NOISE IMPACT ASSESSMENT

FOR

STEWART MILNE HOMES

AT

ARGOED VIEW MOLD

AC106316-1R3

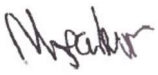
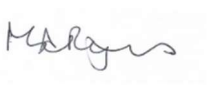
MAY 2021

Prepared For

Ben Sutton
Stewart Milne Homes NW
Harrier House, 2 Lumsdale Road
Cobra Business Park
Trafford Park
Manchester
M32 0UT

Prepared By

Ross Millington
Ensafe Group
2 Browns Road
Daventry
Northamptonshire
NN11 4NS

Issue/revision	Revision 2	Revision 3	Revision 4	
Remarks	Updated Layout	Updated Layout	Updated Layout	
Date	26/04/2019	18/08/2020	28/05/2021	
Prepared by	Martyn Parker	Ross Millington	Ross Millington	
Signature				
Position	Senior Acoustic Consultant	Acoustic Consultant	Acoustic Consultant	
Checked by	Conal Kearney	Nick Haigh	Mark Rogers	
Signature				
Position	Head of Noise and Air	Senior Acoustic Consultant	Senior Acoustic Consultant	
Verified by	Conal Kearney	Conal Kearney	Diana O'Monteiro	
Signature				
Position	Head of Noise and Air	Head of Noise and Air	Principle Acoustic Consultant	
Project number	AC106316-1r2	AC106316-1r3	AC106316-1r4	

EXECUTIVE SUMMARY

Ensafe (formerly REC Ltd) were commissioned by Stewart Milne Homes to provide a Noise Impact Assessment for a residential development on land off Argoed View in Mold.

A Survey has been completed in order to determine the existing levels of noise across the Site due to road traffic associated with New Brighton Road and the A5119.

Noise modelling software has been used in order to predict levels in external amenity areas and also incident upon the facades for the proposed residential development due to road traffic.

With regard to road traffic, the Noise Impact Assessment has determined that mitigation measures are required to ensure that external and internal noise levels do not exceed criteria.

Acoustic barriers are recommended for certain gardens at heights of 1.8m and 2.2m, all of which are displayed in Figure 4 of Appendix III. Additionally, mitigation is required to the facades of certain plots in the form of an alternative ventilation system such that habitable rooms can be sufficiently ventilated without opening a window. The mitigation requirements for the site are displayed in figures 5 and 6 of Appendix III.

The assessment has been based on robust and worst-case assumptions. This assessment has shown that, in principle, there should be no adverse impact at the closest receptors as a result of the existing noise sources.

TABLE OF CONTENTS

1. INTRODUCTION

Ensafe (Formerly REC Ltd) have been commissioned by Stewart Milne Homes to provide a Noise Impact Assessment for a residential development on land off Argoed View in Mold, to be referred to hereafter as *'the Site'*.

This assessment has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact upon the proposed noise-sensitive development.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.1 Site Location and Proposed Development

The Site is bound by New Brighton Road to the north east and the A5119 to the south. Existing residential dwellings border to the east. Argoed View lies to the west beyond which further residential dwellings are found.

Key noise sources assessed with potential to impact upon the Site are due to traffic noise from New Brighton Road and the A5119.

Proposals include for the construction of 84 residential dwellings together with amended means of access, landscaping and ancillary works.

This assessment has been undertaken with due regard to the supplied planning layout shown on the following planning drawings:

- Proposed Planning Layout (Dwg No: SK296/NBM/PL50) dated March 2021.

The Sketch Layout is shown in Figure 1 of Appendix III.

1.2 Limitations

All limitations of this report are presented in Appendix I.

1.3 Confidentiality

Ensafe has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Ensafe; a charge may be levied against such approval.

2. ASSESSMENT METHODOLOGY

2.1 Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise – October 1997

3. This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

Local authorities should adopt a corporate approach and ensure close co-operation between planning and environmental health departments when considering noise and noise generating developments.

Noise Exposure Categories (NECs) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.

Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities.

Local planning authorities should consider whether proposals for new noise-sensitive development would be incompatible with existing activities, taking into account the likely level of noise exposure at the time of the application and any increase that may reasonably be expected in the foreseeable future. Such development should not normally be permitted in areas which are, or are expected to become, subject to unacceptably high levels of noise and should not normally be permitted where high levels of noise will continue throughout the night.

Measures introduced to control the source of, or limit exposure to, noise should be proportionate and reasonable, and may include:

1. engineering: reduction of noise at point of generation (e.g. using quiet machines and/or quiet methods of working); containment of noise generated (e.g. insulating buildings which house machinery and/or providing purpose-built barriers around sites); protection of surrounding noise-sensitive buildings (e.g. improving sound insulation in these buildings and/or screening them by purpose-built barriers);
2. lay-out: adequate distance between noise source and noise-sensitive building or area; screening by natural barriers, other buildings, or non-critical rooms in a building;

3. administrative: limiting operating time of noise source; restricting activities allowed on the site; specifying an acceptable noise limit.

