Cambridge Waste Water Treatment Plant Relocation Project
Anglian Water Services Limited

Environmental Statement Chapter 17: Noise and vibration

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Summary

Noise and vibration impacts have been assessed during the construction, operation, maintenance and decommissioning phases of the Proposed Development. This Chapter provides an assessment of the noise and vibration impacts of the Proposed Development upon nearby sensitive receptors through these phases.

Impacts would be greatest during works at the closest locations to existing noise and vibration sensitive receptors. Overall, the results of the assessment, taking into account all mitigation measures which are provided to avoid and minimise adverse effects, determine that the resulting effects at sensitive receptors are adverse but are not significant.

Mitigation

Primary mitigation measures implemented within the design include:

- Relocation of Shaft 4 to increase distance to work site from the nearest noise sensitive receptors and minimise adverse noise and vibration impacts during construction; and,
- Minimising operational noise impacts by design including consideration of location, layout and plant/equipment selections. Use of Earth Bank and enclosures to reduce noise emissions.

Secondary mitigation measures which will be implemented include:

- Measures set out within the CoCP Part A and B. The CoCP requires implementation of mitigation measures including the application BPM in accordance with the CoPA and BS 5228. Implementation of management plans as specified by the CoCP Part A and B. In addition to the requirements of the CoCP there will also be a requirement to avoid, minimise and control noise and vibration impacts through implementation of the Decommissioning Management Plan, CTMP and CLP.
- In construction there will be controls on vehicle movements so that no construction traffic will be permitted to travel through Horningsea or Fen Ditton.
- Solid site hoarding/acoustic barriers will be used to minimise noise levels around construction working areas at Shaft 4, the Waterside Pipeline construction compound and continuous HDD works.
- Restriction of working hours will be used to avoid sensitive times of the day and adverse impacts for works at Shaft 4 and the final effluent outfall.

Measures secured through legal requirements or those that are best practice (tertiary):

- Environmental compliance during the operational phase will be monitored under the Environmental Permit. The permit also requires the operator to have a written Environmental Management System (EMS), which includes a set of plans and procedures describing measures to avoid, reduce and

eliminate potential environmental impacts associated with the activities covered by the permit

Summary of construction effects

Construction noise and vibration impacts have been assessed through all relevant daily assessment time periods to consider potential impacts at receptors in the areas surrounding proposed construction activities. The preliminary assessments taking into account primary and tertiary mitigation have determined that impacts would predominantly result in negligible or minor adverse impacts that would not be significant, however, in a few instances would be moderate adverse and result in significant adverse effects. Additional/ secondary mitigation measures are therefore implemented to include the provision of solid site hoarding/acoustic barriers around construction compounds in select areas close to receptors, restriction of working hours to avoid sensitive times of the day and application of measures and Best Practicable Means (BPM) in accordance with BS 5228. These measures are reflected in the Code of Construction Practice (CoCP Part A and B). With implementation of mitigation measures the noise and vibration moderate adverse impacts would be avoided or reduced and resulting effects would be not significant.

Construction traffic has the potential to affect noise sensitive receptors in Waterbeach and Fen Ditton. Impacts have been assessed as minor adverse and would not result in significant effects.

Noise impacts to recreational users of the River Cam have been assessed to be not significant due to the limited and temporary exposure people would receive when moving through these areas.

Summary of operation effects

Noise impacts during operation of the Proposed Waste Water Treatment Plant (WWTP) have been completed using noise modelling following methodology of BS 4142. Assessment results indicate that noise impacts are negligible at the closest noise sensitive receptor locations surrounding the proposed WWTP and are not significant.

Operational traffic associated with the proposed WWTP has been assessed using methodology and guidance from the Design Manual for Roads and Bridges (DMRB) LA111. Assessment shows that noise impacts would be limited due to changes in road traffic as a result of high existing traffic flows and that resulting effects are not significant.

Summary of decommissioning effects

The noise effects from decommissioning activities (draining and cleaning of tanks to rescind the existing Cambridge WWTP permit) have been assessed for works at the existing Cambridge WWTP. Assessment shows noise impacts due to these works are limited and are not significant.

Planning policy

National and local planning policy aims include the requirement for developers to avoid significant adverse effects on health and quality of life, mitigate and minimise adverse impacts and where possible contribute to the improvement of health and quality of life within the context of sustainable development. In accordance with these policies, including the National Policy Statement (NPS) for Waste Water and the Noise Policy Statement for England (NPSE), the proposed WWTP location and design aims to avoid significant adverse effects and minimise adverse noise and vibration impacts. Appropriate mitigation design through operation, maintenance, construction and decommissioning of the Proposed Development has been included within proposals also to avoid significant adverse effects and minimise adverse noise impacts at the nearest sensitive receptors.

1 Introduction

1.1 Purpose of this chapter

1.1.1 This chapter of the Environmental Statement (ES) presents the findings of Environmental Impact Assessment (EIA) completed in relation to the potential impacts of the Proposed Development on noise and vibration.

1.1.2 The ES has been prepared as part of the application to the Planning Inspectorate (PINS) for development consent.

1.1.3 This chapter presents the noise and vibration assessment for the ES and discusses the matters associated with the construction and operation of the Proposed Development, with reference to:

- noise and vibration impacts due to construction;
- noise impacts due to construction traffic using the existing road network; and
- noise impacts due to operation of the proposed WWTP and operational traffic.

1.1.4 Potential impacts of the Proposed Development on biodiversity are assessed in Chapter 8: Biodiversity.

1.1.5 Potential impacts of the Proposed Development on the community are assessed in Chapter 11: Community.

1.1.6 This chapter summarises information from supporting studies, technical reports and publicly available data which are included within the Book of Figures – Noise & Vibration (App Doc Ref 5.3.17) and Code of Construction Practice (CoCP) Part A, and Part B (Appendix 2.1 & 2.2, App Doc Ref 5.4.2.1 & 5.4.2.2).

1.1.7 This chapter refers to Appendix 17.1: Noise Guidance and Policy (App Doc Ref 5.4.17.1),Appendix 17.2: Baseline Noise Report (App Doc Ref 5.4.17.2),Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3), and Appendix 17.4: Operational Noise Sources (App Doc Ref 5.4.17.4).

1.2 Competency statement

1.2.1 Summaries of the qualifications and experience of the chapter authors are set out in Table 1-1.

Table 1-1: Competent experts

Author	Qualification/Professional membership	Years of experience	Project experience summary
[redacted]	MPhys (Hons) Physics Chartered Engineer (CEng) Member of the Institute of Acoustics (MIOA) Member of the Institute of Physics (MInstP)	12	Senior acoustic engineer with experience in environmental noise and vibration assessment and EIA. Projects include environmental noise and vibration for transportation, highways,

Author	Qualification/Professional membership	Years of experience	Project experience summary
			industrial, waste and energy generation.
[redacted]	Diploma in Acoustics and Noise Control, Southampton Solent University, 2015 BA in Psychology (minoring in Sociology), Florida Atlantic University, 2011 Member of the Institute of Acoustics (MIOA)	7	Various assessments and EIA chapter author (flood defence, roads, transport infrastructure), Town and Country Planning Acts (TCPA) and Transport and Works Act Orders (TWAO) consenting regime. Environmental surveys and reporting. Noise and vibration assessment chapter author flood mitigation scheme.
[redacted]	BA Engineering Science (Hons) Chartered Engineer (CEng) Fellow of the Institute of Acoustics (FIOA)	37	Acoustics team leader with expert witness, Special Development Order (SDO) and Development Consent Order (DCO) experience. Projects include environmental noise and vibration for highways, urban transport and railways.

1.3 Planning policy context

National Policy Statement requirements

1.3.1 Planning policy in relation to noise and vibration is contained in the National Policy Statement (NPS) for Waste Water (Department for Environment, Food and Rural Affairs, 2012).

1.3.2 Table 1-2 sets out how the scope proposed in this chapter complies with the NPS for Waste Water.

Table 1-2: Scope and NPS compliance

NPS requirements	Compliance of ES scope with NPS requirements
Assessment of noise and vibration impacts in accordance with relevant British Standards and guidance (as stated in 4.9.1 – 4.9.6)	Assessment of operational and construction noise and of vibration impacts has been undertaken and is summarised in Section 2.2: Assessment methodology, of this chapter. Assessments have been undertaken in accordance with relevant British Standards and guidance.
Mitigation of noise impacts (as stated in 4.9.8 – 4.9.13)	Noise and vibration mitigation has been considered, assessed and included within the design of the Proposed Development, where appropriate in accordance with NPS guidance and policy aims.

NPS requirements	Compliance of ES scope with NPS requirements
Assessment of noise impacts with respect to policy aims which reference those of the Noise Policy Statement for England NPSE (as stated in 4.9.9)	The assessment of noise and vibration impacts and inclusion of mitigation measures have been undertaken in accordance with the aims of the NPS for Waste Water and the NPSE.

National planning policy

1.3.3 National planning policies of particular relevance to noise and vibration are listed below:

- The National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, 2021) with particular reference to:
  - Section 15 (Conserving and Enhancing the Natural Environment).
- The NPSE: the purpose of the NPSE is to promote 'good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development'.
- The three main aims of the NPSE are to:
  - avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;
  - mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and
  - where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Within the aims stated above there are several key phrases that lead to additional concepts now considered in the assessment of noise impact; these and their definitions are detailed below:
  - Lowest Observed Adverse Effect Level (LOAEL): the level above which adverse effects on health and quality of life can be detected; and
  - Significant Observed Adverse Effect Level (SOAEL): the level above which significant adverse effects on health and quality of life occur.
- There are no pre-defined levels within the NPSE for these effect levels as it is acknowledged that they will be different for different sources, different receptors and at different times.

Local planning policy

1.3.4 Local planning policy of relevance to the Proposed Development includes:

- South Cambridgeshire District Council Local Plan (South Cambridgeshire District Council, 2018) with particular reference to policy SC/10 (Noise Pollution).
- Greater Cambridge Sustainable Design and Construction Supplementary Planning Document (Greater Cambridge Shared Planning, 2020) with particular reference to Section 3.6 (Noise Pollution).
- Cambridge City Council Local Plan (Cambridge City Council, 2018) with particular reference to Policy 35 (Protection of human health and quality of life from noise and vibration).
- Cambridgeshire and Peterborough Minerals and Waste Local Plan (Cambridgeshire District Council and Peterborough City Council, 2021) with particular reference to Policy 18 (Amenity considerations), where proposals must ensure that development must not result in unacceptable adverse impacts on the amenity of existing occupiers including noise and/or vibration levels).

1.4 Legislation

National legislation

1.4.1 Legislation, planning policy and guidance relating to noise and vibration and pertinent to the Proposed Development comprises the following:

- Sections 60 and 61 of the Control of Pollution Act 1974 (Her Majesty's Stationery Office, Control of Pollution Act, 1974) concern impacts relating to construction sites, and the Environmental Protection Act 1990 (Her Majesty's Stationery Office, Environmental Protection Act, 1990) places a duty on local authorities to serve abatement notices where noise from premises, vehicles and machinery is judged to constitute a statutory nuisance. Compliance with these controls is required although the requirements fall outside the planning system.
- The Land Compensation Act 1973 Part 1 (Her Majesty's Stationery Office, Land Compensation Act, 1973) includes provision for compensation for loss in property value resulting from physical agents, including noise and vibration, resulting from the use of public works, such as new or improved roads.
- The Environmental Noise (England) Regulations (Her Majesty's Stationery Office, Environmental Noise Regulations, 2006 (Amended 2018)) implement European legislation requiring noise action plans to be developed on a five-year rolling programme. Action plans have to be developed for the major noise sources and areas for which maps have been produced, which identified 'Important Areas' for future mitigation. The action plans seek to manage noise issues and effects including noise reduction, if necessary, based on the results obtained through the mapping process.

1.5 Consultation

Scoping

1.5.1 Table 1-3 provides a summary of key points raised during scoping.

Table 1-3: Key points raised during scoping

ID	Consultee	Points raised	Response
3.13.4	PINS	The ES should consider noise effects associated with decommissioning of the existing Cambridge WWTP and Waterbeach WRC.	Noise assessment for decommissioning of the Existing Cambridge WWTP and Waterbeach Water Recycling Centre (WRC) as described in Chapter 2: Project description are included within this ES chapter (Section 4.4: Decommissioning) and cumulative impact assessments. Noise associated with demolition activities at the existing Cambridge WWTP and Waterbeach WRC are outside the scope of this project. However, they are considered within the cumulative assessment section of this ES chapter (Section 4.5: Cumulative effects).
3.13.5	PINS	The ES should consider the potential for noise and vibration on heritage assets and cross–refer to the historic environment aspect assessment where significant effects are likely to occur.	This ES chapter assesses noise and vibration impacts at all relevant sensitive receptors including heritage assets. Cross-reference is made with the assessment of the historic environment.
3.13.6	PINS	Consideration of temporal overlap of construction activities.	Assessment within this chapter includes combined effects due to any activities which would occur concurrently within the same or nearby areas.
N/A	Greater Cambridge Shared Planning	GCSP recommend clarification for definition of construction vibration study area.	The construction vibration study area includes all potential vibration impacts. The rationale is provided in Section 2.3: Study area.
N/A	Greater Cambridge Shared Planning	GCSP requested that the Greater Cambridgeshire Sustainable Design and Construction SPD should be included and referenced within the EIA.	As outlined in Section 1.3: Planning policy context, the Greater Cambridgeshire Sustainable Design and Construction SPD constitutes a relevant local planning policy document.

N/A	Greater Cambridge Shared Planning	GCSP provided comments on proposed construction working hours, monitoring and complaints procedure.	The CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) sets out proposed working hours, community engagement and complaints procedure. The CoCP places an obligation on the appointed contractor to implement monitoring.
N/A	Greater Cambridge Shared Planning	GCSP requested further details on proposed construction methodology including piling and concrete pours.	The construction methodology is described in Chapter 2: Project description. Relevant noise and vibration impacts from these activities are assessed within this ES chapter.
N/A	Greater Cambridge Shared Planning	GCSP requested further details on construction traffic relating to noise impacts including management of the contractor.	Noise impacts due to construction traffic are assessed within Section 4.2: Construction Phase, of this chapter. The Construction Traffic Management Plan (CTMP) (Appendix 19.7, App Doc Ref 5.4.19.7) sets out construction traffic management measures.
N/A	Greater Cambridge Shared Planning	GCSP commented that a CEMP will be required during decommissioning to also consider noise and vibration.	Potential noise and vibration impacts from decommissioning are assessed within this ES chapter. Measures to control noise and vibration impacts are included within CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) and the Outline Decommissioning Management Strategy (Appendix 2.3, App Doc Ref 5.4.2.3).

Technical Working Groups

1.5.2 Table 1-4 provides a summary of key points raised during engagement with Technical Working Groups.

Table 1-4: Key points raised during engagement with Technical Working Groups

Date	Consultee	Points raised	How and where addressed
16 November 2021	SCDC and Greater Cambridge Shared Planning	Review of proposed baseline noise survey locations, survey and assessment methodologies. Discussion to agree proposed mitigation measures.	Baseline surveys were completed following proposed methodology at agreed locations. Embedded and secondary/additional mitigation measures have been incorporated through design development as described within Section 2.8. Embedded measures have been incorporated within the design (e.g. including the earthwork embankment to reduce noise during operation). Additional secondary measures have been included during construction such as restriction of working hours and use of temporary acoustic barriers. These measures are specified

Date	Consultee	Points raised	How and where addressed
			within the Code of Construction Practice. Full details are provided within Section 2.8.
2 February 2022	SCDC and Greater Cambridge Shared Planning	Summary of the PEIR. Review of baseline survey results, assessment methodology, construction and operational impacts. Review of proposed construction working hours. Summary of proposed mitigation measures. And likely significant effects. Discussion on complaints procedure and Section 61 consent applications.	The CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) includes proposed working hours (Section 4.11 of the CoCP Part A) and sets out community engagement and complaints procedure (Section 2 of the CoCP Part A).

Statutory s42 consultation

1.5.3 Table 1-5 provides a summary of key points raised during statutory s42 consultation.

Table 1-5: Key points raised during statutory consultation

Date	Consultee	Points raised	How and where addressed
27 April 2022	Cambridge City Council	Further information is required on the likely residual / retained / altered CWWTP operational infrastructure at the existing Cowley Road Plant / Works. This is particularly important in the City Council's view if the full benefits of relocation to allow for the desired redevelopment of this previously developed land are to be realised in the way the Council's seek. Details of the retained infrastructure and any noise and potential odour impacts will need to be detailed. The City Council is concerned that these future residual uses of the CWWTP site should complement rather than conflict with neighbouring future sensitive uses such as the future NECAAP site in terms of noise, servicing, odour generation including any venting /	No noise sources would remain following decommissioning of the existing Cambridge WWTP. Tanks would be drained and cleaned. Electrical and mechanical equipment would be disconnected. Noise impacts associated with operation of the existing Cambridge WWTP are therefore expected to result in negligible or small beneficial effect and are scoped out from assessment. Assessment considers decommissioning activities at the Existing Cambridge WWTP. Details of the retained infrastructure and decommissioning are provided in the ES Chapter 2: Project description. Assessment of the redevelopment of the existing Cambridge WWTP is outside the scope of assessment and this EIA.

Date	Consultee	Points raised	How and where addressed
		ventilation (depending on design sewage systems may need a venting system to allow gases to escape the system avoiding dangerous build ups or airlocks to form).	
27 April 2022	Fen Fitton Parish Council	Please provide us with a copy of the report on baseline noise measurements. Please give an assessment of the combined effect of baseline and operational noise.	Reporting of measured baseline noise levels is included within the ES. Assessment of operational and construction noise impacts includes consideration of baseline noise conditions.
27 April 2022	Horningsea Parish Council	Noise mitigation appears to focus predominantly on construction, but the Horningsea document states that 'new low-level noise sources during operation of the proposed WWTP have the potential to result in adverse noise effects, particularly during night-time periods as existing noise levels are lowest at this time.' The PEI Noise and Vibration document provides general information on potential areas of mitigation and that noise levels are only considered significant following an increase greater than 10dB but no specific information is provided. Further information is requested on the operational noise sources and levels involved, particularly at night.	Preliminary assessment indicated the potential for noise during operation to alter baseline noise levels and result in adverse noise impacts. Mitigation includes measures embedded within design such as selection of low noise equipment and inclusion of the proposed WWTP Earth Bank. Noise from operation of the Proposed WWTP is scoped in and assessed within the ES. Further information regarding proposed noise sources and associated impacts are provided within this ES chapter.

Statutory s47 local community consultation

1.5.4 The Consultation Report (App Doc Ref 6.1) details the responses to all comments made during the public consultation. One key matter was raised which is of relevance to noise:

- provision of more information regarding the potential night time noise sources or potential noise levels anticipated from construction activities.

1.5.5 A description of activities that would be undertaken during the construction phase including night-time periods and resulting noise levels are provided in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3). The assessment of construction noise impacts during relevant periods including night-time is provided within Section 4.2: Assessment of effects – construction phase.

2 Assessment Approach

2.1 Guidance

2.1.1 The following standards and guidance documents specific to noise and vibration have been considered and inform the methodology and significance criteria for assessment of noise and vibration impacts due to construction and operation of the Proposed Development and decommissioning of the existing Cambridge WWTP for the purpose of rescinding the permit. Further information on these standards and guidance documents is provided in Appendix 17.1: Noise guidance and policy (App Doc Ref 5.4.17.1).

- Planning Practice Guidance (PPG) Noise (Department for Communities and Local Government, 2019);
- World Health Organization (WHO) Environmental Noise Guidelines (ENG) for the European Region (World Health Organization, 2018);
- World Health Organization (WHO) Night Noise Guidelines (NNG) (World Health Organization, 2009);
- World Health Organization (WHO) Community Noise Guidelines (CNG) (World Health Organization, 2000);
- British Standard (BS) 8233, 2014 'Guidance on sound insulation and noise reduction for buildings' (British Standards Institution, 2014);
- British Standard (BS) 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (British Standards Institution, 2019);
- British Standard (BS) 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (British Standards Institution, 2014);
- British Standard (BS) 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' (British Standards Institution, 2014);
- British Standard (BS) 7385-2 'Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration (British Standards Institution, 1993);
- DIN 4150 'Vibration in buildings' (Deutsches Institut für Normung, 2016);
- Design Manual for Roads and Bridges (DMRB) LA111 Noise and Vibration (Highways England, 2020); and
- Calculation of Road Traffic Noise (CRTN) (Department for Transport, 1988).

2.2 Assessment methodology

2.2.1 The general approach to assessment is described in Chapter 5: EIA Methodology.

2.2.2 Following the preliminary assessment of the likely significant effects of the Proposed Development, any further mitigation measures (secondary mitigation) are identified and described. These mitigation measures would further reduce an adverse effect or enhance a beneficial one. The assessment of likely significant effects is then carried out taking into account the identified secondary mitigation measures to identify the 'residual' environmental effects.

2.2.3 This section provides specific details of the noise and vibration methodology applied to the assessment of the Proposed Development.

2.2.4 The scope of this assessment has been established through the formal EIA scoping process with the planning inspectorate. A request for an EIA scoping opinion was made in 2021 see 'Scoping Report' (Appendix 4.2, App Doc Ref 5.4.4.2) of the ES.

2.2.5 The points raised at scoping and how they are addressed are provided in Section 1.5.

2.2.6 The spatial scope of assessment for noise and vibration are provided in Section 2.3.

2.2.7 The assessment parameters approach described in Section 1.5 of Chapter 5 is addressed for noise and vibration in Section 2.5.

Impact assessment criteria

2.2.8 The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the receptor affected by the impact of that magnitude. This section describes the criteria applied in this chapter to characterise the magnitude of potential impacts and sensitivity of receptors. The terms used to define magnitude and sensitivity are based on relevant assessment methodologies and guidance including BS 5228 (British Standards Institution, 2014), BS 4142 (British Standards Institution, 2019) and DMRB LA111 (Highways England, 2020).

2.2.9 The assessment criteria used to assess the potential effects on noise and vibration arising from the Proposed Development differs from the generic EIA methodology and are described below.

LOAEL and SOAEL

2.2.10 The concepts of LOAEL and SOAEL were introduced in paragraph 1.3.3 as the lowest and significant observed adverse effect levels, respectively. Table 2-1 describes the LOAEL and SOAEL values selected for use within the assessment of noise and vibration magnitude of impacts and significance of effects. These values have been selected following review of the relevant guidance and methodology.

2.2.11 Values are presented in accordance with guidance for construction noise as free-field noise levels (i.e., noise levels in open space or without the effect of reflections from nearby surfaces except the ground) and operational noise as façade noise levels (i.e., the noise level 1m from a building façade which includes effect of reflections).

