



UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks
and adjoining land, Bedford

Environmental Statement Volume 1

Chapter 9 - Noise and Vibration

Report reference: 2.9.0

Revision number: 00

Date: June 2025



CONTENTS

9. NOISE AND VIBRATION	1
-------------------------------	----------

9.1. INTRODUCTION	1
9.2. ASSUMPTIONS USED TO INFORM ASSESSMENT	2
9.3. ENGAGEMENT, SCOPE AND STUDY AREA	2
9.4. METHODOLOGY	7
9.5. BASELINE CONDITIONS	17
9.6. ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS	24
9.7. POTENTIAL MITIGATION DURING OPERATIONAL PHASE	38
9.8. DEMONSTRATION OF COMPLIANCE WITH CORE ZONE NOISE LIMITS	40
9.9. CUMULATIVE EFFECTS	41
9.10. DIFFICULTIES AND UNCERTAINTIES	41
9.11. SUMMARY OF LIKELY SIGNIFICANT EFFECTS AND PROPOSED MITIGATION	41
9.12. REFERENCES	52

TABLES

Table 9-1 – Summary of engagement undertaken	2
Table 9-2 – Elements scoped into the assessment	3
Table 9-3 – Elements scoped out of the assessment	4
Table 9-4 - Assessment Methodology	7
Table 9-5 - Magnitude of Impact - Construction Noise	8
Table 9-6 - Magnitude of Impact – Construction Vibration	9
Table 9-7 - Magnitude of Impact – Construction Road Traffic Noise	9
Table 9-8 - Magnitude of Impact – Operational Road Traffic Noise	10
Table 9-9 – Core Zone Noise Magnitude of Impact Criteria – Daytime	14
Table 9-10 - Core Zone Noise Magnitude of Impact Criteria – Night-time	14

Table 9-11 - Core Zone Noise Matrix of Significance of Effect – Daytime	15
Table 9-12 - Core Zone Noise Matrix of Significance of Effect – Night-time	15
Table 9-13 – Utility Compound Noise Magnitude of Impact Criteria	16
Table 9-14 – Utility Compound Noise Significance of Effect	17
Table 9-15 - Summary of baseline noise survey results	18
Table 9-16 - Identified Noise Sensitive Receptors Within 300m of the Site Boundary	20
Table 9-17 – Receptor Control Locations (RCLs)	21
Table 9-18 - Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring during Construction	24
Table 9-19 - Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring for Operational Road Traffic	27
Table 9-20 - Core Zone Noise Assessment for Typical Noise Levels at each RCL	30
Table 9-21 - Core Zone Significance of Effect for Typical Noise Levels at each RCL	31
Table 9-22 – Core Zone Noise Assessment for Maximum Allowable Noise Levels at RCL02-04	34
Table 9-23 – Core Zone Significance of Effect for Maximum Allowable Noise Levels at RCL02-04	35
Table 9-24 - Summary of Residual Noise and Vibration Effects: Construction Phase	42
Table 9-25 - Summary of Residual Noise and Vibration Effects: Operational Phase – New and Altered Roads	44
Table 9-26 - Summary of Residual Noise and Vibration Effects: Operational Phase – Operational Noise	45

IMAGES

Image 9-1 – Location of sensitive receptors and baseline survey measurement locations	19
Image 9-2 – Receptor Control Locations	23

9. NOISE AND VIBRATION

9.1. INTRODUCTION

9.1.1. This chapter has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement (ES). This reports the outcome of the assessment of likely significant effects arising from the Proposed Development in relation to Noise and Vibration during construction and operation.

SUPPORTING DOCUMENTATION

9.1.2. This chapter is intended to be read in conjunction with the following supporting figures and appendices:

- **Figure 9.1: Construction Noise and Vibration Study Area and Sensitive Receptors (Volume 2);**
- **Figure 9.2: DEFRA Road and Rail Noise Mapping – Day-time Ambient Noise Level (Volume 2);**
- **Figure 9.3: DEFRA Road and Rail Noise Mapping - Night-time Ambient Noise Level (Volume 2)**
- **Figure 9.4: Construction Road Traffic Noise Level Change - Scenario 2 vs Scenario 1 (Volume 2)**
- **Figure 9.5: Operational Road Traffic Noise Level Change - Scenario 4 vs Scenario 3 (Volume 2);**
- **Figure 9.6: Operational Road Traffic Noise Level Change - Scenario 4a vs Scenario 3 (Volume 2);**
- **Figure 9.7: Operational Road Traffic Noise Level Change - Scenario 5 vs Scenario 3 (Volume 2);**
- **Figure 9.8: Receptor Control Locations (Volume 2);**
- **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3);**
- **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3);**
- **Appendix 9.1: Baseline Noise Survey Details (Volume 3);**
- **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3);**
- **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3);**
- **Appendix 9.4: Operational Noise Assessment (Volume 3); and**
- **Appendix 9.5: Demonstration of compliance with Operational Phase noise limits (Volume 3).**

LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

9.1.3. The legislation, policy and guidance relevant to the assessment of noise and vibration effects that may be associated with the Proposed Development are detailed in **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3)**.

9.2. ASSUMPTIONS USED TO INFORM ASSESSMENT

9.2.1. The assessment presented in this chapter has been based on the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)**. This chapter has also used the following assumptions to build on the information in **Chapter 2: Description of the Proposed Development (Volume 1)** to support undertaking an assessment of a cautious worst case (where the phrase “*cautious worst case*” is used it means “*a cautious worst case that provides a robust assessment of likely significant effects*”):

- The construction noise and vibration assumptions as set out in **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)**;
- The construction and operational road traffic assessment is based on traffic flow data from the transport model (with further details on the traffic modelling set out in **Appendix 5.1: Transport Assessment (Volume 3)**), and further specific noise modelling assumptions as set out in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**; and
- The operational noise assumptions as set out in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

9.3. ENGAGEMENT, SCOPE AND STUDY AREA

ENGAGEMENT

9.3.1. **Table 9-1** provides a summary of the engagement activities undertaken in support of the preparation of this assessment.

Table 9-1 – Summary of engagement undertaken

Body/organisation	Individual/stat body/organisation	Meeting dates and other forms of engagement	Summary of outcome of discussions
Bedford Borough Council (Bedford BC)	Environment Health Department	10 April 2024	Introduction to project and likely significant impacts for the noise and vibration assessment. Commentary that the operational noise assessment would be bespoke, and further detail would be provided for review.

Body/organisation	Individual/stat body/organisation	Meeting dates and other forms of engagement	Summary of outcome of discussions
Bedford BC and Central Bedfordshire Council	Environment Health Department	10 May 2024	Email to councils to set out the approach to the derivation of the significance criteria proposed for the operational noise assessment. Acknowledgment received from Bedford BC with superficial queries, 20 May 2024.
Bedford BC	Priority Project Manager Manager for Strategic Sites & Inward Investment Planning Consultant Acoustic specialist	14 and 15 May 2025	Update provided to Bedford BC on scope and approach to the Noise and Vibration Assessment, including proposed noise controls. A document setting out the Summary of Agreed Position between the two parties is submitted as Appendix 4 of the Planning Statement (Document Reference 6.1.0) .

SCOPE OF THE ASSESSMENT

- 9.3.2. The assessment of noise and vibration has considered the potential for the Construction and Operational Phases of the Proposed Development to result in significant effects.
- 9.3.3. The elements shown in **Table 9-2** are considered to have the potential to give rise to significant effects during construction and/or operation of the Proposed Development and have therefore been considered within this assessment.

Table 9-2 – Elements scoped into the assessment

Element scoped in	Construction phase	Operational phase
Noise impacts arising during the Construction Phase of the Proposed Development	✓	
Vibration impacts arising during the Construction Phase of the Proposed Development	✓	
Noise impacts arising from additional road traffic resulting from the construction of the Proposed Development	✓	
Noise impacts arising from additional road traffic resulting from the operation of the Proposed Development		✓
Noise impacts arising from changes to traffic flows resulting from new connections, alterations and improvements to the existing road network		✓

Element scoped in	Construction phase	Operational phase
Noise impacts from the operation of the Proposed Development		✓

Elements Scoped out of the Assessment

- 9.3.4. The elements shown in **Table 9-3** are considered unlikely to give rise to significant effects as a result of the Proposed Development and have therefore been excluded from further consideration within this assessment.

Table 9-3 – Elements scoped out of the assessment

Element scoped out	Justification
Vibration impacts arising from construction vehicles on the surrounding road network	As stated in the <i>Design Manual for Roads and Bridges LA111 (Ref. 9.1)</i> – “A maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects.”
Noise impacts arising from additional rail traffic resulting from the operation of the Proposed Development	The expanded Wixams Station introduces a new stopping point, which previously received planning consent from Bedford BC for existing services on the Midland Main Railway Line; however the Proposed Development will not introduce any new rail movements. A new East West Rail (EWR) Station will potentially be built on the Marston Vale Railway Line between the West Gateway and Core Zones. This would be serviced by three trains per hour in each direction as per the existing <i>Transport Works Order Act 2020 (The Network Rail (East West Rail) (Bicester to Bedford Improvements) Order 2020)</i> (Ref. 9.2); the Proposed Development will not introduce any additional rail movements.
Noise from emergency backup generators	Back-up diesel generators to provide additional back-up power to critical systems and facilities within the Site in case of power failure will be co-located with the facilities they intend to power and not centralised within the Utility Compound. Critical systems and facilities will include: ■ Theme park shows/rides; ■ Foul water pump stations; ■ Fire water pump stations; ■ Visitor accommodation emergency power to support minimum services; ■ Train stations; ■ Data and communication facilities;

Element scoped out	Justification
	■ Emergency services support facilities; and ■ Other critical facilities that may be necessary during power failure. Generators will routinely be tested for approximately one hour per month and no more than 50 hours annually. Generators will not be operated without the necessary permit as a Medium Combustion Plant from the Environment Agency, as per the per the <i>Environmental Permitting (England and Wales) Regulations 2016 (as amended 2018)</i>
Vibration from equipment and operations on the Site	The Proposed Development is not expected to produce levels of vibration, in normal operation, which could affect existing nearby sensitive receptors due to the separating distances from the Site boundary. The potential effects of structure borne vibration on occupants within hotels at the Proposed Development, e.g. from building services plant within plant rooms, will be controlled by effective isolation of such plant from the building structure, for example by following the guidance provided in CIBSE Guide B4 <i>Noise and vibration control for building services systems 2016 (Ref. 9.3)</i>.
Noise and vibration from fireworks associated with the Proposed Development	Fireworks will have a minimum horizontal clearance of 50m from the Ecological Enhancement Areas within which no fireworks would be launched/detonated. No regular firework displays are proposed as part of the day-to-day operation of the Proposed Development. No more than 10 Fireworks shows are permitted each year, at least five of which would take place on or around the events of Chinese New Year, 5th November, Diwali and New Year's Eve. Use of fireworks will be subject to the requirements and restrictions of the <i>Fireworks Regulations 2004 (Ref. 9.4)</i>. Day-to-day pyrotechnic effects are expected to operate in very short bursts and not continuously. Furthermore, they will be in use in close proximity to an audience and therefore will be heavily controlled and will generate limited noise or vibration.
Noise from visitor accommodation, retail, dining and entertainment	The ERC includes the development of visitor accommodation, retail, dining and entertainment in the Core Zone, Lake Zone and/or West Gateway Zone. These have the potential to generate noise, mostly from building services plant, e.g. heating, ventilation and cooling (HVAC) equipment not already served by the energy centre located within

Element scoped out	Justification
	the utility compound. With the exception of properties on Manor Road, it is unlikely that visitor accommodation, retail, dining and entertainment operations will be located within 100m of an existing sensitive receptor. Manor Road will be subject to separate noise limits applicable to the operation of the Core Zone and to the operation of the nearby Utility Compound. At the West Gateway Zone, the nearest properties are >200m from the site boundary and are close to both the A421 and the nearby distribution centres at Commercial Park, which are the dominant sources of noise in this area. Therefore, based on professional judgment, it is considered that additional noise limits for visitor accommodation, retail, dining and entertainment operations are not necessary and thus noise from these sources may be scoped out of the assessment. See Appendix 9.4 Operational Noise Assessment (Volume 3) for further details.
Noise from recreational sports pitches	The ERC could include indoor and outdoor sport facilities. A sensitivity test was undertaken by modelling noise from multiple football pitches using guidance provided in the <i>Sport England Design Guidance Note Artificial Grass Pitches (AGP) Acoustics – Planning Implications (Ref. 9.5)</i> . Noise modelling indicated a minimal risk of adverse noise impact from this source and as such has been scoped out of the assessment. See Appendix 9.4 Operational Noise Assessment (Volume 3) for further details.
Noise from onsite car parks	A combination of surface and multi storey car parks are to be constructed for use by employees and patrons. As a result of low vehicle speeds, car parks are predicted to generate relatively low noise levels in comparison to the noise generated by proposed new sections of highway serving the development. As such, the risk of noise impact from car parks is low or may be controlled by other proposed noise limits already in place. As such, noise from this source has been scoped out of the assessment. See Appendix 9.4 Operational Noise Assessment (Volume 3) for further details.

