

9. Noise & Vibration

Appendix 9.1

NOISE & VIBRATION ASSESSMENT

Everton Stadium Development Ltd

The People's Project, Merseyside

Noise and Vibration Assessment

August 2020

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1.0 Introduction

1.1 Purpose of this Report

This report presents the findings of a noise assessment undertaken to support a full planning application for the development of a new stadium with associated facilities and infrastructure at Bramley-Moore Dock (BMD), Regent Road, Liverpool, on behalf of Everton Stadium Development Ltd (hereafter 'Everton'). The proposed development is known as The People's Project.

A full planning application was submitted to Liverpool City Council ('LCC') in December 2019 (application reference 20F/0001) and has been subject to statutory consultation. Following receipt of the consultation feedback, the applicant has progressed design-led changes to the submitted application scheme which requires the original submission to be updated.

This version of the report includes the following updates in relation to Noise and Vibration:

- Redesign of the western elevation to incorporate a new elevated stepped amenity area/public realm and removal of the multi-storey carpark;
- Removal of surface carpark PV canopy to the west of the water channel (PV relocated to stadium roof);
- Relocation of Outside Broadcasting (OB) compound and substation to the northern extent of the west quay with surface car park area moving south on the west quay);
- Proposed chiller compound relocated from the southwest corner of stadium to the northwest corner of the stadium;
- Additional receptor location assessed for the proposed cumulative scheme 20F/0217 – Land bounded by Blackstone Street, Fulton Street and Regent Road (opposite the application site); and
- Consideration of consultation feedback/comments received by Liverpool City Council.

This ES technical appendix relating to noise and vibration has been reviewed against the following aspects and for each it has been confirmed that there are no amendments required to the content of the appendix:

- Baseline data validity: there have been no relevant changes to the baseline data, and the results of the noise survey presented in Section 5.0 remain valid;
- Legislation/policy revisions: the assessment of road traffic noise has been updated to reflect the latest version of the Design Manual for Roads and Bridges, however there have been no related updates to legislation/policy that have affected either the methodology or findings of this assessment;

- Amendments to construction methodology: the changes to the proposed construction methodology do not affect the findings of the construction assessment as the proposed items of plants to be used remain the same; and
- Operational traffic data: no relevant changes to operational traffic data as confirmed by Mott MacDonald.

In accordance with the methodology outlined in Chapter 2, ES Volume II, a Level 2 update has been undertaken. Due to:

- The relevance and scale of the proposed development amendments (including amendments to the stadium design);
- Addition of new cumulative schemes (20F/0217 – proposed hotel adjacent to Bramley-Moore Dock referred to as the Regent Road Hotel, 20F/1947 – 210 residential units at the junction of Lightbody Street and Great Howard Street);
- The relocation of the proposed chiller compound to the northwest corner of the stadium; and
- Statutory consultee comments (received after submission of the planning application to Liverpool City Council – ref. 20F/0001);

limited technical assessment has been undertaken relating to noise and vibration to confirm the validity of the previous conclusions. The relevant assessment information is presented/discussed within this appendix and therefore this report has been revised to reflect these updates.

The sections that have been updated are detailed below:

- Section 1.1 – Description of changes considered for the noise and vibration assessment;
- Section 1.3 – Consideration of consultee comments received from Liverpool City Council (LCC);
- Section 4.1 – Figure 4.1 updated to include design changes;
- Section 4.2 – Updates to location and sound power level of proposed chiller compound;
- Section 4.4 – Additional proposed receptor assessed (planning permission ref. 20F/0217);
- Section 6.3 – Updated building services plant assessment to include design changes and additional receptor;
- Section 6.4 – Updated assessment tables to include design changes and additional receptor;
- Section 6.7 – Updated assessment tables to include design changes; and

Appendix B – Sketches updated to include design changes.

Appendix C – Changes to the CEMP operational hours

The noise levels from the proposed development have been predicted at local representative receptors using CADNA noise modelling software which incorporates ISO 9613 and CRTN methodologies and calculations. A list of acoustic terminology and abbreviations used in this report is provided in Appendix A and a set of location plans and noise contour plots relevant to the assessment are presented in Appendix B.

1.2 Proposed Development

The application site is located at Bramley-Moore Dock (BMD) in Liverpool, National Grid Reference SJ3345292491. The site is 8.67 hectares and is bounded to the north by the United Utilities waste water treatment plant and Sandon Half Tide Dock, to the east by Regent Road, to the south by Nelson Dock and to the west by the River Mersey wall. The western boundary of the site is limited to the foot of the concrete crown wall, built on top of the River Mersey wall.

The proposed 52,888 seated capacity stadium will be orientated in a north-south direction with entrance via Regent Road.

The predominant use of the stadium will be for football use, however in addition to this, the stadium may also host other events such as sporting events and concerts. The current assessment scenario is based on four non-football events at full capacity per year. In addition, the following events may also take place throughout the year:

- Meetings/Conferences – potential for up to 261 days per year
- Exhibitions/Conventions – potential for up to 339 days per year
- Weddings – potential for up to 79 days per year
- Funerals – potential for up to 261 days per year
- Banqueting – potential for up to 339 days per year
- Christmas Parties – potential for up to 27 days per year
- Stadium Tours – potential for up to 339 days per year

1.2.1 Liverpool Waters Planning Permission – Future Baseline

Peel Land & Property secured outline planning permission in 2013 (LPA ref. 100/2424 – latest site-wide variation is 19NM/1121) for a mixed-use development comprising a maximum of 1,690,000m² of mixed-use development including 9,000 dwellings and 310,000m² of office space (figures rounded). The site stretches from Princes Dock to the south to Bramley-Moore Dock to the north. The timeframe for full delivery of the scheme at the time of planning application was 2041.

Since planning permission was granted, Peel Land & Property has submitted a series of discharge of conditions applications, reserved matters and non-material amendment applications. A neighbourhood masterplan for the Central Docks has recently been submitted (ref:19DIS/1315) in accordance with the requirements of the planning conditions attached to the outline planning permission. At time of writing this application is still to be determined.

It should be noted that the proposed stadium site is located within the Northern Docks (comprising Nelson Dock and Bramley-Moore Dock) neighbourhood in the Liverpool Waters scheme with development anticipated to take place between 2036 and 2041 for the following uses:

- C3 Dwellings- 219,500m².
- A1 Retail- 5,000m².
- A2 Financial & Professional services- 300m².
- A3 Food & drink- 2,200m².
- A4 Drinking establishments- 1,200 m².
- B1 Business- 1,800m².
- D1 Non-Residential Institutions- 6,600m².
- D2 Assembly and Leisure-1,000m².

The original outline planning permission (ref. 100/2424) has been subject to a number of non-material amendments ('NMAs') with the latest being ref. 19NM/1121 which was approved in August 2019. A further non-material amendment to the Liverpool Waters scheme is currently pending determination (LPA ref. 20NM/1801).

An extract of the approved parameters plan for the Northern Docks neighbourhood (comprising Bramley-Moore Dock and Nelson Dock) is provided below to show how the application site relates to the future baseline. The approved parameters plan has been used to identify the receptors at the outline building facades. It should however be noted that as the approved scheme parameter blocks for the east and west quay of Nelson Dock straddle the application site boundary with Bramley-Moore Dock, therefore a robust position has been adopted whereby the scheme block is reduced back to the application site boundary between Nelson Dock and Bramley-Moore Dock.

1.3 Post Submission Consultation Response - Liverpool City Council (LCC)

LCC provided a consultation response to the submitted full application (dated 13th May 2020) regarding the previously submitted noise and vibration assessment. Within the document, it is proposed that a standard condition is to be applied regarding proposed fixed building services plant as follows:

"The rating level of the noise emitted from any plant shall not exceed the existing background noise level. The noise level shall be determined at the nearest noise sensitive premises. The measurements and assessments shall be made according to BS4142:2014. 'Method for Rating Industrial and Commercial Sound'".

The assessment shown in Section 6.3 of this report, presents an assessment of building services plant which demonstrates that building services plant is not expected to exceed existing background noise levels when assessment in accordance with BS 4142:2014+A1:2019.

With respect to the proposed Liverpool Waters scheme, the LCC consultation response identifies that the impacts associated with the proposed development will be addressed by an "up-to-date noise assessment to determine a suitable package of acoustic insulation", in-line with the planning consent (100/2424).

The LCC consultation response also considers a proposed curfew time for up to six non-football events of 23:00, with up to two non-team sporting events (such as boxing and wrestling) concluding no later than

23:30, which would be consistent with the recently approved planning consents at Anfield Stadium (Liverpool Football Club) to protect future residential amenity.

To clarify, this assessment accounts for up to four non-football events, in-line with the proposals by Everton and therefore, the results of the entertainment noise assessment in sub-section 6.4.4 of this report (which considers up to and beyond 23:00) are considered to represent an appropriate assessment of late evening non-football events.

2.0 Planning Policy and Legislation

Section 38(6) of the Planning and Compulsory Purchase Act 2004 and Section 70(2) of the Town & Country Planning Act 1990 requires planning applications should be determined in accordance with the statutory development plan, unless material considerations indicate otherwise. The statutory development plan for the City of Liverpool currently comprises the Unitary Development Plan (adopted 2002).

The statutory development plan policies relevant to the application proposal are summarised below. The following policies and guidance are material considerations which also inform the assessment:

- Liverpool Local Plan (Submission Draft, May 2018);
- National Planning Policy Framework (February 2019);
- Planning Practice Guidance (continually updated - October 2019); and
- Supplementary Planning Documents (where relevant).

2.1 Local Planning Policy

Chapter 13 of the Liverpool Unitary Development Plan (UDP): A Plan for Liverpool (2002) contains the relevant policies with respect to noise:

Pollution – Policy EP11

- "1. Planning permission will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance.*
- 2. Where existing uses adversely affect the environment through noise, vibration, soot, grit, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems, the City Council will:*
 - i. seek to reduce the problem on site;*
 - ii. refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;*
 - iii. impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such permission, in order to regulate uses;*
 - iv. take enforcement action where appropriate; and*
 - v. in appropriate circumstances, compulsorily acquire the premises whilst endeavouring to assist in the relocation of the firm, where resources permit.*
- 3. In the case of new development close to existing uses which are authorised or licensed under pollution control legislation, and which are a potential nuisance to the proposed development, planning permission will not be granted unless the City Council is satisfied that sufficient measures can and will be taken to protect amenity and environmental health.*

Paragraph 13.103 also states:

"In determining whether a development is likely to cause unacceptable levels of pollution, the City Council will consider:

- national and international standards and regulations;*
- the advice of the pollution and control authorities;*
- Government guidance;*
- neighbouring land uses; and*
- the cumulative effect that may result i.e. where emissions, noise, discharge or nuisance from the development would combine with those already existing to reach unacceptable levels."*

Economic Development outside the Regeneration Areas – Policy E5

"1. Outside the Economic Regeneration Areas, the City Council will encourage the development of a range of employment generating activities, subject to the following specific criteria:

...ii. the nature of any industrial processes and operations involved, particularly with regard to potential generation of environmental pollutants, noise, visual intrusion, traffic and parking/access arrangements."

New Development in Conservation Areas – Policy HD11

"1. Planning permission will not be granted for:

...v. development that does not generate levels of traffic, parking, noise or environmental problems which would be detrimental to the character or appearance of the area."

The emerging Liverpool City Council Local Plan 2013-2033 (submission version May 2018) also contains the relevant policies with respect to noise from the proposed development:

Draft Policy STP2 (Sustainable Growth Principles and Managing Environmental Impacts)

"New development should seek to avoid negative impacts on the environment through adoption of best practice. Where a negative effect is identified this should be mitigated by appropriate measures.

To ensure the sustainable growth of the City, new development should:

...i. Deliver high quality contextual design which helps to reinforce the distinct character and identity of the various parts of the City; and results in the efficient use of resources generally including materials, water and energy; reduces carbon emissions and thus contributes to achieving zero carbon buildings; promotes opportunities for physical activity; and minimises waste, light and noise pollution;"

Draft Policy HD11 (New development in Conservation Areas)

Same as Policy HD11 outlined within the Liverpool UDP above.

Policy SP4 (Food and Drink Uses and Hot Food Take-aways)

"5. Proposals for all food and drink uses including hot food take-aways both within and outside designated centres should demonstrate that:

(a) There would be no adverse impact on residential amenity in terms of noise, customer activity, vibrations, odours, traffic disturbance and litter;

(d) Appropriate fume extraction systems and/ or noise insulation are provided;”

Policy R1 Air, Light and Noise Pollution

“1. Development proposals which are likely to have a pollution impact should demonstrate that:

a. Appropriate measures are incorporated to avoid pollution to air, water and soil;

b. The impact of noise, vibration and lighting will not be significant;

c. The proposal will not undermine the achievement of Air Quality Management Area (AQMA) objectives; and

d. It will not lead to a significant decline in air quality

2. Where existing uses adversely affect the environment through noise, vibration, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems the City Council will:

a. Refuse planning permission for proposals which would result in a consolidation or expansion of uses giving rise to environmental problems.

b. Impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such a permission in order to regulate uses.

3. New development proposals close to existing uses which are authorised or licenced under pollution control legislation, and which are a potential nuisance to the proposed development, will not be permitted unless the City Council is satisfied that sufficient measures will be taken by the developer to protect amenity and environmental health.

4. Where appropriate Major developments should incorporate measures to reduce and minimise air pollution.”

2.2 National Planning Policy

National policy guidance with respect to noise is found in National Planning Policy Framework (NPPF), published on 19th February 2019. With regard to noise and planning, NPPF contains the following statement at paragraph 170:

“170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions*

such as air and water quality, taking into account relevant information such as river basin management plans

A further 2 short statements are presented at paragraph 180, which state:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) "mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

Furthermore, paragraphs 182 and 183 state:

"182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Planning Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance is, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England (NPSE), is to identify *'whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated as follows:

Table 2.1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

3.0 Assessment Criteria

3.1 PPG Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Tables 3.1 – 3.4 present the equivalent noise levels and associated actions with the target noise level criteria identified. The noise level criteria detailed below have been derived from standards and design guidance:

- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings – Code of practice'
- BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'
- IEMA (Institute for Environmental Management and Assessment) 'Guidelines for Environmental Noise Impact Assessment October 2014'
- BS 5228-1: 2009 + A1:2014 'Code of Practice for Noise and vibration control on construction and open sites'
- Tables 3.54a & 3.54b of LA 111 'Noise and Vibration' (Design Manual for Roads and Bridges)
- Noise Council: Code of Practice on Environmental Noise Control at Concerts [NCCPENCC]

Table 3.1 Noise Level Criteria and Actions

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect Level (NOAEL)	Building Services Plant	BS4142 Score of zero or lower	No Action Required Score of zero or lower is an indication of the sound source having a low impact
	Matchday Operations	Noise levels less than: Bedrooms (night-time) – 30 dB $L_{Aeq,8hours} / 45 \text{ dB } L_{Amax}$ Living Rooms (daytime) – 35 dB $L_{Aeq,16hours}$	No Action Required Within BS8233 / WHO
	Assessment of Overall Change in Noise Levels	Up to 3.0 dB Change or a Reduction in Noise Levels	No Action Required – Change in noise levels unlikely to be perceptible
Lowest Observed Adverse Effect Level (LOAEL)	Building Services Plant	BS4142 Score of +5 or lower	No Action Required Difference of +5db likely to be an indication of an adverse effect BS4142 Score of plus 5 or lower
	Matchday Operations	Noise levels exceed: Bedrooms (night-time) – 30 dB $L_{Aeq,8hours} / 45 \text{ dB } L_{Amax}$ Living Rooms (daytime) – 35 dB $L_{Aeq,16hours}$	Mitigate to achieve: <i>Bedrooms – 30 dB $L_{Aeq,8hours} / 45 \text{ dB } L_{Amax}$</i> <i>Living Rooms – 35 dB $L_{Aeq,16hours}$</i> Within BS8233 / WHO
	Assessment of Overall Change in Noise Levels	Up to 4.9 dB Increase in Noise Levels	No Action Required Slight Impact at Receptor of Some Sensitivity

Effect Level	Assessment	Noise Level Criteria	Action / Justification
Significant Observed Adverse Effect Level (SOAEL)	Building Services Plant	BS4142 Score greater than +5	Difference of up to +10db likely to be an indication of a significant adverse effect Mitigate to achieve: BS4142 Score of + 5 or lower
	Matchday Operations	Noise levels exceed: Bedrooms (night-time)– 35 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms (daytime)– 45* dB $L_{Aeq,16hours}$	Mitigate to achieve: <i>Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax}</i> <i>Living Rooms – 35 dB $L_{Aeq,16hours}$</i> Within BS8233 / WHO * Values correspond with PPG24 Category B (15 dB open window reduction)
	Assessment of Overall Change in Noise Levels	3.0 to 5.0 dB Change in Noise Levels at a receptor of high sensitivity or Up to 5.0 dB Increase in Noise Levels	Mitigate to achieve: Increase in Noise Levels of less than 3.0 dB (high sensitivity) or Increase in Noise Levels of less than 5.0 dB (receptor of some sensitivity)
Unacceptable Observed Adverse Effect Level (UOAEL)	Building Services Plant	BS4142 Score of + 10 or higher	Avoid Mitigate to achieve: BS4142 Score of 5 dB or lower
	Matchday Operations	Noise levels exceed: Bedrooms (night-time) – 51 dB $L_{Aeq,8hours}$ / 67 dB L_{Amax} Living Rooms (daytime) – 57 dB	Avoid Values correspond with PPG24 Category D (mixed sources), planning permission should normally be refused. L_{Amax} noise levels based on PPG24 regular exceedance of 82 dB L_{Amax} less 15 dB for an open window. *Noise at Work Regulations Lower Action Value
	Assessment of Overall Change in Noise Levels	Greater than 5.0 dB Increase in Noise Levels	Mitigate to achieve: Increase in Noise Levels of less than 5.0 dB

