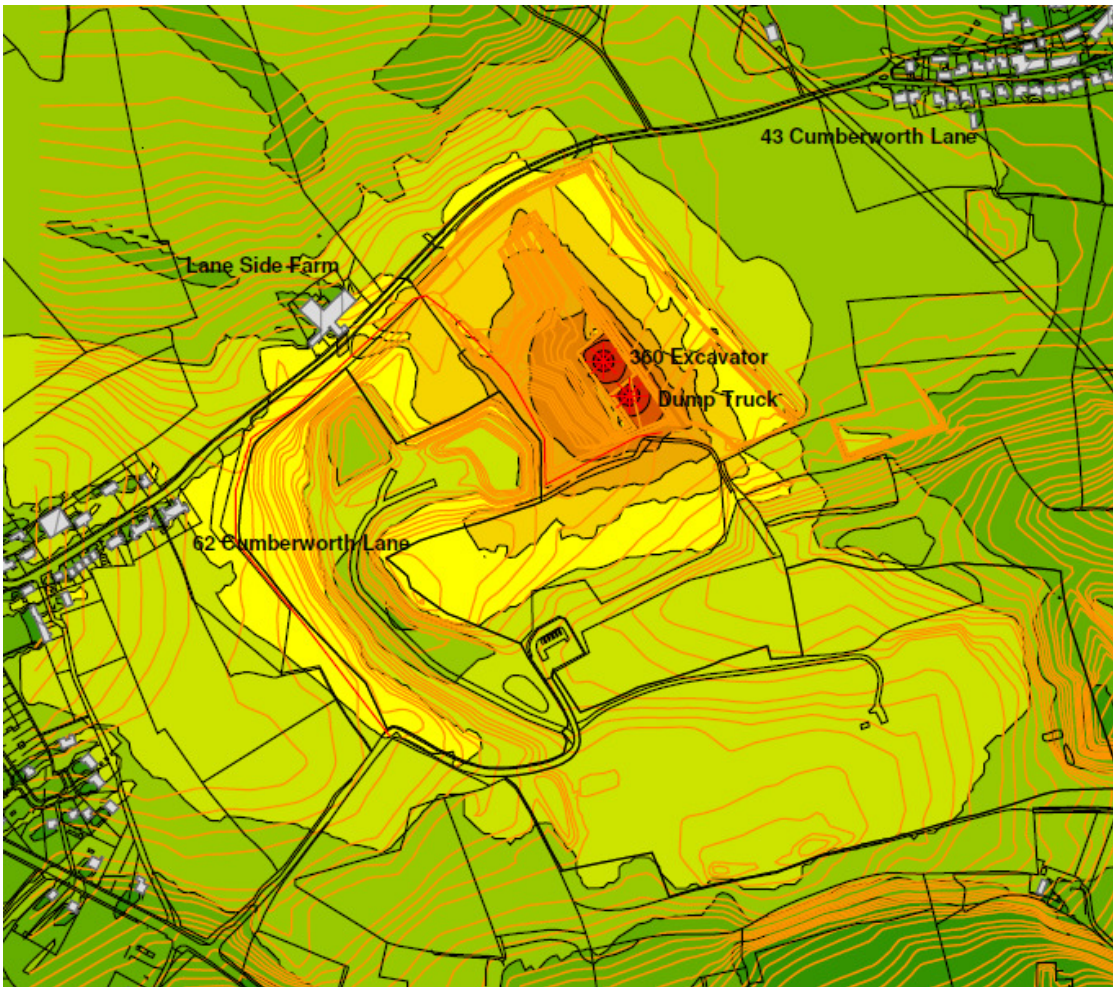
Bromley Farm Quarry Extension

NOISE ASSESSMENT



January 2023
(Revised August 2023)

Silkstone
Environmental Ltd
Geotechnical, Mineral Waste Management
& Environmental Consultancy for Industry

CONTENTS

Noise Assessment

1. Introduction

1.1 This report details the findings of a noise impact assessment for a planning application on behalf of Wavin Ltd for a 8.4 Hectare extension at Bromley Farm Quarry, Upper Cumberworth.

1.2 The proposed 8.4 Hectare extension area consists of three fields in agricultural use and lies within a larger allocated mineral site, Ref MS5 in the Calderdale Development Plan.

1.3 All soils required for restoration would be stripped and stored around the eastern, southern and western perimeter of the workings to act as a visual and acoustic barrier and would remain in-situ until required for restoration of the site. Should there be insufficient soils to screen the workings, soil making and overburden material would be used.

1.4 The extracted sandstone is transported by dedicated HGV's approximately 5km to the Hazelhead Clay Manufacturing Site in Crow Edge.

1.5 The quarry is to be restored with overburden from the inferior quarry waste and imported inert waste to enable the site to be restored back close to original ground levels, subject to the granting of an Environmental Permit from the Environment Agency.

1.6 The clay and shale reserves are approximately 700,000 tonnes which would equate to 25 years supply at a rate of 30,000 tonnes per annum.

1.7 Clay would be lifted using one dedicated 360 hydraulic excavator. No blasting would be required. A dozer would also be utilised for the stripping and reinstatement of topsoil for restoration.

1.8 There would be no crushing or screening plant operating on site.

1.8 The noise impact assessment comprised data calculated using SoundPlan modelling software and free-field noise survey data. SoundPlan modelling software provides three dimensional sound propagation simulations, and generates predicted noise levels for user defined scenarios.

1.9 Noise survey data and SoundPlan model calculations were used to assess noise impact associated with the proposed development in accordance with British Standard 5228. The assessment findings are presented further in the report.

2. Noise Assessment Methodology

2.1 Relevant Guidance and Assessment Criteria

2.1.1 The relevant guidance and assessment criteria for the development were identified as follows;

- National Planning Policy Framework (NPPF) – Revised 2019
- Planning Policy Guidance
- British Standard 5228-1:2009+A1:2014

National Planning Policy Framework

2.1.2 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied.

Paragraph 174.

2.1.3 Planning policies and decisions should contribute to and enhance the natural and local environment by:

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

Paragraph 185

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

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

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

Planning Practice Guidance (PPG, 2014)

2.1.6 PPG is written in support of the NPPF and provides an increased level of specific planning guidance.

2.1.7 PPG states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It is also suggested that noise should not be considered in isolation and separately from issues such as the economic, social and other environmental dimensions of proposed development.

2.1.8 Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

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

2.1.9 The supporting Minerals Planning Practice Guidance to the NPPF, is the current Government advice applicable to the control of noise from surface mineral workings in England.

2.1.10 Minerals includes the appropriate noise criteria for 'normal operations';

"Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900).

2.1.11 Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq,1h (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq,1h (free field). For any operations during the period 2200 – 0700 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

2.1.12 Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. Lmax in specific octave or third-octave frequency bands – and that should not be allowed to occur regularly at night.)

2.1.13 Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed."

2.1.14 The same document includes instances where particularly noisy short-term activities may occur and the appropriate criteria for such circumstances;

"Activities such as soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance"

2.1.15 Increased temporary daytime noise limits of up to 70dB(A) LAeq,1h (free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.

2.1.16 Where work is likely to take longer than eight weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dB(A) LAeq,1h (free field) limit referred to above should be regarded as the normal maximum".

2.2 British Standard BS 5228-1:2009+A1:2014; Code of practice for noise and vibration control on construction and open sites

2.2.1 BS5228 provides a methodology for predicting noise levels associated with activity such as construction and industrial development. The standard also provides sound power level data for a number of different types of operations and machinery.

2.2.2 The extent of noise generated by the proposed development would be subject to a number of variables relevant to the noise assessment, including;

- The Sound Power Lever (L_{WA}) of plant and machinery to be utilised at the development.
- Noise Characteristics (i.e. clatters and bangs which are accounted by tonal or impulse correction)
- The extent of the operational periods of plant (percentage on time)
- Distance between noise source and identified receptors (e.g. noise sensitive property).
- Noise attenuation provided by either barrier or soft ground located between source and receptor.
- Noise propagation associated with reflection and influence of buildings and hard surfaces.

2.2.3 Existing and proposed noise levels were determined using noise modelling software (SoundPlan Essential 2.0), which utilises accepted UK noise calculation methodology including standards BS 5228-1:2009+A1:2014 and ISO9613-2:1996. The proprietary modelling software is the accepted industry standard in noise propagation simulation.

2.3 SoundPlan Modelling Approach

2.3.1 Noise levels associated with the proposed compliment of plant at the site were simulated using SoundPlan software. Model validation was done by comparing calculated (using SoundPlan) noise levels at specified locations (at the closest residential properties), with free field noise measurements recorded at the same location in a previous assessment. Validation was confirmed where modelled values match free-field recorded noise levels within an acceptable range of variation (±0.5 dB).

2.3.2 Model parameterisation of the proposed development was based on reference Sound Power Levels (L_{WA}) of similar plant/equipment specification as provided by British Standard BS5228. Noise associated with waste export from the site was considered in the SoundPlan model. Full details of BS5228 reference values and SoundPlan model parameterisation are provided in later sections of the report.

2.3.3 The SoundPlan model software was used to calculate noise levels associated with the proposed new development. A simulation of noise associated with the proposed development was provided by SoundPlan modelling software to predict noise levels for the purpose of undertaking a BS5228 assessment.

2.4 Additional Information

2.4.1 Site specific information related to plant compliment, vehicle numbers for mineral extraction were provided by the applicant. The information was used to parameterise the SoundPlan models to accurately replicate the proposed development.

2.4.2 During the background noise survey on the 14th April 2022, there was no activity on the former Bromley Farm Quarry as the site is now fully restored. The noise survey results for the model validation position are therefore considered to represent free field measurement for existing operations.

3. Instrumentation and Meteorology

3.1 Instrumentation

3.1.1 Instrument description and specification used during the noise survey on the 14th April 2022 was as specified in Table 1.

Table 1. Instrumentation

Manufacturer	Description	Type	Serial No.
Cirrus	Integrating Averaging Sound Level Meter	CR:811B (Type 1)	C19842FD
Cirrus	Acoustic Calibrator	CR:515	45577

3.1.2 The sound level meter was configured with the set up parameters as detailed in Table 2 for all noise survey positions.

Table 2. Sound level meter set-up parameters

Time Weighting	Fast
Frequency Weighting	A
Operational Mode	Broadband Mode
Measurement Period	1 hour (15 minute multiples)

3.1.3 All instrumentation used during the noise survey was within the manufacturer's recommended period for both service and calibration. Certification of service and calibration are provided in Appendix E.

3.1.4 The sound level meter was calibrated in-situ using an acoustic calibrator (Serial no.45577) prior to the commencement of the noise measurement at each survey position. In-situ calibration results are provided in Appendix C.

3.2 Noise Measurement Parameters

3.2.1 The following free-field noise measurement indices were recorded at each survey position;

- L_{Aeq} – A-weighted equivalent noise measurement for the survey duration.
- L_{90} – A-weighted noise measurement for exceeded for 90% of the survey duration.

3.3 Meteorological Conditions

3.3.1 Meteorological conditions observed during the noise survey periods were as follows;

- Cloud cover ranging between 40% and 50%
- Low wind speed ranging between 0.01 and 2.7m s^{-1}.
- Wind direction from the south-west.
- Dry ground conditions and no rainfall.

3.3.2 Details of meteorological conditions specific to each noise survey position are provided on the survey log sheets in Appendix D.

3.3.3 Meteorological conditions during the noise survey period complied with the criteria specified in British Standard BS 4142.

4. Noise Sensitive Properties

4.1 Three noise sensitive properties were identified in the surrounding area of the proposed as shown on plan no 21007/200 in Appendix A. The properties were identified as follows;

- 62 Cumberworth Lane
- Lane Side Farm
- 43 Cumberworth Lane

4.2 A noise survey was carried out on the 14th April 2022 at the selected noise sensitive properties considered relevant to the proposed development.

4.3 Noise survey positions were set up at the properties as discussed, and at least 3.5m distance from any vertical reflective surface, and 1.5m above ground level.

4.4 A noise measurement of 1hr duration (1hr LAeq) comprising 15 minute intervals was recorded on the 14th April 2022 at 62 Cumberworth Lane, Lane Side Farm and 43 Cumberworth Lane at 10.53am, 12.12pm and 13.29pm respectively.

4.5 All readings were taken at the rear boundary fence of each property. No access onto private land was carried out for the purposes of the background noise monitoring.

5. Background Noise Survey Results

5.1 Noise survey data was downloaded from the sound level meter using Deaf Defier 3.2 software. The noise survey results and graphs are provided in Appendix C.

5.2 A summary of the noise survey results are presented in Table 3 below.

Table 3. Free field noise measurements taken on 14th April 2022.

Location	L_{Aeq} dB(A)					L_{A90} dB(A)				
	0 to 15 min	15 to 30 min	30 to 45 min	45 to 60 min	**$L_{Aeq\ 60\ min}$**	0 to 15 min	15 to 30 min	30 to 45 min	45 to 60 min	**$L_{A90\ 60\ min}$**
62 Cumberworth Lane	53.7	54.6	48.4	54.3	**52.8**	36.8	37.2	35.8	37.5	**36.8**
Lane Side Farm	52.5	53.1	52.6	51.7	**52.5**	32.3	33.3	34.2	29.6	**32.4**
43 Cumberworth Lane	39.9	43.7	43.5	42.2	**42.3**	32.2	33.1	35.7	36.7	**34.4**

5.3 All of the noise survey locations were subject to varying degrees of noise associated with the rural location, Lane Side operational farm and road noise from the adjacent Cumberworth Lane.

5.4 As previously stated, the previous Bromley Farm Quarry is now completed and fully restored so no activity was taking place on the site,

6.0 Plant and Machinery (Noise Sources)

6.1 For the purpose of the noise assessment, all plant and equipment with attributable noise at the development were identified. The plant identified in the noise models were as follows;

HGV's associated with mineral export and waste importation
HGV's movements up to 12 per hour peak (6 in, 6 out)

Soil Stripping and Construction of Screening Mounds
360 Excavator and Dump Truck

Mineral extraction
360 Excavator (100% on time for worse case scenario calculations)

Movement of overburden
Articulated Dump Trucks (100% on time)

Replacement of soils for restoration

Bulldozer required only when an area has been restored ready to spread soils (Max once per year – Measured at 50% on time)

6.2 Details of the number and type of plant and equipment to be used at the development are provided in Table 3. Sound power levels for specific plant and equipment were sourced from literature values.

Table 3. Plant and equipment proposed for use for the proposed extension area

Plant/ Equipment	No.	Sound Power Level (L_{WA}) dB (A)	% on time	Corrected Sound Power Level dB (L_{WA})	BS5228 reference
360 Excavator	1	106	100%	106	Table C.1 No 16
HGV lorry – 4 axle wagon	12 per hour max (6 in, 6 out)	110	50%	71	Table C1 No 34
Articulated Dump Truck	1	110	100%	110	Table C1 No 30
Bulldozer	1	108	50	54	Table C1 No 11

6.3 The 360 excavator used at the quarry have been modelled at 100% on time to demonstrate worse case scenario levels.

6.4 No other noise sources (other than those identified in Table 3) were considered at the site in the noise models.

7. SoundPlan Model Parameters

7.1 SoundPlan noise modelling software was utilised to determine the noise impact for the proposed extension to Bromley Farm Quarry. The model was parameterised based on operational details provided by the applicant for the type, number, and location of plant, operational periods, and HGV movements.

7.2 The models have been produced for soil stripping and bund construction to get the site established and 3 different scenarios for mineral extraction progressing through the extension area, in Phases 1, 3 and 5.

7.3 SoundPlan was used to create a three dimensional replication of the topographic and structural detail of the assessment area. It was also possible to characterise the ground type, and include further structural detail such as bunds, walls and reflective surfaces. Sound Power Levels (L_{WA}) were assigned to individual items of plant such as the 360 excavator etc.

7.4 The core calculation model of SoundPlan used for predicting noise levels from the proposed development, utilised British Standard BS5228 and ISO9613-2:1996 methodology. The two standards are the accepted methodology for calculating noise propagation.

7.5 A combination of site specific topographic details and ground level data purchased from Ordnance Survey were used to create the ground terrain model (GTM) of the study area. The terrain model was therefore considered an accurate 3-dimensional replication of the development and the surrounding land.

7.6 The type and location of modelled plant/equipment was as detailed by the applicant to accurately replicate the proposed development. The SoundPlan model calculations are therefore considered to be very reliable.

7.7 General parameters assigned to the SoundPlan model was as follows;

- HGV's – Assigned as a linear noise source 2m above ground (Sound Power Level calculated in accordance with section F2.5.2 of BS5228). Maximum 6 per hour.
- Plant (360 excavator) – Only one excavator assigned as a single point noise source at 2m height above ground (Sound Power Level from literature value or BS5228).
- Articulated Dump Trucks (ADT's) – One required for the movement of overburden. Modelled at 100% for worse case scenario but would be an infrequent operation due to the low levels of overburden encountered.
- 1 bulldozer required for soil stripping and bund construction
- 1 bulldozer required for soil reinstatement
- Noise sensitive properties – Assigned as free-field single point receivers, 3.5m distance from façade and 1.5m height above ground.
- Ground absorption – Ground type assigned set at default setting (hard).

