

# Glyn Rhonwy Pumped Storage Development Consent Order

## Deadline 5 – Operational Noise Management Plan

---



|                       |                            |                    |
|-----------------------|----------------------------|--------------------|
| <b>PINS Reference</b> | EN010072                   |                    |
| <b>Document Nos.</b>  | SPH_GREX_DCOD5_05          |                    |
| <b>Authors</b>        | SPH/AECOM/GVA/BS           |                    |
| <b>Revision</b>       | <b>Date</b>                | <b>Description</b> |
| 0                     | 21 <sup>st</sup> June 2016 | Issued             |

| Version        | Checked By | Approved By |
|----------------|------------|-------------|
| 0 – Deadline 5 | DP         | AM          |

# Contents

|                   |   |
|-------------------|---|
| <b>SECTION 1</b>  | <b>INTRODUCTION</b>                               |
| <b>SECTION 2</b>  | <b>METHODOLOGY TO ESTABLISH BASELINE POSITION</b> |
| <b>SECTION 3</b>  | <b>SCHEME ELEMENTS AND TIMES</b>                  |
| <b>SECTION 4</b>  | <b>OPERATIONAL NOISE &amp; VIBRATION LIMITS</b>   |
| <b>SECTION 5</b>  | <b>MITIGATION</b>                                 |
| <b>SECTION 6</b>  | <b>MONITORING &amp; INCIDENT RESPONSE</b>         |
| <b>APPENDIX A</b> | <b>NOISE &amp; VIBRATION LIMITS</b>               |
| <b>APPENDIX B</b> | <b>INCIDENT PROCEDURE FLOWCHART</b>               |

# 1 INTRODUCTION

## 1.1 Introduction

- 1.1.1 The objective of this Operational Noise Management Plan (ONMP) is to set out the principles to be followed in the management of noise throughout the operational phase of the Development.
- 1.1.2 The ONMP is designed to ensure that the requirements of legislation, the Requirements of the DCO, the Environmental Statement (ES) and Snowdonia Pumped Hydro (“the Applicant”) Environmental Policies are complied with. It shall be the policy of the Applicant to ensure the project is executed in a manner that demonstrates its commitment to the care and protection of the environment.
- 1.1.3 This draft ONMP has been developed by the Applicant and will be adopted and updated/refined by the design team and operator of the scheme. All personnel and sub-contractors working on the project shall perform their duties in accordance with the requirements of the ONMP.
- 1.1.4 The ONMP will be in accordance with Requirement 11 of the DCO and sets out the framework for setting operational noise limits as agreed with Gwynedd Council (GC). This ONMP will also provide details regarding the assessment of Low Frequency Noise (LFN), Ground Borne Vibration (GBV) and Ground Borne Vibration Noise (GBN) which will take place during the detailed design phase.
- 1.1.5 This ONMP identifies mitigation measures to be adopted on the project and will be updated as necessary.
- 1.1.6 It is proposed that this ONMP will be finalised by the operator and submitted to Gwynedd Council for approval, as per the Requirement 11 of the DCO. The operator will undertake the following tasks:
- Updated baseline noise surveys (locations to be agreed with GC).

- Operational noise and vibration assessment during detailed design stage, including assessment of LFN, GBV and GBN.
- Set operational noise limits based on updated background sound levels and BS 4142 criteria. Limits to be agreed with GC. Operational noise limits to be listed in Table 1 in Appendix A.
- Pro-active and complaint monitoring as detailed in Section 6.

