Section 11

Remondis Ltd, Birtley

Noise impact assessment

11687.1

28th May 2024

Revision A

Remondis Ltd, Birtley

Noise impact assessment

11687.1A

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Contents

1 Summary

1.1 Apex Acoustics has been appointed by Remondis Ltd, Birtley to carry out a noise impact assessment in support of a permit application for their site at West Line Industrial Estate, Birtley, DH2 1AU.

1.2 The nearby noise sensitive receptors (NSRs) are identified as the residential properties on West Line Industrial Estate Road, circa 250m to the north-west of the site; residential properties on Turnberry, circa 550m to the west of the site, and residential properties on Durham Road, circa 370m to the south-east of the site.

1.3 Background sound levels have been measured at positions considered representative of the identified noise-sensitive receptors.

1.4 Existing noise from plant associated with the site have been measured on site. Noise due to HGV movements have been determined from previous measurements.

1.5 The proposed plant is not yet operational on site and assessment is based on manufacturer noise data provided by the client.

1.6 The sound propagation is modelled and calculated according to ISO 9613-2 implemented by Cadna/A software.

1.7 The noise impacts on these noise sensitive receptors are assessed in accordance with BS 4142.

1.8 The rated plant noise impact at NSR 1 is predicted to be 4 dB above the background sound level. The rating level is however lower than the lowest measured residual sound level at the NSR, and is therefore unlikely to be distinguishable against other existing residual sources.

1.9 The rated plant noise impact is predicted to be below the background sound levels and the lowest existing residual sound levels at NSRs 2 and 3.

1.10 The site is located within an existing industrial area, with other industrial/commercial sites closer to the NSRs, which likely have a higher noise impact on the NSRs.

1.11 Given the predicted rated noise impact, the existing acoustic environment, and the context discussed, the assessment result indicates the likelihood of a barely audible or detectable noise as defined in the EA guidance.

1.12 Measurement or calculation uncertainties are considered unlikely to change the assessment outputs.

3 Introduction

3.1 A proposal has been submitted for the integration of additional wash plant treatment processes at Remondis Ltd, located at West Line Industrial Estate, Birtley, DH2 1AU. The site currently receives Construction and Demolition (C&D) waste internally, which is treated inside the building, with soils, aggregate waste, and treatment in the form of crushing and screening carried out externally.

3.2 The proposed wash plant will be added to increase the recyclability of all wastes and will grade waste through the process, reducing the need for crushing and screening of waste. The site location is shown in Figure 1.

3.3 The operational hours of the site are as follows:

- 07:00 – 17:30, Monday to Friday;
- 07:00 -13:00, Saturday; and
- Closed on Sunday/Bank/public holidays.

3.4 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the noise from plant and operations associated with the development in support of an Environmental Permit application.

3.5 The scope of our instruction includes:

- Measurement of the existing noise environment over the operational hours of the site at a location representative of the nearest noise-sensitive receptors;
- Measurement of existing plant and operational noise levels on site;
- Analysis of existing source noise levels, based on measurements;
- Use previous measurements to determine noise levels due to HGV movements on site;
- Use previously measured noise data that is representative of the proposed plant, as provided by the client;
- Calculate noise propagation using proprietary noise modelling software to the noise-sensitive receptors and assess the impact in accordance with BS 4142: 2014; and
- Advise on a scheme for noise mitigation to avoid a significant adverse impact and mitigate and reduce to a minimum any adverse impacts, if required.

Figure 1: Site location outlined in red

4 Assessment location

4.1 **Site boundary**

4.2 The site location and boundary are indicated by the red outline in Figure 1.

4.3 **Noise sources on site**

4.4 Details of the existing and proposed plant/ machinery on site are summarised in Table 1.

Onsite	Location	Plant	Model
Existing	Internal	Excavator	Case CX210E
		Hopper	-
		Incline Belt	-
		Screen	-
		Conveyors	-
	External	Crusher	McCloskey J45
Proposed	External	R-Series	CDE R1500
		Feed Conveyor	CDE S2910
		AggMax	CDE 83SR
		Evowash with CFCU	CDE EVO B.50.40.100.22, CFCU 70
		Organics Screen	CDE D1-63
		Convetyors	CDE H0710, M1265, M0765
		Aquacycle	CDE A400
		Aquastore with Static Screen	CDE AS100
		Buffer Tank	CDE BS100
		Filterpress	CDE X1-60

Table 1: Existing and proposed plant

4.5 It is also understood that up to six HGV movements occur on site in any one hour of operation as a worst-case approximation.

4.6 **Noise sensitive receptors**

4.7 The nearest noise sensitive receptors (NSRs) are identified as the following:

- Single story residential properties on West Line Industrial Estate Road circa 250m to the north-west of the site (NSR 1);
- Two story residential properties on Turnberry circa 550m to the west of the site (NSR 2); and
- Single story residential properties on Durham Road circa 370m to the south-east of the site (NSR 3).

4.8 The NSR locations are shown in Figure 2.

Figure 2: Noise sensitive receptors and background survey positions as indicated by green marker.

4.9 All other receptors in the vicinity are located further away from the site and therefore the impact will be lower than that predicted at the identified nearest NSRs.

4.10 **Background monitoring locations**

4.11 **Position 1 (P1)**

4.12 The existing acoustic environment was measured between 14:19 hours on 2nd May 2024 and 14:15 hours on 7th May 2024 to account for both weekday and weekend noise levels.

4.13 Although the site was in operation during the background measurements, noise from operations at the site were not identifiable at the measurement location and is therefore considered representative of the noise environment in the absence of the site in operation.

4.14 Significant noise sources at the measurement locations included road traffic noise on West Line Industrial Estate Road, operations at other commercial/ industrial premises located closer to the NSR, and bird song.

4.15 Picture of the measurement in progress at Position 1 is shown in Figure 3.

Figure 3: Picture of the measuring equipment at Position 1

4.16 **Position 2 (P2)**

4.17 The existing acoustic environment was measured between 10:06 hours on 2nd May 2024 and 13:44 hours on 7th May 2024 to account for both weekday and weekend noise levels.

4.18 The measurement at this position is considered representative of the noise environment at NSRs 2 and 3, although the background levels to the rear of NSR 3 are likely to be higher considering their proximity to other existing businesses and Durham Road, which is considerably busier than both Turnberry and West Line Industrial Estate Road. As such the use of the measured background levels at Position 2 is considered prudent for NSR 3.

4.19 Although the site was in operation during the background measurements, noise from operations at the site were not identifiable at the measurement location and is therefore considered representative of the noise environment in the absence of the site in operation.

4.20 Significant noise sources at the measurement locations included road traffic noise on Turnberry, operations at other commercial/ industrial premises located closer to the NSR, and bird song.

4.21 Picture of the measurement in progress at Position 2 is shown in Figure 4

Figure 4: Picture of the measuring equipment at Position 2

4.22 **Source measurement locations.**

4.23 As the site is currently operational, measurements of the existing sources were made on site on 2nd May 2024.

4.24 Measurements were taken of individual plant items, both internally and externally, which are depicted in Figure 5

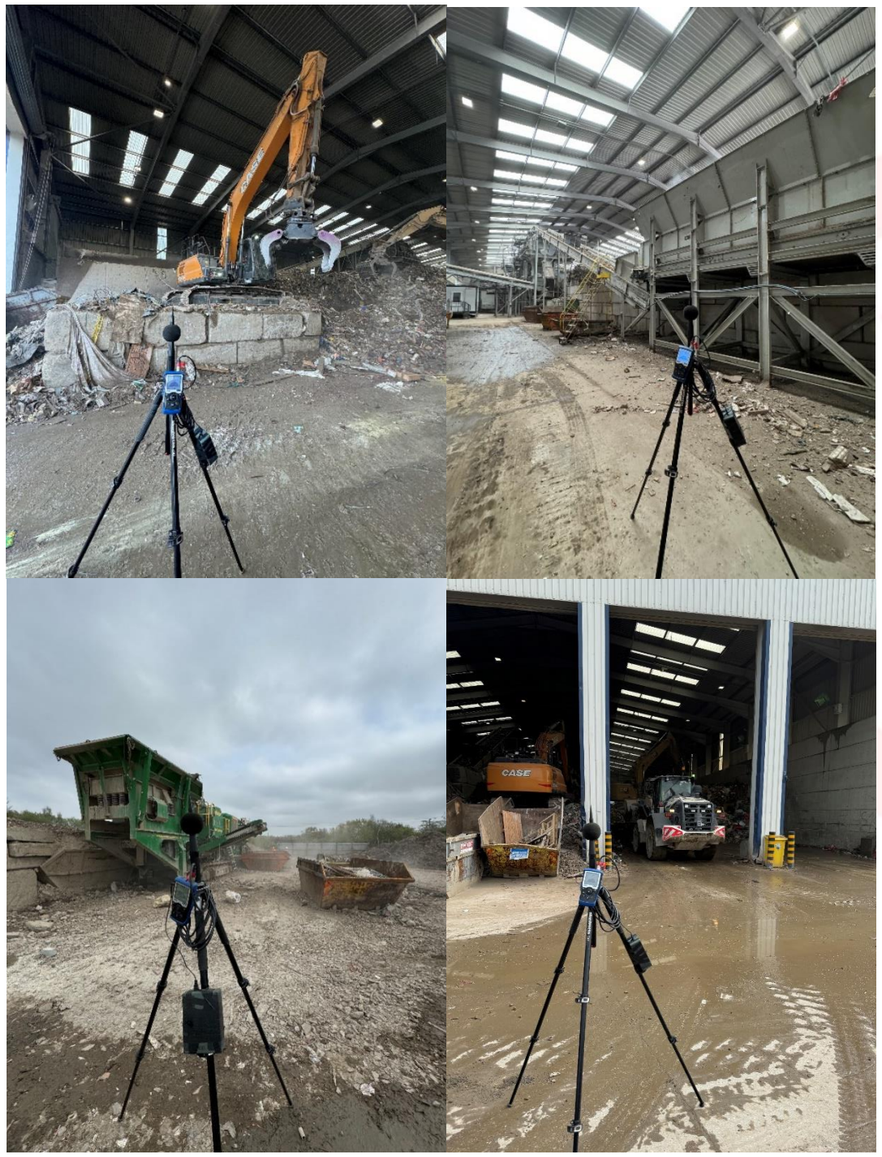


Figure 5: Pictures showing plant source measurements in progress

4.25 All items were conceptually enclosed within an imaginary box (illustrated in Figure 6) comprising dimensions corresponding to the specific dimensions of the individual plant. Measurements were conducted at 1 m from all sides of the imaginary box, as well as from the top.

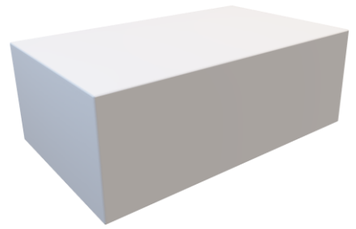
Imaginary box	Plant	Box Dimensions (L=Length, W=Width, H=Height
	Excavator	*12m x 7m x 4m*
	Hopper	*9m x 4m x 6m*
	Incline Belt	*23m x 3.5m x 13m*
	Screen	*17m x 4m x 13m*
	Conveyors	*27m x 4m x 3m*
	Crusher	*12m x 7m x 4m*

Figure 6: Imaginary box dimensions.

4.26 The duration of the measurement periods for each plant item was determined based on the typical operational process of each item. These measurement periods varied, ranging from 30 seconds to 12 minutes, and covered all operational processes associated with each vehicle.