7.8 The sound power level (SWL) for HGV movements into the quarry along the haul road from the site entrance was calculated as follows;

$L_{Aeq} = L_{WA} - 33 + 10Log_{10}Q - 10Log_{10}V$
L_{WA} = HGV sound power level = 107dB
Q = Maximum number of movements per hour = 12 (6in, 6 out)
V = Average vehicle speed = 25 Km/Hr

Calculated L_{Aeq} = **71dB (A)**

7.9 Plant and equipment used at the existing and proposed development was parameterised in SoundPlan as detailed in Table 3 above.

7.10 Noise propagation model simulations were used to create noise contour plans, indicating the noise impact at the site and surrounding area. The noise contour plans accurately illustrate noise propagation at the study area and also anticipated noise levels at NSP's from the proposed development (see Appendix B).

8.0 Noise Level Predictions

8.1 Prediction Methodology

8.1.1 The noise prediction methodology used in the SoundPlan modelling simulations were British Standard BS5228 and ISO9613-2:1996. The simulation results therefore conform to accepted prediction methodologies for the proposed development.

8.1.2 The prediction calculations therefore provided a range of anticipated noise levels from typical operations (including worst case scenario).

8.1.3 Prediction calculations also accounted for HGV movements within the site boundary based on calculation methodology provided in BS5228.

8.1.3 Four scenarios were modelled showing soil stripping and mineral extraction.

1) Plans 1 and 2 – Soil Stripping and bund construction
2) Plans 3 and 4 – Overburden mound construction
3) Plans 5 and 6 – Mineral extraction in Cut 1
4) Plans 7 and 8 – Mineral extraction in Cut 3
5) Plans 9 and 10 – Mineral extraction in Cut 5.
6) Plans 11 and 12 – Restoration by waste importation

8.2 Noise Prediction Assumptions

8.2.1 A number of assumptions were applied during noise prediction modelling. These related to operational specifics of the proposed development. It was assumed that worst case scenario for noise generation would be when plant was operated at closest proximity to any particular NSP.

8.2.2 Rates of clay extraction are estimated to be a maximum of 30,000 tonnes per annum (tpa) but is dependent upon market demand.

8.2.3 For 30,000 tpa, over a 48 week working year, a maximum of 120 HGV movements per day (60 in, 60 out) is required to cope with peak periods of high demand. 12 movements per hour as a maximum (6in, 6out) have been included in the noise modelling calculations. 12 movements per hour is considered the maximum number practically from an operational perspective due to the low numbers of mobile plant on site to manage loading and unloading of mineral and waste.

8.2.4 The 120 movements (60 in, 60 out) includes the importation of inert waste for restoration when a sufficient void has been created for this to be undertaken. This is expected to be approximately during the working of Cut 3.

8.2.5 The previous quarry had a restriction of 20 HGV imports of waste per day and this is anticipated to be sufficient in any new permission.

8.3 Noise Assessment Results

8.3.1 The following tables present the assessment results of predicted continuous free field noise levels at nearby NSP's, and comparison with the relevant assessment noise limit criteria.

8.3.2 Predicted free-field noise levels L_{Aeq} were compared with NPPF technical guidance criteria of no more than 10dB above background measurements (L_{90}) where possible, or in any case against a maximum permitted level of 70 dB for temporary operations such as soil stripping and bund construction and 55dB for normal daytime mineral extraction activity. The assessment results are presented in tables 5.1 to 5.5.

Table 5.1 – Soil Stripping and Screening Bund Construction

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	Difference between predicted noise and assessment criteria dB*1	Compliance with NPPF
62 Cumberworth Lane	46.5	36.8	70	*-23.5*	Yes
Lane Side Farm	56.5	32.4	70	*-13.5*	*Yes*
43 Cumberworth Lane	27.9	34.4	70	*-42.1*	*Yes*

Note *1: NPPF technical guidance criteria of 70dB maximum for temporary activities such as baffle mound construction etc

Table 5.2 – Construction of Overburden Mound (Phase 1 only)

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	Difference between predicted noise and assessment criteria dB*1	Compliance with NPPF
62 Cumberworth Lane	45.7	36.8	55	*-9.3*	Yes
Lane Side Farm	47.9	32.4	55	*-7.1*	*Yes*
43 Cumberworth Lane	45.8	34.4	55	*-9.2*	*Yes*

Note *1: NPPF technical guidance criteria of no more than 10dB above background where possible or a maximum of 55dB

Table 5.3 – Mineral extraction (Phase 1)

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	*Difference between predicted noise and assessment criteria dB*1*	*Compliance with NPPF*
62 Cumberworth Lane	37.0	36.8	55	*-8.0*	*Yes*
Lane Side Farm	42.6	32.4	55	*-12.4*	*Yes*
43 Cumberworth Lane	27.4	34.4	55	*-27.6*	*Yes*

Note *1: NPPF technical guidance criteria of no more than 10dB above background where possible or a maximum of 55dB

Table 5.4 – Mineral extraction (Phase 3)

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	*Difference between predicted noise and assessment criteria dB*1*	*Compliance with NPPF*
62 Cumberworth Lane	46.7	36.8	55	*-8.3*	*Yes*
Lane Side Farm	48.0	32.4	55	*-7.0*	*Yes*
43 Cumberworth Lane	34.8	34.4	55	*-20.2*	*Yes*

Note *1: NPPF technical guidance criteria of no more than 10dB above background where possible or a maximum of 55dB

Table 5.5 – Mineral extraction (Phase 5)

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	*Difference between predicted noise and assessment criteria dB*1*	*Compliance with NPPF*
62 Cumberworth Lane	46.7	36.8	55	*-8.3*	*Yes*
Lane Side Farm	48.0	32.4	55	*-7.0*	*Yes*
43 Cumberworth Lane	34.8	34.4	55	*-20.2*	*Yes*

Table 5.6 – Waste Importation (Phases 3 to 5)

Location	Predicted noise emission from Soil Stripping & Bund Construction activity LAeq, 1hr dB	Measured background noise level LA90, 1hr dB	NPPF technical guidance. noise criteria dB*1	Difference between predicted noise and assessment criteria dB*1	Compliance with NPPF
62 Cumberworth Lane	47.2	36.8	55	*-7.8*	Yes
Lane Side Farm	50.0	32.4	55	*-5.0*	*Yes*
43 Cumberworth Lane	42.8	34.4	55	*-12.2*	*Yes*

Note *1: NPPF technical guidance criteria of no more than 10dB above background where possible or a maximum of 55dB

9. Conclusions

9.1 The background noise readings at various locations around the proposed development were low due to the rural location and the previous Bromley Farm Quarry being now completed and fully restored.

9.2 Part of the development includes the construction of 2m high perimeter bunds on the northern and eastern boundaries. NPPF guidelines allow for a noise limit criteria of 70dB for bund engineering work for a period of 8 weeks per year.

9.3 Noise model results for bund engineering activity indicated compliance with the 70dB temporary noise limit criteria for all noise sensitive properties near to the development.

9.4 Noise model results for mineral extraction indicated compliance with the 55dB limit in the NPPF at all locations.

9.5 All noise model results produced in SoundPlan are provided in Appendix B. The noise model results and contour plans indicate that noise from the development complied with the noise limit criteria specified in NPPF and PPG guidelines at all noise sensitive properties and would not have a significant adverse noise impact at the surrounding locality.

9.6 Noise prediction calculations confirm that the proposed extension to Bromley Farm Quarry is unlikely to cause any significant noise impact at nearby noise sensitive properties (NSP's).

9.7 Predicted noise levels from the proposed development were below the noise limit criteria as specified in the National Planning Policy Framework and Planning Practice Guidance at all NSP's.

9.8 Based on the findings of the noise assessment it was concluded that the proposed development would not have an adverse noise impact on nearby noise sensitive properties or the surrounding area.

REPORT ISSUE

This report was completed on 3rd January 2023.

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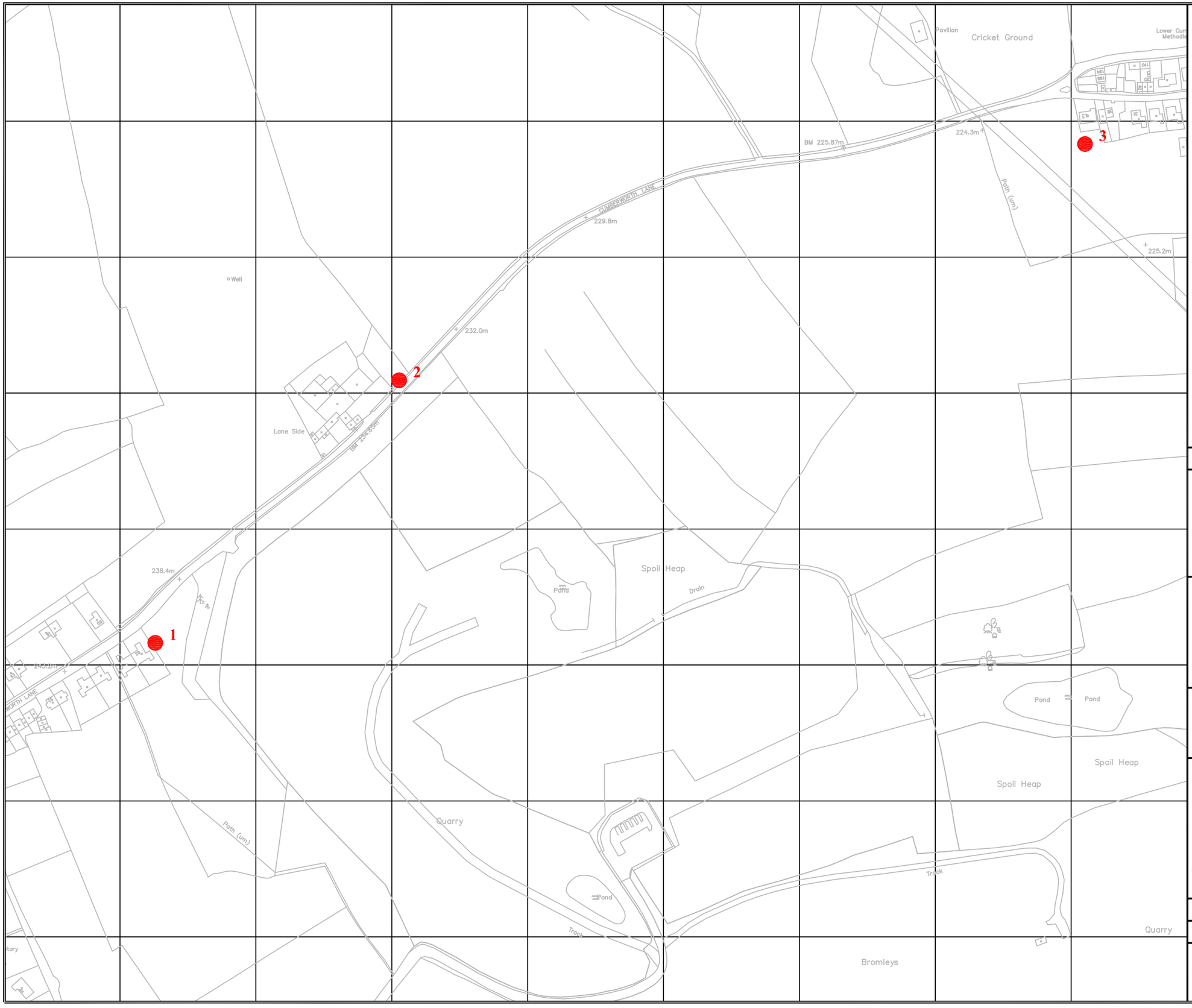
APPENDIX A

Plans and Drawings



Rev	Description	Date	Drawn	Chkd

Client:

WAVIN LTD

Project:

BROMLEY FARM EXTENSION

Plan Title:

NOISE MONITORING LOCATIONS

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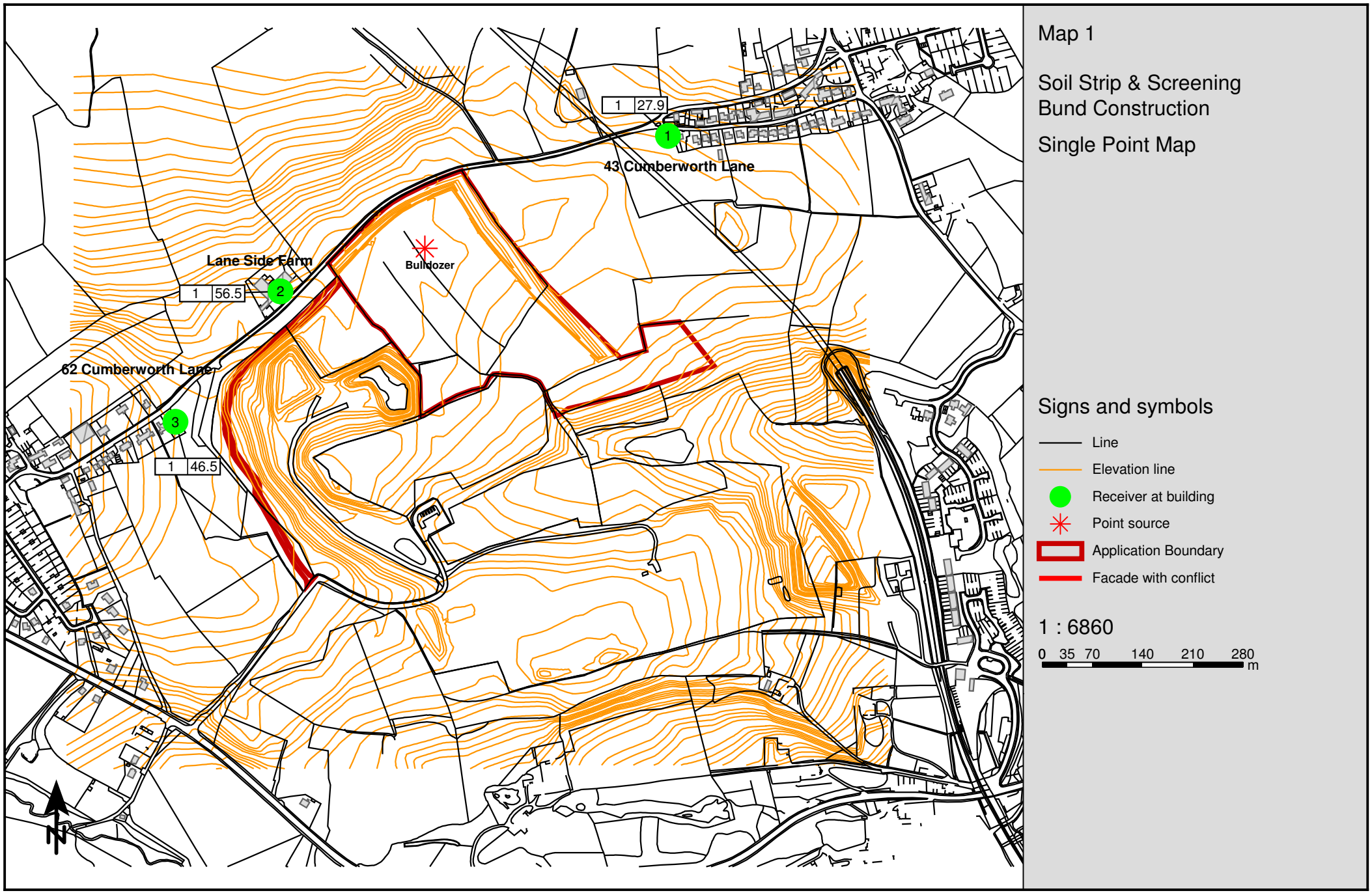
Project No. 22007	Dwg No. 22007/100	Rev