Table 3.2 Noise Level Criteria (Traffic Noise Assessment)

Short-term Change in Noise Levels L _{A10,18hr} (dB)	Category (Short-term)	Long-term Change in Noise Levels L _{A10,18hr} (dB)	Category (Long-term)
0.0	No Change	0.0	No Change
0.1 – 0.9	Negligible Adverse	0.1 – 2.9	Negligible Adverse
1.0 – 2.9	Minor Adverse (LOAEL)	3.0 – 4.9	Minor Adverse (LOAEL)
3.0 – 4.9	Moderate Adverse (SOAEL)	5 – 9.9	Moderate Adverse (SOAEL)
> 5.0	Major Adverse	> 10.0	Major Adverse

Table 3.3 Noise Level Criteria and Actions (Construction Noise Assessment)

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect Level	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 50dB In urban areas noise levels exceed 55dB	No Action Required Complaints Relating to Construction Noise Unlikely
Lowest Observed Adverse Effect Level	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 60dB In urban areas noise levels exceed 65dB	Mitigate to achieve total noise levels below relevant category threshold
Significant Observed Adverse Effect	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 70dB In urban areas noise levels exceed 75dB	Mitigate to achieve total noise levels below relevant category threshold
Unacceptable Observed Adverse Effect	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 80dB In urban areas noise levels exceed 85dB	Mitigate to achieve total noise levels below relevant category threshold

Table 3.4 Noise Level Criteria and Actions (Live Music Assessment)

Effect Level	Noise Level Criteria	Action / Justification (NCCPENCC)
No Observed Adverse Effect	MNL of less than 15 dB above background noise levels over a 15 minute period (4 – 12 events per year)	No Action Required Within Guideline Values
Lowest Observed Adverse Effect Level (LOAEL)	MNL of up to 15 dB above background noise levels over a 15 minute period (4 – 12 events per year)	No Action Required Within Guideline Values
Significant Observed Adverse Effect Level (SOAEL)	MNL in excess of 65 dB over a 15 minute period (4 – 12 events per year)	Mitigate to achieve: MNL of 65 dB or below over a 15 minute period. MNL 15 dB above background noise levels or below.
Unacceptable Observed Adverse Effect Level (UOAEL)	MNL in excess of 75 dB over a 15 minute period (4 – 12 events per year)	Mitigate to achieve: MNL of 65 dB or below over a 15 minute period. MNL 15 dB above background noise levels or below.

*MNL = Music Noise Level

3.3 Vibration Assessment Criteria

BS5228-2:2009 +A1:2014, 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' provides the guidance for construction assessment.

Reference is also made to the potential for building damage that could as a result of the construction phases of the development. Guidance levels on acceptable values of transient vibration from BS 7385-2:1993 'Evaluation and Measurement for Vibration in Buildings' are referred to in the assessment.

3.3.1 Construction Assessment Criteria

BS 5228-2:2009 +A1:2014, "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration" provides a methodology for assessment and guidance with regard to mitigation of construction related vibration.

Vibration levels from potential piling activities associated with the proposed development of the application site have been assessed in accordance with the criteria to enable determination of if a significant effect is likely to occur at noise sensitive properties.

The calculation methodology set out in Annex E of BS 5228-2 for percussive piling has been used to determine the propagation of vibration.

$$v_{res} \leq k_p \left[\frac{\sqrt{W}}{r^{1.3}} \right]$$

Where

- v_{res} is the resultant PPV, in mms^{-1}
- k_p is the scaling factor of 3
- W is the nominal hammer energy, in joules
- r is the slope distance from the pile toe or tunnel crown, in meters

Table 3.5 below outlines the guidance with regard to the effect on human exposure to construction vibration.

Table 3.5 Guidance on effects of vibration levels

Vibration Level ^{a), B), C)}	Effect
0.14 mms^{-1}	Vibration may be just perceptible in the most sensitive situations for most vibration frequencies associates with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mms^{-1}	Vibration might just be perceptible in residential environments
1.0 mms^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated and explanation has been given to residents.
10 mms^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.
a) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient. b) A transfer function (which relates to an external level to an internal level) needs to be applied if only external measurements are available c) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.	

3.3.2 Building Damage

BS 7385-2:1993 *Evaluation and Measurement for Vibration in Buildings* provides guidance on acceptable values of transient vibration for avoidance of cosmetic damage to buildings as follows.

Table 3.6 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Component Particle Velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential of Light Commercial Type Buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 50 Hz and above

Table 3.6 above shows the limits for transient vibration, above which cosmetic damage could occur. Minor damage is possible at vibration magnitudes which are greater than twice those given above and major

damage to a building structure may occur at values greater than four times the tabulated values. PPV values of below 15 mm/s are unlikely to result in any damage to buildings.

Damage is classified into the following categories:

Table 3.7 Vibration Damage Classification

Damage	Description
Cosmetic	The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.
Minor	The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks.
Major	Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc

3.4 Assessment of Ecological Receptors

Additional consideration has been given to the effects of noise on identified species in the vicinity of the application site; Table 3.8 details the equivalent noise level criteria detailed within the TIDE Tidal River Development Toolbox 2016 for waterbird disturbance.

Table 3.8 Noise Disturbance Thresholds for Water Birds (from TIDE Tidal River Development Toolbox 2016)

Noise Disturbance Significance Level	Associated Noise Levels/Types
High Noise Level Effects	Sudden noise event of >60 dB Prolonged noise event of >72 dB
Moderate Noise Level Effects	Occasional noise events >55 dB Regular noise events of 60 – 72 dB Long term regular noise events of >72 dB where birds have become habituated
Low Noise Level Effects	Noise events of <55 dB

4.0 Assessment Methodology

4.1 Noise Modelling Methodology

The proposed development has been assessed using three-dimensional noise modelling of source noise levels at a large number of locations both horizontally and vertically using CADNA noise modelling software (as shown in Figure 4.1). This model is based on ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in the table below have been used.

Figure 4.1 CADNA Noise Model

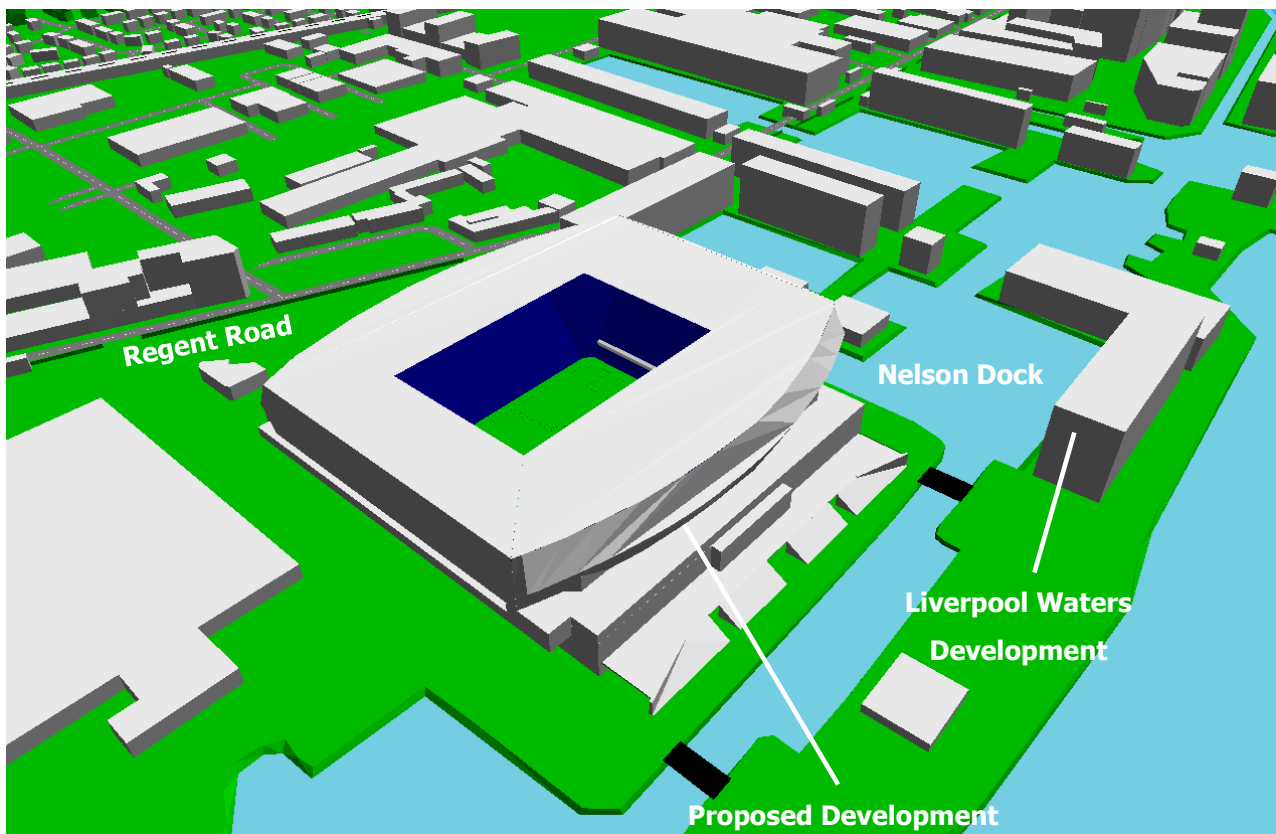


Table 4.1 Modelling Parameters Sources and Assumptions

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	Ordnance Survey	Ordnance Survey
Ground levels – other areas	Site Observations and Ordnance Survey	OS 1:25,000 contours and OS 1:10,000 spot heights.
Traffic data – main surrounding roads	Mott MacDonald	Provided by Mott MacDonald transport consultants
Building heights – around site	WYGE Observations	8 m height for two storey residential properties, and 4 m for Bungalows
Barrier heights	WYGE Observations	All existing barriers at 1.8 m. The top of the Grade II listed Regent Road wall level is 11.26m AOD. The Regent Road level (bottom of kerb) is 7.1m AOD at the northern access point, and 7.2m AOD at the southern access point.
Receptor positions	WYGE	1 m from façade, height of 1.5 m for ground floor, 4 m for first floor properties with ground floor or bungalow dormer windows, 3 m increments per storey. 1.5 m height for model grid and monitoring locations for validation.
Proposed Plans	Pattern Design	Application Drawings

It is acknowledged that a number of these assumptions will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are worst-case.

4.2 Model Input Data

4.2.1 Building Services Plant Noise Data

Plant designs and some specifications are detailed within the Ventilation and Refrigeration Statement produced by BuroHappold Engineering (updated statement submitted with the revised application). The statement details the location of building services plant serving the development (also reflected in the submitted roof plans). Noise levels for the proposed centralised chiller water system have been provided (detailed in Table 4.2) and is to be located to the northwest of the stadium.

Table 4.2 Noise Level Data for Central Chillers

Description	Sound Power Level	Sound Pressure Level @ 10m
5 x 1080kW Chillers	92.0 dB(A)	59.6 dB(A)

Noise levels associated with internal plant rooms have not been specified, therefore, vertical area sources have been defined to represent potential breakout associated with internal plant rooms for the proposed development within the designated plant areas. The maximum sound pressure levels of the vertical area sources at 1 and 3 metres were estimated in the model as a conditional maximum level that the noise levels at nearby receptors were predicted to meet the BS 4142 criteria.

4.2.2 Car Park Noise Data

Noise levels within the proposed car park have been based on measurements of a similar sized car park. It is understood there is surface car parking adjacent to the sea wall and to the west of the proposed water channel, which has been modelled as an area source.

- *Car Park* is 53.0 dB @ 1m

4.2.3 Matchday Operations: Crowd Footfall, Fan Zone, Food/Drink Vans, Stadium Crowd Noise and PA/VA System

For the purposes of this cumulative assessment, two scenarios have been assessed as detailed below:

- Scenario 1 – Matchday operations prior to kick-off: crowd footfall in and around the stadium, noise associated with the proposed fan zone, noise associated with food and drink vans, parking movements and use of the PA/VA system; and
- Scenario 2 – Matchday operations during match: crowd noise including contributions from fans cheering and chanting, a goal being scored and celebratory music and full use of the PA/VA system in and around the stadium.

Noise associated with crowd footfall within Scenario 1 has been included within the model as an area source across the application site. Noise levels associated with the fan zone and food/drink vans on the eastern part of the site adjacent to Regent Road have been included as point sources. A typical matchday event was measured at Goodison Park during a Premier League fixture where monitoring was undertaken which included source noise associated with footfall from fans, fan zone noise including amplified music, which were monitored prior to match kick-off, when movements around the stadium are at their highest.

Crowd Footfall

L_{Aeq,1hr} Noise Level

1 x 15mins at L_p 69.6 dB at 1 m distance

$$L_{Aeq(60 \text{ mins})} = 10\log(1/60)(900 \text{ sec} \times 10^{0.1 \times 69.6 \text{ dB}})$$

$$= 63.6 \text{ dB at 1m distance}$$

Fan Zone + Food/Drink Vans

L_{Aeq,1hr} Noise Level

1 x 15mins at L_p 80.1 dB at 1 m distance

$$L_{Aeq(60 \text{ mins})} = 10\log(1/60)(900 \text{ sec} \times 10^{0.1 \times 80.1 \text{ dB}})$$

$$= 74.1 \text{ dB at 1m distance}$$

Noise from the proposed stadium associated with Scenario 2 has been modelled to represent worst-case noise levels from crowds within the stands as measured at Goodison Park during a match, including contributions from fans cheering and chanting, a goal being scored and celebratory music. For the purposes of the assessment, the stands are modelled as area sources over the entire seating area, which are assumed to be at full capacity.

- *Crowd Noise Level* = 84 dB L_{Aeq} at 1m distance

Noise from the PA/VA system has been included, with FIFA Football Stadium Technical requirements specifying “the system shall provide maximum continuous sound levels of not less than 100 dB(A)”. The calculation below has averaged this level over a one-hour period. These systems have been modelled as point sources at locations and heights defined in drawing BMD01-BHE-ZX-XX-DR-YA-0300_P01 – 03001_P01.

L_{Aeq,1hr} Noise Level

1 x 30 sec at L_p 100 dB at 1 m distance

$$L_{Aeq(60 \text{ mins})} = 10\log(1/60)(30 \text{ sec} \times 10^{0.1 \times 100 \text{ dB}})$$

$$= 79.2 \text{ dB at 1m distance}$$

Noise from the outdoor broadcast compound has been included to represent noise from the manoeuvring and loading/unloading of broadcast vehicles; two point sources have been defined within the compound to represent continuous noise in both matchday scenarios (i.e. including contributions before, during and after the match).

L_{Aeq,1hr} Noise Level

1 x 5 minutes at Lp 69.5 dB at 3 m distance	(vehicle arriving and manoeuvring)
1 x 5 minutes at Lp 61.9 dB at 3 m distance	(vehicle unloading)
1 x 60 minutes at Lp 65.8 dB at 3 m distance	(plant contribution)

$$L_{Aeq(1hour)} = 10\log(1/60)(5 \text{ mins} \times 10^{0.1 \times 69.5 \text{ dB}} + 55 \text{ mins} \times 10^{0.1 \times 61.9 \text{ dB}} + 60 \text{ mins} \times 10^{0.1 \times 65.8 \text{ dB}})$$

$$= 67.8 \text{ dB at 3 m distance}$$

4.2.4 Stadium Concert Music Noise Data

The proposed development is expected to host up to four non-football events at full capacity per year. Noise limits from noise associated with live music events vary depending on the type of music. For the purposes of this worst-case assessment, noise limit guidance defined by the Health and Safety Executive (HSE) has been used. The guidance states that "HSE strongly recommends that the A-weighted equivalent continuous sound level over the duration of the event (Event L_{Aeq}) in any part of the audience should not exceed 107 dB." Noise from speakers has been modelled as a vertical area source across an indicative stage location to the north of the stadium so as to represent a worst-case scenario, facing towards the nearest existing and proposed sensitive receptors. In order to present a worst-case assessment; as well as the assessment of daytime hours, additional consideration has been given to the 23:00 – 02:00 period to account for unplanned overrunning events as part of this worst-case assessment.

4.2.5 Road Traffic Noise Data

All roads expected to make a significant contribution have been included within this assessment. Traffic flows and HGV percentages have been provided by Mott MacDonald transport consultants. Estimates of the vehicle speeds have been made based upon the speed restrictions currently in force in the area. The two scenarios detailed below have been considered for assessment, with the future year incorporating the proposed development (non-matchday with a conference event at the site), the Liverpool Waters scheme (LPA ref. 100/2424 – latest approved non-material amendment is ref. 19NM/1121) and other cumulative developments, so as to represent a worst-case scenario.

