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FCC Environment GRP

Tees Valley Energy Recovery Facility
Tees Valley

Noise Impact Assessment

MCA2135

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Notice

EXECUTIVE SUMMARY

BWB Consulting was instructed by FCC Environment GRP to undertake a Noise Impact Assessment to support an Environmental Permitting application for the Tees Valley Energy Recovery Facility, Tees Valley.

The results of a detailed noise modelling exercise undertaken by BWB have been assessed against adopted noise level limits that were set based on a series of baseline noise measurements at nearest noise sensitive receptors.

The results of the assessment indicate that, based on the current design, appropriate noise levels are likely to be achieved at nearest noise sensitive receptors.

Adopting an active approach to noise management, it is considered that the Installation is low risk from a noise perspective.

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1. INTRODUCTION

Appointment and Background

1.1 BWB Consulting (BWB) was instructed by FCC Environment GRP (the Client) to undertake a Noise Impact Assessment to support an Environmental Permitting application for a Tees Valley Energy Recovery Facility, Tees Valley (the Installation).

1.2 The results of a detailed noise modelling exercise undertaken by BWB, informed by noise data supplied by the technology provider, have been assessed against the appropriate British Standard following a series of baseline noise measurements at nearest noise sensitive receptors.

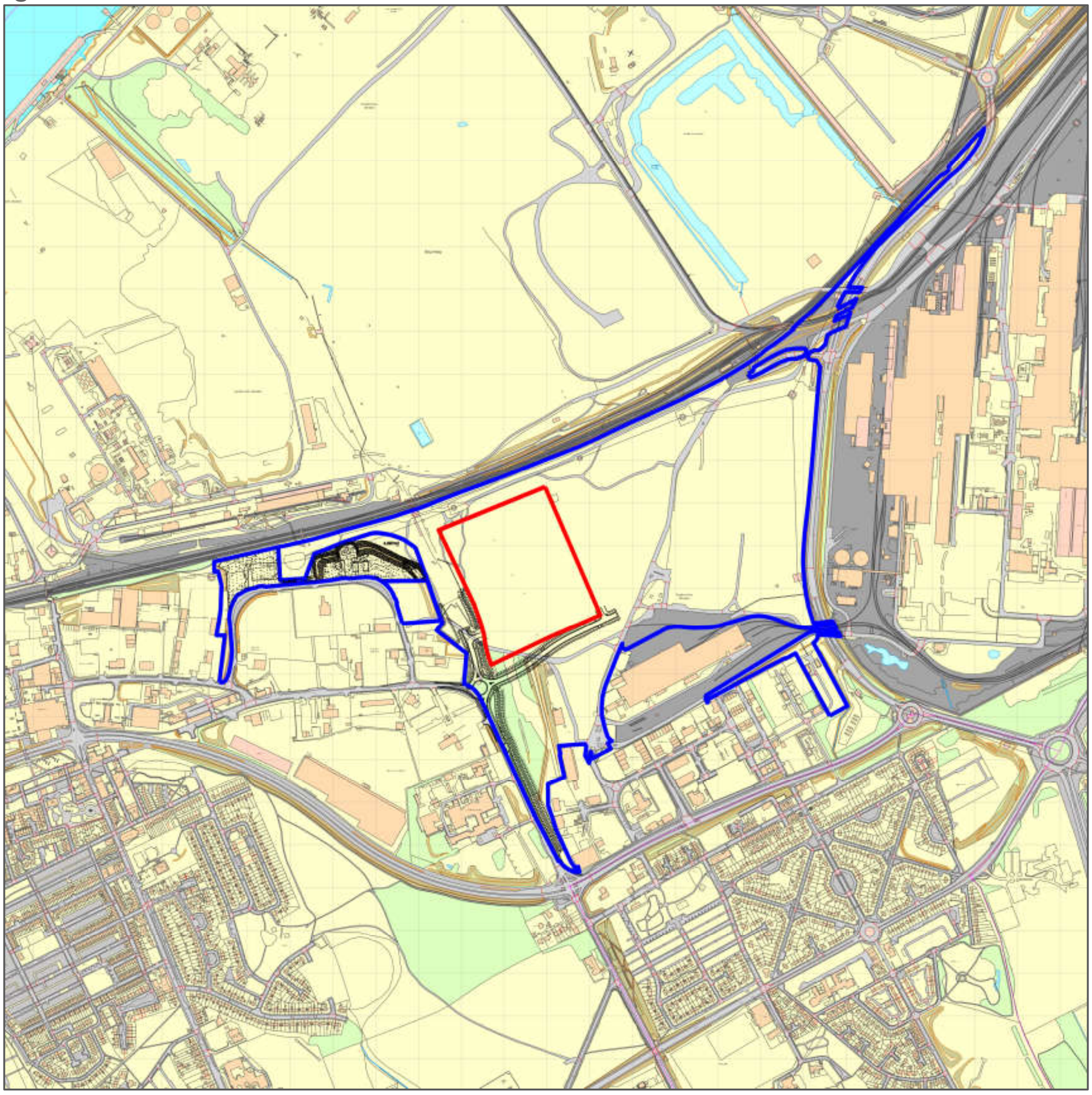
1.3 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

1.4 An earlier version of this report was submitted to the Environment Agency (EA) in 2022, following which a number of comments were received. This report seeks to address those comments and to provide sufficient baseline noise data on which to satisfy the requirements of the EA.

Site Description

1.5 The proposed site covers an area approximately 10 hectares and is known as Grangetown. It forms part of the South Tees Development Corporation (STDC) Master Plan for the creation of a world-class industrial park on the River Tees and is located north of Grangetown, approximately 6.5km to the northeast of Middlesbrough town centre. The site is bound by the proposed new access road to the west, further development plots of the STDC to the east and south and the Tees Valley railway line to the north. The site location is shown in **Figure 1.1**.

Figure 1.1: Site Location



Proposed Development

1.6 The proposed Tees Valley Energy Recovery Facility ("ERF") will be located at Grangetown Prairie, Grangetown, Redcar, TS6 6TY. The proposed Installation will cover an area of approximately 10 hectares and is located within the western footprint of the former Cleveland Steel Works, now part of the South Tees Development Corporation ("STDC").

1.7 The proposed Installation will thermally process up to 512,000 tonnes of non-hazardous municipal solid waste, together with non-hazardous commercial and industrial waste ("C&I"). The associated Waste Transfer Station will provide storage capacity for waste during shutdown of one or both of the proposed incinerator lines.

1.8 The proposed ERF has been designed and configured as a Combined Heat and Power ("CHP") plant and will have the capability to export electricity to the National Grid and heat to local users, employing highly regulated technology to extract low carbon and renewable energy from the municipal wastes.

1.9 Based on an operational regime of 8,000 hours, the Installation will have an annual average throughput that will vary depending on calorific value of the incoming waste - grate has a maximum capacity of 32 tonnes per hour (100% mechanical capacity per grate) at 8.438 MJ/kg (load point 1) giving maximum throughput of 512,000 tonnes per annum. However, the most likely operating condition is based on a grate capacity of 28.125t/hr (88% mechanical capacity per grate) at 9.6MJ/kg (load point nominal) which gives an annual throughput of 450,000 tonnes per annum.

1.10 In accordance with Annex IIB of the Waste Framework Directive (as amended), the operations at the Installation will be classed as:

- R1 – Use principally as a fuel or other means to produce energy; and
- R13 - Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced).

1.11 The indicative site masterplan and the proposed layout of the link road infrastructure serving the wider STDC area are shown in **Appendix B.**

Existing Sensitive Receptors

1.12 Noise from any proposed sources will be assessed at nearby existing noise sensitive receptors (NSRs), which are detailed below in **Table 1.1.**

Table 1.1: Noise Sensitive Receptor Locations

NSR Number	Description	Grid Reference		Bearing from Site	Distance from Site Boundary
		Easting	Northing		
1	Residential dwellings on Jones road	453805	520817	South west	640m
2	Residential dwellings on St James Court	454772	520635	South	600m
3	Bolckow Road	455314	520891	South east	770m

1.13 An impact may be experienced at other receptors, however, given the greater distance, any impact is likely to be less than at those stated above.

Previous Noise and Vibration Work

1.14 **Table 1.2** summarises the noise and vibration work that has previously been undertaken to date in support of planning stage works for the development.

Table 1.2: Previous noise and vibration work

Planning Reference	Description	Noise and Vibration work
R/2019/0767/OOM	Outline Application for Original Scheme	Baseline noise monitoring; Environmental Statement (ES) chapter.

1.15 The original ES and noise and vibration work has been accepted by Redcar and Cleveland Borough Council (RCBC).

1.16 With respect to elements relevant to the Environmental Permit application, the noise and vibration chapter included baseline noise monitoring representative of the nearest NSRs to the Installation. The work recommended that the noise climate as a consequence of the development should not increase above the existing baseline background level at the NSRs.

1.17 This report utilizes the noise survey data gathered for the positions selected and the subsequent analysis to determine the baseline noise environment at NSRs, and concludes that mitigiation selections should achieve maximum design targets relative to the background noise level.

Planning Obligations

1.18 The current planning consent does not include any noise specific planning conditions relevant to the operations of the installation. The adopted limits within the previous works do not form part of any planning conditions.

1.19 Condition 18 states that the proposed incinerator will require a permit under Schedule 5.1 Part A (1) of the Environmental Permitting Regulations (England and Wales) 2016, for which noise and vibration is a consideration.

2. POLICY, STANDARDS AND GUIDANCE

Noise and Vibration Management: Environmental Permits, 2021

2.1 In July 2021 technical guidance was published by the Environment Agency (EA) setting out how UK environment agencies assess noise, legal requirements for managing noise, noise impact assessments and noise management plans. This 2021 guidance replaces the H3 "horizontal" guidance and relies on noise impact assessments made using the recently updated BS4142 assessment method.

2.2 The document outlines permit conditions and regulation of noise. It also describes the principles of noise measurement and prediction, and the control of noise by design, operational and management techniques and abatement technologies.

2.3 The Environment Agency, Scottish Environment Protection Agency (SEPA), Natural Resources Wales and Northern Ireland Environment Agency have produced this guidance to help holders and potential holders of permits apply for, vary, and comply with their permits.

2.4 The document identifies that an assessment of noise will be site-specific and will depend upon many factors but that, generally speaking, more data will be needed to assess an impact than to assess the risk of an impact.

2.5 To determine whether a more stringent level of control is required, it will be necessary to identify the required end-point or desired noise output from the process at the sensitive receptors. To achieve this, each source may have to be addressed individually.

2.6 The performance required to achieve a reduction in emissions will be determined by Permit conditions, and the need to achieve Best Available Techniques (BAT) for a particular operation. For any remedial option, an assessment of the costs and benefits should be undertaken to inform the final selection. In many cases the decision will be straightforward, but in others it will not be clear-cut. Several factors may have to be balanced. Noise must also be balanced alongside other emissions and environmental impacts in determining BAT for a particular installation. Conflict between noise and other pollutants is rare however, and it is normally a balance of costs and benefits.

Guidance on noise impact assessment involving calculations or modelling, 2018

2.7 This web-based guidance was published on 23 October 2018 and provides direction on the information that must be submitted to the Environment Agency in a noise impact assessment that uses computer modelling or spreadsheet calculations.

BS 4142: 2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

2.8 The Environmental Permitting guidance draws heavily on the BS 4142 Standard, which describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;

- Sound from fixed installations which comprise mechanical and electrical plant and equipment;

- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial Site.

2.9 The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The Standard advises the purpose of the methodology includes the assessment of sound from any plant and activities associated with existing industrial and/or commercial uses at proposed residential dwellings.