4.27 Residual measurements were also made with all plant switched off, at the position shown in Figure 7.

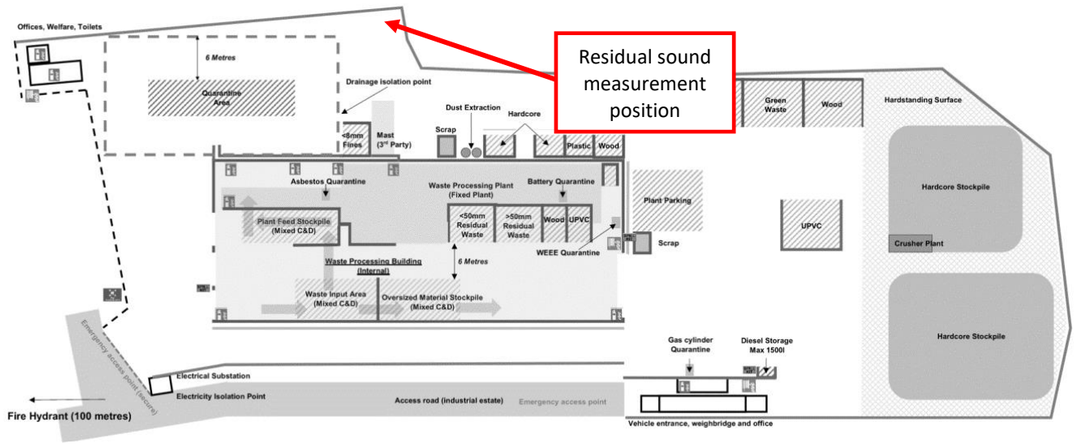


Figure 7: Site layout and residual measurement position.

4.28 **Surrounding buildings, geography, and ground type**

4.29 The buildings surrounding the site have been included in the noise model, based on Google satellite and street view.

4.30 The site is set within an existing industrial estate, surrounded by other commercial/ industrial premises.

4.31 There are other industrial/ commercial premises in closer proximity to the NSRs in comparison to the site, which also provide shielding against the sources on site.

4.32 The ground type between the site and the NSRs primarily consists of soft ground, while hard ground is more prevalent in the commercial areas to the east.

4.33 There are large earth bunds located to the east of the site that serves as a natural noise barrier. This barrier helps to reduce sound transmission that is generated on-site from impacting on the nearest source sensitive receptors, most notably at NSR3.

5 Methodology

5.1 The guidance on Noise and vibration management: environmental permits, Reference 1, published by the Environmental Agency (EA) requires assessment of plant and operations following BS 4142, Reference 2, methodology.

5.2 BS 4142 defines an assessment method to quantify the potential level for adverse impact from commercial and / or industrial noise sources impacting upon sound sensitive receptors i.e. residential properties.

5.3 The specific sound source of an industrial/ commercial nature is rated according to BS 4142 and compared against the measured existing background sound environment, considering the context.

5.4 The rating level is calculated based on the specific sound level plus penalties due to perceptible sound features, including:

- Tonality penalty

  It is stated in BS 4142 that tonality can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

- Impulsivity penalty

  It is stated that impulsivity can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

- Intermittency penalty

  If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

- Other features penalty

  Penalties can be applied due to other readily distinguishable features.

5.5 The method estimates the impact significance by comparing the Rated noise against the background sound levels, as summarised below:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around + 5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound sources having a low impact, depending on the context.

5.6 The terminology used in BS 4142 to describe the various levels of potential adverse impact is respect to the PPG-N noise hierarchy, are summarised in Appendix A.

5.7 The EA guidance identifies three levels of noise impact relating to the BS 4142 descriptors:

- Unacceptable level of audible or detectable noise, which corresponds to a BS 4142 significant adverse impact, and requires taking further action or reducing/ stopping operations;
- Audible or detectable noise, which corresponds to a BS 4142 adverse impact, and requires using appropriate measures to prevent or, where this is not practicable minimise noise;
- No noise, or barely audible or detectable noise, which corresponds to BS 4142 low impact or no impact.

5.8 The guidance also requires consideration of context when determining the impact.

5.9 **Prediction of sound levels**

5.10 Noise transmission and propagation is modelled to the noise sensitive receptors using proprietary software, CadnaA, Reference 3, which models noise propagation outdoors according to ISO 9613-2, Reference 4.

5.11 ISO 9613-2 is a widely used and accepted standard to calculate sound propagation outdoors. This standard includes sound reflection, sound diffraction over buildings, meteorological conditions, ground effects, and sound propagating over built-up areas. This is considered the most appropriate calculation method available for this assessment.

6 Equipment and meteorology

6.1 **Equipment used**

6.2 The equipment used in the background and source sound measurements are shown in Table 2.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-12269-E0
Calibrator	Larson Davis CAL 200	13404
Sound Level Meter	NTi XL2	A2A-09585-E0
Calibrator	Larson Davis CAL 200	12573
Weather station	Aercus Instruments WS2083	180619

Table 2: Equipment used

6.3 Meters and calibrators have current calibration certificates traceable to national standards. The sound level meters have been calibrated within the last two years and calibrators have been calibrated within the last year in accordance with the guidance of BS 4142; calibration certificates are available on request.

6.4 The equipment was field-calibrated before and after the measurements with no significant drift in sensitivity noted.

6.5 **Weather conditions**

6.6 The weather conditions were measured during the background sound measurements.

6.7 The weather station was positioned on-site in a secure and safe location, which, due to logistical constraints, could not be directly adjacent to the background measurement setup.

6.8 The weather conditions at the site are considered representative for the background measurement locations as well.

6.9 The measured weather data for the operational period of the site is shown in Appendix B.

6.10 Wind speeds were below 5 m/s and there was little to no precipitation affecting the measurements.

6.11 As weather conditions are identified to not have any impact on the measurement, all measured data can be used in the assessment.

7 Noise monitoring data

7.1 The microphone was located 1.8 m above the ground level for all source noise measurements.

7.2 Data was recorded in one-third octave band frequencies at one-second intervals throughout the measurement periods.

7.3 **Background sound level**

7.4 A time history of the measured $L_{A90,1hr}$ and $L_{Aeq,T}$ levels are shown in Appendix C.

7.5 The background sound levels at positions 1 and 2, $L_{A90,\ 1hr}$, are calculated from the L_r, $L_{Aeq\ 1hr}$ with results shown in Table 13 and Table 14 of Appendix C.

7.6 Statistical analysis is undertaken of the results of all the $L_{A90,\ 1hr}$ data following the guidance of BS 4142, to determine a background sound level considered to be representative of the daytime operational period of the site. Results of the analysis are shown in Appendix C.

7.7 Based on the statistical analysis results, the background sound level considered representative of the daytime assessment period is shown in Table 3.

Assessment period	Position	L_{A90} (dB)	Range of measured $L_{Aeq,T}$ (dB)
Daytime (07:00 – 17:30 Mon-Fri, and 07:00 – 13:00 Sat)	1	43	48 - 61
	2	49	49 - 69

Table 3: Background and range of existing residual sound levels representative of the assessment periods

7.8 The range of measured $L_{Aeq,T}$ levels at the measurement position are also shown in Table 3.

7.9 **Existing source noise measurements**

7.10 Measurements made at 1 m from the imaginary box enclosing each plant at the site is shown in Table 15 of Appendix D.

7.11 The residual sound level, measured for just under a 3 minute period, with all plant at the site turned off is also shown in Table 16 of Appendix D, which is significantly lower than the ambient sound levels measured with the plant turned on. As such corrections for residual levels are not required.

7.12 The residual noise levels are shown in Table 4.

Parameter	L_p, dB(A)	Octave band centre frequency, Hz Measured A-weighted sound power level, dB								
		31.5	63	125	250	500	1000	2000	4000	8000
Residual	**72**	32	44	51	55	63	67	67	61	47

Table 4: Measured residual noise level with all plant turned off

7.13 Measurements were conducted on each side of the plant where possible (all sides and above), positioned 1 m from the imaginary box that encloses the entire plant, as shown in Figure 6. The measured average sound pressure levels across all five sides for each item of plant is presented in Table 5

Plant	Average L_p dB(A)	Octave band centre frequency, Hz Measured A-weighted sound power level, dB								
		31.5	63	125	250	500	1000	2000	4000	8000
Excavator	**84**	35	52	63	72	78	79	79	73	64
Hopper	**84**	37	52	64	71	76	79	79	74	65
Incline Belt	**87**	41	56	67	74	80	82	82	78	69
Screen	**91**	46	62	73	79	84	87	85	81	73
Conveyors	**89**	48	61	76	77	82	84	83	79	76
Crusher	**81**	42	63	69	73	74	74	73	71	64

Table 5: Measured surface average sound pressure levels

7.14 To calculate the sound power from the surface average sound pressure levels, the following equation is used:

$$L_w = L_p + 10\log_{10}(S)$$

Where S is the measurement surface area (m^2), at a specified distance from the unit, i.e., 1 m.

7.15 The predicted sound power levels of the existing plant/machinery are shown in Table 6.

Parameter	L_w dB(A)	Octave band centre frequency, Hz Predicted A-weighted sound power level, dB								
		31.5	63	125	250	500	1000	2000	4000	8000
Excavator	**108**	59	75	87	95	101	103	102	97	88
Hopper	**106**	60	74	86	94	99	102	101	97	87
Incline Belt	**116**	70	85	96	103	109	111	110	106	97

Parameter	L_w dB(A)	Octave band centre frequency, Hz Predicted A-weighted sound power level, dB								
		31.5	63	125	250	500	1000	2000	4000	8000
Screen	**119**	74	90	101	107	112	114	113	109	101
Conveyors	**114**	72	86	101	102	107	108	108	104	101
Crusher	**104**	66	87	93	96	98	98	97	94	88

Table 6: Predicted sound power level of the existing plant/machinery

7.16 Noise levels in single octave band centre frequencies have been determined from measured data in one-third octave band centre frequencies.

7.17 **Internal measurements**

7.18 As the measurements were made inside the building, an environmental correction is applicable to the calculation of sound power level, following the method detailed in Appendix A of ISO 3746:2010, Reference 7. The environmental correction is calculated using the following equation:

$$K_{2A} = 10log\left(1 + 4\frac{S}{A}\right)$$

where, A is the equivalent sound absorption area, in square metres, of the room; and

S is the area, in square metres, of the measurement surface.

7.19 Equivalent sound absorption area (A) is calculated using the following equation:

$$A = \alpha S_V$$

where, α is the mean sound absorption coefficient, as given in Table A.1 of the standard; and

S_V is the total area, in square metres, of the boundary surfaces of the test room (walls, ceiling, and floor).

7.20 A mean sound absorption coefficient of 0.15 is assumed for the store, considering a *"Right cuboid room with furniture; right cuboid machinery room or industrial room".*

7.21 The total sound power level (L_w) due to all sources is used to calculate the reverberant sound pressure level (L_{rev}) inside the warehouse, using the following equation:

$$L_{rev} = L_w + 10log\left(\frac{4}{R_c}\right)$$

where, R_c is the Room Constant calculated using the following equation:

$$R_c = \frac{S\alpha_{avge}}{(1 - \alpha_{avge})}$$

where,

S is the total surface area of the source room, based on dimensions undertaken on site and

α_{avge} is the average absorption coefficient of all surfaces in the source room.

7.22 The average absorption coefficient of all surfaces in the store is based on a "medium live" room as defined in CIBSE Guide B4, Reference 8.

7.23 The calculated total reverberant source pressure level within the warehouse is shown in Table 7.

Parameter	Single-octave band centre frequency (Hz)							dB(A)
	63	125	250	500	1k	2k	4k	
Total sound power level due to all sources L_w, dB(A)	88	98	104	110	112	111	107	117
α_{avge} of "Medium live" room	0.02	0.05	0.08	0.10	0.15	0.20	0.20	-
Room constant R_c, m^2	140	360	595	760	1207	1710	1710	-
Reverberant sound pressure level L_{rev}, dB(A)	72	79	83	87	87	85	81	93

Table 7: Calculated reverberant sound pressure level inside warehouse

7.24 Noise breakout from the warehouse is calculated using the following equation in the noise model:

$$SPL_{ext} = SPL_{int} - SRI - 6$$

where,

SPL_{ext} is the external free-field sound pressure level after breakout through the building element;

SPL_{int} is the internal reverberant sound pressure level, as shown in Table 7;

SRI is the sound reduction index of the building element; and

6 dB is the correction between an internal diffuse field and external free field.

