Appendix 9.4 Operational Noise Assessment

Hownsgill Energy Facility

Hownsgill Park, Consett, Durham

For:

Project Genesis Limited

CRM.0138.001.NO.R.001

'Experience and expertise working in union'

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Appendix 9.4 Operational Noise Assessment

Project:	Hownsgill Energy Facility, Hownsgill Park, Consett, Durham
For:	Project Genesis Limited
Status:	FINAL
Date:	November 2020
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1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited (Enzygo) has been commissioned by Project Genesis Limited (PGL) to undertake an environmental noise impact assessment, as part of an Environmental Statement, to support a planning application for a new energy facility at Hownsgill Park, Consett, Durham.

1.1.2 The noise assessment has been undertaken to assess the potential impacts, in accordance with the relevant standards and guidance, at the nearest noise-sensitive properties to the site and to provide outline mitigation advice where considered necessary.

1.1.3 Details of the assessment methodology employed, together with the results of the noise predictions, assessment and conclusions are presented within this report.

1.2 Site Description

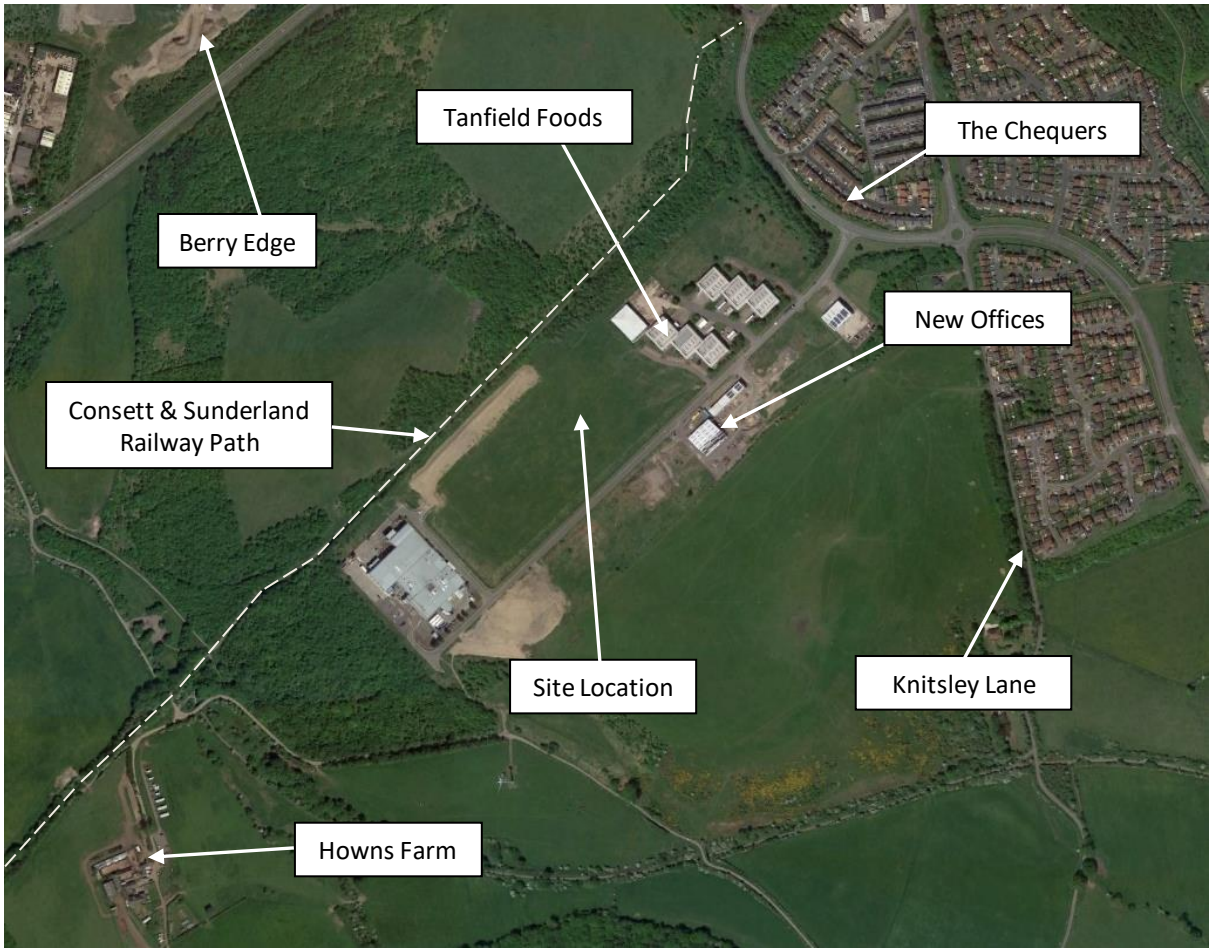
1.2.1 The proposed facility would be located within Hownsgill Park, Consett, Durham, on land to the north of the main road. The site is centred at grid reference NZ 10374 49735 approximately.

1.2.2 To the north of the proposed development site is the Consett & Sunderland Railway Path (also known as Hownsgill Viaduct National Cycle Route) with woodland beyond to the A692; beyond that is new residential development at Berry Edge. To the east are other commercial/industrial premises within Hownsgill Park with residential development beyond. To the south is further commercial/industrial development under construction with open land beyond as far as the Lanchester Valley Railway Path and woodland beyond. To the west is further commercial/industrial development with woodland beyond to the Lanchester Valley Railway Path and Consett & Sunderland Railway Path beyond which is Hownsgill Viaduct.

1.2.3 The nearest identified noise-sensitive properties are shown in Figure 1.1, namely:

- Properties on Berry Edge to the north of the A692;
- Properties on The Chequers to the northeast of the site;
- Properties on Knitsley Lane to the east on the site;
- Howns Farm, to the southwest of the site;
- Tanfield Foods offices to the east within Hownsgill Park;
- The Consett & Sunderland Railway Path; and
- Offices in the commercial/industrial unit under construction on the opposite side of the road.

Figure 1-1: Site Location Plan



1.3 Noise Assessment Methodology

1.3.1 The noise assessment for the proposed development has been undertaken in accordance with the guideline noise criteria outlined in British Standard 4142:2014+A1:2019 *Method for rating and assessing industrial and commercial sound* (BS4142), British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and the World Health Organisation's *Guidelines for Community Noise*.

1.3.2 Noise levels generated by the day to day operation of the proposed energy facility at the nearby noise-sensitive receptors has been predicted using the calculation methodology outlined in ISO9613:1996 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*' (ISO9613) using the proprietary noise modelling software CadnaA.

1.3.3 The assessment is based upon the results of a baseline noise survey undertaken at locations representative of the nearest residential receptors to the site over representative daytime and night-time periods.

2 Standards and Guidance

2.1 Planning Practice Guidance for Noise

2.1.1 The guidance contained within the Planning Practice Guidance for Noise indicates that noise should be considered when:

- New developments may create additional noise; and/or
- New developments would be sensitive to the prevailing acoustic environment.

2.1.2 The guidance indicates that Local Planning Authorities should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or is likely to occur; and
- Whether or not a good standard of amenity can be achieved.

2.1.3 The impact of noise is rated within the policy document in terms of the relative '*Observed Effect Level*'. The Planning Practice Guidance provides the matrix shown in Table 2-1.

