8 Noise And Vibration

8.1 Introduction

8.1.1 This Noise and Vibration Chapter of the Environmental Statement (ES) has been prepared by Sol Acoustics Limited (Sol Acoustics) and presents an assessment of the likely significant effects of the Development on receptors which are deemed to be sensitive to Noise and Vibration. Mitigation measures are identified where appropriate in order to avoid, reduce and/or offset any adverse effects identified in acoustic terms. The nature and significance of the likely residual effects are also reported (in acoustic terms).

8.1.2 This Noise and Vibration Chapter is supported by the following appendices:

- Appendix 8.1 – Glossary of Acoustic Terms;
- Appendix 8.2 – Legislation, Policy, and Guidance;
- Appendix 8.3 – Noise Survey and Summary Results;
- Appendix 8.4 – Calibration Certificates;
- Appendix 8.5 – Site Plan Indicating Location of Modelled Noise Sources;
- Appendix 8.6 – Noise Source Schedule and Outline Required BAT Noise Control;
- Appendix 8.7 – Environmental Noise Modelling Results; and
- Appendix 8.8 – Façade Composite Sound Insulation Performance Calculations.

Competence

8.1.3 Brian Horner is the Principal Author of this ES Chapter. He has acted as an Acoustic Consultant for 16 years and he is Associate Director of Sol Acoustics. Brian has gained significant experience during this time, having worked on a wide variety of major projects including numerous biomass power generation plants and other major industrial, power, and commercial schemes. Brian is a Member of the Institute of Acoustics (“MIOA”), holds a First Class BSc (Hons) Degree in Acoustics and was awarded the Association of Noise Consultants (“ANC”) Architectural Acoustics Award in 2014.

8.1.4 Simon Ferenczi (Member of the Institute of Acoustics, MIOA) is the Co-Author of this ES Chapter. He has worked within the Acoustics Industry for over 35 years, with 27 years of specific Acoustic Consultancy experience. He founded Sol Acoustics in 2001 and he is its Managing Director and Principal Consultant.

8.1.5 During this time, Simon Ferenczi has gained significant experience across the complete spectrum of Acoustic Consultancy, as ranging from sitting on Design Teams for the largest mixed residential, commercial, and industrial schemes across the UK, working for large industrial Clients within the UK and abroad, as well as acting as an Expert Witness, including for large Public Sector claims.

8.1.6 Simon Ferenczi has held the Institute of Acoustics (“IoA”) Diploma in Acoustics and Noise Control since 1987 and sits on the Institute of Acoustics Silver Members Group. He was awarded the ANC Prize in 1987.

8.1.7 The assessment and ES Chapter has also been subject to peer review by Noise Consultants Ltd.

8.2 Legislation, Planning Policy, and Guidance

Planning Policy Context

National

8.2.1 The following planning policy is relevant to the Development:

- Planning Policy Wales (2021)[1]
- Future Wales – The National Plan 2040 (2021)[2]; and
- Noise and Soundscape Action Plan (2018 to 2023)[3].

Vale of Glamorgan

8.2.2 The following local planning policy is relevant to the Development:

- Vale of Glamorgan Local Development Plan ("LDP") 2011 – 2026[4].

Guidance

8.2.3 The following acoustic guidance and British Standards are relevant to the Development:

- Technical Advice Note Wales 11: Noise – October 1997[5] ("TAN11");
- CL-01-15 Updates to Tan 11 Noise - Noise Action Plan (2013-18) Commitments[6];
- Guidance on Noise and Vibration Management: Environmental Permits[7];
- British Standard 2014+A1:2019: '*Method for rating and assessing industrial and commercial sound*'[8];
- British Standard 8233: 2014: '*Guidance on sound insulation and noise reduction for buildings*'[9];
- IEMA Guidelines for Environmental Noise Impact Assessment (Version 1.2, November 2014)[10];
- Design Manual for Roads and Bridges, LA 111, Noise and Vibration, Revision 2[11];
- Calculation of Road Traffic Noise ("CRTN")[12];
- Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping[13];
- British Standard 5228-1: 2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'*[14];
- British Standard 5228-2:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration'*[15];
- World Health Organisation, Europe: '*Environmental Noise Guidelines for the European Region*' 2018[16];
- International Standard ISO 9613-2:1996 '*Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*'[17];
- NANR45 '*Procedure for the assessment of low frequency noise complaints*'[18];
- ISO 3744: 2010 '*Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*'[19];

- ISO 12354-4:2017 '*Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 4: Transmission of indoor sound to the outside*'[20]; and
- Acoustics of Schools: A Design Guide[21].
- BRONER N. *A simple outdoor criterion for assessment of low frequency noise emission*. Acoustics Australia – Vol 39 April (2011) No. 1 – 7[22].

8.3 Assessment Methodology

Consultation

8.3.1 Consultation with the Vale of Glamorgan Local Authority ("VoGC") has not been undertaken for the purposes of preparing this ES Chapter. However, the scope of the assessment has been informed by previous scoping correspondence with the Welsh Government in relation to the 2021 VES and the WSP review of previously prepared Environmental Statements. This includes a scoping document, detailing the methodology and approach to be adopted in the preparation of the Noise Assessment which was issued to the Welsh Government on 13th November 2020 (Appendix 3.2). The methodology was informally agreed by Welsh Government in February 2021 (relevant correspondence is included in Appendix 3.2).

Scope of the Assessment

Potential Sources of Impact

8.3.2 The potential sources of noise and vibration impact associated with the Development include:

- Construction activities (construction noise and vibration) and road traffic movements – undertaken as a retrospective assessment;
- Noise associated with the operation of the Development, i.e. operational sound, both for Normal Operating Condition ("NOC"), and Other Than Normal Operating Conditions ("OTNOC");
- Development-generated road traffic movements (operational road traffic noise); and
- Potential decommissioning activities (demolition noise and vibration) and road traffic movements.

Matters Scoped Out

8.3.3 The following matters have been scoped out of consideration by this ES Chapter:

- In keeping with standard ES assessment practice, noise arising from *emergency* operating conditions (e.g. fire condition, steam blowoff etc.) has not been considered;
- The assessment of the noise and vibration impact on ecological receptors, on the basis that the nearest identified noise sensitive European designated site is located c.3.9 kilometres distance from the Development (and is thereby considered as unlikely to be affected);
- Operational Phase vibration impact, since there are no significant sources of vibration associated with the completed Development; and
- Potential decommissioning Phase vibration impact, as there shall be similarly no significant sources of vibration likely to operate at the Development during this phase.

Spatial Scope

8.3.4 The Development is located off Woodham Road, Barry, Wales, CF63 4JE, within a predominately industrial area. The following types of receptors have been identified within the vicinity of the Development which have the potential to be deemed to be sensitive to noise and vibration as arising from the Development (i.e. constitute noise sensitive receptors – "NSRs"):

- Existing and future residential housing;
- Private gardens, public outdoor amenity space and public footpaths; and
- Commercial premises;
- Industrial premises; and
- Ecological receptors (scoped out due to distance).

8.3.5 The nearest identified existing and future *residential premises* in close proximity to the Development are as follows:

- R1) Existing residential housing on Dock View Road, located c.215 metres distance to the north west of the closest perimeter site boundary of the Development;
- R2) *Future* residential housing (currently under construction as of May 2022), as to be located on Cory Way, c.170 metres distance to west of the closest perimeter site boundary;
- R3) *Future* residential housing (currently under construction as of May 2022), as to be located on East Quay, c.100 metres distance to south west of the closest perimeter site boundary;
- R4) Existing residential housing located on Cei Dafydd, sited c.370 metres distance to the west of the closest perimeter site boundary; and
- R5) Existing residential housing as located on Subway Road, sited c.380 metres distance to the west of the closest perimeter site boundary.

8.3.6 In addition to private garden areas associated with the identified residential housing (namely receptor refs. R1 to R5 above), there is a proposed new large public *external amenity area* (receptor ref. A1) that is to be located c.170 metres distance to the west of the perimeter Development boundary (currently under construction as of July 2022).

8.3.7 The nearest identified existing *commercial premises* which are in close proximity to the Development are as follows:

- C1) Vale of Glamorgan Council offices, off Ffordd Y Mileniwm, as located c.290 metres distance to the west of the closest perimeter site boundary of the Development; and
- C2) Unit 13: "Denise's Café", located c.30 metres to the south west of the Development.

8.3.8 The nearest identified *industrial premises* that are in close proximity to the Development are as follows:

- I1) Units 1 & 2: "German Car & Camper", located c.30 metres distance to the south west;
- I2) Unit 3: Vacant, located c.30 metres distance to the south west;
- I3) Unit 4: "Cars on Gas", located c.30 metres distance to the south west;
- I4) Unit 5: "Diamond Repair Centre", located c.30 metres distance to the south west;
- I5) Unit 6: 7 & 8: Vacant, located c.30 metres distance to the south west;

- I6) Unit 9: “G&B Autos” / “GMB Paving Ltd”, located c.30 metres distance to the south west;
- I7) Units 10 & 11: Vacant, located c.30 metres distance to the south west;
- I8) Unit 12: “One Stop Garage”, located c.30 metres distance to the south west;
- I9) Unit 14: Vacant, located c.30 metres distance to the south west;
- I10) Unit 15: “Spectrum Displays”, located c.30 metres distance to the south west;
- I11) Unit 16: “Church Motors”, located c.30 metres distance to the south west;
- I12) Unit 17: Vacant, located c.50 metres distance to the west;
- I13) Unit 18: “PM Autobody Repair Centre”, located c.65 metres distance to the west;
- I14) Unit 20: Vacant, located c.15 metres distance to the south west;
- I15) Unit 17A: “Aqua Clear”, located c.15 metres distance to the south west;
- I16) Units 21-23: “Hawkins Antiques and Reproductions”, located c.15 metres distance to the south west;
- I17) “S&K Haulage”, adjoining the north west Site boundary;
- I18) “Bruno Timber Merchants”, located c.80 metres distance to the north east;
- I19) “EWI Wales Superstore”, located c.40 metres distance to the north east;
- I20) “S&K Haulage”, located c.130 metres distance to the north east;
- I21) “ADP”, located c.330 metres distance to the north east;
- I22) “Scott Pallets”, located c.230 metres distance to the south east; and
- I23) “O’Reilly Oakstown”, located c.190 metres distance to the south east.

8.3.9 Figure 8.1 shows the location of the Development in relation to the nearest identified *residential*, *outdoor amenity*, and *commercial premises* receptors.

8.3.10 Figure 8.2 shows the location of the Development in relation to the nearest identified *industrial premises* receptors.

8.3.11 Figure 8.3 shows the location of all identified *ecological* receptors in relation to the Development. This shows that the nearest noise sensitive ecological receptor is located c.3.9 kilometres distance to the east of the Development (RAMSAR site located at Sully Island).

Figure 8.1: Aerial Photograph of the Development in Relation to Key Residential, Outdoor Amenity and Commercial Receptors (Google 2022)

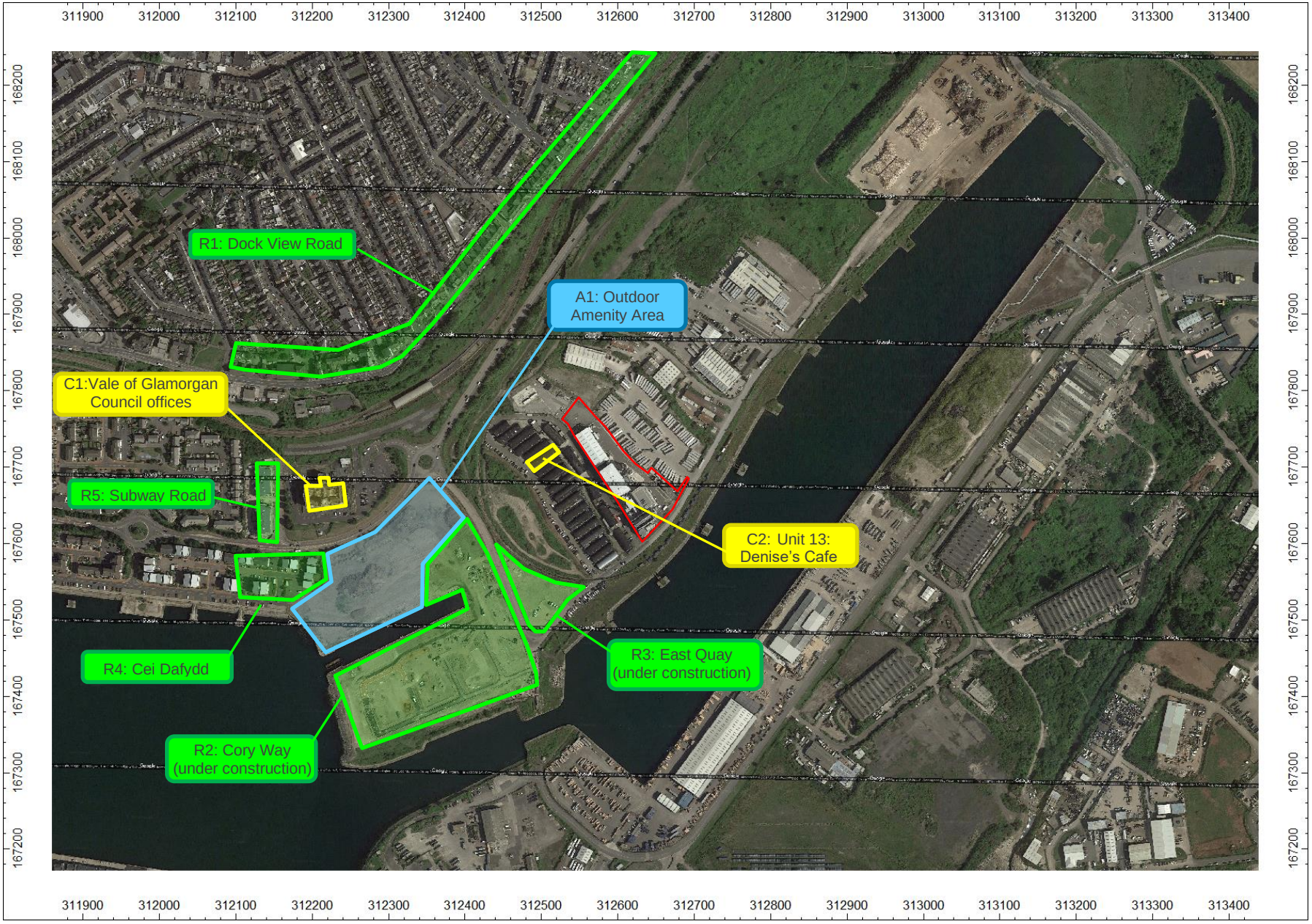


Figure 8.2: Aerial Photograph of the Development in Relation to Existing Industrial Premises (Google 2022)

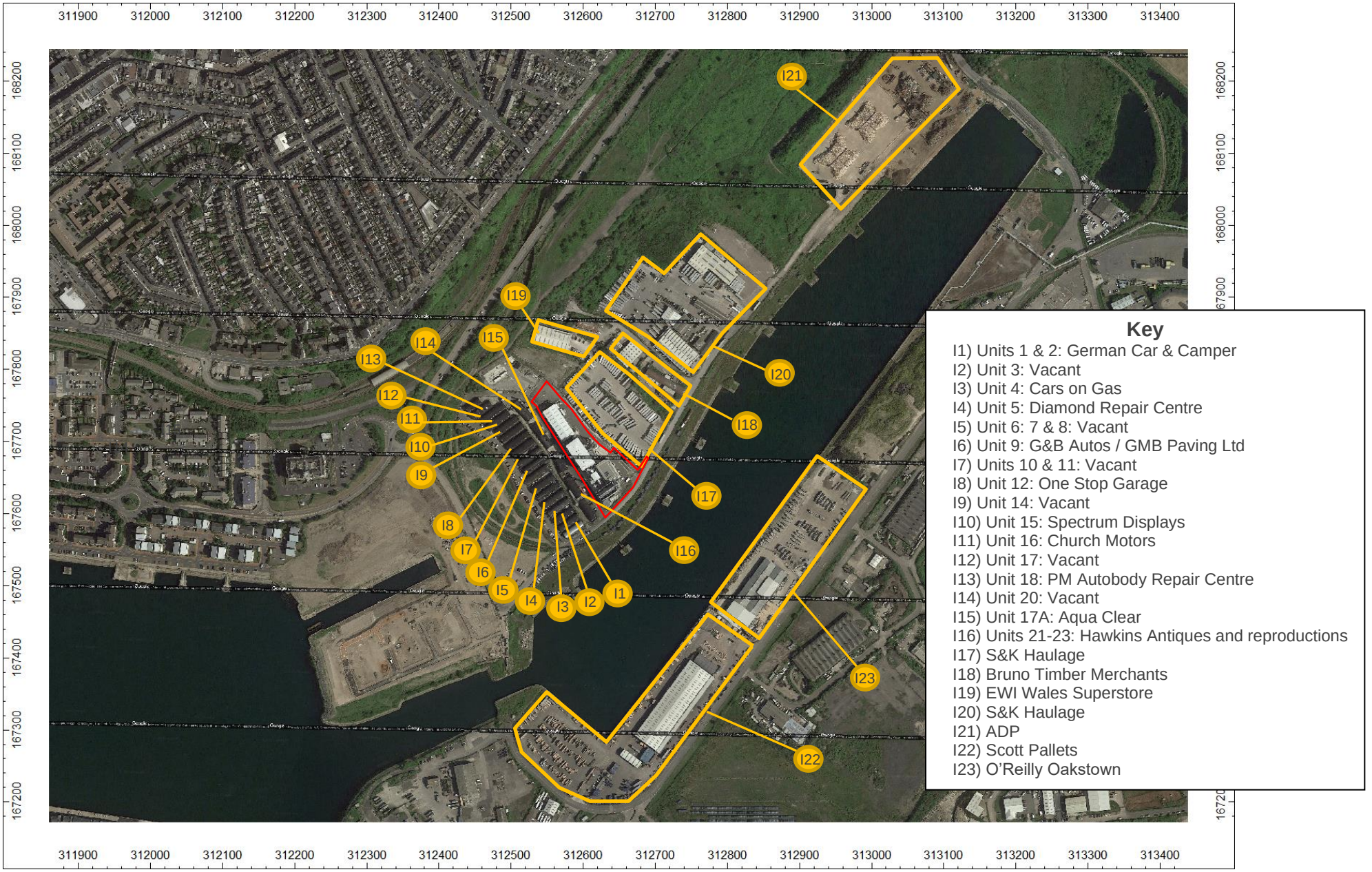
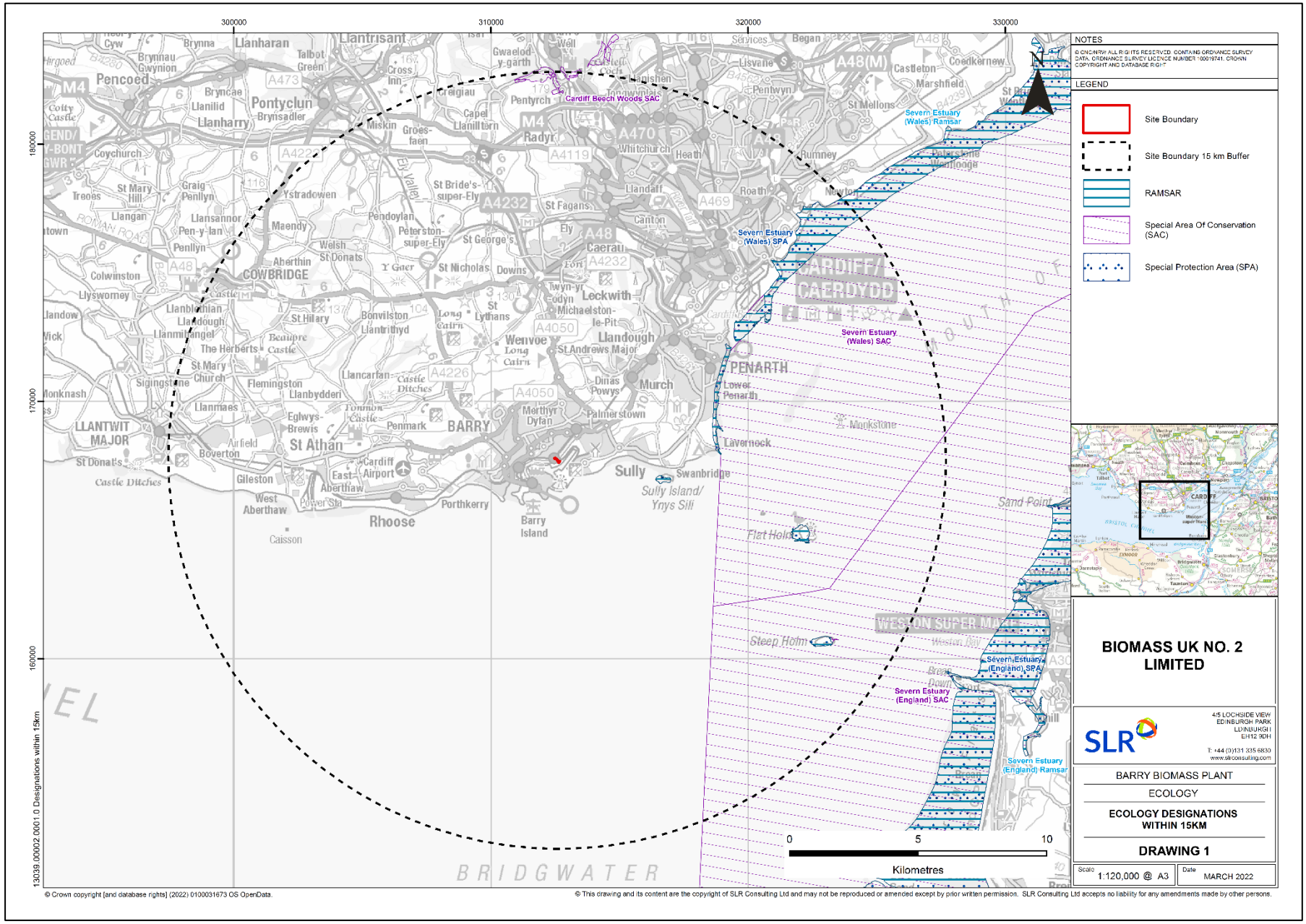


Figure 8.3: Location of the Development in Relation to Noise Sensitive Ecological Destinations



Temporal Scope

8.3.12 Following the granting of the 2015 Permission on 31 July 2015, site works commenced during February 2016. These were substantially complete (i.e. allowing testing and commissioning of the Development to commence) by the first quarter (Q1) of 2018. Construction of the Development did not take place continuously over this period spanning from February 2016 to Q1 2018, although this period is assumed as the construction phase for the purposes of the assessment.