Date: May 22	Drawn: PS	Chkd:	Scale: NTS @ A3

APPENDIX B

SoundPlan Noise Contour Plans



Map 1

Soil Strip & Screening
Bund Construction

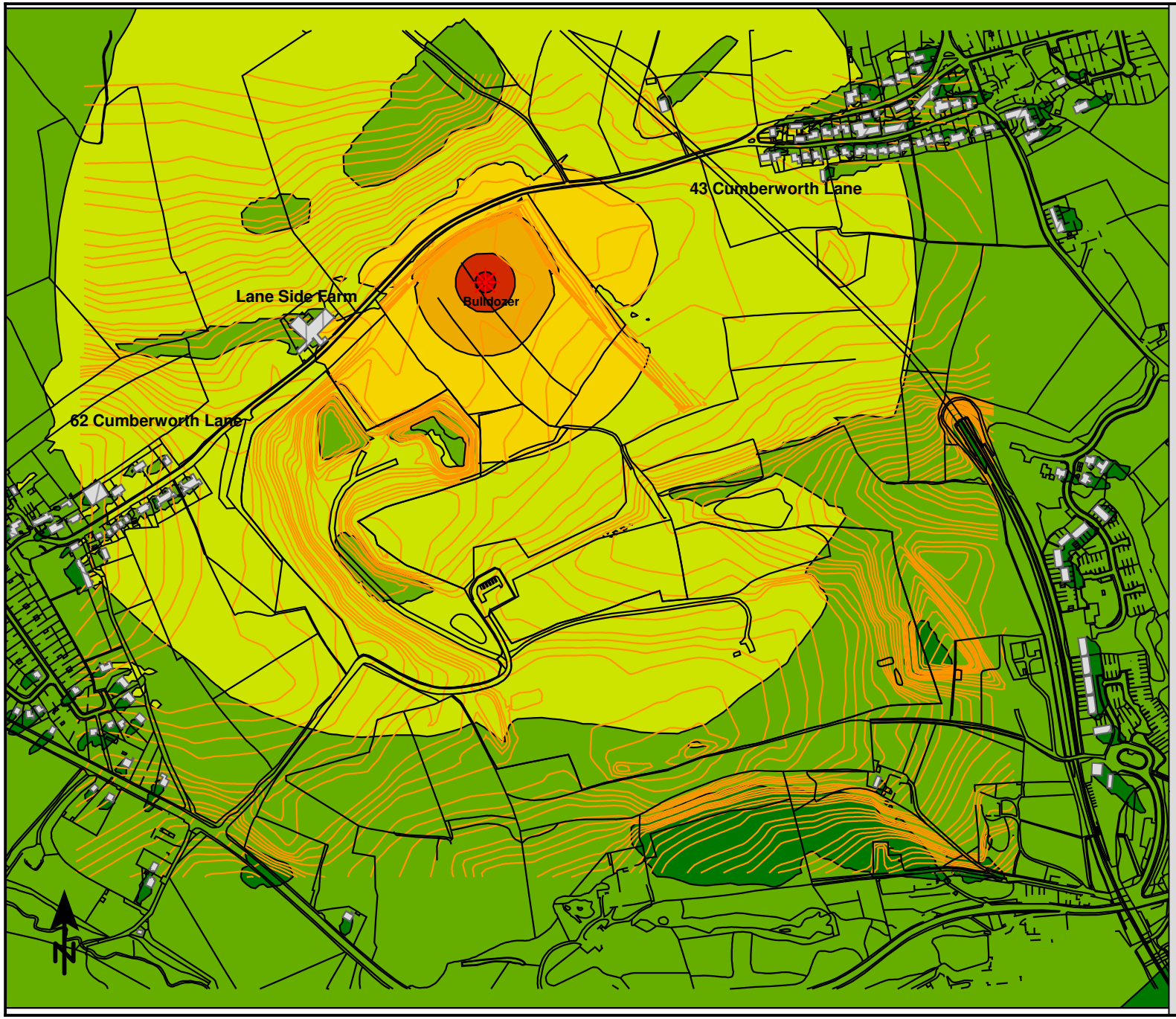
Single Point Map

Signs and symbols

- Line
- Elevation line
- Receiver at building
- Point source
- Application Boundary
- Facade with conflict

1 : 6860

0 35 70 140 210 280 m



Map 2

Soil Strip & Screening
Bund Construction

Noise Contour Plan

Signs and symbols

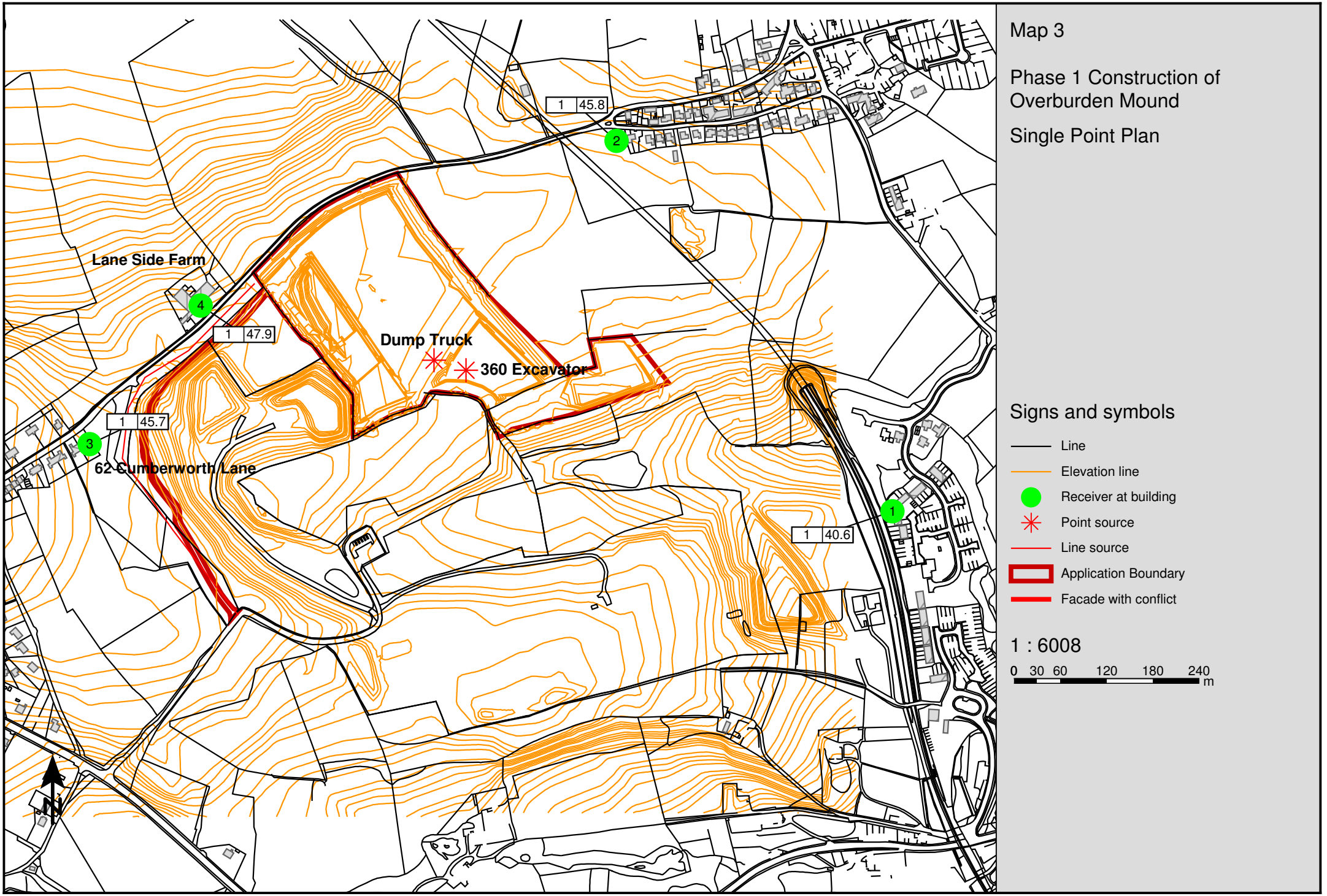
- Line
- Elevation line
- Point source
- Application Boundary

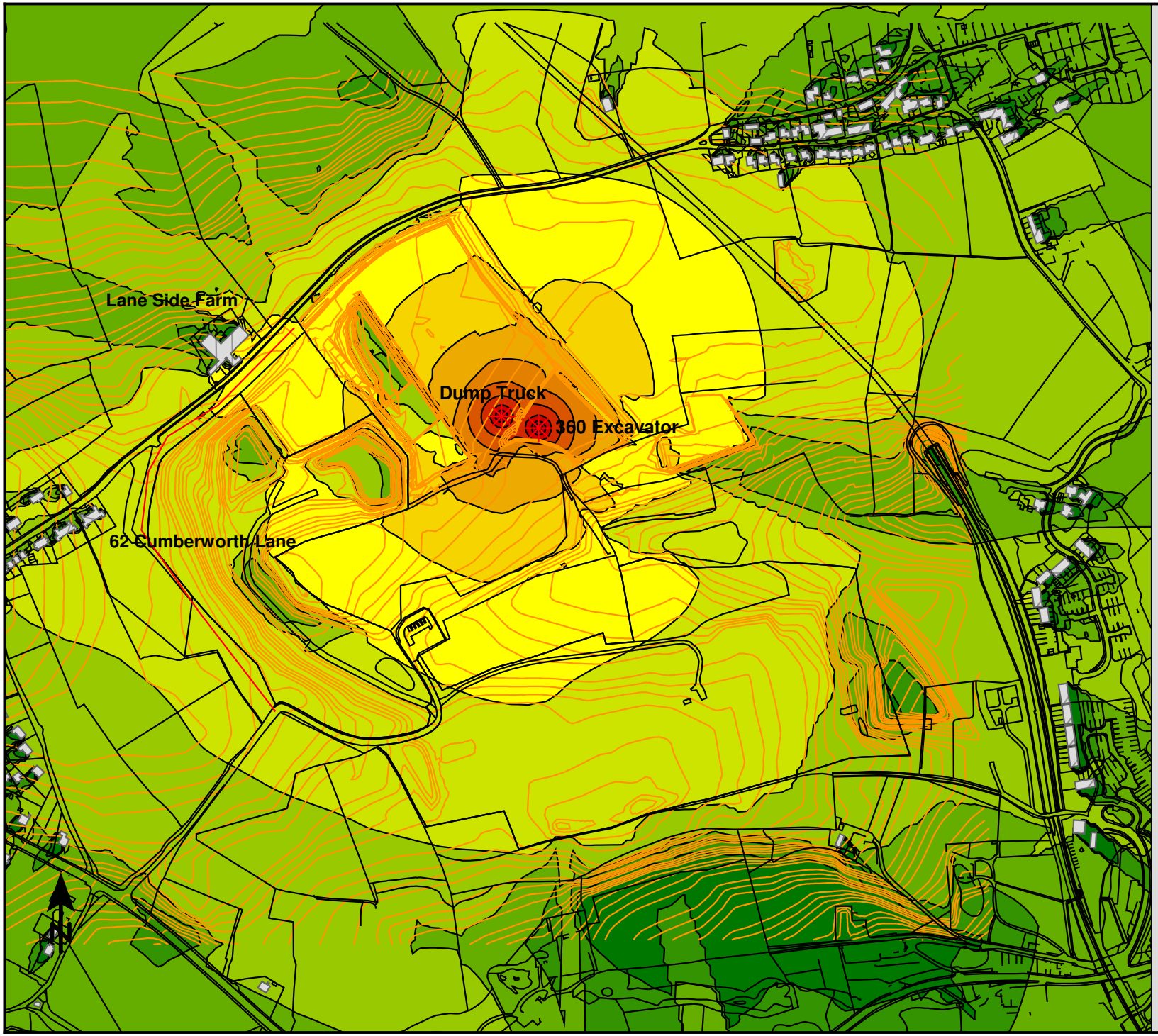
Levels in dB(A)

<=	30
30 -	40
40 -	50
50 -	60
60 -	70
70 -	80
80 -	90
>	90

1 : 6860

0 35 70 140 210 280 m


Map 3
Phase 1 Construction of Overburden Mound
Single Point Plan
1 45.8
2
Lane Side Farm
4
1 47.9
Dump Truck
360 Excavator
1 45.7
3
62 Cumberworth Lane
1
1 40.6
Signs and symbols
Line
Elevation line
Receiver at building
Point source
Line source
Application Boundary
Facade with conflict
1 : 6008
0 30 60 120 180 240
m



Map 4

Phase 1 Construction of Overburden Mound

Signs and symbols

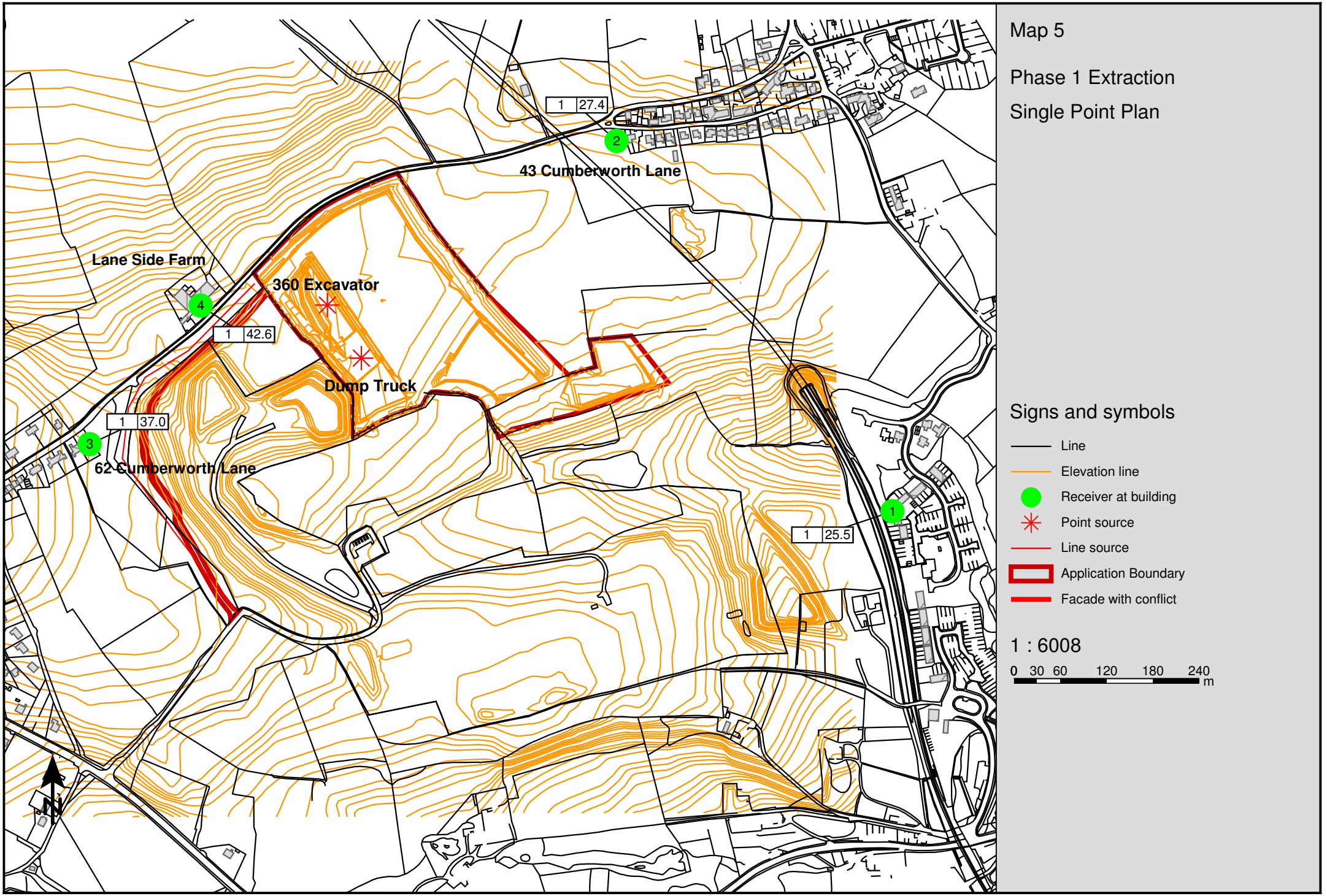
- Line
- Elevation line
- Point source
- Line source
- Application Boundary

Levels in dB(A)

	<=	25
25	-	30
30	-	35
35	-	40
40	-	45
45	-	50
50	-	55
55	-	60
60	-	65
65	-	70
70	-	75
75	-	80
80	-	85
85	-	90
90	-	95
	>	95