Table 2-1: Planning Practice Guidance – Noise Exposure Hierarchy

Perception	Example of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required

Perception	Example of Outcomes	Increasing Effect Level	Action
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

Perception	Example of Outcomes	Increasing Effect Level	Action
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

Perception	Example of Outcomes	Increasing Effect Level	Action
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 and/or awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.2 British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*

2.2.1 BS4142 provides a methodology for rating and assessing sound associated with both industrial and commercial premises. The purpose of the Standard is clearly outlined in the opening section where it states that the method is appropriate for the consideration of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and,
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

2.2.2 The Standard is based around the premise that the significance of the noise impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise level (not necessarily the lowest background level measured, but the typical background of the receptor) from the measured/calculated rating level of the specific sound under consideration. This comparison will enable the impact of the specific sound to be concluded based upon the premise that typically "*the greater this difference, the greater the magnitude of the impact*". This difference is then considered as follows:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending upon context; and,
- 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.

2.2.3 BS4142 further states that "*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*" again depending upon the specific context of the site. The Standard further qualifies the assessment protocol by outlining conditions to the comparative assessment and stating that "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*", thus implying that all sites should be assessed on their own merits and specifics.

2.2.4 The Standard quantifies the typical reference periods to be used in the assessment of noise, namely:

Typical Daytime	07:00 – 23:00	1-hr assessment period
Typical Night-time	23:00 – 07:00	15-min assessment period

2.2.5 The Standard outlines methods for defining appropriate "*character corrections*" within the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Methods for tonality and c) the Reference Method. It is noted by the Standard that where multiple features are present the corrections should be added in a linear fashion to the specific level.

2.2.6 The Subjective Method is based on the following corrections:

Table 2-2: BS4142 Subjective Method Rating Corrections

Level of Perceptibility	Tonal Correction	Impulsivity Correction	Correction for "Other sound characteristics"	Intermittency Correction
No Perceptibility	+0 dB	+0 dB	Where neither tonal nor Impulsive but clearly identifiable +3 dB	If intermittency is readily identifiable +3 dB
Just Perceptible	+2 dB	+3 dB		
Clearly Perceptible	+4 dB	+6 dB		
Highly Perceptible	+6 dB	+9 dB		

2.3 British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*

2.3.1 BS8233 provides guidance and recommendations for the control of noise from outside sources to maintain an internal acoustic environment appropriate for the intended use. The Standard suggests appropriate criteria and limits for differing situations which are, primarily, intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes to the external noise climate. However, it is considered that the guidance provides suitable criteria for the assessment of internal noise levels in this instance.

2.3.2 The Standard suggests suitable guidance values for residential dwellings shown in Table 2-3.

Table 2-3: BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 Hours	23:00 to 07:00 Hours
Resting	Living room	35dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

2.3.3 Whilst it is considered desirable to achieve these internal noise levels with the windows open, it is not stipulated with the Standard which states:

"If relying on closes windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

2.3.4 The Standard suggests that the level of noise reduction provided by a partially open window would be approximately 15dB.

2.3.5 BS8233 also sets out a design-criteria for external noise in external amenity spaces such as gardens and patios stating:

"it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments."

2.3.6 These guideline design-criteria values are meant for new residential development rather than for assessing new noisy development being introduced into a residential area. However, the guideline values provide good noise limits to attain in this instance.

2.3.7 BS8233 also sets design range noise criteria for non-domestic buildings which should not normally be exceeded. The design ranges adopted for this assessment are shown in Table 2-4 below.

Table 2-4: BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	Design Range
Study and work requiring concentration	Executive Offices	35 – 40dB $L_{Aeq,T}$
Listening	Places of worship	30 – 35dB $L_{Aeq,T}$

2.4 ISO9613 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

2.4.1 The noise levels generated by the operation of the proposed development have been predicted using the calculation methodology set out in ISO9613-2. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

2.4.2 The methodology assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3 Baseline Noise Survey & Receptor Noise Climate

3.1 Baseline Noise Survey

3.1.1 Baseline noise measurements were undertaken on Thursday 6th and Friday 7th August 2020 to gather background and ambient noise levels at locations at or representative of the nearest residential receptor locations to the proposed development site.

3.1.2 Measurement were taken over two non-consecutive 1-hour period during the daytime and two non-consecutive 30-minute periods at night. The monitoring locations used for the survey are shown in Figure 3-1 and detailed in Table 3-1 below (grid reference coordinates are approximate).

Table 3-1: Noise Monitoring Location

Location Reference	Grid Ref (NGR)
MP1 – Berrys Edge (NSR1)	410254, 550298
MP2 – The Chequers (NSR2)	410706, 550029
MP3 – Knitsley Lane (NSR3)	411019, 549478
MP4 – Howns Farm (NSR4)	409915, 549339

3.1.3 The noise monitoring equipment used during the surveys is shown in Table 3-2 and was set to record the $L_{Aeq,T}$, L_{A90}, L_{A10} and L_{Afmax} parameters.

Table 3-2: Noise Monitoring Equipment

Location	Equipment Description	Serial Number	Calibration Date
MP1 & MP3	01dB Solo Class 1 sound level meter	065396	05/02/2020
MP2	01dB Solo Class 1 sound level meter	065446	17/04/2020
All	Cirrus CR:515 Acoustic calibrator	59522	05/02/2020

3.1.4 The following set-up parameters were used on the sound level meter during all the noise measurements undertaken:

Time Weighting: Fast

Frequency Weighting: "A"

3.1.5 The sound level meters were field calibrated, using an electronic calibrator, prior to commencement and upon completion of the overall survey, no drift in calibration was observed. The external calibration documentation for the equipment used is available upon request.

Figure 3-1: Noise Monitoring Location Plan

3.2 Weather

3.2.1 Weather conditions during the baseline survey periods were noted and are detailed in Table 3-3.

Table 3-3: Weather Conditions

Period	Precipitation	Cloud Cover	Max. wind-speed	Temperature
Daytime	None, dry roads	90%	<5.0ms^{-1}	18°C
Night-time	None, dry roads	40%	<5.0ms^{-1}	15°C

3.3 Survey Results

3.3.1 The results of the baseline surveys are summarised in Table 3-4 and can be found in full in Appendix A.

Table 3-4: Summary of Baseline Survey Results, dB

Location	Period	$L_{Aeq,T}$	L_{Amax}	L_{A90}	L_{A10}
MP1 – Berrys Edge	Day	76.1	91.7	60.6	79.7
	Night	64.5	90.7	25.5	58.9
MP2 – Roman Gardens	Day	68.4	87.1	41.8	73.0
	Night	53.0	79.4	31.5	37.7
MP3 – Rockliffe Avenue	Day	50.4	77.3	35.8	47.3
	Night	39.8	56.3	26.7	37.2
MP4 – Howns Farm	Day	50.7	78.2	35.2	46.4
	Night	46.7	78.4	30.5	37.8

3.4 Subjective Field Monitoring Notes

MP1 – Properties north of the A692, Berry Edge Development

3.4.1 The daytime noise climate at this location is dominated by road traffic using the A692, which has a 50mph speed limit. The night-time noise climate comprised road traffic using the A692 with lorry loading activities and reversing beepers also audible at times.

MP2 – The Chequers

3.4.2 The daytime noise climate comprised road traffic using the adjacent road, distant road traffic, bird song and wind in nearby trees. The night-time noise climate comprised occasional traffic on the adjacent road, distant background road traffic, a constant low frequency buzzing from Hownsgill Park was audible as were occasional metallic bangs.