EXTENT OF THE STUDY AREA

- 9.3.5. The study area for construction noise encompasses the existing sensitive receptors around the Site up to a distance of 300m from the Site boundary. Construction vibration has been assessed up to a distance of 100m from the Site boundary. The construction noise and vibration study areas are in line with the guidance in *LA111* as well as professional judgement.

- 9.3.6. The study area for potential noise effects from development-related traffic on the surrounding road network encompasses the full extent of the road traffic model. Details of the road traffic model are presented in **Chapter 5: Traffic and Transport (Volume 1)**.
- 9.3.7. The study area for detailed operational noise predictions at sensitive receptors extends to 300m from the Site boundary, as it is considered this would most effectively capture the cautious worst case (that provides a robust assessment of likely significant effects) impacts based on professional judgement and supported by the operational noise assessment set out in Section 9.4 below.

9.4. METHODOLOGY

METHOD OF BASELINE DATA COLLECTION

Desk Study

- 9.4.1. Recently recorded third party sound level data for a site in the vicinity has been reviewed to supplement the data acquired during the surveys carried out in 2024 and 2025 at the Site. The data was obtained from publicly accessible online planning portals and are presented in **Appendix 9.1: Baseline Noise Survey Details (Volume 3)**.

Site Visit and Surveys

- 9.4.2. The Site and surrounding area were visited between 11 to 15 March 2024 to ascertain noise measurement positions representative of noise sensitive receptors (NSRs) in the area. Based on these observations various noise surveys were carried out to determine the baseline noise levels. Subsequent to this, a second visit to site between 31 January to 12 February 2025 was undertaken to supplement previous measurements at two locations to better establish representative ambient and background sound levels.
- 9.4.3. Details of the baseline noise surveys carried out in 2024 and 2025 in proximity to the Site are presented in **Appendix 9.1: Baseline Noise Survey Details (Volume 3)**.

ASSESSMENT METHODOLOGY

- 9.4.4. **Table 9-4** sets out the methodology used in the assessment of the elements scoped in for noise and vibration. Further details on the methodology used in construction noise and vibration assessments are presented in **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)**, details of the construction and operational road traffic noise assessments are presented in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**, and details of the operational noise assessment are presented in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

Table 9-4 - Assessment Methodology

Elements scoped in	Methodology
Construction Noise	An assessment of temporary construction noise impacts has been undertaken in line with the guidance contained in <i>BS 5228:2009+A1:2014 Part 1: Noise (Ref. 9.6)</i> .
Construction Vibration	An assessment of temporary construction vibration impacts has been undertaken in line with the guidance contained in <i>BS 5228:2009+A1:2014 Part 2: Vibration (Ref. 9.7)</i> .

Elements scoped in	Methodology
Construction Road Traffic Noise	An assessment of temporary construction road traffic noise impacts has been undertaken in line with the guidance contained in <i>LA 111</i> .
Operational Road Traffic Noise	An assessment of permanent operational road traffic noise impacts has been undertaken in line with the guidance contained in <i>LA 111</i> .
Operational Noise	An assessment of permanent operational noise impacts has been undertaken in line with the guidance contained in <i>BS 8233 (Ref. 9.8)</i> , <i>BS 4142 (Ref. 9.9)</i> , <i>IEMA Guidelines (Ref. 9.10)</i> . Other guidance has also been used to support the derivation of the assessment methodology, as detailed in Appendix 9.4: Operational Noise Assessment (Volume 3) .

SIGNIFICANCE CRITERIA

Magnitude of Impact

Construction Noise

- 9.4.5. An assessment of temporary construction noise impacts has been undertaken in line with the guidance contained in *BS 5228:2009+A1:2014 Part 1: Noise*.
- 9.4.6. The baseline noise environment for the construction assessment has been quantified using data from the noise survey.
- 9.4.7. Construction noise levels anticipated at the façades of the nearest sensitive receptors have been predicted based on the likely plant items (type, quantity and location), construction activities and proposed construction programme. A degree of professional judgement has been used to pragmatically group construction plant/activities and sensitive receptors where appropriate.
- 9.4.8. The methodology for determining the magnitude and significance of effects for construction noise is set out in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**. The magnitude of impact scale for construction noise is set out in **Table 9-5** below.

Table 9-5 - Magnitude of Impact - Construction Noise

Magnitude of impact	Construction noise level
High	Above or equal to SOAEL +5 dB
Medium	Above or equal to SOAEL and below SOAEL +5 dB
Low	Above or equal to LOAEL and below SOAEL
Very Low	Below LOAEL

Construction Vibration

- 9.4.9. An assessment of temporary construction vibration impacts has been undertaken in line with the guidance contained in *BS 5228:2009+A1:2014 Part 2: Vibration* as well as reference to *LA111*.
- 9.4.10. The methodology for determining the magnitude and significance of effects for construction vibration is set out in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**, and the magnitude of impact scale for construction vibration is set out in **Table 9-6** below.

Table 9-6 - Magnitude of Impact – Construction Vibration

Magnitude of impact	Construction vibration level peak particle velocity (PPV) MM/S
High	Above or equal to 10 mm/s PPV
Medium	Above or equal to 1 mm/s and below 10 mm/s PPV
Low	Above or equal to 0.3 mm/s and below 1 mm/s
Very Low	Below 0.3 mm/s

Construction Road Traffic Noise

- 9.4.11. An assessment of temporary construction road traffic noise impacts has been undertaken in line with the guidance contained in *LA111*. The following scenarios have been compared to determine the short-term impacts associated with the construction traffic:
- Scenario 1 - 2023 Existing. For the noise assessment, this represents existing baseline traffic conditions in 2023. Hereafter referred to as the '2023 Base Scenario'.
 - Scenario 2 - 2023 Existing plus Peak Construction. For the noise assessment, this represents peak construction traffic in 2029. Hereafter referred to as the '2029 Peak Construction'.
- 9.4.12. The methodology for determining the magnitude and significance of effects for construction road traffic noise is set out in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**. The magnitude of impact scale for construction road traffic noise is set out in **Table 9-7** below.

Table 9-7 - Magnitude of Impact – Construction Road Traffic Noise

Magnitude of impact	Short term noise change (dB L _{A10,18hr})
Negligible	Less than 1.0
Minor	1.0 to 2.9
Moderate	3.0 to 4.9
Major	Greater than or equal to 5.0

Operational Road Traffic Noise

- 9.4.13. An assessment of permanent operational road traffic noise impacts has been undertaken in line with the guidance contained in *LA111*. The following scenarios have been compared to determine the short and long-term impacts that may be associated with the operational traffic:

- Scenario 4 - Opening Year Reference Case plus Development vs Scenario 3 - Opening Year Reference Case. For the noise assessment, this represents the existing road network and traffic plus traffic associated with agreed consented developments plus Opening Year related demands from the Site. This is based on expanded Wixams Station being open, EWR running between Oxford and Milton Keynes only and the A421 slips being complete. This assumes no significant development in the Core Zone and Lake Zone. Hereafter referred to as 'Opening Year Do Something'.
- Scenario 4a - Opening Year Reference Case plus Development plus Construction vs Scenario 3 - Opening Year Reference Case. For the noise assessment, this represents the existing road network and traffic plus traffic associated with agreed consented developments plus Opening Year plus 10 years (midpoint between Opening Year and Future Year demands) related demands from the Site. This is based on expanded Wixams Station being open, EWR running between Oxford and Milton Keynes only and the A421 slips being complete. This assumes construction activities in the Core Zone and Lake Zone. Hereafter referred to as 'Midpoint Year Do Something'.
- Scenario 5 - Future Year - Reference Case plus Development vs Scenario 3 - Opening Year Reference Case. For the noise assessment, this represents the existing road network and traffic plus traffic associated with agreed consented developments plus Future Year related demands from the Site. This is based on expanded Wixams Station being open, EWR running between Oxford and Milton Keynes only and the A421 slips being complete. This assumes full development of the Core Zone and Lake Zone. Hereafter referred to as 'Future Year Do Something'.

9.4.14. The methodology for determining the magnitude and significance of effects for operational road traffic noise is set out in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**. The magnitude of impact scale for operational road traffic noise is set out in **Table 9-8** below.

Table 9-8 - Magnitude of Impact – Operational Road Traffic Noise

Magnitude of impact	Short term noise change (dB L_{A10,18hr})	Long term noise change (dB L_{A10,18hr})
Negligible	Less than 1.0	Less than 3.0
Minor	1.0 to 2.9	3.0 to 4.9
Moderate	3.0 to 4.9	5.0 to 9.9
Major	Greater than or equal to 5.0	Greater than or equal to 10.0

Operational Noise

- 9.4.15. There are currently no recognised standards or assessment methodologies applicable specifically to operational noise generated by a Theme Park. The assessment criteria for the Core Zone noise have been derived considering typical noise levels generated at other UDX parks, evidence on acceptable noise limits drawing on UK British Standards and guidance documents and World Health Organisation publications and the anticipated change in noise level at receptors.
- 9.4.16. Noise from the following sources has been considered within this assessment:
- Operational noise associated with the Core Zone;
 - Noise from 'third shift' activities within the Core Zone; and

- Noise from the utility compound located in the Lake Zone.

9.4.17. This assessment considers only the impact of noise on human receptors. The impact of noise on ecological receptors is considered within **Chapter 6: Ecology and Nature Conservation (Volume 1)**.

9.4.18. Operational noise sources are discussed in more detail below.

Core Zone

9.4.19. Based on discussions with Universal Destinations and Experiences (UDX), several sources have been identified as the most significant likely contributors to noise generated by the Core Zone:

- Outdoor rides such as roller coasters, which would include a combination of mechanical noise generated by the roller coaster travelling along the track and occasional patron noise i.e. screams, at certain sections of the ride;
- General Site noise from patrons, for example such as that associated with gatherings of people at outdoor events;
- 'Immersion zones' which may involve live shows, parades, entertainers, water, and special effects etc.;
- Noise from drone displays (which will only take place within airspace above UDX property) and non-firework pyrotechnics. Typically, small battery powered and computer controlled drones are utilised which generate relatively low levels of high frequency noise; and
- Outdoor event stages hosting live shows, which may include amplified music with a low frequency (bass) component.

9.4.20. Noise limits applicable to the Core Zone are discussed in the following sections.

'Third Shift' Activities

9.4.21. Activities associated with the 'third shift' during the evening and night include:

- Routine maintenance within the Core Zone and safety critical repairs; and
- Testing of roller coasters without passengers.

9.4.22. Each roller coaster is sent on a daily test run without passengers prior to the opening of the park. The roller coaster test is likely to be the loudest individual noise source during third shift activities. The routine procedures for roller coasters during the third shift include the following:

- Pre-opening: Start-up cycling of roller coasters prior to patrons arriving – up to 3 hours in total;
- Post-close: Cycling guests out (i.e. clearing patrons from roller coasters prior to closing) and shutdown procedure – up to 2 hours in total; and
- Overnight: Track is typically locked out overnight with no vehicle movements on the track. Some vehicle motion can be required occasionally overnight for repairs, testing or maintenance.

9.4.23. Third shift activities fall within the definition of night-time operational noise sources and the noise limit applicable to the third shift is therefore the same as the night-time Core Zone noise limit (as discussed in the following sections). However, noise levels generated by third shift activities are anticipated to be significantly lower than those generated by other operational noise sources due to greatly reduced operations of outdoor attractions (e.g. testing and maintenance/repair only) and the

omission of most other noise sources, including patrons, pyrotechnics, immersion zones, live shows, etc.

