exceed 44dB LAeq(1 hour) between 07:00 to 23:00 hours and 41 dB LAeq(15mins) between the hours of 23:00 to 07:00, as measured at the nearest noise sensitive receptor. Where access to the nearest sound sensitive property is not possible, measurements shall be undertaken at an appropriate location and corrected to establish the noise levels at the nearest sound sensitive property.

Reason: In the interests of protecting the amenity of the area and adjoining occupiers."

This report specifically addresses Planning Condition 17 which relates to the laboratory sound insulation index performance of the building construction envelope.

It is not considered practical or not even necessary to provide a sound insulation performance of 40dB Rw to all the building fabric elements of the building. Therefore, an alternative noise mitigation scheme analysis has been completed as suggested in Planning Condition 17, to demonstrate that the proposed construction selected by the client and its laboratory sound insulation index performances are sufficient to meet the noise limits imposed by Planning Condition 18 at the nearest noise sensitive receivers.

The design of the proposed site also progressed since the submission of 2019 ACL's NIA report, and therefore, these changes have also been considered in sections below in the noise modelling shown in this report.

The author of this report is a Full Member of the Institute of Acoustics (MIOA) with a recognised acoustic qualification and twelve years' experience within the field of noise and acoustics and as such is suitably qualified and experienced to undertake a British Standard 4142:2014 assessment.

2. The Site & Proposals

The site is located at Land North East of Dove Valley Park, Derby. The proposal is for a "Part single, two-storey facility for the extraction, processing, bottling and distribution of water-based products (combined B2 and B8 use), with associated parking and landscaping".

The nearest noise sensitive residential dwellings are those located to the north on the northern boundary facing Littlemeadow Lane and north west boundary abutting Woodyard Lane.

The nearest noise sensitive receivers in relation to the proposed site operations are the existing dwellings to the South and East of the site.

The main source of noise source currently affecting the site is road traffic in the surrounding road network, including distant road traffic on A50 (Foston – Hatton – Hilton Bypass) and industrial noise from the existing operations around the site.

It is understood that the development will be constructed in two Phases. This report considers the operation of the whole scheme (Phase 1 & 2).

The existing aerial view and proposed site plan (including Phase 1 & 2) are shown in Figures below.

Figure 1: Aerial Google view of the existing industrial site at Dove Valley Park

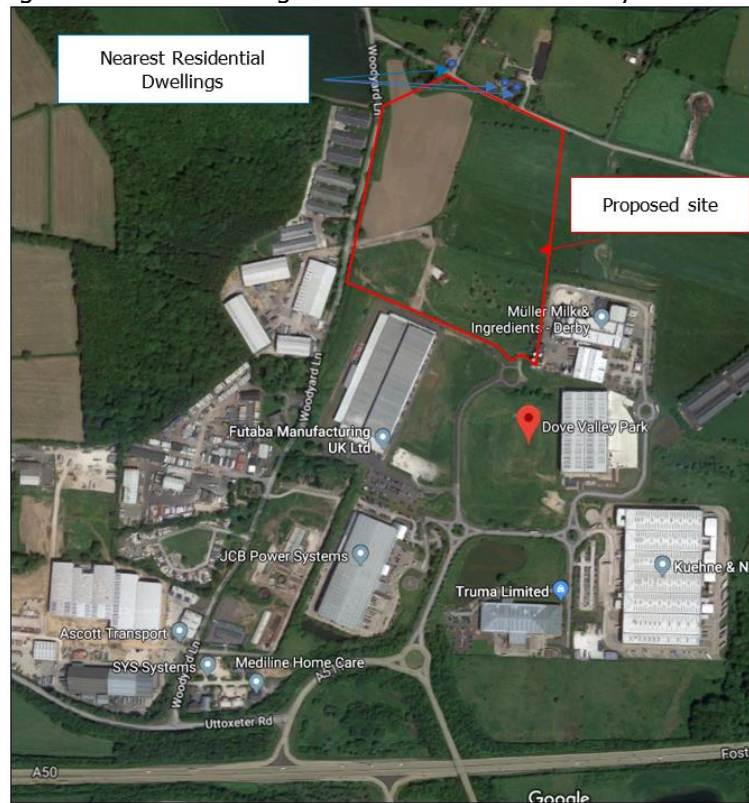


Figure 2: Proposed Site Industrial Site Plan (indicative Site Layout)

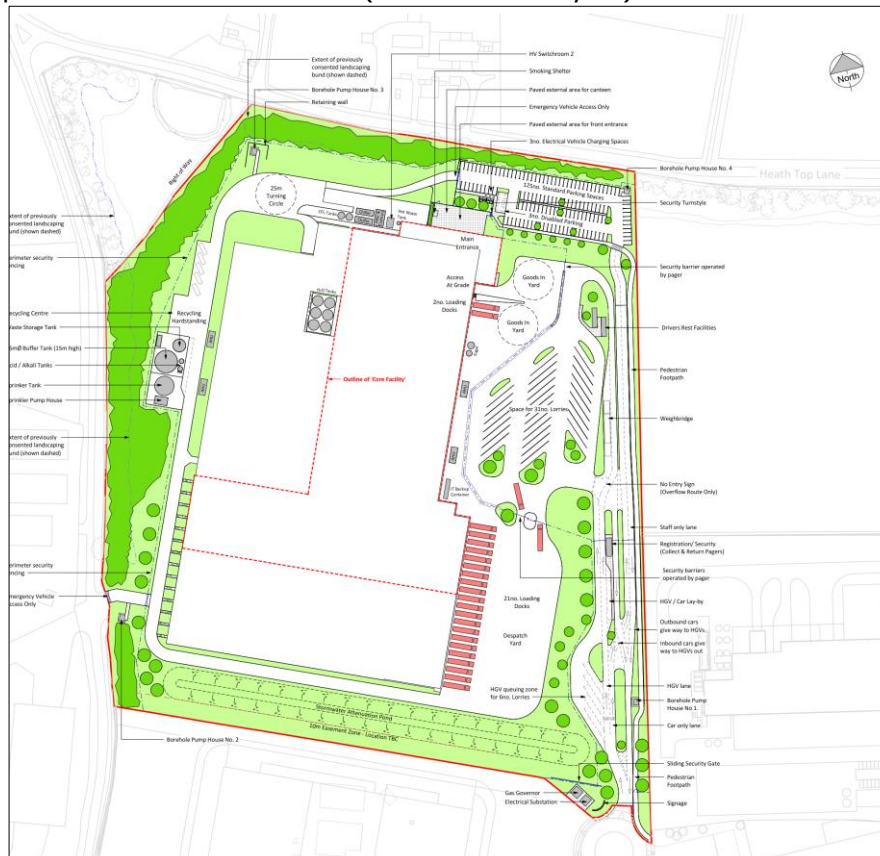
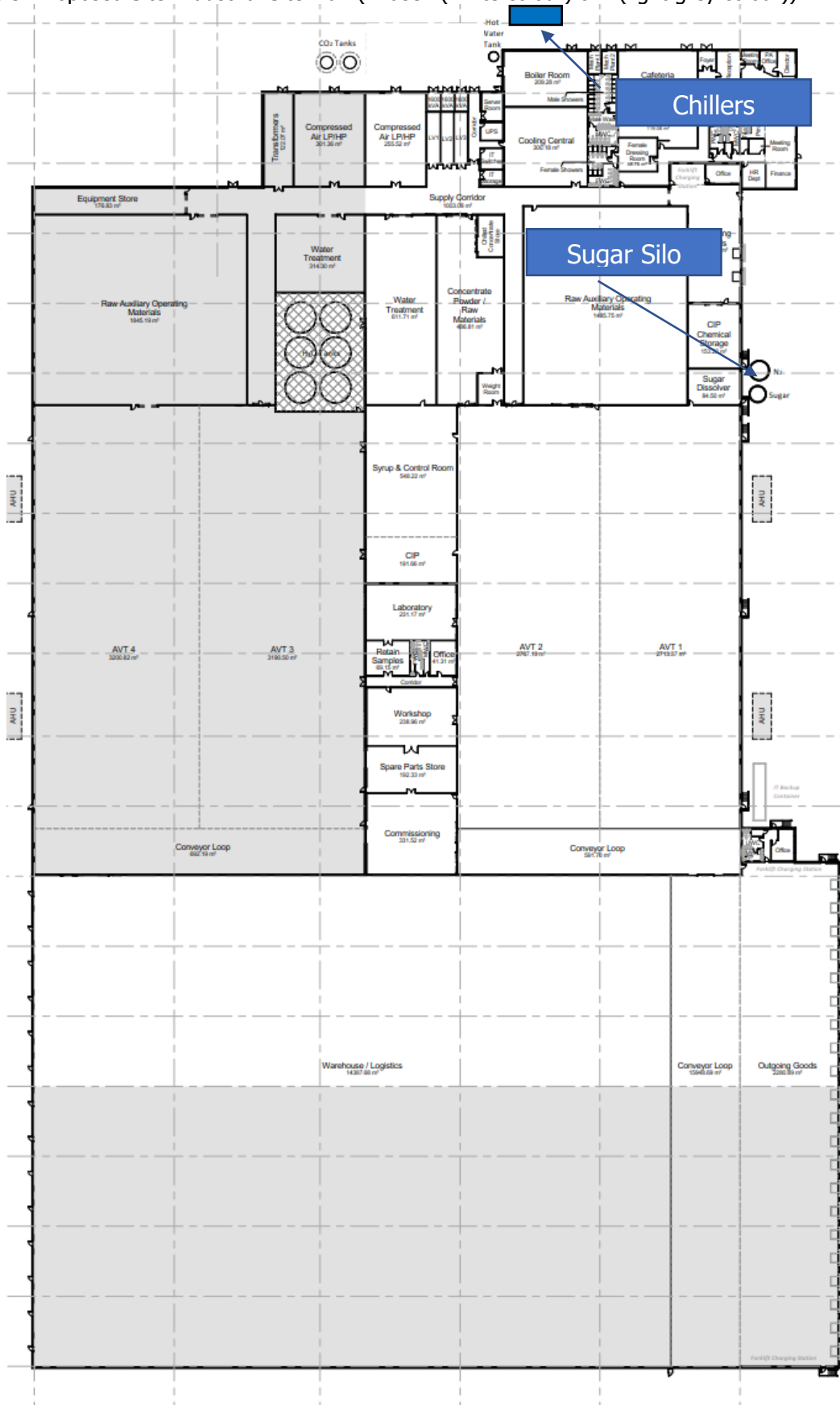


Figure 3: Proposed Site Industrial Site Plan (Phase 1(white colour) & 2 (light grey colour))



3. Planning and Noise

3.1. Planning Conditions

The proposed Dove Valley development (Ref. DMPA/2019/1205) received planning permission on the 21st October 2019, subject to the following 'noise' related conditions:

"17. The design and construction of the proposed building shall be capable of achieving sound insulation performance index R_w of 40dB which shall be maintained for the life of the approved development. Alternatively, prior to the construction of the main building in whole or in part, a noise mitigation scheme that specifies provisions for the control of noise emanating from noise sources within the proposed building shall be submitted to and approved in writing by the Local Planning Authority. The noise mitigation scheme shall be maintained as approved for the lifetime of the development.

Reason: In the interests of protecting the amenity of the area and adjoining occupiers."

"18. The level of noise emitted from the site shall not exceed 44dB LAeq(1 hour) between 07:00 to 23:00 hours and 41 dB LAeq(15mins) between the hours of 23:00 to 07:00, as measured at the nearest noise sensitive receptor. Where access to the nearest sound sensitive property is not possible, measurements shall be undertaken at an appropriate location and corrected to establish the noise levels at the nearest sound sensitive property.

Reason: In the interests of protecting the amenity of the area and adjoining occupiers."

This report specifically addresses Planning Condition 17 which relates to the laboratory sound insulation index performance of the building construction envelope.

4. Assessment Methodology

4.1. British Standard 2014:2014+A1:2019

For industrial and commercial noise, the most relevant guidance is provided within British Standard 4142:2014+A1:2019. The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premise used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'. The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location. In Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider 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."

Based on the initial assessment outcomes of BS4142, and depending on context, it is our opinion that the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the NPPG Noise.

Table 1: BS4142 Difference in Relation to Effect Levels

BS4142 Assessment Difference	Corresponding Effect Level*	Action*
≤ -10 dB	No Observed Effect	No specific measures required
-9.9 dB to 0 dB	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
0.1 dB to 5 dB	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level	
5.1 dB to 10 dB	Significant Observed Adverse Effect	Avoid
≥ 10.1 dB	Unacceptable Adverse Effect	Prevent

* BS4142 states that “where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration”. Therefore, the assessment levels and effect levels above are not definitive and can be modified due to context.

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. This paragraph states:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause [8](#)) from the rating level (see Clause [9](#)).

NOTE 1 More than one assessment might be appropriate.

The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed are not exhaustive and all pertinent factors should be considered.

4.2. British Standard 8233:2014

British Standard 8233:2014 entitled 'Guidance on sound insulation and noise reduction for buildings' came into effect on 28th February 2014 and supersedes British Standard 8233:1999. In the section of the Foreword entitled 'Information about this document', it outlines the principal changes to the previous version. The changes relevant to new student development are as follows:

Publication in England of the National Planning Policy Framework in March 2012, with the concurrent withdrawal of numerous individual planning guidance and policy statement documents, including those specifically relating to noise.

Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources 'without a specific character' and these are based on existing guidelines issued by the World Health Organisation in 1999.

The British Standard guideline states that noise levels should not exceed those as noted in Table 4 of the British Standard, and this is summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16 \text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16 \text{ hour}}$	30 dB $L_{Aeq,8 \text{ hour}}$

5. Noise Monitoring

A partially attended noise monitoring exercise was undertaken between the 08th October and 10th October 2019 to determine the existing environmental ambient noise levels at the proposed site.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using a Sound Level Meter with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection upon request. Table 3 below provides the equipment and calibration status.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-11053-E0	17/04/18	28365
Pre-Amp, NTI, MA220	5871	17/04/18	28365
Microphone, NTI, MC230A	9276	16/04/18	28364
Calibrator, Larson Davis, CAL200	12605	16/04/18	283673

The measuring system was checked for calibration before and after the tests and no significant drift was detected.

5.2. Weather Conditions

During the measurement the weather was partially dry with occasional periods of rain during the daytime period an average temperature of approximately 9-13 degrees Celsius. Wind speeds during the night time period were calm with average speeds below 5 m/s. During the daytime period, there were occasions where wind speeds were slightly above 5 m/s. Nevertheless, weather conditions are not expected to have adversely affected the measured noise data.

5.3. Baseline Noise Monitoring Procedure

A partially attended baseline noise monitoring exercise was undertaken between 13:30 hours on the 08th October 2019 and 12:00 hours on the 10th October 2019 at the monitoring location shown on figure below. The microphone was situated on a tripod at a height of 1.5 metres above the ground, in a free-field position.

Figure 4: Baseline Noise Monitoring Location



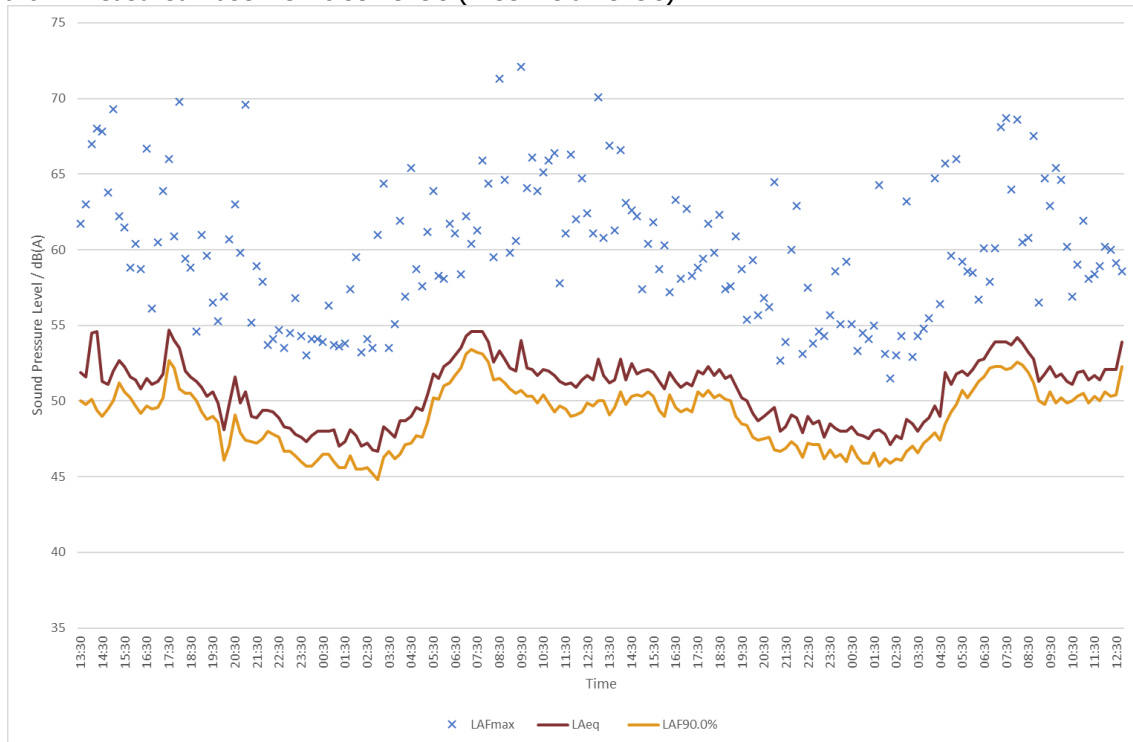
Borehole operations are currently taking place on site at Borehole Location No.1; see Figure 2 above.