1 : 6008

0 30 60 120 180 240 m



Map 5

Phase 1 Extraction

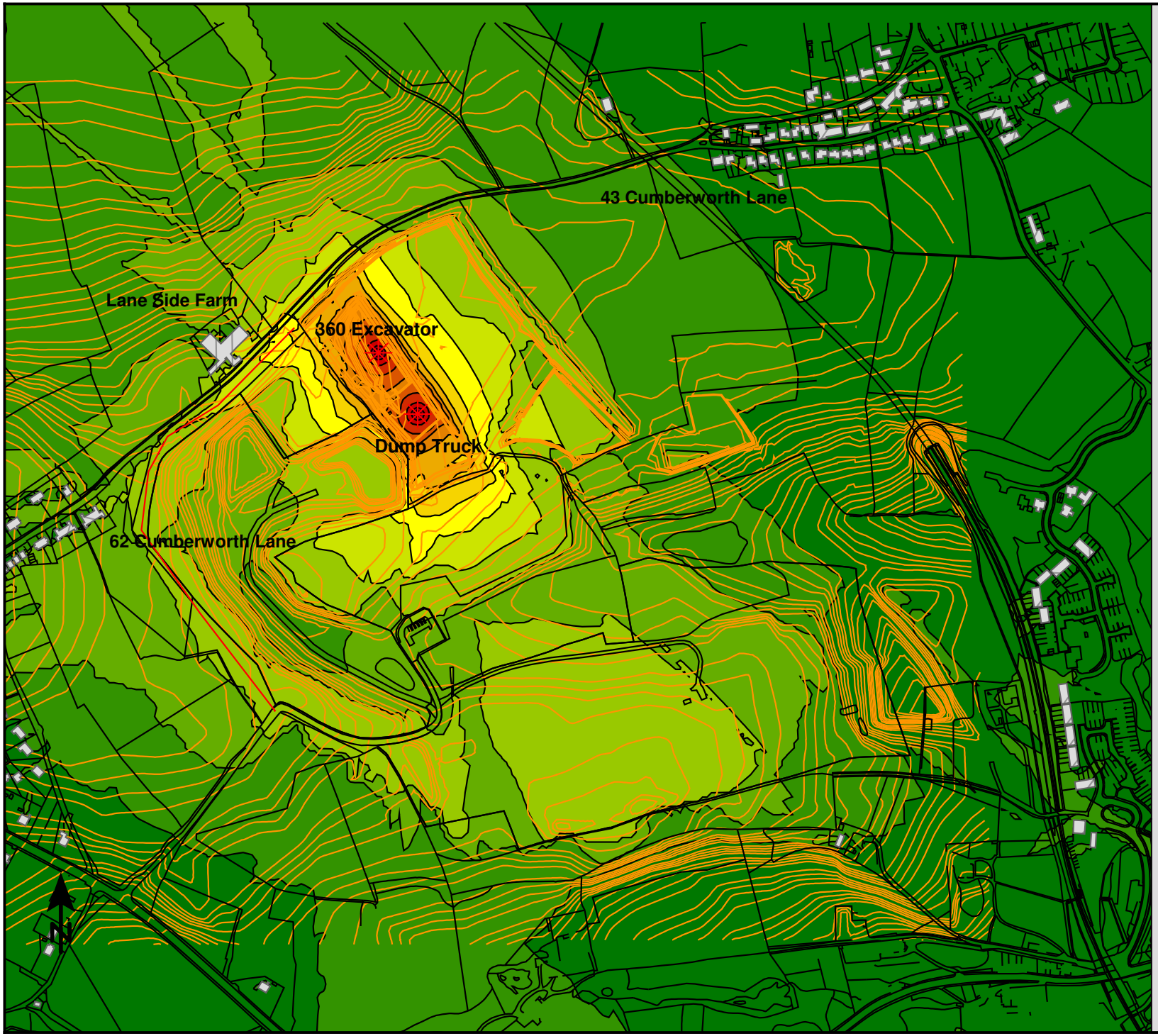
Single Point Plan

Signs and symbols

- Line
- Elevation line
- Receiver at building
- Point source
- Line source
- Application Boundary
- Facade with conflict

1 : 6008

0 30 60 120 180 240 m



Map 6

Phase 1 Extraction

Noise Contour Plan

Signs and symbols

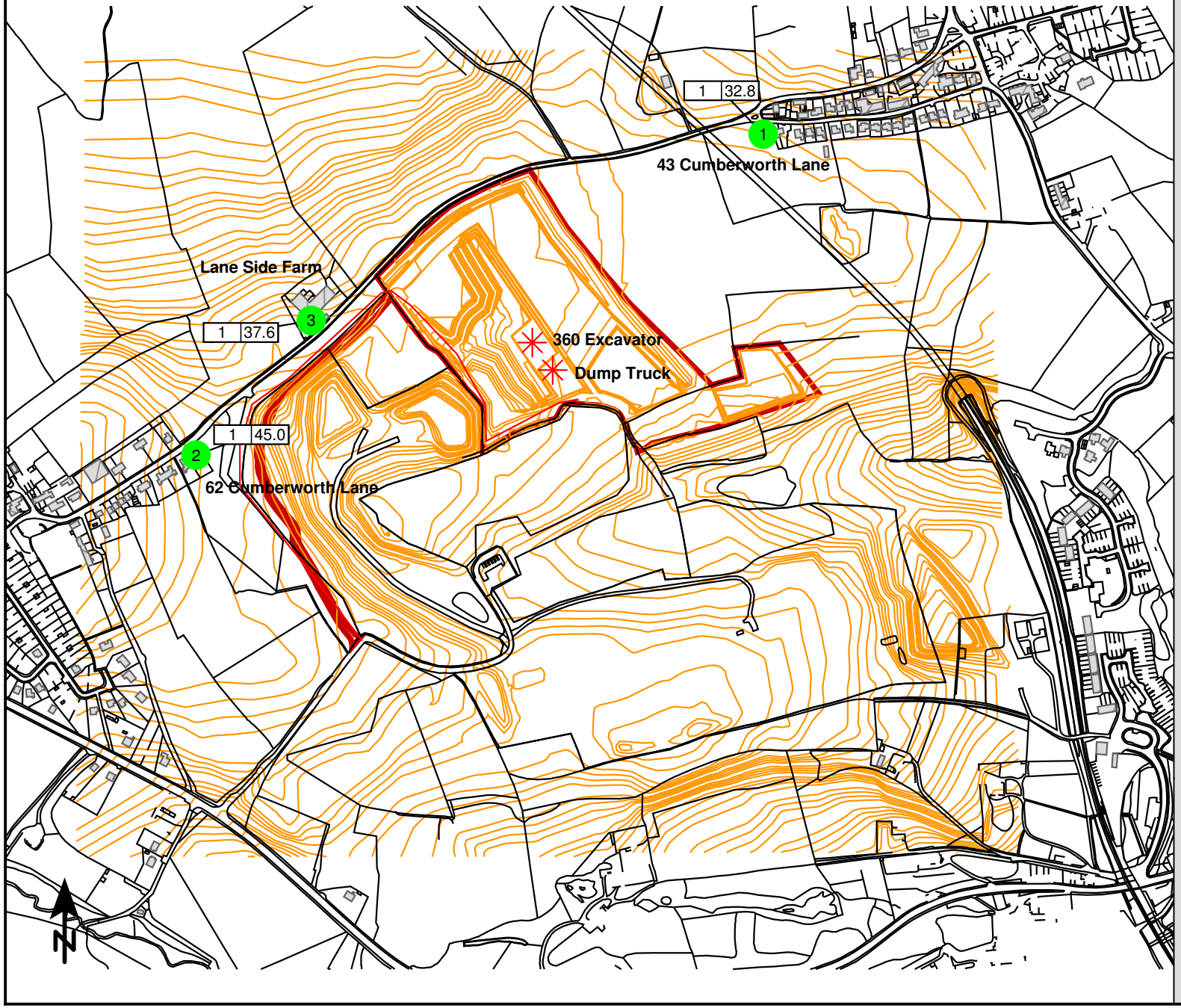
- Line
- Elevation line
- Point source
- Line source
- Application Boundary

Levels in dB(A)

<=	25
25 -	30
30 -	35
35 -	40
40 -	45
45 -	50
50 -	55
55 -	60
60 -	65
65 -	70
70 -	75
75 -	80
80 -	85
85 -	90
90 -	95
>	95

1 : 6008

0 30 60 120 180 240 m



Map 7

Phase 3 Extraction

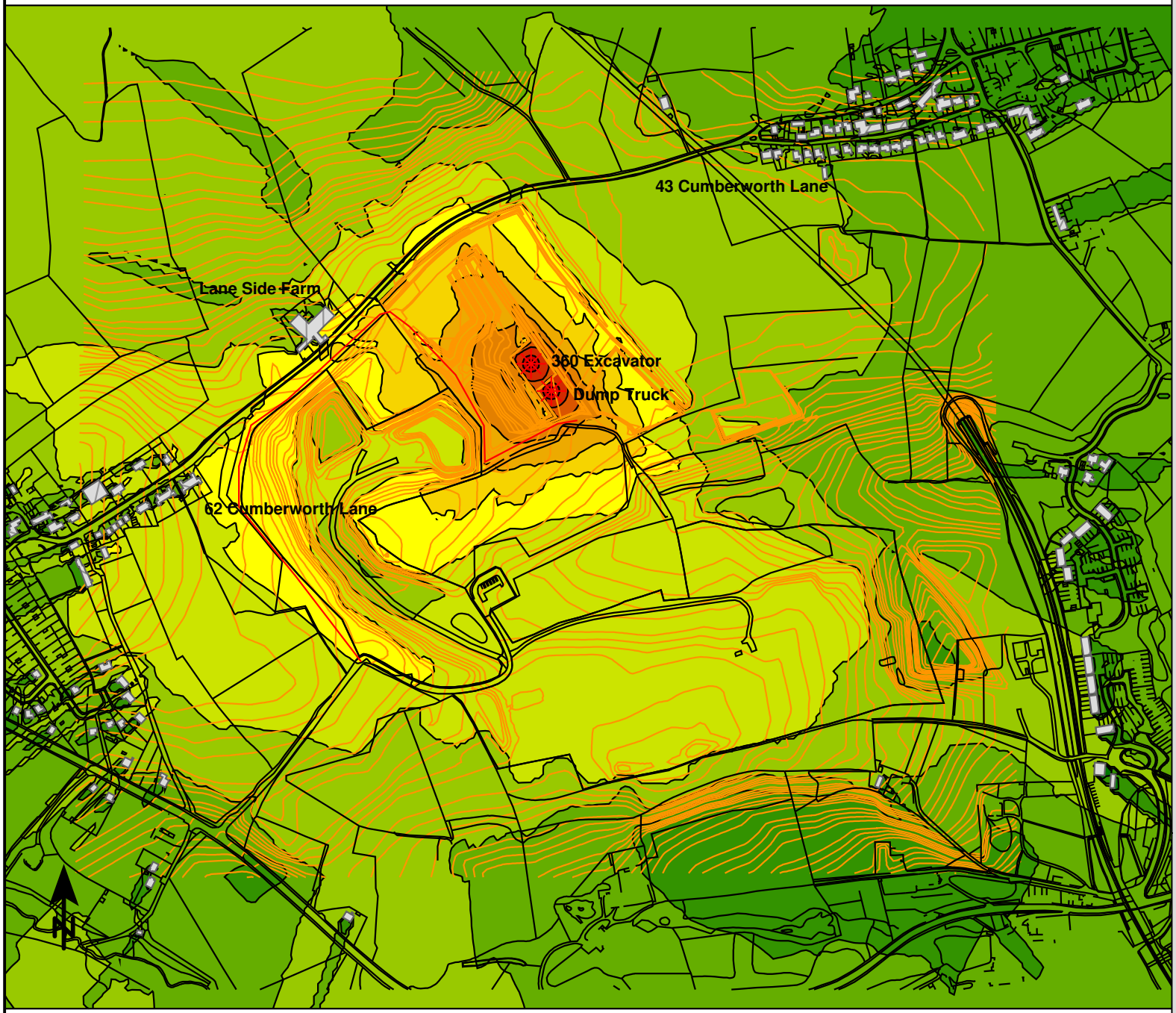
Single Point Map

Signs and symbols

- Line
- Elevation line
- Receiver at building
- Point source
- Line source
- Application Boundary
- Facade with conflict

1 : 6860

0 35 70 140 210 280 m



Map 8

Phase 3 Extraction

Noise Contour Plan

Signs and symbols

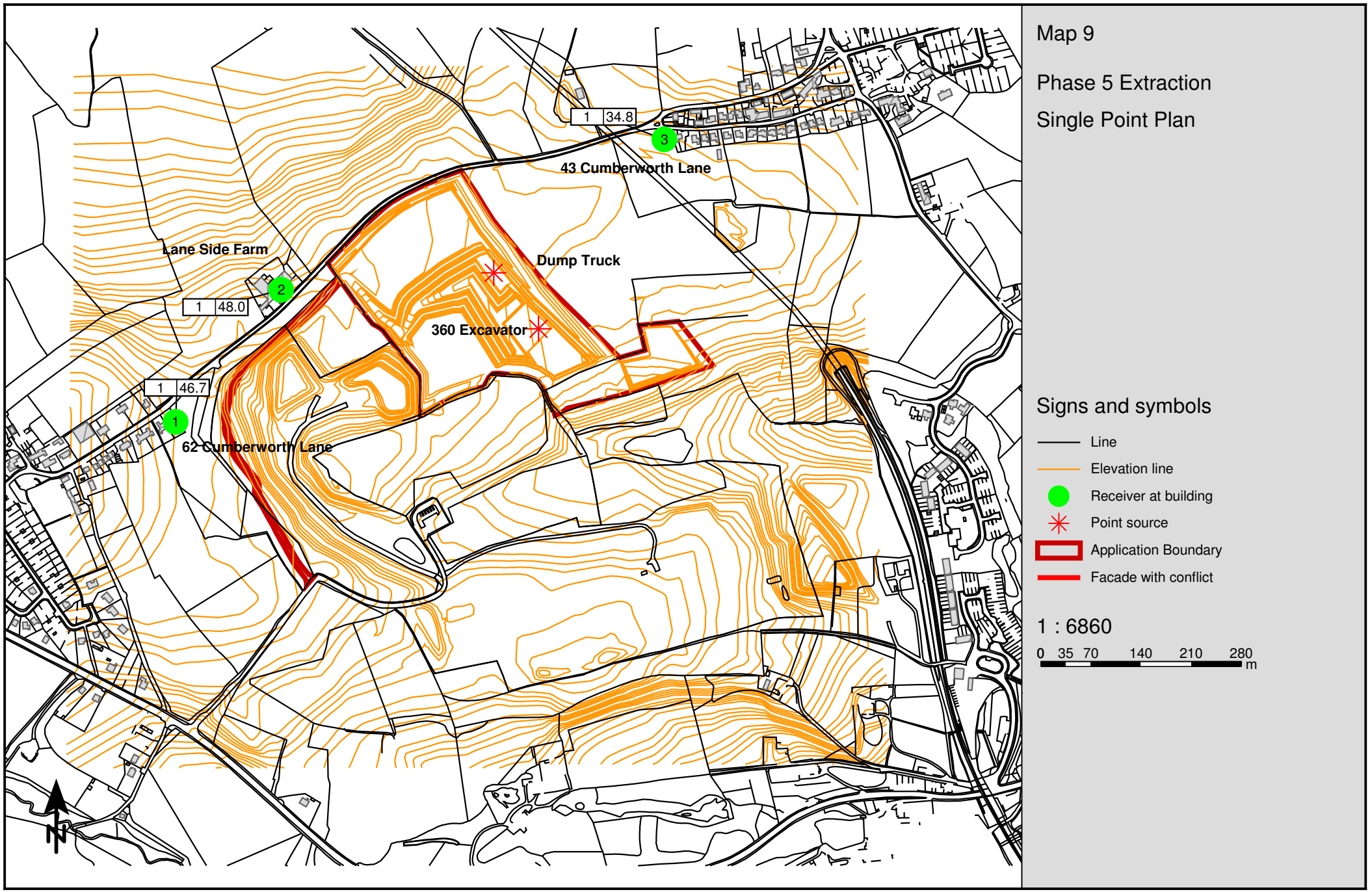
- Line
- Elevation line
- Point source
- Line source
- Application Boundary

Levels in dB(A)

<=	18
18 -	24
24 -	30
30 -	36
36 -	42
42 -	48
48 -	54
54 -	60
60 -	66
66 -	72
72 -	78
78 -	84
84 -	90
90 -	96
>	96

