Greater Dublin Drainage Project

Irish Water

Environmental Impact Assessment Report: Volume 3 Part A of 6

Chapter 15 Noise and Vibration

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Contents

15. Noise and Vibration

This Chapter assesses the potential noise and vibration impacts which may be generated during the Construction Phase and Operational Phase of the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project). The principal Construction Phase noise and vibration impacts will be associated with machinery use, excavation works, tunnelling works and construction of the proposed Wastewater Treatment Plant and Abbotstown pumping station, while Operational Phase noise and vibration impacts are anticipated to be imperceptible following completion of the Construction Phase works.

Noise levels will vary throughout the Construction Phase with a range of noise generating activities involved in the various locations where construction works will take place. Noise modelling has been completed for a set of conservative scenarios to account for all significant noise generating activities and has shown that the noise impacts can be effectively managed and controlled. The entire construction programme has been assessed as being short-term in duration while the construction traffic noise impacts have been assessed as Moderate and within the adopted noise criteria.

The results of the Operational Phase noise assessment indicate that the operation of the Proposed Project will make no measurable change to the prevailing daytime, evening time and night-time ambient noise environment. The predicted increase in Operational Phase traffic noise at the Noise Sensitive Receptors is anticipated to be barely perceptible, and the associated noise impact is classified as negligible.

A range of best practice noise management measures will be employed to mitigate any potential noise disturbance during the Construction Phase. As the noise impact assessment has shown there are no adverse noise impacts associated with the Operational Phase of the Proposed Project, mitigation measures are not required during the operation of the proposed Wastewater Treatment Plant and Abbotstown pumping station.

15.1 Introduction

This Chapter considers and assesses the impacts of the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project) due to noise and vibration anticipated to occur during the Construction Phase and Operational Phase. Impacts of the Construction Phase and Operational Phase are considered in the context of appropriate standards and guidelines, together with requirements for noise and vibration monitoring and control. The glossary of terms presented in Appendix A15.1 in Volume 3 Part B of this EIAR defines all of the noise terms used in this Chapter.

The Proposed Project will form a significant component of a wider strategy to meet future wastewater treatment requirements within the Greater Dublin Area as identified in a number of national, regional and local planning policy documents. The plant, equipment, buildings and systems associated with the Proposed Project will be designed, equipped, operated and maintained in such a manner to ensure a high level of energy performance and energy efficiency.

The table below includes a summary of the Proposed Project elements. A full description of the Proposed Project is detailed within Volume 2 Part A, Chapter 4 Description of the Proposed Project and outlined in Figure 4.1 Proposed Project Overview in Volume 5 of this Environmental Impact Assessment Report (EIAR).

Proposed Project Element	Outline Description of Proposed Project Element
Proposed Wastewater Treatment Plant (WwTP)	• WwTP to be located on a 29.8 hectare (ha) site in the townland of Clonshagh (Clonshaugh) in Fingal. • 500,000 population equivalent wastewater treatment capacity. • Maximum building height of 18m. • Sludge Hub Centre (SHC) to be co-located on the same site as the WwTP with a sludge handling and treatment capacity of 18,500 tonnes of dry solids per annum. • SHC will provide sustainable treatment of municipal wastewater sludge and domestic septic tank sludges generated in Fingal to produce a biosolid end-product. • Biogas produced during the sludge treatment process will be utilised as an energy source. • Access road from the R139 Road, approximately 400m to the southern boundary of the site. • Egress road, approximately 230m from the western boundary of the site, to Clonshaugh Road. • A proposed temporary construction compound to be located within the site boundary.
Proposed Abbotstown pumping station	• Abbotstown pumping station to be located on a 0.4ha site in the grounds of the National Sports Campus at Abbotstown. • Abbotstown pumping station will consist of a single 2-storey building with a ground level floor area of 305m^2 and maximum height of 10m and a below ground basement 17m in depth with floor area of 524m^2 incorporating the wet/dry wells. • The plan area of the above ground structure will be 305m^2 and this will have a maximum height of 10m. • A proposed temporary construction compound to be located adjacent to the Abbotstown pumping station site.
Proposed orbital sewer route	• The orbital sewer route will intercept an existing sewer at Blanchardstown and will divert it from this point to the WwTP at Clonshagh. • Constructed within the boundary of a temporary construction corridor. • 13.7km in length; 5.2km of a 1.4m diameter rising main and 8.5km of a 1.8m diameter gravity sewer. • Manholes/service shafts/vents along the route. • Odour Control Unit at the rising main/gravity sewer interface. • Proposed temporary construction compounds at Abbotstown, Cappoge, east of Silloge, Dardistown and west of Collinstown Cross to be located within the proposed construction corridor.
Proposed North Fringe Sewer (NFS) diversion sewer	• The NFS will be intercepted in the vicinity of the junction of the access road to the WwTP with the R139 Road in lands within the administrative area of Dublin City Council. • NFS diversion sewer will divert flows in the NFS upstream of the point of interception to the WwTP. • 600m in length and 1.5m in diameter. • Operate as a gravity sewer between the point of interception and the WwTP site.
Proposed outfall pipeline route (land based section)	• Outfall pipeline route (land based section) will commence from the northern boundary of the WwTP and will run to the R106 Coast Road. • 5.4km in length and 1.8m in diameter. • Pressurised gravity sewer. • Manholes/service shafts/vents along the route. • Proposed temporary construction compounds (east of R107 Malahide Road and east of Saintdoolaghs) located within the proposed construction corridor.
Proposed outfall pipeline route (marine section)	• Outfall pipeline route (marine section) will commence at the R106 Coast Road and will terminate at a discharge location approximately 1km north-east of Ireland's Eye. • 5.9km in length and 2m in diameter. • Pressurised gravity tunnel/subsea (dredged) pipeline. • Multiport marine diffuser to be located on the final section. • Proposed temporary construction compounds (west and east of Baldoyle Bay) to be located within the proposed construction corridor.
Proposed Regional Biosolids Storage Facility	• Located on an 11ha site at Newtown, Dublin 11. • Maximum building height of 15m. • Further details and full impact assessment are provided in Volume 4 Part A of this EIAR.

The total Construction Phase will be approximately 48 months, including a 12 month commissioning period to the final Operational Phase. The Proposed Project will serve the projected wastewater treatment requirements of existing and future drainage catchments in the north and north-west of the Dublin agglomeration, up to the Proposed Project's 2050 design horizon.

Please note that the noise impact assessment of the proposed RBSF aspect of the Proposed Project is addressed in Chapter 9 Noise in Volume 4 Part A of this EIAR.

15.2 Methodology

15.2.1 Study Area

Potential noise and vibration impacts associated with the Proposed Project are predicted to be at their most significant close to the construction works boundaries, but potential impacts may be observed at further removed locations. The general area surrounding the Proposed Project was assessed in order to identify the receptors that have the potential to be impacted by noise emissions associated with the Proposed Project works. Noise sensitive receptors (NSRs) which could potentially be adversely affected by the noise and vibration impacts of the Proposed Project are considered in this Chapter.

15.2.2 Desktop Survey

The desktop survey for the Proposed Project involved reviewing the available project information, including the Outline Construction Environmental Management Plan (CEMP), *Engineering Specialist Report for Crossings* (Jacobs Tobin 2017) and the planning drawings. Proposed Project Workshops were also attended in 2014, 2015 and 2016 for updates and additional information sessions.

The desktop review also included a review of drawings, aerial shots and online mapping sites, such as Google Earth and Bing Maps, in order to identify potential NSRs that may be impacted by the Construction Phase and Operational Phase of the Proposed Project.

15.2.3 Field Surveys

Baseline environmental noise and vibration monitoring was carried out to determine the existing noise and vibration levels at NSR locations surrounding the Proposed Project locations. Full details of the noise and vibration monitoring completed are presented in Appendix A15.2 and in Section 15.3 of this Chapter.

