1MC04 Main Works - Contract Lot S2

Noise and Vibration Management Plan - Waste Transfer and Treat Station - Ruislip Southern Sustainable Placement S2

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Contents

1 Definitions and abbreviations

1.1.1 The tables below outline abbreviations and technical terms used within this management plan.

1.1 Abbreviations

Table 1 - Abbreviations

Abbreviation	Definition
BPM	Best practicable means
CoCP	Code of Construction Practice
EMRs	Environmental Minimum Requirements
EMS	Environmental Management System
ES	Environmental Statement
EWC	Early Works Contract
GPCN	General Principle Compliance Notes
HORACE	HS2 Online Reporting, Assurance, COSHH and Environment Reporting System
HS2	High Speed 2 Ltd
ITT	Invitation to Tender
LA	Local authority
LBH	London Borough of Hillingdon
LEMP	Local Environmental Management Plan
MWCC	Main Works Construction Contract
NVMP	Noise and Vibration Management Plan
PQQ	Pre-qualification Questionnaire
RAMS	Risk Assessment Method Statements
RSSP-WTS	Ruislip Southern Sustainable Placement - Waste Transfer Station
SCSJV	Skanska Costain Strabag Joint Venture
SSECP	Site Specific Environmental Control Plan

1.2 Technical Definitions

Table 2 - Technical Definitions

Term	Definition
Noise	Is defined as unwanted sound and will generally radiate in all directions from a construction noise source and will find its way (curve) around and over walls, buildings, and fencing. Sound waves will also deflect from solid surfaces like walls. Noise causes more complaints than any other environmental topic and can result in working hours being restricted, community relations ruined, a notice to stop work being served or possibly a prosecution or fine.
Section 60	A Section 60 is an abatement or improvement notice that is served by the Local Authority on the person responsible for the noise requiring specific controls to be put into place to minimise noise and vibration.
Sound	Any pressure variation (in air, water or other medium) that the human ear can detect.
Vibration	Is oscillation of a body around its point of rest and is therefore measured in terms of acceleration (m/s2). Vibration levels that may result in building damage can be expressed in terms of the Peak Particle Velocity (PPV), which is the maximum velocity measured over the measurement period. Where the effect of vibration on humans is assessed, and the source of vibration is of an intermittent nature, vibration levels may be expressed in terms of the Vibration Dose Value (VDV).

2 Introduction

2.1 Background

2.1.1 Phase One of HS2 will provide dedicated high speed rail services between London, Birmingham, and the West Midlands. It will extend for approximately 230km (143 miles). Just north of Lichfield, high speed trains will join the West Coast Main Line for journeys to and from Manchester, the North West and Scotland.

2.1.2 Phase One of HS2 is the first phase of a new high speed railway network proposed by the Government to connect major cities in Britain. It will bring significant benefits for inter-urban rail travellers through increased capacity and improved connectivity between London, the Midlands, and the North. It will release capacity on the existing rail network between London, Birmingham and the West Midlands and so provide opportunities to improve existing commuter, regional passenger, and freight services.

2.1.3 HS2 Ltd has developed an integrated design approach that uses excavated material to satisfy the engineering and environmental mitigation earthworks material requirements to reduce the need for imported materials and reduce the amount of excavated material requiring offsite disposal.

2.1.4 As part of the approach to the management of excavated materials, the Waste Transfer and Treat Station – Ruislip Southern Sustainable Placement (RSSP-WTS) will be used as a waste transfer station, operated by Skanska Costain STRABAG Joint Venture (SCSJV).

2.1.5 In line with current waste legislation, the handling of excavated material at the site will need to be undertaken in line with the Environmental Permitting (England and Wales) Regulations 2016. In accordance with the HS2 guidance the screening process for the proposed waste facility at RSSP-WTS has identified the need for a Bespoke Permit application.

2.2 Purpose

2.2.1 The environmental permit application comprises a suite of supporting documentation of which this Noise and Vibration Management Plan (NVMP) is a part as required by the Environment Agency. The NVMP provides a summary of the site-specific Noise Impact Assessment undertaken for the site (included in Appendix B) and details how the operator (Skanska Costain STRABAG Joint Venture (SCSJV)) and its supply chain will manage potential noise and vibration impacts from the operation of the RSSP-WTS facility and how this will be managed in accordance with relevant legislation, regulations and HS2 Project Requirements Specification for Phase One.

2.2.2 The NVMP defines how SCSJV intend to:

- Comply with relevant legislation, regulation (EPR Regulations) and HS2 Company

Standards;

- Comply with permits/consents/licences or obligations related to the work;
- Record how all significant environmental aspects and impacts will be dealt with;
- Compliance with the undertakings and assurances detailed in the register;
- Achieve a high level of environmental performance; and
- Detail how environmental performance will be monitored and reviewed.

2.2.3 The NVMP outlines the responsibilities assigned to SCSJV that specifically relate to noise and vibration. It shall also act as an assurance document for the Client, providing detail in response to how SCSJV intend to manage these responsibilities on behalf of the Client.

2.2.4 The NVMP is a live document and will be reviewed and updated every six months or when deemed necessary.

2.2.5 This document will be kept on site along with the other suite of permit documents.

2.3 Associated Documents

2.3.0 This report should be read in conjunction with the following documents:

- Environmental Permit Application Forms (1MC04-SCJ_SDH-EV-FRM-SS05_SL07-000011);
- Non-technical summary (1MC04-SCJ_SDH-EV-NOT-SS05_SL07-000008);
- Site Condition Report (1MC04-SCJ_SDH-EV-REP-SS05_SL07-000009);
- Site Operating Plan (1MC04-SCJ_SDH-EV-PLN-SS05_SL07-000016);
- Management Systems and Procedures (1MC04-SCJ_SDH-EV-PRO-SS05_SL07-000004);
- Dust and Emissions Management Plan (1MC04-SCJ_SDH-EV-PLN-SS05_SL07-000013); and
- Noise Impact Assessment (1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018).

2.4 Relationship with other documents

2.4.1 This NVMP has been written to support the permit application for the RSSP-WTS. This document is intended to be a stand-alone document for the management of noise and vibration at RSSP-WTS and as such it is consistent with the overarching requirements of other relevant HS2 specific legislation and guidance, including:

- Local Environmental Management Plan (LEMP) – London Borough of Hillingdon [R1]

2.4.2 In November 2013, HS2 Ltd deposited a hybrid Bill with Parliament to seek powers for the construction and operation of Phase One of HS2; which was thereafter enacted. The Secretary of State has published Environmental Minimal Requirements (EMRs), which set out the environmental and sustainable commitments that will be observed in the construction of the Phase One of Hs2. Information papers have been produced which detail how the commitments will be applied to the design and construction of Phase One. The following Information Papers have been referred to in the production of this NVMP:

- High Speed Two Phase One Information Paper E22: Control of noise from the operation of stationary systems [R2]
- High Speed Two Phase One Information Paper E23: control of construction noise and vibration [R3]

2.5 Environmental Management System

2.5.1 The Noise Quality Management Plan is drafted in line with SCSJV's EMS, certified to BS EN ISO 140001:2015.

3 Roles and Responsibilities

3.1.1 There are three key parts to the SCSJV's organisational structure critical to the delivery of the noise and vibration management requirements of the HS2 main works civils contractor (MWCC). These are:

- Environmental Managers/Advisors;
- Construction Teams; and
- Noise and Vibration Specialists.

3.1.2 The overarching noise and vibration management roles for the wider project and therefore the operation of the RSSP-WTS is summarised below in Table 3.

Table 3 - Roles and Responsibilities

Role	Responsibility
SCSJV Environmental Managers and Advisors	Develop scopes of works incl. provision of required technical standards, Pre-qualification Questionnaire (PQQ) and Invitation to Tender (ITT) questionnaires and ultimately instruct the noise and vibration specialist work package. Ensure the appointed noise and vibration Specialist meets the appropriate competencies and can meet the resourcing needs to deliver contract Topic requirements Review requirements of the Environmental Minimum Requirement (EMRs) and specifically the CoCP to identify Topic management commitments relevant to the MWCC. Communication of the noise and vibration management related requirements in the CoCP and Hs2 Technical Standards to construction teams and the noise and vibration specialist. Assurance activities such as audit and inspection of work sites (for CoCP, EMR, EMP, HS2 Technical Standards and other control plan conformance). Lead, support and advise the construction team to ensure they have the required training, competences, and resources and that they are suitably deployed for the successful delivery of the NVMP. Support site meetings as required. Review/ QA and agree scope of works within noise and vibration deliverables prior to submission to HS2. Consultation on Local Environmental Management Plans (LEMPs). Support complaint and incident investigation and closeout within 5 working days (using the HS2 On-line incident reporting system (HORACE)).

	Support all site meetings and regular monthly (or when required) meetings with HS2 (including Local Authorities other HS2 Contractors). Sharing of good practice and noise and vibration related innovations with other sites and HS2 contracts. Provide support and direction to Stakeholder manager to ensure compliance with Undertakings and Assurances is achieved.
Environmental Team	Responsible for working collaboratively throughout design and construction to advise the Project Team and monitoring compliance, for obtaining and managing consents, the provision of training, and for managing communications with each of the appropriate local authority. (variations); Lead on the investigation of any breaches of Trigger Action Levels and report to the local authority/HS2. This will include maintaining overall assurance of the works anticipated on both Lot S1 and S2, this includes, but not limited to: - Ensuring Contractors and Specialist Consultants have the required competences and resource. Undertaking site inspections and audits to ensure the adoption of Best Practical Means. Liaison with local authorities. Review and assurance of design and construction works to assure compliance with Best Practical Means (BPM), Environmental Minimum Requirements (EMRs), Undertakings and Assurances (U&As) etc. Identification and evaluation (in conjunction with NV Specialists) potential NITR qualification. Specific training to Construction disciplines Develop scopes of works incl. provision of required technical standards, PQQ and ITT questionnaires and ultimately instruct the noise and vibration specialist work package. Ensure the appointed noise and vibration Specialist meets the appropriate competencies and can meet the resourcing needs to deliver contract Topic requirements Review requirements of the Environmental Minimum Requirement (EMRs) and specifically the CoCP to identify Topic management commitments relevant to the MWCC. Communication of the noise and vibration management related requirements in the CoCP and Hs2 Technical Standards to construction teams and the noise and vibration specialist. Assurance activities such as audit and inspection of work sites (for CoCP, EMR, EMP, HS2 Technical Standards and other control plan conformance) Lead, support and advise the construction team to ensure they have the required training, competences, and resources and that they are suitably deployed for the successful delivery of the noise and vibration management Plan. Support site meetings as required.

	Review/ QA and agree scope of works within noise and vibration deliverables prior to submission to HS2. Consultation on Local Environmental Management Plans (LEMPs). Support complaint and incident investigation and closeout within 5 working days (using the On- line incident reporting system (HORACE)). Support all site meetings and regular monthly (or when required) meetings with HS2 (including Local Authorities other HS2 Contractors). Sharing of good practice and noise and vibration related innovations with other sites and HS2 contracts.
Construction Managers, Supervisors and Engineers	Responsible for managing construction and producing Method Statements which include information and requirements, covered by Site Environmental Control Plans. They have the responsibility for the management of construction activities and for ensuring Best Practicable Means (BPM) are identified and implemented, including; - Responsible for the day-to-day implementation of the BPM mitigation measures required to minimise the impact arising from the works. Development of work methodologies and mitigation in accordance with best practicable means (BPM) to control noise and vibration. Implementation of control measures. Undertaking incident/complaint investigation and resolution, in conjunction with the Environment and Stakeholder Interface teams. Implementation and delivery of the necessary roles/ resourcing/ meetings to ensure adherence to the HS2 Technical Standards as listed in this document and the requirements of the CoCP Attend site inspections and meetings with Noise & Vibration Specialist and Environmental Managers/ Advisors as requested, to identify any issues and reduce risks, including technical issues (surveys / monitoring); access; risks; good practice; and H&S issues. Seek Environmental Manager/ Advisor approval for Environment sections of risk assessments and method statements (RAMS). Daily records of operations undertaken, together with noise and vibration conditions. Self-certification of site activities. Provide site supervision/ support through site inspections, identification, and delivery of environmental toolbox talks (TBTs). Attendance at community meetings as required. Undertake investigation of complaints or incidents (actions commenced within 2 hours during core working hours, within 12 hours outside these times) and implement additional mitigation measures as required. Production of incident investigation report and submission to S1/ S2 Environmental Manager/ Advisors (within 5 working days).

	Production of complaint investigation report (to Community Liaison Manger) and closeout (within 5 working days).
Site Managers	Responsible for communicating the NVMP requirements to subcontractors and the effective management of the works in line with the NVMP.
Noise and Vibration Specialist (General)	Provide technical expertise and competence for project advice and guidance on noise and vibration related matters through-out design and construction to ensure works are delivered in accordance with the HS2 contractual and legal requirements. Lead on the development Noise and Vibration designs solutions suitable to relevant work activities and construction methodologies. Support the development and review of this NVMP, including regular updates and revisions to reflect changes and developments of the project. Provision of specialist noise and vibration services and management support to the MWCC: Modelling of noise and vibration from construction works (including cumulative impacts from other HS2 works) and noise insulation / temporary rehousing assessment. Installation (or adoption), set-up, maintenance and reporting of continuous real time monitoring of noise and vibration around project work sites Advise construction and consents teams on how to meet legal and contractual requirements; Check all results for compliance with requirements and advise construction teams on actions required and follow-up; Assist Environmental Manager /Advisors with data gathering for reporting purposes in advance of deadlines; Review, update, and report to Environment Team on noise and vibration performance; Provide reports on progress and any problems with noise and vibration management on site to Environmental team and Construction teams. Deliver TBT/training (as required) to construction teams; Attendance at community meetings as required. Provide input with investigation of complaints of incidents and with the production of incident investigation reports (where required) Provide support and direction to Stakeholder manager to ensure compliance with Undertakings and Assurances is achieved.

Noise and Vibration Specialist (Construction N&V)	Advise and instruct construction teams on how to meet noise and vibration requirements, including the HS2 Noise and Vibration Mitigation Scheme, including potential changes in eligibility for Noise Insulation or Temporary Rehousing; Work closely with construction teams, particularly the construction planning team; Work with Environmental Team and other contractors to ensure that potential cumulative noise issues are considered; Identify and undertake baseline noise and vibration surveys (where required); Locate, set-up and oversee permanent noise and vibration monitoring stations; Train nominated staff to undertake basic monitoring tasks correctly, such as downloading data and undertaking initial checking of results for compliance with requirements; Check all results for compliance with requirements and advise construction teams on action required and follow-up; Provide reports on progress and any problems with noise and vibration issues; Liaise with Local Authorities as necessary and in conjunction with the Project Manager and Stakeholder Interface Manager.
Noise and Vibration Specialist (Construction N&V Monitoring)	Undertake attended monitoring of noise and vibration to demonstrate compliance. Manage the installation of permanent monitoring equipment and complete weekly monitoring reports (either adopted equipment or installation of additional monitoring equipment). Advise and instruct construction teams on how to meet noise and vibration requirements. BPM checks will be carried out during attended monitoring.
All project staff	Responsible for complying with Risk Assessment Method Statements Risk (RAMS) Environmental Control Plans and instructions given by supervision in relation to the work they are undertaking and for reporting and responding to **ANY** incident.

4 Requirements and Obligations

4.1 Legislation and Policy

4.1.1 The SCSJV EMS (adopted from Costain's EMS) includes a legal register which is a live document maintained by the Costain corporate head office. The MWCC Aspects and Impacts Register identifies which sections of the legal register are applicable to this project and these are shown in the HS2 MWCC Legal Register.

4.1.2 The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015 [R12], approves the following guidance for the purpose of this management plan:

- BS 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound [R4]
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites –Part 1: Noise [R5]
- BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites –Part 2: Vibration [R6]

4.1.3 **Best Practicable Means (BPM)** will be applied during construction works to reduce noise and vibration impacts as far as is reasonably practicable, BPM defined as:

'practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;

4.1.4 The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures."

The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1995

4.1.5 The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1995 [R8] give a discretionary power to railway authorities to provide insulation or grant for insulation where noise from the construction of a new or altered railway is expected seriously to affect residential and other buildings for a substantial time. Schedule 1 to the Regulations sets out construction and performance specifications for the noise insulation package. SCSJV will have regard to these specifications in implementing the HS2 noise insulation and temporary rehousing policy as set out in the Guidance Document E23 [R3]. Please refer to Section 6.3 for further information.

4.1.6 It is noted that noise insulation is being offered for qualifying buildings as defined in the noise insulation and temporary rehousing policy within HS2 Information Paper E23 [R3]. Noise insulation or temporary rehousing will mitigate residents being significantly affected by levels of construction noise inside their dwellings.

High Speed Rail (London - West Midlands) Act 2017

4.1.7 On 23 February 2017, Royal Assent was granted for Phase One of HS2. The High Speed Two Bill is now an Act of Parliament (law) and called the High Speed Rail (London - West Midlands) Act 2017 [R10].

Environmental Minimum Requirements - General Principles

4.1.8 The Environmental Minimum Requirements - General Principles require that the controls to be implemented in delivering the scheme (including the internal EMRs, powers contained in the Act and Undertakings) will ensure that impacts which have been assessed in the ES will not be exceeded. If the significant adverse impacts identified in the ES are likely to be exceeded, all reasonable steps will be taken to minimise or eliminate those additional impacts.

4.1.9 Annex 1 to the EMRs comprises a Code of Construction Practice (CoCP), which shall be adopted and implemented by the SCSJV and its Contractors in delivering the works, the high-level requirements of which are set out below.

4.1.10 In developing the scheme through the Parliamentary process and beyond into the detailed design stage, site specific control measures are being developed in conjunction with local authorities. Such measures are to be set out in each of the Local Environmental Management Plans (LEMPs) and shall be implemented in delivering the works. The high-level requirements of the LEMP for the London Borough of Hillingdon [R1] are set out below.

Code of Construction Practice (CoCP)

4.1.11 The CoCP sets out the general control measures to be implemented and the standards to which the nominated undertaker and its Contractors will comply in delivering the scheme. Its aim is to ensure that likely significant construction effects that are reported in the Environmental Statement will either be avoided or mitigated. Notwithstanding this, SCSJV and its Contractors will adopt appropriate measures to design and construct the scheme so that noise and vibration from the construction does not give rise to adverse effects, as identified in the ES. Where reasonably practicable, environmental mitigation will be integrated within the design and implemented by the contractors within the works.

4.1.12 This approach is considered to align with the noise policy aims set out in the Noise Policy Statement for England and the principles of Best Practicable Means.

4.1.13 The general control measures and monitoring arrangements for noise and vibration identified in the CoCP have been considered in the development of this management plan and, where appropriate, are incorporated in section 5.

4.1.14 Site specific controls are to be developed in conjunction with local communities, local authorities, and other stakeholders.

Local Environmental Management Plan - London Borough of Hillingdon (LEMP - Hillingdon)

4.1.15 The LEMP for Hillingdon sets out control measures specific to HS2 works within the local authority's jurisdiction to be adopted by SCSJV that will be developed further following consultation with relevant stakeholders. This includes items such as requirements for construction site layout and good housekeeping, hoardings, fencing and screening, and specific requirements relating to noise and vibration (as outlined in Section 13 of the LEMP for Hillingdon Borough). The requirements of the LEMP will be implemented and certified to BS EN ISO 14001: 2015.

4.1.16 The area specific noise and vibration arrangements identified in the LEMP-Hillingdon have been considered for the development of this NVMP and, where appropriate, are incorporated in Section 6.

4.2 Undertakings and Assurances

4.2.1 Undertakings and Assurances (U&As) in relation to the NVMP exist route wide and within the MWCC for SCSJV. Requirements or mitigations needed to meet applicable Undertakings and Assurances, which will be set out in the site environmental control plans and briefed to site teams to ensure they are met. Evidence of compliance against Undertakings and Assurances will be submitted by SCSJV to HS2 Ltd through commitment compliance plans. NVMP related U&As are captured in Appendix A of this document.

4.2.2 The register of undertakings and assurances details all commitments offered throughout the parliamentary process for the High-Speed Rail (London - West Midlands) Bill up until Royal Assent. The relevant MWCC noise and vibration related U&As are detailed in Appendix A.

4.2.3 In the summary, the noise and vibration related U&As for MWCC commit to:

- Reducing the impacts and effects of noise and vibration;
- Implementation of Best Practicable Means in the control of noise and vibration;
- Implementation of a noise insulation and temporary rehousing policy, including special cases;
- Prediction methodologies for noise and vibration;
- The noise and vibration performance of control measures;
- Development of site-specific noise and vibration monitoring protocols and trigger action plans;

- Further mitigation measures;
- Monitoring of noise and vibration, including reporting; and
- Compliance and intervention processes

4.2.4 SCSJV and its Contractors will comply with the requirements and terms of U&As entered into by the nominated undertaker, as detailed in the "HS2 Register of Undertakings and Assurances" published by the Department for Transport or as otherwise notified. Specific details of such U&As, including requirements and terms, will be identified in the applicable Site-Specific Environmental Control Plan. Individual Commitment Compliance Plans will be prepared to record how each applicable U&A is being complied with.

