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Noise Assessment
To Comply with Improvement Notice
Measures for Environmental Permit (IC7)

Margam Green Energy Plant
Margam
Port Talbot

For

Eco2 Ltd

Report No.: R19.1106/1/DRK
Report Date: 19th November 2019

Noise & Vibration Consultants Ltd

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Date: 19th November 2019

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1.0 INTRODUCTION

1.1 At the request of Eco2 Ltd, Noise & Vibration Consultants Ltd have been instructed to carry out a noise assessment in order to comply with Improvement Condition 7 (IC7) as part of the environmental permit for the Margam Green Energy Plant at Margam, Port Talbot. The requirement of the condition is as follows:

The requirements of Improvement Condition 7 (IC7) are as follows:

"Following successful commissioning and establishment of routine steady operation, the Operator shall undertake noise monitoring at the nearest local receptors. This shall include:

1. *A full noise monitoring survey and assessment meeting the BS4142:2014 standard*
2. *1/3rd octave and narrow band (FFT) measurements to identify any tonal elements or low frequency noise*
3. *Reference to the World Health Organisation guidelines for community noise*

Upon completion of the work, a written report shall be submitted to Natural Resources Wales. The report shall make reference to the predictions in the report produced in accordance with PO5. If rating levels likely to cause complaints at sensitive receptors are detected, the report shall include an assessment of the most suitable abatement techniques, an estimate of the cost and a proposed timetable for their installation."

1.2 NVC Ltd provided a baseline noise report (ref. R15.0103/DRK dated 15th January 2015) for compliance with pre-operational measures (PO1) as part of the environmental permit. Baseline sound levels were recorded during a weekend and two weekday periods during suitable weather conditions for monitoring. The noise survey commenced on Saturday 29th November and was completed during early morning on Wednesday 3rd December 2014.

1.3 Mach Acoustics have undertaken an Acoustic Design Report for Interserve Construction to provide acoustic design input to the proposed biomass energy plant, which provides detail of the noise source levels and proposed construction of the associated buildings (dated 9 June 2016).

1.4 NVC Ltd provided a noise assessment to comply with Pre-operational Condition 5 for the Environmental Permit (PO5) dated 2nd August 2016 (ref. R16.0609/1/DRK).

1.5 Hawksmoor Engineering Ltd produced a noise assessment report in April 2019 for the purpose (ref. Rep-26/033- MWE Cond 13 - R2) of showing compliance with Planning Conditions 12 and 13 of the project planning consent.

1.6 The Green Energy Plant has now been commissioned and is operating under load conditions.

Sources of Information

1.7 Information used in this assessment has been obtained from the following sources:

- Mach Acoustics Report dated 9 June 2016;
- Baseline Noise Survey NVC Ltd Report R15.0103/DRK dated 15th January 2015);
- NVC Report for Pre-operational Condition 5 for the Environmental Permit (PO5) dated 2nd August 2016 (ref. R16.0609/1/DRK).
- Hawksmoor Engineering Ltd noise assessment report dated 15th April 2019 (ref. Rep-26/033- MWE Cond13 - R2).
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors
- Original Environmental Statement Chapter 12 - Noise;
- BS4142: 1997 Method for rating industrial noise affecting mixed residential and industrial areas;
- BS4142: 2014 `Methods for rating and assessing industrial and commercial sound';
- Guidelines for Community Noise – World Health Organisation: April 1999; and
- Planning Appeal Decision (Ref. APP/Y6930/A/10/2135473) dated 8th March 2011.

1.8 Appendix 1 provides details of technical terms within the report described in layman terms for ease of reference. There is also a chart showing typical every day noise levels to assist in understanding the subjective level of noise in terms of decibels.

2.0 SITE DESCRIPTION

2.1 Site Location

2.1.1 The site of the new Green Energy Plant is located at on land off Longlands Lane, Margam in Port Talbot. The site is positioned approximately 400m south west of the M4 Motorway.

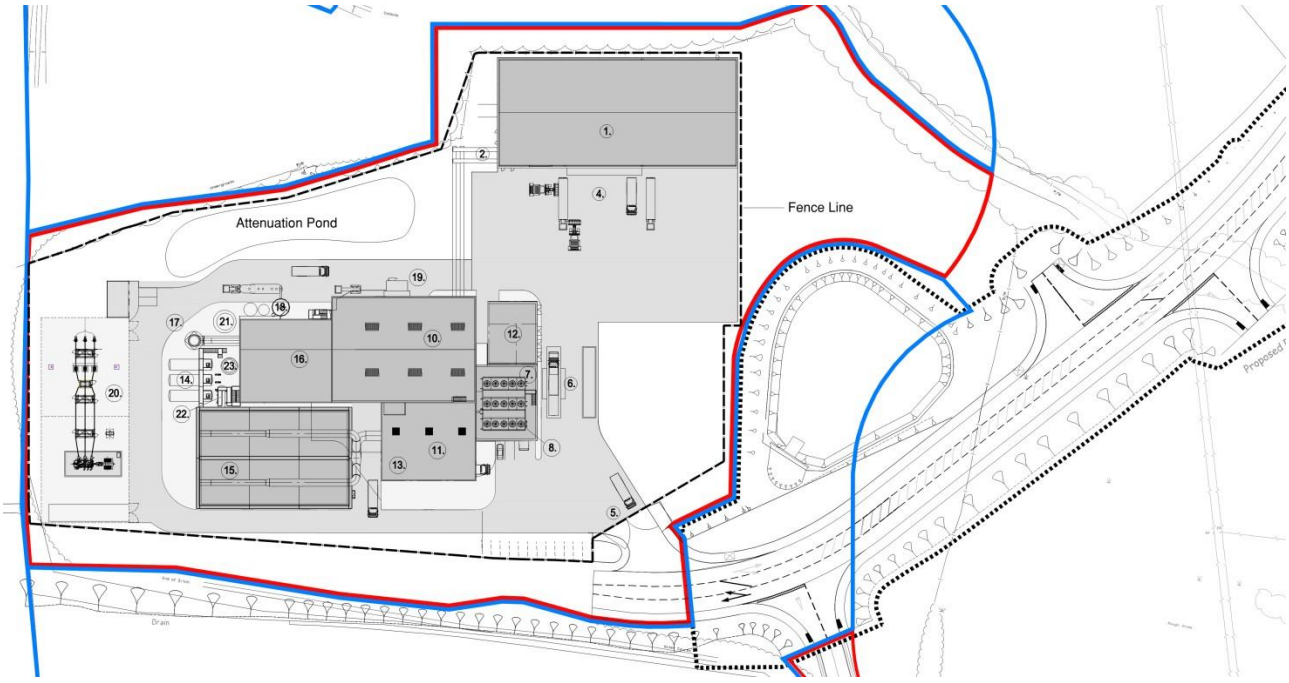
2.1.2 The Site is in a mixed industrial and residential area of Margam with an existing biomass power station located circa 50m to the south of the proposed site. There is an additional large BOC gas liquefaction plant site further to the southwest and Port Talbot steelworks to the west to northwest.

2.1.3 The development includes a number of buildings which contain the following main plant areas:

- Wood Chip Storage Silo;
- Boiler Building;
- Turbine Building;
- Flue Gas Building;
- Service Electrical Building
- Air Cooled Condensers

2.1.4 The plan of the site is provided below in Figure 2.1.

Figure 2.1: Margam Green Energy Plant Layout



2.1.5 The nearest sensitive receptors (NSRs) have been determined during previous studies and include the following and includes subjective observations noted during the previous baseline sound surveys.

NSR Location and Subjective Baseline Noise Climate

Position 1: Abbots Close (Grid Reference: 278953 186887)

2.1.6 The houses at the edge of Abbots Close facing the proposed development approximately 640m to the North of the site boundary. Noise levels observed at this location are formed by distant road traffic from the Motorway and the bypass road and local road traffic movements onto the recreation ground. Noise from sporting activities occurs at times during weekend periods and on some evening periods. During night-time periods when traffic noise has subsided there is a general `drone' type noise emanating from the direction of the industrial areas to the west and southwest of site. Occasional reverse `beeper' noise can be heard at distance from reverse alarms from mobile plant.

Position 2: Longlands House (Grid Reference: 279320 186116)

2.1.7 The house located on Heol Caer y Bont, known as Longlands House, approximately 324m to the south east of the site boundary. The noise observed at this position included occasional local road traffic movements, distant road traffic noise and general `drone' and peak noise events emanating from BOC plant to the west of the position. There is a general `drone' type noise from the BOC site with regular and intermittent peak impulse noise levels from BOC which sounds like an air discharge or product discharge type sound.

Position 3: Ten Acres (Grid Reference: 279550 186344)

2.1.8 The houses located on the opposite side of the M4 motorway at Ten Acres approximately 700m to the east of the site boundary. The noise climate at this location is formed in general by the local road traffic noise from the M4 Motorway. Occasional dog barking and high level aircraft noise and local vehicle movements along the lane provide additional noise sources at different times of the day and night.

3.0 PLANNING CONDITIONS & WHO GUIDANCE

3.1 The planning conditions for the development in terms of noise limits and assessment of site noise levels during the operational phase are detailed below:

Noise Limits:

"12. Operational noise from the site shall not be greater than the following levels at the specified locations:

- *Longlands House; 48 dbALeq 1 hour during the day and Leq 5 minutes at night.*
- *Abbots Close; 48 dbALeq 1 hour during the day and Leq 5 minutes at night.*
- *10 Acre Wood: 48 dbALeq 1 hour during the day and Leq 5 minutes at night. All measurements shall be taken in accordance with BS4142 (1997)"*

Noise Assessment:

"13. Within 3 months of commencement of operation of the plant a noise assessment using the original monitoring locations as *identified in the Environmental Statement, shall be submitted to and approved in writing by the local planning authority. The assessment shall include measures, including appropriate timescales, to address any noise issues identified. Theseshall be implemented as approved within the timescales agreed."*

World Health Organisation (WHO) Guidelines for Community Noise: April 1999

3.2 This document provides further updated information on noise and its effects on the community. Within the document for noise 'In Dwellings' it states that *"To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq}. To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."*

4.0 ASSESSMENT METHODOLOGY

4.1 Due to the prevailing residual sound levels, which are relatively high in far field positions (due to road traffic noise and other industrial noise), it is not possible to directly measure the noise contribution from the Energy Plant facility at the NSRs. To enable the noise contribution from site to be established and determination of any relevant site noise character, it was therefore necessary to adopt the following assessment methodology.

Noise Monitoring Positions

1. On-site near field noise measurements at accessible positions close to external plant, plant buildings, louvres and doorways.

2. Intermediate noise monitoring positions in relevant directions to NSRs. This included the following positions:

   (a) Circa 75m SE of nearest plant building
   (b) Circa 100m E of nearest plant building
   (c) Circa 140m SE of nearest plant building
   (d) Circa 150m N of nearest plant building

3. Far field noise monitoring positions at NSRs during daytime and night-time sensitive periods (refer to Figure 1 attached for approximate positions):

   P1. Abbotts Close (north of site)
   P2. Longlands House (southeast of site)
   P3. Ten Acre Wood (east of site)

4. Monitoring height of microphone was undertaken at 1.2m to 1.5m above ground level at the chosen monitoring positions.

Site Operational Noise Monitoring

5. Noise monitoring was carried out with all appropriate plant operational and under typical operating conditions. Monitoring was carried out at the required height above ground during daytime and night-time periods.

6. During the daytime and night-time monitoring subjective observations were noted of any audible noise at intermediate and far field positions to determine whether there was any acoustic character present.

7. Monitoring at the near field locations were undertaken typically over 1-minute measurement periods where the plant noise was reasonably stable. Monitoring at intermediate monitoring positions were undertaken over 5-minute periods.

8. Monitoring at far field positions (as detailed in 3) above) were carried out using the Leq measurement index and monitoring undertaken in 5-minute time periods at the 3 locations.

9. Monitoring during daytime and night-time periods to include one-third octave band centre frequency spectra to determine the existence of any tonal characteristics. Additional FFT analysis carried out at NSR positions during night-time periods.

Noise Monitoring Equipment

10. Noise measurements were carried out using a Type 1 integrating real time analysers, which fully comply with British Standards for sound level meter specifications.

11. An effective windshield was used to minimise turbulence at the microphone.

12. An acoustic calibrator was applied to the microphone before and after measurements to check the sensitivity of the measuring equipment and to ensure that there is no shift in calibration. Calibration certificates are provided for the instrumentation from a suitable test laboratory to demonstrate that its measurements are traceable to national or international standards.

Noise Monitoring Conditions/methodology

13. Monitoring was undertaken in suitable weather conditions:

    a) wind speeds lower than 3 metres/second
    b) dry conditions
    c) temperatures above zero degrees.

14. Noise monitoring was undertaken by an experienced noise consultant with appropriate qualifications and affiliations to IOA and ANC.

15. Determination of site attributable noise will be determined by:

    a) Using calculation methods using the near field/intermediate field noise data and correcting to receptor locations by propagation attenuation adjustment. The method used to calculate the noise contribution from the Margam Green Energy Centre site at the identified receptor positions utilises ISO9613-2.

5.0 NOISE SURVEY DETAILS & RESULTS

5.1 Noise Monitoring

5.1.1 Noise monitoring was undertaken on Tuesday 5th to Wednesday 6th November 2019 during daytime and night-time periods.

5.1.2 Refer to Figure 1 attached for the NSR noise monitoring locations.

5.2 Noise Monitoring Equipment and Survey Positions

5.2.1 Noise monitoring was undertaken in accordance with the approved noise compliance monitoring scheme.

5.2.2 Noise measurements were undertaken with Type 1 integrating real time analysers, which fully comply with the relevant British Standard.

Instrumentation:

Manufacturer	***Description***	***Type***	***Calibration Due date***	***Serial No.***
Norsonic	Real time Analyser	118	August 2020	31992
Cirrus	Real time Analyser	171A	February 2020	G056142
Cirrus	Electronic Calibrator	513A	June 2020	031523

5.2.3 An effective windshield was used to minimise turbulence at the microphone. Monitoring in intermediate and far field positions were undertaken at a height of 1.2 to1.5 metres above ground level and at least 3.5 metres from the nearest reflecting surface.

5.2.4 An acoustic calibrator was applied to the microphone before and after measurements to check the sensitivity of the measuring equipment. No drift in calibration was observed. Calibration certificates for the noise meters and calibrator are available on request.

5.2.5 Monitoring of site noise was recorded during the daytime and night-time operating periods in terms of LAeq, LA10, LA90 and LAmax and one-third octave band centre frequency measurement indices. The noise monitoring exercise was carried out during appropriate weather conditions as defined by BS4142:2014.

5.2.6 The following set-up parameters were used on the sound level meters during noise measurements:

Time Weighting: Fast
Frequency Weighting: `A'
Measurement Period: 1 minute or 5 minutes

5.3 Meteorological Conditions

5.3.1 Weather conditions were recorded during the period of the survey and are detailed below:

Tuesday 5th November 2019

5.3.2 During the morning monitoring period it was dry, mostly cloudy with light south easterly winds (1-2m/s) and temperature ranging between 8deg to 10deg C. During the afternoon survey, it remained dry, overcast conditions turning to light cloud and sunny spells, wind direction variable from south east-northwest-northeast (1-3m/s) and temperature ranging between 9deg and 11deg C.

Wednesday 6th November 2019

5.3.3 During the early morning monitoring period it remained dry, light cloud cover with light north-north-east winds (0-1m/s) and temperature ranging between 8 to 9deg C.

5.3.4 The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS4142: 2014.

5.3.5 Mr D. R. Kettlewell of Noise & Vibration Consultants Ltd set up the noise monitoring equipment and undertook measurements at near field, intermediate and far field positions relative to the site.

5.4 Site Operations

5.4.1 The site was operating normally during the daytime and night-time monitoring periods and all plant was working under typical operating conditions and load.

6.0 NOISE SURVEY RESULTS

6.1 Noise measurements undertaken by NVC Ltd in near field positions are provided below in Table 6.1 and in Appendix 2.

Near Field Survey

Table 6.1: Noise Survey Results in near field positions

Location	LAeq	LA10	LA90	LAFmax
Near Field Positions				
Inside Boiler Room	77.6	78.5	76.1	79.2
5m Below ACC Fan	68.7	69.4	68.1	70.2
Below ACC Fans (centre)	71	71.6	69.8	81.3
5m End of ACC Fans	66.3	66.8	65.9	67.4
10m Corner of ACC Fans	63.9	64.5	63.2	64.8
5m Main Transformer & 20m ACC	61.5	62	61	62.8
5m Stack (no audible noise, traffic noise mainly)	60.5	61.5	59.5	62.8
1m Activated Carbon Silo Pump at ground level	74.4	77.3	64.6	81.8
1m Calcium Hydroxide Pumps at ground level	73.8	74.1	73.4	74.5
Fly Ash Silo ground level (no audible noise)	70.8	74	64	74.5
Rear of Carbon Silo pumps at ground level	67.6	68.5	66.6	69.3
1m FGT Building vent louvre at end of building	61.8	62.6	61.2	63.6
Ammonia Tank Pumps	64.7	66.2	64	66.8
Door opening to Turbine Hall	84.1	86.2	79.5	87
Door opening to FGT Plant	78.8	79.2	78.4	79.8
Condensate Tanks 3m pumps/motors at ground level	78.3	79	77.4	79.8
Condensate Tanks first floor level on platform	80.8	81.3	80.5	81.8
Condensate Tanks top floor on platform	83	83.5	82.4	84.4
1m FGT Building vent louvre at side# of building	68.5	69	67.6	69.9
FGT Building door opening	81.5	82.3	80.7	82.7
Stairwell to FGT Roof 30m up 1m cladding wall	62	62.3	61.6	62.9
Stairwell to FGT Roof top of Fly Ash Silo	60.7	61.4	60	62.8
Top of FGT Building at stairwell	57.6	58.4	56.8	60
1m above roof of FGT Building	54	54.8	53.1	56.6
1m Cladding to Boiler Building at high level	54.5	55.4	53.2	56.6
Boiler building close to cladding at high level	56.4	57.2	55.8	58.2
Close to roof cladding of FGT Building	57.5	58.2	56	58.6
1m above roof of FGT Building	52.9	53.5	52.2	55
Close to roof of Boiler Building cladding	57.7	59.4	56.5	62.6
5m Boiler steam vents on roof	57.9	62.9	61.9	63.2
1m Boiler room vent louvre next to IBA skip	66.2	66.9	65.6	67.3
1m Roller Shutter Door to Boiler Room next to IBA skip	68	68.3	67.6	68.6
10m Bulker offloading fuel into the Fuel Store Building	72.9	76	65.5	84.5
1m bottom of enclosed conveyor	66.4	68.2	64.4	71.4
Close to cladding at rear wall of Fuel Store Building (traffic)	59.8	61	59.2	61.7
10m Condensate plant at corner of boiler building	70.9	71.3	70.5	72.1

6.2 The above table provides an indication of operating noise levels at positions close to external plant, buildings, doorways and ventilation openings. Further measurements recorded during the afternoon period at Site are represented below in Table 6.2.