2.10 If appropriate, the specific sound level of the source (Ls) is corrected, by the application of one or more corrections for acoustic features such as tonal qualities and/or distinct impulses, to give a 'rating' level ($L_{Ar,Tr}$).The Standard effectively compares and rates the difference between the rating level of the specific sound and the typical background sound level ($L_{A90,T}$) in the absence of the specific sound.

2.11 The Standard advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) the source in question operates or is proposed to operate in the future.

2.12 Comparing the rating level with the background sound level, BS 4142 states:

> "Typically, the greater this difference, the greater the magnitude of impact.
>
> A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
>
> A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
>
> 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 source having a low impact, depending on the context."

3. NOISE MODELLING

Source noise data

3.1 A detailed CadnaA noise model has been contructed to reflect the technology provider's information. This has included using internal reverberant sound pressure levels for process buildings, sound power levels for external items of plant, predicted stack noise emission level, sound reduction indices of potential materials, and predicted noise levels for HGV deliveries.

3.2 The following prediction methodologies were adopted for the modelling exercise:

- The model was generated using the PC based CadnaA® noise modelling package.
- The noise model was set up to apply the noise prediction methodology set out in ISO9613-2: 1996: Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation.
- Mapping of the Site and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points.
- Indicative ground topography was approximated using the LIDAR Composite 1m DTM information freely available from the data.gov website.
- To reflect the local ground cover, ground absorption was set to G = 0.5 (50% acoustically absorptive ground).
- The model was set to include second order reflected noise from solid structures.
- A 1x1m grid spacing was used at a calculated height of 4m above local ground height.
- Buildings which would provide screening have been incorporated as reflective façades.
- The layout and elevations as shown in **Appendix B** have been incorporated into the noise model in order to account for screening that is provided by the development itself.

Noise from Vehicle Trip Movements

3.3 Total Weekday Vehicle Trip Movements have been provided for waste delivery and residual waste. Traffic data is detailed in **Appendix C**.

3.4 The assumed quantity of deliveries in any 1-hour period, and 15-minute night-time period have been derived based on maximum hourly movements as worst-case. HGV movements related to each event are shown in **Table 3.1**.

Table 3.1: Total number of HGV movements

Event	Max number of events per hour
Waste Delivery	25
Bottom Ash Collection	2

Event	Max number of events per hour
APCR Residue Collection	2
Fuel / Ammonia Delivery	2
PAC / Lime Delivery	2
Workshop Access	2

3.5 In the absence of specific noise data, noise data has been gathered from other representative sources, including BWB library data and BS5228:2019+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1:Noise*.

3.6 A summary of the octave band line source noise data utilised within the operational noise assessment is presented in **Table 3.2** below.

Table 3.2: Octave band data for line sources associated with known operations, at 10m

Source	Octave Band Sound Pressure Levels (L_{Amax} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
HGV Movement (BS5228 Table C6 Row 21 Road Lorry Full)	96	82	74	73	77	72	71	64	80

3.7 For HGV movements, the calculations detailed in BS5228:2019+A1:2014, for calculating sound power levels (SWL) from mobile plant and haulage routes have been used:

$SWL = L_{Amax@10m} + 28$

3.8 In calculating the level of noise produced by the site access road, vehicle quantities and vehicle speed of 10mph (16kmph) have been accounted for. The following equation has been used:

$L_{Aeq,1hr} = L_{WA} - 33 + 10\log_{10} Q - 10\log_{10} V - 10\log_{10} (d)$ (BS5228-1:2009+A1:2014(F.6)).

Where:

L_{WA}	*sound power level of the plant;*
Q	*number of vehicles per hour; and*
V	*average vehicle speed in km/h.*
d	*distance in m.*

3.9 **Table 3.3** calculates the level of noise from the site access roads as per the calculation detailed in BS5228-1:2009+A1:2014. The sound power level used in equation F.6 has been derived from the sound pressure level in **Table 3.2**.

Table 3.3: Calculation of noise level from the access road

Event	L_{WA}	Number of vehicles per hour	Average vehicle speed in km/h	Sound pressure level of access road at 10m $L_{Aeq,1hr}$
Waste Delivery	108	25	16	67
Bottom Ash Collection	108	2	16	56
APCR Residue Collection	108	2	16	56
Fuel / Ammonia Delivery	108	2	16	56
PAC / Lime Delivery	108	2	16	56
Workshop Access Route 1	108	1	16	53
Workshop Access Route 2	108	1	16	53

Noise from installation operations

3.10 The technology provider has provided guaranteed source noise data, which has been used as a basis for the design work. This has been supplemented by noise data from similar schemes. The original data is included in **Appendix D**.

Table 3.4: Octave band data for mechanical ventilation outlet – Turbine hall and bottom ash hall

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Mechanical venilation outlet	-	85	88	85	84	80	74	69	64	85

Table 3.5: Octave band data for stack

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Stack opening	107	110	101	92	88	84	90	80	73	94

Table 3.6: Octave band data for ACC

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
ACC inlet	102	104	105	101	99	97	92	88	81	102
ACC outlet	101	103	103	99	97	95	90	85	78	100
ACC steam duct	100	96	96	90	89	90	97	88	84	100

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Total	106	107	107	103	101	100	99	92	86	106

Table 3.7: Octave band data for conveyor

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Conveyor	95	90	88	86	85	84	80	77	76	88

Table 3.8: Octave band data for Transformer

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Transformer	98	100	102	97	97	91	86	81	74	97

Table 3.9: Octave band data for Roof Chiller Unit

Source	Octave Band Sound Power Levels (L_w dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Roof Chiller Unit	84	99	98	94	90	91	89	85	79	96

Breakout noise

3.11 Internal to external noise breakout calculations have been used to assess the noise levels produced from within the Installation buildings to the external façades. Regarding internal to external breakout noise, assumed internal reverberant noise level have been adopted as below, based on experience of similar scale projects that BWB has been involved in. The overall and octave band reverberant data in **Table 3.10** was supplied by the technology provider for Southmoor Energy Centre in North Yorkshire, which was submitted to and accepted by the EA previously.

Table 3.10: Internal reverberant noise levels used in assessment

Type	Internal Revereant Noise Level (dB)									A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	
Tipping hall and bunker	84	84	84	77	74	74	74	65	71	80
Turbine hall	88	85	90	88	89	90	90	85	79	95
Boiler hall	86	86	83	83	82	78	78	77	71	85
Bottom ash hall	86	85	77	71	71	69	68	68	59	75

3.12 Regarding the façade makeup, **Table 3.11** details the assumed façade components, which have been used in the model.

Table 3.11: Octave band specification of façade component

Type	Octave band reduction (dB)								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Wall system 1W Kingspan AWP/60 + no lining (RW24)	5	15	16	19	23	26	22	39	39
Roof 10R Kingspan KS1000RW/80+no lining (RW25)	5	20	18	20	24	20	29	29	47
Louvres	-	5	6	11	12	15	22	25	18

3.13 The following noise inputs have been converted into sound power levels where appropriate assuming line source point source attenuation respectively, and subsequently included within the model as described below:

- Calculated specific sound levels from the HGV access route has been calculated using equation F.6 detailed in BS5228-1:2009+A1:2014 based on indicative number of HGV pass-bys provided by the client. No Waste Deliveries take place during the 23:00 - 07:00 nigh-time period. These have been corrected in the model as a line source at a height of 1.5m using the sound pressure level in **Table 3.3**;
- The Bottom ash hall and Turbine building are equipped with three and six mechanical ventilation units on the roof, respectively. These have been modelled as point sources using the sound power level in **Table 3.4**.
- The supplied sound power level of the two stacks is based on a stack height of 90m and has been included as a point source as per **Table 3.5**. The exhaust velocity has been modelled at 20m/s with a nominal flue gas temperature of 135°C.
- The outdoor part of the steam duct to the ACC shall be foreseen with sufficient sound insulation to meet the specification in **Table 3.6**, also in steam bypass operation. The combined sound power levels have been included as point sources.
- The conveyors been included as a line source with the sound power levels provided in **Table 3.7**.
- The transformer been included as a point source with the sound power levels provided in **Table 3.8**.
- The roof chiller unit has been included as a point source with a sound power level provided in **Table 3.9**.
- Calculated specific sound level from breakout noise has been included in the model as a horizontal and vertical area source on each aspect of the buildings, based on the internal reverberant noises level in **Table 3.10** and façade components as specified in **Table 3.11**. No correction for "On-time" has been accounted for.

3.14 The specific sound levels at the NSR have been calculated as receiver points at 4m above ground for the daytime and night-time. The calculated levels due to operations during each period are presented in **Table 3.12.**

Table 3.12: Predicted specific sound level at NSR

Period	NSR 1	NSR 2	NSR 3
Daytime	40	42	40
Night-time	36	39	38

3.15 Noise contour maps have been generated in outdoor living areas at heights of 4m for the daytime and night-time in **Appendix E**.

4. BASELINE NOISE CLIMATE

4.1 The results of the noise modelling exercise have been used to compare the predicted noise levels against the rating level limits set out in this section.

Short term baseline noise monitoring from planning application

4.2 A baseline noise survey was undertaken by PHA Ltd to inform the study encompassing daytime, late evening and night-time periods between 5th and 6th December 2019. The noise measurements established typical ambient and background noise levels externally at the closest noise sensitive dwellings to the installation.

4.3 The equipment used during the survey is detailed below.

- Integrating Sound Level Meter, RION NA-27, Type 1, Serial No 431986
- RION UC-53A Microphone Serial No 307060
- RION NC-74 Calibrator Serial No 530712

4.4 The noise monitoring equipment was stated to be calibrated to a traceable standard within the 2 years preceding the survey, and no variations were noticed in field calibration.

4.5 The adopted noise survey measurement locations, which were selected as representative of the nearest noise sensitive receptors, are shown in **Figure 4.1**, and described as follows:

- Location 1 (L1) – sound level meter positioned adjacent to No 21 Jones Road, 660m SW of site. The meter was mounted on the tripod at a height of 1.5m above ground and at least 3m from any reflective surfaces
- Location 2 (L2) – sound level meter positioned outside No 3 St James Court, 560m SSE of site. The meter was mounted on the tripod at a height of 1.5m above ground and at least 3m from any reflective surfaces
- Location 3 (L3) – sound level meter positioned outside No 139 Bolkow Road, 825m ESE of site The meter was mounted on the tripod at a height of 1.5m above ground and at least 3m from any reflective surface

4.6 Weather conditions during the survey were as follows:

- 5th Dec 2019 - Daytime – 8°C, Overcast sky, Wind 0-10 mph SW, 1010mb, 79% rh.
- 5th Dec 2019 – Evening – 11°C, Overcast sky, Wind 0-10 mph SW, 999mb, 84% rh.
- 6th Dec 2019 – Night-time – 12°C, Overcast sky, Wind 0-10 mph SW, 994mb, 85% rh.

4.7 A summary of the noise levels measured at L1, L2, and L3 during the survey period is provided in **Table 4.1** to **Table 4.3**.