1. 2023 "Do Minimum (DM)" – without development opening year
2. 2023 "Do Something (DS)" – with development opening year (The Proposed Development [non-matchday with a conference event at the site] + Liverpool Waters + Cumulative Development)
3. 2028 "Do Minimum (DM)" – without development future year (DM)
4. 2028 "Do Something (DS)" – with development future year (The Proposed Development [non-matchday with a conference event at the site] + Liverpool Waters + Cumulative Development)

Table 4.3 Traffic Data

Road Link	Do Minimum 2023	HGV %	Do Something 2023	HGV %	Do Minimum 2028	HGV %	Do Something 2028	HGV %
Regent Road adjacent to Boundary Street	7207	2	10194	2	7607	2	11803	2
Regent Road adjacent to Blackstone Street	7243	2	10437	2	7645	2	12052	2
Regent Road adjacent to Walter Street	8545	2	11792	2	9019	2	13484	2
Regent Road adjacent to Saltney Street	5523	1	8980	1	5828	1	10504	1
Boundary Street West	1485	1	1683	1	1568	1	1766	1
Blackstone Street West	1715	2	2755	2	1810	2	2850	2
Walter Street	1189	1	2039	1	1255	1	2105	1
Derby Road North	21905	2	24232	2	23126	2	26061	2
Derby Road South	22025	2	24152	2	22652	2	25387	2
Great Howard Street North	23668	1	25776	1	24987	1	27703	1
Great Howard Street South	23677	1	26276	1	24996	1	28204	1
Boundary Street East	466	7	466	7	473	7	473	7
Blackstone Street East	3815	2	4163	2	4028	2	4376	2

4.2.6 Proposed Taxi Rank

The Transport Assessment proposes a taxi rank and taxi stands along Boundary Street, adjacent to sensitive residential receptors (illustratively shown on SK02b). There will be a pick-up/drop off point to the west of the railway line, away from sensitive receptors, however, the taxis will queue/park within designated areas adjacent to residential receptors to the east of the railway line. In a single hour before and after a matchday event, it is understood that there will be approximately 900 taxi vehicle movements in a peak, worst-case scenario. The calculation below assumes over an extreme worst-case period, there will be approximately 3600 vehicle movements over a 4-hour period during a match-day event.

L_{Aeq,4hr} Noise Level

1 x 32 sec at L_p 52.7 dB at 10 m distance

$$L_{Aeq(240 \text{ mins})} = 10 \log(1/240)(115200 \text{ sec} \times 10^{0.1 \times 52.7 \text{ dB}})$$

$$= 61.7 \text{ dB at 10m distance}$$

4.3 Construction Data

Information regarding noise emissions from equipment used during the construction phase has been obtained from Annex C of BS 5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. This annex presents a range of current sound level data on typical site equipment and common site activities.

This data is obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in the database are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The results are presented as un-weighted octave band activity L_{eq} levels, and overall A-weighted activity L_{eq} levels in dB. All sound pressure levels are standardized to 10 metres from the plant.

The items of plant and associated noise levels shown in Table 4.4 below has been used for the purposes of this assessment and consider the range of typical activities likely to be employed during the construction phase of the proposed development. These have been determined in conjunction with the Construction Management Plan produced by Laing O'Rourke. Items of mobile plant have been positioned in the areas on the development site that are close to existing sensitive receptors.

Table 4.4 Mobile Plant Construction Phase

Mobile Plant	BS 5228-1:2009 Annex C Ref.	Octave Band Sound Pressure Levels (Hz)								Model Input $L_{Aeq,1hour}$ at 10 m
		63	125	250	500	1K	2K	4K	8K	
Articulated Dump truck	Table C.2 No.33	85	87	77	75	76	73	69	62	81 dB
Tracked Excavator- loading truck	Table C.1 No.10	82	78	82	81	81	78	72	64	85 dB
Tracked Excavator	Table C.2 No.19	95	84	79	73	70	68	64	57	77 dB
Crane	Table C.4 No.48	82	77	80	76	66	66	56	50	76 dB
Delivery Trucks	Table C2 No.34	73	78	78	78	74	73	68	66	80 dB
Concrete Pumps	Table C4 No.28	79	80	73	72	69	68	59	53	75 dB
Hand-held Pneumatic Breaker	Table C.1 No. 6	83	83	81	74	73	76	78	77	83 dB
Percussive Piling Rig	Table C.3 No.1	82	82	82	89	83	78	75	70	89 dB
Road Sweeper	Table C.4 No.90	80	75	69	75	71	67	61	58	76 dB
Angle Grinding (Power Tools)	Table C.4 No.93	57	51	52	60	70	77	73	73	80 dB
Concrete Mixer Truck	Table C.4 No.20	83	74	66	69	70	78	60	55	80 dB
Lifting Platform	Table C.4 No.57	78	76	62	63	60	59	58	49	67 dB
Water Pump (diesel)	Table C.4 No.88	70	65	66	64	64	63	56	46	68 dB
Dredger	Table C.7 No. 2	83	91	80	78	78	73	66	58	82 dB

4.4 Sensitive Receptors

The tables below summarise receptor locations that have been selected to represent worst-case existing and future residential receptors with respect to construction, site related traffic noise and direct noise from the site. The locations of the receptors are shown on SK02a – SK02b in Appendix B. Ecological receptors have

been also been assessed at regular intervals from the site boundary which are illustratively shown on SK02c in Appendix B.

Table 4.5 Existing Residential Receptor Locations (Construction & Operational Noise)

Ref.	Description	Closest Source (Operational)	Approximate Distance to Source (m) Construction/Operation	Height (m)
Existing Receptors				
R01	76 Boundary Street	Matchday Operations	442.0/442.0	1.5
R02	2 St. Albans Court	Matchday Operations	489.0/475.0	1.5
R03	30 Snowdon Lane	Matchday Operations	463.0/463.0	1.5
R04	31 Houlgrave Road	Matchday Operations	475.0/472.0	1.5
R05	52 Colin Drive	Matchday Operations	535.0/535.0	1.5
R06	Titanic Hotel, Stanley Dock, Regent Road	Matchday Operations	214.0/225.0	8.0
R07	27 Egremont Promenade	Matchday Operations	1428.0/1428.0	1.5
R08	40 Egremont Promenade	Matchday Operations	1472.0/1455.0	1.5
R09	Mariners' Park Care Home, Royden Avenue	Matchday Operations	1590.0/1569.0	1.5
R10	62 Radnor Drive	Matchday Operations	1759.0/1751.0	1.5
R11	62 Regent Road	Matchday Operations	16.0/16.0	1.5
Proposed Receptors				
PR1	Proposed Liverpool Waters Development	Matchday Operations	50.0/20.0	19.0
PR2	Proposed Liverpool Waters Development	Matchday Operations	148.0/61.0	19.0
PR3	Proposed Liverpool Waters Development	Matchday Operations	49.0/58.0	4.0
PR4	Proposed Liverpool Waters Development	Matchday Operations	48.0/54.0	4.0
PR5	Proposed Liverpool Waters Development	Matchday Operations	117.0/83.0	14.0
PR6	Proposed Liverpool Waters Development	Matchday Operations	34.0/27.0	14.0
PR7	Proposed Liverpool Waters Development	Matchday Operations	162.0/133.0	10.0
PR8	Proposed Liverpool Waters Development	Matchday Operations	16.0/140.0	16.0
PR9	Proposed Stanley Dock Apartments	Matchday Operations	373.0/345.0	4.0
PR10	Proposed Hotel – Regent Road (LPA ref. 20F/0217)	Matchday Operations	16.0/16.0	4.0
PR11	Proposed Lightbody Street Development (LPA ref. 20F/1947)	Matchday Operations	328.0/328.0	10.0

Table 4.6 Receptor Locations – Traffic Noise Assessment

Ref.	Description	Closest Source	Approximate distance to closest source (m)	Height (m)
TR01	92 Boundary Street	Boundary Street	15.0	4.0
TR02	76 Boundary Street	Boundary Street	25.0	4.0
TR03	2 St. Albans Court	Blackstone Street East	121.0	4.0
TR04	30 Snowdon Lane	Great Howard Street N	199.0	4.0
TR05	31 Houlgrave Road	Great Howard Street S	179.0	4.0
TR06	52 Colin Drive	Great Howard Street S	158.0	4.0
TR07	5 O'Reilly Court	Great Howard Street S	172.0	4.0
TR08	10 Jack McBain Court	Great Howard Street S	162.0	4.0
TR09	Titanic Hotel, Stanley Dock, Regent Road	Regent Road	28.0	4.0
TR10	62 Regent Road	Regent Road	6.0	4.0

Table 4.7 Receptor Locations – Ecological Assessment

Ref.	Description	Height (m)
EC01	50m west from site boundary	0.2
EC02	100m west from site boundary	0.2
EC03	150m west from site boundary	0.2
EC04	200m west from site boundary	0.2
EC05	250m west from site boundary	0.2
EC06	300m west from site boundary	0.2
EC07	350m west from site boundary	0.2
EC08	400m west from site boundary	0.2
EC09	450m west from site boundary	0.2
EC10	500m west from site boundary	0.2
EC11	50m north from site boundary	0.2
EC12	100m north from site boundary	0.2
EC13	150m north from site boundary	0.2
EC14	200m north from site boundary	0.2
EC15	250m north from site boundary	0.2
EC16	300m north from site boundary	0.2
EC17	350m north from site boundary	0.2
EC18	400m north from site boundary	0.2
EC19	450m north from site boundary	0.2
EC20	500m north from site boundary	0.2
EC21	50m south from site boundary	0.2
EC22	100m south from site boundary	0.2
EC23	150m south from site boundary	0.2
EC24	200m south from site boundary	0.2
EC25	250m south from site boundary	0.2
EC26	300m south from site boundary	0.2
EC27	350m south from site boundary	0.2
EC28	400m south from site boundary	0.2
EC29	450m south from site boundary	0.2
EC30	500m south from site boundary	0.2

4.5 Tranquillity Rating

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). By reference to these maps the development is assessed as falling into Zone 1.

5.0 Noise Survey

5.1 Noise Survey Methodology

The monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on and around the application site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Norsonic 140	Building Acoustics Analyser	s/n	1402989
Norsonic 1251	Sound Calibrator	s/n	31043
Rion NL-52	Environmental Noise Analyser (WYG15)	s/n	620858
Rion NL-52	Environmental Noise Analyser (WYG17)	s/n	1043466
Rion NL-52	Environmental Noise Analyser (WYG20)	s/n	253702
Rion NC-74	Sound Calibrator	s/n	35046823

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at twelve locations (as specified in the following table and shown in SK01 of Appendix B) from Friday 20th April 2018 to Tuesday 1st May 2018. Attended short-term measurements were undertaken at eleven locations during the day, evening and night-time periods on a weekday, a Saturday and a Sunday with one additional location being measured unattended over a 263-hour period. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*. Weather conditions during the survey period were observed as being dry with scattered showers. Anemometer readings confirmed that wind speeds were less than 5 ms⁻¹ at all times during the attended survey.

Table 5.1 Noise Monitoring Locations

Ref	Description
LT1	East of Gibson House on embankment above Egremont Promenade
ST1	On Bramley Moore Dock southwest of Northwest Sand & Ballast Co Ltd building
ST1a	On Regent Road, adjacent to 35 Regent Road
ST2	Adjacent to 93 Regent Road
ST3	Southwest of 60-61 Regent Road
ST4	North of Titanic Hotel, Walter Street
ST5	At the junction of Regent Road and Dublin Street northwest of B&B
ST6	Outside 70 Snowdon Lane
ST7	At junction of A504 Boundary Street and Barmouth Way
ST8	Atlantic Park east of A565 Great Howard Street
ST9	On Seacombe Promenade, east of 12 Wilson Road
ST10	On Egremont Promenade, east of 62 Radnor Drive
ST11	East of 10 Oakland Vale, on Magazine Promenade

5.2 Noise Survey Results

The ambient noise climate of the area is dominated by road traffic noise on Regent Road including a high proportion of HGVs. The A565, A5054 and other smaller roads including Walter Street and Barmouth Way also make contributions to the noise climate. Other transport sources include passing trains on the railway to the east of the site approximately 420m away and occasional vessels on the River Mersey. The area is largely industrial and as such there are a number of industrial activities contributing towards the noise climate including unloading noise and HGV movements on Bramley Moore Dock, Wellington Dock and other businesses in the area, plant and a turbine on the waste water treatment works site and plant from other businesses including restaurants and hotels in the wider study area.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period).

Table 5.2 Meteorological Conditions during the Survey

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Weekday Day						
ST1 Weekday Day	20/04/2018 12:05	14.0	1-3	NW	4	Distant road traffic noise on Regent Road.
ST1a Weekday Day	30/04/2018 12:42	11.0	1-2	N	4	Road traffic noise including HGVs (Regent Road), forklifts in docks.
ST2 Weekday Day	30/04/2018 12:50	11.0	3-4	NN	4	Road traffic noise (Regent Road), occasional dockland activity.
ST3 Weekday Day	30/04/2018 13:11	11.0	4-5	NN	4	Road traffic noise (Regent Road), timber yard and dock activity.

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST4 Weekday Day	30/04/2018 13:01	11.0	1-2	N	4	Road traffic noise (Regent Road), distant plant.
ST5 Weekday Day	01/05/2018 10:46	12.0	1-2	S	4	Road traffic noise (Regent Road), aircraft, dockland activity.
ST6 Weekday Day	30/04/2018 13:30	11.0	3-4	N	4	Distant road traffic noise (A5054, A565).
ST7 Weekday Day	30/04/2018 13:07	11.0	3-4	N	4	Road traffic noise (A5054, Barmouth Way), distant roadworks
ST8 Weekday Day	30/04/2018 12:45	10.0	3-4	N	4	Road traffic noise (A565).
ST9 Weekday Day	30/04/2018 16:22	11.0	3-4	N	3	Waves crashing, pedestrians.
ST10 Weekday Day	30/04/2018 16:29	11.0	3-4	N	3	Wave noise, sea birds, aircraft, pedestrians on beach, boats.
ST11 Weekday Day	30/04/2018 16:24	11.0	1-3	N	3	Pedestrian footfall, distant plant, passing seagulls.
Weekday Evening						
ST1 Weekday Evening	30/04/2018 21:18	10.0	3-4	N	3	Seagulls, road traffic noise (Regent Road), waves.
ST1a Weekday Evening	30/04/2018 21:39	10.0	1-2	N	2	Road traffic noise (Regent Road), turbines audible.
ST2 Weekday Evening	30/04/2018 21:18	9.0	3-4	NW	2	Road traffic noise (Regent Road), seagulls, sweeping noise from wind turbines.
ST3 Weekday Evening	30/04/2018 21:58	9.0	1-2	N	2	Road traffic noise including tankers (Regent Road), plant.
ST4 Weekday Evening	30/04/2018 21:57	9.0	2-3	NW	1	Plant noise, man loading van, regular seagull noise, distant aircraft
ST5 Weekday Evening	30/04/2018 21:38	9.0	2-3	NW	1	Road traffic noise (regent Road), occasional seagull, pedestrian and aircraft
ST6 Weekday Evening	30/04/2018 21:53	9.0	1-2	NW	0	Road traffic noise (A5054, A565).
ST7 Weekday Evening	30/04/2018 21:32	9.0	2-3	NW	0	Road traffic noise (A565).
ST8 Weekday Evening	30/04/2018 21:13	9.0	3-4	NW	0	Road traffic noise (A59).
ST9 Weekday Evening	30/04/2018 22:38	8.0	1-2	NW	0	Waves hitting seawall, distant dockland noise.
ST10 Weekday Evening	30/04/2018 22:37	8.0	1-2	NW	1	Water, distant hum from boat.
ST11 Weekday Evening	30/04/2018 22:42	8.0	1-2	NW	2	Waves crashing against beach (tide in).
Weekday Night						
ST1 Weekday Night	30/04/2018 23:59	7.0	1-3	NW	2	Waves, seagulls, gates rattling, tankers.
ST1a Weekday Night	01/05/2018 00:56	7.0	2-3	W	1	Road traffic noise (Regent Road), turbine noise.
ST2 Weekday Night	01/05/2018 00:59	7.0	0-2	NW	2	Road traffic noise (Regent Road), plant noise.
ST3 Weekday Night	01/05/2018 01:10	7.0	1-2	NW	1	Road traffic noise (Regent Road), plant noise from docks.
ST4 Weekday Night	01/05/2018 00:27	7.0	1-2	W	1	Plant noise, occasional road traffic noise (Regent Road), occasional seagull.