Table 6.2: Noise Survey Results in near field positions

Location	LAeq	LA10	LA90	LAFmax
Near Field Positions				
1m above Conveyor to Boiler from Fuel Store	66.8	67.8	63.1	79.1
Close to roof cladding of Fuel Store Building	59.4	60.4	58.2	62.8
Close to wall cladding of Fuel Store Building (traffic sign)	63.6	64.6	62.6	66
1m cladding at high level to Fuel Store Building (traffic sign.)	58.1	61.4	58.9	64.8
Close to cooler fans on roof of transformer room	67.1	67.6	66.5	68
Close to door/louvre into step up transformer	69.3	69.6	68.9	69.8
5m from Boiler Roof steam vent	78.6	79.9	77.2	80.7
Above roof of Boiler at opposite end (near stairwell)	62.6	63.2	61.9	63.8
Inside Boiler Room	80.6	80.9	80.3	81.2
7m Switchgear area compound	53.5	54.3	52.5	81.2
5m Mains Transformer	61.5	62	61.2	62.4
30m JCB Loadall (reversing alarm)	80.7	84.7	70.5	85.3

Intermediate Distance Positions

6.3 Monitoring at positions on intervening land between the site and nearest sensitive receptors are represented below in Table 6.3.

Table 6.3: Noise Survey Results in intermediate distance positions

Intermediate Positions	LAeq	LA10	LAmax
75m from nearest plant building (40m gate into site)	55.7	56.6	58.2
75m from nearest plant building (40m gate into site)	56	56.7	61.6
100m from nearest plant building	54.9	56.1	59.8
100m from nearest plant building	54.5	55	55.9
100m from nearest plant building	55.4	57	60.8
140m southeast of nearest plant building	55.2	56	58.2
140m southeast of nearest plant building	53.8	54.8	57.9
140m southeast of nearest plant building	53.2	54.2	55.8
Dual Carriageway 150m from Fuel Store (north)	54.6	55.9	59.7
Dual Carriageway 150m from Fuel Store (north)	49.9	51.7	55.3

6.4 Observations at these locations indicated that subjectively, noise levels were affected by distant road traffic movements. Other audible sources at the nearest intermediate site positions at ground level included low level noise from steam vents at roof level and condensate plant at low level and reversing alarm on mobile plant.

Far Field Survey

6.5 Measurements of site noise including any residual noise from non-site noise sources have been undertaken at NSRs during daytime and night-time periods together with subjective observations of audible noise, which are provided below.

Subjective Observations

Position 1: Abbots Close (Grid Reference: 278953 186887)

6.6 Daytime noise levels observed at this location are formed by distant road traffic from the Motorway and the bypass road. No noise character or distinctive noise was perceptible at this location from the Green Energy Plant.

6.7 During night-time periods distant road traffic noise does dominate the noise climate at this location. There is a general low level `drone' type noise emanating from the direction of the industrial areas to the south, west and southwest of site (i.e. Steelworks, BOC and existing EfW). No noise character identified at near field was observed at this location from the Green Energy Plant. The only audible noise was associated with the operation of the JCB Loadall when it was used for short periods an could be heard from reverse alarms on the mobile plant.

Position 2: Longlands House (Grid Reference: 279320 186116)

6.8 Noise observed at this position during daytime periods included occasional local road traffic movements, distant road traffic noise and general `drone' and peak noise events emanating from BOC plant to the west of the position. There is a general `drone' type noise from the BOC site with regular and intermittent peak impulse noise levels from BOC which sounds like an air discharge or product discharge type of sound.

6.9 During night-time monitoring periods, distant road traffic noise was the main source of noise interspersed with the low level `drone' and occasional impulse from the BOC site as observed during the daytime. Noise from the Green Energy Plant in terms of character was not distinctive or perceptible at this receptor above the ambient noise from other industrial sites in the area.

Position 3: Ten Acres (Grid Reference: 279550 186344)

6.10 The noise climate at this location is formed in general by the local road traffic noise from the M4 Motorway. During daytime observations no noise was perceptible from the Green Energy Plant due to local traffic movement. During night-time periods site noise character was not perceptible or distinctive at this location above the general ambient noise level.

Noise Levels at NSRs with Residual Noise

6.11 Measurements at NSRs during the daytime and night-time are provided below in Table 6.4. This includes residual noise associated with distance road traffic and other industrial sites in the general area.

Table 6.4: Noise Survey Results at positions adjacent to NSR locations during daytime

Location	LAeq	LA10	LA90	LAFmax
Receptor Positions				
Adjacent to Longland House (general traffic noise) no site noise	57.1	57.9	56.3	61.9
Adjacent to Longland House (general traffic noise) no site noise	57.3	58.9	55.2	62.4
Adjacent to Longland House (general traffic noise) no site noise	55.9	57.4	54.4	60.1
Ten Acre Wood (dominated by road traffic noise) no site noise	59.4	60.8	57.6	64.4
Ten Acre Wood (dominated by road traffic noise) no site noise	59	60.2	57.5	62.4
Ten Acre Wood (dominated by road traffic noise) no site noise	59.8	61	58.2	64.3
Abbotts Close (distant road traffic noise) no site noise	51	52	49.9	65.5
Abbotts Close (distant road traffic noise) no site noise	51.7	52.6	50.5	62
Abbotts Close (distant road traffic noise) no site noise	51.8	52.9	50.6	56.4

Table 6.5: Noise Survey Results at positions adjacent to NSR locations during night-time

Receptor Positions	Time	LAeq	LA10	LA90	LAmax
Longland House	00:35	49.7	52	46.5	58
Longland House	00:40	48.3	49.9	45.5	56
Longland House	00:45	50.1	52.4	47.1	63.9
Longland House	00:50	48.2	49.3	46.5	50.1
Longland House	00:55	47.3	48.5	46.3	55.1
Receptor Positions	**Time**	**LAeq**	**LA10**	**LA90**	**LAmax**
Ten Acre Wood	01:15	49.5	53.9	46.2	64.4
Ten Acre Wood	01:20	49.8	53.1	42.3	58.2
Ten Acre Wood	01:25	48.9	51.7	43.5	57.6
Receptor Positions	**Time**	**LAeq**	**LA10**	**LA90**	**LAmax**
Abbotts Close	01:40	50.5	53.5	44.7	64.4
Abbotts Close	01:45	49.7	52.8	44.4	63
Abbotts Close	01:50	51.3	53.7	46.2	65.5

Assessment of Tonality

Frequency Analysis

6.11 One-third octave band centre frequency analysis has been recorded during the noise surveys to establish whether there are likely to be any tonal characteristics.

6.12 According to BS4142: 2014 Annex C the analysis for tonal components is defined by the following methodology:

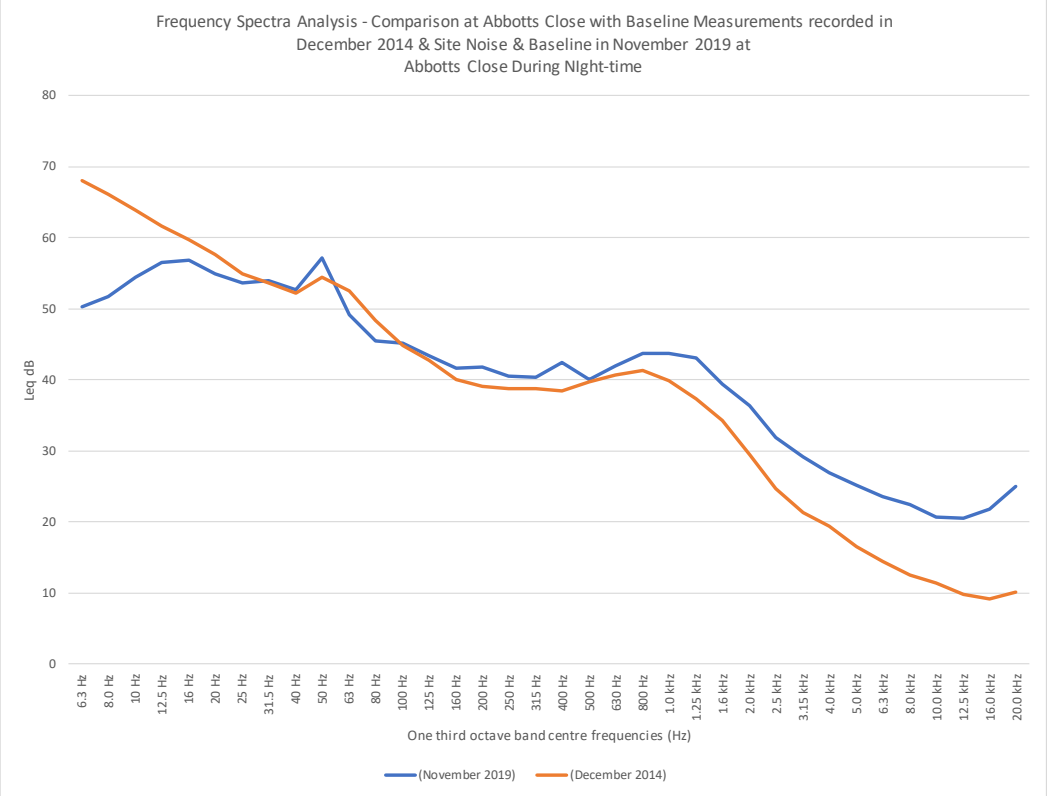
"The test for the presence of a prominent, discrete-frequency spectral component (tone) typically compares the $L_{Zeq,T}$ sound pressure level averaged over the time when the tone is present in a one-third-octave band with the time-average linear sound pressure levels in the adjacent one-third-octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference.

The level differences between adjacent one-third-octave bands that identify a tone are:

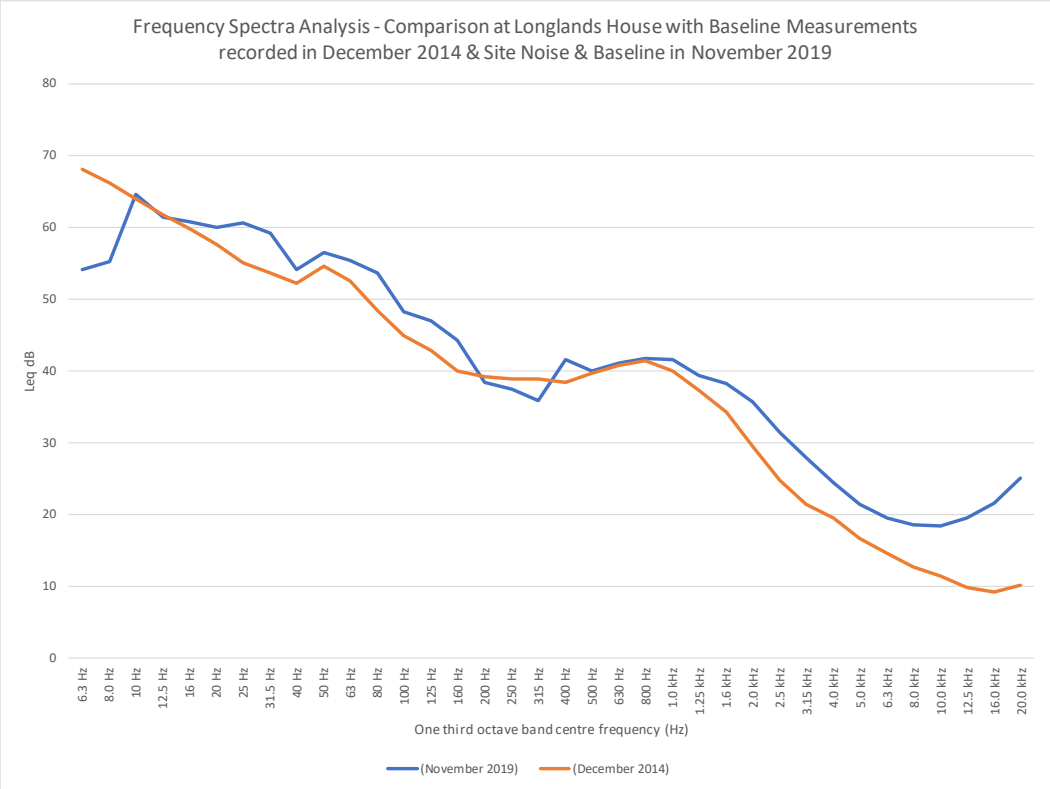
- *15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);*
- *8 dB in the middle-frequency one-third-octave bands (160 Hz to 400 Hz); and*
- *5 dB in the high-frequency one-third-octave bands (500 Hz to 10 000 Hz).”*

6.13 The following graphs depict the frequency spectra measured at NSRs during night-time, which compares levels from the 2014 baseline survey and during this latest survey with the plant in operation.

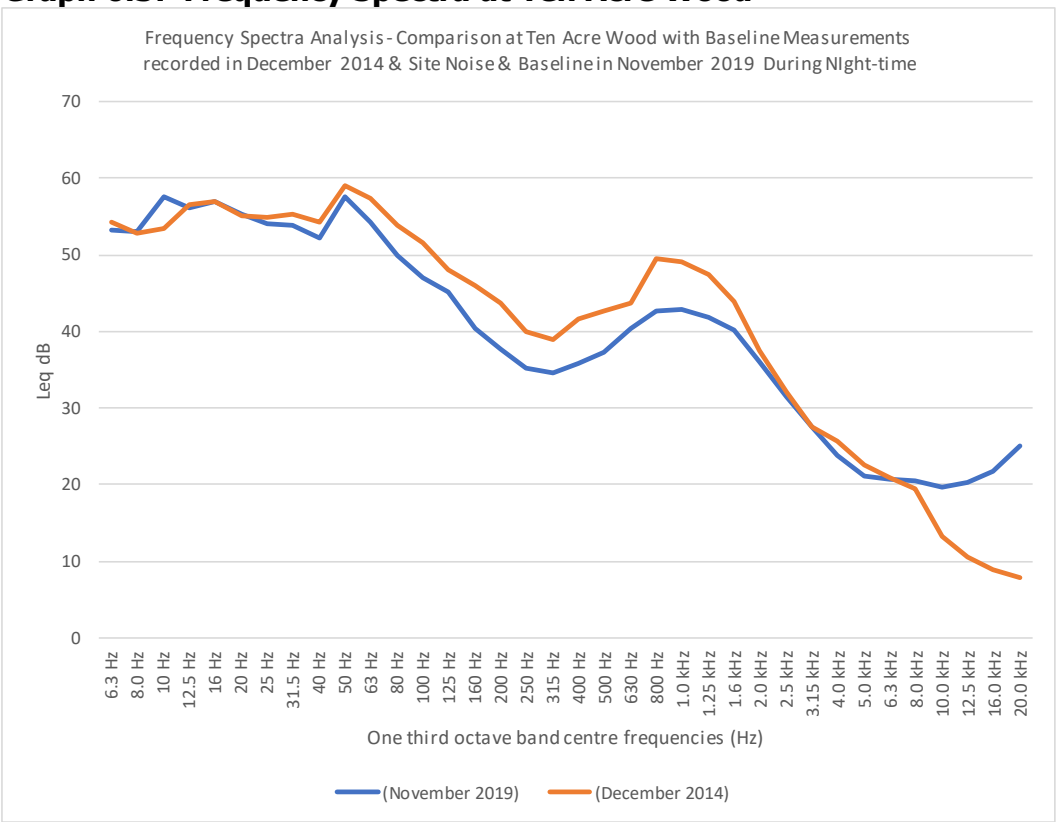
Graph 6.1: Abbots Close Frequency Spectra



Graph 6.2: Frequency Spectra at Longlands House

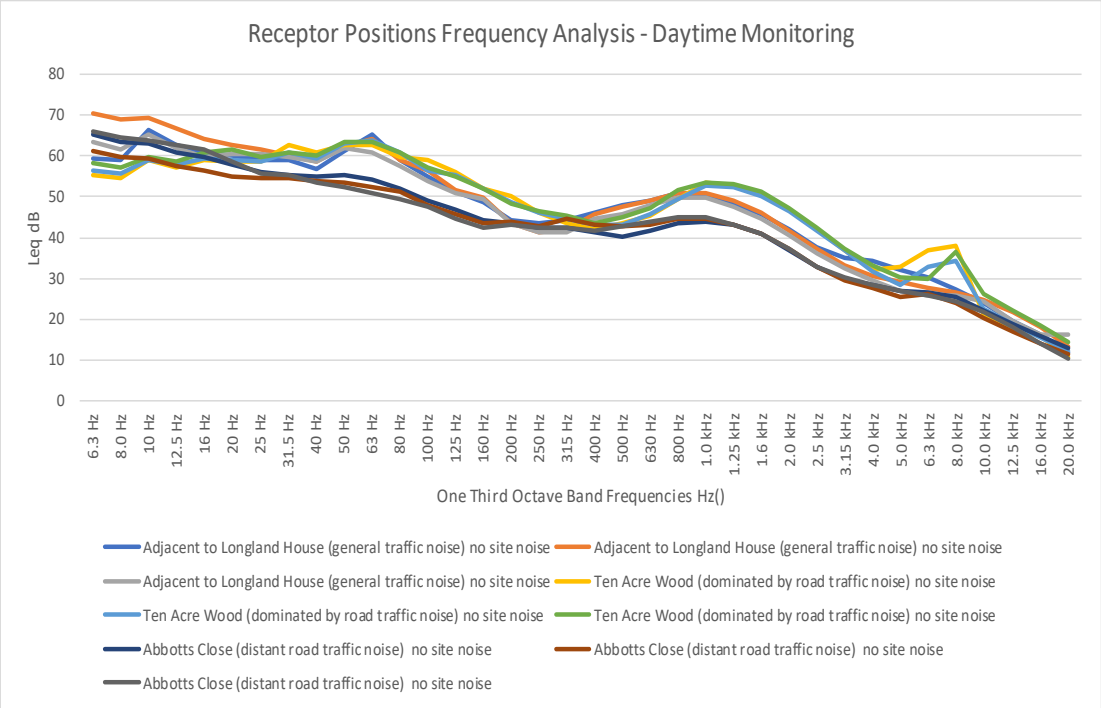


Graph 6.3: Frequency Spectra at Ten Acre Wood



Daytime Frequency Spectra

Graph 6.4: Frequency Spectra During Daytime at NSRs



6.14 The above graphs indicate no evidence of any tonal characteristics and no significant change in noise levels or change in frequency spectral shape that could be attributed to the Green Energy Plant.

