



# The Sizewell C Project

## 6.4 Volume 3 Northern Park and Ride Chapter 4 Noise and Vibration

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Revision: 1.0  
Applicable Regulation: Regulation 5(2)(a)  
PINS Reference Number: EN010012

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May 2020

Planning Act 2008  
Infrastructure Planning (Applications: Prescribed  
Forms and Procedure) Regulations 2009



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## 4. Noise and Vibration

### 4.1 Introduction

4.1.1 This chapter of **Volume 3** of the **Environmental Statement (ES)** presents an assessment of the potential effects on noise and vibration arising from the construction, operation and removal and reinstatement of the northern park and ride at Darsham (referred to throughout this volume as the 'proposed development'). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

4.1.2 Detailed descriptions of the northern park and ride site (referred to throughout this volume as the 'site'), the proposed development and the different phases of development are provided in **Chapters 1** and **2** of this volume. A glossary of terms and list of abbreviations used in this chapter is provided in **Volume 1, Appendix 1A** of the **ES**.

4.1.3 The assessment considers noise and vibration impacts from construction, operation, and removal and reinstatement of the proposed development on sensitive receptors around the site, including traffic on the new access road between Willow Marsh Lane and the A12. Changes in noise levels on the wider road network are assessed and presented in **Volume 2, Chapter 11** of the **ES**.

4.1.4 This assessment has been informed by data presented in **Appendix 4A** of this volume.

### 4.2 Legislation, policy and guidance

4.2.1 **Volume 1, Appendix 6G** of the **ES** identifies and describes legislation, policy, and guidance of relevance to the assessment of the potential noise and vibration impacts associated with the Sizewell C Project across all **ES** volumes.

4.2.2 This section provides an overview of the specific legislation, policy and guidance of relevance to the assessment of the proposed development.

#### a) International

4.2.3 There is no international legislation and policy that is relevant to the noise and vibration assessment of the proposed development.

#### b) National

- 4.2.4 The Overarching National Policy Statement for Energy (NPS EN-1) (Ref. 4.1), and the National Policy Statement for Nuclear Power Generation (NPS EN-6) (Ref. 4.2) include requirements that are relevant to the noise and vibration assessment. A summary of the relevant NPS EN-1 and NPS EN-6 requirements, together with consideration of how these requirements have been taken into account are discussed in detail in **Volume 1, Appendix 6G**.
- 4.2.5 Part III of the Control of Pollution Act 1974 (Ref. 4.3) gives local authorities powers to control noise from construction sites, and enable developers to apply for prior consent for construction works. Section 72 of that Act defines what is meant by "best practicable means" and requires that regard be had to relevant codes of practice, one of which is British Standard BS5228 (parts 1 and 2) (Ref. 4.4 and 4.5).
- 4.2.6 Other relevant policy, as described in **Volume 1, Appendix 6G**, comprise:
- National Planning Policy Framework (NPPF) 2019 (Ref. 4.6).
  - Planning Practice Guidance (PPG) 2019 (Ref. 4.7).
  - Noise Policy Statement for England (NPSE) 2010 (Ref. 4.8).
  - Government's 25 Year Environment Plan 2019 (Ref. 4.9).

#### c) Regional

- 4.2.7 No regional policy is deemed relevant to the noise and vibration assessment for this site.

#### d) Local

- 4.2.8 Local policy relating to noise and vibration assessment is found in:
- Suffolk Coastal District Council Local Plan Core Strategy and Development Management Policies (2013) (Ref. 4.10).
  - Suffolk Coastal District Council Final Draft Local Plan (2013) (Ref. 4.11).
- 4.2.9 The requirements of these, as relevant to the noise and vibration assessment, are set out in **Volume 1, Appendix 6G**.

#### e) Guidance

4.2.10 In addition to these policy requirements, this assessment has been undertaken in accordance with the following guidance documents:

- World Health Organisation Regional Office for Europe Environmental Noise Guidelines for the European Region 2018 (Ref. 4.12).
- Guidance in the Design Manual for Roads and Bridges (DMRB) LA111 (Ref. 4.13).
- Calculation of Road Traffic Noise (CRTN) (Ref 4.14).
- British Standard BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings (Ref. 4.15).
- British Standard BS 5228-1 Noise: 2009+A1: 2014 – Code of Practice for noise and vibration control at open construction sites – Noise (Ref. 4.4).
- British Standard BS 5228-2 Vibration: 2009+A1: 2014 – Code of Practice for noise and vibration control at open construction sites – Vibration (Ref. 4.5).
- British Standard BS 4142: 2014+A1: 2019 – Methods for rating and assessing industrial and commercial sound, BSI Standards Publication (Ref. 4.16).

4.2.11 Further details on this guidance, as relevant to the noise and vibration assessment for the proposed development is contained in **Volume 1, Appendix 6G**.

### 4.3 Methodology

#### a) Scope of the assessment

4.3.1 The generic Environmental Impact Assessment (EIA) methodology is detailed in **Volume 1, Chapter 6**.

4.3.2 The full method of assessment for noise and vibration that has been applied for the Sizewell C Project is included in **Volume 1, Appendix 6G**.

4.3.3 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate. A request for an EIA Scoping Opinion was initially issued to the Planning Inspectorate in 2014, with an updated request issued in 2019, provided in **Volume 1, Appendix 6A**.

4.3.4 Comments raised in the EIA Scoping Opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Volume 1, Appendix 6A to 6C**.

b) **Consultation**

4.3.5 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory consultees throughout the design and assessment process. Details of the consultation process are provided in **Volume 1, Appendix 6G**.

4.3.6 The following matters have been developed in consultation with the local authorities:

- assessment criteria;
- noise source data; and
- assessment approach (both noise and vibration).

c) **Study area**

4.3.7 The geographical extent of the study area for noise and vibration impacts includes noise sensitive receptors surrounding the site, which have any potential to be exposed to noise or vibration levels which might result in a minor adverse effect (or greater).

4.3.8 Potentially sensitive receptors such as residents within buildings in the vicinity of the site which may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration have been taken into consideration. The receptors selected in this assessment are those considered to be representative of the nearest receptors to the site, for example, the receptors that would likely experience the highest levels of noise and vibration.

4.3.9 Further details on the study area and the location of representative receptors are provided in **Figure 4.1** and **section 4.4** of this chapter.

d) **Assessment scenarios**

4.3.10 The assessment scenarios for the proposed development comprise the construction phase, operational phase, and the subsequent removal and reinstatement phase. The assessment scenarios are as follows:

- Construction: it is expected that the construction phase for the proposed development would take place over a period of approximately 12–18 months, in various stages as outlined in **Chapter 2** of this volume;

- Operation: the operation phase includes the use of the park and ride facility by the construction workforce travelling to the Sizewell C main development site, and would operate seven days per week. Peak use of the park and ride facility is anticipated to be in 2028 when the construction workforce at the Sizewell C main development site would also reach its peak; and
- Removal and reinstatement: this phase is when the need for the park and ride facility has ceased once all of the construction activities associated with the Sizewell C main development site are complete and Sizewell C power station is operational. This phase includes the removal of the park and ride facility and reinstatement of the site to agricultural use.

e) Assessment criteria

4.3.11 As described in **Volume 1, Chapter 6**, the EIA methodology considers whether impacts of the proposed development would have an effect on any resources or receptors. Assessments broadly consider the magnitude of impacts, and value/sensitivity of resources/receptors that could be affected in order to classify effects.

4.3.12 A detailed description of the assessment methodology used to assess the potential noise and vibration effects arising from the proposed development is provided in **Volume 1, Appendix 6G**.