8.3.13 It is understood that the Development has a design life of at least 25 years, although the operational life could extend beyond this. For the purposes of this acoustic assessment, 2022 is assumed as the starting *operational* year.

8.3.14 Effects from any future decommissioning stage have also been assessed against an assumed future baseline, although the effects are not dependent on a specific assessment year.

Establishing Baseline Conditions

Construction Phase Baseline

8.3.15 The potential noise impact of the Development on the identified noise sensitive receptors as during the Construction Phase have been assessed against the absolute noise level criteria as set out in BS 5228-1+A1:2014[14]. As such, the prevailing, contemporaneous environmental noise climate as during the Construction Phase (i.e. February 2016 to March 2018) has not been considered.

Operational Phase Baseline

8.3.16 An environmental noise survey has been conducted by Sol Acoustics, commencing at c.12:15 hours during Tuesday 22 February until c.09:00 hours on Monday 7 March 2022. The purpose of this noise survey was to determine the prevailing pre-existing Background Sound Levels and Ambient Sound Levels expected as at the nearest existing and proposed residential housing to the Development perimeter boundary, for environmental noise benchmarking and subsequent acoustic impact assessment purposes.

8.3.17 The environmental noise survey consisted of two unmanned environmental noise measurement positions (designated Position 1 and Position 2). Further environmental noise data has also been obtained from three environmental noise monitoring positions as located at the external perimeter boundary of the Development (designated Position B1, Position B2 and Position B3). All environmental noise measurements were conducted in accordance with the requirements of BS 4142:2014+A1:2019[8]. The environmental noise data obtained at each position has been processed in terms of $L_{Aeq,15min}$, $L_{A90,15min}$, and $L_{Afmax,15min}$ acoustic parameters (and also in corresponding unweighted, one-third octave band frequency terms, per parameter), as for the full duration of the survey in all cases.

8.3.18 No baseline environmental vibration measurements were undertaken.

8.3.19 Table 8.1 provides a description of the adopted noise measurement positions. The approximate locations of all noise monitoring positions are as shown in Figure 8.4.

Table 8.1: Noise Monitoring Positions

Monitoring Location	Location	Measurement Period	Description
1	Dock View Road	22/02/2022 15:50hrs to 07/03/2022 09:15hrs	Mast-mounted microphone at c.2.2 metres height above local ground level[1], attached to existing palisade fencing to the south of Dock View Road Way. Environmental noise measurements as conducted at this position are considered to be representative of the existing residential housing on Dock View Road (receptor ref. R1).
2	Cory Way	22/02/2022 20:15hrs to 07/03/2022 08:45hrs	Mast-mounted microphone at c.2.2 metres height above local ground level[1], attached to existing palisade fencing at the boundary of the Associated British Ports' land to the east of Cory Way. Environmental noise measurements as conducted at this position are considered to be representative of the proposed residential housing at Cory Way and East Quay (receptor refs. R2 and R3). The environmental noise levels as measured at this position were also used to assess the environmental noise level impact at the existing housing on Cei Dafydd and Subway Road (receptor refs. R4 and R5).
B1	Site boundary (north)	22/02/2022 12:45hrs to 24/02/2022 12:00hrs	Mast-mounted microphone at c.2.2 metres height above local ground level[1], attached to the Development boundary palisade fencing. (Due to a fault with the equipment, accurate noise levels were only recorded between 12:45 hours during 22 February 2022 and c.12:00 hours during 24 February 2022).
B2	Site boundary (east)	22/02/2022 12:15hrs to 07/03/2022 08:15hrs	Mast-mounted microphone at c.2.2 metres height above local ground level[1], attached to the Development boundary palisade fencing.
B3	Site boundary (west)	22/02/2022 13:00hrs to 07/03/2022 08:30hrs	Mast-mounted microphone at c.2.2 metres height above local ground level[1], attached to the Development boundary palisade fencing.

[1] *The microphone was necessarily positioned at this height above local ground level, such that it protruded above the height of the palisade fencing and was thus in so-called "free-field" conditions. The increased height (above the BS 4142:2014+A1:2019[8] suggested height of 1.2 metres to 1.5 metres above local ground level) is not expected to have any material impact on the measured results.*

8.3.20 Characteristics of the acoustic environment (i.e. soundscape) as typically prevailing at Measurement Positions 1 and 2 (which are pertinent to the BS 4142:2014+A1:2019[8] assessment) are as summarised in Table 8.2:

Table 8.2: Noise Survey Observations

Monitoring Location	Description
1	The environmental noise climate at this position was dominated by noise from road traffic on Dock View Road, Ffordd Y Mileniwm and the wider local road network. Noise from the Barry Docks railway line, pedestrians and birdsong was also audible.
2	The environmental noise climate at this position was dominated construction noise from the Cory Way residential development during daytime periods. At other times, including evening and night time periods, noise from road traffic on Cory Way, Ffordd Y Mileniwm and the wider local road network was audible.

8.3.21 All noise measurements were carried out using Type 1 Precision Grade noise monitoring equipment, and the complete measuring systems were field calibrated immediately prior to and following the noise survey period.

8.3.22 There were no national lockdowns relating to the Covid-19 Pandemic in place as during the time of February/March 2022 environmental noise survey. Notwithstanding, however, it may be the case that the level of road traffic on local roads were reduced as compared to pre-pandemic levels, e.g. as a result of an increased number of people working from home/self-isolating etc. This may, in turn, have had an impact on the measured environmental noise levels. Whilst any such impact is likely to be minimal, it shall be noted that any reduction in the measured environmental noise levels as a result of the Covid-19 Pandemic is likely to result in a more onerous assessment.

8.3.23 Meteorological data was recorded at Position B1 for the duration of the noise survey, as using a Professional Grade Vaisala “WXT520” weather station.

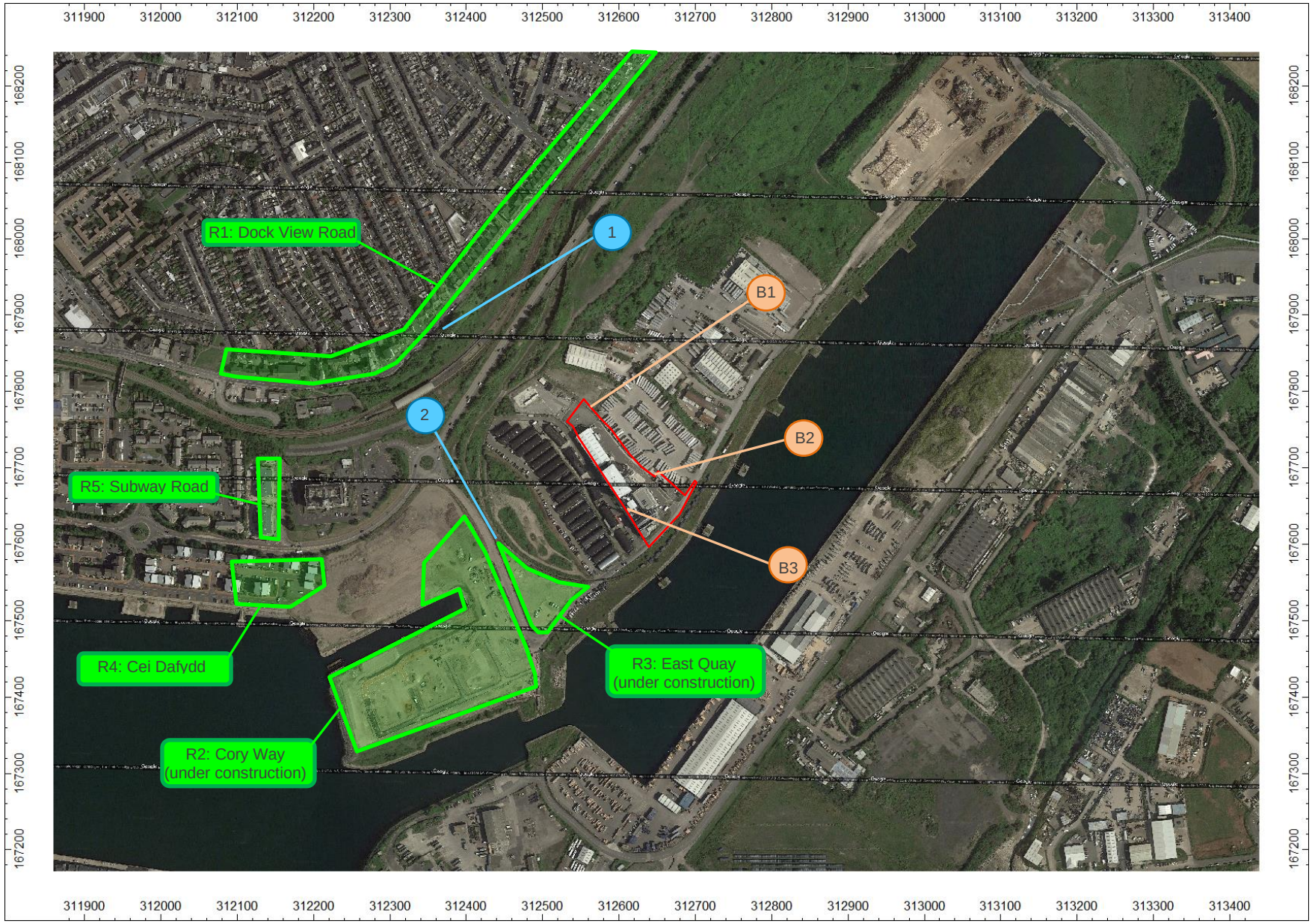
8.3.24 Significant rainfall occurred during 23 February, 24 February, 28 February and 2 March 2022. Wind speeds were typically below $5ms^{-1}$ for the vast majority of the entire survey period. Noise data as recorded during any 15-minute periods where the measured average wind speed exceeded $5ms^{-1}$ and/or the rainfall exceed $1mmh^{-1}$ has been excluded from the dataset forming the basis of this acoustic assessment.

8.3.25 Notwithstanding the weather conditions recorded, the microphone systems were entirely weatherproofed and fitted with all-weather environmental windshields, each with bird spikes.

8.3.26 Appendix 8.3 provides full details of the recorded environmental noise levels and weather conditions during the survey including the equipment used and Sol Acoustics’ personnel undertaking the surveys.

8.3.27 Appendix 8.4 provides the calibration certification for each of the adopted environmental noise measurement positions.

Figure 8.4: Aerial Photograph of the Development Showing the Location of the Noise Monitoring Positions and Identified Residential Receptors



Future Baseline (Decommissioning Phase)

8.3.28 It is not possible to measure or predict the baseline environmental noise levels at the identified noise sensitive receptors as during any future Decommissioning Phase of the Development.

8.3.29 The potential noise impact of the Development on the various identified noise sensitive receptors as during the Decommissioning Phase has been assessed against the absolute noise level criteria as set out in BS 5228-1+A1:2014[14].

Identifying Likely Significant Effects

Construction Phase (Retrospective)

8.3.30 The assessment includes a retrospective assessment of noise associated with the Construction Phase of the Development. Details of the construction activities, which have been used to inform this assessment, are all as also presented within Chapter 6: *Construction and Decommissioning* forming part of this ES.

8.3.31 British Standard 5228-1:2009+A1:2014[14] and British Standard 5228-2:2009+A1:2014[15] have been used to assess the noise and vibration level impact as due to the construction of the Development as at surrounding receptor locations respectively. A summary of these Standards is as presented in Appendix 8.2.

8.3.32 As detailed in Chapter 6, normal hours of construction were set out in the Construction Phase Plan (CPP) (Appendix 6.1), which was previously as agreed with VoGC. Construction works were limited in the CPP to the following periods:

- Monday to Friday: 07:30 – 18:00 hours; and
- Saturday and Sunday: 07:30 – 15:00 hours.

8.3.33 Activities that could potentially be heard at the Development boundary were restricted to the following working hours under the CPP:

- Monday to Friday: 07:30 – 18:00 hours; and
- Saturday: 08:00 – 12:30 hours.

8.3.34 Construction activities therefore occurred during daytime hours only. On this basis, Table 8.3 sets out the adopted Magnitude of Impact as based upon the absolute noise level criteria as presented in the BS 5228-1:2009+A1:2014[14], as using the "ABC Method". This shall be used to determine the Magnitude of Impact for noise from the Construction Phase of the Development at all identified residential receptors, and also at the VoGC offices (i.e. Commercial Receptor ref. C1[1]).

Table 8.3: Magnitude of Impact Assessment Criteria for the Construction Phase Noise Impact

Magnitude of Impact	Ambient Noise Level, dB $L_{Aeq,T}$
Negligible	≥65
Minor	<65 and ≤70
Moderate	<70 and ≤75
Major	<75

8.3.35 Table 8.4 sets out the adopted Magnitude of Impact as based upon the adopted BS 5228-2:2009+A1:2014[15] assessment criteria for the human response to vibration. This shall be used to determine the Magnitude of Impact as due to the levels of vibration as generated during the Construction Phase of the Development at all identified residential receptors and Commercial Receptor ref. C1[1]:

Table 8.4: Magnitude of Impact Assessment Criteria for the Construction Phase Vibration Impact

Magnitude of Impact	Peak Particle Velocity Vibration Level, $mm \cdot s^{-1}$
Negligible	<0.14
Minor	≤0.14 to <0.3
Moderate	≤0.3 to <1.0
Major	≥1.0

8.3.36 BS 5228-2:2009+A1:2014[15] also provides guidance for the possibility of vibration-induced damage in buildings. It states the following in this regard:

'… *BS 7385-2 gives guidance on the assessment of the possibility of vibration-induced damage in buildings due to a variety of sources. This guidance indicates that the probability of damage tends towards zero at a component PPV of 12.5 $mm \cdot s^{-1}$* ...'

8.3.37 It shall be noted that the magnitude of ground-borne vibration that is required in order to create the possibility for vibration-induced damage in buildings is significantly higher than the levels of vibration that are as set out in Table 8.4.

[1] Whilst the assessment criteria as presented in BS 5228-1:2009+A1:2014 applies only to residential receptors, the same criteria have also been applied to the Commercial Receptor ref. C1 (i.e. Vale of Glamorgan Council offices). The potential noise impact on all other identified commercial and industrial receptors has not been considered.

8.3.38 The *'Design Manual for Roads and Bridges, LA 111, Noise and Vibration, Revision 2'*, as issued by Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure during May 2020 ("DMRB")[11] has been used to assess the noise level impact as due to Development-generated road traffic at surrounding receptor locations.

8.3.39 Separate guidance is provided within the DMRB for the assessment of "short term" impacts (i.e. when the project is opened) and "long term" impacts (i.e. typically 15 years after the project is opened). For Construction Phase impacts, the DMRB guidance for short term noise impact shall be considered only. On this basis, Table 8.5 provides the adopted Magnitude of Impact for the assessment of construction generated road traffic:

Table 8.5: Magnitude of Impact for the Assessment of Construction Phase Road Traffic

Magnitude of Impact	Short Term Noise Change, (dB $L_{A10,18hour}$ or L_{night})
Negligible	Less than 1.0
Minor	1.0 to 2.9
Moderate	3.0 to 4.9
Major	Greater than or equal to 5.0

Operational Phase

Residential Receptors

8.3.40 Natural Resources Wales (NRW) is the Regulator for all environmental emissions and operations associated with the Development. A Permit for the Development was issued by NRW in 2018 (included as Appendix 1.2).

8.3.41 Section 3.4 of the Permit relates to noise level and vibration emissions from the Development; this states the following:

'… 3.4 Noise and vibration

3.4.1 Emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved noise and vibration management plan to prevent or where that is not practicable to minimise the noise and vibration.

3.4.2 The operator shall:

(a) if notified Natural Resources Wales that the activities are giving rise to pollution outside the site due to noise and vibration, submit to Natural Resources Wales for approval within the period specified, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration;

(b) implement the approved noise and vibration management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales ...'

8.3.42 In addition to the above, Improvement Condition 4 ("IC4") of the Permit relates to noise; this states the following (emphasis added in ***bold italics***):

Table 8.6: Requirements of Improvement Condition 4 of the Permit

Ref.	Requirement	Date
IC4	Following successful commissioning and establishment of routine steady operation, the operator shall undertake noise monitoring at the nearest local receptors. This shall include: • A full noise monitoring survey and assessment meeting the BS 4142:2014 standard • 1/3rd octave and narrow band (FFT) measurements to identify any tonal elements or low frequency noise • Reference to the World Health Organisation guidelines for community noise Upon completion of the work, a written report shall be submitted to Natural Resources Wales. The report shall refer to the predictions in the report produced as part of the application. If rating levels likely to cause ***adverse impact*** at sensitive receptors are detected, the report shall include an assessment of the most suitable abatement techniques, an estimate of the cost and a proposed timetable for their installation.	Within 6 months of the completion of commissioning

8.3.43 In short, the requirements of Improvement Condition 4 are clear, in that a post completion environmental noise survey and assessment shall be required, and furthermore, the Rating Level as arising at any noise sensitive receptor(s) shall not result in an "*Adverse Impact",* as defined in Table 8.7. In specific terms in relation to BS 4142:2014:+A1:2019[8], the Permit directly equates to a limiting Rating Level that should not exceed the Background Sound Level by +5dB or greater, depending on context.

Table 8.7: BS 4142 Initial Estimate of Impact – Residential Receptors

BS 4142 Initial Estimate of Impact	Rating Level ($L_{Ar,Tr}$) Sub. Background Sound Level ($L_{A90,T}$)
An indication of a low impact, depending on the context	<0dB
Range not formally defined; "sub adverse", depending on the context	0dB to +4dB
An indication of an adverse impact, depending on the context.	+5dB to +9dB
An indication of a significant adverse impact, depending on the context.	+10dB

8.3.44 As stated in BS 4142:2014:+A1:2019[8], the context in which the sound occurs must be taken into consideration when determining the resultant Magnitude of Impact, and ultimately the resultant Significance of Effect. The context of the Development and its surroundings is discussed further in Sections 8.6.40 and 8.6.79 of this ES Chapter.

8.3.45 Once the context of the BS 4142:2014:+A1:2019 assessment has been considered, Table 8.8 sets out the Magnitude of Impact criteria as based upon the BS 4142:2014:+A1:2019[8] Impact Magnitude which shall be used to determine the Magnitude of Impact as at the identified residential receptors. It shall be noted that the criteria as presented for a *Minor* impact is in line with the requirements of the Permit as defined in Table 8.6:

Table 8.8: Magnitude of Impact for the Operational Phase Noise Impact – Residential Receptors

Magnitude of Impact	BS 4142:2014+A1:2019 Impact Magnitude
Negligible	Low impact
Minor	*"Sub adverse"*
Moderate	Adverse impact
Major	Significant adverse impact

Outdoor Amenity Space

8.3.46 The potential noise impact from the Operational Phase of the Development on nearby outdoor amenity spaces (including private gardens, open public space and public walkways and pavements) has been assessed in accordance with the applicable generic acoustic guidance for amenity spaces, as presented within British Standard 8233:2014[9]. Table 8.9 sets out the adopted Magnitude of Impact criteria:

Table 8.9: Magnitude of Impact for the Operational Phase Noise Impact – Amenity Space

Magnitude of Impact	Specific Sound Level ($L_{Aeq,T}$)
Negligible	<50dB
Minor	50dB to 54dB
Moderate	55dB to 59dB
Major	≥60dB

8.3.47 The above-noted criteria are applicable during daytime periods only (i.e. 07:00 hours to 23:00 hours inclusive), as it is considered unlikely that amenity spaces would be used during night time periods.

Commercial Receptors

8.3.48 The potential noise impact on commercial receptors (such as offices) has considered the guidance provided by BS 8233:2014[9] for non-domestic buildings (refer to Appendix 8.2 for further details). As a worst case scenario, the adopted Magnitude of Impact criteria assume there could be executive office spaces located within the office accommodation. Table 8.10 sets out the Magnitude of Impact for office buildings on this basis:

Table 8.10: Magnitude of Impact for the Operational Phase Noise Impact – Offices

Magnitude of Impact	Indoor Ambient Noise Level ($L_{Aeq,T}$)
Negligible	<35dB
Minor	35dB to 39dB
Moderate	40dB to 45dB
Major	≥45dB

8.3.49 Similarly, the potential noise impact on the identified café (Receptor C2) has also considered the BS 8233:2014[9] guidance for non-domestic buildings (refer to Appendix 8.2 for further details). Table 8.11 sets out the Magnitude of Impact for the café:

Table 8.11: Magnitude of Impact for the Operational Phase Noise Impact – Café/Restaurant

Magnitude of Impact	Indoor Ambient Noise Level ($L_{Aeq,T}$)
Negligible	<40dB
Minor	40dB to 44dB
Moderate	45dB to 49dB
Major	≥50dB

Industrial Receptors

8.3.50 The existing identified industrial receptors are not deemed to be sensitive to noise and therefore the potential noise impact on these receptors has not been considered. However, given the proximity of some of the industrial uses to the Development, this assessment considers the possibility for vibration-induced damage to buildings (see Section 8.3.36) as during the (retrospective) Construction Phase.

Site Generated Road Traffic

8.3.51 The document entitled *'Design Manual for Roads and Bridges, LA 111, Noise and Vibration, Revision 2'*[11] has been used to assess the noise level impact as due to Development-generated road traffic at surrounding receptor locations.

8.3.52 As previously described, separate guidance is provided within the DMRB for the assessment of short term impacts (i.e. when the project is opened) and long term impacts (i.e. typically 15 years after the project is opened). For the Operational Phase, the DMRB guidance for both short term and long term noise impacts shall be considered. On this basis, Table 8.12 and Table 8.13 provide the adopted Magnitude of Impact for the assessment of Operational Phase generated road traffic for short term and long term impact respectively.

Table 8.12: Magnitude of Impact for the Assessment of Operation Phase Road Traffic – Short Term

Magnitude of Impact	Short Term Noise Change, (dB $L_{A10,18hour}$ or dB L_{night})
Negligible	Less than 1.0
Minor	1.0 to 2.9
Moderate	3.0 to 4.9
Major	Greater than or equal to 5.0

Table 8.13: Magnitude of Impact for the Assessment of Operation Phase Road Traffic – Long Term

Magnitude of Impact	Short Term Noise Change, (dB $L_{A10,18hour}$ or dB L_{night})
Negligible	Less than 3.0
Minor	3.0 to 4.9
Moderate	5.0 to 9.9
Major	Greater than or equal to 10.0

Decommissioning

8.3.53 The Magnitude of Impact criteria as set out for the Construction Phase noise and vibration impact shall also be applied to the potential Decommissioning Phase, since these are assumed to be commensurate. Please refer to Table 8.3 and Table 8.4 for the Magnitude of Impact criteria.