6.15 Further spectral analysis of plant noise in near field positions is presented in Appendix 2. This shows tonal frequencies to occur at the following positions close to the plant and buildings or mobile plant:

(i) 1m Activated Carbon Filter Pump at 630Hz.
(ii) Close to FGT building roof cladding (i.e. within 50mm) at 160Hz
(iii) Close to door into step up transformer at 63Hz
(iv) JCB Loadall mobile plant reversing alarm at 1.25kHz

6.16 None of the above tonal characteristics are shown to be significant in terms of frequency spectra during the survey in November 2019 or the change in spectra compared with the survey in December 2014.

7.0 NOISE LEVEL PREDICTIONS

Introduction

7.1 To enable the site noise contribution at NSRs to be established it is necessary in this particular case to be calculated by the use of a noise model of the plant in operation using the measurement noise levels or where this was not practicable (e.g. end of stack) using established noise levels from the plant levels provided at the detailed design stage of the project.

7.2 For site operational noise the assessment has utilised CadnaA noise prediction modelling software for producing a noise map of the highest likely generated noise. The Input settings for the noise model include:

Ground factor (G) = 0.5 (mixed ground absorption) beyond the site compound and G = 0 (hard ground absorption) within compound
Temperature = 10degC
Maximum order of reflection = 1
Relative humidity = 70%
Receptor height = Assumed to be 4.0m above ground for daytime or night-time periods.
No screening assumed between the site and the receiver.

Prediction Methodology

7.3 For site operational noise we have used ISO9613-2 prediction methodology to calculate the noise contribution at nearest sensitive receptors during normal operating conditions.

7.4 The methodology takes into account source position, size, frequency content and distance in relation to site activities and the nearest sensitive receptors. The noise modelling assumes that the noisiest activity and plant is operating. The prediction calculations therefore provide an indication of the highest likely noise level.

7.5 The results of the CadnaA software prediction modelling for site operations is provided in Appendix 4.

Results of Noise Predictions

7.6 Noise levels from fixed plant (and HGV movements during daytime) operating at the development site is assessed against the site noise limits determined by the planning consent (refer to Table 7.1) and assessed against established background sound levels as determined during the baseline survey in 2014 refer to Table 7.2).

Table 7.1: Predicted Noise Contribution from site operations compared with background sound levels

Receptor Position (Refer to Figure 1)	Time Period	Planning Consent Condition LAeq 1hr day, 5mins night	Predicted highest noise level LAeq(dB)	Level Difference dB(A)
1. Abbotts Close	Daytime Night-time	48 48	40 40	-8 -8
2. Longlands House	Daytime Night-time	48 48	44 42	-4 -6
3. 10 Acre Wood	Daytime Night-time	48 48	41 39	-7 -9

Table 7.2: Predicted Noise Contribution from site operations compared with background sound levels

Receptor Position (Refer to Figure 1)	Time Period	Background sound levels 2014 LA90 dB [LAeq]	Predicted highest rating noise level LAeq(dB)	Level Difference dB(A)
1. Abbotts Close	Daytime Night-time	54 43	40 40	-14 -3
2. Longlands House	Daytime Night-time	54 51	44 42	-10 -9
3. 10 Acre Wood	Daytime Night-time	56 49	41 39	-15 -10

Note: No noise character is included in the rating level based on observations at NSRs and objective results.

7.7 The above tables show the predicted highest likely noise levels from the site operations which would occur during daytime and night-time periods. The results show that site noise is likely to be lower than the noise limits set by planning condition 12) and below the representative background sound levels. See noise Maps 1 and 2 in Appendix 4.

7.8 The predicted highest rating noise levels are shown to be between -3dB and -15dB lower than the representative background sound level during daytime or night-time operating periods assuming all plant in operation. According to BS4142: 2014 the impact magnitude would be **low**.

7.9 Further assessment detail in terms of BS4142:2014 is provided in Appendix 3. The intermediate position measurement at 75m from nearest plant building of circa 55-56dB LAeq correlates well with the noise model at night-time.

7.10 FFT Analysis at receptor positions show no significant peak frequency energy, which is provided within Appendix 5.

Site Noise Source Contribution

7.11 The calculated site noise partial contribution is provided in Appendix 4 for each receptor position. The results show that the main contributors to night-time noise levels from the plant, in summary, include:

a) Abbots Close:

Fixed Noise Sources
- Boiler Room Building
- Steam vent on Boiler Room roof
- Wood Chip Store Building
- FGT Building

Occasional Tonal Noise Source
- Reversing alarm on JCB Loadall

b) Longlands House:

Fixed Noise Sources
- Steam vent on Boiler Room roof
- Air Cooled Condenser
- Condensate Pumps
- Wood Chip Store Building

Occasional Tonal Noise Source
- Reversing alarm on JCB Loadall

c) 10 Acre Wood:

Fixed Noise Sources
- Air Cooled Condenser
- Steam vents on Boiler Room roof
- Wood Chip Store Building
- Condensate Pumps

8.0 CONCLUSIONS & IMPROVEMENTS

Conclusions

8.1 At the request of Eco2 Ltd, Noise & Vibration Consultants Ltd have been instructed to carry out a noise assessment in order to comply with Improvement Condition 7 (IC7) as part of the environmental permit for the Margam Green Energy Plant at Margam, Port Talbot.

8.2 Due to the prevailing residual sound levels, which are relatively high in far field positions (due to road traffic noise and other industrial noise), it is not possible to directly measure the noise contribution from the Energy Plant facility at the NSRs. To enable the noise contribution from site to be established and determination of any relevant site noise character, it was therefore necessary to monitor noise levels in near field positions and calculate the noise level at NSRs using a noise prediction model.

8.3 Some additional noise monitoring was undertaken at intermediate positions to try and establish site noise contribution at positions far enough away from the plant to pick up all noise sources but close enough to minimise residual noise from road traffic movement and other industrial noise sources in the area. This data would be used to correlate the noise prediction model.

8.4 For site operational noise the assessment has utilised CadnaA noise prediction modelling software for producing a noise map of the highest likely generated noise. ISO9613-2 prediction methodology has been applied to calculate the noise contribution at nearest sensitive receptors during normal maximum operating conditions.

8.5 The results of noise predictions show the highest likely noise levels from the site operations would be lower than the noise limits set by planning condition 12).

8.6 The predicted highest site rating noise levels are shown to be between 3dB and 15dB lower than established background sound levels during daytime and night-time periods. According to BS4142: 2014 the impact magnitude would be low.

8.7 Subjective observations and objective results show no tonal noise character at NSRs and no perceptible noise character was noted in far field positions. The only audible character related to the occasional use of the reversing alarm on the JCB Loadall vehicle.

8.8 The resultant noise contribution levels are well within the daytime guidelines based on the `Guidelines for Community Noise' – World Health Organisation: April1999;

Improvements

8.9 Whilst there are no identified significant impacts associated with the operation of the Green Energy Plant, the following improvements should be considered and investigated to assist in removing the occasional tonal source and minimising noise from high level noise sources.

(a) Replace the reversing alarm on the JCB Loadall mobile plant with a `white noise' type alarm that adjusts to the ambient noise level in the immediate area (e.g. Brigade bbs-tek white sound warning alarms). We understand that this improvement has now been actioned and the reversing alarm has been replaced.

(b) Investigate whether the steam vent located at the front edge of the Boiler Room roof (nearest the reception building) can be fitted with a steam vent silencer.

References:

Mach Acoustics Report dated 9 June 2016.

Baseline Noise Survey NVC Ltd Report R15.0103/DRK dated 15th January 2015).

Interserve Traffic Management Plan dated 12 July 2016 (Ref. SW41391).

ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors.

Original Environmental Statement Chapter 12 – Noise.

Planning Appeal Decision (Ref. APP/Y6930/A/10/2135473) dated 8th March 2011.

BS4142: 1997 Method for rating industrial noise affecting mixed residential and industrial areas.

BS4142: 2014 `Methods for rating and assessing industrial and commercial sound'.

Brigade bbs-tek White Sound Warning Alarms

FIGURES

Figure 1: Plan showing receptor locations

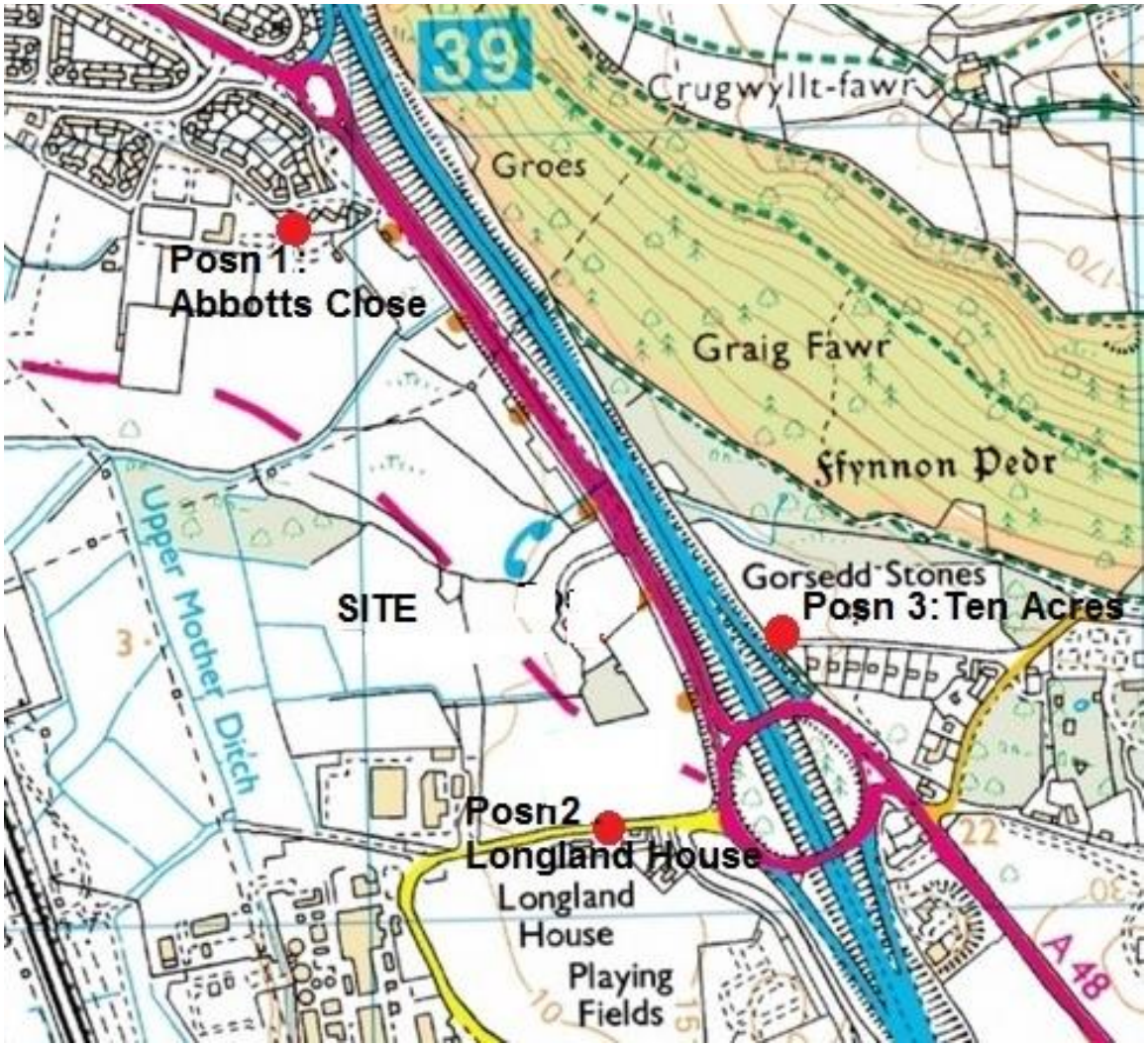


Figure 2: Site Layout

APPENDIX 1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Sound Pressure Level is a measurement of the size of these pressure fluctuations. It is expressed in decibels (dB) on a logarithmic scale. Each 3 dB increase in sound pressure level represents a doubling of the sound energy. The threshold of hearing is approximately 0 dB.

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hz to 20,000 Hz. Although sound can be of one discrete frequency - a 'pure tone' - most noises are made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same 'subjective' way. This is the basis of the A-weighted sound level dB(A), normally used to assess the effect of noise on people. The dB(A) weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a period of time is the Equivalent Continuous Sound Level. Normally written as L_{Aeq} this value takes into account both the level of noise and the length of time over which it occurs. There are many meters available which are capable of measuring L_{Aeq} by electronic integration over the measurement period.

The L_{Aeq} or A-weighted equivalent continuous noise level is a measure of the total noise energy over a stated time period and includes all the varying noise levels and re-expresses as an 'average', allowing for the length of time for which each noise level was presented.

The L_{An} parameters are defined as the noise levels which are exceeded for n% of the monitoring period, thus, for example, the L_{A90} parameter is the noise level exceeded for 90% of the 15 minute period, ie. 13.5 minutes. The L_{A50} parameter is the noise level exceeded for 50% of the hourly period, i.e. 30 minutes, etc. The L_{max} parameter is the maximum RMS A-weighted noise level occurring during the measurement period.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to `A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

$L_{A10,T}$: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

$L_{A90,T}$: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest A weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

APPENDIX 2

NOISE SURVEY RESULTS

Noise Survey Results

Date: Tuesday 5th November 2019
Location: Margam Green Energy Plant **TABLE 1**
Client: Eco 2
Project: Environmental Permit IC7
Data: **Near Field Survey**
Instrumentation: Norsonic 118 Real Time Analyser (31992)
Calibration: 94dB

Start Time	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
09:32	77.6	78.5	76.1	79.2	Inside Boiler Room
09:35	68.7	69.4	68.1	70.2	5m Below ACC Fan
09:35	71.0	71.6	69.8	81.3	Below ACC Fans (centre)
09:37	66.3	66.8	65.9	67.4	5m End of ACC Fans
09:38	63.9	64.5	63.2	64.8	10m Corner of ACC Fans
09:39	61.5	62.0	61.0	62.8	5m Main Transformer & 20m ACC
09:41	60.5	61.5	59.5	62.8	5m Stack (no audible noise, traffic noise mainly)
09:43	74.4	77.3	64.6	81.8	1m Activated Carbon Silo Pump at ground level
09:44	73.8	74.1	73.4	74.5	1m Calcium Hydroxide Pumps at ground level
09:44	70.8	74.0	64.0	74.5	Fly Ash Silo ground level (no audible noise)
09:47	67.6	68.5	66.6	69.3	Rear of Carbon Silo pumps at ground level
09:48	61.8	62.6	61.2	63.6	1m FGT Building vent louvre at end of building
09:50	64.7	66.2	64.0	66.8	Ammonia Tank Pumps
09:52	84.1	86.2	79.5	87.0	Door opening to Turbine Hall
09:53	78.8	79.2	78.4	79.8	Door opening to FGT Plant
09:53	78.3	79.0	77.4	79.8	Condensate Tanks 3m pumps/motors at ground level
09:56	80.8	81.3	80.5	81.8	Condensate Tanks first floor level on platform
09:57	83.0	83.5	82.4	84.4	Condensate Tanks top floor on platform
10:00	68.5	69.0	67.6	69.9	1m FGT Building vent louvre at side# of building
10:01	81.5	82.3	80.7	82.7	FGT Building door opening
10:03	62.0	62.3	61.6	62.9	Stairwell to FGT Roof 30m up 1m cladding wall
10:06	60.7	61.4	60.0	62.8	Stairwell to FGT Roof top of Fly Ash Silo
10:08	57.6	58.4	56.8	60.0	Top of FGT Building at stairwell
10:09	54.0	54.8	53.1	56.6	1m above roof of FGT Building
10:09	54.5	55.4	53.2	56.6	1m Cladding to Boiler Building at high level
10:10	56.4	57.2	55.8	58.2	Boiler building close to cladding at high level
10:11	57.5	58.2	56.0	58.6	Close to roof cladding of FGT Building
10:13	52.9	53.5	52.2	55.0	1m above roof of FGT Building
10:14	57.7	59.4	56.5	62.6	Close to roof of Boiler Building cladding
10:19	57.9	62.9	61.9	63.2	5m Boiler steam vents on roof
10:26	66.2	66.9	65.6	67.3	1m Boiler room vent louvre next to IBA skip
10:27	68.0	68.3	67.6	68.6	1m Roller Shutter Door to Boiler Room next to IBA skip
10:27	72.9	76.0	65.5	84.5	10m Bulker offloading fuel into the Fuel Store Building
10:36	66.4	68.2	64.4	71.4	1m bottom of enclosed conveyor
10:37	59.8	61.0	59.2	61.7	Close to cladding at rear wall of Fuel Store Building (traffic)
10:51	70.9	71.3	70.5	72.1	10m Condensate plant at corner of boiler building

Noise Survey Results

Date: Tuesday 5th November 2019
Location: Margam Green Energy Plant **TABLE 2**
Client: Eco 2
Project: Environmental Permit IC7
Data: **Far Field Survey at Receptors**
Instrumentation: Norsonic 118 Real Time Analyser (31992)
Calibration: 94dB

Start Time	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
11:50	57.1	57.9	56.3	61.9	Adjacent to Longland House (general traffic noise) no site noise
11:54	57.3	58.9	55.2	62.4	Adjacent to Longland House (general traffic noise) no site noise
12:00	55.9	57.4	54.4	60.1	Adjacent to Longland House (general traffic noise) no site noise
12:13	59.4	60.8	57.6	64.4	Ten Acre Wood (dominated by road traffic noise) no site noise
12:18	59.0	60.2	57.5	62.4	Ten Acre Wood (dominated by road traffic noise) no site noise
12:23	59.8	61.0	58.2	64.3	Ten Acre Wood (dominated by road traffic noise) no site noise
12:39	51.0	52.0	49.9	65.5	Abbotts Close (distant road traffic noise) no site noise
12:46	51.7	52.6	50.5	62.0	Abbotts Close (distant road traffic noise) no site noise
12:51	51.8	52.9	50.6	56.4	Abbotts Close (distant road traffic noise) no site noise

