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Mr Andy McMullan  
Freeths LLP  
1<sup>st</sup> Floor  
5 New York Street  
Manchester  
M1 4JB



Sent by email only: andy.mcmullan@freeths.co.uk

Dear Mr McMullan

**NOISE IMPACT ASSESSMENT FOR THE PROPOSED MIXED USE REDEVELOPMENT  
OF MONARCHS QUAY, KINGS DOCK, LIVERPOOL, L3 4FP**

**PHASE 1b APPLICATION**

**1.00 INTRODUCTION**

- 1.01 Environmental Noise Solutions Limited (ENS) has been commissioned by YPG Developments Ltd to carry out a noise impact assessment (NIA) for the proposed mixed use redevelopment of Monarchs Quay, Kings Dock, Liverpool L3 4FP. This NIA relates to the Phase 1b application (hereafter referred to as the application site).
- 1.02 The wider proposals comprise of the redevelopment of the Monarchs Quay site to provide a number of residential, office, commercial, retail and leisure buildings. This application is the second of a number of applications to be submitted to the Local Planning Authority (LPA) in respect of the wider masterplan for Kings Dock. A summary of the previous and current applications is as follows:
- Application 1 (Phase 1a): submitted in full (app ref: 17F/2490) and including The Contact Centre (TCC) office building (Building 1).
  - Application 2 (Phase 1b - this application): to be submitted in full and including (i) Building 2: part Interpretation Centre and part flexible commercial space and (ii) Building 4: seven storey building with commercial units and a 33 space car park at ground floor level and circa 102 apartments over the 1<sup>st</sup> to 6<sup>th</sup> floors.
- 1.03 There was no noise assessment required by the LPA for the Phase 1a development proposals (TCC building). It is understood that the Phase 1b development proposals are not subject to an Environmental Impact Assessment (EIA). This report is a 'stand alone' NIA to consider the potential impact of the existing environment (and noise emitting elements of the proposed development) on noise sensitive receptors (NSRs) outwith the application site and introduced as part of the development. The proposed development contains noise sensitive elements, including potential office accommodation and residential use (apartments). Recommendations for the provision of a good standard of amenity for the noise sensitive elements of the proposed development are considered in this report.
- 1.04 The objectives of the assessment were to:
- Measure the existing ambient noise climate in the vicinity of the application site during representative periods of the daytime and at night.
  - Determine the ambient noise climate at the application site during the daytime and night time periods with reference to pertinent calculation methods where appropriate.
  - Assess the potential impact of the existing noise climate (and noise emitting elements of the proposed development) on the identified NSRs (with reference to the National Planning Policy Framework and other pertinent guidance).

- Provide recommendations for a scheme of attenuation works, as necessary, to ensure that the identified NSRs do not experience any unacceptable loss of amenity due to noise.
  - Consider the potential impact on existing commercial premises associated with introducing NSRs at the site.
- 1.05 This report details the methodology and results of the assessment and provides recommendations for the building envelope design (fenestration and ventilation) of the noise sensitive receptors introduced as part of the development and limiting noise emission levels for plant. It has been prepared to accompany a full planning application to be submitted to the LPA for the proposed Phase 1b development of the Monarchs Quay site.
- 1.06 This report has been prepared for YPG Developments Ltd for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult YPG Developments Ltd (applicant), Freeths LLP (applicant's agent) and ENS as to the extent to which the findings may be appropriate for their use.
- 1.07 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

## **2.00 SITE SETTING AND PROPOSED DEVELOPMENT**

- 2.01 The Monarchs Quay site is located in a mixed use area of Liverpool's redeveloped docks. An annotated aerial image of the site, including an approximate red line boundary, is contained in Appendix 2.1. An indicative annotated masterplan is contained in Appendix 2.2 (with the Phase 1b buildings highlighted). The Monarchs Quay site is bound by:
- Wapping Dock and Queens Dock to the east, with various residential/commercial uses and the A5036 beyond.
  - Halftide Wharf to the south with residential development beyond (The Keel Apartments).
  - The western boundary has a number of adjacent uses, including the ACC Liverpool Echo Arena and Convention Centre and Exhibition Centre Liverpool, hotels, apartments, Keel Wharf and a multi-storey car park. Further west, Kings Parade runs adjacent to the River Mersey.
  - Apartments to the north.
- 2.02 As stated, the Phase 1b proposals comprise of the construction of two buildings with associated infrastructure. A more detailed description is provided below:
- Building 2: Interpretation Centre. Located at the entrance to the site, to the south of Queens Wharf. The Interpretation Centre comprises circa 10% of the floor area, with the remainder as flexible commercial space.
- Building 4: Located to the south of Queens Wharf, adjacent to an existing sub-station, and comprises a seven storey building with commercial units and a 33 space car park at ground floor level and circa 102 apartments over the 1<sup>st</sup> to 6<sup>th</sup> floors.