7.25 The roller shutters are considered open during the operational hours, for worst case assessment, such that the SRI = 0 dB.

7.26 Noise breakout through the external walls will be less significant is comparison to breakout from the open shutters and are therefore not separately modelled.

7.27 **Other sources**

7.28 It is understood that up to six HGV movements occur within the site within any 1 hour period. The noise from HGV movements is assessed based on previously measured representative data.

7.29 Noise measurements used are shown in Appendix E, and the predicted sound power is shown in Table 8 below.

HGV movement	Single-octave band centre frequency (Hz) A-weighted sound power levels (dB)							dB(A)
	63	125	250	500	1k	2k	4k	
Sound power level	75	77	83	86	91	87	80	**93**

Table 8: HGV sound power

7.30 The resulting sound power for the 1-hour daytime assessment periods is calculated in the noise model as a moving point source along the yard, considering 6 HGV movements, on the basis that the HGV travels at a speed of 10 km/h.

7.31 **Proposed noise sources**

7.32 The plant that is proposed to be installed on site is shown in Table 9, along with the sound power data as provided by the client, Reference 6.

Unit	Single-octave band centre frequency (Hz) Linear noise levels (dB)									L_w (dBA)
	31.5	63	110	250	500	1k	2k	4k	8k	
R-Series	114	115	111	110	108	107	108	107	99	**114**
Feed Conveyor	88	84	78	75	72	68	68	67	62	**76**
AggMax	125	119	108	106	105	106	108	109	105	**114**
Evowash with CFCU	125	114	102	102	99	96	95	93	88	**103**
Organics Screen	100	88	74	75	72	74	74	72	70	**80**
Aggregate Stockpile Conveyors	92	79	74	70	67	65	70	75	79	**81**
Sand Stockpile Conveyor	88	76	74	70	68	66	66	64	56	**73**
Aquacycle Bottom Motor	97	93	90	86	90	90	85	80	72	**94**
Aquacycle Top Motor	72	72	73	68	74	65	67	50	50	**73**
Aquastore with Static Screen	72	72	73	68	74	65	67	50	50	**80**
Buffer Tank	76	76	77	77	76	77	74	73	68	**82**
Agitators	89	79	69	70	68	71	61	51	46	**73**
Filterpress	75	72	63	58	61	47	53	53	45	**61**[1]

Table 9: $L_{w\ and}$ spectral noise level data for each plant, as provided by the client

[1] *The sound power levels used in the model are based on internal measurements of the Filterpress as provided by the client. These levels represent a worst-case scenario as the Filterpress's compound would significantly attenuate the noise, resulting in lower actual sound levels externally.*

8 Noise impact assessment

8.1 **Operation times**

8.2 All plant is assumed to operate continuously during the daytime 1-hour assessment period; this is a prudent assumption.

8.3 **Noise transmission and propagation**

8.4 Noise transmission and propagation is modelled to the NSRs based on the noise source data detailed, using proprietary software, CadnaA.

8.5 This models noise propagation outdoors according to ISO 9613.

8.6 The model parameters and assumptions are summarised in Appendix F.

8.7 The noise breakout due to existing internal plant through open warehouse doors is modelled as vertical area sources and attributed the internal reverberant sound pressure levels shown in Table 7, and a sound reduction index of 0 dB.

8.8 The existing Crusher is located externally, and is modelled as a point source, attributed the sound power level shown in Table 6.

8.9 The proposed plant associated with the development are modelled as point sources and attributed the sound power levels shown in Table 9.

8.10 The resulting sound power of six HGV movements for the 1-hour assessment period is predicted in the noise model as a moving point source along the yard based on observations made on site and on the basis on the sound power level as shown in Table 8, and considering the HGVs travel at a speed of 10 km/h.

8.11 **Assessment results – based on current operation**

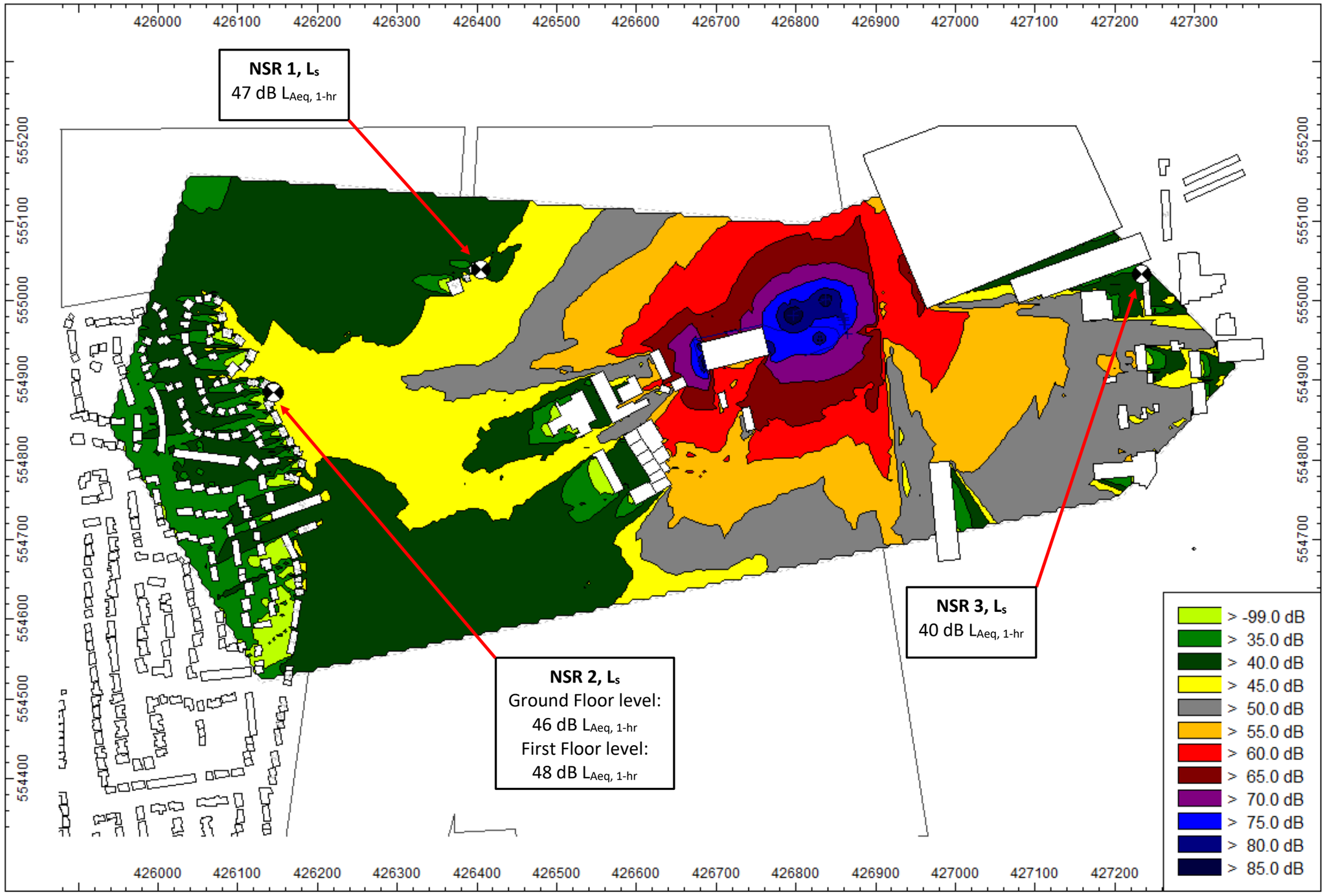


Figure 8: Sound contours at 1.5 m (ground floor window height), showing the predicted specific sound level, $L_{Aeq\ 1\ hr\ based}$ on current operation

Parameter	Daytime Assessment during Operational Hours			Relevant clause of BS 4142	Commentary
	NSR 1	NSR 2	NSR 3		
Lowest measured residual noise level	48	49		7.3.6	These are the lowest measured residual noise levels measured during typical operational hours.
Background sound level	43 dB $L_{A90, 1hr}$	49 dB $L_{A90, 1hr}$		8.1.2 8.1.4	Considered representative of the assessment period based on statistical analysis detailed in Appendix C.
Specific sound level $L_{s,}$ due to all sources for the required assessment interval	47 dB $L_{Aeq, 1hr}$	48 dB $L_{Aeq, 1hr}$	40 dB $L_{Aeq, 1hr}$	7.2 7.3.6	The predicted L_s contours across the site due to all sources during the assessment period are shown in Figure 8; the L_s assessed is the highest predicted level at the NSRs.
Acoustic feature correction	0 dB			9.2	The specific sound levels due to existing and proposed plant does not exceed the lowest existing residual sound levels due to road traffic noise. As such, any acoustic features are unlikely to be perceptible at the NSRs. The following acoustic feature corrections are considered applicable by subjective assessment: • Tonality – 0 dB; • Impulsivity – 0 dB; • Intermittency – 0 dB; • Other – 0 dB.
Rating level, $L_{Ar,Tr}$	47 dB	48 dB	40 dB		
Uncertainty of assessment				10	Background data was obtained over a 6-day period, accounting for the changing acoustic environment. The locations are considered representative for NSRs 1 and 2, and worst-case for NSR 3. Measurements of the exact plant during operation were undertaken, which allows for the existing operational noise impact to be determined.
Excess of $L_{Ar,Tr}$ over background sound level	+ 4 dB	- 1 dB	- 9 dB	11	The rated noise impact does not exceed the background sound levels at NSRs 2 and 3, and does not exceed the background sound level at NSR 1 by more than 4 dB. The rated levels are lower than the lowest measured residual levels, as such, the noise levels due to the plant sources associated with the site are unlikely to be distinguishable against other residual sources. The site is located within an existing industrial area, with other industrial/commercial sites closer to the NSRs, which likely have a higher noise impact on the NSRs. Given the predicted rated noise impact, the existing acoustic environment, and the context discussed, the assessment result indicates the likelihood of a barely audible or detectable noise as defined in the EA guidance.

Table 10: BS 4142 assessment results, based on current operation

9 Uncertainty of assessment

9.1 The background sound levels were measured over six consecutive days to minimise the uncertainty due to noise level fluctuations.

9.2 Wind speeds were below 5 m/s. Although gusts during the noise measurement periods were occasionally higher than 5 m/s, this is not observed to have a significant impact on the measured background sound levels. Also, as the measurement period is long enough to make most of the noise data be recorded at suitable meteorological conditions, the uncertainty due to weather conditions were minimised.

9.3 The weather measurements were not made immediately adjacent to the background measurement position due to unavailability of suitable locations to leave the equipment unattended. The measurement was made within the site and is considered representative of the weather conditions at Positions 1 and 2.

9.4 Background sound levels were measured when the site is operational. Noise from the site were however not identifiable at positions 1 and 2, and the measurements were dominated by road traffic noise and operations of other nearby industrial premises. These premises also shielded the NSRs to some extent from the site. The background sound levels are therefore considered representative.

9.5 Uncertainty in the predicted impact has been reduced by the use of a calculation method in accordance with ISO 9613-2.

9.6 The above uncertainties are unlikely to change the output of the assessment.

10 Conclusion

10.1 Noise from existing plant were measured at the site, HGV movements determined from previous measurements, and of new plant from noise data provided by the client.

10.2 Representative background sound levels at the nearby noise sensitive receptors were also measured.

10.3 Noise propagation to the identified residential NSRs is modelled.

10.4 Noise impact from the proposed permit application site has been assessed according to BS 4142. The assessment results indicate the indicates the likelihood of a barely audible or detectable noise impact on all identified noise sensitive receptors.