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST5 Weekday Night	30/04/2018 23:54	7.0	2-3	NW	1	Occasional road traffic noise (Regent Road), aircraft, noise from gulls.
ST6 Weekday Night	01/05/2018 00:39	7.0	1-2	NW	1	Road traffic noise (A5054).
ST7 Weekday Night	01/05/2018 00:17	7.0	1-2	NW	1	Road traffic noise (A5054).
ST8 Weekday Night	30/04/2018 23:52	7.0	1-2	NW	1	Road traffic noise (A565), plant noise.
ST9 Weekday Night	30/04/2018 23:01	8.0	1-2	NW	1	Waves, distant dockland noise.
ST10 Weekday Night	30/04/2018 23:00	8.0	1-2	NW	1	Waves crashing, distant hum of boats.
ST11 Weekday Night	30/04/2018 23:01	8.0	0-1	NW	2	Waves, ships passing.
Saturday Early Afternoon/ Mid Afternoon						
ST1a Saturday Early/Mid Afternoon	21/04/2018 13:00	17.0	1-2	SE	1	Road traffic noise (Regent Road), vehicles in Terry's Timber.
ST2 Saturday Early/Mid Afternoon	21/04/2018 16:19	18.0	2-3	SE	0	Road traffic noise (Regent Road), aircraft.
ST2 Saturday Early/Mid Afternoon	21/04/2018 13:21	17.0	1-2	SE	1	Road traffic noise Regent Road and hum from turbine.
ST3 Saturday Early/Mid Afternoon	21/04/2018 12:57	20.0	1-2	SE	1	Road traffic noise (Regent Road, Blackstone Street), plant noise, seagulls, boats.
ST3 Saturday Early/Mid Afternoon	21/04/2018 16:15	20.0	1-2	SE	1	Road traffic noise on Regent Road, pedestrian footfall and shouting from outside pub in the distance.
ST4 Saturday Early/Mid Afternoon	21/04/2018 13:19	20.0	1-2	SE	1	Road traffic noise (Regent Road, Walton Street), pedestrians, hotel noise, plant noise.
ST4 Saturday Early/Mid Afternoon	21/04/2018 13:47	20.0	1-2	SE	1	Road traffic noise from Regent Road and A565, plant from substation.
ST5 Saturday Early/Mid Afternoon	21/04/2018 13:40	20.0	1-2	SE	1	Road traffic noise (Regent Road), occasional road traffic noise (Dublin Street), aircraft, low hum in distance.
ST5 Saturday Early/Mid Afternoon	21/04/2018 16:13	18.0	1-2	SE	1	Road traffic noise from Regent Road.
ST6 Saturday Early/Mid Afternoon	21/04/2018 13:42	20.0	1-2	SE	0	Aircraft, birdsong, distant road traffic noise, occasional train.
ST7 Saturday Early/Mid Afternoon	21/04/2018 13:23	20.0	0-1	SE	0	Road traffic noise (Boundary Street, Barmouth Way), occasional train.
ST8 Saturday Early/Mid Afternoon	21/04/2018 13:03	20.0	3-4	SE	0	Road traffic noise (A565).
ST9 Saturday Early/Mid Afternoon	21/04/2018 12:04	20.0	3-4	SE	0	Waves crashing, pedestrians, aircraft, cyclists and birdsong.
ST10 Saturday Early/Mid Afternoon	21/04/2018 12:04	20.0	2-3	SE	1	Pedestrians, aircraft, construction activity, waves.

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST11 Saturday Early/Mid Afternoon	21/04/2018 12:10	20.0	1-3	SE	1	Pedestrians, cyclists, distant industrial hum.
Saturday Evening						
ST1a Saturday Evening	21/04/2018 20:20	18.0	1-2	S	4	Music and talking breakout from pub, road traffic noise on Regent Road, taxi's dropping off at pub.
ST1a Saturday Evening	21/04/2018 21:01	17.0	1-2	S	3	Pub noise, road traffic noise (Regent Road), occasional seagulls, passengers loaded into taxis.
ST2 Saturday Evening	21/04/2018 20:56	17.00	0-2	S	2	Road traffic noise on regent Road, seagulls, hum from plant from wastewater treatment works/turbine.
ST3 Saturday Evening	21/04/2018 20:37	17.0	0-2	S	2	Road traffic noise on regent Road and Blackstone Street, seagulls.
ST4 Saturday Evening	21/04/2018 20:37	18.0	0-1	S	3	Road traffic noise from Regent Road, pedestrian footfall, plant noise, seagulls.
ST5 Saturday Evening	21/04/2018 20:17	18.0	0-1	S	2	Road traffic noise on Regent Road, pedestrian footfall, distant aircraft. seagulls.
ST6 Saturday Evening	21/04/2018 20:36	18.0	1-2	S	4	Distant road traffic noise, aircraft, birdsong, passing trains.
ST7 Saturday Evening	21/04/2018 20:14	18.0	1-2	S	4	Road traffic noise (A5054, Boundary Street, occasionally Barmouth Way).
ST8 Saturday Evening	21/04/2018 21:02	17.0	0-1	S	4	Road traffic noise (A565), roof plant on Tai Pan restaurant.
ST9 Saturday Evening	21/04/2018 19:38	18.0	2-3	S	4	Wave noise, pedestrian footfall, distant ferry engine, seagulls.
ST10 Saturday Evening	21/04/2018 19:30	18.0	1-2	S	3	Wave noise, pedestrian footfall and cyclists, distant aircraft.
ST11 Saturday Evening	21/04/2018 19:37	18.0	0-2	S	4	Footfall, passing cyclists, distant waves, industrial hum from across Mersey River.
Sunday Early Afternoon						
ST1a Sunday Early Afternoon	22/04/2018 13:45	14.0	1-2	W	6	Road traffic noise (Regent Road), occasional pub activity.
ST1a Sunday Early Afternoon	22/04/2018 13:04	14.0	1-2	W	5	Road traffic noise (Regent Road), distant plant noise from Terry's Timber.
ST2 Sunday Early Afternoon	22/04/2018 13:22	14.0	0-2	W	6	Road traffic noise (Regent Road), hum from treatment works.
ST2 Sunday Early Afternoon	22/04/2018 13:59	14.0	1-3	W	7	Road traffic noise on Regent Road.
ST3 Sunday Early Afternoon	22/04/2018 14:00	14.0	1-2	W	8	Road traffic noise on Regent Road and A5054.
ST3 Sunday Early Afternoon	22/04/2018 13:39	14.0	1-3	W	6	Road traffic noise (Regent Road).
ST4 Sunday Early Afternoon	22/04/2018 13:23	14.0	2-3	W	6	Road traffic noise (Regent Road), occasional pedestrians and seagull, plant noise, hotel activity.

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST4 Sunday Early Afternoon	22/04/2018 14:05	14.0	2-3	W	6	Plant noise, road traffic noise (Regent Road), occasional hotel activity, seagull and aircraft.
ST5 Sunday Early Afternoon	22/04/2018 13:01	14.0	1-2	W	6	Road traffic noise (Regent Road), seagull, occasional aircraft.
ST5 Sunday Early Afternoon	22/04/2018 14:18	14.0	1-2	W	6	Road traffic noise (Regent Road).
ST6 Sunday Early Afternoon	22/04/2018 12:59	14.0	0-1	W	2	Aircraft noise, local road traffic noise.
ST7 Sunday Early Afternoon	22/04/2018 13:20	14.0	1-2	W	6	Road traffic noise (Boundary Street, Barmouth Way), occasional train.
ST8 Sunday Early Afternoon	22/04/2018 13:39	14.0	2-3	W	6	Road traffic noise (A565), Tai Pan plant.
ST9 Sunday Early Afternoon	22/04/2018 12:14	14.0	1-2	W	7	Aircraft, pedestrians, waves crashing, birdsong.
ST10 Sunday Early Afternoon	22/04/2018 12:12	14.0	1-2	W	7	People chanting, birds, occasional aircraft, occasional small boat.
ST11 Sunday Early Afternoon	22/04/2018 12:17	14.0	1-2	W	7	Football, distant plant noise, cyclists.
Sunday Late Afternoon						
ST1a Sunday Late Afternoon	22/04/2018 18:17	13.0	0-2	W	2	Road traffic noise (Regent Road), pedestrians.
ST1a Sunday Late Afternoon	22/04/2018 17:37	13.0	0-1	W	2	Road traffic noise (Regent Road).
ST2 Sunday Late Afternoon	22/04/2018 17:02	13.0	0-2	W	2	Road traffic noise (Regent Road), hum from treatment works.
ST2 Sunday Late Afternoon	22/04/2018 17:57	13.0	1-2	W	2	Road traffic noise (Regent Road), hum from treatment works.
ST3 Sunday Late Afternoon	22/04/2018 17:57	13.0	1-2	W	2	Road traffic noise (Regent Road, A5054), occasional seagull noise.
ST4 Sunday Late Afternoon	22/04/2018 17:53	13.0	1-2	W	2	Plant noise, road traffic noise (Regent Road), seagulls, occasional hotel activity and pedestrians.
ST4 Sunday Late Afternoon	22/04/2018 18:12	13.0	1-2	W	3	Road traffic noise on Regent Road, plant on hotel roof.
ST5 Sunday Late Afternoon	22/04/2018 17:08	13.0	2-3	W	3	Road traffic noise (Regent Road), seagulls, occasional aircraft.
ST5 Sunday Late Afternoon	22/04/2018 17:33	13.0	2-3	W	2	Road traffic noise (Regent Road), occasional seagull, plane and pedestrians.
ST6 Sunday Late Afternoon	22/04/2018 16:56	13.0	0-1	W	2	Aircraft, road traffic noise.
ST7 Sunday Late Afternoon	22/04/2018 17:17	13.0	0-1	W	2	Road traffic noise (Boundary Lane, Barmouth Way).

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST8 Sunday Late Afternoon	22/04/2018 17:37	13.0	1-2	W	2	Road traffic noise (A565), Tai Pan Plant.
ST9 Sunday Late Afternoon	22/04/2018 18:57	13.0	0-1	W	4	Aircraft, birdsong, pedestrians, waves crashing.
ST10 Sunday Late Afternoon	22/04/2018 18:58	13.0	0-1	W	2	Waves noise, cyclists and footfall, occasional seagull noise.
ST11 Sunday Late Afternoon	22/04/2018 19:05	13.0	0-1	W	2	Waves noise, footfall, kids playing on beach, aircraft.
Sunday Night						
ST1a Sunday Night	23/04/2018 01:12	11.0	3-4	W	6	Occasional road traffic on Regent Road. Turbine audible. Occasional seagull noise.
ST2 Sunday Night	23/04/2018 00:27	12.0	2-4	W	6	Plant from Wastewater treatment works and turbine, occasional road traffic noise on Regent Road.
ST3 Sunday Night	23/04/2018 00:47	11.0	1-3	W	6	Occasional road traffic noise on Regent Road.
ST4 Sunday Night	23/04/2018 00:48	11.0	2-3	W	6	Occasional vehicle on Regent Road, occasional seagull, distant aircraft.
ST5 Sunday Night	23/04/2018 00:27	12.0	3-4	W	6	Road traffic noise on Regent Road.
ST6 Sunday Night	23/04/2018 00:33	11.0	1-2	W	6	Distant road traffic noise, Plant at Tai Pan.
ST7 Sunday Night	23/04/2018 00:51	11.0	1-2	W	6	Plant at Tai Pan, occasional road traffic noise on Boundary Lane.
ST8 Sunday Night	23/04/2018 01:04	11.0	2-4	W	6	Road traffic noise on A565, delivery unloading at Alaco, plant and turbine audible.
ST9 Sunday Night	23/04/2018 01:52	11.0	1-2	W	6	Wave noise.
ST10 Sunday Night	23/04/2018 01:50	11.0	1-2	W	6	Waves noise from River Mersey.
ST11 Sunday Night	23/04/2018 01:57	11.0	0-1	W	6	Wave noise, distant industrial hum just audible, 2 vessels moving on Mersey.

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2×10^{-5} Pa). For the long-term (LT) location, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Table 5.3 Results of Baseline Noise Monitoring Survey (Average Levels)

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekday Day 07:00 - 23:00	111 Hours	20/04/2018 – 01/05/2018 07:00 - 23:00	LT1	52.3	98.6	30.5	51.3	45.0
Weekday Night 23:00 – 07:00	56 Hours	20/04/2018 – 01/05/2018 23:00 - 07:00		52.7	82.3	27.9	48.0	41.0
Weekend Day 07:00 - 23:00	64 Hours	20/04/2018 – 01/05/2018 07:00 - 23:00		51.2	83.9	32.1	50.8	44.0

Period	Duration (T)	Monitoring Date and Times	Location	L _{Aeq,T} (dB)	L _{Amax,T} (dB)	L _{Amin,T} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
Weekend Night 23:00 – 07:00	32 Hours	20/04/2018 – 01/05/2018 23:00 - 07:00		52.8	84.2	31.3	48.0	44.0
Weekday								
Weekday Day 07:00 – 19:00	15 Mins	20/04/2018 12:05	ST1	47.4	64.7	41.1	49.3	43.5
	15 Mins	30/04/2018 12:42	ST1a	72.5	95.5	53.9	74.8	62.2
	15 Mins	30/04/2018 12:50	ST2	74.4	95.1	54.5	77.2	60.7
	15 Mins	30/04/2018 13:11	ST3	71.2	89.3	54.4	74.5	61.6
	15 Mins	30/04/2018 13:01	ST4	58.6	78.2	48.0	59.3	50.8
	15 Mins	01/05/2018 10:46	ST5	72.2	90.2	54.8	75.5	61.7
	15 Mins	30/04/2018 13:30	ST6	50.7	67.6	42.7	53.4	45.7
	15 Mins	30/04/2018 13:07	ST7	65.4	80.7	50.3	68.9	55.0
	15 Mins	30/04/2018 12:45	ST8	65.1	79.4	52.1	68.5	56.9
	15 Mins	30/04/2018 16:22	ST9	57.6	84.8	50.9	58.7	53.3
	15 Mins	30/04/2018 16:29	ST10	55.0	72.9	40.0	56.6	50.2
	15 Mins	30/04/2018 16:24	ST11	50.7	68.2	45.4	51.1	47.4
Weekday Evening 19:00 - 23:00	15 Mins	30/04/2018 21:18	ST1	52.2	75.3	40.8	55.8	43.5
	15 Mins	30/04/2018 21:39	ST1a	68.4	86.3	42.5	72.5	46.0
	15 Mins	30/04/2018 21:18	ST2	66.6	85.7	49.9	70.3	54.3
	15 Mins	30/04/2018 21:58	ST3	67.2	80.8	46.3	72.2	49.9
	15 Mins	30/04/2018 21:57	ST4	55.7	76.5	48.6	58.2	50.6
	15 Mins	30/04/2018 21:38	ST5	73.3	102.0	39.5	70.7	45.1
	15 Mins	30/04/2018 21:53	ST6	48.1	68.0	36.7	47.7	38.9
	15 Mins	30/04/2018 21:32	ST7	61.5	75.6	44.6	66.0	47.9
	15 Mins	30/04/2018 21:13	ST8	59.5	73.5	47.4	63.6	50.8
	15 Mins	30/04/2018 22:38	ST9	53.0	65.0	47.4	55.7	49.8
	15 Mins	30/04/2018 22:37	ST10	62.2	66.4	40.1	63.9	60.3
	15 Mins	30/04/2018 22:42	ST11	49.7	63.5	45.2	51.1	47.8
Weekday Night 23:00 – 07:00	15 Mins	30/04/2018 23:59	ST1	47.6	63.3	38.7	50.9	41.2
	15 Mins	01/05/2018 00:56	ST1a	59.1	77.9	40.4	56.6	42.8
	15 Mins	01/05/2018 00:59	ST2	58.5	78.5	48.2	59.7	50.4
	15 Mins	01/05/2018 01:10	ST3	61.4	82.5	44.6	62.2	45.8
	15 Mins	01/05/2018 00:27	ST4	51.7	67.6	40.3	52.6	49.0
	15 Mins	30/04/2018 23:54	ST5	69.5	98.8	40.6	67.9	43.6
	15 Mins	01/05/2018 00:39	ST6	42.3	73.3	35.4	43.5	37.7
	15 Mins	01/05/2018 00:17	ST7	56.3	74.7	41.5	58.3	43.1
	15 Mins	30/04/2018 23:52	ST8	59.0	71.7	47.0	63.8	49.1
	15 Mins	30/04/2018 23:01	ST9	47.7	55.4	43.4	49.1	45.7
	15 Mins	30/04/2018 23:00	ST10	55.2	66.7	47.2	58.3	50.6
	15 Mins	30/04/2018 23:01	ST11	47.7	62.5	43.6	49.0	46.1
Saturday								
Saturday Afternoon 12:00- 15:00	15 Mins	21/04/2018 13:00	ST1a	69.9	84.4	46.1	73.6	56.8
	15 Mins	21/04/2018 16:19	ST2	70.0	82.7	49.7	73.6	57.4
	15 Mins	21/04/2018 13:21	ST2	71.0	83.0	47.7	75.0	57.6
	15 Mins	21/04/2018 12:57	ST3	69.6	81.5	46.7	73.5	58.3