Table 2-1: LOAEL and SOAEL values

Time period	LOAEL	SOAEL	Criteria/guidance
Construction noise			

Time period	LOAEL	SOAEL	Criteria/guidance
Weekday daytime (08:00-18:00) Saturday mornings (08:00-13:00)	65dB $L_{Aeq,T}$ (free-field)	72dB $L_{Aeq,T}$ (free-field)	LOAEL is the lower cut-off value in BS 5228-1 Example Method 2. SOAEL is the noise insulation trigger level (converted from a façade level to a free-field level).
Monday to Saturday early morning (07:00 – 08:00) Monday to Friday early evening (18:00 – 19:00)	60dB $L_{Aeq,T}$ (free-field)	67dB $L_{Aeq,T}$ (free-field)	LOAEL is the equivalent lower cut-off value in BS 5228-1 Example Method 2 for daytime shoulder periods. following BS 5228-1 Table E.2 values. SOAEL is the noise insulation trigger level (converted from a façade level to a free-field level).
Evenings (19:00 – 22:00) Saturday afternoons (13:00 – 22:00) Sundays and public holidays (07:00 – 21:00)	55dB $L_{Aeq,T}$ (free-field)	62dB $L_{Aeq,T}$ (free-field)	LOAEL is the lower cut-off value in BS 5228-1 Example Method 2. SOAEL is the noise insulation trigger level (converted from a façade level to a free-field level).
Night-time (22:00 – 07:00)	45dB $L_{Aeq,T}$ (free-field)	52dB $L_{Aeq,T}$ (free-field)	LOAEL is the lower cut-off value in BS 5228-1 Example Method 2. SOAEL is the noise insulation trigger level (converted from a façade level to a free-field level).
Construction vibration			
Any time	0.3mm/s PPV	1.0mm/s PPV	Values described in BS 5228-2 Table B.1. LOAEL is the level at which vibration might be just perceptible in residential environments. SOAEL is set at the level at which vibration is likely to cause complaint in residential environments but can be tolerated if prior warning and explanation has been given to residents.
Operational traffic			
Daytime	55dB $L_{A10,18hr}$ (façade)	68dB $L_{A10,18\ hr}$ (façade)	LOAEL and SOAEL are set out in DMRB LA111.

Magnitude of impact

Construction noise

2.2.12 The assessment of construction noise has been carried out in accordance with BS 5228-1. The methodology from BS 5228-1 is used to calculate likely noise levels from construction activities based on noise levels from plant, periods of operation, distances from source to receivers, screening barriers, reflections and ground attenuation. Calculations have been completed at selected receptor locations

representative of the most affected sensitive receptors during relevant construction activities.

2.2.13 Chapter 2: Project description includes a summary of the construction programme, activities, compounds and details of construction plant which have been used to inform calculations. Noise levels for relevant construction plant have been extracted from BS 5228-1 Annex C, which includes a database of equivalent continuous noise levels (L_{Aeq} dB at 10m) generated by a range of fixed and mobile plant used for typical construction activities.

2.2.14 Calculations account for construction working areas as described in Figure 17.1: Construction and decommissioning assessment locations (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17).

2.2.15 Construction noise impacts are assessed for relevant hourly and daily periods during proposed works in accordance with BS 5228 guidance.

2.2.16 Noise levels from construction are compared with LOAEL and SOAEL values. The total noise (the baseline noise and the predicted construction noise) are also compared with the baseline noise before any construction noise takes place. These comparisons inform the magnitude of impact. The criteria for defining magnitude for the assessment of construction noise impacts are defined within in Table 2-2.

Table 2-2: Impact magnitude criteria – construction noise

Magnitude of impact	Construction noise
Negligible	Noise from construction is less than LOAEL
Minor	Noise from construction is greater than LOAEL but less than SOAEL; or Noise from construction is greater than SOAEL and the total noise (baseline plus construction) exceeds the baseline by less than 5dB.
Moderate	Noise from construction is greater than SOAEL and the total noise (baseline plus construction) exceeds the baseline by 5dB or more.
Major	Noise from construction exceeds the temporary rehousing criteria (SOAEL + 10dB). Total noise (baseline plus construction) exceeds the baseline by 5dB or more.

Construction vibration

2.2.17 The assessment of construction vibration is completed at selected representative receptors using BS 5228-2 methodology and criteria. Vibration levels can be difficult to predict as there are many variables to take into consideration. BS 5228-2 describes a number of factors that determine the acceptability of vibration arising from construction sites.

2.2.18 Effects on human receptors and risk of damage to structures are characterised by estimating the Peak Particle Velocity (PPV). The level of groundborne vibration from construction activities that have the potential to generate high levels of vibration (such as piling, compaction or tunnelling) is estimated using empirical predictors and guidance of BS 5228-2. Calculations are undertaken to determine vibration levels at receptor locations representative of the most affected sensitive receptors for relevant construction phases and activities.

2.2.19 Comparison is made between predicted vibration levels and threshold values to determine the magnitude of impact. The criteria for defining magnitude for the assessment of construction vibration impacts are defined in Table 2-3.

Table 2-3: Impact magnitude criteria – construction vibration

Magnitude of Impacts	Vibration level PPV
Negligible	Less than LOAEL (0.3mm/s PPV)
Minor	Greater than or equal to LOAEL (0.3mm/s PPV) and less than SOAEL (1.0mm/s PPV)
Moderate	Greater than or equal to SOAEL (1.0mm/s PPV) and less than 10.0mm/s PPV
Major	Greater than or equal to 10.0mm/s PPV

Construction traffic

2.2.20 Assessment of noise from construction traffic using the wider road network follows guidance of DMRB LA111 which compares Basic Noise Levels (BNL) between existing baseline and construction phases. Noise levels from construction traffic using the existing road network are determined in accordance with CRTN calculation methodology. This comparative assessment indicates the relative changes in noise level due to changes in traffic flow during construction at nearby noise sensitive receptors. Assessment is completed for all relevant construction traffic routes shown in Figure 19.2: Construction access routes (Book of Figures – Traffic and Transport, App Doc Ref 5.3.19).

2.2.21 The criteria for defining magnitude for the assessment of construction traffic noise impacts are defined in Table 2-4.

Table 2-4: Impact magnitude criteria – construction traffic noise

Magnitude of impact	Increase in BNL due to construction traffic ($L_{A10,18hr}$)
Negligible	Less than 1.0dB
Minor	Greater than or equal to 1.0dB and less than 3.0dB
Moderate	Greater than or equal to 3.0dB and less than 5.0dB
Major	Greater than or equal to 5.0dB

Operational noise

2.2.22 The assessment of operational noise from activities and plant within the proposed WWTP follows BS 4142:2014+A1:2019 methodology and criteria. The method compares the rating level (equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location plus any adjustment for the characteristic features of the sound) with the representative background noise level.

2.2.23 Noise predictions are undertaken to determine the specific sound level from operation of the proposed WWTP at the nearest representative receptors. Calculations of noise propagation from plant have been completed within CadnaA 2021 modelling software implementing ISO 9613-2 (International Organization for Standardization, 1996) methodology.

2.2.24 Character corrections are applied to the specific sound level, accounting for tonality, impulsivity and intermittency, to determine the rating level. The rating level is compared against representative background sound level to determine the magnitude of noise impact. Typically, the greater the difference between the rating level and background sound level, the greater the magnitude of impact. The criteria for defining magnitude for the assessment of operational noise impacts are provided in Table 2-5.

Table 2-5: Impact magnitude criteria – operational noise

Magnitude of Impacts	Difference between rating level and background sound level	BS 4142 description
Negligible	Less than 0dB	*'Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'*
Minor	Greater than or equal to 0dB and less than +10dB	A difference greater than 0dB is an indication the noise impact is greater than 'low', depending on the context. *'A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.'*
Moderate	Greater than or equal to +10dB	*'A difference of around + 10 dB or more is likely to be an indication of a significant adverse effect, depending on the context.'*
Major	Substantially greater than +10dB	*'A difference of around + 10 dB or more is likely to be an indication of a significant adverse effect, depending on the context.'* And *'Typically, the greater this difference, the greater the magnitude of the impact.'*

Operational traffic

2.2.25 Noise from operational vehicle movements on access routes to the Proposed Development is assessed using a proportionate approach following methodology and guidance of DMRB LA111. Assessment is completed at representative noise sensitive receptors near to operational traffic routes associated with the Proposed Development (routes used to access the proposed WWTP which have the potential to result in a noise level change of at least 1dB BNL $L_{A10,18hr}$ or more). Assessment has been completed for the opening year only (DMRB LA111 short-term impacts) for the determination of significance which aligns with the scoping stage level of assessment.

2.2.26 Assessment requires the comparison of noise levels with (Do-Something) and without (Do-Minimum) a scheme in the opening year to determine the magnitude of impact. DMRB LA111 also considers LOAEL and SOAEL values relevant to impacts of road traffic noise which are adopted for the purposes of assessment.

2.2.27 The criteria for defining magnitude for the assessment of operational traffic noise impacts are provided in Table 2-6.

Table 2-6: Impact magnitude criteria – operational traffic noise

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

Sensitivity of receptor

2.2.28 The criteria for defining receptor sensitivity for the assessment of impacts to noise and vibration are defined as follows.

2.2.29 There is no nationally adopted approach or guidance which define the sensitivity of noise and vibration sensitive receptors. The sensitivity of different receptors has been reviewed in accordance with prevailing standards and guidance accounting for criteria such as their ability to absorb change, their importance and value. Receptors which may be affected by noise and vibration due to the Proposed Development include people and communities. These receptors primarily include residential properties but also noise and vibration sensitive uses such as educational facilities (schools and nurseries), listed buildings and assets of historical interest, community facilities such as village halls and health centers, as well as external spaces that provide recreational amenity to the local community (for example parks, and Public Rights of Way (PRoW)).

2.2.30 Noise and vibration sensitive receptors may also include commercial, industrial and agricultural uses. However, unless otherwise identified due to their specific circumstances, these receptor types are regarded to have a lower sensitivity to noise and vibration.

Table 2-7: Receptor sensitivity criteria

Sensitivity	Criteria	Examples
Low	Tolerant to change Lower quality/importance	Commercial, industrial and agricultural uses unless otherwise identified due to their specific circumstances.
Medium	Moderate tolerance to change Moderate quality/importance	Residential properties, educational facilities (such as schools and nurseries), listed buildings and assets of historical interest, community facilities such as village halls and health centres. External spaces for recreational amenity such as parks and PRoW.
High	Low tolerance to change Locally significant attribute of high value	Subject to specific circumstances.
Very High	Very low tolerance to change Nationally significant attribute of high value	Subject to specific circumstances.

2.2.31 In addition to the potential impact of noise and vibration on people and communities, the NPS for Waste Water also requires that the impact of noise on protected species or other wildlife should be considered and that the results of any noise surveys and predictions should be used to inform the ecological assessment. The assessment on protected species and wildlife is addressed within Chapter 8: Biodiversity.

Significance of effect

2.2.32 The significance of noise and vibration effects at sensitive receptors can be subject to several factors. These include the resultant noise or vibration level at receptor (with respect to LOAEL and SOAEL), the amount that new noise or vibration sources affect existing conditions, the duration of impact (i.e., a shorter duration noise event is more likely to be less significant than a continuous noise source), the acoustic context (e.g., the type, level and acoustic character of noise within the existing environment).

2.2.33 The significance of the effect upon identified noise and vibration sensitive receptors is determined initially by assigning an impact magnitude and sensitivity to the receptor. Table 2-8 sets out the significance matrix.

2.2.34 For the purpose of this assessment, any effects with a significance level of slight or less are considered to be not significant.

Table 2-8: Initial assessment of significance

Magnitude of impacts	Sensitivity/value of receptor			
	Low	**Medium**	**High**	**Very High**
Negligible	Neutral Not significant	Neutral Not significant	Slight Not significant	Slight Not significant
Minor	Neutral Not significant	Slight Not significant	Slight Moderate Significant	**Moderate** **Significant**
Moderate	Slight Not significant	**Moderate** **Significant**	**Moderate** **Significant**	**Major** **Significant**
Major	Slight Not significant	**Moderate** **Significant**	**Major** **Significant**	**Major** **Significant**

2.2.35 The NPPF, NPS for Waste Water and NPSE aims are to avoid significant adverse effects and mitigate adverse effects. However, simply breaching the LOAEL and SOAEL thresholds does not form adequate significance noise criteria as the context of the noise change also needs to be taken into account. Therefore, the following criteria have been selected for determination of final significance in accordance with prevailing guidance for medium, high or very high sensitivity receptors. Where a range of significance is presented, the final assessment for each effect is based upon expert judgement.

Construction noise and vibration

2.2.36 For the assessment of construction noise and vibration effects from the Proposed Development:

- an adverse noise or vibration effect arises due to a minor impact; and
- a potential significant adverse effect arises when a moderate or major impact occurs for a period of 10 or more days in 15 days or for 40 days in any consecutive six months.

2.2.37 Assessment of the final significance for each effect is based upon expert judgement.

Construction traffic

2.2.38 DMRB LA 111 guidance advises that a moderate or major impact constitutes a significant effect at noise sensitive receptors where it occurs for an extended duration.

2.2.39 For the assessment of construction traffic noise from the Proposed Development:

- an adverse noise effect for construction traffic arises due to a minor impact which relates to increases in road traffic noise by 1dB or more due to construction traffic; and; and
- a potential significant adverse effect due to construction traffic arises due to a moderate or major impact when road traffic noise increases by 3dB or more due to construction traffic for a period of 10 or more days in 15 days or for 40 days in any consecutive six months.

2.2.40 Professional judgement is applied for impacts which are potentially significant. Factors that are applied to determine the final significance include the resultant level of noise at the nearest receptors, the prevailing existing ambient noise levels and the character of noise in the surrounding area.

Operational noise

2.2.41 The lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. The following are considered:

- where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact and is considered negligible and not significant, depending on the context;
- an adverse noise effect for operational noise arises due to a minor impact which relates to a difference between 0db and 10dB, depending on the context; and
- a potential significant adverse effect arises due to a moderate or major impact; this occurs when the difference between rating noise level and background sound level is 10dB or more, depending on the context.

2.2.42 Following initial assessment, additional factors relating to the context are reviewed to determine the final significance of noise effects. Professional judgement is used to apply these factors which may include the following:

- the resultant level of sound at the receptor location;
- comparison of the character and level of sound in the existing and proposed scenarios; and
- the specific sensitivity of receptor (e.g., façade insulation treatment, acoustic screening, etc.).

Operational traffic

2.2.43 The noise assessment for changes in road traffic on site access routes follows guidance of DMRB LA111. The assessment considers the significance of noise level changes using criteria based on the classification of impact and noise levels with respect to the LOAEL and SOAEL as follows:

- a potential significant adverse effect arises for moderate or major impacts (i.e., an increase of 3dB or more in the short-term) where noise levels are above LOAEL; or for minor, moderate or major impacts (i.e.; an increase of 1dB or more in the short-term) where noise levels are above SOAEL; and
- in all cases professional judgement is used to determine if a significant adverse effect arises that includes consideration of the sources of noise, the causes of the change in noise levels, the magnitude of the impact and noise levels relative to LOAEL and SOAEL.

Residual effect

2.2.44 The assessment of effects follows the approach set out within Chapter 5: EIA Methodology. Effects have been assessed to take into account both embedded (primary) mitigation and legal requirements (tertiary mitigation), and after the application of further mitigation measures (secondary mitigation). Effects after mitigation are referred to as 'residual effects'.

2.3 Study area

2.3.1 The maximum area of land required for the construction, operation, and maintenance of the Proposed Development and decommissioning of the existing WWTP, including land required for permanent and temporary purposes, within the Scheme Order Limits as provided in App Doc Ref 4.1.

2.3.2 In accordance with BS 5228-1 guidance, the study area for airborne noise during the construction phase includes an area 300m from any construction works (including but not exclusively, the proposed WWTP, the existing Cambridge WWTP, the Outfall, waste water transfer tunnel, Waterbeach pipeline and construction compounds).

2.3.3 Groundborne vibration typically has the potential to affect the closest receptors during activities that involve high vibratory sources (for example piling, vibratory compaction or tunnelling). Vibration effects are assessed for receptors within 100m

of these relevant activities. This distance is extended, however, for specific circumstances where significant adverse effects appear likely at larger distances.

2.3.4 Assessment of noise impacts due to construction traffic using the wider road network are undertaken in accordance with DMRB LA111. Assessment is completed for receptors within 50m from the kerb of a public road with the potential to increase the Basic Noise Level (BNL) by 1dB or more due to construction traffic.

2.3.5 Noise during operation of the Proposed Development, including fixed plant and mobile plant, has the potential to impact a wide area subject to existing background noise levels and predicted operational noise levels. The study area for operation noise impacts therefore includes an area 2km from operational noise sources at the proposed WWTP. However, the closest residential properties have the potential to be most affected. Assessment of operational effects is therefore undertaken at receptors representative of the closest affected receptors to the Proposed Development within this study area.

2.3.6 Vehicles accessing the Proposed Development (heavy goods vehicles (HGV) and staff vehicles) have the potential to result in changes to the baseline noise conditions at the closest receptors to site access routes within the wider road network. Noise impacts from vehicles accessing the site on these routes is assessed at representative noise sensitive receptors within a 600m study area in accordance with DMRB LA111.

2.3.7 The study areas relating to noise and vibration impacts are summarised in Table 2-9 and shown in Figure 17.2: Noise and Vibration Study Receptors (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17).

Table 2-9: Noise and vibration study areas

Potential impact	Study area
Construction noise	300m from the construction work areas (including but not exclusively the proposed WWTP site, transfer and pipelines, construction compounds) in accordance with BS 5228-1 guidance.
Construction vibration	100m from construction activities that have the potential to generate high vibration levels (e.g., piling, vibratory compaction, tunnelling, etc.) unless significant adverse effects are predicted to arise at a greater distance.
Construction traffic	50m from the kerb of a public road with the potential to increase the BNL by 1dB or more due to construction traffic in accordance with DMRB LA 111.
Operational noise	2km from the Proposed WWTP. Assessment will be undertaken for selected representative receptors within this 2km area accounting for the closest noise sensitive receptors to new noise sources associated with the Proposed Development.
Operational traffic	Assessment at the closest affected receptors within 600m from roads used for site access during operation where noise levels have the potential to increase at the receptors by 1dB or more due to changes in road traffic.

2.4 Temporal scope of assessment

Construction

2.4.1 For the assessment, these effects will be taken to be those for which the source begins and ends during the construction and commissioning stages prior to the proposed WWTP becoming fully operational as set out in Chapter 2 Project Description.

2.4.2 The assumed assessment years for construction are from Year 1 to Year 4 (currently assumed to be 2024 until 2028).

2.4.3 The noise and vibration construction effects considered within this assessment are unaffected by potential changes to the overall construction durations and/or likely start year.

Operation and maintenance

2.4.4 For the assessment, these effects start once the proposed WWTP is commissioned and fully operational and include the effects of the physical presence of the infrastructure, its operation, use and maintenance, including the permanent change in land use.

2.4.5 The assessment of operational effects considers the operation of the Proposed Development in the first full 12 month period of opening (excluding any commissioning period for the proposed WWTP as this is part of the Construction Phase). The proposed WWTP is expected to become operational in 2028, therefore the assessment year for the Operational Phase is 2028. Phase 2 of operation associated with the additional PST and FST at year 7 of operation (as described in Chapter 2) would not materially alter noise emissions as that relatively small increases or variations in plant and equipment over time would not result in different effects or new significant effects.)

2.4.6 The operational noise effects considered within this assessment are unaffected by potential changes to the assessment year.

Duration of effects

2.4.7 Timescales associated with these effects, regardless of phase are as follows:

- Short-term – endures for up to 12 months after construction or decommissioning
- Medium-term – endures for 1-5 years
- Long-term – endures for 5-15 years
- Permanent effects – endures for more than 15 years and / or effects which cannot be reversed (e.g. where buried archaeology is permanently removed during construction)

Phase 2 expansion

2.4.8 Phase 2 construction is within the operational lifetime of the WWTP, expected to be 2036-2050, but likely before 2041.

2.4.9 Construction of 2 additional tanks would not result in any new significant effects or worse adverse impacts than those considered at the construction phase years 1 – 4, on the basis that works would be less extensive and working hour restrictions would apply as set out within the CoCP Part A. Works would comprise site preparation, groundworks, foundations, assembly of precast structures, connections and commissioning. Construction activities would be undertaken within the earth bank that provides acoustic screening to the nearest sensitive receptors and controlled by measures within a CEMP (and associated sub-plans), a CTMP, and CWTP approved prior to the start of construction.

2.4.10 Noise levels from operation of the proposed WWTP are significantly lower than potential construction noise levels from construction of the additional tanks such that the combined noise effect would not result in worse impacts compared to construction activities alone.

2.4.11 In the case of short term temporary vehicle movements the expected construction movements in combination with operational movements would be fewer than the peak assessed at construction in year 3. Associated construction traffic noise impacts would therefore be no worse than considered at year 3 of construction.

2.4.12 Phase 2 of operation associated with the additional PST and FST would not materially alter noise emissions as that relatively small increases or variations in plant and equipment over time would not result in different effects or new significant effects.

2.5 Baseline study

Desktop data

2.5.1 Baseline information within the noise and vibration study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 2-10.

Table 2-10: Desktop information sources

Item or feature	Year	Source
Ordnance Survey (OS) Mapping	2021	Ordnance Survey MasterMap
Properties	2021	Ordnance Survey AddressBase
Strategic Noise Maps (Round 3) England	2017	Open data: strategic noise mapping (Department for Environment, Food and Rural Affairs, 2019)
Noise Important Areas (Round 3) England	2021	Defra/Noise Action Planning Important Areas Round 3 (Department for Environment, Food and Rural Affairs, 2021)

Baseline measurements

2.5.2 Baseline noise measurements were completed in January 2022 at locations representative of the closest noise sensitive receptors to construction and operational noise sources. The noise surveys included a combination of unattended measurements (these measure noise conditions continuously over a period of approximately one week) supplemented with attended measurements at a number of other locations (completed during the daytime only).

2.5.3 Measurements have been completed in accordance with relevant requirements of BS 5228 and BS 4142 to determine representative ambient and background noise levels respectively. The full methodology for the baseline noise measurements is provided within Appendix 17.2: Noise Baseline Report (App Doc Ref 5.4.17.2).

2.6 Maximum design envelope (Rochdale) parameters for assessment

2.6.1 The design parameters and assumptions presented are in line with the 'maximum design envelope' approach (base scheme design) as described in introductory chapters of the ES (2 and 5). For each element of this chapter, the maximum design envelope parameters detailed within Table 2-11 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group.

2.6.2 The assessment parameters are based on the design of the proposed WWTP and access, transfer tunnel route and outfall location, Waterbeach Pipeline and connections within the existing Cambridge WWTP as described in Chapter 2: Project description. The assessment considers a realistic maximum design envelope based on the maximum scale of the elements and as a result no effects with greater significance than those assessed are likely.

