

4.4 Noise and Vibration

- 4.4.1 This section of the ECR reports the effects and specific commitments of the Consented Scheme on noise and vibration. It also describes the various Planning Conditions attached for the topic, as required up to Construction Stage, and identifies how and where information required by such conditions is located.
- 4.4.2 This section revisits and builds upon (where necessary) Chapter 9: Noise & Vibration of the 2013 ES by assessing the detailed scheme for Plots D and K, introducing further mitigation (as required), before concluding whether the detailed scheme is in compliance with the findings of the 2013 ES.
- 4.4.3 Chapter 9: Noise & Vibration of the 2013 ES, considered the following potential noise and vibration impacts:
- Potential demolition and construction noise and vibration effects at existing, and future, sensitive receptors, including the potential effects of construction works.
 - Potential operational noise effects, including:
 - The likely significant effects of noise from the Proposed Development (e.g., new fixed plant) on existing sensitive receptors;
 - The likely significant effects of noise on future residents of the Proposed Development.
- 4.4.4 This Section has been written by Thomas Leach MIOA and it is supported by Appendix 4.4.1.

Findings and commitments of the 2013 ES

- 4.4.5 This section presents the findings and commitments of the 2013 ES with respect to noise and vibration as written in the 2013 ES.

Baseline

Environmental Noise

- 4.4.6 The 2013 ES Chapter assessment adopts baseline environmental noise measurements undertaken by Waterman Energy in 2011.
- 4.4.7 The measurements were carried out at ground floor level during the daytime and night-time periods at two locations, representative of the façade locations of the Royal Arsenal OSD development fronting on to Plumstead Road and Arsenal Way.
- 4.4.8 Daytime noise levels were 72 dB $L_{Aeq,16h}$ at the location fronting on to Plumstead Road and 63dB $L_{Aeq,16h}$ at the location fronting on to Arsenal Way.
- 4.4.9 Night-time noise levels were 60dB $L_{Aeq,16h}$ at the location fronting on to Plumstead Road and 56dB $L_{Aeq,16h}$ at the location fronting on to Arsenal Way.

Environmental Vibration

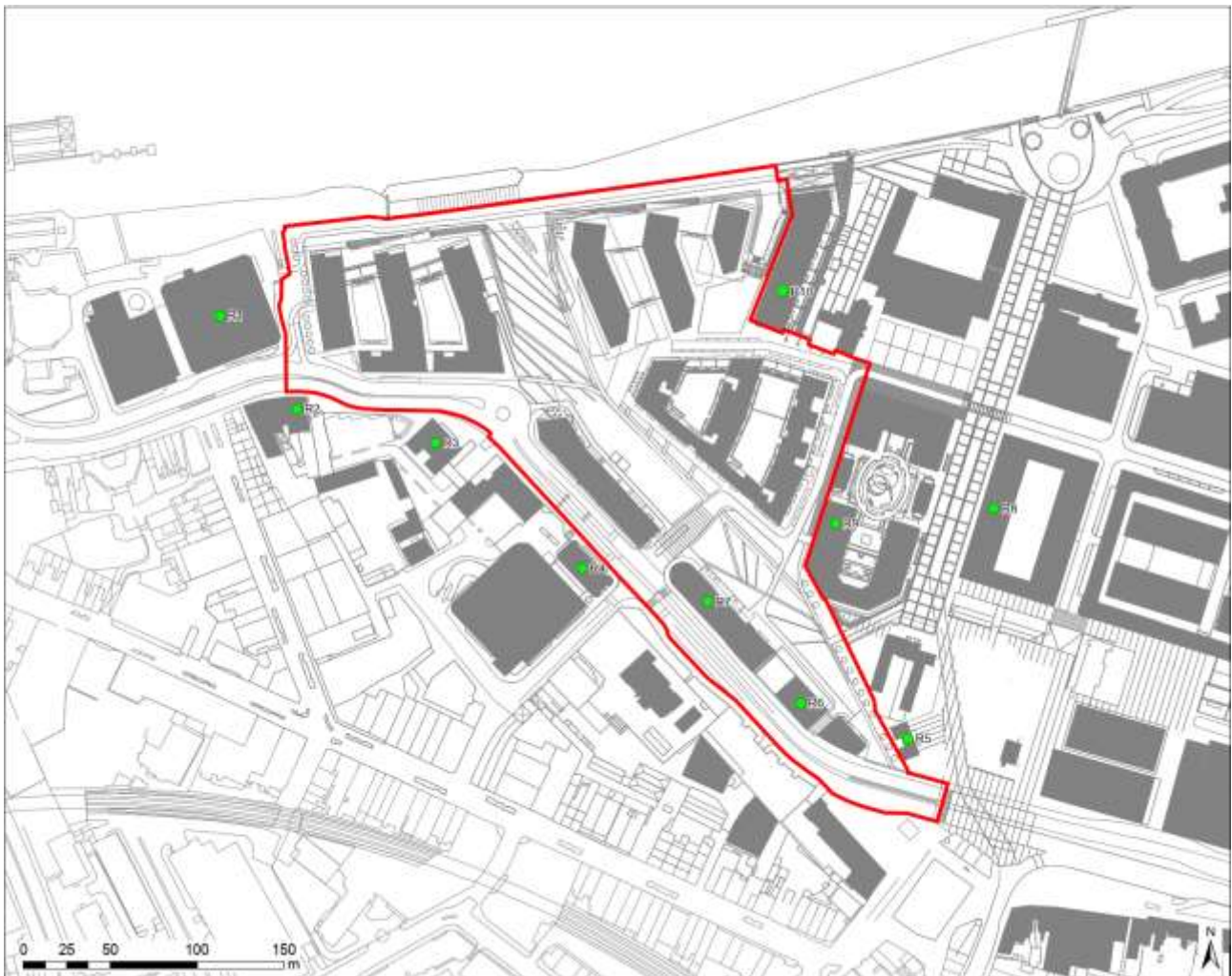
4.4.10 No baseline environmental vibration measurements were undertaken as part of the 2013 ES assessment.