8.3.54 Similarly, the Magnitude of Impact criteria as set out for the Construction Phase road traffic assessment shall also be applied to the Decommissioning Phase. Please refer to Table 8.5 for the Magnitude of Impact criteria.

Cumulative Effects

8.3.55 Quod has provided Sol Acoustics with details of all cumulative schemes as located within a 10km radius of the Development as detailed in Chapter 3: EIA Methodology**.**

8.3.56 An assessment of the cumulative effects due to the identified cumulative schemes as during the (retrospective) Construction Phase, Operational Phase and Decommissioning Phase is included within this ES Chapter.

Determining Significance of Effect

Sensitivity of Receptor

8.3.57 Table 8.14 provides a summary of the various receptor types and their sensitivity to noise:

Table 8.14: Receptor Sensitivity Descriptors

Value (Sensitivity)	Descriptor
High	Residential dwellings, private gardens, schools, hospitals, care homes
Medium	Offices, public external amenity space
Low	Retail shops, restaurants
Negligible	Industrial premises, warehouse, public pavement

Significance of Effect

8.3.58 Table 8.15 sets put the adopted Significance of Effect matrix based upon the sensitivity of the receptors and the Magnitude of Impact:

Table 8.15: Significance of Effect Matrix

Sensitivity	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Assumptions and Limitations

8.3.59 Specific assumptions made in relation to each assessment are as set out within the relevant sections of this ES Chapter.

8.4 Baseline Conditions

Pre-Construction Baseline

8.4.1 The potential noise and vibration impact of the Development on the identified noise sensitive receptors as during the Construction Phase are assessed against the absolute noise level criteria as set out in BS 5228-1:2009+A1:2014[14] and BS 5228-2:2009+A1:2014[15] respectively. Pre-Construction baseline environmental noise and vibration levels are therefore not considered.

Current Baseline

8.4.2 The 2022 baseline noise survey was undertaken during a period when the Development was constructed, not operational but in "preservation mode" (see para 8.4.12 for further details). Table 8.16 to 8.20 provide a basic summary of the typical overall, A-weighted noise levels, in $L_{Aeq,T}$ and $L_{A90,T}$ terms, as recorded during the survey.

8.4.3 Figure 8.5 and Figure 8.6 provide a full-time history of the environmental noise levels as recorded at Measurement Positions 1 and 2, respectively.

8.4.4 Baseline environmental noise levels were not measured at the existing housing that is located on Cei Dafydd or Subway Road during the latest 2022 environmental noise survey, as it was not possible to obtain a secure monitoring position at this location. However, there are other more critical (i.e. more onerous) noise sensitive receptors that are located within closer proximity to the Development, and thus the degree of noise mitigation that is required for this more onerous housing that is located closer to the Development is greater than that which is applicable to Cei Dafydd or Subway Road. Additionally, the housing located on Cei Dafydd shall also benefit from a degree of noise screening effects (from environmental noise arising from the operation of the Development) as to be afforded by the proposed new housing on Cory Way (once this has been constructed). Therefore, the environmental noise measurements as conducted at Measurement Position 2 have been used to assess the impact at these locations.

Table 8.16: Summary of Typical, Measured Broadband Environmental Noise Levels – Position 1

Date	Daytime 07:00hrs - 19:00hrs		Evening 19:00hrs - 23:00hrs		Night Time (23:00hrs – 07:00hrs	
	dB $L_{Aeq,12hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,4hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,8hour}$	dB $L_{A90,15min}$ (Typical)
Tuesday 22 February 2022	63[1]	57	59	47	54	36
Wednesday 23 February 2022	62	56	59	49	53	38
Thursday 24 February 2022	62	57	61	48	54	36
Friday 25 February 2022	63	56	61	50	56	38
Saturday 26 February 2022	64	57	62	52	57	42
Sunday 27 February 2022	63	57	60	46	55	39
Monday 28 February 2022	64	57	60	46	56	43
Tuesday 1 March 2022	65	60	62	51	57	43
Wednesday 2 March 2022	65	59	62	50	56	42
Thursday 3 March 2022	65	59	61	49	56	35
Friday 4 March 2022	64	58	61	50	55	40
Saturday 5 March 2022	63	57	61	49	55	42
Sunday 6 March 2022	63	57	61	45	55	40
Monday 7 March 2022	65[1]	-	-	-	-	-

[1] *Measurement not conducted for the full assessment period*

Table 8.17: Summary of Typical, Measured Broadband Environmental Noise Levels – Position 2

Date	Daytime 07:00hrs - 19:00hrs		Evening 19:00hrs - 23:00hrs		Night Time (23:00hrs – 07:00hrs	
	dB $L_{Aeq,12hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,4hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,8hour}$	dB $L_{A90,15min}$ (Typical)
Tuesday 22 February 2022	-	-	54[1]	44	52	34
Wednesday 23 February 2022	67	50	57	48	54	40
Thursday 24 February 2022	66	53	55	46	53	40
Friday 25 February 2022	67	50	53	42	54	39
Saturday 26 February 2022	59	43	56	43	56	41
Sunday 27 February 2022	59	41	52	38	53	34
Monday 28 February 2022	69	50	54	42	53	41
Tuesday 1 March 2022	67	53	57	47	53	42
Wednesday 2 March 2022	65	54	58	41	51	40
Thursday 3 March 2022	66	52	55	46	52	39
Friday 4 March 2022	65	50	53	44	53	40
Saturday 5 March 2022	60	47	54	46	52	42
Sunday 6 March 2022	60	47	53	43	53	39
Monday 7 March 2022	65[1]	52	-	-	-	-

[1] *Measurement not conducted for the full assessment period*

Table 8.18: Summary of Typical, Measured Broadband Environmental Noise Levels – Position B1

Date	Daytime 07:00hrs - 19:00hrs		Evening 19:00hrs - 23:00hrs		Night Time (23:00hrs – 07:00hrs	
	dB $L_{Aeq,12hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,4hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,8hour}$	dB $L_{A90,15min}$ (Typical)
Tuesday 22 February 2022	54[1]	50	48	43	43	34
Wednesday 23 February 2022	52	50	50	46	49	36
Thursday 24 February 2022	-	-	-	-	-	-

[1] *Measurement not conducted for the full assessment period*

Table 8.19: Summary of Typical, Measured Broadband Environmental Noise Levels – Position B2

Date	Daytime 07:00hrs - 19:00Hrs		Evening 19:00hrs - 23:00hrs		Night Time (23:00hrs – 07:00hrs	
	dB $L_{Aeq,12hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,4hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,8hour}$	dB $L_{A90,15min}$ (Typical)
Tuesday 22 February 2022	53[1]	50	49	48	49	48
Wednesday 23 February 2022	52	49	50	49	49	49
Thursday 24 February 2022	55	52	52	51	51	50
Friday 25 February 2022	54	50	51	50	52	51
Saturday 26 February 2022	53	50	51	51	51	51
Sunday 27 February 2022	52	50	51	50	50	48
Monday 28 February 2022	54	50	50	49	52	50
Tuesday 1 March 2022	56	54	54	52	52	51
Wednesday 2 March 2022	56	53	51	50	51	50
Thursday 3 March 2022	56	53	52	51	51	50
Friday 4 March 2022	55	52	52	51	52	51
Saturday 5 March 2022	53	52	52	51	53	51
Sunday 6 March 2022	53	51	52	51	51	50
Monday 7 March 2022	54[1]	52	-	-	-	-

[1] *Measurement not conducted for the full assessment period*

Table 8.20: Summary of Typical, Measured Broadband Environmental Noise Levels – Position B3

Date	Daytime 07:00hrs - 19:00hrs		Evening 19:00hrs - 23:00hrs		Night Time (23:00hrs – 07:00hrs	
	dB $L_{Aeq,12hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,4hour}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,8hour}$	dB $L_{A90,15min}$ (Typical)
Tuesday 22 February 2022	56[1]	49	48	46	47	45
Wednesday 23 February 2022	54	49	52	49	49	47
Thursday 24 February 2022	55	53	54	53	53	52
Friday 25 February 2022	55	53	53	52	53	52
Saturday 26 February 2022	53	52	53	52	52	52
Sunday 27 February 2022	56	52	52	52	52	51
Monday 28 February 2022	54	53	53	51	52	52
Tuesday 1 March 2022	58	52	53	52	53	52
Wednesday 2 March 2022	54	52	52	52	52	52
Thursday 3 March 2022	54	48	49	47	46	45
Friday 4 March 2022	53	48	47	46	47	45
Saturday 5 March 2022	49	46	47	46	50	42
Sunday 6 March 2022	51	46	47	45	47	45
Monday 7 March 2022	52[1]	46	-	-	-	-

[1] *Measurement not conducted for the full assessment period*

Figure 8.5: Time-History Graph of Environmental Noise Levels at Measurement Position 1, 22 February 2022 to 7 March 2022

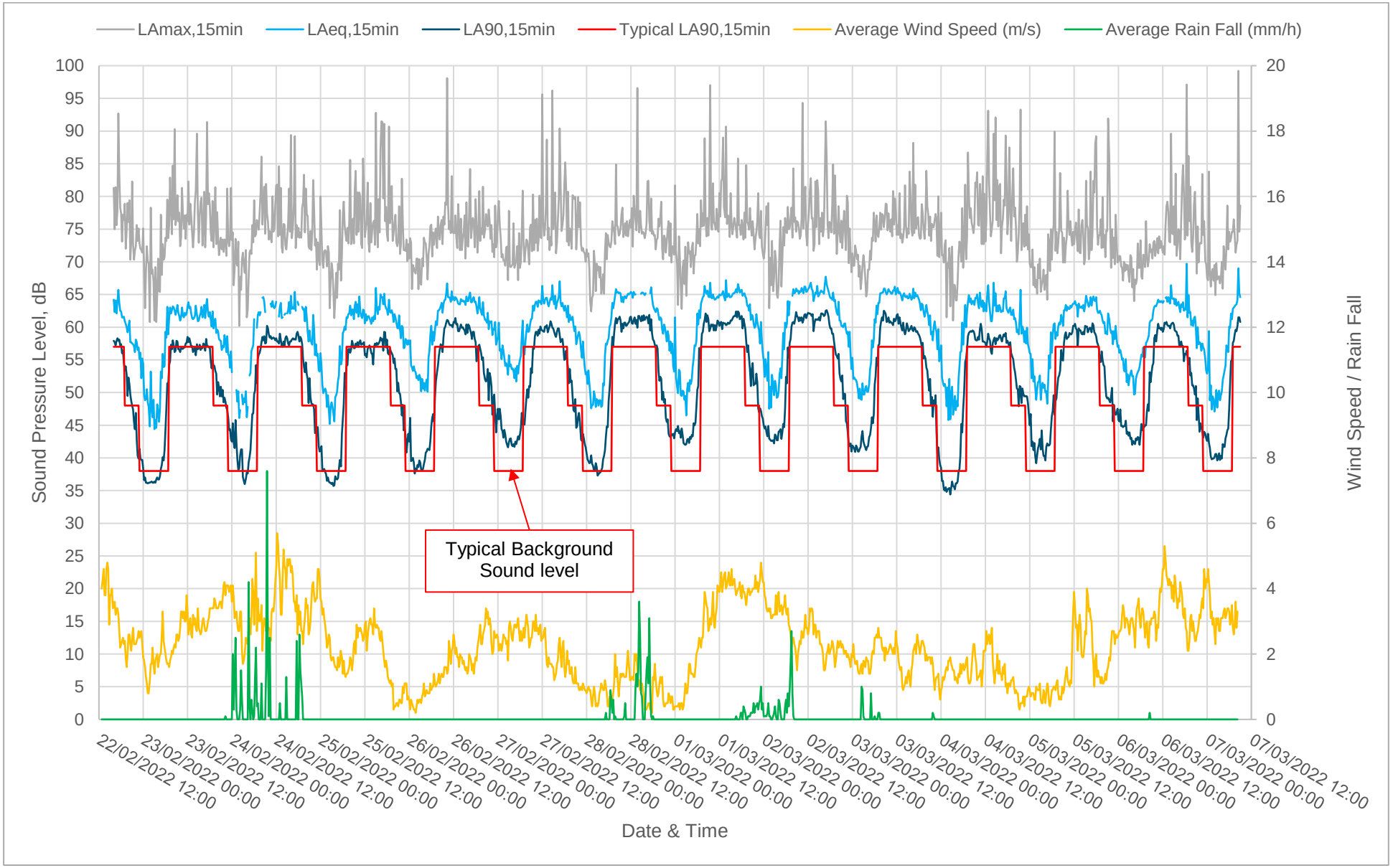
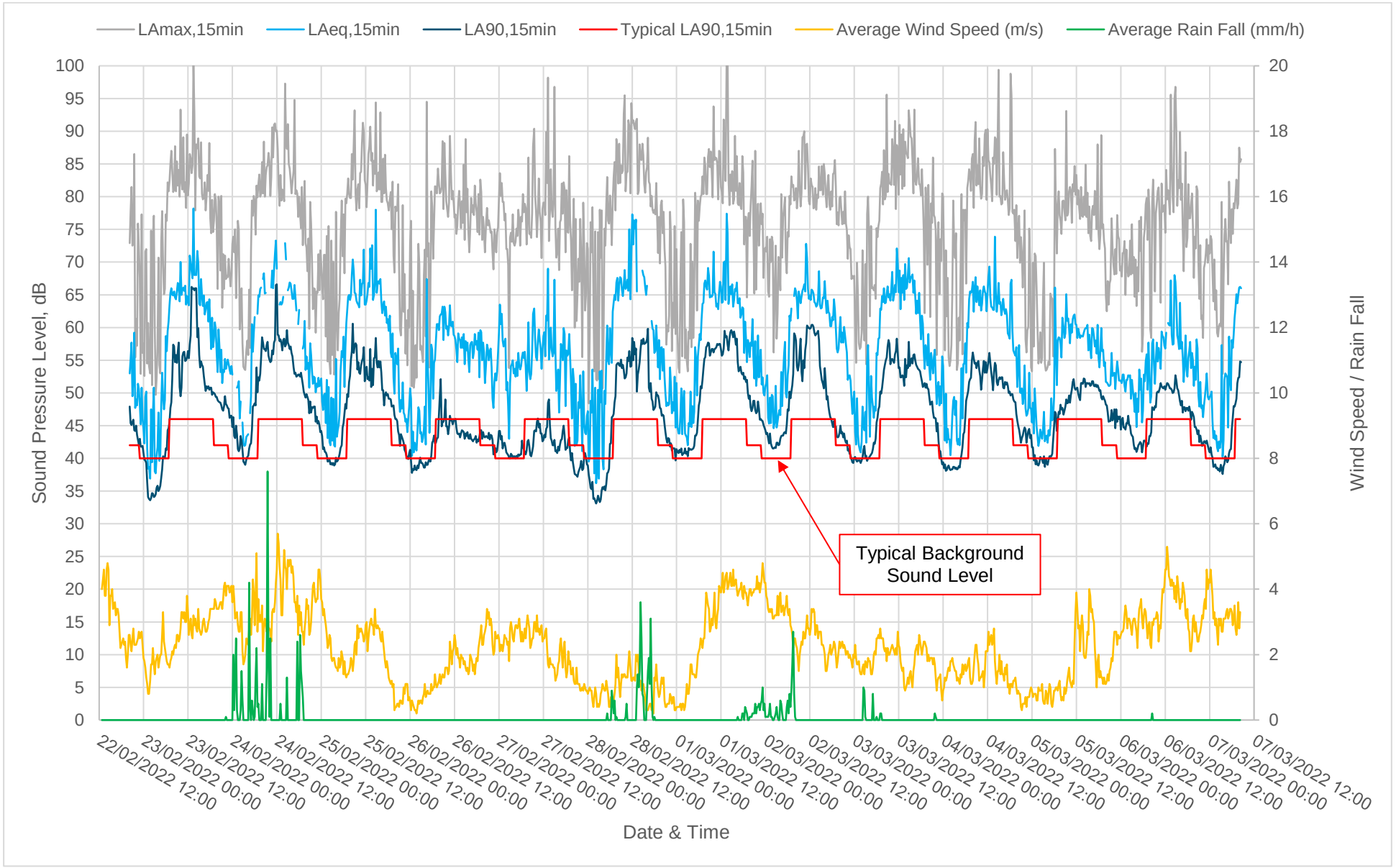


Figure 8.6: Time-History Graph of Environmental Noise Levels at Measurement Position 2, 22 February 2022 to 7 March 2022



8.4.5 For BS 4142:2014+A1:2019 assessment purposes, it is necessary to determine the *typical* Background Sound Level as occurring during each assessment period. Section 8.1 of BS 4142:2014+A1:2019[8] states the following:

'… In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods …'

8.4.6 The typical Background Sound Level has been determined as based upon statistical analysis of the full, measured dataset (excluding periods that were affected by adverse weather conditions as previously described) for each assessed period, as at each noise measurement position. The following specific assessment periods have been considered:

- Daytime: 07:00 hours to 19:00 hours;
- Evening: 19:00 hours to 23:00 hours; and
- Night time: 23:00 hours to 07:00 hours.

8.4.7 The adopted *typical* Background Sound Level, per period, per position, has been determined as based upon analysis of histograms (as is specifically supported by BS 4142:2014+A1:2019[8] assessment methodology) of the full noise dataset for each assessment period, per measurement location. Care has been taken to ensure that the adopted *typical* Background Sound Level is indeed representative of the full survey period and has not been unduly affected by outlying measurement data which occurred on a single day/couple of days which may have been subject to spurious events (e.g. local road closures or similar).

8.4.8 Figures A8.3.6, A8.3.7 and A8.3.8 of Appendix 8.3 each provide visual statistical analysis (histograms) of the measured Background Sound Levels as during the daytime, evening and night time periods respectively, as at Measurement Position 1. Similarly, Figures A8.3.9, A8.3.10 and A8.3.11 of Appendix 8.3 similarly provide visual statistical histogram analysis relating to the Measurement Position 2 noise datasets.

8.4.9 Table 8.21 provides an overarching summary of the *typical* measured Background Sound Level as at each of the existing and proposed residential receptors.

8.4.10 These adopted typical Background Sound Levels, per assessment period, are all as indicated on all relevant figures presented herein.

8.4.11 The level of vibration as generated during the Operational Phase of the Development has been scoped out (as previously reported) and as such the current vibration baseline has not been measured.

Table 8.21: Summary of Typical Background Sound Levels at Residential Receptors

Receptor	Representative Noise Measurement Position	Typical Background Sound level, dB $L_{A90,15min}$		
		Daytime 07:00 -19:00 hours	Evening 19:00 -23:00 hours	Night Time 23:00 -07:00 hours
R1: Dock View Road (existing)	1	57	48	38
R2: Cory Way (proposed)	2	46	42	40
R3: East Quay (proposed)	2	46	42	40
R4: Cei Dafydd (existing)	2	46	42	40
R5: Subway Road (existing)	2	46	42	40

Site Operating Conditions as During the Environmental Noise Survey

8.4.12 The Development was being maintained in so-called "Preservation Mode" during the baseline environmental noise survey period (i.e. c.12:15 hours during Tuesday 22 February until c.09:00 hours on Monday 7 March 2022). The Operator has advised Sol Acoustics that other than the continued operation of the internally sited compressors - small-scale, relatively low noise plant that is located within the Main Processing Building lean-to building - all other Operational Phase fixed plant associated with the Development was not in operation at any time during the stated survey period. It is understood that the compressors operate intermittently on/off load, but at a broadly consistent noise level throughout the daytime, evening and night time periods. This lone, nominal operation of the Development's compressors only is not expected to have any acoustic significance, nor any bearing on any of the offsite noise sensitive receptors (residential, commercial, or industrial).

8.4.13 Table 8.22 provides a summary of the Ambient Sound Levels as measured at the boundary of the Development (Measurement Position refs. B1, B2 and B3).

Table 8.22: Ambient Sound Levels as Measured at the Boundary of the Development

Measurement Position	Ambient Sound Level, dB $L_{Aeq,T}$		
	Daytime 07:00hrs - 19:00hrs T = 12 hours	Evening 19:00hrs - 23:00hrs T = 4 hours	Night Time 23:00hrs – 07:00hrs T = 8 hours
B1	52 - 54	48 - 50	43 - 49
B2	52 - 56	49 - 54	49 - 53
B3	49 - 58	47 - 54	46 - 53

8.4.14 The Ambient Sound Levels as measured at the boundary of the Development are relatively low, particularly at night, and as such these do not suggest that there were any significant levels of noise emanated from any fixed plant associated with the Development. Given that Measurement Positions 1 and 2 are located c.200 metres and c.160 metres distance from the Development respectively, it is considered very unlikely that any residual noise arising from the Development, when maintained in Preservation Mode as described above, would have had any impact on the measured noise levels at any offsite receptors (and/or their proxy locations).

Future Baseline

8.4.15 As previously reported, it is not possible to measure or predict the baseline environmental noise levels at the identified noise sensitive receptors as during any future Decommissioning Phase of the Development.

8.4.16 Also as previously reported, the potential noise impact of the Development at the identified noise sensitive receptors as during any Decommissioning Phase has been assessed against the absolute noise level criteria as set out in BS 5228-1:2009+A1:2014[14]. Therefore, consideration of the future baseline is not needed.