5 Site Specific Details

5.1 Introduction

5.1.1 The following section presents a summary of the findings of the Noise Impact Assessment 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (NIA) (Appendix B) for the site considering the BPM mitigation measures adopted as standard by SCSJV as part of their commitments to the measures set out in the relevant undertakings and assurances, CoCP and LEMP. As such the following BS4142:2014 assessment baseline includes all relevant noise and vibration BPM including the provision of noise insulation at the nearest residential receptors. These BPM measures are discussed in Section 6.2. The assessment has also taken account of the measures included in the HS2 Information Paper E22: Control of noise from the operation of stationary systems [R2].

5.1.2 The methodology in line with BS4142:2014 for the assessment of noise impact is detailed in Appendix B. The BS4142:2014 standard also looks at the local acoustic environment and context into which the sound sources are being introduced.

5.1.3 The initial noise assessment concluded that there were a number of significant adverse impacts at the receptors. Therefore, further discussions were undertaken with the construction team and additional mitigation measures were implemented. The findings from the reassessed noise assessment will be discussed further in the following sections (see Section 6, Appendix B).

5.2 Identified Receptors

5.2.1 The receptors considered include: Shorthill Cottage (R1), Harvil Farm (R2), Brackenbury House (R3), Brackenbury Barn (R4), The Bungalow (R5), 160 Hoylake Crescent (R6), 178 Hoylake Crescent (R7), 77 The Greenway (R8) and Oak Farm (R9). These have been identified as potentially affected by sound due to their relative proximity to the RSSP-WTS area boundaries. As such these receptors will be considered representative locations for the basis of the Noise Impact Assessment. The location of these receptors is shown within the NIA in 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (Appendix B).

5.2.2 Semi-permanent unattended noise monitoring systems were installed at monitoring positions MP01 and MP02, from 6th February 2021 and data was obtained for this assessment up to 21st February 2021.

5.2.3 In advance of significant construction works being undertaken in the area, semi-permanent noise monitors were installed at monitoring positions N056 and N057. Noise data obtained from 1st November to 18th December 2020 from these two monitoring positions has been analysed to determine representative background noise levels at nearby sensitive receptor groups.

5.2.4 Supplementary attended measurements were obtained on Harvil Road and Breakspear Road on the 22nd and 23rd March 2021 for validation of the use of unattended data at satellite receptor locations (MP02).

5.2.5 Further information on noise monitoring systems and locations is included in 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (Appendix B).

5.3 Site Procedure

5.3.1 The following sections provide an overview of the operating procedure at the site in relation to activities that may generate noise and/or vibration which will require specific mitigation measures.

5.3.2 The site is required in order to manage waste soils arising from the nearby Tunnel Boring Machines (TBM) operating at West Ruislip Portal. As these are required to operate 24hrs a day, 7 days a week the site will be required to operate to this schedule too.

5.3.3 The RSSP-WTS facility will receive TBM arisings via a conveyor system extending from Northolt Tunnels West and the West Ruislip Portal. Materials will not enter the site via any other means other than the conveyor. The incoming material will be temporarily stored in sheltered storage bins (should no treatment be required, location on 1MC04-SCJ-EN-SKE-SS05_SL07-650028), which will be deposited into the bins off of the conveyor by a tripper unit. Should the materials require treatment with lime/ggbs, the arisings will be treated within a designated materials treatment area (concrete construction apron comprising pugmills which will assimilate lime/ggbs with the arisings).

5.3.4 A designated, separate materials quarantine area will be present at the end of the conveyor, should any materials not meet the permitted waste criteria.

5.3.5 Once the materials are treated at the RSSP-WTS facility, onward transport of treated materials will be via a return conveyor, to be used as reinstatement material for Copthall backfill. Materials will be transported to the Ruislip Southern Sustainable Placement (RSSP) mounds to the south of the treatment area via dump trucks along haul roads.

5.3.6 Further details pertaining to the site configuration and general processes in operation are included within the Site Operating Plan (1MC04-SCJ_SDH-EV-PLN-SS05_SL07-000016).

5.4 Likely Noise and Vibration Sources

5.4.1 The following sources of noise and vibration are anticipated at the RSSP-WTS facility during its operation:

- Noise and vibration from the delivery of construction plant and mobile working plant (also out of normal core hours), general site traffic during the operation of the site;

- Noise and vibrations from haulage vehicles departing the site, idling or manoeuvres at the site compound and reception, audible reversing warnings, movement within the site via dedicated haulage route and tipping waste (increased throttle);
- Noise and vibrations from earthworks machinery and conveyor machinery operating on site; and
- Noise from the tipping of materials at the site from conveyors, and haulage vehicles (e.g., that generated from the materials itself rather than the machinery noise).

5.4.2 The data and sources for the noise levels assumed in the Noise Impact calculations that this assessment is based on are included in the NIA included as 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (Appendix B).

5.5 Background sound levels

5.5.1 In order to ascertain a baseline understanding of the sound levels at the permit boundary, sound levels have been obtained from the semi-permanent unattended noise monitoring systems (MP01 and MP02). Monitoring was undertaken during periods where there was no site activity, and therefore the data is considered to be representative of background noise levels in the absence of construction noise (see Section 3.3, Appendix B).

5.5.2 Further noise monitoring was also undertaken at monitoring locations on Breakspear Road and Harvil Road.

5.5.3 Summary and statistical analysis of the background sound results are provided at each monitoring location (MP01, MP02, N056, NO57) in Appendix B.

5.5.4 This data has been used to feed into the noise impact assessments.

5.5.5 Raw background monitoring data is also provided in Appendix B.

5.6 Noise Impact Assessment Findings

Noise Level Calculations of Plant at Nearest Receptors

5.6.1 Appendix B presents a calculation of sound pressure levels at the receptor, associated with the activities at RSSP-WTS.

5.6.2 The sound modelling has been undertaken using SoundPLAN (version 8.2) sound modelling software. SoundPLAN is a propriety software package which allows the calculation of sound levels using acoustical ray-tracing techniques through implementing the prediction procedure detailed in ISO 9613-2: 1996.

5.6.3 The assessment considers a number of assumptions based on the activities associated with the RSSP-WTS.

5.6.4 This includes any design features associated with the treatment facility that may impact noise levels at the receptor (both positively and negatively). This includes aspects such as noise barriers, e.g., *2.4 m noise barriers installed at strategic locations to provide mitigation to the residential receptors.* See Appendix B (Section 6) for the list of assumptions included in the model and a figure showing the location of the noise barrier.

5.6.5 The modelled specific sound levels are for construction noise only (i.e., they exclude any ambient noise). Resulting levels are presented in Appendix B (Tables 26 - 28).

Further assessment considerations

5.6.6 Acoustic character corrections have been applied to the assessment of noise in this case. The justification for the acoustic character application is presented in Appendix B (Section 5.3).

5.6.7 The results of the BS4142:2014 assessment are presented in Appendix B (Tables 29 - 31). This includes assessment at each receptor, including the representative background noise levels, the predicted construction noise levels (the Specific Sound Levels), any correction applied, the resulting Rating Levels and the difference or the Rating Levels with the relevant background noise levels.

5.6.8 Both uncertainty and context were considered in the assessment of noise for the purpose of the BS4142:2014 assessment, presented in Appendix B (Sections(s) 5.5 and 5.6 respectively).

5.6.9 A separate BS5228:2014 assessment was undertaken (method 1), which allows an assessment of the effects from construction noise using a matrix of established noise thresholds above which a potential significant effect is concluded. ABC threshold levels are to be applied to residential receptors only. This is also summarised in Appendix B (Section 6.8).

Conclusions

5.6.10 Detailed assessment conclusions are provided in Appendix B (Section 7). From the BS4142:2014 assessment findings, the comparison between mitigated construction levels and pre-existing ambient levels indicates that four receptor groups have significant adverse impact (R1, R2, R3 & R4) and one receptor group (R5) has adverse impacts from construction during daytime. During evening periods (19.00-23.00) there is a significant adverse impact at one receptor (R1) and adverse impact at three receptor groups (R2, R & R4). During night-time periods (23.00-0.700) three receptor groups have significant adverse impact (R1, R3 and R4), four receptor groups have adverse impacts (R2, R5, R6 & R7)

5.6.11 Based upon the findings of the BS5228:2014 assessment, the assessment indicates that the noise from construction activities would not exceed the threshold during daytime periods for any of the receptors considered. During the evening period the threshold level is not exceeded at any receptor groups. During night-time periods, there is an adverse impact at just one receptor group (R1) which represents just 1 property.

5.6.12 See Section 6 for potential mitigation measures.

6 Noise and Vibration Control Measures

6.1 Introduction

6.1.1 A summary of the noise assessment (Appendix B) is provided in Section 5 of this document.

6.1.2 The following section provides details of the proposed mitigation measures which will be adopted as part of SCSJVs commitment to the relevant undertakings and assurances (Refer to Appendix A), CoCP and LEMP.

Section	Controls in the management of noise and vibration
6.2.1 6.6.1 6.3.1 6.4.1 8.1.12	Best Practicable Means (development of noise and vibration control measures) Site-Specific Mitigation Noise insultation and temporary rehousing Innovation and Best Practice Community notification
6.5.1 7.2.1 8.2.1	Commencement Noise and vibration monitoring and reporting Complaint and incident management Training and awareness
8.1	Communications SCSJV Project Team, Contractors, HS2 local authorities and local communities

6.2 Best practicable means

6.2.1 Best Practicable Means (BPM) will be applied during construction works to reduce noise (including vibration) at neighbouring residential properties and other sensitive receptors (including local businesses and any quiet areas designated by the local authority) arising from construction activities. BPM are defined in Section 72 of the Control of Pollution Act 1974 [R8] and Section 79 of the Environmental Protection Act 1990 [R7] as those measures which are "reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications".

6.2.2 SCSJV and its Contractors will consider mitigation in the following order:

- Evaluation of design to identify potential for reduction in construction impacts through modifications;
- BPM, including noise and vibration control at source e.g., the selection of quiet and low vibration equipment, review of construction programme and methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; screening: e.g., local screening of equipment, perimeter hoarding or the use of temporary stockpiles; and
- The recommendations of BS5228:2014 Code of practice for noise and vibration control on construction and open sites, parts 1 and 2 will be implemented. The requirements and control measures set out within the CoCP will also be implemented by the SCSJV and its Contractors in delivering the scheme.

6.3 Noise insulation and temporary rehousing

6.3.1 As identified in High Speed Two Information Paper E23: Control of Construction Noise and Vibration [R3], HS2 are required to operate a noise insulation and temporary re-housing policy with the aim that noise and vibration from the construction of the scheme does not give rise to significant adverse effects on health and quality of life. In order to do so, where noise or vibration from the construction of the scheme is found to exceed the significant observed adverse effect levels set out in Appendix A of Information Paper E23, noise insulation or temporary re-housing is to be offered to the occupiers of eligible properties. In the first instance, however, the SCSJV and its Contractors will implement BPM to minimise the extent to which noise insulation or temporary re-housing of occupiers will be required.

6.3.2 Eligibility and qualification criteria for noise insulation and temporary re-housing is detailed within Appendix B of Information Paper E23 [R3], including consideration of special cases.

6.3.3 It should be noted that the goal of the noise assessment (Appendix B) is to determine the noise impact associated with the proposed works and act as a means of supporting the associated permit application. Eligibility of properties surrounding areas of SCSJV works for noise insulation is constantly reviewed periodically in line with the HS2 technical standard as the works progress in the area, and a number of properties exposed to noise from material transfers and other construction activities (including properties on Hoylake Crescent, the Greenway and Breakspear Road South) are currently being considered for provision of noise insulation in line with the criteria of determination outlined in the technical standard.

6.4 Innovation and Best Practice

6.4.1 Through-out the design phase and the development of construction methodologies consideration will be given to the environmental/sustainable opportunities as part of the processes. Design will be developed with consideration to cost, fitness for purpose, aesthetics, buildability, and maintainability. As part of this process, regular environmental review will be undertaken. This will include, as a minimum, a regular environmental design review against the HS2 Environmental Minimum Requirements.

6.4.2 In addition to this SCSJV Environmental and Construction team will work collaboratively to identify best practices opportunities and innovation to enhance the implementation of BPM the noise exposure exceeds the criteria defined in the CoCP, in particular where the works have activated the requirement to offer noise insulation or temporary rehousing.

6.5 Noise and vibration monitoring and reporting

6.5.1 SCSJV and its Contractors will undertake noise and vibration monitoring (as well as acquiring weather data) as necessary to comply with the requirements of the CoCP and applicable U&As. Such monitoring will be undertaken for the following purposes:

- monitoring the impact of construction works;
- to investigate noise complaints, incidents, and exceedance of trigger levels;
- monitoring the effectiveness of noise and vibration control measures; or
- collection of additional baseline data.

6.5.2 Reporting of resulting noise and vibration data shall be carried out in accordance with the requirements stated therein, in addition to the requirements of the EMRs or U&As. All data reports issued to HS2 shall be uploaded to the electronic document management system.

6.5.3 In addition to the foregoing requirements, SCSJV and its Contractors will support HS2 in the provision of noise and vibration monitoring data and other related information to the local community, as necessary under the Community Engagement Framework.

6.6 Assessment and Site-Specific Mitigation

6.6.1 Specific mitigation relating to noise and vibration was stated as part of the NIA (1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (Appendix B)) including 2.4m noise barriers, reductions in plant use and restricted working hours within the stockpile area.

6.6.2 The BS4142:2014 assessment indicates that the noise from construction activities would still have a significant adverse or adverse impact at numerous receptors.

6.6.3 The following BPM will be adopted at the site:

- Within the site, internal haulage will be restricted to clearly delineated routes, on a prepared surface, vehicle speeds will be regulated on site. The haul route runs around the perimeter of the site and includes laybys for vehicles waiting to park and turn off their engines;
- Selection of modern quiet/low vibration equipment, equipped with silencers and operated in accordance with the manufactures specifications and maintained in good working order – plant found to have defective silencing systems will be stood down until the system is rectified;
- Daily inspections will be carried out to all plant;
- Vehicles delivering waste will be in good working order;
- Vibratory compaction exclusion zone when carrying out vibratory compaction near existing sensitive receptors:
  - Large Roller (Single roller JCB Type) on high setting – 70m
  - Large Roller (Single roller JCB Type) on low setting – 35m
  - Small Ride-on Roller – 25m
- Equipment will be located on site in order to reduce noise and vibration impact to identified receptors as much as possible;
- Drop heights from conveyors will be kept to the reasonably practical minimum to prevent excessive noise from falling soils;
- Conveyors will be fully enclosed;
- Where practicable, mobile plant will not be left idling when not mobile;
- All SCSJV site vehicles will use smart alarms, which use a white noise system which can only be heard over short distances. Waste vehicles will be directed around the site in such a way to minimise the necessity for reversing;
- The larger holding compound will have a concrete base with a 3.75m high concrete wall which will reduce noise from the transfer of waste. Waste will be kept at least 0.5m below the top of the wall height. This has been included as an assumption within the noise assessment model (Appendix B);
- The isolation holding bunded compound will have a concrete base with a 3.75m high concrete wall which will reduce noise from the transfer of waste. Waste will be kept at least 0.5m below the top of the wall height. This has been included as an assumption within the noise assessment model (Appendix B);

- Control of working hours in line with the CoCP (See Sections 6.6.4 to 6.6.10);
- Restrictions on working periods for specific activities will be in force;
- Hoardings will be used where practicable to do so (see section 6.6.13 to 6.6.15);
- Localised screening of plant and equipment to mitigate noise at source;
- Use of noise insulation for identified receptors (see section 6.3);
- Real time monitoring of noise and vibration (using existing noise monitoring locations identified in 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018 (Appendix B)); and,
- Training for the SCSJV team to ensure appropriate monitoring and response to alerts and triggers.

Working hours

6.6.4 The HS2 CoCP sets out the provisions for core working hours. These core working hours are 08:00-18:00 Monday to Friday (excluding Public Holidays) and 08:00 to 13:00 on Saturday. However, the CoCP sets out provisions for site-specific variations to core house and/or additional hours where these are likely to be required to be included within the LEMP following consultation with the relevant Local Authority.

6.6.5 In addition, section 5.2.6 of the CoCP provides for Additional Working Hours. In this it sets out that tunnelling and directly associated activities (such as removal of excavated materials, supply of materials and maintenance of tunnelling equipment) will be carried out on a 24-hour day, seven days a week basis. Where reasonably practicable, material will be stockpiled within the site boundary for removal during normal working hours (Core Hours). On this basis, given the RSSP-WTS site's purpose is to manage spoil arising from tunnelling the site will operate on a 24-hour day, seven days a week basis. However, the WTS will operate as two distinct areas with different operating periods for noise mitigation.

6.6.6 Noise from activities in the southern stockpile area would be mitigated by restricting activities to daytime (07:00-19:00 hrs) periods only, and the northern area which includes muck bins, conveyors and lime treatment station will be operational on a 24-hour day, but there will be no material transport to the stockpiles in the southern area. The noise model (Appendix B) includes these working hour assumptions.

6.6.7 The LEMP-Hillingdon [R1] identifies that certain work activities at specific locations within the Local Authority area will need to take place outside of the core working hours for safety and engineering purposes. The work activities specific to RSSP-WTS listed in the LEMP-Hillingdon [R1] include:

- Continuous operation of conveyors, pumping equipment, and essential generators;

and

- Excavated material handling for railhead formation and transport of excavated material.

6.6.8 Repairs or maintenance of construction equipment will be carried out within core working hours, or offsite where practicable. Where these works are required to be carried out outside of core working hours, this will be carried out on Saturday afternoons between 13.00 and 18.00 or Sundays between 10:00 and 17:00.

6.6.9 Only essential repairs or maintenance works will be undertaken on Sundays. Major plant associated with the activity, and the expected operational hours are included in Appendix B.

6.6.10 In the case of work required in response to an emergency or which, if not completed, would be unsafe or harmful to the works, staff, the public or the local environment, the relevant Local Authority will be informed as soon as reasonably practicable of the reasons for the works and their likely duration. This information will also be made available to the HS2 helpline. Examples of the type of work envisaged include where unexpectedly poor ground conditions, encountered while excavating, require immediate stabilisation.

Abnormal deliveries

6.6.11 Abnormal loads or those that require a police escort may require to be delivered outside core working hours, with such movements not permitted in London between 07:00-19:00 hours Monday to Friday, or 10:00-19:00 hours Saturday.

Construction site layout and good housekeeping

6.6.12 To reduce the likelihood of noise and vibration incidents or complaints, the following control measures will be implemented by SCSJV and its Contractor:

- the use of less intrusive noise alarms that meet the particular safety requirements of the site, such as broadband reversing warnings, or proximity sensors to reduce the requirement for traditional reversing alarms;
- management of staff congregating outside the site prior to commencing or leaving work;
- avoidance of the use of loudspeaker or loudhailer devices.

Hoardings, fencing and screening

6.6.13 As part of the BPM, the following mitigation measures will be applied, as appropriate:

- use of different types of fencing, including hoardings used for noise control.

6.6.14 Hoarding for noise mitigation is proposed at strategic locations to provide mitigation to residential receptors. Hoarding will be 2.4m in height and will be raised (and possibly altered

in form) to enhance acoustic performance. The noise model includes the assumption of this hoarding.

6.6.15 It is noted that during the EWC existing hoarding on site was increased in height and where missing additional hoarding was installed.

7 Complaints and incident management

7.1 Incident Response

7.1.1 The SCS JV has adapted its incident management procedures to align with the HS2 incident management process which, in summary includes:

- A three-tier response command structure (Gold, Silver, Bronze) to manage an incident;
- A single process for the management of all events that constitute an incident, with defined levels to help frame the response – Levels 1 to 4 (Level 1 being the most serious incidents);
- A 24-hour, 365-day Help Desk, operated by HS2, to start the co-ordination of HS2's response to an incident and to support the SCS JV where appropriate. The help desk is the first point of contact (08081 434 434) to HS2. for all Level 1 and 2 incidents on the programme; and
- An on-line incident reporting system (HORACE) that records the details of an incident and supports communications, investigation, and follow-up activities to avoid a recurrence.

7.1.2 The Environmental Incident Control Plan is consistent with the requirements, definitions and terminology used in WI1600: Incident Management.

Pollution Incident Control Plan

7.1.3 SCSJV will implement the Pollution Incident Control Plan, aligned with the HS2 Ltd incident management process which, in summary includes:

- A three-tier incident response command structure (Gold, Silver, Bronze) to manage an incident;
- A single process for the management of all events that constitute an incident, with defined levels to help frame the response – Levels 1 to 4, with Level 1 being the most serious incidents;
- Report any incidents to the Environment Agency;
- A 24-hour, 365-day Help Desk, operated by HS2Ltd, to start the co-ordination of HS2 Ltd's response to an incident and to support the SCSJV where appropriate. The help desk is the first point of contact (08081 434 434) to HS2 Ltd. for all Level 1 and 2 incidents on the programme; and
- An online incident reporting system (HORACE) that records the details of an

incident and supports communications, investigation, and follow-up activities to avoid a recurrence.

Exceedance of noise and vibration trigger levels

7.1.4 As part of the assurance process, the SCSJV will be undertaking extensive noise and vibration monitoring throughout the duration of works. Amongst other reasons, this monitoring will be used to demonstrate compliance with the EMRs, and specific requirements of U&As (notably compliance with Trigger Action Plans prepared for the protection of certain sensitive receptors).