Construction phase impacts*Sensitive Receptors*

4.4.11 The 2013 ES assessment considered the following as sensitive receptors, as shown in Figure 4.4.1:

- R1: Waterfront Leisure Centre;
- R2: Commercial/residential property;
- R3: Council offices;
- R4: Commercial Offices;
- R5: Commercial Offices;
- R6: Catholic Club;
- R7: Hotel (under construction);
- R8: Royal Arsenal Development (Phase 2);
- R9: Royal Arsenal Development (Phase 3) (consented); and
- R10: Royal Arsenal Development (Phase 5) (resolution to grant consent).

Figure 4.4.1: Sensitive Receptor Locations



Construction Noise Impact

4.4.12 Table 5.4.1 and Table 5.4.2 below presents the 2013 ES assessment predicted construction noise levels at both existing and future receptors for the construction phases of Plot D and Plot K respectively.

Table 4.4.1: Calculated Construction Noise Levels (Plot D)

Receptor	Construction Noise Level (dB L _{Aeq, 1 hour})			
	Ground Works	Piling and Substructure	Road Works	Superstructure
R1	52	49	45	44
R2	54	49	46	46
R3	67	60	57	58
R4	69	65	61	61
R5	48	56	53	48
R6	67	62	59	58
R7	72	66	65	63
R8	68	54	57	57
R9	75	68	69	66
R10	78	72	62	72
Block B	76	69	62	67
Block A	67	61	57	59
Block D	-	-	-	-

Table 4.4.2: Calculated Construction Noise Levels (Plot K)

Receptor	Construction Noise Level (dB L _{Aeq, 1 hour})			
	Ground Works	Piling and Substructure	Road Works	Superstructure
R1	57	44	45	48
R2	60	48	47	51
R3	73	63	53	64
R4	76	72	68	68
R5	68	73	72	68
R6	69	80	78	73
R7	75	70	66	69
R8	44	52	56	44
R9	66	62	59	61
R10	51	44	45	43
Block B	76	64	64	65
Block A	74	63	64	65
Block D	80	68	68	69

4.4.13 As per the above, without mitigation in place, the following receptors would experience noise levels above 75dB_{LAeq} for short durations during the construction, and would risk experiencing medium term negative, direct, moderate construction noise effects:

Plot D Construction

- R10, RAR Plot B

Plot K Construction

- R4, R6, RAR Plot B, RAR Plot D

Mitigation

4.4.14 By employing appropriate site management practices, the potential for negative noise effects from construction vehicles and plant during the works can be minimised. A range of measures are suggested, which would form part of a site specific Construction Environmental Management Plan (CEMP).

4.4.15 It is suggested that a CEMP would cover the following matters:

- Methods and materials that should be used to ensure that the generation of noise is minimised;
- Good housekeeping and management, i.e.:
 - Review of plant and activities to ensure noise minimisation measures are in place and operating;
 - Public relations, e.g. provision of telephone numbers for complaints, pre-warning of noisy activities, sensitive working hours;
 - Controlling of site traffic and setting up of access routes away from sensitive receptors; and
 - Provision of noise monitoring during activities likely to affect sensitive receptors.