4.3.13 The effect of noise and vibration on a receptor or community is dependent on the magnitude of the impact, the sensitivity of the receptor, and may also depend on other factors such as the existing acoustic environment. A summary of the assessment criteria used in this assessment is presented in the following sub-sections.

i. Sensitivity

4.3.14 The criteria used in noise and vibration assessment for determining the sensitivity of receptors are set out in **Table 4.1**.

**Table 4.1: Assessment of the value or sensitivity of receptors for noise and vibration.**

Sensitivity	Description
High	Receptors that are highly sensitive to noise or vibration such as theatres, auditoria, recording studios, concert halls and highly vibration sensitive structures or uses such as certain laboratories medical facilities or industrial processes.



Sensitivity	Description
<b>Medium</b>	Noise and vibration sensitive receptors such as permanent residential buildings, hospitals and other buildings in health/community use, buildings in educational use, hotels and hostels.
<b>Low</b>	Receptors with limited sensitivity to noise and vibration such as offices, libraries buildings in religious use, and other workplaces with a degree of sensitivity due to the need to concentrate.
<b>Very Low.</b>	Receptors of very low sensitivity to noise and vibration such as industrial or commercial buildings and transient or mobile receptors.

4.3.15 No high sensitivity receptors have been identified within the study area. The receptors assessed in this chapter are considered to be of medium sensitivity, or less.

ii. Magnitude

Construction noise and vibration

4.3.16 The approach taken to evaluate noise effects for all construction work associated with the Sizewell C Project on occupiers of dwellings and other permanent residential accommodation is that outlined in Part 1 of BS 5228. This recommends that, for dwellings, significant effects may occur when the site noise level, rounded to the nearest decibel, exceeds the value listed in **Table 4.2** below. The table is used as follows: for the appropriate period (daytime, evening, night-time, weekends), the pre-construction ambient noise level is determined and rounded to the nearest 5 dB. This rounded value is compared to the Category A criteria in **Table 4.2** and depending on whether the rounded values are below, equal to, or above the Category A values, the Category A, B or C criteria will apply to the construction works as an indicator of significant effects. Further detail is provided in **Volume 1 Appendix 6G** of the **ES**.

**Table 4.2: Thresholds of potential significant construction effects at dwellings, from Part 1 of BS 5228.**

Period	Assessment Category		
	A	B	C
Day: Weekdays, 0700-1900 Saturday, 0700-1300	65 dB LAeq,T	70 dB LAeq,T	75 dB LAeq,T

Period	Assessment Category		
	A	B	C
Evenings and weekends: Weekdays 1900-2300 Saturdays 1300-2300 Sundays 0700 - 2300	55 dB L <sub>Aeq,T</sub>	60 dB L <sub>Aeq,T</sub>	65 dB L <sub>Aeq,T</sub>
Every day 2300 - 0700	45 dB L <sub>Aeq,T</sub>	50 dB L <sub>Aeq,T</sub>	55 dB L <sub>Aeq,T</sub>

Notes:

Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values;

Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values; and

Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

If the ambient sound level exceeds the Assessment Category C threshold values given in the table (i.e. the ambient sound level is higher than the above values), then an impact is deemed to occur if the total L<sub>Aeq,T</sub> sound level for the period increases by more than 3 dB due to construction activity.

4.3.17 A significant effect is deemed to occur where the relevant criteria is exceeded for the following periods of time:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

4.3.18 Where an assessment conclusion identifies a significant effect, it is on the basis that the effect is assumed to meet both the noise level criteria and the duration criteria, unless otherwise stated. Where there is uncertainty as to whether the duration criteria will be met, a precautionary approach has been adopted and it is assumed that the works will continue for a sufficient period to meet the duration criteria.

4.3.19 The values to be used to assess the magnitude of impact for construction work are as shown in **Table 4.3**.

**Table 4.3: Values to assess the magnitude of noise impact for construction work.**

Sensitivity of receptor.	Period	Magnitude of impact.				Parameter
		Very low	Low	Medium	High	
High	Any	Bespoke assessment method to be used.				
Medium and low	Day	Below baseline values.	Baseline noise levels.	ABC <sup>(1) (2)</sup>	ABC <sup>(1) (2)</sup> + 10	L <sub>Aeq, 12h</sub> , dB
	Evening					L <sub>Aeq, 4h</sub> , dB
	Night					L <sub>Aeq, 8h</sub> , dB
Very low	Any	Bespoke assessment method to be used.				

Notes:

(1) ABC indicates the significance threshold from **Table 4.2** above, based on the “ABC method” from BS 5228-1.

(2) Where levels are predicted as free field values, the ABC criteria are reduced by 3dB, to account for the difference between free field and façade levels

4.3.20 For the assessment of magnitude of construction vibration, Table 4.4 below will be used.

**Table 4.4: Values to assess the magnitude of vibration impact from all construction sources (day or night).**

Sensitivity of receptor.	Magnitude of impact.				Parameter
	Very low	Low	Medium	High	
High	Bespoke assessment method to be used.				
Medium and low	<0.3	0.3	1	>10	PPV mm/s
Very low	No assessment normally required.				

4.3.21 A construction vibration will be considered significant if the effect is moderate or major adverse and occurs for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

4.3.22 As with the assessment of construction noise, where an assessment conclusion identifies a significant effect, it is on the basis that the effect is assumed to meet both the vibration level criteria and the duration criteria, unless otherwise stated. Where there is uncertainty as to whether the duration criteria will be met, a precautionary approach has been adopted and it is assumed that the works will continue for a sufficient period to meet the duration criteria.

Operational noise

4.3.23 The assessment of mechanical services noise from the operational park and ride site would be considered using the assessment approach from BS 4142. The initial magnitude of impact is defined by the difference between the rating and background sound levels as shown in **Table 4.5**, prior to any consideration of context. “BG” in this table is shorthand for background sound level,  $L_{A90}$ , dB, assessed in accordance with the procedures in BS 4142. Day is taken to be 07:00 to 23:00 hours and night is 23:00 to 07:00 hours.

**Table 4.5: Values to be used to assess the magnitude of impact for mechanical services (all values are free field).**

Sensitivity of receptor.	Period	Magnitude of impact.				Parameter
		Very low	Low	Medium	High	
High	Any	Bespoke assessment method to be used				
Medium or Low	Day	<BG+0*	BG+0*	BG+5*	BG+10*	$L_{Ar}$ 1 hour, dB
	Night					$L_{Ar}$ 15 mins, dB
Very low	Any	No assessment normally required.				

Note: \*All assessments of significance must be considered in the context in which the sound occurs, in accordance with the guidance in BS 4142: 2014+A1: 2019.

4.3.24 Where background noise levels are at or below 30dB,  $L_{A90}$ , an adverse effect will not occur at night below an absolute threshold of 40 dB,  $L_{night}$ .

4.3.25 **Table 4.6** shows the magnitudes of impact for receptors of different sensitivity for park and ride operations.

**Table 4.6: Magnitude of impact for receptors of different sensitivity for park and ride operations (all values are free field).**

Sensitivity of receptor.	Period	Magnitude of impact.				Parameter
		Very low	Low	Medium	High	
High	Any	Bespoke assessment method to be used.				
Medium	Day	<50	50	55	60	$L_{Aeq, 16h}$ , dB
	Night	<40	40	45	55	$L_{Aeq, 8h}$ , dB
		<60	60	65	70	$L_{Amax}$ , dB
Low	Day or night.	<55	55	60	65	$L_{Aeq, 8h}$ , dB
Very low	Any	No assessment normally required.				



iii. Classification of effects

4.3.26 Following the classification of the magnitude of the impact and the value/sensitivity of the receptor/feature, the effect is classified as shown in **Table 4.7**. Definitions of each of the different levels of effect, which can be adverse, beneficial or neutral are shown in **Table 4.8**.