Utility Compound

9.4.24. The Utility Compound will include buildings, structures and facilities comprising:

- An EHV power substation;
- Energy centres (less than 50MW in combination) that serve a defined district heating, cooling, and power network, comprising heat pumps (air, water, or ground geothermal), heat recovery, electric boilers, thermal storage, electric chillers, gas boilers (which might be required for one year following opening year);
- A Water Processing and Collection Plant for the treatment and re-use of harvested non-potable water; and
- Utility metering equipment.

9.4.25. It is not yet determined whether or not a Battery Energy Storage System, (BESS) will be provided, however, the ERC could include the development of a BESS and has therefore been considered within the assessment.

Core Zone Noise Limits

9.4.26. The Core Zone noise limits for which consent is being sought are below and apply at the Receptor Control Locations (RCLs) identified in **Figure 9.8: Receptor Control Locations (Volume 2)**:

Daytime (from 07:00 to 23:00 hours):

- 60 dB $L_{Aeq,1hour}$;
- 79 dB $L_{eq,1hour}$ at 63 Hz; and
- 69 dB $L_{eq,1hour}$ at 125 Hz.

Night-time (from 23:00 to 07:00 hours) applicable to all RCLs with the exception of RCL04 (Wixams) and RCL05 (Stewartby):

- 55 dBL $_{Aeq,15minutes}$;
- 74 dB $L_{eq,15mins}$ at 63 Hz; and
- 64 dB $L_{eq,15mins}$ at 125 Hz.

Night-time (from 23:00 to 07:00 hours) – applicable to RCL04 (Wixams) and RCL05 (Stewartby) only:

- 50 dBL $_{Aeq,15minutes}$;
- 70 dB $L_{eq,15minutes}$ at 63 Hz; and
- 59 dB $L_{eq,15minutes}$ at 125 Hz.

9.4.27. The A-weighted limits apply to all forms of noise associated with the Core Zone, including screams from riders of roller coasters. The frequency specific noise limits apply only to amplified music in the Core Zone area. Based on WSP's professional judgment regarding the noise to be generated by operations in the Core Zone, the low frequency noise limits are only required for outdoor amplified music within the Core Zone, as other activities will not generate noise levels at these frequencies that would be expected to be problematic.

- 9.4.28. The low frequency noise limits have been derived by reference to Noise Rating Curves¹ corresponding to the A-weighted noise limits for which consent is being sought. Therefore, such that the broadband noise limit is not exceeded due to contributions in the 63 Hz and 125 Hz frequency bands - i.e. the low frequency noise limits proposed do not compromise the broadband noise limits being achieved.
- 9.4.29. The reasons for adopting a lower night-time Core Zone noise limit at RCL04 and RCL05 are discussed in Section 9.6.
- 9.4.30. The broadband noise limits are similar to those established for other UDX parks, namely:
- Universal Epic Universe: 60 dBA daytime; 55 dBA night-time; and
 - Universal Studios Japan: daytime ranges from 60 dBA to 65 dBA; 55 dBA night-time
- 9.4.31. Some UDX parks are exempt from noise standards. In these cases, UDX self-regulates noise to mitigate impacts to adjacent residential communities. In its experience, noise levels consistent with those proposed for the Core Zone are sufficient to achieve such mitigation.

Noise monitoring at Universal Studios Hollywood

- 9.4.32. Noise monitoring was undertaken at several locations within the community adjacent to UDX's Entertainment Resort Complex at Universal Studios Hollywood over a 24-hour period commencing Friday 23 August 2024.
- 9.4.33. The results from the noise monitoring at two locations closest to the Universal Studios Hollywood site boundary are presented graphically in **Annex A of Appendix 9.4: Operational Noise Assessment (Volume 3)**.
- 9.4.34. These results indicate the measured daytime $L_{Aeq,1hr}$ noise levels were below the 60 dB $L_{Aeq,1hr}$ daytime Core Zone noise limit for the majority of the measurement period, and the night-time $L_{Aeq,1hr}$ noise levels were below the 55 dB $L_{Aeq,15min}$ night-time Core Zone noise limit (assuming the $L_{Aeq,1hr}$ equates to the $L_{Aeq,15min}$ during the night). Furthermore, the measurement data indicates the 50 dB $L_{Aeq,15min}$ night-time limit for which consent is being sought at RCL04 and RCL05 would also be met for the majority of the night-time period.
- 9.4.35. Monitoring data at both locations includes contributions from sources other than those within the Universal Studios Hollywood Entertainment Resort Complex and nevertheless demonstrate that the noise limits for which consent is being sought are achievable at locations in the community close to the site boundary.
- 9.4.36. Further information on the relevant guidance documents considered for the assessment of Core Zone noise is provided in Section 1.5 of **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

¹ Noise Rating (NR) Curve – a range of octave band curves often used to represent the acceptability of indoor acoustic environments with weightings provided to reflect the sensitivity of the ear to different frequencies of sound.

Core Zone Significance of Effect

9.4.37. The magnitude of impact of daytime and night-time noise criteria from the operations associated with the Core Zone are defined in **Table 9-9** and **Table 9-10** with the matrix of significance of effect during the daytime and night-time provided in **Table 9-11** and **Table 9-12** respectively.

Table 9-9 – Core Zone Noise Magnitude of Impact Criteria – Daytime

Impact magnitude	Broadband noise ⁽¹⁾		Low frequency noise ⁽³⁾	
	Core zone noise level, dB L _{Aeq,1hr}	Increase in ambient noise level, dB L _{Aeq,T} ⁽²⁾	63 Hz dB L _{eq,1hr}	125 Hz dB L _{eq,1hr}
High	≥ 60	≥ 5	≥ 79	≥ 69
Medium	≥ 55 and < 60	≥ 3 and < 5	≥ 74 and < 79	≥ 64 and < 69
Low	≥ 50 and < 55	≥ 1 and < 3	≥ 70 and < 74	≥ 59 and < 64
Very Low	< 50	≥ 0 and < 1	< 70	< 59

Notes

- (1) The interaction of Core Zone noise level and the increase in ambient noise level is addressed in the Matrix of Significance of Effect tables.
- (2) Scales informed by IEMA, Design Manual for Roads and Bridges (DMRB) LA111: Noise and Vibration and from specific developments such as High Speed 2.
- (3) Applies only to amplified music within the Core Zone.

Table 9-10 - Core Zone Noise Magnitude of Impact Criteria – Night-time

Impact magnitude	Broadband noise ⁽¹⁾		Low frequency noise ⁽³⁾	
	Core zone noise level, dB L _{Aeq,15min}	Increase in ambient noise level, dB L _{Aeq,T} ⁽²⁾	63 Hz dB L _{eq,15min}	125 Hz dB L _{eq,15min}
High	≥ 55	≥ 5	≥ 74	≥ 64
Medium	≥ 50 and < 55	≥ 3 and < 5	≥ 70 and < 74	≥ 59 and < 64
Low	≥ 45 and < 50	≥ 1 and < 3	≥ 65 and < 70	≥ 54 and < 59
Very Low	< 45	≥ 0 and < 1	< 65	< 54

Notes

- (1) The interaction of Core Zone noise level and the increase in ambient noise level is addressed in the Matrix of Significance of Effect tables.
- (2) Scales informed by IEMA, Design Manual for Roads and Bridges (DMRB) LA111: Noise and Vibration and from specific developments such as High Speed 2.
- (3) Applies only to amplified music within the Core Zone.

- 9.4.38. The significance of effect criteria have been derived through the use of matrices that combine the magnitude of impact relating to the absolute noise level from the Core Zone and the impact relating to the change in existing ambient noise level at the RCL.
- 9.4.39. As set out in **Chapter 3: Approach to EIA (Volume 1)** effects described as moderate or major (positive or adverse) are deemed to be significant. Effects that are minor (positive or adverse), or negligible, are considered not significant.

Table 9-11 - Core Zone Noise Matrix of Significance of Effect – Daytime

Increase in ambient noise level, dB $L_{Aeq,T}$	Core zone noise level, dB $L_{Aeq,1hr}^{(1),(2)}$			
	≥ 60 (high impact)	≥ 55 and < 60 (medium impact)	≥ 50 and < 55 (low impact)	< 50 (negligible impact)
≥ 5 (high impact)	Major	Major/Moderate	Moderate/Minor	Negligible
≥ 3 and < 5 (medium impact)	Major/Moderate	Moderate	Moderate/Minor	Negligible
≥ 1 and < 3 (low impact)	Moderate	Moderate/Minor	Minor	Negligible
≥ 0 and < 1 (negligible impact)	Moderate/Minor	Moderate/Minor	Minor/Negligible	Negligible
Notes The above matrix is based on the assumption that all receptors have high sensitivity to noise. (1) Low frequency noise is excluded from the matrix above, with the approach taken in determination of the significance of effect described below.				

Table 9-12 - Core Zone Noise Matrix of Significance of Effect – Night-time

Increase in ambient noise level, dB $L_{Aeq,T}$	Core zone noise level, dB $L_{Aeq,15min}$			
	≥ 55 (high impact)	≥ 50 and < 55 (medium impact)	≥ 45 and < 50 (low impact)	< 45 (negligible impact)
≥ 5 (high impact)	Major	Major/Moderate	Moderate/Minor	Negligible
≥ 3 and < 5 (medium impact)	Major/Moderate	Moderate	Moderate/Minor	Negligible
≥ 1 and < 3	Moderate	Moderate/Minor	Minor	Negligible

Increase in ambient noise level, dB $L_{Aeq,T}$	Core zone noise level, dB $L_{Aeq,15min}$			
	≥ 55 (high impact)	≥ 50 and < 55 (medium impact)	≥ 45 and < 50 (low impact)	< 45 (negligible impact)
(low impact)				
≥ 0 and < 1 (negligible impact)	Moderate/Minor	Moderate/Minor	Minor/Negligible	Negligible
Notes The above matrix is based on the assumption that all receptors have high sensitivity to noise. (1) Low frequency noise is excluded from the matrix above, with the approach taken in determination of the significance of effect described below.				

Utility Compound Noise Limits

- 9.4.40. The following limits to noise from the normal operation of the Utility Compound are proposed at the location of the nearest sensitive receptors, namely dwellings on Manor Road as represented by RCL01:
- Noise associated with the operation of the Utility Compound, when assessed in accordance with BS4142:2014+A1:2019, will not exceed the following rating levels: 56 dB $L_{A_{r,Tr}}$ during the day and 47 dB $L_{A_{r,Tr}}$ at night.
- 9.4.41. This is based on the measured noise levels at location MP2b (dwellings on Manor Road) reported in **Appendix 9.1: Baseline Noise Survey Details (Volume 3)** and is equivalent to a rating level of +10dB above the representative background noise levels.
- 9.4.42. If the Utility Compound is to be located on the western side of Public Road B, Segment 1, the receptor at NSR13, as identified in **Image 9-2**, may experience higher noise levels than RCL01. If this is the case, the limits would apply at both RCL01 and NSR13.
- 9.4.43. Further supporting information on the assessment of noise from the Utility Compound is provided in Section 1.5 of **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

Utility Compound Significance of Effect

- 9.4.44. The magnitude of impact of noise from the Utility Compound is defined in **Table 9-13** below:

Table 9-13 – Utility Compound Noise Magnitude of Impact Criteria

Impact magnitude	Increase of rating level over representative background sound level, dB ^{(1), (2)}
High	$\geq +10$
Medium	$\geq +5$ and $< +10$
Low	≥ 0 and $< +5$

Impact magnitude	Increase of rating level over representative background sound level, dB ^{(1), (2)}
Very Low	< 0
Notes (1) The above criteria apply equally to the daytime or night-time condition, i.e. daytime rating level, dB L_{Ar,Tr}, when compared with the daytime representative background sound level, dB L_{A90,T}; or the night-time rating level, dB L_{Ar,Tr}, when compared with the night-time representative background sound level, dB L_{A90,T}. (2) The representative daytime and night-time background sound levels are derived using the L_{A90,15min} metric and following the procedure described in BS4142:2014+A1:2019	

9.4.45. The matrix of significance of effect is provided in **Table 9-14**, below.

Table 9-14 – Utility Compound Noise Significance of Effect

Impact magnitude	Level of significance, relative to sensitivity of receptor		
	Low	Medium	High
High	Moderate	Moderate/Major	Major
Medium	Minor	Moderate	Moderate
Low	Negligible	Minor	Minor
Very Low	Negligible	Negligible	Negligible

9.4.46. All receptors are assumed to have a high sensitivity to noise from the Utility Compound.

9.4.47. The significance of effects has been defined as follows:

- Moderate or major effects are considered to be '**Significant**'; and
- Minor and negligible effects are considered to be '**Not Significant**'.