### 3.00 BASELINE NOISE MONITORING

- 3.01 In order to determine the existing ambient noise levels in the vicinity of the Monarchs Quay site, a baseline noise survey was undertaken during Tuesday 17<sup>th</sup> and Wednesday 18<sup>th</sup> January 2017.
- 3.02 For the purpose of the noise impact assessment, the following monitoring positions (MPs) were adopted (the approximate location of the MPs is contained in Appendix 2.1):
- MP1 was located at 1.5 metres above ground level (mAGL), approximately 5 metres from the southern kerb of Queens Wharf at the entrance to the site (representative of Building 2).
  - MP2 was located at 5.0 mAGL, approximately 5 metres from the southern kerb of Queens Wharf in the eastern area of the site (representative of Building 4).
  - MP3 was located at 1.5 mAGL, approximately 5 metres from the kerb of the access road to the existing external car parks in the south eastern area of the site. Note: MP3A located at same location at 5.0 mAGL for comparison.
  - MP4 was located at 5.0 mAGL, adjacent to the service yard of the exhibition centre in the south western area of the site.
  - MP4A was located at 5.0 mAGL, approximately 5 metres from the kerb of Halftide Wharf in the south western area of the site.
  - MP4B was located at 2.5 mAGL, approximately 12 metres from the kerbs of Kings Parade and Halftide Wharf in the south western area of the site.
  - MP4C was located at 2.5 mAGL, approximately 5 metres from the kerb of Kings Parade in the south western area of the site.
  - MP5 was located at 5.0 mAGL, roughly central to the main northern site boundary (representative of the existing Pullman Hotel and The Block apartments).
  - MP6 was located at 5.0 mAGL, off Keel Wharf to the east of The Block apartments (representative of The Block apartments).
  - MP7 was located approximately 5 metres from the kerb of Keel Wharf in the northern area of the site.
- 3.03 Noise measurements were undertaken in a free field environment using Bruel & Kjaer 2260 Type 1 integrating sound level meters. A windshield was fitted for all measurements. The measurement systems calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions for the noise survey were acceptable, with light winds (< 5 m/s), albeit road surfaces were wet for part of the survey and there were light fog banks on the Mersey during the late evening period.
- 3.04 Measurements consisted of logged, A-weighted broadband parameters, together with linear octave band or one-third octave band  $L_{eq}$  levels depending on the noise source under consideration. The following table contains a summary of the measurement data for each measurement session, at each measurement position, rounded to the nearest decibel.

**Table 3.1 – Summary of Noise Measurement Data**

Position	Date	Time	L <sub>Aeq,T</sub> (dB)	L <sub>AF1,T</sub> (dB)	L <sub>A10,T</sub> (dB)	L <sub>A90,T</sub> (dB)	Comment
MP1	17/1/17	18:18-18:38	65	72	68	55	Distant (including A5036) and local Queens Wharf traffic noise. Typical L <sub>AFmax</sub> of vehicle pass on Queens Wharf ≤ 75 dB.
MP1	18/1/17	13:22-13:41	64	72	67	54	Distant (including A5036) and local Queens Wharf traffic noise. Typical L <sub>AFmax</sub> of vehicle pass on Queens Wharf ≤ 75 dB. Circa 1800 vehicles/hour on A5036.
MP1	18/1/17	15:06-15:26	64	71	67	55	Distant (including A5036) and local Queens Wharf traffic noise. Typical L <sub>AFmax</sub> of vehicle pass on Queens Wharf ≤ 75 dB.
MP2	18/1/17	01:59-02:17	48	58	50	43	Distant (including A5036) traffic noise and distant non-specific HVAC plant noise. No significant noise emissions associated with adjacent electricity sub-station.
MP2	18/1/17	06:10-06:27	58	67	61	49	Distant (including A5036) traffic noise and local Queens Wharf traffic noise. 10 vehicle passes on Queens Wharf during measurement. Typical L <sub>AFmax</sub> of vehicle pass on Queens Wharf ≤ 73 dB. Coaches in HGV car park with engines idling.
MP2	18/1/17	13:08-15:35	62	70	65	54	Distant (including A5036) traffic noise and local Queens Wharf traffic noise. Typical L <sub>AFmax</sub> of vehicle pass on Queens Wharf ≤ 75 dB. Circa 230 vehicles/hour on Queens Wharf.
MP3	17/1/17	18:54-19:28	53	61	57	48	Noise climate consisting of distant traffic/city noise. Measurement at 1.5 mAGL.
MP3A	17/1/17	19:07-19:27	56	63	59	51	Noise climate consisting of distant traffic/city noise. Measurement at 5.0 mAGL. Circa 2 to 3 dB increase in noise level with height.
MP4	17/1/17	19:55-20:43	58	70	59	51	Noise climate consisting of distant traffic/city noise and HVAC plant associated with louvred southern façade of the exhibition centre (forming background climate).
MP4	18/1/17	03:01-03:32	52	58	52	50	Noise climate consisting of distant traffic/city noise and HVAC plant associated with louvred southern façade of the exhibition centre (forming background climate).
MP4A	18/1/17	15:46-16:53	60	71	62	52	Noise climate consisting of distant traffic/city noise, local traffic on Half Tide Wharf and HVAC plant associated with louvred southern façade of the exhibition centre. Typical L <sub>AFmax</sub> of vehicle pass on Half Tide Wharf ≤ 74 dB. Circa 100 vehicles/hour on Half Tide Wharf.