MP3 – Knitsley Lane

3.4.3 The daytime noise climate at this location consisted of background road traffic noise, occasional vehicles passing on Knitsley Lane, birdsong and wind in nearby trees. The night-time noise climate was similar to that during the daytime but to a lesser extent. Sheep bleating was also audible during the night.

MP4 – Howns Farm

3.4.4 The noise climate during the daytime at this location comprised distant road traffic, occasional farm vehicles and occasional passing vehicles. Natural sounds such as birdsong and sheep bleating were also audible. During the night, the noise climate was similar as that noted during the daytime but to a lesser extent. A constant sound 'like gas being burned' was audible from the east and was thought to be roof vents at the food factory on Hownsgill Park.

4 Noise Assessment

4.1.1 The predictions have been made using the calculation methodology outlined in ISO9613 and the assessment of potential noise impacts has been undertaken in accordance with BS4142 and BS8233.

4.1.2 Reference has also been made, where appropriate, to the guidance noise levels outlined in the WHO guidance documents *Guidelines for Community Noise*.

4.1.3 The significance of the calculated noise impact is then further referenced to the noise exposure hierarchy presented in Section 2. In terms of BS4142, BS8233 and WHO the following thresholds are proposed.

Table 4-1: Effect Levels relating to BS4142 Impact

Threshold	BS4142 assessment of impacts
NOEL	Indication of a low impact (rating level does not exceed the background level)
LOAEL	Indication of an adverse impact (rating level is around 5dB above the background level)
SOAEL	Indication of a significant adverse impact (rating level is around 10dB above the background level)

Table 4-2: Effect levels relating to BS8233 Internal Noise Limit Guidance

Threshold	BS8233 assessment of impacts	
	Residential Sleeping in bedrooms at night	Office – study & work requiring concentration
NOEL	Internal noise level below 30dB $L_{Aeq,8hr}$	below 35dB $L_{Aeq,T}$
LOAEL	Internal noise levels between 30dB and35 $L_{Aeq,8hr}$	between 30dB and 40dB $L_{Aeq,T}$
SOAEL	Internal noise levels above 35dB $L_{Aeq,8hr}$	above 40dB $L_{Aeq,T}$

Table 4-3: Effect levels relating to WHO Guidance

Threshold	WHO assessment of impacts - Outdoor Living Area
NOEL	<50dB
LOAEL	>50dB and <55dB
SOAEL	>55dB

4.2 Noise Modelling Protocols

4.2.1 The noise model was constructed using the proprietary noise modelling software package CadnaA. The potential noise impacts at the nearby residential properties have been predicted using the calculation methodology outlined in ISO9613.

4.2.2 The noise model was constructed utilising Google Earth geo-referenced 1:1 scaled aerial photography, openstreetmap.org mapping data, DEFRA ground height data and noise source data supplied by the client/equipment manufacturer.

4.2.3 Operational noise sources associated with the proposed development would include noise emissions from buildings containing operational plant, external plant, stack outlets and vehicle movements. Table 4-4 shows the plant, equipment and vehicle movements related to the site along with the adopted sound power levels used within the noise model.

Table 4-4: Modelled Source Emission Heights

Description		Noise Source Level
Enclosed Process Building	Average reverberant sound pressure level measured at the internal face of the external wall of the building, L_i	80dB(A)
Plastics Recovery Plant	Average reverberant sound pressure level measured at the internal face of the external wall of the building, L_i	80dB(A)
Energy Centre	Average reverberant sound pressure level measured at the internal face of the external wall of the building, L_i	80dB(A)
Turbine Room	Average reverberant sound pressure level measured at the internal face of the external wall of the building, L_i	85dB(A)
Stack Outlet	Sound Power Level, L_w	108dB
Odour Control Plant	Sound Pressure Level @ 10m, L_P	53dB(A)
Odour Control Outlet	Sound Pressure Level @ 10m, L_P	53dB(A)
Dry Air Coolers	Sound Pressure Level @ 10m, L_P – per cooler	53dB(A)
HGV Movements	Drive-by sound power level, L_W (BS5228-1:2009+A1:2014)	111dB(A)

4.3 Noise Modelling Assumptions

4.3.1 The final construction details of the building wall and roof are subject to minor changes to suit the evolving site conditions and final equipment configurations. However, based on our experience with other sites, the building construction would be based on a portal steel frame design clad with plastic-coated sheet steel panels to the walls and roof. Personnel access doors would be composite construction and acoustically treated (if necessary) and vehicle access doors would be double-skinned insulated roller shutter doors. The overall sound reduction index of the building, R_W, used for the assessment is 25dB to reflect a conservative reduction.

4.3.2 Modelled noise levels form the basis of the calculated specific sound level. Noise emissions from the site have also been plotted graphically and are shown in Appendix B. The following assumptions have been made during the modelling process:

- All sources have a 100% operational time over the assessment period.
- Wind and temperature gradient assisted sound propagation at all receptors.

4.4 Noise Assessment Details

4.4.1 An assessment of the potential noise impacts at the nearest residential receptors identified has been made in accordance with the guidance contained in BS4142 with the night-time assessment also made in accordance with the guidance contained in BS8233.

4.4.2 An assessment of the potential impacts at nearby offices has been made in accordance with the guidance contained in BS8233 for the daytime only.

4.5 Predicted Sound Levels

4.5.1 For the purposes of this assessment the predicted noise levels assume that all plant would be operating simultaneously and at 100% load.

4.5.2 The client has advised that there would be 12no. HGVs visiting the site during the daytime only (deliveries taking place between 07:00 and 19:00 hours). It is expected that these will be distributed evenly over the working day; however, it is possible that 2no. HGVs could be visiting the site in any working hour therefore the predictions are based on 4no. HGV movements per hour (2no. in and 2no. out). Predictions are based on HGV speeds of 25kph between the site and the roundabout with the A692.