9.5. BASELINE CONDITIONS

9.5.1. This section provides information on the baseline noise levels used for the noise assessments in this chapter.

9.5.2. Details of the baseline noise surveys carried out in 2024 and 2025 in proximity to the Site and methodology used to determine baseline noise levels at noise sensitive receptors (NSRs) are presented in **Appendix 9.1: Baseline Noise Survey (Volume 3)**. **Appendix 9.1: Baseline Noise Survey (Volume 3)** also provides details of publicly available third-party noise data which has been reviewed.

9.5.3. The measured baseline noise levels are summarised in **Table 9-15** below. These are identified in **Figure 9.1: Construction Noise and Vibration Study Area and Sensitive Receptors (Volume 2)** and shown in **Image 9-1**.

Table 9-15 - Summary of baseline noise survey results

Position	Representative ambient noise levels		Representative background noise levels	
	Day-time 07:00-23:00hrs dB L _{Aeq,T}	Night-time 23:00-07:00hrs dB L _{Aeq,T}	Day-time 07:00-23:00hrs L _{A90,15min}	Night-time 23:00-07:00hrs L _{A90,15min}
MP1	64	53	59	40
MP2a	52	45	46	35
MP2b ^{(1),(2)}	67 ⁽²⁾	58 ⁽²⁾	48 ⁽²⁾	39 ⁽²⁾
MP3	59	49	53	41
MP4	52	46	44	38
MP4 ⁽³⁾	51	45	43	39
MP5	64	53	59	40
Pos A	62 ⁽⁴⁾	54	46	32
Pos B	66 ⁽⁴⁾	52	49	32
MP1A ⁽⁵⁾	53	51	39	37
(1) Long term measurement, 31/01/25 – 12/02/25 (2) Measured 1m from external façade, facing south. Data as reported includes effect of façade reflection. Deduct 2 dB to correct to free-field equivalent level. (3) Long term measurement, 31/01/25 – 11/02/25 (4) Partial measurement during period (5) 3rd party noise survey data at this location utilised for NSR11				

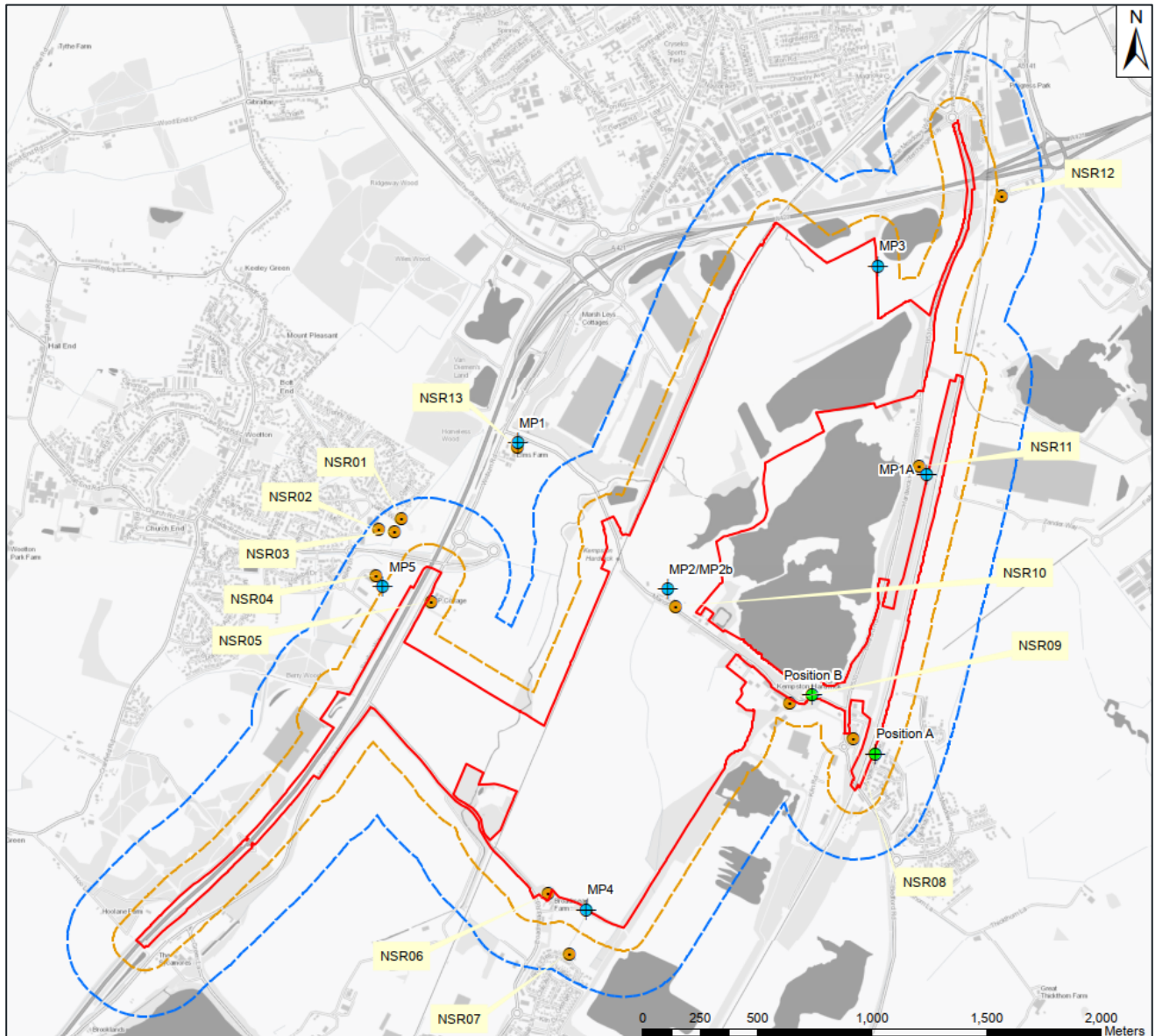


Image 9-1 – Location of sensitive receptors and baseline survey measurement locations

FUTURE BASELINE

- 9.5.4. For the construction and operational noise impact assessments in this chapter, conservative assumptions have been made when determining representative noise conditions at sensitive receptors. Any changes to the future noise baseline are not expected to substantially change the outcomes of the construction activity and operational noise assessments in this chapter.
- 9.5.5. For construction and operational road traffic noise assessments, the relevant changes in future baseline road traffic flows (e.g. due to other committed developments) have been factored into the traffic flows used in the noise assessment.

SENSITIVE RECEPTORS

- 9.5.6. Noise and vibration sensitive receptors within 300m of the Site boundary have been identified based on a detailed desktop review of the surrounding area.

- 9.5.7. The identified NSRs are described in **Table 9-16** below, and all the sensitive receptors listed in are assigned as having a high sensitivity. The receptors are also presented on the map in **Figure 9.1: Construction Noise and Vibration Study Area and Sensitive Receptors (Volume 2)** and shown in **Image 9-1**.

Table 9-16 - Identified Noise Sensitive Receptors Within 300m of the Site Boundary

Noise sensitive receptor reference	Description	Town/ village location	Receptor category	Approximate No. of properties
NSR01	Properties along Steele Walk and Lomax Gardens Properties off Folkes Road, Moore Close and Sherwood Close Properties along Harris Way, Waite Meadows, and Stevenson Walk	Wootton	Residential	300
NSR02	Wootton Lower School, Harris Way	Wootton	Educational/School	1
NSR03	Wootton Community Centre, Harris way	Wootton	Community Centre	1
NSR04	Blue Orkids Wootton Nursery, Innovation Way	Wootton	Educational/School	1
NSR05	Individual property east of Woburn Road	Stewartby	Residential	1
NSR06	Farmhouse off Broadmead Road	Stewartby	Residential	1
NSR07	Properties along Brick Crescent (south of the Site boundary)	Stewartby	Residential	180
NSR08	Properties along Ampthill Road (east off the B530) Properties along Angelica Grove and Borage Walk (northeast off the B530) Properties southwest off the B530	Kempston Hardwick	Residential	100
NSR09	Properties to the south of Manor Road	Kempston Hardwick	Residential	5
NSR10	Properties off Manor Road	Kempston Hardwick	Residential	15

Noise sensitive receptor reference	Description	Town/ village location	Receptor category	Approximate No. of properties
NSR11	Properties on the east of the B530 Hardwick Hill	Wixam	Residential	2
NSR12	Holiday Inn Express (northeast to the Site boundary)	Bedford	Hospitality/ Hotel	1
NSR13	Property bound by Proposed Development to the east, Manor Road to north and Woburn Road to the west	Stewartby	Residential	1

Note

The receptors identified in this table are, for the purposes of this assessment, considered noise sensitive. If in the future any of the identified sensitive receptors are removed or if their use class changes such that they are no longer considered sensitive to noise, the noise limits for which consent is being sought would no longer apply.

- 9.5.8. In order to determine compliance with the Core Zone noise limits set out in Section 9.4, a series of Receptor Control Locations (RCLs) is proposed. These are locations beyond the Site boundary that represent the nearest residential communities to the Proposed Development.
- 9.5.9. The purpose of the RCLs is two-fold: firstly, they will act as verification points for future noise modelling that will be implemented and developed as the detailed design of the Theme Park progresses. Secondly, the RCLs are publicly accessible and therefore may be used as future noise monitoring locations in order to confirm compliance with the Core Zone noise limits.
- 9.5.10. The locations of the proposed Receptor Control Locations are described in **Table 9-17** and identified in **Figure 9.8: Receptor Control Locations (Volume 2)**.

Table 9-17 – Receptor Control Locations (RCLs)

RCL Ref.	Description	Approximate distance from core zone ⁽¹⁾	Coordinates, British National Grid	
			X (m)	Y (m)
RCL01	Manor Road. Represents the residential properties located along the western stretch and on the northern side of Manor Road.	100m	502752	244667
RCL02	Manor Road, west of B530. Represents the dwellings located along the eastern stretch and to the south of Manor Road.	200m	503445	244228
RCL03	Amphill Road, north. Represents the travellers' site located between the	450m	503607	244024

RCL Ref.	Description	Approximate distance from core zone ⁽¹⁾	Coordinates, British National Grid	
			X (m)	Y (m)
	Midland Main Line railway and the B530 Ampthill Road.			
RCL04	Ampthill Road, south. Represents the Wixams community to the immediate northeast of B530 Ampthill Road, east of the Midland Main Line railway. ⁽²⁾	780m	503765	243673
RCL05	Brick Crescent, Stewartby. Represents the community of north Stewartby located to the east of Broadmead Road	250m	502493	243019
RCL06	Broadmead Farm, Stewartby. Represents the residential dwelling at Broadmead Farm to the east of Broadmead Road.	50m	502252	243350

Notes

- (1) This is the approximate distance to the closest boundary of the Core Zone
- (2) Sensitivity checks were undertaken to determine if additional RCLs would be needed to represent dwellings located farther east from this position. However, checks on topography and intervening structures indicated that the RCL at this location would be appropriate to represent where the likely highest Core Zone noise level could be anticipated and that dwellings farther east of RCL04 would be subject to lower noise levels. Therefore, additional RCLs in the Wixams area were not considered necessary.