15.2.4 Impact Assessment Methodology

This Chapter of the EIAR evaluates the potential noise and vibration impacts which may be generated during the Construction Phase and Operational Phase of the Proposed Project. The assessment considers all potential impacts and evaluates the significance of potential impacts on NSRs near the Proposed Project. The methodologies adopted in the assessment are summarised as follows:

(i) A project specific baseline noise and vibration survey was carried out to provide up-to-date information on existing background and specific site noise levels at the Proposed Project boundaries. This baseline noise survey captured current noise data representative of all NSRs near the Proposed Project that could be impacted by the noise generating activities associated with the Proposed Project. The baseline noise survey was executed in accordance with the requirements of *ISO 1996-2:2007 – Acoustics – Description, Measurement and Assessment of Environmental Noise, Part 2: Determination of Environmental Noise Levels* (International Organization for Standardization (ISO 1996-2) and, in addition, with reference to the Environmental Protection Agency (EPA) publication *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (EPA 2016). Noise monitoring was carried out in June, July and October 2017 at 20 noise monitoring locations near the Proposed Project. The monitoring locations are shown in Figure 15.1 Noise Monitoring Locations;

(ii) Identification of appropriate criteria against which to assess the noise and vibration impacts associated with the Proposed Project. Criteria for noise assessment are discussed in Section 15.2.5, and the criteria for vibration assessment are discussed in Section 15.2.6;

(iii) Noise and vibration impacts associated with the Construction Phase have been calculated in accordance with ISO 9613-2:1996 – *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation* (ISO 9613-2) using input data sourced from *BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise* (British Standards Institution 2014a) and *BS 5228-2:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2: Vibration* (British Standards Institution 2014b)*;*

(iv) Noise impacts associated with the Operational Phase have been calculated in accordance with ISO 9613-2 and with the use of noise modelling software. Details on the noise modelling are provided in Section 15.4;

(v) The results generated by the impact assessments have been compared against the relevant criteria for both the Construction Phase and Operational Phase; and

(vi) Mitigation and avoidance measures have been proposed where required to ensure that impacts are managed and controlled to minimise the impact on receptors.

The impacts of the Proposed Project are described by considering the possible impacts that could occur as a result of the Proposed Project, the probability of their occurrence and the nature and significance of such impacts. The EPA document *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA 2017) are draft Guidelines which take account of the revised Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (EIA Directive) and which have been considered in this assessment. Effects are described in the draft Guidance under various headings, including Quality, Significance, Extent and Context, Probability, Duration and Frequency.

A description of the significance, duration and frequency of effects is presented in Table 15.1, which shows the approach taken to quantifying the effects of potential noise impacts.

Table 15.1: Description of Significance of Effects

Aspect	Description
Significance of Effects	
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment

Aspect	Description
Profound	An effect which obliterates sensitive characteristics
Duration and Frequency of Effects	
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting less than a year
Short-term	Effects lasting from one to seven years
Medium-term	Effects lasting from seven to 15 years
Long-term	Effects lasting from 15 to 60 years
Permanent	Effects lasting over 60 years
Reversible	Effects that can be undone, e.g. through remediation or restoration
Frequency	How often the effect will occur

15.2.5 Noise Assessment Criteria

There is no specific Irish legislation which sets out environmental noise limits that must be achieved, and therefore the assessment criteria that are presented in this report are based on the guidelines set out by regulatory bodies such as the EPA, the World Health Organization (WHO) and the Department of Communications, Climate Action and Environment whose guidance and standards are based on international best practice.

Construction Phase Noise Criteria

Construction noise is temporary in nature and is usually experienced over a short- to medium-term period, and this characteristic requires it to be considered differently to other longer-term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated.

BS 5228-1 (British Standards Institution 2014a) is a commonly used standard to assess the potential noise impacts associated with the construction phase of a project. This standard states that noise complaints related to new industrial/commercial noise sources are more likely to arise as the difference between the industrial noise source and the existing background noise increases. Practical noise reduction measures are detailed in BS 5228-1, and these measures can be implemented in order to reduce the overall noise emissions from a construction site.

There is no Irish guidance specifically published for short- to medium-term construction work such as that required for the Proposed Project. Construction noise impacts are assessed in terms of the requirements of BS 5228-1 (British Standards Institution 2014a). Annex E of BS 5228-1 details acceptable construction noise limits for differing scenarios. Annex E.2 looks at the potential significance of noise impacts based on fixed noise limits, and states:

'*noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*

70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;

75 decibels (dBA) in urban areas near main roads in heavy industrial areas.'

International best practice dictates that noise limits in the range $L_{Aeq,1hr}$ = 65 - 75dB(A) are generally acceptable in the community during daytime construction activities.

Transport Infrastructure Ireland (formerly the National Roads Authority (NRA)) is the only government body in Ireland to publish construction noise limits, which are presented in their document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA 2004) (the NRA Guidelines).

The NRA Guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration. The NRA Guidelines point out that there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, they say that Local Authorities, where appropriate, should control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The NRA Guidelines present indicative noise levels that are typically deemed acceptable during the construction phase of road developments. These are presented in Table 15.2.

Table 15.2: National Roads Authority (2004) Maximum Permissible Construction Phase Noise Levels at the Façade of Dwellings During Road Developments

Days and Times	$L_{Aeq, 1hr}$ dB	$L_{pA(max) slow}$ dB
Monday to Friday – 07:00 to 19:00	70	80
Monday to Friday – 19:00 to 22:00	60[1]	65[1]
Saturday – 08:00 to 16:30	65	75
Sundays and Bank Holidays – 08:00 to 16:30	60[1]	65[2]

Note:1: Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant Local Authority.

A Tunnel Boring Machine (TBM) will be used to construct the underground tunnel for the proposed outfall pipeline route (marine section) and also at a number of other locations along the proposed orbital sewer route and proposed outfall pipeline route (land based section) where rivers, roads and other essential infrastructure will have to be crossed. The microtunnelling works will, for the most part, operate on a round-the-clock basis once microtunnelling commences and, therefore, will operate through the night-time and at weekends. Some plant and machinery required for the microtunnelling works will operate continuously in the proposed temporary construction compounds during these works. There is no night-time noise limit specified in Table 15.2. However, the EPA's (2016) guidance note (NG4) sets out a night-time noise criterion, $L_{Aeq,T}$ (23:00 to 07:00), of 45dB for non-quiet areas.

For the Proposed Project, it is considered appropriate to adopt the construction noise criteria presented in Table 15.2 above for all NSR locations and the EPA Guidance limit of $L_{Aeq,T}$ 45dB for night-time works where required. The proposed construction noise criteria applicable at the nearest facades of the NSRs that may be impacted by the construction works for the Proposed Project are summarised as follows:

- Monday to Friday (07:00 to 19:00) 70dB $L_{Aeq,1hr}$
- Saturdays (08:00 to 16:30) 65dB $L_{Aeq,1hr}$
- Monday to Friday (19:00 to 22:00)[1] 60dB $L_{Aeq,1hr}$
- Sundays and Bank Holidays (08:00 to 16:30)[1] 60dB $L_{Aeq,1hr}$
- Night-time (22:00 to 07:00)[1] 45dB $L_{Aeq,1hr}$

- All other times[1] 45dB $L_{Aeq,1hr}$

Note 1 above refers to the fact that construction activity at these times, other than that required in respect of specific underground tunnelling works and emergency works, will require the explicit permission of the LA.

TMS Environment Ltd has developed a noise impact scale to match the significance descriptions in the EPA's (2017) *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* based on the draft document *Guideline for Noise Impacts Assessment* (Institute of Acoustics 2002) and professional experience. Table 15.3 presents an impact scale for the comparison of future noise against the existing noise levels for the assessment of cumulative noise impacts.

Table 15.3: Impact Scale for Comparison of Future Noise Against Existing Noise

Significance	Noise Level Change /(dB)
Imperceptible	<1
Not Significant	1 to <2
Slight	2 to <3
Moderate	3 to 5
Significant	>5 to 10
Very Significant	>10 to 15
Profound	>15

The criteria in Table 15.3 reflect the key benchmarks that relate to human perception of noise. A change of 3dB is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB change in noise represents a doubling or halving of the noise level. It is considered that the criteria specified in Table 15.3 provide a good indication as to the likely significance of changes in noise levels in this case and have been used to assess the impact of Construction Phase and Operational Phase noise.

In order to assist with the interpretation of traffic noise, Table 15.4 offers guidance as to the likely impact associated with changes in traffic noise level. For construction traffic, due to the short-term time period over which this impact will occur, the magnitude of impacts can be assessed against the 'short term' period as described in the *Design Manual for Roads and Bridges Volume 11, Section 3, Part 7* (Highways Agency 2011) as revised in November 2011.