**Table 4.7: Classification of effects**

		Value/Sensitivity of Receptor.			
		Very Low	Low	Medium	High
Magnitude	Very low	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

**Table 4.8: Effect definitions.**

Effect	Description
Major	The noise causes a material change in behaviour attitude or other psychological response. Adverse change may result in the potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished or improved due to change in acoustic character of the area.
Moderate	Effects that may result in moderate changes in behaviour, attitude or other psychological response. Adverse effects may result in some reported sleep disturbance. Changes to the acoustic character of the area such that there is a perceived change in the quality of life.
Minor	Effects that may result in small changes in behaviour attitude or other psychological response. Adverse effects may result in some minor reported sleep disturbance. Small changes to the acoustic character of the area such that there is a low perceived change in the quality of life.
Negligible	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.

4.3.27 Following the classification of an effect as detailed in **Tables 4.7** and **4.8**, a clear statement is made as to whether the effect is ‘significant’ or ‘not significant’. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate. In addition to considering these tables, other project-specific factors, such as the number of receptors affected and the duration and character of the impact need to be considered where these have a potential bearing on significance.

iv. Use of LOAEL and SOAEL values in the assessment

- 4.3.28 The NPSE, the NPSs and the PPG require the assessment of noise and vibration against the lowest observed adverse effect levels (LOAEL) and the significant observed adverse effect level (SOAEL). These will differ dependent on variables such as the level and character of the noise or vibration source, timings of when it would occur, its duration, existing sounds present and the frequency of the occurrence of the source.
- 4.3.29 Each different source type requires its own specific value for LOAEL and SOAEL, which depends on these factors. The methodology for assigning significance differs from the general methodology set out in **Volume 1 Chapter 6**, as it does not allow for these variables to be properly considered. Each source has therefore been considered separately and values for LOAEL and SOAEL defined for different sensitivities.
- 4.3.30 In line with the NPSE, the concept of LOAEL and SOAEL has been established for the assessment of noise and vibration generating activities associated with the proposed main development site and associated developments. **Table 4.9** below sets out the generic descriptions for and actions recommended in relation to these categories.

**Table 4.9: Generic effect descriptions and actions recommended.**

Effect	Description	Action
Below LOAEL	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No specific measures required.
Between LOAEL and SOAEL	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Mitigate and reduce to a minimum.
Above SOAEL	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Avoid

- 4.3.31 Actual values for the noise and vibration sources assessed vary, dependent on the source of noise, as recommended in the various noise assessment standards and sources of guidance.

- 4.3.32 The descriptions and actions recommended in **Table 4.9** are based on the guidance in the NPSE and associated guidance in the PPG. This approach was discussed in meetings with the local authorities between 2015 and 2019.
- 4.3.33 For construction noise, the LOAEL is considered to be equal to the existing baseline ambient level. SOAEL values are as shown in **Table 4.10** below.

**Table 4.10: SOAEL values for noise from all construction work associated with the proposed development (all values are façade levels).**

Day	Time (hours)	Averaging Period T	Significant Observed Adverse Effect Level <sup>1</sup> L <sub>Aeq,T</sub> (dB)
Mondays to Fridays	0700 – 0800	1 hour	70
	0800 – 1800	10 hours	75
	1800 – 1900	1 hour	70
	1900 – 2300	4 hours	65
Saturdays	0700 – 0800	1 hour	70
	0800 – 1300	5 hours	75
	1300 – 1400	1 hour	70
	1400 - 2300	1 hour	65
Sundays & Public Holiday	0700 – 2300	1 hour	65
Any night	2300 – 0700	1 hour	55

Note: (1) Duration of exceedance must occur for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 days or nights in any 6 consecutive months.

- 4.3.34 **Table 4.11** sets out the LOAEL and SOAEL values adopted for construction and vibration and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1** of the **ES**

**Table 4.11: LOAEL and SOAEL values for construction vibration.**

LOAEL	SOAEL	Parameter
0.3	10.0	PPV mm/s

- 4.3.35 **Table 4.12** sets out the LOAEL and SOAEL values for mechanical services and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1**.

**Table 4.12: LOAEL and SOAEL values for mechanical services (all values are free field values).**

Period	Sensitivity of receptor.	LOAEL	SOAEL
Day	Medium	BG+0dB, L <sub>Ar</sub> , dB	BG+10, L <sub>Ar</sub> or Above 60dB, L <sub>Aeq, 16h</sub> , whichever is the higher.
	Low		65dB, L <sub>Aeq, 16h</sub>
Night	Medium	BG+0dB, L <sub>Ar</sub> , dB or 40dB L <sub>Night</sub> , whichever is the higher <sup>1</sup>	BG+10, L <sub>Ar</sub> or Above 55dB, L <sub>Night</sub> , dB, whichever is the higher.
	Low (if occupied at night).		65dB, L <sub>Aeq, 8h</sub>

Note: (1) The 40dB L<sub>Night</sub> threshold is stated as a lower cut-off for the LOAEL at night as there is unlikely to be an adverse effect below this level. This is part of the contextual consideration required by BS 4142, embedded in the definition of the night-time LOAEL.

4.3.36 **Table 4.13** sets out the LOAEL and SOAEL values for the park and ride activities and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1**.

**Table 4.13: LOAEL and SOAEL values for park and ride operations.**

Time Period.	LOAEL	SOAEL
Day (07:00-23:00)	50dB L <sub>Aeq, 16h</sub> , free field level	60dB L <sub>Aeq, 16h</sub> , free field level
Night (23:00-07:00)	40dB L <sub>Night</sub> , outside (free-field)	55dB L <sub>Aeq, 8h</sub> , free field level
	60dB, L <sub>Amax</sub> , free field	70dB, L <sub>Amax</sub> , free field

f) Assessment Methodology

i. Baseline surveys

4.3.37 Baseline monitoring was undertaken at a number of locations around the site, as shown in **Figure 4.2**, in 2014 to characterise the existing noise environment. These locations were chosen to be representative of levels at nearby noise sensitive receptors.

4.3.38 At each location, a survey was carried out to characterise sound levels over the 24 hour period. Summaries of each monitoring location, along with plans identifying the locations; photo of the site and a summary graph of the measurement results are provided in **Volume 2 Appendix 11A**.

4.3.39 An additional survey was undertaken at location PRN1 during school term-time to verify that there was no substantial difference between term-time and school holidays in the area. This verification check confirmed that the difference was negligible between these two periods. Results for the first set



of survey measurements at this location are presented as PRN1A, and for the second are presented as PRN1B.

## ii. Construction assessment

4.3.40 Various construction activities have been considered for the construction and removal and reinstatement phase, and the noise impacts assessed at each of the noise sensitive receptors. The construction phases have been identified and described as follows:

- enabling works, excavations and earthworks (including construction of landscape bunds);
- construction of parking and circulation routes;
- utilities and building construction;
- final surfacing of parking and circulation routes; and
- removal of infrastructure on-site and reinstatement of the land back to agricultural use.

4.3.41 Calculations have been carried out to predict noise levels for each phase of work at each receptor, based on the methodology set out in **Volume 1 Appendix 6G** of the **ES**.