11 References

1 Guidance – Noise and vibration management: Environmental permits, Environmental Agency, Updated 31 January 2022.

https://www.gov.uk/government/publications/noise-and-vibration-management-environmental-permits/noise-and-vibration-management-environmental-permits#step-3-source-assessment

2 BS 4142 2014: A1+2019, Method for rating and assessing industrial and commercial sound.

3 CadnaA environmental noise modelling software, version 2023, Datakustik GmbH.

4 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

5 Remondis Washplant Design and Specification – Birtley. Drawing no. OppID-00246, 9th Feb 2024.

6 RPS Acoustic Survey Report, report no. JAT11497-REPT-01RO

7 BS EN ISO 3746:2010, Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane.

8 CIBSE Guide B4: Noise and vibration control for building services systems, 2016.

9 DEFRA LIDAR height data, 2022

https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

10 ISO 12913-1:2014 Acoustics, Soundscape, Part 1: Definition and conceptual framework

Appendix A Noise exposure hierarchy

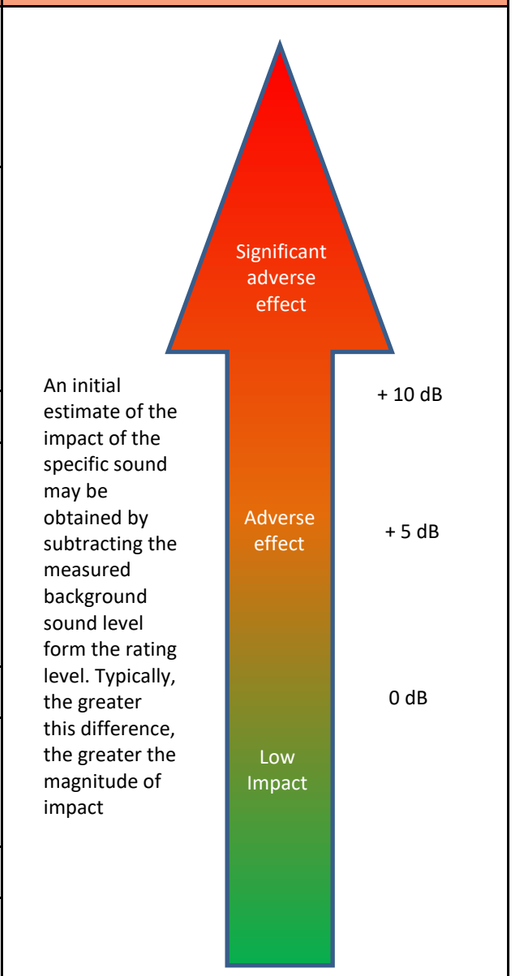
Planning Practice Guidance - Noise				BS 4142: Initial estimate of external noise risk significance
Noise	***Example of outcomes***	***Increasing effect level***	***Action***	
Present and very distributive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	**Prevent**	
Present and distributive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	**Avoid**	
Significant Observed Adverse Effect Level (SOAEL)				
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	**Mitigate and reduce to a minimum**	
Lowest Observed Adverse Effect Level (LOAEL)				
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	**No specific measures required**	
No Observed Adverse Effect Level (NOAEL)				
Not present	No effect	No Observed Effect	**No specific measures required**	
No Observed Effect Level (NOEL)				

Table 11: PPG-N Noise Exposure Hierarchy and BS 4142 initial estimate of impact

Appendix B Weather data

B.1 The measured weather data during the operational hours of the site are shown in Table 12.