Table 15.4: Classification of Magnitude of Traffic Noise Impacts in the Short-Term (Construction Phase)

Change in Sound Level (dB L_{A10})	Magnitude of Impact (Short-Term)
0	No change
0.1 to 0.9	Negligible
1.0 to 2.9	Minor
3.0 to 4.9	Moderate
5+	Major

Groundborne noise may be generated as a result of the TBM. The WHO's (1999) *Guidelines for Community Noise* recommends that indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{AMax} for single

sound events. The tunnelling activity is planned to operate continuously once commenced until completion and will therefore operate through the night-time. The 30dB L_{Aeq} guide value is therefore adopted as the impact assessment criteria for private residences during night-time works for groundborne noise.

Operational Phase Noise Criteria

The operation of the proposed WwTP will require a Wastewater Discharge Licence from the EPA. However, this licence will not stipulate noise limits for the operation of the activity. Fingal County Council have developed a *Guideline on Noise Levels* document in conjunction with Dún Laoghaire–Rathdown County Council for industrial, commercial and public leisure activities. This document sets out noise level targets for any noise sensitive location.

The document states that noise levels shall not exceed the EPA's (2016) guidance note (NG4) noise limits or exceed the existing background level by 10dB, whichever is deemed to be the lesser.

The EPA license a wide range of industrial activities, and their guidance is based on WHO standards and best international practice. The EPA's (2016) guidance note (NG4) sets out noise criteria to be met at the nearest NSRs for industrial noise. The relevant table from the guidance note (NG4) is presented in Table 15.5, and the criteria presented within are considered the appropriate noise criteria for this Proposed Project.

Table 15.5: Recommended Noise Limit Criteria

Scenario	Daytime Noise Criterion (dB $L_{Ar,T}$) (07:00 to 19:00 hrs)	Evening Noise Criterion (dB $L_{Ar,T}$) (19:00 to 23:00 hrs)	Night-time Noise Criterion (dB $L_{Aeq,T}$) (23:00 to 07:00 hrs)
Quiet Area	Noise from the licensed site to be at least 10dB below the average daytime background noise level measured during the baseline noise survey	Noise from the licensed site to be at least 10dB below the average evening background noise level measured during the baseline noise survey	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey
Areas of Low Background Noise	45dB	40dB	35dB
All other Areas	55dB	50dB	45dB

The proposed location of the proposed WwTP is not in a 'Quiet Area', as defined in Section 4.4.2 of the EPA's (2016) guidance note (NG4). The screening criteria (that the site does not meet) for a Quiet Area includes the following:

- At least 3km from urban areas with a population >1,000 people;
- At least 10km from any urban areas with a population >5,000 people;
- At least 15km from any urban areas with a population >10,000 people;
- At least 3km from any local industry;
- At least 10km from any major industry centre;
- At least 5km from any National Primary Route; and
- At least 7.5km from any Motorway or Dual Carriageway.

In order to establish whether the noise sensitive locations near the Proposed Project site would be considered 'low background noise' areas, the noise levels measured during the environmental noise survey need to satisfy the following three criteria:

- Average Daytime Background Noise Level ≤40dB L_{AF90};
- Average Evening Background Noise Level ≤35dB L_{AF90}; and
- Average Night-time Background Noise Level ≤30dB L_{AF90}.

The Proposed Project was assessed and found not to be in a Quiet Area, and the baseline noise survey does not meet the requirements of a low background noise area, in which case the appropriate noise criteria for the nearest NSRs to the Proposed Project are:

- $L_{Ar,T}$ Day (07:00 to 19:00 hrs) 55dB;
- $L_{Ar,T}$ Evening (19:00 to 23:00 hrs) 50dB; and
- $L_{Aeq,T}$ Night (23:00 to 07:00 hrs) 45dB.

It is reasonable to assume that the above noise criteria are appropriate for the operation of the proposed WwTP site and should also be applied to any other site locations with the capacity to generate observable noise emissions beyond site boundaries, including the proposed Abbotstown pumping station and the Odour Control Unit (OCU) at Dubber.

The *Design Manual for Roads and Bridges Volume 11, Section 3 Part 7* (Highways Agency 2011) also offers guidance on 'long-term' noise impacts associated with changes in traffic noise level. For the Operational Phase, traffic impacts are assessed against the 'long-term' impact classification presented in Table 15.6.

Table 15.6: Classification of Magnitude of Traffic Noise Impacts in the Long-Term (Operational Phase)

Change in Sound Level (dB L_{A10})	Magnitude of Impact (Long-Term)
0	No change
0.1 to 0.9	Negligible
1.0 to 2.9	Minor
3.0 to 4.9	Moderate
5+	Major

In addition to the EPA's (2016) guidance note (NG4) noise criteria, it was considered appropriate to carry out a BS 4142 assessment to ensure a fully robust approach has been undertaken for the noise impact assessment. *BS 4142:2014 – Method for Rating and Assessing Industrial and Commercial Sound* (British Standards Institution 2014c) describes a method for rating sound from industrial and commercial sources affecting people inside or outside dwellings or premises used for residential purposes. The glossary of terms presented in Appendix A15.1 defines all the noise terms used in this report and all terms used in the BS 4142 assessment.

An assessment of the significance of sound which is industrial/commercial in nature can be made by subtracting the measured background noise level ($L_{A90,T}$), measured in the absence of the Proposed Project plant items, from the rating level ($L_{Ar,T}$), which is the specific sound level of the source with any corrections or penalties for distinctive acoustic characteristics included.

Penalties for the presence of tonal noise characteristics according to BS 4142 include a 2dB penalty for a tone that is just perceptible at an NSR, 4dB where it is clearly perceptible and up to 6dB where the tone is highly notable.

Typically, the greater the difference between the pre-existing background noise level and the rated industrial noise level, the greater the magnitude of the impact. BS 4142 states the following:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; 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.

15.2.6 Vibration Assessment Criteria

Some activities during the Construction Phase of the Proposed Project have the potential to generate ground vibrations at sensitive receptor locations. Activities such as piling, rock-breaking, movement of loaded Heavy Goods Vehicles (HGVs) and other construction traffic and tunnel boring can all cause significant vibration to occur. The levels of vibration associated with these activities would not normally be expected to cause structural damage to buildings, but may have the potential to impact negatively on humans depending on environmental factors such as distance from source and mitigation measures employed. Blasting activities would have the potential to cause a significant negative impact on sensitive receptors, but it is not planned to carry out any blasting as part of the Proposed Project.

The Operational Phase of the Proposed Project will not generate any significant vibration emissions, and the only activity with the potential to generate low-level ground vibrations will be the movement of HGVs into and out of the proposed WwTP and Abbotstown pumping station sites along the road network.

Construction Phase Vibration Criteria

Vibration standards are defined for dealing with human comfort, and for dealing with structural or cosmetic damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV). PPV is the simplest indicator of both perceptibility and the risk of damage to structures. PPV is measured in millimetres per second (mm/s and can be defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Humans are particularly sensitive to vibration, with the threshold of perception typically being in the range of 0.14mm/sec PPV to 0.3mm/s PPV. Levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans. BS 5228-2 (British Standards Institution 2014b) provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration, and Table 15.7 below outlines these impacts.

Table 15.7: Guidance on Impacts of Vibration Levels

Vibration Level	Impact
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3mm/s	Vibration might be just perceptible in residential environments.
1.0mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

The response of a building to groundborne vibration is affected by numerous factors, including the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Guide to Damage Levels Arising from Groundborne Vibration (British Standards Institution 1993) provides guidance on vibration measurement, data analysis and reporting, as well as building classification and guide values for building damage, and is referenced in BS 5228-2 (British Standards Institution 2014b). The damage threshold criteria presented in BS 7385-2 are based upon systematic studies using a carefully controlled vibration source near buildings. This standard states that there should be no cosmetic damage to buildings if transient vibration levels do not exceed 15mm/s in the low frequency range, and this rises to 20mm/s at frequencies of 15Hz and to 50mm/s at 40Hz and above. These guidelines should be reduced by up to 50% for listed structures or similar. For continuous vibration, the threshold is considerably less at around half this value. It is also noted that the probability of damage for transient vibrations tends towards zero at 12.5mm/sec at component PPV.

Table 15.8 presents the vibration levels below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required and are presented for both transient and continuous vibrations. Groundborne vibrations from underground tunnelling have the potential to be continuous even though they are much more likely to be transient. However, the assessment for groundborne vibrations will be against the criteria for continuous vibrations to ensure a worst-case is considered. For protected or potentially vulnerable buildings, the recommended construction vibration limit is reduced by half.