7.1.5 Long term noise and vibration monitoring (at locations to be agreed with HS2, local authorities and other stakeholders, as necessary) will be configured to provide real time access to data and allow alerts (by text, email, or other means) to be sent to designated recipients when levels approach or exceed predetermined thresholds. These thresholds are based upon identified levels within Trigger Action Plans, or vibration thresholds for the protection of building occupants or building damage (as defined at 13.2.21 et seq. of the CoCP). Through this process any exceedance, or potential exceedance, of noise and vibration thresholds will trigger an alert and subsequent investigation.

7.1.6 Following the exceedance of an agreed trigger levels HS2 and the relevant Local Authority shall be notified within 24 hours, or as soon as practicable thereafter. SCSJV will coordinate investigation of any exceedances, with the SCSJV contractor being required to consider the immediate cause of any exceedance and, where necessary, implement suitable control measures. The Specialist NV Consultant shall provide monitoring data and interpretation to support the investigation.

7.1.7 The monthly noise and vibration monitoring report to be provided to HS2 will include a summary of agreed trigger level, the measured exceedance level, the likely causes of the exceedance, a description of relevant on-site activities, actions taken for verification/remediation, weather data and comparison with the baseline monitoring data recorded at prior to the start of works.

7.2 Complaints

7.2.1 HS2 operate the HS2 Public Help Desk 24 hours per day, 7 days a week, to manage all complaints, handle enquiries and co-ordinate incident response. The SCS JV community engagement team will maintain a 24/7 contact with the helpdesk and be available to answer any queries or liaise with site supervisors for investigation and resolution ofcomplaints.

7.2.2 All complaints received will be recorded, investigated and corrective actions implemented, and feedback given to the complainant. The local authority will be advised of any complaint and the actions taken to investigate the validity and, any actions which have been put in place to rectify the situation if this is found necessary. Where appropriate any noise complaint will

be referred to the Site Manager for investigation to check whether all BPM are being used to control noise and vibration and to assess whether any corrective action taken was sufficient.

7.2.3 This will be achieved on site through the use of a complaints tracker by the Community Relations Representative (CRR). They will pass on any environmental (including noise and vibration) related complaints to the Environmental Team who will investigate the complaints and report back to the CRR to provide feedback to the complainant. The Environment Team will use the assistance of the Noise and Vibration Specialists to investigate and effectively resolve any complaints and will also keep a tracker of complaints related to noise and vibration which will be provided on a monthly basis to the appropriate local authority, the Project Manager and the HS2 Noise Specialist.

7.2.4 The CRR will manage and resolve complaints or enquiries directed to the Community Relations Representative from the HS2 Public Helpdesk or Project Manager and advise of the outcome of action taken within 24 hours.

7.2.5 SCSJV shall respond promptly to emergencies, complaints or other contacts made via the HS2 Helpdesk or any other recognised means and if possible, the SCSJV staff shall rectify the problem directly. SCSJV cooperates with and provides information to the HS2 Community Relations Team to resolve enquiries and complaints. In all cases the HS2 Community Relations Team and the Project Manager shall be kept fully informed of actions taken.

Response time to complaints

7.2.6 The following timescales will be adhered to when responding to complaints:

- Initial response to complainant by phone or email within 24 hours.
- Written response within 5 working days unless a lengthy investigation is required. Then the response time will be extended to 5 days after completion of the investigation.

7.2.7 SCSJV will implement the MWCC Community Engagement Strategy, which requires the development of Local Community Engagement Plans. All community relations issues will be managed in accordance with the principles of the strategy and local plans and be led by the Community Relations Manager in collaboration with HS2.

7.2.8 Section 8.1.12 contains further information regarding community notifications, and Section 7.2.1 contains further information on the handling of complaints.

8 Communication

8.1 Site-Specific Environmental Control Plans

8.1.1 Site-specific environmental control plans (SSECP) will set out the procedures to be followed for construction activities which will address, amongst other matters the noise and vibration control measures necessary to comply with the requirements of the EMRs and U&A's. Prior to commencement of works activities, the SSECP will be approved by the Environmental Manager and briefed to the site team. The SSECP will be updated after each quarterly environmental audit (see 1MC04-SCJ_SDH-EV-PRO-SS05_SL07-000004).

8.1.2 The SCSJV Noise & Vibration Specialist, along with other members of the SCSJV Project team will work closely with the Contractors on a day-to-day basis to ensure the contract requirements are suitably addressed. Site inductions, Work Package Plans and task briefing documents will be used to communicate key noise and vibration requirements to the Contractors, as appropriate.

Communication between SCSJV and Contractors

8.1.3 The contents and requirements of this Noise and Vibration Management Plan (NVMP) will be communicated to the SCSJV Project team and its Contractors. Site inductions, Work Package Plans and task briefing documents will be used to communicate key noise and vibration requirements to the Contractors, as appropriate.

8.1.4 The SCSJV Noise & Vibration Specialist, along with other members of the SCSJV Project team will work closely with the Contractors on a day-to-day basis to ensure the contract requirements are suitably addressed.

Communication with HS2

8.1.5 The SCSJV Noise & Vibration Specialist will maintain day to day communications with counterparts in the HS2 Environment Team at both strategic and operational levels. More formal arrangements in the shape of monthly meetings will be implemented to ensure effective management of ongoing noise and vibration matters and continual improvement.

8.1.6 In addition, joint meetings will be held between HS2, SCSJV, relevant local authorities and other HS2 Contractors. The frequency of these meetings will be determined by the nature and extent of works.

8.1.7 Other formal communications will relate to deliverables, including noise insulation and temporary rehousing, noise and vibration monitoring reports, incident, and complaint investigation / close-out.

Local Authorities

8.1.8 In order to build trusted relationships, the SCSJV will undertake full and early engagement with relevant Local Authorities on noise and vibration related matters, including advanced discussion of proposed construction and engineering works, the methodologies and control measures to be implemented.

8.1.9 Joint meetings will also be held between HS2, SCSJV, relevant local authorities and other HS2 Contractors, there frequency of which will be determined by the nature and extent of works.

Liaison with the Local Community

8.1.10 SCSJV will implement the MWCC Area South Community Engagement Strategy which requires the development of Local Community Engagement Plans. All community relations issues will be managed in accordance with the principles of the strategy and local plans and be led by the Community Relations Manager in collaboration with HS2.

Community engagement

8.1.11 The Project Management Team recognises the importance of maintaining good relations with the local community. SCSJV will undertake frequent inspections of the site to ensure that it remains in a good state, with all housekeeping issues under control resulting in the development of a positive perception of the public in respect to the project. As part of this process SCSJV has developed an SCSJV MWCC Interface Management Plan which provides details on key contract contacts and information on the local catchment area in relation to construction works.

Community notification

8.1.12 A proactive approach to the management of noise and vibration requires appropriate coordination with community relations activities. Local stakeholders and Local Authorities will be kept informed of site activities prior to and over the course of the works. A general project update of works will be sent out periodically to inform the residents and businesses in the area of upcoming works and what to expect over a 3-month period (or more, where necessary for specific stakeholders).

8.1.13 More locally to work sites, information will be communicated to the residents and businesses, through information sheets, including as a minimum, the start date, a site plan, nature, and duration of the works, and will specify occurrences of night and weekend works, and the HS2 Ltd helpline details. Such information sheets will be distributed at least 2 weeks prior to commencement of works and will extend to a catchment area of up to 300 metres from worksites (radius of catchment may vary depending on location).

8.1.14 In the case of work required in response to an emergency, local residents and businesses will be advised as soon as practicable that emergency work is taking place. This will be done by the Community Relations Representative.

8.2 Training and Awareness

Project and site inductions

8.2.1 All staff will receive a HS2 MWCC Induction. SCSJV and HS2 staff and operatives engaged on-site will undertake a site-specific health, safety, and environmental management induction prior to visiting or commencing work on site.

8.2.2 The induction will include the main requirements of the Overarching EMP or SSECP respectively and inform staff and operatives of the main environmental risks and controls to be implemented on site. Where relevant this will include identification of specific noise and vibration risks.

Specific noise and vibration training

8.2.3 Where specific high noise and vibration risks are identified, site-specific training modules will

8.2.4 be delivered that are relevant to operatives' roles and responsibilities.

Start of Shift Briefings

8.2.5 Site Supervisors/Managers will hold daily start of shift briefings to ensure suitable coordination of site activities. Relevant noise and vibration risks and control measures identified in the Environmental Control Plans will be communicated as required.

Work Package Plans / Risk Assessment Method Statement

8.2.6 Having regard to the information contained in SCSJV EMPs, SCSJV and its Contractors will set out the procedures to be followed for construction activities in Risk Assessment Method Statements (RAMS) which will address, amongst other matters, noise, and vibration control measures necessary to comply with the requirements of EMRs and U&As. Prior to commencement of works activities RAMSs developed by the WP Contractor will be approved by SCSJV.

Toolbox Talks

8.2.7 Environment related Toolbox Talks will be delivered at least once a month to highlight and maintain awareness about relevant topics. Toolbox talks will, on occasion, address key noise and vibration risks and control measures associated with certain site activities. A record of attendance at these toolbox talks will be kept and used to update the site personnel training records.

8.3 Interface

8.3.1 Each work site has individual sensitivities and different levels surrounding stakeholders and residents. Under stage 2 of the MWCC, construction activities are programmed to commence in early 2019, at this time SCSJV will become the Principal Contractor for the majority of the work areas where they will be undertaking activities. However, as part of the design

development there are some locations where SCSJV require to work collaboratively with other HS2 contracts, in particular the EWC to provide access for surveys, site familiarisation and undertake the impact of overlapping scopes of works. At these worksites, liaison to implement a site-specific Interface management to facilitate an integrated approach towards the requirements of both the SCSJV and Other Employer's contractors as defined within the SCSJV Interface Management Plan (IMP) and its associated documents.

8.3.2 Interfacing will include the exchange of information between SCSJV and Other HS2 subcontractors relating to the design process, access and egress and collaborative working.

8.3.3 SCSJV will also interface with third parties including, but not limited to Local Authorities, Consenting Bodies (e.g., Environment Agency) and Stakeholders. This may include, but not limited, timely updates on design progress and options, land quality management and mitigation measures.

9 Assurances

9.1 Document Review

9.1.1 This NVMP will be reviewed as often as is necessary to include significant changes in risk, scope of works, circumstances, or personalities. As a minimum, this NVMP will be reviewed every six months and changes recorded.

9.1.2 The suitability of, and performance against, the NVMP will be reviewed to ensure that it remains valid and reflects the arrangements for managing current activities on site.

9.1.3 Following revision, copies of amendments will be forwarded to the HS2 Project Manager for acceptance via SCSJV document control process. Once accepted by HS2 the revised EMP will be formally issued to the project sub-contractors.

9.2 Compliance Audits

9.2.1 The NVMP will be audited at least annually as part of the Internal Audits programmed throughout the year and detailed in the SCSJV Audit Plan.

10 References

10.1.1 The following documents are client and industry related documents from which the above information is drawn or to be referred to:

Reference	Title	Document Number
R1	Local Environmental Management Plan - London Borough of Hillingdon	P1S-HS2-EV-REP-S000-000007
R2	High Speed Two Information Paper E22: Control of noise from the operation of stationary systems	LWM-HS2-HY-PPR-000-000057
R3	High Speed Two Information Paper E23: Control of Construction Noise and Vibration	LWM-HS2-HY-PPR-000-000057
R4	Methods for rating and assessing industrial and commercial sound	BS 4142:2014+A1:2019
R5	Code of practice for noise and vibration control on construction and open sites – Part 1: Noise	BS 5228-1:2009+A1:2014
R6	Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration	BS 5228-2:2009+A1:2014
R7	The Environmental Protection Act 1990	https://www.legislation.gov.uk/ukpga/1990/43/contents
R8	The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1995	http://www.legislation.gov.uk/uksi/1996/428/contents/made
R9	Register of Undertakings and Assurances	https://www.gov.uk/government/publications/high-speed-rail-london-west-midlands-bill-register-of-undertakings-and-assurances
R10	High Speed Rail (London - West Midlands) Act 2017	http://www.legislation.gov.uk/ukpga/2017/7/contents/enacted
R11	Control of Pollution Act 1974	https://www.legislation.gov.uk/ukpga/1974/40
R12	The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015	https://www.legislation.gov.uk/uksi/2015/227/made?view=plain
R13	High Speed 2 Information Paper E22: Control of noise from the operation of stationary systems	HS2 Information Paper E22

Appendix A - Undertakings and Assurances

The following U&As have been identified as being applicable to this discipline topic and will be managed through the mitigations detailed in this management plan.

Reference	To Whom	Detail
1832	London Borough of Hillingdon	1.1 The Secretary of State will require the Nominated Undertaker to engage actively with TfL and the Council in a study to reduce HGV movements in the Ickenham area of Hillingdon during the construction of HS2, and in carrying out the study in accordance with the 'Brief'. The study would include, but not be limited to, the following proposals: (a) maximising as far as reasonably practicable, the volume of excavated and construction material from the construction of HS2 to be removed by rail so as to reduce the volumes on the road; (b) changes to the gradient of the Copthall cutting to reduce the amount of spoil removal; (c) greater reuse of excavated material locally to reduce the volume of material that has to be removed from site; (d) changes to the Harvil Road railhead design and footprint; (e) Bringing forward the completion of Harvil Road sidings earlier in the construction programme so as to reduce the volume of material excavated by road; and (f) explore measures to reduce the number of road vehicles associated with workforce travel. 1.2 For the avoidance of doubt the 'Brief was agreed by the Promoter, TfL and the Council during a meeting on 22 January 2016. The agreed version of the Brief is appended to this letter. 1.3 Upon completion of the study, it will be submitted to TfL, the Council and the Promoter for comment. This will be no later than May 2016.

		1.4 The study will then be submitted to the Promoter for his consideration who will use reasonable endeavours to implement the plan, taking into account the safe, economic and timely delivery of the railway. The Promoter will notify both TfL and the Council to what extent the study will be implemented, no later than one month after the plan's submission. 1.5 If not satisfied with the Promoter's decision regarding implementation of the findings of the study, or if the Council has not been notified of the decision in accordance with the timescales set out above, the Council will be able to petition the House of Lords HS2 Select Committee for resolution.
1993	Mr Fred Dawson and Mrs Jean Valerie Dawson	4. The Secretary of State for Transport shall, prior to completion of the detailed design of the Northolt tunnel and earthworks construction compound, require the Nominated Undertaker to engage with the Petitioners, or their nominated representative to take account of any reasonable proposals made by the Petitioners to, so far as reasonably practicable, reduce the visual, noise and dust impacts of the temporary material stockpile within Northolt tunnel and earthworks compound located across Harvil Road from Harvil Farm, on the residential dwellings within Harvil Farm. 5. The assurance in paragraphs 4 above are subject to the Nominated Undertaker obtaining all necessary approvals and consents. In these assurances: "Plot AP4-21" means Plot AP4-21 as shown on replacement sheet 1-49 of the deposited plans for Additional Provision 4 in the London Borough of Hillingdon; "Proposed Scheme" means the development on Plot AP4-21 of a temporary material stockpile, temporary provision of a haul road and temporary diversion of footpath U50 west of Harvil Road.
2095	General	The design of the conveyors, for example whether they are open or enclosed systems, will take into consideration the potential noise generated by the conveyors and further assessment of the predicted effects on any receptors within close proximity. The Nominated Undertaker will carry out such noise predictions with reference to the Environmental Minimum Requirements.
2096	General	The Promoter will look to provide sound barriers in this area that will perform to the standards set out in the Environmental Statement and, in accordance with the design policy, their appearance will be sympathetic to their local context, environment and setting.

2517	Mrs Beryl Upton	In these assurances: "the Conveyor" means the temporary conveyor system represented by Work No. 1/63 in the London Borough of Hillingdon, shown on Sheet No. 1-34, 1-35 and 1-36 of the plans deposited with the Bill, operating between Northolt tunnel and West Ruislip railhead The Secretary of State will require the Nominated Undertaker to, in accordance with its duty to employ Best Practicable Means to control noise and dust during the HS2 Works, pay particular attention to the following matters when designing the Conveyor to be used between Northolt tunnel and West Ruislip railhead: (i) the precise route and elevation of the Conveyor within the limits and powers of the Bill; and (ii) the positioning and screening of the Conveyor drive motors.
2517	Mrs Beryl Upton	In these assurances: "the Conveyor" means the temporary conveyor system represented by Work No. 1/63 in the London Borough of Hillingdon, shown on Sheet No. 1-34, 1-35 and 1-36 of the plans deposited with the Bill, operating between Northolt tunnel and West Ruislip railhead The Secretary of State for Transport will require the Nominated Undertaker to cover the Conveyor where it is above ground and in the areas adjacent to The Greenway and Hoylake Crescent.

Appendix B – RSSP-WTS Site-Specific Noise Impact Assessment

1MC04 Main Works - Contract Lot S2

Noise Impact Assessment – Northolt Storage & Treatment Area – Material Treatment

Document no.: 1MC04-SCJ_SDE-EV-REP-SS05_SL07-000018

Revision	Author	Checked by	Approved by		Date approved	Reason for revision
C01	Patrick Schafstein	Matthew Weston				
C02	Patrick Schafstein	Matthew Weston				Report updated in response to Client Comments
C03	Patrick Schafstein	Matthew Weston				Report updated incorporating additional mitigation

SECURITY CLASSIFICATION: OFFICIAL

Handling instructions: None

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1 Introduction

1.1.1 The intent of this report is to investigate and assess the sound impact of the proposed waste management facilities associated with the westernmost section of the Skanska Costain Strabag Joint Venture (SCSjv) High Speed 2 (HS2) works. The waste management facilities commonly known as the Northolt Storage & Treatment Area (S&T).

1.1.2 The Northolt Storage & Treatment Area (S&T) is bounded by Harvil Road to the west, train tracks to the north, and agricultural land immediately to the south and east. The residential property, Shorthill Cottage, occupies a segment within the western portion of site. There are few residential properties located immediately surrounding the site off Harvil Road and Breakspear Road. A more densely populated area of West Ruislip is located east of Breakspear Road.

1.1.3 In brief, excavated material will be transported to the S&T area by conveyors. Material will undergo onsite treatment with lime, through the lime mixing plant, and deposited in muck bins. The material will then be transported to stockpiles using heavy machinery such as dump trucks, the material will be spread out in layers using excavators and compacted by repeated movement of earthmoving machinery.

1.1.4 The receptors Shorthill Cottage, Brackenbury House, Brackenbury Barn, Oak Farm, The Bungalow, Harvil Farm, 160 Hoylake Crescent, 178 Hoylake Crescent and 77 The Greenway are identified as potentially affected by sound due to their relative proximity to the S&T area boundaries. As such these receptors are considered representative locations for the basis of the sound impact assessment. Figure 1 below illustrates the receptors location in relation to the S&T Area.

1.1.5 This sound assessment will form part of the requested waste permitting documentation.

1.1.6 An initial assessment was undertaken and indicated significant adverse impacts several receptor groups. Further discussion was held with the construction team to identify additional extraordinary mitigation which could be practicably implemented. The assessments of both pre and post extraordinary mitigation scenarios are presented it this report.

1.1.7 The report has been produced by Patrick Schafstein (AMIOA) who also undertook attended environmental monitoring at Harvil Road. Patrick has over three years' experience in acoustic consultancy. Sound modelling was undertaken by Robin Bolt (AMIOA). The modelling and calculations have been checked by Sam Geering (MIOA). Matthew Weston (MIOA) managed and directed the assessment. Matthew has over 16 years' experience of work in the field of environmental sound

assessment including a significant number of projects where assessment in accordance with the principles of BS 4142 was required.

Figure 1: Area surrounding S&T Area – Representative Receptors and Conveyor Line

2 Methodology

2.1.1 An investigation and assessment of noise impact has been undertaken using guidance outlined in British Standard (BS) 4142:2014 Methods for rating and assessing industrial and commercial sound. This assessment has been undertaken in line with Environment Agency Guidance.

2.1.2 In principle, when determining noise impact in line with BS 4142:2014, the assessment must include the following:

- *Background noise survey at relevant local receptors.*
- *Specific noise levels at these receptors due to site operations (usually by calculation).*
- *Assessment of the impact of characteristic features of the site noise (e.g. tonality, irregularity, impulsiveness).*
- *Comparison of the rating noise level (specific noise level + any feature correction applied) in relation to the background noise level to assess the noise impact. and*
- *General consideration of all of the above in context of the situation in addition to uncertainty to conclude on the overall acceptability of the noise impact.*

2.1.3 When assessing the likelihood of complaints determining the differences between the rating level and the background $L_{A90,T}$ noise level is paramount. The Standard states that:

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. (EA definition of 'Unacceptable level of audible or detectable noise').*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context. (EA definition of Audible or detectable noise') and*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact depending on the context. (EA definition of 'No noise, or barely audible or detectable noise').*

2.1.4 The rating level ($L_{Ar,Tr}$) is defined in BS 4142: 2014 and is used to rate the industrial source (known as the specific noise source) outside residential dwellings. This

level is obtained by adding suitable correction values (outlined in table 1) to the specific sound level.

2.1.5 Reference time intervals, Tr, of 1 hour and 15 minutes are specified for the determination of rating levels during the day and night, respectively, as stated in BS 4142:2014:

"The shorter reference time interval at night means that short duration sounds with an on time of less than 1 h can lead to a greater specific sound level when determined over the reference time interval during the night than when determined during the day."