Table 2-11: Maximum design envelope (Rochdale) for noise and vibration assessment

Potential impact	Maximum design scenario	Justification
Noise impacts due to construction activities at sensitive receptors.	The locations of construction activities (including, but not exclusively, of the proposed WWTP, the outfall, waste water transfer tunnel, Waterbeach Pipeline, haul/access roads, construction compounds, existing Cambridge WWTP, Waterbeach WRC) are described in Chapter 2: Project description and shown on General Arrangement drawings and Works Plans (App Doc Ref 4.2 & 4.3).	Maximum potential construction noise impacts for sensitive receptors based on proposed working areas.
	Plant and equipment required during construction are described in Chapter 2: Project description and Appendix 17.3: Construction noise assessment (App Doc Ref 5.4.17.3). This includes the quantity, type and noise levels of plant and equipment associated with activities during peak periods of construction.	Represents the plant and equipment required during the periods of greatest construction activity which represent the greatest potential noise impacts. Plant includes all expected significant sources of noise required during works.
	Working hours for construction are set out within Appendix 2.1: Code of Construction Practice (CoCP) Part A (App Doc Ref 5.4.2.1).	Represents the proposed working hours that are required to meet engineering and programme constraints. Hours include periods outside of daytime working hours, continuous works and exceptional working hours which may result in greater impacts.
	The durations of construction activities in each area are stated in Chapter 2: Project description and summarised within Appendix 17.3: Construction noise assessment (App Doc Ref 5.4.17.3).	Represents the maximum duration of potential noise impacts for specific activities in each area of the Proposed Development.
	Noise due to concurrent construction activities which affect the same receptors that may result in adverse impacts. Assessment assumes construction of the waste water transfer tunnel and Waterbeach Pipeline in the Fen Ditton area will occur concurrently.	Represents the worst case should the alignment of programmes result in construction works in the same area which occur at the same time. Assessment assumes maximum potential noise impacts at any one time due to concurrent works.
	Waterbeach pipeline construction methodology includes trenchless techniques (HDD) and open cut trenching. HDD is considered for identified locations and crossings shown General Arrangement drawings (App Doc Ref 4.2). Open cut trenching is assumed for remaining route which represents greatest potential impacts.	Represents the likely areas where HDD will be used and the maximum potential noise impacts due to pipeline construction.

Potential impact	Maximum design scenario	Justification
Vibration impacts due to construction activities at sensitive receptors.	Piling within the proposed WWTP includes augered methods. Vibratory or impact sheet piling may be required during outfall construction.	Represents the maximum potential vibration impacts due to piling according to construction methodology.
	Use of a Micro Tunnel Boring Machine (MTBM) has the potential to generate vibration. Alignment of the waste water transfer tunnel is provided within Chapter 2: Project description. The closest distance from MTBM to the nearest receptor is approximately 25m.	Represents the scenario for the maximum potential vibration impacts according to proposed tunnel route.
	Excavation of the waste water transfer tunnel shafts will include use of excavators and concrete works to form temporary and permanent shafts. No piling or significant sources of vibration are required for construction of the transfer tunnel shafts.	Represents the maximum potential vibration impacts due to construction methodology for shafts.
Noise impacts due to construction traffic using the wider road network at sensitive receptors.	Construction traffic volumes are stated in Chapter 2: Project description Section 4.2 and Chapter 19: Traffic and transport. These values represent the peak construction activity for each area of the works during (e.g., initial setup of construction areas), however, noise impacts would reduce in magnitude following these peak periods over the construction programme.	Represents the maximum vehicle movements according to construction activities and requirements in each area and through each phase of works.
Operational noise impacts at sensitive receptors due to operation of the proposed WWTP.	proposed WWTP layout design, heights of structures and associated noise sources are stated in Chapter 2: Project description.	Represents the layout of the Proposed WWTP including the location and height of buildings, structures and noise sources to meet design requirements. Assumed maximum heights for noise sources within the Proposed WWTP.
	The earth bank surrounding noise sources within the proposed WWTP has a minimum height of 5m.	Represents the minimum height of the Earth Bank.
	Proposed plant and equipment is summarised in Chapter 2: Project Description. Plant and equipment noise levels include maximum reasonable values for equivalent units based on required unit specifications where selections have not yet been made.	Represents the Applicant's proposed design requirements for operation of the proposed WWTP.
	Proposed WWTP plant and equipment would operate continuously during day- and night-time periods except for the flare stack.	Represents the operational scenario of continuous operation of the proposed WWTP. The flare stack has been included within calculations to represent the worst-case noise level during operation. The flare stack however would be used for

Potential impact	Maximum design scenario	Justification
		emergency circumstances only and would not be used during normal plant operation.
Noise impacts due to operational traffic using the wider road network.	Proposed WWTP operational traffic volumes are stated in Chapter 2: Project Description and Chapter 19: Traffic and transport. During operation approximately 92 cars/vans and 146 HGV would access the site on a daily basis via the A14 and the B1047 Horningsea Road entrance.	Represents the expected vehicle movements in operation according to operational plant requirements.
Noise impacts due to decommissioning works at the existing Cambridge WWTP.	The locations of decommissioning activities at the existing Cambridge WWTP are shown in Chapter 2: Project description and the General Arrangement drawings and the Works Plans (App Doc Ref 4.2 & 4.3).	Represents the maximum potential construction noise impacts for receptors based on proposed working areas.
	Plant and equipment required during decommissioning are described in Chapter 2: Project Description and Construction noise assessment (Appendix 17.3, App Doc Ref 5.4.17.3) of this chapter. This includes the quantity, type and noise levels of plant and equipment associated with activities during peak periods of construction.	Represents the plant and equipment required during peak periods of decommissioning activity which represent the greatest potential noise impacts. Plant includes all significant sources of noise required during works.

2.7 Impacts scoped out of the assessment

2.7.1 Table 2-12 describes noise and vibration impacts that have been scoped out from the assessment.

Table 2-12: Impacts scoped out of the noise and vibration assessment

Potential impact	Justification
Permanent noise and vibration impacts from plant and machinery related to operation of the waste water transfer pipeline	The transfer pipelines will be buried below ground and there are unlikely to be significant noise or vibration effects once they are operational. The Planning Inspectorate agrees (Scoping Opinion, ID 3.13.1) that these matters can be scoped out of the assessment on this basis.
Permanent noise impacts due to increases in road traffic noise related to operation of the waste water transfer tunnel and Waterbeach Pipelines	There will be no traffic generated by the operation of the below ground pipelines once installed (with the possible exception of small numbers during routine maintenance or in an emergency event). The Planning Inspectorate agrees (Scoping Opinion, ID 3.13.2) that this matter can be scoped out of the assessment for the transfer zone and Waterbeach zone on this basis.
Operational vibration from the Proposed Development	There are likely to be limited sources of operational vibration. The level of vibration from operational sources is expected to be negligible at nearest receptors due to the large distance (>100m) from sources to receptors and would not result in significant adverse effects. No significant sources of vibration in the existing baseline that would result in cumulative significant adverse vibration effects due to operation of the Proposed Development. The Planning Inspectorate agrees (Scoping Opinion, ID 3.13.3) that this matter can be scoped out of the assessment on this basis and that, in respect of the core zone, the nearest residential receptors are more than 100m away.
Noise impacts from operation of the outfall, the treated effluent transfer pipelines and traffic associated with outfall and pipelines during operation	The outfall and the treated effluent transfer pipelines do not include operational noise sources. Maintenance of these elements during operation would be limited and very infrequent. There are no relevant sources of noise. Potential impacts are negligible. The Planning Inspectorate agrees (Scoping Opinion, ID 3.13.1) that these matters can be scoped out of the assessment on this basis.

2.8 Mitigation measures adopted as part of the Proposed Development

2.8.1 This section refers to the mitigation types, as defined in Section 1.5 of Chapter 5: EIA Methodology, and how they apply to the assessment of noise and vibration.

2.8.2 In developing the Proposed Development through an iterative process including consultation and engagement with consultees, and through the Environmental Impact Assessment, (EIA) the Applicant has sought to identify and incorporate suitable measures and mitigation for potentially significant adverse effects, as well as maximising beneficial effects where possible.

2.8.3 Some measures are **'embedded**' in the design of the Proposed Development for which consent is sought by virtue of the scope of the authorised development as set out in Schedule 1 to the DCO and the accompanying Works Plans. These are

considered **primary mitigation**. For example, adjustment of Order Limits to avoid sensitive features, amending the sizing and location of temporary access routes and compounds.

2.8.4 Secondary measures may be detailed activities for example the preparation of detailed AIMS in accordance with the CoCP, the preparation and delivery of a monitoring plan for specific matters (air quality, water quality) or the preparation and delivery of specific environmental management plans (for example air, noise, water), and the preparation and implementation is secured through the CoCP. These secondary measures are differentiated from the good practice measures.

2.8.5 Tertiary measures comprise good practice measures (such as measures within Considerate Contractors Scheme), and measures integrated into legal requirements secured through environmental permits and consents (least flexible as either the legislation exists to create the mitigation or does not (i.e. Protected Species Licensing).

2.8.6 Section 1.5 of Chapter 5: EIA Methodology sets out required permits and consents related to the Proposed Development.

2.8.7 Where beneficial effects are voluntarily introduced without the requirement to mitigate an effect, these are termed 'enhancement measures'.

2.8.8 The remainder of this section sets out the embedded measures (primary) and tertiary, and secondary/additional measures and enhancements relevant to the assessment of noise and vibration.

Primary (embedded) and tertiary measures

2.8.9 Primary and tertiary mitigation form part of the Proposed Development and therefore, the preliminary assessment of effects takes account of these measures

2.8.10 Table 2-13 sets out the embedded mitigation measures that will be adopted during the construction, operation, maintenance and decommissioning of the Proposed Development.

Table 2-13: Primary and tertiary mitigation measures relating to noise and vibration adopted as part of the Proposed Development

Mitigation measures	Type	Applied to	Justification
Construction			
Relocation of Shaft 4 to increase distance to work site from the nearest noise sensitive receptors.	Primary	Shaft 4	To avoid noise impacts and prevent significant adverse noise effects at the nearest sensitive receptors during construction.
Operation			
Specification of low noise generating plant and equipment.	Primary	Proposed WWTP	To minimise noise impacts and prevent significant adverse noise effects at the nearest sensitive receptors during operation.
Implementation of noise reduction measures (i.e. acoustic enclosures for plant including blowers)	Primary	Proposed WWTP	To minimise noise impacts and prevent significant adverse noise effects at the nearest sensitive receptors during operation.
Considerate siting and orientation of plant and equipment to maximise distances and screening effects.	Primary	Proposed WWTP	To minimise noise impacts and prevent significant adverse noise effects at the nearest sensitive receptors during operation.
Acoustic attenuation from Re integrated into the landscape masterplan (relative height 5m above existing ground level).	Primary	Proposed WWTP	To minimise noise impacts and prevent significant adverse noise effects at the nearest sensitive receptors during operation.

Secondary mitigation

2.8.11 There are two main plans which provide secondary mitigation for noise and vibration during the construction phase. These are the CoCP and CTMP. These are described in more detail in the following sections.

Construction

2.8.12 During the construction phase, the CTMP (Appendix 19.7, App Doc Ref 5.4.19.7) and the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) and associated management plans (which are secured through Schedule 2 requirement) specify the range of measures to avoid and minimise impacts that may occur in construction.

2.8.13 The CoCP requires the appointed contractor to implement general and specific measures to minimise noise and vibration. The CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) Section 7.7 (Noise and Vibration) requires general mitigation measures to minimise noise and vibration impacts including the application of Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and the Environmental Protection Act 1990 (EPA). The CoCP Part B requires mitigation measures to be applied to specific activities or areas.

2.8.14 Section 3.4 of the COCP Part A requires that the Principal Contractor(s) prepare a Noise and Vibration Management Plan (NVMP) before development commences. The Applicant will require the Principal Contractor(s) to undertake and report monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments.

2.8.15 Section 4.10 of the CoCP Part A, Working Hours Table 4:1, sets out the general working hours applied to the Proposed Development. This section also reinforces the commitment for ongoing communication in relation to works activities and timing.

2.8.16 The CoCP Part A Section 3 (Community Consultation and Engagement) requires a proactive approach to communication with the local community and stakeholders. Through a Community Liaison Plan the local community and stakeholders will be informed of the works taking place, including durations, particularly where these will involve works outside of the core working hours or impact community facilities and business and local infrastructure such as Public Rights of Way (PRoW)/cycleways.

2.8.17 A draft Community Liaison Framework Plan (App Doc Ref 7.8) sets out the approach to ongoing communication with residents, the community, and businesses, including communication in relation to traffic and transport matters. Post grant of the DCO and prior to commencement of development a detailed plan will be prepared and agreed with the local authority. This will remain a 'live' document and periodically modified throughout the duration of construction.

2.8.18 Section 6.6 of the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1), Traffic and Transport and the CTMP (Appendix 19.7, App Doc Ref 5.4.19.7) contain measures pertaining to vehicle movements.

2.8.19 The outline CTMP secures the commitments in relation to the management of construction vehicle movements. The outline CTMP (Appendix 19.7, App Doc Ref

5.4.19.7) will be developed into a final CTMP plan post grant of the DCO and prior to commencement of development. The final CTMP will set out the detailed management measures, procedures and best practices required for managing the impact of construction traffic on the local and strategic road networks during the construction period.

2.8.20 Specific measures within the CoCP Part B (Appendix 2.2, App Doc Ref 5.4.2.2) include the following in relation to noise and vibration during construction of the Proposed Development:

- Section 3.2 of Part B (Transfer Tunnel) requires solid site hoarding (or acoustic barriers) to be provided around the waste water transfer tunnel shaft 4 construction compound. This measure is provided to minimise noise impacts and prevent significant adverse effects during construction at the nearest noise sensitive receptor located to the west of this shaft location.
- Section 3.4 of Part B (Waterbeach Pipeline) requires solid site hoarding (or acoustic barriers) to be provided around HDD pit locations and HDD plant during continuous working periods. This measure is provided to minimise noise impacts and prevent significant adverse effects during HDD works which occur during the most sensitive time periods.
- Section 3.4 of Part B (Waterbeach pipeline) requires solid site hoarding (or acoustic barriers) to be provided at the Waterbeach pipeline northern construction compound. This measure is provided to minimise noise impacts and prevent significant adverse effects at nearby receptors within Waterbeach on Capper Road and located off Burgess Drove.
- Section 3.1 of Part B (Treated effluent and storm pipelines and outfall to the River Cam) requires control of working hours for activities during core hours at the final effluent outfall to not commence before 07:00. This measure aims to reduce noise impacts due to works during more sensitive times of the day and to prevent significant adverse effects.
- Section 3.2 of Part B (Transfer Tunnel) requires control of working hours for activities during core hours at Shaft 4 to not commence before 07:00 (e.g. during site preparation, enabling and shaft construction). This measure aims to reduce noise impacts due to works during more sensitive times of the day and to prevent significant adverse effects.
- The CoCP Part B (Appendix 2.2, App Doc Ref 5.4.2.2) also requires the Principal Contractor(s) where appropriate to undertake settlement/condition surveys and monitoring of vibration at the closest properties and major infrastructure crossings with stakeholder agreement.

Operation

2.8.21 Operation and maintenance activities would be subject to operational management plans and procedures. The management plans and procedures will sit within the EMS required under the environmental permitting regime. These would be 'live' documents that identify the environmental risks and legal obligations associated

with the operations of the Proposed Development once construction has been completed. These specify the management measures the operator will implement in order to prevent or minimise the environmental effects associated with the Proposed Development.

Decommissioning

2.8.22 Decommissioning of the existing Cambridge WWTP would be subject to a Decommissioning Management Plan (Appendix 2.3, App Doc Ref 5.4.2.3) which is to be agreed with the Local Planning Authority(LPA). An outline Decommissioning Management Plan (Appendix 2.3, App Doc Ref 5.4.2.3) describes measure applied to this activity. Post grant of the DCO and prior to commencement of decommissioning, a detailed plan will be prepared by the Applicant and agreed with the Local Planning Authority and the Environment Agency in accordance with activities to surrender the existing environmental permit for the existing Cambridge WWTP.

2.8.23

2.8.24 Para 5.1.14 of the outline DMP requires that decommissioning will be undertaken in accordance with the Code of Construction Practice Parts A and B (Appendix 2.1 & 2.2, App Doc Refs 5.4.2.1 and 5.4.2.2) to manage risks to the environment'.

2.9 Assumptions and limitations

Construction noise and vibration

2.9.1 Chapter 2: Project Description includes a summary of the construction programme, activities, compounds and details of construction plant which have been used to inform calculations. Construction plant assumptions are provided in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3).

2.9.2 Calculations assume that construction activities occur within fixed working areas or at typical working areas within compounds during a daily assessment period. Calculations assume that for linear works (i.e., pipelines, tunnelling, construction of haul roads) activities would occur at locations representative of the closest approach to each receptor during a daily assessment period. This ensures results represent the likely or reasonable worst-case noise or vibration level for relevant phases of works. In practice, activities would move along linear activities such that distances to receptors are larger and resultant noise levels would be lower than predictions. This is discussed further in assessment sections for relevant works. Working areas are described in Works Plans (App Doc Ref 4.3).

2.9.3 Proposed construction working hours are set out within Appendix 2.1: Code of Construction Practice (COCP) Part A (App Doc Ref 5.4.2.1). These hours are considered within the assessment of construction noise and vibration impacts and are summarised below.

Table 2-14: Construction working hours

Hours	Description
Winter core hours (October to March) 7:00 to 18:00 Monday to Friday	These are the core hours that will apply to the majority of works areas and activities.

Hours	Description
8:00 to 16:00 Saturday **Daily mobilisation** – plus up to one hour before and after for mobilisation/maintenance activities	
Summer core hours (April to September) 6:00 to 19:00 Monday to Friday 8:00 to 18:00 Saturdays **Daily mobilisation** – plus up to one hour before and after for mobilisation/maintenance activities	Longer working hours are proposed in the summer months in order to maximise the works which can be undertaken (to shorten the overall duration of works) in better weather conditions albeit that they may not be used every day.
Extended hours for special circumstances and specific construction activities 6:00 to 22:00 Monday to Friday 18:00 to 22:00 on Saturdays 8:00 to 14:00 on Sundays	Specific activities which it will not be possible to complete during the core working hours: • major concrete pours including base slabs; • abnormal load delivery; and • contract lifts, i.e., lifting of pieces of equipment on crane.
Continuous Working Hours 24 hours, Monday to Sunday	Certain specific construction activities will need to take place on a continuous 24 hour, 7 day a week basis for longer durations: • the operations at shafts 3 and 5 will be 24hr working for 2 years • tunnelling and underground work; • pumping and dewatering of deep shafts / excavations; Certain specific construction activities will need to take place on a continuous 24 hour, 7 day a week basis on intermittent / short-term basis: • some critical concrete pours • works at Network Rail and/or National Highways assets; and • horizontal directional drilling (HDD) (including under the River Cam).
Out-of-hours working	To minimise disruption to the local community: • construction deliveries to utilise periods of low traffic flow; • works within the highway or footpaths; • connections into Anglian Water's existing network; and • utility connections.

Source: Code of Construction Practice Part A and B (Appendix 2.1 & 2.2, App Doc Refs 5.4.2.1 & 5.4.2.2)

2.9.4 Daily mobilisation would include the following activities:

- arrival and departure of the workforce to and from the construction compounds;
- movement from compounds to the working areas (if parked, engines shall be turned off and workforce shall be considerate toward neighbours with no loud music or raised voices);
- site meetings (briefings in compound buildings) and quiet walk-overs or site inspections;
- refuelling; and
- site cleaning and maintenance (which does not require the use of plant or hammering/banging).

2.9.5 The above mobilisation activities are assumed to not include significant sources of noise or vibration. Assessment of noise and vibration impacts therefore does not consider mobilisation periods.

2.9.6 The outline construction programme is provided within Chapter 2: Project Description. The programme has been considered within construction noise and vibration assessments including assessment of inter-related effects. It is assumed inter-related works between different zones could occur at the same time.

2.9.7 Construction noise calculations do not take into account existing screening features i.e., noise barriers or other screening whether natural (e.g., an embankment or cutting) or man-made (e.g., a building). Noise levels have been predicted over acoustically absorbent ground accounting for the predominantly rural environment adjacent proposed working areas.

2.9.8 Preliminary calculations do not include the benefit of acoustic screening from solid site hoarding around construction compounds and works areas. Acoustic screening has been identified and would be required as secondary mitigation to minimise noise levels from works in areas which are closest to noise sensitive receptors. Where acoustic screening is required as secondary mitigation, calculations and assessment assume solid site hoarding or acoustic barriers would provide between 5dB and 10dB attenuation to the closest receptors in accordance with BS 5228 guidance.

2.9.9 Noise from movement of construction vehicles using haul routes is included within construction noise calculations provided in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) in accordance with BS 5228-1 methodology.

Construction traffic

2.9.10 Parameters provided within Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) have been used to calculate noise levels from construction traffic.

2.9.11 Calculations follow CRTN methodology assuming traffic flow, proportion of HGV and traffic speed to determine BNL for comparison on associated noise level on each route. Other parameters, including the effect of road surfacing on noise levels, are assumed to be unchanged between ‘with’ and ‘without’ construction traffic scenarios.

Operational noise

2.9.12 Calculations assume operational plant noise source data provided in Appendix 17.4: Operational Noise Sources (App Doc Ref 5.4.17.4).

2.9.13 Receptor locations have been identified from OS mapping and AddressBase.

2.9.14 Ground absorption has been assumed within acoustic modelling as mixed soft and hard ground (G = 0.5) for the areas between the proposed WWTP and nearest receptors.

2.9.15 The proposed WWTP design has been incorporated within acoustic modelling to include structures and buildings. The Earth Bank is also included within acoustic modelling at a height of 5m above existing ground level as per the proposed design.

2.9.16 The operational site will operate continuously 24 hours a day. Due to the nature of the Proposed Development as critical infrastructure operations will occur during daytime and night-time. It is understood some plant items will cycle between systems during normal operation and for maintenance purposes. When assessed at the nearest noise sensitive receptors, noise would not result in intermittent noise character due to the continuous nature of the plant during normal operation over daily assessment periods and the overall level of noise at receptors when compared with the existing ambient noise levels. This is described further during assessment in Section 4.3: Operation phase.

2.9.17 Emergency power generators would not be used during typical plant operation and would only be used in an emergency scenario during a power cut except for testing which would occur during daytime periods (assumed weekly). Noise from backup power systems has therefore been excluded from calculations and assessment.