## **1.2 Guidance**

1.2.1 The ONMP takes into account good practice guidance contained within, but not limited to, the following documents:

- British Standards Institute (2014), BS 4142 – Methods for rating and assessing industrial and commercial sound
- World Health Organisation (WHO) (1999), Guidelines for Community Noise
- British Standards Institute (1993), BS 7385-2 – Evaluation and measurement for vibration in buildings. Guide to damage levels from Ground-borne vibration
- British Standards Institute (2008), BS 6472-1 – Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting
- BS 8233:Sound Insulation and Noise Reduction for Buildings (1999)
- University of Salford (2011) Procedure for the assessment of Low Frequency Noise Complaints (NANR 45)

## 2 METHODOLOGY TO ESTABLISH BASELINE POSITION

### 2.1 Introduction

- 2.1.1 The operational noise limits (excluding LFN) will be set in accordance with the guidance in BS 4142:2014 and the existing background noise levels. Baseline noise surveys have been undertaken in July 2012 and April 2015 at representative sample noise sensitive receptors (NSRs) surrounding the development,
- 2.1.2 Due to the time elapsed between the existing surveys and operation of the scheme commencing, updated baseline noise monitoring is likely to be required.

### 2.2 Proposed Monitoring Locations

- 2.2.1 The operational noise monitoring locations are likely to include those previously used for the ES assessment and a new location, Glyn Peris Guest House, which is the closest noise sensitive receptor to the proposed scheme.
- 2.2.2 The existing locations are:
- Tan Hafotty
  - Ty Newydd
  - Glan Llyn
  - 4 Warden Street
  - Ty-Du/ Ael y Glyn
  - Lake View Hotel
  - Llanberis Caravan Park
  - Surf Lines

- 2.2.3 In total, 9 locations are proposed
- 2.2.4 Prior to the surveys being undertaken the locations will be reviewed and discussed with GC. The exact position of the monitoring instrumentation at each location will be selected to represent the facade most likely to be worst affected by operation of the Scheme.
- 2.2.5 Pre-construction noise surveys are also required as detailed in the Construction Noise Management Plan. It is proposed that the results from the updated baseline surveys may be suitable for setting operational noise limits as well as construction noise limits.

### **2.3 Survey Durations**

- 2.3.1 It is proposed that long term (minimum of 1 week) unattended monitoring will be undertaken, which will be supplemented by short term attended surveys to determine the main noise sources and their contribution to the prevailing noise climate.
- 2.3.2 During the surveys, meteorological data will be gathered at a minimum of one location to record wind speed, direction and rainfall.

# 3 SCHEME ELEMENTS AND NOISE SOURCES

## 3.1 Introduction

3.1.1 This section describes the main potential operational noise elements of the Development.

## 3.2 Operation Noise Sources Scheme

3.2.1 Potential operational noise sources are limited to the above ground power house and underground turbine hall and include:

- Turbines & Generators;
- Transformers & Switchgear; and
- Workshop.

## 3.3 Operational Hours

3.3.1 The Development will operate 24 hours a day, 365 days a year with the exception of required maintenance.

## 3.4 Prediction of Operational Impacts

3.4.1 During the detailed design stage an operational noise assessment will be undertaken based on the confirmed design and plant selections. The potential for LFN, GBV and GBN will also be assessed during the detailed design phase. As part of the assessment the noise sensitive receptors already identified as part of the ES work will be reviewed and any new NSRs will be included in the assessment. The predicted noise levels will be compared to the operational noise, LFN, GBV and GBN limits set out in section 4 and where necessary mitigation measures will be employed to ensure these limits are achieved.

3.4.2 The operational noise (including LFN, GBV and GBN) assessment will be submitted and approved by GC as required by Requirements 11 and 24.



## 4 OPERATIONAL NOISE LIMITS

### 4.1 Introduction to Operational Noise Limits

- 4.1.1 The operational noise limits have been recommended in Chapter 13 of the submitted ES (Doc Ref: 6.02). The limits are based on relevant British Standards and guidance documents. There is also concern about the potential for LFN, GBV and GBN during the operation of the development. These will be assessed during the detailed design stage and further information is provided in this section.
- 4.1.2 There will be ongoing consultation with GC to discuss the operational noise limits as part of this plan, as required by Requirement 11 of the DCO.
- 4.1.3 Approval of these limits by GC will be required prior to the commencement of development.
- 4.1.4 The following provides an explanation of the various operational noise and vibration limits which will be set for the operational phase of the development providing reference to relevant guidance documents. The noise and vibration limits are set out in Appendix A.