1 : 6860

0 35 70 140 210 280 m



Map 9

Phase 5 Extraction

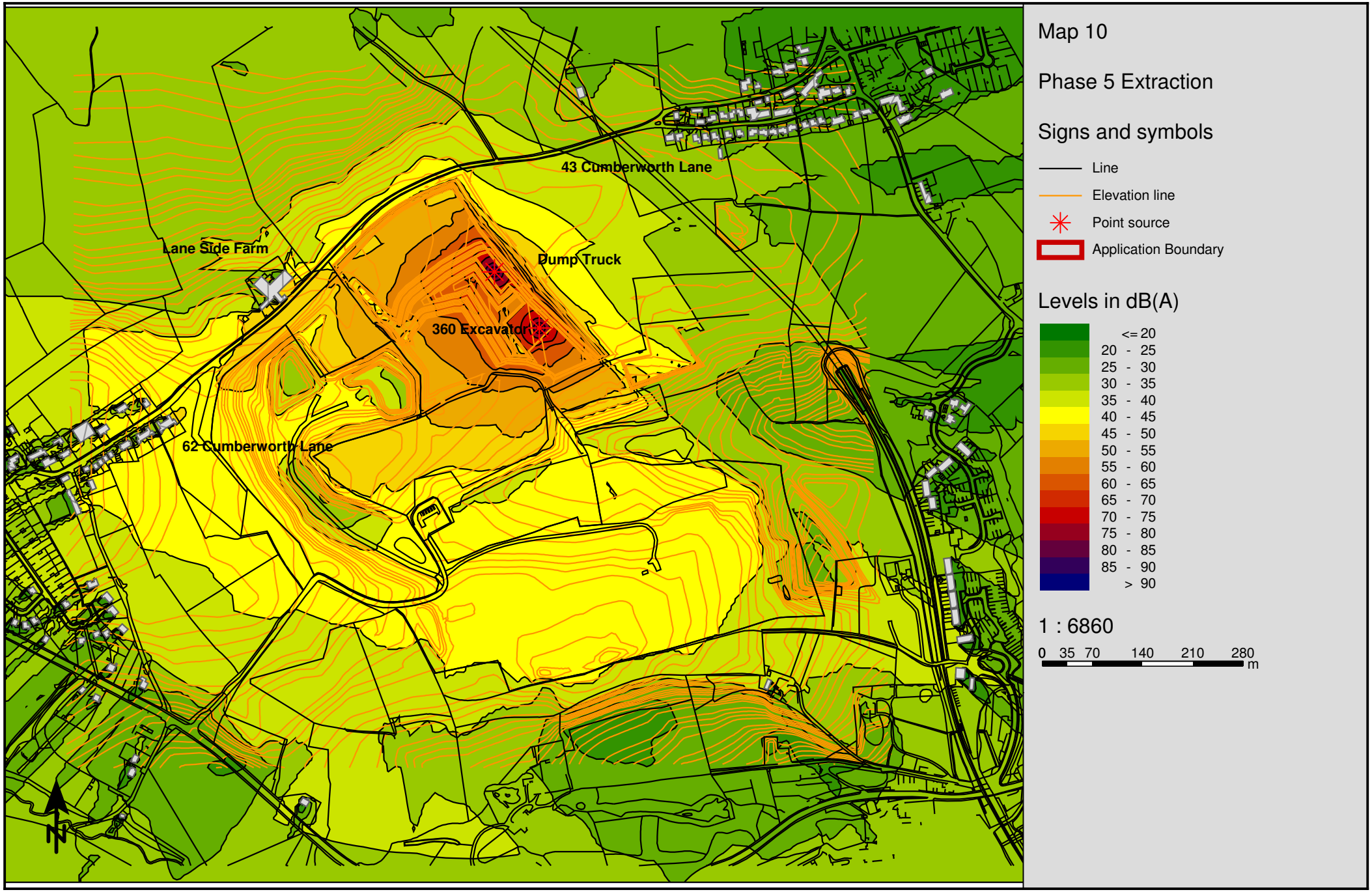
Single Point Plan

Signs and symbols

- Line
- Elevation line
- Receiver at building
- Point source
- Application Boundary
- Facade with conflict

1 : 6860

0 35 70 140 210 280 m



Map 10

Phase 5 Extraction

Signs and symbols

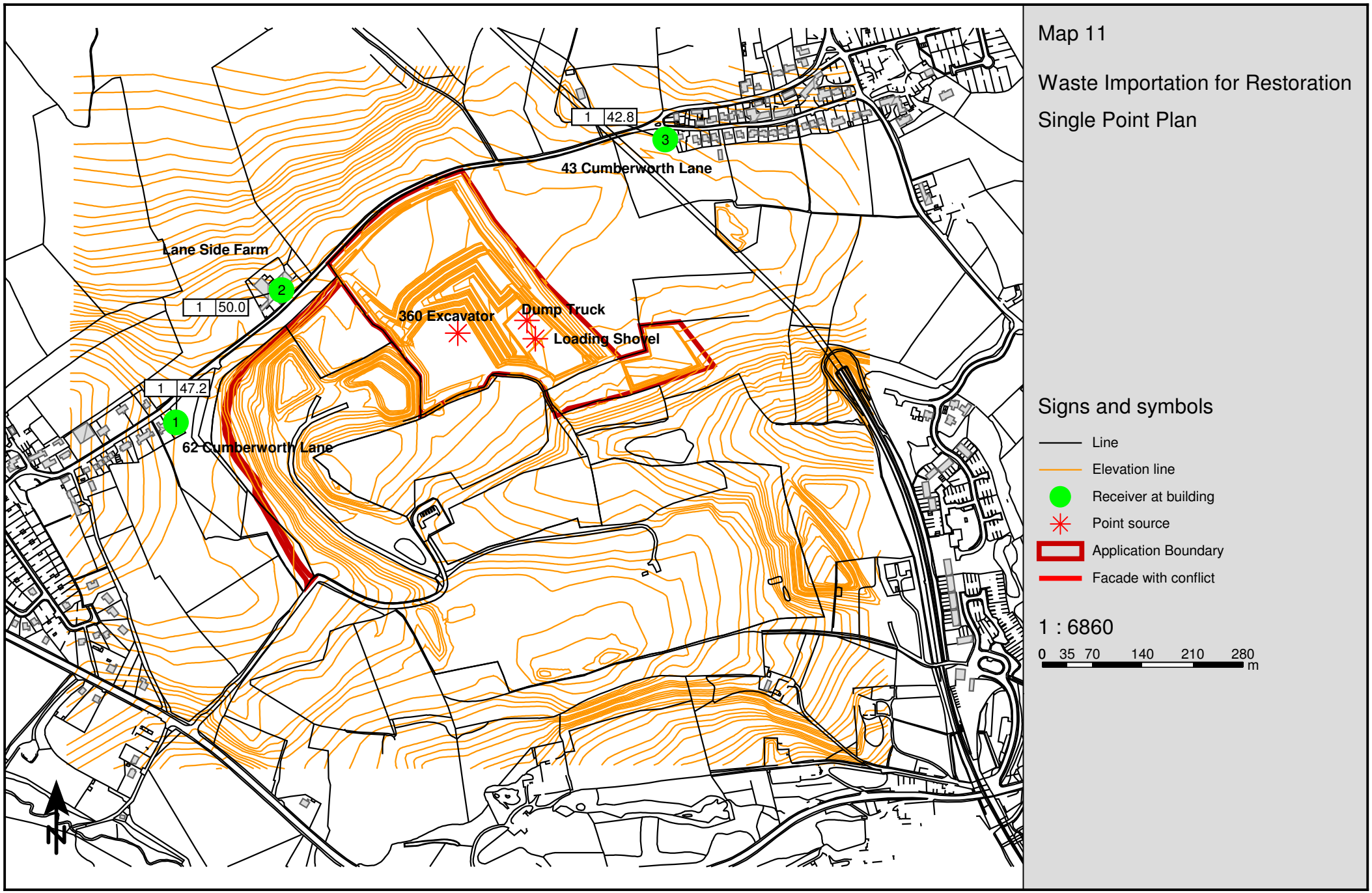
- Line
- Elevation line
- Point source
- Application Boundary

Levels in dB(A)

<= 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
> 90

1 : 6860

0 35 70 140 210 280 m



Map 11

Waste Importation for Restoration

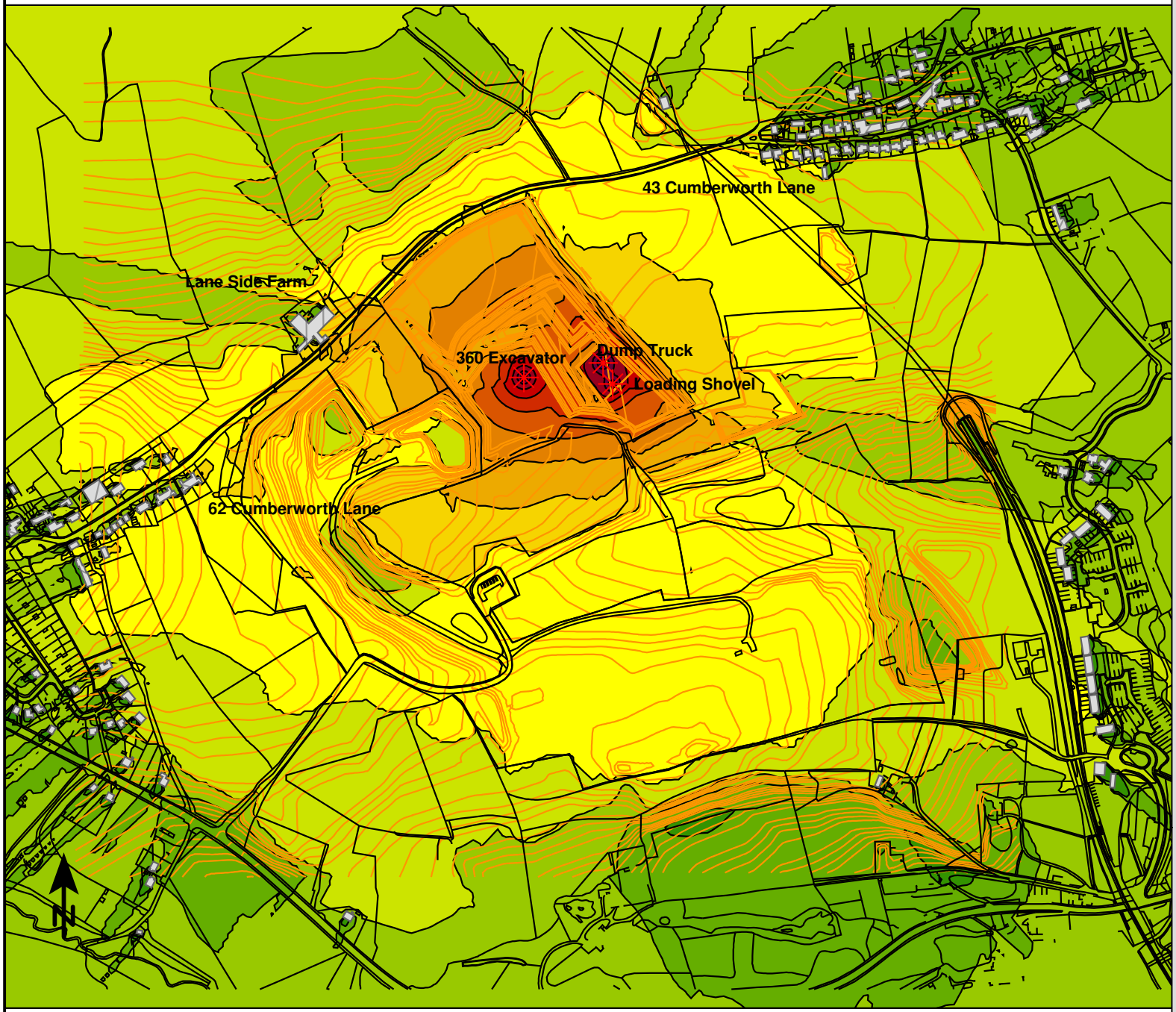
Single Point Plan

Signs and symbols

- Line
- Elevation line
- Receiver at building
- Point source
- Application Boundary
- Facade with conflict

1 : 6860

0 35 70 140 210 280 m



Map 12

Waste Importation for Restoration

Noise Contour Plan

Signs and symbols

- Line
- Elevation line
- Point source
- Application Boundary

Levels in dB(A)

<= 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
> 90

1 : 6860

0 35 70 140 210 280 m

APPENDIX C

Noise Survey Results

Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 12:12□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Calibrated to:□	93.7 dB□dB□
Calibration Offset:□	0.5 dB□dB□

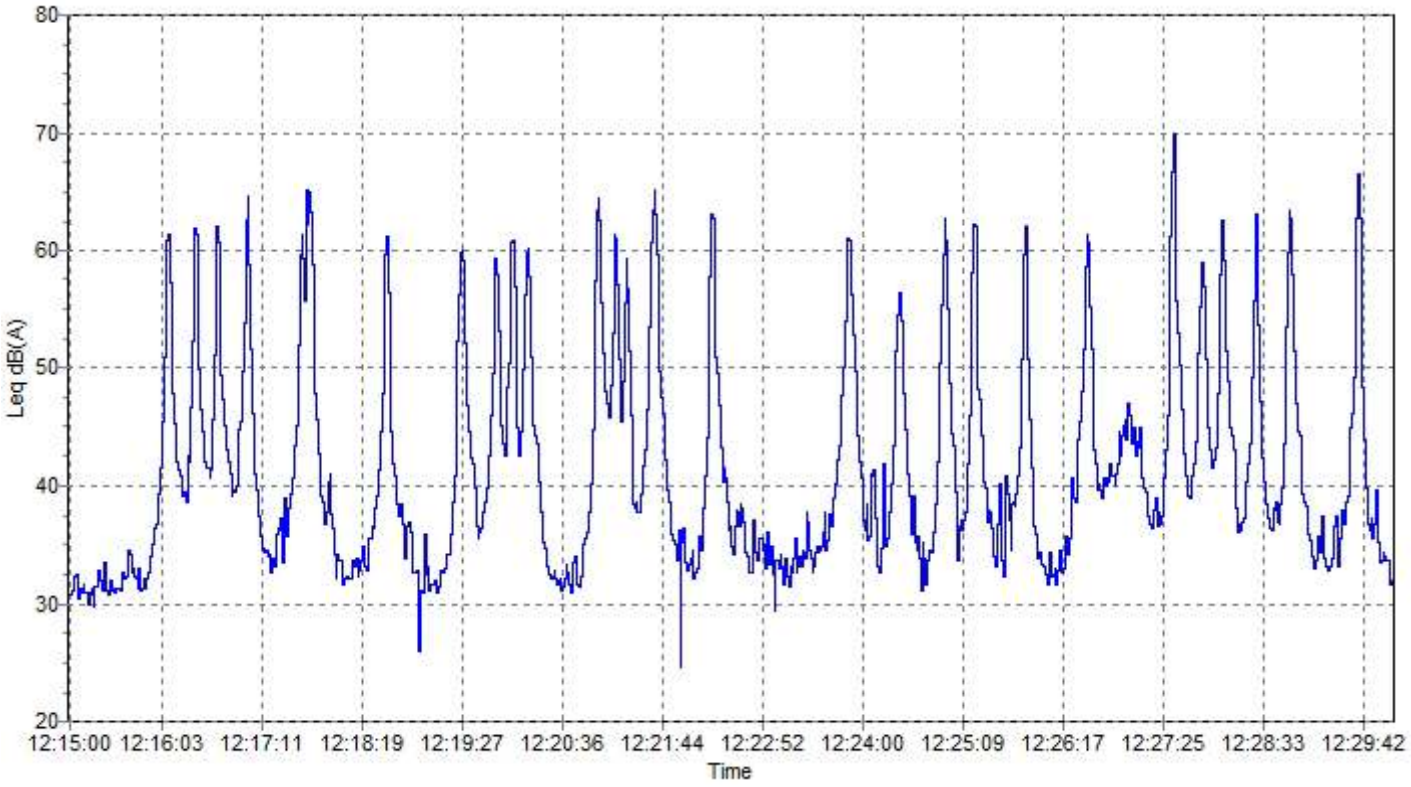
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 12:15□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:01□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	52.5□dBA□	L1.0□	63.6□dBA□
Lepd□	37.4□dBA□	L10.0□	55.9□dBA□
LAE□	81.8□dBA□	L50.0□	38.5□dBA□
LAFmax□	70.8□dBA□	L90.0□	32.3□dBA□
Peak□	93.0□dBC□	L95.0□	31.6□dBA□
		Lmin□	29.7□dBA□