Figure 4.1: Noise Measurement Locations

Table 4.1: Location 1 Results

Location	Period	Data ID	LAmax	LAeq	LA10	LA90	Measurement Duration	Date	Time	Comment
			dB	dB	dB	dB				
1	Daytime	1	74.1	58.0	60.4	52.9	00:15:00.00	05-12-2019	09:05:15	Traffic flow along A66 and local road network dominant source.
		2	68.5	55.6	57.5	52.9	00:15:00.00	05-12-2019	09:20:15	
		3	74.5	58.4	60.1	53.5	00:15:00.00	05-12-2019	09:35:15	
		4	76.8	59.2	60.0	52.9	00:15:00.00	05-12-2019	09:50:15	
		5	73.1	56.7	58.1	52.9	00:15:00.00	05-12-2019	10:05:15	
		6	66.5	55.9	58.4	52.2	00:15:00.00	05-12-2019	10:20:15	
		23	63.6	55.9	58.0	52.9	00:15:00.00	05-12-2019	17:58:56	
		24	62.8	56.4	58.8	53.4	00:15:00.00	05-12-2019	18:13:56	
Average Daytime Values			**72.4**	**57.8**	**59.0**	**53.0**				
1	Evening	25	65.4	56.8	59.4	52.0	00:15:00.00	05-12-2019	20:34:13	Traffic flow along A66 and local road network dominant source.
		26	59.6	54.6	55.6	51.5	00:15:00.00	05-12-2019	20:49:13	
		27	59.9	56.7	58.1	55.6	00:15:00.00	05-12-2019	21:04:13	
		28	55.3	54.1	55.0	53.0	00:15:00.00	05-12-2019	21:19:13	
Average Evening Values			**61.5**	**55.7**	**57.4**	**53.3**				
1	Nightime	37	56.5	47.7	50.2	42.9	00:15:00.00	06-12-2019	00:10:24	Traffic flow along A66 and local road network dominant source. Birdsong audible during early morning period
		39	51.0	43.8	46.6	40.5	00:15:00.00	06-12-2019	00:25:24	
		40	62.4	50.5	53.0	40.7	00:15:00.00	06-12-2019	00:40:24	
		54	48.2	40.7	42.6	38.3	00:15:00.00	06-12-2019	00:55:24	
		53	61.4	49.4	50.6	42.3	00:15:00.00	06-12-2019	05:30:49	
		38	59.8	53.3	57.6	47.7	00:15:00.00	06-12-2019	05:45:49	
		55	69.2	57.7	60.6	50.4	00:15:00.00	06-12-2019	06:00:49	
		58	63.7	55.0	58.2	49.1	00:15:00.00	06-12-2019	07:10:54	
Average Nighttime Values			**62.8**	**52.5**	**55.5**	**46.0**				

Table 4.2: Location 2 Results

Location	Period	Data ID	LAmax	LAeq	LA10	LA90	Measurement Duration	Date	Time	Comment
			dB	dB	dB	dB				
2	Daytime	7	68.7	59.1	62.2	54.0	00:15:00.00	05-12-2019	11:02:17	Traffic flow along A66 and local road network dominant source.
		8	70.4	59.0	61.7	55.0	00:15:00.00	05-12-2019	11:17:17	
		9	67.7	57.8	59.8	54.6	00:15:00.00	05-12-2019	11:32:17	
		10	70.3	58.5	61.1	53.7	00:15:00.00	05-12-2019	11:47:17	
		11	70.7	60.2	63.1	54.0	00:15:00.00	05-12-2019	12:02:17	
		12	71.3	59.6	61.8	56.3	00:15:00.00	05-12-2019	12:17:17	
		21	69.2	58.4	61.5	53.4	00:15:00.00	05-12-2019	17:22:30	
		22	70.8	60.6	64.6	54.2	00:15:00.00	05-12-2019	17:37:30	
Average Daytime Values			**70.0**	**59.2**	**62.2**	**54.5**				
2	Evening	29	62.5	57.7	60.8	53.1	00:15:00.00	05-12-2019	21:39:31	Traffic flow along A66 and local road network dominant source.
		30	62.4	53.4	55.9	48.8	00:15:00.00	05-12-2019	21:54:31	
		31	57.9	53.1	56.2	49.7	00:15:00.00	05-12-2019	22:09:31	
		32	58.9	52.6	54.7	49.3	00:15:00.00	05-12-2019	22:24:31	
Average Evening Values			**60.9**	**54.7**	**57.6**	**50.6**				
2	Nightime	41	58.6	42.1	44.1	38.9	00:15:00.00	06-12-2019	01:20:39	Traffic flow along A66 and local road network dominant source. Birdsong audible during early morning period
		42	59.3	48.0	51.2	40.3	00:15:00.00	06-12-2019	01:35:39	
		43	56.5	47.5	52.4	38.3	00:15:00.00	06-12-2019	01:50:39	
		51	50.9	42.9	46.0	36.9	00:15:00.00	06-12-2019	02:05:39	
		52	54.9	46.5	50.6	36.8	00:15:00.00	06-12-2019	04:58:12	
		44	60.4	50.3	54.3	42.1	00:15:00.00	06-12-2019	05:13:12	
		56	74.3	65.5	68.6	57.4	00:15:00.00	06-12-2019	06:20:29	
		59	77.1	65.6	69.0	58.4	00:15:00.00	06-12-2019	07:34:59	
Average Nighttime Values			**70.1**	**60.3**	**63.0**	**52.1**				

Table 4.3: Location 3 Results

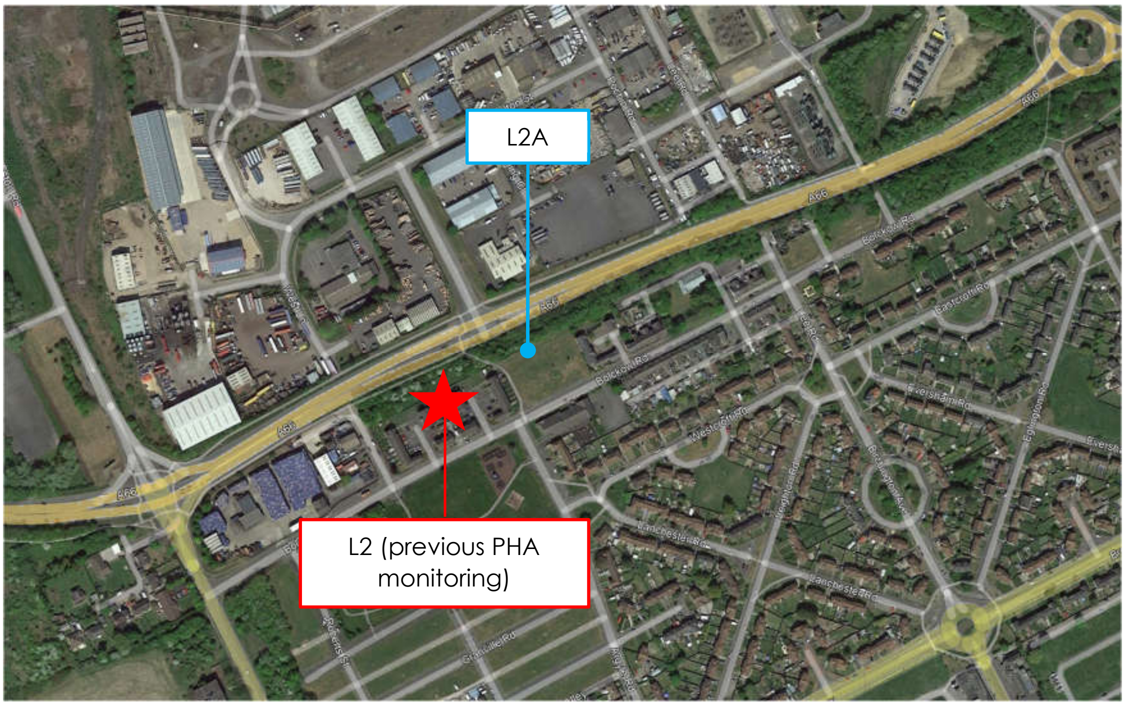
Location	Period	Data ID	LAmax	LAeq	LA10	LA90	Measurement Duration	Date	Time	Comment
			dB	dB	dB	dB				
3	Daytime	13	71.9	62.0	64.1	59.3	00:15:00.00	05-12-2019	13:07:20	Traffic flow along A66 and local road network dominant source.
		14	75.8	61.8	63.5	56.9	00:15:00.00	05-12-2019	13:22:20	
		15	69.2	61.0	63.4	56.3	00:15:00.00	05-12-2019	13:37:20	
		16	69.7	60.9	62.9	57.6	00:15:00.00	05-12-2019	13:52:20	
		17	67.9	61.2	63.5	57.5	00:15:00.00	05-12-2019	14:07:20	
		18	67.1	61.6	64.0	58.0	00:15:00.00	05-12-2019	14:22:20	
		19	71.8	60.9	63.7	55.9	00:15:00.00	05-12-2019	16:46:58	
		20	69.4	60.5	63.5	55.7	00:15:00.00	05-12-2019	17:01:58	
Average Daytime Values			**71.2**	**61.3**	**63.6**	**57.3**				
3	Evening	33	58.4	52.1	53.6	49.7	00:15:00.00	05-12-2019	22:45:55	Traffic flow along A66 and local road network dominant source. Electrical hum from sub station transformers on opposite side of A66 audible drone between traffic
		34	55.4	51.8	53.4	50.5	00:15:00.00	05-12-2019	23:00:55	
		35	51.6	50.4	51.1	49.7	00:15:00.00	05-12-2019	23:15:55	
		36	53.8	51.1	53.2	49.1	00:15:00.00	05-12-2019	23:30:55	
Average Evening Values			**55.5**	**51.4**	**52.9**	**49.8**				
3	Nightime	45	50.2	46.1	48.1	44.0	00:15:00.00	06-12-2019	02:23:41	Traffic flow along A66 and local road network dominant source. Electrical hum from sub station transformers and generator engines on opposite side of A66 audible drone
		46	52.7	43.8	46.2	41.4	00:15:00.00	06-12-2019	02:38:41	
		47	54.3	46.1	48.0	43.1	00:15:00.00	06-12-2019	02:53:41	
		48	50.3	41.3	43.2	38.9	00:15:00.00	06-12-2019	03:08:41	
		49	46.4	44.7	45.6	43.8	00:15:00.00	06-12-2019	03:23:41	
		50	47.6	44.7	45.4	43.9	00:15:00.00	06-12-2019	03:38:41	
		57	67.5	60.5	62.9	56.6	00:15:00.00	06-12-2019	06:48:07	
		60	66.4	61.1	63.7	58.0	00:15:00.00	06-12-2019	07:55:51	
Average Nighttime Values			**61.3**	**55.1**	**57.6**	**51.8**				

Longer Term Baseline Noise Monitoring undertaken by BWB

4.8 Based on discussions with the EA following submission of the initial report, further baseline noise data has been sought to provide a longer term view of the existing noise climate in the local area.

4.9 A baseline noise survey has been undertaken to determine the prevailing noise climate at a location representative of the closest noise sensitive receptors to Location 2 (L2A). The measurement location adopted during the survey is identified in **Figure 4.2** as L2A.

Figure 4.2: Baseline Noise Measurement Location 2A



4.10 Continuous unattended noise monitoring was undertaken at Location 2A between 23:00 on Friday 17th March 2023 and 14:00 on Monday 20th March 2023. The microphone at Location 2A was established in free-field conditions at 1.5 m above local ground level and was positioned immediately adjacent to the northern boundary of recreational grounds located between residential properties on St Nicholas Court and Bolckow Road.

4.11 During periods of attendance on-site, the daytime and night-time noise climate was noted to be dominated by road traffic noise on the A66 and the wider road network. Distant, anonymous mechanical plant noise was noted to be faintly audible during the night-time during lulls in traffic flows on the local network.

Measurement Equipment

4.12 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 4.4**.

4.13 Equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed. The sound level meter, pre-amplifier and microphone were calibrated to traceable standards at an accredited laboratory within the 24 months prior to the measurements. The portable calibrator was calibrated within the 12 months preceding the date of the survey.