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
02/05/2024 13:04:08	19	0	S	0.00
02/05/2024 13:09:08	19	0	S	0.00
02/05/2024 13:14:08	18.9	0	S	0.00
02/05/2024 13:19:08	18.9	0	S	0.00
02/05/2024 13:24:08	18.9	0	S	0.00
02/05/2024 13:29:08	18.9	0	S	0.00
02/05/2024 13:34:08	18.9	0	S	0.00
02/05/2024 13:39:08	18.9	0	S	0.00
02/05/2024 13:44:08	18.9	0	S	0.00
02/05/2024 13:49:08	18.8	0	S	0.00
02/05/2024 13:54:08	18.7	0	SSW	0.01
02/05/2024 13:59:08	18	1.7	SW	0.11
02/05/2024 14:04:08	14.8	1.7	WSW	0.07
02/05/2024 14:09:08	14.1	2.4	SW	0.07
02/05/2024 14:14:08	13.7	2.7	NE	0.07
02/05/2024 14:19:08	13.7	2	S	0.07
02/05/2024 14:24:08	13.6	1	N	0.07
02/05/2024 14:29:08	13.4	1.7	SW	0.07
02/05/2024 14:34:08	13.2	1.4	SW	0.07
02/05/2024 14:39:08	13.2	3.1	SW	0.07
02/05/2024 14:44:08	13.1	1.4	SW	0.07
02/05/2024 14:49:08	13.2	2	W	0.07
02/05/2024 14:54:08	13.3	1.4	SW	0.07
02/05/2024 14:59:08	13.1	2.4	SW	0.07
02/05/2024 15:04:08	13.4	1.7	SW	0.00
02/05/2024 15:09:08	13.4	2.4	W	0.00
02/05/2024 15:14:08	13.3	1.7	N	0.00
02/05/2024 15:19:08	13.4	2	W	0.00
02/05/2024 15:24:08	13.3	3.1	SW	0.00
02/05/2024 15:29:08	13.1	2	S	0.00
02/05/2024 15:34:08	13.1	0.3	SE	0.00
02/05/2024 15:39:08	13.5	1	W	0.00
02/05/2024 15:44:08	13.8	0.7	W	0.00
02/05/2024 15:49:08	13.6	1	E	0.00
02/05/2024 15:54:08	13.5	1.7	SE	0.00
02/05/2024 15:59:08	13.5	1	SE	0.00
02/05/2024 16:04:08	13.2	2.7	SW	0.00
02/05/2024 16:09:08	12.9	1.7	S	0.00
02/05/2024 16:14:08	12.7	2.4	SW	0.00
02/05/2024 16:19:08	12.7	2	SW	0.00
02/05/2024 16:24:08	12.5	1.7	NE	0.00
02/05/2024 16:29:08	12.5	1.4	SW	0.00
02/05/2024 16:34:08	12.6	1.7	NW	0.00
02/05/2024 16:39:08	12.6	1.4	NW	0.00
02/05/2024 16:44:08	12.7	1.7	W	0.00
02/05/2024 16:49:08	12.9	1	NE	0.00
02/05/2024 16:54:08	12.7	0.7	NE	0.00
02/05/2024 16:59:08	12.6	1.4	ENE	0.00
02/05/2024 17:04:08	12.5	2	SW	0.00
02/05/2024 17:09:08	12.6	1.4	SW	0.00
02/05/2024 17:14:08	12.5	0.3	SW	0.00
02/05/2024 17:19:08	12.7	1.4	S	0.00
02/05/2024 17:24:08	12.7	1.4	N	0.00
02/05/2024 17:29:08	12.6	1	SE	0.00
03/05/2024 07:04:08	10.5	0.3	W	0.00
03/05/2024 07:09:08	10.6	0.7	S	0.00
03/05/2024 07:14:08	10.6	0.3	NW	0.00
03/05/2024 07:19:08	10.7	0.3	SW	0.00
03/05/2024 07:24:08	10.7	1	SW	0.00
03/05/2024 07:29:08	10.7	0.7	SE	0.00
03/05/2024 07:34:08	10.8	0.7	SW	0.00
03/05/2024 07:39:08	10.9	1	NW	0.00
03/05/2024 07:44:08	11.1	0.7	SW	0.00
03/05/2024 07:49:08	11.2	0.3	NW	0.00
03/05/2024 07:54:08	11.3	0.7	WNW	0.00
03/05/2024 07:59:08	11.3	0.3	SW	0.00
03/05/2024 08:04:08	11.4	1.4	S	0.00
03/05/2024 08:09:08	11.6	1.4	WSW	0.00
03/05/2024 08:14:08	11.8	1.4	SE	0.00
03/05/2024 08:19:08	11.9	0.7	W	0.00
03/05/2024 08:24:08	12.1	1.4	SW	0.00
03/05/2024 08:29:08	12.3	1.4	W	0.00
03/05/2024 08:34:08	12.4	1	SSW	0.00
03/05/2024 08:39:08	12.5	2.4	W	0.00
03/05/2024 08:44:08	12.4	1.7	W	0.00
03/05/2024 08:49:08	12.3	2	SW	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
03/05/2024 08:54:08	12.3	1.4	W	0.00
03/05/2024 08:59:08	12.6	1	NW	0.00
03/05/2024 09:04:08	12.8	2.4	W	0.00
03/05/2024 09:09:08	12.8	2	SW	0.00
03/05/2024 09:14:08	12.9	2.4	SW	0.00
03/05/2024 09:19:08	12.9	1	SW	0.00
03/05/2024 09:24:08	13	1.7	W	0.00
03/05/2024 09:29:08	12.9	1.7	SW	0.00
03/05/2024 09:34:08	12.9	1.7	W	0.00
03/05/2024 09:39:08	12.9	2.4	SSW	0.00
03/05/2024 09:44:08	13.1	1	S	0.00
03/05/2024 09:49:08	13.3	1.4	N	0.00
03/05/2024 09:54:08	13.4	1.4	S	0.00
03/05/2024 09:59:08	13.6	1	N	0.00
03/05/2024 10:04:08	14.2	0.7	NNW	0.00
03/05/2024 10:09:08	14.7	1.4	S	0.00
03/05/2024 10:14:08	14.6	1.4	W	0.00
03/05/2024 10:19:08	14.7	1	NW	0.00
03/05/2024 10:24:08	14.4	1.7	E	0.00
03/05/2024 10:29:08	14.4	2.4	SW	0.00
03/05/2024 10:34:08	14.7	2	NW	0.00
03/05/2024 10:39:08	15.2	1	W	0.00
03/05/2024 10:44:08	15.2	2	SW	0.00
03/05/2024 10:49:08	15.5	1.4	SW	0.00
03/05/2024 10:54:08	15.7	2.4	S	0.00
03/05/2024 11:00:08	15.1	2	SW	0.00
03/05/2024 11:05:08	15.5	2	W	0.00
03/05/2024 11:10:08	15.5	1.7	SW	0.00
03/05/2024 11:16:08	15.7	2	SE	0.00
03/05/2024 11:21:08	15.6	1.7	WNW	0.00
03/05/2024 11:26:08	15.2	2.4	NE	0.00
03/05/2024 11:32:08	14.9	1.7	W	0.00
03/05/2024 11:37:08	15	2	SE	0.00
03/05/2024 11:42:08	15	1.4	SW	0.00
03/05/2024 11:48:08	14.9	1	SW	0.00
03/05/2024 11:53:08	15.2	1.4	WSW	0.00
03/05/2024 11:58:08	15.1	1.7	NW	0.00
03/05/2024 12:03:08	15.2	1	S	0.00
03/05/2024 12:08:08	15.7	0.7	S	0.00
03/05/2024 12:13:08	16.1	0.7	WNW	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
03/05/2024 12:18:08	16.5	2.7	E	0.00
03/05/2024 12:23:08	16.6	0.7	NE	0.00
03/05/2024 12:28:08	16.4	0.7	NE	0.00
03/05/2024 12:33:08	16.7	1.4	W	0.00
03/05/2024 12:38:08	16.6	2.4	W	0.00
03/05/2024 12:43:08	16.1	3.4	N	0.00
03/05/2024 12:48:08	15.8	4.1	NW	0.00
03/05/2024 12:53:08	15.6	1.7	S	0.00
03/05/2024 12:58:08	15.6	2	SW	0.00
03/05/2024 13:03:08	15.5	2	SW	0.00
03/05/2024 13:08:08	15.3	1.4	W	0.00
03/05/2024 13:13:08	15.4	3.1	SW	0.00
03/05/2024 13:18:08	14.8	1.7	W	0.00
03/05/2024 13:23:08	14.5	1.7	SW	0.00
03/05/2024 13:28:08	14.7	1.7	S	0.00
03/05/2024 13:33:08	15.5	2	W	0.00
03/05/2024 13:38:08	15.4	1.7	SW	0.00
03/05/2024 13:43:08	15.8	2.4	SW	0.00
03/05/2024 13:48:08	16.1	2	W	0.00
03/05/2024 13:53:08	15.6	2.4	W	0.00
03/05/2024 13:58:08	15.6	1.4	S	0.00
03/05/2024 14:03:08	16.1	1.4	E	0.00
03/05/2024 14:08:08	16.3	1.4	W	0.00
03/05/2024 14:13:08	16.6	1.7	NW	0.00
03/05/2024 14:18:08	16.6	1.4	NE	0.00
03/05/2024 14:23:08	16.3	2	S	0.00
03/05/2024 14:28:08	16.1	1	SE	0.00
03/05/2024 14:33:08	16.1	1.4	W	0.00
03/05/2024 14:38:08	16.6	0.3	NW	0.00
03/05/2024 14:43:08	17	0.7	NW	0.00
03/05/2024 14:48:08	17.2	1	W	0.00
03/05/2024 14:53:08	17.4	1	SSW	0.00
03/05/2024 14:58:08	17.5	0.7	SE	0.00
03/05/2024 15:03:08	17.3	1.7	SW	0.00
03/05/2024 15:08:08	16.8	1	W	0.00
03/05/2024 15:13:08	16.8	1.7	SW	0.00
03/05/2024 15:18:08	16.9	1	SW	0.00
03/05/2024 15:23:08	16.6	2.7	SW	0.00
03/05/2024 15:28:08	16.3	1	SE	0.00
03/05/2024 15:33:08	16.4	2	W	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
03/05/2024 15:38:08	16.7	1	NW	0.00
03/05/2024 15:43:08	17	2.4	SW	0.00
03/05/2024 15:48:08	16.3	1.4	WNW	0.00
03/05/2024 15:53:08	16.2	1.7	S	0.00
03/05/2024 15:58:08	15.8	1.4	N	0.00
03/05/2024 16:03:08	16	2	SW	0.00
03/05/2024 16:08:08	15.8	1.7	SW	0.00
03/05/2024 16:13:08	15.7	2.7	SW	0.00
03/05/2024 16:18:08	15.3	1.4	NW	0.00
03/05/2024 16:23:08	15	2	SW	0.00
03/05/2024 16:28:08	14.8	1.7	S	0.00
03/05/2024 16:33:08	14.4	0.7	SW	0.00
03/05/2024 16:38:08	14.2	1	N	0.00
03/05/2024 16:43:08	13.8	1	NW	0.07
03/05/2024 16:48:08	13	0	NE	0.09
03/05/2024 16:53:08	12.6	0.7	SW	0.11
03/05/2024 16:58:08	12.4	0.3	WNW	0.12
03/05/2024 17:03:08	12.4	0.3	SW	0.00
03/05/2024 17:08:08	12.4	0.7	S	0.00
03/05/2024 17:13:08	12.5	0.7	SW	0.00
03/05/2024 17:18:08	12.5	0.7	NW	0.00
03/05/2024 17:23:08	12.6	0.3	SW	0.00
03/05/2024 17:28:08	12.5	1	E	0.00
04/05/2024 07:03:08	10.6	0	NW	0.00
04/05/2024 07:08:08	10.6	0.3	NE	0.00
04/05/2024 07:13:08	10.6	0.3	NW	0.01
04/05/2024 07:18:08	10.7	0.3	NE	0.01
04/05/2024 07:23:08	10.7	0.3	NE	0.01
04/05/2024 07:28:08	10.8	0	NE	0.01
04/05/2024 07:33:08	10.8	0.3	NE	0.01
04/05/2024 07:38:08	10.8	0.3	N	0.01
04/05/2024 07:43:08	10.8	0	NE	0.01
04/05/2024 07:48:08	10.8	0	N	0.01
04/05/2024 07:53:08	11	0.3	N	0.01
04/05/2024 07:58:08	11	0.3	NE	0.01
04/05/2024 08:03:08	10.9	0.7	NW	0.00
04/05/2024 08:08:08	10.9	0.7	N	0.00
04/05/2024 08:13:08	11	0.3	N	0.00
04/05/2024 08:18:08	11	0.3	NE	0.00
04/05/2024 08:23:08	11	0	N	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
04/05/2024 08:28:08	11.1	0.3	NW	0.00
04/05/2024 08:33:08	11.1	0.7	NE	0.00
04/05/2024 08:38:08	11.1	0.7	NE	0.00
04/05/2024 08:43:08	11.1	0	NE	0.00
04/05/2024 08:48:08	11.2	0.7	N	0.00
04/05/2024 08:53:08	11.3	0.3	NE	0.00
04/05/2024 08:58:08	11.3	0.3	N	0.00
04/05/2024 09:03:08	11.3	0.7	SW	0.00
04/05/2024 09:08:08	11.3	0.7	N	0.00
04/05/2024 09:13:08	11.3	0.7	NE	0.00
04/05/2024 09:18:08	11.3	0.3	NE	0.00
04/05/2024 09:23:08	11.4	0.3	W	0.00
04/05/2024 09:28:08	11.5	0.7	SW	0.00
04/05/2024 09:33:08	11.6	0.3	N	0.00
04/05/2024 09:38:08	11.6	0.3	N	0.00
04/05/2024 09:43:08	11.7	0.3	NE	0.00
04/05/2024 09:48:08	11.7	0.3	WNW	0.00
04/05/2024 09:53:08	11.8	0.3	NE	0.00
04/05/2024 09:58:08	12	0.7	NW	0.00
04/05/2024 10:03:08	12.1	0	NE	0.00
04/05/2024 10:08:08	12.3	0.7	NE	0.00
04/05/2024 10:13:08	12.5	0.7	NE	0.00
04/05/2024 10:18:08	12.7	1	N	0.00
04/05/2024 10:23:08	12.9	0.7	N	0.00
04/05/2024 10:28:08	13.2	0	NE	0.00
04/05/2024 10:33:08	13.4	0.3	NE	0.00
04/05/2024 10:38:08	13.6	0.3	NW	0.00
04/05/2024 10:43:08	13.8	0.7	N	0.00
04/05/2024 10:48:08	13.9	0	NW	0.00
04/05/2024 10:53:08	14.2	0.7	NE	0.00
04/05/2024 10:58:08	14.4	1	NNE	0.00
04/05/2024 11:03:08	14.7	1	NW	0.00
04/05/2024 11:08:08	14.6	1	NW	0.00
04/05/2024 11:13:08	14.3	2.4	NE	0.00
04/05/2024 11:18:08	14.1	1.4	W	0.00
04/05/2024 11:23:08	14.1	1.4	SE	0.00
04/05/2024 11:28:08	14.1	1	NE	0.00
04/05/2024 11:33:08	14.1	1.4	N	0.00
04/05/2024 11:38:08	14	1	N	0.00
04/05/2024 11:43:08	14	0.7	N	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
04/05/2024 11:48:08	14	0.7	N	0.00
04/05/2024 11:53:08	14	1	NE	0.00
04/05/2024 11:58:08	14	1	NW	0.00
04/05/2024 12:03:08	14.3	1	NE	0.00
04/05/2024 12:08:08	14.4	1	N	0.00
04/05/2024 12:13:08	14.5	1	NW	0.00
04/05/2024 12:18:08	14.7	1.4	NE	0.00
04/05/2024 12:23:08	14.8	1	NE	0.00
04/05/2024 12:28:08	14.8	0.7	NW	0.00
04/05/2024 12:33:08	14.8	1.4	NNE	0.00
04/05/2024 12:38:08	14.8	2	N	0.00
04/05/2024 12:43:08	14.8	0.7	NE	0.00
04/05/2024 12:48:08	14.8	0.3	NE	0.00
04/05/2024 12:53:08	14.8	1.4	NE	0.00
04/05/2024 12:58:08	14.7	0.3	N	0.00
06/05/2024 07:02:08	13	0	N	0.00
06/05/2024 07:07:08	13.1	0	NW	0.00
06/05/2024 07:12:08	13.2	0	NW	0.00
06/05/2024 07:17:08	13.3	0	NW	0.00
06/05/2024 07:22:08	13.5	0	NW	0.00
06/05/2024 07:27:08	13.8	0.3	SW	0.00
06/05/2024 07:32:08	14	0	N	0.00
06/05/2024 07:37:08	14.1	0	N	0.00
06/05/2024 07:42:08	14.4	0	N	0.00
06/05/2024 07:47:08	14.6	0	NW	0.00
06/05/2024 07:52:08	14.8	0	N	0.00
06/05/2024 07:57:08	14.9	0.3	NE	0.00
06/05/2024 08:02:08	14.8	0.3	N	0.00
06/05/2024 08:07:08	14.8	0	E	0.00
06/05/2024 08:12:08	14.9	0	N	0.00
06/05/2024 08:17:08	15	0.3	SW	0.00
06/05/2024 08:22:08	15.1	0	NE	0.00
06/05/2024 08:27:08	15.4	0.7	N	0.00
06/05/2024 08:32:08	15.8	0.3	ENE	0.00
06/05/2024 08:37:08	16	0.7	NE	0.00
06/05/2024 08:42:08	15.8	0.7	N	0.00
06/05/2024 08:47:08	15.8	0	N	0.00
06/05/2024 08:52:08	15.8	0	NW	0.00
06/05/2024 08:57:08	15.8	0	NW	0.00
06/05/2024 09:02:08	15.8	0	S	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
06/05/2024 09:07:08	15.8	0.3	N	0.00
06/05/2024 09:12:08	15.8	0.3	SE	0.00
06/05/2024 09:17:08	15.9	0.3	W	0.00
06/05/2024 09:22:08	15.8	0.3	S	0.00
06/05/2024 09:27:08	15.9	0.3	NE	0.00
06/05/2024 09:32:08	15.9	0	N	0.00
06/05/2024 09:37:08	16	0.3	N	0.00
06/05/2024 09:42:08	15.9	0	N	0.00
06/05/2024 09:47:08	15.9	0.3	E	0.00
06/05/2024 09:52:08	15.8	0.3	E	0.00
06/05/2024 09:57:08	15.9	0	NW	0.00
06/05/2024 10:02:08	16.2	0	WNW	0.00
06/05/2024 10:07:08	16.4	0.3	SW	0.00
06/05/2024 10:12:08	16.6	0	N	0.00
06/05/2024 10:17:08	16.8	0	NW	0.00
06/05/2024 10:22:08	16.9	0.3	W	0.00
06/05/2024 10:27:08	16.8	0.3	N	0.00
06/05/2024 10:32:08	16.7	0.3	NW	0.00
06/05/2024 10:37:08	16.9	0.7	S	0.00
06/05/2024 10:42:08	17	0	SW	0.00
06/05/2024 10:47:08	17	0	N	0.00
06/05/2024 10:52:08	17.1	0	NW	0.00
06/05/2024 10:57:08	17.3	0.3	SW	0.00
06/05/2024 11:02:08	17.4	0.3	W	0.00
06/05/2024 11:07:08	17.5	0	NW	0.00
06/05/2024 11:12:08	17.6	0.3	W	0.00
06/05/2024 11:17:08	18.4	0.7	W	0.00
06/05/2024 11:22:08	19	0.3	NE	0.00
06/05/2024 11:27:08	19.1	0.7	W	0.00
06/05/2024 11:32:08	19.3	0.3	NW	0.00
06/05/2024 11:37:08	19.4	0.3	E	0.00
06/05/2024 11:42:08	19.4	0.3	SW	0.00
06/05/2024 11:47:08	19.3	1	S	0.00
06/05/2024 11:52:08	19	0.7	NE	0.00
06/05/2024 11:57:08	18.8	0	SE	0.00
06/05/2024 12:02:08	18.7	1	W	0.00
06/05/2024 12:07:08	18.1	1.4	E	0.00
06/05/2024 12:12:08	17.3	1	W	0.00
06/05/2024 12:17:08	16.9	1	NW	0.00
06/05/2024 12:22:08	16.7	1	SE	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
06/05/2024 12:27:08	16.7	1.7	SW	0.00
06/05/2024 12:32:08	16.7	1	NE	0.00
06/05/2024 12:37:08	16.9	1	SSW	0.00
06/05/2024 12:42:08	17.4	1.4	N	0.00
06/05/2024 12:47:08	17.7	1.4	S	0.00
06/05/2024 12:52:08	17.2	1.7	SW	0.00
06/05/2024 12:57:08	17.1	2	E	0.00
06/05/2024 13:02:08	17	1.7	SW	0.00
06/05/2024 13:07:08	17.1	1.4	W	0.00
06/05/2024 13:12:08	16.8	1	SW	0.00
06/05/2024 13:17:08	16.7	1.4	NW	0.00
06/05/2024 13:22:08	17	1	S	0.00
06/05/2024 13:27:08	17.2	0.3	S	0.00
06/05/2024 13:32:08	18	0.7	NE	0.00
06/05/2024 13:37:08	18.5	0.7	NW	0.00
06/05/2024 13:42:08	18.3	1	S	0.00
06/05/2024 13:47:08	18.1	0.7	NE	0.00
06/05/2024 13:52:08	18.2	0.3	N	0.00
06/05/2024 13:57:08	18.8	0.7	S	0.00
06/05/2024 14:02:08	18.4	1	S	0.00
06/05/2024 14:07:08	18	0.7	SW	0.00
06/05/2024 14:12:08	17.9	0.7	E	0.00
06/05/2024 14:17:08	18.2	1	NE	0.00
06/05/2024 14:22:08	18.1	0.3	NE	0.00
06/05/2024 14:27:08	18.1	0.7	E	0.00
06/05/2024 14:32:08	17.9	0.7	S	0.00
06/05/2024 14:37:08	17.7	1.7	NE	0.00
06/05/2024 14:42:08	17.4	0.7	WNW	0.00
06/05/2024 14:47:08	17.1	0.3	SE	0.00
06/05/2024 14:52:08	16.8	0.3	N	0.00
06/05/2024 14:57:08	16.6	0.7	N	0.00
06/05/2024 15:02:08	16.3	0.7	NW	0.00
06/05/2024 15:07:08	16.1	1	NE	0.00
06/05/2024 15:12:08	16	1	W	0.00
06/05/2024 15:17:08	16	0.3	SSW	0.00
06/05/2024 15:22:08	16	1.4	NW	0.00
06/05/2024 15:27:08	16	0.3	S	0.00
06/05/2024 15:32:08	16	0.7	NW	0.00
06/05/2024 15:37:08	16.8	1	NW	0.00
06/05/2024 15:42:08	17.5	0.7	SW	0.00
06/05/2024 15:47:08	17.9	1	SE	0.00
06/05/2024 15:52:08	17.9	1	N	0.00
06/05/2024 15:57:08	17.6	1	SE	0.00
06/05/2024 16:02:08	17.5	0.7	SE	0.00
06/05/2024 16:07:08	17.4	1.4	E	0.00
06/05/2024 16:12:08	17.5	0.3	S	0.00
06/05/2024 16:17:08	17.3	0.7	W	0.00
06/05/2024 16:22:08	17.2	0.3	SSE	0.00
06/05/2024 16:27:08	17.1	0.3	W	0.00
06/05/2024 16:32:08	17.3	0	N	0.00
06/05/2024 16:37:08	17.8	0.7	NE	0.00
06/05/2024 16:42:08	17.9	1.4	W	0.00
06/05/2024 16:47:08	17.4	1	WNW	0.00
06/05/2024 16:52:08	17.1	0.7	SE	0.00
06/05/2024 16:57:08	16.8	0	W	0.00
06/05/2024 17:02:08	16.7	0.3	NE	0.00
06/05/2024 17:07:08	16.4	0.3	NE	0.00
06/05/2024 17:12:08	16.3	0.3	SW	0.00
06/05/2024 17:17:08	16.1	0.3	NE	0.00
06/05/2024 17:22:08	16.1	0.7	NE	0.00
06/05/2024 17:27:08	16.1	0	SE	0.00
07/05/2024 07:02:08	11.3	0.3	N	0.00
07/05/2024 07:07:08	11.3	0.3	SW	0.00
07/05/2024 07:12:08	11.3	0	NW	0.00
07/05/2024 07:17:08	11.4	0.3	NE	0.00
07/05/2024 07:22:08	11.5	0.3	W	0.00
07/05/2024 07:27:08	11.5	1	W	0.00
07/05/2024 07:32:08	11.5	0.7	W	0.00
07/05/2024 07:37:08	11.5	0.7	S	0.00
07/05/2024 07:42:08	11.6	1.7	W	0.00
07/05/2024 07:47:08	11.5	0.3	WSW	0.00
07/05/2024 07:52:08	11.5	1.7	S	0.00
07/05/2024 07:57:08	11.4	1	S	0.00
07/05/2024 08:02:08	11.6	1	W	0.00
07/05/2024 08:07:08	11.7	0.3	W	0.00
07/05/2024 08:12:08	11.8	0.3	SW	0.00
07/05/2024 08:17:08	11.8	0.7	S	0.00
07/05/2024 08:22:08	11.8	2	SW	0.00
07/05/2024 08:27:08	11.8	1.4	W	0.00
07/05/2024 08:32:08	11.9	0.3	W	0.00