Table 1: BS 4142 feature correction

Section 9.2 Subjective Method	Perceptibility to noise sensitive façades	Correction
Tonality Ranging from not tonal to prominently tonal	Not tonal	+0
	Just perceptible	+2
	Clearly perceptible	+4
	Highly perceptible	+6
Impulsivity Considering both the rapidity and any overall change in sound levels	Not impulsive	+0
	Just impulsive	+3
	Clearly impulsive	+6
	Highly impulsive	+9
Readily Distinctive Characteristic is neither tonal nor impulsive	Is not present	+0
	Is present	+3
Intermittency Identifiable "on/off" conditions	Is not present	+0
	Is present	+3

3 Noise Monitoring

3.1.1 Semi-permanent unattended noise monitoring systems were installed at monitoring positions MP01 and MP02, identified in Figure 1, from 6th February 2021 and data was obtained for this assessment up to 21st February 2021. Site logs were analysed to identify periods of non-site activity and this data was processed to provide indicative background noise levels for the sensitive receptors identified in the assessment.

3.1.2 In advance of significant construction works being undertaken in the area, semi-permanent noise monitors were installed at monitoring positions N056 and N057. Noise data obtained from 1st November to 18th December 2020 from these two monitoring positions has been analysed to determine representative background noise levels at nearby sensitive receptor groups. The locations of N056 and N057 are shown on Figure.

3.1.3 For the purposes of this assessment the following sensitive receptors, followed by the ES ID where applicable, have been identified:

- R1 – Shorthill Cottage - 408811;
- R2 – 2 Harvil Farm - 406098;
- R3 – Brackenbury House – N/A;
- R4 – Brackenbury Barn - 419116;
- R5 – The Bungalow – N/A;
- R6 – 160 Hoylake Crescent - 419214;
- R7 – 178 Hoylake Crescent - 419186;
- R8 – 77 The Greenway - 700377; and
- R9 – Oak Farm – N/A.

3.1.4 The MP01 monitoring location was considered to represent the ambient and background noise levels for receptors Shorthill Cottage; Brackenbury House and Brackenbury Barn.

3.1.5 The MP02 monitoring location was considered to represent the ambient and background noise levels for the receptors Harvil Farm and The Bungalow due to its proximity to the neighbouring road network.

3.1.6 The N056 location was considered to represent the ambient and background noise levels for the receptors Oak Farm; 160 and 178 Hoylake Crescent and 77 The Greenway due to their proximity to residential roads and the undeveloped area to the North.

3.1.7 Supplementary attended noise measurements on the 22nd and 23rd March 2021 were obtained on Harvil Road and Breakspear Road for validation of the use of unattended data at satellite receptor locations (MP02), the locations are shown on Figure 4 below.

3.1.8 The grid references for the noise monitoring data used for this assessment are as follows:

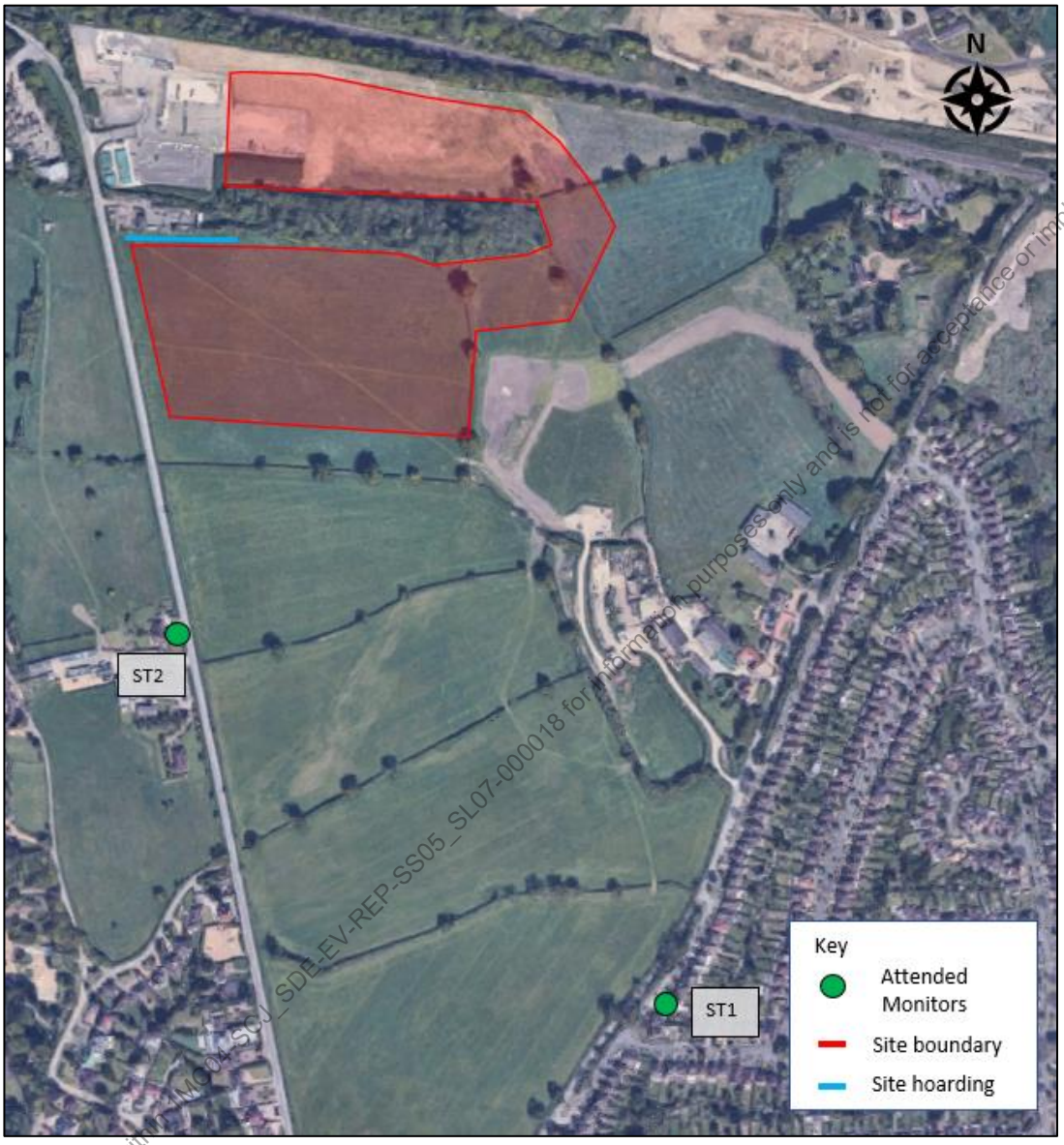
- Monitoring Position 1 (MP01) – Latitude 51.573324; Longitude -0.46691052;
- Monitoring Position 2 (MP02) – Latitude 51.574401; Longitude -0.46880803;
- Monitoring Position N056 – Latitude 51.57172; Longitude -0.44515; and
- Monitoring Position N056 – Latitude 51.57065; Longitude 0.44175.

3.1.9 Figure 2 and 3 below shows the monitoring systems as set-up in situ.

Figure 2: Noise monitoring systems setup, MP01 and MP02 respectively.

Figure 3: Noise monitoring systems setup, N056 and N057 respectively.

Figure 4: Location of supplementary attended monitoring.



3.2 Weather Conditions

3.2.1 The weather conditions during the unattended noise measurements between 1st November and 18th December 2020 and from 6th February 2021 to 21st February 2021 are summarised in Table 3 in Appendix B.

3.2.2 Weather data was obtained from an additional noise monitor, N048, fitted with a weather station within West Ruislip Portal Compound.

3.2.3 During the attended noise survey on the 22nd March 2021 the temperature was measured to be 14°C with a relative humidity of 50%. Wind speeds were measured to be around 1 ms^{-1} and there was no precipitation throughout the attended survey.

3.2.4 During the attended noise survey on the 23rd March 2021 the temperature was measured to be 13°C with a relative humidity of 50%. Wind speeds were measured to be around 0.8 ms^{-1} and there was no precipitation throughout the attended survey.

3.3 Background sound levels

3.3.1 The $L_{A90,T}$ levels presented in this document were measured during the Covid-19 pandemic, during a government lockdown. It is considered that this may have led to unusually low weekday and weekend $L_{90,T}$ daytime and night-time levels, as road traffic is likely to have reduced due to restrictions in place at the time.

3.3.2 Unattended weather data from monitoring location N048 has been analysed to identify where periods of elevated wind or higher levels of precipitation occurred. Corresponding measured noise levels during the adverse weather periods were reviewed and excluded from the assessment if judged to have been adversely influenced.

3.3.3 The MP01 and MP02 background sound levels used in this assessment have been obtained from the semi-permanent unattended noise monitoring systems identified, the following periods were identified where there was no site activity and data is considered to be representative of background noise levels in the absence of construction noise:

- weekend of the 6th February;
- 9th February;
- weekend of the 13th February; and
- weekend of the 20th February.

3.3.4 The N056 and N057 background sound levels used in the assessment have been obtained from the semi-permanent unattended noise monitoring systems, the following periods were identified where there was no significant site activity and data considered to be representative of background noise levels in the absence of construction noise:

- from 1st Nov 2020 to 19th Dec 2020.

3.3.5 Additional attended noise measurements were obtained between 16:03 and 16:18 hrs on Breakspear Road on 22nd March and between 15:10 and 15:25 hrs on 23rd March to provide additional noise reference data for the sensitive receptors located off Breakspear Road. The measurement location is marked as ST1 on Figure 4. During the attended noise measurements construction noise from the Harvil Road site was not audible.

3.3.6 Further attended noise measurements were obtained c. 15 m south of 2 Harvil Farm between 15:03 and 17:08 hrs on 22nd March and between 15:35 and 15:50 hrs on 23rd March. The measurement location is marked as ST2 on Figure 5. During the attended noise measurements construction noise from the Harvil Road site was not audible.

3.3.7 The proposed S&T area will be operational during daytime and night-time hours, weekdays Monday to Friday, Saturday, and Sunday.

3.3.8 Analysis of the most frequently occurring daytime background sound levels, has been undertaken using the data sets obtained in the absence of significant construction at MP01, MP02, N056 and N057. The most commonly occurring daytime level for MP01 and MP02 monitoring locations was 48 dB $L_{A90,16hr}$ while for night-time the MP01 level was 45 dB $L_{A90,8hr}$, excluding outlying data, and the MP02 level was 47 dB $L_{A90,8hr}$.

3.3.9 The most commonly occurring daytime level for N056 was 47 dB $L_{A90,16hr}$ while for night-time the level was 38 dB $L_{A90,8hr}$. The most commonly occurring daytime level for N057 was 46 dB $L_{A90,16hr}$ while for night-time the level was 38 dB $L_{A90,8hr}$. N056 has been selected to represent R6 – R9 receptors as this lies in closer proximity and has lower values to represent a worse case assessment.

3.3.10 Statistical analysis showing the frequency of background level occurrences in the absence of significant construction is presented graphically in Figures A1 to A6 of Appendix A.

Table 2: Breakdown of $L_{A90,T}$ Results from MP01

Monitoring Period		MP01 – Measured Sound Pressure Level
Hours	Period	$L_{A90,T}$
07:00 - 23:00 hrs	Daytime	48
07:00 - 19:00 hrs	Daytime*	48
19:00 - 23:00 hrs	Evening*	48
23:00 - 07:00 hrs	Night-time	45

Note: *Added for post mitigation assessment.

Table 3: Breakdown of $L_{A90,T}$ Results from MP02

Monitoring Period		MP02 – Measured Sound Pressure Level
Hours	Period	$L_{A90,T}$
07:00 - 23:00 hrs	Daytime	48
07:00 - 19:00 hrs	Daytime*	48
19:00 - 23:00 hrs	Evening*	49
23:00 - 07:00 hrs	Night-time	47

Note: *Added for post mitigation assessment.

Table 4: Breakdown of $L_{A90,T}$ Results from N056

Monitoring Period		N056 – Measured Sound Pressure Level
Hours	Period	$L_{A90,T}$
07:00 - 23:00 hrs	Daytime	47
07:00 - 19:00 hrs	Daytime*	47
19:00 - 23:00 hrs	Evening*	44
23:00 - 07:00 hrs	Night-time	38

Note: *Added for post mitigation assessment.

Table 5: Breakdown of $L_{A90,T}$ Results from N057

Monitoring Period		N057 – Measured Sound Pressure Level
Hours	Period	$L_{A90,T}$
07:00 - 23:00 hrs	Daytime	46
07:00 - 19:00 hrs	Daytime*	46
19:00 - 23:00 hrs	Evening*	46
23:00 - 07:00 hrs	Night-time	38

Note: *Added for post mitigation assessment.

3.4 MP01 Unattended Survey Results

3.4.1 Daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ ambient sound levels at MP01 are presented in Table 6 overleaf. These ambient sound levels have been calculated using logarithmic averaging of 1-minute measurements, whilst mean $L_{Amax,F}$ and $L_{A90,T}$ sound levels have been calculated using arithmetic averaging of 1-minute measurements. The range of measured 1-minute levels from which each logarithmic or mean value has been calculated is shown in parenthesis.

Table 6: Summary of unattended sound monitoring result at MP01

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	06-Feb-21	64 (45-83)	63 (44-76)	50 (43-73)	55 (47-81)	50 (44-62)	46 (43-50)
Sun	07-Feb-21	61 (46-83)	57 (44-69)	51 (44-63)	57 (46-83)	52 (45-66)	47 (44-56)
Tue	09-Feb-21	65 (46-84)	61 (44-72)	52 (44-70)	57 (42-75)	52 (40-60)	44 (39-52)
Sat	13-Feb-21	60 (47-84)	53 (45-66)	48 (44-58)	51 (46-71)	48 (44-58)	46 (42-50)
Sun	14-Feb-21	60 (48-86)	56 (45-67)	51 (44-60)	60 (58-72)	59 (57-62)	58 (57-60)
Sat	20-Feb-21	64 (49-98)	58 (47-73)	52 (46-60)	56 (47-77)	50 (45-62)	46 (43-51)
Sun	21-Feb-21	62 (48-96)	55 (45-71)	48 (41-54)	57 (49-78)	53 (47-65)	49 (46-58)
Overall Mean Values		**62 (60-65)**	**58 (53-63)**	**50 (48-52)**	**56 (51-60)**	**52 (48-59)**	**48 (44-58)**

3.4.2 The results of the unattended sound survey at MP01 show that during the daytime periods, ambient sound levels ranged between 53 and 63 dB $L_{Aeq,16hr}$ with an overall mean level of 58 dB $L_{Aeq,16hr}$ obtained over the 7-day monitoring period.

3.4.3 Mean daily background sound levels measured at MP01 during the daytime periods ranged between 48 and 52 dB $L_{A90,16hr}$. The overall mean 16-hour daytime background sound level measured over the 7-day monitoring period was 50 dB $L_{A90,16hr}$.

3.4.4 The results of the unattended sound survey at MP01 show that during the night-time periods, ambient sound levels ranged between 48 and 59 dB $L_{Aeq,8hr}$ with an overall mean level of 52 dB $L_{Aeq,8hr}$ obtained over the 7-day monitoring period.

3.4.5 Mean daily background sound levels measured at MP01 during the night-time periods ranged between 44 and 58 dB $L_{A90,8hr}$. The overall mean 8-hour night-time background sound level measured over the 7-day monitoring period was 48 dB $L_{A90,8hr}$.

3.5 MP02 Unattended Survey Results

3.5.1 Daytime $L_{Aeq,16hr}$ ambient sound levels at MP02 are presented in Table 7 overleaf. These ambient sound levels have been calculated using logarithmic averaging of 1-minute measurements, whilst mean $L_{Amax,F}$ and $L_{A90,T}$ sound levels have been calculated using arithmetic averaging of 1-minute measurements. The range of measured 1-minute levels from which each logarithmic or mean value has been calculated is shown in parenthesis.

Table 7: Summary of unattended sound monitoring result at MP02

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	06-Feb-21	72 (42-98)	62 (40-82)	47 (39-67)	63 (42-91)	55 (40-68)	44 (39-53)
Sun	07-Feb-21	71 (44-92)	61 (41-75)	48 (38-59)	65 (43-93)	58 (41-73)	46 (39-62)
Tue	09-Feb-21	71 (44-91)	64 (41-76)	53 (39-75)	60 (42-92)	59 (39-76)	42 (37-65)
Sat	13-Feb-21	61 (47-96)	57 (45-76)	48 (44-67)	55 (49-80)	50 (45-61)	47 (44-51)
Sun	14-Feb-21	59 (48-89)	55 (46-71)	49 (45-63)	57 (50-89)	57 (46-76)	49 (44-64)
Sat	20-Feb-21	69 (48-90)	60 (46-73)	51 (44-68)	56 (44-82)	51 (41-62)	44 (40-50)
Sun	21-Feb-21	68 (48-91)	59 (44-73)	48 (41-67)	59 (46-87)	58 (43-76)	47 (42-63)
Overall Mean Values		**67 (59-72)**	**60 (55-64)**	**49 (47-53)**	**59 (55-65)**	**55 (50-59)**	**46 (42-49)**

3.5.2 The results of the unattended sound survey at MP02 show that during the daytime periods, ambient sound levels ranged between 55 and 64 dB $L_{Aeq,16hr}$ with an overall mean level of 60 dB $L_{Aeq,16hr}$ obtained over the 7-day monitoring period.

3.5.3 Mean daily background sound levels measured at MP02 during the daytime periods ranged between 47 and 53 dB $L_{A90,16hr}$. The overall mean 16-hour daytime background sound level measured over the 7-day monitoring period was 49 dB $L_{A90,16hr}$.

3.5.4 The results of the unattended sound survey at MP02 show that during the night-time periods, ambient sound levels ranged between 50 and 59 dB $L_{Aeq,8hr}$ with an overall mean level of 55 dB $L_{Aeq,8hr}$ obtained over the 7-day monitoring period.

3.5.5 Mean daily background sound levels measured at MP02 during the night-time periods ranged between 42 and 49 dB $L_{A90,8hr}$. The overall mean 8-hour night-time background sound level measured over the 7-day monitoring period was 46 dB $L_{A90,8hr}$.

3.6 Supplementary Attended Survey Results

3.6.1 A summary of the attended survey results obtained at ST1 and ST2 are presented overleaf in Table 8 and Table 9 respectively.

Table 8: Summary of Attended sound monitoring result at ST1

Meas. Date	Start Time	Duration	Measured Sound Levels, dB re. 2 x 10^{-5} Pa		
			$L_{Amax,F}$	$L_{Aeq,T}$	$L_{A90,T}$
22/03/2021	16:03	15	92.3	68.8	51.0
23/03/2021	15:10	15	85.2	67.7	54.7
Overall Mean Values			**92.3**	**68.3**	**52.9**

3.6.2 Attended noise measurements presented in Table 8 above indicate that background noise levels in the vicinity of the Breakspear Road receptors were between 51 dB and 55 dB $L_{A90,T}$ during the short-term measurement periods with a mean level of 53 dB. This is 5 dB higher than the level adopted for assessment purposes and indicates a worse case assessment has been undertaken.

Table 9: Summary of Attended sound monitoring result at ST2

Measurement Date	Start Time	Duration	Measured Sound Levels, dB re. 2 x 10^{-5} Pa		
			$L_{Amax,F}$	$L_{Aeq,T}$	$L_{A90,T}$
22/03/2021	15:33	15	85.1	70.7	50.7
22/03/2021	16:53	15	84.7	72.4	52.2
23/03/2021	15:35	15	84.7	68.6	50.7
Overall Mean Values			**85.1**	**70.8**	**51.2**

3.6.3 Attended noise measurements presented in Table 9 above indicate that background noise levels in the vicinity of the 2 Harvil Farm receptor were between 51 dB and 52 dB $L_{A90,T}$ during the short-term measurement periods with a mean level of 51 dB. This is 3 dB higher than the level adopted for assessment purposes and indicates a worse case assessment has been undertaken.

3.7 N056 Unattended Survey Results

3.7.1 A summary of the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ ambient sound levels at N056 are presented in Table 10 overleaf with the full daily results presented in Appendix B. These ambient sound levels have been calculated using logarithmic averaging of 15-minute measurements, whilst mean $L_{Amax,F}$ and $L_{A90,T}$ sound levels have been calculated using arithmetic averaging of 15-minute measurements. The range of measured 15-minute levels from which each logarithmic or mean value has been calculated is shown in parenthesis.

Table 10: Summary of unattended sound monitoring result at N056

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Overall Mean Values		**83 (77-85)**	**61 (59-64)**	**44 (33-48)**	**61 (47-82)**	**54 (45-58)**	**38 (28-46)**

Note: 1 – Data not available due to unfavourable weather.

3.7.2 The results of the unattended sound survey at N056 show that during the daytime periods, ambient sound levels ranged between 59 and 64 dB $L_{Aeq,16hr}$ with an overall mean level of 61 dB $L_{Aeq,16hr}$ obtained over the 48-day monitoring period.

3.7.3 Mean daily background sound levels measured at N056 during the daytime periods ranged between 33 and 48 dB $L_{A90,16hr}$. The overall mean 16-hour daytime background sound level measured over the 48-day monitoring period was 44 dB $L_{A90,16hr}$.