Table 4.4: Noise Measurement Equipment

Location	Equipment	Make & Model	Serial Number
Location 2A	Sound Level Meter	SVAN 971	80344
	Microphone	ACO 7052E	69566

Location	Equipment	Make & Model	Serial Number
	Preamp	SV18	71577
	Calibrator	B&K DB0311	449050

Meteorological Conditions

4.14 Based on a review of meteorological data from nearby weather stations it is understood that weather conditions remained generally conducive to environmental noise measurement, it being dry with negligible winds (<5ms^{-1}).

Measurement Results

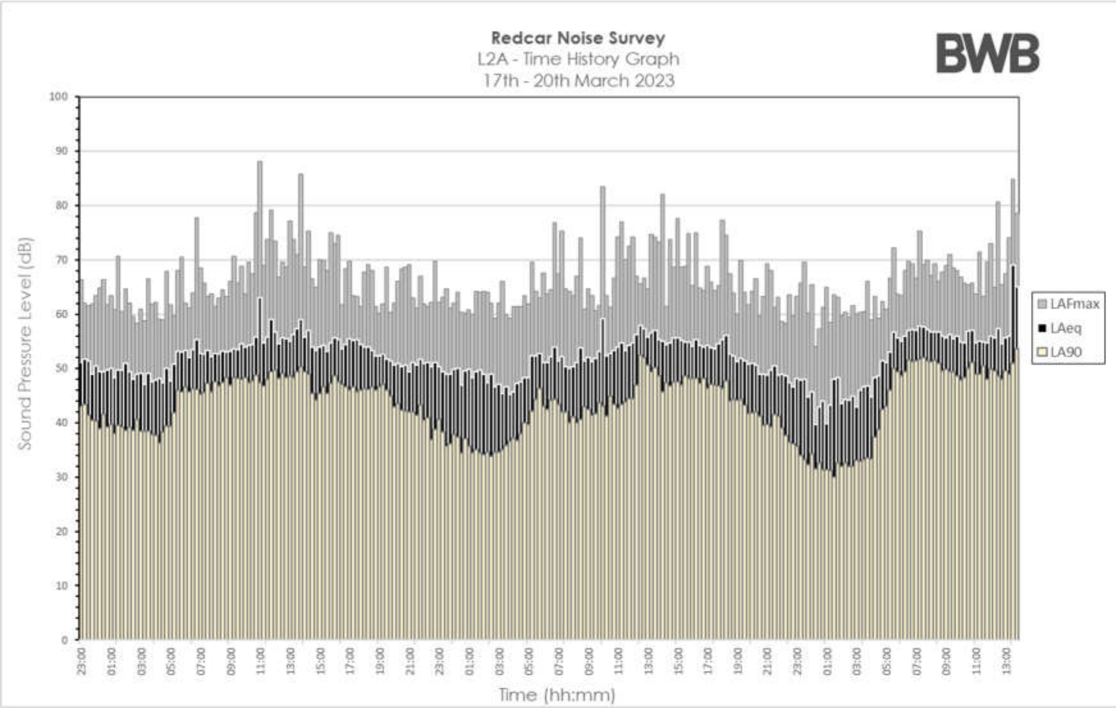
4.15 A summary of daytime and night-time noise levels measured at Location 2A is presented in **Table 4.5**. A graphical summary of the survey data is presented in **Figure 4.3**.

Table 4.5: Summary of Measured Sound Pressure Level at Location 2A

Description	Start Time	Period (T)	dB $L_{Aeq,T}$	dB $L_{A90,T}$[1]	dB L_{AFmax}[2]
Friday Night	17/03/2023 23:00	8-hours	51	41	68
Saturday Day	18/03/2023 07:00	16-hours	55	46	-
Saturday Night	18/03/2023 23:00	8-hours	50	38	66
Sunday Day	19/03/2023 07:00	16-hours	54	46	-
Sunday Night	19/03/2023 23:00	8-hours	51	44	75
Monday Day	20/03/2023 07:00	7-hours	59	50	-

[1] arithmetic average $L_{A90,15mins}$ during measurement period
[2] 10th Percentile $L_{AFmax,15min}$ noise levels during measurement period

Figure 4.3: Full Results – Location 2A



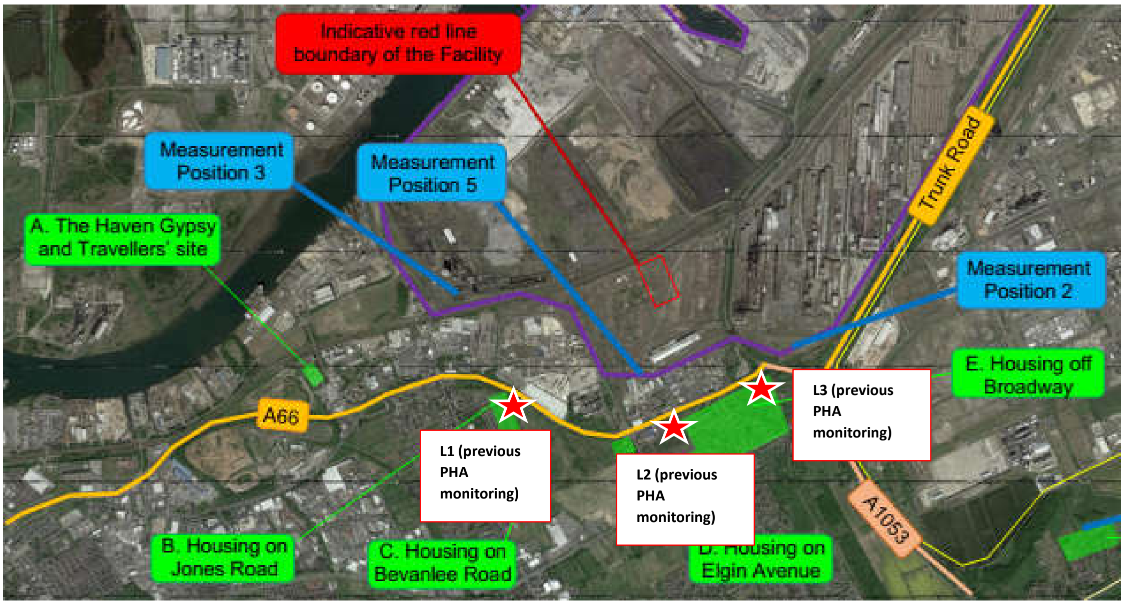
Longer Term Baseline Noise Monitoring – Other Sources

4.16 A planning application has previously been submitted for a DME production site immediately to the east of the proposed installation, and was accompanied by a baseline noise survey (Redcar & Cleveland planning application R/2023/0080/ESM).

4.17 **Figure 4.4** shows an excerpt from the baseline noise survey report (Sol Acoustics document ref: P2055-REP01-REV A-BDH), with PHA's noise Locations 1-3 annotated. The survey included a number of Measurement Positions in blue, some of which were close to receptors relevant to this assessment. Key residential receptors are shown in green. Their Measurement Positions 2 and 3 covered 15 days (including two weekends) from 1st-16th February 2022, so the data is more recent and more extensive than the PHA data.

4.18 For L2, the nearest Measurement Position featured in the adjacent development's planning application is Measurement Position 5, however this measurement position is not considered by BWB to be representative of the noise climate at L2.

Figure 4.4: Noise Measurement Positions from the DME application (taken from Sol Acoustics report, annotated)



4.19 Their Measurement Positions 3 and 2 are considered representative of L1 and L3, respectively.

4.20 The following details are provided in the Sol Acoustics report:

> *"**Noise Monitoring Position 3**: Mast-mounted microphone at c.2.5 metres above local ground level and c.600 metres distance to the north of the housing on Jones Road. The microphone was mounted in free-field acoustic conditions. Continuous long term unattended environmental noise level measurements were undertaken at this position between c.13:20 hours during Tuesday 1 February and c.09:15 hours during Wednesday 16 February 2022. Key noise sources included noise from road traffic on the A66 Road (c.430 metres to the south) and infrequent passing road traffic on the existing access roads within the Teesworks site."*

> *"**Noise Monitoring Position 2**: Mast mounted microphone at c.2.5 metres above local ground level and c.320 metres distance to the north east of the housing off Broadway. The microphone was mounted in free-field acoustic conditions. Continuous long term unattended environmental noise level measurements were undertaken at this position between c.12:15 hours during Tuesday 1 February and c.09:30 hours during Wednesday 16 February 2022. Key noise sources included noise from road traffic on Trunk Road (c.100 metres distance to the south east) and the A1053 (c.180 metres distance to the south west). During the daytime period, noise from the demolition of existing buildings within the Teesworks site was also audible."*

4.21 An overview of the results is provided in **Table 4.6**.

Table 4.6: Noise Monitoring Position 2 to 3 results

Measurement Position	Date	Daytime (07:00 – 23:00 Hours)		Night Time (23:00 – 07:00 Hours)	
		dB $L_{Aeq,T}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,T}$	dB $L_{A90,15min}$ (Typical)
2	Tuesday 1 February 2022	-[A]	-[A]	50	40
	Wednesday 2 February 2022	57	48	54	39
	Thursday 3 February 2022	59	55	50	41
	Friday 4 February 2022	56	48	50	44
	Saturday 5 February 2022	51	47	50	42
	Sunday 6 February 2022	51	***45***	53	45
	Monday 7 February 2022	59	48	56	54
	Tuesday 8 February 2022	58	52	53	42
	Wednesday 9 February 2022	57	47	51	40
	Thursday 10 February 2022	59	47	53	46
	Friday 11 February 2022	59	56	-[A]	-[A]
	Saturday 12 February 2022	-[A]	-[A]	51	41
	Sunday 13 February 2022	53	47	51	***38***
	Monday 14 February 2022	57	56	48	39
	Tuesday 15 February 2022	56	47	49	43
	Wednesday 16 February 2022	-[A]	-[A]	-	-
3	Tuesday 1 February 2022	-[A]	-[A]	50	46
	Wednesday 2 February 2022	55	47	50	46
	Thursday 3 February 2022	56	53	49	46
	Friday 4 February 2022	54	***43***	47	***42***
	Saturday 5 February 2022	48	***43***	46	***42***
	Sunday 6 February 2022	48	44	48	***42***
	Monday 7 February 2022	55	52	53	48
	Tuesday 8 February 2022	55	49	49	46
	Wednesday 9 February 2022	54	47	49	46
	Thursday 10 February 2022	54	47	50	47
	Friday 11 February 2022	54	48	-[A]	-[A]
	Saturday 12 February 2022	-[A]	-[A]	48	47
	Sunday 13 February 2022	49	47	49	46
	Monday 14 February 2022	54	47	49	46
	Tuesday 15 February 2022	54	48	51	47
	Wednesday 16 February 2022	-[A]	-[A]	-	-

[A] *Measurement period significantly affected by adverse weather conditions*

Discussion

4.22 The longer term noise monitoring data has been compared against the previous background sound level data from the PHA planning application work in **Table 4.7**.

Table 4.7: Comparison of noise monitoring campaigns

Noise Sensitive Receptor	Short term PHA Location	Long Term BWB/Sol Location	Period (T)	Short Term dB $L_{A90,T}$	Long Term dB $L_{A90,T}$[1]	Difference (= Long term – short term), dB
NSR1	L1	Position 3 (Sol)	Daytime 0700-23:00	51	**43**	-8
			Night-time 23:00-0700	**38**	42	+4
NSR2	L2	L2A (BWB)	Daytime 0700-23:00	49	**46**	-3
			Night-time 23:00-0700	**37**	38	+1
NSR3	L3	Position 2 (Sol)	Daytime 0700-23:00	49	**45**	-4
			Night-time 23:00-0700	39	**38**	-1

[1] lowest measured typical background sound level per daytime and night-time period

4.23 It can be seen that the difference between the short term $L_{A90,T}$ values and those from the longer term monitoring campaigns have identified a range of differences, between -8dB and +4dB. It is considered a conservative approach therefore to use the lower of the two values for a given Location during a given period, highlighted in bold in **Table 4.7**.