### 4.2 Operational Noise Limits

- 4.2.1 BS 4142 'Methods for rating and assessing industrial and commercial sound' can be used for assessing the effect of noise of an industrial nature, including mechanical services plant noise. The method is based on the difference between the 'rating level' of the industrial noise and the prevailing 'background sound level' at the receptor position.
- 4.2.2 Operational noise limits will be determined using the BS 4142:2014 assessment methodology, based on the measured daytime and night time background noise level at the representative NSRs.
- 4.2.3 A difference of zero between the background and rating sound levels has been set as a target so as to achieve a magnitude of effect no greater than

negligible (i.e. rating sound level equals the measured background noise level. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background.

- 4.2.4 Note that, as per BS 4142 guidance, the rating sound level includes any potential character corrections (due to characteristics such as tonality, impulsivity and intermittency) to the specific sound level.
- 4.2.5 BS 4142: 2014 allows for, as an absolute worst case, a cumulative +15 dB character correction to be applied to the sound rating level. Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account.
- 4.2.6 For tonal noise, the subjective method detailed in section 9.2 of BS 4142 gives a correction of between 0 dB and +6 dB, Subjectively, this can be converted to a penalty of +2 dB for a tone which is just perceptible at the noise receptor, +4 dB where it is clearly perceptible, and +6 dB where it is highly perceptible.
- 4.2.7 For impulsivity a correction of up to +9 dB can be applied for sound which is highly impulsive. Subjectively, this can be converted to a penalty of +3 dB for impulsivity which is just perceptible at the noise receptor, +6 dB where it is clearly perceptible, and +9 dB where it is highly perceptible.
- 4.2.8 Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.
- 4.2.9 At this stage information on the characteristics of the sound sources (e.g. any tonal features) are yet to be determined, however these will be considered during detailed design and the character corrections to be applied to the rating sound level will be agreed with GC.
- 4.2.10 The operational noise limits recommended in ES Chapter 13 (Doc. Ref: 6.02) are set out below. However these limits will be revised once the updated noise surveys are completed to ensure the most robust background noise levels are used.

**Table 1 Recommended Operational Noise Limits Taken from ES Chapter 13.**

| Recommended Operational Noise Limits * |   |  |   |   |
|--|---|--|---|---|
| Location                               | Daytime 07:00 – 23:00                                   |  | Night-time 23:00 – 07:00                                |   |
|  | Representative Background sound level dB<br>$L_{A90,T}$ | Operational Limit (Rating sound level) dB ( $L_{Ar,1 h}$ ) | Representative Background sound level dB<br>$L_{A90,T}$ | Operational Limit (Rating sound level) dB ( $L_{Ar,15 min}$ ) |
| 1                                      | 29  | 29   | 30  | 30  |
| 2                                      | 31  | 31   | 32  | 32  |
| 3                                      | 42  | 42   | 42  | 42  |
| 4                                      | 44  | 44   | 45  | 45  |
| 5                                      | 38  | 38   | 36  | 36  |
| 6                                      | 37  | 37   | 33  | 33  |
| 7                                      | 37  | 37   | 36  | 36  |
| 8                                      | 44  | 44   | n/a**   | n/a**   |

\* All values are in dB re 20 $\mu$ Pa, Free-field, fast time-weighting.  $L_{A90}$  has been calculated using the 10th percentile of the  $L_{A90,5min}$  noise levels during the respective time periods, which is representative of the lower range of background levels

\*\* Not open at night- commercial/leisure premises.

### 4.3 Low Frequency Noise

4.3.1 There may be potential for LFN from the operation of the turbines but this is deemed unlikely due to the advancement in technology, the depth of the turbines below ground level and the incorporated attenuation and building design. However Low Frequency noise (LFN) from all operational plant will be considered during the detailed design phase as part of the ONMP.