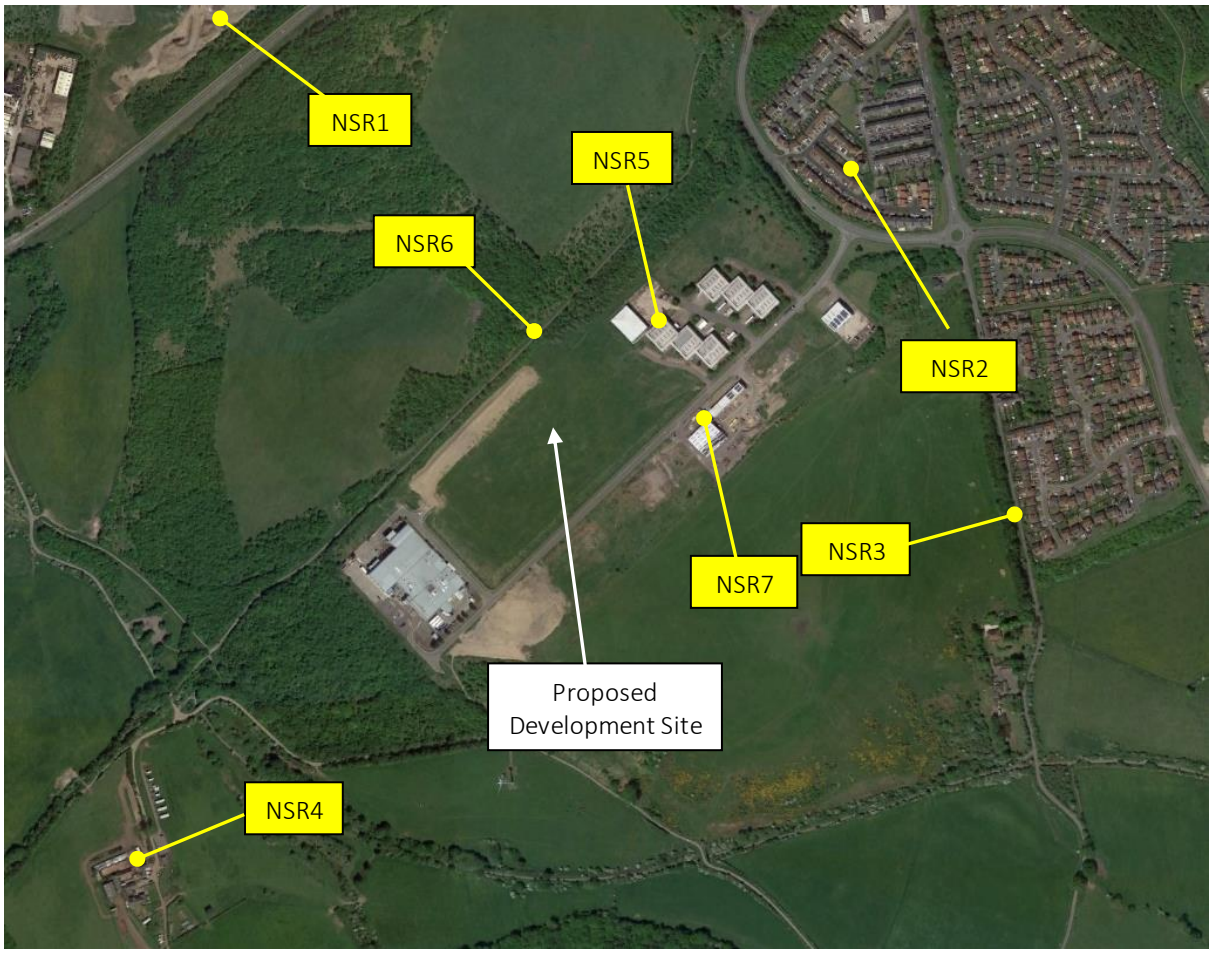
4.5.3 The noise assessment locations are shown in Figure 4-1. Noise predictions to the receptor locations have been made to a height of 1.5m for outdoor residential amenity space, ground floor offices and the Consett & Sunderland Railway Path and to a height of 4.0m for upstairs residential bedrooms and first floor offices as appropriate.. The results are shown in Table 4-5.

Table 4-5: Predicted Specific Sound Levels at the Assessment Locations

Receptor Location	Period (hrs)	Receptor Height (m)	Predicted Specific Sound Level, $L_{Aeq,1hr}$
NSR1 – Berry Edge Development	07:00 – 19:00	1.5	34.9
	19:00 – 23:00	1.5	34.9
	23:00 – 07:00	4.0	35.0
NSR2 – The Chequers	07:00 – 19:00	1.5	42.0
	19:00 – 23:00	1.5	38.0
	23:00 – 07:00	4.0	42.1
NSR3 – Knitsley Lane	07:00 – 19:00	1.5	34.8
	19:00 – 23:00	1.5	34.8
	23:00 – 07:00	4.0	38.9
NSR4 – Howns Farm	07:00 – 19:00	1.5	34.5
	19:00 – 23:00	1.5	34.5
	23:00 – 07:00	4.0	38.6
NSR5 – Tanfield Food Co. – GF	07:00 – 19:00	1.5	45.7
NSR5 – Tanfield Food Co. – 1F	07:00 – 19:00	4.0	49.9
	07:00 – 19:00	1.5	54.8

NSR6 – Consett & Sunderland Railway Path	19:00 – 23:00	1.5	54.8
NSR7 – Office Opposite – GF	07:00 – 19:00	1.5	45.7
NSR7 – Office Opposite – 1F	07:00 – 19:00	4.0	49.6

Figure 4-1: Noise Assessment Location Plan



(Image Source: ©Google)

4.6 Sound Rating Level

4.6.1 It is considered that any tonal content of the noise sources located within the building would be negated by the building structure and unlikely to be audible at the nearest noise-sensitive residential receptors. It is understood that the processes within the building do not contain any impulsive or intermittent features. Therefore, no acoustic feature corrections have been applied and the sound rating level would equal the specific sound level.

4.6.2 The stack outlet may have a tonal content that may just be audible at night. Therefore, a 2dB penalty has been applied to the predicted night-time noise levels.

4.6.3 It is noted that BS4142 assessments are undertaken using whole dB values with 0.5dB being rounded up. Table 4-6 details the derived sound rating levels.

Table 4-6: Sound Rating Levels

Location	Period (hrs)	Specific Sound Level dB $L_{Aeq,T}$	Penalties Applied, dB	Sound Rating Level dB $L_{Ar,T}$
NSR1 – Berry Edge Development	07:00 – 19:00	35	0	35
	23:00 – 07:00	35	2	37
NSR2 – The Chequers	07:00 – 19:00	42	0	42
	23:00 – 07:00	42	2	44
NSR3 – Knitsley Lane	07:00 – 19:00	35	0	35
	23:00 – 07:00	39	2	41
NSR4 – Howns Farm	07:00 – 19:00	35	0	35
	23:00 – 07:00	39	2	41

4.7 BS4142 Assessment

4.7.1 A comparative assessment has been undertaken to determine the potential impact of the predicted sound rating levels at the nearest residential receptors upon the prevailing background noise levels. Table 4-7 summarises the results of the assessment.

Table 4-7: BS4142 Assessment

Location	Period (hrs)	Specific Rating Level dB $L_{Aeq,T}$	Background Noise Level dB L_{A90}	Difference
NSR1 – Berry Edge Development	07:00 – 19:00	35	61	-26
	23:00 – 07:00	37	26	+11
NSR2 – The Chequers	07:00 – 19:00	42	42	0
	23:00 – 07:00	44	32	+12
NSR3 – Knitsley Lane	07:00 – 19:00	35	36	-1
	23:00 – 07:00	41	27	+14
NSR4 – Howns Farm	07:00 – 19:00	35	35	0
	23:00 – 07:00	41	31	+10

4.7.2 Table 4-7 shows that the predicted sound rating levels during the daytime are equal to, or below, the measured background noise levels at all residential receptors assessed. This would indicate that the specific sound level has a **low impact** depending on the context.

4.7.3 Table 4-7 also shows that the predicted sound rating levels during the night are above the measured background noise levels at all residential receptors assessed indicating that the specific sound would have a **significant adverse impact** depending on the context.

4.7.4 The context in this instance is that it is unlikely that residents would be using outdoor amenity spaces during the night. Therefore, an assessment of internal noise levels would be more

appropriate. It should be noted that BS4142 is not suitable guidance for assessing internal noise levels from external sources, rather the guidance contained in BS8233 should be used.

4.8 BS8233 Assessment - Residential

4.8.1 An assessment of the predicted internal noise levels has been made against the guideline values for internal ambient noise levels for sleeping in bedrooms at night outlined in BS8233. Table 4-8 details the results of the assessment when considering a 15dB reduction for a window left partially open for ventilation purposes as described in the guidance.