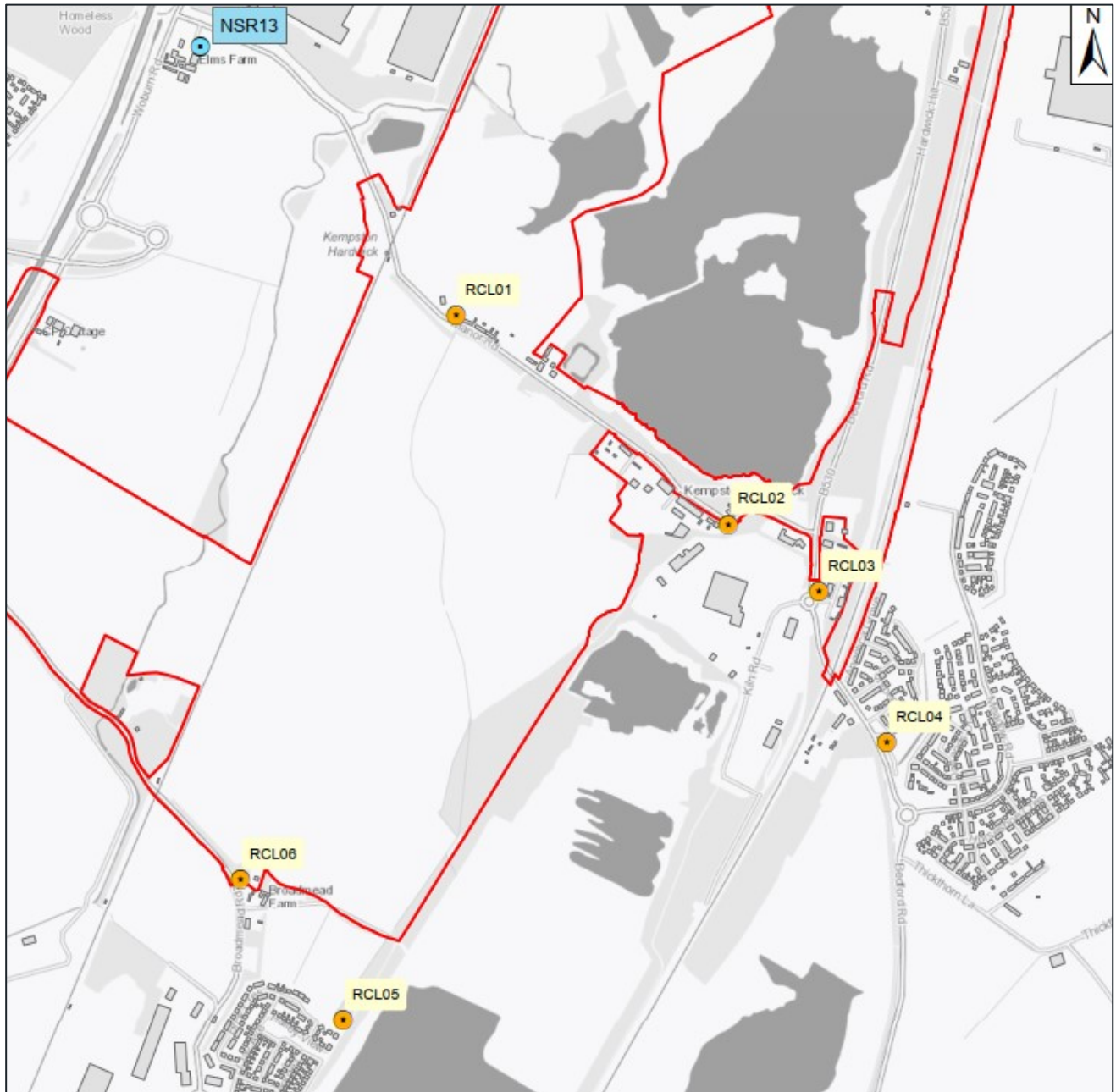


Image 9-2 – Receptor Control Locations

Community at Wooton

- 9.5.11. Consideration was given to including an RCL to represent the Wooton community to the west of the Proposed Development. However, given the large distance from the nearest sensitive receptors to the Core Zone and the presence of the A421, the dominant source of ambient noise, between Wooton and the Core Zone it was concluded that noise from the Core Zone is unlikely to result in an adverse effect and noise limits would not be applicable.

Residential Status of Properties represented by RCLs

- 9.5.12. The Core Zone noise limits would only apply to an RCL for as long as all of the properties associated with that RCL remain in residential use.

Hotels

- 9.5.13. Hotels will be designed to achieve the guideline internal noise levels referenced in *BS 8233:2014 Guidance on sound insulation and noise reduction for buildings* unless the hotel operator has its own design code which includes internal noise limits for bedrooms.

9.6. ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

CONSTRUCTION PHASE

- 9.6.1. **Table 9-18** presents a summary of the predicted construction noise and vibration effects at each of the previously identified noise-sensitive receptors. Details of the construction noise and vibration assessments are presented in **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)** including proposed mitigation measures which are set out in Section 4 of **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)**, and details of the construction road traffic noise assessment is presented in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**.

Table 9-18 - Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring during Construction

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
Construction Noise – Day-time		
NSR01-04 NSR12-13	Potential Effects	Negligible for both peak and typical construction noise levels.
	Additional Mitigation	None required
	Residual Effects and Monitoring	The sensitivity of the residential, community and educational receptors is high, and the magnitude of change is Negligible (Not Significant) . Further mitigation measures are not required.
NSR07 NSR11	Potential Effects	Minor or Negligible for both peak and typical construction noise levels.
	Additional Mitigation	Principal Contractor to employ Best Practicable Means (BPM), as defined in Section 72 of the <i>Control of Pollution Act 1974</i> (Ref. 9.11), to limit construction noise. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of the residential receptors is high, and the magnitude of change is Minor or Negligible (Not Significant) . Further mitigation measures are not required.
NSR05-06 NSR08-10	Potential Effects	Moderate to Major for peak construction noise levels. Negligible to Major for typical construction noise levels.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
	Additional Mitigation	Principal Contractor to employ BPM to limit construction noise. Further details on mitigation set out in and Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of the residential receptors is high, and the magnitude of change is Moderate to Major Adverse (Significant) . Therefore, there is likely to be a direct, temporary, short to medium-term Moderate to Major Adverse residual effect on the receptors (Significant) following the implementation of mitigation measures.
Construction Noise – Evening and night-time		
All NSRs	Potential Effects	Certain construction activities may require extended working hours for reasons of engineering practicability, weather and safety such as major concrete pours and piling, surveys, lifting/fitting of infrastructure and equipment, and abnormal deliveries. As identified in Appendix 2.1: Environmental Statement Basis of Assessment (Volume 3), during the final 18 months of the Primary Phase Construction programme there will be a requirement for out of hours working within the Core Zone for Theme Park ride and show fit-out activities, which will be carried out after heavy construction activities cease. A detailed quantitative assessment of any evening and night-time construction works has not been undertaken at this stage given the lack of detailed information. However, given that works are likely to be undertaken to varying extents over a period of several years and potentially late into the night on occasion, it is assumed that Moderate to Major impacts could occur at sensitive receptors close to the Site.
	Additional Mitigation	Principal Contractor to employ BPM to limit construction noise. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of the residential receptors is high, and the magnitude of change is Moderate to Major Adverse (Significant) . Therefore, there is likely to be a direct, temporary, short-term Moderate to Major Adverse residual effect on the receptors (Significant) following the implementation of mitigation measures.
Construction Vibration		
NSR05-06 NSR08-10	Potential Effects	There is the potential for Significant Adverse vibration effects as a result of the use of vibratory rollers and piling rigs (impact and continuous flight auger) during the construction works. Moderate Adverse impacts are predicted at NSR05-06 and NSR08-10 during the use of a vibratory roller. Moderate Adverse impacts are predicted at NSR05-06 and NSR08-10 during impact piling. Minor Adverse impacts are predicted at NSR05-06 and NSR08-10 during CFA piling.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
	Additional Mitigation	Principal Contractor to employ BPM to limit construction vibration. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of receptors is high, and the magnitude of change, following mitigation, is Moderate Adverse during vibratory rolling and impact piling. Therefore, there is likely to be a direct, temporary, short-term Moderate Adverse residual effect (Significant) following the implementation of mitigation measures.
Kempston Hardwick moated site	Potential Effects	There is the potential for Moderate Adverse vibration effects at the Kempston Hardwick moated site monument during the use of a vibratory roller and Major Adverse effects during impact piling. CFA piling is predicted to result in Negligible effects.
	Additional Mitigation	Due to unknowns regarding the structural integrity of the Kempston Hardwick moated site, a Piling Risk Assessment should be undertaken and this should consider potential vibration impacts at the monument. Further details are set out in Appendix 2.3: Outline Construction Environmental Management Plan (OCEMP) (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of the heritage asset is high, and the magnitude of impact is Moderate Adverse (Significant) .
Construction Road Traffic Noise (Scenario 2 – 2023 Existing plus Peak Construction)		
NSR06 NSR09-10	Potential Effects	There is the potential for Significant effects (both Beneficial and Adverse) as a result of additional vehicles, and in particular heavy vehicles, on the existing road network during the Construction Phase. Moderate Beneficial impacts are predicted at receptors adjacent to Manor Road (NSR09-10), based on the assumption that Manor Road will be closed during the construction period as it coincides with Network Rail's <i>Transport and Works Act Order (TWAo)</i> works to construct a new bridge over the Marston Vale Railway Line. Furthermore, as the impacts are predominately due to a decrease (halving) in vehicle flow and in the proportion of heavy vehicles, it is considered that the decreases may be perceptible to residents. Whilst it is acknowledged that the decrease in road traffic noise as a result of the closure of Manor Road does not occur as a direct result of the Proposed Development, there is nevertheless a cumulative beneficial impact. Depending on the timing of delivery of the Network Rail Manor Road bridge over the Marston Vale Railway Line, Manor Road (west) could be available to construction traffic during some phases of the construction period. However, as shown in the Transport Assessment, there would be no change in the number of vehicles or proportion of heavy vehicles using Manor Road (west) during the construction works (i.e. vehicles using this route during the Construction Phase would be no greater than the existing scenario) and therefore the impact would be Negligible. Consequently, Moderate Beneficial cumulative impacts are likely and these are considered Significant. A Moderate Adverse impact is predicted at a single dwelling adjacent to Broadmead Road (NSR06). As the increase in noise is predominately

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
		due to an increase in heavy vehicles, it is considered that the increase may be perceptible to residents. Consequently, this Moderate Adverse impact, whilst affecting only one property, is considered Significant. The magnitude of impact on all other road links within the network provided by the transport consultants were Negligible or Minor, and considered Not Significant. Out of hours working may be required, details of which are provided in Appendix 2.3: OCEMP (Volume 3). As a result, there may be some night-time periods where construction vehicles, including heavy duty vehicles (HDVs) and light duty vehicles (LDVs), are accessing the site. These movements will be spread overnight and potentially by different routes and therefore the impact on any one link will be Not Significant.
	Additional Mitigation	Principal Contractor to employ BPM to limit construction noise. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .
	Residual Effects and Monitoring	The sensitivity of receptors is high, and the magnitude of change, following mitigation, is Moderate Beneficial to Moderate Adverse. Therefore, depending on the location of the NSR, there is likely to be a direct, temporary, short-term Moderate Beneficial to Moderate Adverse residual effect (Significant) following the implementation of mitigation measures.

OPERATIONAL PHASE

Operational Road Traffic Noise

- 9.6.2. **Table 9-19** presents a summary of the predicted operational noise effects of operational road traffic at each of the previously identified noise-sensitive receptors. Details of the operational road traffic noise assessments are presented in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**, and details of the operational noise assessment are presented in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

Table 9-19 - Assessment of Potential Effects, Additional Mitigation, Residual Effects and Monitoring for Operational Road Traffic

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
Operational Road Traffic Noise – Existing road network (Scenario 4 – Opening Year - Reference Case plus Development, Scenario 4a - Opening Year - Reference Case plus Development plus Construction and 5 — Future Year - Reference Case plus Development)		
All NSRs	Potential Effects	The magnitude of impact on all road links within the existing network based on the traffic flow data for all scenarios were Minor Beneficial to Minor Adverse and considered Not Significant .
	Additional Mitigation	No additional mitigation is considered to be required.

Sensitive receptor	Potential effects/additional mitigation/residual effects and monitoring	
	Residual Effects and Monitoring	The sensitivity of receptors is high, and the magnitude of change, following mitigation, is negligible to minor adverse. Therefore, there is likely to be a direct, permanent, long-term Minor Beneficial to Minor Adverse residual effect (Not Significant).
Operational Road Traffic Noise – New and altered roads (Scenario 4 – Opening Year - Reference Case plus Development, Scenario 4a - Opening Year - Reference Case plus Development plus Construction and 5 – Future Year - Reference Case plus Development)		
NSR09 – NSR10	Potential Effects	The change in noise level predicted at all receptors within the 300m Study area for new and altered roads based on the traffic flow data for all scenarios is predicted to be Negligible to Minor Adverse , with the exception of Vine Cottages (two dwellings) at the eastern end of Manor Road near to NSR09 which are predicted to experience a Major Adverse impact. However, it is understood that both dwellings have been purchased by UDX and will be demolished and will therefore no longer be considered a sensitive receptor.
	Additional Mitigation	Following removal of Vine Cottages, no additional mitigation is required.
	Residual Effects and Monitoring	The sensitivity of receptors is high and following removal of Vine Cottages (or change of use so they are no longer used as residential accommodation), there is likely to be a direct, permanent, long-term Negligible to Minor Adverse residual effect (Not Significant).