4.4.16 The contractor will be responsible for the execution of the CEMP and will need to ensure that appropriate personnel understand their responsibilities in terms of the minimisation of noise and the appropriate reporting and dealing with incidents.

4.4.17 Mitigation measures may include the following where practicable:

- Where possible, low noise plant and equipment to be used;
- Where vehicles are standing for a significant period of time, engines to be switched off;
- Screening around those parts of the site at which activities are likely to generate noise impacts;
- Location of noise generating plant at a low level and as distant as possible from sensitive receptor;
- Plant to operate at low speeds, where possible, and incorporate automatic low speed idling;
- Location of site haul roads, entrances and exits to prevent the need for vehicles to reverse and also minimise impacts upon sensitive receptors;
- The inclusion of the traffic route management plan;

- All plant to be properly maintained (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc.);
- Consideration to be given to temporary screening or enclosures for static noisy plant to reduce noise emissions and plant should be certified to meet any relevant EC Directive standards;
- Early and good public relations with the adjacent tenants and occupants of buildings will also reduce the likelihood of complaints.

4.4.18 Once the exact methods and plant to be employed are confirmed, the need for further mitigation measures can be determined and specified within the CEMP.

4.4.19 It may also be prudent for the contractor to apply for 'Prior Consent' to work from the local authority under Section 61 of the Control of Pollution Act.

Residual Effect

4.4.20 With the implementation of the above mitigation, it is considered that the worst case predicted noise levels could be reduced by at least 5dBA, and it is therefore likely that significant effects relating to construction noise will be avoided at all receptors. However, medium-term negative direct, minor residual effects may be experienced at receptors.

Construction Vibration Effects

4.4.21 An indicative construction vibration assessment has been undertaken for the 2013 ES in accordance with the guidance provided in BS 5228.

4.4.22 At that stage, limited details of the required vibration-inducing construction activities were available, therefore a worst-case assumption has been made, resulting in predicted vibration levels which have been calculated using the empirical formula provided within BS 5228. Further details of the construction activities are limited and therefore no changes to the method are required.

4.4.23 Worst case distances have been assessed i.e. the shortest potential distances between the piling rig and the sensitive receptors.

4.4.24 Predicted vibration levels have been assessed in accordance with the informative construction vibration criteria provided in BS 5228 (in terms of Peak Particle Velocity).

4.4.25 Overall, the classification of construction noise and vibration effects is assessed as negligible and therefore not significant.

Mitigation

4.4.26 As no significant negative effects are predicted, no noise mitigation is proposed.

Residual Effect

4.4.1 No residual effects are predicted.

Construction Noise from Off-Site Construction Traffic

- 4.4.2 The assessment of impact of noise from off-site construction traffic was scoped out of the 2013 ES assessment.

Operational phase impacts

- 4.4.3 This section identifies and assesses the scale and nature of the main effects arising from the Proposed Development during the operational phase.

Off-Site Operational Traffic

- 4.4.4 The assessment of impact of noise from off-site development generated operational traffic was scoped out of the 2013 ES assessment.

Noise from Fixed Plant

- 4.4.5 As outlined in the 2013 ES, there is limited information available for the type and configuration of the fixed plant items and as such a meaningful plant noise emission assessment cannot be undertaken at the ES assessment stage.
- 4.4.6 The ES chapter states that an assessment according to the methodology provided in BS 4142: 1997 '*Rating industrial noise affecting mixed residential and industrial areas*' will be carried out as part of the detailed design work for each phase of the proposed development. It is anticipated that this would be a condition of the proposed development.

Mitigation

- 4.4.7 The principle mitigation technique is assessing and designing the fixed plant to achieve the proposed noise emission limits (highlighted above), which may include sound reduction of the housed/ enclosed equipment or selection of lower noise plant, if required.

Residual Effect

- 4.4.8 With the implementation of the above mitigation (i.e. suitable design), no adverse noise effects are predicted in relation to fixed plant.

Site Suitability - Noise

- 4.4.9 The 2013 ES Chapter sets out indicative façade sound insulation requirements, based on the baseline environmental noise survey, to achieve suitable internal ambient noise levels, as defined 'Good' by BS 8233:1999, which is 30dB $L_{Aeq,T}$ for both bedrooms and living rooms.