Date/ Time (hh:mm)	Outdoor Temperature (℃)	Wind speed (m/s)	Wind direction	Hour Rainfall (inch)
07/05/2024 08:37:08	12	0.3	N	0.00
07/05/2024 08:42:08	12	0.3	N	0.00
07/05/2024 08:47:08	12	1	SW	0.00
07/05/2024 08:52:08	12	0.7	W	0.00
07/05/2024 08:57:08	12	0.3	SW	0.00
07/05/2024 09:02:08	11.9	1	SW	0.00
07/05/2024 09:07:08	11.9	1.4	W	0.00
07/05/2024 09:12:08	11.9	1.4	SW	0.00
07/05/2024 09:17:08	12	0.7	SW	0.00
07/05/2024 09:22:08	12.2	1	WSW	0.00
07/05/2024 09:27:08	12.2	0.7	S	0.00
07/05/2024 09:32:08	12.2	1	WSW	0.00
07/05/2024 09:37:08	12.3	1.4	W	0.00
07/05/2024 09:42:08	12.3	0.7	SE	0.00
07/05/2024 09:47:08	12.5	0.3	SE	0.00
07/05/2024 09:52:08	12.5	1	SE	0.00
07/05/2024 09:57:08	12.5	1	SW	0.00
07/05/2024 10:02:08	12.4	0.7	S	0.00
07/05/2024 10:07:08	12.2	1	SW	0.00
07/05/2024 10:12:08	12.1	1.7	SW	0.00
07/05/2024 10:17:08	12	2	SW	0.00
07/05/2024 10:22:08	11.8	1.4	SW	0.00
07/05/2024 10:27:08	11.8	1	SW	0.00
07/05/2024 10:32:08	11.9	1	SW	0.00
07/05/2024 10:37:08	11.9	1	SW	0.00
07/05/2024 10:42:08	11.9	1	SE	0.00
07/05/2024 10:47:08	11.8	1.4	SW	0.00
07/05/2024 10:52:08	11.7	1	SW	0.00
07/05/2024 10:57:08	11.7	1	W	0.00
07/05/2024 11:02:08	12	0.3	W	0.00
07/05/2024 11:07:08	12.2	0.7	SW	0.00
07/05/2024 11:12:08	12.3	1.7	S	0.00
07/05/2024 11:17:08	12.1	0.7	S	0.00
07/05/2024 11:22:08	12.1	0.3	NW	0.00
07/05/2024 11:27:08	12.2	1.7	SW	0.00
07/05/2024 11:32:08	12.2	0.7	SW	0.00
07/05/2024 11:37:08	12.5	0.3	W	0.00
07/05/2024 11:42:08	12.7	1	S	0.00
07/05/2024 11:47:08	12.6	0.7	SW	0.00
07/05/2024 11:52:08	12.8	0.3	SW	0.00
07/05/2024 11:57:08	13	0	W	0.00
07/05/2024 12:02:08	13.1	0.3	S	0.00
07/05/2024 12:07:08	13.6	0.7	SW	0.00
07/05/2024 12:12:08	14	0	W	0.00
07/05/2024 12:17:08	14.5	1.4	S	0.00
07/05/2024 12:22:08	14.3	1	E	0.00
07/05/2024 12:27:08	14.2	0.7	S	0.00
07/05/2024 12:32:08	14.4	0.7	W	0.00
07/05/2024 12:37:08	14.5	0.7	NW	0.00
07/05/2024 12:42:08	15	0.7	SW	0.00
07/05/2024 12:47:08	15.4	0	NW	0.00
07/05/2024 12:52:08	15.8	0.7	SW	0.00
07/05/2024 12:57:08	15.6	0.7	N	0.00
07/05/2024 13:02:08	15.7	0.7	NE	0.00
07/05/2024 13:07:08	16	0.7	NW	0.00
07/05/2024 13:12:08	15.6	0.3	SSE	0.00
07/05/2024 13:17:08	15.6	0.7	N	0.00
07/05/2024 13:22:08	16.1	0.7	N	0.00
07/05/2024 13:27:08	16.4	1	SW	0.00
07/05/2024 13:32:08	16.4	0.3	W	0.00
07/05/2024 13:37:08	16.5	0.7	SW	0.00
07/05/2024 13:42:08	16.6	1	NW	0.00
07/05/2024 13:47:08	16.5	1	NW	0.00
07/05/2024 13:52:08	16.5	1	N	0.00
07/05/2024 13:57:08	16.6	1	N	0.00
07/05/2024 14:02:08	16.8	1	NW	0.00

Table 12: Measured weather data

Appendix C Residual and background sound levels

C.1 Measurement time history

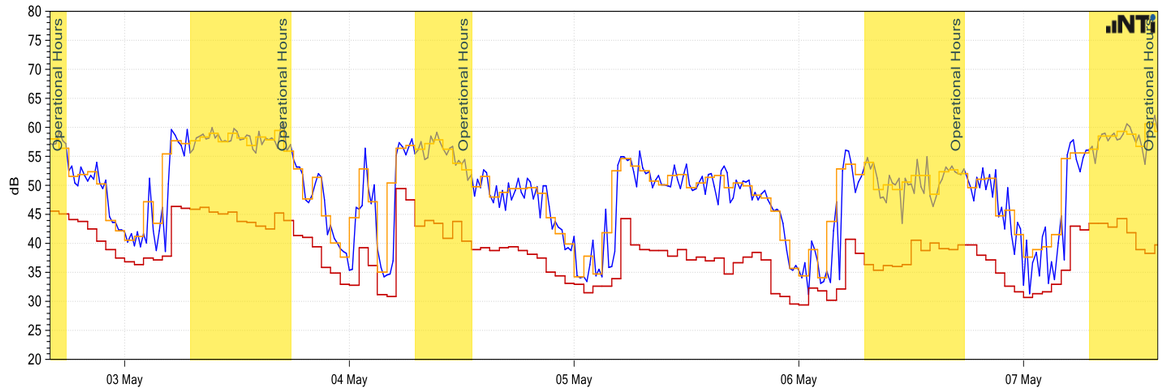


Figure 9: Residual sound level time history, $L_{A90,1hr}$ (red), $L_{Aeq,\ 5min}$ (blue), and $L_{Aeq,\ 1hr}$ (orange) levels – Position 1

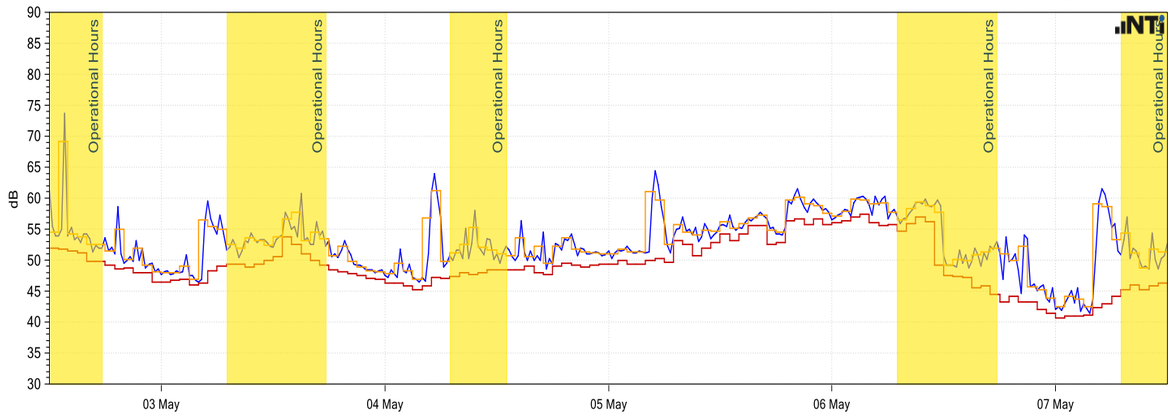


Figure 10: Residual sound level time history, $L_{A90,1hr}$ (red), $L_{Aeq,\ 5min}$ (blue), and $L_{Aeq,\ 1hr}$ (orange) levels – Position 2

C.2 Background and residual sound level data

C.3 The measured daytime $L_{A90,1hr}$ and $L_{Aeq,1hr}$ levels during the operational period of the site are shown in Table 13 and Table 14.