Core Zone Noise Assessment

- 9.6.3. The Core Zone Noise Limits identified in Section 9.4 apply to all noise sources operating within the Core Zone, under all conditions. As set out in **Appendix 2.1: Environmental Statement Basis of Assessment (Volume 3)**, operation of the Theme Park will include up to 60 days a year of Halloween Horror Nights (or other seasonal events), up to five days a year of Holiday operating hours, and up to 30 days a year of Special Events. During Normal Hours, the specialist additional offerings associated with Halloween Horror Nights, Holidays and Special events will be absent. As a result, the noise levels generated during normal operation of the Theme Park are anticipated to be lower than the Core Zone Noise Limits for which consent is being sought, particularly at night.
- 9.6.4. For all RCLs the night-time Core Zone noise limits are set lower than the daytime Core Zone noise limit. For all RCLs except RCL04 (Wixams) and RCL05 (Stewartby), the night-time Core Zone noise limit is set at 5 dB lower than the daytime Core Zone limit. For RCL04 and RCL05, the night-time Core Zone noise limit was further reduced and set at 10 dB lower than the daytime Core Zone noise limit. A lower noise limit has been set at RCL04 and RCL05 in consideration of:
- The relatively large sizes of the communities at RCL04 (Wixams) and RCL05 (Stewartby), as opposed to isolated dwellings;
 - The proximity of RCL05 to the Core Zone boundary;
 - The fact that the night-time ambient noise at Wixams is driven in part by rail traffic, which is intermittent and irregular at night resulting in quieter periods during lulls in rail traffic; and

- The relatively low night-time ambient noise levels at Stewartby due to the distance from major transportation noise sources.

- 9.6.5. The application of a stricter night-time noise limit at RCL04 and RCL05 compared with other RCLs will therefore result in a reduced noise impact with fewer properties significantly affected.
- 9.6.6. Assessments have been undertaken of daytime and night-time noise impacts at the nearest RCLs resulting from the operation of the Core Zone at its anticipated maximum allowable noise level, i.e. at the Core Zone noise limits for which consent is being sought, which for this assessment is defined as occurring during the Halloween Horror Night, Holidays and Special Events. The noise levels experienced at RCLs located farther from the Core Zone boundary are unlikely to be as high as the Core Zone limits for which consent is being sought. Whilst the noise limits for which consent is being sought are the same for all RCLs (with the exception of RCL04 and RCL05, as described above), it is appropriate to also present a more likely and realistic assessment for these more distant RCLs. The assessment provides an approximate outcome based only on the noise propagation model results and not on a final Theme Park layout. The model results for the more distant RCLs are referred to as the 'typical' noise levels. Since the closer RCLs, which for this assessment are RCL01 (Manor Road), RCL05 and RCL06 (north of Stewartby), are the controlling receptors, the typical noise levels here equate to the Core Zone Noise Limits.
- 9.6.7. By applying the Matrix of Significance of Effect in **Table 9-11** and **Table 9-12**, the initial significance of effect – referred to as the 'Stage 1' significance - was determined, prior to consideration of factors other than noise levels alone which may influence the final significance outcome. The final significance assessment outcome is defined in the 'Stage 2' determination of significance.
- 9.6.8. The assessment of typical noise impacts at nearby communities is provided in **Table 9-20** with the determination of the significance of effect in **Table 9-21**.
- 9.6.9. As noted above, it is acknowledged that the Core Zone noise limits for which consent is being sought are to be applied to all RCLs, even those at greater distances from the Core Zone boundary. The noise impacts considering the farther away RCLs – namely, RCL02-04, would be higher than those presented in **Table 9-20** and **Table 9-21**. The assessments for the Core Zone noise limits (i.e. the maximum allowable noise levels) at RCL02-04 are provided in **Table 9-22** and **Table 9-23** for context.

Table 9-20 - Core Zone Noise Assessment for Typical Noise Levels at each RCL

Community	Location	Period	Typical core zone noise level ⁽¹⁾ , dB L _{Aeq,T}	Baseline noise level ⁽²⁾ , dB L _{Aeq,T}	Baseline noise level derivation method ⁽³⁾	Combined noise level, dB L _{Aeq,T} ⁽⁴⁾	Change in noise level, dB ⁽⁵⁾
Manor Road dwellings	North of Core Zone, near RCL01	Day	60	65	Measured at MP2b	66.2	1.2
		Night	55	56		58.5	2.5
Isolated Manor Road dwellings west of the B530 Ampthill Road	Northeast of Core Zone, near RCL02	Day	56	53	DEFRA	57.8	4.8
		Night	51	49		53.1	4.1
Travelers site east of the B530 Ampthill Road	Northeast of Core Zone, near RCL03	Day	53	64	DEFRA	64.3	0.3
		Night	48	59		59.3	0.3
Residential community south of Wixams	East of Core Zone, near RCL04	Day	50	61	DEFRA	61.3	0.3
		Night	45	57		57.3	0.3
Residential community north of Stewartby	South of Core Zone, near RCL05	Day	60	51	Measured at MP4	60.5	9.5
		Night	50	45		51.2	6.2
Single dwelling at Broadmead Farm	South of Core Zone, near RCL06	Day	60	51	Measured at MP4	60.5	9.5
		Night	55	45		55.4	10.4
Notes							
(1) Based on the more likely level where noise levels at farther RCLs are determined by RCLs closest to the Core Zone boundary. Any stated Core Zone noise levels at RCLs that are below the noise limits are indicative only and actual levels will depend on park layout, screening from intervening buildings etc. Core							

Community	Location	Period	Typical core zone noise level ⁽¹⁾ , dB L _{Aeq,T}	Baseline noise level ⁽²⁾ , dB L _{Aeq,T}	Baseline noise level derivation method ⁽³⁾	Combined noise level, dB L _{Aeq,T} ⁽⁴⁾	Change in noise level, dB ⁽⁵⁾
Zone noise limits are: 60 dB L_{Aeq,1hr} during the day and 55 dB L_{Aeq,15min} during the night for all RCLs except RCL04 and RCL05, where night-time limit is 50 dB L_{Aeq,15min}. (2) Daytime noise level: dB L_{Aeq,16hr} and night-time noise level: dB L_{Aeq,8hr}. (3) Baseline noise levels derived from DEFRA noise maps are determined from the logarithmic addition of road noise and rail noise at each location for daytime and night-time periods. (4) Combined noise level determined from the logarithmic addition of baseline noise level and Core Zone noise level at each location for daytime and night-time periods. (5) Combined noise level minus baseline noise level, dB.							

Table 9-21 - Core Zone Significance of Effect for Typical Noise Levels at each RCL

Community	Period	Typical core zone noise level ⁽¹⁾ , dB L _{Aeq,T}	Change in noise level, dB	Stage 1 significance determination	Additional information for context	Stage 2 significance determination
Manor Road dwellings, RCL01	Day	60	1.2	Moderate Adverse	South facing facades will experience the highest noise levels from the Core Zone. However, north-facing facades to the rear will be impacted by noise from the utility compound so no 'quiet' façade available. However, ambient noise already high for south facing facades. Maximum allowable noise level only likely to occur during special events with all sources operating.	Moderate Adverse (Significant)
	Night	55	2.5	Moderate Adverse		Moderate Adverse (Significant)
Isolated Manor Road dwellings west of the	Day	56	4.8	Moderate Adverse	Rear facades of dwellings face Core Zone. Ambient noise levels from Manor Road are lower at rear façade than front. Rear gardens have line of sight to Core Zone. Dwellings benefit from interrupted line of sight	Moderate Adverse (Significant)

Community	Period	Typical core zone noise level ⁽¹⁾ , dB L_{Aeq,T}	Change in noise level, dB	Stage 1 significance determination	Additional information for context	Stage 2 significance determination
B530 Ampthill Road, RCL02	Night	51	4.1	Moderate Adverse	from intervening buildings. Maximum allowable noise level only likely to occur during special events with all sources operating.	Moderate Adverse (Significant)
Travelers site east of the B530 Ampthill Road, RCL03	Day	53	0.3	Minor Adverse /Negligible	Noise from the Core Zone is unlikely to reach the maximum allowable of 60 dBA as other RCLs closer to the site will likely dictate the maximum noise level generated by the Core Zone. Existing noise levels are already high with rail noise important area (NIA) close to this location. Results in negligible increase in ambient noise level.	Negligible (Not Significant)
	Night	48	0.3	Minor Adverse /Negligible		Negligible (Not Significant)
Residential community south of Wixams, RCL04	Day	50	0.3	Minor Adverse / Negligible	Noise from the Core Zone is unlikely to reach the maximum allowable of 60 dBA during the day and 50 dBA at night as other RCLs closer to the site will dictate the maximum noise level generated by the Core Zone. Existing noise levels are already high with rail NIA close to this location. Results in negligible increase in ambient noise level.	Negligible (Not Significant)
	Night	45	0.3	Minor Adverse / Negligible		Negligible (Not Significant)
Residential community north of Stewartby, RCL05	Day	60	9.5	Major Adverse	A lower (50 dBA) night-time noise limit applicable at RCL05 compared with other RCLs. Exposed, north facing facades experience highest Core Zone noise levels. South facing 'quiet' facades or facades with glancing angles of incidence have the lowest noise levels. The maximum allowable noise level only likely to occur during special events with all sources operating.	Major Adverse (Significant)
	Night	50	6.2	Major / Moderate Adverse		Moderate Adverse (Significant)

Community	Period	Typical core zone noise level ⁽¹⁾ , dB L _{Aeq,T}	Change in noise level, dB	Stage 1 significance determination	Additional information for context	Stage 2 significance determination
Single dwelling at Broadmead Farm, RCL06	Day	60	9.5	Major Adverse	Single property impacted. Property located within 30m of site boundary. Will be quiet façade to front of property although garden to rear is north facing towards the development. The maximum allowable noise level only likely to occur during special events with all sources operating.	Major Adverse (Significant)
	Night	55	10.4	Major Adverse		Major Adverse (Significant)
Notes						
(1) Based on the more likely level where noise levels at farther RCLs are determined by RCLs closest to the Core Zone boundary. Any stated Core Zone noise levels at RCLs that are below the noise limits of 60 dB L _{Aeq,1hr} during the day and 55 dB L _{Aeq,15min} at night (or 60 dB L _{Aeq,1hr} during the day and 50 dB L _{Aeq,15min} at night at RCL04 and RCL05) are indicative only and actual levels will depend on park layout, screening from intervening buildings etc.						