3.7.4 The results of the unattended sound survey at N056 show that during the night-time periods, ambient sound levels ranged between 45 and 58 dB $L_{Aeq,8hr}$ with an overall mean level of 54 dB $L_{Aeq,8hr}$ obtained over the 48-day monitoring period.

3.7.5 Mean daily background sound levels measured at N056 during the night-time periods ranged between 28 and 46 dB $L_{A90,8hr}$. The overall mean 8-hour night-time background sound level measured over the 48-day monitoring period was 38 dB $L_{A90,8hr}$.

3.8 N057 Unattended Survey Results

3.8.1 A summary of the daytime $L_{Aeq,16hr}$ and night-time $L_{A90,8hr}$ ambient sound levels at N057 are presented in Table 11 overleaf, with the full daily results presented in Appendix B. These ambient sound levels have been calculated using logarithmic averaging of 15-minute measurements, whilst mean $L_{Amax,F}$ and $L_{A90,T}$ sound levels have been calculated using arithmetic averaging of 15-minute measurements. The range of measured 15-minute levels from which each logarithmic or mean value has been calculated is shown in parenthesis.

3.8.2 The results of the unattended sound survey at N057 show that during the daytime periods, ambient sound levels ranged between 54 and 60 dB $L_{Aeq,16hr}$ with an overall mean level of 57 dB $L_{Aeq,16hr}$ obtained over the 48-day monitoring period.

3.8.3 Mean daily background sound levels measured at N056 during the daytime periods ranged between 33 and 49 dB $L_{A90,16hr}$. The overall mean 16-hour daytime

background sound level measured over the 48-day monitoring period was 44 dB $L_{A90,16hr}$.

3.8.4 The results of the unattended sound survey at N057 show that during the night-time periods, ambient sound levels ranged between 37 and 53 dB $L_{Aeq,8hr}$ with an overall mean level of 50 dB $L_{Aeq,8hr}$ obtained over the 48-day monitoring period.

3.8.5 Mean daily background sound levels measured at N057 during the night-time periods ranged between 30 and 45 dB $L_{A90,8hr}$. The overall mean 8-hour night-time background sound level measured over the 48-day monitoring period was 39 dB $L_{A90,8hr}$.

Table 11: Summary of unattended sound monitoring result at N057

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Overall Mean Values		**77 (71-80)**	**57 (54-60)**	**44 (33-49)**	**58 (48-75)**	**50 (37-53)**	**39 (30-45)**

4 Storage & Treatment Area Plant

4.1.1 The plant sound levels outlined in Tables 12 to 15 below are understood to be representative of the plant to be used on site.

4.1.2 The plant listed below has been processed and using a sound modelling software, the receptor associated Sound Power Level has been determined.

Table 12: Plant and Equipment Assumptions – Conveyor / Muck Storage Bins

Plant	No.	Daytime % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
30-35t ADT dumpers	8	95	5	106	BS 5228-1:2009+A1:2014 Table C.4:2
25t Excavator	2	95	95	105	BS 5228-1:2009+A1:2014 Table C.2:19
30-40t Excavators	2	10	95	107	BS 5228-1:2009+A1:2014 Table C.2:14
Tractors	2	30	20	108	BS 5228-1:2009+A1:2014 Table C.4:74
Loading shovel	3	95	95	113	BS 5228-1:2009+A1:2014 Table C.10:16
4x4 Vehicles	2	20	20	102	Measured
4x4 Diesel tankers	1	15	15	110	BS 5228-1:2009 Table C.11:4-20
Generator	1	0	40	102	BS 5228-1:2009+A1:2014 Table C.4:84
Conveyor In	1	100	100	98	Measured
Conveyor Out	1	100	10	98	Measured
Wheel Wash	1	12	33	91	BS 5228-1:2009+A1:2014 Table C.3:13

Table 13: Plant and Equipment Assumptions – Lime Station Operation

Plant	No.	Daytime % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Delivery Lorries	4	60	-	110	BS 5228-1:2009 Table C.11:4-20
Compressor	4	60	-	106	BS 5228-1:2009 Table D.7:10
Pugmill / Mixer	3	100	100	104	BS 5228-1:2009+A1:2014 Table C.4:22
Hopper (Discharge Point)	3	100	100	103	BS 5228-1:2009+A1:2014 Table C.6:32

Table 14: Plant and Equipment Assumptions – Stockpile Plant

Plant	No.	Daytime % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Loading Shovel	3	100	100	113	BS 5228-1:2009+A1:2014 Table C.10:16
40 T Excavator	1	100	100	107	BS 5228-1:2009+A1:2014 Table C.2:14
30-35 T ADT Dumpers	5	100	100	106	BS 5228-1:2009+A1:2014 Table C.4:2

Table 15: Plant and Equipment Assumptions – Attenuation Pond

Plant	No.	Daytime % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Tractor w/ Water Bowser	1	50	-	109	BS 5228-1:2009+A1:2014 Table C.6:37
40 T Excavator	3	80	100	107	BS 5228-1:2009+A1:2014 Table C.2:14
Bulldozers	2	80	100	107	BS 5228-1:2009+A1:2014 Table C.2:11
30-35 T ADT Dumpers	5	80	100	106	BS 5228-1:2009+A1:2014 Table C.4:2
Dust Suppression Cannon	10	80	80	106	BS 5228-1:2009+A1:2014 Table C.4:91
Generator & Pump	2	100	100	90	BS 5228-1:2009+A1:2014 Table C.8:23

5 Sound Impact Assessment – Calculated Levels

5.1 Background Noise level

5.1.1 Receptors R1, R3 and R4 background noise levels, L_{A90}, relate to monitoring position MP01. Receptors R2 and R5 relate to monitoring position MP02. Receptors R6, R7, R8 and R9 relate to monitoring position N056. As such, background noise levels adopted for pre and post mitigations assessments are presented in Table 16 below.

Table 16: Background levels adopted per receptor.

Monitor	Receptor	Daytime		Evening	Night-time
		07:00 - 23:00 hrs $L_{A90,16hr}$	07:00 - 19:00 hrs $L_{A90,12hr}$ *	19:00 - 23:00 hrs $L_{A90,4hr}$ *	23:00 - 07:00 hrs $L_{A90,8hr}$
MP01	R1, R3, R4	48	48	48	45
MP02	R2, R5	48	48	49	47
N056	R6 to R9	47	47	44	38

Note: *Added for post mitigation assessment.

5.2 Sound Level Calculations of Plant at Nearest Receptors

5.2.1 The sound power levels presented in Tables 12 to 15 have been used to calculate the receptor sound pressure levels associated with the Storage & Treatment area operation.

5.2.2 The sound modelling has been undertaken using the SoundPLAN (version 8.2) sound modelling software. SoundPLAN is a propriety software package which allows the calculation of sound levels using acoustical ray-tracing techniques through implementing the prediction procedure detailed in ISO 9613-2: 1996.

5.2.3 Areas of hard and soft ground have been estimated from Google aerial mapping images and proposed site layouts.

5.2.4 All sources have been modelled as omnidirectional point sources except for the conveyor and any plant utilising haul roads which have been modelled as line sources.

5.2.5 All plant within the assessment has been calculated at height of 1.5 metre relative to the local ground height, with the following plant exceptions:

- Conveyor belt – modelled at above local ground from 2.5 m to 9.0 m; and
- Plant operating atop the stockpile – modelled at 5.0m above local ground.

5.2.6 A 2.4 metre noise barrier has been positioned between the stockpile and Shorthill cottage the closest and potentially worse affected noise sensitive receptor.

5.2.7 Calculations have been carried out based upon machinery operating for a reasonable worse case daytime hour and 15-minute night-time period. Calculations include all the construction activities identified for the operation of the Storage & Treatment Area.

5.2.8 Sound pressure levels have been calculated as $L_{Aeq,T}$ levels at 1 metre from the facades of noise sensitive receptors. The modelled specific sound levels are for construction noise only (i.e., they exclude any ambient noise). Resulting levels are presented in Tables 17 and 18 below for day (07:00 – 23:00 hrs) and night (23:00 – 07:00 hrs) respectively.

Table 17: Specific Noise Level dB at Receptors (07:00-23:00 hrs) Daytime

Receptor ID / ES ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	61.7
R2 - Harvil Farm / 406098	59.4
R3 - Brackenbury House / N/A	56.4
R4 - Brackenbury Barn / 419116	55.4
R5 - The Bungalow / N/A	52.9
R6 - 160 Hoylake Crescent / 419214	48.6
R7 - 178 Hoylake Crescent / 419186	49.1
R8 - 77 The Greenway / 700377	44.8
R9 - Oak Farm / N/A	43.5

Table 18: Specific Noise Level dB at Receptors (23:00-07:00 hrs) Night-time

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	63.8
R2 - Harvil Farm / 406098	60.0
R3 - Brackenbury House / N/A	57.0
R4 - Brackenbury Barn / 419116	55.8
R5 - The Bungalow / N/A	55.5
R6 - 160 Hoylake Crescent / 419214	49.6
R7 - 178 Hoylake Crescent / 419186	49.6
R8 - 77 The Greenway / 700377	46.4
R9 - Oak Farm / N/A	45.8

5.2.9 Review of the calculated specific levels presented in Tables 17 and 18 above shows that calculated night-time levels are up to 2.6 dB higher than daytime levels, this is due to alternative plant operating and/or higher percentage operating times.

5.3 Acoustic Character

5.3.1 Acoustic character corrections have been applied in this assessment, as proposed items of plant such as generators may have a slight perceivable tonality, or other characteristic requiring a feature correction. Where appropriate an acoustic feature correction has been applied to the specific noise levels in Tables 19 and 20 overleaf.

5.3.2 Character corrections have been applied to different receptors groups as acoustic characteristics are not expected to be the same for each receptor. It is anticipated that tonal plant noise may be just perceptible at receptors in close proximity to site works, a +3dB correction is proposed for other sound characteristics that are neither tonal or impulsive but could be perceptible.

5.3.3 Receptor R1 has been applied a +7dB correction (+4dB for tonality; +3dB for other characteristics) due to its proximity to the site main noise sources and the specific sound levels being greater than the pre-existing ambient levels, and therefore, having the potential for characteristics to be more noticeable.

5.3.4 Receptors R2 to R7 and R9 have been applied a +5dB correction (+2dB for tonality; +3dB for other characteristics), as the pre-existing ambient levels are c.1. dB higher than the specific sound levels, therefore, site sources are expected to be less perceptible at the receptor.

5.3.5 Receptor R8 has been applied a +2dB correction for tonality due to the conveyor system producing the highest sound at the receptor, but slightly perceptible as it is c.20 dB lower than the ambient sound levels.

5.3.6 Reversing alarms are to comprise broadband 'white noise' whenever possible, and not have tonal characteristics such as standard reversing alarms.

5.3.7 It has been deemed that no other characteristic correction needs to be applied.

5.4 Assessment

5.4.1 The BS 4142 assessments are presented overleaf in Tables 19 and 20 with predicted sound levels, for the affected receptors, and are compared to existing background sound levels and the resulting final noise rating levels for this assessment.

Table 19: BS 4142 Assessment Summary Calculations – Daytime 07:00-23:00 hrs

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	62	7	69	21
R2 - Harvil Farm / 406098	48	59	5	64	16
R3 - Brackenbury House / 1868	48	56	5	61	13
R4 - Brackenbury Barn / 419116	48	55	5	60	12
R5 - The Bungalow / 1021	48	53	5	58	10
R6 - 160 Hoylake Crescent / 419214	47	49	5	54	7
R7 - 178 Hoylake Crescent / 419186	47	49	5	54	7
R8 - 77 The Greenway / 700377	47	45	2	47	0
R9 - Oak Farm / 1935	47	44	5	49	2

Table 20: BS 4142 Assessment Summary Calculations – Night-time 23:00-07:00 hrs

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	45	64	7	71	26
R2 - Harvil Farm / 406098	47	60	5	65	18
R3 - Brackenbury House / 1868	45	57	5	62	17
R4 - Brackenbury Barn / 419116	45	56	5	61	16
R5 - The Bungalow / 1021	47	56	5	61	14
R6 - 160 Hoylake Crescent / 419214	38	50	5	55	17
R7 - 178 Hoylake Crescent / 419186	38	50	5	55	17
R8 - 77 The Greenway / 700377	38	46	2	48	10
R9 - Oak Farm / 1935	38	46	5	51	13

5.5 Uncertainty

5.5.1 Uncertainty should be considered at each step of the design process and in each step of the source/receiver chain, including:

- Propagation of sound from the sources to the receptors.
- Determination of the background sound level.
- Measurement and commissioning of the system.

5.5.2 The rounding of integer values, as required by BS 4142, has been used in the derivation of the background sound levels and calculations, to avoid an impression of false precision to decimal places.

5.5.3 A qualitative estimate has been made of the uncertainty of the measured sound levels based on several site-specific factors, as outlined in BS4142:2014. Some potential measurement uncertainties that have been considered are listed below:

- Selected monitoring location - The monitoring location have been selected as free field away from reflecting surfaces. The monitoring locations were located at locations considered to be representative of the property facades that will face the future HS2 works and thus representative of the background sound at the most exposed façade.
- The monitoring location MP01 was positioned at a location considered to be representative of Shorthill Cottage that will face the future HS2 works and thus representative of the background sound at the most exposed façade. Brackenbury House and Brackenbury Barn are located c. 700 m to the east of the monitor but both properties of similar distance to adjacent road and rail networks. The monitoring location MP02 was considered representative to 2 Harvil Farm and The Bungalow due to the close proximity with adjacent roads and similar distance to the future S&T site. The monitoring location N056 was positioned at a location representative of 77 The Greenway, Oak Farm, and both 160 and 178 Hoylake Crescent, this is considered representative due to the similar noise environment with residential roads, rural areas and proximity to HS2 works.
- A limited data set was available for unattended monitors MP01 and MP02 where site logs indicated inactivity, as such the background levels adopted may not be as robust as extended period data sets.
- There is c. 7 weeks data for the unattended monitor N056 and N057 in the absence of significant site activity. This data set length is considered robust for the derivation of noise sensitive receptor background sound levels.
- Comparison between measured data MP01 and MP02 and extended period data

obtained at N056 and N057 indicates that daytime levels vary by just 1dB, however, night-time levels vary by up to 9dB across the full locations.

- Calibration drift - Each of the unattended monitors has been calibrated on a regular basis using Class 1 field calibrators with no significant drift noted.
- For unattended monitor references MP01 and MP02, it was necessary to exclude periods of site activity to reduce noise from the adjacent site influencing the background data used. As such the periods removed were more biased towards weekdays leaving the potentially quieter weekend periods. This too may have led to lower background noise levels being adopted for the assessment.
- Equipment measurement range - The noise floor of the Class 1 sound level meter used on this project is specified to be 17 dB(A) or less. At the monitoring location, the specified noise floor of the equipment is sufficiently below the measured noise levels and is unlikely to have affected the measured background sound levels.
- Weather affected data – Weather conditions throughout the monitoring period have been deemed suitable, and are considered to have not changed the $L_{A90,T}$ levels used in this assessment.
- Covid-19 related changes – It was noted that the $L_{A90,T}$ levels during the unattended survey periods, may have been lower than the normal expected level, due to inactivity and movements of local businesses and residential movements during the government-imposed lockdown. This potentially leads to a lower-than-expected $L_{A90,T}$ for the area, and therefore, represents an increased level dB difference, between the $L_{A90,T}$ and predicted construction sound levels, calculated in this assessment. It is not possible to provide a robust estimate of how much the background noise levels could potentially have been reduced by reduced environmental activity.

5.6 Context

5.6.1 When considering the significance of an impact, BS 4142 advises that the context of the impact should be taken into account. The context of the impact should consider factors such as: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; the sensitivity of the receptor; and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

5.6.2 The proposed operations are not permanent and are proposed to be in operation until April 2024. It would therefore be usual for the HS2 construction project noise

levels to be assessed against criteria presented in BS 5228 part 1. For context purposes a BS 5228 construction noise assessment is presented in Section 5.7 for reference.

5.6.3 Background noise levels were obtained during a period of national lockdown and may therefore be lower than periods of normal national activity. The assessment levels presented within this report may therefore overestimate the potential impacts.

5.6.4 The assumed plant operating times are high and represent a worse case assessment. Several Items of plant are assumed to have 100% operation and so actual usage levels may be less and result in lower receptor noise levels.

5.6.5 The mean ambient noise level at MP01, which represents R1, R3 and R4, in the absence of site activity is 58 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 6. In comparison, the calculated construction level at the closest receptor (R1) is 62 dB $L_{Aeq,16hour}$ which is c. 4 dB above pre-existing ambient noise levels, however, at the other MP01 receptors (R3 & R4) the calculated level is up to 56 dB $L_{Aeq,16hour}$ and so are 2 dB or more lower than pre-existing ambient noise levels. It is noted therefore that construction noise impacts at R3 and R4 are likely to be mitigated by higher pre-existing ambient noise levels.

5.6.6 The mean ambient noise level at MP02, which represents R2 and R5, in the absence of site activity is 60 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 7. In comparison the calculated construction levels at the receptors R2 and R5 are 59 dB $L_{Aeq,16hour}$ and 53 dB $L_{Aeq,16hour}$ which are 1 and 7 dB lower than the pre-existing ambient noise levels. Potential noise impacts are therefore likely to be mitigated by the higher pre-existing ambient noise levels.

5.6.7 The mean ambient noise level at N056, which represents R6 to R9, in the absence of site activity is 61 dB $L_{Aeq,16hour}$ for daytime, as presented in Table 10. In comparison, the highest calculated construction level at the receptors R6 to R9 is 49 dB $L_{Aeq,16hour}$, and the lowest is 44 dB $L_{Aeq,16hour}$ which are 12 and 17 dB lower than pre-existing ambient noise levels. It is therefore noted that the audibility of site operations and the noise impacts at these receptors will be mitigated by the higher pre-existing ambient noise levels.

5.7 BS 5228 Assessment

5.7.1 The BS 5228 (ABC) example assessment method 1 allows an assessment of the effects from construction noise using a matrix of established noise threshold levels above which a potential significant effect is concluded. ABC threshold levels are to be applied to residential receptors only.

5.7.2 An extract from BS 5288, Table E1 setting out the example ABC threshold values is provided below on Figure 5.

Figure 5: Table E.1 extracted from BS 5228.

Table E.1 **Example threshold of potential significant effect at dwellings**

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

5.7.3 The baseline noise levels used in the BS 5228 assessment have been taken from the semi-permanent unattended noise monitoring systems during a period where no construction works were taking place, using background levels obtained from monitors MP01 and MP02 for the period from 12th to 31st March 2021 and using background levels obtained from monitor N056 for the period from 1st November to 18th December 2020. The $L_{Aeq,T}$ levels presented in this document were measured during the Covid-19 pandemic, during a government lockdown. It is considered that this may have led to an unusually low $L_{Aeq,T}$ levels, as road traffic reduced due to restrictions in place at the time.

5.7.4 Sensitive receptor pre-existing ambient noise levels have been calculated for day (07:00 to 19:00 hrs), evening, (19:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods for BS 5228 assessment purposes.

5.7.5 A summary of the pre-existing ambient noise levels assigned to each receptor is presented in Table 21 overleaf with the BS 5228 assessment category and significant effect level.

Table 21: Receptor BS 5228 Assessment Categories and Significant Effect Levels

Baseline Monitor	Baseline Period	Ambient Level, dB $L_{Aeq,T}$ (no Construction)	Threshold Category / Value, dB $L_{Aeq,T}$
MP01 (R1, R3 & R4)	Day Evening Night	58 52 52	A - 65 A - 55 C - 55
MP02 (R2 & R5)	Day Evening Night	61 56 55	A - 65 B - 60 C - 55
N056 (R6, R7, R8 & R9)	Day Evening Night	61 60 54	A - 65 C - 65 C - 55

5.7.6 A comparison between the predicted receptor day, evening and night construction noise levels with the corresponding significant effect threshold level is presented below in Table 22.

Table 22: Comparison between Calculated Receptor Construction Levels and Significant Effect Levels

Receptor	Assessment Period	Construction Level , dB $L_{Aeq,T}$ (a)	Threshold Level , dB $L_{Aeq,T}$ (b)	Difference (a-b)
R1	Day Evening Night	62 62 64	65 55 55	-3 7 9
R2	Day Evening Night	59 59 60	65 60 55	-6 -1 5
R3	Day Evening Night	56 56 57	65 55 55	-9 1 2
R4	Day Evening Night	55 55 56	65 55 55	-10 0 1
R5	Day Evening Night	53 53 56	65 60 55	-12 -7 1
R6	Day Evening Night	49 49 50	65 65 55	-16 -16 -5
R7	Day Evening Night	49 49 50	65 65 55	-16 -16 -5
R8	Day Evening Night	45 45 46	65 65 55	-20 -20 -9

Receptor	Assessment Period	Construction Level , dB $L_{Aeq,T}$ (a)	Threshold Level , dB $L_{Aeq,T}$ (b)	Difference (a-b)
R9	Day	44	65	-21
	Evening	44	65	-21
	Night	46	55	-9

5.7.7 Summary differences presented in Table 22 above indicate that at R1 construction noise levels are below the daytime significant threshold level by 3 dB but exceed the evening by 7 dB and night threshold levels by up to 9 dB. It is noted at R1 represents a single property.