5. ASSESSMENT OF NORMAL SITE OPERATIONS

5.1 For the purposes of the assessment, the predicted noise levels at the nearest residential buildings have been used as assessment locations for NSR 1 to NSR 3. The assessment has been undertaken in accordance with BS 4142:2014+A1:2019, with no character corrections applied.

5.2 **Appendix F** presents a partial noise level breakdown of sources ranked by contribution for each receptor, and indicates that, at all receptors, waste delivery noise is the dominant contributor to the cumulative noise levels.

5.3 The predicted specific noise level at NSR 1 is 40 dB(A) during the daytime, and 36 dB(A) during the night-time. The defined background noise levels at this location are 43dB $L_{A90,1h}$ for the daytime and 38 dB $L_{A90,15min}$ during the night-time (see **Table 4.7**). Therefore, the daytime BS4142 assessment is **3 dB below background** and the night-time BS4142 assessment is **2 dB below background**, both of which indicate a low impact.

5.4 The predicted specific noise level at NSR 2 is 42 dB(A) during the daytime, and 39 dB(A) during the night-time. The defined background noise levels at this location are 46 dB $L_{A90,1h}$ for the daytime and 37 dB $L_{A90,15min}$ during the night-time (see **Table 4.7**). Therefore, the daytime BS4142 assessment is **4 dB below background** and the night-time BS4142 assessment is **2 dB above background**, both of which indicate a low impact.

5.5 The predicted specific noise level at NSR 3 is 40 dB(A) during the dayimte, and 38 dB(A) during the night-time. The defined background noise levels at this location are 45dB $L_{A90,1h}$ for the daytime and 38 dB $L_{A90,15min}$ during the night-time. Therefore, the daytime BS4142 assessment is **5 dB below background** and the night-time BS4142 assessment is **equal to background**, both of which indicate a low impact.

Context

5.6 BS4142 requires context to be considered. In this regard, the historic use of the land on which the Installation will be built has been an industrial and noise generative one, and the character of the area is industrially dominated, with a trunk road separating this from residential uses. The notable existing noise sources in the area are general mechanical/industrial in nature, masked to some degree by road traffic noise. Noise from the proposed Installation will therefore not be dissimilar from that already experienced at residential receptors and therefore it is considered that the context does not affect the final assessment.

Uncertainty

5.7 Reasonably practicable steps have been taken to reduce the level of uncertainty with respect to the measurements and assessment calculation methodology. The level of uncertainty of the measurement is considered low given the length of the measurement period and intervals, and the valid weather conditions.

5.8 The level of uncertainty from the calculation is considered low. The resultant levels have been derived using acoustic modelling software, which uses industry recognised standard IOS 9613-2 calculation method. Notwithstanding this, uncertainty in the operation or sound emission characteristics of the specific source remains, albeit a low risk for this particular assessment.

5.9 There are a number of assumptions in the technology provider's acoustic data regarding acoustic treatment of noise sources, as well as the selection of equipment itself. These are considered in more detail below. It is important to note that the mitigation measures are based on a number of assumptions regarding noise output of candidate items of plant which will be subject to final selection.

6. BEST AVAILABLE TEQUNIQUES

Best Available Techniques (BAT) Audit

6.1 The design of the ERF is employing basic good practice measures to control noise. This involves consideration to the orientation of the installation, the implementation of a one-way system around the site for vehicles. Waste deliveries are also limited to the daytime period.

6.2 Further measures include the erection of an acoustic bund to the south and west of the site, the use of acoustic enclosures where appropriate and the use of attenuators.

6.3 The cumulative noise from the Installation is likely to result in the masking of perceivable characteristic and therefore it is anticipated to be indistinguishable against the existing ambient noise environment at NSRs. The rating level of the noise as defined in BS4142:2014+A1:2019 will be up to 2dB above background during the night-time, and the majority will be below pre-existing background sound levels, which indicates an impact which is below adverse.

6.4 Noise modelling has been undertaken as part of the design of the site and this model is still "live". It can be periodically updated as more information is known to assist with the ongoing management of noise.

6.5 These elements comprise the indicative requirements of the permitting regulations to demonstrate the achievement of BAT for the ERF. This, together with the information contained within this report on background noise levels, noise source information and methods of noise control, should ably demonstrate to the EA that BAT has been achieved for this project.

7. CONCLUSION

7.1 BWB was instructed by FCC Environment GRP to undertake a Noise Impact Assessment to support an Environmental Permitting application for a Tees Valley Energy Recovery Facility, Tees Valley.

7.2 The results of a detailed noise modelling exercise undertaken by BWB have been assessed against adopted noise level limits that were set based on a series of baseline noise measurements at nearest noise sensitive receptors.

7.3 The results of the assessment indicate that, based on the current design, there will be, at worst, a low impact from noise on local receptors.

7.4 It is considered that the site is low risk from a noise perspective.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

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

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

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

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

Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX B: Site Layout and Elevations

BWB

Figure B.1: Site Wide Elevations North and East

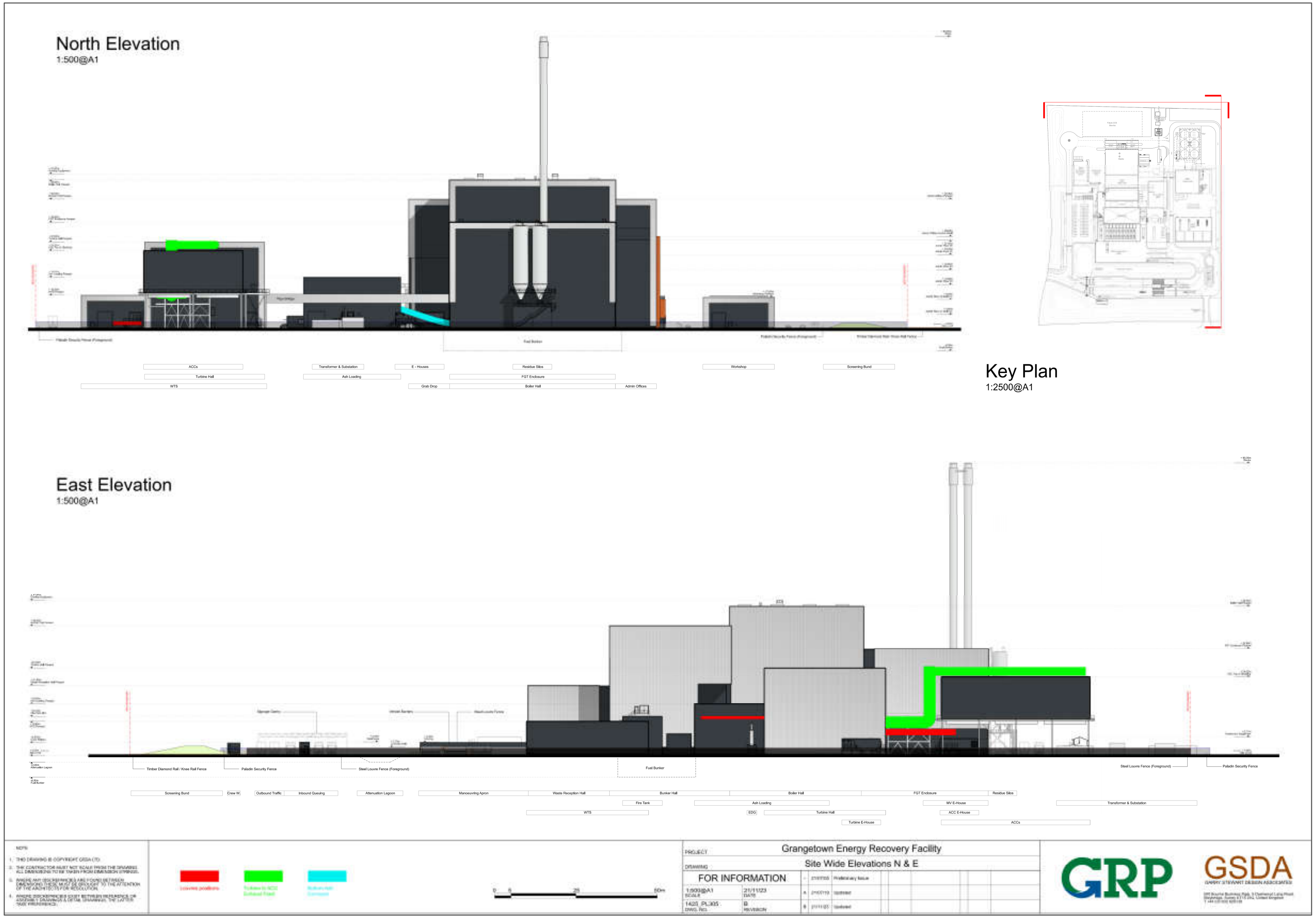
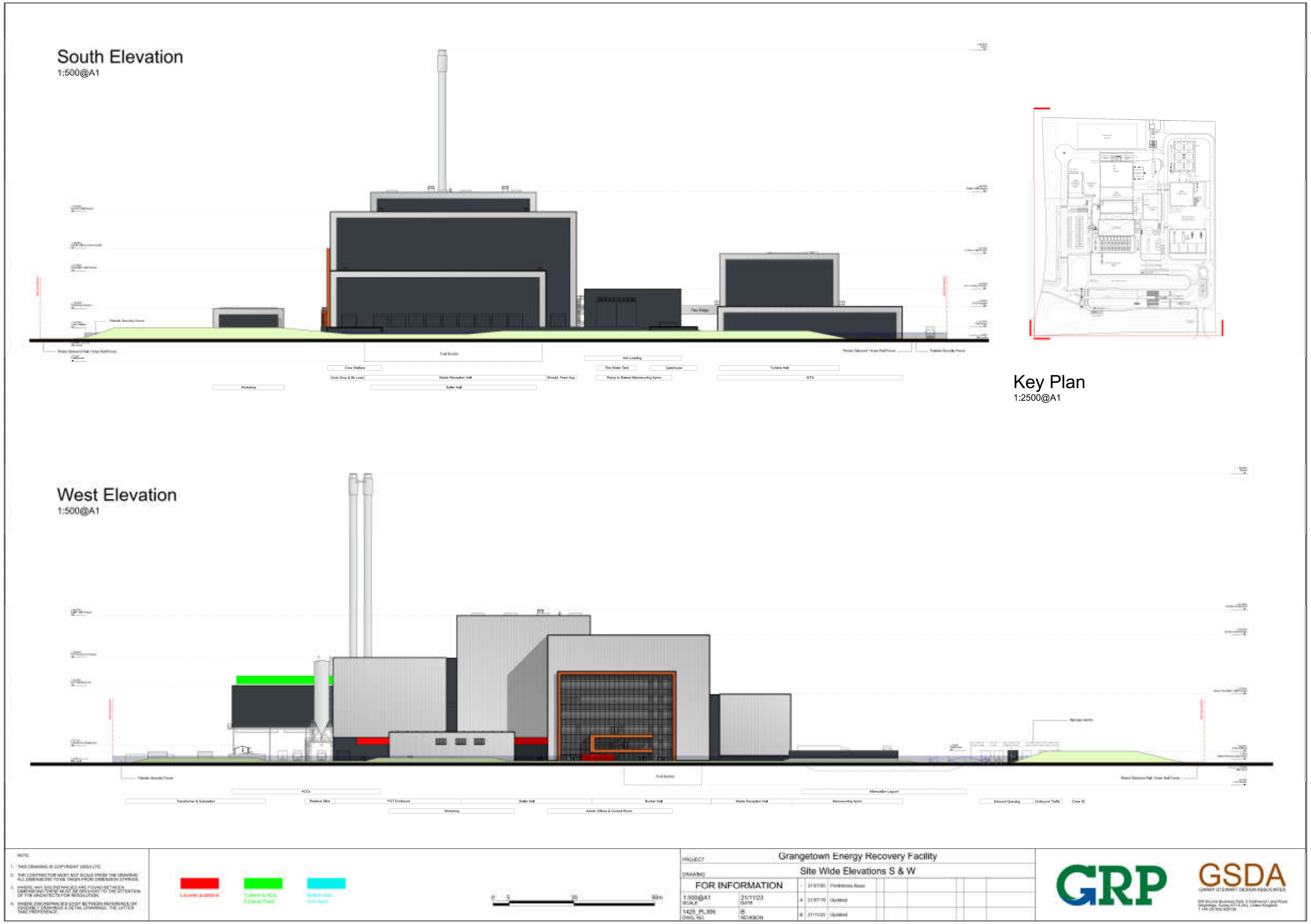