Table 9-22 – Core Zone Noise Assessment for Maximum Allowable Noise Levels at RCL02-04

Community	Location	Period	Maximum allowable core zone noise level ⁽¹⁾ , dB L _{Aeq,T}	Baseline noise level ⁽²⁾ , dB L _{Aeq,T}	Baseline noise level derivation method ⁽³⁾	Combined noise level, dB L _{Aeq,T} ⁽⁴⁾	Change in noise level, dB ⁽⁵⁾
Isolated Manor Road dwellings west of the B530 Ampthill Road	Northeast of Core Zone, near RCL02	Day	60	53	DEFRA	60.8	7.8
		Night	55	49		56.0	7.0
Travelers site east of the B530 Ampthill Road	Northeast of Core Zone, near RCL03	Day	60	64	DEFRA	65.5	1.5
		Night	55	59		60.5	1.5
Residential community south of Wixams	East of Core Zone, near RCL04	Day	60	61	DEFRA	63.5	2.5
		Night	50	57		57.8	0.8

Notes

- (1) Core Zone noise limit: 60 dB L_{Aeq,1hr} during the day and 55 dB L_{Aeq,15min} during the night at all RCLs except RCL04 and RCL05 where the limits is 60 dB L_{Aeq,1hr} during the day and 50 dB L_{Aeq,15min} at night
- (2) Daytime noise level: dB L_{Aeq,16hr} and night-time noise level: dB L_{Aeq,8hr}
- (3) Baseline noise levels derived from DEFRA noise maps are determined from the logarithmic addition of road noise and rail noise at each location for daytime and night-time periods.
- (4) Combined noise level determined from the logarithmic addition of baseline noise level and Core Zone noise level at each location for daytime and night-time periods
- (5) Combined noise level minus baseline noise level, dB

Table 9-23 – Core Zone Significance of Effect for Maximum Allowable Noise Levels at RCL02-04

Community	Period	Maximum allowable core zone noise level ⁽¹⁾ , dB <i>L_{Aeq,T}</i>	Change in noise level, dB	Stage 1 significance determination	Additional information for context	Stage 2 significance determination
Isolated Manor Road dwellings west of the B530 Ampthill Road, RCL02	Day	60	7.8	Major Adverse	Rear facades of dwellings face the Core Zone. Ambient noise levels from Manor Road are relatively high at front facades but lower at rear façades. Rear gardens have partial line of sight to Core Zone. Maximum allowable noise level only likely to occur during special events with all sources operating.	Major Adverse (Significant)
	Night	55	7.0	Major Adverse		Major Adverse (Significant)
Travellers site east of the B530 Ampthill Road, RCL03	Day	60	1.5	Moderate Adverse	West facing facades will experience higher noise levels than those facing east. Dwellings further east will also benefit from screening provided by intervening buildings. Existing noise levels are already high with rail NIA close to this location. Maximum allowable noise level only likely to occur during special events with all sources operating.	Moderate Adverse (Significant)
	Night	55	1.5	Moderate Adverse		Moderate Adverse (Significant)
Residential community south of Wixams, RCL04	Day	60	2.5	Moderate Adverse	Ambient noise levels are already high at this location. West facing facades will experience higher noise levels than those facing east. Dwellings further east will also benefit from screening provided by intervening buildings. Gardens of these properties tend to be located away from Ampthill Road and therefore benefit from screening from dwellings. Maximum allowable noise level only likely to occur during special events with all sources operating. There is a rail NIA just west of this location.	Moderate Adverse (Significant)
	Night	50	0.8	Moderate / Minor Adverse		Minor Adverse (Not Significant)

Community	Period	Maximum allowable core zone noise level ⁽¹⁾ , dB L_{Aeq,T}	Change in noise level, dB	Stage 1 significance determination	Additional information for context	Stage 2 significance determination
Notes (1) Based on achieving the Core Zone noise limit: 60 dB L _{Aeq,1hr} during the day and 55 dB L _{Aeq,15min} during the night (or 60 dB L _{Aeq,1hr} during the day and 50 dB L _{Aeq,15min} at night at RCL04 and RCL05)						

Additional Assessment at Residential Community North of Stewartby

- 9.6.10. The residential community north of Stewartby (represented by RCL05) is predicted to experience maximum allowable noise levels, i.e. the Core Zone noise limits for which consent is being sought (60 dB $L_{Aeq,1hr}$ during the day and the lower night time limit of 50 dB $L_{Aeq,15min}$ at night), at properties located on Brick Crescent, 210m south of the Site boundary and mostly those with north facing facades. Properties located farther south, and those benefiting from screening provided by intervening dwellings, would experience lower noise levels. Furthermore, not all facades of each property would be equally impacted, with south facing facades experiencing lower noise levels than north facing facades due to the self-screening effect of the property. South facing gardens will also benefit from this effect.
- 9.6.11. The Core Zone noise propagation model was used to determine where noise levels are likely to fall below certain thresholds, namely 55 dB $L_{Aeq,1hr}$ / 45 dB $L_{Aeq,15min}$ day/night, and 50 dB $L_{Aeq,1hr}$ / 45 dB $L_{Aeq,15min}$ day/ night. These were identified as follows:
- 55 dB $L_{Aeq,1hr}$ / 45 dB $L_{Aeq,15min}$ day/night – likely to be achieved at properties south of Chimney Way and north of Kiln Drive approximately 310m south of the Site boundary.
 - 50 dB $L_{Aeq,1hr}$ / 40 dB $L_{Aeq,15min}$ day/night – likely to be achieved at properties south of Kiln Drive approximately 500m south of the Site boundary.
- 9.6.12. Dwellings approximately north of Kiln Drive would be exposed to a **Major** or **Moderate Adverse** effect which is considered **Significant**. Dwellings to the south of this area are likely to be exposed to **Minor** or **Negligible Adverse** effect which is **Not Significant**.
- 9.6.13. The magnitude of impact criteria and significance of effect matrices are based on noise levels external to a property but assessed inside buildings with the assumption that windows are open for the purposes of ventilation. With windows closed, indoor noise levels - and hence the magnitude of impact - will be lower and will depend on the materials used for the construction of the building envelope.
- 9.6.14. Properties in the northern area of Stewartby, having been built within the previous 10 years, have been constructed with modern materials, to current Building Regulations, with good levels of sound insulation - for example, thermal double glazing rather than single glazed windows - and as such would experience lower indoor noise levels with windows closed than within many traditional properties with original features. Further Commentary on Core Zone Noise Impacts
- 9.6.15. As identified in **Table 9-20** and **Table 9-21**, noise levels at communities located farther from the Core Zone will be determined by RCLs closest to the Core Zone, i.e. RCL01 (Manor Road) and RCL05/RCL06 (north of Stewartby). Therefore, the maximum allowable noise levels (i.e. noise levels equivalent to the Core Zone noise limits) will likely affect a relatively small proportion of the surrounding residential communities resulting in a limited number of properties experiencing an adverse impact that was significant. It is acknowledged that UDX currently owns four of the most significantly impacted properties on Manor Road, which would not, on completion of the Proposed Development, be returned to residential use.

- 9.6.16. Due to the controlling effect of the RCLs closest to the Core Zone, it is highly unlikely that all other RCLs would experience noise levels equivalent to the Core Zone noise limits for which consent is being sought of 60 dB $L_{Aeq,1hr}$ / 55 dB $L_{Aeq,15min}$ during the day / night (at all RCLs other than RCL04 and RCL05, where the limits are 60 dB $L_{Aeq,1hr}$ / 50 dB $L_{Aeq,15min}$ during the day / night). However, in the unlikely event that this did occur there would be a greater number of properties experiencing a significant effect.
- 9.6.17. Under Normal Hours Theme Park operation (which make up the majority of the year), Core Zone noise levels would be anticipated to be lower than during Halloween Horror Nights, Holidays and Special Events, particularly during the night and the extent of significant effects will be reduced.

Noise from Utility Compound

- 9.6.18. The proposed location of the Utility Compound relative to the properties on Manor Road results in rear (north) facing facades of these properties experiencing higher noise levels from the Utility Compound than front (south) facing facades, which benefit from self-screening.
- 9.6.19. The Utility Compound will be designed so that noise at the most exposed façades of the nearest residential properties on Manor Road do not exceed the noise limits stated in Section 9.4, i.e. 56 dB $L_{Ar,Tr}$ / 47 dB $L_{Ar,Tr}$ during the day / night which would equate to +10 dB above the background sound level and would equate to the onset of a **Major Adverse** effect, which would be **Significant**. The noise propagation model indicates that all dwellings on Manor Road within around 350m of the Utility Compound would experience noise levels up to these limits.
- 9.6.20. The next closest sensitive receptors, namely dwellings located farther east along Manor Road near to RCL02, are likely to experience daytime/night-time noise levels of up to around 50 dB $L_{Ar,Tr}$ / 40 dB $L_{Ar,Tr}$ respectively, equating to levels that are less than +5 dB above background. This represents a **Minor Adverse** effect which is **Not Significant**.
- 9.6.21. The in-combination effects of noise from both the Core Zone and the Utility Compound have been considered. The facades of Manor Road properties most exposed to Core Zone noise are those facing south, i.e. those also exposed to the lowest levels of noise from the Utility Compound. The noise propagation model has been utilised to predict the combined noise level due to the contributions from both types of noise source at front and rear facades. This indicates that the predicted noise level from both sources combined would not exceed the Core Zone noise limits at either front or rear façades of affected properties.

9.7. POTENTIAL MITIGATION DURING OPERATIONAL PHASE

- 9.7.1. Rather than relying on and committing to specific mitigation measures, three primary measures are proposed to control noise from the operation of the Proposed Development:
- The compliance with the Core Zone noise limits set out in Section 9.4;
 - Demonstrating compliance through a limited period of noise monitoring following Grand Opening of the development; and
 - Following completion of the noise monitoring period, undertaking predictive noise modelling whenever a new ride is proposed to demonstrate ongoing compliance with the noise limits.
- 9.7.2. The above principles are discussed in more detail in **Appendix 9.5: Demonstration of compliance with Operational Phase noise limits (Volume 3)**.

Mitigation Measures

- 9.7.3. Mitigation measures may be required to achieve the noise limits and therefore this section summarises the potential mitigation measures that will be considered as part of detailed design and those mitigation measures that have already been embedded into the Proposed Development. This includes learning from UDX's experience of operating other theme parks around the world.
- 9.7.4. Examples are provided below on mitigation that will be employed at the outset and therefore are regarded embedded. The need for any other mitigation measures will be determined as the design of the park progresses and are therefore listed as optional.

Embedded Mitigation

- 9.7.5. Of the potential examples of mitigation that could be employed if and when required to reduce noise, the measures that will be employed as part of the primary Core Zone design and which, therefore, may be regarded as embedded include:
- Speaker and PA system directional placement to avoid projecting into the community;
 - Use of buildings around the park to act as noise barriers;
 - Event stages are strategically placed to direct sound away from sensitive areas; and
 - Significant noise generating attractions and events will have a predictive noise assessment completed to mitigate noise levels.

Optional Mitigation

- 9.7.6. Optional mitigation measures that could be deployed in the Proposed Development, if required, could include:

Roller Coasters

- Damping of roller coaster beams and rails to reduce structure-radiated noise;
- Quieter roller coaster support beam design;
- Limiting high sections of roller coasters;
- Increasing dispatch intervals for noisier attractions during evening hours;
- Roller coasters designed to project screams and mechanical noise into the park property; and
- Limiting the routine (i.e. non-safety critical) testing of roller coasters to daytime hours where possible.

Noise barriers

- Park perimeter berm in selected areas;
- Temporary sound barriers located for special events;
- Designing park features or design elements that would act as sound barriers; and
- Strategically locating noisiest sources to optimise sound levels.

Operational Controls

- Noise hotline for the community to call;
- Active community engagement to ensure the community is aware of special events that may increase park hours or generate incremental noise;
- Limiting noisier night-time activities; and

- Noise monitoring during special events for active compliance in the community.

Specific Examples

- 9.7.7. This section provides specific examples of noise barrier designs utilised at existing Universal Theme Parks and which may be employed within the Site if required.
- 9.7.8. Physical barriers are highly effective at mitigating ground level noise. Operational “Back of House” service areas are typically isolated with solid fencing to minimise visual sight lines of workers’ activities and the noise generated around those activities.
- 9.7.9. Other barriers include:
- Park perimeter berm: earthen berm with fencing and planting;
 - Solid fencing;
 - Temporary sound barriers located for special events: these have been constructed of shipping containers stacked on top of each other and draped with noise dampening acoustic blankets;
 - Park features such as faux building façade walls and scenic trompe l’oeil walls; and
 - Use of buildings around the park to act as noise barriers.

Utility Compound Mitigation

- 9.7.10. The following examples of mitigation could potentially be implemented, if required, to reduce noise levels from the Utility Compound affecting nearby sensitive receptors on Manor Road:
- Locate Utility Compound as far from Manor Road properties as practicable;
 - Where feasible, locate ERC buildings that generate relatively low levels of noise (e.g. warehousing) between the Utility Compound and houses on Manor Road. Locate service yards to the north of warehouses to maximise screening opportunities;
 - Locate the noisiest chiller units at ground level and to the north of the energy centre, using this building to screen properties on Manor Road; and
 - Where feasible, locate ventilation louvres on north facing façades of the energy centre.

Other Mitigation

- 9.7.11. Separate to the above considerations regarding the Core Zone noise limits and potential Utility Compound Mitigation, embedded mitigation that must be employed (and secured by **Design Standards (Document Reference 6.3.0)**) is as follows:
- Hotels will be designed to achieve the guideline internal noise levels referenced in BS 8233:2014 Guidance on sound insulation and noise reduction for buildings unless the hotel operator has its own design code which includes internal noise limits for bedrooms; and
 - Where vibration isolation is required, e.g. plant rooms within hotels, then the guidance provided in CIBSE Guide B4 *Noise and vibration control for building services systems 2016* should be followed.