5.7.8 Calculated construction levels at R2 are predicted to fall below significant effect threshold levels by 6 dB during the daytime and by 1 dB during evening periods, but exceed the night-time threshold level by up to 5 dB. It is noted that Receptor location R2 represents just 2 properties.

5.7.9 Daytime construction noise levels at R3 are predicted to fall below significant effect threshold levels by 9 dB during daytime periods but are calculated to exceed the evening periods by 1 dB and the night threshold levels by 2 dB. It is noted that Receptor location R3 represents 1 property.

5.7.10 Daytime construction noise levels at R4 are predicted to fall below significant effect threshold levels by 10 dB during daytime periods and by 0 dB during evening periods but are calculated to night threshold levels by 1 dB. Receptor Location R4 represents 1 property.

5.7.11 Calculated construction levels at R5 are predicted to fall below significant effect threshold levels by 12 dB during the daytime and by 7 dB during evening periods but exceed the night-time threshold level by up to 1 dB. around 30 properties are represented by Receptor location R5.

5.7.12 At receptor locations R6, R7, R8 and R9 calculated construction levels fall below significant effect threshold levels by 5 dB or more during all day, evening, and night-time periods. It is noted that receptor locations R6 to R9 represent the vast majority of properties potentially affected by noise.

6 Reassessment With Additional Mitigation

6.1 Summary of adopted mitigation

6.1.1 Based on the initial assessment results and the observation of significant adverse impact predicted further discussions were undertaken with the construction team to identify additional extraordinary mitigation which could be adopted to reduce noise impacts. Based on these discussions the following measures were agreed:

- Working Areas - restricted working hours withing the stockpile area;
- Reductions in plant use;
- Removal of Attenuation Pond Works;
- Introduction of 2.4 m high noise barriers;

6.1.2 Further detail on the mitigations is provided in the following sub-sections.

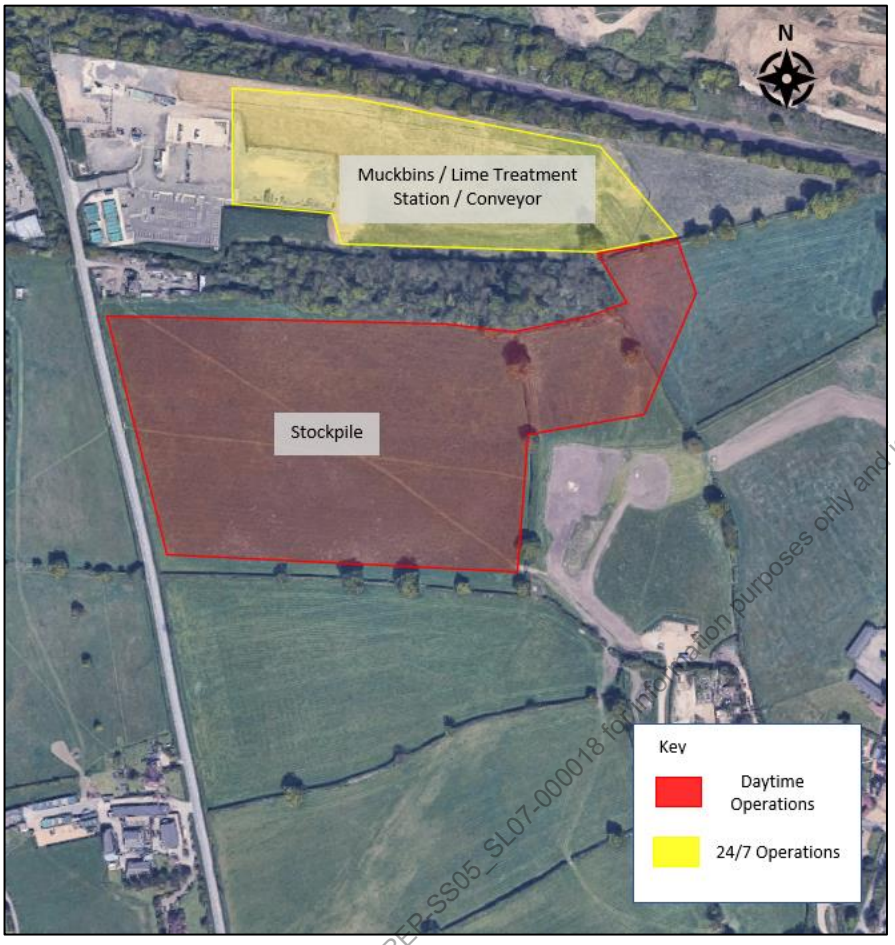
6.2 Working Areas

6.2.1 The initial assessment considered all activities working 24 hours a day, 7 days a week. Subsequently it was agreed that the Storage & Treatment Area (S&T) will operate as two distinct areas with different operating periods as part of the noise mitigation plan.

6.2.2 Noise from activities in the southern stockpile area would be mitigated by restricting activities to daytime (07:00-19:00 hrs) periods only, and the northern area which includes muck bins, conveyors and lime treatment station will be operational on a 24 hours shift, but there will be no material transport to the stockpiles in the southern area.

6.2.3 Figure 6 overleaf indicates the total working area of the Storage & Treatment activities.

Figure 6: Working areas.



6.3 Reduction to Plant Assumptions

6.3.1 The revised plant lists and assumptions is presented overleaf in Tables 23 to 25. It is noted that the restriction of working hours in the stock pile effectively splits the daytime period of 07:00 to 23:00 hours into two periods which are 07:00 – 19:00 hrs and 19:00 – 23:00 hrs. Further assessment therefore follows these revised assessment periods.

6.3.2 The conveyor plant and equipment listed for the conveyor and muck storage bins presented overleaf in Table 23 will operate on a 24-hour basis within the area marked on Figure 6.

6.3.3 The initial assessment included a plant list for the construction of the Attenuation Pond, however, this has been removed from the reassessment as the SCS site team confirmed it won`t be an ongoing activity for the S&T Area.

Table 23: Plant and Equipment Assumptions – Conveyor / Muck Storage Bins

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
30-35t ADT dumpers	8	85	20	5	106	BS 5228-1:2009+A1:2014 Table C.4:2
25t Excavator	2	85	20	5	105	BS 5228-1:2009+A1:2014 Table C.2:19
30-40t Excavators	2	10	85	85	107	BS 5228-1:2009+A1:2014 Table C.2:14
Tractors	2	30	20	20	108	BS 5228-1:2009+A1:2014 Table C.4:74
Loading shovel	3	85	85	95	113	BS 5228-1:2009+A1:2014 Table C.10:16
4x4 Vehicles	2	10	10	10	102	Measured
4x4 Diesel tankers	1	5	0	0	110	BS 5228-1:2009 Table C.11:4-20
Generator	1	0	40	40	102	BS 5228-1:2009+A1:2014 Table C.4:84
Conveyor In	1	100	100	100	98	Measured
Conveyor Out	1	100	10	10	98	Measured
Wheel Wash	1	12	0	0	91	BS 5228-1:2009+A1:2014 Table C.3:13

6.3.4 The lime station plant and equipment listed below in Table 24 will operate on a 24-hour basis within the area marked on Figure 7.

Table 24: Plant and Equipment Assumptions – Lime Station Operation

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Delivery Lorries	4	60	20	-	110	BS 5228-1:2009 Table C.11:4-20
Compressor	4	60	60	-	106	BS 5228-1:2009 Table D.7:10
Pugmill / Mixer	3	100	100	100	104	BS 5228-1:2009+A1:2014 Table C.4:22
Hopper (Discharge Point)	3	100	100	100	103	BS 5228-1:2009+A1:2014 Table C.6:32

6.3.5 The stockpile plant and equipment listed below in Table 25 will operate between 07:00 and 19:00 within the Daytime area marked on Figure 7.

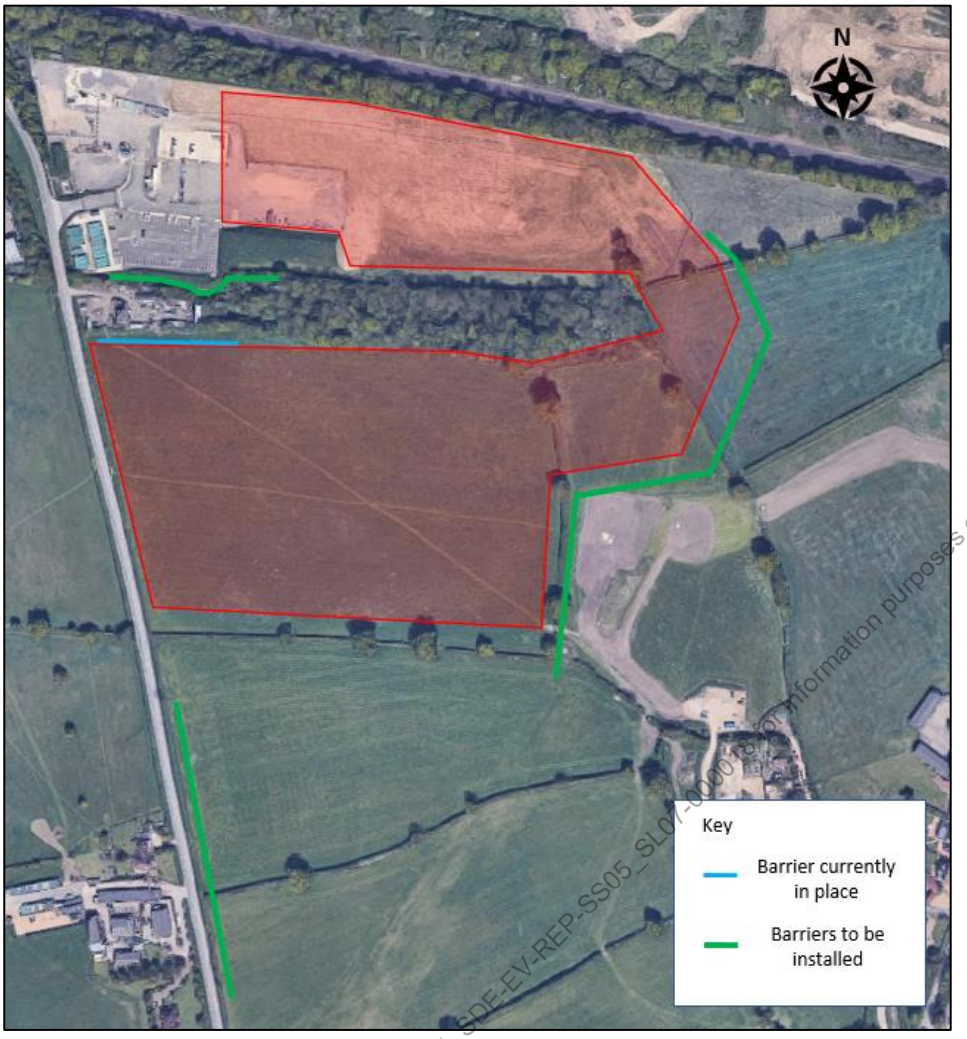
Table 25: Plant and Equipment Assumptions – Stockpile Plant

Plant	No.	Daytime % on-time	Evening % on-time	Night-time % on-time	Overall Sound Power Level [dB(A)]	Reference
Loading Shovel	3	85	-	-	113	BS 5228-1:2009+A1:2014 Table C.10:16
40 T Excavator	1	85	-	-	107	BS 5228-1:2009+A1:2014 Table C.2:14
30-35 T ADT Dumpers	5	85	-	-	106	BS 5228-1:2009+A1:2014 Table C.4:2

6.4 Noise Mitigation Barriers

6.4.1 The mitigated site assessment considers 2.4m barriers installed at strategic locations to provide mitigation to the residential receptors groups detailed in this assessment. The locations of proposed and pre-existing noise barriers are described in Figure 7 overleaf.

Figure 7: Implementation of noise barriers.



6.5 Calculation of Mitigated Noise Levels

6.5.1 Based on the adoption of the mitigation options presented above a recalculation of the mitigated sound levels at the sensitive receptor locations considered is presented below in Tables 26 to 28 overleaf. This included the adoption of 2.4m barriers.

6.5.2 Sound pressure levels have been calculated as $L_{Aeq,T}$ levels at 1 metre from the facades of noise sensitive receptors. The modelled specific sound levels are for construction noise only (i.e., they exclude any ambient noise).

26: Specific Noise Level dB at Receptors (07:00-19:00 hrs) Daytime

Receptor ID / ES ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	57.7
R2 - Harvil Farm / 406098	55.0
R3 - Brackenbury House / N/A	53.3
R4 - Brackenbury Barn / 419116	53.0
R5 - The Bungalow / N/A	49.7
R6 - 160 Hoylake Crescent / 419214	45.9
R7 - 178 Hoylake Crescent / 419186	46.1
R8 - 77 The Greenway / 700377	41.0
R9 - Oak Farm / N/A	38.7

Table 27: Specific Noise Level dB at Receptors (19:00-23:00 hrs) Evening

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Full operation of S&T Areas.
R1 - Shorthill Cottage / 408811	55.1
R2 - Harvil Farm / 406098	49.4
R3 - Brackenbury House / N/A	49.9
R4 - Brackenbury Barn / 419116	49.6
R5 - The Bungalow / N/A	44.9
R6 - 160 Hoylake Crescent / 419214	42.9
R7 - 178 Hoylake Crescent / 419186	42.6
R8 - 77 The Greenway / 700377	37.1
R9 - Oak Farm / N/A	31.9

Table 28: Specific Noise Level dB at Receptors (23:00-07:00 hrs) Night-time

Receptor ID	Highest Calculated Sound Pressure Level dB L_{Aeq} – Northern S&T Area
R1 - Shorthill Cottage / 408811	57.7
R2 - Harvil Farm / 406098	49.8
R3 - Brackenbury House / N/A	49.8
R4 - Brackenbury Barn / 419116	49.7
R5 - The Bungalow / N/A	46.7
R6 - 160 Hoylake Crescent / 419214	43.7
R7 - 178 Hoylake Crescent / 419186	43.4

R8 - 77 The Greenway / 700377	38.3
R9 - Oak Farm / N/A	32.6

6.6 Mitigated Levels Acoustic Character Corrections

6.6.1 Based on revised calculations and discussion with SCS, characteristic penalties have been reviewed and are presented below.

6.6.2 Character corrections have been applied to different receptors groups as acoustic characteristics are not expected to be the same for each receptor. Potentially an impulsive plant noise may be just perceptible at receptors in close proximity to site works as potentially there might be a low level of audibility when deposited material is collected from material piles. It is not anticipated that impulsivity will be noticeable at distant receptors.

6.6.3 A +3dB correction is proposed for other sound characteristics that are neither tonal, impulsive or intermittent but could be perceptible.

6.6.4 Receptor R1 has been applied a +5dB correction for the daytime and evening periods (+2dB for impulsivity; +3dB for other characteristics), for the night-time period a +5dB correction (+2dB for impulsivity; +3dB for intermittency) due to its proximity to the site main noise sources and the specific sound levels being greater than the pre-existing ambient levels, and therefore, having the potential for characteristics to be more noticeable.

6.6.5 An impulsivity or intermittency correction has not been applied for other receptors at any time periods as the dominating noise sources are noted to be from the loading shovel and it is not anticipated for the loading shovel to have impulsivity or intermittency characteristics perceptible at the more distant receptors.

6.6.6 Receptors R2 to R5 been applied a +3dB correction for other characteristics, as the pre-existing ambient levels are between 2 and 11 dB higher than the specific sound levels, therefore, site sources are expected to be less perceptible at the receptor.

6.6.7 Receptors R6 to R9 have not been applied any characteristic adjustments, as the pre-existing ambient levels are 10 dB or more higher than the specific sound levels. Therefore, site sources are not expected to be perceptible at the receptor. At night-time this is also expected as the highest noise source, that could be potentially noticeable at closer receptors, produces sound levels of up to 26 dB lower than the pre-existing ambient levels at this group of receptors.

6.7 Assessment of Mitigated Sound Levels

6.7.1 The BS 4142 assessments of mitigated sound levels are presented below in Tables 29 to 31. Calculated rating levels, for the potentially impacted receptors, and are compared to existing background sound levels with the resulting differences shown.

Table 29: Daytime 07:00 -19:00 - All Areas

Receptor	Representative $L_{A90,T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	58	5	63	15
R2 - Harvil Farm / 406098	48	55	3	58	10
R3 - Brackenbury House / 1868	48	53	3	56	8
R4 - Brackenbury Barn / 419116	48	53	3	56	8
R5 - The Bungalow / 1021	48	50	3	53	5
R6 - 160 Hoylake Crescent / 419214	47	46	0	46	-1
R7 - 178 Hoylake Crescent / 419186	47	46	0	46	-1
R8 - 77 The Greenway / 700377	47	41	0	41	-6
R9 - Oak Farm / 1935	47	39	0	39	-8

Table 30: Evening 19:00 - 23:00 – Muck bins / Conveyor / Lime treatment station

Receptor	Representative $L_{A90,T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	48	55	5	60	12
R2 - Harvil Farm / 406098	49	49	3	52	3
R3 - Brackenbury House / 1868	48	50	3	53	5
R4 - Brackenbury Barn / 419116	48	50	3	53	5
R5 - The Bungalow / 1021	49	45	3	48	-1
R6 - 160 Hoylake Crescent / 419214	44	43	0	43	-1
R7 - 178 Hoylake Crescent / 419186	44	43	0	43	-1
R8 - 77 The Greenway / 700377	44	37	0	37	-7

R9 - Oak Farm / 1935	44	32	0	32	-12

Table 31: Night-time 23:00 - 07:00 - Muck bins / Conveyor / Lime treatment station

Receptor	Representative $L_{A90, T}$	BS4142 Specific Sound Level $L_{ar,T}$ dB	Character Correction dB	BS4142 Rating Level $L_{ar,T}$ dB	BS4142 Assessment Level dB
R1 - Shorthill Cottage / 408811	45	58	5	63	18
R2 - Harvil Farm / 406098	47	50	3	53	6
R3 - Brackenbury House / 1868	45	50	3	53	8
R4 - Brackenbury Barn / 419116	45	50	3	53	8
R5 - The Bungalow / 1021	47	47	3	50	3
R6 - 160 Hoylake Crescent / 419214	38	44	0	44	6
R7 - 178 Hoylake Crescent / 419186	38	43	0	43	5
R8 - 77 The Greenway / 700377	38	38	0	38	0
R9 - Oak Farm / 1935	38	33	0	33	-5

6.7.2 Results presented in Tables 29 above shows that for the majority of the daytime the assessment shows an average of 5 dB reduction in the assessment level when compared to the initial daytime (07:00 – 23:00 hrs) assessment without mitigation. The adverse impacts at receptors R6 and R7 are removed and receptor R5's impact is reduced to an adverse impact from a significant adverse impact. Receptors R1 and R2 are still rated with significant adverse impact, however, levels are reduced.

6.7.3 Results presented in Tables 30 above shows that for the evening period (19:00 – 23:00 hrs) the assessment shows no impact at receptors R5 to R9, adverse impacts at R2 to R5 and a significant adverse impact at R1.

6.7.4 Results presented in Tables 31 above shows that for the night-time period (23:00 – 07:00 hrs) assessment levels have reduced by 8 to 13 dB when compared to the initial assessment without mitigation. The adverse significant impact at receptors R8 and R9 are removed, and the significant adverse impacts at receptors R2, R5, R6 and R7 are reduced to adverse impacts. Receptor R1 is still rated with significant adverse impact, however, levels are reduced by 8 dB. Levels at Receptors R3 and R4 are reduced by 9 dB and 8 dB respectively and are still rated with significant adverse impact.

6.8 BS 5228 Reassessment

6.8.1 An updated post mitigation comparison between the predicted receptor day, evening and night construction noise levels with the corresponding significant effect threshold level is presented below in Table 22. The pre-existing ambient noise levels assigned to each receptors remains the same as in Table 21.

Table 32: Comparison between Calculated Receptor Construction Levels and Significant Effect Levels

Receptor	Assessment Period	Construction Level , dB $L_{Aeq,T}$ (a)	Threshold Level , dB $L_{Aeq,T}$ (b)	Difference (a-b)
R1	Day	58	65	-7
	Evening	55	55	0
	Night	58	55	3
R2	Day	55	65	-10
	Evening	49	60	-11
	Night	50	55	-5
R3	Day	53	65	-12
	Evening	50	55	-5
	Night	50	55	-5
R4	Day	53	65	-12
	Evening	50	55	-5
	Night	50	55	-5
R5	Day	50	65	-15
	Evening	45	60	-15
	Night	47	55	-8
R6	Day	46	65	-19
	Evening	43	65	-22
	Night	44	55	-11
R7	Day	46	65	-19
	Evening	43	65	-22
	Night	43	55	-12
R8	Day	41	65	-24
	Evening	37	65	-28
	Night	38	55	-17
R9	Day	39	65	-26
	Evening	32	65	-33
	Night	33	55	-22

6.8.2 Summary differences presented in Table 32 above indicate that with the inclusion of a 2.4m barrier and other adopted mitigation measures the construction noise levels fall below the significant threshold at all properties and time periods except

at receptor R1 where the night threshold is exceeded by 3 dB. It is noted at R1 represents a single property.