Summary of Receptors and Sensitivity

8.4.17 Table 8.23 provides a summary of the receptor noise sensitivity:

Table 8.23: Summary of Receptor Noise Sensitivity

Receptor	Receptor Type	Sensitivity (Value)	Construction Phase (Retrospective)	Operational Phase	Decommissioning Phase
R1: Dock View Road	Residential	High	✓	✓	✓
R2: Cory Way (proposed)	Residential	High	×	✓	✓
R3: East Quay (proposed)	Residential	High	×	✓	✓
R4: Cei Dafydd	Residential	High	✓	✓	✓
R5: Subway Road	Residential	High	✓	✓	✓
A1: External amenity area	External Amenity	Medium	×	✓	×
C1: Vale of Glamorgan Council offices	Office	Medium	✓	✓	✓
C2: Unit 13: “Denise’s Café”	Restaurant	Low	×	✓	×
I1: Units 1 & 2: “German Car & Camper”	Industrial	Negligible	×	×	×
I2: Unit 3: Vacant	Industrial	Negligible	×	×	×
I3: Unit 4: “Cars on Gas”	Industrial	Negligible	×	×	×
I4: Unit 5: “Diamond Repair Centre”	Industrial	Negligible	×	×	×
I5: Unit 6: 7 & 8	Industrial	Negligible	×	×	×

Receptor	Receptor Type	Sensitivity (Value)	Construction Phase (Retrospective)	Operational Phase	Decommissioning Phase
I6: Unit 9: “G&B Autos” / “GMB Paving Ltd”	Industrial	Negligible	×	×	×
I7: Units 10 & 11: Vacant	Industrial	Negligible	×	×	×
I8: Unit 12: “One Stop Garage”	Industrial	Negligible	×	×	×
I9: Unit 14: Vacant	Industrial	Negligible	×	×	×
I10: Unit 15: “Spectrum Displays”	Industrial	Negligible	×	×	×
I11: Unit 16: “Church Motors”	Industrial	Negligible	×	×	×
I12: Unit 17: Vacant	Industrial	Negligible	×	×	×
I13: Unit 18: “PM Autobody Repair Centre”	Industrial	Negligible	×	×	×
I14: Unit 20: Vacant	Industrial	Negligible	×	×	×
I15: Unit 17A: “Aqua Clear”	Industrial	Negligible	×	×	×
I16: Units 21-23: “Hawkins Antiques and Reproductions”	Industrial	Negligible	×	×	×
I17: “S&K Haulage”	Industrial	Negligible	×	×	×
I18: “Bruno Timber Merchants”	Industrial	Negligible	×	×	×
I19: “EWI Wales Superstore”	Industrial	Negligible	×	×	×
I20: “S&K Haulage”	Industrial	Negligible	×	×	×
I21: “ADP”	Industrial	Negligible	×	×	×
I22: “Scott Pallets”	Industrial	Negligible	×	×	×
I23: “O’Reilly Oakstown”	Industrial	Negligible	×	×	×

8.4.18 The following should be surmised from Table 8.23.

- The *Construction Phase* (retrospective) noise and vibration impact assessment considers only *existing* (i.e. constructed prior to February 2016) commercial (office) and residential receptors;
- The *Operational Phase* noise impact assessment considers all identified *existing* and *proposed* residential, external amenity and commercial (offices and restaurant) receptors;
- Any *Decommissioning Phase* noise impact assessment considers all known *existing* and *proposed* residential and commercial (offices) receptors; and
- None of the identified *industrial receptors* are deemed to be noise sensitive. Therefore, the noise and vibration impact as expected at the identified industrial receptors is not considered as during any phase of the Development.

8.5 Construction Assessment (Retrospective)

Embedded Design and Mitigation

8.5.1 Chapter 6 of the ES provides details of the plant and equipment that was expected to have operated during the Construction Phase of the Development (i.e. from February 2016 to March 2018). Table 8.24 overleaf provides a summary of the construction plant that is understood to have been used during each construction stage. Stage 1 Site Preparation and Enabling Works (including Excavation), as defined in Chapter 6 of the ES, has been split into two stages for assessment purposes: Site Enabling Works and Excavation. The assumed utilisation of each plant item has been estimated in each case and this information is also presented within the table.

Table 8.24: Summary of Construction Plant and Activity

Stage	Activity (Programme Stage)	Plant	Quantity	Utilisation
1	Site Enabling Works	360º excavator	2	100%
		D5 bulldozer	1	100%
		Compacter / roller	1	100%
		Generators	1	100%
		Scaffolding	✓	n/a
		Mechanical road sweeper	1	100%
		Lorries and vans	15/hour	n/a
2	Excavation	360º excavator	3	100%
		Breaker	2	100%
		Generators	1	100%
		Mechanical road sweeper	1	100%
		Lorries and vans	15/hour	n/a
3	Construction	360º excavator	1	100%
		Tower / mobile crane	2	100%
		Breaker	2	100%
		Compressor and air tools	2	100%
		Drills / cutters	1	100%
		D5 bulldozer	2	100%
		Compactor / roller	2	100%
		“Juntann” / “Banut” piling rigs	2	100%
		Concrete pumps	2	100%
		Generators	2	100%
		Forklift truck	2	100%
		Mechanical road sweeper	1	100%
		Floodlights	✓	100%
		Lorries and vans	15/hour	n/a
		Ready mix concrete trucks	2	100%
4	Installation and Commissioning	Compressor and air tools	1	100%
		Drills / cutters	1	100%
		Generators	3	100%
		Scaffolding	✓	n/a
		Mechanical road sweeper	1	100%
		Forklift truck	2	100%
		Floodlights	✓	n/a
		Lorries and vans	15/hour	n/a
		Ready mix concrete trucks	1	100%

8.5.2 Source noise data for the construction site operations have been determined as based upon the noise source database as presented within BS 5228-1:2009+A1:2014[14]. Table 8.25 presents the noise data as used to inform the assessment:

Table 8.25: Summary of Noise Data Adopted to Inform the Assessment

Equipment Name	BS5228 Source Reference	A-weighted Sound Pressure Level, dB $L_{Aeq,T}$ at 10m	Comment
Concrete crusher	Table C.1 ref 15	84	
360º excavator	Table C.2, ref 14	79	
Tower / mobile crane	Table C.4 ref 38	78	
Breaker	Table C.5 ref 6	95	
Compressor and air tools	Table C.5 ref 5	65	
Drills / cutters	Table C.6 ref 35	86	
D5 bulldozer	Table C.2, Ref 10	80	
Compacter / roller	Table C.2 ref 42	78	
“Juntann” / “Banut” piling rigs	Table C.3 ref 22	80	
Concrete pumps	Table C.4 ref 28	75	
Generators	Table C.4 ref 83	65	
Concrete vibration equipment	Table C.5, ref 24	84	
Scaffolding	-	-	Not acoustically significant
Forklift truck	Manufacturer published noise data	72	
Goods / passenger hoist	-	-	Not acoustically significant
Mast-climber platforms	-	-	Not acoustically significant
Mechanical road sweeper	Table C.4 ref 90	76	
Floodlights	-	-	Not acoustically significant
Hydraulic benders and cutters	Table C.1 ref 18	79	
Lorries and vans	Table C.6 ref 22	83	
Cement Mixer Truck (discharging)	Table C.4 ref 18	75	

Assessment of Effects

Construction Noise

8.5.3 As previously described, in order to predict the likely resultant noise level impact impinging on the nearest residential and office receptors from the proposed construction activities, a 3D computer-based noise model of the Development construction site (per programme stage) has been generated using the proprietary DataKustik "CadnaA" noise mapping software. The following assumptions have been made in the generation of the noise models:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2:1996[17];
- The 3D noise model was set to include up to second order reflected noise from solid structures;
- The existing land topography of the Development and its surrounding areas (up to and including the nearest noise sensitive premises) has been taken into consideration in the assessment. Third party, proprietary topographical information has been obtained from emapsite.com;
- The base ground absorption for the model has been set to G=0.5 (mixed ground);
- The noise impact as expected at the worst affected NSR has been determined at a receptor height of 1.5 metres (ground floor), 4 metres (first floor) and 7 metres (second floor, where applicable). The highest predicted value at each floor level, per receptor, has been used to inform the assessment;
- The plant noise data and utilisation rates as presented in Table 8.24 and Table 8.25 have been assumed;
- In general, each noise source has been modelled as a separate point source located at 1.5 metres height above local ground level. Lorries and vans have been modelled at 0.5 metres height above local ground level in accordance with CRTN[12] calculation methodology;
- The HGV movements have been modelled as a moving "point source" (in acoustic terms), as located along the proposed access road within the Site boundary, as at an average speed of 10kph;
- The potential noise level impacts as expected at Receptor refs. R2 (Cory Way) and R3 (East Quay) have not been assessed, since these *new build* receptors did not exist during the Construction Phase (i.e. February 2016 to March 2018); and
- Whilst the assessment criteria as presented in BS 5228-1:2009+A1:2014[14] applies only to residential receptors, the same criteria have also been applied to the Commercial Receptor: C1 (Vale of Glamorgan Council Office). The potential noise impact on all other identified commercial and industrial receptors has not been considered.

8.5.4 Figure 8.7 provides a three-dimensional visualisation of the noise model used to inform the construction phase noise impact assessment.

8.5.5 Figure A8.5.1 through to Figure A8.5.4 of Appendix 8.5 provides a detailed, fully annotated site plan to show the precise, modelled location of all discrete, external noise sources used to inform the Construction Phase (programme stage) noise impact assessment (Stages 1 through to 4).

8.5.6 Appendix 8.7 provides the daytime noise plots as produced by the 3D CadnaA environmental noise model for Construction Phase.

Figure 8.7: 3D View of the Noise Model for the Construction Phase of the Development (Stage 3) (Google 2022)

8.5.7 Table 8.26 presents the predicted construction noise level impact expected at the worst affected NSRs (at the worst affected floor level in each case), per construction stage, and all as predicted from the 3D noise model of the Development construction site:

Table 8.26: Predicted Noise Level Impact at Each Receptor per Construction Stage

Noise Sensitive Receptor	Predicted Noise Level Per Stage, dB $L_{Aeq,T}$				Worst Case Predicted Noise Level, dB $L_{Aeq,T}$
	Stage 1	Stage 2	Stage 3	Stage 4	
R1: Dock View Road	54	61	62	55	**62**
R2: Cory Way[1]	N/A	N/A	N/A	N/A	**N/A**
R3: East Quay[1]	N/A	N/A	N/A	N/A	**N/A**
R4: Cei Dafydd	42	48	49	43	**49**
R5: Subway Road	42	42	48	43	**48**
C1: Vale of Glamorgan Council offices	43	45	50	44	**50**

[1] *Receptor did not exist during the Construction Phase (i.e. February 2016 to March 2018)*

8.5.8 The corresponding noise contour plots are as presented in Appendix 8.7:

- Figure A8.7.1: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 1.5 metre grid height (i.e. ground floor) – *Stage 1* of the Construction Phase;
- Figure A8.7.2: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 4 metre grid height (i.e. first floor) – *Stage 1* of the Construction Phase;
- Figure A8.7.3: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 7 metre grid height (i.e. second floor) – *Stage 1* of the Construction Phase;
- Figure A8.7.4: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 1.5 metre grid height – *Stage 2* of the Construction Phase;
- Figure A8.7.5: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 4 metre grid height – *Stage 2* of the Construction Phase;
- Figure A8.7.6: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 7 metre grid height – *Stage 2* of the Construction Phase;
- Figure A8.7.7: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 1.5 metre grid height – *Stage 3* of the Construction Phase;
- Figure A8.7.8: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 4 metre grid height – *Stage 3* of the Construction Phase;
- Figure A8.7.9: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 7 metre grid height – *Stage 3* of the Construction Phase;
- Figure A8.7.10: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 1.5 metre grid height – *Stage 4* of the Construction Phase;
- Figure A8.7.11: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 4 metre grid height – *Stage 4* of the Construction Phase; and
- Figure A8.7.12: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at 7 metre grid height – *Stage 4* of the Construction Phase.

8.5.9 Table 8.27 presents the Magnitude of Impact as expected from the worst case predicted noise impact as during the Construction Phase at each identified receptor:

Table 8.27: Predicted Worst Case Noise Level Impact at Each Receptor

Noise Sensitive Receptor	Worst Case Predicted Noise Level, dB $L_{Aeq,T}$	Magnitude of Impact (see Table 8.3)
R1: Dock View Road	62	Negligible
R2: Cory Way[1]	N/A	N/A
R3: East Quay[1]	N/A	N/A
R4: Cei Dafydd	49	Negligible
R5: Subway Road	48	Negligible
C1: Vale of Glamorgan Council offices	50	Negligible

[1] *Receptor did not exist during the Construction Phase (i.e. February 2016 to March 2018)*

8.5.10 Table 8.27 shows that the predicted noise level impact from construction activities at the Development were not expected to exceed 65dB $L_{Aeq,T}$ at any residential or the Vale of Glamorgan Council offices (receptor ref. C1) and therefore is expected to result in a *Negligible* noise level impact for all receptors.

8.5.11 The assessed resultant Significance of Effect is ***Negligible***.

Construction Induced Vibration

8.5.12 Ground-borne vibration can result from construction works and may lead to perceptible levels of vibration at nearby receptors, which at higher levels can cause annoyance to building occupants and residents. In extreme cases, cosmetic or structural building damage can occur, albeit vibration levels have to be very high for this effect to be manifested and such cases are rare.

8.5.13 High vibration levels arise from "heavy" construction works such as piling, deep excavation, or dynamic ground compaction. Quod has informed Sol Acoustics that the vibratory driven piling method was adopted during the Construction Phase.

8.5.14 Vibration (in terms of peak particle velocity) as arising from vibratory piling can be estimated using the following expression (as provided in BS 5228-2:2009+A1:2014[15]):

$$v_{res} = \frac{k_v}{x^{\delta}}$$

Where:

δ=1.3 for all operations

x is the distance as measured along the ground surface between source and receiver, in metres

k_v is a scaling factor to be applied which accounts for the likelihood of the predicted peak particle velocity being exceeded. For 50% probability, $k_v = 60$. For 33.3 probability %, $k_v = 126$, and for just 5% probability, $k_v = 266$.

8.5.15 Table 8.28 presents the predicted peak particle velocity (PPV) at each noise sensitive receptor:

Table 8.28: Predicted Peak Particle Velocity at Receptors in Accordance with BS5228-2

Receptor	Distance to Receptor (metres)	Predicted Peak Partial Velocity, mm·s^{-1} (Resultant Magnitude of Impact, See Table 8.4)		
		50th Percentile	66th Percentile	95th Percentile
R1: Dock View Road	240	0.05 (negligible)	0.10 (negligible)	0.21 (minor)
R2: Cory Way[1]	N/A	N/A	N/A	N/A
R3: East Quay[1]	N/A	N/A	N/A	N/A
R4: Cei Dafydd	370	0.03 (negligible)	0.06 (negligible)	0.12 (negligible)
R5: Subway Road	390	0.03 (negligible	0.05 (negligible)	0.11 (negligible)
C1: Vale of Glamorgan Council offices	310	0.03 (negligible)	0.07 (negligible)	0.15 (negligible)

[1] *Receptor did not exist during the Construction Phase (i.e. February 2016 to March 2018)*

8.5.16 Table 8.28 shows that up to a minor impact would have been expected at the worst affected receptor (receptor ref. R1, Dock View Road) as during piling activities.

8.5.17 Furthermore, the predicted levels of vibration at each assessed receptor are significantly below the BS 5228-2:2009+A1:2014[15] advised threshold of 12.5mm·s^{-1} for the onset of vibration induced cosmetic damage (see Section 8.3.36), suggesting that cosmetic damage would have been very unlikely to occur as a consequence.

8.5.18 Whilst the adjacent industrial units on the opposite side of Woodham Road (receptors refs. I15 and I16) are deemed to have a Negligible sensitivity (Table 8.14), the potential for vibration induced cosmetic damage on these receptors must still be considered given their proximity to site activities.

8.5.19 A PPV of 7.87mm·s^{-1} (95th percentile) is predicted to have potentially arisen as at the nearest industrial building (Receptors ref. I15 and I16, which are located c.15 metres distance from the nearest Development site building), specifically as during vibratory piling activities. It should be noted that this is significantly below the BS 5228-2:2009+A1:2014[15] advised threshold of 12.5mm·s^{-1}, suggesting that cosmetic damage as due to piling would have been unlikely to occur at the closest industrial receptors.

8.5.20 The assessed, resultant Significance of Effect (see Table 8.15) is therefore ***Negligible/Minor***.

Construction Generated Road Traffic

8.5.21 The following road traffic data, as supplied by the Project Transport Consultant, Vectos, have been used to inform this assessment:

- 2022 Baseline; and
- Construction Phase.

8.5.22 Table 8.29 provides a summary of the provided Annually Average Weekday traffic data for the 18-hour period (between 06:00 hours and 00:00 hours inclusive). The Traffic Consultant has advised Sol Acoustics that there was no Development-generated road traffic arising during night time periods (i.e. 23:00 – 07:00 hours inclusive) as occurring during the Construction Phase, and thus there would have been no noise impact during the night time periods:

Table 8.29: Summary of Provided Road Traffic Data – Construction Phase (AAWT 18-hour)

Road Name	Average Speed, kph	2022 Baseline Traffic		Construction Phase Traffic	
		Total Vehicles	%HGV	Total Vehicles	%HGV
Cory Way	37	1571	37	200	50
Ffordd Y Mileniwm	64	18143	12	200	50
A4055 Cardiff Road	49	23360	10	200	50
A4231 Barry Docks Link Road	65	13334	14	200	50
A4050 Port Road	55	24930	13	200	50
A4232	112[1]	69051	4	200	50

[1] *Average speed not available, national speed limit applied*

8.5.23 Table 8.30 presents a per-receptor summary of the predicted increase in noise level as due to Construction Phase generated road traffic:

Table 8.30: Predicted Increase in Road Traffic Noise Level – Construction Phase – 2022 Baseline

Road	Predicted 18-hour AAWT Road Traffic Noise Level, dB $L_{A10,18hour}$		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.5)
	2022 Baseline	2022 Baseline + Operational Phase Traffic		
Cory Way	64.7	65.4	0.7	Negligible
Ffordd Y Mileniwm	73.4	73.6	0.2	Negligible
A4055 Cardiff Road	72.9	73.2	0.3	Negligible
A4231 Barry Docks Link Road	72.4	72.5	0.1	Negligible
A4050 Port Road	74.2	74.4	0.2	Negligible
A4232	81.8	81.8	0.0	Negligible

8.5.24 Table 8.30 shows that up to a *Negligible* increase in road traffic noise level was expected as a result of the (retrospective) Construction Phase of the Development.

8.5.25 The assessed, resultant Significance of Effect is therefore ***Negligible***.

Mitigation Measures, Monitoring and Residual Effects

8.5.26 No significant impacts have been identified from construction plant noise and vibration, nor for associated construction road traffic. Therefore, no further mitigation would have been deemed to be necessary.

8.6 Operational Assessment

Embedded Design and Mitigation

8.6.1 The as-built Development comprises of an Advanced Thermal Treatment (ATT) gasification line which is consented under the 2015 Permission to process up to exceed 72,000 dry tonnes (86,400 wet tonnes) of shredded mixed waste wood feedstocks per annum. The main features of the Development are as follows:

- **Fuel Reception Building**: For the delivery and reception of mixed waste wood feedstocks;
- **Waste Processing**: For the screening and sampling of the fuel feedstocks before being delivered to the gasification unit;
- **Fluidised Bed Gasification System**: Comprising of a gasification line for the thermal conversion and combustion of syngas from the fuel feedstocks;
- **Steam Turbine Generator**: Comprising of a steam turbine and generator for the conversion of steam into electricity within a steam turbine; and
- **Gas Cleaning and Pollution Abatement Plant**: Consisting of selective non-catalytic reduction ("SNCR") and selective catalytic reduction ("SCR") for the reduction of Nitrogen Oxides ("NOx"), sorbent injection for acid gas neutralisation and activated carbon powder injection for absorption and removal of heavy metals, dioxins, VOC, and other harmful substances.

8.6.2 The assessment has been based on the Development as-built and is defined by the 3D AutoCAD Navisworks model of the Site: BARRY_01_DWG_01_20191.

8.6.3 The Development has been designed taking full consideration of the sensitivity of the local environment and identified residential receptors. Accordingly, substantial noise control engineering and mitigation has been incorporated into the basic design of the plant to ensure that the plant meets the requirements of the NRW EPR permitting guidance.

8.6.4 In accordance with the requirements of the Environmental Permitting (England and Wales) Regulations 2016, any installation that has the potential for significant noise impacts is required provide a detailed Noise Management Plan (NMP) as part of an application for an Environmental Permit that details the specific noise mitigation and control measures that will be adopted as part of the project, in order to ensure that all impacts are adequately managed and controlled.

8.6.5 In respect of the Development, an NMP was submitted to the NRW as part of the original Permit application in July 2017 that was subsequently verified and validated as part of the Permit determination process and subsequent public consultation processes.

8.6.6 As part of the determination and consultation process, NRW carried out a process of verification modelling and has been satisfied that the measures proposed within the submitted NMP both meet the requirements of the Regulations, demonstrate BAT and are sufficient to ensure that the noise and vibration are not likely to cause an adverse effect at occupied sensitive receptors.

8.6.7 Details of the noise mitigation measures and associated NMP already incorporated into the Development are provided within Appendix 8.6. All acoustic model information and assessment assumes and requires the full and satisfactory implementation of all the noise control measures in their entirety.

8.6.8 Details of the external building envelope fabric to key buildings comprising part of the Development are provided within Appendix 8.8.

8.6.9 Roller shutter doors are required to be kept closed at all times when not in use.

8.6.10 Further modifications are currently proposed for the as-built Development which have yet to be implemented at the time of reporting (July 2022). In particular, it is proposed that the existing blowdown exhausts as located on the west façade of the Main Processing Building are to be relocated. Sol Acoustics has been informed by the Operator that these exhausts are only ever to be used for emergency conditions. Emergency plant which would only ever be used in case of a genuine emergency are excluded from the scope of this ES Chapter acoustic assessment and therefore the potential noise impact associated with this proposed alteration has not been considered.

Operational Phase Noise

Noise Data

8.6.11 The assessment of the Operational Phase noise impact from the Development is predominantly based upon as-measured environmental noise level data appertaining to the actual, as-built plant.

8.6.12 Sol Acoustics conducted numerous site-based noise surveys during a time period encompassing 2018 through to 2020, specifically in order to conduct close-quarters noise measurements of key, individual plant items and processes as during their typical operation (where possible). The main purpose of these targeted noise measurements was to identify acoustically significant items of plant and to obtain representative noise level data in each case.

8.6.13 In some instances, where it was not possible to directly measure noise from the as-installed plant, representative noise data was obtained from plant noise level measurements as undertaken by Sol Acoustics at other very similar Metso Outotec plant-based biomass installations. Further information was also drawn from published noise data as provided by the Vendor/Supplier, the original Contractor's Acoustic Consultant, O&M Manuals appertaining to the Development etc., or in a very few instances due to site constraints, representative noise data has been estimated. The overall acoustic assessment encompasses over 150 individual, discrete noise sources.

8.6.14 Appendix 8.6 provides a full summary of all noise data as used to inform the acoustic assessment.

3D Noise Model

8.6.15 In order to predict the noise levels impinging on the surrounding noise sensitive receptors, 3D computer noise models of the Development and its surrounding environment have been created using proprietary DataKustik CadnaA Noise Mapping software, as previously described. Also as described in preceding sections, the following assumptions have been made in the generation of the noise models:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2:1996[17];
- The model was set to include second order reflected noise from solid structures;
- The base ground absorption for the model has been set to G=0.5 (mixed ground). The ground absorption for large, tarmacked areas, such as that on the Development Site have been modelled as G=0.0 (hard ground);

- The noise impact as expected at the worst affected NSRs has been determined at the following receptor heights above local ground level:
  - 1.5 metre height, equivalent to ground floor level;
  - 4 metres height, equivalent to first storey level; and
  - 7 metres height, equivalent to second storey level.