2.9.18 The flare stack would be used infrequently to prevent excess gas pressure at the proposed WWTP for safety reasons. The flare stack operation is for safety reasons only but could operate during day- or night-time periods. The flare stack exhaust is located approximately 16m above local ground level. Whilst noise from the flare stack is not expected to occur during normal operation it has been included within calculations to represent a reasonable worst-case scenario accounting for the elevated location and potential operation during day- and night-time periods.

Operational traffic

2.9.19 Calculations use the CRTN methodology assuming traffic flow, proportion of HGV and traffic speed to determine BNL for comparison on associated noise level on operational traffic routes. Other parameters including the effect of the road surfacing on noise levels are assumed to be unchanged between ‘with’ and ‘without’ operational traffic scenarios.

Prediction methodology and uncertainty

2.9.20 Predictions of sound levels have an associated degree of uncertainty. It is unavoidable that some degree of prediction uncertainty remains within the modelling approach, however, modelling, calculation and measurement processes are undertaken in such a way as to reduce such uncertainty and to be conservative.

2.9.21 Construction works noise levels are predicted following guidance from BS 5228:2009+A1:2014 which provides an estimate of sound propagation from construction plant. The predictions use representative noise levels, sourced from industry standard guidance documents such as BS 5228:2009+A1:2014 for typical items of plant that are likely to be used during construction as advised by the Applicant.

2.9.22 Predictions of operational plant and activities sound pressure levels will be undertaken following guidance to ISO 9613 Attenuation of sound during propagation outdoors – Part 2: General method of calculation, which are based on an assumption of moderate downwind propagation, and hence could be considered as a reasonable worst-case calculation. However, the standard also indicates an estimated accuracy of ±3dB(A) in predicted levels.

Baseline measurements

2.9.23 Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Any measurement of existing ambient or background sound levels will therefore be subject to a degree of uncertainty. Measurements were undertaken in a manner to minimise uncertainty and provide a representative same of conditions including to avoid periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from such a measurement survey. Full details of measurement methodology is provided within Appendix 17.2: Baseline Noise Report (App Doc Ref 5.4.17.2).

2.9.24 At the time of baseline surveys (January 2022) in the context of the relaxing of Covid-19 restrictions, it is considered that measured ambient and background noise levels were representative for the purposes of assessment and are not significantly affected due to the effects of Covid-19. This is discussed further in Section 3.1: Baseline environment.

2.9.25 Baseline noise levels have been assigned to representative receptor locations for the purposes of operational and construction noise impact assessments. Baseline measurement results have been reviewed and assigned accordingly to assessment locations based on the surrounding ambient noise sources including distance from main transportation noise sources.

3 Baseline Environment

3.1 Current baseline

Desktop study

3.1.1 A desktop review of existing baseline noise and vibration conditions has been completed to identify locations that may be affected by changes to noise and vibration as a result of the relocation of the existing Cambridge WWTP.

3.1.2 The Proposed Development is located within a primarily rural area. The nearest residential receptors are located within communities at Milton, Horningsea, Chesterton in North Cambridge and Fen Ditton. The nearest sensitive receptors to the proposed WWTP are isolated properties located off Low Fen Drove. Residential receptors adjacent to the proposed new pipeline route section from Waterbeach to the proposed WWTP include those within Waterbeach, Clayhithe and Horningsea.

3.1.3 The desktop study and noise measurements of existing conditions show that noise levels are typically higher at locations closer to main roads including the A14 and A10. Existing noise levels in the area immediately surrounding the proposed WWTP are dominated by road traffic from the A14 which is a high-speed trunk road.

3.1.4 Existing noise levels in areas further from the A14 and A10 are characterised by a combination of other sources including road traffic from minor roads, rail, aircraft, commercial or agricultural activities, and environmental noise sources such as birdsong and wind in trees.

3.1.5 National noise mapping indicates existing ambient noise levels are less than 55dB $L_{Aeq,16hr}$ (daytime) for the majority of sensitive receptors within the operational noise study area.

3.1.6 The Noise Important Areas (as defined by the Noise Action Planning Important Areas Round 3 (Department for Environment, Food and Rural Affairs, 2021)) nearest to the EIA Scheme Order Limits are located west of junction 33 of the A14, A10 (between Milton and Waterbeach) and A1303 Newmarket Road (between junction 35 of the A14 and Cambridge Airport) and all relate to road traffic noise. These Important Areas do not affect baseline noise levels at receptor locations surrounding the EIA Scheme Order Limits. However, they are noted here to identify noise sensitive receptors and for context within the surrounding noise environment.

3.1.7 There are no significant existing sources of vibration surrounding the Proposed Development that are relevant to or affect the assessment of associated construction and operation impacts.

Baseline measurements

3.1.8 Baseline noise surveys have been completed at locations representative of surrounding noise sensitive receptors to determine ambient and background noise levels for the assessment of noise impacts. The noise surveys included a combination of unattended measurements (these measure noise conditions continuously over a

period of approximately one week) supplemented with attended measurements at a number of other locations (completed during the daytime only).

3.1.9 Ambient noise levels relevant for assessment of impacts from construction noise are measured in terms of the $L_{Aeq,T}$ parameter. The proposed construction working hours include daytime, evening and night-time periods. Measurement results have been analysed accordingly to establish baseline conditions during proposed construction working hours.

3.1.10 Background noise levels relevant for assessment of impacts from new operational noise sources within the proposed WWTP are measured in terms of the $L_{A90,T}$ parameter. Potential noise impacts due to operation of the new plant would be greatest during the night-time period when existing noise levels are lowest. Noise survey data from the closest receptors surrounding the proposed WWTP show that the representative night-time background noise level at those receptors is between approximately 35dB $L_{A90,T}$ and 40dB $L_{A90,T}$. Representative background noise levels for day- and night-time periods have been determined using the modal value based on measurements of one-hour and 15-minute intervals, respectively, in accordance with BS 4142:2014+A1:2019.

3.1.11 National and local Covid-19 restrictions implemented in 2020 and 2021 resulted in changes to the ambient noise environment in many areas across the country. Locations most affected include areas near to sources of transportation noise (i.e., main roads, railways and airports). In general, this resulted in lower ambient noise levels for many locations but also some changes in the distribution of noise throughout a typical day and week. Noise measurements undertaken in January 2022 were completed during a period when Covid-19 restrictions had been removed and resulting impacts on ambient noise conditions were limited. It is noted that a minor reduction in transportation noise during baseline measurements would result in a conservative baseline dataset. It is therefore considered that baseline noise measurements are representative for the purposes of assessment.

3.1.12 Full details and results from noise measurements are provided within Appendix 17.2: Baseline Noise Report (App Doc Ref 5.4.17.2). Measurement locations are shown in Figure 17.3: Baseline Noise Survey (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17).

3.2 Future baseline

3.2.1 The methodology relating to the approach to future baseline is presented in Chapter 5. Chapter 22: Cumulative Effects provides a list of proposed developments identified as being relevant to the future baseline. As such, these developments form part of the baseline for assessment within the EIA.

3.2.2 The Waterbeach New Town development (S/2075/18/OL5 and S/0559/17/OL6) is proposed in land located to the north of the existing settlement of Waterbeach. It consists of residential development of around 11,000 new homes in total (over both east and west sites), retail and office use, educational facilities (primary, secondary schools and a sixth form centre) and community, recreation and leisure space. In relation to the Waterbeach New Town development (S/0791/18/FL7), an application

has been submitted to relocate Waterbeach Rail Station from its existing site at Station Road to a new site east of Bannold Drove. The timing of these proposals is uncertain; however, it is reasonable to expect that some construction activities could coincide with the construction of the Proposed Development.

3.2.3 Ambient noise levels in the areas adjacent the Proposed Development are predominantly controlled by road traffic noise from the A14 which is a high-speed main trunk road. Ambient noise levels are not anticipated to alter significantly due to committed developments. Committed developments do not introduce new noise sensitive receptors that would be any closer to noise and vibration sources associated with the Proposed Development or would be any more greatly affected by noise and vibration impacts. No committed developments would introduce new noise sensitive receptors closer to the Proposed Development than current existing sensitive receptors. It is therefore assumed baseline conditions will remain unchanged at the time of the start of construction of the Proposed Development compared to current baseline conditions.

Impacts of climate change on future baseline

3.2.4 Changes in climatic and environmental factors (e.g., temperature, wind speed, precipitation, frequency of extreme weather events) during the operation of the Proposed Development are not considered to materially affect the future baseline conditions for noise and vibration or would affect the sensitivity of sensitive receptors.

3.2.5 The predominant existing noise source in areas adjacent to the Proposed Development is the A14, which is a high-speed main trunk road. Noise from vehicles on higher speed roads is mainly attributed to tyre-road interactions (opposed to engine noise) which would not be affected by a shift in usage to electric vehicle types as a result of indirect effects of climate change. Future baseline noise conditions surrounding the proposed WWTP are therefore not expected to be significantly affected due to impacts of climate change on transportation noise sources.

4 Assessment of Effects

4.1.1 The section presents the assessment of effects and sets out a preliminary assessment that takes into account primary and tertiary mitigation in determining effects and then considers secondary mitigation and the assessment of residual effects.

4.2 Construction Phase

4.2.1 The potential environmental impacts related to noise and vibration from the construction of the Proposed Development have been assessed using the maximum design scenario (Table 2-11). These are the assumptions (maximum parameters) for the purposes of the noise and vibration assessment against which each impact has been assessed. A description of the potential noise and vibration effects caused by each identified impact is set out below.

4.2.2 All noise and vibration construction impacts would be temporary and occur during the construction phase only.

Proposed Development

4.2.3 This section sets out the assessment effects in relation to the construction of the Proposed Development as a whole, including construction of the proposed WWTP, Waterbeach Pipeline and the existing Cambridge WWTP.

Construction traffic noise

Magnitude of impact

4.2.4 Construction traffic using the wider road network is not limited spatially to one area of the works and has the potential to affect areas beyond the Scheme Order Limits. Construction traffic noise impacts have therefore been considered for all routes in accordance with DMRB LA111 guidance (Highways England, 2020). Assumptions about changes in road traffic due to construction traffic are included in Chapter 2: Project Description.

4.2.5 The assessment has considered changes in road traffic on routes used to access construction works areas. Additional details of construction traffic flows are provided within Chapter 19: Traffic and transport. Full details of construction traffic noise calculations are provided in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3). Construction traffic routes are shown in Appendix: 19.3. Comparisons of BNL noise levels for relevant road links are shown in Table 4-1.

Table 4-1: Construction traffic noise

Road link	Existing traffic BNL, dB(A) $L_{A10,18hr}$	Existing + construction traffic BNL, dB(A) $L_{A10,18hr}$	BNL increase, dB	Assessment
Horningsea and Fen Ditton				
A14	82.6	82.8	+0.2	Negligible adverse
A14 J34 slip road	75.3	75.8	+0.5	Negligible adverse
B1047 Horningsea Road (at main site access)	65.9	67.8	+1.9	Minor adverse
B1047 Horningsea Road (at waste water transfer tunnel access)	65.9	66.2	+0.3	Negligible adverse
Waterbeach				
Denny End Road	65.4	65.8	+0.4	Negligible adverse
Bannold Road	60.7	61.9	+1.2	Minor adverse
Car Dyke Road	65.0	65.5	+0.6	Negligible adverse
Clayhithe Road	63.2	63.9	+0.7	Negligible adverse
Burgess Road	N/A	N/A	N/A	Minor adverse
Milton				
A10	71.8	71.9	+0.1	Negligible adverse
Chesterton				
Cowley Road	N/A	N/A	N/A	Minor adverse
Milton Road	69.9	70.0	+0.1	Negligible adverse
Green End Road	66.0	66.5	+0.5	Negligible adverse
Fen Road	63.8	64.5	+0.7	Negligible adverse

4.2.6 Changes in road traffic noise would result in **negligible adverse** impacts during the majority of construction phases along main trunk roads and routes which carry a relatively large existing traffic flow (i.e., the A10, the A14 and the B1047 Horningsea Road).

4.2.7 Changes in road traffic noise would result in **minor adverse** impacts due to construction traffic using the B1047 Horningsea Road (at the main site entrance).

4.2.8 Changes in road traffic noise during construction on routes with very low existing traffic flow (e.g., Cowley Road in Milton, Burgess Road and Bannold Road in Waterbeach) have the potential to result in adverse noise impacts with a greater magnitude. Quantitative assessment has not been completed for several of these routes due to a limitation of data available for very minor routes and CRTN calculation methodology, which is not reliable for very low flow routes. Professional judgement is therefore used to assess these very minor routes. The increase in noise levels on these routes would be relatively high, however, it is a function of the very low existing traffic flows. In practice, noise levels at noise sensitive receptors due to

road traffic with very low flows would not exceed the daytime construction noise LOAEL (65 dB $L_{Aeq,T}$). This is an indication that noise impact would be limited when accounting for the relatively low existing traffic flows and resulting absolute noise levels due to addition of construction traffic. Noise impacts on these construction traffic routes are therefore assessed to be **minor adverse**.

Sensitivity of receptor

4.2.9 All noise sensitive receptors considered within the assessment of construction traffic noise are assigned a medium sensitivity.

Significance of effect

4.2.10 It is noted that temporary noise disturbance due to construction traffic may occur at several receptors during peak construction activity, however, the usage of these routes would vary over the construction programme according to relevant phases. The magnitude of impacts would therefore reduce from these peak days/activities. The use of construction traffic routes is assessed to be **negligible or minor adverse on all routes** and is therefore assessed to be **not significant**.

Secondary mitigation or enhancement

4.2.11 Construction traffic will be managed throughout the construction period as per the CTMP (Appendix 19.7, App Doc Ref 5.4.19.7) which includes measures to reduce associated noise impacts.

4.2.12 Through the application of these measures the impact of construction traffic noise would be minimised however does not change the magnitude of impact. Through the application of these measures, the effect would be **negligible** and **minor adverse on all routes** and **not significant**.

Residual effect

4.2.13 The residual effect is **negligible** or **minor adverse** and is **not significant**.

Proposed WWTP

4.2.14 This section sets out the assessment of effects in relation to the construction of the proposed WWTP including the landscaping proposals, final effluent pipeline, outfall, transfer tunnel and new access connecting with the B1047 Horningsea Road.

Construction noise

Magnitude of impact

4.2.15 Calculations have been completed using methodology assumptions stated in Section 2.2: Assessment methodology and Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) at representative receptors.

4.2.16 Construction noise prediction results are provided in full in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3). Results relevant to activities and sensitive receptors within this area have been filtered to assess potential impacts.

Weekday daytime and Saturday morning

4.2.17 The relevant predicted daytime noise levels for weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) are shown in Table 4-2. Results that exceed the daytime LOAEL (65dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (72dB $L_{Aeq,T}$) are highlighted orange.

Table 4-2: Proposed WWTP construction predicted noise levels, weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC15**	**RC17**	**RC19**	**RC22**	**RC23**	**RC25**	**RC26**	**RC27**	**RC28**
Daytime baseline, dB $L_{Aeq,T}$	**62**	**60**	**60**	**60**	**57**	**57**	**55**	**57**	**52**
Saturday morning baseline, dB $L_{Aeq,T}$	**59**	**54**	**54**	**54**	**55**	**55**	**51**	**55**	**49**
Proposed WWTP Phase 1 enabling works							50	50	53
Proposed WWTP Phase 2 enabling works							50	50	53
Proposed WWTP - water recycling and Sludge Treatment Centre (STC) (compound and external to Earth Bank area)							46	49	50
The treated effluent transfer pipelines and outfall enabling, construction of access/haul road	55		43	39					
The treated effluent transfer pipelines and outfall enabling, setup of site hoarding and compounds	52	46	47	45					
Excavation of outfall trench and the treated effluent transfer pipelines installation	52		44	39					
Outfall, construction of cofferdam and river bank improvements	49	41	41	39					
Outfall, construction of cofferdam and river bank improvements (piling)	53	50	50	48					

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Shaft 4 enabling, construction of access/haul road	43	54	60	39	48		
Shaft 4 enabling, setup of site hoarding and compounds	48	59	65	44	51		
Excavation for and construction of Shaft 4	42	53	59	39	45		
Shaft 4 dewatering	32	44	50	29	36		
Shaft 4 recovering of MTBM	38	49	55	34	41		
Shaft 5 enabling, construction of access/haul road		40			39		48
Shaft 5 enabling, setup of site hoarding and compounds		45			44		51
Excavation for and construction of Shaft 5		39			38		48
Shaft 5 tunnelling *(drive from Shaft 5 to Shaft 4, and drive from Shaft 5 to terminal pumping station)*		41			40		48

4.2.18 Results for weekday daytime and Saturday morning periods indicate that none of the construction noise predictions are greater than LOAEL. The impacts are therefore assessed to be **negligible**.

Shoulder hours

4.2.19 The relevant predicted daytime noise levels for shoulder hours (Monday to Saturday early morning period between 07:00 and 08:00 and Monday to Friday early evening period between 18:00 and 19:00) are shown in Table 4-3. Results that exceed the daytime LOAEL (60 dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (67 dB $L_{Aeq,T}$) are highlighted orange.

Table 4-3: Proposed WWTP construction predicted noise levels, shoulder hours (Monday to Saturday 07:00 – 08:00 and Monday to Friday 18:00 – 19:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC15**	**RC17**	**RC19**	**RC22**	**RC23**	**RC25**	**RC26**	**RC27**	**RC28**

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Early morning baseline, dB $L_{Aeq,T}$	**60**	**59**	**59**	**59**	**56**	**56**	**55**	**56**	**50**
Early evening baseline, dB $L_{Aeq,T}$	**59**	**56**	**56**	**56**	**54**	**54**	**51**	**54**	**48**
Proposed WWTP Phase 1 enabling works							50	50	53
Proposed WWTP Phase 2 enabling works							50	50	53
Proposed WWTP water recycling and STC (compound and external to Earth Bank area)							46	49	50
The treated effluent transfer pipelines and outfall enabling, construction of access/haul road	55		43	39					
The treated effluent transfer pipelines and outfall enabling, setup of site hoarding and compounds	52	46	47	45					
Excavation of outfall trench and the treated effluent transfer pipelines installation	52		44	39					
Outfall, construction of cofferdam and river bank improvements	49	41	41	39					
Outfall, construction of cofferdam and river bank improvements (piling)	53	50	50	48					
Shaft 4 enabling, construction of access/haul road		43	54	60	39	48			
Shaft 4 enabling, setup of site hoarding and compounds		48	59	65	44	51			
Excavation and construction of Shaft 4		42	53	59	39	45			

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Shaft 4 dewatering	32	44	50	29	36		
Shaft 4 recovering of MTBM	38	49	55	34	41		
Shaft 5 enabling, construction of access/haul road		40			39		48
Shaft 5 enabling, setup of site hoarding and compounds		45			44		51
Excavation and construction of Shaft 5		39			38		48
Shaft 5 tunnelling *(drive from Shaft 5 to Shaft 4, and drive from Shaft 5 to terminal pumping station)*		41			40		48

4.2.20 Results for the two shoulder hours indicate that the majority of construction activities would not exceed the LOAEL (not highlighted). These impacts are therefore assessed to be **negligible** during these periods.

4.2.21 Results indicate that Shaft 4 enabling works (construction of access/haul road, setup of hoarding and compounds) exceed LOAEL at RC22 (Red House Close), if these activities were to occur during the shoulder periods. Enabling activities would also increase the existing ambient noise level at RC22 by at least +5dB if they were to take place during these assessment periods. Due to the nature of these activities the enabling works would only take place within normal construction hours and are unlikely to occur during these periods unless under exceptional circumstances. In addition, noise levels would reduce as the precise work locations vary resulting in a reduced impact over the enabling works construction phase. Results indicate noise levels from these construction activities would not exceed SOAEL. This impact is assessed to be **minor adverse**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.22 The relevant predicted noise levels for evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00 but considered exceptional hours for certain works to be determined) are shown in Table 4-4. Results that exceed the daytime LOAEL (55 dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (62 dB $L_{Aeq,T}$) are highlighted orange.

Table 4-4: Proposed WWTP construction predicted noise levels, evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC15**	**RC17**	**RC19**	**RC22**	**RC23**	**RC25**	**RC26**	**RC27**	**RC28**
Evening baseline, dB LAeq, T	**59**	**56**	**56**	**56**	**54**	**54**	**51**	**54**	**48**
Saturday afternoon baseline, dB LAeq, T	**59**	**53**	**53**	**53**	**52**	**52**	**51**	**52**	**50**
Sunday baseline, dB LAeq,T	**57**	**56**	**56**	**56**	**55**	**55**	**50**	**55**	**47**
Proposed WWTP Phase 1 enabling works							50	50	53
Proposed WWTP Phase 2 enabling works							50	50	53
Proposed WWTP water recycling and STC (compound and external to Earth Bank area)							46	49	50
The treated effluent transfer pipelines and outfall enabling, construction of access/haul road	55		43	39					
The treated effluent transfer pipelines and outfall enabling, setup of site hoarding and compounds	52	46	47	45					
Excavation of outfall trench and the treated effluent transfer pipelines installation	52		44	39					
Outfall, construction of cofferdam and river bank improvements	49	41	41	39					
Outfall, construction of cofferdam and river bank improvements (piling)	53	50	50	48					
Shaft 4 enabling, construction of access/haul road		43	54	60	39	48			
Shaft 4 enabling, setup of site hoarding and compounds		48	59	65	44	51			
Excavation for and construction of Shaft 4		42	53	59	39	45			
Shaft 4 dewatering		32	44	50	29	36			

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$					
Shaft 4 recovering of MTBM	38	49	55	34	41	
Shaft 5 enabling, construction of access/haul road		40			39	48
Shaft 5 enabling, setup of site hoarding and compounds		45			44	51
Excavation for and construction of Shaft 5		39			38	48
Shaft 5 tunnelling *(drive from Shaft 5 to Shaft 4, and drive from Shaft 5 to terminal pumping station)*		41			40	48

4.2.23 Results for evenings, Saturday afternoons, and Sundays and public holidays indicate that the majority of the construction activities would not exceed the LOAEL (not highlighted). Impacts are therefore assessed to be **negligible**.

4.2.24 Results indicate that Shaft 4 enabling works (construction of access/haul road, setup of hoarding and compounds) and shaft excavation exceed LOAEL at receptors RC19 (Poplar Hall) and RC22 (Red House Close), if these activities were to occur during the evening, on a Saturday afternoon or a Sunday. These activities that exceed LOAEL but do not exceed SOAEL do not increase the existing ambient noise level by +5dB or more. These impacts are therefore assessed to be **minor adverse**.

4.2.25 Results indicate that Shaft 4 enabling works (setup of hoarding and compounds) exceeds SOAEL at RC22 (Red House Close), if these activities were to occur during the evening, on a Saturday afternoon or a Sunday. Enabling activities would also increase the existing ambient noise level at RC22 by at least +5dB if they were to take place during these assessment periods. These impacts are assessed to be **moderate adverse**. Due to the nature of these activities the enabling works would only take place within normal construction hours and are unlikely to occur during these periods unless under exceptional circumstances. In addition, noise levels would reduce as the precise work locations vary resulting in a reduced impact over the enabling works construction phase.