**Table 3.1 cont.... – Summary of Noise Measurement Data**

Position	Date	Time	L <sub>Aeq,T</sub> (dB)	L <sub>AF1,T</sub> (dB)	L <sub>A10,T</sub> (dB)	L <sub>A90,T</sub> (dB)	Comment
MP4B	17/1/17	20:26-20:35	55	62	58	51	Noise climate consisting of distant traffic/city noise, local traffic on Halftide Wharf , HVAC plant associated with louvred southern façade of the exhibition centre and distant fog horn.
MP4B	17/1/17	20:35-20:55	55	63	57	51	Noise climate consisting of distant traffic/city noise, local traffic on Halftide Wharf , HVAC plant associated with louvred southern façade of the exhibition centre and distant fog horn.
MP4B	18/1/17	02:27-03:22	52	56	54	51	Noise climate consisting of distant traffic/city noise and HVAC plant associated with louvred southern façade of the exhibition centre.
MP4B	18/1/17	03:22-05:50	51	57	53	49	Noise climate consisting of distant traffic/city noise and HVAC plant associated with louvred southern façade of the exhibition centre.
MP4C	18/1/17	16:01-16:43	57	68	60	52	Noise climate consisting of distant traffic/city noise, local traffic on Kings Parade and HVAC plant associated with louvred southern façade of the exhibition centre. Typical L <sub>AFmax</sub> of vehicle pass on Kings Parade ≤ 73 dB. Circa 90 vehicles/hour on Kings Parade.
MP5	18/1/17	04:23-04:44	48	58	50	43	Noise climate consisting of distant traffic/city noise, distant non-specific HVAC plant and HVAC plant associated with multi-storey car park.
MP5	18/1/17	17:10-17:38	57	65	61	49	Noise climate consisting of distant traffic/city noise, cars exiting the multi-storey car park, distant non-specific HVAC plant and HVAC plant associated with multi-storey car park.
MP6	18/1/17	03:57-04:17	48	56	48	42	Noise climate consisting of distant traffic/city noise and distant non-specific HVAC plant
MP7	18/1/17	14:10-14:47	61	71	64	52	Distant (including A5036) traffic noise and local Keel Wharf traffic noise (including HGVs). Typical L <sub>AFmax</sub> of vehicle pass on Keel Wharf ≤ 75 dB.
MP7	18/1/17	05:21-05:41	50	57	52	47	Distant (including A5036) traffic noise, distant non-specific HVAC plant and HVAC plant associated with hotel opposite MP.

- 3.05 In summary, the existing ambient noise climate in the vicinity of the site was noted to consist of general distant road traffic and 'city' noise (including distant HVAC plant), together with localised traffic noise associated with the Kings Dock road network and HVAC plant associated with a number of the adjacent commercial uses. The acoustic horizon associated with distant noise sources was noted to increase with height, with an associated circa 2 to 3 dB increase in ambient noise level.