2.2 British Standard BS8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings

Noise Criteria Limits

The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including dwellings, as shown in Table 1:

Table 1 BS8233 Recommended Internal Noise Levels

Criterion	Typical Situation	Design $L_{Aeq,T}$ (dB)
Suitable resting/ sleeping conditions	Living Room	35
	Bedroom	30
For a Reasonable standard in bedrooms at night, individual noise evens (measured with fast time weighting) should not exceed 45dB L_{max}		

BS8233 goes on to recommend noise levels for gardens. According to BS8233;

"It is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors might be warranted".

BS8233 goes on to say:

"In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited".

Ventilation Requirements

Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS8233 states:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

Section 7.7.2 states:

"NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

2.3 World Health Organisation's (WHO) 'Guidelines for Community Noise'

The WHO 'Guidelines for Community Noise' offers advice with regard to setting noise criteria applicable to sleep disturbance. Section 4.2.3 specifies:

'If the noise is not continuous, L_{Amax} or SEL are used to indicate the probability of noise-induced awakenings. Effects have been observed at individual L_{Amax} exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a L_{Amax} exceeding 45 dB.'

The guidelines go on to state:

'At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax}, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.'

The sound insulation performance value of 15dB for a façade containing a partially open window accords with the guidance offered in BS8233:2014.

The guidelines reference a study by Vallet & Vernet, 1991, which concluded that:

'For a good sleep, it is believed than indoor sound pressure levels should not exceed approximately 45 dB $L_{AF,max}$ more than 10-15 times per night.'

Accordingly, this assessment has utilised the 10th highest measured maximum noise level from the night-time period and allows for an assessment of a typical maximum noise level in determining façade sound insulation performance.

3. SOUND SURVEYS

3.1 Road Traffic Noise Survey – New Brighton Road

Ensafe (formerly REC Ltd) has conducted a Road Traffic Noise Survey in order to assess the noise generated by vehicles using New Brighton Road to the north east of the Site. The survey was carried out over the following time period:

- 12:10 Tuesday 25th September to 12:10 Wednesday 26th September 2018.

The following noise measurement position was chosen for the Sound Survey:

- Noise Measurement Position 1 (NMP1): Located on the north eastern boundary approximately 5m from the nearside kerbstone of New Brighton Road. The survey took place in free-field conditions with the microphone at a height of 1.5m above ground level, during a typical weekday period. Noise at this location was dominated by vehicle pass-bys.

A summary of the measured sound pressure levels from the Road Traffic Survey is presented in Table 2 below.

Table 2 Summary of Measured Sound Levels for NMP1

Measurement Period Start	Measured Sound Pressure Levels (dB)	
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$
25/09/2018 12:10	58.6	N/A
25/09/2018 13:10	59.2	
25/09/2018 14:10	59.4	
25/09/2018 15:10	60.9	
25/09/2018 16:10	61.5	
25/09/2018 17:10	62.0	
25/09/2018 18:10	60.1	
25/09/2018 19:10	58.1	
25/09/2018 20:10	55.3	
25/09/2018 21:10	53.7	
25/09/2018 22:10	52.3	
25/09/2018 23:10	50.1	79
26/09/2018 00:10	46.9	
26/09/2018 01:10	49.0	

Measurement Period Start	Measured Sound Pressure Levels (dB)	
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$
26/09/2018 02:10	46.6	
26/09/2018 03:10	43.4	
26/09/2018 04:10	49.0	
26/09/2018 05:10	53.8	
26/09/2018 06:10	57.8	
26/09/2018 07:10	61.6	
26/09/2018 08:10	63.2	
26/09/2018 09:10	59.4	N/A
26/09/2018 10:10	56.9	
26/09/2018 11:10	59.2	
Daytime, $L_{Aeq,16hr}$	**60**	**N/A**
Night-time $L_{Aeq,8hr}$	**52**	**79**

3.2 Road Traffic Survey – A5119

Ensafe has conducted a Road Traffic Noise Survey in order to assess the noise generated by vehicles using the A5119 to the south of the Site. The survey was carried out over the following time period:

- 11:03 Monday 24th September to 11:03 Tuesday 25th September 2018.

The following measurement position was chosen for the Road Traffic Noise Survey:

- Noise Measurement Position 2 (NMP2): Located on the southern site boundary approximately 7m from the nearside kerbstone of the A5119. The survey took place in free-field conditions with the microphone at a height of 1.5m above ground level, during a typical weekday period. Noise at this location was dominated by vehicle pass-bys.

A summary of the measured sound pressure levels from the Road Traffic Survey is presented in Table 3.