4.3.2 The following paragraphs provide information regarding the assessment of LFN.

#### *Assessment of LFN*

4.3.3 Low frequency noise relates to sound that occurs within the frequency range of approximately 10 Hz to 200 Hz and thus includes the upper region of the Infrasound range (sound with frequencies below 20 Hz

4.3.4 Although it is acknowledged that a subjective evaluation of noise is possible to determine whether a noise nuisance exists, the assessment of low frequency noise can typically be split into two categories, namely, 1) the assessment of low frequency noise (LFN) through measurement and 2) the assessment of LFN through prediction.

*Measurement, Effects and Coping Strategies Relating to LFN*

4.3.5 Guidance with regard to the assessment of LFN based on measurement is provided in two research documents prepared by Salford University on behalf of DEFRA. These documents are:

- Moorhouse, A. T., Waddington, D. C. And Adams, M. Procedure for the Assessment of Low Frequency Noise Complaints. Rev 1: London: Department for Environment, Food and Rural Affairs. 2011

[http://usir.salford.ac.uk/493/1/NANR45-procedure\\_rev1\\_23\\_12\\_2011.pdf](http://usir.salford.ac.uk/493/1/NANR45-procedure_rev1_23_12_2011.pdf)

- Moorhouse, A. T., Waddington, D. C. And Adams, M. Proposed Criteria for the Assessment of Low Frequency Noise Disturbance. London: Department for Environment, Food and Rural Affairs. 2011.

<http://usir.salford.ac.uk/491/>

4.3.6 In addition to the aforementioned documents the following paper provides a review of LFN noise and effects:

- Leventhall, G., Pelmeur, P. and Benton, S. A Review of Published Research on Low Frequency Noise and its Effects: London: Department for Environment, Food and Rural Affairs 2003.

[http://westminsterresearch.wmin.ac.uk/4141/1/Benton\\_2003.pdf](http://westminsterresearch.wmin.ac.uk/4141/1/Benton_2003.pdf)

4.3.7 There is also the following report that discusses possible coping mechanisms for individuals where a LFN was not resolved:

- Leventhall, G., Benton S. And Robertson D. Coping Strategies for Low Frequency Noise (NANR 125). London: Department for Environment, Food and Rural Affairs. 2005.

<http://coping.confweb.org/Papers/Coping%20JLFNV.pdf>

4.3.8 So, with regard to the measurement approach, LFN effects and coping strategies relating to LFN, there is published guidance on each of these matters. However, when it comes to the prediction of LFN there is little available guidance on sound propagation and the factors to be considered.

*The Prediction of LFN*

4.3.9 There are currently no published standards or guidance on the prediction of LFN. However, a method to determine whether there is a significant element of LFN as stated in NANR 45 is to compare the dB  $L_A$  noise level with the dB  $L_C$  noise level. A noise level difference dB  $L_C - dB L_A$  greater than 20 dB is a positive indication that there may be a low frequency problem<sup>1</sup>. It should be appreciated that the ( $L_C - L_A$ ) noise level difference cannot be used as an annoyance predictor, but is a simple indicator as to whether further investigations of LFN may be necessary.

4.3.10 In the UK BS 4142: 2014 Methods for Rating and Assessing Industrial and Commercial Sound is the standard that is used to assess the impact of industrial or commercial noise at NSR. However BS 4142 is not applicable to the assessment of low frequency noise and refers the reader to the two NANR45 reports (see Paragraph 4.3.5, above).

4.3.11 However, the question arises as to what methods should be adopted in order to determine the internal noise levels within habitable rooms of potentially affected LFN exposed NSR?

4.3.12 The Key issues are:

- 1) What method of attenuation of sound propagation outdoors should be adopted?
- 2) What method should be adopted to predict the internal noise level within a habitable room based on a predicted external noise level?
- 3) What are the source noise levels?

---

<sup>1</sup> The difference between C- and A-weightings has been considered as a predictor for LFN annoyance (Broner, 1979; Broner and Leventhall, 1983; Kjellberg et al., 1997). Kjellberg et al used existing noise in work places (offices, laboratories, industry etc) with 508 subjects. Three sub-groups were identified with a maximum difference in low and high frequency exposure.