- 3.06 Whilst specific events were not occurring at the ACC Liverpool venues during the course of the survey, anecdotally, it is understood that there is no specific noise breakout from the buildings associated with events and the main potential noise sources are associated with attendees/customers arriving at and departing from the venues (a combination of increased road and pedestrian traffic) and HGV movements associated with transporting tour equipment and exhibition sets etc. This is consistent with ENS's experience of similar venues.

#### 4.00 NOISE IMPACT ASSESSMENT CRITERIA

##### National Planning Policy Framework

- 4.01 The National Planning Policy Framework (NPPF) is a material consideration in planning decisions. At the heart of the NPPF is a presumption in favour of sustainable development, and the policies in Paragraphs 18 to 219 of the NPPF, taken as a whole, constitute the Government's view on what sustainable development in England means in practice for the planning system.
- 4.02 The NPPF states that there are three dimensions to sustainable development, which include an economic role (contributing to building a strong, responsive and competitive economy), a social role (providing the supply of housing required to meet the needs of present and future generations) and an environmental role (which includes minimising waste and pollution).
- 4.03 The NPPF supersedes Planning Policy Guidance Note 24 (PPG 24). The main policy statement in relation to noise is Paragraph 123 of the NPPF, which states

*Planning policies and decisions should aim to:*

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

- 4.04 In relation to 'adverse impacts', the NPPF refers to the Explanatory Note to the Noise Policy Statement for England (NPSE) for guidance.
- 4.05 The Noise Policy Statement for England (NPSE) and associated Explanatory Note were published by DEFRA in 2010 and set out the Government's noise management strategy to enable noise management decisions to be made within the wider context (i.e. guiding principles of sustainable development), in a cost-effective manner and in a timely fashion.
- 4.06 Fundamental to this approach is '*there is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors*'.
- 4.07 The noise policy aims of NPSE are to (i) avoid significant adverse impact on health and quality of life, (ii) mitigate and minimise adverse impacts on health and quality of life, and (iii) where possible, contribute to the improvement of health and quality of life. The policy aims are always to be considered within the context of the Government's policy on sustainable development.

- 4.08 In relation to the mitigation and minimisation of adverse impacts, NPSE considers that *‘in reality, although not always stated, the aim has tended to be to minimise noise ‘as far as is reasonably practical’.* This is reinforced in Paragraph 2.24 of the Explanatory Note, which requires that *‘all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur’.*
- 4.09 In relation to explaining the ‘significant adverse’ and ‘adverse’ effects quoted in the NPPF, NPSE uses the two established concepts from toxicology that are currently being applied to noise impacts, for example by the World Health Organisation (WHO), these are:
- NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.
  - LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.
- 4.10 The NPSE then extends these concepts to lead to a SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.
- 4.11 No specific criteria are presented in the NPSE, to provide the necessary policy flexibility until further evidence and suitable guidance is available. In lieu of specific criteria, for this assessment, ENS makes reference to existing guideline documents, which are summarised in the following paragraph(s).

#### **BS 8233:2014**

- 4.12 BS 8233:2014 *‘Guidance on sound insulation and noise reduction for buildings’* (BS 8233) sets guideline indoor ambient noise levels for dwellings, for steady external noise sources, which it is desirable are not exceeded. These levels are reproduced in Table 4.1 and are based on guidelines issued by the World Health Organisation (WHO). The Standard also states that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The Standard considers that for regular individual noise events, a guideline value may be set in terms of SEL or  $L_{AFmax}$  depending on the character and number of events per night. The WHO Guidelines on Community Noise (1999) considers that if negative effects on sleep are to be avoided, noise events exceeding 45 dB  $L_{Amax}$  should be limited.

**Table 4.1 – Indoor Ambient Noise Levels in Dwellings (as recommended in BS 8233:2014)**

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

- 4.13 In relation to the internal design criteria detailed above, BS 8233 states: *‘if relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.’*
- 4.14 For traditional external areas that are used for amenity space, such as gardens and patios, BS 8233 considers that it is desirable that the external noise level does not exceed 50 dB  $L_{Aeq,T}$ , with an upper guideline value of 55 dB  $L_{Aeq,T}$  which would be acceptable in noisier environments. BS 8233 also states *‘However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met,*