## iii. Operational assessment

4.3.42 The proposed development would operate during daytime, evening, and night-time assessment periods, with varying occupation levels in the parking areas, and bus frequencies adapting to demand. Noise from movements of vehicles on site would be the dominant source, therefore predictions have been made of levels during the busiest periods. Noise from mechanical services in use at the welfare building, and security buildings on-site are also assessed.

4.3.43  $L_{Aeq,T}$  noise contour plots have been produced for daytime and night-time periods ( $L_{Aeq,16hour}$  07:00 – 23:00, and  $L_{Aeq,8hour}$  23:00 – 07:00 respectively) for the operation of the proposed development. These plots capture the overall sound level from typical site operation predicted to a height of 1.5 metres (m) above ground level at noise sensitive receptors for daytime, and to a height of 4.5m (first floor bedroom equivalent) for the night-time assessment period. At noise sensitive receptors, predicted values account for the effect of façade reflection by adding 3dB.

4.3.44 To assess the impact of sudden, higher sound level events (e.g. vehicle door closing), the  $L_{Amax}$  sound parameter has also been predicted for all relevant noise sensitive receptors for comparison with the criterion. Façade reflection has again been accounted for in the same way.

4.3.45 Background and ambient sound levels can be expected to be lower at night at noise sensitive receptors, and this assessment period is considered to be more sensitive. The  $L_{Amax}$  contour plot therefore shows predicted noise levels at a height of 4.5m above ground, the equivalent of first floor bedrooms at the noise sensitive receptors.

g) Assumptions and limitations

4.3.46 Construction noise predictions have been undertaken using the activities and plant described in **Chapter 2** of this volume, with further detail as provided in **Appendix 4B**, also of this volume. Construction work would take place during Monday to Saturday 07:00 to 19:00 hours, with no working on Sundays or bank holidays. No evening or night-time works during construction are proposed. However, if night time works are required, for example for unplanned dewatering, East Suffolk Council (ESC) would be notified in advance and noise control measures agreed, as necessary.

4.3.47 The operational noise assessment has been undertaken based on the description of development set out in **Chapter 2** of this volume, and includes the following key features:

- a park and ride facility, including up to 1,250 car parking spaces (of which 40 would be accessible spaces, and 12 would be pick-up only spaces);
- up to 10 spaces for minibuses/vans/buses, up to 80 motorcycle parking spaces and secure cycle parking for approximately 20 bicycles, a bus terminus area and parking, including shelters, an amenity and welfare building, security buildings and an administration office; and
- the park and ride facility is not assumed to be operational (i.e. no bus or car movements in and out) between the hours of 01:00 and 05:00 hours.

4.3.48 The following limitations have been identified:

- As the mechanical services plant required on site would not be selected until the detailed design phase, a target level is set below the level at which an adverse is expected to occur.

- The construction noise has been predicted, based on the assumptions provided in **Chapter 2** of this volume, including the construction methodology, phasing and source data for each different source type. The details would be developed as part of the detailed design, however the assumptions provided are considered sufficient to enable robust assessment of a realistic 'worst case' scenario of likely significant effects.
- The standards used in the assessment of permanent or new effects do not always provide guidance for the consideration of short-term impacts (such as any impact occurring over a period of less than a whole day or a whole night); or for a change in an existing situation. In such circumstances, the use of these standards may need to be adapted, based on professional judgement, as required.

#### 4.4 Baseline environment

4.4.1 This section presents a description of the baseline environmental characteristics within the site and in the study area.

##### a) Current baseline

4.4.2 Baseline monitoring was undertaken at a number of locations around the site, as shown in **Figure 4.2**, in 2014 to characterise the existing noise environment. An additional survey was undertaken at location PRN1 during school term-time to verify that there was no substantial difference between term-time and school holidays in the area.

4.4.3 A summary of measured levels at each location is shown in **Table 4.14**. Further detail is provided in **Volume 2, Appendix 11A**. The principal noise source in the study area is from road traffic using the A12.

**Table 4.14: Summary of baseline survey data.**

Receptor Reference.	Receptor Name.	Typical sound level DAY.		Typical sound level NIGHT.	
		L <sub>Aeq,T</sub> (dB).	L <sub>A90,T</sub> (dB).	L <sub>Aeq,T</sub> (dB).	L <sub>A90,T</sub> (dB).
PRN1A	Willow Marsh Cottage (surveyed during School Holidays).	57	40	45	32
PRN1B	Willow Marsh Cottage (surveyed during Term Time).	55	35	-	-
PRN2	Willow Marsh Lane/A12 Junction.	60	47	55	30

Receptor Reference.	Receptor Name.	Typical sound level DAY.		Typical sound level NIGHT.	
		L <sub>Aeq,T</sub> (dB).	L <sub>A90,T</sub> (dB).	L <sub>Aeq,T</sub> (dB).	L <sub>A90,T</sub> (dB).
PRN3	Darsham – A12 south of Darsham service station.	74	55	65	40

4.4.4 As road traffic noise is the dominant source, noise levels have been modelled (based on flows: 8,309 vehicles per hour during the day and 1,015 per hour at night) to estimate levels at facades, and in the vicinity of noise sensitive receptors around the site. **Figures 4.3** and **4.4** contain noise contour plots for day and night respectively showing predicted noise levels from existing road traffic.

4.4.5 The noise and vibration sensitive receptors close to the site are predominantly residential of medium sensitivity except Darsham service station, which is low sensitivity. The locations of the representative noise sensitive receptors A, B, C, D, E, F and G are illustrated in **Figure 4.1**.

4.4.6 Existing day and night time values are shown in **Table 4.15** for each receptor.

**Table 4.15: Existing day and night-time noise levels at each identified receptor.**

Receptor	Existing level, L <sub>Aeq</sub> , dB.	
	Day	Night
A – Properties west of the East Suffolk Line, south site, (medium sensitivity).	54	48
B – Properties east of the A12 at the southern end of the site (medium sensitivity).	62	56
C – Properties east of the A12 at the centre of the site (medium sensitivity).	65	59
D – Properties to the west of the A12, to the east of the site (medium sensitivity).	49	44
E – Properties to the west of the A12, to the north end of the east of the site (medium sensitivity).	54	48
F – Properties north-west of the site (medium sensitivity).	43	36
G – Properties north of the site, west of the A12 (medium sensitivity).	62	55

**b) Future baseline**

4.4.7 It is not predicted that there would be any change in the future noise and vibration baseline. One new scheme, an 82 bedroom hotel, is proposed to the east of the site (application reference DC/14/0420/OUT). This has the potential to become a receptor in the future once constructed, but for the



purpose of this assessment the potential impacts on the hotel are represented by the assessment of effects on Receptor C.

- 4.4.8 Potential cumulative impacts of the proposed hotel with the proposed development, is considered and assessed in the cumulative impact assessment presented in **Volume 10, Chapter 4**.

## 4.5 Environmental design and mitigation

- 4.5.1 As detailed in **Volume 1, Chapter 6**, a number of primary mitigation measures have been identified through the iterative EIA process, and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements, or are standard practices that will be implemented as part of the proposed development.

- 4.5.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. For noise and vibration, these measures are identified in this section, with a summary provided on how the measures contribute to the mitigation and management of potentially significant environmental effects.

### a) Primary mitigation

- 4.5.3 Primary mitigation is often referred to as ‘embedded mitigation’ and includes modifications to the location or design to mitigate impacts, these measures become an inherent part of the proposed development.

- 4.5.4 The site layout would incorporate landscape bunds as shown in **Figure 2.1** of this volume. This would provide approximately a 5dB reduction in sound level for residential receptors in the area south of Willow Marsh Lane, to the east of the landscape bund and to the west of the A12 once constructed.