Date/Time (hh:mm)	Position 1	
	$L_{Aeq,1hr}$ (dB)	$L_{A90,\ 1hr}$ (dB)
2024-05-02 14:00:00	59	47
2024-05-02 15:00:00	57	46
2024-05-02 16:00:00	58	46
2024-05-02 17:00:00	56	45
2024-05-03 07:00:00	58	46
2024-05-03 08:00:00	58	46
2024-05-03 09:00:00	59	45
2024-05-03 10:00:00	58	45
2024-05-03 11:00:00	59	45
2024-05-03 12:00:00	58	44
2024-05-03 13:00:00	57	44
2024-05-03 14:00:00	58	43
2024-05-03 15:00:00	58	42
2024-05-03 16:00:00	60	45
2024-05-03 17:00:00	56	44
2024-05-04 07:00:00	56	43
2024-05-04 08:00:00	57	44
2024-05-04 09:00:00	58	43
2024-05-04 10:00:00	56	41
2024-05-04 11:00:00	54	44
2024-05-04 12:00:00	53	40
2024-05-04 13:00:00	50	39
2024-05-06 07:00:00	54	36
2024-05-06 08:00:00	49	35

Date/Time (hh:mm)	Position 1	
	$L_{Aeq,1hr}$ (dB)	$L_{A90,\ 1hr}$ (dB)
2024-05-06 09:00:00	50	36
2024-05-06 10:00:00	49	36
2024-05-06 11:00:00	51	36
2024-05-06 12:00:00	52	41
2024-05-06 13:00:00	52	39
2024-05-06 14:00:00	48	40
2024-05-06 15:00:00	52	39
2024-05-06 16:00:00	53	39
2024-05-06 17:00:00	52	40
2024-05-07 07:00:00	56	43
2024-05-07 08:00:00	59	44
2024-05-07 09:00:00	59	43
2024-05-07 10:00:00	59	44
2024-05-07 11:00:00	59	42
2024-05-07 12:00:00	57	39
2024-05-07 13:00:00	61	38
2024-05-07 14:00:00	59	40

Table 13: Measured background sound $L_{A90,\ 1hr}$ levels and $L_{Aeq,1hr}$ levels at Position 1

Date/Time (hh:mm)	Position 2	
	$L_{Aeq,1hr}$ (dB)	$L_{A90,\ 1hr}$ (dB)
2024-05-02 10:00:00	54	52
2024-05-02 11:00:00	59	52
2024-05-02 12:00:00	55	52
2024-05-02 13:00:00	69	52
2024-05-02 14:00:00	54	51

Date/Time (hh:mm)	Position 2	
	$L_{Aeq,1hr}$ (dB)	$L_{A90,\ 1hr}$ (dB)
2024-05-02 15:00:00	54	51
2024-05-02 16:00:00	53	50
2024-05-02 17:00:00	53	50
2024-05-03 07:00:00	53	49
2024-05-03 08:00:00	52	49
2024-05-03 09:00:00	54	49
2024-05-03 10:00:00	53	49
2024-05-03 11:00:00	52	50
2024-05-03 12:00:00	54	51
2024-05-03 13:00:00	57	54
2024-05-03 14:00:00	58	53
2024-05-03 15:00:00	53	51
2024-05-03 16:00:00	55	50
2024-05-03 17:00:00	54	49
2024-05-04 07:00:00	51	47
2024-05-04 08:00:00	53	48
2024-05-04 09:00:00	55	48
2024-05-04 10:00:00	52	48
2024-05-04 11:00:00	52	48
2024-05-04 12:00:00	51	48
2024-05-04 13:00:00	51	49
2024-05-06 07:00:00	57	55
2024-05-06 08:00:00	58	56
2024-05-06 09:00:00	60	57
2024-05-06 10:00:00	59	56
2024-05-06 11:00:00	58	49

Date/Time (hh:mm)	Position 2	
	$L_{Aeq,1hr}$ (dB)	$L_{A90,\ 1hr}$ (dB)
2024-05-06 12:00:00	49	48
2024-05-06 13:00:00	50	47
2024-05-06 14:00:00	50	47
2024-05-06 15:00:00	51	46
2024-05-06 16:00:00	51	46
2024-05-06 17:00:00	52	45
2024-05-07 07:00:00	54	45
2024-05-07 08:00:00	51	46
2024-05-07 09:00:00	49	45
2024-05-07 10:00:00	52	46
2024-05-07 11:00:00	51	46
2024-05-07 12:00:00	52	44
2024-05-07 13:00:00	50	44

Table 14: Measured background sound $L_{A90,\ 1hr}$ levels and $L_{Aeq,1hr}$ levels at Position 2

C.4 Analysis to determine the typical background sound level representative of the daytime assessment period is undertaken following the guidance of BS 4142, with results shown in Figure 11.

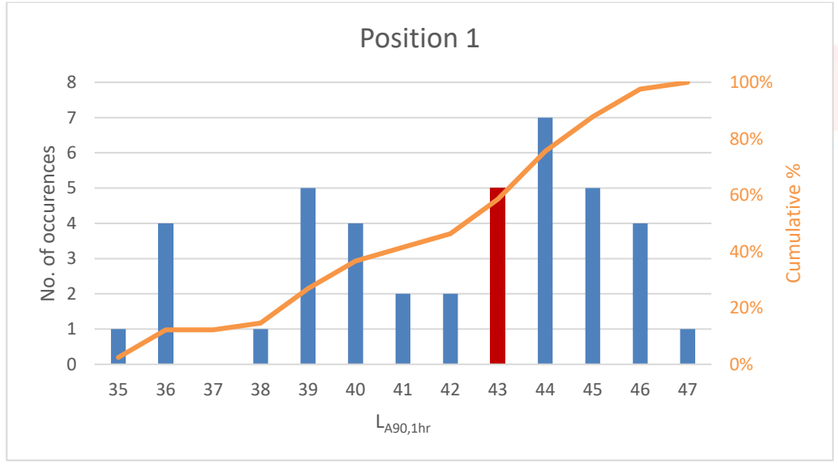


Figure 11: Analysis of daytime background levels, $L_{A90,\ 1hr}$ – Position 1

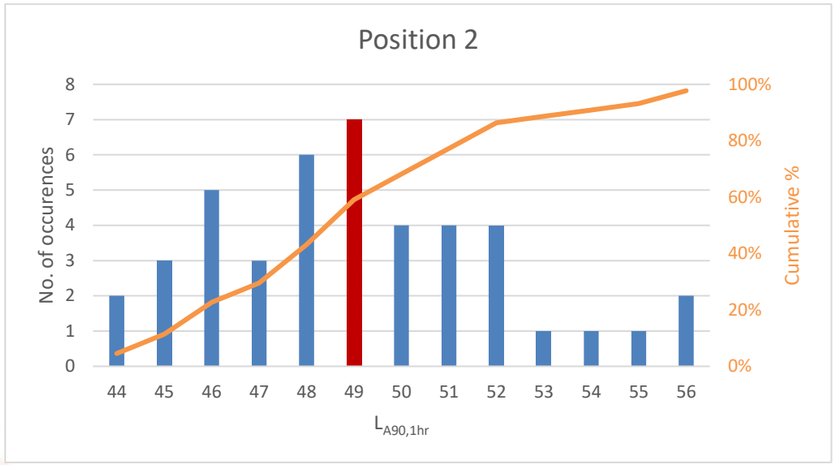


Figure 12: Analysis of daytime background levels, $L_{A90,\ 1hr}$ – Position 2

Appendix D Source measurements

D.1 Measurements around the imaginary box enclosing all the existing plant on site are shown in Table 15.

Plant	dB(A)	1/3rd octave band centre frequency, Hz Measured A-weighted sound level, dB																									
		25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
Excavator	**81**	24	28	35	41	44	49	51	57	60	62	65	66	68	72	71	72	72	71	71	71	69	67	65	63	60	57	53
	87	23	28	33	40	45	50	53	57	61	64	68	70	72	75	76	77	77	77	78	77	76	73	70	67	63	61	58
	85	23	28	33	41	43	50	53	58	61	65	68	69	71	74	74	75	76	75	75	75	74	71	68	65	62	59	54
	83	23	28	34	42	44	51	52	58	61	65	67	68	70	73	73	74	74	74	74	73	71	69	67	64	62	59	55
	83	23	29	33	42	44	50	52	58	61	64	68	67	69	72	72	73	73	73	73	73	71	69	67	64	62	59	55
Hopper	**84**	27	29	35	40	45	50	53	58	62	64	67	68	71	73	74	74	75	74	74	74	72	70	67	64	61	58	54
	82	22	31	37	40	42	49	52	57	60	61	65	67	68	71	72	73	73	72	73	73	71	68	65	62	60	57	54
	85	28	32	36	43	44	52	54	59	63	64	67	68	70	72	73	74	75	75	76	76	75	74	71	69	65	61	56
Incline Belt	**86**	28	33	40	45	47	54	56	61	63	66	69	70	74	76	76	77	76	76	76	76	75	73	70	68	64	61	56
	87	29	35	41	45	48	54	57	61	64	67	70	71	74	76	76	78	77	77	77	77	76	74	73	71	67	63	58
	87	29	34	39	44	50	55	57	62	66	67	69	71	73	75	76	77	77	77	77	77	76	75	72	70	66	63	58
	86	30	32	41	43	50	53	57	61	65	67	68	70	72	74	75	76	76	76	76	76	75	73	71	69	66	62	58
	89	29	35	40	44	50	57	60	63	65	67	70	71	74	76	77	79	79	79	79	79	78	77	75	72	69	65	60
Screen	**88**	32	34	42	49	53	59	63	63	68	70	71	74	77	78	78	79	78	78	78	77	76	75	73	70	67	65	60
	89	36	35	44	48	55	59	63	65	68	71	71	73	76	78	78	79	79	79	78	78	77	75	73	71	68	65	60
	92	35	38	45	51	56	60	63	67	69	73	73	75	78	81	82	83	83	83	82	82	80	79	77	75	72	69	65
	91	36	38	43	48	55	61	64	67	70	74	74	76	79	80	81	83	82	82	81	81	79	77	75	73	70	67	63
	93	37	42	47	54	58	61	67	71	73	75	75	78	80	82	82	83	84	84	84	84	82	81	79	77	74	71	67
Conveyors	**91**	38	41	48	54	58	61	64	67	68	71	74	75	78	80	81	81	81	82	82	81	80	78	76	74	72	71	70
	90	36	38	43	49	56	60	66	67	68	70	73	74	77	78	79	79	80	80	80	79	78	77	75	74	74	74	74
	88	37	40	48	53	56	58	62	65	68	71	71	74	75	77	77	77	77	77	77	77	76	74	73	72	70	70	69
	85	33	36	44	49	54	57	62	65	67	67	69	70	72	73	73	73	74	75	75	74	74	73	72	71	69	67	65
Crusher	**78**	28	32	43	47	50	62	68	63	63	63	66	66	66	67	68	68	67	66	66	67	65	64	63	59	57	56	53
	80	24	35	45	50	54	67	72	63	65	65	65	67	66	69	67	67	67	67	67	65	65	64	63	59	57	54	50