These operations have started on Wednesday 9th October 2019 and are understood to run only during the daytime period between 10:00 and 17:00 hours. Nevertheless, the noise impact from the borehole operations at the measurement location were considered negligible when compared to the surrounding noise sources and therefore this measurement location and measured background sound levels can be considered representative of the nearest noise sensitive receivers. This is also shown in Chart 1 and summary result table below, where the variation in noise was considered consistent and similar throughout the whole survey period.

5.4. Measured Levels

The variation in A-weighted baseline background sound levels and equivalent noise levels are provided in Chart 1 below. The tabular data is available upon request.

Chart 1: Measured Baseline Noise Levels (Free-Field Levels)



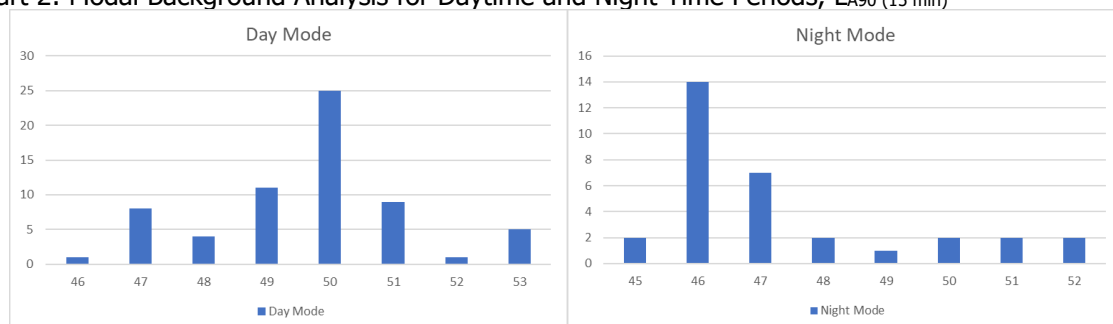
From the measured data, we have determined the following design background sound level and equivalent noise level over the monitoring period for the assessment proposed critical operational periods. The levels are free-field levels.

Table 4: Summary of Measured Noise Levels (free-field levels)

Parameter	LA90(15min)		LAeq(15min)	
	Range	Mode	Range	Mode
Daytime (07:00 – 23:00 hours)	46 - 53	50	48 - 55	52
Night Time (23:00 – 07:00 hours)	45 - 52	46	47 - 54	48

We would consider the above modal background sound levels and equivalent noise levels to be typical for the noise-sensitive receivers during the operational assessment critical hours. The modal analysis for background LA90 is also provided below.

Chart 2: Modal Background Analysis for Daytime and Night Time Periods, LA90 (15 min)



6. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured data noted above. The software predicts industrial noise using the general method of calculation from ISO 9613-1.

6.1. Proposed Industrial Operations

The Mitteldeutsche Erfrischungsgetränke (MEG) group of companies, a subsidiary of the Schwarz Group, is proposing to build a beverage production at the Dove Valley Park, Derby site.

It is understood that the proposed plant and operations that will take place at the new proposed industrial site will be very similar to the current ones taking place at the existing sites in Germany.

For this reason, plant noise levels have been supplied to us by the PGF III's European acoustic consultant. Sound levels provided below are understood to be sound pressure levels obtained at the distance of 1 metre from the source indoors, according to PGF III's European acoustic consultant.

Figure 6 below presents the expected noise sources and indoor sound power levels at in each unit/ area of the proposed industrial site. The sound pressure levels are based on sound level measurements obtained at MEG Löningen GmbH & Co. KG (Germany) in 2017 and carried out by ZECH Ingenieurgesellschaft, a similar site and building with similar sources and levels according to the client. These Noise Source codes are shown in Figure 5 and are also identified on Figure 6 below. External plant noise sources have also been provided; however, these might change.

All the meters used in the measurements carried out at the MEG Löningen GmbH & Co. KG (Germany) site were understood to be calibrated (DKD German Calibration Service) and using a precision sound level meter of class 1. The weather conditions were also considered to be acceptable and are not expected to have adversely affected the measured noise data.

This layout plan of Figure 5 is understood to be now out of date and was recently updated to the proposed layout plan shown above in Figure 3. Nevertheless, the noise levels indoors and types of rooms are still considered to be same and therefore these levels were applied to the new layout. All sources are understood to run continuously over 24 hours.

Figure 5: Proposed ground floor layout plan and plant – Out of date layout plan, showing noise sources from Figure 6 associated with each room/ area and applied in the proposed layout used in the noise model.

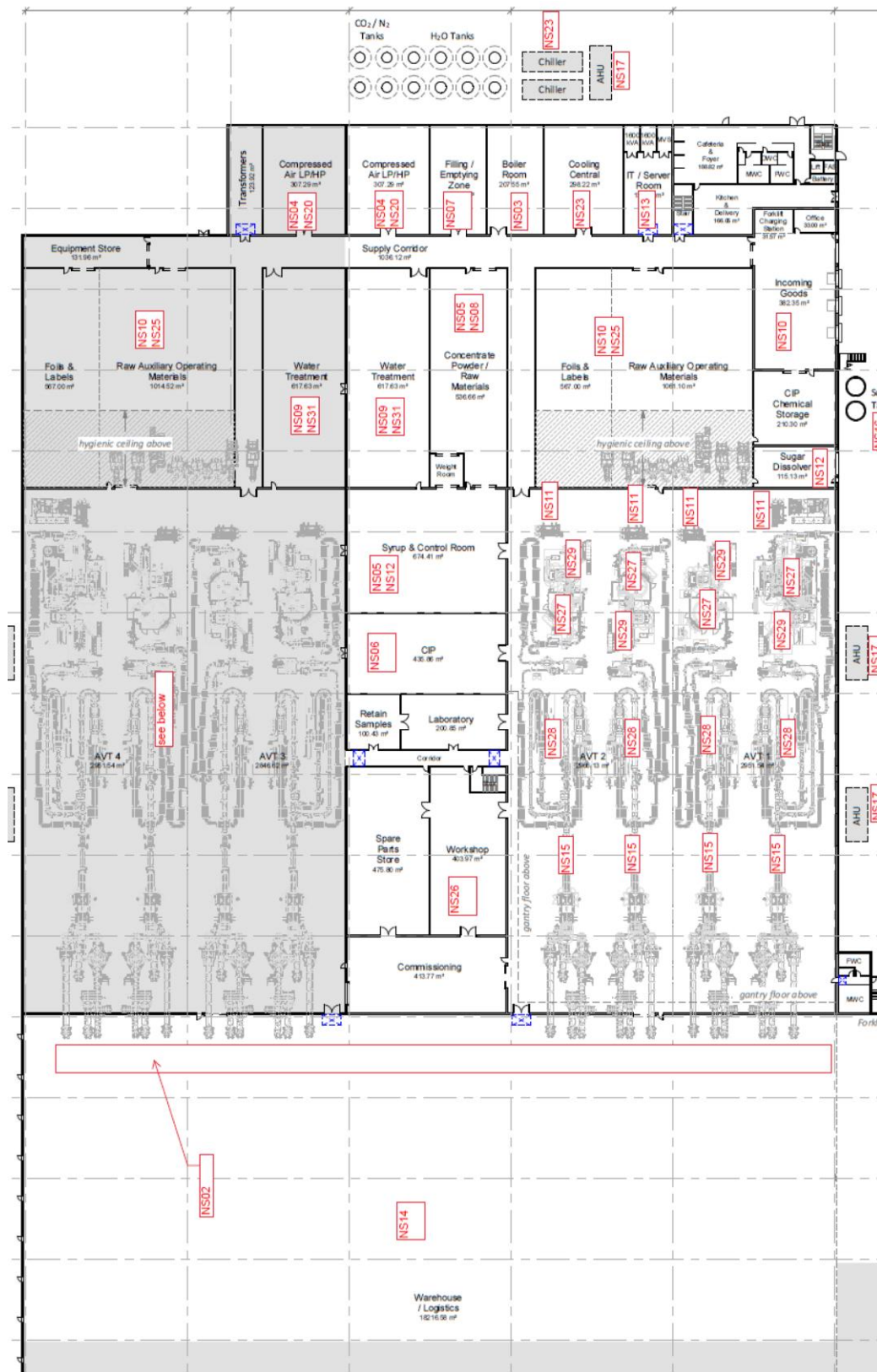


Figure 6: Proposed plant, respective sound power levels, and operating times

Noise Source Code	Unit / Area	Sound Pressure Level dB(A) at 1 metre
NS02	Warehouse, telpher	89
NS03	Steam / boiler room	69
NS04	Compressed air, LP	86
NS05	Process technology, general	63
NS06	Process technology, CIP	69
NS07	Process technology, valve island	85
NS08	Pulver solution	63
NS09	Water house	68
NS10	Incoming warehouse, raw auxiliary operating materials	70
NS11	filling and packing line, mixer & flash pasteurizer	85
NS12	Sugar dissolver	80
NS13	Low voltage distribution	80
NS14	Warehouse, general	63
NS15	Filling and packing line, general	85
NS16	Sugar delivery	89
NS17	ventilating systems	60
NS20	Compressed air, hp	85
NS23	Chiller	90
NS25	Filling and packing line, preform supply	79
NS26	Workshop, general	80
NS27	Filling and packing line, filling unit	90
NS28	Filling and packing line, foil shrinking unit	83
NS29	Filling and packing line, blowing station	87
NS31	Water treatment	84

Based on the current proposed layout, and noise sources associated with each area as shown in Figure 5 and Figure 6, we have predicted and considered the following operational indoor noise sources in our model. The cumulative sound pressure noise levels below were used to predict the indoor noise levels in each unit/ area that will then be used in the model as a horizontal (roof) / vertical (Wall/ Plant) area source.

Table 5: Proposed Indoor/ Outdoor Noise Sources

Room's Name (as stated in proposed layout)	Noise Source(s) Code	Resultant Sound Pressure Level dB(A) at 1 metre
Warehouse & Logistics	NS14+NS02	89
Conveyor Loop + Outgoing Goods	NS14	63
NS26-Workshop	NS26	80
NS06 - CIP	NS06	69
Syrup & Control Room	NS12+NS05	80
Raw Auxiliary Operating	NS25+NS10	80
Water Treatment	NS31+NS09	84
Water Treatment	NS31+NS09	84
Concrete Powder / Raw Materials	NS08+NS05	66
Folls & Labels + Raw Aux Operating Materials	NS10+NS25	80
Incoming Goods	NS10	70
Sugar Dissolver	NS12	80
Compressed Air LP/HP	NS20++NS04	89
Compressed Air LP/HP	NS20+NS04	89
Boiler Room	NS03	69
Cooling Central	NS23	85
Server Room (wall only)	NS13	80
AVT 1+AVT 2	NS11 (x4) +NS15 (X4) + NS27 (x4) + NS29 (X4)	100
AVT 3 +AVT 4	NS11 (x4) + NS15 (X4) +NS27 (x4) + NS29 (X4)	100

6.2. Industrial Noise Levels

6.2.1. Predicted Industrial Indoor Noise Levels

Based on the supplied plant sound pressure indoor noise levels above, we have predicted the cumulative indoor noise levels expected within each room of the building. The rooms were considered reflective (average α of 0.1) and dimensions are based on the supplied Stride Treglown architectural drawings. Calculations also assume plant to be at the centre of the room ($Q=2$). Predicted indoor plant noise levels are shown below in Table 6; calculations for each room are provided in more detail in Appendix 2. All levels below operate continuously over 24 hours.

Table 6: Predicted indoor noise levels

Room area	Predicted Indoor Sound Pressure Level (dBA)
Warehouse & Logistics	70
Conveyor Loop + Outgoing Goods	49
NS26-Workshop	74
NS06 - CIP	63
Syrup & Control Room	72
Raw Auxiliary Operating	69
Water Treatment	76
Water Treatment	77
Concrete Powder / Raw Materials	58
Folls & Labels + Raw Aux Operating Materials	69
Incoming Goods	63
Sugar Dissolver	77
Compressed Air LP/HP	83
Compressed Air LP/HP	84
Boiler Room	65
Cooling Central	85
Server Room (wall only)	77
AVT 1+AVT 2	87
AVT 3 +AVT 4	87

6.2.2. Proposed Industrial External Plant Noise Levels

The proposed plant is understood to comprise Air Conditioning DAIKIN units and Air Handling Unit Dalair Ltd. The plant type and relevant manufacturer's noise data is provided in more detail in Appendix 3 and was provided to us by Hoare Lea's M&E Engineers. This plant might however change and is not confirmed at this stage; however, it should provide an indication of the levels affected by future installed condenser units of similar operational level.

It is understood that plant has only been selected for Phase 1 of the project. No plant has been proposed currently for Phase 2, however, it is anticipated that the roof plant applied will be the same or very similar as for Phase 1. For this reason, we have duplicated the proposed Phase 1 plant located on the roof area above production rooms (AHU and supply/ extract fans) in the Phase 2 roof area. The location of the external Sugar Silo and Chillers are shown in more detail in Figure 12.

Below we show a list of the proposed plant areas (Phase 1 only) as shown in supplied Hoare Lea drawings. It also shown the proposed external Silo and Chiller as supplied by the client.

Table 7: Number and Type of External plant currently proposed (Phase 1) & assumed (Phase 2)

Source Type/ Drawing Code	Location	Number of Units	Sound Pressure Level at 1 metre
Air Handling Unit (Dalair Ltd) / (AHU – X)	Roof	9 Units+6 Extra Assumed (Phase 2)	See Appendix 10.2.4
Extract Fans (Dalair Ltd) / (EF)	Roof	5 Units +1 Extra Assumed (Phase 2)	See Appendix 10.2.4
Supply Fans (Dalair Ltd) / (SF)	Roof	2 Units + 1 Extra Assumed (Phase 2)	See Appendix 10.2.4
Condenser Units (Daikin) (COND-X)	External, GF, North	12 Units	See Appendix 10.2.4
Sugar Silo's Filter	External, GF (Eastern Elevation)	1 Unit (18 metres height above ground)	86
Sugar Silo's Dry Air Generator (assumed 2 metres height)	External, GF (Eastern Elevation)	1 Unit	80
Sugar Silo's Injector (assumed 2 metres height)	External, GF (Eastern Elevation)	1 Unit	89
Chiller (1No. Area used)	External, GF, North	1 No, comprising multiple units occupying an area of approximately 13 x 2.5 metres	82 ⁽¹⁾

⁽¹⁾ Based on a sound power level of 90dB(A) at 32°C (worst case of supplied provided)

Figure 7: Proposed roof plant above production Area – Phase 1 (AHU & Extract/ Supply Fans)