*might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited'.*

- 4.15 Further, for balconies, roof gardens and terraces, BS 8233 considers *'other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB  $L_{Aeq,T}$  or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space'.*
- 4.16 With reference to the BS 8233 guidelines, by definition, 'reasonable internal conditions' cannot represent a significant adverse impact (the prevention of which is the 1<sup>st</sup> aim of NPSE). With cognisance to the 2<sup>nd</sup> aim of NPSE (to minimise noise impact), the internal ambient noise levels detailed in Table 4.1 are considered appropriate.
- 4.17 On the basis of the above, for the residential elements of the proposed development, the following criteria are considered to be in keeping with the aims of the NPPF:
- 35 dB  $L_{Aeq}(0700-2300)$  in living rooms and bedrooms during the daytime.
  - 30 dB  $L_{Aeq}(2300-0700)$  in bedrooms at night.
  - 45 dB  $L_{AFmax}$  not normally exceeded in bedrooms at night.
- 4.18 In addition to guideline criteria for residential development, BS 8233 considers that design ranges for internal ambient noise levels (IANLs) of 45 to 50 dB  $L_{Aeq,T}$  in open plan offices and 35 to 40 dB  $L_{Aeq,T}$  in executive offices are appropriate. Whilst BS 8233 does not specifically considered internal discrete event maxima in non-domestic buildings, Building Bulletin 93 (Acoustic design of schools: performance standards) considers that IANLs should not exceed 60 dB  $L_{A1,30mins}$ , which is considered appropriate for office environments requiring concentration.

#### **BS 4142:2014**

- 4.19 The methods described in British Standard BS 4142:2014 *'Methods for Rating and Assessing Industrial and Commercial Sound'* (BS 4142) use outdoor sound levels to assess the likely effects of sound on people for the purposes of (i) investigating complaints, (ii) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature, and (iii) assessing sound at proposed new dwellings or premises used for residential purposes.
- 4.20 BS 4142 considers that the potential impact is dependent on the difference between the rating level and background noise level; the greater this difference the greater the potential impact, depending on the context in which the sound occurs/will occur. BS 4142 states:
- 'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs'.* Typically, the greater this difference, the greater the magnitude of the impact. For example:
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
  - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
  - *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*



*Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*

- 4.21 The rating level is described as the specific sound level (the equivalent continuous A-weighted sound pressure level at the assessment position (noise sensitive receptor (NSR)) produced by the specific sound source over the given reference time interval) plus any adjustment for the characteristic features of the sound. The character correction relates to whether and to what degree the specific sound is assessed to have an element of tonality, impulsivity and/or characteristics that are readily distinctive against the residual acoustic environment.
- 4.22 The background noise level is the A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 percent of a given time interval, T, measured using time weighting 'F' and quoted to the nearest whole number of decibels.
- 4.23 Where the initial estimate of the impact needs to be modified due to the context, factors to be taken into account include the absolute level of sound and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions. In addition, for the introduction of a new noise sensitive receptor, BS 4142 considers *'where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.'*
- 4.24 In order to assess the impact of HVAC plant noise sources introduced as part of the development on existing NSRs in the vicinity of the application site, based on BS 4142 and in the context of the NPPF, an external plant rating level of <10 dB above the background noise level is not considered to represent a significant adverse impact (the prevention of which is the 1<sup>st</sup> aim of Para 123 of the NPPF), whilst a rating level not exceeding the background noise level is considered to be in keeping with the 2<sup>nd</sup> aim of Para 123 of the NPPF, i.e. to mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development.
- 4.25 In order to assess the impact of existing HVAC plant noise sources, and sources introduced as part of the development, on the NSRs introduced as part of the development, in addition to consideration of existing background noise levels, it is considered appropriate to consider absolute noise levels associated with plant and the design of attenuation measures to secure good internal acoustic conditions (with reference to Para. 4.23).