Figure B.2: Site Wide Elevations South and West



APPENDIX C: Traffic Data

Table C.1: Total Vehicle Trip Movements, Weekday - Fore Consulting Limited (2019) Grangetown Prairie ▪ Transport Statement

Time (hours)	Staff Movements		HGV (waste delivery)		HGV (residual waste)	
	Arr	Dep	Arr	Dep	Arr	Dep
0000-0100		8				
0100-0200						
0200-0300						
0300-0400						
0400-0500						
0500-0600						
0600-0700					4	4
0700-0800	25				4	4
0800-0900		8	5		4	4
0900-1000			10	5	4	4
1000-1100			20	10	4	4
1100-1200			30	20	4	4
1200-1300			20	30	4	4
1300-1400			15	20	4	4
1400-1500			12	15	4	4
1500-1600	8		10	22	4	4
1600-1700		25				
1700-1800						
1800-1900						
1900-2000						
2000-2100						
2100-2200						
2200-2300						
2300-0000	8					
Total	41	41	122	122	40	40

APPENDIX D: GUARANTEED SOUND POWER DATA FROM TECHNOLOGY PROVIDER

7 Noise control requirements

The following acoustical configuration has been implemented in the model.

7.1 Civil

In the model an indoor installation of all equipment is assumed. All buildings except the tipping hall are completely closed except for doors/ gates and ventilation openings.

The ventilation specification is assuming natural draft ventilation. This is a first approximation, when the detailed ventilation concept is known the specification should be reviewed.

7.1.1 Claddings

Walls and ceilings with cladding with the following transmission loss was considered:

f oct/Hz	63	125	250	500	1k	2k	4k	8k	Rw
TL/dB	14	22	24	30	26	38	44	48	31

This represents a sandwich cladding.

7.1.2 Gates

For the tipping hall it is assumed that the gates for waste delivery in direction North east are open during the day time, no specific transmission loss has to be achieved.

For the gates of the bottom ash storage the gate has to achieve a transmission loss of 18dB

7.1.3 Ventilation Inlets

Assumptions were used for the positions of the ventilation openings. The ventilation inlets have to be equipped with either sound absorbing acoustical louvers or a silencer. With the detail design and the exact position of the openings optimisation is possible.

For the ventilation inlets the following insertion loss was considered:

f oct/Hz	63	125	250	500	1k	2k	4k	8k	Rw
TL/dB	5	5	7	12	18	21	16	16	17

7.1.4 Ventilation Outlets

For the ventilation outlet natural draft ventilation is considered. The ventilation outlet shall be equipped with silencer to reach the following insertion losses:

f oct/Hz	63	125	250	500	1k	2k	4k	8k	Rw
TL/dB	5	6	11	12	15	22	25	18	17

7.1.5 Mechanical ventilation Outlet ST and IBA

IBA and steam turbine building are equipped with mechanical ventilation on the roof. The IBA building with 3 units and the steam turbine building with 6 units. The sound power level of each unit shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	85	88	85	84	80	74	69	64	85

7.2 Exhaust duct

The maximum sound power level emitted by the complete exhaust duct outside the building (stack body) shall not exceed (sum of two lines)):

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	75	82	87	94	85	73				87

7.3 Stack opening

The maximum sound power level emitted by the stack openings (sum of two lines) shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/Db	107	110	101	92	88	84	90	80	73	94

The height of the stack is 90m. In case the stack height is changed this specification is no longer valid!

7.4 ACC

The maximum sound power level emitted by the ACC inlet shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	102	104	105	101	99	97	92	88	81	102

The maximum sound power level emitted by the ACC outlet shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	101	103	103	99	97	95	90	85	78	100

The sound power emitted by the outdoor part of the ACC steam duct shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	100	96	96	90	89	90	97	88	84	100

The outdoor part of the steam duct to the ACC shall be foreseen with sufficient sound insulation to meet the above specification also in steam bypass operation.

7.5 Re-Coolers

The sound power level emitted by the re-coolers shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	96	97	103	103	99	95	91	85	81	101

7.6 Transformer

The sound power level emitted by the main transformer is assumed to:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	98	100	102	97	97	91	86	81	74	97

The location of the auxiliary transformers is not known. As a first assumption the sound power level of any auxiliary transformer will not exceed 80 dB(A).

7.7 Conveyer

The sound power level emitted by the conveyer between boiler building and IBA building shall not exceed:

Sound Power Level LW ref = 1 pW

f oct/Hz	31	63	125	250	500	1k	2k	4k	8k	∑A
Lw/dB	95	90	88	86	85	84	80	77	76	88

7.8 Indoor equipment

Sound emitting equipment installed indoor are relevant to the near field guarantee. With the near field guarantee fulfilled also the far field limits are met with the specified civil design. The limits will be expressed as surface sound pressure levels as this is the relevant acoustical parameter for the indoor sound levels. Table 2 lists some of the significant sound emitting equipment installed indoor and their maximum permissible surface sound pressure level.

Equipment	**Maximum surface sound pressure level at 1m**
Hydraulic Station	82dB(A)
Blow down tank pump	82dB(A)
Bottom Ash Conveyors	82dB(A)
Steam turbine	90dB(A)
Feed water pumps	90dB(A)
Turbine Oil Unit	82dB(A)
Auxiliary condensate pump	82dB(A)
Condensate pump	82dB(A)
Closed cooling water pump	82dB(A)
ID fan	82dB(A)
Air compressors	82dB(A)
Primary/secondary air fans	82dB(A)

Table 2: Maximum surface sound pressure levels for noise emitting equipment installed indoor.

For all other sound emitting equipment installed indoor surface sound pressure level at 1m distance from any single indoor equipment shall not exceed 82 dB(A).

In case it is not possible to fulfil the specification noise abating measures have to be applied, such as enclosures, housings or insulations.

7.9 Overview of implemented sound power levels

All of the known noise sources were implemented in the acoustical model either as point sources (i.e. ventilation fans), line sources (i.e. steam lines) and flat sources (representing buildings' emissions)

Given all the above, the sound power levels of the noise sources as used in the model results:

Source Area / Equipment	L_{WA}
Stacks (body and opening)	95.1 dB(A)
ACC (incl. steam piping Bypass operation)	105.1 dB(A)
Transformer area	97.5 dB(A)
Tipping Hall incl. Vent. and gates (only daytime)	103.7 dB(A)
Storage Tipping Hall (only daytime)	92.6 dB(A)
Bunker Hall	89.3 dB(A)
Boiler hall/Flue Treatment Hall incl. Ventilation	100.3 dB(A)
Steam Turbine Building incl. Ventilation	96.5 dB(A)
Re-cooler	100.9 dB(A)
Conveyer	88.5 dB(A)
Bottom ash storage building (only daytime)	94.4 dB(A)
Overall Sound Power Level	**109.9 dB(A)**

Table 3 – Summary of the sound power levels of the noise sources

APPENDIX E: CadnaA Noise Contours, $L_{Aeq,T}$, 4 metres above local ground height

Figure E.1: Industrial Noise Contour – Predicted Daytime Specific Noise Levels, Ls, dB