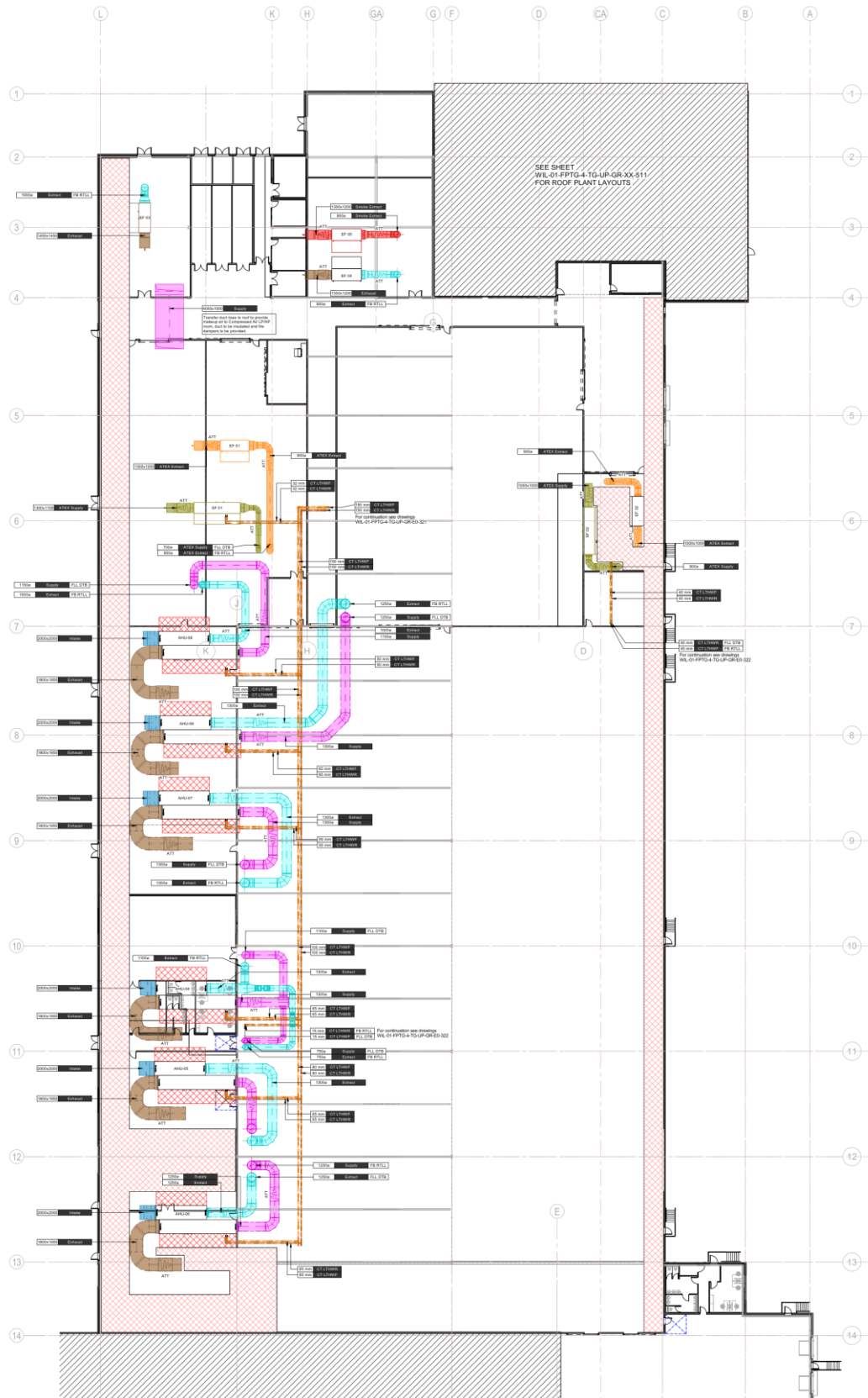
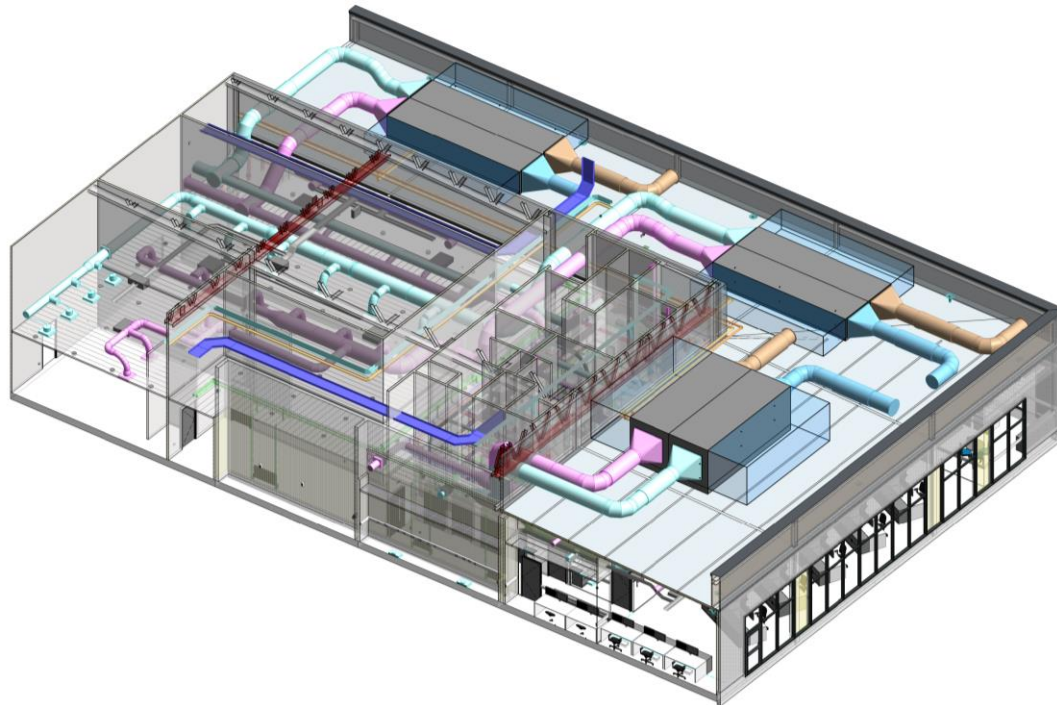


Figure 10: Proposed roof plant above Office Area (North Eastern Corner above offices) – Phase 1 (AHU units) (3/3) – 3D View



2 Office Roof - 3D View

Figure 11: Proposed Condenser Units – Phase 1 – Layouts & 3D views

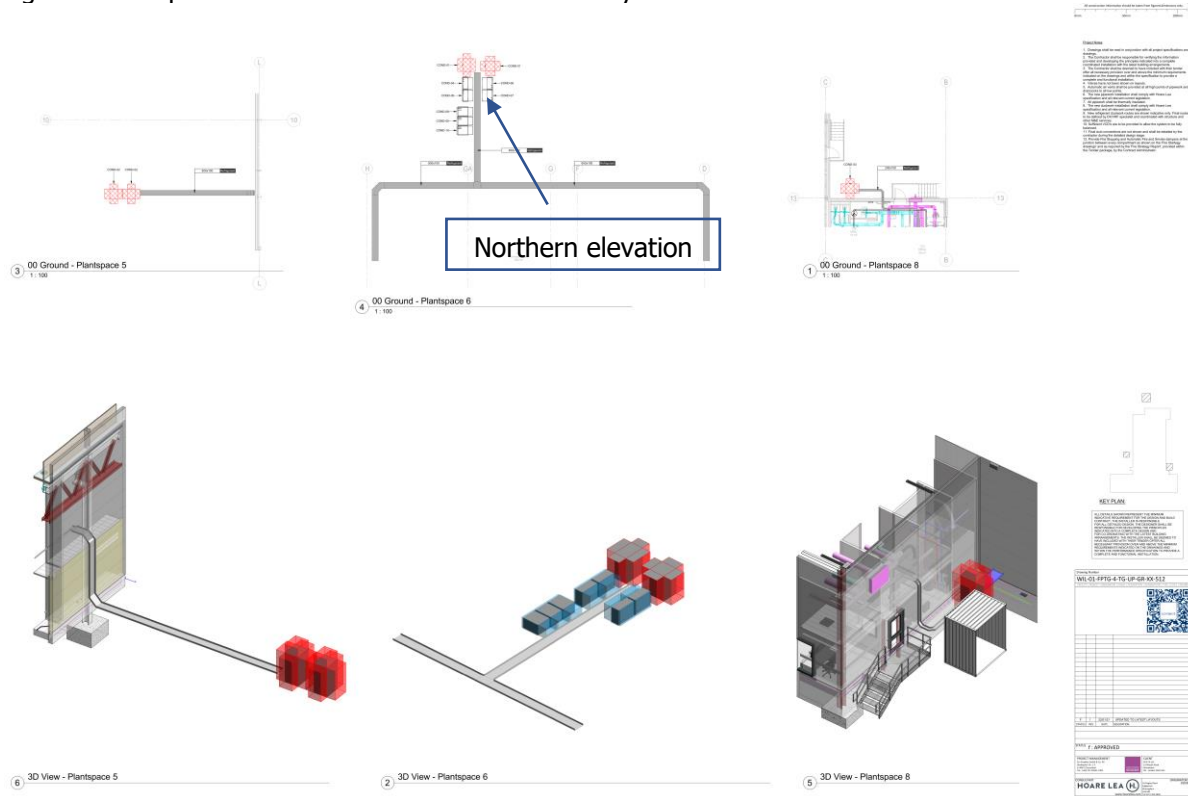
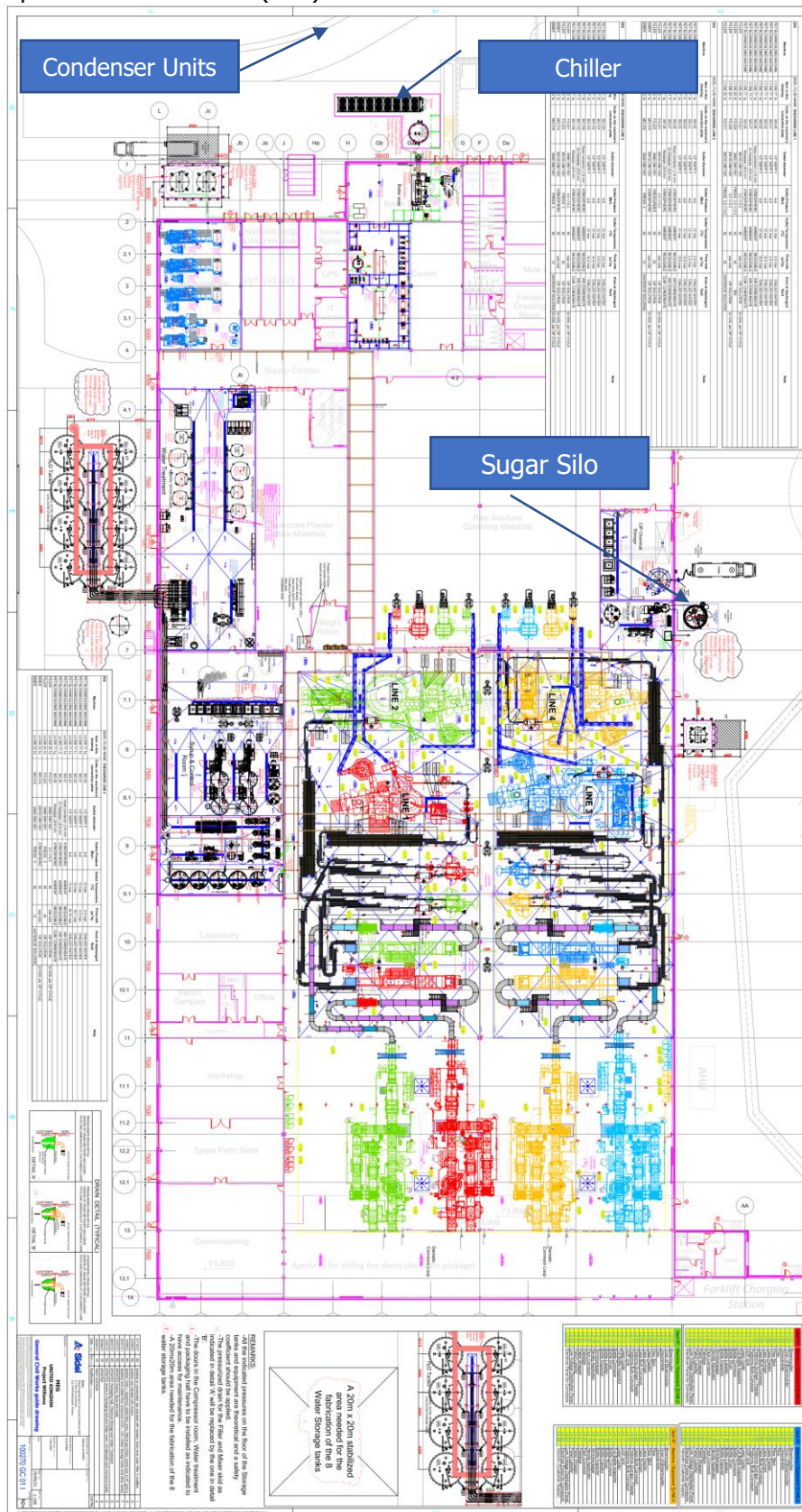


Figure 12: Proposed Chiller Location (N23)



It is understood that the proposed AHU/ SF & EF units will include attenuators. At this point in time, only a provisional space was provided so attenuators can be fitted by the contractor which might change current proposals to fit their own plant selection which should be similar to plant described above. For this reason, we have assumed generic attenuation, based on a standard NOICO rectangular attenuator, Model 40 with 600mm length. Higher attenuation is available, the selected attenuation can be used as a guide only to set the minimum insertion loss that should be provided by these attenuators.

The spectral insertion loss provided by a NOICO, Model 40 (600mm length) is shown below and was applied to all the supply & extract terminals of the proposed/ assumed AHU/ EF and SF. Any other alternative attenuators can be used, as long as the minimum insertion losses shown below are achieved. The selection of the final attenuator should also consider other design ventilation parameters. We would advise that any final selection is confirmed by the M&E engineers to check whether the selected attenuator complies with their design requirements.

Table 8: Recommended Minimum Insertion Loss for Attenuators

Attenuator Model	Insertion Loss, Octave Band Spectrum (dB) / Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
NOICO Model 40 - 600mm length	4	6	10	17	23	16	12	10

6.2.3. Proposed Industrial Delivery Noise

It understood that the proposed site will include HGV movements and loading/ unloading of goods operations at the proposed loading docks shown on the proposed site plan above. The proposed HGV circuits are understood to follow the circuits shown in Figure 13 below.

Figure 13: Vehicle movement's strategy and proposed loading docks location



It is also understood that the proposed HGV movements are expected to be as follows based on the client's provided information:

- Outgoing Goods (21no. loading docks to south of the site) = 0600 – 2200 hours
- Incoming Goods (2no. loading docks and 1no. silos to north of the site) = 0700 – 1900 hours

The respectively HGV circuits are marked up in pink and red colour above (Goods In/ Out). There is also one HGV circuit used occasionally to access the recycling area and Gas/ H2O tanks located to the north of the site.

6.2.4. Predicted Industrial Delivery Noise

It is also understood that each 1no. HGV takes 35 minutes to arrive to a dock, load the trailer, and leave. On this basis, we have assumed the following:

- Max of 42no. HGV movements (Loading/ Unloading) at 21no. loading docks to south of the site – per 60-minute intervals – Daytime.
- Max of 10no. HGV movements (Loading/ Unloading) at 21no. loading docks to south of the site – per 15-minute intervals – Night Time (1/4 of the total daytime period).
- Max of 4no. HGV movements (Loading/ Unloading) at 2no. loading docks – per 60-minute intervals- Daytime.
- Max of 1no. HGV movements (Loading or Unloading) at 1no. loading docks to south of the site – per 15-minute intervals – Night Time (1/4 of the total daytime period).
- Max of 1no.HGV movements (Loading or Unloading) at 1no. silos area to north of the site) - per 60-minute intervals – Daytime.

- Max of 1no.HGV movements (Loading or Unloading) at 1no. silos area to north of the site per 15-minute intervals- Night Time (1/4 of the total daytime period).

Acoustic Consultants Limited have measured the HGV vehicle movements on many industrial sites. The typical noise level of an HGV manoeuvring back including reverse alarm beeping is shown in Table 9 below. Noise levels were then used and been modelled in the noise modelling software Cadna:A.

The measured levels are free-field levels and have been corrected to a distance of 10 metres where appropriate. The microphone was situated on a tripod at a height of 1.5 metres above the ground, in a free-field position.

Table 9: Typical Delivery Operation Noise Emission within Industrial/ Commercial Sites

Duration, T (min)	L _{Aeq, T} (dB)	Activity at 10m
5	68	HGV Arrive
60	54	HGV unloading
2	69	HGV Depart

The measured and predicted sound power octave band levels for the activities above are also shown in Appendix 2 and were used in our noise modelling below.

It is also understood that the HGV will reverse and load/ unload their goods inside the store at the loading docks. The docks are surrounded by a 'rubber curtain' which will protect some noise from escaping through the any gaps. However, we have considered that the loading dock's door to be open and therefore no sound insulation has been considered; this is considered to be a worst-case scenario. The level radiating through the open door is considered to be similar to the above predicted indoor noise levels.

Loading / Unloading activity associated with the above vehicle delivery movements was also inserted at the 1no. silos area to north of the site. Noise levels used are based on above ones measured and shown in Table 9 above and are shown in more detail in Appendix 2.