## **5.00 SOUND ATTENUATION SCHEME PROPOSALS**

### **5.01 Introduction**

- 5.02 The following assessment/sound attenuation scheme proposals are based on the noise criteria specified above (Paragraphs. 4.17, 4.18, 4.24 and 4.25) and the noise measurement data detailed in Section 3. Attenuation proposals are set out on a building by building basis.
- 5.03 In order to calculate the sound insulation requirements of the building envelope for residential/office accommodation associated with the development, the Building Research Establishment (BRE) building envelope insulation calculation spreadsheet was used. This spreadsheet is based on the calculation methodology advocated in BS 8233. The spreadsheet allows input of external noise levels, room dimensions and reverberation time together with parameters for the various elements of the building envelope and calculates the internal noise level in terms of the external noise level metric ( $L_{Aeq,T}$ ,  $L_{A1,T}$  and  $L_{AFmax}$  in this case). For the calculations, typical room dimensions and a high percentage of façade glazing have been assumed.
- 5.04 As discussed previously, whilst specific events were not occurring at the ACC Liverpool venues during the course of the survey, anecdotally, it is understood that there is no specific noise breakout from the buildings associated with events and the main potential noise sources are associated with attendees/customers arriving at and departing from the venues (a combination of increased road and pedestrian traffic) and HGV movements associated with transporting tour equipment and exhibition sets etc. This is consistent with ENS's experience of similar venues.
- 5.05 It is understood that the arena can seat up to 7,500 and the main auditorium of the conference centre has a capacity of 1,350, with 1,800 capacity in a multi-purpose hall. There are also smaller capacity breakout rooms. The existing multi-storey car park has a capacity of 1,600 spaces and a proposed multi-storey car park (subject to a future planning application) circa 850 spaces. Additionally, it is understood that there are a further 3,000 parking spaces outwith the Kings Dock but within easy walking distance.
- 5.06 On this basis, it is evident that for the existing and proposed venues, leisure and commercial facilities, the majority of attendees/customers will arrive onto the Kings Dock area on foot. Whilst road traffic will access the multi-storey car parks on site, it is not considered that the 'hourly' traffic will increase significantly, rather the local road network will be busier for a longer period of time relative to non-event periods. As such, the measured noise levels over approximately an hour period have been taken as representative of the full daytime and night time periods. It is noteworthy that when road traffic is queuing, the  $L_{Aeq,T}$  level tends to decrease and the  $L_{A90,T}$  increase relative to free flowing conditions. It should also be recognised that there is existing residential development in close proximity to the Kings Dock road network and venue facilities.
- 5.07 In relation to development led traffic associated with the wider Monarchs Quay masterplanning, modelling by Vectio Consulting indicates circa 289 two-way movements on Queens Wharf during the am weekday peak, 356 two-way movements during the pm weekday peak and 392 two-way movements during the mid afternoon on a Saturday. Based on existing traffic flows, there is the potential for a circa 4 dB increase in traffic noise levels in proximity to Queens Wharf when accounting for development led traffic (where the ambient noise climate is not dominated by A5036 traffic noise, i.e. MP2 as opposed to MP1).

## **5.08 Building 2: Interpretation Centre**

- 5.09 Building 2 comprises of the Interpretation Centre and flexible commercial space. The building is located off Queens Wharf at the entrance to the application site. Based on the criteria detailed in Section 4, it is considered that good internal acoustic conditions can be secured by achieving IANLs of  $\leq 40$  dB  $L_{Aeq,T}$  and  $\leq 60$  dB  $L_{AF1,T}$  (i.e. robustly assuming the noise sensitivity of an 'office type' use).
- 5.10 Based on the MP1 noise data and with cognisance to potential development led traffic noise emissions, the building envelope is required to provide a sound reduction index of  $\geq 28$  dB  $R_w + C_{tr}$  (e.g. 6 mm glass (16 mm air) 4 mm glass double glazing).
- 5.11 In order to provide ventilation without the need to open windows (reducing the acoustic integrity of the building façade), it is recommended that the units are provided with a mechanical ventilation strategy.
- 5.12 Details of externally located HVAC plant servicing Building 2 are not currently available.
- 5.13 It is considered that the control of noise emissions associated with external plant is amenable to a planning condition with the following criteria (based on the noise measurement data and the requirements of BS 4142):
- The cumulative rating level of external plant operating during the daytime/evening (07:00 to 23:00 hours) should not exceed 48 dB  $L_{Ar,T}$  when measured as a free field level at the nearest noise sensitive receptor.
  - The cumulative rating level of external plant operating during the night time (23:00 to 07:00 hours) should not exceed 42 dB  $L_{Ar,T}$  when measured as a free field level at the nearest noise sensitive receptor.
- 5.14 Given the separation distances involved, it is considered that appropriate noise control can be achieved with the judicious selection and siting of plant and/or standard noise mitigation techniques.