- The assessment considers the worst affected floor level, at the worst affected dwelling(s) within each receptor group (i.e. the assessment has considered the noise impact to individual properties as located on Dock View Road and Cory Way etc.).
- The existing land topography of the Site and surrounding area up to and including the nearest receptor(s) has been taken into consideration in the assessment. Third party, proprietary topographical information has been obtained from emapsite.com;
- All externally sited plant noise sources have been modelled as point, line, or area sources, as appropriate, as based on physical size of the plant in question and the results of the close-quarters noise level measurements as conducted by Sol Acoustics. For modelling purposes, the effective sound power level of each identified noise source has been determined broadly in accordance with the principles presented in International Standard ISO 3744: 2010[19], taking into due consideration the physical dimensions of each noise source. The plant dimensions in each case have been determined from the as-built drawings and/or the 3D BIM model (Navisworks) information supplied to Sol;
- Noise breakout from internal plant has been modelled by determining the level of noise radiated from the external building fabric of the building, all as based upon the assessment methodology provided within British Standard BS 12354-4:2017[20]. The sound power level per unit area for each external building element has been determined based on the combined sound power level of all known noise sources expected within each space, the building's room dimensions and the anticipated reverberation time for each space. The sound power level per unit area for each external building element has then been determined by applying a "diffusivity term", as defined in BS 12354-4:2017[20] and subtracting the calculated composite sound insulation performance of each building face. Specifically, a diffusivity term of -5dB and a reverberation time of 2 seconds have been assumed for each modelled building;
- Sound insulation data for the various elements of the external building fabric of each building have been derived as based on information as provided to Sol Acoustics by the operator (e.g. in terms of each building constructional specification and wall build ups etc.), in turn based on manufacturer or third-party acoustic consultant data. Appendix 8.8 provides the sound insulation performance data for each building element of each building;
- A correction of -6.1dB has been applied to the noise level egress from the Reception Building during night time periods, in order to account for the reduction in the reverberant sound pressure level within the building when the loading shovel is not operational;
- The HGV movements for deliveries have been modelled as a moving point source located along the access road within the Site boundary, as at an average speed of 10kph. Noise from the HGV manoeuvring has been modelled based upon noise level measurement data obtained by Sol Acoustics during 10 August 2017 at a similar site to the Development;
- The noise model assumes that up to two HGVs could arrive at and depart from the Development during the worst case the 1-hour daytime assessment period. No HGVs are expected to arrive at or depart from the Development during the night time period; and

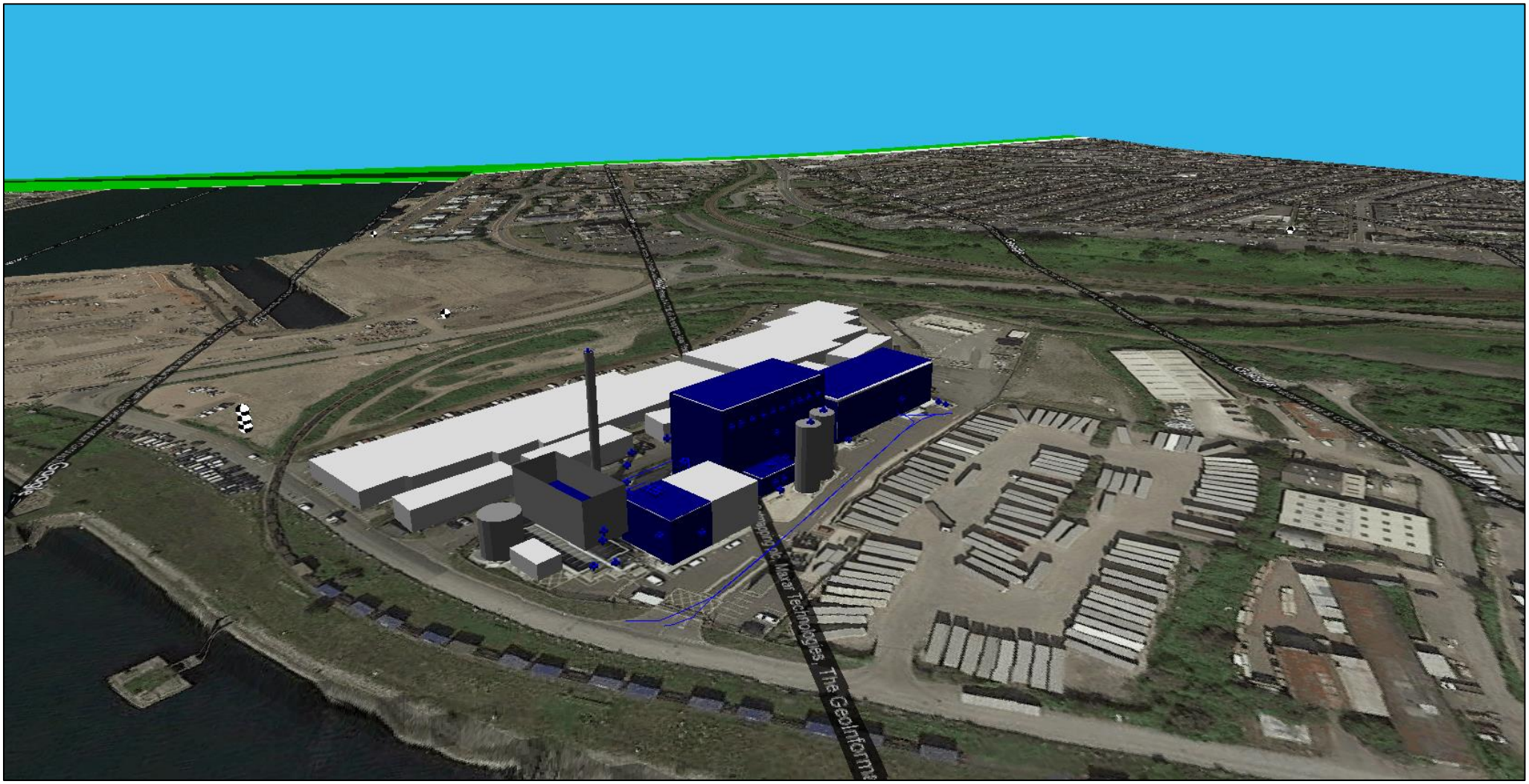
- The noise model assumes that all Duty and Start-up noise sources are operating simultaneously as this presents the worst case. Emergency plant which would only ever be used in case of genuine emergency are excluded from the scope of the assessment.

8.6.16 Figure 8.8 overleaf provides a three-dimensional visualisation of the noise model used to inform the Operational Phase noise impact assessment.

8.6.17 Figure A8.5.5 of Appendix 8.5 provides a detailed, fully annotated site plan to show the precise, modelled location of all discrete, external noise sources used to inform the Operational Phase noise model.

8.6.18 Appendix 8.7 provides the daytime and night time noise plots as produced by the 3D CadnaA environmental noise model for the Operational Phase.

Figure 8.8: 3D View of the Noise Model for the Operational Phase of the As-Built Development (Google 2022)



3D Noise Model Validation

Internal Building Reverberant Sound Pressure Level

8.6.19 The internal reverberant sound pressure levels as predicted by the 3D noise model within the Main Processing Building and Reception Building have been compared to the results of actual noise measurements that were conducted within similar buildings at an existing (Metso Outotec technology based) biomass plant in Hull, as during 21 June 2019. Table 8.31 and Table 8.32 provide a comparison of the predicted internal reverberant sound pressure level as compared to these actual, as-measured noise levels for the Main Processing Building and Reception Building respectively. Note that both the predicted and as-measured reverberant sound pressure levels within the Reception Building are in the absence of noise arising from the operation of the loading shovel (mobile plant):

Table 8.31: Comparison of Predicted and Measured Reverberant Sound Pressure Level within Main Processing Building

	Data Origin	Reverberant Sound Pressure Level, dB $L_{prev,T}$ at Octave Band Centre Frequency, Hz								dB L_{Aprev}
		63	125	250	500	1k	2k	4k	8k	
Predicted	3D noise model	87	82	83	78	75	75	70	66	82
Measured	On-site measurements at Hull Biomass during 21/06/2019	80	79	77	78	74	74	73	67	81
Level Difference		+7	+3	+6	0	+1	+1	-3	-1	+1

Table 8.32: Comparison of Predicted and Measured Reverberant Sound Pressure Level within Reception Building

	Data Origin	Reverberant Sound Pressure Level, dB $L_{prev,T}$ at Octave Band Centre Frequency, Hz								dB L_{Aprev}
		63	125	250	500	1k	2k	4k	8k	
Predicted	3D noise model	76	77	76	71	70	68	58	44	75
Measured	On-site measurements at Hull Biomass during 21/06/2019	73	73	71	68	67	66	59	47	72
Level Difference		+3	+4	+5	+3	+3	+2	-1	-3	+3

8.6.20 Table 8.31 shows that there is good correlation between the as predicted and as-measured internal reverberant sound pressure level within the Main Processing Building; the 3D noise model conservatively predicts a slightly increased noise level at low frequencies. In terms of the Reception Building (see Table 8.32), the 3D noise model conservatively predicts a reverberant sound pressure that is 3dB higher overall than as-measured at the very similar Hull biomass site. The 3D noise model is therefore considered to be conservatively and likely representative of worst case conditions.

Environmental Noise Levels at the Site boundary

8.6.21 The Development is known to have been in commissioning between 24 August and 9 September 2021. The three Development *site boundary* noise monitors (at Position B1, B2 and B3) were also installed and operational during this period, and the noise data obtained from these has been used to further validate the outputs obtained from 3D noise model of the Development. As part of this validation exercise, the operator has provided Sol Acoustics with key plant operating status information as during this period; this includes:

- Induced draught ("ID") fan speeds;
- Air cooled condenser ("ACC") fans speeds and number of fans running; and
- Total electrical output of the plant as expressed as a percentage of the Development's "Maximum Continuous Rating" (i.e. %MCR).

8.6.22 Figure 8.9 provides a comparison of the as-measured sound pressure levels (in dB $L_{Aeq,15min}$ and dB $L_{A90,15min}$ terms) with the advised plant operating status for the complete commissioning period of the Development (i.e. as between 24 August and 9 September 2021, all as per previous). The reported plant operating status parameters, per time period, are presented as a percentage of the MCR of the Development (i.e. %MCR), and also the data logged ID fan speed and ACC fan speeds.

8.6.23 Figure 8.10 similarly provides a comparison of the as-measured sound pressure levels (again in dB $L_{Aeq,15min}$ and dB $L_{A90,15min}$ terms) with the advised plant operating status for the condensed period of 2 September through to 6 September 2021. This figure shows that there was a single c.4-hour duration period that occurred between 16:00 hours and 20:00 hours during 2 September 2021 where the Development was operating at c.100% MCR (i.e. at its intended duty design condition, with maximum electrical generation). Accordingly, the noise arising from the Development during this commissioning period of 100% MCR output is considered to be representative of the worst-case noise levels as expected from the combined plant and processes associated with the intended operation of the Development, as during Normal Operating Condition (NOC).

8.6.24 This verified, known 100% MCR period has been used to validate the results of the 3D noise model. Table 8.33 provides a comparison of the 3D model predicted vs. actual measured noise levels as at the three Development Site boundary monitoring locations.

8.6.25 The as-measured results are Ambient Sound Level measurements, which includes noise from the Development (i.e. the Specific Sound Level), as well as extraneous noise from other environmental noise sources (i.e. Residual Sound) such as that arising from external (i.e. non-Development) road traffic. These Ambient Sound Levels are also likely to have been affected by meteorological conditions, and as a result, they are likely to vary with time. Therefore, in order to assist with the comparison, the as-measured sound levels are presented in both overall time-averaged and underlying noise terms, dB $L_{Aeq,15min}$ and dB $L_{A90,15min}$ respectively.

8.6.26 In contrast, the outputs from the 3D noise model comprise of predicted Specific Sound Levels, which consider noise from the Development plant and processes only (i.e. they by definition exclude any extraneous Residual Sound from other environmental noise sources). The 3D noise model predicts a single value per receptor, in dB $L_{Aeq,15min}$ terms only.

Table 8.33: Comparison of Predicted vs. Measured Sound Level during NOC, 100% MCR

Boundary Measurement Position	Predicted Specific Sound Level, dB $L_{Aeq,1hour}$	Measured Ambient Sound Level Sound Pressure Level					
		dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	Average Wind Speed, m/s	Wind Direction	Rainfall, mm/h	Temp, ºC
B1	55[1]	55 - 65	51 - 58	2.4	E	0.0	18
B2	62[1]	62 - 65	60 - 61				
B3	69	70 - 71	69 - 70				

[1] *Excludes noise from HGV deliveries*

8.6.27 Table 8.33 shows that that there is a good correlation between the predicted and as-measured results at each of the three Development boundary measurement locations (i.e. Position B1, B2 and B3). In each case, the predicted Specific Sound Level generally falls within the range of the as-measured Ambient Sound Level results, and this serves to validate the outputs (predicted noise levels at specific locations) of the 3D model and suggests that the predicted noise levels are likely to be representative of the noise level emissions as expected during typical "worst case" operation of the Development (i.e. NOC/100% MCR, design condition).

Figure 8.9: Comparison of Measured Sound Levels (Primary Axis) vs. Advised Plant Status (Secondary Axis) 24/08/2021 – 06/09/2021

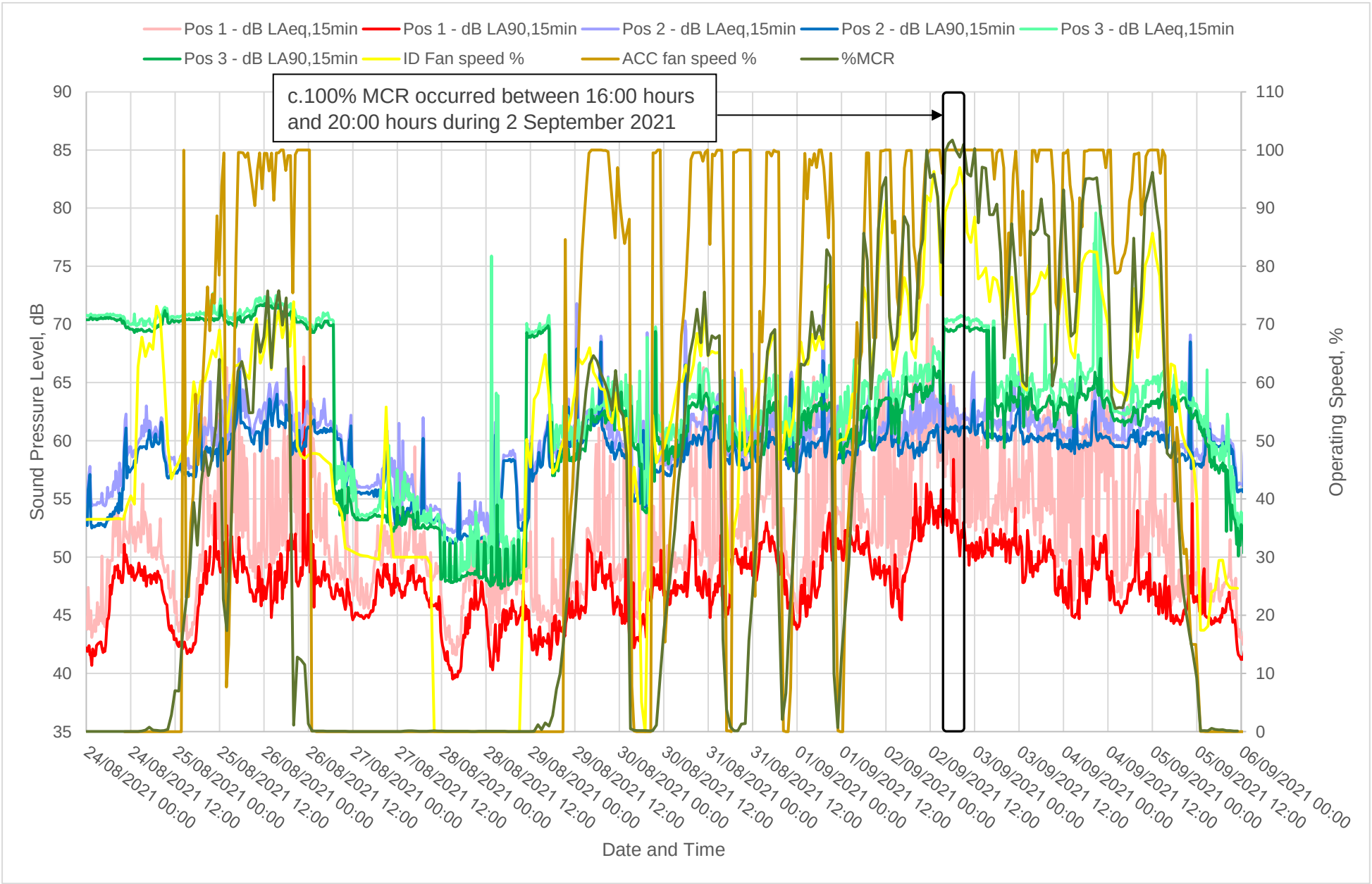
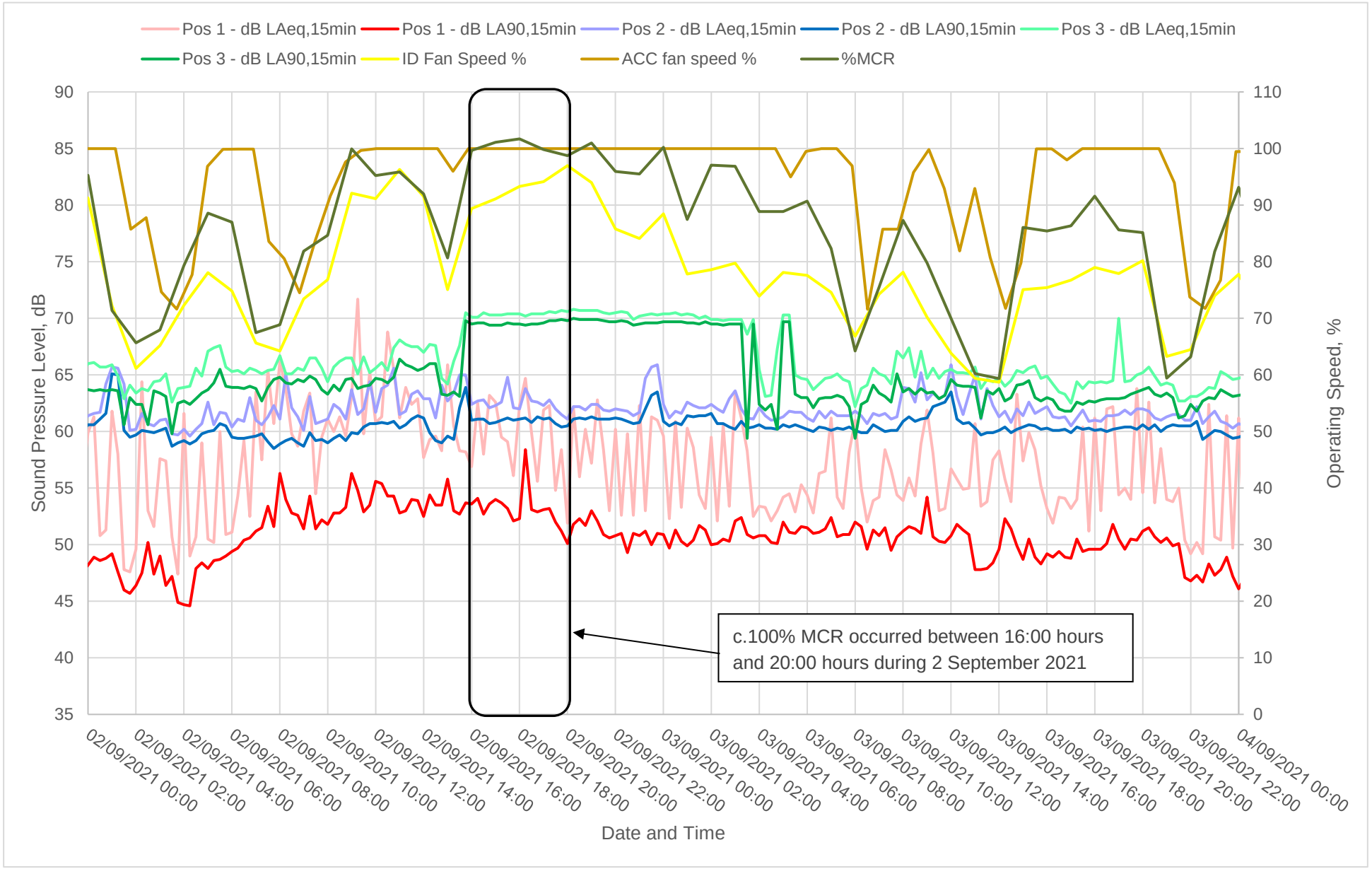


Figure 8.10: Comparison of Measured Sound Levels (Primary Axis) vs. Advised Plant Status (Secondary Axis) 02/09/2021 – 04/09/2021



Assessment of Effects

Residential Receptors

8.6.28 Table 8.34 presents the predicted Specific Sound Levels at the worst affected dwelling (including external garden areas) within each identified receptor group, per floor level (i.e. ground, first and second floor level, where applicable), as determined from the 3D computer-based noise model:

Table 8.34: Predicted Specific Sound Level, per Floor Level, per Receptor

Residential Receptor	Daytime (07:00hrs - 23:00hrs) Specific Sound Level, dB $L_{Aeq,1hour}$			Night time (23:00hrs - 07:00hrs) Specific Sound Level, dB $L_{Aeq,15min}$		
	Ground Floor (1.5m height)	First Floor (4m height)	Second Floor (7m height)	Ground Floor (1.5m height)	First Floor (4m height)	Second Floor (7m height)
R1: Dock View Road	42	42	n/a	38	38	n/a
R2: Cory Way	41	42	43	41	42	43
R3: East Quay	41	43	44	41	43	44
R4: Cei Dafydd	35	35	35	34	35	35
R5: Subway Road	33	34	34	33	34	34

8.6.29 The corresponding noise contour plots (as follows) are as presented in Appendix 8.7:

- Figure A8.7.13: Predicted Operational Phase *daytime*, $L_{Aeq,1hour}$, Specific Sound Level from the as-built Development, at *1.5 metre grid height (ground floor);*
- Figure A8.7.14: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the as-built Development, at *1.5 metre grid height (ground floor);*
- Figure A8.7.15: Predicted Operational Phase *daytime*, $L_{Aeq,1hour}$, Specific Sound Level from the as-built Development, at *4 metre grid height (first floor);*
- Figure A8.7.16: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the as-built Development, at *4 metre grid height (first floor);*
- Figure A8.7.17: Predicted Operational Phase *daytime,* $L_{Aeq,1hour}$, Specific Sound Level from the as-built Development, at *7 metre grid height (second floor);* and
- Figure A8.7.18: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the as-built Development, at *7 metre grid height (second floor).*

8.6.31 The BS 4142:2014+A1:2019[8] defined "Rating Level" has been determined from the predicted Specific Sound Levels by applying an acoustic character correction. The acoustic character correction applied has been determined by considering the following:

- The acoustic character of individual noise sources as based upon on site observation (i.e. from the individual noise source measurements as carried out by Sol Acoustics on site);
- The likely overriding acoustic character expected from the Development with all noise sources operating simultaneously as during NOC; and
- The likely perception of any residual acoustic character when compared to the pre-existing Background Sound Level at the assessed residential receptors.