6.3. Proposed Construction

6.3.1. Proposed Cladding/ Wall

It is understood that the building cladding/ wall will be built of a thermal insulated type of panel, more specifically 175mm thick PAROC panel system, with a laboratory sound insulation performance index of 31dB Rw; See Appendix 10.2.7.

6.3.2. **Proposed Roof**

The proposed Roof construction is also understood to be 130mm thick on a metal deck with a single ply membrane. According to the client, the system will be similar to 'Test 3' shown in the Kingspan's 'Technical Bulletin, Acoustics: Airborne Sound Transmission, UK' manual' which have achieved a laboratory sound insulation index result of 31dB Rw; See Appendix 10.2.7.

We are not aware of any rooflight system being proposed for this scheme, however, should the roof include rooflight areas, then these would need to achieve at least 31 dB Rw. This can be achieved by using double polycarbonate panels of 6mm each (mass per unit area of 3.6kg/m²) with a cavity of around 100mm.

6.3.3. **Proposed Windows**

The proposed windows are unknown; however, windows are only expected to be installed within office areas with no risk for noise breaking out, therefore, no specific sound insulation performance is required. However, please note that typical standard double window a configuration of '4mm-12mm-4mm' is expected to achieve Rw 31dB.

6.3.4. **Proposed Loading Bay Doors/ Openings**

These areas were assumed in our noise model to be 'open' and with a laboratory sound insulation performance of 0dB Rw. These areas are located to the south east of the building, with very low impact upon the nearest noise sensitive receivers, and therefore do not require any specific laboratory sound insulation index performance. However, please note that when closed, basic roller shutter doors achieve at least 18dB Rw, or 25dB Rw if insulated panel doors are used.

6.4. **Proposed & Existing Topography**

The proposed absolute heights within the site are based on the topographical drawings provided by the architect and Civil Engineer.

The existing site, outside the proposed site boundaries was modelled using the current available LIDAR topography and a grid of 2x2 m height points was used.

Both the contour and height points can be seen within the attached CadnaA noise model file.

6.5. Proposed Earth Bund & Parapets

6.5.1. Proposed Earth Bund

An earth bund has been proposed on the northern boundary of the site between the proposed development and the nearest noise sensitive receivers. The proposed absolute heights of the earth bund and site contour heights have been provided by the architect and are provided in appendix 2.

The northern building floor finish of the site is understood to have an absolute height of 73.8 metres above sea level. The site's heights decrease slightly towards the southern direction by some 0.45 metres to an absolute floor finish height of 73.35 metres.

For this reason, the buildings ground heights in our noise model (CadnaA) below were considered to be flat, and the absolute ground height was considered to be 73.8 metres.

The proposed landscape earth bund is based on the supplied proposed topography of the site and is understood to be around 5 to 7 metres approximately above the absolute ground floor buildings height of 73.8 metres.

Figure 14: Proposed Northern Elevation showing proposed absolute floor finish heights

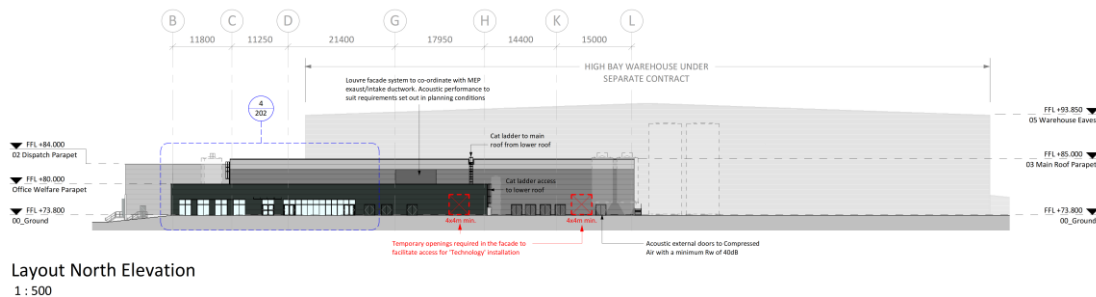


Figure 15: Cross Section between site and receivers (assumed head top lane height) and indicative variation of absolute earth bund height

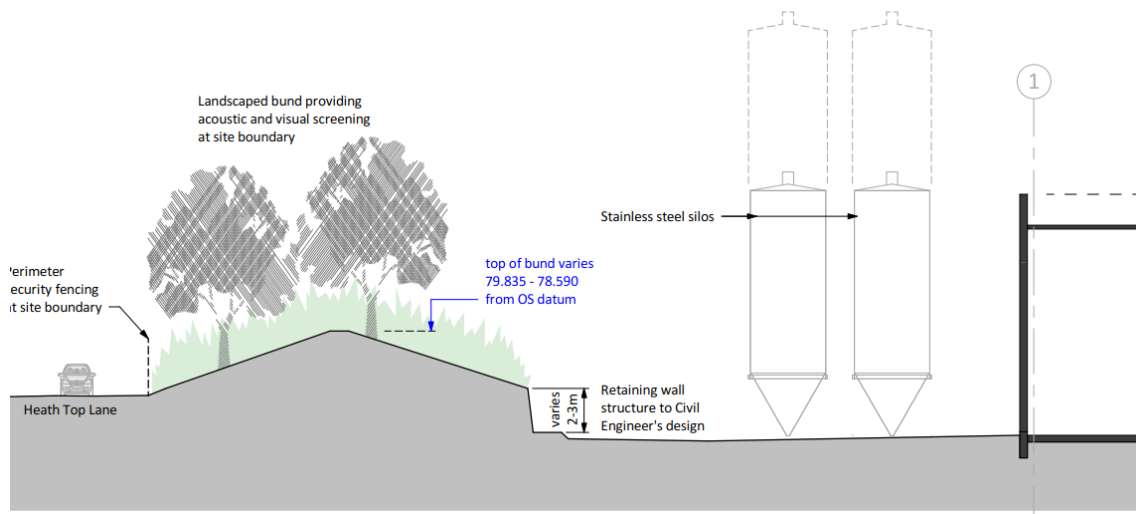
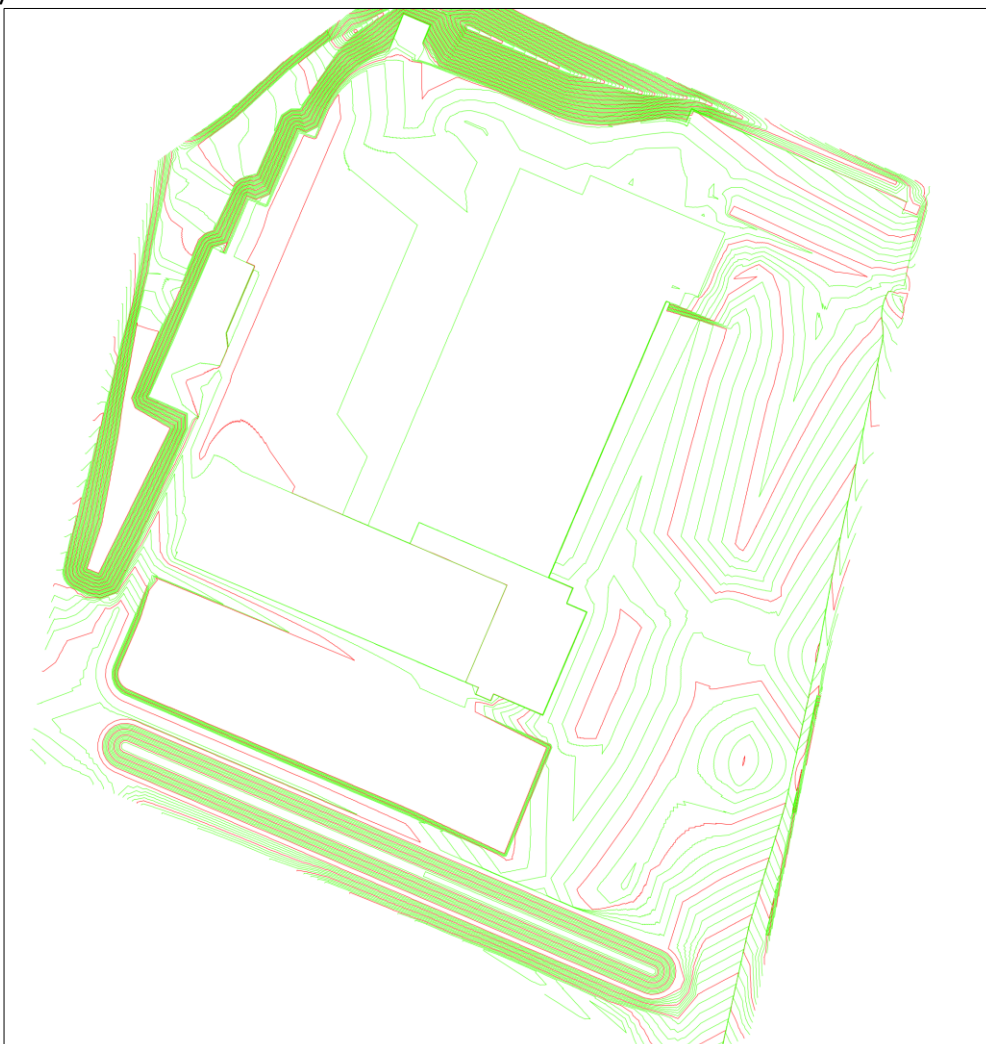


Figure 16: Proposed Site Height contours including of earth bund to be erected along the northern boundary of the site

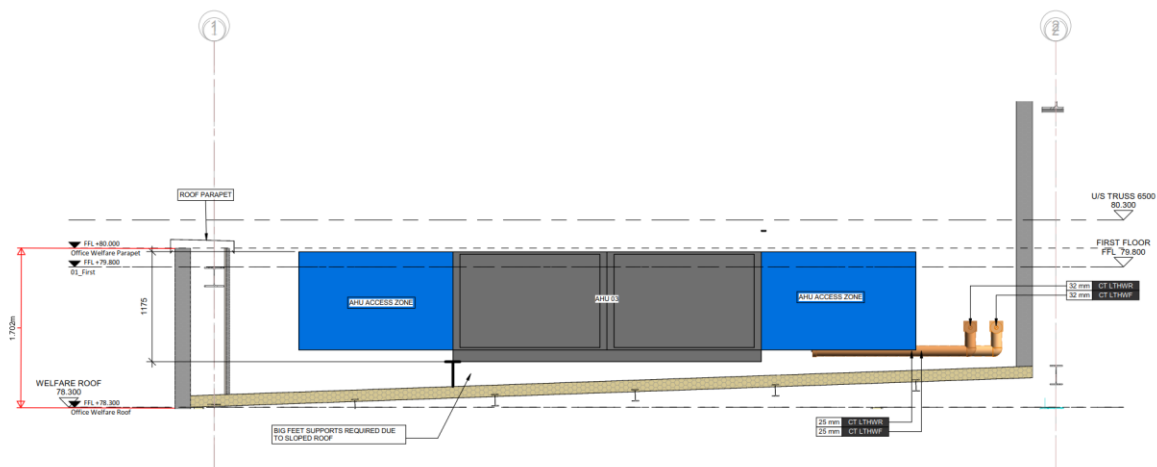


6.5.2. Proposed Building Parapets

It is understood that the building will include a parapet around the buildings with approximately 1.7 metres height, which was inserted as a relative height above the roof height of the buildings within CadnaA. This will provide some level of screening from proposed plant located at the roof of the proposed buildings. The only exception where this does not seem to be applied is at the warehouse building, however, no plant has been proposed on top of this roof.

Below we show a cross section of the proposed building showing the parapet.

Figure 17: Proposed parapet around the roof edge.



6.6. Industrial Modelling Parameters

The parameters within the Cadna:A model are as follows and are considered reasonable assumptions:

- The proposed building height is based on the supplied architectural elevations
- The existing building heights are based on site observations and vary between 7 to 15 metres high
- The 'max. Order of Reflection' was considered to be 1
- The ground across the site and surrounding area is considered hard and reflective ($G=0$) (worst-case)
- Buildings are considered to be reflective (alfa within CadnaA assumed to be 0.21)
- The predictions are based on the indoor, external plant and vehicle movement noise levels shown above in Section 6.2.1 to 6.2.3.
- The vehicle movements predictions are based on the measured pass by noise emission levels shown above (arrival/ departure). This level was then inserted in CadnaA using a moving point source to represent the pass by noise level of an HGV vehicle at 10km/h.

- The indoor noise levels were inserted in CadnaA as an indoor area noise source and vertical area noise source with the respective R_w performances stated above. The height of the vertical area sources is assumed to be the full height of the proposed buildings which are shown in Appendix 2.
- The proposed absolute heights within the site are based on the topographical drawings provided by the architect and are provided in appendix 2.
- The existing site, outside the proposed site boundaries was modelled using the current available LIDAR topography and a grid of 2x2 m height points was used.
- The predicted noise map level is given at a height of 4.5 metres (worst case first floor window) above the ground height; absolute heights of receivers & building evaluation relative height above ground is provided in appendix.
- The generated noise map is given in a 5x5metres calculation grid

6.7. Industrial Modelling Results

Noise levels have been predicted for both, daytime and night time periods based on the parameters set out above. The following scenarios have been assessed.

- **Scenario 1:** All Internal & External Sources
- **Scenario 2:** Only Internal Noise Sources (Condition 17)
- **Scenario 3:** All Internal & External Sources, with the exception of Condenser Units (2No. COND 01) and Chiller (1No.)

6.7.1. Scenario 1 – All Indoor & External Sources

The predicted worst-case noise levels at the NSR were determined to be 46dB $L_{Aeq, 1 \text{ hour}}$ and 46dB $L_{Aeq, 15 \text{ min}}$.

Figure 18: Predicted daytime $L_{Aeq, 1 \text{ hour}}$ noise levels – Scenario 1



Figure 20: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels – Scenario 1



Figure 21: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels at nearest receivers – Scenario 1

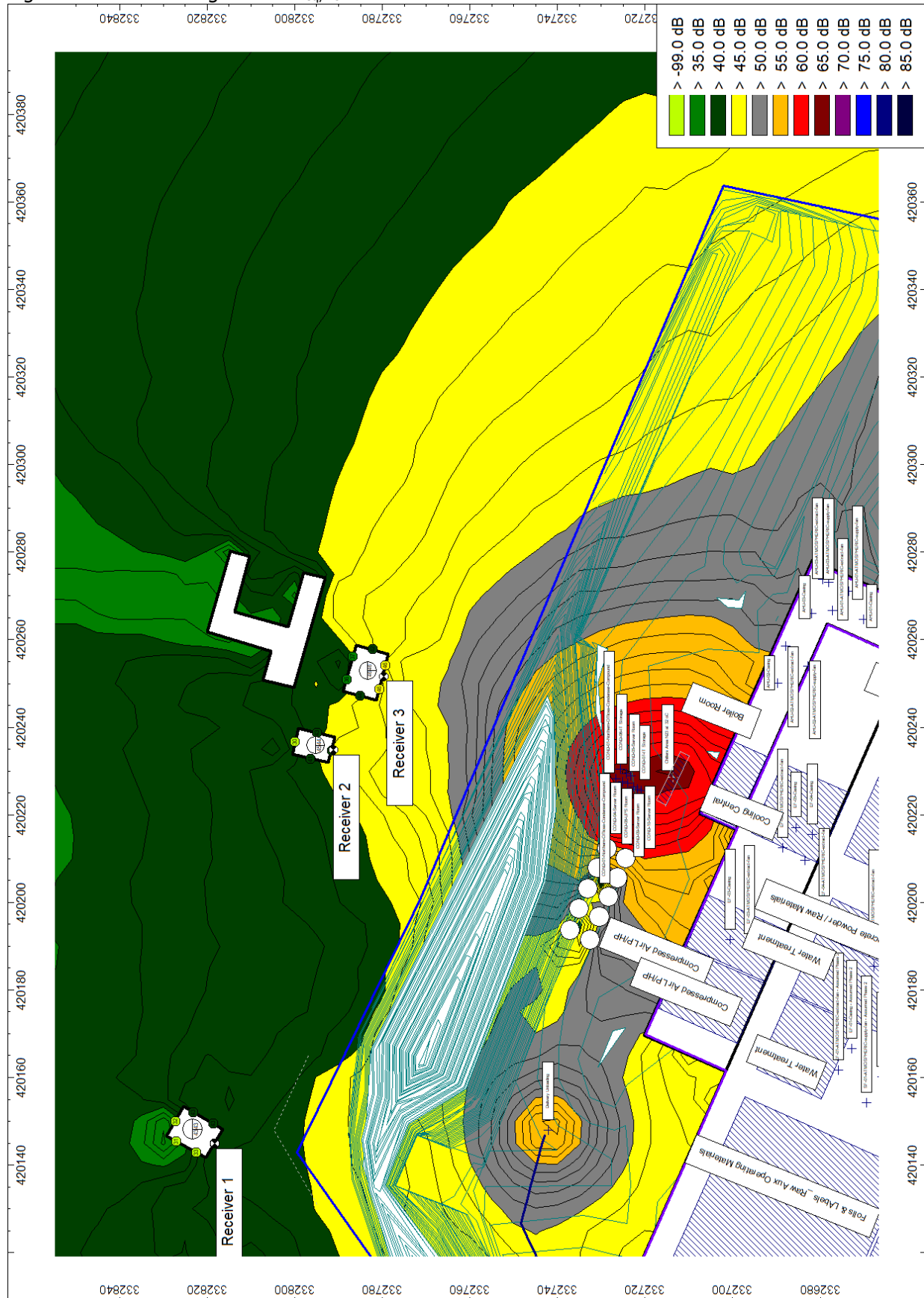


Figure 23: Predicted daytime $L_{Aeq, 1 \text{ hour}}$ noise levels at Nearest Receivers – Scenario 2