- 4.5.5 The mechanical services plant (such as air conditioning condenser units and air handling units) would be selected to ensure that limit values would be met.

### b) Tertiary mitigation

- 4.5.6 Tertiary mitigation will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices.

- 4.5.7 The standard of good practice outlined in BS 5228-1 would be followed, as set out in the **Code of Construction Practice (CoCP)** (Doc Ref. 8.11). Tertiary mitigation for the control of noise and vibration would include:
- selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earth moving activities;
  - switching off equipment when not required;
  - use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
  - provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.
- 4.5.8 BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.
- 4.5.9 During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Workforce Travel Plan** (Doc Ref. 8.8) will be implemented to help reduce and manage the effects of traffic generated by the Sizewell C Project, provided in **Volume 2, Chapter 10**.

c) **Other Mitigation**

- 4.5.10 A Noise Mitigation Scheme, provided in **Volume 2 Appendix 11H** is proposed as part of the DCO Section 106 obligations, so that noise insulation or temporary rehousing may be provided where specified noise criteria are exceeded.
- 4.5.11 NPS EN-1 (Ref. 4.1) indicates that noise insulation is a valid form of mitigation, as part of a package of noise mitigation measures, stating at paragraph 5.11.13:
- "In certain situations, and only when all other forms of noise mitigation have been exhausted, it may be appropriate for the IPC to consider requiring noise mitigation through improved sound insulation to dwellings."*
- 4.5.12 Similarly, paragraph 010 of the PPG for noise refers to the use of insulation when seeking to address noise impacts:
- "In general, for developments that are likely to generate noise, there are 4 broad types of mitigation:*

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- *engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building.* (emphasis added)

4.5.13 Offering temporary rehousing where short term construction noise is forecast to exceed specified levels is also commonly regarded as best practice for projects involving significant construction activity.

d) **Monitoring**

4.5.14 Routine monitoring would be carried out during construction in accordance with the **CoCP** (Doc Ref. 8.11) and SZC Co. would have a system for the receipt, and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

## 4.6 **Assessment**

a) **Introduction**

4.6.1 This section presents the findings of the noise and vibration assessment for the construction, operation and removal and reinstatement phases of the proposed development

4.6.2 This section identifies any potentially significant effects that are predicted to occur and **section 4.7** of this chapter, identifies any secondary mitigation, and monitoring measures that are required to minimise any adverse effects, if required.

4.6.3 The site would be accessed during both construction and operation from a new roundabout which would be constructed off the A12 to the north-east of the site. During the earliest phases of construction whilst the new roundabout is being constructed, it is anticipated that a temporary construction access point would be provided off the A12, most likely at the junction with Willow Marsh Lane. Seven representative dwellings or groups of dwellings have been identified as noise sensitive receptors for the purposes of assessment positions for the assessment phases described in this chapter. The noise sensitive receptors A, B, C, D, E, F and G are illustrated in **Figure 4.1**.

b) Construction

i. Noise

4.6.4 A description of the construction methods is provided in **Chapter 2** of this volume. Associated environmental control measures are summarised in **section 4.5** of this chapter, and further detail is detailed in the **CoCP** (Doc Ref. 8.11), and. The hours of working during the construction phases have been discussed during consultation meetings with Suffolk County Council and East Suffolk Council. For the purposes of this assessment, construction site working hours are therefore considered as follows:

- Monday to Saturday 07:00–19:00 hours.

4.6.5 The working hours fall entirely within the daytime assessment period of 07:00 to 19:00 hours, and therefore, for work taking place during a weekday working and work between 07:00 and 13:00 hours on Saturday, only the daytime criteria in **Table 4.2** apply to this part of the assessment. For work taking place between 13:00 and 19:00 hours on a Saturday, the “Evenings and Weekends” criteria in **Table 4.2** would apply.

4.6.6 Various construction activities have been considered for the construction and removal and reinstatement phase, and the noise and vibration effects then assessed at each of the noise and vibration sensitive receptors A - G. The construction phases have been identified and described as follows:

- enabling works, and excavation and earthworks (including construction of landscape bunds);
- construction of parking and circulation routes;
- utilities and building construction;
- final surfacing of parking and circulation routes; and
- removal and reinstatement (including removal of buildings, breaking of concrete and earthworks).

4.6.7 The formation of the landscape bund would be undertaken early in the construction programme, following the enabling works. Predictions of construction sound levels at noise sensitive receptors from the phases that follow the formation of the landscape bund, therefore, take account of the presence of the 3m high landscape bund located as indicated in **Figure 2.1** of this volume. However, prior to construction during the enabling works and excavations and earthworks (including bund forming) phases, predictions do not take into account the mitigating effect of the landscape bund.

4.6.8 Calculations have been carried out to predict noise levels during each phase of construction work at each of the closest noise sensitive receptors. Details of these calculations, the assumptions which support them, and the analysis of results are in **Appendix 4A** of this volume. **Table 4.16** shows a summary of the predicted levels.

**Table 4.16: Summary of predicted construction noise levels at the nearest noise sensitive receptor locations around the site – free field values.**

Receptor Reference	Predicted Sound Level $L_{Aeq,day}$ dB.				
	Enabling Works, Earthworks & Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Reinstatement
<b>A</b>	62	63	58	62	65
<b>B</b>	63	66	61	66	67
<b>C</b>	66	65	66	68	68
<b>D</b>	64	60	60	63	67
<b>E</b>	61	57	57	55	61
<b>F</b>	54	52	55	49	56
<b>G</b>	57	53	53	63	59

4.6.9 The significance of effects of these noise levels during weekdays and Saturdays 07:00 to 13:00 hours are shown in **Table 4.17**, based on each receptor being of medium sensitivity.



**Table 4.17: Summary of predicted construction noise effects at the nearest noise sensitive receptor locations around the site on weekdays and Saturdays 07:00 to 13:00.**

Receptor Reference	Predicted Sound Level $L_{Aeq,day}$ dB.				
	Enabling Works, Earthworks & Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Reinstatement
<b>A</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>
<b>B</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Negligible, <b>not significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>C</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>D</b>	Moderate adverse, <b>significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>E</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>
<b>F</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>	Minor adverse, <b>not significant</b>
<b>G</b>	Minor adverse, <b>not significant</b>	Negligible, <b>not significant</b>	Negligible, <b>not significant</b>	Moderate adverse, <b>significant</b>	Minor adverse, <b>not significant</b>

4.6.10 The assessment of impacts from construction noise at noise sensitive receptors is considered to represent a typical day during each period.

4.6.11 Between Monday and Friday, 07:00 and 19:00 hours, and Saturday 07:00 and 13:00 hours, construction noise levels are predicted to result in significant adverse effects at Receptor A, B, C, D and G during some phases of construction work, removal and reinstatement work. Where moderate adverse effects are predicted to occur, these are considered to be **significant**. Mitigation to reduce the adverse effects will be implemented in accordance with the **CoCP** (Doc Ref. 8.11). All effects at other receptors during construction Between Monday and Friday, 07:00 and 19:00 hours, and Saturday 07:00 and 13:00 hours are **not significant**.

4.6.12 Between 13:00 and 19:00 hours on Saturday, the impacts (from the same activities) have been assessed against the more stringent assessment criteria, as defined in **Table 4.3**. The significance of the noise effects are shown in **Table 4.18**, based on each receptor being of medium sensitivity.