8.6.32 Details of the operation of each assessed plant item are described in Appendix 8.6. The majority of plant as considered as part of this acoustic assessment is expected to operate continuously during both daytime and night time periods. However, a number of noise sources, such as the fuel handling equipment (i.e. fuel conveyors, disc screen, weigh belt etc.) may periodically stop operating (e.g. when the fuel bins are full).

8.6.33 The acoustic character as associated with fans and fan-based plant (e.g. ACC, ID fan etc.) may vary over time depending on the specific requirements of the plant. However, these changes are likely to be relatively gradual over time.

8.6.34 Certain noise sources including the soot blowers, the loading shovel (internally sited within the Reception Building) and HGVs have an intermittent acoustic character, albeit these noise sources are not acoustically significant in comparison to other key noise sources forming part of the Development and furthermore none of these operate during night time periods.

8.6.35 The partial noise level tables presented within Tables A8.7.1 through to A8.7.1.10 of Appendix 8.7 show that the noise contribution from each individual 3D modelled noise source is below the existing, typical Background Sound Level in all cases and at all residential receptors. As a result, any acoustic character associated with individual noise sources is not expected to be clearly discernible at the nearest noise sensitive receptors above the pre-existing environmental noise climate.

8.6.36 Furthermore, whilst individual noise sources associated with the Development are likely to generate noise with a particular acoustic character (e.g. acoustically tonal, impulsive and/or intermittent features), it is considered that such acoustic features would not be as prominent when perceived as when the remainder of the Development plant and processes are also simultaneously running. For example, the intermittent nature of the noise generated from HGV movements etc. is less likely to be perceptible when perceived whilst other plant items are operating. Likewise, the acoustically tonal character of any individual noise source is likely to be less prominent when perceived whilst other noise sources of similar magnitude, each with its own distinctive acoustic features, are also running.

8.6.37 Therefore, it is unlikely that the Specific Sound Level (i.e. cumulative noise level as due to the noise arising from all individually identified noise sources) would have any significant overriding acoustic character. Notwithstanding, however, the following BS 4142:2014+A1:2019[8] defined "acoustic character corrections" have been applied to the predicted Specific Sound Levels in order to determine the overall noise Rating Level at each noise sensitive residential receptor:

- Where the predicted Specific Sound Level is less than 10dB below the pre-existing Background Sound Level, no acoustic character correction has been applied.
- Elsewhere, a +3dB has been added in line with specific guidance as provided by the NRW (please refer to Section A8.2.6 of Appendix 8.2), in order to allow for any residual "readily distinctive" acoustic features.

8.6.38 Table 8.35 presents the predicted overall A-weighted, BS 4142:2014+A1:2019 defined Rating Level at each of the identified noise sensitive residential receptors. The Specific Sound Levels are presented per receptor, as at the worst affected floor level in each case (i.e. ground floor, including garden areas where appropriate), first floor and second floor level as applicable; it should be noted that the worst affected residential dwelling located on Dock View Road is a two-storey height building.

Table 8.35: Operational Phase Assessment – As-Built – Residential Receptors (BS 4142:2014+A1:2019[8])

Noise Sensitive Receptor	Assessment Period	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB $L_{A90,15min}$	Rating Level sub. Background ±dB	BS 4142:2014+A1:2019 Initial Estimate of Impact (See Table 8.7)
R1: Dock View Road	Daytime (07:00hrs- 17:00hrs) T = 1 hour	42 (first floor)	0	42	57	-15	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	42 (first floor)7	+3	45	48	-3	An indication of a low impact, depending on the context
	Night time (23:00hrs – 07:00hrs) T = 15 minutes	38 (first floor)	+3	41	38	+3	*Range not formally defined; "sub adverse", depending on the context*
R2: Cory Way	Daytime (07:00hrs - 17:00hrs) T = 1 hour	43 (second floor)	+3	46	46	+0	*Range not formally defined; "sub adverse", depending on the context*
	Evening (17:00hrs - 23:00hrs) T = 1 hour	43 (second floor)	+3	46	42	+4	*Range not formally defined; "sub adverse", depending on the context*
	Night time (23:00hrs – 07:00hrs) T = 15 minutes	43 (second floor)	+3	46	40	+6	An indication of an adverse impact, depending on the context.

Noise Sensitive Receptor	Assessment Period	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB $L_{A90,15min}$	Rating Level sub. Background ±dB	BS 4142:2014+A1:2019 Initial Estimate of Impact (See Table 8.7)
R3: East Quay	Daytime (07:00hrs - 17:00hrs) T = 1 hour	44 (second floor)	+3	47	46	+1	*Range not formally defined; "sub adverse", depending on the context*
	Evening (17:00hrs - 23:00hrs) T = 1 hour	44 (second floor)	+3	47	42	+5	An indication of an adverse impact, depending on the context.
	Night time (23:00hrs – 07:00hrs) T = 15 minutes	44 (second floor)	+3	47	40	+7	An indication of an adverse impact, depending on the context.
R4: Cei Dafydd	Daytime (07:00hrs - 17:00hrs) T = 1 hour	35 (second floor)	0	35	46	-11	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	35 (second floor)	+3	38	42	-4	An indication of a low impact, depending on the context
	Night time (23:00hrs – 07:00hrs) T = 15 minutes	35 (second floor)	+3	38	40	-2	An indication of a low impact, depending on the context
R5: Subway Road	Daytime (07:00hrs - 17:00hrs) T = 1 hour	34 (second floor)	0	34	46	-12	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	34 (second floor)	+3	37	42	-5	An indication of a low impact, depending on the context

Noise Sensitive Receptor	Assessment Period	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB $L_{A90,15min}$	Rating Level sub. Background ±dB	BS 4142:2014+A1:2019 Initial Estimate of Impact (See Table 8.7)
	Night time (23:00hrs – 07:00hrs) T = 15 minutes	34 (second floor)	+3	37	40	-3	An indication of a low impact, depending on the context

8.6.39 Thus, the calculated and assessed Rating Level is expected to exceed the existing typical Background Sound Level by up to +7dB (receptor ref. R3, East Quay, as during the night time period). This is above the threshold for an indication of a '… *Significant impact, depending on the context* …' as defined by BS4142:2014+A1:2019[8].

8.6.40 The predicted magnitude of the impact is subject to the consideration of context. In this case, the Development is situated alongside an existing Port and within an industrial area. Noise from the as-built industrial Development is therefore within the context of its surrounding environment. In this case and taking the magnitude of the Specific Sound Level in absolute terms (44dB $L_{Aeq,15min}$), the context in which the sound occurs does not affect the outcome of the assessment.

8.6.41 Based upon the above, Table 8.36 provides the Magnitude of Impact and resultant Significance of Effect for each assessed residential receptor:

Table 8.36: Magnitude of Impact and Resultant Significance of Effect (Residential Receptors)

Residential Receptor	Magnitude of Impact (see Table 8.8)	Receptor Sensitivity	Significance of Effect (see Table 8.15)
R1: Dock View Road	Minor	High	Minor
R2: Cory Way	Moderate	High	Moderate
R3: East Quay	Moderate	High	Moderate
R4: Cei Dafydd	Negligible	High	Negligible
R5: Subway Road	Negligible	High	Negligible

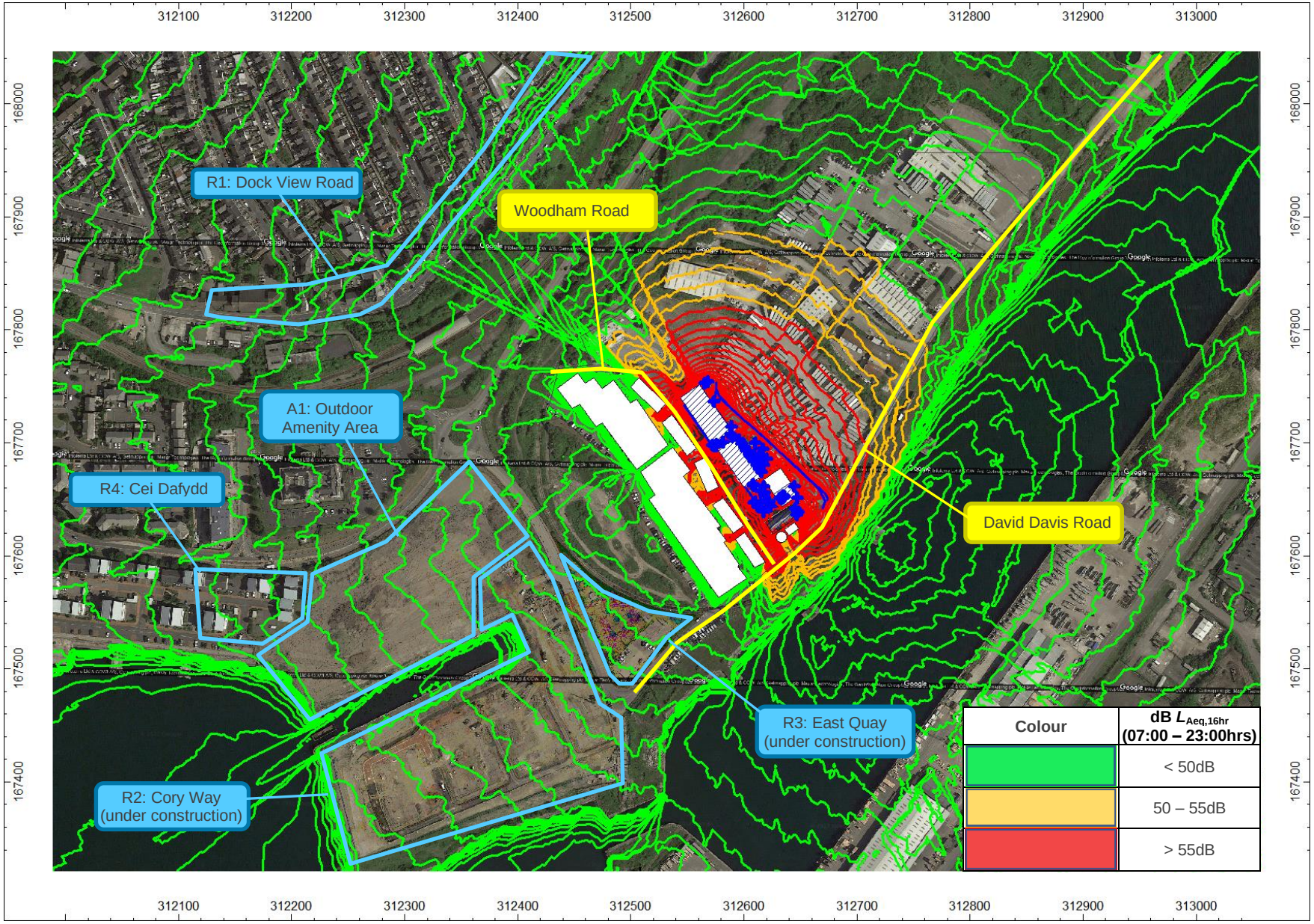
8.6.42 Table 8.36 shows that up to a *Moderate* Significance of Effect is anticipated from the Development at the Cory Way (R2) and East Quay (R3) receptors. It will therefore be necessary to implement further noise mitigation measures which are described within the subsection entitled 'Mitigation, Monitoring Measures and Residual Effects' of this ES Chapter.

External Amenity Areas

8.6.43 The 3D computer-based noise model has been used to predict the likely daytime ambient noise levels as expected within *private garden areas* that are associated with the existing and proposed residential housing, together with public outdoor amenity areas and footpaths also, as due to noise arising from the Development during its Operational Phase.

8.6.44 Figure 8.11 shows the colour-coded, predicted Specific Sound Level as due to the normal operation of the Development at the location of each of the variously identified external amenity areas.

Figure 8.11: Predicted Daytime Ambient Noise Levels (dB $L_{Aeq,16hour}$) in External Amenity Areas (Google 2022)



8.6.45 Figure 8.11 shows that noise from the Development is expected to fall below the BS 8233:2014[9] defined desirable guidance limit of 50dB $L_{Aeq,16hours}$ in each of the identified outdoor amenity spaces.

8.6.46 Figure 8.11 also shows that a noise level exceeding 60dB $L_{Aeq,16hour}$ is expected at the pavements alongside David Davis Road and Woodham Road, which are within the immediate vicinity of the Development. In accordance with the assessment criteria as presented in Table 8.9, the Magnitude of Impact is *High*. However, these footpaths are not deemed to be noise sensitive, and the resultant Significance of Effect (see Table 8.15) is thereby assessed as *Negligible*.

8.6.47 Elsewhere, the predicted Specific Sound Level from the Development is expected to be below the desirable guidance limit of 50dB $L_{Aeq,16hours}$. As such, the operation of the Development is not expected to have an adverse noise level impact on any existing or proposed external amenity areas.

8.6.48 **The assessed, resultant Significance of Effect (see Table 8.15) is *Negligible***.

Commercial Receptors

8.6.49 The assessment criteria for the Magnitude of Impact for *commercial receptors* is as based upon achieving appropriate, absolute internal ambient noise levels. It is therefore necessary to consider the external building fabric of the various commercial receptors.

8.6.50 The external façade of the Vale of Glamorgan Council offices (Receptor ref. C1) includes sash windows. As a worst case scenario, this acoustic assessment assumes that the windows to these offices are open. Accordingly, a sound reduction of 12dB has been assumed for the open window (in line with guidance as published by the IOA and ANC[21]).

8.6.51 The external façade to Unit 13, "Denise's Café" (Receptor ref. C2) is of a masonry/cladding construction. A nominal c.20dB broadband sound reduction has been assumed to be applicable for the external building fabric to the café (albeit this is likely to be conservative in practice).

8.6.52 On this basis, Table 8.37 provides the predicted internal noise level within the identified commercial receptors as a result of the Operational Phase of the Development (as during NOC):

Table 8.37: Operational Phase Predicted Noise Level on Commercial Receptors - Daytime Only

Noise Sensitive Receptor	Predicted External Sound Pressure Level, dB $L_{Aeq,T}$	Assumed Sound Reduction of Building, dB SRI	Predicted Internal Sound Pressure Level, dB $L_{Aeq,T}$	Magnitude of Impact
C1: Vale of Glamorgan Council offices	36	12	24	Negligible (see Table 8.1)
I9: Unit 13: Denise's Café	53	20	33	Negligible (see Table 8.2)

8.6.53 Thus, the Magnitude of Impact on the identified commercial receptors is *Negligible*. **The resultant Significance of Effect** (see Table 8.15) **is also *Negligible***.

Operational Phase Road Traffic Noise Impact Assessment

8.6.54 The assessment of traffic noise effects is based on the Design Manual for Roads and Bridges[11], Calculation of Road Traffic Noise[12], TRL Limited guidance[13] and using traffic data as provided by generated by the Project Transport Consultant, Vectos.

8.6.55 The following road traffic data have been used to inform this assessment:

- 2022 Baseline;
- 2022 Baseline + Committed Development; and
- Operational Phase.

Daytime Road Traffic Assessment

8.6.56 Table 8.38 provides a summary of the Annually Average Weekday traffic data for an 18-hour period (as between 06:00 hours and 00:00 hours):

Table 8.38: Summary of Road Traffic Data - Operational Phase (AAWT 18-hour)

Road Name	Average Speed, kph	2022 Baseline		2022 Baseline + Committed Development		Operational Phase Traffic	
		Total Vehicles	%HGV	Total Vehicles	%HGV	Total Vehicles	%HGV
Cory Way	37	1571	37	3193	18	54	70
Ffordd Y Mileniwm	64	18143	12	19834	11	54	70
A4055 Cardiff Road	49	23360	10	24809	10	54	70
A4231 Barry Docks Link Road	65	13334	14	15069	12	54	70
A4050 Port Road	55	24930	13	27052	12	54	70
A4232	112[1]	69051	4	71173	4	54	70

[1] *Average speed not available, national speed limit applied*

8.6.57 Table 8.39 presented the predicted increase in noise level as a result of the Operational Phase of the Development based upon the 2022 baseline traffic data (i.e. “Short Term” impact):

Table 8.39: Predicted Increase in *Daytime* Road Traffic Noise Level - Operational Phase – 2022 Baseline (Short Term)

Road	Predicted 18-hour AAWT Road Traffic Noise Level, dB $L_{A10,18hour}$		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.12)
	2022 Baseline	2022 Baseline + Operational Phase		
Cory Way	64.7	64.9	0.2	Negligible
Ffordd Y Mileniwm	73.4	73.4	0.0	Negligible
A4055 Cardiff Road	72.9	73.1	0.2	Negligible
A4231 Barry Docks Link Road	72.4	72.5	0.1	Negligible
A4050 Port Road	74.2	74.2	0.0	Negligible
A4232	81.8	81.8	0.0	Negligible

8.6.58 Table 8.40 presented the predicted increase in noise level as a result of the Operational Phase of the Development based upon the 2022 baseline traffic plus committed Development traffic (i.e. “Long Term” impact):

Table 8.40: Predicted Increase in *Daytime* Road Traffic Noise Level - Operational Phase – 2022 Baseline + Committed Development (Long Term)

Road	Predicted 18-hour AAWT Road Traffic Noise Level, dB $L_{A10,18hour}$		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.13)
	2022 Baseline + Committed Development	2022 Baseline + Committed Development + Operational Phase		
Cory Way	65.3	65.5	0.2	Negligible
Ffordd Y Mileniwm	73.6	73.6	0.0	Negligible
A4055 Cardiff Road	73.2	73.2	0.0	Negligible
A4231 Barry Docks Link Road	72.6	72.6	0.0	Negligible
A4050 Port Road	74.4	74.4	0.0	Negligible
A4232	82.0	82.0	0.0	Negligible

8.6.59 Table 8.39 and Table 8.27 show that the predicted (short term and long term) increase in road traffic as a result of the Operational Phase of the Development is expected to result in a *Negligible* increase in noise level. **The resultant Significance of Effect is *Negligible***.

Night Time Road Traffic Assessment

8.6.60 Table 8.41 provides a summary of the Annual Average Weekday traffic data for the night time period (as between 23:00 hours and 07:00 hours), as supplied by the project Transport Consultant, Vectos, which has been used to inform this assessment:

Table 8.41: Summary of *Night Time* Road Traffic Data - Operational Phase

Road Name	Average Speed, kph	2022 Baseline		2022 Baseline + Committed Development		Operational Phase Traffic	
		Total Vehicles	%HGV	Total Vehicles	%HGV	Total Vehicles	%HGV
Cory Way	37	51	39	60	33	7	0
Ffordd Y Mileniwm	64	989	13	998	12	7	0
A4055 Cardiff Road	49	1678	11	1686	11	7	0
A4231 Barry Docks Link Road	65	592	16	601	16	7	0
A4050 Port Road	55	2201	18	2212	18	7	0
A4232	112[1]	6097	5	6107	5	7	0

[1] *Average speed not available, national speed limit applied*

8.6.61 Table 8.42 presents the predicted increase in noise level as a result of the Operational Phase of the Development based upon the 2022 baseline traffic data (i.e. "Short Term" impact):

Table 8.42: Predicted Increase in *Night Time* Road Traffic Noise Level – Operational Phase – 2022 Baseline (Short Term)

Road	Predicted Night Time Road Traffic Noise Level, dB L_{Night}		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.12)
	2022 Baseline	2022 Baseline + Operational Phase		
Cory Way	51.1	51.1	0.0	Negligible
Ffordd Y Mileniwm	61.9	61.8	-0.1[1]	Negligible
A4055 Cardiff Road	62.7	62.9	0.2	Negligible
A4231 Barry Docks Link Road	60.7	60.7	0.0	Negligible
A4050 Port Road	65.9	65.9	0.0	Negligible
A4232	73.4	73.4	0.0	Negligible

[1] *The predicted reduction in noise level is likely due to very small number of vehicles expected and the absence of any additional HGVs associated with the Development during the night time period. This results in a lower percentage of HGV which has a significant bearing on the predicted night time road traffic level.*

8.6.62 Table 8.43 presents the predicted increase in noise level as a result of the Operational Phase of the Development based upon the 2022 baseline traffic plus committed Development traffic (i.e. "Long Term" impact):

Table 8.43: Predicted Increase in *Night Time* Road Traffic Noise Level – Operational Phase – 2022 Baseline + Committed Development (Long Term)

Road	Predicted Night Time Road Traffic Noise Level, dB L_{Night}		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.13)
	2022 Baseline + Committed Development	2022 Baseline + Committed Development + Operational Phase		
Cory Way	51.7	51.7	0.0	Negligible
Ffordd Y Mileniwm	62.1	62.0	-0.1	Negligible
A4055 Cardiff Road	63.0	63.0	0.0	Negligible
A4231 Barry Docks Link Road	60.9	60.8	-0.1[1]	Negligible
A4050 Port Road	66.1	66.1	0.0	Negligible
A4232	73.6	73.6	0.0	Negligible

[1] *The predicted reduction in noise level is likely due to very small number of vehicles expected and the absence of any additional HGVs associated with the Development during the night time period. This results in a lower percentage of HGV which has a significant bearing on the predicted night time road traffic level.*

8.6.63 Table 8.42 and Table 8.43 show that the predicted increase in road traffic as a result of the Operational Phase of the Development as during the night time period expected to result in a *Negligible* increase in noise level. **The resultant Significance of Effect is *Negligible***.

Mitigation, Monitoring and Residual Effects

8.6.64 The Operational Phase assessment has identified that the Significance of Effect of noise from the Development is Moderate at the worst affected residential receptors (R2 and R3). As such, this section sets out the required *additional* noise mitigation and noise monitoring that will be required to reduce the significance of effect. This section also provides the predicted residual effect as expected at the residential receptors ref. R2 and R3 with these measures in place.

8.6.65 The Operational Phase significance of Effect on other receptor types, including commercial, industrial, and external amenity spaces is *Negligible* and therefore not considered further.

8.6.66 As previously described, a number of noise control measures have already been implemented at the Development and these are duly considered as part of the Operational Phase noise impact assessment. Full details of the measured noise levels are presented in Appendix 8.6.

8.6.67 This section sets out the recommended additional noise mitigation measures which have been identified to reduce predicted environmental noise impacts to within appropriate limits at residential receptors ref. R2 and R3.