Night-time

4.2.26 The relevant predicted noise levels for night-time (23:00 – 07:00) are shown in Table 4-5. Results that exceed the daytime LOAEL (45dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (52dB $L_{Aeq,T}$) are highlighted orange. Note that none of the works in this area would be undertaken between 23:00 and 06:00 except for continuous or short-term exceptional activities (such as dewatering of shafts, tunnelling activities at drive shafts, and large concrete pours within the area of land required for the construction of the proposed WWTP). However, the assessment of this time period is included for all relevant activities for proposed work between 06:00 and 07:00 during summer core construction hours.

Table 4-5: Proposed WWTP construction predicted noise levels, night-time (23:00 – 07:00)

Activity	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
	RC15	RC17	RC19	RC22	RC23	RC25	RC26	RC27	RC28
Night-time baseline, dB $L_{Aeq,T}$	**58**	**56**	**56**	**56**	**54**	**54**	**51**	**54**	**48**
Proposed WWTP Phase 1 enabling works							50	50	53
Proposed WWTP Phase 2 enabling works							50	50	53
Proposed WWTP water recycling and STC (compound and external to Earth Bank area)							46	49	50
The treated effluent transfer pipelines and outfall enabling, construction of access/haul road	55		43	39					
The treated effluent transfer pipelines and outfall enabling, setup of site hoarding and compounds	52	46	47	45					
Excavation of outfall trench and the treated effluent transfer pipelines installation	52		44	39					
Outfall, construction of cofferdam and river bank improvements	49	41	41	39					
Outfall, construction of cofferdam and river bank improvements (piling)	53	50	50	48					
Shaft 4 enabling, construction of access/haul road		43	54	60	39	48			
Shaft 4 enabling, setup of site hoarding and compounds		48	59	65	44	51			
Excavation for and construction of Shaft 4		42	53	59	39	45			
Shaft 4 dewatering		32	44	50	29	36			

Calculated free-field receptor noise level, dB $L_{Aeq,T}$

Shaft 4 recovering of MTBM	38	49	55	34	41			
Shaft 5 enabling, construction of access/haul road		40			39		48	
Shaft 5 enabling, setup of site hoarding and compounds		45			44		51	
Excavation for and construction of Shaft 5		39			38		48	
Shaft 5 tunnelling *(drive from Shaft 5 to Shaft 4, and drive from Shaft 5 to terminal pumping station)*		41			40		48	

4.2.27 Results for night-time indicate that a large number of the construction activities would not exceed LOAEL (not highlighted). These impacts are therefore assessed to be **negligible.**

4.2.28 Results for the night-time assessment period indicate exceedances of LOAEL (highlighted blue) due to at least one construction activity at RC15, RC17, RC19, RC22, RC25, RC26, RC27 and RC28. None of these impacts increase the existing ambient noise level by +5dB. These impacts are therefore assessed to be **minor adverse.**

4.2.29 Results for the night-time assessment period show exceedances of SOAEL at RC15 and RC19. These SOAEL exceedances at RC15 and RC19 would increase ambient noise levels by less than +5dB. The impact are therefore assessed as **minor adverse.**

4.2.30 Results indicate that Shaft 4 enabling works (construction of access/haul road, setup of hoarding and compounds) exceed SOAEL at RC22 (Red House Close), if these activities were to occur during the night-time period. Enabling activities would also increase the existing ambient noise level at RC22 by at least +5dB if they were to take place during this assessment period. This impact is assessed to be **moderate adverse**. Due to the nature of these activities the enabling works would only take place within normal construction hours and are unlikely to occur during these periods unless under exceptional circumstances. In addition, noise levels would reduce as the precise work locations vary resulting in a reduced impact over the enabling works construction phase.

4.2.31 The SOAEL exceedance at receptor RC28 (Parsonage Farm, Low Fen Drove) due to the proposed WWTP enabling works would increase ambient noise levels by +5dB or more. This impact is assessed to be **moderate adverse**. Similarly due to the nature of these activities the enabling works would only take place within normal construction hours and are unlikely to occur during these periods unless under exceptional

circumstances. In addition, noise levels would reduce as the precise work locations vary resulting in a reduced impact over the enabling works construction phase.

4.2.32 It is noted that these works have been included within assessment due to the proposed works between 06:00 and 07:00 during summer core construction hours.

Sensitivity of receptor

4.2.33 All noise sensitive receptors assessed within the construction assessment are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during construction of the Proposed Development.

Significance of effect

Weekday daytime and Saturday morning

4.2.34 Assessment of construction noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Shoulder hours

4.2.35 Assessment of construction noise during these assessment periods found impacts to be negligible or minor adverse and are therefore assessed to be **not significant**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.36 Assessment of construction noise impacts during evenings, Saturday afternoons, and Sundays and public holidays found the majority of impacts to be negligible or minor adverse and are therefore assessed to be **not significant**.

4.2.37 The assessment found construction noise impacts from Shaft 4 enabling works (setup of hoarding and compounds) during these time periods to be moderate adverse at RC22 and is therefore assessed to be **significant adverse**.

Night-time

4.2.38 Assessment of construction noise impacts during night-time periods found the majority of impacts to be negligible or minor adverse and are therefore assessed to be **not significant**.

4.2.39 Assessment of construction noise impacts found moderate adverse impacts at RC28 (Parsonage Farm) due to proposed WWTP enabling works during the night-time assessment period. Impacts during this assessment period are included due to the proposed working hours between 06:00 and 07:00 during summer core construction hours. The magnitude of impact at this receptor location is highly dependent on the specific location of works within the proposed WWTP. The works would occur over a large area and impacts would therefore reduce over the construction programme to minor adverse or negligible. The moderate adverse impact is unlikely to occur for an extended duration (i.e. not more than 10 in 15 consecutive days or, more than 40 days in a 6 month period), which reduces the significance of effect. On review of the assessed impacts and consideration of duration, this impact is assessed to be **not significant**.

Recreational amenity

4.2.40 Noise due to construction activities would increase existing ambient noise levels for areas used for recreational amenity, including the River Cam and nearest PRoW. Users of these spaces may notice noise during construction and experience temporary disturbance (subject to the precise location of receptors and ongoing activities). These impacts are assessed to be **not significant** due to the limited and temporary exposure people would receive when moving through these areas.

Secondary mitigation or enhancement

4.2.41 Measures to minimise noise impacts during construction are required as specified in section 7.7 (Noise and vibration) of the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) and include the application of BPM in accordance with BS 5228-1. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2) requires application of mitigation measures to minimise noise impacts.

4.2.42 The assessment found noise levels greater than SOAEL and moderate adverse impacts at RC22 due to Shaft 4 construction activities during enabling works during evenings, Saturday afternoons, Sundays and public holidays and night-time periods (including the proposed working hours between 06:00 and 07:00 within the summer core construction hours). Restriction of construction working hours is proposed at Shaft 4 during core hours activities to minimise noise impacts due to works. Works during core hours will start no earlier than 07:00 at this work site. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) secures this mitigation measure such that none of the relevant works as described above will be undertaken between 23:00 and 07:00. This restriction of working hours removes the moderate adverse impact and significant effect.

4.2.43 To minimise noise levels during construction activities at Shaft 4, solid site hoarding or temporary acoustic barriers will be provided. These barriers will be implemented to reduce moderate adverse impacts and noise emissions during enabling and shaft excavation activities. With mitigation noise levels at receptors are reduced to less than SOAEL such that moderate adverse impacts are reduced to minor adverse impacts. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires use of solid site hoarding or temporary acoustic barriers at this work site to reduce noise impacts at RC22.

4.2.44 The assessment found noise levels greater than SOAEL during works undertaken at the outfall during the proposed working hours between 06:00 and 07:00 within the summer core construction hours. Restriction of construction working hours is a requirement here to minimise noise impacts due to works undertaken at the outfall. Works during core hours will start no earlier than 07:00 at this work site. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) secures this mitigation measure such that none of the relevant works as described above will be undertaken between 23:00 and 07:00. This restriction of working hours removes the moderate adverse impact and significant effect.

Residual effect

4.2.45 Following implementation of secondary mitigation measures described above, the residual effects due to works within this area are negligible or minor adverse and **not significant**.

Construction vibration

Magnitude of impact

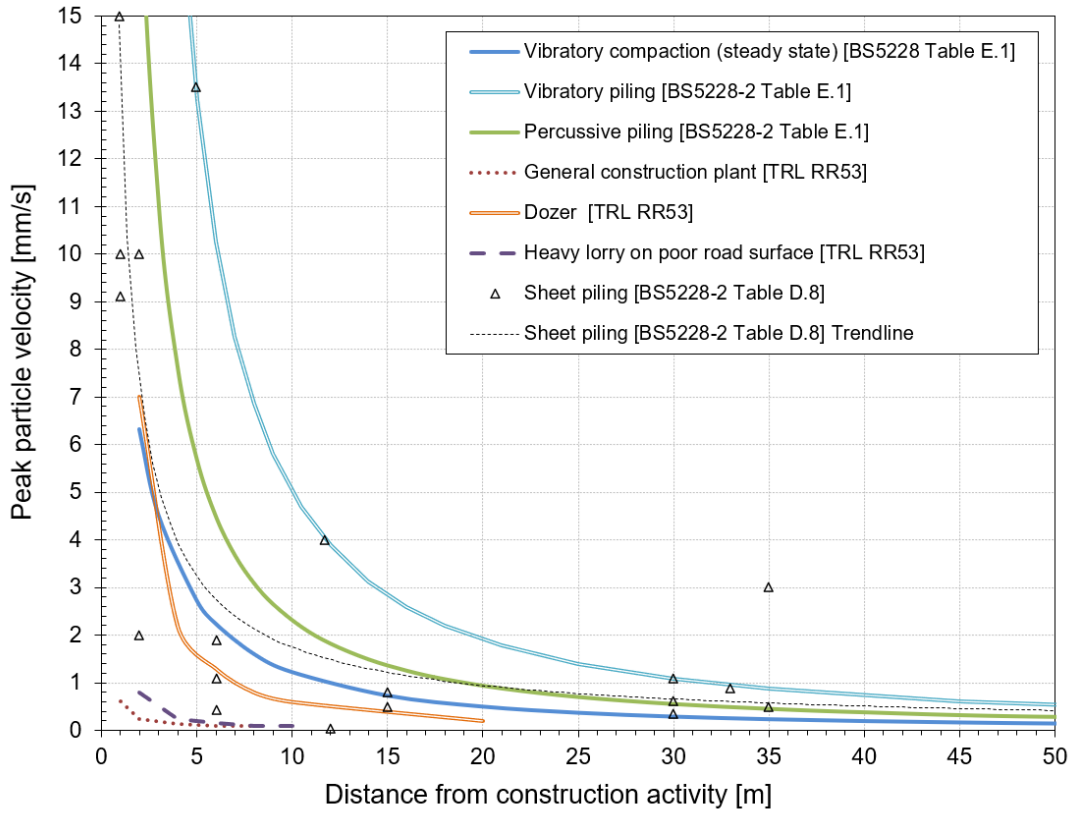
4.2.46 Piling has the potential to generate high levels of vibration. Piling is proposed during construction of the outfall which would include sheet piling. The nearest receptors are RC15 (Biggin Abbey and Biggin Abbey Cottages) which are greater than 300m from these works.

4.2.47 Piling is also proposed within the proposed WWTP and would comprise rotary bored piling methods. The nearest receptors to these works are RC28 (Parsonage Farm) which is more than 350m away and RC26 (Gate House, Low Fen Drove Way) at a distance greater than 500m from these activities.

4.2.48 General construction activities may also generate vibration during the construction phase. These activities include use of heavy vehicles on construction traffic routes and compaction for earthworks, excavation and pipeline. Movement of heavy vehicles would occur on construction access routes off the B1047 Horningsea Road to Shaft 5 within approximately 50m of the nearest receptors. Compaction activities would occur along the treated effluent transfer pipelines route and at shaft compounds within approximately 65m from receptors at the closest point.

4.2.49 Figure 4.1 below, provides example data for piling and general construction activities.

Figure 4.1: Vibration from piling and general construction activities



Source: BS 5228-2 Table E.1 and Table D.8, TRL RR53 Figure 3.

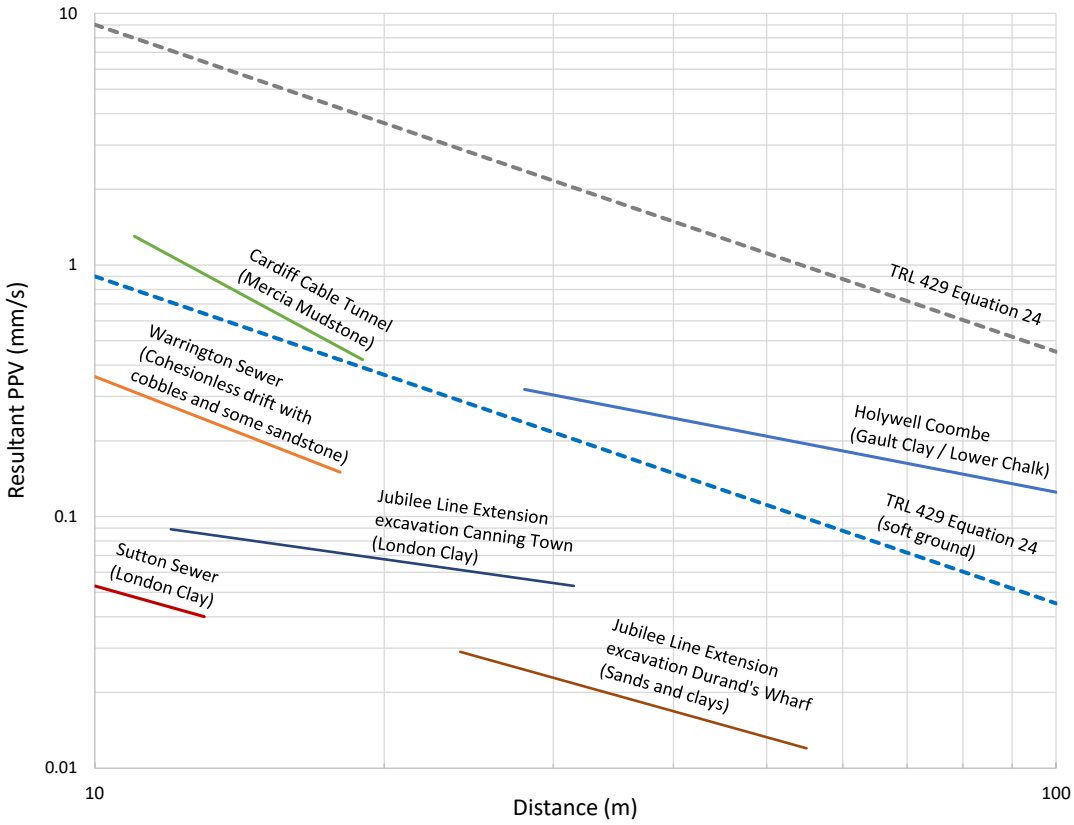
4.2.50 It can be seen from Figure 4.1 that vibration levels from movement of construction vehicles (heavy lorry on poor road surface) would not exceed LOAEL at the nearest sensitive receptors. These impacts are assessed to be **negligible**.

4.2.51 Activities including compaction (vibratory compaction and dozer activities) are unlikely to exceed LOAEL (0.3mm/s PPV) at the nearest sensitive receptors. These impacts are assessed to be **negligible**.

4.2.52 Vibration due to piling activities at the outfall is unlikely to exceed LOAEL (0.3mm/s PPV) at the nearest sensitive receptors. These impacts are assessed to be **negligible**.

4.2.53 Operation of the MTBM during construction of the waste water transfer tunnel would generate vibration. The nearest receptors to these works include residential properties within Fen Ditton (RC17, RC19, RC22). BS 5228-2 and TRL 429 (D M Hiller, 2000) provide reference vibration data and empirical formulae for the prediction of vibration from tunnelling activities. Reference data provides tunnel boring machine (TBM) vibration data from larger-scale tunnelling activities and different soil types. TRL 429 Equation 24 empirical relationship relates to hard ground conditions and is noted to likely overestimate potential impacts due to tunnelling activities. Figure 4.2 summarises reference data for tunnelling activities.

Figure 4.2: Vibration from tunnelling activities



Source: BS 5228-2 and TRL 429

4.2.54 Figure 4.2 shows that the TRL 429 Equation 24 (hard ground) approach likely overestimates potential impacts when comparing with example data, particularly when considering smaller diameter TBM works and soft ground conditions. The TRL Equation 24 (soft ground) shows good correlation with reference data for similar ground conditions. In general, results indicate vibration levels from tunnelling activities for distances greater than 25m would not exceed LOAEL (0.3mm/s PPV) based on comparison with example data and empirical predictions using soft ground assumptions.

4.2.55 The proposed tunnelling works comprise a comparatively small diameter TBM (2.4m diameter). Ground conditions on the tunnel route near the closest sensitive receptor, Red House Close, are predominantly clay (the geology comprises clay and slightly sandy gravelly clay). Further details of baseline geology at tunnel depths are provided in Chapter 14: Land Quality.

4.2.56 The approach in TRL 429 soft ground empirical formulae has been used to predict vibration levels at those vibration sensitive receptors nearest to the waste water transfer tunnel route. Results are shown in Table 4-6. It is noted that the tunnel depth from ground level will vary along the waste water transfer tunnel route but is assumed to be 20m for the purpose of assessment.

Table 4-6: Predicted vibration levels, waste water transfer tunnel

Receptor	Shortest distance from vibration source to receptor, m	Predicted PPV, mm/s
Red House Close (residential)	26	0.26
Poplar Hall (residential)	105	0.04
Northern Bridge Farm (residential)	55	0.10

4.2.57 Results show that vibration levels do not exceed LOAEL at the nearest vibration sensitive receptors when tunnelling activities are at the closest approach. It is noted that higher vibration levels may occur subject to localised ground conditions and may at instances exceed LOAEL. These impacts are therefore assessed to be **negligible** for all identified receptors, except for Red House Close where the impact is assessed to be **minor adverse**. This impact would be temporary and short-term (days).

Sensitivity of receptor

4.2.58 All vibration sensitive receptors assessed within the construction assessment are assigned a medium sensitivity.

Significance of effect

4.2.59 Assessment of construction vibration found impacts to be negligible or minor adverse at the nearest sensitive receptors within this area of the Proposed Development and are therefore assessed to be **not significant**.

Secondary mitigation or enhancement

4.2.60 Measures to minimise vibration impacts during construction are set out within the CoCP Part A and include the application of BPM in accordance with BS 5228-2.

4.2.61 It is required that building condition surveys are undertaken prior to construction works at any sensitive buildings, including historic or listed buildings that are located near works where there is potential risk vibration would exceed SOAEL (1.0mm/s PPV). This requirement is included within the CoCP Part A.

4.2.62 A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires application of BPM to minimise vibration impacts and undertaking of building condition surveys.

Residual effect

4.2.63 Following implementation of secondary mitigation measures described above, the residual effects due to works within this area are negligible or minor adverse and **not significant**.

Waterbeach transfer pipeline

4.2.64 This section sets out the assessment of effects in relation to the Waterbeach Pipeline which consists of a transfer section running from the north near Waterbeach to Low Fen Drove Way, a section crossing the area of land required for the construction of

the proposed WWTP and a section south of the A14 which connects to the area of land where the existing Cambridge WWTP is located.

Construction noise

Magnitude of impact

4.2.65 Calculations have been completed using methodology assumptions stated in Section 2.2 and Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) at representative receptors.

4.2.66 Construction noise prediction results are provided in full in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3). Results relevant to activities and sensitive receptors within this area have been filtered to assess potential impacts.

Weekday daytime and Saturday mornings

4.2.67 The relevant predicted daytime noise levels for weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) are shown in Table 4-7 and Table 4-8. Results that exceed the daytime LOAEL (65dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (72dB $L_{Aeq,T}$) are highlighted orange.

Table 4-7: Waterbeach pipeline construction predicted noise levels, weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) – RC1 to RC14

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC1**	**RC2**	**RC3**	**RC4**	**RC5**	**RC6**	**RC7**	**RC8**	**RC9**	**RC10**	**RC11**	**RC12**	**RC13**	**RC14**
Daytime baseline, dB $L_{Aeq,T}$	**50**	**52**	**52**	**52**	**52**	**50**	**50**	**50**	**50**	**52**	**52**	**52**	**52**	**60**
Saturday morning baseline, dB $L_{Aeq,T}$	**47**	**49**	**49**	**49**	**49**	**47**	**47**	**47**	**47**	**49**	**49**	**49**	**49**	**57**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds	53	62	46											
Waterbeach Pipeline, compound	46	55	39											
Waterbeach Pipeline, HDD	55	63	59	55	65	55	59	50						
Waterbeach Pipeline, excavation of	49	59	49	45	69	61	51	46	70	53	54	49	46	53

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
trench, installation of pipe														

Table 4-8: Waterbeach Pipeline construction predicted noise levels, weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) – RC15 to RC28

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC15**	**RC16**	**RC17**	**RC18**	**RC19**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**	**RC25**	**RC26**	**RC27**	**RC28**
Daytime baseline, dB $L_{Aeq,T}$	**62**	**66**	**60**	**66**	**60**	**60**	**66**	**60**	**57**	**60**	**57**	**55**	**57**	**52**
Saturday morning baseline, dB $L_{Aeq,T}$	**59**	**63**	**54**	**63**	**54**	**57**	**63**	**54**	**55**	**57**	**55**	**51**	**55**	**49**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds														
Waterbeach Pipeline, compound														
Waterbeach Pipeline, HDD			67		48			68	56		59		65	51
Waterbeach Pipeline, excavation of trench, installation of pipe	39	53	58	44	49	43	41	66	46	35	55	28	60	42

4.2.68 Results for weekday daytime and Saturday morning periods indicate that the majority of the construction activities would not exceed LOAEL (not highlighted). The impacts are therefore assessed to be **negligible**.

4.2.69 Results indicate that trench excavation and installation of pipes works exceeds LOAEL at RC5, RC9, RC17 and RC22 receptors. Due to the proximity of these works, noise levels are found to be relatively high and increase the existing ambient noise level at the nearest receptors by more than +5dB for both weekday daytime and Saturday morning periods. Noise levels from these construction activities would not exceed SOAEL. These noise impacts are therefore assessed to be **minor adverse**.

Shoulder hours

4.2.70 The relevant predicted daytime noise levels for shoulder hours (Monday to Saturday early morning period between 07:00 – 08:00 and Monday to Friday early evening period between 18:00 – 19:00) are shown in Table 4-9 and Table 4-10. Results that exceed the daytime LOAEL (60dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (67dB $L_{Aeq,T}$) are highlighted orange.