**Table 4.18: Summary of predicted construction noise effects at the nearest noise sensitive receptor locations around the site on Saturdays 13:00 to 19:00.**

Receptor Reference	Predicted Sound Level $L_{Aeq,day}$ dB.				
	Enabling works, Earthworks & Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Reinstatement
<b>A</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>B</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Negligible	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>C</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>D</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>E</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>
<b>F</b>	Moderate adverse, <b>significant</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>	Minor adverse, <b>not significant</b>	Moderate adverse, <b>significant</b>
<b>G</b>	Moderate adverse, <b>significant</b>	Negligible	Negligible	Moderate adverse, <b>significant</b>	Moderate adverse, <b>significant</b>

4.6.13 The reason for the predicted increase in adverse effects is not due to any difference in activities that would occur between 13:00 and 19:00 hours on a Saturday, but is a result of the lower impact thresholds that apply outside of Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours.

4.6.14 On a Saturday between 13:00 and 19:00 hours, if no additional mitigation measures are in place, moderate adverse effects from noise are predicted for the many of the construction phases. These are considered to be **significant**.

- 4.6.15 It can be seen from **Table 4.16** that the construction SOAEL of 75dB for the weekday daytime period of 08:00 to 18:00 hours will not be exceeded at any of the assessed receptors, even when the predicted free-field values are adjusted by +3dB to obtain façade values. Setting aside the removal and reinstatement phase, which is considered later in this chapter, the lower SOAELs that are adopted for the periods outside of the main weekday daytime works are predicted to be exceeded at five receptors, with at least one exceedance occurring in each phase of work.
- 4.6.16 It is inevitable that construction noise will vary over the course of any given day, and the predicted levels in **Table 4.16** are considered to be a reasonable representation of the likely construction noise levels for time periods other than the 12 hour period used in the calculations.
- 4.6.17 Exceedances of the SOAEL will be avoided by managing the works in a way that avoids the noisiest activities at the most sensitive parts of the day, secured through the **CoCP** (Doc Ref. 8.11). Where such works can not be managed in this manner, exceedances of the SOAEL will be avoided through the provision of noise insulation under the Noise Mitigation Scheme, provided in **Volume 2 Appendix 11H** of the **ES**.
- 4.6.18 The LOAEL, which for construction noise is taken to be equal to the existing baseline sound levels, is likely to be exceeded at all of the receptor locations for at least some of the time during the construction works. This will be mitigated and minimised through the measures described in the **section 4.5** of this chapter and through the implementation of the **CoCP** (Doc Ref. 8.11).
- 4.6.19 The potential for combined effects with the increased traffic on the A12 to the east of the site is assessed and presented in the project-wide effects assessment in **Volume 10 Chapter 3**. In summary, no additional significant adverse effects are predicted to arise at receptors as a result of the in combination effects.

## ii. Vibration

- 4.6.20 The approach taken for predicting vibration levels is described in **Volume 1, Chapter 6, Appendix 6G, Annex 6G.2**, all of this volume. Using Figures 1 and 2 from this, it can be seen, that for earthmoving, including bulldozers, breakers, crushers and small twin drum vibratory rollers, there would be a negligible vibration effect beyond a distance of 40m from the activity. For plant which produces higher vibration levels (such as piling and large single drum compactors), there would be a negligible vibration effect beyond a distance of 90m from the activity.

4.6.21 The distances between the receptors and the main working areas during the construction phases are all greater than 90m, so vibration levels from construction would be less than 0.3mm/s. This is expected to be below a low magnitude of impact and would therefore result in no more than minor adverse effects. These are considered to be **not significant**.

4.6.22 There are predicted to be no exceedances of the SOAEL of 10mm/s nor of the LOAEL of 0.3mm/s as a result of these works.

### iii. Inter-relationship effects

4.6.23 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** of this volume, and in **Volume 10, Chapter 2**, also of this volume.

### iv. Operation

4.6.24 Once operational, the proposed development is expected to operate seven days per week, providing a park and ride service for workers accessing the Sizewell C main development site. Construction at Sizewell C main development site would take place up to 24 hours a day, seven days per week, and therefore the proposed development would operate during daytime, evening, and night-time assessment periods, with varying occupation levels in the parking areas and bus frequencies adapting to demand. On the basis of the shift patterns, the proposed development is not assumed to be operational between the hours of 01:00 and 05:00 hours, i.e. no bus or car movements in and out.

4.6.25 There will also be some noise from mechanical services in use at the welfare building, and security buildings on-site as detailed below.

### Operational noise from car parking and vehicle movements on-site

4.6.26 The noise sensitive receptor locations A, B, C, D, E, F and G used for the construction phase noise assessment have also been used for reporting the operational phase noise assessment.

4.6.27 The potential activities associated with the operation of the proposed development that could give rise to a noise impact at the receptor locations are as follows:

- vehicle movements within the site, including cars and motorbikes parking, door closing, engine start-ups;

- park and ride buses entering and leaving site; and
- park and ride users, security and visitors using the facility.

4.6.28 Buses would operate to and from the proposed development to accommodate the Sizewell C main development site's construction site shift patterns. Between Monday and Friday shifts are expected to consist of the shift start and finish times as set out in **Table 4.19**. Whilst the proposed development would operate seven days a week, the use would vary throughout the construction and typically, there would be fewer shifts on Fridays and weekends.

**Table 4.19: Main development site construction shift times.**

Shift	Start Time	Finish Time
Shift 1	From 06:00 to 07:30	From 14:00 to 16:00 or after 17:30
Shift 2	From 13:30 to 15:00	From 22:00 to 24:00
Night Shift	From 20:30 to 22:00	From 06:00 to 08:00
Single Shift	From 07:00 to 08:30	From 16:30 to 18:30.
Office Shift	From 07:30 to 09:00	From 17:30 to 19:00

4.6.29 The criteria for assessing the potential noise impact from the operation of the proposed development does not distinguish the day of the week but considers the daytime and night time assessment periods set out in **Table 4.6**. Traffic data for movements of vehicles associated with these shift patterns have, therefore, been categorised into movements in each day or night time period.

4.6.30 During the day there are predicted to be 1,732 vehicle movements on-site, of which 158 would be by vehicles over 3.5 tonnes (including buses). At night there are predicted to be 809 vehicle movements on-site, of which 40 would be by vehicles over 3.5 tonnes (including buses).

4.6.31 Noise levels have been predicted using computer modelling and details of the modelling carried out, and assumptions made are shown in **Appendix 4B** of this volume. **Figures 4.5, 4.6 and 4.7** show predicted noise contours for day time  $L_{Aeq}$  levels, night time  $L_{Aeq}$  levels and night time  $L_{Amax}$  noise levels, respectively.

4.6.32 **Table 4.20** shows a summary of predicted noise levels at each receptor and the noise effects predicted for each period, based on the predicted levels and each receptor being of medium sensitivity.