Table 4-8: BS8233 Assessment of Internal Noise Levels at Night - Residential

Location	Predicted External Noise Level, dB $L_{Aeq,T}$	Predicted Internal Noise Level, dB $L_{Aeq,T}$	Guidance Levels dB $L_{Aeq,T}$	Difference
NSR1 – Berry Edge	37	22	30	-8
NSR2 – The Chequers	44	29		-1
NSR3 – Knitsley Lane	41	26		-4
NSR4 – Howns Farm	41	26		-4

4.8.2 Table 4-8 shows that predicted internal noise levels at night would meet the guideline value for sleeping in bedrooms at all residential receptors assessed.

4.9 BS8233 Indoor Noise Level Assessment – Non-domestic Buildings

4.9.1 An assessment of the predicted internal noise levels within buildings within Hownsgill Park has been made against the guideline values for typical noise levels in non-domestic buildings. The assessment has been made against the guidelines set out in BS8233, i.e. the guideline design range of 35 to 40dB $L_{Aeq,T}$ in an executive office range for study or work requiring concentration.

4.9.2 Table 4-9 details the results of the assessment when considering a 15dB reduction for a window left partially open for ventilation as described by the guidance.

Table 4-9: BS8233 External Noise Assessment

Location	Floor	Predicted External Noise Level, dB $L_{Aeq,T}$	Predicted Internal Noise Level, dB $L_{Aeq,T}$	Guideline Design Range dB $L_{Aeq,T}$	Difference
NSR5 – Tranfield Food Co,	GF	46	31	35 to 40	-4 to -9
	1F	50	35		0 to -5
NSR7 – Office Opposite Site	GF	46	31		-4 to -9
	1F	50	35		0 to -5

4.9.3 Table 4-9 shows that the predicted internal noise levels would comfortably meet the guideline noise level design range in ground and 1st floor offices in the adjacent buildings.

4.10 WHO Guidance Assessment – Consett & Sunderland Railway Path

4.10.1 Consett & Sunderland Railway Path users would not remain close to the proposed development site for any significant period and therefore any disturbance to path users would not be considered significant or permanent.

4.10.2 As assessment of the predicted noise levels at the nearest point on the path to the proposed development has been made against the guideline value for moderate annoyance in outdoor living areas outlined in the World Health Organisation's document *Guidelines for Community Noise*, i.e. 50dB $L_{Aeq,16hrs}$.

4.10.3 The length of the route which would experience noise levels of 50dB or greater is approximately 250m. It is generally excepted that 1.4m per second is the walking pace of an average person; assuming that individuals walking the path would be slower than this, a conservative walking pace of less than 1.0m per second has been assumed. It would therefore take approximately 300 seconds (or 5-minutes) to traverse 250m. The predicted $L_{Aeq,1hr}$ noise level at the closest point to the proposed development would be 55dB. Using the following formula, the average noise level over the 5-minute traverse period would be 44dB. Table 4-10 details the results of the assessment.

$$L_{Aeq,1hr} = 10Log_{10}\left(\frac{10^{\frac{55}{10}} \times 300}{3600}\right) dB$$

Table 4-10 WHO Guidance Assessment

Location	Predicted External Noise Level, dB $L_{Aeq,T}$	Guidance Levels dB $L_{Aeq,16hr}$	Difference
NSR6 – Consett & Sunderland Railway Path	44	50	-6

4.10.4 Table 4-10 shows that predicted average noise levels during the time it takes to traverse the Consett & Sunderland Railway Path would remain below the level which would cause moderate annoyance to users of the route.

4.11 Assessment of Observed Effect Level

4.11.1 The significance of the calculated noise impact has been assessed in accordance with the Planning Practice Guidance for Noise using the definitions of NOEL, LOAEL and SOAEL shown in Tables 4-1.

4.11.2 The daytime BS4142 assessment has shown that predicted noise levels would be below the measured background noise levels and would therefore fall into the NOEL threshold of impact.

4.11.3 The BS8233 assessment has shown that predicted internal noise levels in nearby offices would meet the guideline design range for 'study or work requiring concentration' in executive offices and would therefore fall into the NOEL threshold of impact.

4.11.4 The BS8233 assessment has shown that predicted internal noise levels in residential properties would meet the guideline value for night-time sleeping in bedrooms and therefore fall into the NOEL threshold of impact.

4.11.5 Predicted noise levels in outdoor amenity spaces would be below the 50dB $L_{Aeq,16hr}$ noise level suggested by the WHO and therefore fall into the NOEL threshold of impact.

5 Mitigation

5.1 Noise Assessment

5.1.1 Although the noise assessment has shown that daytime external and night-time internal predicted noise levels would meet the relevant guidance the BS4142 assessment has shown that predicted night-time noise levels may lead to significant adverse impacts. Analysis of the noise model outputs has indicated that this is caused by noise emissions from the stack outlet.

5.1.2 The client has advised that additional attenuation can be achieved by installing a single column silencer which would provide an additional 18dB of noise reduction at the stack outlet, effectively reducing the sound power level at the stack outlet to 90dB(A) L_W.

5.2 Mitigated BS4142 Assessment

5.2.1 Table 5-1 details the results of the night-time BS4142 assessment with the additional silencer fitted to the stack.

Table 5-1: Mitigated BS4142 Assessment – Night-time

Location	Period (hrs)	Specific Rating Level dB $L_{Aeq,T}$	Background Noise Level dB L_{A90}	Difference
NSR1 – Berry Edge	23:00 – 07:00	22	26	-4
NSR2 – The Chequers	23:00 – 07:00	29	32	-3
NSR3 – Knitsley Lane	23:00 – 07:00	25	27	-2
NSR4 – Howns Farm	23:00 – 07:00	26	31	-5

5.2.2 Table 5-1 shows that predicted mitigated sound rating levels at night would be below the measured background noise levels at the residential receptors assessed. This would indicate that the specific sound level would have a low impact depending on the context.

5.2.3 The context under the mitigation scenario remains the same as before, i.e. it is unlikely that residents would be using outdoor amenity space during the night. Therefore, an assessment of internal noise levels would be more appropriate.

5.2.4 Following the application of the mitigation measures, daytime external and internal noise levels and night-time internal noise levels would reduce accordingly.

6 Conclusion

6.1 Background

6.1.1 Enzygo Limited (Enzygo) has been commissioned by Project Genesis Limited (PGL) to undertake an environmental noise impact assessment, as part of an Environmental Statement, to support a planning application for a new energy facility at Hownsgill Park, Consett, Durham.

6.1.2 The noise assessment has been undertaken to assess the potential impacts, in accordance with the relevant standards and guidance, at the nearest noise-sensitive properties to the site and to provide outline mitigation advice where considered necessary.

6.2 Noise Assessment

6.2.1 Sound levels generated by the proposed development have been predicted using CadnaA and assessments have been made in accordance with the guidance contained in BS4142, BS8233 and WHO Guidelines for Community Noise. Reference has also been made to the noise exposure hierarchy described in the planning practice guidance.

6.2.2 The daytime BS4142 assessment has shown that predicted sound rating levels in outdoor amenity spaces, at the nearest residential receptors assessed, would remain at or below the measured background noise levels indicating that the specific sound has a **low impact** and fall into the **NOEL** threshold of impact.