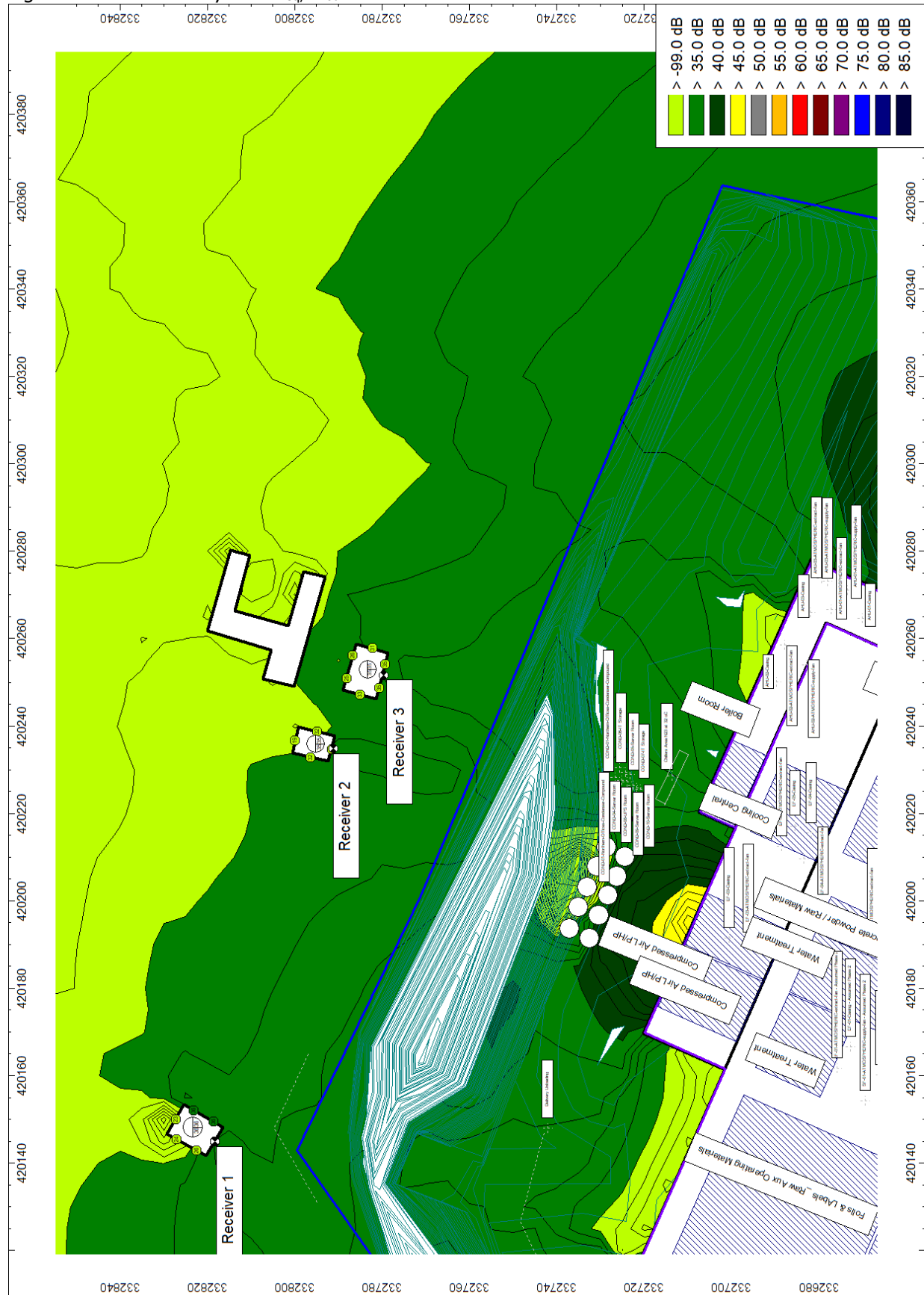


Figure 24: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels – Scenario 2

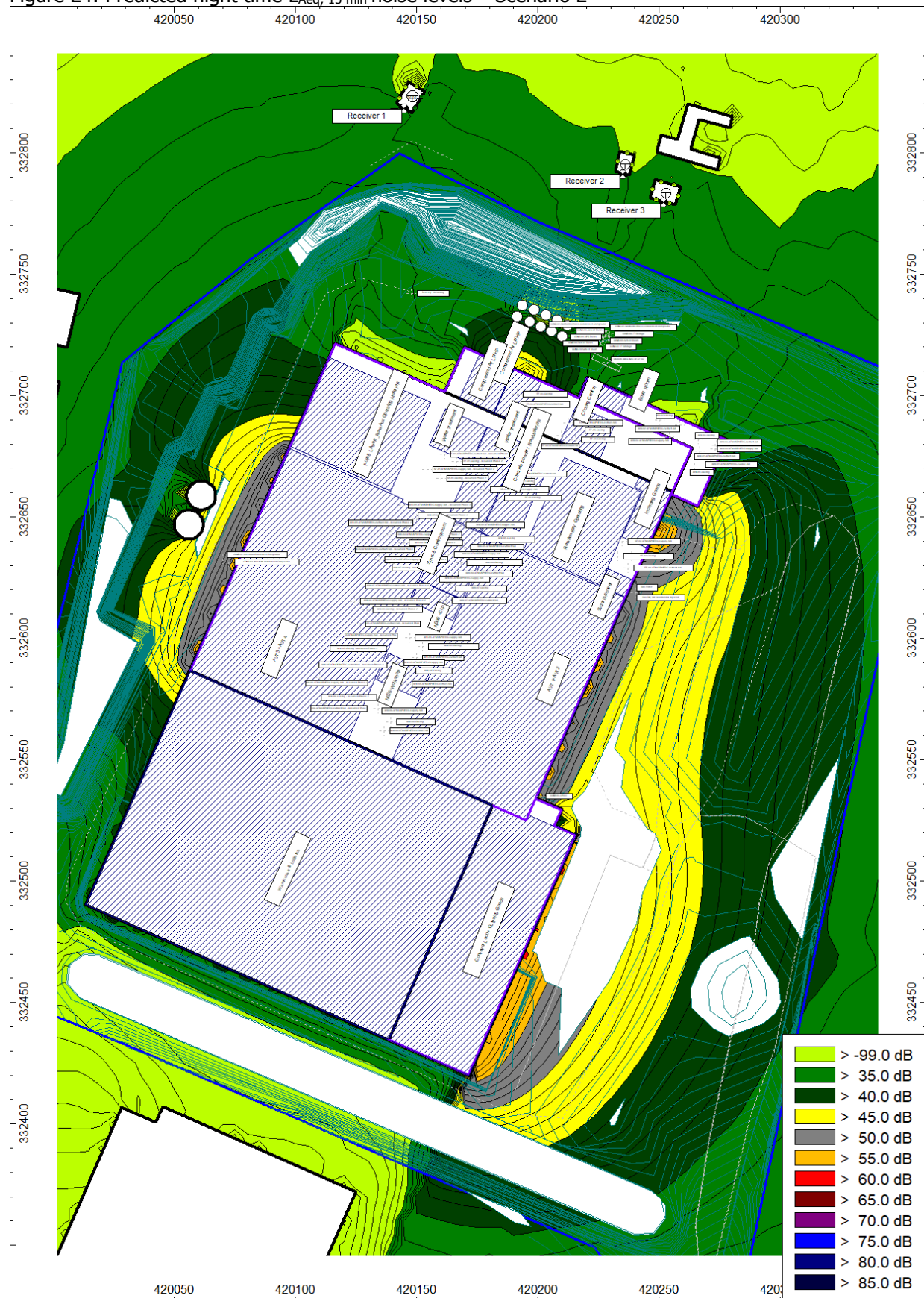
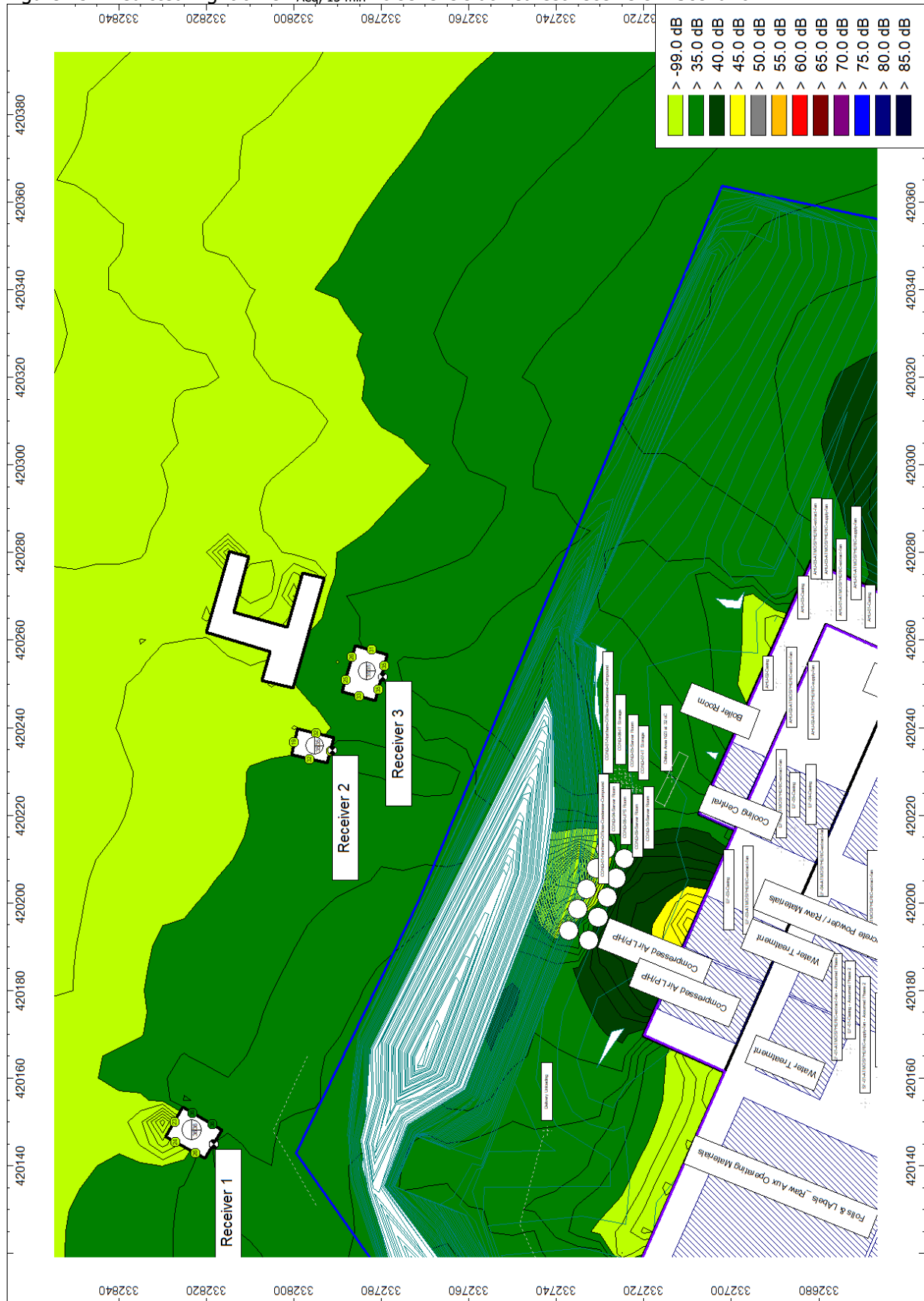


Figure 25: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels at nearest receivers – Scenario 2



6.7.3. Scenario 3 – All Internal & External Sources, with the exception of Condenser Units (2No. COND 01) and Chiller (1No.)

The predicted worst-case noise levels at the NSR were determined to be 43dB $L_{Aeq, 1 \text{ hour}}$ and 40dB $L_{Aeq, 15 \text{ min}}$.

Figure 26: Predicted daytime $L_{Aeq, 1 \text{ hour}}$ noise levels – Scenario 3



Figure 28: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels – Scenario 2



Figure 29: Predicted night time $L_{Aeq, 15 \text{ min}}$ noise levels at nearest receivers – Scenario 2



7. Noise Assessment – Planning Condition 17

As it can be seen from the noise modelling scenario 2, where only internal noise levels have been considered in order to address planning condition 17, which relates to noise breaking out from the building, that the noise limits set by Planning Condition 18 of 44dB $L_{Aeq, 1 \text{ hour}}$ (daytime) and 41dB $L_{Aeq, 15 \text{ min}}$ (night time) are likely to be achieved where the proposed building construction is used.

Despite the fact that the proposed construction does not achieve a laboratory sound insulation index of 40dB R_w as required in Planning Condition 17, it has been demonstrated that the proposed construction is clearly sufficient to control the noise levels from breaking out the building.

When all sources are considered (Scenario 1), the results obtained at the NSR are mainly dictated by the external noise sources, in particular from the proposed northern chillers and condenser units – 2No. 'COND 01' that are considered to be particularly dominant in comparison to other external noise sources. It has been demonstrated that in order to comply with Planning Condition 18 noise limits, these sources will need to be provided with additional mitigation measures, which could comprise full proprietary enclosures or attenuators to reduce the noise levels further by at least 10dB(A) / 15dB(A), relocation of current proposed plant location to a further southern location and away from sensitive receivers, or replacement of current units by others that are significantly quieter.

The mitigation required to control external plant noise, in particular condenser units and chillers located on the north side of the development, can be discussed and addressed with the client at a later stage once further details on the exact manufacturer's models and noise data is provided to us, including octave band noise spectral data where possible.

Therefore, we are of the opinion that current proposed constructions, particularly the wall and roof constructions and their laboratory sound insulation index R_w performances are sufficient to control noise breaking out from the building based on the supplied and predicted indoor levels expected for this type of development.

The requirements of Planning Condition 17 which states that "*prior to the construction of the main building in whole or in part, a noise mitigation scheme that specifies provisions for the control of noise emanating from noise sources within the proposed building shall be submitted to and approved in writing by the Local Planning Authority*" have been achieved and therefore can be discharged by the Local Authority.

8. Summary & Conclusions

PGF III Ltd appointed Acoustic Consultants Limited to carry out a noise impact assessment from the proposed industrial development operations at Dove Valley Park, Derby in support of the following planning application (Ref. DMPA/2019/1205).

A noise impact assessment report has been completed (8018 - Dove Valley Park, Derby V1.0' - 17th October 2019) and submitted in support of the above planning application which has been approved on the 21st October 2019 with attached conditions 17 & 18 which relate to noise control and noise limits set at the nearest noise sensitive receivers around the site.

This report specifically addresses Planning Condition 17 which relates to the laboratory sound insulation index performance of the building construction envelope.

It is not considered practical or not even necessary to provide a sound insulation performance of 40dB Rw to all the building fabric elements of the building. Therefore, an alternative noise mitigation scheme analysis has been completed as suggested in Planning Condition 17, to demonstrate that the proposed construction selected by the client and its laboratory sound insulation index performances are sufficient to meet the noise limits imposed by Planning Condition 18 at the nearest noise sensitive receivers.

It was demonstrated with noise modelling scenario 2 where only internal noise levels have been considered in order to address planning condition 17, that the noise limits set by Planning Condition 18 of 44dB L_{Aeq}, 1 hour (daytime) and 41dB L_{Aeq}, 15 min (night time) are likely to be achieved where the proposed building construction materials are used.

Despite the fact that the proposed construction does not achieve a laboratory sound insulation index of 40dB Rw as required in Planning Condition 17, it has been demonstrated that the proposed construction is clearly sufficient to control the noise levels from breaking out the building. It was demonstrated that the results obtained at the nearest noise sensitive receivers are mainly dictated by external plant noise and therefore internal noise levels breaking out are likely to be sufficiently controlled with the current proposed construction.