8.6.68 The locations of the noise sources forming part of the Development which require the additional noise mitigation measures specified herein are as shown in Figure 8.12:

- **ID fan stack**: High performance, *replacement* rectangular splitter attenuator required to achieve a sound pressure level of 76dB $L_{Aeq,T}$ at maximum required gas flowrate when measured at a distance of one metre from the high level ID fan stack outlet (noise measurement distance to be taken from outer stack wall surface and the specified noise level must be achieved when including the additional, cumulative effects of all gas velocity induced, regenerated "self-noise" effects of the as-fitted combined attenuator, together with all guide vanes and ductwork transition pieces etc.), as at 90° off the vertical axis of the stack. Note that the existing ID fan attenuator will need to be removed and replaced, together with modifications to pre-existing support steelwork *et al.*

- **Reagent recycle ("APCR") conveying blower**: Further enhancement, corrective measures required to the existing, as-fitted acoustic enclosure, in order to meet the original acoustic specification requirement of 70dB $L_{Aeq,T}$ when measured at a distance of one metre from any external surface(s) of the enclosure (the current enclosure achieves c. 75dB $L_{Aeq,T}$ at one metre distance).

- **Dust extract fans (2 off)**: Acoustic enclosure required to the combined fan casing and motor in both cases, so as to achieve a maximum permissible sound pressure level of 65dB $L_{Aeq,T}$ when measured at a distance of one metre from any external surface(s) formed by the new acoustic enclosures. (The acoustic enclosures must incorporate adequate, attenuated ventilation to enable sufficient heat dissipation and motor cooling etc.).

- **Dust extract louvres (2 off)**: Internally lined acoustic ductwork bend to be fitted to each of the two existing high level air outlets, as located at the top of the dust extract filtration cone; must provide a demonstrable (additional) in-duct insertion loss of at least 7dB at 125Hz octave band centre frequency (or greater).

- **Fresh lime blower**: Acoustic enclosure is required to envelop this plant; the unit is required to achieve a maximum permissible sound pressure level of 60dB $L_{Aeq,T}$ when measured at a distance of one metre from any external surface formed by the new acoustic enclosure. (The acoustic enclosure must incorporate adequate, attenuated ventilation to enable sufficient heat dissipation and motor cooling etc.).

- **Recycled lime conditioning drum blower**: Acoustic enclosure is required to envelop this plant; the unit is required to achieve a maximum permissible sound pressure level of 60dB $L_{Aeq,T}$ when measured at a distance of one metre distance from any external surface formed by the new enclosure. (The acoustic enclosure must incorporate adequate, attenuated ventilation to enable sufficient heat dissipation and motor cooling etc.).

8.6.69 Construction noise and vibration effects associated with the installation of the ID fan attenuator and other measures listed above would be temporary and short term. All works to be carried out in accordance with the PEP (please refer to ES Chapter 6).

8.6.70 These additional mitigation measures are proposed to be implemented prior to the Development becoming fully operational.

Figure 8.12: Location of Noise Sources Requiring Additional Noise Mitigation Measures (Google 2022)

8.6.71 Table 8.44 presents the predicted Specific Sound Levels at the worst affected dwelling within each identified receptor group per floor level (i.e. ground, first and second floor level, where applicable) once the above *additional* noise mitigation measures have been successfully and adequately implemented in full accordance with the stated acoustic performance specification requirements in each case:

Table 8.44: Predicted Specific Sound Level, per Floor Level, per Receptor – *Additional* Noise Mitigation Measures Duly Implemented

Residential Receptor	Daytime (07:00hrs – 23:00hrs) Specific Sound Level, dB $L_{Aeq,1hour}$			Night time (23:00hrs – 07:00hrs) Specific Sound Level, dB $L_{Aeq,15min}$		
	Ground Floor (1.5m height)	First Floor (4m height)	Second Floor (7m height)	Ground Floor (1.5m height)	First Floor (4m height)	Second Floor (7m height)
R1: Dock View Road	41	41	n/a	37	37	n/a
R2: Cory Way	38	39	40	38	38	39
R3: East Quay	38	40	41	38	39	41
R4: Cei Dafydd	32	32	33	32	32	32
R5: Subway Road	31	31	32	30	31	31

8.6.72 The corresponding noise contour plots with noise mitigation measures in place are presented in Appendix 8.7:

- Figure A8.7.20 Predicted Operational Phase *daytime*, $L_{Aeq,1hour}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 1.5 metre grid height (*ground floor*);
- Figure A8.7.21: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 1.5 metre grid height (*ground floor*);
- Figure A8.7.22: Predicted Operational Phase *daytime*, $L_{Aeq,1hour}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 4 metre grid height (*first floor*);
- Figure A8.7.23: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 4 metre grid height (*first floor*);
- Figure A8.7.24: Predicted Operational Phase *daytime*, $L_{Aeq,1hour}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 7 metre grid height (*second floor*); and

8.6.73 Figure A8.7.25: Predicted Operational Phase *night time*, $L_{Aeq,15min}$, Specific Sound Level from the Development with all proposed noise mitigation measures duly implemented, at 7 metre grid height (*second floor*).

8.6.74 The partial noise level tables presented within Tables A8.7.11 through to A8.7.20 of Appendix 8.7 show that the noise contribution from each individual 3D modelled noise source is below the existing, typical Background Sound Level in all cases and at all receptors. As a result (and as previously explained), any acoustic character associated with individual noise sources is not expected to be clearly discernible at the nearest noise sensitive receptors above the existing environmental noise climate.

8.6.75 Furthermore (and also as previously explained), whilst individual noise sources associated with the Development are likely to generate noise with a particular acoustic character (e.g. acoustically tonal, impulsive and/or intermittent features), it is considered that such acoustic features would not be as prominent when perceived as when the remainder of the Development plant and processes are also simultaneously running.

8.6.76 Therefore, it is unlikely that the Specific Sound Level (i.e. cumulative noise level due to the noise all individually identified noise sources) would have any significant overriding acoustic character. Notwithstanding however, the following BS 4142:2014+A1:2019[8] defined "acoustic character corrections" have been applied to the predicted Specific Sound Levels in order to determine the BS 4142:2014+A1:2019 defined Rating Level:

- Where the predicted Specific Sound Level is less than 10dB below the pre-existing Background Sound Level, no acoustic character correction has been applied.
- Elsewhere, a +3dB correction in line with guidance as provided by the NRW (see Section A8.2.6 of Appendix 8.2) has been applied to allow for any residual "readily distinctive" acoustic features.

8.6.77 Table 8.45 presents the predicted overall A-weighted, BS 4142:2014+A1:2019[8] defined Rating Level at the identified noise sensitive receptor. The at-receptor specific noise levels shown are each as based upon the worst affected receptor height above local ground level (i.e. ground floor, first floor and second floor where appropriate and applicable).

Table 8.45: Operational Phase Assessment – Additional Noise Mitigation Measures Duly Implemented – Residential Receptors (BS4142:2014+A1:2019[8])

Noise Sensitive Receptor	Assessment Period	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB $L_{A90,15min}$	Rating Level sub. Background ±dB	BS 4142:2014+A1:2019 Initial Estimate of Impact (see Table 8.7)
R1: Dock View Road	Daytime (07:00hrs - 17:00hrs) T = 1 hour	41 (first floor)	0	41	57	-16	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	41 (first floor)	+3	44	48	-4	An indication of a low impact, depending on the context
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	37 (first floor)	+3	40	38	+2	*Range not formally defined; "sub adverse", depending on the context*
R2: Cory Way	Daytime (07:00hrs - 17:00hrs) T = 1 hour	40 (second floor)	+3	43	46	-3	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	40 (second floor)	+3	43	42	+1	*Range not formally defined; "sub adverse", depending on the context*
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	39 (second floor)	+3	42	40	+2	*Range not formally defined; "sub adverse", depending on the context*
R3: East Quay	Daytime (07:00hrs - 17:00hrs) T = 1 hour	41 (second floor)	+3	44	46	-2	An indication of a low impact, depending on the context

Noise Sensitive Receptor	Assessment Period	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB $L_{A90,15min}$	Rating Level sub. Background ±dB	BS 4142:2014+A1:2019 Initial Estimate of Impact (see Table 8.7)
	Evening (17:00hrs - 23:00hrs) T = 1 hour	41 (second floor)	+3	44	42	+2	*Range not formally defined; "sub adverse", depending on the context*
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	41 (second floor)	+3	44	40	+4	Range not formally defined; "sub adverse", depending on the context
R4: Cei Dafydd	Daytime (07:00hrs - 17:00hrs) T = 1 hour	33 (second floor)	+0	33	46	-13	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	33 (second floor)	+0	33	42	-9	An indication of a low impact, depending on the context
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	32 (second floor)	+3	35	40	-5	An indication of a low impact, depending on the context
R5: Subway Road	Daytime (07:00hrs - 17:00hrs) T = 1 hour	32 (second floor)	0	32	46	-14	An indication of a low impact, depending on the context
	Evening (17:00hrs - 23:00hrs) T = 1 hour	32 (second floor)	+3	35	42	-7	An indication of a low impact, depending on the context
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	31 (second floor)	+3	34	40	-6	An indication of a low impact, depending on the context

8.6.78 Thus with all of the prescribed, additional noise mitigation measures applied, the calculated and assessed Rating Level is expected to exceed the existing typical Background Sound Level by up to +4dB (but only at East Quay housing, receptor ref. R3, as during night time periods). The calculated and assessed Rating Level at receptor ref. R1 and R2 is expected to exceed the typical Background Sound Level by +2dB. It should be noted that, in all cases, the initial estimate of impact is below the threshold for an indication of a '… *Significant impact, depending on the context* …' as defined by BS 4142:2014+A1:2019[8].

8.6.79 The predicted magnitude of the environmental noise impact is subject to the consideration of context. In this case, the Development is located alongside an existing Port and within an industrial area. Noise from the as-built industrial Development is therefore within the context of its surrounding environment. In this case and taking the magnitude of the Specific Sound Level at the worst affected residential receptor in absolute terms (i.e. 41dB $L_{Aeq,15min}$), the context in which the sound occurs does not affect the outcome of the assessment.

8.6.80 Based upon the above, Table 8.46 provides the Magnitude of Impact and resultant Significance of Effect for each assessed residential receptor:

Table 8.46: Magnitude of Impact and Resultant Significance of Effect (Residential Receptors)

Residential Receptor	Magnitude of Impact (see Table 8.8)	Receptor Sensitivity	Significance of Effect (see Table 8.15)
R1: Dock View Road	Minor	High	Minor
R2: Cory Way	Minor	High	Minor
R3: East Quay	Minor	High	Minor
R4: Cei Dafydd	Negligible	High	Negligible
R5: Subway Road	Negligible	High	Negligible

8.6.81 Table 8.46 shows that up to a *Minor* Significance of Effect is anticipated from the Development at the Dock View Road (R1), Cory Way (R2) and East Quay (R3) receptors.

8.6.82 Furthermore, the predicted noise level impact complies with the requirements of the Permit and specifically Improvement Condition 4 (please refer to Appendix 8.2 for further information).

Assessment of Low Frequency Noise

8.6.83 BS 4142:2014+A1:2019[8] states that it is not applicable for the assessment of low frequency noise. However, the presence of low frequency noise within the Specific Sound Level has the potential to increase the magnitude of the impact at the affected noise sensitive receptors, and this aspect has therefore been additionally considered as part of the overall acoustic assessment of the Development.

8.6.84 There is limited acoustic guidance available for the assessment of low frequency noise forming part of the external soundscape of a residential property. The NANR45[18] acoustic guidance document considers low frequency noise as perceived *within* a building only and does not provide guidance for the assessment of low frequency noise *external* to a (residential) property. Indeed, NANR45[18] specifically states:

'… *Although the majority of environmental noise standards specify that sound measurements should be conducted outside, it is now generally agreed that low frequency noise can only meaningfully be evaluated inside* …'

8.6.85 As such, this assessment methodology cannot be applied in this instance, as it is not possible to accurately predict the level of low frequency noise within a dwelling (which will be subject to numerous considerations and factors, such as internal room dimensions, furnishings, the sound reduction afforded by the external building fabric/glazing etc.).

8.6.86 The Broner Acoustic Australia Journal[22] does however provide "desirable" and "maximum" noise level limits which are applicable *outside* of a noise sensitive receptor. Unlike BS 4142:2014+A1:2019[8] however, noise limits described within the Journal are provided in absolute terms and thus do not consider the pre-existing environmental noise climate. A summary of the guidance is presented in Section A8.2.13 of Appendix 8.2.

8.6.87 The 3D noise model is set to predict the noise impact in octave bands whose centre frequencies lie between 31.5Hz and 8kHz, ergo within the entire audible frequency spectrum. As such it is not possible to determine from the 3D noise model alone whether there is likely to be any significant low frequency noise present at the assessed noise sensitive receptors.

8.6.88 In order to specifically assess the likely presence of low frequency noise, the actual measured Development site boundary one-third octave band sound pressure levels have been used, as measured whilst the Development was operating fully and normally at 100% MCR (as between 10Hz to 20kHz one-third octave band centre frequencies, in dB $L_{90,1hour}$ terms). Specifically, these Development site boundary noise levels were as recorded at the three boundary noise monitoring positions (ref. B1-B3), as between 19:00 hours and 20:00 hours during 2 September 2021 (i.e. when the Development is known to have been operating at 100% MCR, but extraneous noise from other environmental noise sources such as road traffic should be lower).

8.6.89 The 3D noise model has been used to determine the level difference per octave band, from 31.5Hz to 8kHz band centre frequencies, between the predicted night time Specific Sound Level at each assessed noise sensitive residential receptor and the predicted Specific Sound Level at the closest of the three boundary noise monitoring positions. These level differences have been extrapolated to the adjacent frequency bands to provide one-third octave band level differences between 10Hz to 20kHz band centre frequencies.

8.6.90 These level differences are then applied to the as-measured one-third octave bands as actually recorded at the Development site boundary as during 100% MCR site operation etc., in order to approximate the likely corresponding one-third octave band noise levels at each of the assessed residential noise sensitive receptors. The results are then C-weighted and summed (decibel addition) in order to provide a single broadband sound pressure level which can be compared to the assessment criteria as presented within the Broner Acoustic Australia Journal[22].

8.6.91 Table 8.47 presents the predicted C-weighted Specific Sound levels in dB $L_{Ceq,T}$ terms, at each assessed receptor location. The results are compared to the "desirable" criterion for night time as presented within the Broner Acoustic Australia Journal[22]:

Table 8.47: Predicted Specific Sound Level in Broadband C-Weighted Terms, Per Receptor –Additional Noise Mitigation Measures Duly Implemented

Noise Sensitive Receptor	Receptor Type	Predicted Night Time Specific Sound Level, dB $L_{Ceq,T}$	"Desirable" Criterion for Night Time Operation, dB $L_{Ceq,T}$	Exceedance, dB
R1: Dock View Road	Residential	46	60	-14
R2: Cory Way	Residential	47	60	-13
R3: East Quay	Residential	49	60	-11
R4: Cei Dafydd	Residential	40	60	-20
R5: Subway Road	Residential	39	60	-21
C1: Vale of Glamorgan Council offices	Office	41	70	-29

8.6.92 ***Table 8.47 shows that the predicted night time specific Sound Level at each assessed noise sensitive receptor does not exceed the absolute "desirable" noise criterion.***

8.6.93 In addition to the absolute noise criteria as presented within the Broner Acoustic Australia Journal[22], this acoustic assessment has considered whether the noise level emissions (as generated by the Development) are likely to include any significant low frequency noise content which may alter the magnitude of the predicted noise impacts.

8.6.94 This assessment considers both the results of the noise levels *as measured* at the boundary of the Development - as during worst case, typical Development operation (i.e. NOC, 100% MCR as it is designed to operate) - as well as the *as predicted* results at each of the assessed residential properties. In all cases, the results have been "A-weighted" in order to account for the sensitivity of the human ear at varying frequencies:

- **As measured**: Figure 8.13 presents the full one-third octave frequency band Ambient Sound Levels as recorded at Boundary Measurement Positions B1, B2 and B3 between 19:00 hours and 20:00 hours during 2 September 2021 (i.e. when the Development is known to have been operating at 100% MCR, ergo its intended design condition, but extraneous noise from other environmental noise sources such as road traffic should be lower).
- **As predicted**: Figure 8.14 presents the predicted octave band Specific Sound Levels as predicted at each of the assessed residential receptors.

Figure 8.13: Measured A-Weighted Third-Octave Band Sound Pressure Level at Boundary Measurement Positions (NOC, 100% MCR), dB $L_{Afeq,T}$

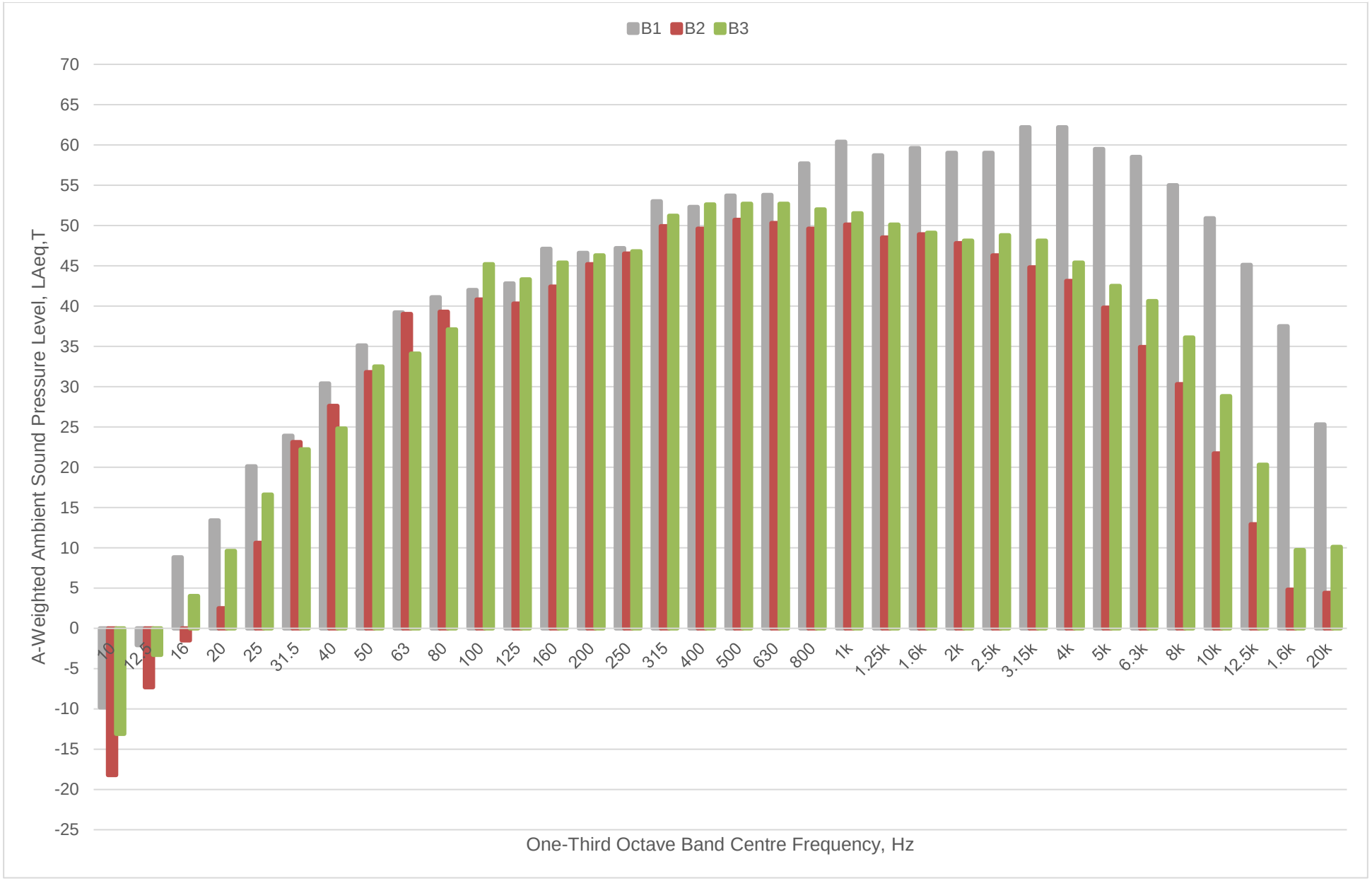
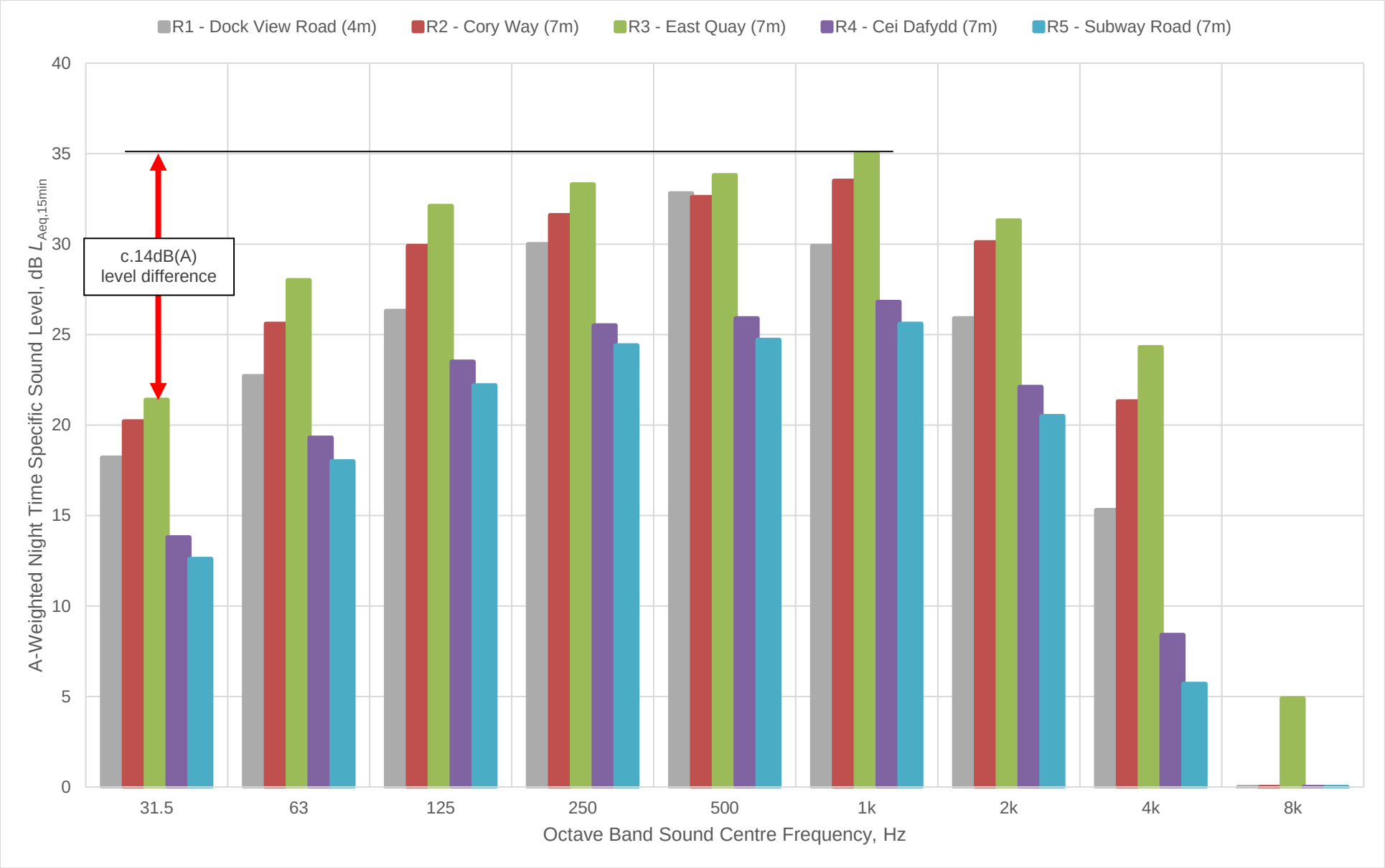


Figure 8.14: Predicted A-Weighted Octave Band Sound Pressure Level at Residential Receptors, Night Time (dB $L_{Afeq,15min}$)



8.6.95 Figure 8.13 shows that the as-measured A-weighted Ambient Sound Levels are dominated by noise levels at mid frequencies (not low frequencies). In the case of Measurement Position 3, the as-measured noise levels are dominated by noise at mid- to high frequencies (i.e. c.800Hz to c.8kHz). In all cases, however, it should be noted that there does not appear to be any significant low frequency noise content.