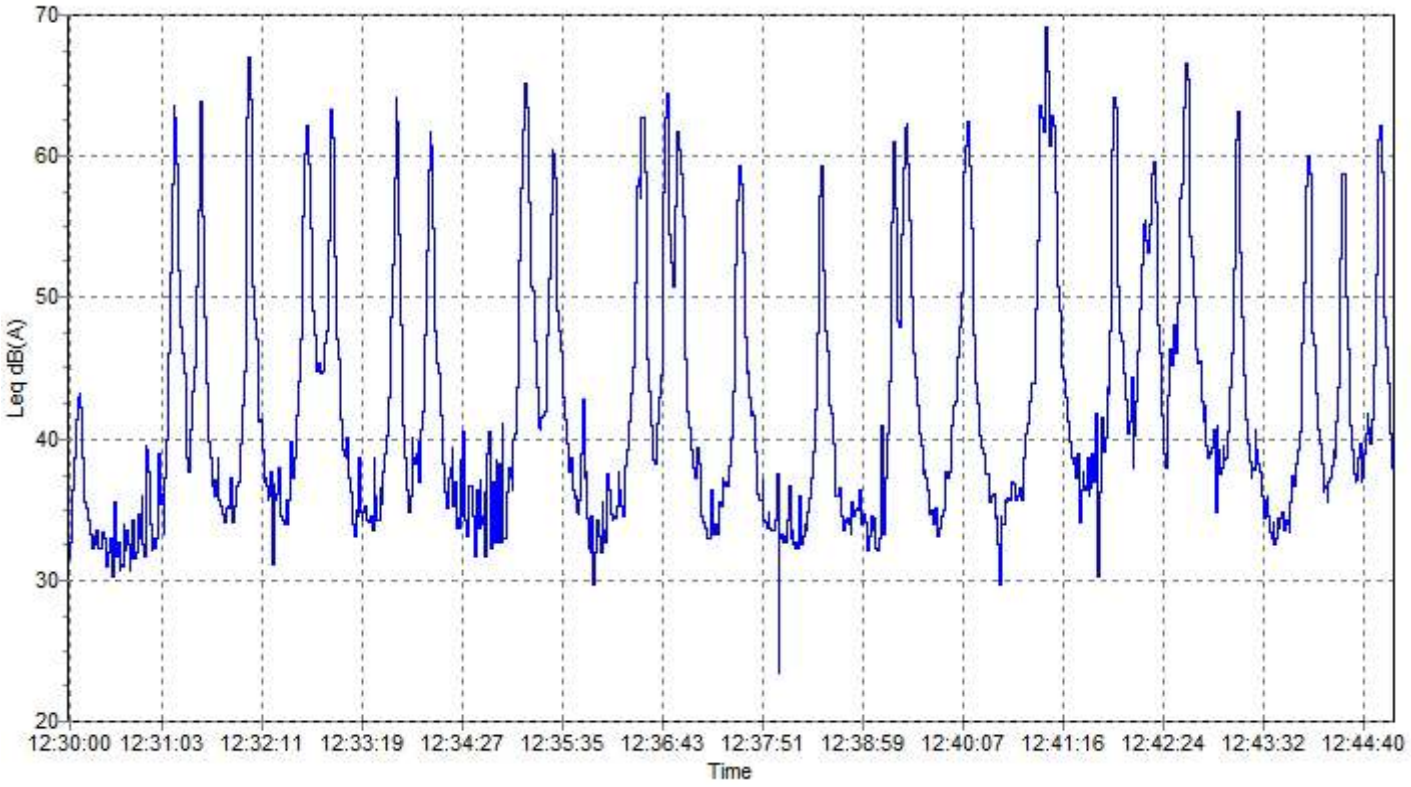
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 12:30□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	53.1□dBA□	L1.0□	64.4□dBA□
Lepd□	38.1□dBA□	L10.0□	57.5□dBA□
LAE□	82.5□dBA□	L50.0□	38.9□dBA□
LAFmax□	70.0□dBA□	L90.0□	33.3□dBA□
Peak□	96.9□dBC□	L95.0□	32.4□dBA□
		Lmin□	30.2□dBA□



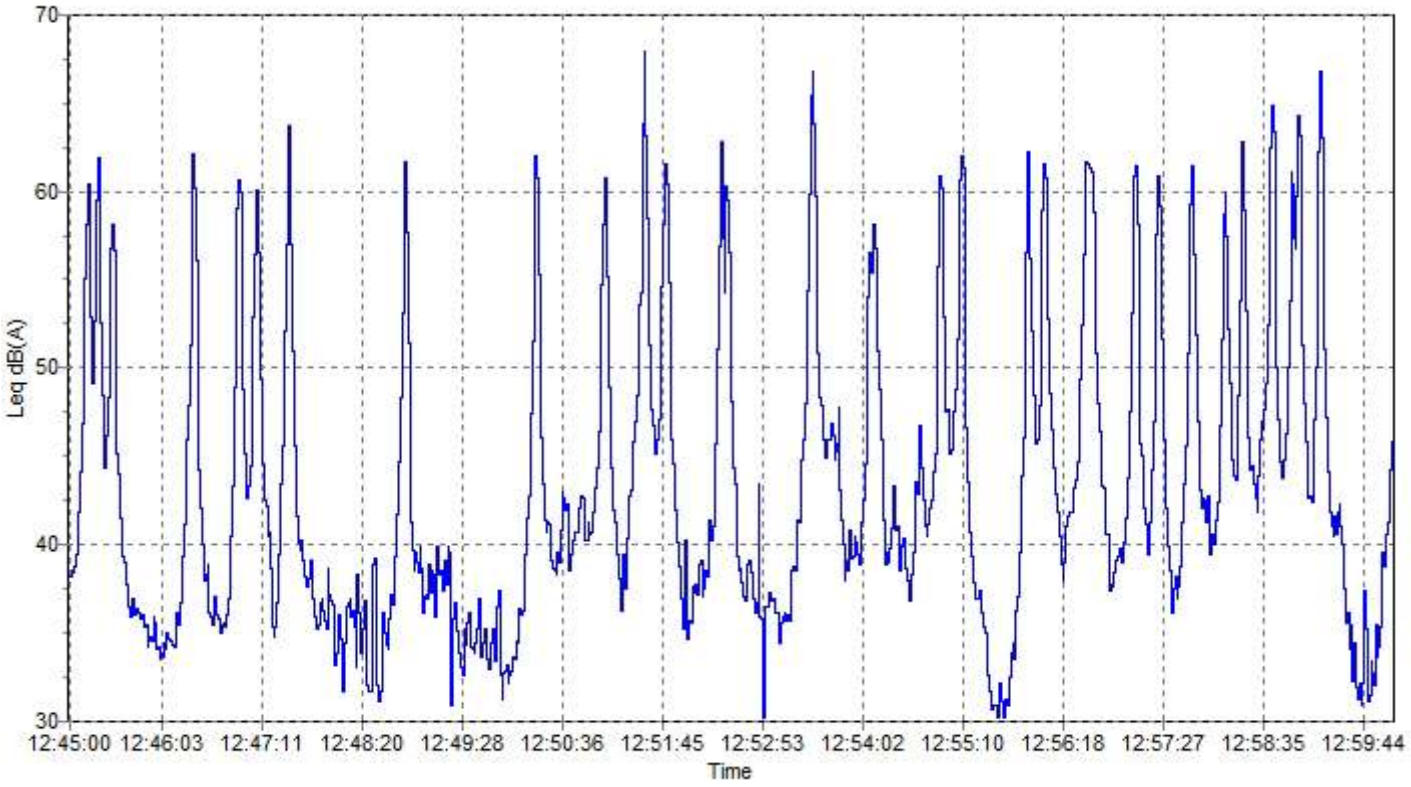
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 12:45□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	52.6□dBA□	L1.0□	63.6□dBA□
Lepd□	37.6□dBA□	L10.0□	57.3□dBA□
LAE□	82.0□dBA□	L50.0□	40.9□dBA□
LAFmax□	68.7□dBA□	L90.0□	34.2□dBA□
Peak□	92.4□dBC□	L95.0□	32.7□dBA□
		Lmin□	29.7□dBA□



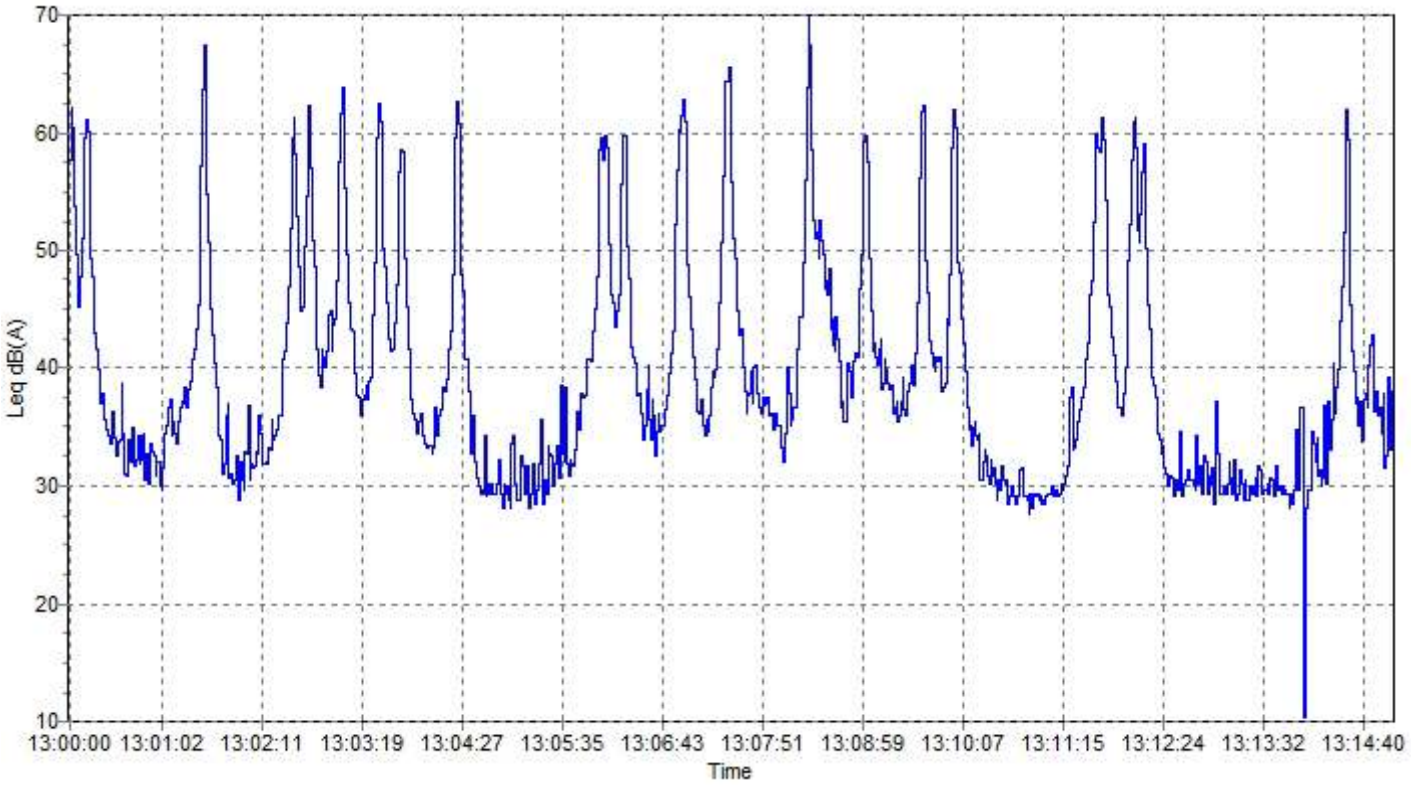
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 13:00□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:01□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	51.7□dBA□	L1.0□	63.4□dBA□
Lepd□	36.6□dBA□	L10.0□	54.3□dBA□
LAE□	81.0□dBA□	L50.0□	36.6□dBA□
LAFmax□	71.5□dBA□	L90.0□	29.6□dBA□
Peak□	94.6□dBC□	L95.0□	29.2□dBA□
		Lmin□	28.1□dBA□



Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 10:53□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Calibrated to:□	93.7 dB□dB□
Calibration Offset:□	-0.3 dB□dB□

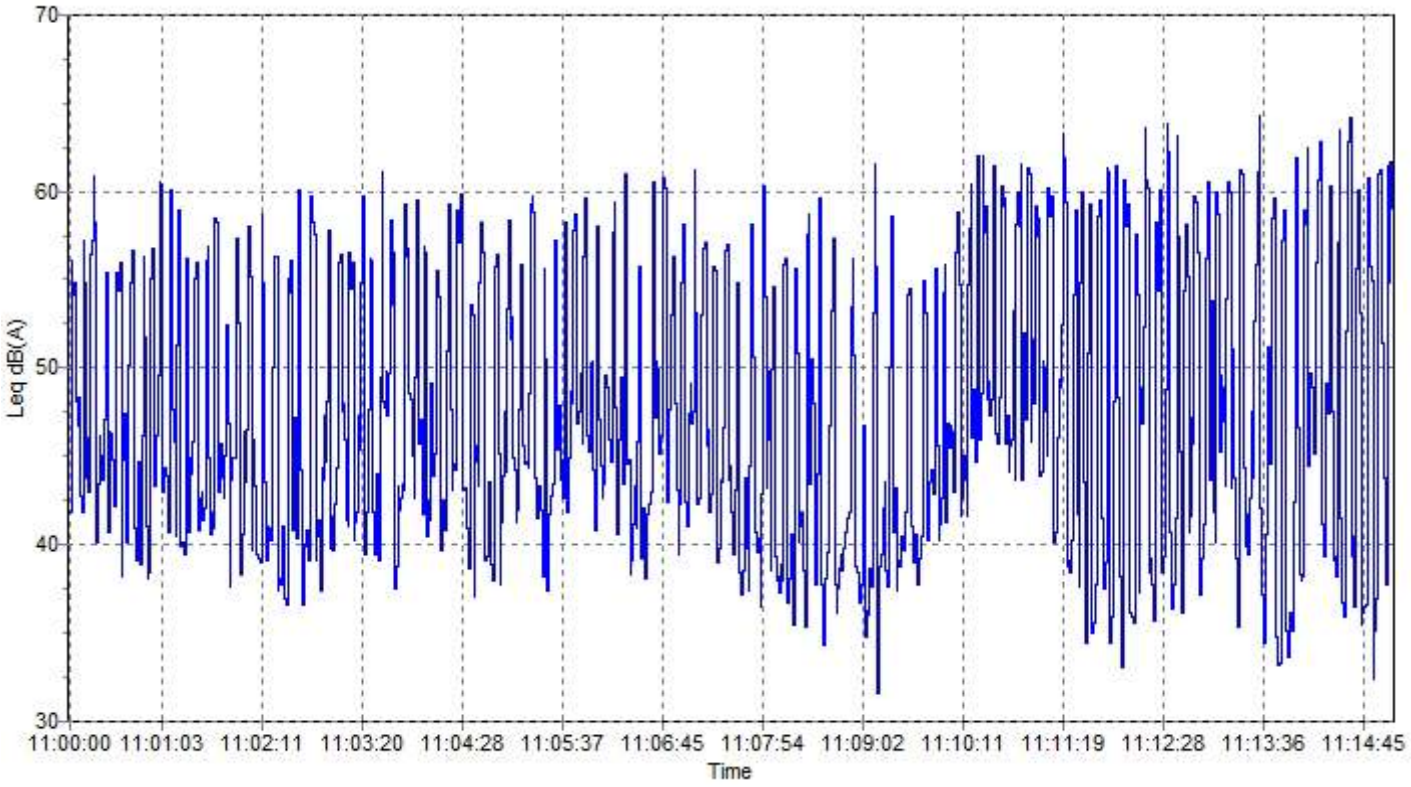
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 11:00□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	53.7□dBA□	L1.0□	64.0□dBA□
Lepd□	38.6□dBA□	L10.0□	58.0□dBA□
LAE□	83.0□dBA□	L50.0□	43.7□dBA□
LAFmax□	69.8□dBA□	L90.0□	36.8□dBA□
Peak□	31.0□dBC□	L95.0□	35.4□dBA□
		Lmin□	30.5□dBA□



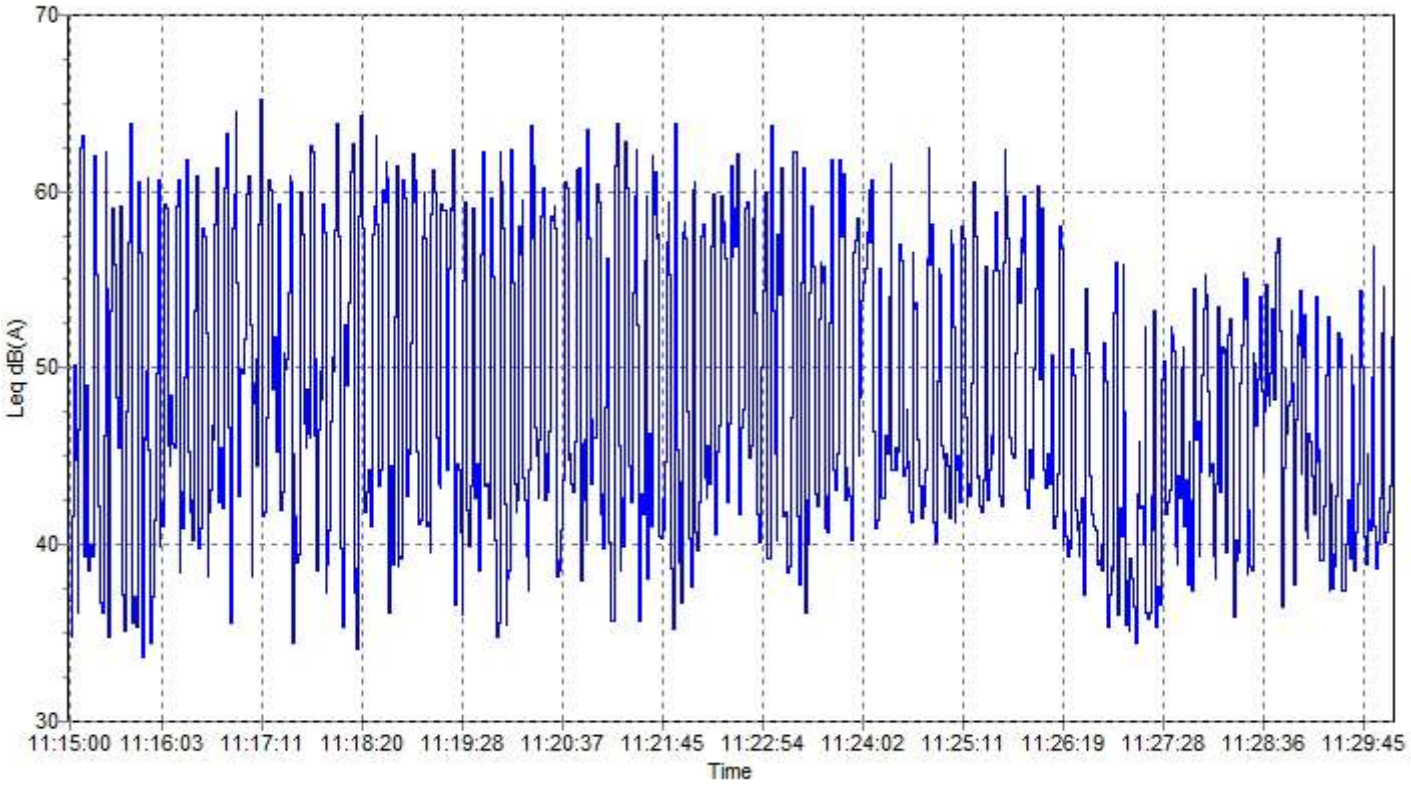
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 11:15□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:01□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	54.6□dBA□	L1.0□	64.9□dBA□
Lepd□	39.6□dBA□	L10.0□	59.0□dBA□
LAE□	84.0□dBA□	L50.0□	44.2□dBA□
LAFmax□	69.5□dBA□	L90.0□	37.2□dBA□
Peak□	31.0□dBC□	L95.0□	35.7□dBA□
		Lmin□	30.7□dBA□