Noise Survey Results

Date: Tuesday 5th November 2019
Location: Margam Green Energy Plant **TABLE 3**
Client: Eco 2
Project: Environmental Permit IC7
Data: **Near Field Survey**
Instrumentation: Norsonic 118 Real Time Analyser (31992)
Calibration: 94dB

Start Time	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
13:11	66.8	67.8	63.1	79.1	1m above Conveyor to Boiler from Fuel Store
13:15	59.4	60.4	58.2	62.8	Close to roof cladding of Fuel Store Building
13:17	63.6	64.6	62.6	66.0	Close to wall cladding of Fuel Store Building (traffic sign)
13:17	58.1	61.4	58.9	64.8	1m cladding at high level to Fuel Store Building (traffic sign.)
13:24	67.1	67.6	66.5	68.0	Close to cooler fans on roof of transformer room
13:29	69.3	69.6	68.9	69.8	Close to door/louvre into step up transformer
16:43	78.6	79.9	77.2	80.7	5m from Boiler Roof steam vent
16:48	62.6	63.2	61.9	63.8	Above roof of Boiler at opposite end (near stairwell)
16:56	80.6	80.9	80.3	81.2	Inside Boiler Room
17:00	53.5	54.3	52.5	81.2	7m Switchgear area compound
17:03	61.5	62.0	61.2	62.4	5m Mains Transformer
17:18	80.7	84.7	70.5	85.3	30m JCB Loadall (reversing alarm)

Near Field Positions	LAeq	LA10	LAmax
Northern boundary fence (opp ACC & Condensate)	66.8	67.1	68.5
5m ACC Fans (side)	70.6	71.3	72.2
10m corner of ACC fans	65.8	66.9	69.7
Below centre of ACC Fans	72.5	73	73.5
10m corner of ACC fans	63.5	64	64.7
5m in front of Condensate Plant	70.1	70.8	73.9
Corner of boiler room and condensate plant	72.8	73.1	73.4
10m Vent on Electrical building wall at high level	64.2	64.6	65
10m Vent on Electrical building wall at high level	64.3	64.9	65.8
Boiler room roof	59.5	60.5	63.2
Boiler room roof	60.9	61.9	63.2
Boiler room roof	60.4	61.3	62.1
5m Boiler roof steam vent	78.7	79.5	80

Intermediate Positions	LAeq	LA10	LAmax
75m from nearest plant building (40m gate into site)	55.7	56.6	58.2
75m from nearest plant building (40m gate into site)	56	56.7	61.6
100m from nearest plant building (100m gate into site)	54.9	56.1	59.8
100m from nearest plant building (100m gate into site)	54.5	55	55.9
100m from nearest plant building (100m gate into site)	55.4	57	60.8
140m southeast of nearest plant building	55.2	56	58.2
140m southeast of nearest plant building	53.8	54.8	57.9
140m southeast of nearest plant building	53.2	54.2	55.8
Dual Carriageway 150m from Fuel Store (north)	54.6	55.9	59.7
Dual Carriageway 150m from Fuel Store (north)	49.9	51.7	55.3

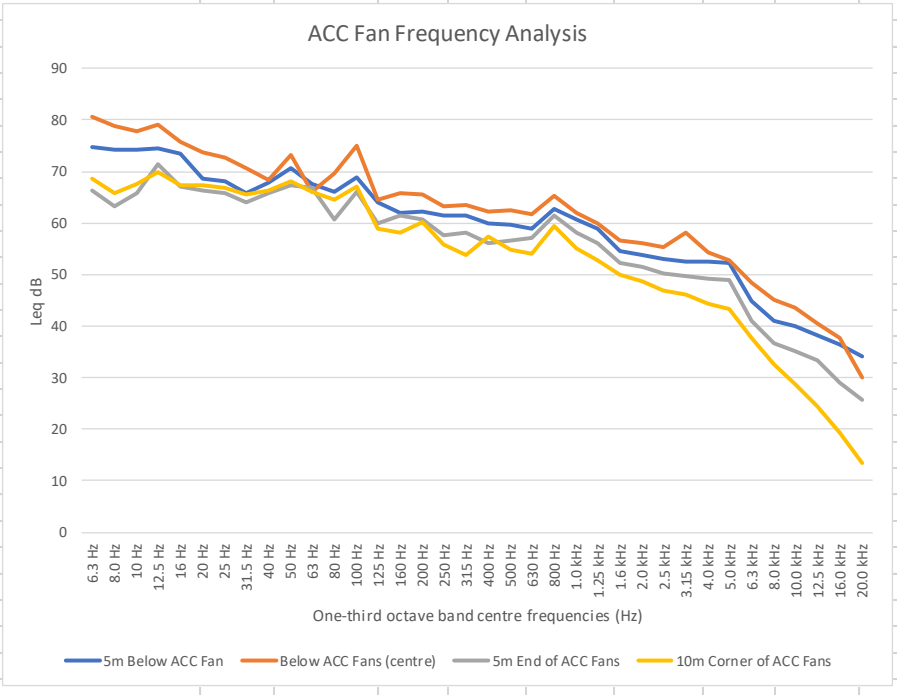
Noise Survey Results

Date: Wednesday 6th November 2019
Location: Margam Green Energy Plant
Client: Eco 2
Project: Environmental Permit IC7
Data: **Far Field Survey**
Instrumentation: Norsonic 118 Real Time Analyser (31992)
Calibration: 94dB

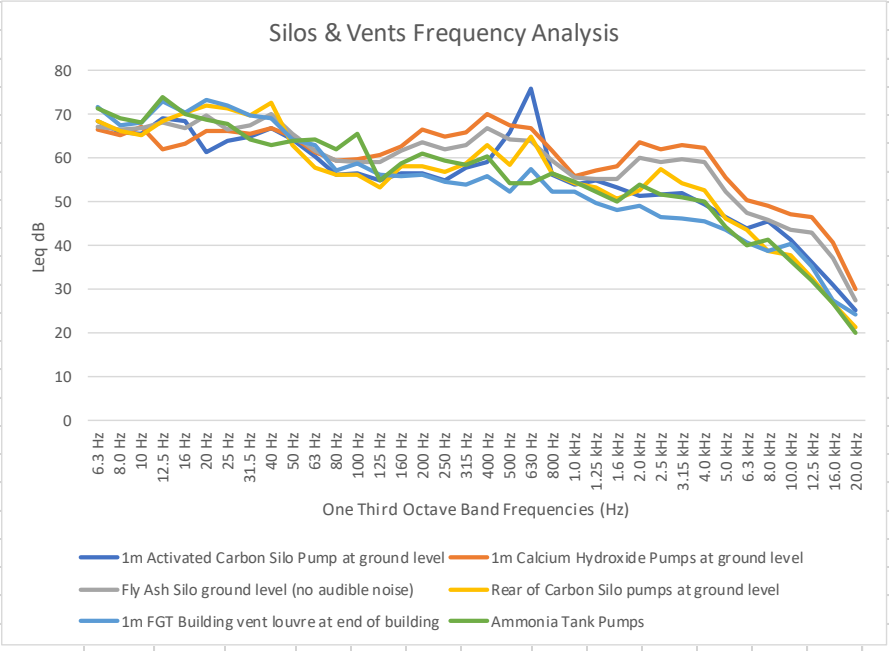
Receptor Positions	Time	LAeq	LA10	LA90	LAmax
Longland House	00:35	49.7	52	46.5	58
Longland House	00:40	48.3	49.9	45.5	56
Longland House	00:45	50.1	52.4	47.1	63.9
Longland House	00:50	48.2	49.3	46.5	50.1
Longland House	00:55	47.3	48.5	46.3	55.1
Receptor Positions	**Time**	**LAeq**	**LA10**	**LA90**	**LAmax**
Ten Acre Wood	01:15	49.5	53.9	46.2	64.4
Ten Acre Wood	01:20	49.8	53.1	42.3	58.2
Ten Acre Wood	01:25	48.9	51.7	43.5	57.6
Receptor Positions	**Time**	**LAeq**	**LA10**	**LA90**	**LAmax**
Abbotts Close	01:40	50.5	53.5	44.7	64.4
Abbotts Close	01:45	49.7	52.8	44.4	63
Abbotts Close	01:50	51.3	53.7	46.2	65.5

NEAR FIELD NOISE SOURCE FREQUENCY SPECTRA

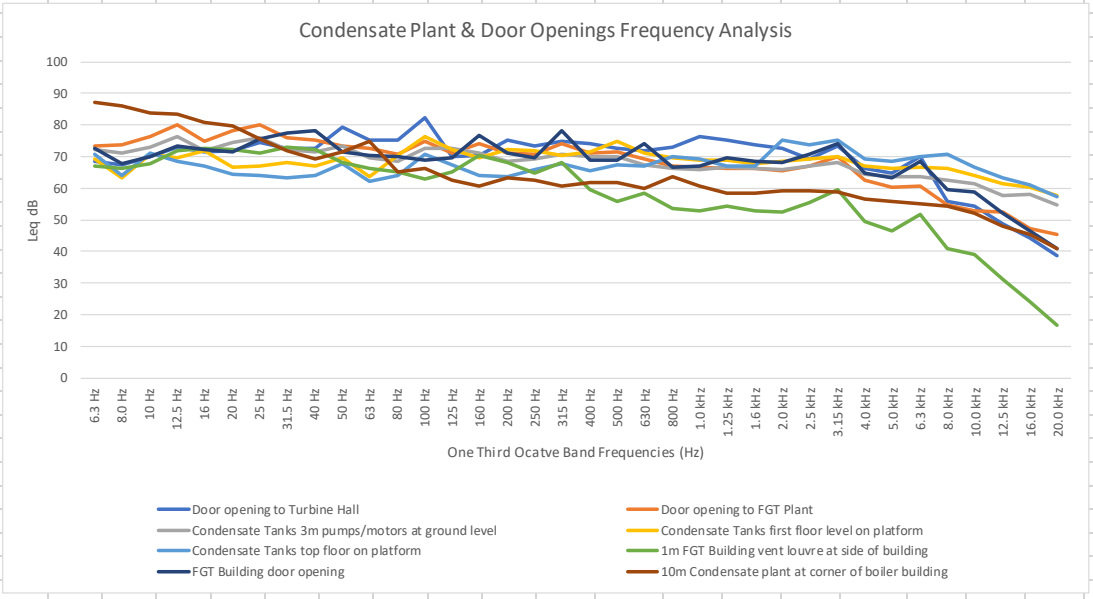
	6.3 Hz	74.8	80.6	66.4	68.6
	8.0 Hz	74.2	78.8	63.3	65.9
	10 Hz	74.2	77.9	65.8	67.5
	12.5 Hz	74.6	79.1	71.4	70
	16 Hz	73.4	75.8	67.1	67.3
	20 Hz	68.7	73.8	66.2	67.2
	25 Hz	68.1	72.8	65.7	66.8
	31.5 Hz	65.9	70.6	64.1	65.6
	40 Hz	67.9	68.3	65.8	66.3
	50 Hz	70.6	73.1	67.3	68.1
	63 Hz	67.6	66	66.8	66.1
	80 Hz	66.1	69.6	60.6	64.4
	100 Hz	68.8	75	66.1	67.1
	125 Hz	64	64.6	59.9	58.9
	160 Hz	62	65.7	61.5	58.2
	200 Hz	62.3	65.5	60.7	60.1
	250 Hz	61.5	63.3	57.7	55.9
	315 Hz	61.4	63.6	58.2	53.9
	400 Hz	60	62.3	56.1	57.3
	500 Hz	59.7	62.5	56.6	54.9
	630 Hz	59	61.8	57.2	54.1
	800 Hz	62.8	65.2	61.4	59.4
	1.0 kHz	60.8	61.9	58.1	55
	1.25 kHz	59	59.9	56.2	52.7
	1.6 kHz	54.6	56.7	52.3	49.9
	2.0 kHz	53.8	56	51.6	48.6
	2.5 kHz	52.9	55.2	50.1	46.8
	3.15 kHz	52.6	58.2	49.8	46.2
	4.0 kHz	52.5	54.4	49.3	44.4
	5.0 kHz	52.3	52.8	48.9	43.4
	6.3 kHz	44.9	48.3	41	37.6
	8.0 kHz	40.9	45	36.7	32.7
	10.0 kHz	40.1	43.5	35.1	28.8
	12.5 kHz	38.3	40.6	33.3	24.5
	16.0 kHz	36.4	37.8	28.9	19.4
	20.0 kHz	34.1	30	25.7	13.3



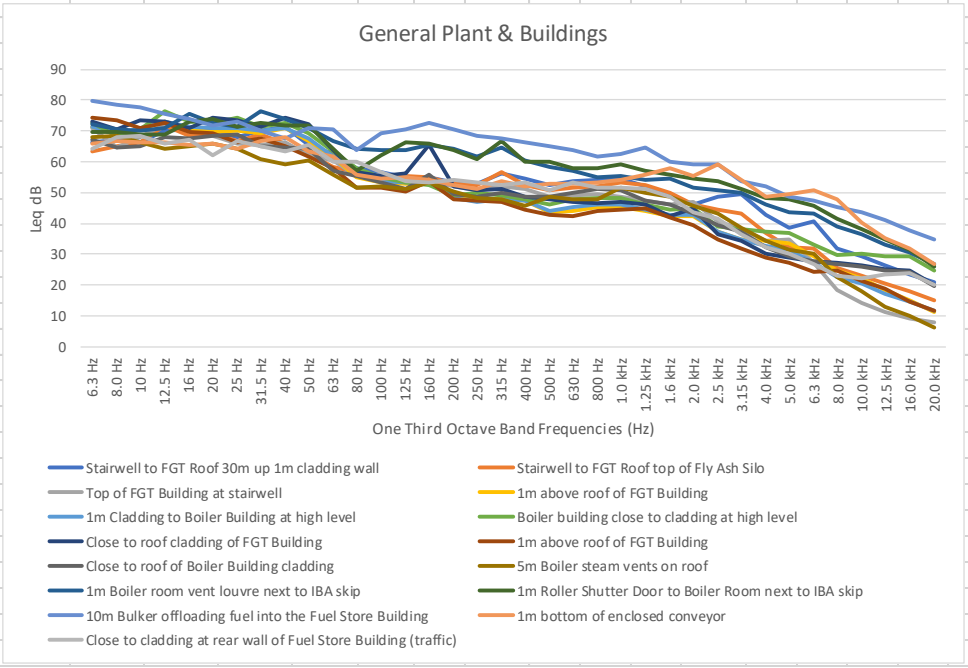
6.3 Hz	68.4	66.6	67.2	68.3	71.6	71.4
8.0 Hz	66	65.2	66.6	66.1	67.6	69.1
10 Hz	65.7	67.1	66.7	65.3	68.1	68
12.5 Hz	69.2	62	68.2	68.3	72.9	74.1
16 Hz	68.5	63.3	66.7	70.3	70.5	70.2
20 Hz	61.2	66.1	69.7	71.9	73.2	68.8
25 Hz	63.8	66.3	66.6	71.2	72	67.8
31.5 Hz	65	65.5	67.4	69.8	69.8	64.3
40 Hz	66.9	66.8	70	72.5	69	62.9
50 Hz	64.4	64.8	65.4	62.8	64.4	64
63 Hz	60.5	61.4	61.6	57.7	63.1	64.3
80 Hz	56.2	59.4	59.4	56.1	57	61.9
100 Hz	56.5	59.8	59.1	56.2	58.6	65.5
125 Hz	55	60.6	59.1	53.3	56.2	55
160 Hz	56.4	62.7	61.6	58.1	55.7	58.7
200 Hz	56.6	66.4	63.5	58.1	56.1	60.9
250 Hz	55	64.9	61.9	56.7	54.5	59.4
315 Hz	57.8	65.8	63	58.8	53.9	58.3
400 Hz	59	70.1	66.9	62.9	55.9	60.4
500 Hz	65.9	67.6	64.3	58.4	52.2	54.2
630 Hz	**76**	66.8	63.8	64.9	57.3	54.3
800 Hz	56.3	61.8	59.3	56.6	52.3	56.5
1.0 kHz	53.9	55.9	55.5	54.2	52.3	54.4
1.25 kHz	55	57	55.2	53.4	49.6	52.2
1.6 kHz	53.2	58	55.3	50.7	48	50.1
2.0 kHz	51.3	63.5	60.2	52.6	49.2	54
2.5 kHz	51.8	62	59	57.6	46.5	51.5
3.15 kHz	52	62.8	59.7	54.3	46.1	50.9
4.0 kHz	49.4	62.2	59	52.6	45.6	49.9
5.0 kHz	46.4	55.4	52.2	46.2	43.4	44.1
6.3 kHz	44	50.3	47.4	43.6	40.8	40
8.0 kHz	45.4	49.2	45.8	38.8	38.7	41.4
10.0 kHz	41.2	47	43.5	37.7	40.4	36.5
12.5 kHz	36	46.5	43	32.5	35.3	31.8
16.0 kHz	31.1	40.6	37.2	26.7	27.3	26.6
20.0 kHz	25.1	30.1	27.4	21.4	24.1	19.8