Period	Duration (T)	Monitoring Date and Times	Location	L _{Aeq,T} (dB)	L _{Amax,T} (dB)	L _{Amin,T} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
	15 Mins	21/04/2018 16:15	ST3	69.7	80.9	41.2	73.4	58.7
	15 Mins	21/04/2018 13:19	ST4	55.1	74.3	40.3	55.0	47.9
	15 Mins	21/04/2018 13:47	ST4	56.3	79.8	46.5	56.6	50.1
	15 Mins	21/04/2018 13:40	ST5	71.5	85.2	44.7	75.0	59.6
	15 Mins	21/04/2018 16:13	ST5	73.3	99.5	49.0	75.8	63.6
	15 Mins	21/04/2018 13:42	ST6	49.7	69.2	41.2	50.7	44.0
	15 Mins	21/04/2018 13:23	ST7	66.4	82.1	46.2	70.4	53.2
	15 Mins	21/04/2018 13:03	ST8	67.5	78.2	48.9	72.1	53.1
	15 Mins	21/04/2018 12:04	ST9	58.7	86.7	44.0	51.5	46.4
	15 Mins	21/04/2018 12:04	ST10	51.4	72.3	43.9	52.8	45.7
	15 Mins	21/04/2018 12:10	ST11	50.3	71.4	43.2	52.9	45.7
Saturday Evening 19:00 – 22:00	15 Mins	21/04/2018 20:20	ST1a	65.8	78.7	43.5	70.9	50.8
	15 Mins	21/04/2018 21:01	ST1a	65.5	83.9	41.6	70.0	49.8
	15 Mins	21/04/2018 20:56	ST2	64.8	82.8	45.8	69.5	49.3
	15 Mins	21/04/2018 20:37	ST3	66.6	82.9	46.8	71.2	50.6
	15 Mins	21/04/2018 20:37	ST4	50.8	63.0	40.9	53.7	46.3
	15 Mins	21/04/2018 20:17	ST5	69.0	84.4	39.8	73.6	53.1
	15 Mins	21/04/2018 20:36	ST6	49.2	66.9	40.4	52.1	42.3
	15 Mins	21/04/2018 20:14	ST7	62.6	81.3	44.3	67.1	48.2
	15 Mins	21/04/2018 21:02	ST8	64.0	76.3	48.3	67.9	51.9
	15 Mins	21/04/2018 19:38	ST9	47.6	63.1	43.0	49.9	44.8
	15 Mins	21/04/2018 19:30	ST10	48.0	65.0	40.2	50.0	44.0
	15 Mins	21/04/2018 19:37	ST11	51.3	81.7	41.6	50.5	43.9
Sunday								
Sunday Early Afternoon/Mid Afternoon 12:00 – 15:00	15 Mins	22/04/2018 13:45	ST1a	70.6	78.0	40.8	74.2	60.1
	15 Mins	22/04/2018 13:04	ST1a	70.1	85.6	53.3	73.6	60.3
	15 Mins	22/04/2018 13:22	ST2	70.5	82.2	49.7	74.6	58.4
	15 Mins	22/04/2018 13:59	ST2	69.2	78.7	51.6	73.2	58.0
	15 Mins	22/04/2018 14:00	ST3	70.2	81.1	55.1	74.2	61.3
	15 Mins	22/04/2018 13:39	ST3	70.1	81.5	51.6	73.9	58.4
	15 Mins	22/04/2018 13:23	ST4	56.4	75.8	48.1	57.7	50.5
	15 Mins	22/04/2018 14:05	ST4	56.8	78.6	48.5	57.9	50.7
	15 Mins	22/04/2018 13:01	ST5	72.2	85.8	43.9	75.8	61.7
	15 Mins	22/04/2018 14:18	ST5	72.8	83.7	45.3	76.7	57.2
	15 Mins	22/04/2018 12:59	ST6	48.9	67.0	37.0	51.9	39.3
	15 Mins	22/04/2018 13:20	ST7	66.4	79.5	45.2	70.3	52.7
	15 Mins	22/04/2018 13:39	ST8	68.1	76.7	49.7	72.8	54.8
	15 Mins	22/04/2018 12:14	ST9	50.1	79.4	40.7	50.8	45.3
	15 Mins	22/04/2018 12:12	ST10	46.8	68.6	36.5	49.0	40.3
	15 Mins	22/04/2018 12:17	ST11	47.5	70.8	34.0	49.2	39.9
Sunday Late Afternoon 16:00 – 19:30	15 Mins	22/04/2018 18:17	ST1a	69.1	81.6	78.8	73.5	55.5
	15 Mins	22/04/2018 17:37	ST1a	68.2	80.6	43.0	72.8	54.8
	15 Mins	22/04/2018 17:02	ST2	69.9	82.2	51.6	74.3	57.4
	15 Mins	22/04/2018 17:57	ST2	68.5	80.8	49.8	73.0	55.6

Period	Duration (T)	Monitoring Date and Times	Location	L _{Aeq,T} (dB)	L _{Amax,T} (dB)	L _{Amin,T} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
	15 Mins	22/04/2018 17:57	ST3	69.0	80.0	44.7	73.3	52.5
	15 Mins	22/04/2018 17:53	ST4	57.2	76.3	44.3	55.7	49.6
	15 Mins	22/04/2018 18:12	ST4	58.2	79.2	46.9	57.0	49.5
	15 Mins	22/04/2018 17:08	ST5	71.8	86.7	43.1	75.7	56.8
	15 Mins	22/04/2018 17:33	ST5	70.2	84.7	41.0	75.0	51.8
	15 Mins	22/04/2018 16:56	ST6	48.5	70.6	38.2	50.0	41.5
	15 Mins	22/04/2018 17:17	ST7	63.8	81.1	43.4	68.5	47.4
	15 Mins	22/04/2018 17:37	ST8	67.1	80.2	46.5	71.8	51.0
	15 Mins	22/04/2018 18:57	ST9	51.3	73.9	36.9	52.0	41.0
	15 Mins	22/04/2018 18:58	ST10	52.0	65.8	43.9	53.5	49.1
	15 Mins	22/04/2018 19:05	ST11	54.6	87.0	37.9	51.7	42.2
Sunday Night 23:00 - 07:00	15 Mins	23/04/2018 01:12	ST1a	54.7	72.4	41.8	56.7	44.4
	15 Mins	23/04/2018 00:27	ST2	57.4	78.4	49.2	56.9	50.8
	15 Mins	23/04/2018 00:47	ST3	57.2	77.7	44.2	57.7	46.3
	15 Mins	23/04/2018 00:48	ST4	52.9	70.9	42.1	54.0	48.4
	15 Mins	23/04/2018 00:27	ST5	61.6	83.2	38.8	60.9	41.9
	15 Mins	23/04/2018 00:33	ST6	41.5	61.4	35.5	43.0	38.4
	15 Mins	23/04/2018 00:51	ST7	56.8	75.3	43.2	58.4	45.3
	15 Mins	23/04/2018 01:04	ST8	59.9	75.8	48.4	63.5	50.7
	15 Mins	23/04/2018 01:52	ST9	54.9	66.1	50.3	56.6	52.6
	15 Mins	23/04/2018 01:50	ST10	51.5	58.9	46.9	53.0	49.3
	15 Mins	23/04/2018 01:57	ST11	50.1	59.5	44.0	51.6	48.1

6.0 Assessment of Key Effects

6.1 Construction Noise Assessment

Noise levels from potential construction activity associated with the proposed development of the application site have been assessed in accordance with BS 5228 criteria which indicates if a significant effect is likely to occur at noise sensitive properties.

This assessment has been undertaken in order to establish the maximum external noise levels at neighbouring properties for the proposed construction activity of the site and whether typical plant and activities and those detailed within the Construction Management Statement by Laing O'Rourke will be within these levels. In order to present a worst-case assessment, the model assumes that all sources will be operating simultaneously across the application site (including piling). The assessment includes 2.4m solid hoarding around the site boundary, as detailed within the Construction Method Statement.

The table below shows predicted levels of construction noise at existing noise sensitive properties and the proposed residential dwellings (Nelson Dock – Liverpool Waters scheme) from cumulative sites for comparison with the BS 5228-1 recommended noise limit criteria of 75 dBA.

Table 6.1 Construction Noise Assessment Results (Fixed Limits Method)

Ref	Description	Construction Noise Level (dBA)	Criteria (dBA)	Within Recommended Fixed Noise Limit?
R01	76 Boundary Street	33.0	75.0	Yes
R02	2 St. Albans Court	36.7	75.0	Yes
R03	30 Snowdon Lane	32.5	75.0	Yes
R04	31 Houlgrave Road	31.4	75.0	Yes
R05	52 Colin Drive	32.7	75.0	Yes
R06	Titanic Hotel, Stanley Dock, Regent Road	44.8	75.0	Yes
R07	27 Egremont Promenade	41.7	75.0	Yes
R08	40 Egremont Promenade	41.5	75.0	Yes
R09	Mariners' Park Care Home, Royden Avenue	40.6	75.0	Yes
R10	62 Radnor Drive	38.9	75.0	Yes
R11	62 Regent Road	63.5	75.0	Yes
PR1	Proposed Liverpool Waters Development	71.9	75.0	Yes
PR2	Proposed Liverpool Waters Development	62.6	75.0	Yes
PR3	Proposed Liverpool Waters Development	63.7	75.0	Yes
PR4	Proposed Liverpool Waters Development	63.8	75.0	Yes
PR5	Proposed Liverpool Waters Development	61.7	75.0	Yes
PR6	Proposed Liverpool Waters Development	70.7	75.0	Yes
PR7	Proposed Liverpool Waters Development	62.2	75.0	Yes
PR8	Proposed Liverpool Waters Development	59.9	75.0	Yes
PR9	Proposed Stanley Dock Apartments	43.0	75.0	Yes
PR10	Proposed Hotel – Regent Road	66.5	75.0	Yes
PR11	Proposed Lightbody Street Development	49.5	75.0	Yes

All values are sound pressure levels in dB re: 2x 10⁻⁵ Pa.

The results indicate that the noise levels at the façades of the existing and proposed noise sensitive properties would be within the recommended criteria. Noise levels within the fixed limit criteria are likely to result in internal conditions where conversation would not be difficult.

6.2 Construction Vibration Assessment

Calculation of vibration levels resulting from piling activities were carried out to determine at what distance there could be impact from piling activities; Figure 6.1 below shows the expected reduction in levels over distance from the works.

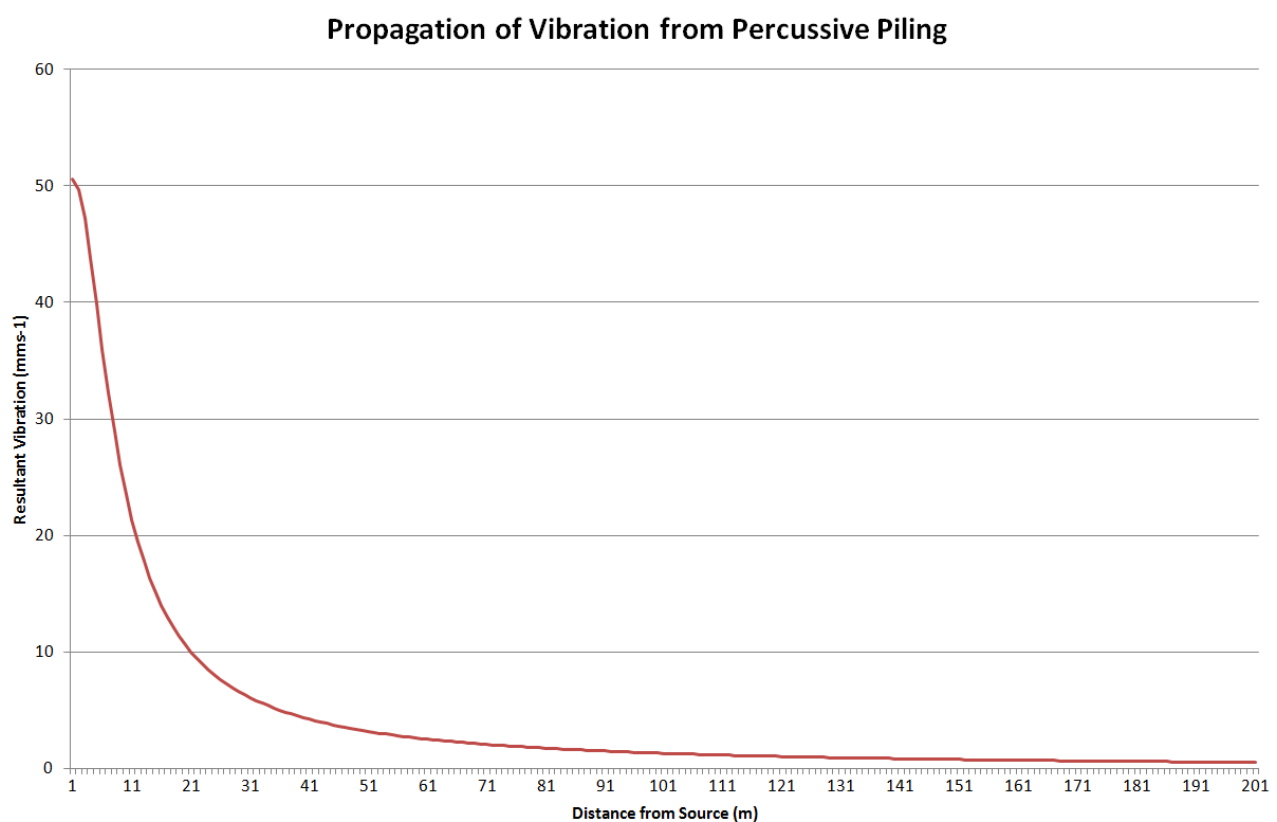


Figure 6.1 Graphical representation of the propagation of vibration from percussive piling

Comparison of the graph above with the criteria presented in Table 3.6, indicates that cosmetic damage to buildings is unlikely to occur beyond 14m.

With respect to the Grade II listed dock walls, Regent Road Wall and Hydraulic Tower immediately adjacent to the application site, the Contractor's Construction Management Plan and Dock Infill Methodology identify that displacement and vibration monitoring equipment will be undertaken on the dock walls during construction works with baseline monitoring to be undertaken immediately (minimum 2 days) prior to works starting on site to establish appropriate monitoring trigger levels for vibration and displacement.

The closest potential sensitive property is identified as being approximately 16m from any on-site activities, at the proposed Liverpool Waters Development, which is considered to represent a worst-case scenario with respect to location and phasing of works given its proximity to the development site.

The approved construction phasing parameters plan for the Liverpool Waters consented scheme indicates that the Central Docks area is proposed to be constructed between 2020-2036; Clarence Docks Area is proposed to be constructed between 2031-2036; and Northern Docks (Bramley-Moore Dock and Nelson Dock) is proposed to be constructed between 2036-2041. On this basis, construction of the Liverpool Waters scheme is not likely to coincide with construction of the current proposals. Therefore, the closest existing sensitive receptor is R11 (Regent Road), which is also identified as being 16m away from the site boundary. This distance is beyond the threshold where cosmetic damage may occur. As such no significant effects with respect to vibration are expected to occur.

6.3 BS4142 Assessment (Building Services Plant)

This assessment has been undertaken to establish the maximum external noise levels from the proposed building services plant. The assessment compares the predicted worst-case breakout noise levels from the plant with the existing measured average background noise L_{A90} at the closest existing residential receptors.

As no sound levels are available for internal plant rooms, a series of predictions were made by defining different sound power levels at vertical area sources. When the sound pressure levels are set as shown in Tables 6.2 (which are considered to be achievable) for the internal plant rooms, the noise levels at all the existing receptors are predicted to be at least 5 dB below existing background levels during the daytime and night-time, where rating noise levels fall below the Lowest Observed Adverse Effect Level.

Noise levels have been specified for the chiller units to be located in the north-west of the proposed west stand of the stadium, which have been included within this assessment. The assessment considers the cumulative effects which includes contributions from the proposed chiller units alongside the breakout associated with internal plant rooms.

In accordance with Section 9.2 of BS4142:2014 an overall +5 dB character correction has been applied to account for any tonal or intermittent characteristics of noise from the proposed plant which may be perceptible at the closest sensitive receptors. The assessment presented below has been undertaken with the plant operating at full capacity, simultaneously. The plant will be housed internally within plant rooms integral to the proposed south stand of the stadium (Level 01), except for the chiller unit. Therefore, the limits set below represent the maximum external breakout noise levels from louvres associated with the proposed plant rooms.

Table 6.2 Proposed Emission Limits for BSP as Modelled

BSP Location	Noise Emission Limit - Sound Pressure Level (Each Unit)	
	Daytime	Night-time
Building Services Plant Room Breakout	63.6 dB(A) at 1 m OR 59.3 dB(A) at 3 m	57.4 dB(A) at 1 m OR 53.8 dB(A) at 3 m

Table 6.3 BS4142 Assessment for Proposed Plant

Ref	Description	Measured Background L_{A90}		Rating level from plant		BS 4142 Score	
		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	76 Boundary Street	48	43	10	11	-38	-32
R02	2 St. Albans Court	48	43	11	13	-37	-31
R03	30 Snowdon Lane	42	38	9	11	-33	-27
R04	31 Houlgrave Road	42	38	9	11	-33	-27
R05	52 Colin Drive	42	38	10	12	-32	-26
R06	Titanic Hotel, Stanley Dock	53	44	17	17	-36	-27
R07	27 Egremont Promenade	44	44	17	17	-27	-27
R08	40 Egremont Promenade	44	44	16	16	-28	-28
R09	Mariners' Park Care Home	44	44	18	18	-26	-26
R10	62 Radnor Drive	44	44	21	21	-23	-23
R11	62 Regent Road	51	46	25	26	-26	-20
PR1	Proposed Liverpool Waters Development	50	41	33	33	-17	-8
PR2	Proposed Liverpool Waters Development	50	41	31	31	-19	-10
PR3	Proposed Liverpool Waters Development	50	41	35	35	-15	-6
PR4	Proposed Liverpool Waters Development	50	43	27	27	-23	-16
PR5	Proposed Liverpool Waters Development	50	43	32	32	-18	-11
PR6	Proposed Liverpool Waters Development	50	43	41	41	-9	-2
PR7	Proposed Liverpool Waters Development	50	41	29	29	-22	-13
PR8	Proposed Liverpool Waters Development	50	43	27	27	-23	-16
PR9	Proposed Stanley Dock Apartments	53	44	15	15	-38	-29
PR10	Proposed Hotel – Regent Road	51	46	26	26	-25	-20
PR11	Proposed Lightbody Street Development	51	48	18	18	-33	-30

All values are sound pressure levels in dBA re: 2×10^{-5} Pa.