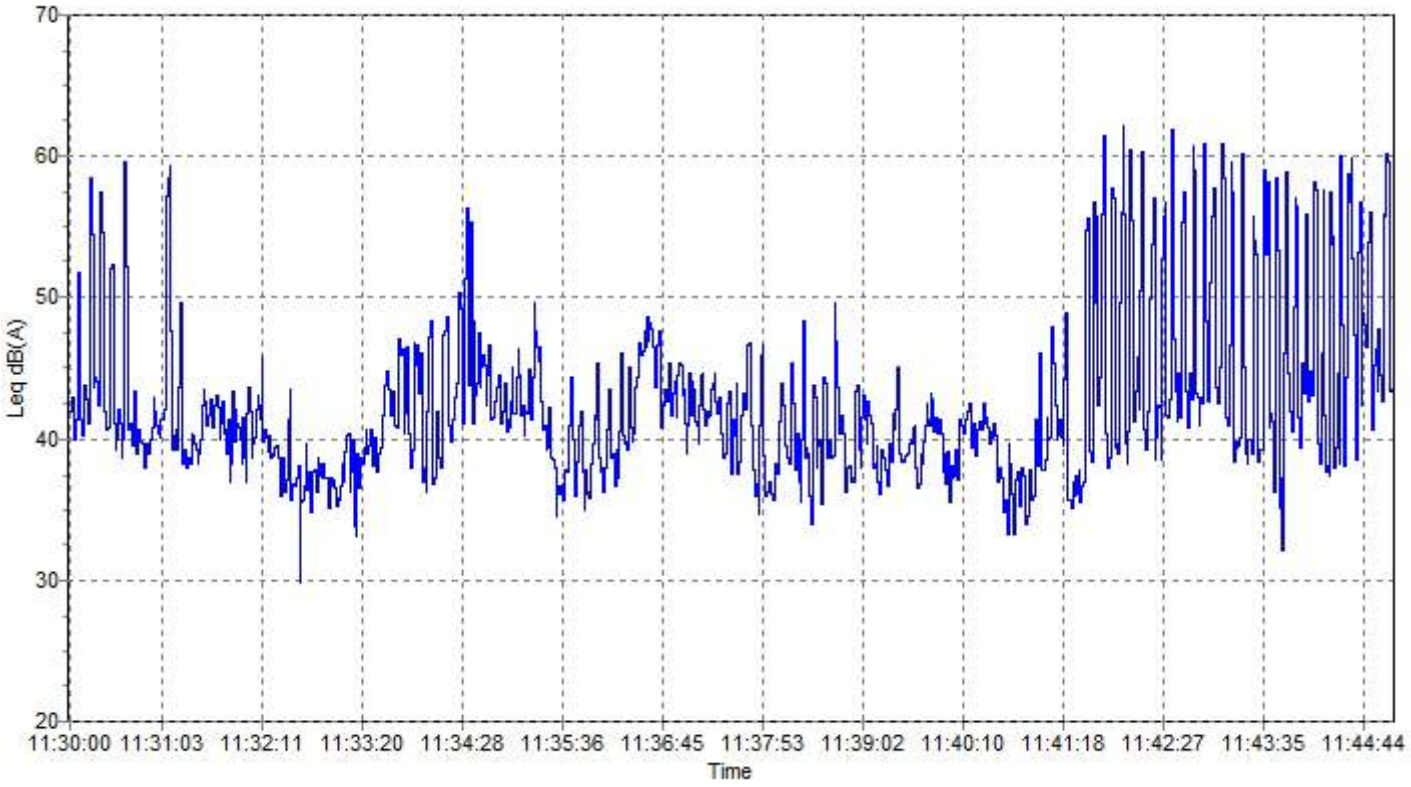
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 11:30□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:01□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	48.4□dBA□	L1.0□	60.4□dBA□
Lepd□	33.3□dBA□	L10.0□	47.8□dBA□
LAE□	77.7□dBA□	L50.0□	40.0□dBA□
LAFmax□	66.1□dBA□	L90.0□	35.8□dBA□
Peak□	31.0□dBC□	L95.0□	34.8□dBA□
		Lmin□	31.8□dBA□



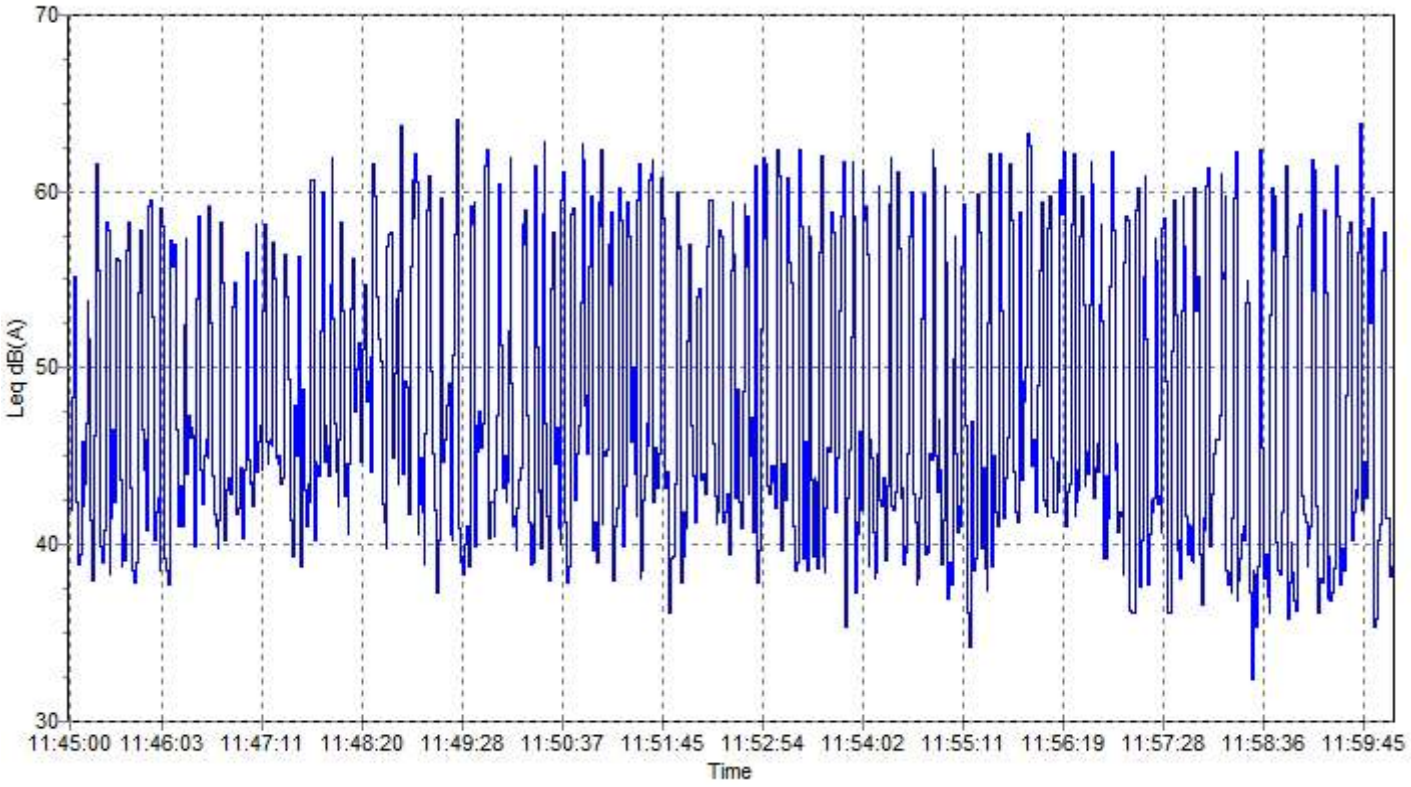
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 11:45□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	54.3□dBA□	L1.0□	64.4□dBA□
Lepd□	39.2□dBA□	L10.0□	58.8□dBA□
LAE□	83.7□dBA□	L50.0□	43.4□dBA□
LAFmax□	68.4□dBA□	L90.0□	37.5□dBA□
Peak□	31.0□dBC□	L95.0□	36.4□dBA□
		Lmin□	31.3□dBA□



Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 13:29□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Calibrated to:□	93.7 dB□dB□
Calibration Offset:□	0.6 dB□dB□

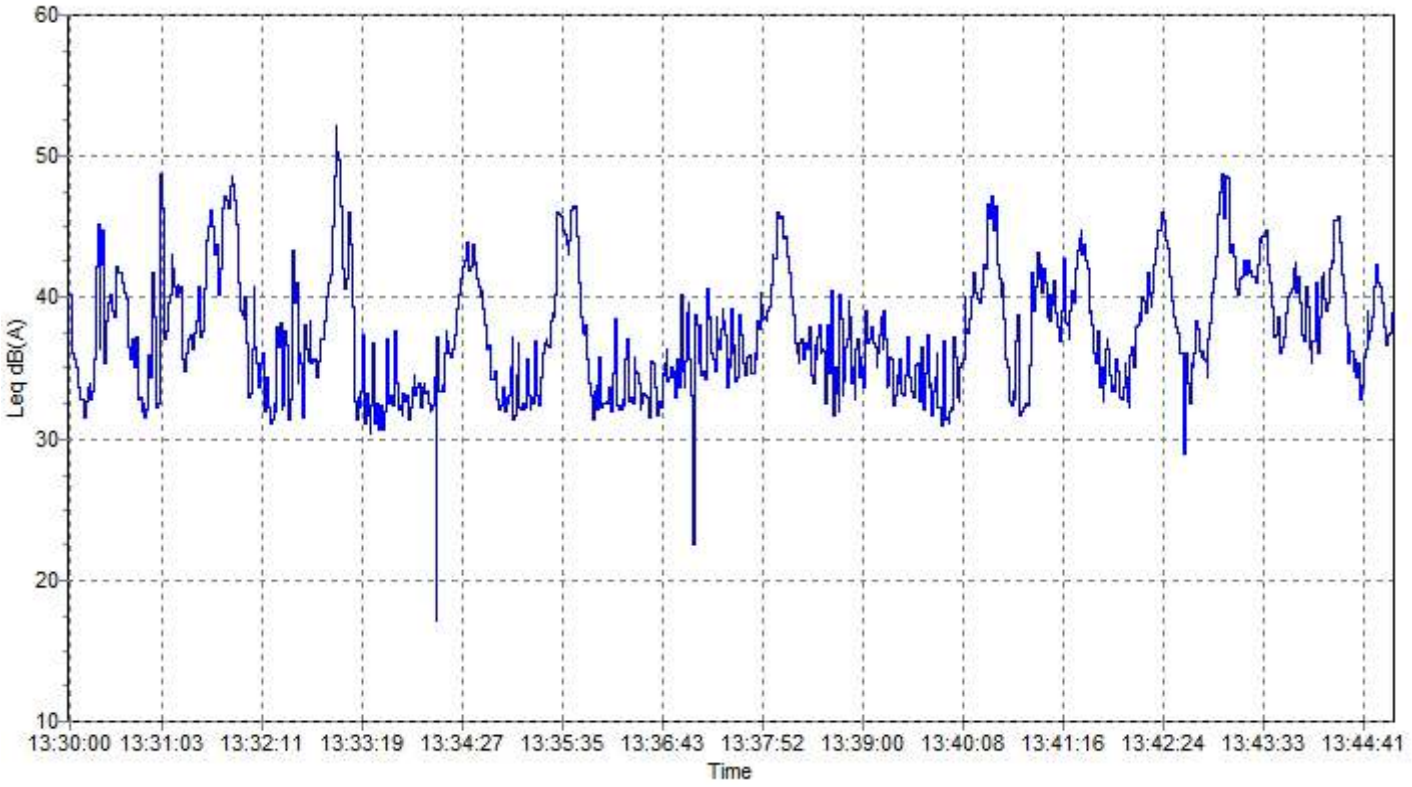
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 13:30□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	39.9□dBA□	L1.0□	48.0□dBA□
Lepd□	24.8□dBA□	L10.0□	43.4□dBA□
LAE□	69.2□dBA□	L50.0□	36.6□dBA□
LAFmax□	55.8□dBA□	L90.0□	32.2□dBA□
Peak□	83.5□dBC□	L95.0□	31.7□dBA□
		Lmin□	30.1□dBA□



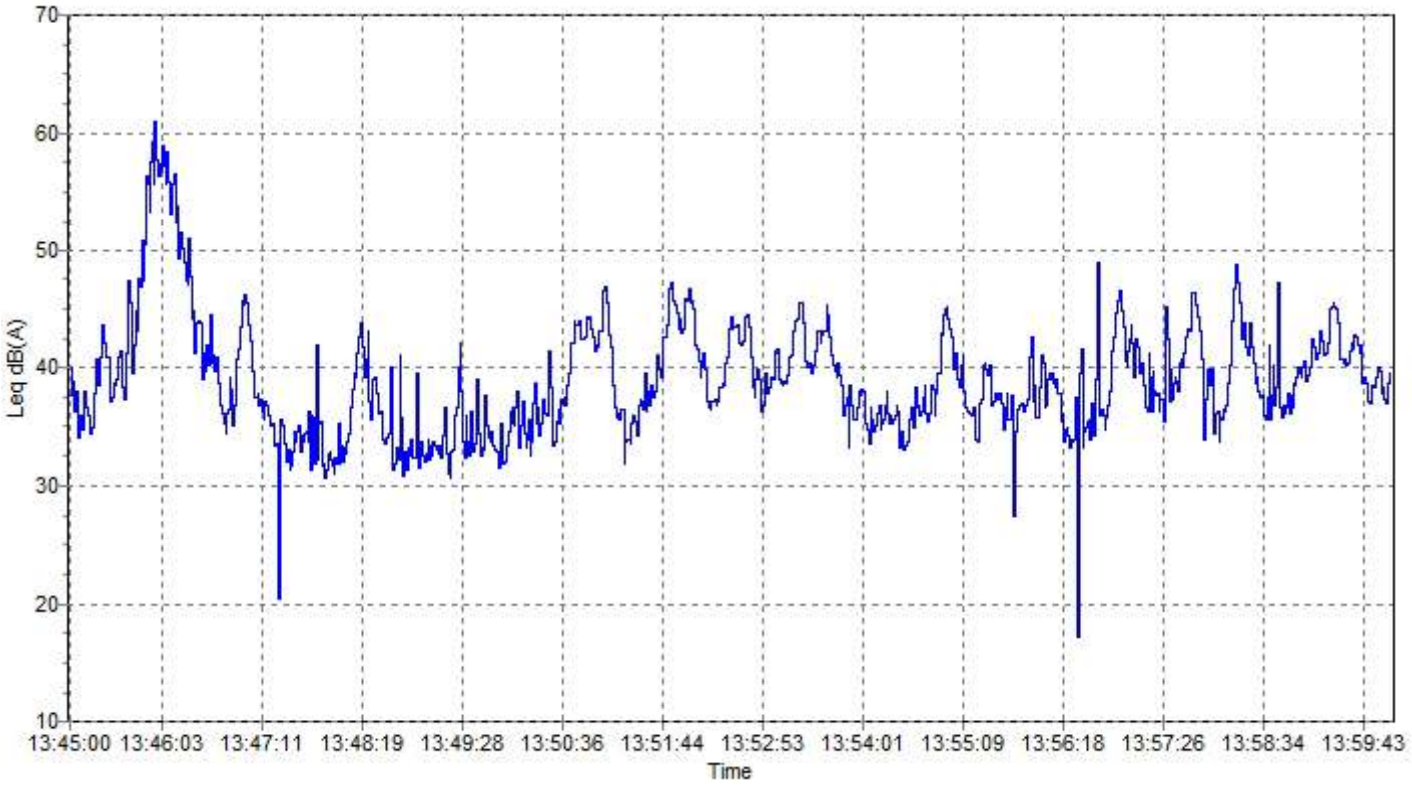
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 13:45□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:14:59□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	43.7□dBA□	L1.0□	56.4□dBA□
Lepd□	28.6□dBA□	L10.0□	44.7□dBA□
LAE□	73.0□dBA□	L50.0□	38.1□dBA□
LAFmax□	62.9□dBA□	L90.0□	33.1□dBA□
Peak□	86.3□dBC□	L95.0□	32.2□dBA□
		Lmin□	30.2□dBA□