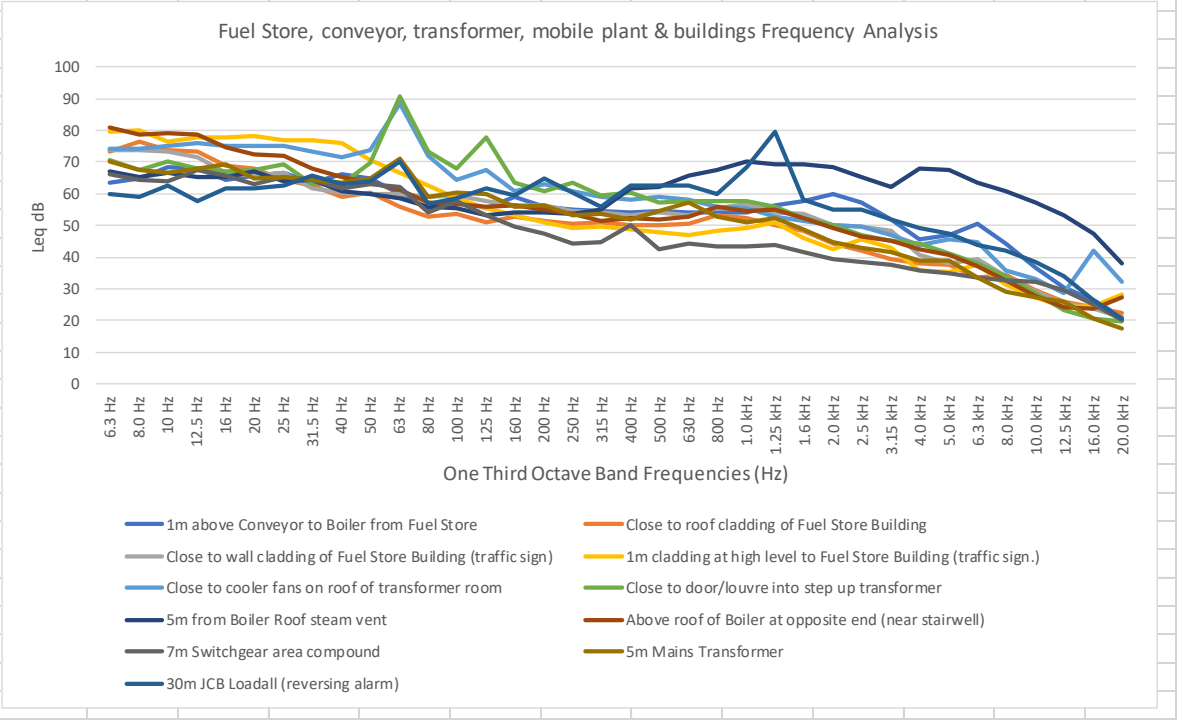
6.3 Hz	68.5	73.2	72.1	69.1	70.6	67.2	72.6	87.2
8.0 Hz	67.4	73.6	71.1	63.4	63.9	66.1	67.8	85.9
10 Hz	70.2	76.4	73.1	70.9	71.1	67.6	70.2	83.9
12.5 Hz	73.1	80.2	76.4	69.5	68.6	71.7	73.4	83.4
16 Hz	71.4	74.7	71.9	71.8	67	72.6	72.4	80.8
20 Hz	71.7	78.2	74.6	66.6	64.4	72.4	71.6	79.6
25 Hz	74.4	80	76.1	66.9	64.2	71.3	75.8	75.5
31.5 Hz	72.6	76	72.4	68.1	63.3	73	77.6	72
40 Hz	72.6	75.4	71.4	67.1	64.2	72.1	78.1	69.2
50 Hz	79.2	73.5	73.2	69.7	67.8	68	71.6	71.4
63 Hz	75.1	72.8	69.8	63.5	62.2	66.2	70.5	74.7
80 Hz	75.1	70.8	68.5	70.3	63.9	65.1	69.9	65
100 Hz	82.4	74.8	72.8	76.4	70.6	63	68.9	66.4
125 Hz	70	71	72.7	72.3	67.3	65.3	69.5	62.5
160 Hz	70.5	74.1	71	69.8	64.2	70.5	76.8	60.6
200 Hz	75.2	71.3	68.6	72.4	63.7	68.3	71	63.4
250 Hz	73.3	70.6	69.4	71.8	66	64.7	69.7	62.6
315 Hz	74.7	74.2	70.9	70.3	67.8	68.2	78.1	60.6
400 Hz	74.1	71.3	70.2	71.5	65.7	59.7	68.9	61.8
500 Hz	72.7	71.6	70	74.9	67.3	55.9	69	61.8
630 Hz	71.8	69.1	67.5	71	66.9	58.5	74.2	60.1
800 Hz	73	66.9	66.4	69.5	70.1	53.5	66.8	63.5
1.0 kHz	76.4	66.6	66	69	69.3	52.8	67	60.5
1.25 kH	75.2	66.4	66.7	68.8	67.1	54.2	69.6	58.3
1.6 kHz	73.6	66.4	66.1	67.6	67.1	52.7	68.5	58.3
2.0 kHz	72.5	65.6	66	68.5	75.1	52.3	68.3	59.3
2.5 kHz	69.1	67.1	67	69.3	73.8	55.3	70.7	59.1
3.15 kH	73.4	69.9	68.1	70.1	75.1	59.5	74	58.8
4.0 kHz	66.3	62.5	64.4	66.9	69.2	49.3	64.8	56.4
5.0 kHz	64.9	60.3	63.8	66.3	68.7	46.6	63.3	55.7
6.3 kHz	70.1	60.5	63.5	66.6	70.1	51.7	68.7	55
8.0 kHz	56	54.6	62.7	66.1	70.9	40.9	59.5	54.4
10.0 kH	54.4	52.9	61.3	64.2	66.7	39.2	58.8	52.2
12.5 kH	48.8	52.6	57.7	61.6	63.4	31.2	52.2	48.1
16.0 kH	44.4	47.3	58.2	60.3	61	24	46.4	45.3
20.0 kH	38.7	45.4	54.7	57.8	57.4	16.7	41	41



6.3 Hz	66.3	63.3	70.8	71.3	71.5	72.4	73.2	74.2	67.2	67.8	72.3	69.7	79.7	66	64.4
8.0 Hz	67.2	65.2	64.5	68.8	68.8	68.3	70.4	73.6	64.7	68.5	70.5	69.6	78.5	66.7	67.9
10 Hz	66.1	66.5	67.8	70.4	71.1	70.7	73.4	71.1	65.1	66.2	69.9	68.7	77.5	66.5	68.2
12.5 Hz	70.1	71.7	72.2	73	73.1	76.2	73.2	72.4	68	64.3	71	68.8	75.6	66.5	65.9
16 Hz	70.7	68.5	71.2	70.6	71.3	73.2	70.9	69.6	67.5	64.9	75.7	72.9	74	65.5	67.2
20 Hz	70	69.4	68.5	69.7	71.1	72.8	74.4	69.1	68.5	65.7	72.6	73.9	71.9	65.8	61.9
25 Hz	68.1	66.9	66	70.2	71.1	74.1	73.6	66.5	68.9	64.4	71.3	71.3	73	64.1	66.9
31.5 Hz	69.9	68.8	65.5	69.2	69.9	71.4	71.3	67.5	65.1	60.9	76.3	72.6	70.2	66.7	64.9
40 Hz	71.5	65.9	66.5	70.9	71	72.6	74.3	64.9	64.6	59.1	74	71.9	67.7	67.8	63.4
50 Hz	65.3	62.5	62.1	66.9	67.6	69.3	72	61.8	64.3	60.6	71.1	71.7	70.8	63.3	65.5
63 Hz	62.5	58.2	60.3	61.5	61.7	63.2	63.9	57.7	57	56	66.6	64.3	70.6	61.7	60.2
80 Hz	58	56.7	55.2	54.9	56.3	57.8	56.8	51.8	55.4	51.4	64	57.1	63.9	55.8	59.8
100 Hz	56.7	54.4	54.3	53.1	53.7	54.9	55.2	51.6	53.4	51.9	63.7	62.1	69.3	54.5	56.8
125 Hz	55	55.4	54.9	53	53.3	53.1	56.1	50.4	51.3	51.3	63.8	66.2	70.6	54.8	53.8
160 Hz	55	55	53.7	52.7	53.5	52.3	**65.5**	53.5	56	53.3	65.5	65.9	72.6	54.2	53.4
200 Hz	53.4	52.8	52	48.7	48.3	49.2	52.2	48	49.4	50.2	64	63.7	70.7	52.4	54.3
250 Hz	52.9	52.5	50.7	47.4	47.1	49.9	50.7	47.4	48.7	48.1	61.8	60.9	68.2	51.3	53.3
315 Hz	56.3	56.6	52.1	48.2	47.7	48.9	51	47	50	47.9	64.6	66.9	67.6	53.6	52.3
400 Hz	54.7	52.4	51.3	47.5	47.5	47.9	48.5	44.4	48.6	45.8	60.3	59.9	66.1	51.9	53.3
500 Hz	52.3	50.9	48.5	43.8	44.2	46	48	42.7	48.5	48.8	58.4	59.9	65	52.7	50.6
630 Hz	53.7	51.8	48.9	44.2	45.1	47.6	46.9	42.4	50.1	47.7	57	57.7	63.8	52.9	53.3
800 Hz	54	52.2	49.3	45.2	46.2	48.4	46.7	44	51.3	47.7	55	57.7	61.7	53.3	51.8
1.0 kHz	54.4	53.4	48.7	45.1	46.2	48.1	47	44.4	50.6	51.5	55.4	59.2	62.5	54.3	51.7
1.25 kHz	51.9	52.3	47.5	43.9	44.3	46.3	46	44.7	47.4	49.9	54.1	56.9	64.8	55.7	51.3
1.6 kHz	48.9	49.8	46.3	42.4	42.7	44.5	42.3	41.8	46.3	48.7	54.4	55.8	59.9	58	48.5
2.0 kHz	46.3	46.3	47.1	42.2	42.7	44.9	44.8	39.3	43.3	45.7	51.8	54.4	59.2	55.3	43.4
2.5 kHz	48.5	44.3	40.5	37.1	37.2	39	36.4	34.9	39.5	43.3	50.7	53.7	59.3	59.3	41.5
3.15 kHz	49.3	43	38.1	34.9	34.8	38.1	34.5	31.8	37.1	38.4	49.8	51.2	53.7	54.2	36.6
4.0 kHz	42.7	36.9	34.4	34.3	32.6	37.1	30	29.1	32.4	34.2	46.3	48.1	51.9	48.8	32.1
5.0 kHz	38.5	32.4	34.6	33.5	31.3	36.8	28.7	27.1	29.4	31.5	43.7	48	48.8	49.3	30
6.3 kHz	40.6	32	27.3	29.5	27.4	33	27.5	24.3	27.8	30	43.3	45.9	47.4	50.8	27
8.0 kHz	31.8	25.5	18.2	24.6	22.7	29.6	27.1	24.5	26.9	22.4	38.9	41.4	45.3	47.7	23.2
10.0 kHz	29.4	23	14.3	22.3	20.6	30	26.4	21.3	25.9	17.8	36.6	38.1	43.5	40.2	22.3
12.5 kHz	26.4	20.6	11.4	18.4	17.1	29.5	25.1	18.9	24.8	13	33.3	34.8	40.9	35.2	23.6
16.0 kHz	23.5	18.1	9.3	15.1	14.5	29.2	24.7	14.6	24.3	9.8	30.7	31.3	37.9	31.9	23.9
20.0 kHz	21.1	15.1	7.7	11.3	11.5	24.8	20	11.5	19.8	6.2	26.6	26.1	34.8	26.8	19.9



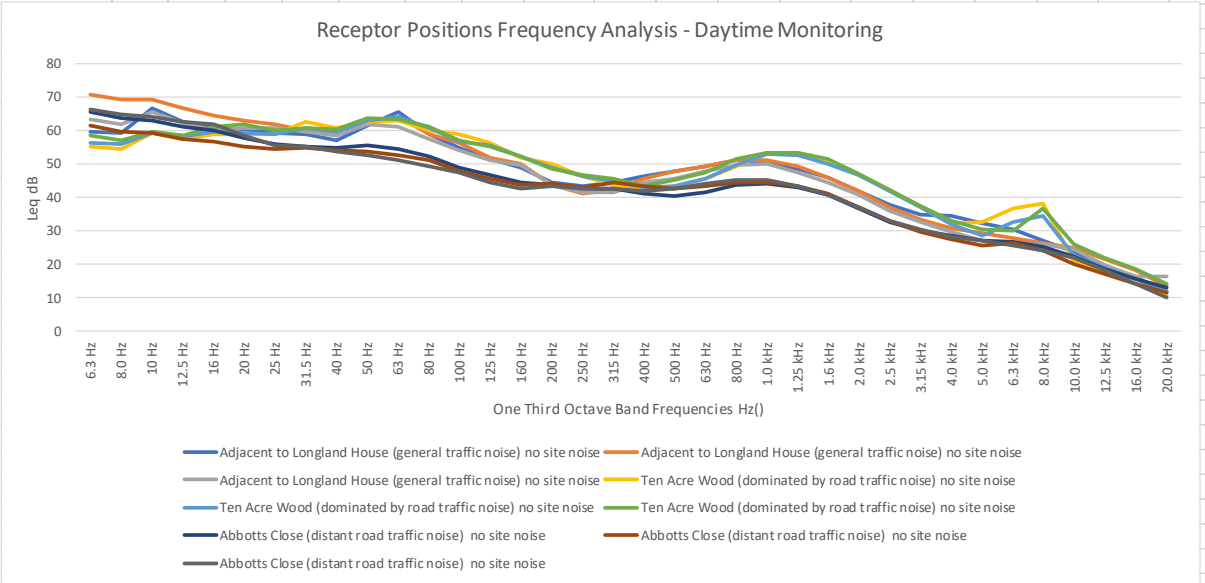
6.3 Hz	63.7	73.4	73.9	79.6	74.3	70.6	67.2	81	66	70.1	59.7
8.0 Hz	64.7	76.3	73.8	80.2	74	67.7	65.2	78.9	64.3	67.6	59
10 Hz	68.5	73.7	73.3	76.6	74.9	70.2	66.4	79.1	64.1	66.7	62.7
12.5 Hz	68	73.3	71.5	77.8	76	68.1	65.5	78.7	67.5	68.1	57.7
16 Hz	64.4	68.8	66.8	77.7	75.3	67	65.4	74.5	65.7	69.5	61.6
20 Hz	65.8	67.8	65.8	78.1	75.3	67.4	66.9	72.4	63	64.7	61.9
25 Hz	66.8	64.6	66.4	77	75.1	69.2	64	71.8	65.4	65.3	62.8
31.5 Hz	63.6	62.8	61.7	76.8	73.5	63.2	64.4	68	64.3	64.3	65.9
40 Hz	66	59.2	60.2	75.8	71.5	63	60.6	65.1	61.8	63.6	63.1
50 Hz	65	60.5	59.8	70.5	73.6	69.9	59.8	63.3	63.2	64.7	63.8
63 Hz	60.1	55.9	59.8	66.4	**88.7**	**90.7**	58.7	61.4	62.2	71.1	70.3
80 Hz	55.5	52.7	59	62.5	72	73.3	55.9	57.3	54.3	58.9	56.7
100 Hz	58	53.6	59.4	58.6	64.5	67.9	55.3	56.9	57.7	60.4	58.7
125 Hz	55.5	51	57.5	55.5	67.7	77.7	53.3	55.9	53.3	59.7	61.5
160 Hz	58.8	52.6	56.3	53.3	61	63.5	54.3	56.5	49.7	55.9	59.5
200 Hz	55.9	51.2	56.4	51.1	63.1	60.7	54.3	54.9	47.6	56.4	65
250 Hz	55	50.7	54.5	49.3	61	63.5	53.7	53.6	44.4	53.2	60.5
315 Hz	54.6	51	54.2	49.5	59.2	59.5	54.8	51.2	44.7	53.8	56
400 Hz	53.9	49.9	53.4	48.8	58.1	60.3	61.5	52.2	50.2	51.7	62.4
500 Hz	54.6	50.3	54.2	47.8	58.8	57.4	62.3	52	42.5	54.6	62.7
630 Hz	54.2	50.7	53.3	46.8	58.1	57.5	65.7	52.8	44.3	57.4	62.7
800 Hz	54.1	53.3	55.6	48.1	56.1	57.9	67.3	56	43.5	52.9	59.8
1.0 kHz	54.3	52.5	56.9	49.4	55.6	57.6	70	54.7	43.5	50.9	68.5
1.25 kHz	56.2	50	54.3	51	52.6	56	69.3	54.8	43.6	52.4	**79.8**
1.6 kHz	57.9	48.4	53.5	45.9	51.6	52.5	69.4	52.3	41.8	48.6	58.2
2.0 kHz	59.9	44.3	50.3	42.3	50.1	50.1	68.5	49	39.2	44.6	55.1
2.5 kHz	57.3	41.9	49.6	45.7	49.5	47	65.1	46.3	38.3	42.8	54.8
3.15 kHz	51.7	39.5	48.4	43.1	47	45.2	62.1	45.1	37.5	41.5	51.7
4.0 kHz	45.8	38	40.6	35.9	44	44.2	67.9	42.6	35.9	38.8	49.2
5.0 kHz	47.1	37.7	38.2	35.2	45.4	41	67.7	40.7	34.7	38.7	47.2
6.3 kHz	50.4	33.6	39.3	37.6	44.5	37.8	63.3	36.9	33.4	33.5	43.8
8.0 kHz	44.1	34.5	33.8	31.4	35.6	33.8	60.6	32.5	32.8	29.2	42.1
10.0 kHz	36.5	29.6	29.2	27.4	33.3	28.4	57.4	27.8	32.3	27.5	38.4
12.5 kHz	30.6	25.9	25.7	24	28.7	23.3	53.1	24	29.5	26	34.1
16.0 kHz	26.4	24.2	23.5	24.6	42.1	20.7	47.5	23.8	25.2	20.6	26.6
20.0 kHz	21.1	22.4	20.9	28	32.1	19.7	38	27.2	20.3	17.3	20.4