8.6.96 Similarly, Figure 8.14 shows that there is no significant low frequency noise component associated with the predicted, A-weighted Specific Sound Level at any receptor. For example, at the East Quay housing receptor (receptor ref. R3, worst-affected receptor), the predicted A-weighted sound pressure level at 31.5Hz octave band (i.e. low frequency) is c.14dB lower than the corresponding A-weighted sound pressure level at 1kHz octave band (i.e. mid-frequency). This demonstrates that the predicted environmental noise level impact is expected to be perceived as being dominated by mid frequency noise rather than low frequency noise.

8.6.97 Accordingly, it is considered unlikely that there shall be any significant low frequency noise component presented at any of the residential receptors.

8.6.98 As such, the outcome of the assessment is not affected by the presence of low frequency noise.

Uncertainty

8.6.99 Section 10 of BS 4142:2014+A1:2019[8] states the following with regards to uncertainty:

'… *Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty* …'

8.6.100 In accordance with the requirements of BS 4142:2014+A1:2019[8], Sol Acoustics has undertaken the following steps, in order to limit the level of uncertainty in the acoustic assessment:

- All noise measurements have been carried out using Type 1 Precision Grade noise mounting equipment. All noise measuring instruments have traceable laboratory calibration certification.
- The environmental noise levels were recorded continuously for thirteen consecutive days, as at key receptor locations, in order to accurately obtain an accurate assessment of the prevailing noise level climate as over a prolonged period (and to accurately determine variation in the environmental noise climate at each of the identified noise sensitive receptors also).
- All baseline environmental noise measurements were accompanied by continuous meteorological measurements also, as conducted at the measurement positions, in order to ensure that the measurement data was not adversely affected by unfavourable weather conditions. Periods of adverse weather conditions have been excluded from the assessment, as based on the empiric weather station data directly obtained.
- Calculations have been conducted in line with appropriate and nationally recognised acoustic standards, and using proprietary 3D noise modelling software, CadnaA.

- The majority of noise data used to generate the 3D noise model of the Development is based upon on-site noise level measurements of the as-installed plant by Sol Acoustics (please refer to Sections 8.6.11 through to 8.6.14).
- The results of the 3D noise model have validated by the directly measured Ambient Sound Levels as recorded at the boundary of the Development Site whilst it was operating in NOC and at 100%MCR. (Please refer to Sections 8.6.19 through to 8.6.19).

8.6.101 On this basis, it is considered that Sol Acoustics has duly considered the potential impact of uncertainty throughout the assessment process, and, in line with the requirements of BS 4142:2014+A1:2019[8], has taken all reasonable steps to reduce the level of uncertainty expected.

Noise Monitoring

8.6.102 Three environmental noise analysers and a weather station have been installed at the boundary of the Development since January 2019 (albeit these were temporarily removed during March 2022 due to inactivity of the Development, although they are to be reinstated prior to any operation of the Development). The purpose of the boundary noise analysers is to identify and report any significant levels of noise which are directly attributable to the operation of processes and/or plant forming part of the Development, as measured at the Development site boundary, which could result in an adverse noise level impact at any of the surrounding residential noise sensitive receptors.

8.6.103 Data previously obtained from the three boundary noise analysers (and weather station) has been vital to assist with the validation of the 3D noise model and the assessment of noise egress from the Development during various periods of its operation.

8.6.104 The locations of the three boundary noise analysers at the are shown in Figure 8.4. These will be reinstated prior to any operation of the Development in order to protect the amenity of nearby noise sensitive receptors and to provide an early warning of any noise issues.

8.6.105 Improvement Condition 4 of the Permit requires the Operator to carry out a full assessment of noise when the plant is operational to confirm predictions made in the Permit application. Further environmental noise monitoring would therefore be undertaken at key noise sensitive receptor locations once the Development is operational (i.e. refired) in line with the requirements of the Permit and any additional mitigation measures will be implemented.

8.6.106 The assessment does not identify the need for any vibration monitoring.

8.7 Decommissioning Assessment

Embedded Design and Mitigation

8.7.1 ES Chapter 6 provides details of the plant and equipment that could reasonably be expected to operate during any future Decommissioning Phase. Table 8.48 provides a summary of this plant. For the purposes of this acoustic assessment, it is assumed that each identified item of plant is 100% utilised as a worst case.

Table 8.48: Summary of Decommissioning Plant and Activity

Activity	Plant	Quantity	Utilisation
Decommissioning and Demolition	360º Excavator	1	100%
	Tower / mobile crane	2	100%
	Breaker	2	100%
	Compressor and air tools	2	100%
	Drills / cutters	2	100%
	D5 bulldozer	1	100%
	Generators	3	100%
	Scaffolding	✓	n/a
	Forklift truck	1	100%
	Mechanical road sweeper	1	100%
	Floodlights	✓	n/a
	Hydraulic benders and cutters	1	100%
	Lorries and vans	15/hour	n/a

8.7.2 Noise data for decommissioning operations have been determined as based upon the noise source database as presented in BS 5228-1:2009+A1:2014[14]. Table 8.49 presents the noise data as adopted from BS 5228:2009+A1:2014[14], all as based upon the details as presented in the Construction and Decommissioning Chapter (ES Chapter 6).

Table 8.49: Summary of Noise Data Adopted to Inform the Assessment

Equipment Name	BS 5228 Source Reference	A-weighted Sound Pressure Level, dB $L_{Aeq,T}$ at 10m	Comment
Tower / mobile crane	Table C.4 ref 38	78	
Breaker	Table C.5 ref 6	95	
Compressor and air tools	Table C.5 ref 5	65	
Drills / cutters	Table C.6 ref 35	86	
Concrete pumps	Table C.4 ref 28	75	
Generators	Table C.4 ref 83	65	
Concrete vibration equipment	Table C.5, ref 24	84	
Scaffolding	-	-	Not acoustically significant
Forklift truck	Manufacturer published noise data	72	
Goods / passenger hoist	-	-	Not acoustically significant

Equipment Name	BS 5228 Source Reference	A-weighted Sound Pressure Level, dB $L_{Aeq,T}$ at 10m	Comment
Mast-climber platforms	-	-	Not acoustically significant
Mechanical road sweeper	Table C.4 ref 90	76	
Floodlights	-	-	Not acoustically significant
Hydraulic benders and cutters	Table C.1 ref 18	79	
Lorries and vans	Table C.6 ref 22	83	

Assessment of Effects

8.7.3 As previously described, in order to predict the resultant noise level impact impinging on the nearest residential receptors from the construction activities, a proprietary 3D computer-based noise model of the Development has been generated using the DataKustik CadnaA Noise Mapping software. Again all as previously described, the following assumptions have been made in the generation of the noise models:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2:1996[17];
- The 3D noise model was set to include up to second order reflected noise from solid structures;
- The existing land topography of the Development and its surrounding areas (up to and including the nearest noise sensitive premises) has been taken into consideration in the assessment.
- Third party, proprietary topographical information has been obtained from emapsite.com;
- The base ground absorption for the model has been set to G=0.5 (mixed ground).
- The noise impact as expected at the worst affected NSR has been determined at a receptor height of 1.5 metres (ground floor), 4 metres (first floor) and 7 metres (second floor, where applicable). The highest predicted value at each floor level, per receptor, has been used to inform the assessment;
- The plant noise data and utilisation rates as presented in Table 8.35 and Table 8.49 have been assumed;
- In general, each noise source has been modelled as a separate point source located at 1.5 metres height above local ground level. Lorries and vans have been modelled at 0.5 metres height above local ground level in accordance with CRTN[12] calculation methodology;
- The HGV movements have been modelled as a moving “point source” (in acoustic terms), as located along the access road within the Site boundary, as at an average speed of 10kph;
- The potential noise level impacts as expected at Receptor refs. R2 (Cory Way) and R3 (East Quay) have not been assessed, since these *new build* receptors did not exist during the Construction Phase (i.e. February 2016 to March 2018); and

- Whilst the assessment criteria as presented in BS 5228-1:2009+A1:2014[14] applies only to residential receptors, the same criteria have also been applied to the Commercial Receptor: C1 (Vale of Glamorgan Council Office). The potential noise impact on all other identified commercial and industrial receptors has not been considered.

8.7.4 Figure 8.15 overleaf provides a three-dimensional visualisation of the noise model used to inform the Decommissioning Phase noise impact assessment.

8.7.5 Figure A8.5.6 of Appendix 8.5 provides a detailed, fully annotated Site plan to show the precise, modelled location of all discrete, external noise sources used to inform the Decommissioning Phase 3D noise model.

8.7.6 Appendix 8.7 provides the daytime noise plots as produced by the 3D CadnaA environmental noise model for Decommissioning Phase.

Figure 8.15: 3D View of the Noise Model for the Decommissioning Phase of the Development (Google 2022)

8.7.7 Table 8.50 presents the Magnitude of Impact as expected at the worst affected receptors (and at the worst affected floor level) as expected during the Decommissioning Phase:

Table 8.50: Predicted Worst Case Noise Level Impact at Each Receptor

Noise Sensitive Receptor	Worst Case Predicted Noise Level, dB $L_{Aeq,T}$	Magnitude of Impact (see Table 8.3)
R1: Dock View Road	63	Negligible
R2: Cory Way	55	Negligible
R3: East Quay	59	Negligible
R4: Cei Dafydd	48	Negligible
R5: Subway Road	47	Negligible
C1: Vale of Glamorgan Council offices	49	Negligible

8.7.8 The corresponding noise contour plots are as presented in Appendix 8.7:

- Figure A8.7.27: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at *1.5 metre grid height* (ground floor) – Decommissioning Phase;
- Figure A8.7.28: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at *4 metre grid height* (first floor) – Decommissioning Phase; and
- Figure A8.7.29: Predicted daytime $L_{Aeq,1hour}$ Specific Sound Level at *7 metre grid height* (second floor) – Decommissioning Phase.

8.7.9 Table 8.50 shows that the predicted noise level impact from the anticipated decommissioning activities at the Development are not expected to exceed 65dB $L_{Aeq,T}$ at any receptor and therefore is expected to result in a *Negligible* noise impact.

8.7.10 **The assessed, resultant Significance of Effect** (see Table 8.15) **is *Negligible***.

Assessment of Effects – Vibration

8.7.11 There are no significant sources of vibration expected to operate at the Development as during the Decommissioning Phase. As such, the anticipated vibration level impact is expected to be *Negligible*.

8.7.12 **The assessed, resultant Significance of Effect** (see Table 8.15) **is *Negligible***.

Decommissioning Phase Road Traffic Noise Impact Assessment

8.7.13 The following road traffic data has been used to inform this assessment:

- 2022 Baseline + Committed Development (i.e. assumed to be representative of the levels of road traffic as expected during the operational phase); and
- Decommissioning Phase.

8.7.14 Table 8.51 provides a summary of the relevant road traffic data, as supplied by the Project Transport Consultant, Vectos, which has been used to inform this assessment:

Table 8.51: Summary of Road Traffic Data – Decommissioning Phase

Road Name	Average Speed, kph	2022 Baseline + Committed Development		Decommissioning Phase Traffic	
		Total Vehicles	%HGV	Total Vehicles	%HGV
Cory Way	37	3193	18	200	50
Ffordd Y Mileniwm	64	19834	11	200	50
A4055 Cardiff Road	49	24809	10	200	50
A4231 Barry Docks Link Road	65	15069	12	200	50
A4050 Port Road	55	27052	12	200	50
A4232	112[1]	71173	4	200	50

[1] *Average speed not available, national speed limit applied*

8.7.15 Table 8.52 presents the predicted increase in noise level as due to Decommissioning Phase generated road traffic:

Table 8.52: Predicted Increase in Road Traffic Noise Level – Decommissioning Phase – 2022 Baseline + Committed Development (Short Term)

Road	Predicted 18-hour AAWT Road Traffic Noise Level, dB $L_{A10,18hour}$		Predicted Increase in Noise Level, dB(A)	Magnitude of Impact (see Table 8.5)
	2022 Baseline	2022 Baseline + Operational Phase Traffic		
Cory Way	65.3	65.9	0.6	Negligible
Ffordd Y Mileniwm	73.6	73.8	0.2	Negligible
A4055 Cardiff Road	73.2	73.2	0.0	Negligible
A4231 Barry Docks Link Road	72.6	72.9	0.3	Negligible
A4050 Port Road	74.4	74.6	0.2	Negligible
A4232	82.0	82.0	0.0	Negligible

8.7.16 Table 8.52 shows that the predicted increase in road traffic as a result of the Decommissioning Phase is expected to result in a negligible increase in noise level. Again, the Traffic Consultant has advised that no Development-generated road traffic shall occur during night time periods (i.e. 23:00 hours to 07:00 hours). Therefore the Magnitude of Impact is *negligible*.

8.7.17 **The assessed, resultant Significance of Effect is *Negligible*.**

8.8 Cumulative Effects

8.8.1 Quod has provided details of all cumulative schemes that are located within a 10km radius of the Development, as detailed in Chapter 3: EIA Methodology.

Construction Phase

8.8.2 All of the identified cumulative schemes were approved during February 2019 or later, which was after the Construction Phase of the Development (i.e. February 2016 to March 2018). Therefore, there will have been no cumulative impact as during the (retrospective) Construction Phase.

8.8.3 **The resultant Significance of Effect is *Negligible*.**

Operational Phase

8.8.4 The majority of the identified cumulative schemes are residential developments, and as such will not generate any noise of an industrial or commercial nature as during their respective Operational Phases (i.e. when construction is complete, and the properties are occupied). Table 8.53 provides details of known cumulative schemes which are understood to include development of a commercial or industrial nature.

8.8.5 Based upon the information provided in Table 8.53 (overleaf), there is not expected to be any significant cumulative noise effects as a result of the Operational Phase of the identified schemes.

8.8.6 Again, the Development is not expected to generate any significant levels of vibration and as such there shall be no cumulative vibration impact.

8.8.7 **The assessed, resultant Significance of Effect is *Negligible***.

Decommissioning Phase

8.8.8 It is assumed that all of the identified cumulative schemes will be long since completed during any Decommissioning Phase of the Development.

8.8.9 The Decommissioning Phase noise and vibration assessment of the Development has been based upon achieving absolute noise criteria (which excludes noise from other environmental noise and vibration sources) at the worst affected receptors. As such, the outcome of any Decommissioning Phase noise and vibration impact assessment is unaffected by any noise and vibration as associated with the cumulative schemes.

8.8.10 **The assessed, resultant Significance of Effect is *Negligible***.

Road Traffic Assessment

8.8.11 The traffic data used for the 2022 Baseline + Committed Development (as used to inform the Operational and Decommissioning traffic assessments) incorporates traffic flows associated with all approved cumulative schemes which would affect flows on the roads included in this assessment. Consequently, the operational impacts, which inherently include the approved cumulative schemes, have been shown to be *negligible* in relation to road traffic noise.

8.8.12 **The assessed, resultant Significance of Effect is *Negligible***.

Mitigation, Monitoring and Residual Effects

8.8.13 Any future decommissioning effects have been assessed as being of negligible significance. No further mitigation measures would therefore be required, although it is assumed best practicable means would be considered as part of any Development Closure Plan to mitigate and minimise the level of noise and vibration. It would be reasonable that these measures could be implemented by the contractor as part of a Decommissioning Environmental Management Plan (DEMP) which would include standard good practice measures which are available at the time.

Table 8.53: Potential Cumulative Noise Impact Associated with the Cumulative Schemes Including Noise of an Industrial or Commercial Nature

ID	Planning Ref	Description	Approx. Distance from Site boundary	Potential Noise Impact
BW1	2021/00379/FUL Land at Barry Waterfront	The construction of a new primary school, access, car parking, landscaping, and associated works	c.1.5km	Possible externally mounted building services plant associated with the school. Details of any proposed building services equipment is not provided as part of the submitted planning application. However, given that the proposed school is located c.1.5km distance from the Development, it is considered unlikely that there any cumulative impact on the identified noise sensitive receptors.
1	2019/00406/FUL Windmill Park, Hayes Road, Barry	Proposed erection of Class B1/B2/B8 Development (Phase 2), together with associated parking and access arrangements	c.1.2km	Details of any proposed building services equipment is not provided as part of the submitted planning application. However, given that the Windmill Park Development is located c.1.2km distance from the Development, it is considered unlikely that there any cumulative impact on the identified noise sensitive receptors.
2	2018/01317/FUL Spider Camp, Hayes Lane, Sully	Construction of six portal framed buildings and associated roads, division of buildings to form 43 light industrial units	c.1.0km	Details of any proposed building services equipment is not provided as part of the submitted planning application. However, given that the Spider Camp Development is located c.1.0km distance from the Development, it is considered unlikely that there any cumulative impact on the identified noise sensitive receptors.
3	2017/00726/FUL Former LME UK Ltd Site, Tank Farm Way, Sully	Extend the existing buildings, the installation of associated plant and machinery and extend an area of existing hardstanding for vehicle parking and circulation in association with the use of the site for the manufacture of precast concrete frame products	c.1.9km	The *'Noise Assessment Report'* (ref. CA11179 - FINAL Noise Assessment Report - Barry – update) as submitted to support the planning application states that the Rating Level at the worst affected noise sensitive receptors (c.55 metres distance from the Former LME UK Ltd site) is 28dB $L_{Ar,Tr}$ during both the night time period and results in a low impact. Nearest noise sensitive receptors to the Development are located c.2km distance from the Former LME UK Ltd site and as such, it is unlikely to be any cumulative noise impact.

8.9 Summary

8.9.1 A summary of residual effects is provided in Table 8.54. In summary, the construction and decommissioning stage noise effects are assessed as negligible, with some minor adverse, temporary vibration effects.

8.9.2 The calculated and assessed Rating Level of the operational Development is expected to exceed the existing typical Background Sound Level by up to +4dB (only at East Quay, receptor ref. R3, as during the night time periods). The calculated and assessed Rating Level at receptor refs. R1 and R2 is expected to exceed the typical Background Sound Level by +2dB. The residual operational noise effects (with additional noise mitigation measures) are therefore assessed as minor. The Development is located alongside an existing Port and within an industrial area. Noise from the as-built industrial Development is therefore within the context of its surrounding environment.

8.9.3 The operational noise assessment also concludes the following:

- Operational noise effects (private gardens, public outdoor amenity space, offices, café, industrial uses) – Negligible;
- Operational road traffic effects – Negligible; and
- Operational vibration effects – Negligible.

Table 8.54: Summary of Residual Effects

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Significance of Effect	Mitigation and Monitoring	Residual Effect
Construction (Retrospective)						
Construction noise	Residential (high) and offices (medium)	Local study area	Temporary (retrospective)	Negligible	None identified	Negligible
Construction vibration	Residential (high) and offices (medium)	Local study area	Temporary (retrospective)	Negligible / Minor	None identified	Negligible / Minor
Construction traffic	Any noise sensitive receptor along study area (high)	Traffic Consultant advised study area	Temporary (retrospective)	Negligible	None identified	Negligible
Operational						
Operational noise	Residential (high)	Local study area	Permanent	R1: Minor R2: Moderate R3: Moderate R4: Negligible R5: Negligible	Further noise mitigation measures required. Monitoring already required under Permit	R1: Minor R2: Minor R3: Minor R4: Negligible R5: Negligible
	Private gardens (high)	Local study area	Permanent	Negligible	-	Negligible
	Public outdoor amenity space (medium)	Local study area	Permanent	Negligible	-	Negligible
	Offices (medium)	Local study area	Permanent	Negligible	-	Negligible
	Café (low)	Local study area	Permanent	Negligible	-	Negligible
	Industrial (negligible)	Local study area	Permanent	Negligible	-	Negligible
Operational vibration	All receptors	Local study area	Permanent	Negligible	-	Negligible

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Significance of Effect	Mitigation and Monitoring	Residual Effect
Operational traffic	Any noise sensitive receptor along study area (high)	Traffic Consultant advised study area	Permanent	Negligible	-	Negligible
Decommissioning						
Decommissioning Noise	Residential (high) and offices (medium)	Local study area	Temporary	Negligible	Best Practicable Means/DEMP	Negligible
Decommissioning vibration	Residential (high) and offices (medium)	Local study area	Temporary	Negligible	Best Practicable Means/DEMP	Negligible
Decommissioning traffic	Any noise sensitive receptor along study area (high)	Traffic Consultant advised study area	Temporary	Negligible	Best Practicable Means/DEMP	Negligible
Cumulative Effects						
Construction	Residential (high) and non-residential receptors (medium)	10km radius	Temporary	Negligible	-	Negligible
Operation	Residential (high) and non-residential receptors (medium)	10km radius	Permanent	Negligible	-	Negligible
Decommissioning	Residential (high) and non-residential receptors (medium)	10km radius	Temporary	Negligible	-	Negligible
Cumulative Traffic	Any noise sensitive receptor along study area (high)	Traffic Consultant advised study area	Permanent	Negligible	-	Negligible

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