- 4.3.13 With regard to Issue 1: The standard method for predicting the propagation of sound outdoors is ISO 9613: 1996 “Acoustics -- Attenuation of sound during propagation outdoors”. However, the method is strictly only valid in the octave band frequency range of 64 Hz to 8 kHz. Yet, with certain assumptions, noise modelling software, such as CadnaA and SoundPlan, do provide for the lower 31.5 Hz octave band in their implementation of ISO 9613, which includes the 25 Hz 1/3 octave band.
- 4.3.14 Accordingly, it is possible to adapt ISO 9613 to facilitate the prediction of sound attenuation outdoors. Obviously the assumptions made with regard to the propagation of sound below the 63 Hz octave band would need to be clearly stated in any assessment of LFN.
- 4.3.15 With regard to Issue 2, for the purposes of assessing LFN within a habitable room there are many factors that would influence the level of LFN. However, if standard bedroom and living room sizes were adopted, say, 4 m x 3 m for a bedroom and 5 m x 4 m for a living room, and a typical brick and glass composite façade were adopted a default transfer function could be used to provide an indication of the likely low frequency noise level within standardised habitable rooms. Consideration of the possible room modes will also be required.
- 4.3.16 With regard to Issue 3, manufacturer’s data is often incomplete or does not include noise levels at lower frequencies.
- 4.3.17 Alternatively, if similar items of equipment are being operated by the client elsewhere, on-site measurements can be used for the purposes of assessing the potential for adverse LFN impacts arising as a consequence of the proposed development. For stationary plant the method of fixing must be taken into account.
- 4.3.18 Accordingly, based on the noise limits presented in Table 2 below, and the assumptions stated above, it is possible to assess whether noise associated with a development is likely to comply with the NANR45 recommended LFN noise limits. Obviously, as with any noise assessment, the method cannot guarantee that compliance will occur as many factors beyond the scope of the assessment can influence the as built noise levels, for example:

- Equipment out of balance
- Equipment defects
- Beat frequencies arising from items of plant
- Defects in workmanship
- Poor maintenance

*Risks/Issues Associated with the Prediction Methodology*

4.3.19 There are a number of risks associated with assessing LFN. The key risks are:

- Obtaining 1/3 octave band source noise levels;
- Agreement with Local Authority regarding propagation method and assumptions;
- Agreement with Local Authority regarding employed transfer function between external to internal noise levels and assumptions made, including room modes;
- Making the assessment process over cautious such that the proposed development is over engineered; and
- It cannot be guaranteed that LFN will not be an issue (See Paragraph 4.3.18, above). However, it is possible to reduce the risk that it will.

*Benefits Associated with the Prediction Methodology*

4.3.20 The key benefit is that it is typically significantly cheaper to design and install appropriate noise mitigation for implementation during the construction phase than it is to retrospectively mitigate.

4.3.21 It gives Local Authorities reassurance that LFN will be effectively considered prior to the development becoming operational. Effectively they are attempting to minimise the likelihood that they will have to investigate complaints when the site becomes operational.

*LFN limits*

4.3.22 Based on the guidance in NANR 45 and the above paragraphs, LFN will be assessed during the detailed design stage and the LFN noise assessment

report will be submitted to and approved by GC. It is noted the use of such criterion as limits should be done with caution.

**Table 2: Proposed LFN Limits**

| 1/3 Octave Band LFN Reference Curve |    |      |    |    |    |      |    |    |    |    |     |     |     |
|-------------------------------------|----|------|----|----|----|------|----|----|----|----|-----|-----|-----|
| Hz                                  | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| $L_{eq}$<br>(dB)                    | 92 | 87   | 83 | 74 | 64 | 56   | 49 | 43 | 42 | 40 | 38  | 36  | 34  |

- 4.3.23 If the noise occurs only during the day time then a 5dB relaxation may be applied to all third octave bands.
- 4.3.24 If unmitigated predicted operational immission noise levels exceed the noise levels presented in Table 2 then details of noise mitigation measures to meet with the NANR45 guideline noise levels should be included in the submitted noise report.
- 4.3.25 It is appreciated that it may be difficult to acquire noise data from manufacturers and, moreover, there may not be an existing site where similar plant is in operation that would enable plant noise levels to be measured. However, as with other noise assessments, if it is not possible to acquire noise level data from manufacturers or through measurements then other assumptions will need to be made in order to provide noise levels based on professional judgement and/or other sources of information, which may include: noise reports, academic papers and books that contain data on machinery noise.