Table 3 Summary of Measured Sound Levels for NMP2

Measurement Period Start	Measured Sound Pressure Levels (dB)	
	$L_{Aeq,T}$	10th Highest $L_{Amax,fast}$
24/09/2018 11:03	65	N/A
24/09/2018 12:03	65.3	
24/09/2018 13:03	65	
24/09/2018 14:03	65.2	
24/09/2018 15:03	65.9	
24/09/2018 16:03	65.8	
24/09/2018 17:03	65.6	
24/09/2018 18:03	64.5	
24/09/2018 19:03	63.5	
24/09/2018 20:03	62.1	
24/09/2018 21:03	61.5	
24/09/2018 22:03	59.7	
24/09/2018 23:03	56.4	79
25/09/2018 00:03	53.8	
25/09/2018 01:03	47.5	
25/09/2018 02:03	48.2	
25/09/2018 03:03	50.3	
25/09/2018 04:03	54.8	
25/09/2018 05:03	61.1	
25/09/2018 06:03	63.6	
25/09/2018 07:03	66.4	N/A
25/09/2018 08:03	66.6	
25/09/2018 09:03	65.5	
25/09/2018 10:03	64.6	
Daytime, $L_{Aeq,16hr}$	**60**	**N/A**
Night-time $L_{Aeq,8hr}$	**52**	**79**

During the noise surveys the weather conditions were conducive to the measurement of environmental noise, i.e. wind speeds no more than 5m/s and dry conditions. The following equipment was used for the Noise Surveys.

Table 4 Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1 and NMP2	Sound Level Meter	01dB-Metravib Black Solo	65771	25th October 2019
	Pre-amplifier	01dB-Metravib PRE 21 S	16539	
	Microphone	01dB Metravib MCE212	175280	
	Calibrator	01dB-Metravib CAL-21	34634218	24th April 2019

The sound level meter was field calibrated prior to and following the survey. No significant drift was reported. Calibration certificates are available on request.

4. NOISE IMPACT ASSESSMENT

4.1 Road Traffic Noise Impact

For the purposes of this assessment, Ensafe has used noise modelling software, CadnaA 2019 MR2, to determine noise levels due to road traffic across the Site.

A noise model has therefore been constructed in order to calculate façade noise levels and external noise levels due to road traffic noise.

The following inputs have been included in the model:

- Proposed Planning Layout dated March 2021;
- Site elevations have been taken as existing around the site;
- Noise Measurement Positions 1 and 2 have been used in order to calibrate the noise model;
- A floor height of 2.5m has been assumed for all proposed dwellings which is a standard separation distance between ground and first floors in a typical dwelling;
- A reflection order of 2 has been used in all calculations; and
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "*Acoustics – Attenuation of sound during propagation outdoors*" as incorporated into the CadnaA 2018 software.

4.1.1 External Amenity Areas

The grid noise map has been used to predict noise levels in the garden areas of the proposed development. Figure 2 of Appendix III details the grid noise map.

It can be seen that noise levels in the proposed garden areas range between below 45dB and up to 62dB in the worst affected garden areas. These levels are not considered acceptable given the locality of the Site and the criteria given in BS8233:2014.

Given the locality of the site next to a strategic transport network, accordingly, 55dB will be targeted as a worst-case level in accordance with BS8233:2014 for gardens closest to the roads.

4.1.2 Internal Habitable Rooms

In order to accurately determine noise levels within habitable rooms, it has been necessary to calculate the external noise level immediately outside the façade. Accordingly, the noise model has been used in order to calculate such noise levels due to road traffic noise.

With regard to internal noise levels, BS6262 suggests that a typical thermal double-glazing unit with configuration 6mm glass/12mm air space/6mm glass affords sound insulation performance of the order of 31dB; however, this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+C_{tr}' correction, has a sound insulation performance value of approximately 27dB and so this value has been used to calculate internal noise levels. BS8233:2014 also goes on to recommend that a partially open window provides approximately 15dB attenuation.

It can be seen in figures 5 and 6 of Appendix III that standard spec glazing is sufficient for all habitable rooms across the site. However, with windows partially opened it can be seen that a number of plots

across the site will experience exceedances of internal criteria. These facades are highlighted in blue in figures 5 and 6. Habitable rooms on these facades will require a means of ventilation that does not entail the opening of a window. The exact requirements of this alternate ventilation are defined in section 5 of this report.

With regard to the maximum instantaneous noise levels at night for New Brighton Road, the 10th Highest measured level at NMP1 was 74dB $L_{Amax,fast}$ which has been distance corrected to the closest façade (70dB $L_{Amax,fast}$). Accordingly, standard glazing is insufficient for bedrooms on the boundary with New Brighton Road. However, a partially open window would not provide sufficient attenuation. This is not, however, above and beyond that required for the average night-time noise levels and so no additional measures are required.