Therefore, the requirements of Planning Condition 17 which states that "*prior to the construction of the main building in whole or in part, a noise mitigation scheme that specifies provisions for the control of noise emanating from noise sources within the proposed building shall be submitted to and approved in writing by the Local Planning Authority*" have been achieved and therefore can be discharged by the Local Authority.

9. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90, T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq, T} = 10 \log_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and
 $p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq, T_r}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, L_{Ar, T_r} – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60-dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60-dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20-dB decay multiplied by three) and T30 (time taken for a 30-dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, $eVDV$ – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

Weighted standardized impact sound pressure level, $L'_{nT, w}$ - single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies. NOTE weighted standardized impact sound pressure level is used to characterize the insulation of floors in buildings (see Annex C and BS EN ISO 717-2).

Weighted standardized level difference, $D_{nT, w}$ – single-number quantity that characterizes the airborne sound insulation between rooms. NOTE Weighted standardized level difference is used to characterize the insulation between rooms in a building (see Annex C and BS EN ISO 717-1).

10. Appendix 2 – Noise Modelling Parameters & Data

10.1. Predicted Indoor Noise Levels

Room's Name	Lw		Cumulative Sound Pressure Level	Resultant Sound Power Level	Total Floor Area	Total Assumed Ceiling Area	Assumed Ceiling Height	Total Room's Wall Area	Total Room's Surface Area (S)	Assumed Room's Absorption Coefficient Alfa (reflective)	Total sound absorption (A=S * α_{avg})	Room's Volume	Assumed Distance to Receiver (Worst Case)	Q Factor (Directivity)	Sound Power within Room	Equivalent Absorption Area (A)	Room Constant (A/(1- α_{avg}))	Direct sound pressure level	Reverberant sound pressure level	Indoor Sound Pressure Level
	Type	Noise Source(s) Code	dB(A)		(m²)	(m²)	(m)	(m²)	(m²)	α	(m²)	(m³)	(m)		dB(A)	(m²)		(dBA)	(dBA)	(dBA)
Warehouse & Logistics	Lw	NS14++NS02	89	97	30336	30336	20.50	14282	74955	0.1	7495	621896	10.25	2	97	7495	8328	69	64	70
Conveyor Loop + Outgoing Goods	Lw	NS14	63	71	17780	17780	10.20	5440	40999	0.1	4100	181352	5.10	2	71	4100	4555	49	40	49
NS26-Workshop	Lw	NS26	80	88	239	239	10.20	631	1109	0.1	111	2437	5.10	2	88	111	123	66	73	74
NS06 - CIP	Lw	NS06	69	77	192	192	10.20	565	948	0.1	95	1955	5.10	2	77	95	105	55	63	63
Syrup & Control Room	Lw	NS12++NS05	80	88	548	548	10.20	955	2052	0.1	205	5592	5.10	2	88	205	228	66	71	72
Raw Auxiliary Operating	Lw	NS25++NS10	80	88	1486	1486	10.20	1573	4544	0.1	454	15155	5.10	2	88	454	505	65	67	69
Water Treatment	Lw	NS31++NS09	84	92	612	612	10.20	1009	2233	0.1	223	6239	5.10	2	92	223	248	70	74	76
Water Treatment	Lw	NS31++NS09	84	92	314	314	10.20	723	1352	0.1	135	3206	5.10	2	92	135	150	70	76	77
Concrete Powder / Raw Materials	Lw	NS08++NS05	66	74	487	487	10.20	900	1874	0.1	187	4965	5.10	2	74	187	208	52	57	58
Labels & Labels + Raw Aux Operating Materials	Lw	NS10++NS25	80	88	1486	1486	10.20	1573	4544	0.1	454	15155	5.10	2	88	454	505	65	67	69
Incoming Goods	Lw	NS10	70	78	300	300	10.20	706	1306	0.1	131	3057	5.10	2	78	131	145	56	62	63
Sugar Dissolver	Lw	NS12	80	88	85	85	10.20	375	544	0.1	54	862	5.10	2	88	54	60	66	76	77
Compressed Air LP/HP	Lw	NS20++NS04	89	97	301	301	6.80	472	1075	0.1	107	2049	3.40	2	97	107	119	78	82	83
Compressed Air LP/HP	Lw	NS20++NS04	89	97	256	256	6.80	435	946	0.1	95	1738	3.40	2	97	95	105	78	82	84
Boiler Room	Lw	NS03	69	77	209	209	6.80	393	812	0.1	81	1423	3.40	2	77	81	90	58	63	65
Cooling Central	Lw	NS23	90	98	300	300	6.80	471	1072	0.1	107	2041	3.40	2	98	107	119	79	83	85
Server Room (wall only)	Lw	NS13	80	88	132	132	6.80	313	577	0.1	58	899	3.40	2	88	58	64	69	76	77
AVT 1+AVT 2	Lw	NS11 (x4)+NS15 (X4)+NS27 (x4)+NS29 (X4)	100	108	5680	5680	10.20	3075	14436	0.1	1444	57941	5.10	2	108	1444	1604	86	82	87
AVT 3 +AVT 4	Lw	NS11 (x4)+NS15 (X4)+NS27 (x4)+NS29 (X4)	100	108	6391	6391	10.20	3262	16044	0.1	1604	65191	5.10	2	108	1604	1783	86	81	87

10.2. CadnaA Noise Sources Used

Name	ID	Type	1/1 Oktave Spectrum (dB)											A	lin	Source
			Weight.	63	125	250	500									
NS17 - Ventilating System (AHU)	AHU	Lw	A	0	0	0	60	0	0	0	0	60	63.2			
NS16- Sugar Delivery	Sugar	Lw	A	0	0	0	89	0	0	0	0	89	92.2			
NS23 - Chiller	CHILLER	Lw	A	0	0	0	85	0	0	0	0	85	88.2			
NS14-Warehouse, General	Warehouse	Lw	A	0	0	0	63	0	0	0	0	63	66.2			
NS02 - Warehouse, telpher	Telpher	Lw	A	0	0	0	89	0	0	0	0	89	92.2			
NS26 - Workshop	Workshop	Lw	A	0	0	0	80	0	0	0	0	80	83.2			
NS06 - Process Technology, CIP	CIP	Lw	A	0	0	0	69	0	0	0	0	69	72.2			
NS05 - Process Technology, General	NS05	Lw	A	0	0	0	63	0	0	0	0	63	66.2			
NS12 - Sugar Dissolver	NS12	Lw	A	0	0	0	80	0	0	0	0	80	83.2			
NS10 - Incoming Warehouse, Raw materials	NS10	Lw	A	0	0	0	70	0	0	0	0	70	73.2			
NS25 - Filling and packing line, perform supply	NS25	Lw	A	0	0	0	79	0	0	0	0	79	82.2			
NS09 - Water House	NS09	Lw	A	0	0	0	68	0	0	0	0	68	71.2			
NS31 - Water Treatment	NS31	Lw	A	0	0	0	84	0	0	0	0	84	87.2			
NS08 - Pulver Solution	NS08	Lw	A	0	0	0	63	0	0	0	0	63	66.2			
NS04 - Compressed Air	NS04	Lw	A	0	0	0	86	0	0	0	0	86	89.2			
NS20 - Compressed Air, Hp	NS20	Lw	A	0	0	0	85	0	0	0	0	85	88.2			
	NS07	Lw	A	0	0	0	85	0	0	0	0	85	88.2			
Ns03 - Boiler Room	NS03	Lw	A	0	0	0	69	0	0	0	0	69	72.2			
NS23 - Chiller	NS23	Lw	A	0	0	0	85	0	0	0	0	85	88.2			
NS13 - Low Voltage distribution	NS13	Lw	A	0	0	0	80	0	0	0	0	80	83.2			
AHU-01-Casing	AHU_01_Casing	Lw (c)		67	74	62	63	54	48	40	49	63.4	75.3	Dalair Ltd		
AHU-01-ATMOSPHERIC-supply-fan	AHU_01_ATMOSPHERIC_supply_fan	Lw		74	77	76	73	68	66	64	62	75.1	81.7	Dalair Ltd		
AHU-01-ATMOSPHERIC-extract-fan	AHU_01_ATMOSPHERIC_extract_fan	Lw		75	85	82	81	80	79	76	71	85.5	89.4	Dalair Ltd		
AHU-02-Casing	AHU_02_Casing	Lw (c)		68	73	65	64	58	54	48	54	65.3	75.2	Dalair Ltd		
AHU-02-ATMOSPHERIC-supply-fan	AHU_02_ATMOSPHERIC_supply_fan	Lw		70	81	77	73	70	67	63	61	76	83.5	Dalair Ltd		
AHU-02-ATMOSPHERIC-extract-fan	AHU_02_ATMOSPHERIC_extract_fan	Lw		77	85	82	81	81	79	77	72	86	89.6	Dalair Ltd		
AHU-03-Casing	AHU_03_Casing	Lw (c)		66	75	63	64	56	49	40	48	64.5	76.1	Dalair Ltd		
AHU-03-ATMOSPHERIC-supply-fan	AHU_03_ATMOSPHERIC_supply_fan	Lw		69	83	77	73	70	67	63	60	76.2	84.7	Dalair Ltd		
AHU-03-ATMOSPHERIC-extract-fan	AHU_03_ATMOSPHERIC_extract_fan	Lw		76	86	79	80	77	73	69	66	82	88.4	Dalair Ltd		
AHU-04-Casing	AHU_04_Casing	Lw (c)		81	84	77	81	74	70	60	66	80.6	87.7	Dalair Ltd		
AHU-04-ATMOSPHERIC-supply-fan	AHU_04_ATMOSPHERIC_supply_fan	Lw		78	90	85	84	88	87	83	79	92.5	94.8	Dalair Ltd		
AHU-04-ATMOSPHERIC-extract-fan	AHU_04_ATMOSPHERIC_extract_fan	Lw		83	91	89	93	92	90	84	79	96.4	98.6	Dalair Ltd		

AHU-05-Casing	AHU_05_Casing	Lw (c)		82	82	80	81	73	69	60	65	80.5	87.6	Dalair Ltd
AHU-05-ATMOSPHERIC-supply-fan	AHU_05 ATMOSPHERIC supply fan	Lw		79	88	89	85	87	86	82	79	91.9	94.7	Dalair Ltd
AHU-05-ATMOSPHERIC-extract-fan	AHU_05 ATMOSPHERIC extract fan	Lw		84	91	91	94	91	89	84	79	96.1	98.8	Dalair Ltd
AHU-06-Casing	AHU_06_Casing	Lw (c)		76	75	75	78	72	68	60	65	78	82.8	Dalair Ltd
AHU-06-ATMOSPHERIC-supply-fan	AHU_06 ATMOSPHERIC supply fan	Lw		73	80	87	82	85	85	81	78	90.4	92	Dalair Ltd
AHU-06-ATMOSPHERIC-extract-fan	AHU_06 ATMOSPHERIC extract fan	Lw		80	88	91	91	88	86	80	74	93.2	96.4	Dalair Ltd
AHU-07-Casing	AHU_07_Casing	Lw (c)		78	81	77	80	71	67	57	64	79	85.5	Dalair Ltd
AHU-07-ATMOSPHERIC-supply-fan	AHU_07 ATMOSPHERIC supply fan	Lw		76	88	86	84	85	83	79	77	89.6	92.9	Dalair Ltd
AHU-07-ATMOSPHERIC-extract-fan	AHU_07 ATMOSPHERIC extract fan	Lw		80	88	91	91	88	87	81	76	93.6	96.6	Dalair Ltd
AHU-08-Casing	AHU_08_Casing	Lw (c)		75	80	75	80	72	69	57	64	79.2	84.6	Dalair Ltd
AHU-08-ATMOSPHERIC-supply-fan	AHU_08 ATMOSPHERIC supply fan	Lw		73	84	82	84	86	85	79	77	90.4	91.8	Dalair Ltd
AHU-08-ATMOSPHERIC-extract-fan	AHU_08 ATMOSPHERIC extract fan	Lw		79	89	92	92	87	86	79	76	93.3	97	Dalair Ltd
AHU-09-Casing	AHU_09_Casing	Lw (c)		74	76	72	76	69	65	56	62	75.6	81.2	Dalair Ltd
AHU-09-ATMOSPHERIC-supply-fan	AHU_09 ATMOSPHERIC supply fan	Lw		72	83	84	80	83	82	78	75	87.8	90.1	Dalair Ltd
AHU-09-ATMOSPHERIC-extract-fan	AHU_09 ATMOSPHERIC extract fan	Lw		76	85	85	88	88	86	80	76	92.2	93.9	Dalair Ltd
SF-01-Casing	SF_01_Casing	Lw (c)		70	70	71	72	65	57	49	57	71.4	77.2	Dalair Ltd
SF-01-ATMOSPHERIC-supply-fan	SF_01 ATMOSPHERIC supply fan	Lw		74	80	87	82	82	80	76	75	87.1	90.5	Dalair Ltd
EF-01-Casing	EF_01_Casing	Lw (c)		67	73	69	70	64	56	48	56	69.9	76.6	Dalair Ltd
EF-01-ATMOSPHERIC-extract-fan	EF_01 ATMOSPHERIC extract fan	Lw		79	88	89	90	90	84	80	77	93.2	95.9	Dalair Ltd
SF-02-Casing	SF_02_Casing	Lw (c)		70	74	71	73	64	59	50	56	72	78.5	Dalair Ltd
SF-02-ATMOSPHERIC-supply-fan	SF_02 ATMOSPHERIC supply fan	Lw		75	86	86	82	84	82	78	75	88.5	91.7	Dalair Ltd
EF-02-Casing	EF_02_Casing	Lw (c)		68	73	72	70	61	57	47	53	69.8	77.3	Dalair Ltd
EF-02-ATMOSPHERIC-extract-fan	EF_02 ATMOSPHERIC extract fan	Lw		80	88	92	90	87	85	79	74	92.4	96.3	Dalair Ltd
EF-03-Casing	EF_03_Casing	Lw (c)		68	73	72	70	61	57	47	53	69.8	77.3	Dalair Ltd
EF-03-ATMOSPHERIC-extract-fan	EF_03 ATMOSPHERIC extract fan	Lw		80	88	92	90	87	85	79	74	92.4	96.3	Dalair Ltd
EF-04-Casing	EF_04_Casing	Lw (c)		68	73	72	70	61	57	47	53	69.8	77.3	Dalair Ltd
EF-04-ATMOSPHERIC-extract-fan	EF_04 ATMOSPHERIC extract fan	Lw		80	88	92	90	87	85	79	74	92.4	96.3	Dalair Ltd
EF-05-Casing	EF_05_Casing	Lw (c)		68	73	72	70	61	57	47	53	69.8	77.3	Dalair Ltd
EF-05-ATMOSPHERIC-extract-fan	EF_05 ATMOSPHERIC extract fan	Lw		80	88	92	90	87	85	79	74	92.4	96.3	Dalair Ltd

10.2.1. CadnaA: proposed/ Existing Building Heights

Name	M.	ID	RB	Residents	Absorption	Height		
						Begin		
						(m)		
		Existing Industrial Building	x	0	0.21	15.00	r	420033 332288
		Existing Industrial Building	x	0	0.21	15.00	r	419916 332446
		Existing Industrial Building	x	0	0.21	7.00	r	419832 332475
		Existing Industrial Building	x	0	0.21	7.00	r	419880 332519
		Existing Industrial Building	x	0	0.21	7.00	r	419884 332543
		Existing Industrial Building	x	0	0.21	7.00	r	419802 332383
		Existing Industrial Building	x	0	0.21	7.00	r	420376 332204
		Existing Industrial Building	x	0	0.37	7.00	r	420264 332806
Receiver 2		Nearest Residential	x	0	0.37	7.00	r	420236 332796
Receiver 1		Existing Industrial Building	x	0	0.37	8.00	r	420148 332823
		Existing Industrial Building	x	0	0.21	7.00	r	420586 332270
		Existing Industrial Building	x	0	0.21	7.00	r	420601 332249
		Existing Industrial Building	x	0	0.21	7.00	r	420660 332324
		ACL_Proposed Industry Silos	x	0	0.21	12.50	r	420061 332659
		ACL_Proposed Industry Silos	x	0	0.21	12.50	r	420056 332647
		ACL_Existing Buildings	x	0	0.21	15.00	r	420401 332377
		ACL_Existing Buildings	x	0	0.21	15.00	r	420390 332341
		ACL_Existing Buildings	x	0	0.21	15.00	r	420360 332310
		ACL_Existing Buildings	x	0	0.21	7.00	r	419933 332581
		ACL_Existing Buildings	x	0	0.21	7.00	r	419944 332606
		ACL_Existing Buildings	x	0	0.21	7.00	r	419950 332631
		ACL_Existing Buildings	x	0	0.21	7.00	r	419972 332701
		ACL_Existing Buildings	x	0	0.21	7.00	r	419980 332737
		ACL_Existing Buildings	x	0	0.21	7.00	r	419966 332671
Receiver 3		Nearest Residential	x	0	0.21	7.00	r	420252 332784
		ACL_Proposed Industry	x	0	0.21			420097 332511
		ACL_Proposed Industry	x	0	0.21			420159 332601
		ACL_Proposed Industry	x	0	0.21			420212 332690
		ACL_Proposed Industry	x	0	0.21			420253 332683