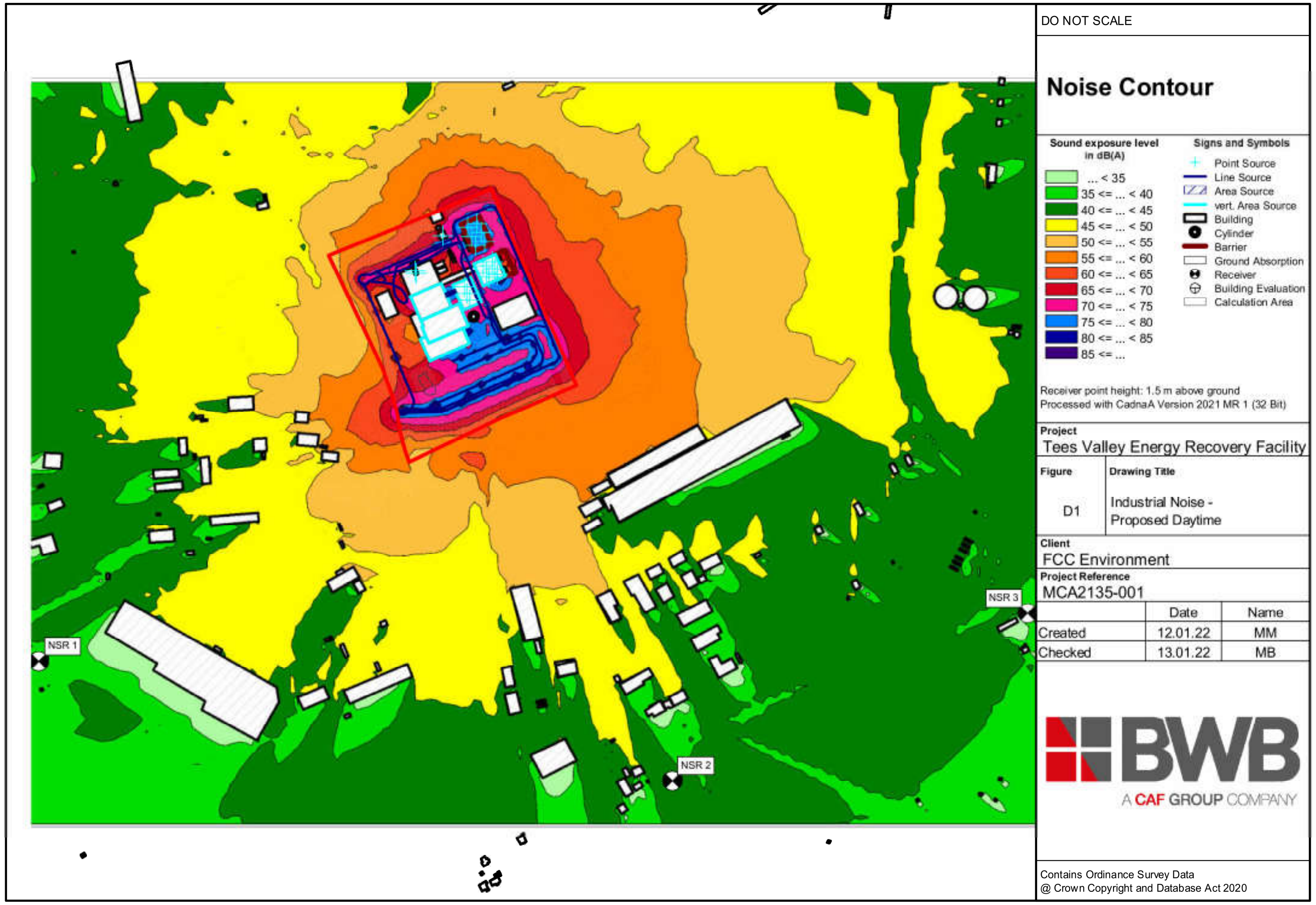
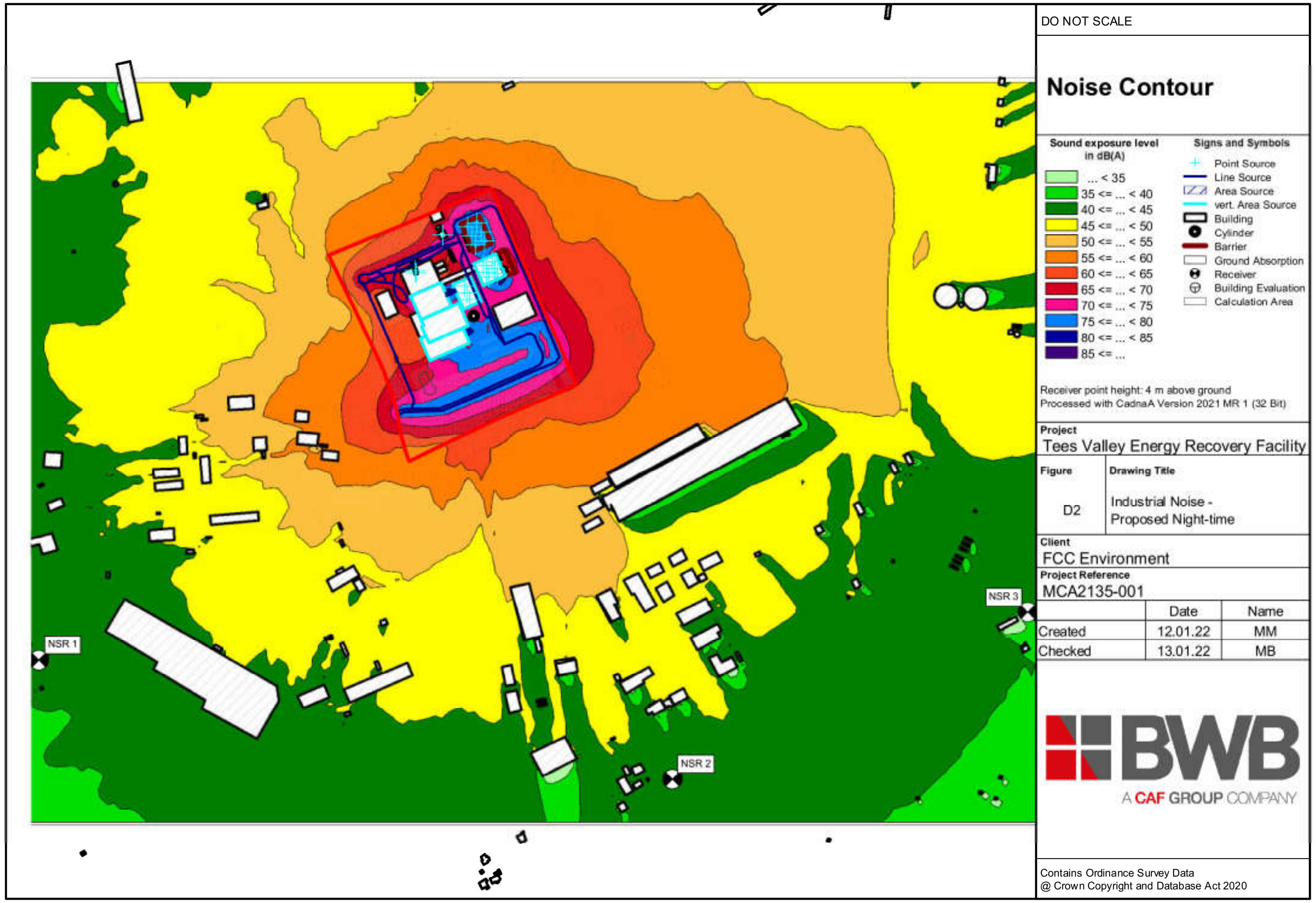


Figure E.2: Industrial Noise Contour – Predicted Night-time Specific Noise Levels, Ls, dB



APPENDIX F: Partial Noise Level Results

Figure F.1: Partial Noise Level Results at NSR 1, dB

Daytime		Night-time	
Source	Noise Level, $L_{Aeq,T}$	Source	Noise Level, $L_{Aeq,T}$
HGV - Waste (Outgoing)	34.8	APCR Residue Collection (Max Length Artic)	26.5
HGV - Waste (Incoming)	33.8	PAC / Lime Delivery (Max Length Artic)	26.5
APCR Residue Collection (Max Length Artic)	26.5	Bunker Hall Gate 1	26.2
PAC / Lime Delivery (Max Length Artic)	26.5	Bunker Hall	25.9
Bunker Hall Gate 1	26.2	Ash Collection	25.4
Bunker Hall	25.9	Fuel / Ammonia Delivery	25.4
Ash Collection	25.4	ACC 2	23.9
Fuel / Ammonia Delivery	25.4	Workshop Access (Max Length Artic)	23.8
ACC 2	23.9	ACC 1	22.3
Workshop Access (Max Length Artic)	23.8	Boiler Hall Gate 1	21.7
ACC 1	22.3	Stack Opening 1	20.8
Boiler Hall Gate 1	21.7	Stack Opening 2	20.8
Stack Opening 1	20.8	Workshop Access (Rigid Truck) - Incoming and Outgoing	20.7
Stack Opening 2	20.8	Boiler Hall	18.5
Workshop Access (Rigid Truck) - Incoming and Outgoing	20.7	Waste Reception Hall Gate 1	18.1
Boiler Hall	18.5	Waste Reception Hall Gate 3	17.9
Waste Reception Hall Gate 1	18.1	Waste Reception Hall Gate 4	17.9
Waste Reception Hall Gate 3	17.9	ACC 4	17.7
Waste Reception Hall Gate 4	17.9	Waste Reception Hall Gate 5	17.7
ACC 4	17.7	Waste Reception Hall Gate 6	17.7
Waste Reception Hall Gate 5	17.7	Waste Reception Hall Gate 9	17.5
Waste Reception Hall Gate 6	17.7	Waste Reception Hall Gate 8	17.4
Waste Reception Hall Gate 9	17.5	Boiler Hall	16.7
Waste Reception Hall Gate 8	17.4	Waste Reception Hall Gate 2	15.8
Boiler Hall	16.7	Waste Reception Hall Gate 7	15.5

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
Waste Reception Hall Gate 2	15.8	ACC 6	14.7
Waste Reception Hall Gate 7	15.5	Bunker Hall	13.2
ACC 6	14.7	Boiler Hall	13.1
Bunker Hall	13.2	ACC 3	11.8
Boiler Hall	13.1	Boiler Hall Louvres	11
ACC 3	11.8	Waste Reception Hall	10.6
Boiler Hall Louvres	11	Turbine Hall Gate 1	9.7
Waste Reception Hall	10.6	Waste Reception Hall	8.9
Turbine Hall Gate 1	9.7	Waste Reception Hall	8.7
Waste Reception Hall	8.9	ACC 5	8.3
Waste Reception Hall	8.7	Bunker Hall	8
ACC 5	8.3	Turbine Hall	6.8
Bunker Hall	8	Boiler Hall	4.8
Turbine Hall	6.8	Turbine Hall	4.6
Boiler Hall	4.8	Transformer	3.9
Turbine Hall	4.6	Bunker Hall	3.3
Transformer	3.9	Conveyor	3
Bunker Hall	3.3	Turbine Hall	2.7
Conveyor	3	Conveyor	2.6
Turbine Hall	2.7	IBA Mechnical Vents	0.4
Conveyor	2.6	Boiler Hall	0.3
IBA Mechnical Vents	0.4	HGV - Waste (Incoming)	-
Boiler Hall	0.3	HGV - Waste (Outgoing)	-
IBA Mechnical Vents	-0.2	IBA Mechnical Vents	-0.2
Turbine Hall	-0.4	Turbine Hall	-0.4
Turbine Hall	-0.4	Turbine Hall	-0.4
Boiler Hall Gate 2	-0.5	Boiler Hall Gate 2	-0.5
IBA Mechnical Vents	-0.6	IBA Mechnical Vents	-0.6
Bunker Hall Gate 2	-1.1	Bunker Hall Gate 2	-1.1
Boiler Hall	-1.6	Boiler Hall	-1.6

Daytime		Night-time	
Source	Noise Level, $L_{Aeq,T}$	Source	Noise Level, $L_{Aeq,T}$
Boiler Hall	-1.7	Boiler Hall	-1.7
IBA Mechnical Vents	-2.5	IBA Mechnical Vents	-2.5
IBA Mechnical Vents	-2.9	IBA Mechnical Vents	-2.9
Waste Reception hall Lourve	-3.2	Waste Reception hall Lourve	-3.2
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Waste Reception Hall	-3.8	Waste Reception Hall	-3.8
Bunker Hall	-4	Bunker Hall	-4
Bunker Hall	-4	Bunker Hall	-4
Bunker Hall	-5.5	Bunker Hall	-5.5
IBA Mechnical Vents	-6.9	IBA Mechnical Vents	-6.9
Waste Reception Hall	-7.4	Waste Reception Hall	-7.4
Ash Loading Gate 1	-7.4	Ash Loading Gate 1	-7.4
Ash Loading Gate 2	-7.6	Ash Loading Gate 2	-7.6
IBA Mechnical Vents	-9.1	IBA Mechnical Vents	-9.1
Waste Reception Hall	-9.7	Waste Reception Hall	-9.7
Boiler Hall Lourve	-10	Boiler Hall Lourve	-10
IBA Mechnical Vents	-11.4	IBA Mechnical Vents	-11.4
Waste Reception Hall	-12.3	Waste Reception Hall	-12.3
Ash Loading	-12.4	Ash Loading	-12.4
Ash Loading	-13	Ash Loading	-13
Ash Loading	-13.1	Ash Loading	-13.1
IBA Mechnical Vents	-14.6	IBA Mechnical Vents	-14.6
Ash Loading	-15.6	Ash Loading	-15.6
Ash Loading	-16.2	Ash Loading	-16.2
Ash Loading Lourve	-16.5	Ash Loading Lourve	-16.5