With regard to the maximum instantaneous noise levels at night for the A5119, the 10th Highest measured level at NMP2 was 79dB $L_{Amax,fast}$ which has been distance corrected to the closest façade (71dB $L_{Amax,fast}$). Accordingly, standard glazing is sufficient for bedrooms on the boundary with the A5119. However, a partially open window would not provide sufficient attenuation. This is not, however, above and beyond that required for the average night-time noise levels and so no additional measures are required.

5. MITIGATION

5.1 External Amenity Areas

The previous Section determined that during the daytime, noise levels in garden areas would range between below 45dB and up to 62dB. This is in exceedance of the requirement for a criterion of 50dB or 55dB. The most appropriate way of controlling this noise will be by way of acoustic barriers.

Accordingly, an additional noise model, Figure 4, has been run with acoustic barriers at a height of 1.8m and 2.2m around the affected gardens. These heights are considered the highest permissible before visual impact issues and thus achieve the lowest practicable levels which are 55dB and below.

The grid noise map shows that with barriers in place, all gardens achieve or fall below the 55dB criteria required with the vast majority achieving levels of below 50dB. It is worth noting that levels within the site are likely to be lower with the introduction of garden fencing/walls not modelled here.

The barriers should be of solid construction (close boarded), be free from holes, sealed at the base and have a minimum mass of 10kg/m^2.

The location of the barriers is shown in Figure 4.

5.2 Internal Habitable Rooms

Section 4.1.2 determined that standard double glazing is sufficient for all habitable rooms across the Site.

However, with a partially open window, the internal noise levels for certain plots will exceed the internal target criteria. Accordingly, it is necessary to consider an alternative ventilation scheme which does not require the opening of windows to provide fresh air flow and background ventilation. Windows should remain openable for purge ventilation.

The vents should be combined with a system that provides background ventilation. Purge ventilation is to be provided via an openable window.

The required performance for the vents range between 17dB and up to 31dB $D_{n,e,w}$ +$C_{t,r}$ for affected living rooms and bedrooms closest to the roads. Detailed plot by plot requirements are shown in Table A4 of Appendix IV.

The exact requirement for alternative ventilation ultimately falls to the developer and, from an acoustics perspective, needs to ensure that fresh air flow can be achieved without the need for opening windows.

6. CONCLUSION

Ensafe (formerly REC Ltd) were commissioned by Stewart Milne Homes to provide a Noise Impact Assessment for a residential development on land off Argoed View in Mold.

A Survey has been completed in order to determine the existing levels of noise across the Site due to road traffic associated with New Brighton Road and the A5119.

Noise modelling software has been used in order to predict levels in external amenity areas and also incident upon the facades for the proposed residential development due to road traffic.

With regard to road traffic, the Noise Impact Assessment has determined that mitigation measures are required to ensure that external and internal noise levels do not exceed criteria.

Acoustic barriers are recommended for certain gardens at heights of 1.8m and 2.2m, all of which are displayed in Figure 4 of Appendix III. Additionally, mitigation is required to the facades of certain plots in the form of an alternative ventilation system such that habitable rooms can be sufficiently ventilated without opening a window. The mitigation requirements for the site are displayed in figures 5 and 6 of Appendix III.

The assessment has been based on robust and worst-case assumptions. This assessment has shown that, in principle, there should be no adverse impact at the closest receptors as a result of the existing noise sources.

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between Ensafe and the Client as indicated in Section 1.2.

2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

3. Ensafe cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Ensafe is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Ensafe in this connection without their explicit written agreement there to by Ensafe.

4. Where a noise survey is required to inform the assessment, Ensafe will endeavour to ensure that all noise measurements taken are robust, representative and reliable in order to inform an accurate noise impact assessment. Where limitations or constraints exist which prevent a suitable noise survey being completed, Ensafe will take all reasonable steps to make the client fully aware of any such limitations or constraints with a view to achieving the best possible outcome for the client. Where additional sound surveys are required, over and above those specified in our scope of works, then Ensafe reserves the right to charge additional fees.

5. Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, Ensafe cannot be held responsible for any subsequent variations in the proposed mitigation performance.

APPENDIX II GLOSSARY OF ACOUSTIC TERMINOLOGY

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1 Typical Sound Pressure Levels

Sound Pressure Level	Location/Example
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain

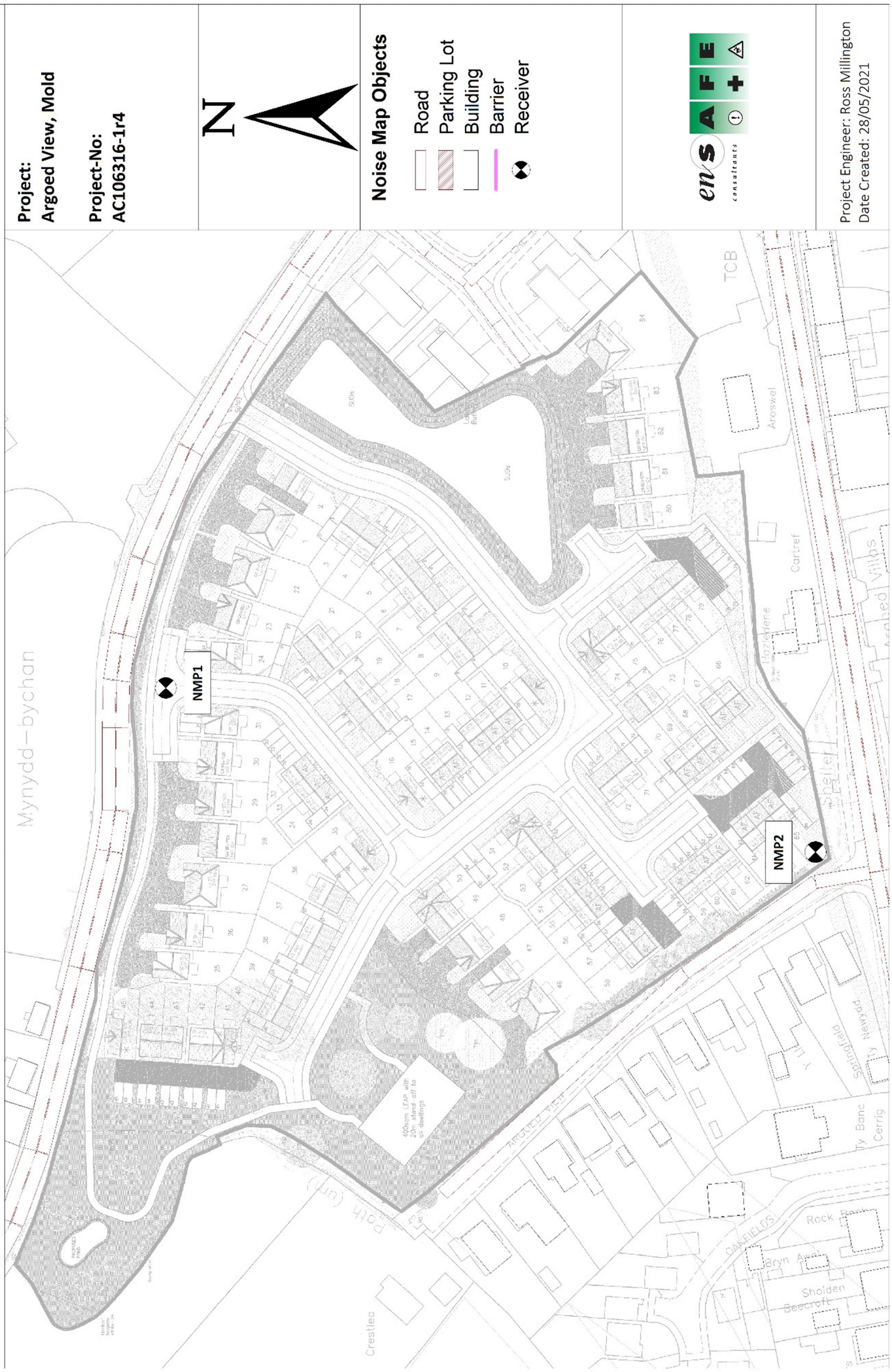
Acoustic Terminology

Table A2 Terminology

Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

APPENDIX III FIGURES

Figure 1 - Noise Survey Measurement Positions



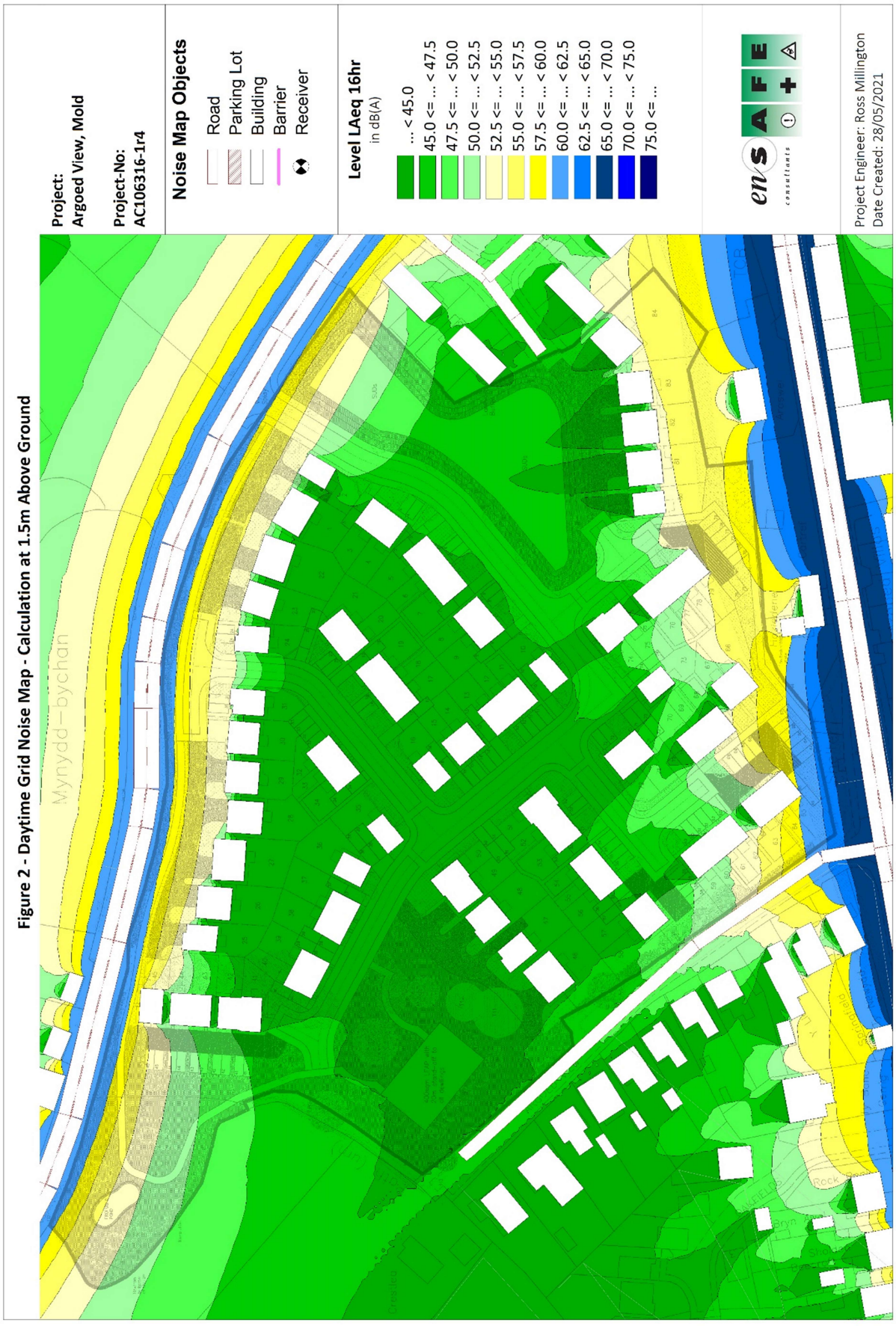