The noise levels shown in Table 6.3 show that noise levels associated with BSP are predicted to fall below background levels at all sensitive receptors during the daytime and night-time, in-line with noise level requirements outlined within the LCC consultation response. As such, there are not expected to be any significant effects relating to building services plant noise.

6.4 Operational Noise – Stadium Noise

6.4.1 Noise Intrusion Assessment

Tables 6.4 and 6.5 below present the external noise levels at nearby sensitive receptors associated with matchday activities including external pre/post match activities and noise from within the proposed stadium. Internal L_{Aeq} noise levels have been assessed both with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of single glazing with a sound reduction of 30 dB has been used.

Table 6.4 Pre/Post Match External Activities: Noise Intrusion Levels $L_{Aeq,1hour}$ (Scenario 1)

Ref	Description	External L_{Aeq} Noise Level at 1 metre from façade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria (Internal L_{Aeq} dB Daytime)
Existing Receptors					
R01	76 Boundary Street	42.3	27.3	12.3	35
R02	2 St. Albans Court	30.4	15.4	0.4	35
R03	30 Snowdon Lane	26.5	11.5	0.0	35
R04	31 Houlgrave Road	23.6	8.6	0.0	35
R05	52 Colin Drive	23.9	8.9	0.0	35
R06	Titanic Hotel, Stanley Dock	43.8	28.8	13.8	35
R07	27 Egremont Promenade	29.0	14.0	0.0	35
R08	40 Egremont Promenade	28.9	13.9	0.0	35
R09	Mariners' Park Care Home	28.8	13.8	0.0	35
R10	62 Radnor Drive	27.9	12.9	0.0	35
R11	62 Regent Road	56.8	41.8	26.8	35
Proposed Receptors					
PR1	Proposed Liverpool Waters Development	57.9	42.9	27.9	35
PR2	Proposed Liverpool Waters Development	49.8	34.8	19.8	35
PR3	Proposed Liverpool Waters Development	50.3	35.3	20.3	35
PR4	Proposed Liverpool Waters Development	49.8	34.8	19.8	35
PR5	Proposed Liverpool Waters Development	45.9	30.9	15.9	35
PR6	Proposed Liverpool Waters Development	58.5	43.5	28.5	35
PR7	Proposed Liverpool Waters Development	45.5	30.5	15.5	35
PR8	Proposed Liverpool Waters Development	41.3	26.3	11.3	35
PR9	Proposed Stanley Dock Apartments	43.2	33.2	13.2	35
PR10	Proposed Hotel – Regent Road	57.7	47.7	27.7	35
PR11	Proposed Lightbody Street Development	35.2	25.2	5.2	35

Table 6.5 Stadium Noise Levels during Match: Noise Intrusion Levels $L_{Aeq,1hour}$ (Scenario 2)

Ref	Description	External L_{Aeq} Noise Level at 1 metre from façade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria (Internal L_{Aeq} dB Daytime)
Existing Receptors					
R01	76 Boundary Street	41.9	26.9	11.9	35
R02	2 St. Albans Court	44.4	29.4	14.4	35

Ref	Description	External L_{Aeq} Noise Level at 1 metre from façade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria (Internal L_{Aeq} dB Daytime)
R03	30 Snowdon Lane	41.4	26.4	11.4	35
R04	31 Houlgrave Road	40.8	25.8	10.8	35
R05	52 Colin Drive	42.0	27.0	12.0	35
R06	Titanic Hotel, Stanley Dock	50.8	35.8	20.8	35
R07	27 Egremont Promenade	42.9	27.9	12.9	35
R08	40 Egremont Promenade	42.9	27.9	12.9	35
R09	Mariners' Park Care Home	42.3	27.3	12.3	35
R10	62 Radnor Drive	41.2	26.2	11.2	35
R11	62 Regent Road	58.9	43.9	28.9	35
Proposed Receptors					
PR1	Proposed Liverpool Waters Development	61.4	46.4	31.4	35
PR2	Proposed Liverpool Waters Development	59.3	44.3	29.3	35
PR3	Proposed Liverpool Waters Development	60.3	45.3	30.3	35
PR4	Proposed Liverpool Waters Development	60.9	45.9	30.9	35
PR5	Proposed Liverpool Waters Development	60.6	45.6	30.6	35
PR6	Proposed Liverpool Waters Development	63.6	48.6	33.6	35
PR7	Proposed Liverpool Waters Development	57.3	42.3	27.3	35
PR8	Proposed Liverpool Waters Development	59.1	44.1	29.1	35
PR9	Proposed Stanley Dock Apartments	49.7	39.7	19.7	35
PR10	Proposed Hotel – Regent Road	59.5	49.5	29.5	35
PR11	Proposed Lightbody Street Development	52.3	42.3	22.3	35

The assessment presented in the tables above demonstrates that worst-case internal $L_{Aeq, 1\text{hour}}$ noise levels associated with a matchday event will be within the BS 8233/WHO noise intrusion criteria at most existing receptors with windows open and closed, with the exception of R06 (Titanic Hotel), which marginally exceeds the target noise intrusion criteria (although considering the transient nature of hotel users, a marginal exceedance during a match is not considered to be significant), and R11 (62 Regent Road) and which is directly opposite the proposed development. It should be noted that the worst-case assessments presented above represent continuous noise occurring across the fan zone and pedestrian areas immediately adjacent to properties along Regent Road and across all areas of the stadium during a match whereas noise before, during and after a game is typically characterised by quieter periods and so overall noise levels associated with a matchday event are expected to be lower.

With respect to regarding proposed sensitive receptors located within the Liverpool Waters Development adjacent to the stadium, internal daytime L_{Aeq} noise levels associated with a matchday event will be within the BS 8233/WHO noise intrusion criteria with windows-closed; however a number of receptors associated with the 'Liverpool Waters' development (100/2424 – latest approved non-material amendment is 19NM/1121) exceed the criteria with windows-open. The approved parameters plan has been used to identify the receptors at the outline building facades. It should however be noted that as the approved scheme parameter blocks for the east and west quay of Nelson Dock straddle the application site boundary with

Bramley-Moore Dock, then a robust position has been adopted whereby the scheme block is reduced back to the application redline boundary between Nelson and Bramley-Moore Dock, as such receptors have been placed in worst-case locations adjacent to the site boundary.

However, it should be noted that Condition 52 of planning permission ref. 10O/2424 (now 19NM/1121) also requires a noise exposure assessment to be undertaken to determine any mitigation measures required for the scheme.

6.4.2 Change in Noise Level Assessment

This assessment compares existing noise levels (L_{Aeq}) to the 'proposed scheme' noise (L_{Aeq}), incorporating worst-case noise breakout associated with Scenario 1 and Scenario 2. The difference between the 'existing' and the 'proposed' development scenarios are presented below.

Table 6.6 Difference Between the 'Existing Noise Levels' and 'Proposed' Scenarios (Daytime) - Scenario 1

Ref.	Description	Existing L_{Aeq} 16 Hour (monitored)	Proposed L_{Aeq} (modelled)	Combined L_{Aeq}	Contribution from Proposed Scheme
R01	76 Boundary Street	61.5	42.3	61.6	0.1
R02	2 St. Albans Court	61.5	30.4	61.5	0.0
R03	30 Snowdon Lane	48.1	26.5	48.1	0.0
R04	31 Houlgrave Road	48.1	23.6	48.1	0.0
R05	52 Colin Drive	48.1	23.9	48.1	0.0
R06	Titanic Hotel, Stanley Dock	69.0	43.8	69.0	0.0
R07	27 Egremont Promenade	51.2	29.0	51.2	0.0
R08	40 Egremont Promenade	51.2	28.9	51.2	0.0
R09	Mariners' Park Care Home	51.2	28.8	51.2	0.0
R10	62 Radnor Drive	46.8	27.9	46.9	0.1
R11	62 Regent Road	67.2	56.8	67.6	0.4

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

Table 6.7 Difference Between the 'Existing Noise Levels' and 'Proposed' Scenarios (Daytime) - Scenario 2

Ref.	Description	Existing L_{Aeq} 16 Hour (monitored)	Proposed L_{Aeq} (modelled)	Combined L_{Aeq}	Contribution from Proposed Scheme
R01	76 Boundary Street	61.5	41.9	61.5	0.0
R02	2 St. Albans Court	61.5	44.4	61.6	0.1
R03	30 Snowdon Lane	48.1	41.4	48.9	0.8
R04	31 Houlgrave Road	48.1	40.8	48.8	0.7
R05	52 Colin Drive	48.1	42.0	49.1	1.0
R06	Titanic Hotel, Stanley Dock	69.0	50.8	69.1	0.1
R07	27 Egremont Promenade	51.2	42.9	51.8	0.6
R08	40 Egremont Promenade	51.2	42.9	51.8	0.6
R09	Mariners' Park Care Home	51.2	42.3	51.7	0.5
R10	62 Radnor Drive	46.8	41.2	47.9	1.1

Ref.	Description	Existing L_{Aeq} 16 Hour (monitored)	Proposed L_{Aeq} (modelled)	Combined L_{Aeq}	Contribution from Proposed Scheme
R11	62 Regent Road	67.2	58.9	67.8	0.6

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

When compared with the criteria in Table 3.1 of this report, all existing residential receptors are predicted to experience a negligible increase in noise levels of less than 1.1 dB during a matchday event. Noise level changes of up to ± 3 dB are generally imperceptible to the human ear and therefore the change in noise levels is within the Lowest Observed Adverse Effect Level and is not considered to be significant.

6.4.3 Internal Facilities Use

It is unlikely that noise breakout from proposed commercial uses within enclosed spaces within the proposed development will result in unacceptable impacts. However, maximum noise breakout levels from within hospitality or other function rooms within the proposed stadium have been specified from the closest point of the proposed stadium to the closest receptor (PR6); when noise breakout levels from music or other sources of internal noise are 57 dB L_{Aeq} (measured externally at 1m from the façade of the stadium), entertainment noise levels will be at least 5 dB below existing daytime and night-time background noise levels at future residential properties in Nelson Dock.

The target noise emission limits will be achieved via a combination of detailed façade and glazing design and/or by defining an internal noise limit for internal spaces of the stadium.

6.4.4 Stadium Concerts/Major Non-Football Events

Noise from potential use of the stadium for music concerts or similar live events (non-football sports events such as boxing or rugby) has been assessed against the NCCPENCC criteria found in Table 3.4 of this report. The tables below show the predicted Music Noise Levels at the existing and proposed sensitive receptors and assesses this against the representative background noise levels. The assessment has been completed using the representative weekend evening data where applicable in order to present a worst-case assessment; additional consideration has been given to the 23:00 – 02:00 period to account for unplanned overrunning events as part of this worst-case assessment.

Table 6.8 Concert Music Noise Level Assessment (Weekend) 4 – 12 Events Per Year

Ref	Description	Measured Background L _{A90}		Music Noise Level		Difference	
		Daytime 07:00-23:00	Night-time 23:00-02:00	Daytime 07:00-23:00	Night-time 23:00-02:00	Daytime 07:00-23:00	Night-time 23:00-02:00
Existing Receptors							
R01	76 Boundary Street	48	43	50	50	2	7
R02	2 St. Albans Court	48	43	52	52	4	9
R03	30 Snowdon Lane	42	38	50	50	8	12

Ref	Description	Measured Background L _{A90}		Music Noise Level		Difference	
		Daytime 07:00- 23:00	Night-time 23:00- 02:00	Daytime 07:00- 23:00	Night-time 23:00- 02:00	Daytime 07:00- 23:00	Night-time 23:00- 02:00
R04	31 Houlgrave Road	42	38	49	49	7	11
R05	52 Colin Drive	42	38	50	50	8	12
R06	Titanic Hotel, Stanley Dock	53	44	58	58	5	14
R07	27 Egremont Promenade	44	44	53	53	9	9
R08	40 Egremont Promenade	44	44	53	53	9	9
R09	Mariners' Park Care Home	44	44	52	52	8	8
R10	62 Radnor Drive	44	44	51	51	7	7
R11	62 Regent Road	51	46	58	58	7	12
Proposed Receptors							
PR1	Proposed Liverpool Waters Development	50	41	67	67	17	26
PR2	Proposed Liverpool Waters Development	50	41	66	66	16	25
PR3	Proposed Liverpool Waters Development	50	41	63	63	13	22
PR4	Proposed Liverpool Waters Development	50	43	63	63	13	20
PR5	Proposed Liverpool Waters Development	50	43	65	65	15	22
PR6	Proposed Liverpool Waters Development	50	43	66	66	16	23
PR7	Proposed Liverpool Waters Development	50	41	64	64	14	23
PR8	Proposed Liverpool Waters Development	50	43	66	66	16	23
PR9	Proposed Stanley Dock Apartments	53	44	57	57	4	13
PR10	Proposed Hotel – Regent Road	51	46	58	58	7	12
PR11	Proposed Lightbody Street Development	51	48	61	61	10	13

Table 6.8 above shows the predicted noise levels at the surrounding receptors from noise associated with typical music concerts or similar live events. For existing sensitive receptors, the predicted noise levels fall within the Lowest Observed Adverse Effect Level for 4 – 12 events per year (albeit 4 such events proposed) during both daytime and night-time periods.

For proposed receptors, the predicted noise levels marginally exceed the 15 dB threshold during the daytime for 4-12 events per year and would exceed the 15 dB threshold in the event of an overrunning concert post 23:00. It should also be noted that the assessment above considers maximum noise levels associated with concerts (based on the thresholds identified by the HSE) and therefore overall music noise levels may be lower. Furthermore, dwellings associated with the Liverpool Waters development (primarily Nelson Dock) are yet to be finalised (only parameters-based outline planning permission) and as noted above, require a noise exposure assessment to determine any mitigation requirements. As such the effects of worst-case music noise at future dwellings are expected to be reduced.

6.5 Road Traffic Noise Assessment

Traffic data provided by Mott MacDonald have been used to determine the change in average road traffic noise levels as a result of the scheme; the assessment below compares the different scenarios presented to

determine the change in noise levels resulting from both the scheme in the opening year 2023 (based on worst-case traffic flows) and in a future assessment year 2028 (also based on worst-case traffic flows). Reference is also given to the change in noise level that occurs from the change in traffic flows through general growth in traffic without the scheme.

A short-term traffic assessment compares 'with' and 'without' development scenarios in the opening year, whilst a long-term assessment compares 'with' and 'without' development scenarios from separate years (typically over a 10-15 year period).

Tables 6.9 – 6.11 below detail both short-term change in noise levels, with comparisons between the 2023 scenario 'with' and 'without' development and the 2028 'with' and 'without' development scenarios, as well as long-term change in noise levels, with a comparison between the 2023 'without' development scenario and the 2028 'with' development scenario.

Table 6.9 Difference between the 'with' and 'without' development 2023 scenario (short-term)

Location	Description	Traffic Noise Without Development 2023 (L _{A10,18hr} dB(A))	Traffic Noise With Development 2023 (L _{A10,18hr} dB(A))	Difference
TR01	92 Boundary Street	61.5	61.9	0.4
TR02	76 Boundary Street	50.4	50.8	0.4
TR03	2 St. Albans Court	42.4	43.0	0.6
TR04	30 Snowdon Lane	40.0	40.7	0.7
TR05	31 Houlgrave Road	40.7	41.3	0.6
TR06	52 Colin Drive	42.4	43.0	0.6
TR07	5 O'Reilly Court	43.4	44.0	0.6
TR08	10 Jack McBain Court	43.6	44.2	0.6
TR09	Titanic Hotel, Stanley Dock, Regent Road	58.0	59.9	1.9
TR10	62 Regent Road	66.8	68.4	1.6

Table 6.10 Difference between the 'with' and 'without' development 2028 scenario (short-term)

Location	Description	Traffic Noise Without Development 2028 (L _{A10,18hr} dB(A))	Traffic Noise Without Development 2028 (L _{A10,18hr} dB(A))	Difference
TR01	92 Boundary Street	61.7	62.1	0.4
TR02	76 Boundary Street	50.7	51.1	0.4
TR03	2 St. Albans Court	42.6	43.3	0.7
TR04	30 Snowdon Lane	40.3	41.0	0.7
TR05	31 Houlgrave Road	40.9	41.6	0.7
TR06	52 Colin Drive	42.7	43.4	0.7
TR07	5 O'Reilly Court	43.7	44.4	0.7
TR08	10 Jack McBain Court	43.9	44.5	0.6
TR09	Titanic Hotel, Stanley Dock, Regent Road	58.2	60.4	2.2
TR10	62 Regent Road	67.1	69.1	2.0

Table 6.11 Difference between the 'without' development 2023 scenario and the future 'with' 2028 scenario (long-term)

Location	Description	Traffic Noise Without Development 2023 (L _{A10,18hr} dB(A))	Traffic Noise With Development 2028 (L _{A10,18hr} dB(A))	Difference
TR01	92 Boundary Street	61.5	62.1	0.6
TR02	76 Boundary Street	50.4	51.1	0.7
TR03	2 St. Albans Court	42.4	43.3	0.9
TR04	30 Snowdon Lane	40.0	41.0	1.0
TR05	31 Houlgrave Road	40.7	41.6	0.9
TR06	52 Colin Drive	42.4	43.4	1.0
TR07	5 O'Reilly Court	43.4	44.4	1.0
TR08	10 Jack McBain Court	43.6	44.5	0.9
TR09	Titanic Hotel, Stanley Dock, Regent Road	58.0	60.4	2.4
TR10	62 Regent Road	66.8	69.1	2.3

The results of the short-term assessments presented in Tables 6.9 and 6.10 indicate that at representative receptors as a result of the implementation of the scheme, there would be a change of less than 2.2 dB and is considered to be 'Minor' when compared to the short-term criteria outlined within Table 3.2.