## **5.15 Building 4: Apartment block including commercial use at ground floor**

- 5.16 Building 4 consists of an apartment block with ground floor commercial use and car parking. The building is located adjacent to the existing sub-station; in the south western area of the application site and to the south of Queens Wharf (on the area of land allocated as a temporary car park for the TCC building in the Phase 1a application).
- 5.17 Based on the criteria detailed in Section 4, it is considered that good internal acoustic conditions can be secured in the residential element of the building by achieving IANLs of  $\leq 35$  dB  $L_{Aeq,T}$  in living rooms and bedrooms during the daytime and  $\leq 30$  dB  $L_{Aeq,T}$  in bedrooms at night, with discrete event maxima typically not exceeding 45 dB  $L_{AFmax}$  in bedrooms at night.
- 5.18 Based on the MP2 noise data and with cognisance to potential event noise emissions/development led traffic, the building envelope is required to provide a sound reduction index of  $\geq 34$  dB  $R_w + C_{tr}$  to bedrooms (e.g. acoustic laminate double glazing) and  $\geq 29$  dB  $R_w + C_{tr}$  to living rooms (e.g. 8 mm glass (16 mm air) 4 mm glass double glazing).
- 5.19 In order to provide ventilation without the need to open windows (reducing the acoustic integrity of the building façade), it is recommended that the residential units are provided with a mechanical ventilation strategy. Appropriate ventilation solutions include:
- A fully ducted mechanical ventilation system with or without heat recovery.
  - A System 3 continuous mechanical extract ventilation (MEV) system with boost facility.

Note: where trickle vents are required as part of the ventilation strategy, they will be required to be high specification acoustic window frame trickle vents or acoustic wall vents at the required Equivalent Area ( $\text{mm}^2$ ) per habitable room. The ventilation recommendations relate to the sound insulation scheme only and the developer should ensure compliance with the ventilation requirements of the Building Regulations.

- 5.20 Details of externally located HVAC plant servicing Building 4 are not currently available, but it is assumed they will include ventilation to the residential units and ventilation/extraction/air conditioning to the ground floor commercial units.
- 5.21 It is considered that the control of noise emissions associated with external plant is amenable to a planning condition with the following criteria (based on the noise measurement data and the requirements of BS 4142):
- The cumulative rating level of external plant operating during the daytime/evening (07:00 to 23:00 hours) should not exceed 48 dB  $L_{A,T}$  when measured as a free field level at the nearest noise sensitive receptor.
  - The cumulative rating level of external plant operating during the night time (23:00 to 07:00 hours) should not exceed 42 dB  $L_{A,T}$  when measured as a free field level at the nearest noise sensitive receptor.
- 5.22 For NSRs introduced as part of the development proposals, it is also considered appropriate to take into account absolute noise levels and the attenuation measures incorporated into the design of the NSRs when assessing the degree of mitigation required for HVAC plant. It is considered that appropriate noise control can be achieved with the judicious selection and siting of plant and/or standard noise mitigation techniques.
- 5.23 In relation to servicing arrangements for the ground floor uses, it is considered that the control of noise emissions associated with servicing activity (deliveries etc.) is amenable to a planning condition restricting delivery times to the units.

## **6.00 CONCLUSIONS**

- 6.01 A noise impact assessment has been undertaken for Phase 1b of the proposed mixed use redevelopment of Monarchs Quay, Kings Dock, Liverpool.
- 6.02 Recommendations for a scheme of sound insulation works have been developed to protect the proposed noise sensitive elements of the development from the external ambient noise climate in accordance with the requirements of the National Planning Policy Framework. On this basis, the ambient noise climate is not considered to represent a constraint to the proposed residential element of proposed development. Consideration has also been given to the setting of limiting noise criteria for plant introduced as part of the development.
- 6.03 The measures recommended to protect the proposed noise sensitive elements of the development from the external ambient noise climate are also considered appropriate to ensure that the development proposals do not represent an unreasonable restriction on the operation of the existing commercial premises on Kings Dock.

I trust that the above meets with your requirements. Should you have any queries please do not hesitate to contact me.

Yours sincerely,



Richard Pennell  
For Environmental Noise Solutions Limited

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## Appendix 1 Glossary of Acoustic Terms

### Sound Pressure Level ( $L_p$ )

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20  $\mu\text{Pa}$  to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where  $L_p$  = sound pressure level in dB;  $p$  = rms sound pressure in Pa; and  $p_0$  = reference sound pressure (20  $\mu\text{Pa}$ ).

### A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

### Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval,  $T$ , has the same mean-square sound pressure as a sound that varies with time.  $L_{Aeq, 16h}$  (07:00 to 23:00 hours) and  $L_{Aeq, 8h}$  (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

### $L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period,  $T$ .  $L_{A10, 18h}$  is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

### $L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval,  $T$ .  $L_{A90}$  is typically taken as representative of background noise.