Mitigation

- 4.4.10 The exact glazing requirements for the Proposed Development would be subject to detailed design, which is yet to be carried out. However, indicative glazing requirements are provided below:

- For façade noise levels above 70 dB(A), the provision of high specification double glazing, for example Pilkington 16.8mm/16mm/16.8mm, and an appropriate ventilation strategy would provide internal noise levels to residential properties of approximately 30 dB L_{Aeq} , equivalent to the “Good” criterion in BS 8233.
- For façade noise levels of 65 to 70 dB(A), the provision of high specification double glazing, for example 10mm/12mm/6mm, and an appropriate ventilation strategy would provide internal noise levels to residential properties of approximately 30 dB L_{Aeq} , equivalent to the “Good” criterion in BS 8233.
- For façade noise levels of 64 dB(A) and less, the provision of double glazing, for example 4mm/12mm/4mm, and an appropriate ventilation strategy would provide internal noise levels to residential properties of approximately 30 dB L_{Aeq} , equivalent to the “Good” criterion in BS 8233.

Residual Effect

4.4.11 With the implementation of the above mitigation (i.e. suitable design), no adverse noise effects are predicted in relation to internal ambient noise levels.

Site Suitability - Vibration

4.4.12 Based on design stage assurances from Crossrail, the impact of tactile vibration from the operation of the subterranean Elizabeth line has been scoped out of the 2013 ES Chapter.

Relevant planning conditions

4.4.13 Condition 41 of the Outline Planning Permission (13/0117/O) for the development is relevant to the pre-commencement assessment of noise and vibration of Plots D & K and states:

“A noise assessment and detailed noise mitigation scheme shall be submitted to, and approved in writing by, the Local Planning Authority prior to the submission of, the first reserved matters application for the relevant part of the development. The assessment and mitigation scheme shall identify noise exposed habitable rooms including dwellings fronting Beresford Street/Plumstead Road as shown on plan 434_05_M_07_120 (Rev. P1) and outdoor amenity spaces (including balconies or shared outdoor amenity space. The scheme shall assess the noise level, the reduction in noise required by mitigation and the means to maintain that standard. It is expected that residential dwellings fronting Beresford Street/Plumstead Road should benefit from a scheme of acoustic window insulation and mechanical ventilation in all habitable rooms. All reserved matters submissions shall be in strict accordance with the identified mitigation measures approved pursuant to this condition.”

Reason 41: In order to safeguard the amenity of the future occupiers of the development and to ensure compliance with Policy E3 of the Unitary Development Plan (2006) and polic E(a) of the Core Strategy with Development Management Policies (Proposed Submission Version, February 2013).”

Assessment methodology

4.4.14 The following section outlines the methodologies applied to identify and assess the potential impacts and likely effects to result from the Proposed Development and highlight any changes from the 2013 ES.

Extent of The Study Area

4.4.15 With regards to the assessment of the impacts of the Proposed development, the spatial extent of the study area is the same as in the 2013 ES. In terms of determining how noise and vibration affect the Proposed Development, this report only assesses Plot D and Plot K.

Method of Baseline Collection

4.4.16 Supplementary baseline noise data was collected to assess whether there has been any significant change in baseline since the 2013 ES. Unattended baseline noise monitoring was undertaken at two locations on the Site, over suitable durations.

4.4.17 The 2013 ES scoped out the impact of vibration from the subterranean TfL Elizabeth Line that bisects the site based on the design stage performance assurances of Crossrail. As the line is now operational, supplementary baseline vibration data was collected to assess the potential impact from tactile vibration and re-radiated groundborne noise.

4.4.18 All monitoring has been undertaken in accordance with relevant British Standards relating to environmental noise measurement and by suitably qualified and experienced acousticians.

4.4.19 Details of the noise monitoring results, and methodology are detailed in Appendix 5.4.1.

Method of Assessment

4.4.20 The assessment has been undertaken using the same general assessment methodology as the 2013 ES. This section highlights any relevant changes to assessment methodology, and changes to Standards and calculation methodologies.

Demolition & Construction Phase

Noise

4.4.21 BS 5228-1:2009+A1:2014 provides guidance on the measurement, prediction and control of noise from construction sites. It summarises the typical sources of construction noise and vibration and provides a calculation methodology for predicting construction noise propagation based on various site-specific factors.

4.4.22 It does not provide normative criteria for assessing the potential impact construction noise, however it does provide informative methods and criteria for assessing potential adverse impact. These methods consider either absolute noise levels, or the change in noise level compared to the existing ambient noise.