Table 15.8: Maximum Permissible Construction Phase Vibration Levels

Building Type	Vibration Limit – Peak Particle Velocity for Transient Vibrations for Frequencies <15Hz	Vibration Limit – Peak Particle Velocity for Continuous Vibrations for Frequencies <15Hz
Structurally sound and not protected structures	15mm/s	7.5mm/s
Protected and/or vulnerable structures	7.5mm/s	3.5mm/s

These guideline values refer to buildings and above ground structures only, while the impacts of vibration on buried services are defined in Section B4.4 of BS 5228-2 (British Standards Institution 2014b), which recommends that a limit value of 15mm/s PPV should be applied to buried services for continuous vibration in the absence of specific

criteria from statutory undertakers. Telecommunications and computer equipment are generally not considered to be sensitive to the levels of vibration produced by construction works inside adjacent buildings.

Irish Rail and Gas Networks Ireland were contacted regarding vibration level requirements for potential microtunnelling works beneath railway lines and gas distribution lines. Irish Rail do not have any specific vibration criteria but request a minimum depth of 4.5m between the rail line and the crown of the underground pipe, which will be satisfied for this Proposed Project. Gas Networks Ireland stipulate a limit of 100mm/s PPV on the gas transmission pipeline before a stress analysis of the pipeline will be required. Maximum vibration levels associated with the Proposed Project will be very significantly below the levels requiring a stress test.

15.2.7 Sources of Noise and Vibration

Construction Phase Noise and Vibration

The specific detailed design of the Proposed Project is not known at this stage. However, the likely construction methods that will be used are presented in the Chapter 4 Description of the Proposed Project in Volume 3 Part A of this EIAR and the Outline CEMP. Consequently, conservative scenarios have been modelled to account for all construction methods, and this approach ensures that a robust and conservative assessment of potential impacts has been undertaken.

The Construction Phase will be of limited duration, and some of the activities required, notably microtunnelling, will be carried out 24 hours per day, seven days per week. The Construction Phase will involve unique construction programmes to account for the entire Proposed Project. These can be broken down into the construction of the proposed WwTP, the construction of the proposed Abbotstown pumping station, the construction of the proposed orbital sewer route and the NFS diversion sewer link as well as the proposed outfall pipeline route (land based section) and the construction of the proposed outfall pipeline route (marine section).

Proposed temporary construction compounds will be used to facilitate the different construction works for the Proposed Project. There are eight proposed temporary construction compounds for the overall proposed orbital sewer route and outfall pipeline route (land based section and marine section) works, in addition to the proposed temporary construction compounds at the proposed WwTP and proposed Abbotstown pumping station sites. These will remain in place for the duration of the respected works. In addition to these, there will be temporary or transient construction compounds used for the microtunnelling works required for road, water and rail crossings. These will be typically be in place for one to two weeks while the microtunnelling works are completed at these locations.

The construction of the proposed WwTP and the proposed Abbotstown pumping station will involve the same general construction activities, as both are currently greenfield sites. There will be significantly more construction required on the proposed WwTP site as this is a significantly larger site with greater amounts of plant and machinery and infrastructure required on-site, but the general construction methodologies will effectively be the same at both locations. Site clearance will require the use of heavy earth-moving machinery and equipment that will be used for soils stripping, excavation, importation of materials to site and foundation laying equipment. Below ground construction will be required, and this may involve some piling activities and rock-breaking at the proposed Abbotstown pumping station site. Conventional construction work will then be required to build up the individual units that will be required on each site. It is anticipated that the proposed WwTP will be constructed over a three-year period, while the proposed Abbotstown pumping station will be constructed within a 12-month period.

Raw materials required for the construction will be delivered to the sites using conventional HGVs, and any wastes requiring removal from the site will also be removed using HGVs. Vehicular movement associated with the Construction Phase is presented in detail in Chapter 13 Traffic and Transport of this EIAR.

It is envisaged that the construction methodology that will be employed for the majority of the proposed orbital sewer route construction will be conventional open cut, whereby the proposed construction corridor for the pipe will be stripped of topsoil, a trench of suitable dimension will be excavated and the pipe will be installed, on suitable bedding material, to the lines and levels determined by the design. The pipe will then be surrounded with specified material and the trench will be backfilled.

This methodology will not be suitable for the full route of the proposed orbital sewer route as the crossing of natural and manmade obstructions, such as significant watercourses, major roads, railways and major infrastructure, will necessitate the use of trenchless techniques. It is envisaged that a combination of microtunnelling and pipe jacking will be used as the trenchless techniques. The proposed orbital sewer route construction will also require heavy earth-moving machinery and equipment that will be used for soils stripping, excavation, trenching and the associated laying of the sewer pipework. Some rock-breaking activities may be required at locations where normal excavation is not possible, but this is considered likely to occur only for a short length of trench over the total length of the proposed orbital sewer route. It is anticipated that the proposed orbital sewer route construction works will be completed within 24 months, inclusive of construction corridor stripping and fencing.

The proposed outfall pipeline route (land based section) commences at the outfall of the proposed WwTP at Clonshagh and runs eastward for approximately 5.5km to the western side of Baldoyle Estuary. From here, where the proposed outfall pipeline route (marine section) commences and runs in an eastern direction for approximately 5.9km to terminate at a marine diffuser, which will be located approximately 1km north-east of Ireland's Eye.

It is envisaged that the proposed outfall pipeline route (land based section) will be constructed by a combination of open cut construction and trenchless construction, similar to the construction of the proposed orbital sewer route, and will take 18 months to complete.

The proposed construction methodology for the proposed outfall pipeline route (marine section) is a combination of microtunnelling and subsea pipe laying techniques. The microtunnelled section will commence at the west side of Baldoyle Estuary, and it is planned to tunnel beneath Baldoyle Estuary and terminate seaward of the Baldoyle Bay Special Area of Conservation (SAC)/Special Protection Area (SPA), a distance of approximately 2km in total.

The tunnel section is envisaged as a maximum of 2m internal diameter, constructed using a TBM, with pipe sections installed as the TBM progresses. The tunnel section will require two proposed temporary construction compounds onshore (proposed temporary construction compound no. 9 west of Baldoyle Estuary and proposed temporary construction compound no. 10 east of Baldoyle Estuary). At proposed temporary construction compound no. 10, to be located adjacent to the Portmarnock Beach car park, an access shaft will be constructed, tunnelling equipment will be located and the tunnel materials will be stored temporarily. Proposed temporary construction compound no. 9 will be located to the west across Baldoyle Estuary and will be completed with the reception shaft for the TBM. It is estimated that the microtunnelling will progress at a rate of approximately 60m per week and that the tunnelling will take in the region of 12 months including for site mobilisation.

Once commenced, it is envisaged that the microtunnelling work will be carried out 24 hours per day, seven days per week, for the vast majority of microtunnelling works.

The remaining section of the proposed outfall pipeline route (marine section) will be constructed using subsea pipe laying methods and will be constructed in a 5m deep trench which will be approximately 5m wide at the base and between 20m and 40m wide at the surface. It is envisaged that the trench will be constructed with a combination of a backhoe dredger, in shallower areas, and a trailer suction hopper dredger, where the water depths are beyond the limits of the backhoe dredger.

Excavated material will be temporarily stored on the seabed along the length of the trench. The pipe will then be floated into place and sunk into the trench, with the previously excavated material replaced around and over the pipe. The Construction Phase for this element is estimated at between four and five months.

The main potential sources of vibration during the Construction Phase of the Proposed Project are likely to be HGV traffic movements on uneven road surfaces, the piling works required at the proposed Abbotstown pumping station, rock-breaking where required and the groundborne vibrations that may arise as a result of the microtunnelling works involving the TBM.

Operational Phase Noise and Vibration

As the proposed orbital sewer route and the proposed outfall pipeline route (land based section and marine section) will be underground, there is no potential for the generation of observable noise and vibration from these sources. The proposed Abbotstown pumping station will handle significant volumes of inflows and outflows and will require multiple pumps operating simultaneously. There will also be a back-up generator required for occasions when power outages occur. The pumps will be housed beneath ground level in the main building and potential for noise breakout will therefore be low. There will be minimal traffic to and from the proposed Abbotstown pumping station on a daily basis, and any traffic movements will not have the potential to impact on the receiving environment.