The results of the long-term assessment shown in Table 6.11 indicate that at representative receptors as a result of the implementation of the scheme, there would be a change in noise level of up to 2.4 dB and is considered to be 'Negligible' when compared to the long-term criteria outlined in Table 3.2.

Therefore, the overall change in road traffic noise levels is considered to be within or below the Lowest Observed Adverse Effect Level at all sensitive receptors.

6.5.1 Proposed Taxi Rank

The calculation presented in Section 4.0 shows the anticipated noise level associated with an extreme worst-case scenario for vehicle movements associated with the taxi rank and taxi stands along Boundary Street is 61.7 dB L_{Aeq} at 10m distance.

The measured baseline noise levels from a representative short-term location (ST7) along Boundary Street have been analysed. Baseline daytime L_{Aeq} noise levels along this road were measured to be between 61.5 and 66.4 dB. Therefore, considering that existing traffic flows along Boundary Street will be restricted during matchdays, the maximum overall difference of 0.2 dB between existing noise levels and noise from the taxi stands and vehicle movements is not considered to be significant.

Furthermore, it should be noted that the operation of the taxi ranks will be monitored by match day stewards to help ensure the ranks operate safely and efficiently. Their operation will be subject to review by the Transport Working Group once the stadium opens and the system refined and improved if found necessary.

6.6 Tranquillity Assessment

An assessment of the existing tranquillity level of the application site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). By reference to these maps the development is assessed as falling into Zone 1 and is not considered to be an area of particularly high tranquillity value, therefore it is considered that any effect on tranquillity of the area would be negligible.

Indeed, the introduction of publicly accessible amenity spaces within the application site (site currently not accessible to the general public and will form part of the termination of a river walk) may in fact improve access to areas of tranquillity.

6.7 Ecological Receptor Assessment

The locations of ecological receptors have been informed by the studies undertaken by WYG (Terrestrial Ecology – ES Chapter 12). In order to assess the effects of noise, the following noise level criteria have been derived from TIDE Tidal River Development Toolbox to determine the likelihood of disturbance to noise-sensitive species in the vicinity of the application site.

The TIDE toolbox identifies that noise effects typically occur after visual stimuli associated with different activities, however as the project has the potential to generate noise sources with a relatively sudden onset that may be fully or partially screened (either by the existing dock wall during construction, or by the stadium itself), this assessment considers construction phase activities as well as noise from specific events within the stadium (such as a goal being scored, or from music).

Table 6.12 Noise Levels at ecological Receptor Locations

Location	Construction Noise			Operational Noise – Goal Being Scored			Music Noise		
	External LAeq Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External L _{max} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External LAeq Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level
West of Site Boundary									
EC01	67.4	55 - 72 dB	Moderate Noise Level Effects	75.4	> 72 dB	High Noise Level Effects	62.8	55 - 72 dB	Moderate Noise Level Effects
EC02	64.3	55 - 72 dB	Moderate Noise Level Effects	74.7	> 72 dB	High Noise Level Effects	62.0	55 - 72 dB	Moderate Noise Level Effects
EC03	62.0	55 - 72 dB	Moderate Noise Level Effects	74.1	> 72 dB	High Noise Level Effects	61.4	55 - 72 dB	Moderate Noise Level Effects
EC04	60.0	55 - 72 dB	Moderate Noise Level Effects	73.5	> 72 dB	High Noise Level Effects	60.8	55 - 72 dB	Moderate Noise Level Effects

Location	Construction Noise			Operational Noise – Goal Being Scored			Music Noise		
	External L _{Aeq} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External L _{Amax} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External L _{Aeq} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level
EC05	58.3	55 - 72 dB	Moderate Noise Level Effects	73.0	> 72 dB	High Noise Level Effects	60.3	55 - 72 dB	Moderate Noise Level Effects
EC06	56.7	55 - 72 dB	Moderate Noise Level Effects	72.4	> 72 dB	High Noise Level Effects	59.7	55 - 72 dB	Moderate Noise Level Effects
EC07	55.4	55 - 72 dB	Moderate Noise Level Effects	72.0	55 - 72 dB	Moderate Noise Level Effects	59.3	55 - 72 dB	Moderate Noise Level Effects
EC08	54.4	< 55 dB	Low Noise Level Effects	71.5	55 - 72 dB	Moderate Noise Level Effects	58.8	55 - 72 dB	Moderate Noise Level Effects
EC09	53.6	< 55 dB	Low Noise Level Effects	71.1	55 - 72 dB	Moderate Noise Level Effects	58.4	55 - 72 dB	Moderate Noise Level Effects
EC10	53.4	< 55 dB	Low Noise Level Effects	70.7	55 - 72 dB	Moderate Noise Level Effects	58.0	55 - 72 dB	Moderate Noise Level Effects
North of Site Boundary									
EC11	64.6	55 - 72 dB	Moderate Noise Level Effects	75.4	> 72 dB	High Noise Level Effects	64.0	55 - 72 dB	Moderate Noise Level Effects
EC12	61.8	55 - 72 dB	Moderate Noise Level Effects	74.8	> 72 dB	High Noise Level Effects	63.2	55 - 72 dB	Moderate Noise Level Effects
EC13	59.6	55 - 72 dB	Moderate Noise Level Effects	74.4	> 72 dB	High Noise Level Effects	62.3	55 - 72 dB	Moderate Noise Level Effects
EC14	57.9	55 - 72 dB	Moderate Noise Level Effects	73.8	> 72 dB	High Noise Level Effects	61.5	55 - 72 dB	Moderate Noise Level Effects
EC15	56.3	55 - 72 dB	Moderate Noise Level Effects	73.3	> 72 dB	High Noise Level Effects	60.7	55 - 72 dB	Moderate Noise Level Effects
EC16	54.9	< 55 dB	Low Noise Level Effects	73.1	> 72 dB	High Noise Level Effects	60.0	55 - 72 dB	Moderate Noise Level Effects
EC17	53.7	< 55 dB	Low Noise Level Effects	72.6	> 72 dB	High Noise Level Effects	59.4	55 - 72 dB	Moderate Noise Level Effects
EC18	53.7	< 55 dB	Low Noise Level Effects	72.2	> 72 dB	High Noise Level Effects	58.8	55 - 72 dB	Moderate Noise Level Effects
EC19	52.0	< 55 dB	Low Noise Level Effects	71.8	55 - 72 dB	Moderate Noise Level Effects	58.3	55 - 72 dB	Moderate Noise Level Effects
EC20	50.4	< 55 dB	Low Noise Level Effects	71.4	55 - 72 dB	Moderate Noise Level Effects	57.8	55 - 72 dB	Moderate Noise Level Effects
South of Site Boundary									
EC21	64.1	55 - 72 dB	Moderate Noise Level Effects	76.0	> 72 dB	High Noise Level Effects	62.8	55 - 72 dB	Moderate Noise Level Effects
EC22	61.6	55 - 72 dB	Moderate Noise Level Effects	75.3	> 72 dB	High Noise Level Effects	62.6	55 - 72 dB	Moderate Noise Level Effects
EC23	57.0	55 - 72 dB	Moderate Noise Level Effects	75.3	> 72 dB	High Noise Level Effects	62.4	55 - 72 dB	Moderate Noise Level Effects

Location	Construction Noise			Operational Noise – Goal Being Scored			Music Noise		
	External L _{Aeq} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External L _{Amax} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level	External L _{Aeq} Noise Level	Criteria (TIDE, dB)	Noise Disturbance Significance Level
EC24	54.9	< 55 dB	Low Noise Level Effects	73.5	> 72 dB	High Noise Level Effects	62.1	55 - 72 dB	Moderate Noise Level Effects
EC25	51.5	< 55 dB	Low Noise Level Effects	72.6	> 72 dB	High Noise Level Effects	60.6	55 - 72 dB	Moderate Noise Level Effects
EC26	47.9	< 55 dB	Low Noise Level Effects	72.8	> 72 dB	High Noise Level Effects	59.4	55 - 72 dB	Moderate Noise Level Effects
EC27	50.3	< 55 dB	Low Noise Level Effects	72.2	> 72 dB	High Noise Level Effects	60.8	55 - 72 dB	Moderate Noise Level Effects
EC28	45.0	< 55 dB	Low Noise Level Effects	72.2	> 72 dB	High Noise Level Effects	60.1	55 - 72 dB	Moderate Noise Level Effects
EC29	42.2	< 55 dB	Low Noise Level Effects	70.3	55 - 72 dB	Moderate Noise Level Effects	58.9	55 - 72 dB	Moderate Noise Level Effects
EC30	40.2	< 55 dB	Low Noise Level Effects	68.2	55 - 72 dB	Moderate Noise Level Effects	54.1	55 - 72 dB	Moderate Noise Level Effects

All values are sound pressure levels in dB re: 2x 10⁻⁵ Pa.

The assessment shown in Table 6.12 demonstrates that external L_{Aeq} noise levels from construction noise is predicted to be within the TIDE Low Noise Level Effects criteria of 55 dB at sensitive receptor locations over 400m away whilst moderate noise level effects may occur within this distance. Noise levels from construction are likely to be below the levels at which interference with bird calls / communication / hunting habits etc would be expected at distances of 50m from the site. At distances of less than 50m, effects of visual stimuli and the presence of machinery/operators are expected to be greater than the effects of noise alone.

The assessment of noise from matchday events indicates that worst-case L_{Amax} levels from noise associated with a goal being scored have the potential to result in high level noise effects within 400m, although it should be noted that existing L_{Amax} noise levels along Bramley Moore Dock are already up to 75 dB and there would typically be a continuous level of noise associate with a matchday event. As such, sensitive species within the urban environment are more likely to habituate to noise from within the stadium.

Worst-case L_{Aeq} noise levels from music event noise are predicted to be within the TIDE Moderate Noise Level Effects criteria of 55-72 dB at all sensitive receptor locations. There are expected to be a maximum of 4 non-matchday event days per year, as such noise levels from the short-term events are likely to be below the levels at which interference with bird calls / communication / hunting habits etc would be expected.

Construction Effects on Aquatic Life

There is currently no specific noise guidance published within the UK. However, research has been undertaken by Popper et al (2014) titled '*ASA S3/SC1.4 TR 4014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and Registered with ANSI*'. The document presents maximum noise levels which would cause temporary threshold shift up to mortality in aquatic life.

Popper et al identify that to cause temporary threshold shift, noise levels would need to exceed 186 dB; considering that driven piling would only be undertaken within the confines of Bramley Moore Dock, with rotary bored piling undertaken on locations currently occupied by wharves, direct noise from piling would not be transmitted into the Mersey.

During the infilling phase, noise from the use of a dredger moored in the River Mersey to import material to the dock is considered to be comparable to existing shipping within channel (which features regular commercial vessels) and wider dockland area.

Therefore, there are not expected to be any significant adverse effects on marine life during the construction phase.

However, best practice measures will be adopted during the construction phase; where practicable, percussive piling activities should be scheduled to avoid migration/mating periods of sensitive ecological species as advised by the project ecologist.

7.0 Conclusions of Noise Assessment

This report presents the findings of an updated noise assessment undertaken to support a revised full planning application for the development of a new stadium with associated facilities and infrastructure at Bramley-Moore Dock (BMD). A planning application (LPA ref. 20F/0001) was originally submitted in December 2019 and has been subject to statutory consultation feedback. Comments provided by LCC have been addressed within this updated assessment. A revised application has been prepared given the extent of the design changes proposed.

Sections 170 (e), 180 (a & b), 182 and 183 of the NPPF provide test points relating to noise, considering each of these points, the following conclusions can be drawn in relation to the proposed development operations:

- During the construction phase of the proposed development, noise levels at existing noise sensitive properties would be within the BS 5228 fixed limit criteria. Assessments of the increase in road traffic noise as a result of the proposed development has shown that noise levels at nearby existing sensitive receptors are predicted to fall within and below the Lowest Observed Adverse Effect Level.
- Noise intrusion assessments have shown that cumulative L_{Aeq} noise levels are predicted to be within the BS 8233/WHO criteria at all nearby sensitive receptor locations on the basis of worst-case assumptions, with windows-closed. Plant and internal entertainment noise emission limits have been specified to ensure that plant and music breakout levels from internal spaces of the development are at least 5 dB below existing daytime and night-time background noise levels.
- Assessments of noise from sporting and entertainment events within the stadium has been undertaken which demonstrate that noise from sporting events are not expected to significantly affect existing ambient noise levels and noise limits for entertainment events have been proposed.
- Given the low tranquillity value of the area, the proposed development is not expected to adversely affect the tranquillity of the area.

Therefore, it is considered that the proposals will not have a 'significant adverse impact' on health or quality of life and are compliant with the provisions of the statutory development plan (Liverpool UDP) and the National Planning Policy Framework (NPPF). There are no noise-related matters which would preclude positive determination of the planning application.

Appendices

Appendix A – Acoustic Terminology and Abbreviations

An explanation of the specific acoustic terminology referred to within this report is provided below.

dB Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.

dB(A) Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.

L_{Aeq} Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The L_{Aeq, 07:00 – 23:00} for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower than the L_{Aeq, 07:00 – 23:00}.

L_{Amin} The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.

L_{Amax} The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.

L_n Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say. 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the L_{A10, 1 hr} = x dB.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.

R_w The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

An explanation of abbreviations used within this report is provided below.

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

PPG – Planning Practice Guidance

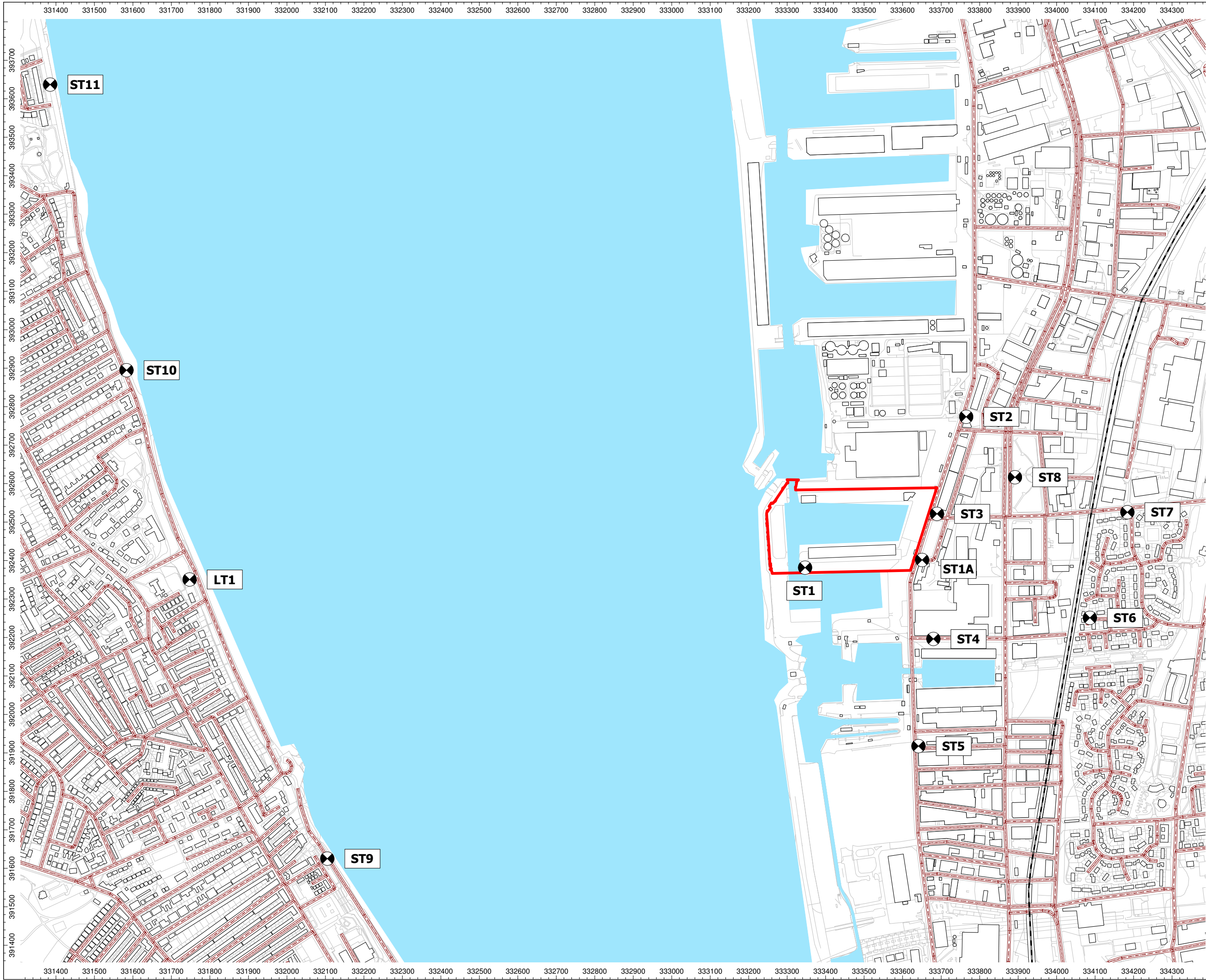
UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