4.4.23 In terms of absolute levels, the standard refers to Advisory Leaflet 72, as follows:

“noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. the noise can be measured with a simple sound level meter, as we hear it, in a-weighted decibels (dB(a))– see note below. noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;
- 75 decibels (dBA) in urban areas near main roads in heavy industrial areas.

4.4.24 These limits are for daytime working outside living rooms and offices.”

Vibration

4.4.25 BS 5228:2014 Part 2 - provides guidance on the measurement, prediction and control of vibration from construction sites. It summarises the typical sources of construction vibration (e.g. piling), and provides a methodology for predicting construction vibration propagation based on empirical data.

4.4.26 The standard does not provide normative criteria for assessing the potential impact of construction vibration, however it does provide an indication of when construction vibration may become problematic, in terms of Peak Particle Velocity levels, summarised in the following Table.

Table 4.4.3: Peak Particle Velocity Vibration Levels and Potential Effects during the Construction Period

Vibration Level (PPV mm/s)	Effect
0.14	Vibration might be just perceptible in the most sensitive situations or most vibration frequencies associated with construction. at lower frequencies, people are less sensitive to vibration.
0.30	Vibration might be just perceptible in residential environments.
1.00	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.00	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Operational Phase

Noise from Fixed Plant and Equipment

4.4.27 The 2013 ES adopted an earlier version of the British Standard (BS 4142:1997) to assess potential effects of plant noise. The following amendments to the document are included, although they are not noted to have an impact on the assessment undertaken as part of the previous ES chapter:

- clarifications to the application of the standard,
- introduction of uncertainty and means of reducing uncertainty,
- and places greater importance on the context of the sound.

4.4.28 The current standard BS 4142:2014+A1:2019: 'Method for rating and assessing industrial and commercial sound' is intended to be used to assess noise of a commercial nature such as that arising from commercial premises.

4.4.29 The procedure contained in BS 4142:2014+A1:2019 for assessing environmental noise impact is to compare the measured or predicted noise level from the source in question, the "Specific Sound Level" immediately outside the noise sensitive premises, with the corresponding representative "Background Sound Level". Where the noise contains attention attracting characteristics such as tonal, impulsive and/or intermittent elements, it may be appropriate to apply a correction to the Specific Sound Level to obtain the "Rating Level".

4.4.30 BS 4142:2014+A1:2019 states that the significance of sound arising from 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 also the context in which the sound occurs:

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

4.4.31 For the daytime, the assessment is carried out over a one-hour period, and over a 15-minute period at night. The daytime and night time periods are defined as occurring between 07:00 hours to 23:00 hours, and 23:00 hours to 07:00 hours, respectively.

Site Suitability

- 4.4.32 The 2013 ES assessed the suitability of the development with regards to ambient noise. It also sets out indicative façade sound insulation requirements to achieve suitable internal noise levels, as defined by BS 8233:1999. Indicative glazing and ventilation requirements were provided to demonstrate that the internal ambient noise criteria are achievable across the development.
- 4.4.33 Considering the proposed changes to the development, the changes in building massing will have a small/ negligible effect on the sound insulation requirements of the façade, however, changes to the baseline noise levels may impact the sound insulation requirements.
- 4.4.34 The exact glazing requirements for the development would be subject to detailed design, which is beyond the scope of the work required for planning purposes.
- 4.4.35 The current version of the British Standard, BS 8233:2014, provides suggested internal ambient noise levels within dwellings, based on World Health Organisation guidelines, reproduced in Table 4.4.4.

4.4.4: BS 8233:2014 Indoor Ambient Noise Level Design Guidance

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

Overheating

- 4.4.36 The 2013 ES did not assess the site against the requirements of ADO, as the regulation was not a statutory requirement at the time of submission.
- 4.4.37 Section 3 of ADO states that it should be ensured that the overheating mitigation strategy is useable and thus if the overheating strategy is to rely on open windows, suitable noise conditions within bedrooms at night should be achieved under such conditions:

“...the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:

- a. *40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).*
- b. *55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).”*

Vibration

- 4.4.38 British Standard 6472:2008 provides guidance on the likely human response to vibration within buildings. This standard assesses the likely adverse impacts of vibration, and can be used to assess the suitability of proposed residential buildings in locations with existing vibration.
- 4.4.39 The standard sets out suggested vibration criteria to assess potential adverse comment in residential buildings, as replicated in Table 4.4.5.