### $L_{AF \max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

### Sound Exposure Level (SEL or $L_{AE}$ )

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

### Weighted Sound Reduction Index ( $R_w$ )

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies ( $R_w$  is used to characterise the insulation of a material or product that has been measured in a laboratory).

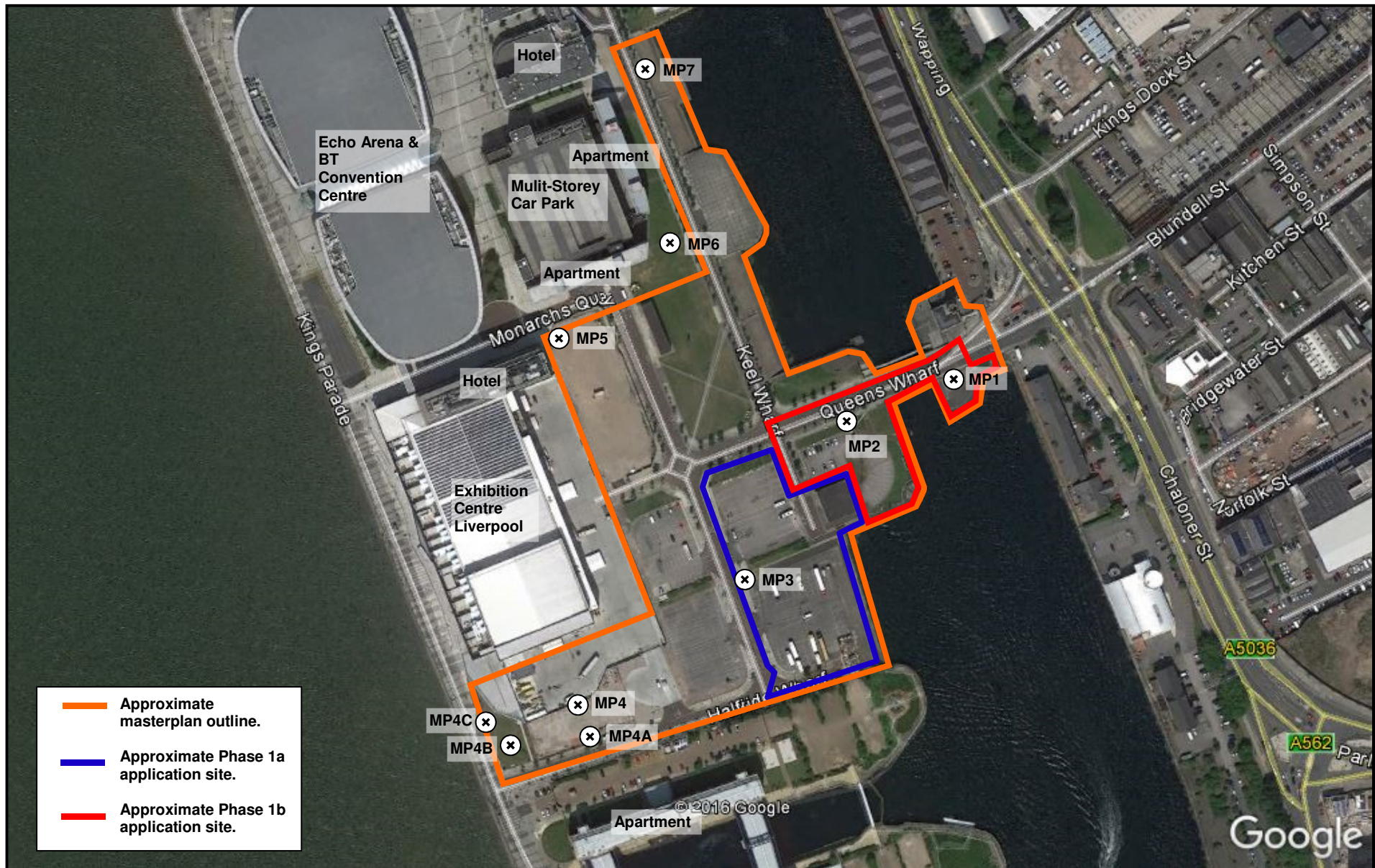
### Weighted Airborne Sound Insulation ( $D_{nT,w}$ )

Single number quantity which characterises the airborne sound insulation between rooms.

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Appendix 2.1: Annotated aerial image indicating approximate noise monitoring positions (MPs) and existing uses



## Appendix 2.2: Annotated indicative Masterplan

### 3.0 THE VISION FOR MONARCHS QUAY.

#### 3.2 MASTERPLAN SKETCH