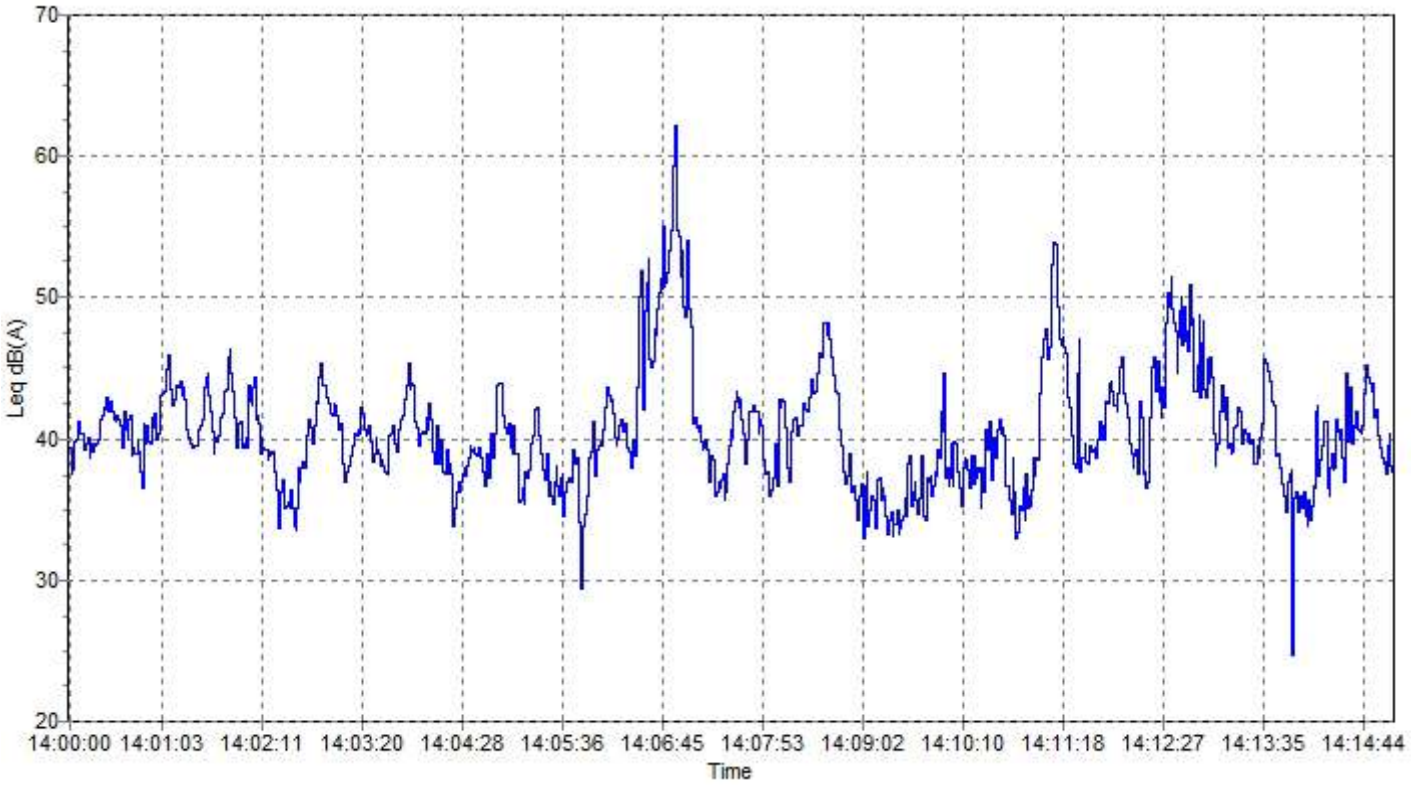
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 14:00□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:00□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	43.5□dBA□	L1.0□	53.4□dBA□
Lepd□	28.5□dBA□	L10.0□	45.2□dBA□
LAE□	72.9□dBA□	L50.0□	39.8□dBA□
LAFmax□	63.1□dBA□	L90.0□	35.7□dBA□
Peak□	89.2□dBC□	L95.0□	34.6□dBA□
		Lmin□	31.6□dBA□



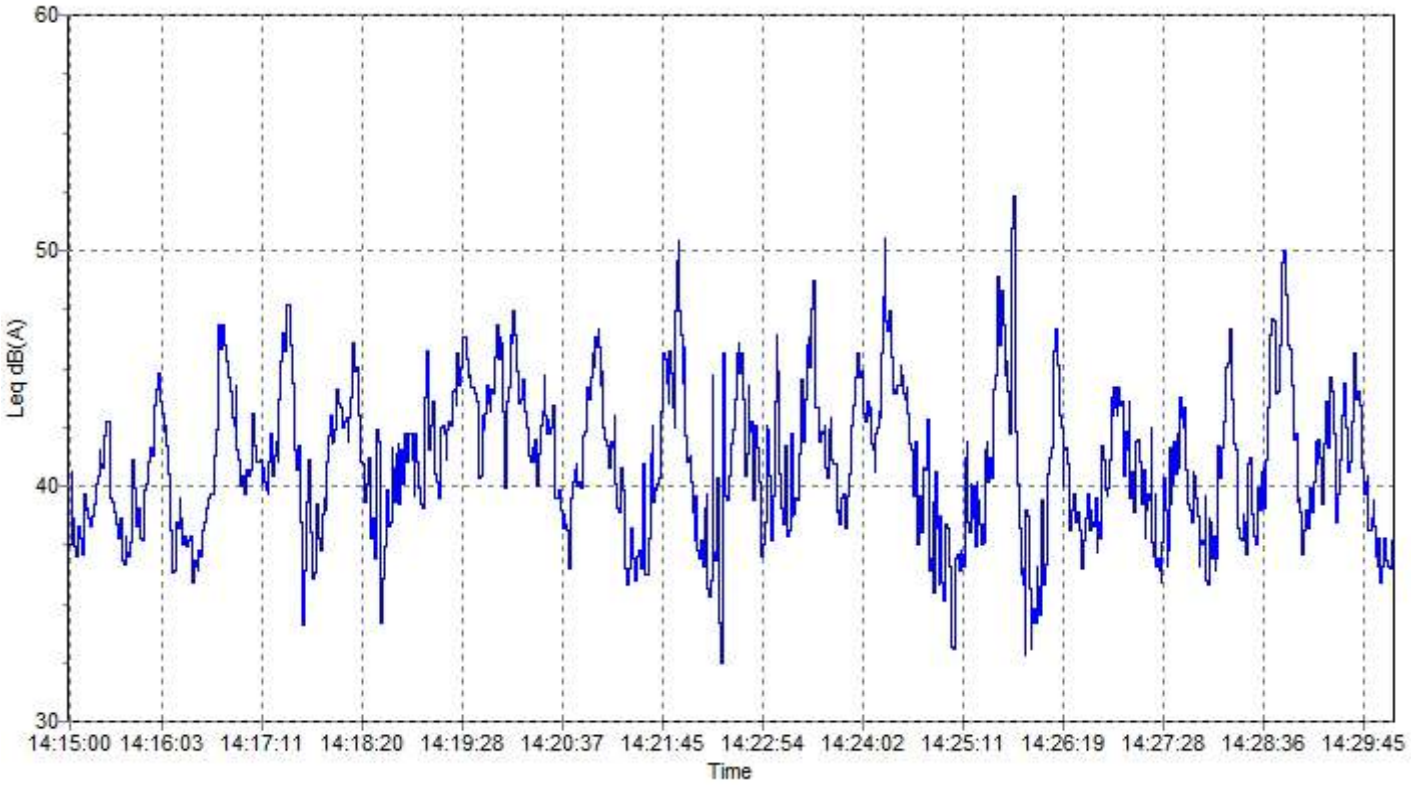
Measurement Report□

Measurement Details□

Date and Time:□	14/04/2022 14:15□
Sound Level Meter:□	Cirrus Research plc □
Recalibration Due:□	31/12/2022□
Run Duration:□	00:15:01□hh:mm:ss□
Range:□	30-100 □dB□
Overload:□	no□

Data□

Leq□	42.2□dBA□	L1.0□	48.5□dBA□
Lepd□	27.2□dBA□	L10.0□	45.1□dBA□
LAE□	71.6□dBA□	L50.0□	40.6□dBA□
LAFmax□	60.2□dBA□	L90.0□	36.7□dBA□
Peak□	76.7□dBC□	L95.0□	36.0□dBA□
		Lmin□	32.1□dBA□



APPENDIX D

Noise Survey Log Sheets

SILKSTONE ENVIRONMENTAL LTD

NOISE MONITORING RECORD SHEET

SURVEY DETAILS

Job Title:	Bromley Farm Extension
Location (Name/Grid Ref.):	1
Address (if applicable):	

Technician:	P Stewart
Date:	14/04/2022

Pre-Survey Calibration (Yes/No)	Yes
Start Time (00:00 hrs)	12:12
Finish Time (00:00 hrs)	13:15

Job Details

Calibrator		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 515/45577	167017	06/12/2022

Sound Level Meter		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 811B/ C19842FD	167012	06/12/2022

Noise Observations (Source Specific)	
Time	**Description/Details**
12:13	Aircraft
12:09	Tractor (Farm)
12:23:50	Car horn
12:26:38	Train horn
13:14	Aircraft

Climatic Conditions
Warm/Overcast/slight breeze

Background Noise Details
Intermittent traffic on Cumberworth Lane, residents within local dwellings, farming activities.

Wind Speed (m/s)		
Time	**Speed**	**Gusts**
00 mins	0.6	1.2
10 mins	1	1.7
20 mins	2.7	3
30 mins	2.0	2.1
40 mins	1.07	1.44
50 mins	0.80	0.85
60 mins	0.72	0.78

Notes:

Survey Completed	
Name	
Signed	

SILKSTONE ENVIRONMENTAL LTD

NOISE MONITORING RECORD SHEET

SURVEY DETAILS

Job Title:	Bromley Farm Extension
Location (Name/Grid Ref.):	2
Address (if applicable):	

Technician:	P Stewart
Date:	14/04/2022

Pre-Survey Calibration (Yes/No)	Yes
Start Time (00:00 hrs)	10:54
Finish Time (00:00 hrs)	12:00

Job Details

Calibrator		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 515/45577	167017	06/12/2022

Sound Level Meter		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 811B/ C19842FD	167012	06/12/2022

Noise Observations (Source Specific)	
Time	**Description/Details**
10:54:46	Aircraft
11:09:49	Aircraft
11:17:50	Aircraft (Distant)
11:34	Aircraft
11:51	Emergency sevice siren (distant)
11:52:20	Aircraft
11:55:40	Aircraft

Climatic Conditions
60% Overcast/ Sunny/ Warm

Background Noise Details
Intermittent traffic on Cumberworth Lane, residents within local dwellings, birds within the nearby trees.

Wind Speed (m/s)		
Time	**Speed**	**Gusts**
00 mins	0.98	1.28
10 mins	0.32	0.50
20 mins	0.01	0.12
30 mins	0.01	0.02
40 mins	2.1	2.98
50 mins	0.8	0.9
60 mins	0.5	0.8

Notes:

Survey Completed	
Name	
Signed	

SILKSTONE ENVIRONMENTAL LTD

NOISE MONITORING RECORD SHEET

SURVEY DETAILS

Job Title:	Bromley Farm Extension
Location (Name/Grid Ref.):	3
Address (if applicable):	

Technician:	P Stewart
Date:	14/04/2022

Pre-Survey Calibration (Yes/No)	Yes
Start Time (00:00 hrs)	13:29
Finish Time (00:00 hrs)	14:29

Job Details

Calibrator		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 515/45577	167017	06/12/2022

Sound Level Meter		
Model Number/ Serial Number	**Calibration Certificate No.**	**Recalibration Due**
CR: 811B/ C19842FD	167012	06/12/2022

Noise Observations (Source Specific)	
Time	**Description/Details**
13:32:38	Train horn x2
13:38	Aircraft
13:45:45	Aircraft
13:50:10	Barking & People talking (<50m)
13:54:20	Aircraft
13:56	Aircraft
14:03	Aircraft
14:10:40	Screaming Children
14:11:30	Train Horn
14:12	Aircraft
14:26	Aircraft

Climatic Conditions
Sunny/Warm/Overcast

Background Noise Details
Intermittent traffic on Cumberworth Lane, residents within local dwellings.

Wind Speed (m/s)		
Time	**Speed**	**Gusts**
00 mins	0.02	0.04
10 mins	0.1	0.12
20 mins	2.1	2.72
30 mins	0.73	1.35
40 mins	2.13	2.59
50 mins	1.5	1.6
60 mins	0.8	1.01

Notes:

Survey Completed	
Name	
Signed	

APPENDIX E

Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **06 December 2021** CERTIFICATE NUMBER **167012**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
N.Smith
Electronically signed:

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc **Notes:**

Model: CR:515

Serial number: 45577

Class: 1

Test summary

Date of calibration: 06 December 2021

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC60942_2003 Annex A to Class 1. This has been confirmed with the PhysikalischTechnische Bundesanstalt (PTB), Laboratoire National d'Essais (LNE) and APPLUS.

Notes:

CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 99.45 kPa
Temperature: 21.2 °C
Humidity: 38.0 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9708001
Distortion Meter	Keithley	2015	1046217
Acoustic Calibrator	Bruel and Kjaer	4231	2610257

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.05	94.03	94.05	**94.04**	0.04	±0.40	0.11 dB
Distortion (%)	< 3.00	0.35	0.30	0.36	**0.34**	0.34	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.1	1000.1	1000.1	**1000.1**	0.1	±10.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

End of results

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **06 December 2021** CERTIFICATE NUMBER **167017**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Thomas
Electronically signed:

Sound Level Meter : IEC 61672-3:2006

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:811B	
Serial number:	C19842FD	
Class:	1	
Firmware version:	03.00	

Test summary

Date of calibration: 06 December 2021

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2006.

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Notes

CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure:	99.44 kPa	Temperature:	22.2 °C	Humidity:	39.5 %
After	Pressure:	99.38 kPa	Temperature:	22.3 °C	Humidity:	39.8 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001635
Attenuator	Cirrus Research	ZE:952	93890
Multi-frequency Calibrator	Bruel and Kjaer	4226	2532068

Additional instrument information

Instruction manual: Technical Data Sheet
Reference level range: 40-110 dB
Pattern approval: No
Source of pattern approval: -

Preamplifier

Manufacturer: Cirrus Research
Model: MV:200C
Serial number: 2945

Microphone

Manufacturer: Cirrus Research
Model: MK:224
Serial number: 20042160

Test results summary

Test	Result
Self-generated noise	Complies
Acoustic frequency weightings	Complies
Electrical frequency weightings	Complies
Weightings at 1 kHz	Complies
Linearity	Complies
Linearity (all ranges)	Complies
Toneburst response	Complies
C-weighted peak	Complies
Overload	Complies

Acoustic Calibrator

Manufacturer: Cirrus Research
Model: CR:515
Serial number: 45577

Calibration

Calibration check frequency: 1000 Hz
Calibrator's certificate ref: 167012
Level before adjustment: 94.00 dB(A)
Level after adjustment: 94.00 dB(A)

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **06/12/21** CERTIFICATE NUMBER **167013**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 20042160

Calibration procedure

Date of calibration: 29 November 2021

Open circuit: 45.4 mV/Pa

Sensitivity at 1 kHz: -26.9 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.50 kPa

Temperature: 20.0 °C

Humidity: 32.0 %

CERTIFICATE OF CALIBRATION

Certificate Number: **167013**

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.04	-0.15
80	0.04	-0.04
100	0.06	0.02
125	0.07	0.06
160	0.04	0.06
200	0.04	0.08
250	0.04	0.08
315	0.06	0.07
400	0.05	0.08
500	0.04	0.06
630	0.03	0.04
800	0.02	0.02
1 000	0.00	-0.01
1 250	-0.02	-0.05
1 600	-0.03	-0.14
2 000	-0.05	-0.25
2 500	-0.11	-0.43
3 150	-0.16	-0.72
4 000	-0.31	-1.19
5 000	-0.46	-1.80
6 300	-0.62	-2.67
8 000	-0.81	-3.95
10 000	-1.01	-5.62
12 500	-0.93	-7.43
16 000	-1.59	-9.54
20 000	-3.44	-12.55

Free-Field Frequency Response : Graphical