FAR FIELD FREQUENCY SPECTRA AT NSRs

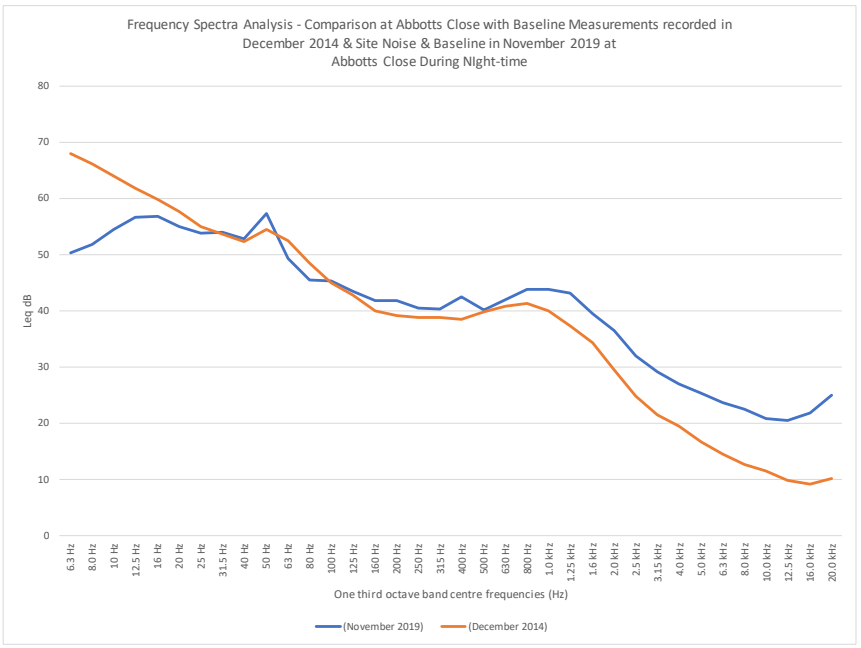
Daytime

6.3 Hz	59.4	70.5	63.3	55.2	56.4	58.3	65.4	61.4	66.2
8.0 Hz	59.2	69	61.6	54.5	55.8	57.1	63.5	59.7	64.6
10 Hz	66.4	69.3	65.3	59.1	59.2	59.6	63	59.3	64
12.5 Hz	62.6	66.7	62	57.3	58	58.5	61	57.5	62.6
16 Hz	60.9	64.2	59.9	58.9	59.4	60.9	59.9	56.5	61.8
20 Hz	60.2	62.9	60.5	58.8	59	61.7	57.8	55.1	58.5
25 Hz	59.1	61.6	60.6	58.8	58.8	59.9	55.9	54.5	55.6
31.5 Hz	58.9	60	59.6	62.6	60.7	60.7	55.3	54.7	55.3
40 Hz	57	58.5	58.6	60.8	59.5	60.3	54.8	54	53.5
50 Hz	61.3	62.5	61.9	62.6	63	63.6	55.5	53.6	52.4
63 Hz	65.4	64.1	61	62.8	63.9	63.4	54.2	52.5	51
80 Hz	58.9	58.9	57.5	59.9	60.7	60.9	52.2	51.2	49.3
100 Hz	54.8	56.4	53.9	58.9	56.6	57.1	48.9	47.8	47.5
125 Hz	51.3	51.8	50.9	56.1	55.5	55.1	46.8	45.6	44.5
160 Hz	48.7	49.8	49.6	51.9	52.2	52.2	44.4	43.6	42.4
200 Hz	44.4	43.6	43.6	50	48.7	48.3	43.6	43.9	43.2
250 Hz	43.4	41.2	41.3	46.2	46.2	46.5	42.4	42.8	42.4
315 Hz	44.3	42.1	41.5	43.5	44.8	45.5	42.6	44.6	42.6
400 Hz	46.2	45.6	44.5	42	43	43.4	41.2	43.2	41.8
500 Hz	47.8	47.7	45.6	43.4	43.3	45	40.4	42.7	42.7
630 Hz	49.2	49.1	47.9	45.5	45.7	47.4	41.6	43.2	44
800 Hz	50.9	51	49.7	49.3	49.5	51.5	43.6	44.6	45
1.0 kHz	50.5	51.1	49.9	53.4	52.9	53.4	43.9	44.6	45.1
1.25 kHz	48.5	49.1	47.5	52.9	52.5	53.1	43	43.2	43.3
1.6 kHz	45.8	46	44.5	50.7	50.1	51.3	40.8	41	40.9
2.0 kHz	41.9	41.8	40.6	46.7	46.5	47.1	36.8	37.2	37.2
2.5 kHz	37.7	37.1	36	42.2	41.8	42.3	32.7	32.8	33
3.15 kHz	34.9	33.3	32.6	37	36.9	37.3	30	29.5	30.3
4.0 kHz	34.4	30.6	29.6	32.2	31.9	33.1	28.4	27.5	28.3
5.0 kHz	32.1	29.2	27.1	32.7	28.4	30.4	26.9	25.6	27.1
6.3 kHz	30.3	27.8	25.8	36.8	32.7	30	26.6	26.2	25.7
8.0 kHz	27.2	26.5	26	38.1	34.3	36.6	25.4	24	24.2
10.0 kHz	23.9	24.9	24.5	20.9	22.6	26.1	22.3	20.2	21.8
12.5 kHz	19.6	21.6	19.7	17.9	18.8	22	18.7	17	18.1
16.0 kHz	16.1	18.2	16.4	15.7	15.5	18.6	15.7	14.1	14.2
20.0 kHz	11.8	13.4	16.2	10.8	12.1	14.3	12.9	11.5	10.2

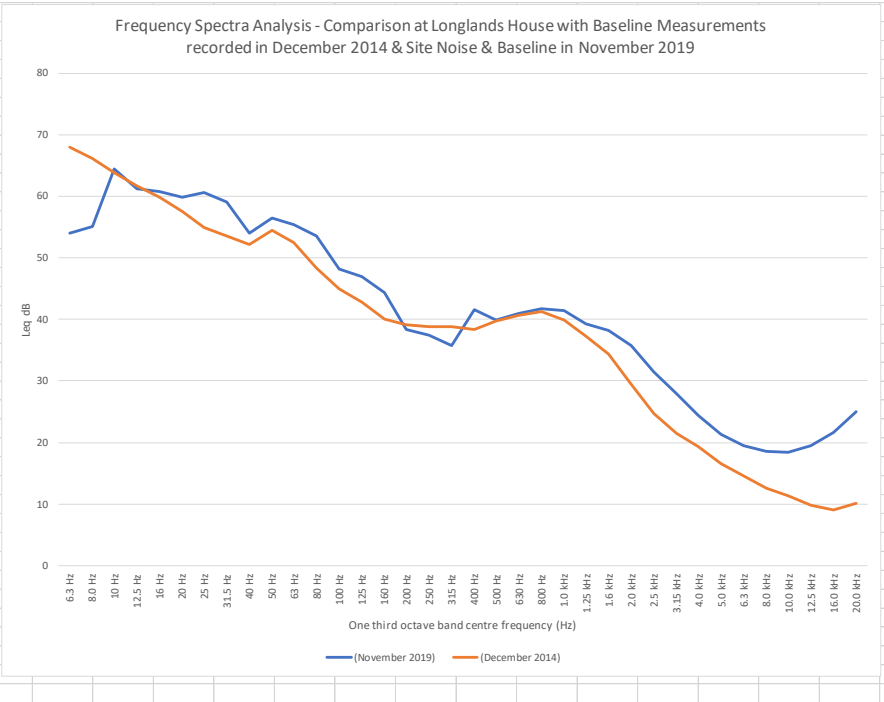


Night-time

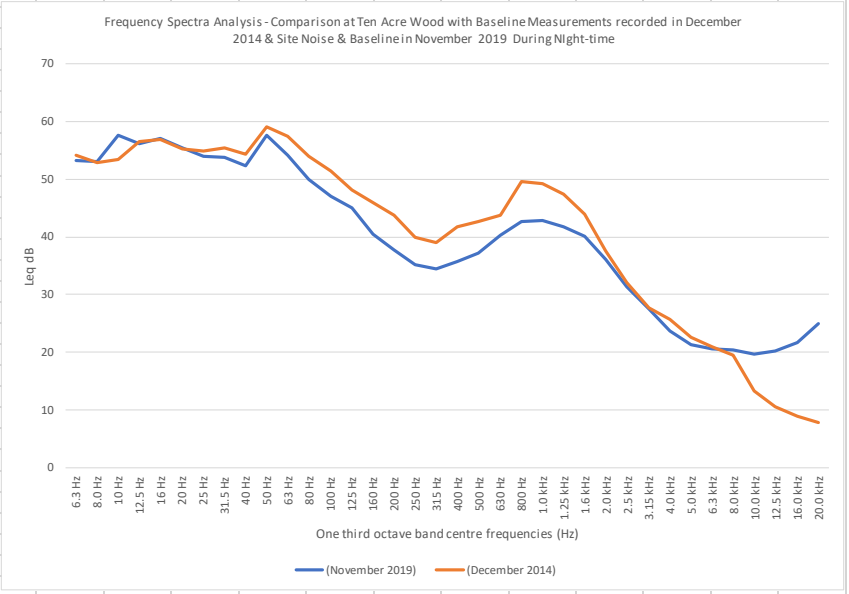
Frequency (Hz)	(November 2019)	(December 2014)
6.3 Hz	50.3	68
8.0 Hz	51.8	66.1
10 Hz	54.4	63.9
12.5 Hz	56.6	61.7
16 Hz	56.8	59.8
20 Hz	54.9	57.6
25 Hz	53.7	55
31.5 Hz	53.9	53.6
40 Hz	52.7	52.2
50 Hz	57.2	54.5
63 Hz	49.2	52.5
80 Hz	45.5	48.4
100 Hz	45.2	44.9
125 Hz	43.4	42.8
160 Hz	41.7	40
200 Hz	41.8	39.1
250 Hz	40.5	38.8
315 Hz	40.3	38.8
400 Hz	42.5	38.4
500 Hz	40.1	39.7
630 Hz	41.9	40.7
800 Hz	43.7	41.3
1.0 kHz	43.7	39.9
1.25 kHz	43.1	37.3
1.6 kHz	39.4	34.3
2.0 kHz	36.4	29.5
2.5 kHz	31.9	24.7
3.15 kHz	29.1	21.4
4.0 kHz	27	19.4
5.0 kHz	25.2	16.6
6.3 kHz	23.6	14.5
8.0 kHz	22.4	12.6
10.0 kHz	20.7	11.4
12.5 kHz	20.5	9.8
16.0 kHz	21.8	9.1
20.0 kHz	25	10.1



Frequency (Hz)	(November 2019)	(December 2014)
6.3 Hz	54	68
8.0 Hz	55.1	66.1
10 Hz	64.5	63.9
12.5 Hz	61.3	61.7
16 Hz	60.8	59.8
20 Hz	59.9	57.6
25 Hz	60.6	55
31.5 Hz	59.1	53.6
40 Hz	54	52.2
50 Hz	56.4	54.5
63 Hz	55.4	52.5
80 Hz	53.6	48.4
100 Hz	48.2	44.9
125 Hz	47	42.8
160 Hz	44.3	40
200 Hz	38.4	39.1
250 Hz	37.4	38.8
315 Hz	35.8	38.8
400 Hz	41.6	38.4
500 Hz	39.9	39.7
630 Hz	41	40.7
800 Hz	41.7	41.3
1.0 kHz	41.5	39.9
1.25 kHz	39.3	37.3
1.6 kHz	38.2	34.3
2.0 kHz	35.7	29.5
2.5 kHz	31.4	24.7
3.15 kHz	27.9	21.4
4.0 kHz	24.4	19.4
5.0 kHz	21.3	16.6
6.3 kHz	19.5	14.5
8.0 kHz	18.6	12.6
10.0 kHz	18.4	11.4
12.5 kHz	19.5	9.8
16.0 kHz	21.6	9.1
20.0 kHz	25	10.1



Frequency (Hz)	(November 2019)	(December 2014)
6.3 Hz	53.2	54.2
8.0 Hz	53	52.9
10 Hz	57.6	53.5
12.5 Hz	56.2	56.5
16 Hz	57	56.9
20 Hz	55.4	55.2
25 Hz	54	54.9
31.5 Hz	53.8	55.4
40 Hz	52.3	54.3
50 Hz	57.7	59
63 Hz	54.2	57.4
80 Hz	50	53.9
100 Hz	47.1	51.5
125 Hz	45.1	48.1
160 Hz	40.4	46
200 Hz	37.8	43.7
250 Hz	35.2	40
315 Hz	34.5	39
400 Hz	35.8	41.7
500 Hz	37.2	42.7
630 Hz	40.3	43.7
800 Hz	42.6	49.5
1.0 kHz	42.9	49.2
1.25 kHz	41.8	47.4
1.6 kHz	40.1	43.9
2.0 kHz	36.1	37.5
2.5 kHz	31.4	32
3.15 kHz	27.5	27.6
4.0 kHz	23.7	25.6
5.0 kHz	21.2	22.5
6.3 kHz	20.6	21
8.0 kHz	20.4	19.5
10.0 kHz	19.7	13.2
12.5 kHz	20.2	10.6
16.0 kHz	21.7	8.8
20.0 kHz	25	7.8



APPENDIX 3

BS4142: 2014 ASSESSMENT DETAIL

BS4142 Assessment Analysis

Receptor 1: Abbots Close (night-time)

Results		Relevant clause	Commentary
Calculated Specific sound level	$L_{Aeq(1hr)}$ = 40dB	7.3.6	Specific sound source calculated using ISO9613-2
Background sound level	$L_{A90(night\text{-}time)}$ = 43dB	**8.1.3** **8.2**	Measured over night-time period deemed to be representative of the background sound.
Assessment during the night-time, so reference time interval is 15mins		**7.2**	
Acoustic feature correction	0dB	**9.2**	The specific sound was not observed to be tonal or impulsive in character and no distinctive intermittency character. Objective evidence shows no tonal character from general plant operations.
Rating level	(40+0) dB = 40dB	**9.2**	No significant perceptible noise character observed from general operations.
Background sound level	$L_{A90(night\text{-}time)}$ = 43dB	**8**	Representative value established from December 2014 pre-operational baseline survey
Excess of rating over background sound level	(40 – 43) dB = -3dB	**11**	
Assessment indicates low impact		**11**	
Uncertainty of the assessment	Not significant	**10**	The excess of the rating level over the background sound level under highest noise conditions is negative. Residual levels are however much higher. Appropriate standards used for the calculation and baseline sound survey undertaken covering the appropriate period. All instruments used Type 1, calibrated and in calibration limits.

Receptor 2: Longlands House (night-time)

Results		Relevant clause	Commentary
Calculated Specific sound level	$L_{Aeq(1hr)}$ = 42dB	7.3.6	Specific sound source calculated using ISO9613-2
Background sound level	$L_{A90(night\text{-}time)}$ = 51dB	**8.1.3** **8.2**	Measured over night-time period deemed to be representative of the background sound.
Assessment during the night-time, so reference time interval is 15mins		**7.2**	
Acoustic feature correction	0dB	**9.2**	The specific sound was not observed to be tonal or impulsive in character and no distinctive intermittency character. Objective evidence shows no tonal character from general plant operations.
Rating level	(42+0) dB = 42dB	**9.2**	No significant perceptible noise character observed from general operations.
Background sound level	$L_{A90(night\text{-}time)}$ = 51dB	**8**	Representative value established from December 2014 pre-operational baseline survey
Excess of rating over background sound level	(42 – 51) dB = -9dB	**11**	
Assessment indicates low impact		**11**	
Uncertainty of the assessment	Not significant	**10**	The excess of the rating level over the background sound level under highest noise conditions is negative. Residual levels are however much higher. Appropriate standards used for the calculation and baseline sound survey undertaken covering the appropriate period. All instruments used Type 1, calibrated and in calibration limits.

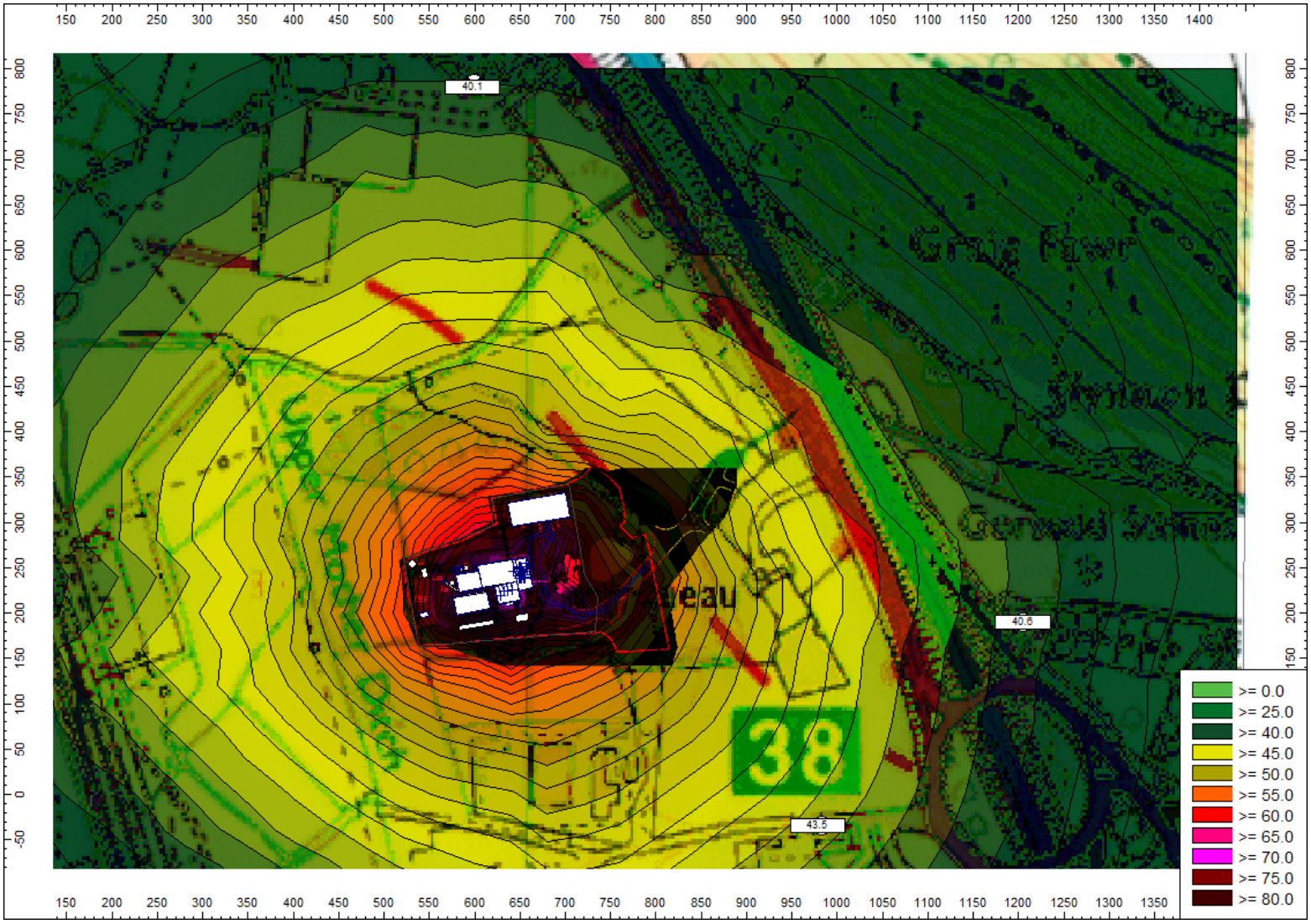
Receptor 3: Ten Acre Wood (night-time)

Results		Relevant clause	Commentary
Calculated Specific sound level	$L_{Aeq(1hr)}$ = 39dB	7.3.6	Specific sound source calculated using ISO9613-2
Background sound level	$L_{A90(night\text{-}time)}$ = 49dB	**8.1.3** **8.2**	Measured over night-time period deemed to be representative of the background sound.
Assessment during the night-time, so reference time interval is 15mins		**7.2**	
Acoustic feature correction	0dB	**9.2**	The specific sound was not observed to be tonal or impulsive in character and no distinctive intermittency character. Objective evidence shows no tonal character from general plant operations.
Rating level	(39+0) dB = 39dB	**9.2**	No significant perceptible noise character observed from general operations.
Background sound level	$L_{A90(night\text{-}time)}$ = 49dB	**8**	Representative value established from December 2014 pre-operational baseline survey
Excess of rating over background sound level	(39 – 49) dB = -10dB	**11**	
Assessment indicates low impact		**11**	
Uncertainty of the assessment	Not significant	**10**	The excess of the rating level over the background sound level under highest noise conditions is negative. Residual levels are however much higher. Appropriate standards used for the calculation and baseline sound survey undertaken covering the appropriate period. All instruments used Type 1, calibrated and in calibration limits.