The proposed WwTP is estimated to have a treatment capacity at approximately 500,000 population equivalent at 2024 and will also have a proposed SHC on-site, which will manage all sludges produced at the facility as well as imported sludges from the surrounding areas. Typically, the operation of the proposed WwTP will involve noise-generating plant and equipment, such as pumps, fans, centrifuges and blowers, and will also have traffic movements into and out of the site.

The operational traffic is discussed in detail in Chapter 13 Traffic and Transport of this EIAR. In summary, there will be up to five HGV movements into the proposed WwTP site and five HGV movements out of the proposed WwTP site during the AM and PM peak hour.

There will be no significant source of vibration during the Operational Phase of the proposed WwTP and the proposed Abbotstown pumping station. The only potential for vibration will arise with the transport of raw materials and waste products to and from the proposed WwTP site. However, the anticipated levels of vibration that will arise as a result of these activities are so low that they will not have the potential to cause any negative impacts on the receiving environment.

15.3 Baseline Environment

15.3.1 Introduction

The baseline noise monitoring locations were chosen in order to best represent the current noise climate at the nearest NSR locations and other key NSR locations near the proposed WwTP and proposed Abbotstown pumping station site. Measurements were also taken at a number of NSR locations near the proposed tunnelling compounds

along the proposed orbital sewer route and outfall pipeline route (land based section and marine section). These monitoring locations are presented graphically in Figure 15.1 Noise Monitoring Locations. Noise monitoring locations were selected in accordance with Section 6.1 of the EPA's (2016) guidance note (NG4) by taking account of the proposed site location and the nearest NSRs to the works boundary perimeter.

Baseline noise monitoring was carried out to determine the existing noise levels at NSR locations surrounding the proposed site locations. The detailed noise monitoring survey report is presented in Appendix A15.2 in Volume 3 Part B of this EIAR.

15.3.2 Existing Noise Climate

Noise measurements were carried out at each monitoring location during the daytime period (07:00 to 19:00), evening time period (19:00 to 23:00) and night-time period (23:00 to 07:00) between 20 June 2017 and 18 October 2017. Monitoring periods for the noise survey were 15-minute intervals for all noise measurements. Precise noise measurement details are presented in Appendix A15.2.

The glossary of terms presented in Appendix A15.1 includes definitions for the noise survey measurement parameters and other acoustic terminology used in this Chapter. A summary of the results are summarised in Table 15.9 below with the detailed measurement report presented in Appendix A15.2. These results are a reliable representation of the existing baseline noise climate near the Proposed Project.

The noise monitoring locations N1 to N20 are described in Table 15.9 and are shown graphically on Figure 15.1 Noise Monitoring Locations (Sheet 1 of 5) to Figure 15.1 Noise Monitoring Locations (Sheet 5 of 5).

Table 15.9: Baseline Noise Monitoring Results (Averaged) at Noise Monitoring Locations

Monitoring Location	Location Description	Measurement Interval	$L_{Aeq, 15min}$ dB	$L_{A90, 15min}$ dB	$L_{A10, 15min}$ dB	L_{Amax} dB
N1	Path outside of St. Francis' Hospice	Daytime	58	54	60	77
		Evening time	57	54	58	57
		Night-time	54	51	56	62
N2	Rear entrance to Elmgreen Nursing Home	Daytime	65	62	65	86
		Evening time	62	59	63	76
		Night-time	61	59	63	70
N3	Green outside Irish Sport Head Quarters	Daytime	52	48	54	70
		Evening time	48	43	48	67
		Night-time	43	41	44	52
N4	Outside No 28 Dubber Cottages Road	Daytime	57	48	58	76
		Evening time	52	46	51	71
		Night-time	48	45	49	54
N5	St. Michael's House	Daytime	63	59	66	79
		Evening time	62	57	65	70
		Night-time	58	49	61	69
N6	First house on right-hand side (RHS) past Clayton Hotel roundabout	Daytime	67	52	71	81
		Evening time	65	54	69	81
		Night-time	53	42	49	77
N7	Fourth house on RHS past Clayton Hotel roundabout	Daytime	69	52	70	93
		Evening time	64	52	63	81
		Night-time	62	52	64	83
N8	Unoccupied farm house 300m north of proposed WwTP site	Daytime	69	52	70	87
		Evening time	67	55	66	86
		Night-time	51	48	53	64
N9	House at end of cul-de-sac north of Balgriffin Cemetery	Daytime	63	48	64	80
		Evening time	61	43	57	80
		Night-time	41	37	42	62
N10	West Wing of Connolly Hospital	Daytime	61	59	62	78
		Evening time	58	55	59	71
		Night-time	55	53	57	70

Monitoring Location	Location Description	Measurement Interval	$L_{Aeq, 15min}$ dB	$L_{A90, 15min}$ dB	$L_{A10, 15min}$ dB	L_{Amax} dB
N11	Connolly Hospital Out-Patient Day Centre Building	Daytime	60	58	61	73
		Evening time	56	54	57	62
		Night-time	56	54	57	67
N12	Private residence off the R106 Coast Road	Daytime	62	46	66	79
		Evening time	59	34	64	76
		Night-time	57	35	59	77
N13	House on junction of the R106 Coast Road	Daytime	67	55	71	87
		Evening time	67	51	72	81
		Night-time	50	37	49	69
N14	House at entrance to Portmarnock Golf Club	Daytime	60	42	62	87
		Evening time	58	39	62	71
		Night-time	36	34	36	67
N15	Grounds of St. Myra National School	Daytime	62	54	64	79
		Evening time	61	40	64	77
		Night-time	53	37	57	70
N16	House at junction of Old Airport Road and R132 Swords Road	Daytime	68	58	71	81
		Evening time	68	53	73	84
		Night-time	67	50	72	84
N17	Adjacent to National Car Test Centre	Daytime	61	59	63	76
		Evening time	50	48	51	57
		Night-time	54	51	56	61
N18	Outside house on R135 Finglas Road	Daytime	60	54	63	81
		Evening time	57	54	58	66
		Night-time	48	45	50	64
N19	Outside of Cappagh Road Cottage	Daytime	55	51	58	68
		Evening time	56	54	58	67
		Night-time	52	49	54	65
N20	Portmarnock Beach	Daytime	63	55	57	83
		Evening time	65	58	68	89
		Night-time	56	52	56	84

On-site observations were made during the monitoring survey to support the baseline noise measurement results. It was generally observed that the main source of noise at all noise monitoring locations was anthropogenic (human related) in nature and included passing traffic on the adjacent roads and on the nearby motorways and passing aircraft overhead that were on approach to or departing from Dublin Airport. Non-anthropogenic noise sources including dogs barking, and the breeze blowing through trees had a minor impact on the noise environment at the noise monitoring locations. These observations were generally consistent throughout the daytime, evening time and night-time periods.

15.3.3 Existing Vibration Climate

There are no significant sources of vibration near the subject sites. The main vibrations experienced at the NSR locations relate to the passing traffic along the surrounding road network. Low-level, short-term vibrations may be experienced when fully loaded HGVs travelling at speeds in excess of 50km/h pass close to private residences. There are no significant residential areas close enough to any of the main construction activity sites to be of concern in terms of vibration activity.

To give an indication of existing vibration levels that can be expected at the subject sites, baseline vibration monitoring was carried out at a property located adjacent to the proposed WwTP site and is presented as monitoring location N7 on Figure 15.1 Noise Monitoring Locations (Sheet 4 of 5). Vibration monitoring was carried out in accordance with the requirements of BS 7385-2 (British Standards Institution 1993).

Continuous vibration monitoring was conducted using a Vibrock V901 tri-axial vibration recorder between 24 February 2016 at 15:00 and 26 February 2016 at 12:30 in order to determine the vibration levels experienced at the property over this time interval.

The measurement parameter recorded was resultant PPV, mm/sec, and the instrument measured vibration levels in excess of 0.2mm/sec. The measurement results are presented below in Table 15.10.