Figure F.2: Partial Noise Level Results at NSR 2, dB

Daytime		Night-time	
Source	Noise Level, $L_{Aeq,T}$	Source	Noise Level, $L_{Aeq,T}$
HGV - Waste (Outgoing)	35.8	Bunker Hall Gate 1	34
HGV - Waste (Incoming)	34.9	APCR Residue Collection (Max Length Artic)	27.6
Bunker Hall Gate 1	34	PAC / Lime Delivery (Max Length Artic)	27.6
APCR Residue Collection (Max Length Artic)	27.6	Fuel / Ammonia Delivery	27.4
PAC / Lime Delivery (Max Length Artic)	27.6	Ash Collection	27.1
Fuel / Ammonia Delivery	27.4	Bunker Hall	27.1
Ash Collection	27.1	Workshop Access (Max Length Artic)	24.8
Bunker Hall	27.1	ACC 1	23.4
Workshop Access (Max Length Artic)	24.8	ACC 2	23.4
ACC 1	23.4	Turbine Hall Gate 1	23.4
ACC 2	23.4	ACC 3	23
Turbine Hall Gate 1	23.4	ACC 4	23
ACC 3	23	ACC 5	22.8
ACC 4	23	ACC 6	22.7
ACC 5	22.8	Stack Opening 2	20.5
ACC 6	22.7	Waste Reception Hall Gate 3	20.1
Stack Opening 2	20.5	Waste Reception Hall Gate 4	19.9
Waste Reception Hall Gate 3	20.1	Turbine Hall	19.8
Waste Reception Hall Gate 4	19.9	Waste Reception Hall Gate 1	19.8
Turbine Hall	19.8	Waste Reception Hall Gate 5	19.4
Waste Reception Hall Gate 1	19.8	Waste Reception Hall Gate 2	19.3
Waste Reception Hall Gate 5	19.4	Waste Reception Hall Gate 6	19.3
Waste Reception Hall Gate 2	19.3	Turbine Hall	19.2
Waste Reception Hall Gate 6	19.3	Turbine Hall	19.1
Turbine Hall	19.2	Workshop Access (Rigid Truck) - Incoming and Outgoing	18.7
Turbine Hall	19.1	Waste Reception Hall Gate 9	18.7

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
Workshop Access (Rigid Truck) - Incoming and Outgoing	18.7	Waste Reception Hall Gate 8	18.5
Waste Reception Hall Gate 9	18.7	Stack Opening 1	17.5
Waste Reception Hall Gate 8	18.5	Bunker Hall Gate 2	17.5
Stack Opening 1	17.5	Waste Reception Hall Gate 7	17
Bunker Hall Gate 2	17.5	Conveyor	16.4
Waste Reception Hall Gate 7	17	Conveyor	16.3
Conveyor	16.4	Boiler Hall	13.9
Conveyor	16.3	Boiler Hall	13.8
Boiler Hall	13.9	Waste Reception Hall	13.5
Boiler Hall	13.8	Ash Loading Gate 1	13.1
Waste Reception Hall	13.5	Bunker Hall	12.2
Ash Loading Gate 1	13.1	Transformer	12.1
Bunker Hall	12.2	Waste Reception Hall	10.9
Transformer	12.1	Bunker Hall	10.7
Waste Reception Hall	10.9	Waste Reception Hall	9.4
Bunker Hall	10.7	Waste Reception Hall	9.4
Waste Reception Hall	9.4	Waste Reception Hall	9.4
Waste Reception Hall	9.4	Waste Reception Hall	9.4
Waste Reception Hall	9.4	Waste Reception Hall	9.4
Waste Reception Hall	9.4	Waste Reception Hall	9.4
Waste Reception Hall	9.4	Waste Reception Hall	9.4
Waste Reception Hall	9.4	IBA Mechnical Vents	9.3
Waste Reception Hall	9.4	IBA Mechnical Vents	9.1
IBA Mechnical Vents	9.3	IBA Mechnical Vents	9
IBA Mechnical Vents	9.1	Boiler Hall	9
IBA Mechnical Vents	9	IBA Mechnical Vents	8.8
Boiler Hall	9	IBA Mechnical Vents	8.8
IBA Mechnical Vents	8.8	IBA Mechnical Vents	8.7
IBA Mechnical Vents	8.8	IBA Mechnical Vents	8.7

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
IBA Mechnical Vents	8.7	IBA Mechnical Vents	8.5
IBA Mechnical Vents	8.7	Waste Reception hall Lourve	8.3
IBA Mechnical Vents	8.5	Waste Reception Hall	7.8
Waste Reception hall Lourve	8.3	Boiler Hall	6.9
Waste Reception Hall	7.8	Bunker Hall	5.4
Boiler Hall	6.9	Turbine Hall	4.8
Bunker Hall	5.4	Ash Loading	3.7
Turbine Hall	4.8	Turbine Hall	3.5
Ash Loading	3.7	Boiler Hall Gate 1	2.6
Turbine Hall	3.5	Ash Loading	2.5
Boiler Hall Gate 1	2.6	Ash Loading	2.3
Ash Loading	2.5	Boiler Hall Gate 2	2.3
Ash Loading	2.3	Waste Reception Hall	0.9
Boiler Hall Gate 2	2.3	HGV - Waste (Incoming)	-
Waste Reception Hall	0.9	HGV - Waste (Outgoing)	-
Bunker Hall	-0.9	Bunker Hall	-0.9
Boiler Hall	-1	Boiler Hall	-1
Ash Loading Gate 2	-2.2	Ash Loading Gate 2	-2.2
IBA Mechnical Vents	-3.2	IBA Mechnical Vents	-3.2
Ash Loading	-5.5	Ash Loading	-5.5
Bunker Hall	-5.7	Bunker Hall	-5.7
Boiler Hall Louvres	-6.5	Boiler Hall Louvres	-6.5
Boiler Hall Lourve	-7.4	Boiler Hall Lourve	-7.4
Ash Loading Lourve	-8.4	Ash Loading Lourve	-8.4
Waste Reception Hall	-9	Waste Reception Hall	-9
Boiler Hall	-9.3	Boiler Hall	-9.3
Ash Loading	-10.5	Ash Loading	-10.5
Bunker Hall	-11.9	Bunker Hall	-11.9
Boiler Hall	-12.1	Boiler Hall	-12.1
Waste Reception Hall	-12.1	Waste Reception Hall	-12.1

Figure F.3: Partial Noise Level Results at NSR 3, dB

Daytime		Night-time	
Source	Noise Level, $L_{Aeq,T}$	Source	Noise Level, $L_{Aeq,T}$
HGV - Waste (Outgoing)	34.3	Bunker Hall Gate 1	33.2
HGV - Waste (Incoming)	33.6	Fuel / Ammonia Delivery	26.3
Bunker Hall Gate 1	33.2	APCR Residue Collection (Max Length Artic)	26.3
Fuel / Ammonia Delivery	26.3	PAC / Lime Delivery (Max Length Artic)	26.3
APCR Residue Collection (Max Length Artic)	26.3	Ash Collection	26.2
PAC / Lime Delivery (Max Length Artic)	26.3	Turbine Hall Gate 1	24.1
Ash Collection	26.2	Bunker Hall	23.5
Turbine Hall Gate 1	24.1	Workshop Access (Max Length Artic)	23.3
Bunker Hall	23.5	ACC 1	20.5
Workshop Access (Max Length Artic)	23.3	Turbine Hall	20.5
ACC 1	20.5	Stack Opening 1	19
Turbine Hall	20.5	Stack Opening 2	19
Stack Opening 1	19	Turbine Hall	18.7
Stack Opening 2	19	Turbine Hall	18.5
Turbine Hall	18.7	ACC 3	18.2
Turbine Hall	18.5	Turbine Hall	16.1
ACC 3	18.2	Waste Reception Hall Gate 9	15.5
Turbine Hall	16.1	Waste Reception Hall Gate 6	15.4
Waste Reception Hall Gate 9	15.5	Waste Reception Hall Gate 4	15.3
Waste Reception Hall Gate 6	15.4	Waste Reception Hall Gate 5	15.3
Waste Reception Hall Gate 4	15.3	Waste Reception Hall Gate 8	15.3
Waste Reception Hall Gate 5	15.3	Waste Reception Hall Gate 3	15.2
Waste Reception Hall Gate 8	15.3	Waste Reception Hall Gate 1	15.1
Waste Reception Hall Gate 3	15.2	ACC 2	14.9
Waste Reception Hall Gate 1	15.1	ACC 4	14.8
ACC 2	14.9	ACC 5	14.3

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
ACC 4	14.8	Boiler Hall	14.1
ACC 5	14.3	Waste Reception Hall Gate 7	13.3
Boiler Hall	14.1	Workshop Access (Rigid Truck) - Incoming and Outgoing	13.1
Waste Reception Hall Gate 7	13.3	Boiler Hall	13
Workshop Access (Rigid Truck) - Incoming and Outgoing	13.1	Waste Reception Hall Gate 2	13
Boiler Hall	13	ACC 6	12.8
Waste Reception Hall Gate 2	13	Bunker Hall	11.8
ACC 6	12.8	Turbine Hall	11.4
Bunker Hall	11.8	Boiler Hall	10.7
Turbine Hall	11.4	Bunker Hall	10
Boiler Hall	10.7	IBA Mechnical Vents	9.2
Bunker Hall	10	IBA Mechnical Vents	9.2
IBA Mechnical Vents	9.2	IBA Mechnical Vents	9.1
IBA Mechnical Vents	9.2	IBA Mechnical Vents	8.8
IBA Mechnical Vents	9.1	Waste Reception Hall	8.7
IBA Mechnical Vents	8.8	Waste Reception Hall	8
Waste Reception Hall	8.7	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	8
Waste Reception Hall	8	Waste Reception Hall	7.6
Waste Reception Hall	8	IBA Mechnical Vents	7.4
Waste Reception Hall	7.6	IBA Mechnical Vents	7.3
IBA Mechnical Vents	7.4	IBA Mechnical Vents	7.3
IBA Mechnical Vents	7.3	IBA Mechnical Vents	7
IBA Mechnical Vents	7.3	Transformer	7

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
IBA Mechnical Vents	7	Bunker Hall Gate 2	6.9
Transformer	7	Waste Reception hall Lourve	6.5
Bunker Hall Gate 2	6.9	Ash Loading Gate 1	5.1
Waste Reception hall Lourve	6.5	Boiler Hall Gate 2	4.5
Ash Loading Gate 1	5.1	Conveyor	4.2
Boiler Hall Gate 2	4.5	Conveyor	4
Conveyor	4.2	Ash Loading	1.2
Conveyor	4	Ash Loading	0.6
Ash Loading	1.2	Ash Loading	0.1
Ash Loading	0.6	Ash Loading Gate 2	0.1
Ash Loading	0.1	HGV - Waste (Incoming)	-
Ash Loading Gate 2	0.1	HGV - Waste (Outgoing)	-
Boiler Hall Lourve	-0.1	Boiler Hall Lourve	-0.1
Ash Loading Lourve	-2	Ash Loading Lourve	-2
Waste Reception Hall	-2.2	Waste Reception Hall	-2.2
Bunker Hall	-2.4	Bunker Hall	-2.4
Boiler Hall	-2.4	Boiler Hall	-2.4
IBA Mechnical Vents	-3.1	IBA Mechnical Vents	-3.1
Boiler Hall Gate 1	-3.5	Boiler Hall Gate 1	-3.5
Boiler Hall	-4	Boiler Hall	-4
Waste Reception Hall	-5.5	Waste Reception Hall	-5.5
Ash Loading	-5.8	Ash Loading	-5.8
Bunker Hall	-8.1	Bunker Hall	-8.1
Ash Loading	-11	Ash Loading	-11
Bunker Hall	-13.4	Bunker Hall	-13.4
Boiler Hall Louvres	-13.5	Boiler Hall Louvres	-13.5
Waste Reception Hall	-14.7	Waste Reception Hall	-14.7
Boiler Hall	-16	Boiler Hall	-16
Bunker Hall	-18.7	Bunker Hall	-18.7
Waste Reception Hall	-18.9	Waste Reception Hall	-18.9

Daytime		Night-time	
Source	**Noise Level, $L_{Aeq,T}$**	**Source**	**Noise Level, $L_{Aeq,T}$**
Boiler Hall	-22.8	Boiler Hall	-22.8

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