Figure 2 - Daytime Grid Noise Map - Calculation at 1.5m Above Ground

Figure 3 - Night-time Grid Noise Map - Calculation at 4m Above Ground

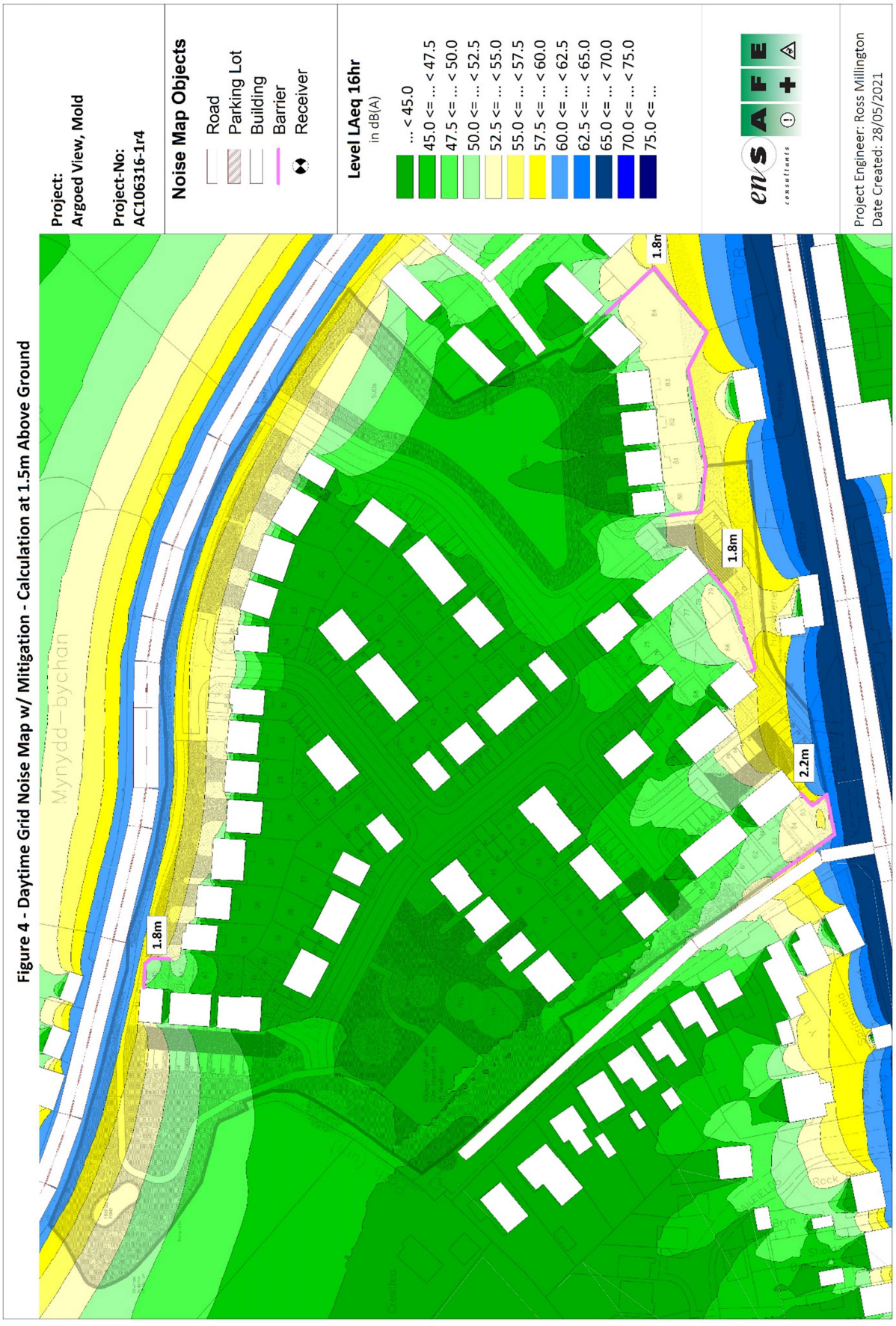


Figure 4 - Daytime Grid Noise Map w/ Mitigation - Calculation at 1.5m Above Ground