Table 15.10: Baseline Vibration Monitoring Summary Results

Measurement Date	Measurement Time	Resultant Peak Particle Velocity (mm/s)
24/02/2016	17:49	0.725
24/02/2016	18:31	0.250
24/02/2016	18:40	0.225
25/02/2016	08:35	1.08
25/02/2016	17:12	0.650
25/02/2016	17:13	1.00
25/02/2016	21:30	0.225
26/02/2016	02:00	0.225
26/02/2016	07:11	2.0

In total, nine vibration events in excess of 0.2mm/sec were recorded, and these occurred for the most part when trucks passed across the yard of the private residence in close proximity to the measurement location.

Vibration monitoring was also carried out at Connolly Hospital in order to ascertain the existing baseline level using a Larson Davis HVM100 vibration monitor fitted with a Larson Davis SEN020 accelerometer. The baseline vibration monitoring completed at Connolly Hospital measured low-level vibrations occurring in the hospital environment..

Vibration monitoring was completed at four locations at the Hospital as shown in Figure 15.2 Vibration Monitoring Locations at Connolly Hospital. Location 1 was adjacent to the Pharmacy Department at the rear of the hospital, Location 2 was in the Department of Psychiatry Meeting Room, Location 3 was in a hallway adjacent to the MRI and CAT scan rooms and Location 4 was in the foyer of the main entrance to the Hospital.

Continuous vibration was recorded in terms of the root mean square value averaged over one second of the frequency-weighted acceleration on the hospital floors of interest. The measurements were recorded over four-minute intervals, and the detailed results are presented in Appendix A15.3 in Volume 3 Part B of this EIAR. Monitoring was carried out between 20 September 2017 and 21 September 2017. A summary of the vibration monitoring is presented in Table 15.11.

Table 15.11:Summary of Baseline Vibration Monitoring Results at Connolly Hospital

Monitoring Location	Root Mean Square Acceleration (Four-Minute Average Range) (m/s^2)	Root Mean Square Acceleration (Maximum) (m/s^2)	Acceleration (Maximum) (m/s^2)
Location 1	0.0017 to 0.0023	0.0176	0.0505
Location 2	0.0017 to 0.0027	0.0172	0.1930
Location 3	0.0031 to 0.0053	0.0289	0.1080
Location 4	0.0023 to 0.0031	0.0211	0.0811

The dominant vibration sources observed in all locations were footfall, doors closing and the movement of trolleys, chairs and other hospital equipment. There was construction activity occurring outdoors in close proximity to monitoring Location 3, which included the intermittent use of a Kango hammer and other construction works. These construction works dominated the vibration environment at Location 3 and account for the increased range of root mean square acceleration values observed at this location. The average level of vibration in all areas is below that which would be perceptible and significantly below that where an adverse impact would be expected as per Table 15.8. A number of the peak vibrations measured were in the range that would be perceptible to people in residential or sensitive environments, particularly at Location 3 where construction activities were occurring nearby.

15.4 Impact of the Proposed Project – Construction Phase

15.4.1 Introduction

The noise levels associated with the Construction Phase of the Proposed Project have been calculated using the Bruel and Kjaer 7810 Predictor software package. The noise-modelling package uses a computer based noise propagation model, in accordance with ISO 9613-2 , which is an international standard used to undertake noise prediction modelling. The noise model accounts for the impacts on noise propagation associated with the magnitude of the noise source, the distance from the source to the receptor, the intervening ground type and topography, the presence of screens or buildings, meteorological impacts and the time that a noise source would be operating.

The noise model was constructed based on the ISO 9613-2 standard method using the named NSR locations as receiver points. Noise data for plant and machinery associated with the various construction activities of the Construction Phase were sourced from BS 5228-1 (British Standards Institution 2014a), which provides sound pressure level data for a wide range of plant and equipment used for different construction activities, and also from machinery manufacturers for plant and equipment likely to be used during the Construction Phase. Building layouts and heights have also been taken into account. Ground topography has been considered as flat as there are no hills, mountains, valleys or notable geographical features near the subject sites.

The noise model has calculated noise levels for a set of specified NSR locations that have been shown on a noise map that presents calculated sound pressure levels for various scenarios. NSR locations were chosen for the closest NSRs near the Proposed Project works to account for where construction works will take place.

The NSR locations are used to assess the potential Construction Phase noise impacts at the nearest NSRs. All other NSRs are further removed from the proposed works and will experience lower noise impacts than the NSRs assessed. The NSR locations used in the impact assessment are described in Table 15.12 and shown in Figure 15.3 Noise Sensitive Receptor Locations.

Table 15.12: Noise Sensitive Receptor Locations

Noise Sensitive Receptor ID	Description
R1	West Wing of Connolly Hospital
R2	Out-Patient Day Centre Building in Front of Connolly Hospital
R3	St. Francis' Hospice
R4	Dunsink Lane House
R5	Elmgreen Nursing Home
R6	Coolbrook Cottage
R7	Premier Business Park
R8	Cappagh Road Cottage
R9	Veterinary Clinic on the R135
R10	Balseskin Reception Centre
R11	Dubber Road Cottage
R12	Sillogue Green Farmhouse
R13	Sillogue Green Halting Site
R14	Carlton Hotel
R15	Swords Road Cottage
R16	Former Bank, Collinstown
R17	Collinstown Cross Industrial Unit
R18	Clayton Airport Hotel
R19	Redbrick Dwelling on Clonshaugh Road
R20	Third house on RHS past Clayton Hotel roundabout
R21	St Michael's House
R22	Halting Site adjacent to St Michael's House
R23	First house on RHS past Clayton Hotel roundabout
R24	Fourth house on RHS past Clayton Hotel roundabout
R25	Unoccupied farm house 300m north of proposed WwTP site
R26	Private residence at end of cul-de-sac north of Balgriffin Cemetery
R27	Kinsealy Riding Ring
R28	Emsworth House
R29	Educate Together National School
R30	St Nicholas Myra National School
R31	R124 Road Cottage
R32	Moyne Road Cottage
R33	Moyne Road House
R34	R106 Coast Road House
R35	Golf Links Road House
R36	Portmarnock Beach

15.4.2 Construction Phase Noise

Construction works will be carried out at a number of different sites across a range of different locations for the various stages of the Proposed Project. The actual noise level produced by construction work will vary at the nearest NSR at any time depending upon a number of factors, including the type of plant in use, plant location, duration of operation, hours of operation and intervening topography. Given that construction involves a number of phases which will encompass a range of different activities on a week-to-week basis, it is difficult to accurately determine the likely noise levels without knowing greater detail. However, the impact assessment carried out for the Proposed Project presents a range of conservative scenarios which represent the key Construction Phase activities.

The Construction Phase will be managed through the use of construction noise limits which the appointed contractor(s) will be required to work within. Best practice control measures, including choice of plant, scheduling of works on-site, provision of temporary screening and other measures, will be employed in order to ensure noise limits are not exceeded.

The different stages of the Construction Phase have been assessed in order to best represent the actual conditions at the various sites during the different Construction Phase works. As there are a significant number of different construction locations and activities associated with the Proposed Project, the construction impacts have been assessed in the following order:

- Proposed WwTP and Abbotstown pumping station works;
- Proposed orbital sewer route works;
- Proposed outfall pipeline route (land based section) works; and
- Proposed outfall pipeline route (marine section) works.

Proposed Wastewater Treatment Plant and Abbotstown Pumping Station Works

A variety of items of plant will be in use for the purposes of site clearance, preparation and construction activities at both the proposed WwTP and proposed Abbotstown pumping station sites. The site preparation and clearance works will be site dependent. Some excavation of the existing ground-rock will be required at the proposed Abbotstown pumping station site, which will be carried out using traditional rock-breaking methods with some low vibration grouting techniques incorporated close to sensitive locations. There will be no blasting techniques used anywhere during construction. All construction works at these locations will be carried out during daytime hours only, and there is no requirement for continuous 24-hour works at these sites. There will be no works completed here on Sundays or Bank Holidays.

The construction works have been broken down into three distinct stages to differentiate the key construction activities for the impact assessment: Stage 1 relates to site excavation and site preparatory works, Stage 2 relates to general site activities and Stage 3 relates to the construction of the buildings. The predicted noise levels are indicative only and are intended for comparison with the adopted noise criteria. Depending on the specific activities occurring at the site, the measured noise levels will vary accordingly.

For the purposes of a conservative assessment, Table 15.13 presents the plant items and their estimated on-time which have been assumed in the model for each of the key construction activities associated with each Stage assessed. An on-time or operating time of 66% for plant items is presented in the assessment, which assumes that plant will operate for a full eight hours over a 12-hour daytime working period (07:00 to 19:00) or for 40 minutes

every hour. This is considered a conservative approach for construction activities such as those on this Proposed Project, considering the dynamic nature of construction works and construction sites.