#### **4.4 Ground-borne Vibration and Noise**

- 4.4.1 GBV and GBN are unlikely to be an issue with the operation of the scheme due to the distance between the source of the vibration (the turbines) and the receivers (greater than 400 m). However, a risk-based assessment will be undertaken during the detailed design and a GBV and GBN assessment report will be submitted to and approved by GC:



- Stage 1. Case-study data will be researched and examined to determine the likelihood of significant GBV and GBN effects due to the proposed scheme.
- Stage 2. From the results of the first stage, if there is a possibility that significant GBV and/or GBN effects will be generated by the proposed scheme, a preliminary model will be developed to estimate the GBV and GBN at the nearest receivers. This preliminary model will include a vibration source element; the vibration isolation used in the turbine design; and a ground propagation through a homogeneous ground.
- Stage 3. From the results of the second stage, if there is a possibility that significant GBV and/or GBN effects exist, the propagation element of the model (the largest uncertainty) will be verified using vibration measurements during (i) trial blasts (if undertaken), or (ii) the initial blasting during construction.
- Stage 4. From the results of the third stage, if there is a possibility that significant GBV and/or GBN effects exist, mitigation measures will be incorporated into the scheme design such as vibration isolation of the vibration source(s).

## 5 MITIGATION MEASURES

### 5.1 Mitigation

- 5.1.1 The best available operational methods shall be employed at all times, having regards to the principles of BATNEEC (the best available techniques not entailing excessive cost) to minimise noise from the development.
- 5.1.2 The design of noise control to meet appropriate operational noise limits will be finalised during detailed design and this ONMP will be updated accordingly. These control techniques will likely include measures such as orientation away from NSRs, vent attenuators, acoustic lining within the vent shaft, and acoustic louvres at intake and extract terminals.
- 5.1.3 Requirement 11 requires an operational noise assessment (including LFN and GBN) which will include noise monitoring at agreed NSRs to be included within the operation noise management plan.
- 5.1.4 If required, mitigation for LFN and GBV and GBN could include vibration isolation, mufflers, attenuators, etc. and will be considered during the detailed design stage.

### 5.2 Community Liaison

- 5.2.1 The Operator of the scheme will work with local communities and businesses within the villages of Waunfawr, Croesywaun, Brynrefail, Cwm-y-Glo, Fachwen, Dinorwig, Llanberis and Groeslon to ensure they are kept informed of the Operating scheme.
- 5.2.2 Should any reasonable and specific complaint regarding noise and or vibration due to operational activities be received, all reasonable endeavours will be undertaken to investigate the source, as detailed in Section 6.

# 6 MONITORING, AUDITING AND INCIDENT RESPONSE

## 6.1 Introduction

- 6.1.1 This section describes what actions to take in the event of a noise and/or vibration incident and the method of reporting.
- 6.1.2 Monitoring of the noise during operational phases will enable the effectiveness of environmental mitigation to be evaluated and ensure the operational limits are achieved.

## 6.2 Noise Monitoring

- 6.2.1 Monitoring of noise during operation will be carried out as necessary and requirements for monitoring will be reviewed as further consents and licences are received and consultations completed.

### Pre-Operational Baseline Monitoring

- 6.2.2 As stated in Section 2 noise-sensitive locations shall be identified and pre-operational monitoring undertaken to re-assess the baseline noise environment. This will allow for appropriate operational noise limits and mitigation measures to be put in place. Monitoring will then be undertaken during the operational phase to ensure compliance with the stated noise limits.