6.2.3 The night-time BS4142 assessment has shown that predicted sound rating levels at the nearest residential receptors assessed, would exceed the measured background noise levels by at least 10dB indicating that the specific sound has a **significant adverse impact** and fall into the **SOAEL** threshold of impact depending on the context. The context in this instance is that it is unlikely that residents would be using outdoor amenity spaces during the night. Therefore, an assessment of internal noise levels would be more appropriate. It should be noted that BS4142 is not suitable guidance for assessing internal noise levels from external sources, rather the guidance contained in BS8233 should be used.

6.2.4 The night-time BS8233 assessment has shown that predicted internal noise levels would meet the guideline values for sleeping in bedrooms at night, when considering a 15dB reduction for a window left partially open for ventilation, at all receptors assessed and therefore fall into the **NOEL** threshold of impact.

6.2.5 The BS8233 assessment has shown that predicted internal noise levels in nearby offices would meet the 35 to 40dB $L_{Aeq,T}$ design range for study of work requiring concentration in an executive office and therefore fall into the **NOEL** threshold of impact.

6.2.6 The WHO assessment of noise impacts on the Consett & Sunderland Railway Path have shown that, during the time it takes to traverse the 250m of path influenced by noise levels of approximately 55dB $L_{Aeq,1hr}$, path users would be subject to an average noise level of 44dB $L_{Aeq,1hr}$ which would be below the level for moderate annoyance.

6.2.7 As the BS4142 assessment has shown a significant adverse impact at night, measures have been considered to minimise the impact in the form of installing a single column silencer within the stack. The mitigated night-time BS4142 assessment has shown that predicted sound rating

levels have reduced to levels below the measured background noise levels indicating a **low impact** and to a level within the **NOEL** threshold of impact.

6.3 General Conclusion

6.3.1 Based on the findings of the assessment, against the guidance contained in the relevant standards it is considered that the proposed development can operate without adversely affecting nearby sensitive receptors in terms of acoustic impact.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
$L_{A10,T}$	The 10th statistical percentile of a measurement period, i.e. the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
$L_{A90,T}$	The 90th statistical percentile of a measurement period, i.e. the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present)*.
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
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:

Term	Definition
	$$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of ±1dB;
- Meteorology – allowance of ±1.9dB; and
- CadnaA noise propagation modelling software – operational accuracy of ±2.1dB

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of ±3dB.

APPENDICES

Appendix A – Baseline Noise Data

Table A-1: Location MP1, Consett Road/Berry Edge Development

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 14:03	75.6	88.7	60.2	79.5
06/08/2020 14:18	75.9	91.7	60.1	80.1
06/08/2020 14:33	69.2	83.1	53.3	72.3
06/08/2020 14:48	76.1	87.7	60.4	80.3
06/08/2020 16:28	76.9	86.3	63.5	80.9
06/08/2020 16:43	76.6	87.3	61.5	81.2
06/08/2020 16:58	77.4	87.5	62.7	81.7
06/08/2020 17:13	77.1	85.9	62.9	81.4
Overall (Daytime)	**76.1**	**91.7**	**60.6**	**79.7**
Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
07/08/2020 00:45	65.4	86.1	23.5	61.6
07/08/2020 01:00	64.6	83.9	25.3	60.5
07/08/2020 02:12	65.9	90.7	28.3	60.3
07/08/2020 02:27	60.1	82.4	24.9	53.3
Overall (Daytime)	**64.5**	**90.7**	**25.5**	**58.9**

Table A-2: Location MP2, The Chequers

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 12:26	68.8	87.1	42.8	73.1
06/08/2020 12:41	69.4	81.3	43.3	74.1
06/08/2020 12:56	69.1	83.0	43.3	73.8
06/08/2020 13:11	68.3	81.6	41.0	73.1
06/08/2020 15:13	68.1	83.6	45.4	73.0
06/08/2020 15:28	67.6	83.7	40.5	72.2
06/08/2020 15:43	67.5	80.4	36.9	72.2
06/08/2020 15:58	68.0	81.8	41.3	72.5
Overall (Daytime)	**68.4**	**87.1**	**41.8**	**73.0**
Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 23:58	47.7	74.0	31.5	36.7
07/08/2020 00:13	56.2	78.0	31.0	41.7
07/08/2020 01:28	54.3	79.4	33.3	38.2
07/08/2020 01:43	45.7	70.3	30.3	34.0
Overall (Daytime)	**53.0**	**79.4**	**31.5**	**37.7**

Table A-3: Location MP3, Knitsley Lane

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 12:20	48.6	71.3	32.0	43.4
06/08/2020 12:35	46.8	70.2	33.7	42.5
06/08/2020 12:50	49.5	71.1	31.6	46.6
06/08/2020 13:05	51.5	77.3	33.0	45.9
06/08/2020 15:08	49.8	71.7	36.9	49.8
06/08/2020 15:23	46.7	68.2	34.3	46.9
06/08/2020 15:38	51.7	69.2	44.0	53.0
06/08/2020 15:53	53.7	76.0	40.9	50.4
Overall (Daytime)	**50.4**	**77.3**	**35.8**	**47.3**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
06/08/2020 23:53	43.8	56.3	37.7	46.0
07/08/2020 00:08	41.3	51.6	26.5	45.9
07/08/2020 01:25	30.0	36.4	22.1	33.0
07/08/2020 01:40	22.4	30.5	20.4	23.9
Overall (Daytime)	**39.8**	**56.3**	**26.7**	**37.2**

Table A-4: Location MP3, Howns Farm

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 13:40	57.0	78.2	31.7	46.8
06/08/2020 13:55	42.2	62.0	33.5	44.8
06/08/2020 14:10	44.9	62.3	34.9	45.2
06/08/2020 14:25	50.8	71.8	34.8	48.3
06/08/2020 16:21	51.1	70.7	37.9	52.0
06/08/2020 16:36	50.0	69.8	38.6	47.8
06/08/2020 16:51	42.2	60.9	35.8	42.5
06/08/2020 17:06	43.7	65.0	34.5	43.4
Overall (Daytime)	**50.7**	**78.2**	**35.2**	**46.4**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
07/08/2020 00:40	41.9	63.9	25.1	33.5
07/08/2020 00:55	51.9	78.4	24.6	36.7
07/08/2020 02:07	38.7	51.3	36.4	40.2
07/08/2020 02:22	39.0	42.1	35.8	40.7
Overall (Daytime)	**46.7**	**78.4**	**30.5**	**37.8**