Table 4-9: Waterbeach Pipeline construction predicted noise levels, shoulder hours (Monday to Saturday 07:00 – 08:00 and Monday to Friday 18:00 – 19:00) – RC1 to RC14

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC1**	**RC2**	**RC3**	**RC4**	**RC5**	**RC6**	**RC7**	**RC8**	**RC9**	**RC10**	**RC11**	**RC12**	**RC13**	**RC14**
Early morning baseline, dB $L_{Aeq,T}$	**48**	**50**	**50**	**50**	**50**	**48**	**48**	**48**	**48**	**50**	**50**	**50**	**50**	**58**
Early evening baseline, dB $L_{Aeq,T}$	**46**	**48**	**48**	**48**	**48**	**46**	**46**	**46**	**46**	**48**	**48**	**48**	**48**	**56**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds	53	62	46											
Waterbeach Pipeline, compound	46	55	39											
Waterbeach Pipeline, HDD	55	63	59	55	65	55	59	50						
Waterbeach Pipeline, excavation of trench and installation of pipe	49	59	49	45	69	61	51	46	70	53	54	49	46	53

Table 4-10: Waterbeach Pipeline construction predicted noise levels, shoulder hours (Monday to Saturday 07:00 – 08:00 and Monday to Friday 18:00 – 19:00) – RC15 to RC28

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC15**	**RC16**	**RC17**	**RC18**	**RC19**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**	**RC25**	**RC26**	**RC27**	**RC28**
Early morning baseline, dB $L_{Aeq,T}$	**60**	**64**	**59**	**64**	**59**	**58**	**64**	**59**	**56**	**58**	**56**	**55**	**56**	**50**
Early evening baseline, dB $L_{Aeq,T}$	**59**	**62**	**56**	**62**	**56**	**56**	**62**	**56**	**54**	**56**	**54**	**51**	**54**	**48**

Calculated free-field receptor noise level, dB $L_{Aeq,T}$

Waterbeach Pipeline, enabling, setup of site hoarding and compounds															
Waterbeach Pipeline, compound															
Waterbeach Pipeline, HDD			67			48			68	56			59		65	51
Waterbeach Pipeline, excavation of trench and installation of pipe	39	53	58	44	49	43	41	66	46	35	55	28	60	42	

4.2.71 Results for the two shoulder hour periods indicate that the majority of the construction activities would not exceed LOAEL (not highlighted). The impacts are therefore assessed to be **negligible**.

4.2.72 Construction noise prediction results for the two shoulder hours show noise levels exceed LOAEL at RC2, RC5, RC6, RC17, RC22 and RC27 during enabling works, HDD and pipeline excavation and installation activities. These activities increase the existing ambient noise level at receptors by +5dB for both shoulder hour periods but do not exceed SOAEL. These impacts are assessed to be **minor adverse**.

4.2.73 Results for the two shoulder hours show noise levels exceed SOAEL at RC5 and RC9 during pipeline excavation and installation activities. These activities also increase the existing ambient noise level at receptors by +5dB for both shoulder hour periods. These short-term impacts are assessed to be **moderate adverse**.

4.2.74 Results for the two shoulder hours show noise levels exceed SOAEL at RC22 during HDD activities. These activities also increase the existing ambient noise level at this receptor by +5dB for both shoulder hour periods. These impacts are assessed to be **moderate adverse**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.75 The relevant predicted noise levels for evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00 but considered exceptional hours for certain works to be determined) are shown in Table 4-11 and Table 4-12. Results that exceed the daytime LOAEL (55dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (62dB $L_{Aeq,T}$) are highlighted orange.

Table 4-11: Waterbeach Pipeline construction predicted noise levels, evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00) – RC1 to RC14

Calculated free-field receptor noise level, dB $L_{Aeq,T}$

Activity	RC1	RC2	RC3	RC4	RC5	RC6	RC7	RC8	RC9	RC10	RC11	RC12	RC13	RC14
Evening baseline, dB $L_{Aeq,T}$	**46**	**48**	**48**	**48**	**48**	**46**	**46**	**46**	**46**	**48**	**48**	**48**	**48**	**56**
Saturday afternoon baseline, dB $L_{Aeq,T}$	**48**	**50**	**50**	**50**	**50**	**48**	**48**	**48**	**48**	**50**	**50**	**50**	**50**	**58**
Sunday baseline, dB $L_{Aeq,T}$	**45**	**47**	**47**	**47**	**47**	**45**	**45**	**45**	**45**	**47**	**47**	**47**	**47**	**55**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds	53	62	46											
Waterbeach Pipeline, compound	46	55	39											
Waterbeach Pipeline, HDD	55	63	59	55	65	55	59	50						
Waterbeach Pipeline, excavation of trench and installation of pipe	49	59	49	45	69	61	51	46	70	53	54	49	46	53

Table 4-12: Waterbeach Pipeline construction predicted noise levels, evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00) – RC15 to RC28

Calculated free-field receptor noise level, dB $L_{Aeq,T}$

Activity	RC15	RC16	RC17	RC18	RC19	RC20	RC21	RC22	RC23	RC24	RC25	RC26	RC27	RC28
Evening baseline, dB $L_{Aeq,T}$	**59**	**62**	**56**	**62**	**56**	**56**	**62**	**56**	**54**	**56**	**54**	**51**	**54**	**48**
Saturday afternoon baseline, dB $L_{Aeq,T}$	**59**	**64**	**53**	**64**	**53**	**58**	**64**	**53**	**52**	**58**	**52**	**51**	**52**	**50**

Calculated free-field receptor noise level, dB $L_{Aeq,T}$

Sunday baseline, dB $L_{Aeq,T}$	**57**	**61**	**56**	**61**	**56**	**55**	**61**	**56**	**55**	**55**	**55**	**50**	**55**	**47**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds														
Waterbeach Pipeline, compound														
Waterbeach Pipeline, HDD			67		48			68	56		59		65	51
Waterbeach Pipeline, excavation of trench and installation of pipe	39	53	58	44	49	43	41	66	46	35	55	28	60	42

4.2.76 Results for evenings, Saturday afternoons, and Sundays and public holidays indicate that the majority of the construction activities would not exceed LOAEL (not highlighted). The impacts are therefore assessed to be **negligible.**

4.2.77 Construction noise prediction results for evenings, Saturday afternoons, and Sundays and public holidays show noise levels are greater than LOAEL at RC2, RC3, RC6, RC7, RC17, RC23, RC25, and RC27 during enabling works, HDD and pipeline excavation, trenching and installation activities. These activities increase the existing ambient noise level at receptors by +5dB during these assessment periods but do not exceed SOAEL. These impacts are assessed to be **minor adverse.**

4.2.78 Results for evenings, Saturday afternoons, and Sundays and public holidays show noise levels are greater than SOAEL at RC5, RC9 and RC22 during pipeline excavation, trenching and installation activities. These works also increase the existing ambient noise level at receptors by +5dB during these assessment periods. These short-term impacts are assessed to be **moderate adverse**.

4.2.79 Results for evenings, Saturday afternoons, and Sundays and public holidays show noise levels are greater than SOAEL at RC2, RC5, RC17, RC22 and RC27 during HDD activities. These activities also increase the existing ambient noise level at receptors by +5dB during these assessment periods. These impacts are assessed to be **moderate adverse**.

Night-time

4.2.80 The relevant predicted noise levels for night-time (23:00 – 07:00) are shown in Table 4-13 and Table 4-14. Results that exceed the daytime LOAEL (45dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (52dB $L_{Aeq,T}$) are highlighted orange. Note that none of the works in this area will be undertaken between 23:00 and

06:00. However, the assessment is included due to the proposed work between 06:00 and 07:00 during summer core construction hours.

Table 4-13: Waterbeach Pipeline construction predicted noise levels, night-time (23:00 – 07:00) – RC1 to RC14

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC1**	**RC2**	**RC3**	**RC4**	**RC5**	**RC6**	**RC7**	**RC8**	**RC9**	**RC10**	**RC11**	**RC12**	**RC13**	**RC14**
Night-time baseline, dB $L_{Aeq,T}$	**43**	**45**	**45**	**45**	**45**	**43**	**43**	**43**	**43**	**48**	**48**	**48**	**48**	**48**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds	53	62	46											
Waterbeach Pipeline, compound	46	55	39											
Waterbeach Pipeline, HDD	55	63	59	55	65	55	59	50						
Waterbeach Pipeline, excavation of trench and installation of pipe	49	59	49	45	69	61	51	46	70	53	54	49	46	53

Table 4-14: Waterbeach Pipeline construction predicted noise levels, night-time (23:00 – 07:00) – RC15 to RC28

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Activity	**RC15**	**RC16**	**RC17**	**RC18**	**RC19**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**	**RC25**	**RC26**	**RC27**	**RC28**
Night-time baseline, dB $L_{Aeq,T}$	**58**	**59**	**56**	**59**	**56**	**53**	**59**	**56**	**54**	**53**	**54**	**51**	**54**	**48**
Waterbeach Pipeline, enabling, setup of site hoarding and compounds														
Waterbeach Pipeline, compound														
Waterbeach Pipeline, HDD			67		48			68	56		59		65	51

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$													
Waterbeach Pipeline, excavation of trench and installation of pipe	39	53	58	44	49	43	41	66	46	35	55	28	60	42

4.2.81 Enabling works, operation of the Waterbeach construction compound and excavation, trenching and installation of pipeline would not occur between 23:00 and 06:00. However, assessment is included due to the proposed works between 06:00 and 07:00 during summer core construction hours. HDD may occur at some locations on a continuous basis including during the full night-time period.

4.2.82 Results for the night-time period indicate that works exceed LOAEL and/or SOAEL at all receptors except for RC15, RC18, RC20, RC21, RC24 and RC26. Impacts where LOAEL and/or SOAEL are not exceeded at receptors are assessed to be **negligible.**

4.2.83 Enabling activities for the setup of site hoarding and compounds would exceed SOAEL during this period at RC1 and RC2 and exceed ambient noise by at least +5dB. These short-term impacts are assessed to be **moderate adverse**. Noise levels due to enabling works at RC3 exceed LOAEL but do not exceed SOAEL and their impacts are assessed to be **minor adverse.**

4.2.84 Results indicate that operation of the Waterbeach construction compound during this period would result in exceedance of SOAEL at RC2. Noise from these activities would also increase the existing ambient noise level by at least +5dB at RC2. This impact is assessed to be **moderate adverse.**

4.2.85 HDD works exceed LOAEL at RC8, RC19 and RC28. In almost all instances, noise from these works would increase the existing ambient noise level by at least +5dB at these receptors but would not exceed SOAEL. These impacts are assessed to be **minor adverse**.

4.2.86 HDD works exceed SOAEL at RC1, RC2, RC3, RC4, RC5, RC6, RC7, RC17, RC22, RC23, RC25 and RC27. These receptors include locations in areas which are subject predominantly to lower existing ambient noise levels (e.g. near Waterbeach) compared to areas near to the A14 where ambient noise levels are typically higher. Noise from these works is found to increase the existing ambient noise level by at least +5dB. These short-term impacts are assessed to be **moderate adverse**.

4.2.87 Excavation, trenching and installation of pipework activities exceed LOAEL at RC1, RC3, RC7, RC8, RC12, RC13, RC19 and RC23. In almost all instances, noise from these works would increase the existing ambient noise level by at least +5dB at these receptors but would not exceed SOAEL. These activities exceed SOAEL at RC14, RC16, RC17 and RC25 but increase the existing ambient noise level by less than +5dB due to prevailing high ambient noise levels. These impacts are assessed to be **minor adverse.**

4.2.88 Excavation, trenching and installation of pipework activities exceed SOAEL at RC2, RC5, RC6, RC9, RC10, RC11, RC22, and RC27. Noise from these works would increase the existing ambient noise level by at least +5dB at these receptors. These short-term impacts are assessed to be **moderate adverse**.

Sensitivity of receptor

4.2.89 All noise sensitive receptors assessed within the construction assessment are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during construction of the Proposed Development.

Significance of effect

Weekday daytime and Saturday mornings

4.2.90 Assessment of construction noise during these assessment periods found impacts to be negligible or minor adverse and are therefore assessed to be **not significant**.

Shoulder hours

4.2.91 Assessment of construction noise during the shoulder hours found the majority of impacts to be negligible or minor adverse and therefore assessed to be **not significant.**

4.2.92 Assessment of construction noise impacts found moderate adverse impacts at RC5 and RC9 due to pipeline excavation, trenching and installation during these assessment periods. Due to the nature of these works (construction moving in a linear fashion) construction noise will only result in moderate adverse impacts at individual receptors for a limited number of days (i.e. not more than 10 in 15 consecutive days or, more than 40 days in a 6 month period) as it moves along the route which reduces the significance. These impacts are therefore assessed to be **not significant**.

4.2.93 Assessment of construction noise impacts found moderate adverse impacts at RC22 due to HDD works during the shoulder hours assessment period. The duration for these works at this location may be up to four weeks due to the longer drill-shot and crossing requirements (e.g., for the A14 or River Cam crossings). These impacts are therefore assessed to be **significant.**

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.94 Assessment of construction noise during evenings, Saturday afternoons, and Sundays and public holidays found the majority of impacts to be negligible or minor adverse and therefore assessed to be **not significant**.

4.2.95 Assessment of construction noise impacts found moderate adverse impacts at RC5, RC9 and RC22 due to pipeline excavation, trenching and installation during these assessment periods. Due to the nature of these works (construction moving in a linear fashion) construction noise will only result in moderate adverse impacts at individual receptors for a limited number of days (i.e. not more than 10 in 15 consecutive days or, more than 40 days in a 6 month period) as it moves along the

route, which reduces the significance. These impacts are therefore assessed to be **not significant**.

4.2.96 Assessment of construction noise impacts found moderate adverse impacts at RC2, RC5, RC17, RC22 and RC27 due to HDD works during this assessment period. HDD activities at the majority of locations would require a relatively short drill-shot in each instance and the duration of these works would be less than the four weeks indicated for a longer drill-shot (e.g., for the A14 or River Cam crossings). The continuous aspect of these activities is therefore expected to occur for less than 10 days (or nights) in 15 consecutive days (or nights). This factor reduces the significance where works would not be undertaken for an extended duration. These impacts at RC2, RC5, and RC27 are therefore assessed to be **not significant.**

4.2.97 The duration for HDD activities relating to A14 and River Cam crossings that result in moderate adverse impacts at RC17 and RC22 may be up to four weeks due to the longer drill-shot and crossing requirements. These impacts are therefore assessed to be **significant.**

Night-time

4.2.98 Assessment of construction noise during the night-time assessment period found several impacts to be negligible or minor adverse and therefore assessed to be **not significant**.

4.2.99 The assessment identified moderate adverse impacts at RC1 and RC2 due to enabling works. The magnitude of impacts at these locations is largely dependent on the specific location of works, and noise levels would reduce as works move away from the receptor from the closest approach. Enabling works would be completed within a four-week period. With consideration of the duration and working area, the identified moderate adverse impact would not occur for an extended duration (i.e. not more than 10 in 15 consecutive days or, more than 40 days in a 6 month period) which reduces the significance of effect. Therefore on review of the assessed impacts and consideration of factors including the duration and type of works this impact is assessed to be **not significant.**

4.2.100 The assessment identified moderate adverse impacts at RC2 due to operation of the Waterbeach construction compound during night-time periods. The operation of the compound will include continuous activities (e.g. use of generators and to support any related continuous works). These impacts are therefore assessed to be **significant**.

4.2.101 Assessment of construction noise impacts found moderate adverse impacts at RC1, RC2, RC3, RC4, RC5, RC6, RC7, RC17, RC22, RC23, RC25 and RC27 due to HDD works during this assessment period. HDD activities at the majority of locations would require a relatively short drill-shot in each instance and the duration of these works would be less than the four weeks indicated for a longer drill-shot (e.g., for the A14 or River Cam crossings). The continuous aspect of these activities is therefore expected to occur for less than 10 days (or nights) in 15 consecutive days (or nights). This factor reduces the significance where works would not be undertaken for an

extended duration. These impacts at RC1, RC2, RC3, RC4, RC5, RC6 and RC27 are therefore assessed to be **not significant.**

4.2.102 The duration for HDD activities relating to A14 and River Cam crossings that result in moderate adverse impacts at RC7, RC17, RC22, RC23, RC25 may be up to four weeks due to the longer drill-shot and crossing requirements. These impacts are therefore assessed to be **significant.**

4.2.103 Assessment of construction noise impacts found moderate adverse impacts at RC2, RC5, RC6, RC9, RC10, RC11, RC22 and RC27 due to pipeline excavation, trenching and installation during the night-time assessment period. Due to the nature of these works (construction moving in a linear fashion) construction noise will only result in moderate adverse impacts at individual receptors for a limited number of days (i.e., not an extended duration of 10 or more days in 15 days or for 40 days in a six-month period) as it moves along the route, which reduces the significance. These impacts are therefore assessed to be **not significant.**

Recreational amenity

4.2.104 Noise due to construction activities would increase existing ambient noise levels for areas used for recreational amenity, including users of the River Cam and nearest PRoW. Users of these spaces may notice noise during construction and experience temporary disturbance (subject to the precise location of receptors and ongoing activities). These impacts are assessed to be **not significant** due to the limited and temporary exposure people would receive when moving through these areas.

Secondary mitigation or enhancement

4.2.105 Measures to minimise noise impacts during construction are required as specified in section 7.7 (Noise and vibration) of the CoCP Part A and include the application of BPM in accordance with BS 5228-1. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires application of mitigation measures to minimise noise impacts.

4.2.106 The assessment found noise levels greater than SOAEL and moderate adverse effects at RC2 due to operation of the construction compound. To minimise noise levels during operation of the compound on receptor in Waterbeach, solid site hoarding or temporary acoustic barriers will be provided. These barriers will be implemented to reduce moderate adverse impacts and noise emissions during these works. With mitigation noise levels at receptors are reduced to less than SOAEL such that moderate adverse impacts are reduced to minor adverse impacts. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires use of solid site hoarding or temporary acoustic barriers at this work site to reduce noise impacts at receptors in Waterbeach including on Capper Road and those located off Burgess Drove.

4.2.107 The assessment found noise levels greater than SOAEL and moderate adverse effects at several receptors due to HDD works which operate on a continuous basis. Solid site hoarding or temporary acoustic barriers will therefore be used to minimise noise levels during continuous HDD works. These barriers will be implemented to reduce

moderate adverse impacts and noise emissions during these works. With mitigation noise levels at receptors are reduced to less than SOAEL such that moderate adverse impacts are reduced to minor adverse impacts. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires use of solid site hoarding or temporary acoustic barriers during these activities to reduce noise impacts at nearby receptors.

Residual effect

4.2.108 Following implementation of the secondary mitigation measures described above, the residual effects due to works at the Waterbeach Pipeline are negligible or minor adverse and **not significant**.

Construction vibration

Magnitude of impact

4.2.109 Vibration impacts associated with tunnelling during construction of the waste water transfer tunnel corridor (between existing Cambridge WWTP and proposed WWTP) are considered within Section 4.2.46 (assessment of the proposed WWTP area).

4.2.110 Construction activities associated with the land required for the construction of the Waterbeach Pipeline that have the potential to generate vibration include general construction activities such as use of heavy vehicles on construction traffic routes and compaction for earthworks, excavation and pipeline. Movement of heavy vehicles would occur on construction access routes within 10m of the nearest receptors. Compaction activities would occur along the Waterbeach pipeline route within approximately 40m from receptors at the closest point.

4.2.111 Figure 4.1 provides example data for general construction activities and shows that vibration levels from movement of construction vehicles (heavy lorry on poor road surface) may exceed LOAEL but would not exceed SOAEL (1.0mm/s PPV) at the nearest sensitive receptors. These impacts are assessed to be **minor adverse**.

4.2.112 Activities including compaction (vibratory compaction and dozer activities) would not exceed LOAEL (0.3mm/s PPV) at the nearest sensitive receptors. These impacts are assessed to be **negligible**.

Sensitivity of receptor

4.2.113 All vibration sensitive receptors assessed within the construction assessment are assigned a medium sensitivity.

Significance of effect

4.2.114 Assessment of construction vibration found impacts to be negligible or minor adverse at the nearest sensitive receptors within this area of the Proposed Development and are therefore assessed to be **not significant**.

Secondary mitigation or enhancement

4.2.115 Measures to minimise vibration impacts during construction are set out within the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) and include the application of BPM in accordance with BS 5228-2.

4.2.116 It is required that building condition surveys are undertaken prior to construction works at any sensitive buildings, including historic or listed buildings that are located near works where there is potential risk vibration would exceed SOAEL (1.0mm/s PPV). This requirement is included within the CoCP Part A.

4.2.117 A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires application of BPM to minimise vibration impacts and undertaking of building condition surveys.

Residual effect

4.2.118 Following implementation of secondary mitigation measures described above, the residual effect due to these works at the Waterbeach Pipeline have been assessed to be **not significant**.

Existing Cambridge WWTP

4.2.119 This section sets out the assessment of effects in relation to activities within the existing Cambridge WWTP.

Construction noise

Magnitude of impact

4.2.120 Calculations have been completed using methodology assumptions stated in Section 2.2 and Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) at representative receptors.

4.2.121 Construction noise prediction results are provided in full in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3. Results relevant to activities and sensitive receptors within this area have been filtered to assess potential impacts.

Weekday daytime and Saturday morning

4.2.122 The relevant predicted daytime noise levels for weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) are shown in Table 4-15. There are no results that exceed the daytime LOAEL (65dB $L_{Aeq,T}$) or SOAEL (72dB $L_{Aeq,T}$).

Table 4-15: Existing Cambridge WWTP construction predicted noise levels, weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC23**
Daytime baseline, dB $L_{Aeq,T}$	**60**	**66**	**60**	**66**	**60**	**66**	**57**

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Saturday morning baseline, dB $L_{Aeq,T}$	**57**	**63**	**54**	**63**	**57**	**63**	**55**
Shaft 1 and 2 – enabling, setup of site hoarding and compounds	46	55		55	55	50	
Shaft 1 and 2 – works at Shaft 1, 2	41	51		50	50	46	
Shaft 1 and 2 – dewatering	30	40		39	40	35	
Shaft 1 and 2 – recovering of MTBM	36	45		45	45	40	
Shaft 3 – Enabling, setup of site hoarding and compounds			50				47
Shaft 3 – Excavation and construction			44				42
Shaft 3 – Tunnelling (drive from Shaft 3 to Shaft 2, and drive from Shaft 3 to Shaft 4)			46				43

4.2.123 Results for weekday daytime and Saturday morning periods indicate that none of the construction noise predictions are greater than LOAEL. Therefore, the impacts are assessed to be **negligible**.