**Table 4.20: Predicted noise levels and noise effects from operation of the proposed development (free field levels).**

Receptor Reference.	Parameter	Predicted level.	Classification of Effect.
<b>A</b>	L <sub>Aeq,16hour</sub> (day)	38	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	37	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	52	Negligible, <b>not significant</b>
<b>B</b>	L <sub>Aeq,16hour</sub> (day)	40	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	41	Minor adverse, <b>not significant</b>
	L <sub>Amax</sub> (night)	60	Negligible, <b>not significant</b>
<b>C</b>	L <sub>Aeq,16hour</sub> (day)	40	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	40	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	57	Negligible, <b>not significant</b>
<b>D</b>	L <sub>Aeq,16hour</sub> (day)	39	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	40	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	52	Negligible, <b>not significant</b>
<b>E</b>	L <sub>Aeq,16hour</sub> (day)	39	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	40	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	53	Negligible, <b>not significant</b>
<b>F</b>	L <sub>Aeq,16hour</sub> (day)	33	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	33	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	40	Negligible, <b>not significant</b>
<b>G</b>	L <sub>Aeq,16hour</sub> (day)	40	Negligible, <b>not significant</b>
	L <sub>Aeq,8hour</sub> (night)	40	Negligible, <b>not significant</b>
	L <sub>Amax</sub> (night)	58	Negligible, <b>not significant</b>

4.6.33 **Table 4.20** shows that, at worst, the effects that result from the use of the proposed development will be minor adverse, **not significant**.

4.6.34 It can also be seen from **Table 4.20** that the predicted noise levels will not exceed the SOAEL at any of the assessed receptors.

4.6.35 The daytime LOAEL will not be exceeded at any location, but the night time LAOEL will be exceeded at one location. This will be mitigated and minimised through the measures described in **section 4.5** of this chapter.

#### v. Mechanical services noise

- 4.6.36 The proposed development includes an amenity welfare building and security buildings on-site shown on **Figure 2.1** of this volume. The detailed design of these buildings is not available at this time, however, the purpose is to provide facilities for the security staff that would be on-site 24 hours per day, office accommodation, and WC facilities for all users of the site.
- 4.6.37 Typically, such buildings can be expected to include extract fans serving the WC areas, and any kitchen area provided for staff. It is also likely that these buildings would be served by heating and cooling systems. The buildings may be occupied by staff, and the facilities available for park and ride users at any time in a 24-hour period. The mechanical services plant can also therefore be expected to operate day and night.
- 4.6.38 Specific details of the proposed mechanical services to be installed are not known at this stage, and therefore it is appropriate that design target noise levels are set for the mechanical services systems in order that plant is selected, designed and installed in such a manner that the design target noise levels are achieved.
- 4.6.39 It should be the aim to ensure that the combined mechanical services plant when all operating would be equal to: either equal to background or no higher than 35dB,  $L_{Ar}$ , where the existing background is low at all noise sensitive receptors (35dB,  $L_{Ar}$  is considered to represent a “very low” rating level for reasons explained in **Volume 1, Appendix 6G, Annex 6G.1** of the **ES**.
- 4.6.40 The design target noise levels must be set relative to the typical background sound levels ( $L_{A90,T}$ ). The nearest noise sensitive receptors to the proposed buildings are at a distance of approximately 100m. The baseline survey work includes noise survey measurements taken at position reference PRN3, provided in **Appendix 4A** of this volume. This position was close to the nearest noise sensitive receptors, and therefore the measurements taken are considered representative of this location.
- 4.6.41 The typical background sound levels ( $L_{A90,T}$ ) are lowest through the night-time period of 23:00 to 07:00 hours. Typical background sound levels at night at a position representative of the nearest noise sensitive receptor was found to be  $L_{A90,15\text{minute}}$  of 29 dB. This means that the design target for mechanical services would be 35dB,  $L_{Ar}$ .
- 4.6.42 For plant noise not to exceed the design target, the  $L_{Ar,15\text{minute}}$  of the combined mechanical services plant will need to be no greater than 35dB,  $L_{Ar}$  at any nearby receptor. Given the likely type of plant to be installed, the separation distances, and the scope for selection of quiet mechanical services (if required), the ability to locate and orientate the plant in such a way as to take

advantage of screening from buildings, and directionality of the sound source, this level would be readily achievable without the need for additional screening or enclosure.

- 4.6.43 By designing the plant to achieve a free-field level of 35 dB  $L_{Ar,15\text{minute}}$  outside the nearest residential receptor, the adopted SOAEL and LOAEL will not be exceeded.

vi. Inter-relationship effects

- 4.6.44 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** and in **Volume 10, Chapter 2**, respectively provided in the **ES**.

c) Removal and Reinstatement

- 4.6.45 The assessment of the removal and reinstatement phase is presented in **section 4.6** of this chapter, as part of the construction assessment.
- 4.6.46 As shown in **Table 4.17**, between Monday and Friday, 07:00 and 19:00 hours, and Saturday 07:00 and 13:00 hours, **significant** noise effects would occur during removal and reinstatement phase receptors B and D, and additional mitigation would be required to reduce these levels.
- 4.6.47 Between 13:00 and 19:00 hours on Saturday, the impacts (from the same activities) would be assessed against different criteria, as shown in **Table 4.19**. For all receptors, noise levels would be **significant** and additional mitigation would be required to reduce these levels.
- 4.6.48 Once the landscape works are complete and the site will be reinstated to agricultural use, noise levels would be similar to those presented for the baseline.
- 4.6.49 It can be seen from **Table 4.16** that the construction SOAEL of 75dB for the weekday daytime period of 08:00 to 18:00 hours will not be exceeded at any of the assessed receptors during the removal and reinstatement works, even when the predicted free-field values are adjusted by +3dB to obtain façade values. The lower SOAELs that are adopted for the periods outside of the main weekday daytime works are predicted to be exceeded at receptors A, B, C and D.

- 4.6.50 It is inevitable that construction noise will vary over the course of any given day, and the predicted levels in **Table 4.16** are considered to be a reasonable representation of the likely construction noise levels for time periods other than the 12 hour period used in the calculations.
- 4.6.51 Exceedances of the SOAEL will be avoided by managing the works in a way that avoids the noisiest activities at the most sensitive parts of the day, secured through the **CoCP** (Doc Ref. 8.11). Where such works cannot be managed in this manner, exceedances of the SOAEL will be avoided through the provision of noise insulation under the Noise Mitigation Scheme, provided in **Volume 2 Appendix 11H** of the **ES**.
- 4.6.52 The LOAEL, which for construction noise is taken to be equal to the existing baseline sound levels, is likely to be exceeded at all of the receptor locations for at least some of the time during the construction works. This will be mitigated and minimised through the measures described in the **section 4.5** in this chapter and through the implementation of the **CoCP** (Doc Ref. 8.11).
- i. [Inter-relationship effects](#)
- 4.6.53 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** and in **Volume 10, Chapter 2**, respectively provided in the **ES**.
- 4.7 [Mitigation and monitoring](#)
- a) [Introduction](#)
- 4.7.1 Primary and tertiary mitigation measures which have been accounted for as part of the assessment are summarised in **section 4.5** of this chapter. Where other mitigation is required to avoid a significant adverse effect, or mitigate and minimise adverse effects, this is referred to as secondary mitigation as described below.
- b) [Mitigation](#)
- 4.7.2 Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant.