Appendix B – Noise Contour Plots

Figure B-1 – Daytime Operational Noise Contour Plot - Unmitigated

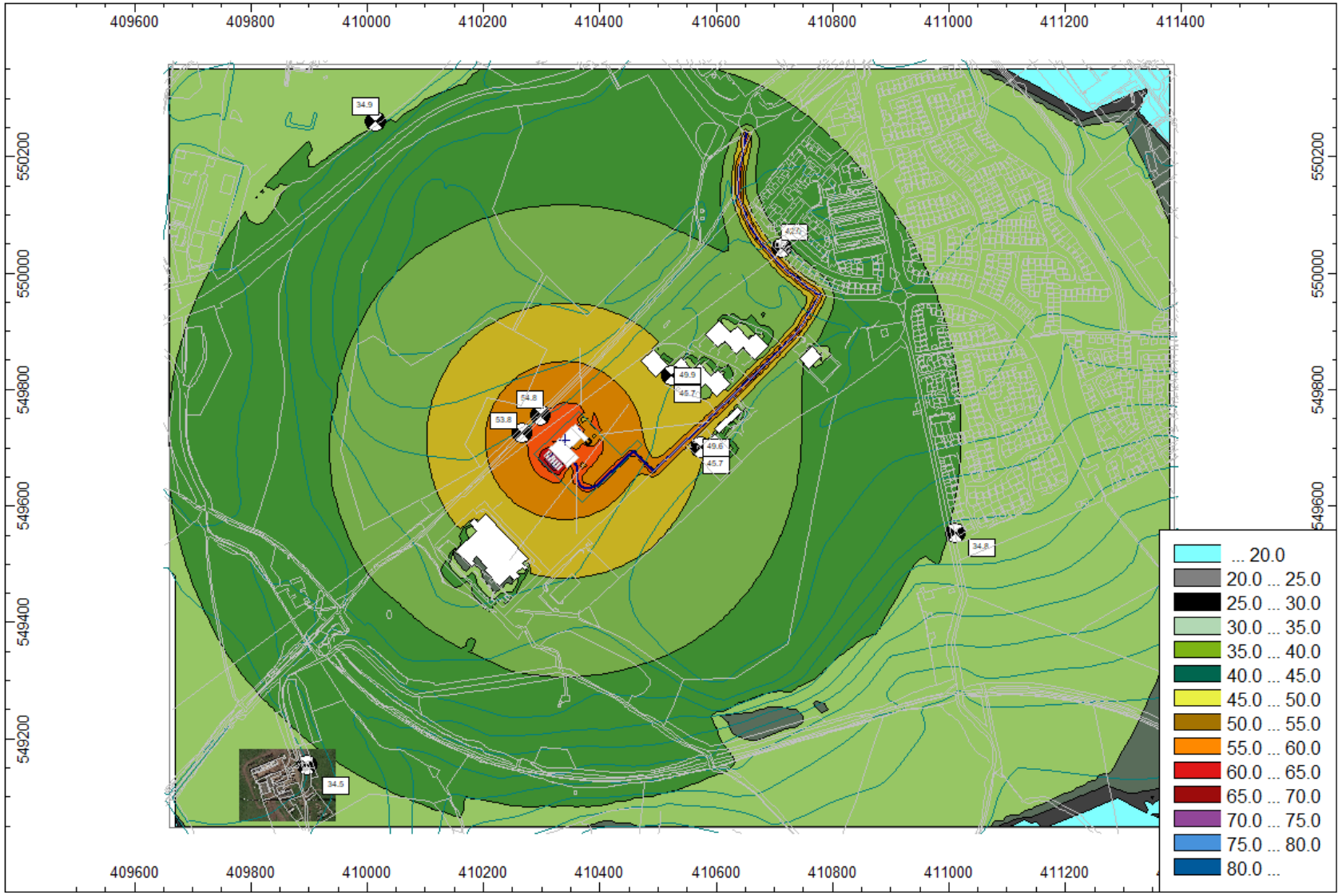


Figure B-2 – Night-time Operational Noise Contour Plot - Unmitigated

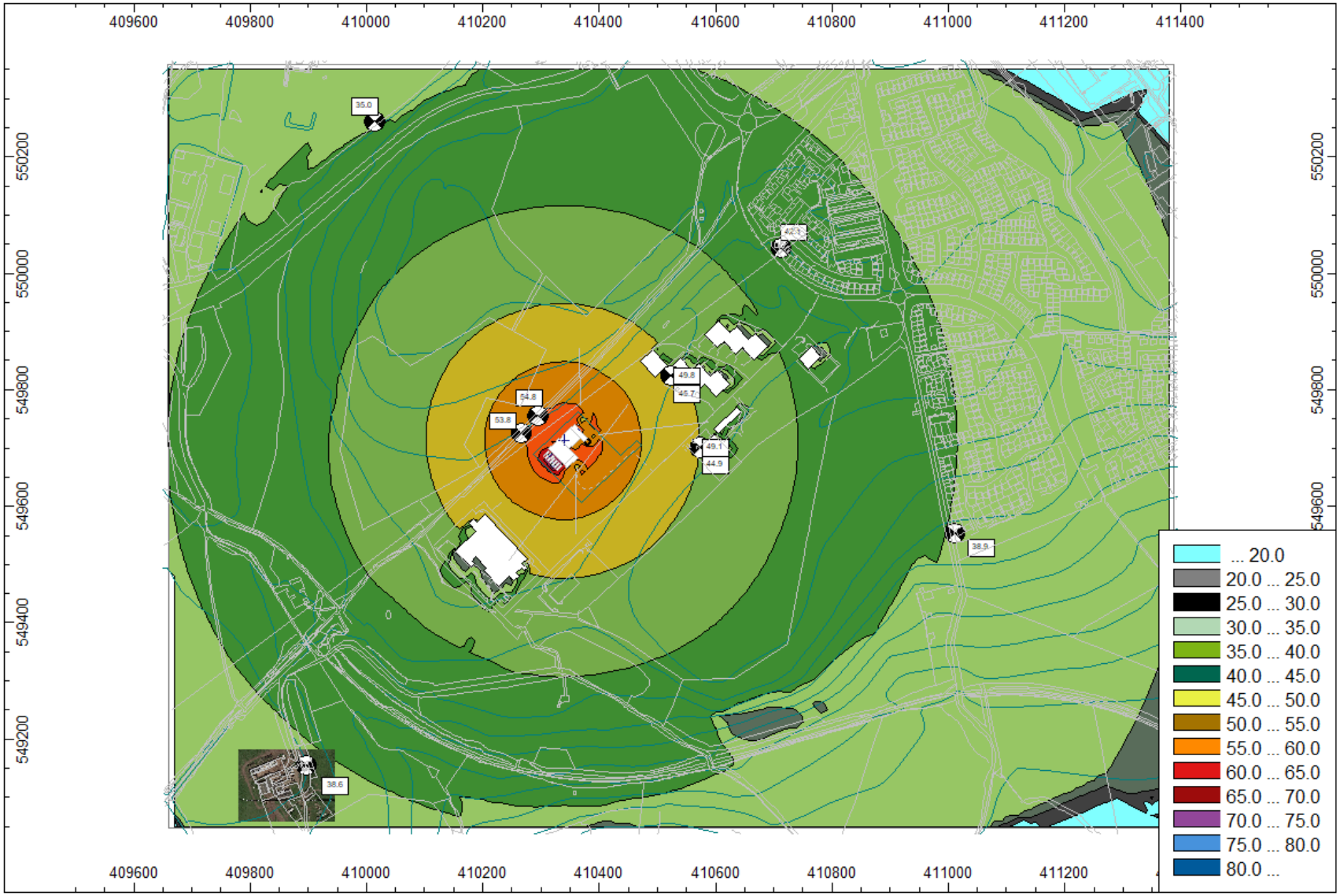