### *Monitoring During Operation (Pro-active monitoring)*

- 6.2.3 The operational monitoring schedule will be agreed with GC. The Operator will carry out representative operational monitoring once the scheme is operational in order to verify the operational noise predictions, ensure the effectiveness of mitigation measures and/or demonstrate compliance with the operation limits set out in Appendix A.
- 6.2.4 The noise monitoring will be in accordance with BS 4142:2014. Measurements shall be carried out by a suitably trained consultant. Suitably

trained is defined as someone who has attended a recognized course in environmental noise measurement and reporting.

- 6.2.5 The monitoring locations must be representative of the potentially worst affected NSRs. The locations will be agreed with GC.

*Operation Noise and vibration Monitoring –Complaints (Re-active monitoring)*

- 6.2.6 If noise and/or vibration complaints are received during the operation phase, it may be necessary to undertake noise and/or vibration monitoring to determine if the operational noise and/or vibration limits are being exceeded. The monitoring will be undertaken at the complainant's property or a suitability representative location. Further details about the complaint procedure can be found in section 6.4 and Appendix B.

- 6.2.7 The following measurement procedure shall be adhered to:

- A Type 1 integrating sound level meter and calibrator shall be employed (the sound level meter shall have a calibration certificate dated within the previous 2 years and the calibrator shall have a calibration certificate dated within the previous year).
- The sound level meter shall be calibration checked prior to the measurement at the first receptor, and calibration checked following the measurement at the last receptor. The calibration levels shall be noted.
- At each location, noise levels shall be logged for a minimum of 30 minutes. This will give an indication of whether or not the approved maximum noise limits are being met.
- Logged noise parameters shall comprise  $L_{Aeq,T}$  and  $L_{Amax}$  values.
- At each receptor, a note of the prevailing noise climate shall be made. This will include a brief description of construction works noise and the contribution of noise from other non-site sources.
- At each receptor, a note of the prevailing meteorological conditions shall be made. If conditions are unsuitable for noise monitoring, the measurements shall be postponed until the following day.

- 6.2.8 The results of all surveys should be reported and as a minimum include the following:

- Compare measured noise levels against the noise limits set out in the ONMP;
- Log any noise nonconformities including nature, status, corrective and preventive actions and potential for statutory intervention;
- Provide information on any environmental noise and vibration complaints and any actions taken in response to complaints; and
- The reports will be submitted to GC and kept on file by the operator.

### **6.3 Nuisance Management**

6.3.1 As outlined in the Statement in Respect of Statutory Nuisance (Document Ref: 5.02) it is considered that nuisance as a result of noise or vibration is unlikely to arise due to the noise from operation of the Development, as potential impacts will be mitigated through design and the implementation of the ONMP. The Statement does however, outline the procedure to be followed should a nuisance complaint be made or an event occur.

### **6.4 Non Compliance and Corrective Actions**

6.4.1 Where complaints due to operational noise are received, or noise monitoring identifies an exceedance of the limits set out in Appendix A, an investigation will take place to determine the likely cause. The investigation will seek to determine:

- whether the exceedance of the criteria was directly related to a source associated with the Project or if environmental factors contributed to the exceedance;
- the primary cause of the incident;
- any contributing factors which led to the incident;
- whether appropriate controls were implemented to prevent the incident; and
- corrective and preventative measures that may be implemented to prevent a recurrence of the incident.

6.4.2 Corrective and/or preventative actions will be assigned to relevant Company personnel. Actions will be communicated internally through planning meetings

and toolbox talks and outstanding actions will be monitored for their effectiveness upon completion.

- 6.4.3 A copy of the investigation report and regular updates on the status of the identified corrective and/or preventative actions will be provided to the GC and, if required, the complainant.
- 6.4.4 An example Incident Procedure Flowchart is provided as Appendix B. This procedure will be implemented should there be any complaints due to operational noise and/or vibration.