Plant	dB(A)	1/3rd octave band centre frequency, Hz Measured A-weighted sound level, dB																									
		25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
Crusher	**81**	21	36	43	49	52	67	73	64	64	65	64	68	68	69	69	69	70	69	70	68	67	66	65	62	60	58	53
	79	19	34	41	46	48	59	63	62	62	61	65	68	66	68	68	66	68	68	69	69	65	64	62	58	56	55	50
	79	19	32	42	47	50	55	59	61	61	61	66	67	67	69	70	68	68	69	68	67	66	66	64	60	58	56	51
	80	21	30	40	45	48	55	60	60	64	64	68	68	67	70	70	67	68	69	69	68	68	68	66	64	62	60	56
	81	24	30	40	46	50	65	70	61	63	66	66	69	66	67	70	68	69	70	69	68	68	68	67	64	62	61	57
	81	28	34	42	46	53	62	67	61	62	63	66	71	69	68	70	70	70	72	71	68	68	69	67	63	61	61	57
	83	25	32	42	45	51	65	70	59	61	64	68	71	69	70	73	72	71	73	71	70	70	71	68	65	63	63	60
	83	25	31	40	45	50	65	70	61	61	65	70	71	70	70	73	73	72	73	72	71	71	71	69	65	63	64	61
	84	24	31	42	48	53	63	67	63	67	69	71	72	71	74	73	74	74	75	73	71	71	72	71	68	66	65	62
	83	23	31	41	46	52	62	67	58	64	69	68	70	69	73	72	72	72	73	72	70	70	70	69	66	64	64	60
	84	23	31	42	47	51	63	67	60	63	66	71	74	72	76	73	72	73	74	72	70	70	70	68	65	63	63	59
	84	22	32	42	47	51	63	67	60	63	66	71	74	72	76	73	72	73	74	72	70	70	71	69	66	64	63	59
	82	20	31	43	48	50	56	56	58	61	67	69	73	69	73	70	71	70	72	70	68	68	69	67	64	63	62	59
	82	21	30	44	49	50	58	58	59	62	67	69	73	70	73	71	71	70	72	70	68	69	69	67	64	63	62	60
	78	23	30	41	46	49	64	69	53	58	63	63	69	64	67	65	66	67	67	67	65	64	65	63	60	59	59	56
	78	22	28	40	46	49	64	69	54	58	64	63	68	65	67	66	66	67	67	67	65	65	65	63	61	59	59	56
	75	19	27	40	46	49	57	62	53	59	67	62	67	61	64	62	61	61	62	61	61	61	61	60	58	56	55	52
	74	21	29	40	46	49	55	60	54	58	66	62	66	60	64	62	61	60	61	60	59	60	60	59	57	55	54	51
	77	20	28	41	46	52	61	65	51	57	67	67	66	64	69	65	62	63	64	63	62	61	61	60	59	57	55	53
	76	21	30	40	46	52	59	64	51	57	66	67	65	64	68	64	62	62	63	62	62	61	61	60	58	57	55	52

Table 15: Measurements around the imaginary box enclosing all plant on site

D.2 Residual sound measurements made with all plant turned off are shown in Table 16.

dB(A)	1/3rd octave band centre frequency, Hz Measured A-weighted sound level, dB																										
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
72	21	26	30	35	40	41	44	47	48	47	50	52	56	59	59	61	63	63	62	64	62	59	56	50	45	42	38

Table 16: Residual sound measurements

Appendix E Representative noise measurements

E.1 The below measurements have been undertaken previously by Apex Acoustics, and sources are considered representative of those proposed.

E.2 HGV movements

Source	Data type	Single-octave band centre frequency (Hz) A-weighted sound pressure levels at 8 m, free field (dB)							dB(A)
		63	125	250	500	1k	2k	4k	
HGV movements	L_p @ 8 m	49	51	57	60	64	61	54	67

Table 17: Measured HGV movements at 8 m

Figure 13: Measurement of HGV movements at 8 m

Appendix F Noise transmission and propagation

F.1 Noise transmission and propagation is modelled using proprietary software, CadnaA. This models noise propagation outdoors according to ISO 9613. The parameters used, source of data and details are described in Table 18.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Drawings	Reference 5
Noise data for proposed sources	RPS Report	Reference 6
Topography	Environment Agency Height Data, Reference 9	Lidar Digital Terrain Model, DTM
Building heights – outside of site	Site observations and Google Street view	3 m per storey + 3 m roof (residential properties)
Receptor positions	Site observations and Google Street view	On the NSR façade closest to the source at a height of 1.5 m, and 4 m to represent ground and first floor window heights respectively
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 1, Soft ground, G = 0 (locally in the model)
Max. order of reflections	Apex Acoustics	Three

Table 18: Modelling parameters and assumptions

11.1 A 3D view of the CadnaA model is shown in Figure 14.

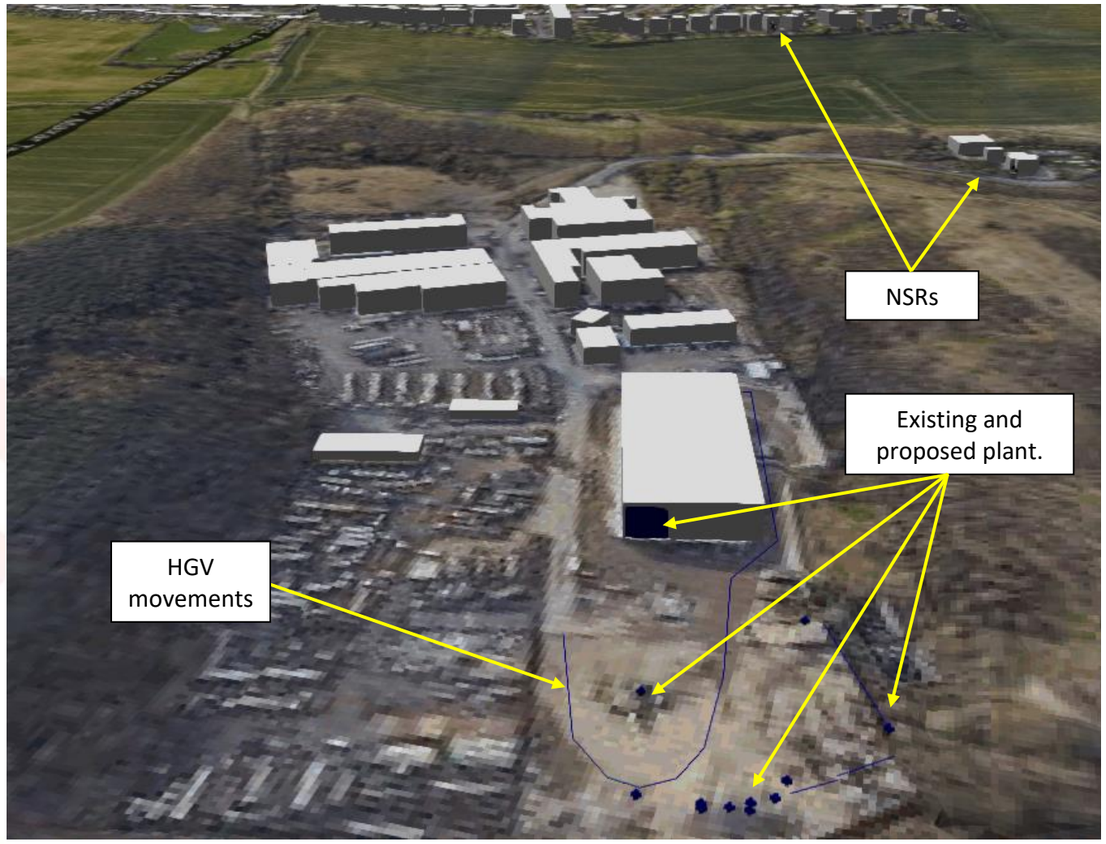


Figure 14: 3D view of the Cadna model

Appendix G Context of acoustic environment

G.1 The context can be expressed in relation with the soundscape, as defined in BS ISO 12913-1, Reference 10.

G.2 ISO 12913-1 states that:

"The context may influence soundscape through the auditory sensation, the interpretation of auditory sensation and the responses to the acoustic environment."

G.3 The process of experiences that describe soundscape and illustrated in Figure 15.

G.4 The acoustic environment is defined as being:

"… the sound from all sound sources modified by the environment. Modification by the environment includes effects on sound propagation, resulting for example from meteorological conditions, absorption, diffraction, reverberation and reflection."

G.5 The auditory sensation is described as:

"… a function of neurological processes that begin when auditory stimuli reach the receptors of the ear. This is the first stage in detecting and representing the acoustic environment. Auditory sensation is influenced by masking, spectral contents, temporal patterns and spatial distribution of the sound sources."

G.6 The interpretation of auditory sensation refers to

"… unconscious and conscious processing of the auditory signal to create useful information, which may lead to awareness or understanding of the acoustic environment. Awareness of the acoustic environment, in context, represents an experience of the acoustic environment."

G.7 Responses describe the short-term reactions and emotions while the outcomes refer to the overall, long-term consequences facilitated or enabled by the acoustic environment.

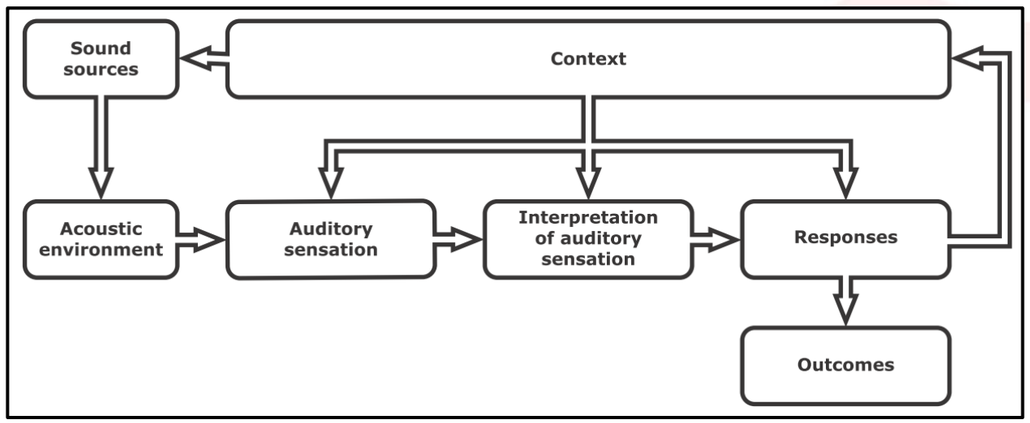


Figure 15: Elements in the perceptual construct of soundscape

G.8 The Planning Practice Guidance notes on noise state that the impact is categorised as SOAEL when "noticeable and disruptive". It details:

"The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise."

G.9 Such effect is typically defined as a difference between the BS 4142 rating level and the background level of +10 dB, depending on the context, and should be avoided on a regular basis.

Appendix H Professional qualifications and competence

H.1 All Apex Acoustics consultants work under the close supervision of a member who holds qualification in acoustics and is a member of the IOA.

H.2 This can be verified by searching the Institute of Acoustics' list of Members, available here, with the surname of the consultant.

http://www.ioa.org.uk/membership-check

H.3 Apex Acoustics is a member of the Association of Noise Consultants (ANC). The ANC is a trade organisation which seeks to raise the standards of acoustic consultancy and as such there are barriers to entry to ensure member's competency.

H.4 This report has been completed and checked by an appropriately qualified and experienced acoustic consultant.