Figure B-3 – Daytime Operational Noise Contour Plot – Mitigated

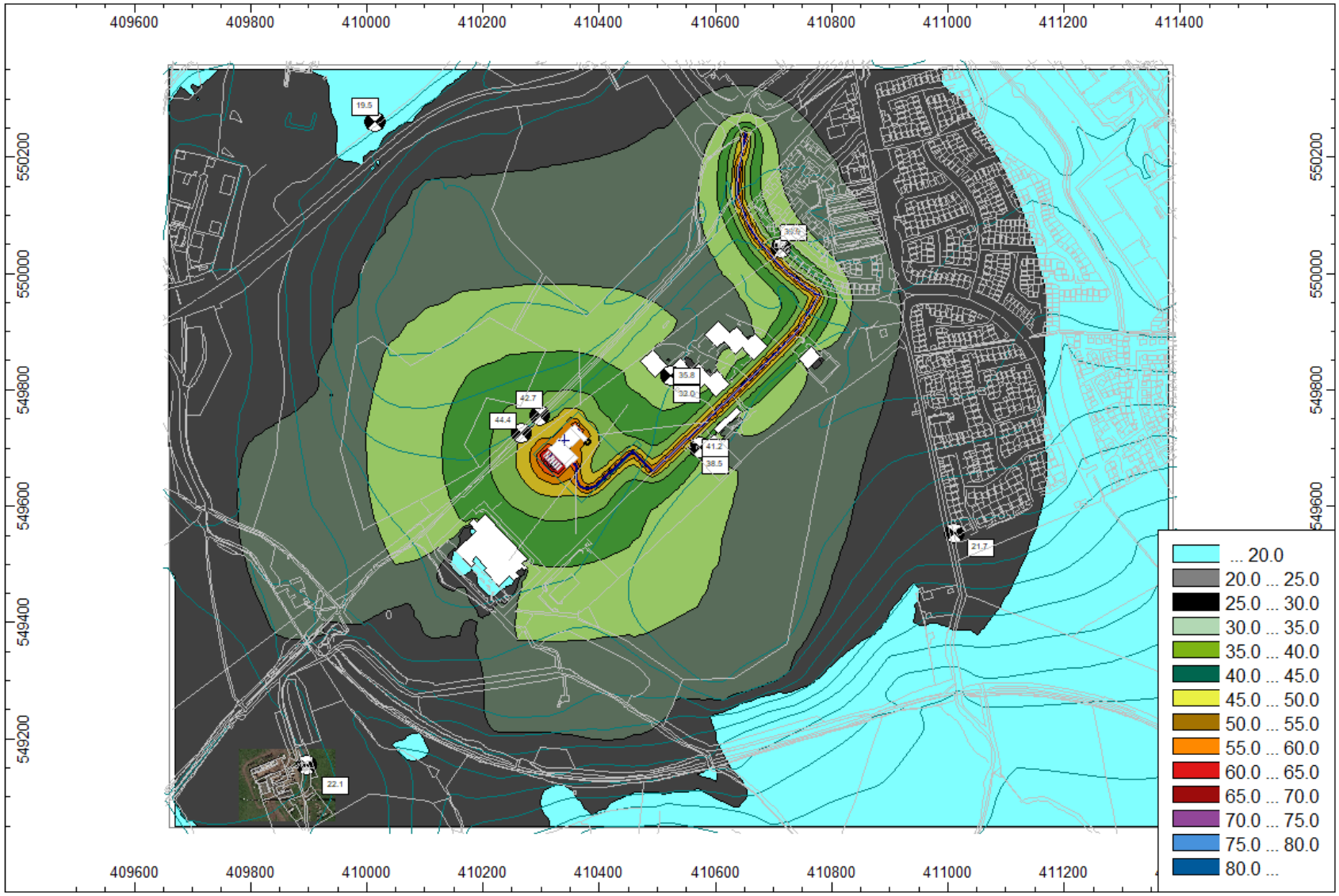
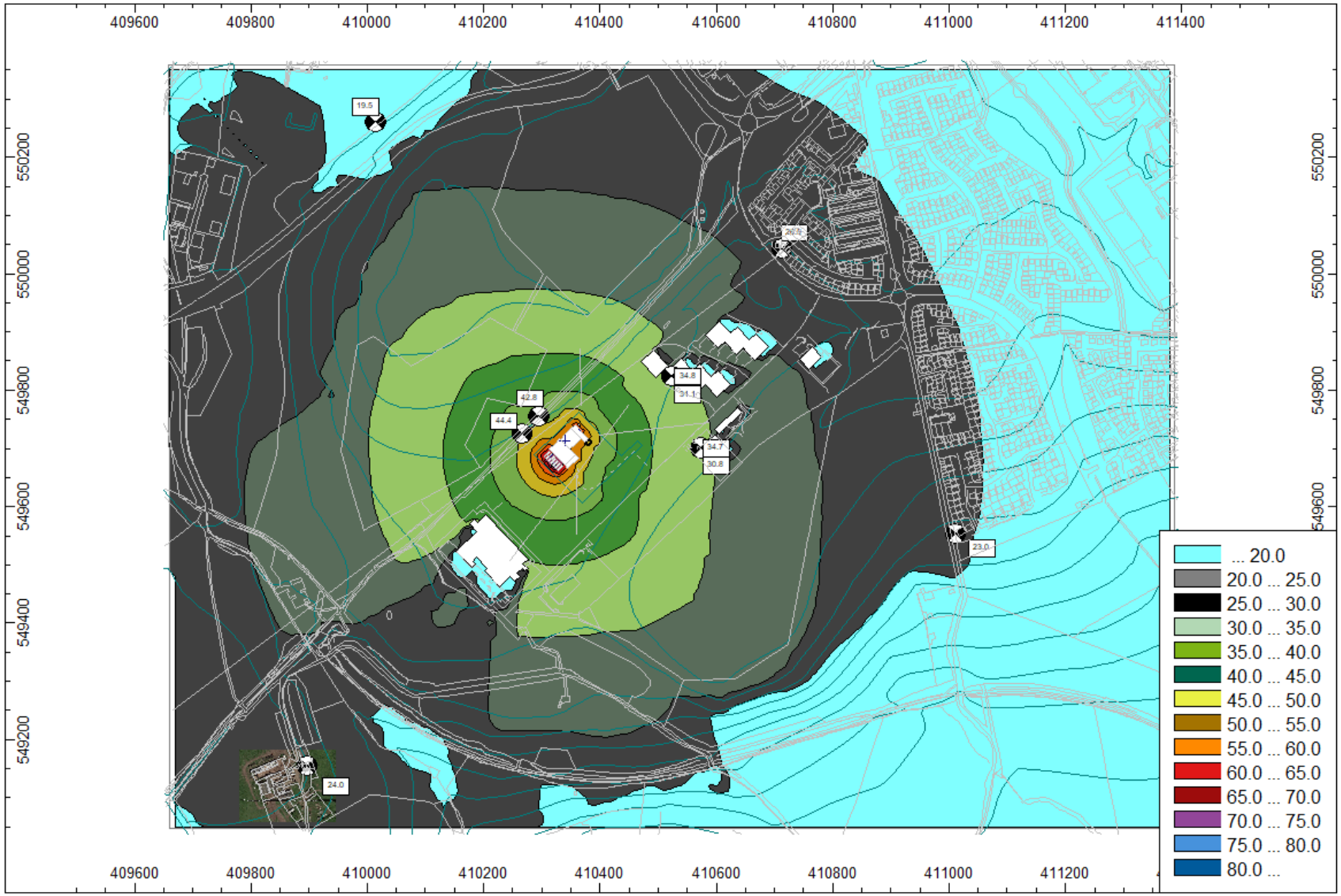


Figure B-3 – Night-time Operational Noise Contour Plot – Mitigated



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