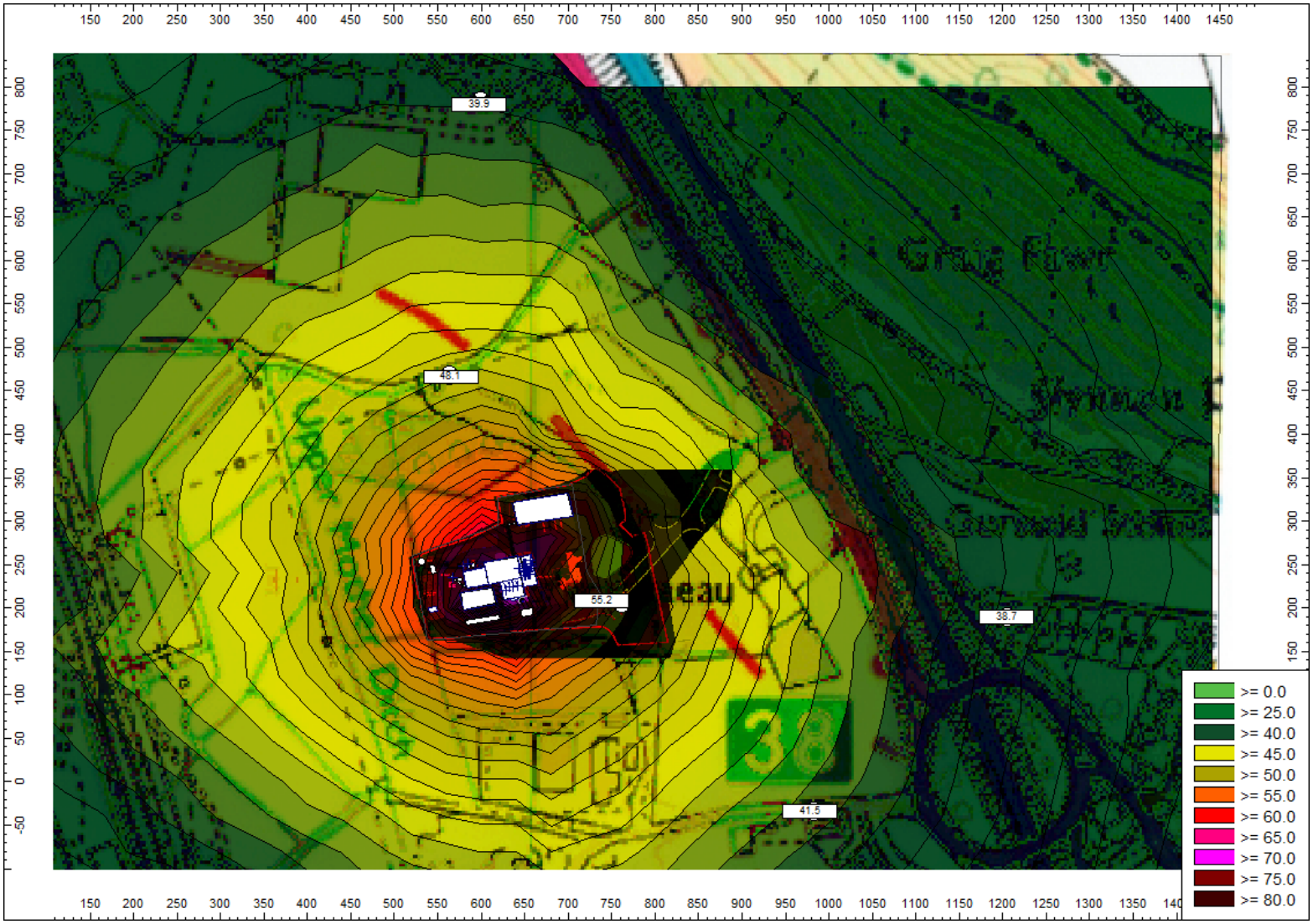
APPENDIX 4

NOISE PREDICTION MAPPING

NOISE MAP 1: SITE OPERATIONAL NOISE – DAYTIME PERIOD



NOISE MAP 2: SITE OPERATIONAL NOISE - NIGHT-TIME PERIOD



Site Noise Partial Contributions

Abbots Close

Source	Partial Level	
Name	Abbotts Close	
	Night	
Component Coolers	0.2	
Wood Chip door	0.2	
Component Coolers	0.3	
FGT Room Louvre	0.3	
Component Coolers	0.6	
Component Coolers	0.9	
Turbine Hall	1.1	
Boiler Room Wall	1.5	
Turbine Hall	1.5	
Boiler Room Door	1.7	
FGT Door	2	
Boiler Room Louvre	2.3	
ACC	2.6	
Boiler Room Louvre	2.9	
Boiler Room Wall	4.6	
FGT Room Wall	4.8	
FGT Roof	5.7	
ACC	5.9	
ACC	6.6	
ACC	7.6	
Transformer	7.6	
Wood Chip Wall	7.7	
Boiler Room Wall	7.7	
FGT Room Louvre	8.2	
Service Area	8.4	
ACC	8.6	
Transformer	10.1	
Boiler Room Wall	11.1	
Transformer	11.9	
FGT Roof	13.6	
FGT Roof	13.7	
Stack	14.9	
Boiler Roof	14.9	
Boiler Roof	15	
FGT Room Wall	15.4	
Woodchip Roof	15.8	
Boiler Room Wall	16.6	
Woodchip Roof	16.7	
Boiler Room Wall	17.4	
FGT Room Louvre	17.6	
Transformer	18.2	
Wood Chip Wall	18.6	
Boiler Room Wall	19	
Transformer	19.8	
Calcium Hydroxide Pump	19.9	
ACS	20.8	
Wood Chip Wall	22.2	
FGT Door	23.8	
FGT Room Louvre	26.5	
Boiler Room Louvre	26.7	
FGT Room Wall	28.4	
Boiler Room Louvre	29.1	
Wood Chip Wall	29.6	
Boiler Room Louvre	29.7	
Boiler Room Louvre	29.8	
Steam Vents	30.7	
Boiler Room Wall	32.5	

Longlands House

Source	Partial Level	
Name	Longland House	
	Night	
Turbine Roof Fan Duct Break out - mitigated	0	
Turbine Roof Fan Duct Break out - mitigated	0.2	
Turbine Roof Fans	0.3	
Electrical Building	0.3	
Electrical Building	0.9	
Boiler Room Louvre	1.5	
FGT Room Louvre	1.6	
FGT Room Louvre	2	
Traffo Roof	2.7	
Traffo Roof	2.8	
Traffo Roof	2.8	
FGT Room Louvre	3.3	
Traffo	4.6	
Boiler Room Wall	4.6	
Component Coolers	4.7	
Component Coolers	4.8	
Component Coolers	5	
Turbine Roof Fan Duct Break out - mitigated	5	
Component Coolers	5.1	
Component Coolers	5.3	
Component Coolers	5.4	
Component Coolers	5.5	
Boiler Room Louvre	5.6	
Component Coolers	5.8	
Electrical Building	6	
Component Coolers	6.1	
Turbine Hall	6.3	
Component Coolers	6.5	
Component Coolers	6.9	
FGT Room Wall	6.9	
Turbine Hall	8	
FGT Door	8	
Boiler Room Louvre	8.4	
Electrical Building	8.8	
Wood Chip Wall	9.3	
Boiler Room Louvre	9.5	
Transformer	9.7	
ACC	9.8	
Boiler Room Wall	10	
FGT Room Wall	10.3	
FGT Door	10.4	
Turbine Room Louvre	11	
Transformer	11.3	
Transformer	11.3	
Wood Chip Wall	12.2	
Boiler Room Wall	12.2	
Boiler Room Door	12.2	
ACC	12.4	
FGT Roof	12.8	
Turbine Roof	12.9	
Component Coolers	13	
Service Building Door	13	
Service Building Door	13	
Component Coolers	13.1	
Turbine Door	13.1	
Component Coolers	13.2	
Electrical Building	13.5	
Turbine Hall	13.6	
Component Coolers	13.8	
FGT Roof	13.8	
Component Coolers	14	
Wood Chip Louvre	14.2	
Condensate Pumps	14.3	
Component Coolers	14.4	
Component Coolers	14.5	
Component Coolers	14.5	
Component Coolers	14.5	
Component Coolers	14.5	
Component Coolers	14.6	
Component Coolers	14.6	
Service Building Door	14.7	
Component Coolers	14.8	
Service Building Door	14.8	
Component Coolers	15	
Component Coolers	15.2	
Component Coolers	15.2	
Component Coolers	15.2	
Wood Chip Louvre	15.3	
Wood Chip Louvre	15.3	
Turbine Hall	15.7	
Stack	15.9	
Boiler Roof	16.2	
ACC	16.3	
Boiler Roof	16.4	
Woodchip Roof	16.9	
Woodchip Roof	17.5	
Electrical Building	19.2	
Transformer	19.3	
Electrical Building	19.4	
FGT Roof	19.7	
Wood Chip Door	19.8	
Wood Chip Door	20.1	
Boiler Room Wall	20.1	
Wood Chip Door	20.4	
Wood Chip Door	20.9	
Boiler Room Wall	21.3	
Transformer	21.5	
Boiler Room Wall	21.6	
FGT Room Wall	21.8	
Boiler Room Wall	22.4	
Condensate Pumps	22.4	
Condensate Pumps	22.5	
Service Area	22.9	
Boiler Room Wall	24.6	
Boiler Room Louvre	25.3	
FGT Room Louvre	26.5	
Wood Chip Wall	27.5	
ACC	27.9	
Wood Chip Door	28	
Boiler Room Louvre	28	
Wood Chip Wall	31.2	
Condensate Pumps	31.7	
ACC	33	
Steam Vents	33.3	

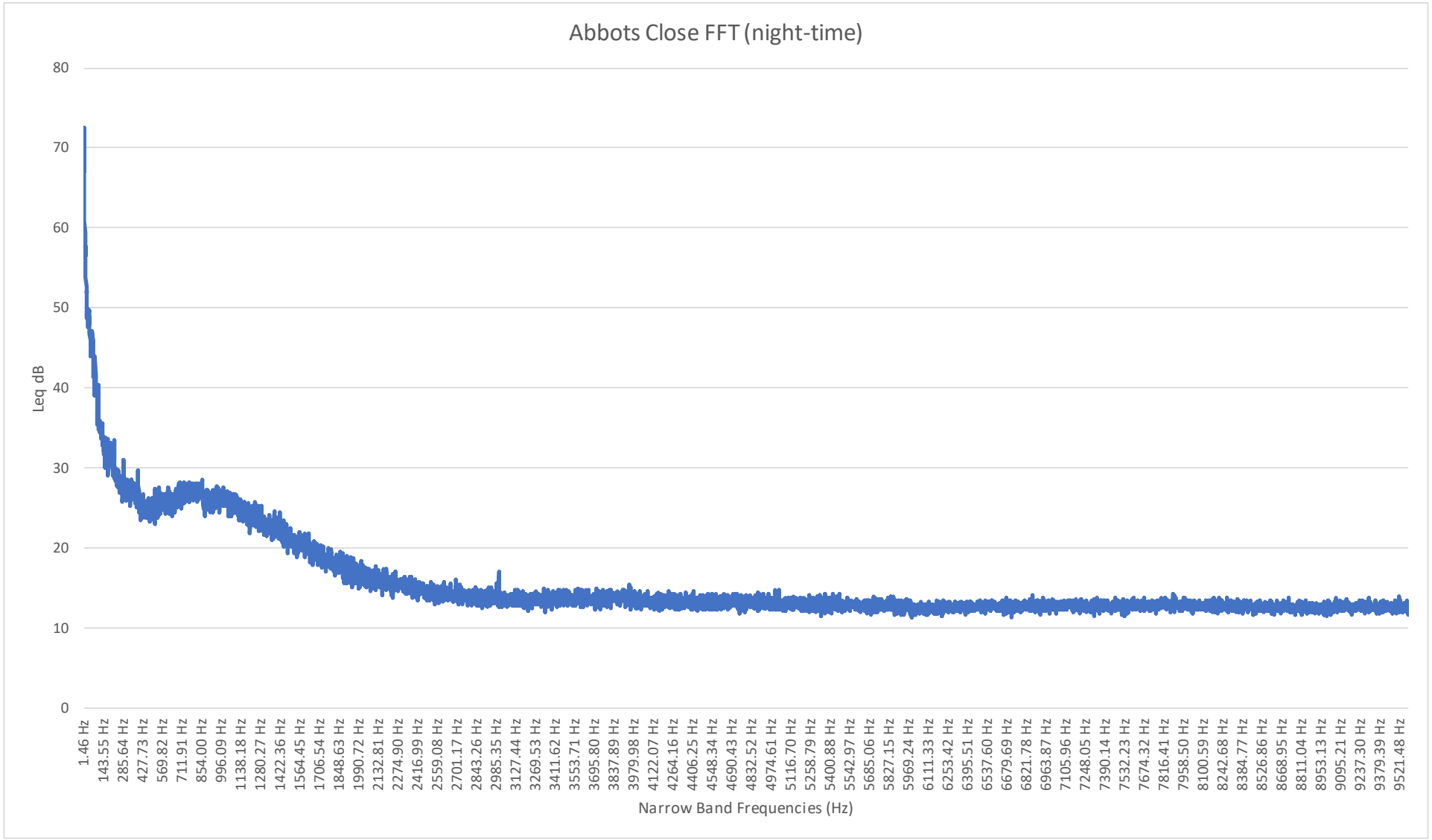
Ten Acre Wood

Source	Partial Lev
Name	Ten Acres
	Night
FGT Room Louvre	0.3
Turbine Hall	0.6
FGT Room Louvre	0.8
ACS	0.9
Traffo Roof	1.6
Transformer	2
Electrical Building	2.1
Turbine Roof Fan Duct Brea	2.4
Traffo	3.2
FGT Room Wall	3.6
ACC	3.6
Boiler Room Louvre	3.8
Boiler Room Wall	4.2
Component Coolers	4.4
Turbine Hall	4.4
Component Coolers	4.6
Component Coolers	4.7
Component Coolers	4.7
Component Coolers	5.1
Component Coolers	5.3
Component Coolers	5.7
Boiler Room Wall	5.7
FGT Door	5.7
Component Coolers	5.8
Component Coolers	5.9
Boiler Room Door	6.9
Wood Chip Wall	7
Component Coolers	7.2
Component Coolers	7.3
FGT Roof	7.8
Component Coolers	8.1
Boiler Room Wall	8.2
FGT Door	8.2
ACC	8.5
Service Building Door	8.6
Service Building Door	8.6
Turbine Room Louvre	8.7
Component Coolers	9.2
Electrical Building	9.2
Component Coolers	9.3
Component Coolers	9.4
Component Coolers	9.6
Component Coolers	9.7
Component Coolers	9.9
Transformer	10.6
Component Coolers	10.7
Turbine Roof	10.7
Component Coolers	10.8
Component Coolers	10.8
FGT Roof	10.8
Transformer	10.8
Component Coolers	10.9
Component Coolers	11
Component Coolers	11
Component Coolers	11
Turbine Hall	11
Component Coolers	11.1
Service Building Door	11.1
Service Building Door	11.1
Component Coolers	11.2
Component Coolers	11.3
FGT Room Wall	11.3
Condensate Pumps	11.4
Turbine Hall	12.2
Wood Chip Louvre	12.3
Boiler Room Louvre	12.3
Wood Chip Wall	12.4
Turbine Door	12.8
ACC	12.9
Wood Chip Louvre	13.2
Wood Chip Louvre	13.2
Stack	13.6
Boiler Room Louvre	13.6
Boiler Roof	14.3
Boiler Roof	14.4
Transformer	14.8
Woodchip Roof	15.2
Woodchip Roof	15.4
Electrical Building	16.2
FGT Roof	17.2
Boiler Room Wall	17.4
Electrical Building	17.5
Wood Chip Door	18
Wood Chip Door	18
Wood Chip Door	18
FGT Room Wall	18.3
Condensate Pumps	18.6
Wood Chip Door	18.9
Boiler Room Wall	18.9
Service Area	19.4
Boiler Room Wall	19.9
Boiler Room Wall	20.1
FGT Room Louvre	21.3
Boiler Room Wall	22.1
ACC	22.1
Boiler Room Louvre	22.7
Wood Chip Door	23.1
Condensate Pumps	24.9
Wood Chip Wall	25.3
Boiler Room Louvre	25.4
Condensate Pumps	28.6
Wood Chip Wall	28.7
Steam Vents	30.4
ACC	30.9