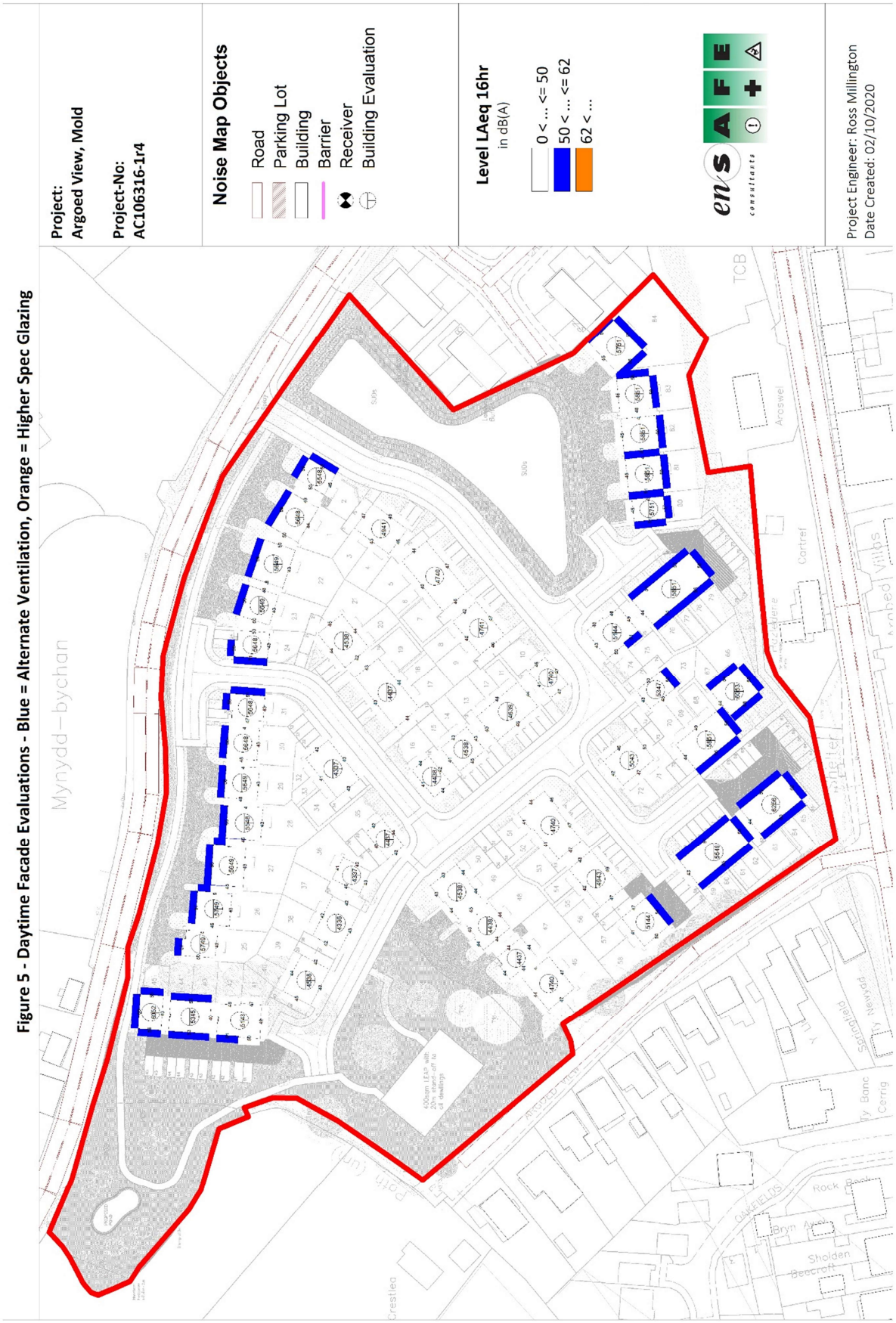


Figure 5 - Daytime Facade Evaluations - Blue = Alternate Ventilation, Orange = Higher Spec Glazing