# APPENDIX A: NOISE & VIBRATION LIMITS

This Appendix sets out the maximum limits which the Development will have to comply with as set out in industry guidance, and also the methodology for setting Development-specific limits where these may be less than the industry maximum allowable. These limits will be reviewed and finalised as part of the approved ONMP at a later date.

## General Operation Noise

1. Prior to finalising the operational noise levels, updated background noise surveys should be undertaken as detailed in Section 2 of the ONMP.
2. The operation daytime limits (07:00-23:00) shall be a zero difference between the Rating Sound Level (dB  $L_{Aeq,1hr}$ ) and the existing background noise levels, in accordance with BS 4142:2014. The BS 4142 character correction to be agreed with GC. Note. where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background.
3. The operational night time limits (23:00-07:00) shall be a zero difference between the Rating Sound Level (dB  $L_{Aeq,15\ min}$ ) and the existing background noise levels, in accordance with BS 4142:2014. The BS 4142 character correction to be agreed with GC.

In the final version of the ONMP, the operational noise limits at specific properties will be summarised in the following table. The specific properties will be agreed in consultation with GC.

**Table A1 Operation Noise Limits**

| Operational Noise Limits * |   |   |   |   |
|----------------------------|---|---|---|---|
| Location                   | Daytime 07:00 – 23:00                                   |   | Night-time 23:00 – 07:00                                |   |
|                            | Representative Background sound level dB<br>$L_{A90,T}$ | Operational Limit (Rating sound level) dB<br>( $L_{Ar,1 h}$ ) | Representative Background sound level dB<br>$L_{A90,T}$ | Operational Limit (Rating sound level) dB ( $L_{Ar,15 min}$ ) |
| 1                          |   |   |   |   |
| 2                          |   |   |   |   |
| 3                          |   |   |   |   |
| 4                          |   |   |   |   |
| 5                          |   |   |   |   |
| 6                          |   |   |   |   |
| 7                          |   |   |   |   |
| 8                          |   |   |   |   |

Low Frequency Noise and Ground-borne Noise

4. The operation of the Development must not commence until a noise report is submitted to and approved by the relevant planning authority that includes the assessment of Low Frequency Noise and Ground-borne Noise. The predicted noise immission levels within a habitable room, as a result of the operation of the Development, should not exceed the levels specified in Table 9 of the document “Proposed Criteria for the Assessment of Low Frequency Noise Disturbance” NANR45, and reproduced in Table 2, below.

**Table A2: 1/3 Octave Band LFN Reference Curve**

| 1/3 Octave Band LFN Reference Curve |    |      |    |    |    |      |    |    |    |    |     |     |     |
|-------------------------------------|----|------|----|----|----|------|----|----|----|----|-----|-----|-----|
| Hz                                  | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| $L_{eq}$ (dB)                       | 92 | 87   | 83 | 74 | 64 | 56   | 49 | 43 | 42 | 40 | 38  | 36  | 34  |

- If the noise occurs only during the day time then a 5dB relaxation may be applied to all third octave bands.
- If unmitigated predicted operational immission noise levels exceed the noise levels presented in Table 1 then details of noise mitigation measures to meet



with the NANR45 guideline noise levels should be included in the submitted noise report.

7. If required, demonstration of compliance with the ground-borne noise limit can be made by measuring the building vibration and applying a suitable empirical correction.

#### Ground-borne Vibration

8. The ground-borne vibration within residential buildings shall be less than those specified in Table 1 of British Standard BS 6472 Part 1 for 'low probability of adverse comment'. These are summarised in Table 3 below. For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the daytime dose ranges.

**Table A3 Ground-borne vibration limit**

| Time                        | Vibration dose value relating to low probability of adverse comment ( $m/s^{1.75}$ ) |
|-----------------------------|--|
| Daytime (07:00 to 23:00)    | 0.2 to 0.4   |
| Night-time (23:00 to 07:00) | 0.1 to 0.2   |

# APPENDIX B: INCIDENT PROCEDURE FLOWCHART