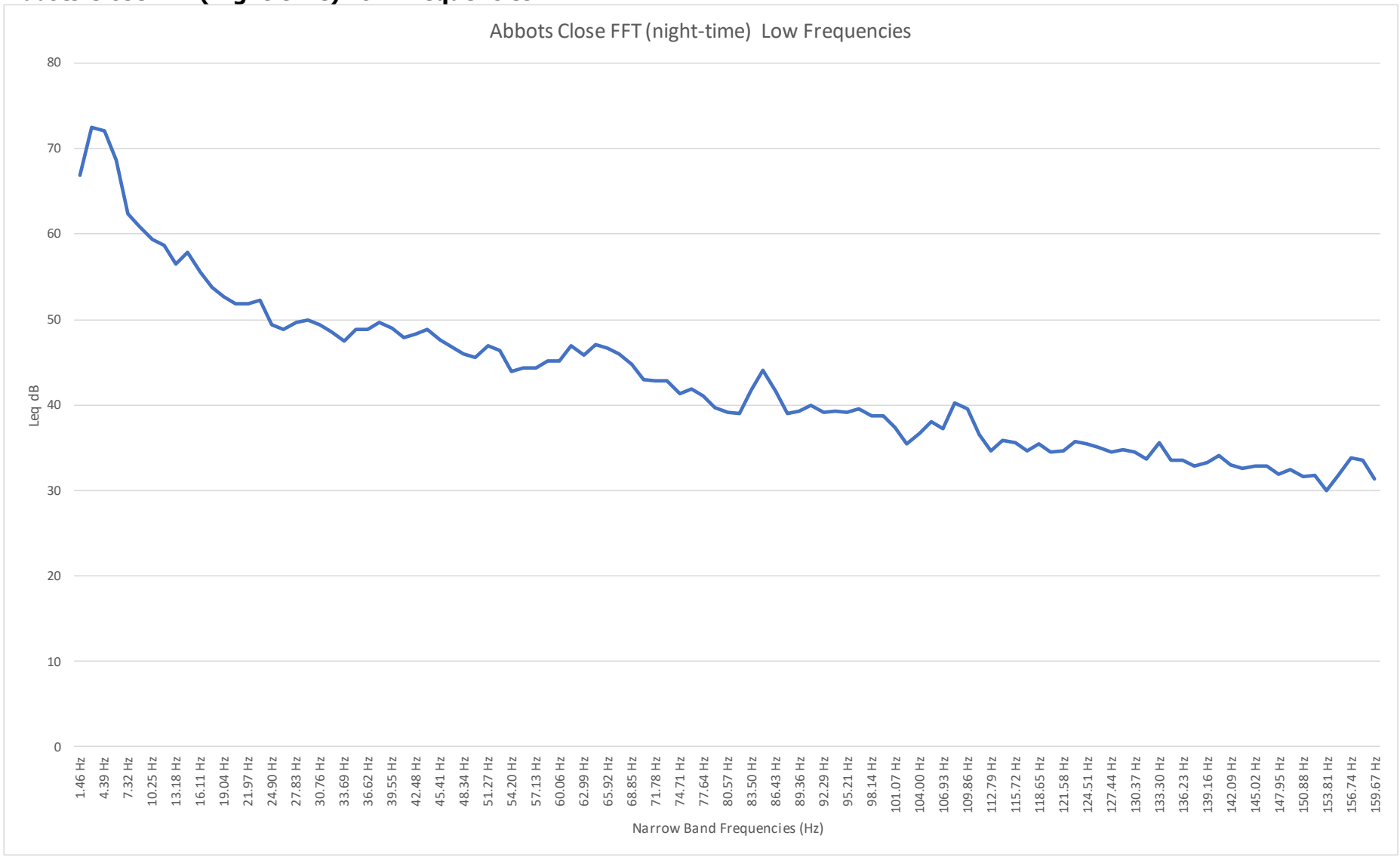
APPENDIX 5

FFT ANALYSIS

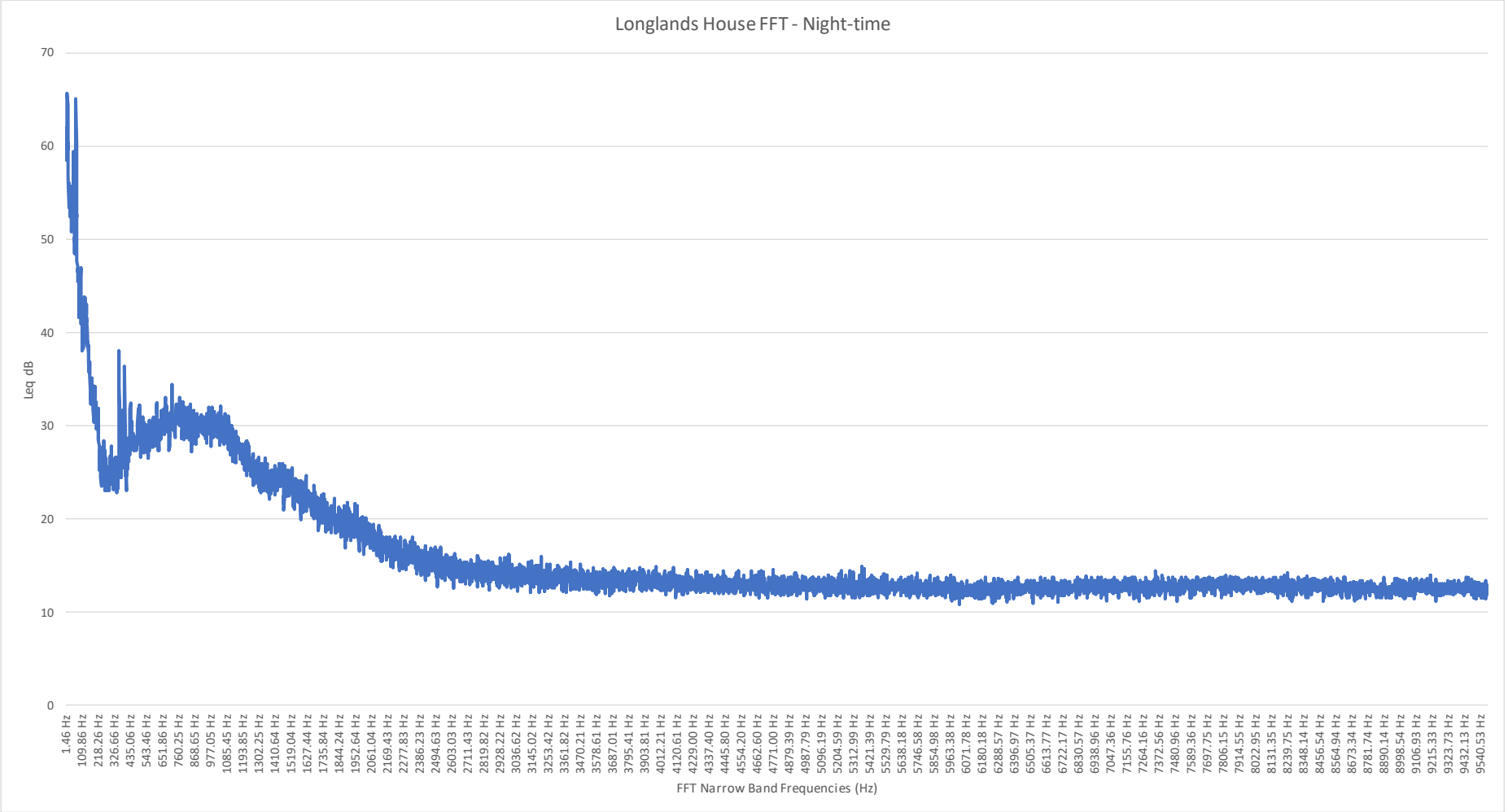
Abbots Close FFT (Night-time)



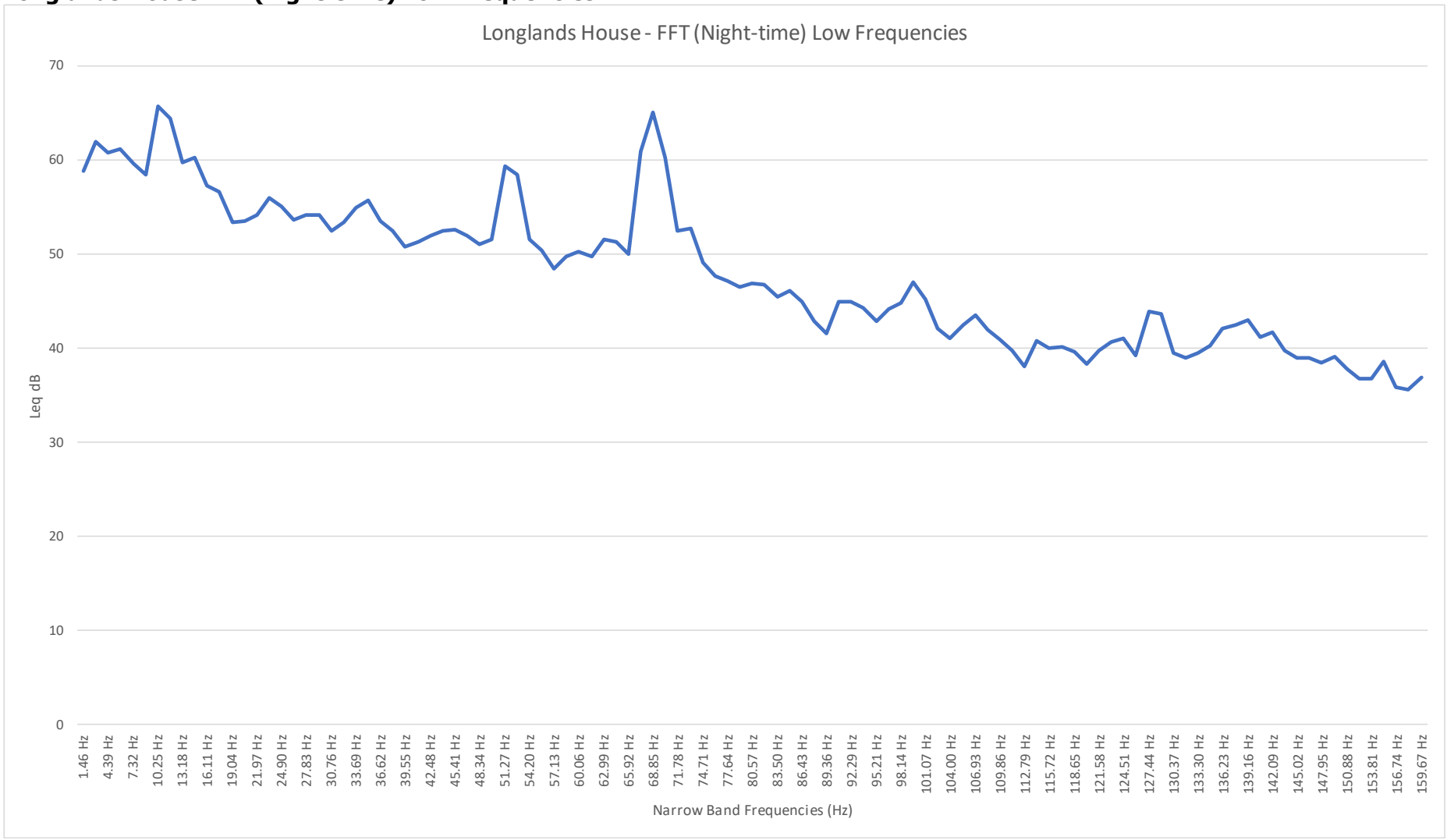
Abbots Close FFT (Night-time) Low Frequencies



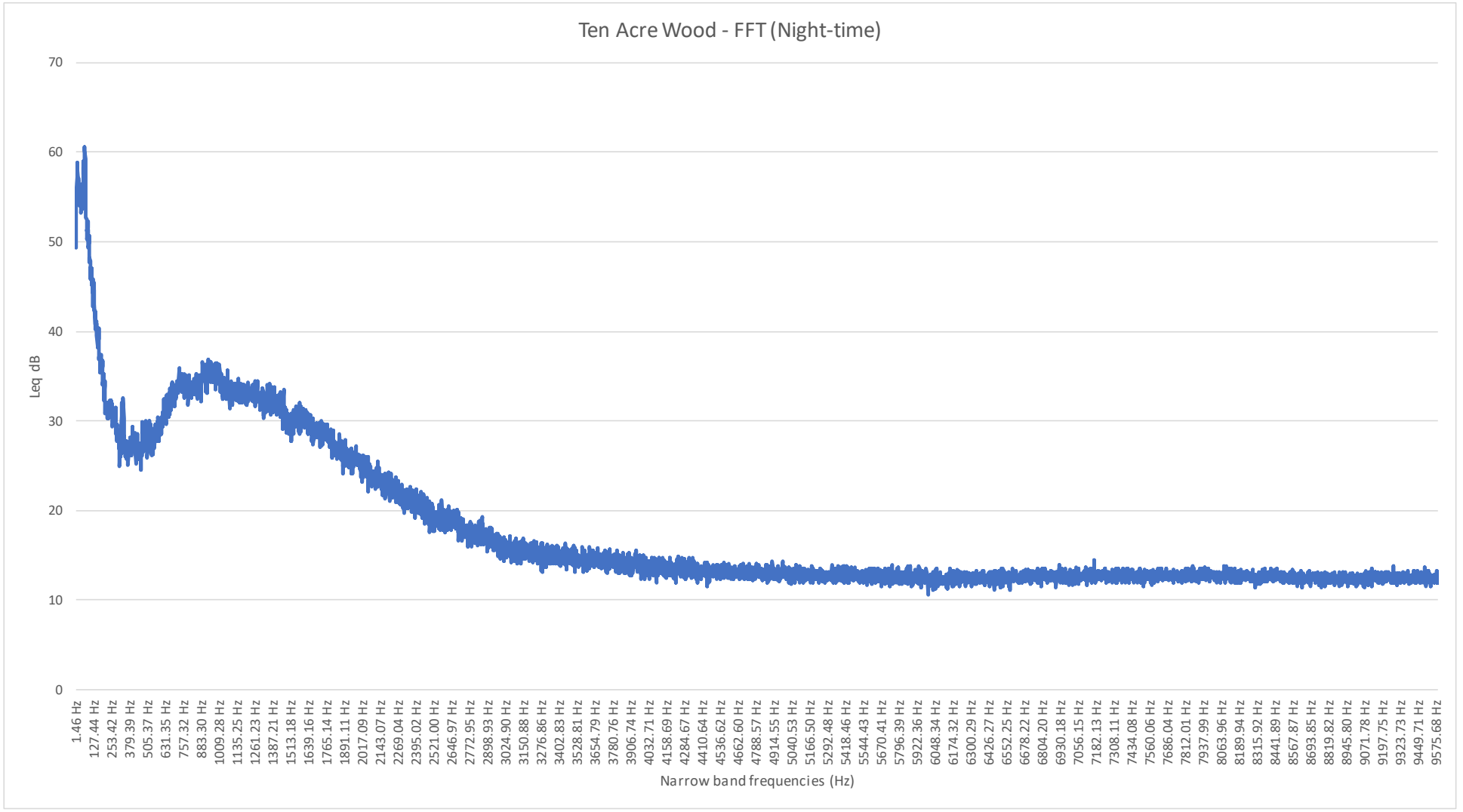
Longlands House FFT (night-time)



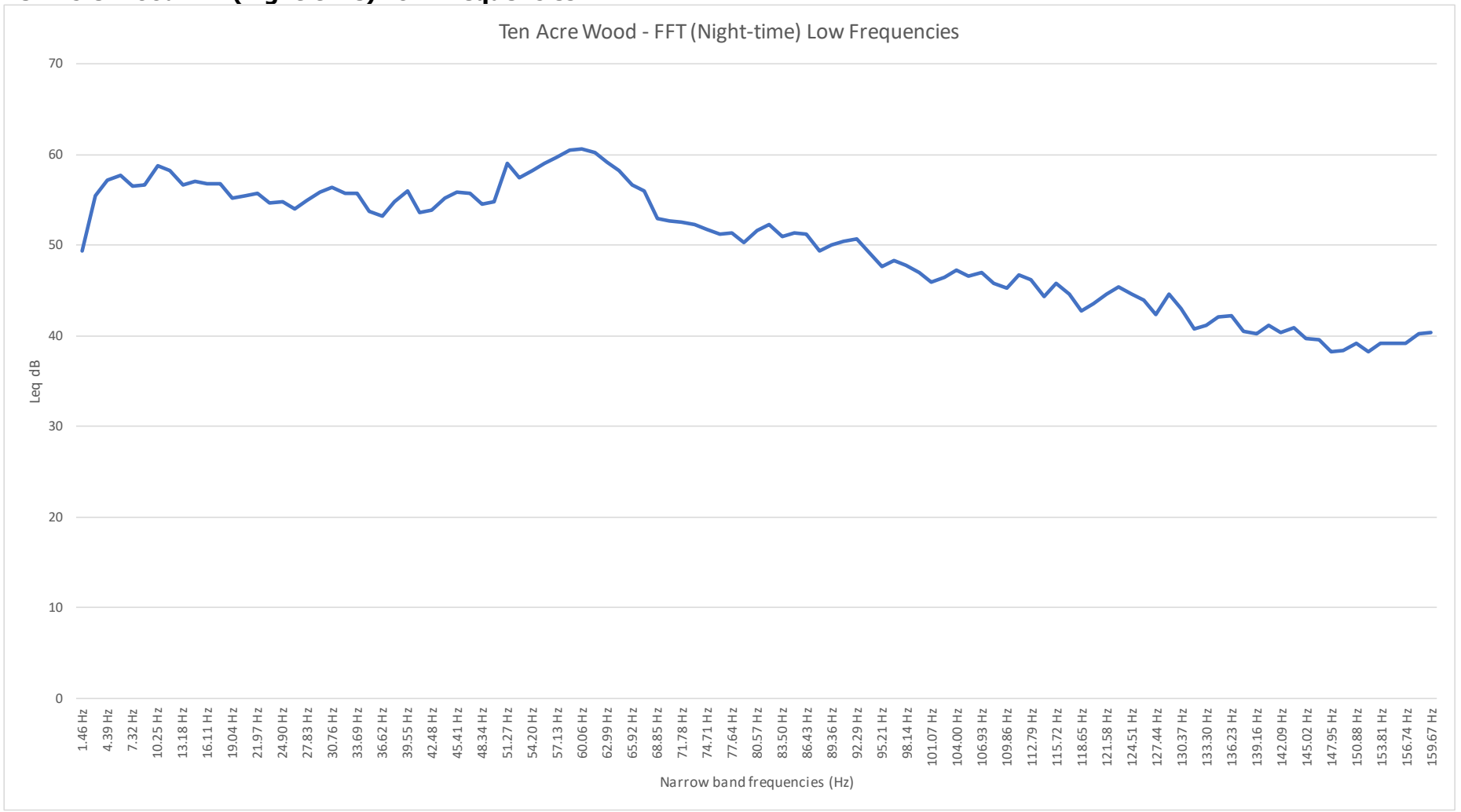
Longlands House FFT (night-time) Low Frequencies

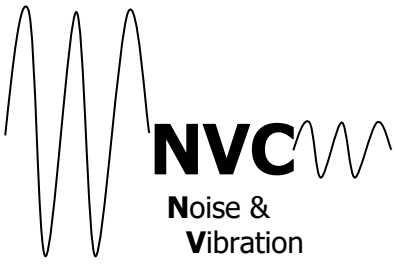


Ten Acre Wood FFT (night-time)



Ten Acre Wood FFT (night-time) Low Frequencies




NVC
Noise &
Vibration
Consultants Ltd