- 4.7.3 On Monday to Friday, 07:00 to 19:00 hours and between Saturday, 07:00 to 13:00 hours, significant effects from noise are predicted for receptors A, B, C, D and G during some phases of construction and receptors A, B, C and D during removal and reinstatement. No other significant effects are predicted from noise or vibration during any other phase of construction during these days and time periods or during operation at these or other receptors.
- 4.7.4 Between 13:00 and 19:00 hours on a Saturday, noise levels are predicted to be significant at all receptor locations during some or all of the construction and removal and reinstatement phases. Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons.
- 4.7.5 The provision of additional mitigation to further reduce construction noise levels would include consideration of the following factors:
- the detailed construction programme and equipment specifications which would not be available until contractors have been appointed;
  - on-site constraints (space, topography or other ecological or geographical feature which may prevent or limit screening);
  - any other impacts which the construction of further acoustic screening may have, such as landscape and visual impacts; and
  - the amount of time over which the reduction would be required.
- 4.7.6 A balance would need to be struck between the aforementioned factors to decide on the extent of screening in each set of circumstances. It is likely that some reduction would be possible in some locations during the construction phase, but the benefit of screening in many circumstances may be outweighed by the disbenefit, particularly given that the construction noise levels predicted would be at a similar level to existing road traffic noise in the area, so would not stand out significantly above this.
- 4.7.7 Where there are potential significant effects, and where predicted levels during some construction phases would be relatively high compared to existing levels, additional temporary screening for noisy activities may be implemented where appropriate. This would result in an additional reduction of between 3 and 8dB, depending on location, and height of the screening.
- 4.7.8 The following mitigation measures provide an example of the measures that would be used, where practicable, during the construction phase, as follows:
- Localised acoustic barriers could be used as an effective noise mitigation measure when construction activities take place within 50m



**NOT PROTECTIVELY MARKED**

of Receptors B, D and E during the construction and reinstatement. The reduction provided by these screens would be likely result in a reduction in noise level of at least 5dB.

- Reducing noisy activities during construction between 13:00 and 19:00 hours on Saturdays.

4.7.9 Mitigation measures listed above and in the **CoCP** (Doc Ref. 8.11), should be capable of reducing levels such that they are no longer significant.

4.7.10 No secondary or additional mitigation is considered to be necessary for operational noise.

4.8 **Residual effects**

4.8.1 The following tables (**Tables 4.21, 4.22, 4.23, 4.24, 4.25** and **4.26**) present a summary of the noise and vibration assessment.

4.8.2 **Tables 4.21, 4.23** and **4.25** relate to the construction, operational and reinstatement phases respectively, identifying the receptors likely to be impacted, the level of effect and, where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect. Receptor coding for **Tables 4.21, 4.23** and **4.25** are as per **Table 4.15**.

4.8.3 **Tables 4.22, 4.24** and **4.26** also relate to the construction, operational and reinstatement phases respectively, identifying the assessment outcomes against LOAEL and SOAEL.

**Table 4.21: Summary of effects for the construction phase.**

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
A, B, C, D and G	Construction noise (during Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00 working hours) some phases of construction work	Landscape bunds and the <b>CoCP</b> (Doc Ref. 8.11), including routine monitoring.	Moderate adverse.	Further acoustic screening and working methodologies to be considered during detailed design.	Minor adverse or negligible ( <b>not significant</b> )
Other receptors.			Minor adverse or negligible.		

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
All receptors.	Construction noise (during Saturday 13:00 to 19:00 working hours) – during some or all phases of construction work.	Landscape bunds and the <b>CoCP</b> , including routine monitoring.	Moderate adverse.	Minimising noisy construction activities between 13:00 and 19:00 on Saturdays. Further acoustic screening and working methodologies to be considered during detailed design.	Minor or negligible, ( <b>not significant</b> )
All receptors.	Construction vibration.	Landscape bunds and the <b>CoCP</b> .	Negligible	None required.	Negligible ( <b>not significant</b> )

**Table 4.22: Summary of assessment against LOAEL / SOAEL for construction.**

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise from construction works.	<p>No exceedances of main daytime SOAEL, but possible exceedances of lower SOAELs outside main working day at five receptors, with at least one exceedance in each phase.</p> <p>LOAEL likely to be exceeded at some points during construction works at all receptors.</p>	<p>Any exceedance of the SOAELs will be avoided by managing the works in a way that avoids the noisiest activities at the most sensitive parts of the day, secured through the <b>CoCP</b>. Where such works cannot be managed in this manner, exceedances of the SOAEL will be avoided through the provision of noise insulation under the <b>Noise Mitigation Scheme</b>.</p> <p>Exceedances of the LOAEL will be mitigated and minimised through the adoption of the measures detailed in <b>section 4.5</b> on Environmental Design and Mitigation, and through the implementation of the <b>CoCP</b>.</p>
Vibration from construction works.	No exceedances of SOAEL or LOAEL.	<p>No action required to avoid significant adverse effects on health and quality of life.</p> <p>No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.</p>

**Table 4.23: Summary of effects for the operational phase.**

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
All receptors.	Noise and vibration from operation of the proposed development.	Landscape bunds and selection of plant below a target level which would result in a level no greater than the LOAEL.	Minor adverse or negligible	None required.	Minor adverse or negligible ( <b>not significant</b> )

**Table 4.24: Summary of assessment against LOAEL / SOAEL for operation.**

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise and vibration from operation of the proposed development.	No exceedances of the SOAEL expected.  Night time LOAEL expected to be exceeded at one location. LOAEL not expected to be exceeded elsewhere at any time.	No action required to avoid significant adverse effects on health and quality of life.  Exceedance of LOAEL will be mitigated and minimised through the measures described in <b>section 4.5</b> on Environmental Design and Mitigation.
Operation of fixed mechanical plant	No exceedances of SOAEL or LOAEL expected.	No action required to avoid significant adverse effects on health and quality of life.  No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.

**Table 4.25: Summary of effects for the removal and reinstatement phase.**

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
A, B, C and D	Noise levels during removal and reinstatement works (during Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00 working hours.	Landscape bunds and the <b>CoCP</b> (Doc Ref. 8.11), including routine monitoring.	Moderate adverse	Further acoustic screening and working methodologies to be considered during detailed design.	Minor adverse or negligible ( <b>not significant</b> )
Other receptors.	Noise levels during removal and reinstatement works (during Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00 working hours.	Landscape bunds and <b>CoCP</b> , including routine noise monitoring.	Minor adverse or negligible	None required.	Minor adverse or negligible ( <b>not significant</b> )
All receptors.	Noise levels during removal and reinstatement works (during Saturday 13:00 to 19:00 working hours).	Landscape bunds and <b>CoCP</b> , including routine noise monitoring.	Moderate adverse	Minimising noisy construction activities between 13:00 and 19:00 on Saturdays. Further acoustic screening and working methodologies to be considered during detailed design to minimise noise effects to below the SOAEL, for example using a quieter alternative to using backhoe mounted	Minor adverse or negligible ( <b>not significant</b> )



Receptor	Impact	Primary or Tertiary Mitigation	Assessment of effects	Additional Mitigation	Residual Effects
				breakers (“concrete peckers”).	
All	Vibration from removal and reinstatement activities.	<b>CoCP</b>	Negligible	None required.	Negligible ( <b>not significant</b> )

**Table 4.26: Summary of assessment against LOAEL / SOAEL for removal and reinstatement phase.**

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise from removal / reinstatement works.	<p>No exceedances of main daytime SOAEL, but possible exceedances of lower SOAELs outside main working day at receptors A, B, C and D.</p> <p>LOAEL likely to be exceeded at some points during construction works at all receptors.</p>	<p>Any exceedance of the SOAELs will be avoided by managing the works in a way that avoids the noisiest activities at the most sensitive parts of the day, secured through the <b>CoCP</b>. Where such works can not be managed in this manner, exceedances of the SOAEL will be avoided through the provision of noise insulation under the <b>Noise Mitigation Scheme</b>.</p> <p>Exceedances of the LOAEL will be mitigated and minimised through the adoption of the measures detailed in <b>section 4.5</b> on the Environmental Design and Mitigation, and through the implementation of the <b>CoCP</b>.</p>
Vibration from construction removal / reinstatement works.	No exceedances of SOAEL or LOAEL.	<p>No action required to avoid significant adverse effects on health and quality of life.</p> <p>No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.</p>

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