Shoulder hours

4.2.124 The relevant predicted daytime noise levels for shoulder hours (Monday to Saturday early morning period between 07:00 – 08:00 and Monday to Friday early evening period between 18:00 – 19:00) are shown in Table 4-16. There are no results that exceed the LOAEL (60dB $L_{Aeq,T}$) or SOAEL (67dB $L_{Aeq,T}$) for these periods.

Table 4-16: Existing Cambridge WWTP construction predicted noise levels, shoulder hours (Monday to Saturday 07:00 – 08:00 and Monday to Friday 18:00 – 19:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC23**
Early morning baseline, dB $L_{Aeq,T}$	**58**	**64**	**59**	**64**	**58**	**64**	**56**
Early evening baseline, dB $L_{Aeq,T}$	**56**	**62**	**56**	**62**	**56**	**62**	**54**
Shaft 1 and 2 – enabling, setup of site hoarding and compounds	46	55		55	55	50	
Shaft 1 and 2 – works at Shaft 1,2	41	51		50	50	46	
Shaft 1 and 2 – dewatering	30	40		39	40	35	
Shaft 1 and 2 – recovering of MTBM	36	45		45	45	40	
Shaft 3 – enabling, setup of site hoarding and compounds			50				47

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$	
Shaft 3 – excavation and construction	44	42
Shaft 3 – Tunnelling (drive from Shaft 3 to Shaft 2, and drive from Shaft 3 to Shaft 4)	46	43

4.2.125 Results for the shoulder periods indicate that none of the construction noise predictions are greater than LOAEL. Impacts are assessed to be **negligible.**

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.126 The relevant predicted noise levels for evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00) are shown in Table 4-17. Results that exceed the daytime LOAEL (55dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (62dB $L_{Aeq,T}$) are highlighted orange.

Table 4-17: Existing Cambridge WWTP construction predicted noise levels, evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC23**
Evening baseline, dB $L_{Aeq,T}$	**56**	**62**	**56**	**62**	**56**	**62**	**54**
Saturday afternoon baseline, dB $L_{Aeq,T}$	**58**	**64**	**53**	**64**	**58**	**64**	**52**
Sunday baseline, dB $L_{Aeq,T}$	**55**	**61**	**56**	**61**	**55**	**61**	**55**
Shaft 1 and 2 – enabling, setup of site hoarding and compounds	46	55		55	55	50	
Shaft 1 and 2 – works at Shaft 1, 2	41	51		50	50	46	
Shaft 1 and 2 – dewatering	30	40		39	40	35	
Shaft 1 and 2 – recovering of MTBM	36	45		45	45	40	
Shaft 3 – enabling, setup of site hoarding and compounds			50				47
Shaft 3 – excavation and construction			44				42
Shaft 3 – tunnelling (drive from Shaft 3 to Shaft 2, and drive from Shaft 3 to Shaft 4)			46				43

4.2.127 Results for evenings, Saturday afternoons, and Sundays and public holiday periods indicate that none of the construction noise predictions are greater than LOAEL. Impacts are therefore assessed to be **negligible.**

Night-time

4.2.128 The relevant predicted noise levels for night-time (23:00 – 07:00) are shown in Table 4-18. Results that exceed the daytime LOAEL (45dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (52dB $L_{Aeq,T}$) are highlighted orange. Note that only

HDD and pipejacking in this area will be undertaken during night-time periods, however, the assessment of other activities is included due to the proposed work between 06:00 and 07:00 during summer core construction hours.

Table 4-18: Existing Cambridge WWTP construction predicted noise levels, night-time (23:00-07:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$						
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC23**
Night-time baseline, dB $L_{Aeq,T}$	**53**	**59**	**56**	**59**	**53**	**59**	**54**
Shaft 1 and 2 – enabling, setup of site hoarding and compounds	46	55		55	55	50	
Shaft 1 and 2 – works at Shaft 1, 2	41	51		50	50	46	
Shaft 1 and 2 – dewatering (shaft dormant while pipe-jacking)	30	40		39	40	35	
Shaft 1 and 2 – recovering of MTBM	36	45		45	45	40	
Shaft 3 – enabling, setup of site hoarding and compounds			50				47
Shaft 3 – excavation and construction			44				42
Shaft 3 – tunnelling (drive from Shaft 3 to Shaft 2, and drive from Shaft 3 to Shaft 4)			46				43

4.2.129 Results for the night-time period indicate that several activities would not result in noise levels greater than LOAEL at receptors. These impacts are assessed to be **negligible**.

4.2.130 Results for the night-time period indicate exceedances of LOAEL and SOAEL at relevant receptor locations. However, given the location of the works and relatively high existing baseline noise levels due to the proximity of receptors to the A14, the combined noise level from construction and baseline does not exceed the existing ambient noise level by +5dB at any of the receptors. Therefore, these noise impacts are assessed to be **minor adverse.**

Sensitivity of receptor

4.2.131 All noise sensitive receptors assessed within the construction assessment are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during construction of the Proposed Development.

Significance of effect

Weekday daytime and Saturday morning

4.2.132 Assessment of construction noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Shoulder hours

4.2.133 Assessment of construction noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.2.134 Assessment of construction noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Night-time

4.2.135 Assessment of construction noise impacts during the night-time assessment periods found impacts to be negligible or minor adverse and are therefore assessed to be **not significant.**

Recreational amenity

4.2.136 Noise due to construction activities would increase existing ambient noise levels for areas used for recreational amenity, including users of the River Cam and nearest PRoW. Users of these spaces may notice noise during construction and experience temporary disturbance (subject to the precise location of receptors and ongoing activities). These impacts are assessed to be **not significant** due to the limited and temporary exposure people would receive when moving through these areas.

Secondary mitigation or enhancement

4.2.137 Measures to minimise noise impacts during construction are required as specified in section 7.7 (Noise and vibration) of the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) and include the application of BPM in accordance with BS 5228-1. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires application of mitigation measures to minimise noise impacts.

Residual effect

4.2.138 Following implementation of the secondary mitigation measures described above, the residual effects due to works at the existing Cambridge WWTP are negligible or minor adverse and **not significant**.

Construction vibration

Magnitude of impact

4.2.139 Construction works within the existing Cambridge WWTP at Shafts 1, 2 and 3 have the potential to generate vibration during construction including from general construction activities. These activities include compaction for earthworks and excavation at the shaft locations, which are approximately 150m from the nearest receptors at the closest point. Figure 4.1, in this document, provides example data for general construction activities. Figure 4.1 shows that vibration levels from activities including compaction (vibratory compaction and dozer activities) would not exceed LOAEL (0.3mm/s PPV) at the nearest sensitive receptors. These impacts are assessed to be **negligible.**

4.2.140 Operation of the MTBM during construction of the waste water transfer tunnel would also generate vibration. These works include tunnelling from Shaft 3 (drive shaft) to inception Shafts 1 and 2 and also to Shaft 4. The nearest receptors to tunnel between Shafts 2 and 3 include businesses off Cowley Road to the south of the existing Cambridge WWTP at a distance of approximately 45m.

4.2.141 With reference to Sections 4.2.53 to 4.2.56 and Figure 4.2, the approach using TRL 429 soft ground empirical formulae has been used to predict vibration levels at the nearest vibration sensitive receptors to the waste water transfer tunnel route adjacent the existing Cambridge WWTP. Results are shown in Table 4-19. It is noted that the tunnel depth from ground level will vary along the transfer tunnel route but is assumed to be 20m for the purpose of assessment.

Table 4-19: Predicted vibration levels, waste water transfer tunnel

Receptor	Shortest distance from vibration source to receptor, m	Predicted PPV, mm/s
Businesses on Cowley Road (industrial/commercial)	45	0.13

4.2.142 Results show vibration levels do not exceed LOAEL at the nearest vibration sensitive receptors when tunnelling activities are at the closest approach. These impacts are therefore assessed to be **negligible.**

Sensitivity of receptor

4.2.143 All vibration sensitive receptors assessed within the construction assessment are assigned a medium sensitivity.

Significance of effect

4.2.144 Assessment of construction vibration found impacts to be negligible at the nearest sensitive receptors within this area of the Proposed Development and are therefore assessed to be **not significant**.

Secondary mitigation or enhancement

4.2.145 Measures to minimise vibration impacts during construction are set out within the CoCP Part A and include the application of BPM in accordance with BS 5228-2.

4.2.146 It is required that building condition surveys are undertaken prior to construction works at any sensitive buildings, including historic or listed buildings that are located near works where there is potential risk vibration would exceed SOAEL (1.0mm/s PPV). This requirement is included within the CoCP Part A.

4.2.147 A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2) requires application of BPM to minimise vibration impacts and undertaking of building condition surveys.

Residual effect

4.2.148 Following implementation of secondary mitigation measures described above, the residual effect due to these works in this area of the Proposed Development have been assessed to be **not significant**.

Monitoring

Construction traffic noise

4.2.149 For noise due to construction traffic, no further monitoring is required for construction of the Proposed Development.

Construction noise

4.2.150 Noise monitoring will be undertaken by the Contractor during construction as necessary to demonstrate compliance with all relevant commitments. Monitoring will be in accordance with the CoCP. This requires the development of an NVMP which will specify monitoring procedures during construction. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1 App Doc Ref 5.4.2.1) requires noise monitoring to be undertaken as necessary and development of a NVMP.

Construction vibration

4.2.151 Vibration monitoring will be undertaken by the appointed contractor(s) during construction as necessary to demonstrate compliance with all relevant commitments. Monitoring will be in accordance with the CoCP. This requires the development of an NVMP which will specify monitoring procedures during construction.

4.2.152 In addition to vibration monitoring requirements, it is required that building condition surveys are undertaken prior to construction works at any sensitive buildings, including historic or listed buildings that are located near to the waste water transfer tunnel pipeline (including Red House Close and Poplar Hall) or where there is potential risk vibration would exceed SOAEL (1.0mm/s PPV).

4.2.153 A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires vibration monitoring to be undertaken as necessary and building condition surveys.

4.3 Operation phase

Proposed WWTP

4.3.1 This section sets out the assessment of effects in relation to the proposed WWTP including the landscaping proposals, the treated effluent transfer pipelines, outfall, waste water transfer tunnel and new access connecting with the B1047 Horningsea Road.

4.3.2 All operational noise impacts are assessed to be permanent and would commence once the proposed WWTP is commissioned and fully operational.

Operational noise

Magnitude of impact

4.3.3 Calculations have been completed to determine the noise level from operation of the proposed WWTP at the nearest noise sensitive receptors. Calculations are based on operational plant noise source data provided in Appendix 17.4: Operational Noise Sources (App Doc Ref 5.4.17.4), in accordance with maximum design parameters described in Section 2.6: Maximum design envelope, and assumptions stated in Section 2.9: Assumptions and limitations.

4.3.4 Representative receptors selected for assessment are described within Table 4-20 and Table 4-21 and their locations are as shown on Figure 17.4: Operational Noise Assessment locations (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17). These receptors include the noise sensitive receptors closest to the proposed WWTP.

Table 4-20: Operational noise representative receptors

ID	Representative receptor	Description	Coordinates X, Y (BNG)
RO1	1 Biggin Abbey Cottages, Horningsea	Representative of receptors at Biggin Abbey and Biggin Abbey Cottages.	548720, 261717
RO2	The Bungalow, High Street, Horningsea	Representative of closest sensitive receptors on the southern extent of Horningsea.	549276, 262147
RO3	Gate House, Low Fen Drove, Stow-cum-Quy	Representative of Gate House and the closest receptors east of the proposed WWTP.	550457, 260941
RO4	15 Musgrave Way, Fen Ditton	Representative of the closest sensitive receptors in Fen Ditton and off the B1047 Horningsea Road south of the A14.	548845, 260710
RO5	Poplar Hall, Horningsea Road, Fen Ditton	Representative of the closest receptors west of the proposed WWTP and south of the A14.	548517, 261372
RO6	Parsonage Farm, Low Fen Drove, Stow-cum-Quy	Recently consented (Jan 2022) conversion of existing barn to residential dwelling off Low Fen Drove north of the proposed WWTP.	549828, 261569

Table 4-21: Operational noise representative receptors

ID	Representative receptor	Representative measurement location	Representative background sound level, dB $L_{A90,T}$		Existing ambient noise level, dB $L_{Aeq,T}$	
			Day	Night	Day	Night
RO1	1 Biggin Abbey Cottages, Horningsea	LT-3	52	42	61	57
RO2	The Bungalow, High Street, Horningsea	LT-4	45	38	51	47

ID	Representative receptor	Representative measurement location	Representative background sound level, dB $L_{A90,T}$		Existing ambient noise level, dB $L_{Aeq,T}$	
			Day	Night	Day	Night
RO3	Gate House, Low Fen Drove, Stow-cum-Quy	LT-2	47*	38*	54*	51*
RO4	15 Musgrave Way, Fen Ditton	LT-1	50	41	56	53
RO5	Poplar Hall, Horningsea Road, Fen Ditton	LT-5	50	40	59	55
RO6	Parsonage Farm, Low Fen Drove, Stow-cum-Quy	LT-4	45	38	51	47

** A correction has been applied to measured background noise levels to account for the difference between LT-2 measurement position and assessment location as described in Appendix 17.2: Baseline Noise Report (App Doc Ref 5.4.17.2).*

4.3.5 The predicted specific sound levels at the identified representative receptors due to the operation of the proposed WWTP are provided in Table 4-22. Figure 17.5: Operational noise results (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17) provides a noise contour map from modelling results for the area surrounding the proposed WWTP.

Table 4-22: Predicted operational noise model results

ID	Representative receptor	Specific sound level, dB $L_{Aeq,T}$	
		Day	Night
RO1	1 Biggin Abbey Cottages, Horningsea	29	29
RO2	The Bungalow, High Street, Horningsea	29	29
RO3	Gate House, Low Fen Drove, Stow-cum-Quy	34	34
RO4	15 Musgrave Way, Fen Ditton	33	33
RO5	Poplar Hall, Horningsea Road, Fen Ditton	28	28
RO6	Parsonage Farm, Low Fen Drove, Stow-cum-Quy	36	36

4.3.6 Operation of the proposed WWTP is assumed continuous during daytime and night-time periods. Therefore, no differences in noise levels are predicted between day- and night-time periods.

4.3.7 Operation of the proposed WWTP would be continuous. Noise levels at the nearest receptor locations are predicted to result in noise levels that are at least 10 dB lower than the prevailing ambient noise conditions at all of the nearest receptor locations. Noise emissions from the development would result in predominantly broad band noise (pumps and mixers) which would not be perceptible when assessed at the nearest noise sensitive receptors due to relatively high existing ambient noise conditions. Therefore, no penalty corrections for noise character have been applied to the specific sound level within assessments.

4.3.8 Assessment of noise impacts during daytime operation of the proposed WWTP has been completed in accordance with BS 4142 and is provided in Table 4-23.

Table 4-23: BS 4142 Assessment of operational noise impacts – daytime

ID	Representative receptor	Representative background sound level, dB $L_{A90,1hr}$	Specific sound level, dB $L_{Aeq,1hr}$	Rating penalty, dB	Rating level, dB	Rating level difference
RO1	1 Biggin Abbey Cottages, Horningsea	52	29	0	29	-23
RO2	The Bungalow, High Street, Horningsea	45	29	0	29	-16
RO3	Gate House, Low Fen Drove, Stow-cum-Quy	47	34	0	34	-13
RO4	15 Musgrave Way, Fen Ditton	50	33	0	33	-17
RO5	Poplar Hall, Horningsea Road, Fen Ditton	50	28	0	28	-22
R06	Parsonage Farm, Low Fen Drove, Stow-cum-Quy	45	36	0	36	-9

4.3.9 Assessment of noise impacts during night-time operation of the proposed WWTP has been completed in accordance with BS 4142 and is provided in Table 4-24.

Table 4-24: BS 4142 Assessment of operational noise impacts – night-time

ID	Representative receptor	Representative background sound level, dB $L_{A90,1hr}$	Specific sound level, dB $L_{Aeq,1hr}$	Rating penalty, dB	Rating level, dB	Rating level difference
RO1	1 Biggin Abbey Cottages, Horningsea	42	29	0	29	-13
RO2	The Bungalow, High Street, Horningsea	38	29	0	29	-9
RO3	Gate House, Low Fen Drove, Stow-cum-Quy	38	34	0	34	-4
RO4	15 Musgrave Way, Fen Ditton	41	33	0	33	-8
RO5	Poplar Hall, Horningsea Road, Fen Ditton	40	28	0	28	-12

ID	Representative receptor	Representative background sound level, dB $L_{A90,1hr}$	Specific sound level, dB $L_{Aeq,1hr}$	Rating penalty, dB	Rating level, dB	Rating level difference
RO6	Parsonage Farm, Low Fen Drove, Stow-cum-Quy	38	36	0	36	-2

4.3.10 The BS 4142 assessment of day and night-time noise impacts shows that the rating level from operation of the proposed WWTP does not exceed the representative background noise level at any of the identified representative receptor locations. This is an indication that noise impact from the proposed WWTP would be low in accordance with BS 4142 and is assessed as **negligible.**

4.3.11 The existing noise environment for the noise sensitive receptors closest to the proposed WWTP is primarily affected by road traffic noise from the A14. The noise character for these receptors would not be affected by noise from the Proposed Development. Consideration of the context of the Proposed Development does not affect the magnitude of negligible noise impacts assessed at representative receptor locations.

4.3.12 Figure 17.5 Operational noise results (Book of Figures – Noise & Vibration, App Doc Ref 5.3.17) shows that predicted noise levels due to operation of the proposed WWTP in the immediate surrounding areas that include external and recreational uses (e.g., gardens, open areas and PRoW) are less than 45dB $L_{Aeq,T}$. This is below the WHO and BS 8233 guidance values for external areas (50 dB $L_{Aeq,16hr}$ – 55dB $L_{Aeq,16hr}$). Accordingly, noise impacts from operation of the Proposed WWTP would not materially increase existing ambient noise levels in these external spaces and are assessed to be **negligible.**

4.3.13 Similarly, noise impacts from the operation of the Proposed Development on users of the closest PRoW (85/14) are assessed to be negligible. Users of PRoW may notice noise from the plant and experience small increases in noise levels for short periods (subject to precise location of receptors and time of day), however, impacts are assessed to be **negligible** due to the limited and temporary exposure people would receive when moving through these areas.

Sensitivity of receptor

4.3.14 All noise sensitive receptors assessed within the operational assessment are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during operation of the Proposed Development.

Significance of effect

4.3.15 The assessment indicates that noise impact due to operation of the site at the nearest noise sensitive receptors would be negligible. The resulting noise effects are therefore assessed to be **not significant.**

4.3.16 Noise impacts for users of recreation areas and PRoW would be negligible. The resulting noise effects are therefore assessed to be **not significant.**

Secondary mitigation or enhancement

4.3.17 There are no secondary mitigation measures relevant to operational noise impacts and the effect remains as **negligible** and is **not significant**.

Residual effect

4.3.18 On the basis that no secondary mitigation or enhancement measures are proposed, the residual effect due to operational noise remains **negligible** and **not significant**.

Operational traffic

Magnitude of impact

4.3.19 Once operational, the proposed WWTP would be accessed from junction 34 of the A14 and the permanent access road directly into the proposed WWTP immediately to the south of the B1047 Horningsea Road/Low Fen Drove Way/Biggin Lane junction.

4.3.20 Approximately 92 cars/vans and 146 HGVs would access the proposed WWTP on a daily basis once operational (future scenario considering full capacity) as described within Chapter 2: Project description.

4.3.21 Table 4-25 summarises calculated changes in BNL due to operational traffic in accordance with the 'scoping stage' level of assessment described in DMBR LA111.

Table 4-25: Operational traffic noise

Road link	Without scheme BNL, dB(A) $L_{A10,18hr}$	With scheme BNL, dB(A) $L_{A10,18hr}$	BNL difference, dB	Assessment
A14	83.2	83.2	0.0	Negligible
A14 J34 Slip Road	75.7	75.9	+0.2	Negligible
B1047 Horningsea Road	66.0	66.8	+0.8	Negligible

4.3.22 The relative increase in vehicle movements via the A14 to access the proposed WWTP is very small due to the volume of existing traffic on these routes. Noise impacts due to the increase in traffic with addition of operational traffic at surrounding noise sensitive receptors would therefore also be very limited.

4.3.23 Similarly, the relative increase in volume of traffic using Horningsea Road is limited and would result in an increase of 0.8dB BNL. Resultant noise levels at the closest receptors to the B1047 Horningsea Road (Biggin Abbey Hall Cottages) are primarily affected by prevailing road traffic noise from the A14. Overall noise level increases at the closest receptors.

4.3.24 The calculated changes in the BNL for operational traffic routes to the proposed WWTP are assessed to have **negligible adverse** impacts at sensitive receptors adjacent these routes.

Sensitivity of receptor

4.3.25 All noise sensitive receptors assessed within the operational assessment are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during operation of the Proposed Development.

Significance of effect

4.3.26 The assessment indicates that noise impact due to operational traffic noise at the nearest noise sensitive receptors would be negligible. The resulting noise effects are therefore assessed to be **not significant.**

Secondary mitigation or enhancement

4.3.27 There are no secondary mitigation measures relevant to operational noise impacts and the effect remains as **negligible** and is **not significant**.

Residual effect

4.3.28 On the basis that no secondary mitigation or enhancement measures are proposed, the residual effect due to operational traffic noise remains **negligible** and **not significant**.

Monitoring

4.3.29 During the operational phase, monitoring of operational noise will be a requirement of the permit issued by the Environment Agency. The monitoring parameters, duration, frequency and reporting will be specified in accordance with the permitting requirements.

Monitoring data will be used by the regulator where required to determine compliance with the operating permit and in instances where permits are varied.

4.4 Decommissioning

4.4.1 This section sets out the assessment of effects in relation to the decommissioning activities completed to surrender the environmental permit at the existing Cambridge WWTP and decommissioning the redundant section of the Waterbeach pipeline. Demolition activities and intrusive works to decommission the existing Cambridge WWTP are considered within the cumulative assessment. Decommissioning of the existing Waterbeach WRC is considered within the cumulative assessment.

4.4.2 All noise and vibration impacts relating to decommissioning would be temporary and occur during the decommissioning phase only.

Decommissioning noise

Magnitude of impact

4.4.3 Calculations have been completed using methodology assumptions stated in Section 2.2: Assessment methodology and Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3) at representative receptors.

4.4.4 Decommissioning noise prediction results are provided in full in Appendix 17.3: Construction Noise Assessment (App Doc Ref 5.4.17.3). Results relevant to activities and sensitive receptors within this area have been filtered to assess potential impacts.

Weekday daytime and Saturday morning

4.4.5 The relevant predicted daytime noise levels for weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00) are shown in Table 4-26. There are no results that exceed the daytime LOAEL (65dB $L_{Aeq,T}$) or SOAEL (72dB $L_{Aeq,T}$).