7 Conclusions

7.1.1 Construction sound levels associated with the operation of a Storage & Treatment Area have been calculated at 9 no. sensitive receptors (R1 – R9) adjacent to a site off Harvil Road located along the route of the conveyor system. Sound levels have been assessed using the principles of BS 4142:2014+A1:2019 in accordance with Environment Agency guidance.

7.1.2 Sensitive receptor background levels have been obtained by analysing data from 3 no. unattended noise monitors in the absence of logged significant construction activities at nearby construction sites. Supplementary attended noise measurements were also obtained to provide some verification of background levels adopted for assessment.

7.1.3 Initial results considering site operations with standard mitigation indicated differences between rating and background levels such that there would be significant adverse impacts at the receptors considered, depending on the context.

7.1.4 Further discussions were undertaken with the construction team to identify extraordinary mitigation measures which could be adopted. These were identified as the introduction of noise barriers, reductions in working areas between 19:00 and 07:00 hrs and some reduction in plant usage.

7.1.5 Mitigated receptor noise levels were reassessed in accordance with BS 4142. Comparisons between basic mitigation and extraordinary mitigation options indicate that daytime (07:00 – 19:00 hrs) assessment levels would reduce by between 4 and 10 dB. During evening (19:00 – 23:00 hrs) periods differences between receptor rating and background levels would reduce by between 11 and 25 dB, and differences during the night-time period (23:00 – 07:00 hrs) differences would reduce by between 8 and 18 dB.

7.1.6 Assessment using BS 4142 requires that the context of the assessment should be considered in the overall assessment of rating levels. A comparison of the standard mitigation construction levels and pre-existing ambient levels is detailed in section 5.6. The comparison indicates that construction levels exceed the existing ambient levels for only one receptor (R1) during daytime. During night-time periods at all receptor groups pre-existing ambient noise levels are greater than the calculated construction noise and thus mitigate the potential noise impacts.

7.1.7 An additional point of context is that activities being undertaken at the Storage & Treatment Area are part of the HS2 construction project. Typically, construction noise is assessed using BS 5228 part 1. Example criteria presented in BS 5228 has been used to assess the construction noise from the operation of the Storage and Treatment Area. The assessment indicates that the noise from construction

activities would not exceed the threshold during daytime periods for any of the receptors considered. During the evening period the threshold level is exceeded at only two receptor groups. During night-time periods, the threshold levels are exceeded at five receptor groups.

7.1.8 With the adoption of the extraordinary mitigation measures listed calculated construction noise levels exceed the BS 5228 threshold criteria at just 1 receptor group during a night-time period. The receptor group represents just 1 property.

7.1.9 When the assessment levels of the BS 4142 study are considered in the context of both the pre-existing ambient noise levels and the conventional construction noise assessment for these limited time activities, it is considered that the significant adverse impacts calculated would reduce to no more than 1 receptor significant adverse impact representing just 1 property.

7.1.10 It should be noted that the goal of this assessment is to determine the noise impact associated with the proposed works and act as a means of supporting the associated permit application. Eligibility of properties surrounding areas of SCSjv works for noise insulation is constantly reviewed periodically in line with the HS2 technical standard as the works progress in the area, and a number of properties exposed to noise from material transfers and other construction activities (including properties on Hoylake Crescent, the Greenway and Breakspear Road South) are currently being considered for provision of noise insulation in line with the criteria of determination outlined in the technical standard.

8 References

Title	Reference
BS 4142:2014+A1:2019.	Methods for rating and assessing industrial and commercial sound. BSI Standards Publication.
BS 5228-1:2009+A1:2014	Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BSI Standards Publication.
ISO:9613-2:1996	Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation

Appendix A

Figure A1: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP01 – NO CONSTRUCTION

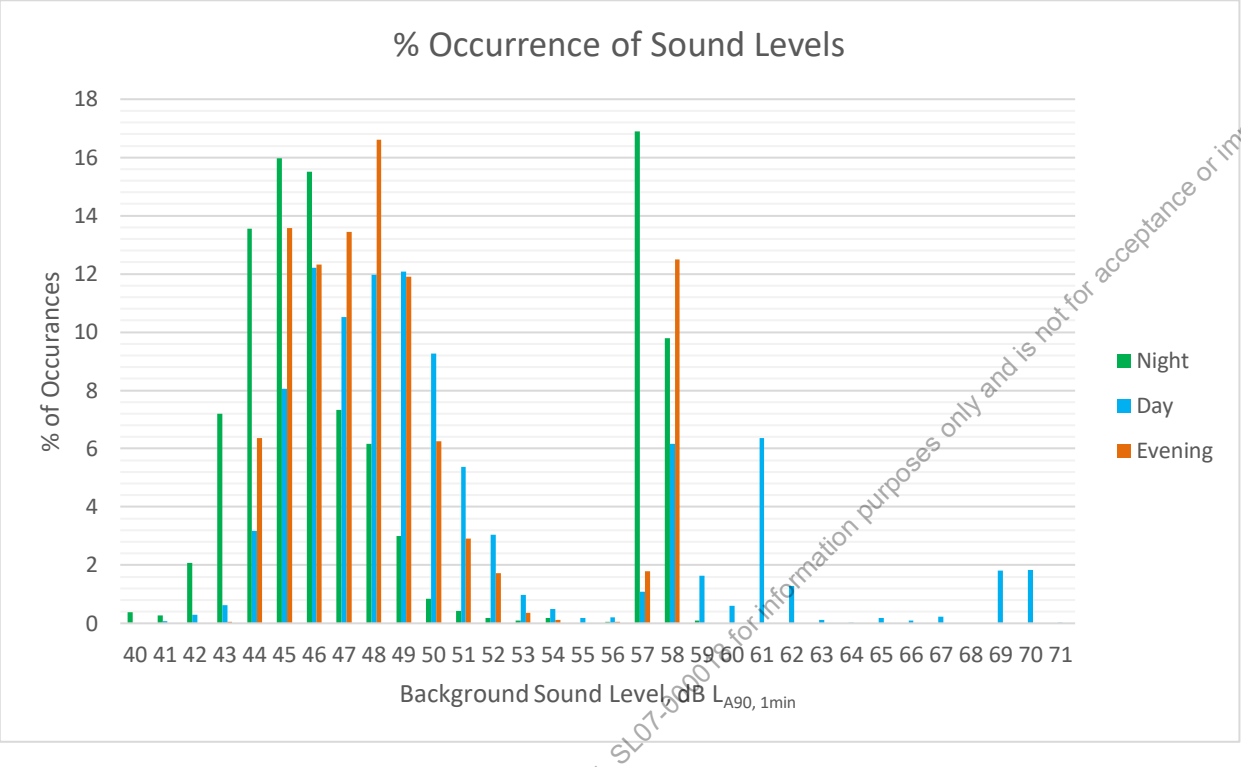


Figure A2: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP02 – NO CONSTRUCTION

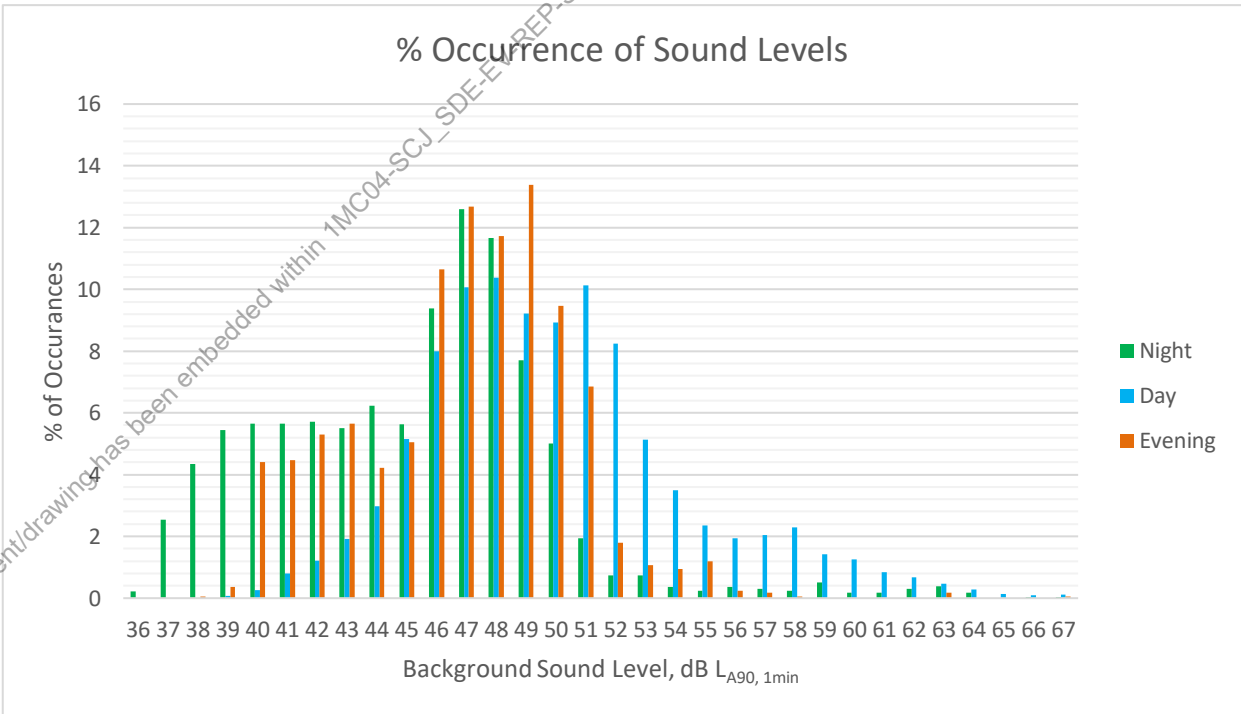


Figure A3: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT N056 - NO SIGNIFICANT CONSTRUCTION

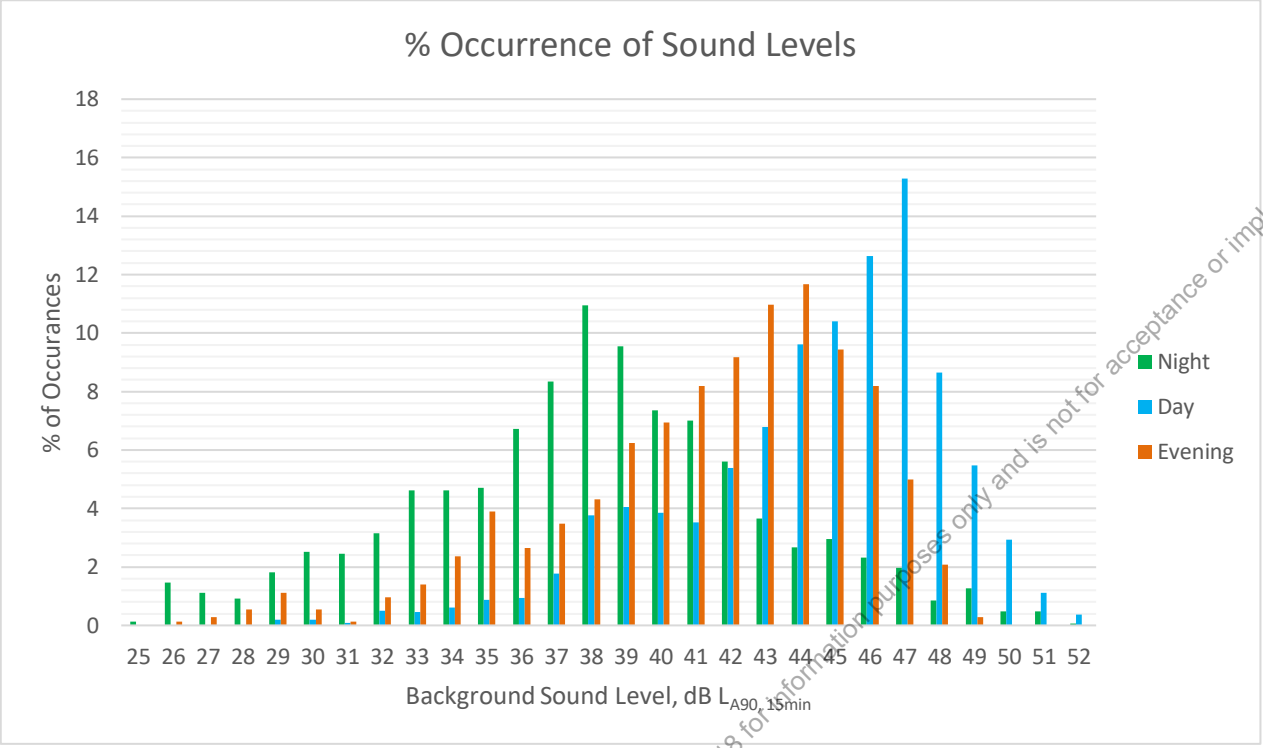


Figure A4: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT N057 - NO SIGNIFICANT CONSTRUCTION

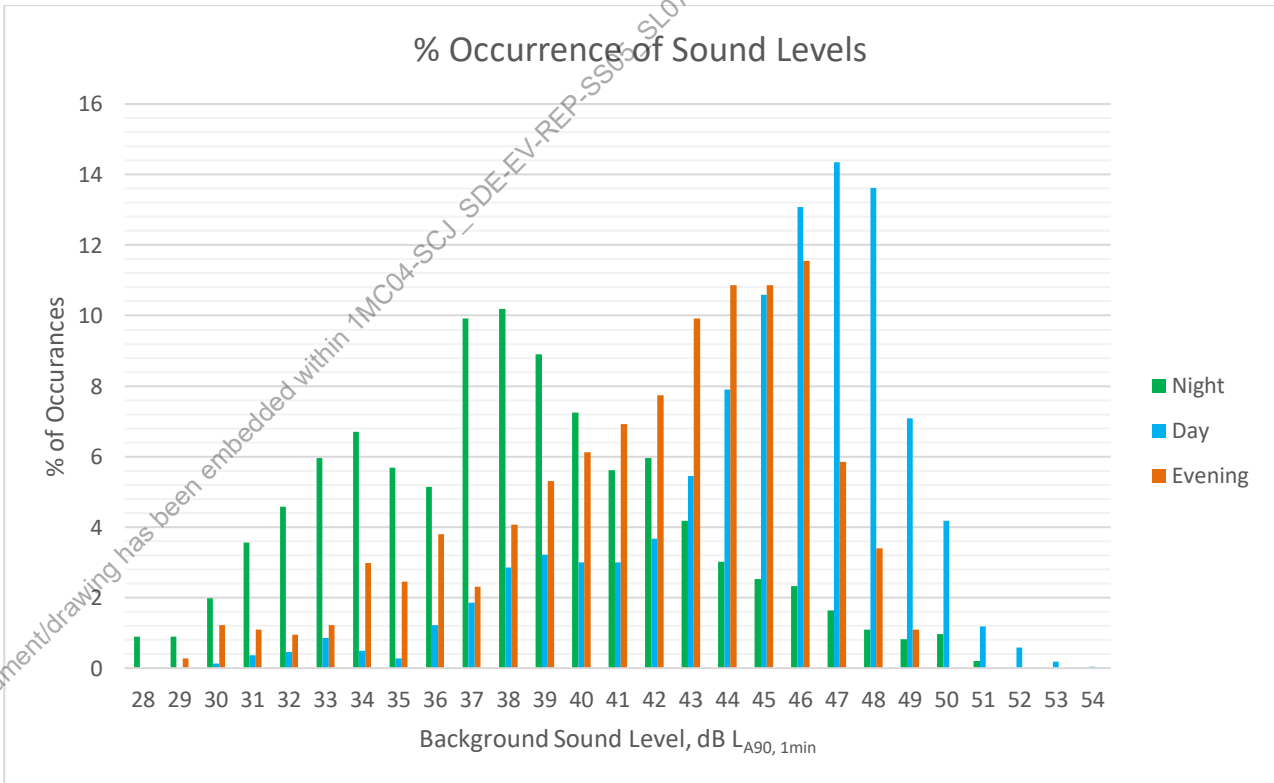


Figure A5: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP01 FOR PERIODS DURING CONSTRUCTION

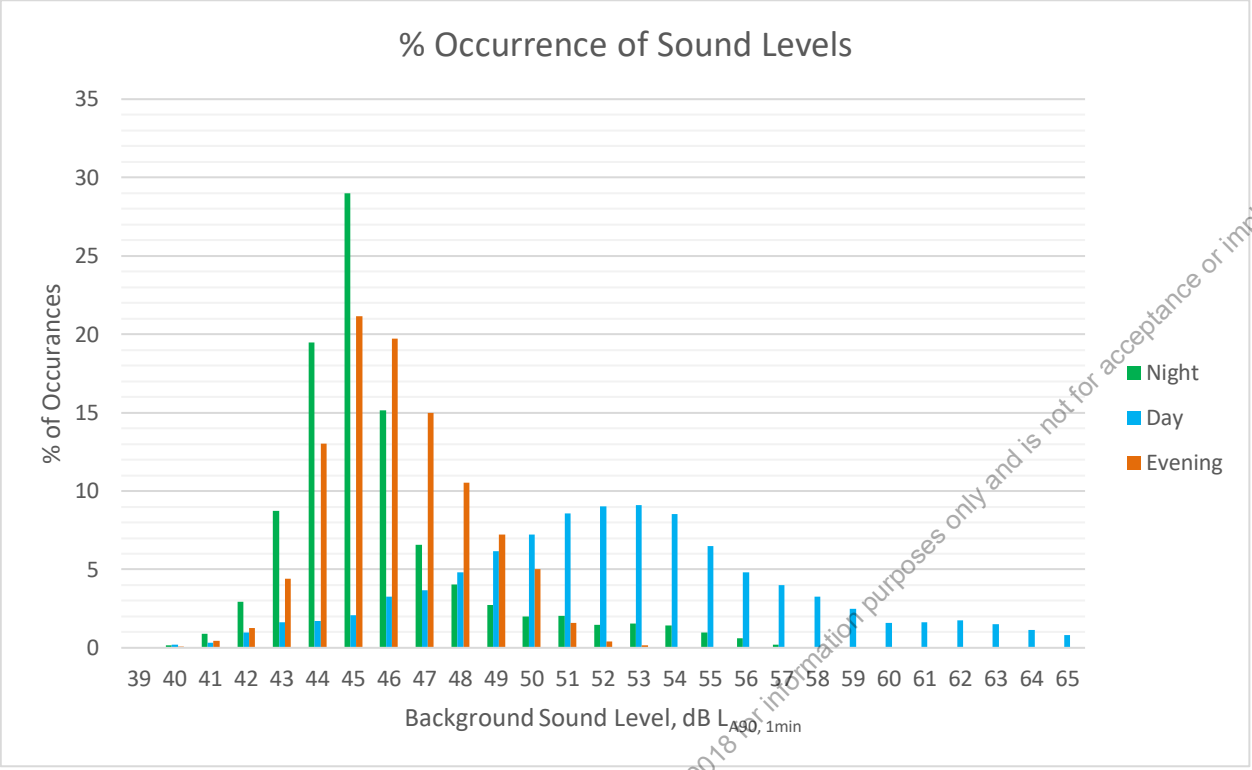
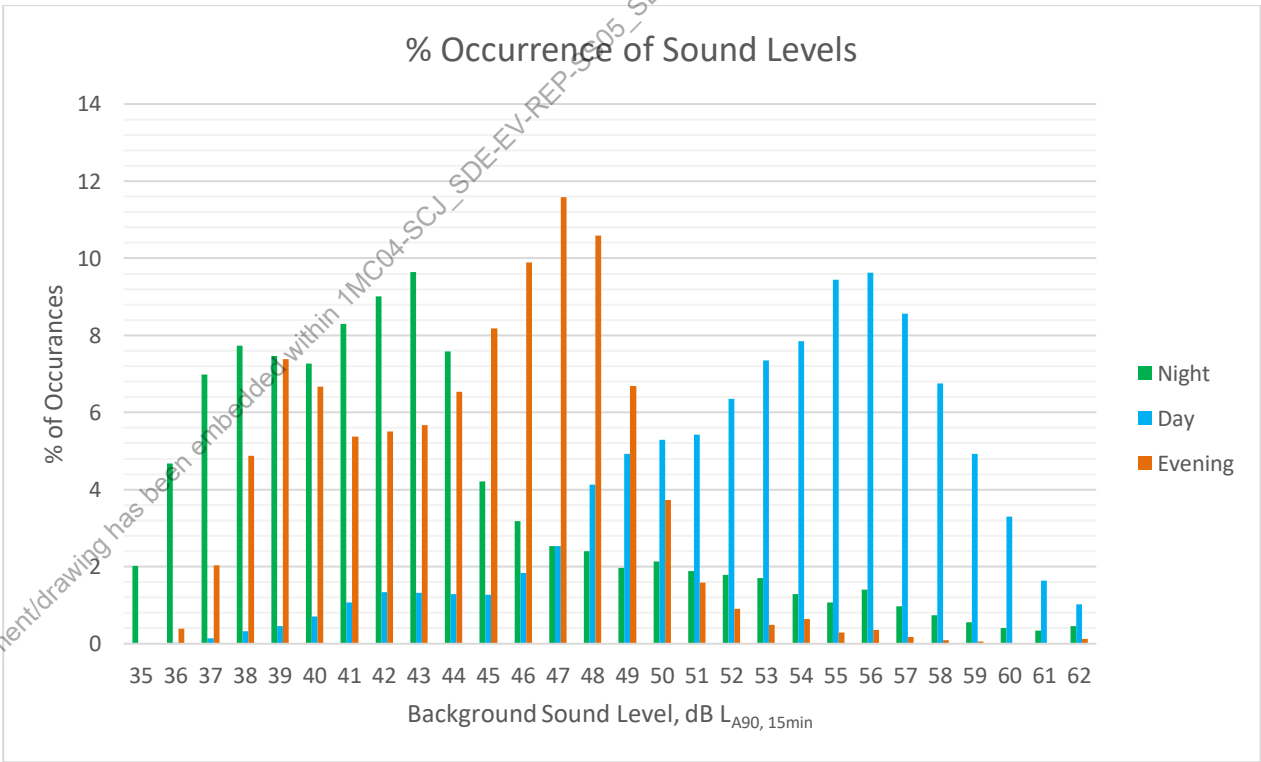