Table 4.4.5: BS 6472:2008 Vibration Dose Values and Possibility of Adverse Comment in Residential Buildings

Time	Low Possibility of Adverse Comment (ms ^{-1.75})	Adverse Comment Possible (ms ^{-1.75})	Adverse Comment Probable (ms ^{-1.75})
16 hour day	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
8 hour night	0.1 – 0.2	0.2 – 0.4	0.4 – 0.8

- 4.4.40 There are currently no criteria set within UK guidance that define a level at which groundborne noise from railway systems becomes a significant adverse impact for residential receptors. Therefore, guidance needs to be drawn from previous experience, national infrastructure projects, and other international authoritative guidance.
- 4.4.41 Guidance from ISO 14837-1:2005 advocates the use of $L_{Amax,slow}$ when assessing groundborne noise.
- 4.4.42 Considering the guidance presented by the Federal Transit Authority (FTA), as referenced by the Association of Noise Consultants (ANC) publication “Measurement and Assessment of Groundborne Noise and Vibration”, it is considered that an internal groundborne noise design criterion of 35dB $L_{Amax,slow}$ represents the LOAEL, with an upper maximum design limit of 40dB $L_{Amax,slow}$ within any residential room which represents the SOAEL.

Assessment of the detailed scheme

4.4.43 An assessment of the detailed Plot D & Plot K schemes have been undertaken. Full details of the assessment can be found in Appendix 4.4.1 including details of subsequent survey work that has been undertaken at site and suitable acoustic mitigation measures where required.

4.4.44 The following aspects of the outline masterplan 2013 ES have not been assessed as part of the detailed assessment for the corresponding reasons given:

ES Assessment Section	Reason
Construction Phase (all)	<p>The assessment of noise and vibration from the construction of Plot D & K is considered as part of the site-wide assessment which is required to include the cumulative effect of all site-wide works. This is unchanged from the 2013 ES.</p> <p>Construction Noise and Vibration is to be suitably controlled by a Construction Management Plan.</p>
Off-site operational traffic effects	<p>The impact of off-site development generated traffic was excluded from the scope of the 2013 ES Chapter as it was not considered significant. The predicted traffic generation remains unchanged and therefore there is no change in impact.</p>

Operational stage effects

4.4.45 Appendix 4.4.1 presents an assessment the proposed detailed scheme with respect to compliance with operational stage considerations presented in the 2013 ES.

4.4.46 The report includes consideration of environmental noise and vibration levels measured during October 2022 at the development site to ensure the assessment is based on the current baseline environmental noise climate.

4.4.47 The report presents full details of the following:

- An outline environmental noise intrusion assessment to demonstrate that suitable internal ambient noise levels can be achieved within habitable rooms,
- An assessment on achieving suitable environmental noise levels within outdoor amenity spaces,
- Suitable environmental plant noise limits to be achieved based on the results of the more recent baseline noise surveys and the typical requirements of RBG.

- An assessment of tactile vibration and re-radiated groundborne noise from the operation of the Elizabeth Line.

4.4.48 The assessment concludes that the proposed detailed scheme can achieve the standards set out in the 2013 ES, and current British Standards and Guidance, with respect to noise and vibration impact.

Cumulative effects

4.4.49 This section considers the likely cumulative effects that could arise from the Proposed Development when considered alongside other committed development schemes proximate to the Site. It identifies whether effects from several developments which individually may be insignificant could, when considered together, cause significant cumulative effects requiring mitigation.

4.4.50 A number of committed developments have been identified as being relevant to this assessment. These were identified through a review of RBG's planning portal and have been agreed with RBG.

4.4.51 The assessment is based on the best available information and draws on the assessments included in the ES and Application Reports that accompany the development applications, where available.

4.4.52 The cumulative effects remain largely unchanged from the 2013 ES as the impact of noise and vibration from the construction phase and operational phase will be limited by the assessment to the closest sensitive receptors which are unlikely to be cumulatively impacted by other consented scheme due to location.

4.4.53 Given the proximity to the site of other consented developments, it is anticipated that the construction and operational noise from the development will have a negligible impact.

Conclusions

4.4.54 Chapter 9 of the 2013 ES has been reviewed and the key findings and commitments have been presented.

4.4.55 An assessment of the proposed Plot D & K development has been undertaken with respect to the relevant considerations of environmental noise impact, as presented within the report in Appendix 4.4.1.

4.4.56 The assessment concludes that the proposed development can comply with the standards as set out within the 2013 ES, and current British Standards and Guidance, with respect to noise and vibration impact.

4.4.57 See the full report in Appendix 4.4.1 for further details.