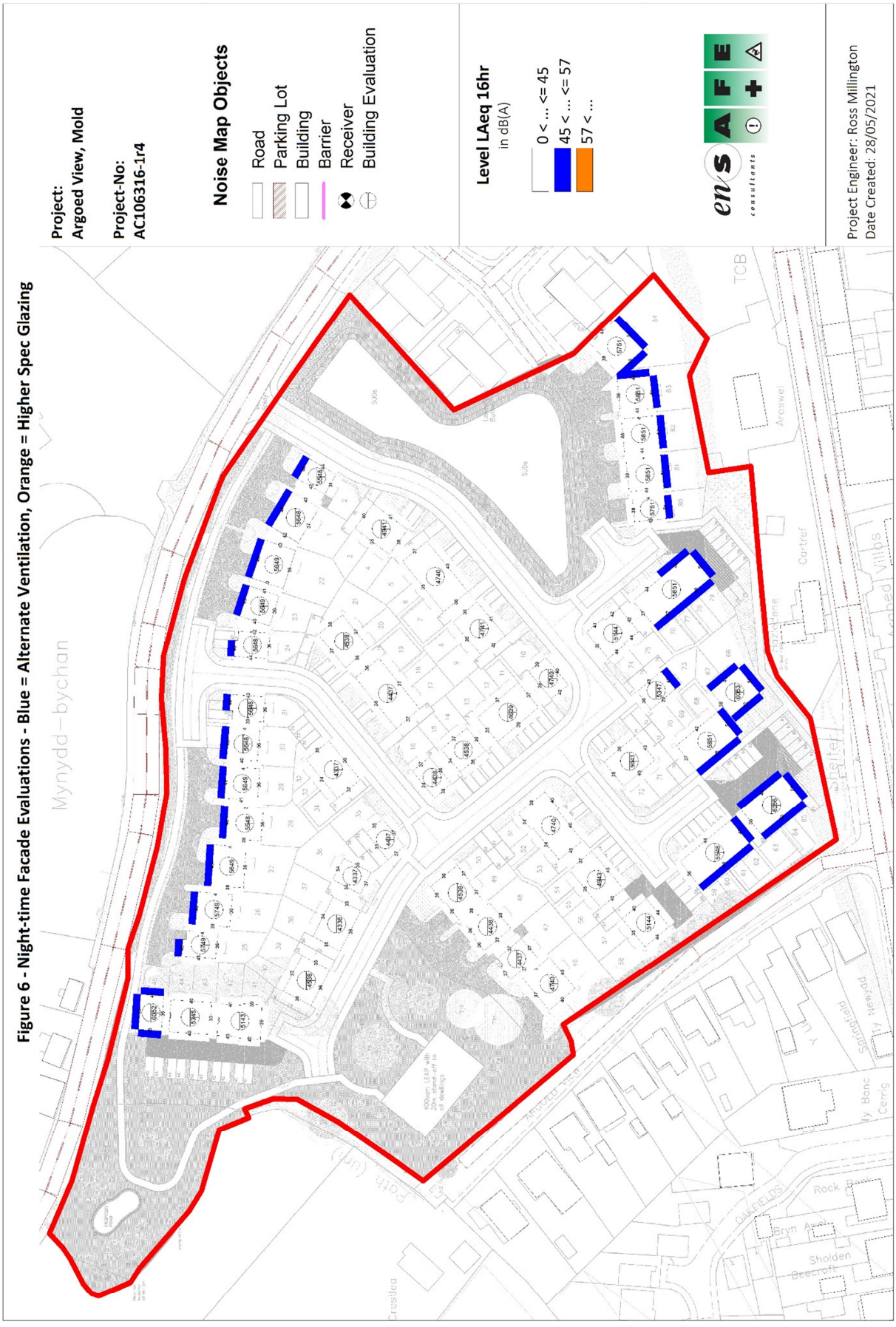


Figure 6 - Night-time Facade Evaluations - Blue = Alternate Ventilation, Orange = Higher Spec Glazing