Table 4-26: Decommissioning existing Cambridge WWTP predicted noise levels, weekday daytime (08:00 – 18:00) and Saturday morning (08:00 – 13:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**
Daytime baseline, dB $L_{Aeq,T}$	**60**	**66**	**60**	**66**	**60**	**66**	**60**	**57**	**60**
Saturday morning baseline, dB $L_{Aeq,T}$	**57**	**63**	**54**	**63**	**57**	**63**	**54**	**55**	**57**
Decommissioning activities	56	48	48	59	58	59	39	45	42

4.4.6 Results for weekday daytime and Saturday morning periods indicate that none of the decommissioning noise predictions are greater than LOAEL and therefore impacts are assessed to be **negligible**.

Shoulder hours

4.4.7 The relevant predicted daytime noise levels for shoulder hours (Monday to Saturday early morning period between 07:00 – 08:00 and Monday to Friday early evening period between 18:00 – 19:00) are shown in Table 4-27. There are no results that exceed the LOAEL (60dB $L_{Aeq,T}$) or SOAEL (67dB $L_{Aeq,T}$).

Table 4-27: Decommissioning existing Cambridge WWTP predicted noise levels, shoulder hours (Monday to Saturday 07:00 – 08:00 and Monday to Friday 18:00 – 19:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Early morning baseline, dB $L_{Aeq,T}$	**58**	**64**	**59**	**64**	**58**	**64**	**59**	**56**	**58**
Evening baseline, dB $L_{Aeq,T}$	**56**	**62**	**56**	**62**	**56**	**62**	**56**	**54**	**56**
Decommissioning activities	56	48	48	59	58	59	39	45	42

4.4.8 Results for shoulder periods indicate that none of the decommissioning noise predictions are greater than LOAEL and therefore impacts are assessed to be **negligible**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.4.9 The relevant predicted noise levels for evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00 but considered exceptional hours for certain works to be determined) are shown in Table 4-28. Results that exceed the daytime LOAEL (55dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (62dB $L_{Aeq,T}$) are highlighted orange.

Table 4-28: Decommissioning existing Cambridge WWTP predicted noise levels, evenings (19:00 – 22:00), Saturday afternoons (14:00 – 22:00), and Sundays and public holidays (07:00 – 21:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**
Evening baseline, dB $L_{Aeq,T}$	**56**	**62**	**56**	**62**	**56**	**62**	**56**	**54**	**56**
Saturday afternoon baseline, dB $L_{Aeq,T}$	**55**	**61**	**56**	**61**	**55**	**61**	**56**	**55**	**55**
Sunday baseline, dB $L_{Aeq,T}$	**55**	**61**	**56**	**61**	**55**	**61**	**56**	**55**	**55**
Decommissioning activities	56	48	48	59	58	59	39	45	42

4.4.10 Results for these assessment time periods indicate that noise predictions at RC16, RC17, RC22, RC23 and RC24 do not exceed LOAEL and therefore impacts are assessed to be **negligible.**

4.4.11 Results for these assessment periods indicate exceedances of LOAEL (highlighted blue) due to decommissioning at RC14, RC18, RC20 and RC21. None of these impacts increase the existing ambient noise level by +5dB. These impacts are therefore assessed to be **minor adverse.**

Night-time

4.4.12 The relevant predicted noise levels for night-time (23:00 – 07:00) are shown in Table 4-29. Results that exceed the daytime LOAEL (45dB $L_{Aeq,T}$) have been highlighted blue and those that exceed SOAEL (52dB $L_{Aeq,T}$) are highlighted orange. Note that no work is scheduled to be undertaken between 23:00 and 06:00. However, the full assessment is included due to the proposed work between 06:00 and 07:00 during summer core construction hours.

Table 4-29: Decommissioning existing Cambridge WWTP predicted noise levels, night-time (23:00-07:00)

	Calculated free-field receptor noise level, dB $L_{Aeq,T}$								
Activity	**RC14**	**RC16**	**RC17**	**RC18**	**RC20**	**RC21**	**RC22**	**RC23**	**RC24**
Night-time baseline, dB $L_{Aeq,T}$	**53**	**59**	**56**	**59**	**53**	**59**	**56**	**54**	**53**
Decommissioning activities	56	48	48	59	58	59	39	45	42

4.4.13 Results for the night-time assessment time period indicate that noise predictions at RC22, RC23 and RC24 do not exceed LOAEL and therefore impacts are assessed to be **negligible.**

4.4.14 Results during the night-time period indicate exceedances of LOAEL (highlighted blue) due to decommissioning activities at RC16 and RC17. None of these impacts increase the existing ambient noise level by +5dB. These impacts are assessed to be **minor adverse.**

4.4.15 Results for the night-time assessment period show exceedances of SOAEL at RC14, RC18, RC20 and RC21. However, given the location of the works and relatively high existing baseline noise levels, the combined noise level from construction and baseline does not exceed the existing ambient noise level by 5dB at any of the receptors except RC20 and impacts are therefore assessed as **minor adverse.**

4.4.16 The SOAEL exceedance at RC20 would increase ambient noise levels by +5dB or more. This impact is assessed to be **moderate adverse.**

4.4.17 Decommissioning works in this area will not be undertaken between 23:00 and 06:00. However, this assessment is included due to the proposed work between 06:00 and 07:00 during summer core construction hours.

Sensitivity of receptor

4.4.18 All noise sensitive receptors assessed within the assessment of impacts due to decommissioning are assigned a medium sensitivity. Assessment locations are selected to be representative of receptors most likely to be affected during decommissioning works.

Significance of effect

Weekday daytime and Saturday morning

4.4.19 Assessment of decommissioning noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Shoulder hours

4.4.20 Assessment of decommissioning noise during these assessment periods found impacts to be negligible and are therefore assessed to be **not significant**.

Evenings, Saturday afternoons, and Sundays and public holidays

4.4.21 Assessment of decommissioning noise during these assessment periods found impacts to be negligible or minor adverse and are therefore assessed to be **not significant**.

Night-time

4.4.22 Assessment of decommissioning noise during these the night-time assessment periods found impacts to be negligible or minor adverse at the majority of receptors and are therefore assessed to be **not significant**.

4.4.23 Moderate adverse impacts were found to occur at RC20. With consideration of the type and duration of decommissioning activities in the area, the duration of moderate adverse impacts is expected to occur for a relatively limited period (i.e., a few days at a time but would not exceed 10 in 15 consecutive days, or 40 days in a 6 month period), which reduces the significance of effects. These impacts are therefore assessed to be **not significant.**

Secondary mitigation or enhancement

4.4.24 All embedded mitigation is described in Table 2-13. No further mitigation is required.

4.4.25 Measures to minimise noise impacts during construction and decommissioning are required as specified in section 7.7 (Noise and vibration) of the CoCP Part A and include the application of BPM in accordance with BS 5228-1. A requirement in Schedule 2 of the DCO to implement the CoCP (Appendix 2.1, App Doc Ref 5.4.2.1) requires application of mitigation measures to minimise noise impacts.

Residual effect

4.4.26 Following implementation of the secondary mitigation measures described above, the residual effects due to decommissioning works are negligible or minor adverse and **not significant**.

Monitoring

4.4.27 For noise from decommissioning activities no monitoring is required for the Proposed Development.

4.5 Cumulative effects

4.5.1 Cumulative effects are those arising from impacts of the Proposed Development in combination with impacts of other proposed or consented development projects that are not yet built or operational. An assessment of cumulative effects for noise and vibration has been completed and is reported in Chapter 22: Cumulative Effects assessment.

4.5.2 The residual cumulative effects for noise and vibration are summarised below:

- The increase in construction traffic for the Proposed Development with other committed developments may result in temporary increase in noise levels, however, would not be of a magnitude that would result in significant adverse cumulative effects.
- The greatest cumulative impacts due to construction and decommissioning noise and vibration would occur during the worst case scenario assuming concurrent construction activities between the Proposed Development and relevant committed developments. Given the duration of works in most areas through Waterbeach, significant cumulative effects are however unlikely. Other committed developments including the Cambridge North Residential Quarter and CEAAP area on the south side of the A14 are too distant from the Proposed Development to result in noise impacts that would result in a cumulative effect on receptors. Cumulative construction and decommissioning noise and vibration impacts would not result in significant adverse effects.
- There is no spatial overlap within 300m of the operational WWTP of committed developments with the exception of CEAAP. Taking into account the distance to noise sensitive receptors, presence of the A14 as the dominant source of noise and the low level of noise related with operation of the proposed WWTP there are no cumulative effects for noise associated with the Proposed Development. Operational vibration from the Proposed Development is scoped out from assessment. Therefore, there are no resulting from operational vibration. Cumulative operational noise and vibration impacts would not result in significant adverse effects.
- Cumulative impacts are inherently included within the assessment of operational traffic noise. Cumulative operational traffic noise would therefore not result in significant adverse effects.

4.6 Inter-related effects

4.6.1 Inter-relationships are the impacts and associated effects of different aspects of the construction and operation of the Proposed Development and the decommissioning of the existing Cambridge WWTP on the same receptor. The assessment of inter-related effects has been completed and is reported in Chapter 21: Cumulative effects assessment.

4.6.2 The following summarises the inter-related effects identified for noise and vibration.

Operational noise

4.6.3 There are no noise impacts due to operation of the Proposed Development associated with the Waterbeach pipeline or existing Cambridge WWTP. Impacts associated with the proposed WWTP therefore do not result in inter-related noise and vibration effects when considering other zones or areas.

Construction noise and vibration

4.6.4 In general, the noise and vibration impact assessment considers that the construction activities would be undertaken sequentially (e.g., as assessed activities would progress consecutively for construction of waste water transfer tunnel compounds, shafts and tunnelling) or would be grouped during peak activity (e.g., works within the proposed WWTP). Due to the large area that construction works would be undertaken and separation of activities, noise impacts at each individual receptor are also in general independent from the next nearest construction activity. On this basis, combined noise impacts due to activities which may occur simultaneously throughout the construction programme would not result in new or different significant effects.

4.6.5 The distance from vibration sources that would result in adverse effects is very limited. Vibration impact assessment results would not be affected by combining all zones.

4.6.6 The combination of construction noise impacts from all zones is most sensitive to additional adverse impacts in the area between the waste water transfer tunnel and the existing Cambridge WWTP. The combination of Waterbeach pipeline HDD and tunnelling works at receptors in Fen Ditton (RC17 Northern Bridge Farm, RC22 Red House Close, RC19 Poplar Hall) may increase noise levels during relevant assessment time periods. The most sensitive receptor location to combined impacts is Red House Close due to these activities (HDD and Shaft 4 construction). The increase in noise levels due to combined activities between zones at RC22 Red House Close would result in new exceedances of LOAEL during shoulder periods, evenings and weekends, however, would not exceed SOAEL and would not result in new significant adverse effects. Combined impacts would not change during night-time periods due to restriction of core working hours at Shaft 4 to exclude night-time works.

4.6.7 Mitigation measures, including provision of solid site hoarding/acoustic barriers around and the restriction of working hours, would also assist to minimise noise impacts and prevent significant adverse effects due to inter-related effects of combined zones.

5 Conclusion and Summary

5.1.1 This assessment of the effects, and their significance, of the Proposed Development as it applies to noise and vibration has been thoroughly carried out based on the information currently available.

5.1.2 The approach to assessment has applied BS 5228, BS4142 and DMRB LA111 guidance, and national and local policy.

5.1.3 National and local planning policy aims include the requirement for developers to avoid significant adverse effects on health and quality of life, mitigate and minimise adverse impacts and where possible contribute to the improvement of health and quality of life within the context of sustainable development. In accordance with these policies, including the NPS for Waste Water and the NPSE, the proposed WWTP location and design aims to avoid significant adverse effects and minimise adverse noise and vibration impacts. Appropriate mitigation design through operation and construction of the Proposed Development has been included within proposals also to avoid significant adverse effects and minimise adverse noise impacts at the nearest noise sensitive receptors.

Construction

5.1.4 The effects of the Proposed Development on noise and vibration sensitive receptors during construction would vary from negligible to moderate adverse prior to mitigation, which would be significant in the case of moderate adverse effects.

5.1.5 During construction there will be a requirement for mitigation measures to be implemented through the application of management plans as specified by the CoCP Part A and B (Appendix 2.1 & 2.2, App Doc Ref 5.4.2.1 & 5.4.2.2). In addition to the requirements of the CoCP there will also be a requirement to avoid, minimise and control noise and vibration impacts through implementation of the Decommissioning Management Plan, CTMP and CLP.

5.1.6 In construction there will be controls on vehicle movements so that no construction traffic will be permitted to travel through Horningsea or Fen Ditton.

5.1.7 Solid site hoarding/acoustic barriers will be used to minimise noise levels around construction working areas at Shaft 4, the Waterside Pipeline construction compound and continuous HDD works.

5.1.8 Restriction of working hours will be used to avoid sensitive times of the day and adverse impacts for works at Shaft 4 and the final effluent outfall.

5.1.9 The CoCP also requires implementation of mitigation measures including the application BPM in accordance with the CoPA and BS 5228.

5.1.10 These measures will avoid impacts / reduce the magnitude of impacts. Potential impacts arising from the construction phase would be expected to be localised and short term. Taking into account the application of mitigation measures the likely

significance of effects would be negligible to minor adverse during the construction phase and not significant.

Operation

5.1.11 The effects of the Proposed Development on noise sensitive receptors during operation would be negligible prior to mitigation, and would not be significant.

5.1.12 The potential impacts in operation due to noise from operation of the proposed WWTP and associated changes in road traffic are negligible. These impacts would be localised and slight. Overall, the significance of effects would be negligible to minor adverse for the operational phase, and not significant.

5.1.13 Environmental compliance during the operational phase will be monitored under the Environmental Permit. The permit also requires the operator to have a written Environmental Management System (EMS), which includes a set of plans and procedures describing measures to avoid, reduce and eliminate potential environmental impacts associated with the activities covered by the permit

5.1.14 Overall, the significance of effects would be negligible for the operation of the Proposed Development and are not significant.

Decommissioning

5.1.15 The potential short-term impacts as a result of decommissioning the existing Cambridge WWTP for the purpose of rescinding the existing Environmental Permit would be negligible or minor adverse and would be not significant.

5.1.16 The decommissioning activities would be subject to a Decommissioning Management Plan which would be agreed with the Environment Agency.

5.1.17 A summary of potential environmental effects, mitigation and monitoring is provided in Table 5-1. Table 5-2 sets out how mitigation would be secured.

Table 5-1: Summary of noise and vibration effects

Description of impact	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
Construction							
Noise from heavy vehicles on construction traffic routes	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP and CTMP.	Not significant	None
Construction noise. Proposed WWTP: weekday daytime and Saturday morning	Relocation of Shaft 4 to increase distance to work site from nearest sensitive receptors	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction noise. Proposed WWTP: shoulder hours	Relocation of Shaft 4 to increase distance to work site from nearest sensitive receptors	Minor adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction noise. Proposed WWTP: evenings, Saturday afternoons, and Sundays and public holidays	Relocation of Shaft 4 to increase distance to work site from nearest sensitive receptors	Moderate adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction noise. Proposed WWTP: night-time	Relocation of Shaft 4 to increase distance to work site from nearest sensitive receptors	Moderate adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers. Restriction of working hours at Shaft 4 and the Outfall during core hours to not start before 07:00.	Not significant	Construction noise monitoring
Construction vibration. Proposed WWTP	Relocation of Shaft 4 to increase distance to work site from nearest sensitive receptors	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction vibration monitoring. Building condition/ settlement surveys.
Construction noise. Waterbeach Pipeline:	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring

Description of impact	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
weekday daytime and Saturday morning					Use of solid site hoarding/temporary acoustic barriers.		
Construction noise. Waterbeach Pipeline: shoulder hours	None	Moderate adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction noise. Waterbeach Pipeline: evenings, Saturday afternoons, and Sundays and public holidays	None	Moderate adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction noise. Waterbeach Pipeline: night-time	None	Moderate adverse	Medium	Significant adverse	Measures are set out within the CoCP. BPM. Use of solid site hoarding/temporary acoustic barriers.	Not significant	Construction noise monitoring
Construction vibration. Waterbeach Pipeline	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction vibration monitoring. Building condition/ settlement surveys.
Construction noise. Existing Cambridge WWTP: weekday daytime and Saturday morning	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Construction noise. Existing Cambridge WWTP: shoulder hours	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Construction noise. Existing Cambridge WWTP: evenings, Saturday afternoons, and	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring

Description of impact	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
Sundays and public holidays							
Construction noise. Existing Cambridge WWTP: night-time	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Construction vibration. Existing Cambridge WWTP	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction vibration monitoring. Building condition/ settlement surveys.
Operation							
Operational noise	Mitigation by design including location, layout and plant/equipment selections. Use of Earth Bank and enclosures to minimise noise emissions.	Negligible	Medium	Not significant	None	Not significant	Monitoring within the requirements of the permit
Operational traffic	None	Negligible	Medium	Not significant	None	Not significant	None
Decommissioning noise. Existing Cambridge WWTP: weekday daytime and Saturday morning	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Decommissioning noise. Existing Cambridge WWTP: shoulder hours	None	Negligible	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Decommissioning noise. Existing Cambridge WWTP: evenings, Saturday afternoons, and Sundays and public holidays	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring
Decommissioning noise. Existing Cambridge	None	Minor adverse	Medium	Not significant	Measures are set out within the CoCP. BPM.	Not significant	Construction noise monitoring

Description of impact	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
WWTP: night-time							

5.2 Securing mitigation

5.2.1 The delivery of mitigation will be controlled through the Development Consent Order (DCO) which:

- identifies parameters within which certain works activities will be located and constructed (e.g. maximum and minimum building dimensions (including below ground), or locational zones);
- sets requirements for construction, operation and maintenance of the Proposed Development to be undertaken in accordance with 'control plans / documents' (including those that are related to compliance with environmental permits); and
- sets requirements for the control of specific issues or works (e.g. time limits around the completion of the outfall construction).

5.2.2 Table 5-2 summarises all mitigation in relation to noise and vibration, how these measures are secured, the party responsible for the implementation of the measure, when the measure would be delivered and any mechanisms to deliver the measure.

Table 5-2: Noise and vibration mitigation summary

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
Construction							
Construction noise	Negligible and minor adverse	Relocation of Shaft 4 to increase distance to work site from the nearest noise sensitive receptors.	Embedded (primary)	Schedule 1	Appointed contractor(s)	Prior to start of construction of Shaft 4	Approved design and construction method statement
Construction noise impacts from the works at Shaft 4 and the Outfall.	Negligible and minor adverse	Application of BPM in accordance within BS 5228 and the Control of Pollution Act 1974 and the Environmental Protection Act 1990. Measures are set out within the CoCP, Part A and B (Appendix 2.1 & 2.2, App Doc Ref 5.4.2.1 & 5.4.2.2). Restriction of working hours to avoid sensitive time periods for works at Shaft 4 and the Outfall. Use of solid site hoarding/temporary acoustic barriers at Shaft 4, Waterbeach construction compound and around HDD pit locations/HDD plant during continuous working periods.	Additional / Secondary	Sections 7.7, CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) secured through a requirement of the draft DCO (App Doc Ref 2.1). Approval and implementation of a Construction Environmental Management Plan secured through a requirement of the draft DCO (App Doc Ref 2.1). Approval and implementation of a Noise & Vibration Management Plan (NVMP) secured through a requirement of the draft DCO (App Doc Ref 2.1).	Appointed contractor(s)	Prior to start of construction	An approved Phasing Plan. An approved CEMP prior to the commencement of the enabling phase. An approved Noise and Vibration Management Plan prior to the commencement of the enabling phase.
Construction vibration during works at the Waterbeach pipeline, Transfer tunnel and Final effluent pipeline	Negligible and minor adverse	Application of BPM in accordance within BS 5228 and the Control of Pollution Act 1974 and the Environmental Protection Act 1990. Measures are set out within the CoCP, Part A and B (Appendix 2.1 & 2.2, App Doc Ref 5.4.2.1 & 5.4.2.2).	Additional / Secondary	Requirement within Schedule 2 to implement the CoCP and develop a detailed Noise and Vibration Management Plan Sections 7.7, CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) secured through a requirement of	Appointed contractor(s)	Prior to start of construction	An approved Phasing Plan. An approved CEMP prior to the commencement of the enabling phase. An approved Noise and Vibration Management Plan prior to the

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
		Use of low vibration sources of equipment.		the draft DCO (App Doc Ref 2.1). Approval and implementation of a Construction Environmental Management Plan secured through a requirement of the draft DCO (App Doc Ref 2.1). Approval and implementation of a NVMP secured through a requirement of the draft DCO (App Doc Ref 2.1).			commencement of the enabling phase.
Noise from heavy vehicles on construction traffic routes	Negligible and minor adverse	Application of BPM in accordance within BS 5228 and the Control of Pollution Act 1974 and the Environmental Protection Act 1990. Measures are set out within the CoCP, Part A and B (Appendix 2.1 & 2.2, App Doc Ref 5.4.2.1 & 5.4.2.2). Implementation of the Construction Traffic Management Plan (Appendix 19.7, App Doc Ref 5.4.19.7). Restriction of working hours to avoid sensitive time periods and the use of solid sit hoarding/temporary acoustic barriers when required.	Additional / Secondary	Sections 7.7, CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) secured through a requirement of the draft DCO (App Doc Ref 2.1). Approval and implementation of a Construction Environmental Management Plan secured through a requirement of the draft DCO (App Doc Ref 2.1). Construction Traffic Management Plan (Appendix 19.7, App Doc Ref 5.4.19.7), secured through a requirement of	Appointed contractor(s)	Prior to start of construction	An approved Phasing Plan. An approved CEMP prior to the commencement of the enabling phase. An approved CTMP prior to commencement of the enabling phase. An approved Noise and Vibration Management Plan prior to the commencement of the enabling phase.

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
				the draft DCO (App Doc Ref 2.1) Approval and implementation of a NVMP secured through a requirement of the draft DCO (App Doc Ref 2.1).			
Operation							
Operational noise	Negligible	Mitigation through design (location, layout, landscaping and Earth Bank, plant and equipment selections, enclosures and additional attenuation).	Embedded (primary)	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to commencement of construction	Approved detailed design
Operational noise	Negligible	Operational noise management plan/noise management procedures within Environmental Management System (EMS)	Embedded (tertiary)	The Environmental Permit will include conditions requiring management systems to cover emergency responses and pollution prevention.	The Applicant	Prior to commencement of operation	Preparation of an operational monitoring programme as part of the written EMS to cover periodic monitoring activities to accord with the requirements of the Environmental Permit.

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Get in touch

You can contact us by:


Emailing at **info@cwwtpr.com**


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