Figure A6: STATISTICAL ANALYSIS OF BACKGROUND LEVELS AT MP02 FOR PERIODS DURING CONSTRUCTION



Appendix B

Table 1: SUMMARY OF UNATTENDED SOUND MONITORING RESULT AT N056

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	01-Nov-20	80 (57-89)	59 (48-64)	46 (43-48)	60 (51-84)	51 (45-60)	41 (38-46)
Sun	02-Nov-20	83 (79-89)	61 (59-64)	48 (42-49)	71 (56-87)	56 (50-63)	46 (41-51)
Mon	03-Nov-20	83 (79-87)	60 (55-63)	46 (43-48)	66 (54-88)	56 (46-64)	42 (39-48)
Tue	04-Nov-20	85 (75-89)	62 (52-66)	44 (39-49)	64 (52-88)	56 (45-65)	40 (37-46)
Wed	05-Nov-20	84 (78-88)	62 (54-65)	41 (37-46)	-[1]	-[1]	-[1]
Thu	06-Nov-20	84 (76-91)	62 (55-66)	44 (38-50)	80 (75-87)	57 (49-60)	38 (38-39)
Fri	07-Nov-20	82 (50-90)	59 (40-65)	41 (38-45)	58 (41-83)	52 (37-61)	38 (36-44)
Sat	08-Nov-20	80 (51-89)	59 (41-64)	38 (34-40)	51 (37-84)	49 (33-59)	34 (32-38)
Sun	09-Nov-20	84 (75-91)	62 (54-66)	43 (38-48)	60 (38-85)	55 (34-61)	36 (32-44)
Mon	10-Nov-20	84 (72-91)	62 (50-67)	43 (39-49)	60 (40-87)	54 (35-63)	37 (32-44)
Tues	11-Nov-20	84 (72-90)	62 (49-66)	46 (43-49)	60 (37-88)	55 (33-63)	39 (31-49)
Wed	12-Nov-20	84 (71-91)	62 (52-65)	45 (42-49)	62 (43-86)	54 (38-61)	39 (37-48)
Thu	13-Nov-20	84 (77-90)	62 (53-68)	46 (41-48)	61 (43-88)	55 (39-65)	41 (37-47)
Fri	14-Nov-20	83 (75-93)	61 (53-70)	46 (42-49)	58 (38-89)	54 (35-66)	39 (34-46)
Sat	15-Nov-20	80 (52-88)	60 (44-65)	44 (41-47)	51 (41-82)	48 (35-59)	38 (34-46)
Sun	16-Nov-20	83 (74-89)	61 (51-65)	45 (39-48)	60 (47-81)	52 (38-59)	38 (36-39)
Mon	17-Nov-20	84 (76-90)	62 (51-65)	44 (40-48)	59 (42-86)	54 (38-63)	39 (35-47)
Tue	18-Nov-20	84 (77-91)	62 (54-66)	47 (42-49)	56 (43-88)	53 (38-64)	39 (36-46)
Wed	19-Nov-20	83 (79-85)	61 (54-63)	40 (36-44)	68 (48-88)	58 (39-64)	38 (35-41)
Thu	20-Nov-20	83 (67-92)	62 (46-69)	48 (41-52)	62 (43-86)	55 (37-62)	40 (34-50)
Fri	21-Nov-20	82 (77-88)	59 (52-62)	43 (41-45)	58 (42-86)	54 (39-64)	39 (37-43)
Sat	22-Nov-20	79 (54-90)	59 (42-66)	39 (37-40)	51 (41-79)	49 (34-58)	35 (31-37)
Sun	23-Nov-20	84 (72-90)	62 (50-66)	46 (43-50)	54 (41-87)	55 (34-64)	38 (32-47)
Mon	24-Nov-20	83 (69-90)	61 (48-65)	45 (43-48)	63 (46-87)	55 (40-64)	40 (37-47)
Tue	25-Nov-20	83 (67-101)	64 (44-75)	43 (34-47)	61 (43-85)	55 (39-64)	41 (37-46)
Wed	26-Nov-20	84 (75-90)	61 (50-65)	42 (40-48)	48 (39-80)	45 (31-57)	31 (29-39)
Thu	27-Nov-20	83 (74-88)	61 (53-66)	45 (40-50)	62 (46-85)	53 (37-59)	39 (34-45)
Fri	28-Nov-20	82 (77-89)	59 (51-62)	38 (33-40)	56 (38-88)	53 (33-63)	34 (31-39)
Sat	29-Nov-20	80 (56-89)	59 (41-63)	33 (29-38)	49 (35-81)	45 (30-58)	30 (28-32)
Sun	30-Nov-20	83 (80-87)	61 (57-63)	44 (41-45)	63 (36-84)	54 (28-59)	28 (26-33)
Mon	01-Dec-20	83 (77-90)	61 (54-65)	41 (35-46)	55 (36-81)	53 (33-60)	34 (32-39)
Tue	02-Dec-20	83 (75-89)	61 (54-65)	43 (37-47)	58 (37-84)	54 (31-62)	37 (29-42)
Wed	03-Dec-20	84 (70-90)	62 (55-66)	48 (34-56)	60 (45-87)	54 (40-63)	42 (36-51)
Thu	04-Dec-20	84 (78-89)	61 (53-65)	47 (44-49)	78 (70-84)	57 (48-60)	45 (44-45)
Fri	05-Dec-20	79 (43-89)	59 (39-64)	41 (38-45)	55 (42-84)	51 (38-61)	40 (36-46)
Sat	06-Dec-20	77 (53-89)	59 (39-64)	34 (29-38)	47 (38-79)	45 (31-57)	32 (30-35)
Sun	07-Dec-20	84 (77-90)	62 (54-66)	38 (32-43)	54 (39-83)	51 (29-59)	29 (26-32)
Mon	08-Dec-20	84 (79-89)	62 (57-65)	46 (42-50)	64 (43-86)	57 (34-63)	37 (32-45)
Tue	09-Dec-20	-[1]	-[1]	-[1]	82 (78-86)	58 (52-60)	43 (43-43)
Wed	10-Dec-20	84 (74-89)	62 (53-66)	44 (40-48)	63 (41-89)	56 (37-64)	39 (36-55)
Thu	11-Dec-20	84 (74-89)	62 (52-67)	44 (38-48)	63 (44-89)	56 (40-65)	43 (36-55)
Fri	12-Dec-20	83 (81-88)	59 (57-62)	40 (39-42)	79 (77-83)	57 (50-61)	32 (32-33)
Sat	13-Dec-20	80 (57-89)	59 (48-65)	46 (43-50)	55 (44-84)	50 (40-59)	41 (37-47)
Sun	14-Dec-20	84 (77-88)	62 (54-66)	47 (43-51)	60 (44-89)	55 (39-63)	42 (37-50)
Mon	15-Dec-20	84 (73-89)	62 (53-66)	48 (45-51)	61 (47-88)	54 (42-63)	43 (39-51)
Tues	16-Dec-20	84 (76-90)	62 (52-66)	47 (44-50)	60 (43-89)	56 (39-67)	41 (38-47)
Wed	17-Dec-20	84 (76-94)	62 (53-66)	48 (43-53)	62 (46-87)	56 (40-65)	43 (38-51)

Thu	18-Dec-20	84 (75-89)	62 (53-67)	47 (43-51)	59 (44-87)	56 (40-65)	41 (38-47)
Overall Mean		**83 (77-85)**	**61 (59-64)**	**44 (33-48)**	**61 (47-82)**	**54 (45-58)**	**38 (28-46)**

Note: [1] Data not available for the period.

Table 2: SUMMARY OF UNATTENDED SOUND MONITORING RESULT AT N057

Day of Meas.	Date	Measured Sound Levels, dB re. 2 x 10^{-5} Pa.					
		Daytime (07:00 hrs - 23:00 hrs)			Night-time (23:00 hrs - 07:00 hrs)		
		$L_{Amax,F}$	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Amax,F}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
Sat	01-Nov-20	75 (54-82)	54 (46-59)	46 (43-48)	55 (43-77)	47 (38-55)	40 (36-46)
Sun	02-Nov-20	77 (75-80)	57 (56-60)	47 (41-49)	69 (57-82)	53 (48-59)	45 (40-50)
Mon	03-Nov-20	78 (77-80)	56 (52-59)	44 (42-47)	61 (45-82)	52 (40-61)	41 (37-48)
Tue	04-Nov-20	79 (73-84)	58 (50-62)	42 (38-48)	58 (40-84)	52 (35-61)	37 (33-44)
Wed	05-Nov-20	77 (72-82)	57 (49-61)	41 (36-44)	-	-	-
Thu	06-Nov-20	79 (73-86)	57 (52-62)	44 (39-50)	75 (71-78)	53 (46-55)	39 (38-39)
Fri	07-Nov-20	77 (54-88)	57 (42-69)	41 (37-45)	65 (47-76)	49 (39-55)	37 (36-39)
Sat	08-Nov-20	76 (56-83)	55 (41-59)	38 (34-41)	51 (39-78)	46 (33-56)	34 (31-38)
Sun	09-Nov-20	78 (71-83)	57 (49-61)	43 (38-47)	60 (41-81)	51 (34-57)	37 (32-45)
Mon	10-Nov-20	79 (72-84)	59 (52-65)	44 (40-50)	60 (46-83)	52 (36-62)	37 (34-44)
Tues	11-Nov-20	78 (71-85)	58 (50-61)	47 (44-50)	57 (36-83)	52 (33-59)	40 (32-49)
Wed	12-Nov-20	79 (73-84)	57 (50-61)	46 (43-48)	60 (45-81)	51 (39-60)	39 (36-48)
Thu	13-Nov-20	78 (73-86)	58 (50-62)	47 (43-50)	60 (43-85)	52 (39-62)	41 (37-47)
Fri	14-Nov-20	78 (72-93)	60 (50-71)	47 (43-50)	56 (40-79)	48 (35-57)	39 (34-47)
Sat	15-Nov-20	76 (50-101)	59 (45-73)	45 (42-49)	51 (43-62)	44 (36-50)	38 (34-47)
Sun	16-Nov-20	78 (70-84)	57 (51-62)	46 (40-49)	60 (44-86)	53 (39-61)	38 (37-40)
Mon	17-Nov-20	78 (71-83)	57 (51-61)	45 (40-49)	59 (43-79)	51 (38-58)	40 (37-48)
Tue	18-Nov-20	78 (72-89)	58 (52-61)	48 (43-49)	54 (44-80)	50 (38-59)	40 (36-47)
Wed	19-Nov-20	79 (76-82)	57 (52-60)	41 (35-47)	62 (43-81)	52 (37-58)	35 (34-39)
Thu	20-Nov-20	78 (63-84)	58 (46-62)	49 (42-53)	62 (43-82)	52 (38-60)	41 (36-50)
Fri	21-Nov-20	76 (73-83)	55 (49-59)	44 (42-46)	57 (44-76)	46 (40-53)	40 (37-43)
Sat	22-Nov-20	74 (53-82)	55 (41-60)	39 (37-40)	53 (44-77)	48 (34-56)	35 (32-38)
Sun	23-Nov-20	78 (62-88)	59 (49-64)	48 (44-59)	55 (40-81)	51 (34-59)	39 (32-46)
Mon	24-Nov-20	77 (65-86)	57 (47-61)	46 (44-49)	61 (44-84)	53 (39-63)	41 (37-47)
Tue	25-Nov-20	78 (64-98)	59 (43-71)	44 (34-48)	57 (43-78)	50 (39-58)	41 (37-47)
Wed	26-Nov-20	78 (72-83)	57 (49-60)	43 (40-49)	50 (37-80)	47 (32-58)	32 (30-38)
Thu	27-Nov-20	71 (0-84)	57 (0-62)	42 (0-50)	60 (46-84)	51 (37-59)	39 (34-44)
Fri	28-Nov-20	77 (71-81)	56 (50-66)	38 (33-41)	53 (36-79)	47 (33-56)	34 (31-37)
Sat	29-Nov-20	75 (52-81)	54 (40-57)	33 (30-36)	48 (35-59)	37 (32-41)	31 (31-33)
Sun	30-Nov-20	78 (76-82)	60 (55-66)	45 (42-46)	58 (34-76)	48 (29-53)	30 (28-33)
Mon	01-Dec-20	77 (71-82)	56 (49-59)	42 (35-47)	54 (37-77)	50 (33-57)	34 (32-39)
Tue	02-Dec-20	78 (74-85)	57 (50-61)	43 (37-47)	57 (36-77)	51 (31-58)	36 (30-41)
Wed	03-Dec-20	78 (73-85)	57 (51-61)	47 (34-52)	59 (44-81)	51 (39-58)	43 (36-51)
Thu	04-Dec-20	78 (73-83)	57 (52-61)	47 (45-49)	69 (47-81)	53 (43-57)	44 (41-46)
Fri	05-Dec-20	75 (46-83)	55 (39-63)	43 (38-47)	53 (43-77)	46 (36-55)	39 (35-45)
Sat	06-Dec-20	72 (54-81)	54 (40-59)	35 (33-38)	52 (36-67)	38 (34-44)	34 (33-35)
Sun	07-Dec-20	79 (74-86)	58 (51-62)	40 (33-45)	57 (37-80)	50 (32-59)	31 (30-33)
Mon	08-Dec-20	77 (70-84)	57 (50-61)	46 (41-50)	63 (39-80)	52 (35-57)	37 (33-43)
Tue	09-Dec-20	78 (73-84)	57 (50-61)	45 (42-48)	63 (43-81)	53 (39-60)	41 (36-44)
Wed	10-Dec-20	78 (73-85)	57 (50-61)	45 (41-48)	61 (43-84)	52 (38-60)	41 (35-50)
Thu	11-Dec-20	79 (74-94)	58 (49-66)	44 (38-48)	61 (45-83)	51 (41-59)	40 (34-45)
Fri	12-Dec-20	80 (77-84)	57 (54-60)	41 (40-42)	51 (46-55)	41 (41-42)	39 (39-39)
Sat	13-Dec-20	75 (55-85)	55 (46-59)	47 (44-49)	55 (44-79)	48 (40-57)	41 (38-48)
Sun	14-Dec-20	78 (71-87)	58 (52-61)	48 (44-52)	59 (44-84)	51 (40-58)	43 (38-50)
Mon	15-Dec-20	78 (70-84)	58 (52-62)	49 (46-51)	59 (47-81)	52 (41-61)	44 (39-51)

Tues	16-Dec-20	78 (72-85)	58 (50-61)	48 (44-50)	57 (45-82)	51 (40-60)	41 (38-48)
Wed	17-Dec-20	79 (69-91)	58 (49-64)	49 (44-54)	59 (44-80)	52 (40-59)	43 (38-50)
Thu	18-Dec-20	78 (69-85)	58 (52-62)	48 (43-51)	58 (46-81)	51 (41-58)	42 (39-48)
Overall Mean Values		**83 (77-85)**	**61 (59-64)**	**44 (33-48)**	**61 (47-82)**	**54 (45-58)**	**38 (28-46)**

Table 3: WEATHER RECORD OBTAINED FOR UNATTENDED MONITOR PERIODS

Data type Unit	Wind Speed, m/s		Rain intensity, mm/h		Temperature, °C		Humidity rate, %	
Period start (dd/mm/yyyy)	Mean	Max	Mean	Max	Mean	Max	Mean	Max
01/11/2020	1.6	9.3	0	0.3	14.4	17.4	81	91
02/11/2020	2.1	13.3	0	6.6	13.2	17	71	87
03/11/2020	1.1	11.4	0.2	22.6	7.1	10.4	78	91
04/11/2020	0.5	3.9	0	0	4.3	12.6	83	94
05/11/2020	0.9	3.2	0	0	3.4	10.7	90	94
06/11/2020	0.8	4.7	0	0	5.7	11.8	79	95
07/11/2020	0.5	2.9	0	1.3	9.9	16	82	93
08/11/2020	0.4	2.3	0	1.6	12.1	14.3	89	93
09/11/2020	0.5	3.8	0.1	8	12.8	16.2	90	95
10/11/2020	0.5	3.2	0.1	3.7	11.3	15.9	88	94
11/11/2020	1.3	8	0.1	4.5	11.2	13.1	86	94
12/11/2020	1.2	7.8	0	1.4	10.6	13.4	77	86
13/11/2020	0.9	6.7	0	3.6	10.5	12.6	77	88
14/11/2020	1.3	7.9	0.2	10.5	12.1	13.7	87	93
15/11/2020	1.4	8	0.2	11.3	10.4	13.1	80	92
16/11/2020	1.3	7	0	1.8	10.6	12.9	78	92
17/11/2020	1.2	7.5	0	0	12.8	14.2	81	89
18/11/2020	1.5	10.5	0	4.1	11.6	15.2	77	89
19/11/2020	1.5	8.5	0	2.4	7.5	10.5	75	89
20/11/2020	0.8	5	0	1.7	5.5	10.7	89	94
21/11/2020	1.4	8.5	0	0	11	12.6	75	83
22/11/2020	0.6	4.5	0	0	7.7	11.4	84	94
23/11/2020	0.6	3.8	0	0	5	10.1	88	94
24/11/2020	1	5.8	0	0	10	12.3	81	90
25/11/2020	0.7	5.2	0	3.6	9.1	12.8	87	93
26/11/2020	0.4	2.5	0	0	4.6	9	87	94
27/11/2020	0.5	3	0	0.3	2.4	5.4	91	95
28/11/2020	0.7	3.8	0	0	8.5	10.3	88	92

29/11/2020	0.7	2.8	0	0	7.2	8.8	91	93
30/11/2020	1.3	7.9	0	1.1	6.7	10.3	87	94
01/12/2020	0.9	4.2	0	0	4	8.3	80	91
02/12/2020	0.5	2.8	0	0	4.3	6.4	86	93
03/12/2020	0.8	4.6	0.4	8.2	4.9	6.8	90	93
04/12/2020	1.4	6.6	0.1	2.8	4.1	5.4	81	93
05/12/2020	1.2	6.4	0	0	5.1	8.5	76	86
06/12/2020	0.8	3.9	0	0.5	2.2	5.9	88	93
07/12/2020	0.6	2.5	0	0.7	0.9	2	93	94
08/12/2020	0.5	2.9	0	3.8	0.7	3.7	92	94
09/12/2020	0.8	4.1	0	2.4	5	6.5	85	93
10/12/2020	1.1	5	0	5.1	6.8	7.4	83	93
11/12/2020	0.5	4.6	0.2	8	8.1	10.7	92	94
12/12/2020	1.2	6.6	0	0	6.8	9.4	84	94
13/12/2020	1.1	6.7	0.1	4.1	6.6	11.4	91	94
14/12/2020	1.2	7.7	0.1	8.5	10.2	13.1	84	91
15/12/2020	0.8	6	0	5.4	8.5	11.5	85	93
16/12/2020	1.3	8.3	0.1	11.2	8.7	10.5	84	91
17/12/2020	0.8	5.2	0	0.9	8.4	11.5	85	94
18/12/2020	1.7	8.3	0	0	11.1	11.9	86	91
19/12/2020	1.4	8.2	0.1	37.2	9.8	12	81	91
20/12/2020	1	7	0	7.9	7.6	10.5	81	88
21/12/2020	1.2	7.5	0.1	6.9	10.9	13.6	89	93
22/12/2020	1	7.8	0	0.8	10.6	13.6	87	93
23/12/2020	0.8	9.6	0.1	22.8	10.2	13.1	85	93
24/12/2020	2.2	9.5	0	4	4.4	6.5	76	88
25/12/2020	1.2	4.8	0	0	1.6	4.1	74	84
26/12/2020	1.4	9.7	0	1.1	6.3	10.6	83	90
27/12/2020	1.4	11.8	0.3	9.8	5.6	9.7	80	93
28/12/2020	0.8	4.7	0	0.1	0.8	2.9	90	94
29/12/2020	1.2	5.1	0	0.2	2.4	4.1	84	89
30/12/2020	0.5	4	0	0	0.6	5.1	88	94
31/12/2020	0.8	3.6	0	0	-0.3	1	89	94
06/02/2021	0.9	6.1	0.2	8.8	5.9	9.1	87	93
06/02/2021	2.4	9.3	0	4.8	1.6	3.7	76	90
09/02/2021	1.3	6.3	0	2.8	-0.5	0.4	77	85
13/02/2021	1.9	7.6	0	0	-0.8	1.8	53	66
14/02/2021	1.7	8.6	0	4.9	2.6	4.3	61	85
20/02/2021	1.5	8.6	0	0	12.7	14.3	65	76
21/02/2021	0.7	4.9	0	0.5	11	13.6	78	90