WYGE – WYG Environment

Appendix B – Sketches

- SK01 Noise Monitoring Locations
- SK02a Sensitive Receptor Locations and Site Layout
- SK02b Existing Sensitive Traffic Receptor Locations
- SK03a $L_{Aeq, 1hr}$ Noise Level Contour Plot – Scenario 1
- SK03b $L_{Aeq, 1hr}$ Noise Level Contour Plot – Scenario 2
- SK04 Do Minimum $L_{A10,18hr}$ Noise Contours (2023)
- SK05 Do Something $L_{A10,18hr}$ Noise Contours (2028)
- SK06 Do Minimum 2023 / Do Something 2028 Noise Level Difference Contours



Client:
Everton Stadium
Development Ltd

Project:
The People's Project,
Merseyside

Project Number:
A100795

Drawing Title / Scenario:
Noise Monitoring Locations

Drawing Number:
SK01

Key:

Site Boundary: ———

Scale : Not to scale

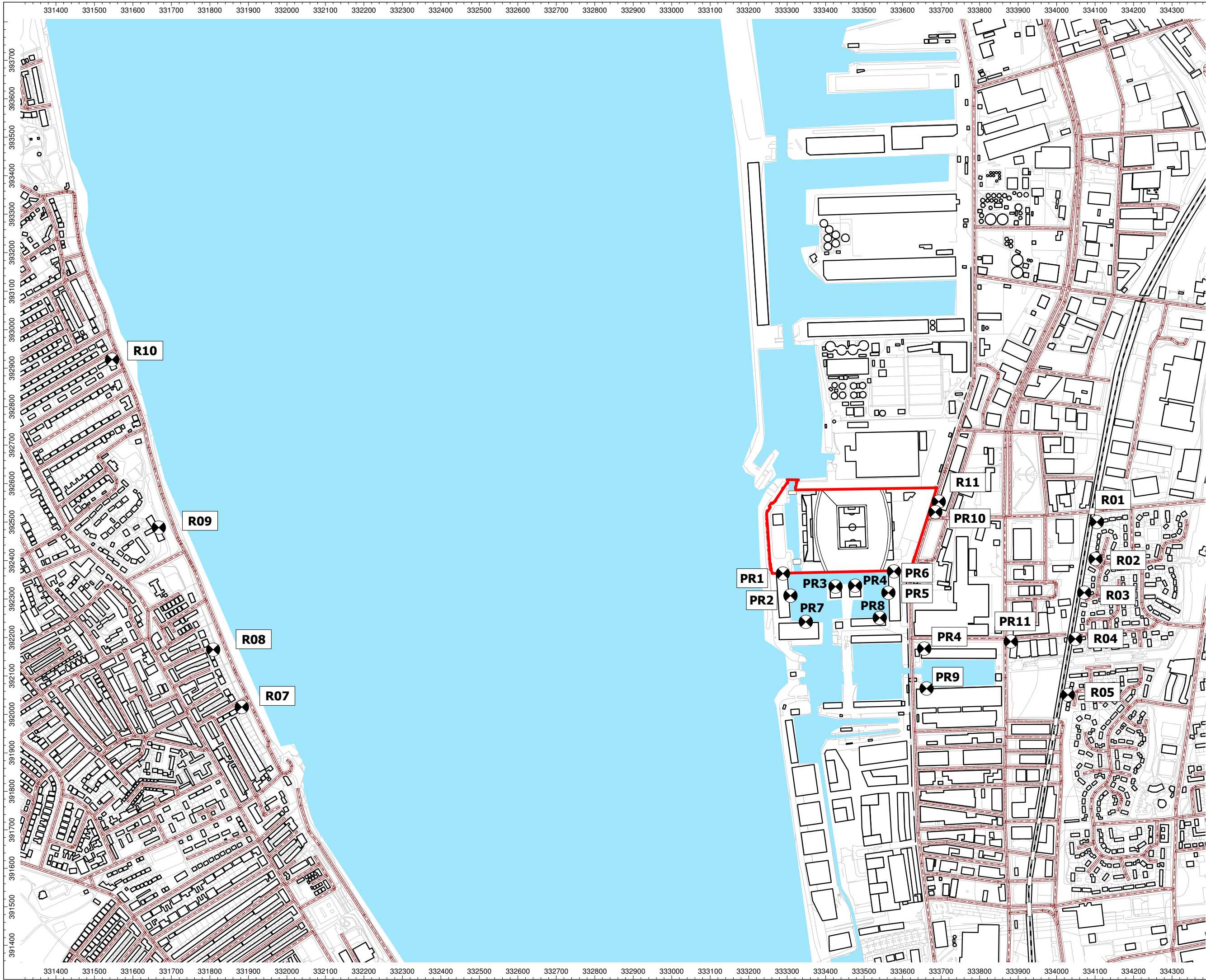
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Project:
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Project Number:
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Drawing Title / Scenario:
Sensitive Receptor Locations
(Construction and Operation)
and Site Layout

Drawing Number:
SK02a

Key:

Site Boundary: —

Scale : Not to scale

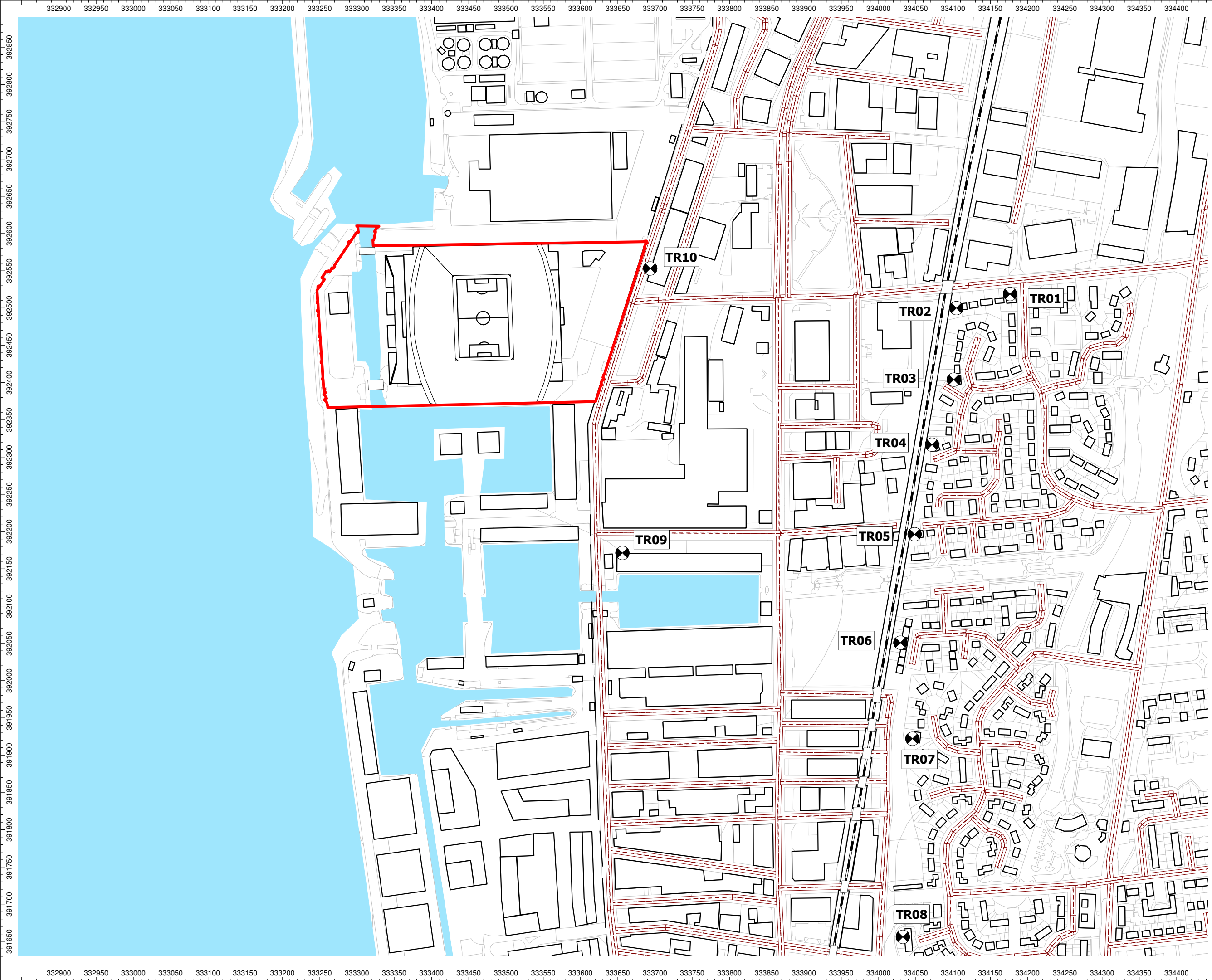
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Drawing Title / Scenario:
Existing Sensitive Traffic
Receptor Locations

Drawing Number:
SK02b

Key:

Site Boundary: —

Scale : Not to scale

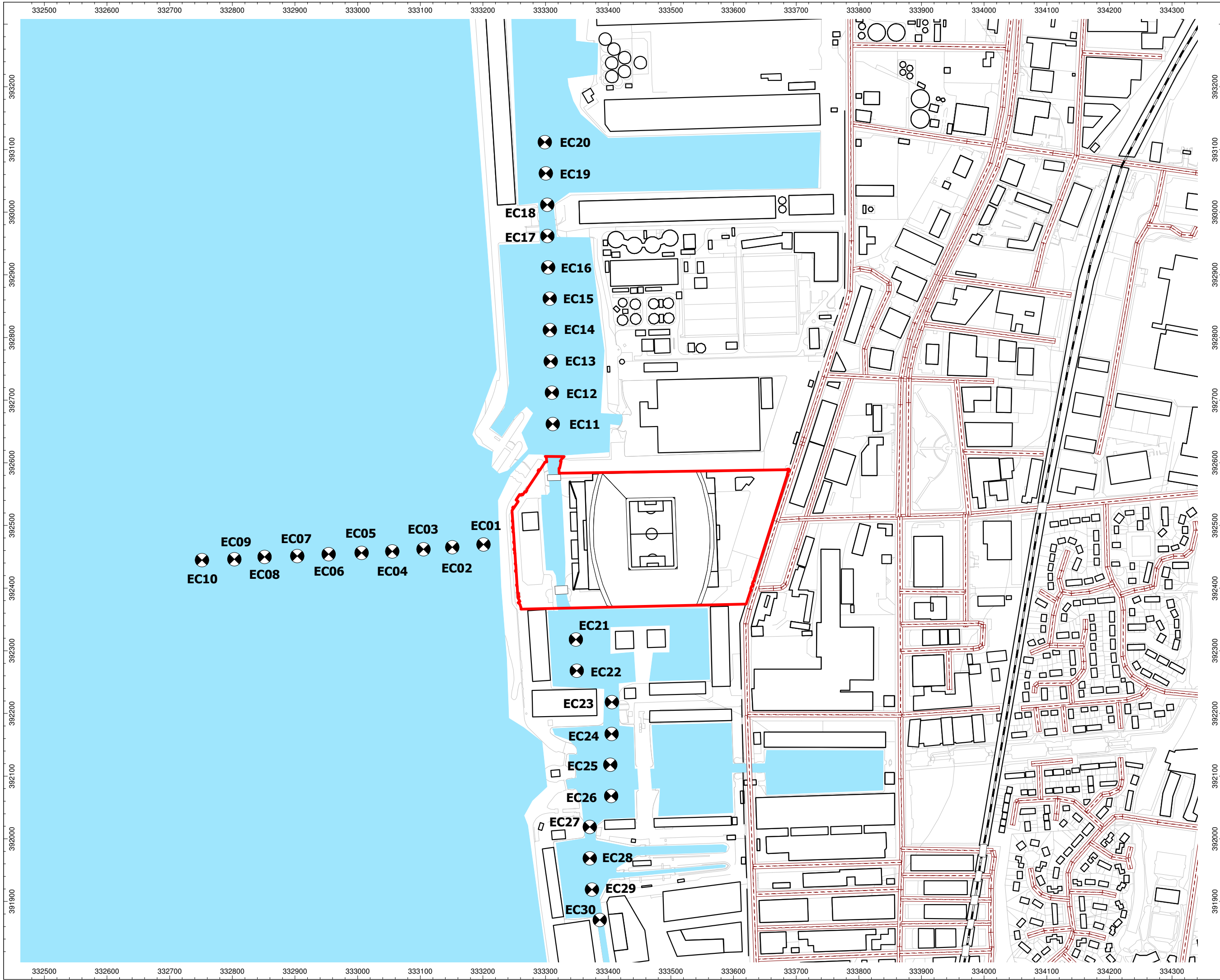
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Drawing Title / Scenario:
Ecological Sensitive
Receptor Locations
50m-500m

Drawing Number:
SK02c

Key:

Site Boundary: ---

Scale : Not to scale

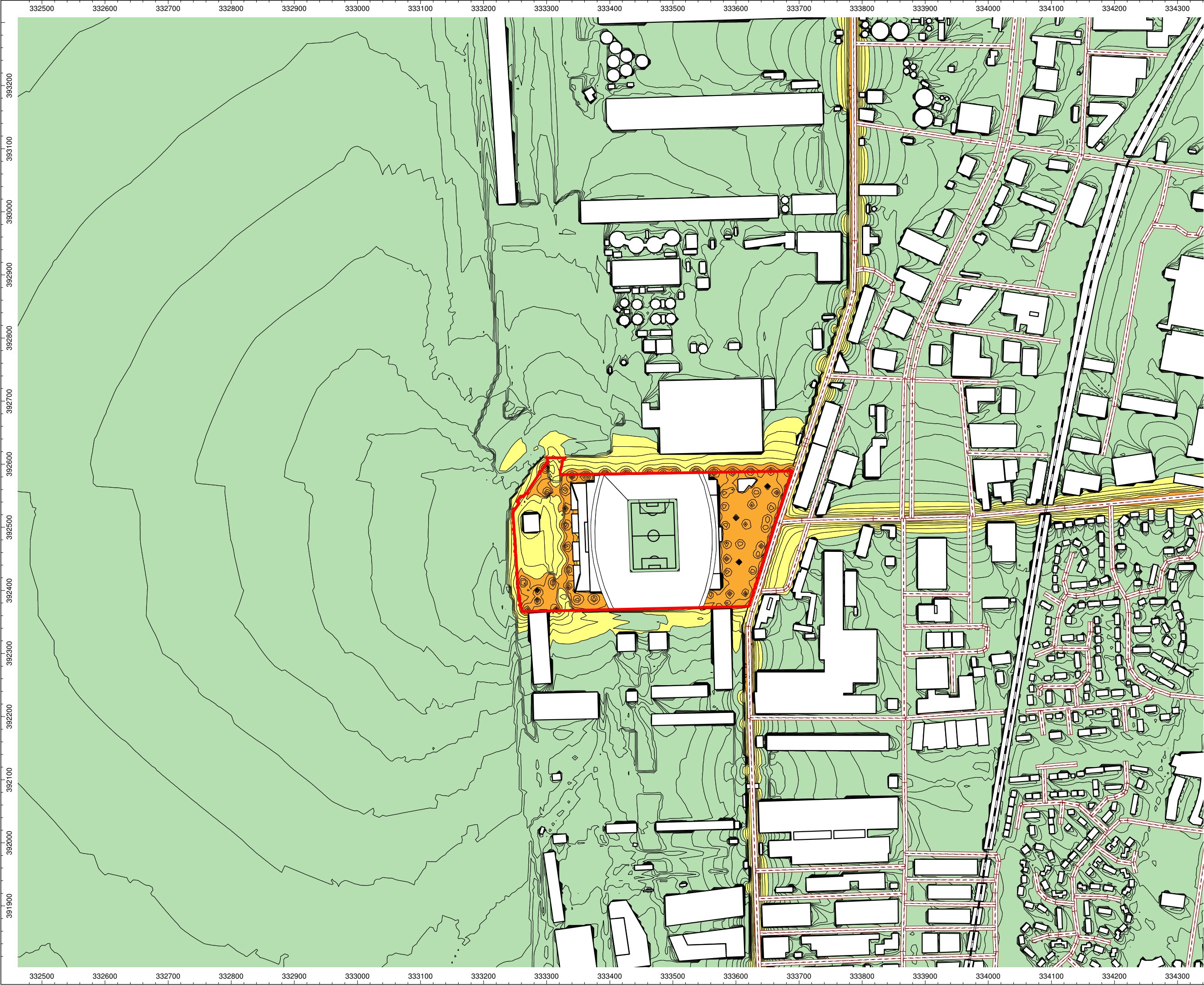
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Client:
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Project:
The People's Project,
Merseyside

Project Number:
A100795

Drawing Title / Scenario:
LAeq,1hr Noise Level
Contour Plot - Scenario
1

Drawing Number:
SK03a

Key:

Site Boundary: 

 0.0 - 50.0 dB
 50.0 - 60.0 dB
 60.0 - 70.0 dB
 > 70.0 dB

Scale : Not to scale

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