9.8. DEMONSTRATION OF COMPLIANCE WITH CORE ZONE NOISE LIMITS

- 9.8.1. In order to demonstrate compliance with the Core Zone noise limits set out in Section 1.5, a combination of noise modelling and monitoring is proposed. Full details are provided in **Appendix 9.5: Demonstration of compliance with Operational Phase noise limits (Volume 3)**.

9.9. CUMULATIVE EFFECTS

- 9.9.1. Cumulative effects have been addressed in the findings presented in **Table 9-19** with committed development accounted for in the traffic data that have been used in the operational road traffic noise assessment. As referred to in **Chapter: 3 Approach to EIA (Volume 1)**, the cumulative assessment for Noise and Vibration is set out in **Chapter 18: Cumulative Effects (Volume 1)**.

9.10. DIFFICULTIES AND UNCERTAINTIES

- 9.10.1. The assumptions adopted and the associated uncertainties relevant to the noise and vibration assessments set out in this chapter are presented in the relevant appendices. Construction noise and vibration assumptions are set out in **Appendix 9.2: Construction Noise and Vibration Assessment (Volume 3)**, construction and operational road traffic noise assumptions are set out in **Appendix 9.3: Construction and Operational Road Traffic Noise Assessment (Volume 3)**, and operational noise assumptions are set out in **Appendix 9.4: Operational Noise Assessment (Volume 3)**.

9.11. SUMMARY OF LIKELY SIGNIFICANT EFFECTS AND PROPOSED MITIGATION

- 9.11.1. **Table 9-24, Table 9-25 and Table 9-26** below present a summary of the likely significant effects relating to Noise and Vibration as a result of the Proposed Development, and the mitigation measures proposed to avoid, prevent, reduce, or offset (if possible and required) any identified significant adverse effects. The tables summarise those effects that were identified within the assessment as likely to be significant prior to the consideration of mitigation. Significant effects are identified as **major or moderate**. Effects that are identified as **negligible or minor** are not considered to be significant, and therefore, are not listed in the summary tables below.

Table 9-24 - Summary of Likely Significant Noise and Vibration Effects: Construction Phase

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
Construction Phase - Noise					
NSR05-06 (individual property located off Woburn Road and Broadmead Farm respectively) NSR08-10 (properties off Ampthill Road and Manor Road respectively)	Moderate to major adverse noise impacts at the closest receptors to the Site during the Construction Phase	Moderate to Major Adverse T/D/MT	Principal Contractor to employ BPM to limit construction noise. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .	Moderate to Major Adverse T/D/MT	Significant
Construction Phase - Vibration					
NSR05-06 (individual property located off Woburn Road and Broadmead Farm respectively) NSR08-10 (properties off Ampthill Road and Manor Road respectively)	Moderate adverse vibration impacts at the closest receptors to the Site during the Construction Phase.	Moderate Adverse T/D/ST	Principal Contractor to employ BPM to limit construction noise. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .	Moderate Adverse T/D/ST	Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
Kempston Hardwick moated site	Moderate to major adverse vibration impacts during the Construction Phase.	Moderate to Major Adverse T/D/ST	Mitigation measures may be required, subject to the results of the Piling Risk Assessment. Further details on mitigation set out in Section 3.7 of Appendix 2.3: OCEMP (Volume 3) .	Moderate Adverse T/D/ST	Significant
Construction Phase – Road Traffic Noise (Scenario 2 – 2023 Existing plus Peak Construction)					
NSR09-10 (properties along Manor Road)	Moderate beneficial impacts are predicted at receptors adjacent to Manor Road due to a reduction in traffic flow and proportion of heavy vehicles.	Moderate Beneficial T/D/MT	N/A	Moderate Beneficial T/D/MT	Significant
NSR06 (Broadmead Farm)	Moderate adverse impacts are predicted at a receptor on Broadmead Road due to an increase in proportion of heavy vehicles.	Moderate Adverse T/D/MT	Subcontractors will be encouraged to minimise heavy vehicle movements to the Site by means of consolidating payloads. A delivery management system will also be used to regulate the flow of heavy vehicles to and from the Site and minimise the number of arrivals per hour. Further details on construction traffic mitigation are set out in Section 3.3 of Appendix 2.3: OCEMP (Volume 3)	Moderate Adverse T/D/MT	Significant

Table 9-25 - Summary of Likely Significant Noise and Vibration Effects: Operational Phase – Operational Road Traffic

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
Operational Road Traffic Noise – Existing road network (Scenario 4 – Opening Year - Reference Case plus Development, Scenario 4a - Opening Year - Reference Case plus Development plus Construction and 5 – Future Year - Reference Case plus Development)					
No residual significant effects					
Operational Road Traffic Noise – New and altered roads (Scenario 4 – Opening Year - Reference Case plus Development, Scenario 4a - Opening Year - Reference Case plus Development plus Construction and 5 – Future Year - Reference Case plus Development)					
No residual significant effects					

Table 9-26 - Summary of Likely Significant Noise and Vibration Effects: Operational Phase – Operational Noise

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
Operational Phase – Core Zone					
RCL01 (properties on Manor Road)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and night results in a moderate adverse effect.	Moderate Adverse at maximum allowable noise level P/D/LT	N/A	Moderate Adverse at maximum allowable noise level P/D/LT	Significant
RCL02 (isolated properties at east of Manor Road)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and	Major Adverse at maximum allowable noise level P/D/LT	N/A	Major Adverse at maximum allowable noise level P/D/LT	Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
	night results in a major adverse effect.				
	Operational noise at the typical level. It is unlikely that noise levels will reach the maximum allowable as achieving compliance with the noise limits at closer receptors to the Core Zone, via embedded mitigations by way of design, will result in lower typical noise levels at this receptor and a moderate adverse effect.	Moderate Adverse at typical noise level P/D/LT	N/A	Moderate Adverse at typical noise level P/D/LT	Significant
RCL03 (traveller's site east of B530 Ampthill Road)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and night results in a moderate adverse effect.	Moderate Adverse at maximum allowable noise level P/D/LT	N/A	Moderate Adverse at maximum allowable noise level P/D/LT	Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
	Operational noise at the typical level. It is unlikely that noise levels will reach the maximum allowable as achieving compliance with the noise limits at closer receptors to the Core Zone, via embedded mitigations by way of design, will result in lower typical noise levels at this receptor and a negligible effect.	Negligible at typical noise level P/D/LT	N/A	Negligible at typical noise level P/D/LT	Not Significant
RCL04 (residential community south of Wixams)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and night results in a moderate adverse effect during the day and a moderate to minor adverse effect at night.	Moderate Adverse at maximum allowable noise level P/D/LT	N/A	Moderate Adverse at maximum allowable noise level P/D/LT	Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
	Operational noise at the typical level. It is unlikely that noise levels will reach the maximum allowable as achieving compliance with the noise limits at closer receptors to the Core Zone, via embedded mitigations by way of design, will result in lower typical noise levels at this receptor and a negligible effect.	Negligible at typical noise level P/D/LT	N/A	Negligible at typical noise level P/D/LT	Not Significant
RCL05 (residential community north of Stewartby)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and night results in a major adverse effect during the day and moderate adverse effect at night	Major Adverse at maximum allowable noise level P/D/LT	N/A	Major Adverse at maximum allowable noise level P/D/LT	Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
RCL06 (Broadmead Farm)	Operational noise at maximum allowable level. Embedded mitigation is incorporated into the design to achieve the noise limits for which consent is being sought. Increased levels of operational noise from the Core Zone during the day and night results in a major adverse effect.	Major Adverse at maximum allowable noise level P/D/LT	N/A	Major Adverse at maximum allowable noise level P/D/LT	Significant
Operational Phase – Utility Compound					
RCL01 (dwellings on Manor Road)	Operational noise from the Utility Compound at the limits for which consent is being sought is predicted to give rise to increased noise levels during the day and night resulting in a moderate adverse effect.	Moderate Adverse P/D/LT	N/A	Moderate Adverse P/D/LT	Significant
Properties >350m from the Utility Compound	Operational noise from the Utility Compound at the limits for which consent is being sought is predicted to give rise	Minor Adverse P/D/LT	N/A	Minor Adverse P/D/LT	Not Significant

Receptor	Description of effect	Classification of effect	Additional mitigation	Classification of residual effect	Significant/not significant
	to increased noise levels during the day and night resulting in a minor adverse effect.				

Summary of Operational Noise Residual Effects in Stewartby

- 9.11.2. As summary **Table 9-26** above only reports likely **Significant** effects, additional text is provided below to give further context regarding the residual Operational noise effects in Stewartby – including **Not Significant** effects.
- 9.11.3. The noise impact assessment has been based on achieving a Core Zone noise limit of 60 dB $L_{Aeq,1hr}$ during the day and 55 dB $L_{Aeq,15min}$ during the night (and associated low frequency noise limits for amplified music) at the nearest RCLs (other than RCL04 and RCL05, where the noise limits are 60 dB $L_{Aeq,1hr}$ during the day and 50 dB $L_{Aeq,15min}$ during the night), for which consent is being sought. This represents a cautious worst case and would include contributions from all Core Zone activities, including Halloween Horror Nights, Holidays and Special Events.
- 9.11.4. Mitigation measures have been proposed that that could be utilised where required to achieve the Core Zone noise limits at RCLs. Several of these measures have been identified as embedded mitigation.
- 9.11.5. When achieving these noise limits, a relatively small number of properties centred on RCL01 (properties on Manor Road), four of which are owned by UDX, are predicted to experience a residual **Major Adverse** effect which is **Significant**.
- 9.11.6. In the case of properties north of Stewartby centred on RCL05 and RCL06, only a relatively small number, i.e. a single property at Broadmead Farm and properties on the northern edge of Stewartby with northern aspects and line of sight to the Development, are predicted to experience a residual **Moderate to Major Adverse** effect which is **Significant**. A selection of properties located farther south are predicted to experience a **Moderate Adverse** effect which is **Significant** with the majority experiencing either a **Minor Adverse** or **Negligible Effect** which is **Not Significant**.

9.12. REFERENCES

- Ref. 9.1** Highways England (2019). *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, LA111 Noise and vibration*. Available at: <https://www.standardsforhighways.co.uk/tses/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364?inline=true> [Accessed: 20 May 2025]
- Ref. 9.2** *Transport Works Order Act 2020 (The Network Rail (East West Rail) (Bicester to Bedford Improvements) Order 2020*, SI 2020/114 (as amended from time to time). Available at: <https://www.legislation.gov.uk/uksi/2020/114/contents/made> [Accessed: 20 May 2025]
- Ref. 9.3:** CIBSE Guide B4 *Noise and vibration control for building services systems 2016* [Accessed: 22 May 2025]
- Ref. 9.4** The National Archives, (2004). *The Fireworks Regulations 2004*. (as amended from time to time). Available at: <https://www.legislation.gov.uk/uksi/2004/1836/contents/made> [Accessed: 20 May 2025]
- Ref. 9.5** Sport England Design Guidance Note: *Artificial Grass Pitches (AGP) Acoustics – Planning Implications*. Available at: <https://www.sportengland.org/how-we-can-help/facilities-and-planning/planning-for-sport/artificial-grass-pitches-acoustics-planning-implications> [Accessed: 22 May 2025]
- Ref. 9.6** BS 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. Available at: <https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise> (available on purchase) [Accessed: 20 May 2025]
- Ref. 9.7** BS 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*. Available at: <https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-vibration> (available on purchase) [Accessed: 20 May 2025]
- Ref. 9.8** BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*. Available at: <https://knowledge.bsigroup.com/products/guidance-on-sound-insulation-and-noise-reduction-for-buildings> (available on purchase) [Accessed: 20 May 2025]
- Ref. 9.9** BS 4142:2014+A1:2019: *Method for Rating and Assessing Industrial and Commercial Sound*. Available at: <https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound> (available on purchase) [Accessed: 20 May 2025]
- Ref. 9.10** Institute of Environmental Management and Assessment 2014. *Guidelines for Environmental Noise Impact Assessment*. Available at: https://n-somerset.gov.uk/sites/default/files/2022-11/CD13.05%20Guidelines%20for%20Environmental%20Noise%20Impact%20Assessment%20IEMA_0.pdf [Accessed: 20 May 2025]
- Ref. 9.11** *Control of Pollution Act 1974* (as amended from time to time). Available at: <https://www.legislation.gov.uk/ukpga/1974/40/contents> [Accessed: 20 May 2025]



WSP House
70 Chancery Lane
London
WC2A 1AF

wsp.com

PUBLIC