The nearest NSR locations have been used as the named receptors in order to assess the potential noise impacts associated with the different stages of the construction works. The calculated results take account of the assumptions presented in Table 15.13. The plant items are assumed to be operating along the construction boundary closest to the nearest NSR, even though in reality they will be much further removed. There are no screening reductions applied, and all plant and equipment was assessed as running simultaneously.

Table 15.13: Construction Phase Activity Assumed for Each Stage of the Construction Works at the Proposed Wastewater Treatment Plant and Abbotstown Pumping Station

Construction Works	Plant Detail	BS 5228-1 Reference	Number of Plant Items Operating		Sound Power Level (Lw, dB(A))	Operating Time (%)
			Proposed Wastewater Treatment Plant	Proposed Abbotstown Pumping Station		
Stage 1 Excavation and site preparation	Tracked excavator	C2.2	5	2	105	66
	Dozer	C2.11	5	2	107	66
	Wheeled loader	C2.28	5	2	104	66
	Excavator rock-breaker	C9.12	0	1	113	66
	Crusher	C9.14	0	1	118	66
	Dump truck	C2.30	5	2	107	66
Stage 2 General site activities	Dump truck	C2.30	5	2	107	66
	Wheeled loader	C2.28	5	2	104	66
	Mobile telescopic crane	C4.41	5	2	99	66
	Generator	C4.77	5	2	88	100
	Angle grinder	C4.93	5	4	108	66
	Piling rig	C3.22	0	1	108	66
Stage 3 Building construction	Water pump	C4.88	2	2	97	66
	Mobile telescopic crane	C4.41	4	2	99	66
	Tower crane	C4.48	1	0	104	100
	Dump truck	C2.30	2	2	107	66
	Generator	C4.77	5	2	88	100
	Concrete pump and truck	C4.28	2	2	103	66
	Poker vibrator	C4.34	5	2	97	66
	Cutting/grinding	C4.72	5	4	107	66

The specific construction works noise levels predicted at each of the nearest surrounding NSR locations are presented in Table 15.14.

Table 15.14: Predicted Noise Levels at the Nearest Noise Sensitive Receptors for the Construction Phase Works

Noise Sensitive Receptor ID	Noise Sensitive Receptor Description	Predicted Noise Level (dB $L_{Aeq,1hr}$)		
		Stage 1 Excavation and Site Preparation	Stage 2 General Site Activities	Stage 3 Building Construction
Proposed Abbotstown Pumping Station				
R2	Out-Patient Day Centre Building in Front of Connolly Hospital	55	53	51
R3	St. Francis' Hospice	59	55	54
R4	Dunsink Lane House	56	52	50
R5	Elmgreen Nursing Home	47	42	41
Proposed Wastewater Treatment Plant				
R20	Third house on RHS past Clayton Hotel roundabout	51	50	44
R21	St Michael's House	43	43	40
R24	Fourth house on RHS past Clayton Hotel roundabout	51	51	46
R25	Unoccupied residence 300m north of WwTP site	49	50	43
R26	Residence at end of cul-de-sac north of Balgriffin Cemetery	45	44	39

The results presented in Table 15.14 indicate that the predicted noise levels associated with each phase of construction works, (excavation and site preparation, general site activities and building construction), at both the proposed Abbotstown pumping station and WwTP sites, are all well below the assessment criteria of 70dB $L_{Aeq,1hr}$ and 65dB $L_{Aeq,1hr}$ for Saturdays at the named NSR locations. Similarly, all other NSRs near the proposed works are much further removed than the named NSRs and will consequently experience a lower noise impact than those named.

The significance of the noise impacts at the named NSR locations are presented in Table 15.15 and Table 15.16. The impact assessment tables used throughout this report are presented in the same format and are comprised of the following details:

- Column 1, NSR, is the nearest NSR or set of NSRs to the noise that is being generated by the Construction Phase or Operational Phase activity. The impact assessment is based on the noise level that is experienced at this location. The various NSR locations are described in Table 15.14 and shown graphically in Figure 15.3 Noise Sensitive Receptor Locations;
- Column 2, Measured Baseline, is the baseline noise measurement result, in dB L_{Aeq}, recorded near the NSR location during the initial baseline noise monitoring survey. These measurement results are taken from Table 15.9;
- Column 3, Predicted Construction Noise or Predicted Operation Noise, is the resultant noise level at the NSR location as a result of the specific Construction Phase or Operational Phase noise associated with the proposed development. These predicted noise levels have been calculated by the noise model that has been run for the various scenarios;

- Column 4, Cumulative Noise Level, is the noise level at the NSR location when the existing baseline noise is added to the predicted Construction Phase or Operational Phase noise. This is calculated by adding the noise levels in column 2 to column 3. The guidance provided in BS 5228-1, Table F.3 of Annex F, was used for the addition of noise levels;
- Column 5, Cumulative Minus Baseline, is the total contribution of the specific Construction Phase or Operational Phase noise to the existing baseline noise environment at the NSR location. This is measured in dB and is calculated by subtracting the noise levels in column 2 from column 4;
- Column 6, Impact Significance is the impact rating assessed according to the appropriate assessment criteria as presented in Table 15.3. The impact rating is based on the result in column 5; and
- Column 7, Compliance with Assessment Criteria, is a statement of fact as to whether the predicted Construction Phase or Operational Phase noise in column 3 complies with the appropriate assessment criteria as presented in Section 15.2 of this Chapter. This column shows 'Yes' if the predicted noise level complies with the criteria and 'No' if it does not comply.

Table 15.15: Noise Impact Assessment for the Proposed Abbotstown Pumping Station Construction Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R2	60	55 (Stage 1)	61	1	Not Significant	Yes
	60	53 (Stage 2)	61	1	Not Significant	Yes
	60	51 (Stage 3)	61	1	Not Significant	Yes
R3	58	59 (Stage 1)	62	4	Moderate	Yes
	58	55 (Stage 2)	60	2	Slight	Yes
	58	54 (Stage 3)	60	2	Slight	Yes
R4	65	56 (Stage 1)	66	1	Not Significant	Yes
	65	52 (Stage 2)	65	0	Imperceptible	Yes
	65	50 (Stage 3)	65	0	Imperceptible	Yes
R5	65	47 (Stage 1)	65	0	Imperceptible	Yes
	65	42 (Stage 2)	65	0	Imperceptible	Yes
	65	41 (Stage 3)	65	0	Imperceptible	Yes

Table 15.16: Noise Impact Assessment for the Proposed Wastewater Treatment Plant Construction Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R20	67	51 (Stage 1)	67	0	Imperceptible	Yes
	67	50 (Stage 2)	67	0	Imperceptible	Yes
	67	44 (Stage 3)	67	0	Imperceptible	Yes
R21	63	43 (Stage 1)	63	0	Imperceptible	Yes
	63	43 (Stage 2)	63	0	Imperceptible	Yes
	63	40 (Stage 3)	63	0	Imperceptible	Yes
R24	69	51 (Stage 1)	69	0	Imperceptible	Yes
	69	51 (Stage 2)	69	0	Imperceptible	Yes
	69	46 (Stage 3)	69	0	Imperceptible	Yes
R25	69	49 (Stage 1)	69	0	Imperceptible	Yes
	69	50 (Stage 2)	69	0	Imperceptible	Yes
	69	43 (Stage 3)	69	0	Imperceptible	Yes
R26	63	45 (Stage 1)	63	0	Imperceptible	Yes
	63	44 (Stage 2)	63	0	Imperceptible	Yes
	63	39 (Stage 3)	63	0	Imperceptible	Yes

The results indicate that the predicted daytime construction noise levels associated with site works will not exceed the assessment criteria for construction works of 70dB $L_{Aeq,1hr}$ at any of the named NSR locations. The Impact Rating for daytime construction activities at the named NSRs, as per Table 15.3, resulted in an Imperceptible impact at all named NSR locations with the exception of NSRs R2, R3 and R4. The impact is assessed as Not Significant at NSR R2, Moderate for Stage 1 works and Slight for Stage 2 and Stage 3 works at NSR R3 and Not Significant at NSR R4 for Stage 1 works. The duration of impact is classified as Temporary for each stage of works and the noise impacts are transient in nature.