10.2.2. CadnaA: Line Sources – Vehicle Movements

Name	M.	ID	Result. PWL			Result. PWL'			Lw / Li			Correction			Sound Reduction		Attenuation	Operating Time			K0	Freq.	Direct.	Moving Pt. Src			
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Evening	Night	R	Area		Day	Special	Night	(dB)	(Hz)		Number		Speed	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			(dB(A))	(dB(A))	(dB(A))	(dB(A))		(m²)		(min)	(min)	(min)				Day	Evening	Night	(km/h)
In going Goods			93.3	-15.7	87.3	65.3	-43.7	59.3	PWL-Pt	Arrive		41.0	0.0	10.0							0.0		(none)	8.0	0.0	2.0	10.0
Incoming Goods			88.6	-17.5	82.5	62.3	-43.7	56.3	PWL-Pt	Arrive		41.0	0.0	10.0							0.0		(none)	4.0	0.0	1.0	10.0
CO2/N2 H2O Vehicle Supply			85.9	-14.1	85.9	56.3	-43.7	56.3	PWL-Pt	Arrive		41.0	0.0	10.0							0.0		(none)	1.0	0.0	1.0	10.0
Out going Goods			96.7	-17.1	93.7	70.7	-43.1	67.7	PWL-Pt	Depart		41.0	0.0	10.0							0.0		(none)	24.0	0.0	12.0	10.0
In going Goods			93.6	-15.5	87.5	65.3	-43.7	59.3	PWL-Pt	Arrive		41.0	0.0	10.0							0.0		(none)	8.0	0.0	2.0	10.0
In going Goods			93.3	-15.7	87.3	65.3	-43.7	59.3	PWL-Pt	Arrive		41.0	0.0	10.0							0.0		(none)	8.0	0.0	2.0	10.0

10.2.3. CadnaA: Area Noise Sources – Roof/ Horizontal Areas

Name	M.	ID	Result. PWL			Result. PWL"			Lw / Li	Type	Value	norm.	Correction			Sound Reduction		Attenuation	operating Time			K0	Freq.
			Day (dBA)	Evening (dBA)	Night (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)					Day dB(A)	Evening dB(A)	Night dB(A)	R	Area (m²)		Day (min)	Special (min)	Night (min)		
Warehouse & Logistics			76.6	76.6	76.6	35	35	35	Li	70			0	0	0	31	14327.18					0	500
NS26-Workshop			62.5	62.5	62.5	39	39	39	Li	74			0	0	0	31	222.85					0	500
Syrup & Control Room			64.3	64.3	64.3	37	37	37	Li	72			0	0	0	31	536.32					0	500
Folls & Labels Raw Aux Operating Materials			66.6	66.6	66.6	34	34	34	Li	69			0	0	0	31	1809.69					0	500
Water Treatment			66.8	66.8	66.8	42	42	42	Li	77			0	0	0	31	304.55					0	500
Water Treatment			68.8	68.8	68.8	41	41	41	Li	76			0	0	0	31	602.34					0	500
Concrete Powder / Raw Materials			49.8	49.8	49.8	23	23	23	Li	58			0	0	0	31	477.55					0	500
Raw Auxiliary Operating			65.6	65.6	65.6	34	34	34	Li	69			0	0	0	31	1460.03					0	500
Incoming Goods			52.8	52.8	52.8	28	28	28	Li	63			0	0	0	31	299.45					0	500
Sugar Dissolver			61.2	61.2	61.2	42	42	42	Li	77			0	0	0	31	83.76					0	500
Compressed Air LP/HP			73	73	73	49	49	49	Li	84			0	0	0	31	251.11					0	500
Compressed Air LP/HP			72.7	72.7	72.7	48	48	48	Li	83			0	0	0	31	295.46					0	500
Boiler Room			51.6	51.6	51.6	30	30	30	Li	65			0	0	0	31	145.8					0	500
Cooling Central			74.7	74.7	74.7	50	50	50	Li	85			0	0	0	31	292.09					0	500
AVT 1+AVT 2			89.8	89.8	89.8	52	52	52	Li	87			0	0	0	31	6017.45					0	500
AVT 3 +AVT 4			90.5	90.5	90.5	52	52	52	Li	87			0	0	0	31	7040.21					0	500
NS06 - CIP			50.6	50.6	50.6	28	28	28	Li	63			0	0	0	31	183.4					0	500
Conveyor Loop + Outgoing Goods			49.8	49.8	49.8	14	14	14	Li	49			0	0	0	31	3823.49					0	500
Chillers Area N23 at 32 oC			90.2	90.2	90.2	75.4	75.4	75.4	Lw	90.2			0	0	0							0	500

10.2.4. CadnaA: Point Sources

Name	M.	ID	Result Day (dBA)	PWL Evening (dBA)	Lw / Li Night (dBA)	Type	Value	norm. dB(A)	Correction Day (dB(A))	Evening (dB(A))	Night (dB(A))	Sound Reduction R	Area (m²)	Attenuation	Operating Day (min)	Time Special (min)	Night (min)	K0	Freq. (Hz)	Direct.	Height (m)	Coordinates				
																						X (m)	Y (m)	Z (m)		
AHU-01-ATMOSPHERIC-extract-fan			61.9	61.9	61.9	Lw	AHU_01_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	q	420266.6	332677.2	79.4	
AHU-01-ATMOSPHERIC-supply-fan			61.9	61.9	61.9	Lw	AHU_01_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	q	420271.2	332673.5	79.4	
AHU-01-Casing			63.4	63.4	63.4	Lw	AHU_01_Casing		0	0	0			(none)				0		(none)	1.7	g	420264.6	332670.1	80	
AHU-02-ATMOSPHERIC-extract-fan			71.4	71.4	71.4	Lw	AHU_02_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	q	420258.5	332687.8	79.4	
AHU-02-ATMOSPHERIC-supply-fan			63.3	63.3	63.3	Lw	AHU_02_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	g	420254.1	332682.9	79.4	
AHU-02-Casing			65.3	65.3	65.3	Lw	AHU_02_Casing		0	0	0			(none)				0		(none)	1.7	g	420250.2	332689.8	80	
AHU-03-ATMOSPHERIC-extract-fan			68.1	68.1	68.1	Lw	AHU_03_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	g	420273.8	332679.5	79.4	
AHU-03-ATMOSPHERIC-supply-fan			64.1	64.1	64.1	Lw	AHU_03_ATMOSPHEI		0	0	0			NC40				0		(none)	1.1	g	420273.1	332678.7	79.4	
AHU-03-Casing			64.5	64.5	64.5	Lw	AHU_03_Casing		0	0	0			(none)				0		(none)	1.7	g	420266.1	332682	80	
AHU-07-ATMOSPHERIC-extract-fan			78.2	78.2	78.2	Lw	AHU_07_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	q	420162.1	332615.6	84	
AHU-07-ATMOSPHERIC-extract-fan - Assumed Phase 2			78.2	78.2	78.2	Lw	AHU_07_ATMOSPHEI		0	0	0			(none)				0		(none)	0.8	q	420138.3	332623.7	84	
AHU-07-ATMOSPHERIC-supply-fan			74.8	74.8	74.8	Lw	AHU_07_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420158.1	332624.1	84	
AHU-07-ATMOSPHERIC-supply-fan - Assumed Phase 2			74.8	74.8	74.8	Lw	AHU_07_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420134.3	332632.2	84	
AHU-07-Casing			79	79	79	Lw	AHU_07_Casing		0	0	0			(none)				0		(none)	1.7	g	420163.8	332622.6	84.9	
AHU-07-Casing - Assumed Phase 2			79	79	79	Lw	AHU_07_Casing		0	0	0			(none)				0		(none)	1.7	g	420140.1	332630.7	84.9	
AHU-08-ATMOSPHERIC-extract-fan			78.3	78.3	78.3	Lw	AHU_08_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420169.7	332637.6	84	
AHU-08-ATMOSPHERIC-extract-fan - Assumed Phase 2			78.3	78.3	78.3	Lw	AHU_08_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420145.9	332645.8	84	
AHU-08-ATMOSPHERIC-supply-fan			74.6	74.6	74.6	Lw	AHU_08_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420168.1	332646.7	84	
AHU-08-ATMOSPHERIC-supply-fan - Assumed Phase 2			74.6	74.6	74.6	Lw	AHU_08_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420144.3	332654.9	84	
AHU-08-Casing			79.2	79.2	79.2	Lw	AHU_08_Casing		0	0	0			(none)				0		(none)	1.7	q	420173.7	332641	84.9	
AHU-08-Casing - Assumed Phase 2			79.2	79.2	79.2	Lw	AHU_08_Casing		0	0	0			(none)				0		(none)	1.7	g	420150	332649.1	84.9	
AHU-09-ATMOSPHERIC-extract-fan			76	76	76	Lw	AHU_09_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420164.8	332626.6	84	
AHU-09-ATMOSPHERIC-extract-fan - Assumed Phase 2			76	76	76	Lw	AHU_09_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420141.1	332634.8	84	
AHU-09-ATMOSPHERIC-supply-fan			72.9	72.9	72.9	Lw	AHU_09_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420163	332634.6	84	
AHU-09-ATMOSPHERIC-supply-fan - Assumed Phase 2			72.9	72.9	72.9	Lw	AHU_09_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420139.2	332642.7	84	
AHU-09-Casing			75.6	75.6	75.6	Lw	AHU_09_Casing		0	0	0			(none)				0		(none)	1.7	g	420168.2	332631.6	84.9	
AHU-09-Casing - Assumed Phase 2			75.6	75.6	75.6	Lw	AHU_09_Casing		0	0	0			(none)				0		(none)	1.7	g	420144.4	332639.3	84.9	
COND-01-Northern-Offices-Condenser-Compound	+		86.3	86.3	86.3	Lw	COND_01		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420228.2	332726.8	74.3	
COND-01-Northern-Offices-Condenser-Compound	+		86.3	86.3	86.3	Lw	COND_01		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420230.4	332725.7	74.3	
COND-02-Western-Condenser-Compound			83.8	83.8	83.8	Lw	COND_02		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420072.5	332631.5	74.02	
COND-02-Western-Condenser-Compound			83.8	83.8	83.8	Lw	COND_02		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420070.2	332632.6	74.02	
COND-03-Office			62	62	62	Lw	COND_03		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420201	332534.9	72.8	
COND-04-Server Room	+		70	70	70	Lw	COND_04		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420227.6	332725.1	74.3	
COND-05-Server Room	+		70	70	70	Lw	COND_05		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420227.2	332724	74.3	
COND-06-IT Storage	+		70	70	70	Lw	COND_06		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420229.4	332724.3	74.3	
COND-07-IT Storage	+		70	70	70	Lw	COND_07		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420229	332723.2	74.3	
COND-08-UPS Room	+		62	62	62	Lw	COND_08		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420226.3	332722.6	74.3	
COND-09-Server Room	+		70	70	70	Lw	COND_09		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420225.9	332721.8	74.29	
COND-10-Server Room	+		70	70	70	Lw	COND_10		0	0	0			0	500	(none)	0.5	r		(none)	0.5	r	420225.6	332721	74.28	
Delivery Unloading		Unloading	82.2	82.2	82.2	Lw	Unloading		0	0	0			0	(none)				0		(none)	1.1	g	420147.9	332742.2	75.05
EF-01-ATMOSPHERIC-extract-fan			77	77	77	Lw	EF_01_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420185.4	332667.7	84	
EF-01-ATMOSPHERIC-extract-fan - Assumed Phase 2			77	77	77	Lw	EF_01_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420161.6	332675.8	84	
EF-01-Casing			69.9	69.9	69.9	Lw	EF_01_Casing		0	0	0			(none)				0		(none)	1.7	g	420190.3	332664.7	84.9	
EF-01-Casing - Assumed Phase 2			69.9	69.9	69.9	Lw	EF_01_Casing		0	0	0			(none)				0		(none)	1.7	g	420166.5	332672.9	84.9	
EF-02-ATMOSPHERIC-extract-fan			77.5	77.5	77.5	Lw	EF_02_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420237.2	332628.9	84	
EF-02-Casing			69.8	69.8	69.8	Lw	EF_02_Casing		0	0	0			(none)				0		(none)	1.7	q	420238.6	332633.8	84.9	
EF-03-ATMOSPHERIC-extract-fan			92.4	92.4	92.4	Lw	EF_03_ATMOSPHEI		0	0	0			(none)				0		(none)	0.8	q	420190.4	332696.2	84	
EF-03-Casing			69.8	69.8	69.8	Lw	EF_03_Casing		0	0	0			(none)				0		(none)	1.7	g	420191.5	332700.6	84.9	
EF-04-ATMOSPHERIC-extract-fan			77.5	77.5	77.5	Lw	EF_04_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420209.6	332683.6	84	
EF-04-Casing			69.8	69.8	69.8	Lw	EF_04_Casing		0	0	0			(none)				0		(none)	1.7	g	420215.6	332681.8	84.9	
EF-05-ATMOSPHERIC-extract-fan			77.5	77.5	77.5	Lw	EF_05_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420212.4	332688.6	84	
EF-05-Casing			69.8	69.8	69.8	Lw	EF_05_Casing		0	0	0			(none)				0		(none)	1.7	g	420217.1	332685.6	84.9	
SF-01-ATMOSPHERIC-supply-fan			72.7	72.7	72.7	Lw	SF_01_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420178	332661.3	84	
SF-01-ATMOSPHERIC-supply-fan - Assumed Phase 2			72.7	72.7	72.7	Lw	SF_01_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420154.3	332669.5	84	
SF-01-Casing			71.4	71.4	71.4	Lw	SF_01_Casing		0	0	0			(none)				0		(none)	1.7	g	420183.9	332657.8	84.9	
SF-01-Casing - Assumed Phase 2			71.4	71.4	71.4	Lw	SF_01_Casing		0	0	0			(none)				0		(none)	1.7	q	420160.1	332665.9	84.9	
SF-02-ATMOSPHERIC-supply-fan			73.7	73.7	73.7	Lw	SF_02_ATMOSPHEI		0	0	0			NC40				0		(none)	0.8	g	420234.6	332639.9</		

10.2.5. CadnaA: Vertical Noise Sources – Wall Cladding/ Loading Bay Opening Areas (Roller Shutter Doors)

Name	M.	ID	Result. PWL		Result. PWL"				Lw / Li			Correction	Sound Reduction			Attenuation	Operating Time			K0	Freq.	Direct.	
			Day (dBA)	Evening (dBA)	Night (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)	Type	Value	norm. dB(A)	Day dB(A)	Evening dB(A)	Night dB(A)	R	Area (m²)		Day (min)	Special (min)	Night (min)	(dB)	(Hz)	
AVT 1+AVT 2			81.3	81.3	81.3	52	52	52	Li	87	0	0	0	0	31	848.7	60	0	60	3	500	(none)	
AVT 3 +AVT 4			81.7	81.7	81.7	52	52	52	Li	87	0	0	0	0	31	943.27	60	0	60	3	500	(none)	
Warehouse & Logistics			69.5	69.5	69.5	35	35	35	Li	70	0	0	0	0	31	2803.09	60	0	60	3	500	(none)	
Warehouse & Logistics			68.3	68.3	68.3	35	35	35	Li	70	0	0	0	0	31	2160.64	60	0	60	3	500	(none)	
Warehouse & Logistics			60.3	60.3	60.3	35	35	35	Li	70	0	0	0	0	31	338.64	60	0	60	3	500	(none)	
Warehouse & Logistics			54.5	54.5	54.5	35	35	35	Li	70	0	0	0	0	31	88.84	60	0	60	3	500	(none)	
Sugar Dissolver			60.5	60.5	60.5	42	42	42	Li	77	0	0	0	0	31	71.52	60	0	60	3	500	(none)	
Incoming Goods			51.5	51.5	51.5	28	28	28	Li	63	0	0	0	0	31	223.88	60	0	60	3	500	(none)	
Boiler Room			49.2	49.2	49.2	30	30	30	Li	65	0	0	0	0	31	82.42	60	0	60	3	500	(none)	
Boiler Room			46	46	46	30	30	30	Li	65	0	0	0	0	31	40.15	60	0	60	3	500	(none)	
Compressed Air LP/HP			68.4	68.4	68.4	49	49	49	Li	84	0	0	0	0	31	87.62	60	0	60	3	500	(none)	
Compressed Air LP/HP			66.4	66.4	66.4	48	48	48	Li	83	0	0	0	0	31	68.44	60	0	60	3	500	(none)	
Folls & LAbels _Raw Aux Operating Materials			59.8	59.8	59.8	34	34	34	Li	69	0	0	0	0	31	383.54	60	0	60	3	500	(none)	
Warehouse & Logistics			65.7	65.7	65.7	35	35	35	Li	70	0	0	0	0	31	1170.81	60	0	60	3	500	(none)	
Warehouse & Logistics			65.1	65.1	65.1	35	35	35	Li	70	0	0	0	0	31	1020.05	60	0	60	3	500	(none)	
Loading Dock 1			74.9	74.9	74.9	66	66	66	Li	70	0	0	0	0	0	7.7	60	0	60	3	500	(none)	
Loading Dock 2			74.7	74.7	74.7	66	66	66	Li	70	0	0	0	0	0	7.46	60	0	60	3	500	(none)	
Loading Dock 3			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.57	60	0	60	3	500	(none)	
Loading Dock 4			75	75	75	66	66	66	Li	70	0	0	0	0	0	7.86	60	0	60	3	500	(none)	
Loading Dock 5			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.61	60	0	60	3	500	(none)	
Loading Dock 6			74.7	74.7	74.7	66	66	66	Li	70	0	0	0	0	0	7.43	60	0	60	3	500	(none)	
Loading Dock 7			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.58	60	0	60	3	500	(none)	
Loading Dock 8			74.7	74.7	74.7	66	66	66	Li	70	0	0	0	0	0	7.45	60	0	60	3	500	(none)	
Loading Dock 9			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.53	60	0	60	3	500	(none)	
Loading Dock 10			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.58	60	0	60	3	500	(none)	
Loading Dock 11			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.58	60	0	60	3	500	(none)	
Loading Dock 12			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.56	60	0	60	3	500	(none)	
Loading Dock 13			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.58	60	0	60	3	500	(none)	
Loading Dock 14			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.62	60	0	60	3	500	(none)	
Loading Dock 15			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.56	60	0	60	3	500	(none)	
Loading Dock 16			74.7	74.7	74.7	66	66	66	Li	70	0	0	0	0	0	7.37	60	0	60	3	500	(none)	
Loading Dock 17			74.7	74.7	74.7	66	66	66	Li	70	0	0	0	0	0	7.41	60	0	60	3	500	(none)	
Loading Dock 18			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.64	60	0	60	3	500	(none)	
Loading Dock 19			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.54	60	0	60	3	500	(none)	
Loading Dock 20			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.62	60	0	60	3	500	(none)	
Loading Dock 21			74.8	74.8	74.8	66	66	66	Li	70	0	0	0	0	0	7.54	60	0	60	3	500	(none)	
Loading Dock 22			77.2	77.2	77.2	66	66	66	Li	70	0	0	0	0	0	13.21	60	0	60	3	500	(none)	
Loading Dock 23			77.1	77.1	77.1	66	66	66	Li	70	0	0	0	0	0	13.01	60	0	60	3	500	(none)	
Warehouse & Logistics			66.8	66.8	66.8	35	35	35	Li	70	0	0	0	0	31	1516.81	60	0	60	3	500	(none)	

10.2.6. Noise Levels at Receivers/ Building Evaluation

Scenario 1

Individual Receivers

Individual Receivers														
Name	M.	ID	Level Lr	Limit. Value				Land Use			Height	Coordinates		
			Day	Night	Day	Night	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)				(m)		(m)	(m)	(m)
Receiver 2			45.1	44.4	0	0		x	Total	4.5	r	420234.9	332791.2	81.22
Receiver 1			43.2	43.1	0	0		x	Total	7.15	r	420144.9	332818.4	83.92
Receiver 3			46.5	45.7	0	0		x	Total	4.5	r	420251.7	332779.7	81.04

Building Evaluation Receivers

Name	M.	ID	Level	Excess Levels		Land Use	Coordinates				Floor Height			Round up	ute Height Code	
			Day	Night	From	To	Type	Auto	Noise Type	X	Y	Ø	EG	OG-OG		
			(dBA)	(dBA)	Floor	Floor				(m)	(m)	(m)	(m)	(m)		
Receiver 3			46.4	45.6				x	Roads	420252.9	332783.3	4	4.5	1000	0.5	r
Receiver 1			43.3	43.1				x	Roads	420148.2	332823.4	4.5	7.15	1000	0.5	r
Receiver 2			45.1	44.4				x	Roads	420235.9	332795.3	4	4.5	1000	0.5	r

Scenario 2

Individual Receivers

Individual Receivers														
Name	M.	ID	Level Lr	Limit. Value				Land Use		Height	Coordinates			
			Day	Night	Day	Night	Type	Auto	Noise Type		X	Y	Z	
			(dBA)	(dBA)	(dBA)	(dBA)				(m)	(m)	(m)	(m)	
Receiver 2			34.9	34.9	0	0		x	Total	4.5	r	420234.9	332791.2	81.22
Receiver 1			36.4	36.4	0	0		x	Total	7.15	r	420144.9	332818.4	83.92
Receiver 3			34.9	34.9	0	0		x	Total	4.5	r	420251.7	332779.7	81.04

Building Evaluation Receivers

Building Evaluation Receivers															
Name	M.	ID	Level	Excess Levels		Land Use		Coordinates			Floor Height			Round up	ute Height Code
			Day	Night	From	To	Type	Auto	Noise Type	X	Y	Ø	EG	OG-OG	
			(dBA)	(dBA)	Floor	Floor				(m)	(m)	(m)	(m)		
Receiver 3			35	35				x	Roads	420252.9	332783.3	4	4.5	1000	0.5 r
Receiver 1			36.4	36.4				x	Roads	420148.2	332823.4	4.5	7.15	1000	0.5 r
Receiver 2			34.9	34.9				x	Roads	420235.9	332795.3	4	4.5	1000	0.5 r

Scenario 3

Individual Receivers

Individual Receivers													
Name	M.	ID	Level Lr		Limit. Value		Land Use			Height	Coordinates		
			Day	Night	Day	Night	Type	Auto	Noise Type		X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)				(m)	(m)	(m)	(m)
Receiver 2			41	38.7	0	0	x	Total		4.5 f	420234.9	332791.2	81.2
Receiver 1			41.6	41.4	0	0	x	Total		7.15 f	420144.9	332818.4	83.9
Receiver 3			42.2	39.8	0	0	x	Total		4.5 f	420251.7	332779.7	81.0

Building Evaluation Receivers

Building Evaluation Receivers																
Name	M.	ID	Level		Excess Levels		Land Use		Coordinates			Floor Height		Round up	Attribute Height Code	
			Day	Night	From	To	Type	Auto	Noise Type	X	Y	Ø	EG	OG-OG		
			(dBA)	(dBA)	Floor	Floor				(m)	(m)	(m)	(m)	(m)		
Receiver 3			43.1	39.9				x	Roads	420252.9	332783.3	4	4.5	1000	0.5	r
Receiver 1			41.7	41.4				x	Roads	420148.2	332823.4	4.5	7.15	1000	0.5	r
Receiver 2			41	38.8				x	Roads	420235.9	332795.3	4	4.5	1000	0.5	r

10.2.7. Laboratorial Sound Insulation Index Performance Rw of Proposed Construction

Wall/ Cladding

Updated: 15.1.2016



Declaration of Performance

No. 60004-CPR/combined

1. Unique identification code of the product-type:
PAROC® (line, smooth, micro, dot) AST E
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4):
See product label

Thickness, Weight		
Nominal Thickness	Actual Thickness	Weight
50 mm	53 mm	16 kg/m ²
80 mm	79 mm	19 kg/m ²
100 mm	99 mm	22 kg/m ²
120 mm	120 mm	24 kg/m ²
150 mm	151 mm	28 kg/m ²
175 mm	173 mm	31 kg/m ²
200 mm	202 mm	34 kg/m ²
240 mm	243 mm	39 kg/m ²
300 mm	305 mm	47 kg/m ²
Material		
Core Material, Density	External Sheet (EN 10326-S320GD+Z275) 0,6 - 0,7 (EN 10326-S320GD+Z100) 0,5	Internal Sheet (EN 10326-S320GD+Z275) 0,6 - 0,7 (EN 10326-S320GD+Z100) 0,5
Stone wool, 120 kg/m ³	PVDF/SP/FoodSafe 0.5/0.6/0.7	PVDF/SP/FoodSafe 0.5/0.6/0.7

3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:
Self-supporting double skin metal faced insulating sandwich panels.
External walls and wall cladding, walls (including partitions) within the building envelope.
Roofs and ceilings
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5):
Paroc Panel System Oy Ab
FI-21600 Parainen
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V:
System 1 for reaction to fire.
System 2+ for other properties.
6. In case of the declaration of performance concerning a construction product covered by a harmonized standard:
Notified certification body No. 0809 – VTT Expert Services Ltd performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of the factory production control under system 1 and system 2+ and issued the certificate of constancy of performance (VTT-0809-CPR-1156).

Updated: 15.1.2016



7. Declared performance

Reaction to Fire, Fire Resistance			
Essential characteristics	Performance		Harmonized technical specification
Reaction to Fire, Euroclass (for all applications)	A2-s1,d0		EN 14509:2013
Fire Resistance, wall Horizontal / Vertical installation	Thickness 50 mm 80 mm 100 mm 120 mm 150 mm 175 mm 200 mm 240 mm 300 mm	Fire Class* EI 45/45 EI 45/90 EI 45/120 EI 45/120 EI 240/240 EI 240/240 EI 240/240 EI 240/240 EI 240/240	EN 14509:2013
*For more information regarding details and spans contact Paroc Panel System / Technical Support			
Fire Resistance, ceiling	100 – 300mm	EI 60	EN 14509:2013

Thermal Transmittance			
Essential characteristics	Performance		Harmonized technical specification
Thermal Conductivity (declared) in 10 °C, λ_{10} Core material: stone wool, 120 kg/m ³	0.045 W/mK		EN 14509:2013
Thermal Transmittance	Thickness 50 mm 80 mm 100 mm 120 mm 150 mm 175 mm 200 mm 240 mm 300 mm	W/m²K 0.77 0.53 0.43 0.36 0.29 0.25 0.22 0.18 0.14	

Water Permeability, Water Vapour Permeability, Air Permeability		
Essential characteristics	Performance	Harmonized technical specification
Water Permeability	Class A	EN 14509:2013
Water Vapour Permeability	Impermeable	
Air Permeability	1,0 m ³ /m ² /h at 50 Pa	

Airborne Sound Insulation, Sound Absorption			
Essential characteristics	Performance		Harmonized technical specification
Airborne Sound Insulation R_w (C; C _v)	Thickness 50 mm 80 mm 100 mm 120 mm 150 mm 175 mm 200 mm 240 mm 300 mm	dB 31 (-3; -3) 31 (-3; -3) 31 (-3; -3) 31 (-3; -3) 31 (-3; -3) 31 (-3; -3) 30 (-3; -3) 30 (-3; -3) 30 (-3; -3)	EN 14509:2013
Sound Absorption α_w	NPD		EN 14509:2013

Durability			
Essential characteristics	Performance		Harmonized technical specification
Durability	Pass		EN 14509:2013

Updated: 15.1.2016



Mechanical Resistance

Strength, Resistance to Point Load and Access Loads			
Essential characteristics	Performance		Harmonized technical specification
Tensile Strength (panel)	0.230 MPa		EN 14509:2013
Compression Strength (core)	0.110 MPa		
Shear Strength	0.090 MPa		
Shear Modulus (core) Mean Value	9 MPa		
Reduced Long Term Shear Strength	0.045 MPa		
Resistance to Point Load and Access Loads	pass		
Creep Coefficient			
Essential characteristics	Performance		Harmonized technical specification
Creep Coefficient t = 2000 h	0.6		EN 14509:2013
Creep Coefficient t = 100 000 h	1.0		
Wrinkling Stress			
Essential characteristics	Performance		Harmonized technical specification
Wrinkling Stress, In Span	165 MPa		EN 14509:2013
Wrinkling Stress, In Span (elevated temp.)	165 MPa		
Wrinkling Stress 300 mm, In Span	150 MPa		
Wrinkling Stress 300 mm, In Span (elevated temp.)	145 MPa		
Wrinkling Stress at Central Support, internal surface	Thickness	MPa	
	50 mm	132	
	80 mm	128	
	100 mm	125	
	120 mm	122	
	150 mm	118	
	175 mm	114	
	200 mm	110	
	240 mm	105	
300 mm	92		
Wrinkling Stress at Central Support (elevated temp.), external surface	Thickness	MPa	
	50 mm	93	
	80 mm	95	
	100 mm	96	
	120 mm	97	
	150 mm	98	
	175 mm	94	
	200 mm	89	
	240 mm	82	
	300 mm	68	

8. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

Paroc Panel System Oy Ab

Kimmo Tamminen, Production Director

Parainen 15.1.2016



(signature)

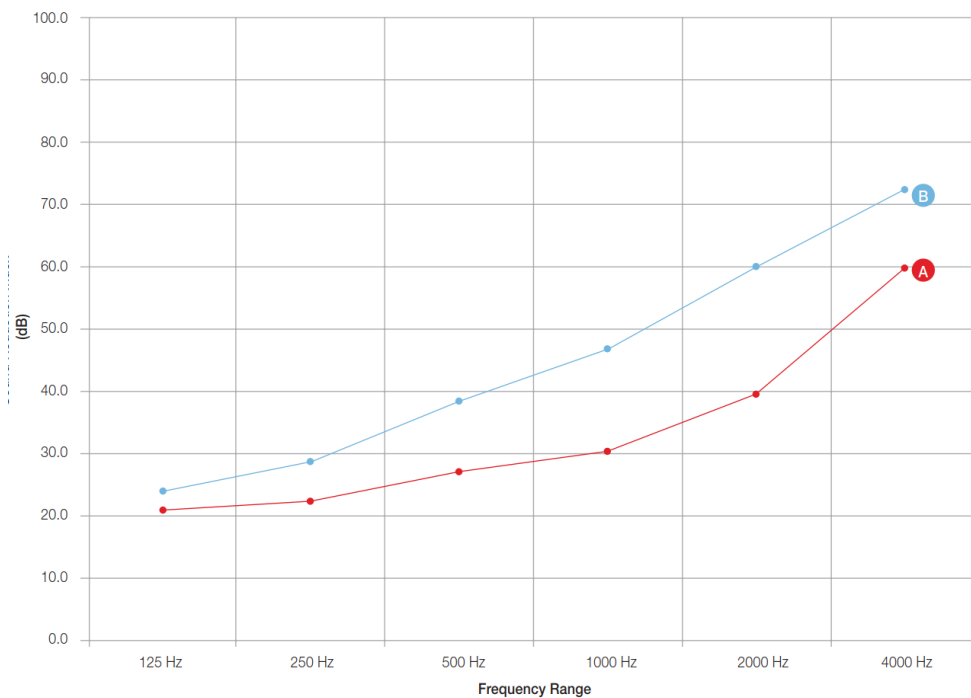
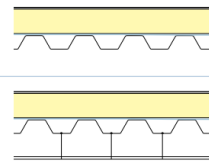
Roof Construction (Test 3A)

**TECHNICAL
BULLETIN**

Test 3

Construction Tested and Assessed

- A** Single ply membrane, 80 mm *Kingspan Thermaroof*® TR26 LPC/FM, 5 Kg/m² acoustic sheet and a galvanized metal deck
- B** Same as above with correction for 24 mm mineral fibre ceiling tile (8.23 Kg/m²) with a 300 mm ceiling void



Sound Reduction Index in dB over a Range of Frequencies

Test	Frequency (Hz)						Provenance
	125	250	500	1000	2000	4000	
A	21.4	22.4	26.9	30.6	39.9	50.9	(SRL Test 39 Report No. C/00/5L/7950/1)
B	24	29	38	47	60	72	(Predicted – SRL Report No. C/40269)

*Assessment carried out by Sound Research Laboratories.

A – weighted Sound Reduction Index (R_w)

Test	R_w (dB)
A	31
B	41



ACOUSTIC
CONSULTANTS LTD

Head Office: 194 West Street, Bedminster, Bristol, BS3 3NB
T: 0117 986 2956

www.acoustic-ltd.co.uk

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