These construction works are not restricted by the Saturday noise criterion of 65dB $L_{Aeq,1hr}$ as the predicted noise levels meet the criterion at all NSR locations, and consequently there are no restrictions on these works for Saturdays.

It should also be noted that the noise model did not provide for any screening reductions, and the use of site hoarding around the site perimeter during construction will further reduce the noise impacts experienced at the nearest NSRs.

Proposed Orbital Sewer Route Works and Outfall Pipeline Route (Land Based Section) Works

The noise associated with the proposed orbital sewer route works and the proposed outfall pipeline route (land based section) involves the laying of pipework along a defined route from Blanchardstown to Baldoyle via the proposed WwTP site. These works will for the most part be completed within proposed construction corridors of

40m width, which will frame the entire route. These works will involve two different construction methodologies namely open trench works and trenchless (microtunnelling) work.

Open Trench Works

For the most part, conventional open cut methodologies will be used, whereby the proposed construction corridor for the whole proposed orbital sewer route and outfall pipeline route (land based section) is stripped of topsoil, a trench of suitable dimension is excavated and the pipe is installed on suitable bedding material and the trench is backfilled. The main noise sources will be the excavation equipment, other earth-moving equipment, vehicles, cranes and rock-breakers, which may be required in a limited number of locations.

An indicative construction programme for the pipelines estimates the work to take approximately 36 months to complete, including three months for mobilisation, six months for wayleave fencing and topsoil stripping, 18 months for the pipeline construction and 12 months for re-instatement. This would very conservatively estimate the rate of progress of the proposed orbital sewer route construction works at 20m to 30m per day. In practical terms, however, each of the construction phases will progress at a significantly faster rate.

The proposed pipeline route construction works will involve the erection of temporary fences, the stripping of topsoil, excavation of the trench, laying of the pipeline and re-instatement of the land for the open cut methods.

The pipeline construction works will require the use of a variety of plant items including excavators, dump trucks, lifting equipment, delivery trucks, conveyer and some sections may require the limited use of a rock-breaker.

The NRA Guidelines refer to BS 5228-1 (British Standards Institution 2014a) for the calculation of noise levels associated with road construction works. Sound pressure levels for plant items commonly used on road construction works as set out in the standard were used for the prediction of noise levels at selected locations.

The calculations use the methodology provided within BS 5228-1. For this method, the sound pressure level of the noise source at a known distance is defined, and the attenuation is calculated between its location and the selected receiver, taking account of distance, screening due to barriers, ground attenuation and the time that a noise source would be operating. The construction works will progress along the route for each phase of works as progress is made. Consequently, noise impacts at any one location will be temporary in duration.

The duration of noise impact at any given NSR will depend on the rate of progress of the works and type of plant employed. The faster the rate of progress, the shorter the duration of noise impact that will be experienced at any NSR along the route. The highest potential noise impacts will be associated with areas where rock-breaking will be required. It is anticipated that rock-breaking, for the most part, will be required along certain sections of the proposed orbital sewer route between Abbotstown and the N2 National Road. In general, the rock that will be encountered is likely to be interbedded limestones and mudstones. Consequently, full rock-breaking equipment may not actually be required, as in many instances, the rock may be removed by ripping and excavating which would be a less noisy activity. In addition, where rock will be encountered it will be for the most part at depths of 1m or more below ground level, which will naturally result in providing some noise mitigation. However, these mitigating factors have not been included in the model so as to present a worst-case scenario, whereby any rock that might be encountered along the route is modelled to require rock-breaking at that section.

There are a small number of NSRs located between 25m and 70m from the proposed pipeline construction works, while the vast majority of NSRs are located more than 80m away from the works. The noise calculations have been completed for distances of 25m to 70m from the works to represent the noise levels at the nearest NSRs. The noise

impacts were assessed for the five stages of the works, including soil stripping, trench excavation, pipe laying, backfilling and re-instatement.

Table 15.17 to Table 15.22 set out assumed plant items during the key stages of the pipeline construction works for the open cut methodology, with the associated noise source reference from BS 5228-1 (British Standards Institution 2014a). The calculations assume plant items are operating simultaneously and at the same distance from the NSR for each item. The assumed scenarios are considered a conservative estimate due to the dynamic nature of such construction works and all plant items will not be located at the closest point to the NSR. The combined noise levels for each of the construction work phases are presented in Table 15.17 to Table 15.22. The tables also show the combined noise levels for the inclusion of a standard construction site hoarding of 2.4m height along the boundary of the construction works.

Table 15.17: Calculated Construction Noise Levels for Open Trench Works (Soil Stripping)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Tracked excavator x 3	C2.2	90	68	62	57	56
Dozer x 2	C2.1	90	64	58	53	52
Combined L_{Aeq} (when all plant items are operating)			69	63	59	57
Combined L_{Aeq} with standard site hoarding adjacent to works included			62	56	52	50

Table 15.18: Calculated Construction Noise Levels for Open Trench Works (Excavation, no Rock-Breaking)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Tracked excavator x 3	C2.2	90	68	62	57	56
Articulated dump truck x 2	C2.30	25	63	57	53	51
Combined L_{Aeq} (when all plant items are operating)			69	63	58	57
Combined L_{Aeq} with standard site hoarding adjacent to works included			61	56	51	50

Table 15.19: Calculated Construction Noise Levels for Open Trench Works (Excavation with Rock-Breaking)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Tracked excavator x 3	C2.2	25	62	56	52	50
Excavator mounted rock-breaker x 2	C9.12	66	71	64	59	57
Articulated dump truck x 2	C2.30	25	63	57	53	51
Combined L_{Aeq} (when all plant items are operating)			72	66	61	59
Combined L_{Aeq} with standard site hoarding adjacent to works included			61	56	52	50

Table 15.20: Calculated Construction Noise Levels for Open Trench Works (Pipe Laying)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Mobile Crane x 2	C4.41	100	62	56	52	50
Articulated dump truck x 2	C4.2	50	64	58	54	53
Tracked excavator x 2	C2.2	50	63	57	53	51
Combined L_{Aeq} (when all plant items are operating)			68	62	58	56
Combined L_{Aeq} with standard site hoarding adjacent to works included			60	55	50	49

Table 15.21: Calculated Construction Noise Levels for Open Trench Works (Backfilling)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Tracked excavator x 3	C2.2	66	66	60	56	54
Conveyor x 3	C10.20	100	70	64	60	59
Combined L_{Aeq} (when all plant items are operating)			71	66	62	60
Combined L_{Aeq} with standard site hoarding adjacent to works included			63	58	54	52

Table 15.22: Calculated Construction Noise Levels for Open Trench Works (Re-instatement)

Plant Details	BS 5228-1 Reference	Operating Time (%)	Calculated Noise Level (dB $L_{Aeq,T}$) at Distance from Works			
			25m	40m	60m	70m
Tracked excavator x 2	C2.2	90	66	60	55	54
Dozer x 3	C2.1	90	66	59	55	54
Combined L_{Aeq} (when all plant items are operating)			69	63	58	57
Combined L_{Aeq} with standard site hoarding adjacent to works included			62	56	52	50

The calculated construction noise levels show that individual plant items all comply with the adopted criteria of 70dB L_{Aeq} for noise levels at NSRs at distances of 25m or less, with the exception of the two rock-breakers working within 25m of an NSR. The combined L_{Aeq} results, which are the resultant noise levels when all plant items are operating together, show that there is potential for the 70dB L_{Aeq} limit to be exceeded at NSRs within 25m of the works for the excavation with rock-breaking works and also for backfilling works. However, once a standard construction site hoarding is used along the boundary of the works, noise emissions from all combined works fall within the prescribed 70dB L_{Aeq} limit, and the 65dB $L_{Aeq,1hr}$ for Saturdays, where required.

It should be noted that the calculated construction noise levels are indicative only and should be used for comparison with the adopted criteria. Where exceedance of the recommended criteria has been predicted, the use of specific additional noise mitigation measures will be used as part of the construction works to ensure that the adopted criteria are met. Details of noise mitigation measures are provided in Section 15.7.

Table 15.23 presents the impact assessment and shows the NSRs within 70m of the proposed pipeline route works along the total length of the proposed orbital sewer route where open trench works will take place. NSRs at distances of greater than 70m from the proposed pipeline route works are not included, as they will experience noise levels significantly less than the adopted noise criteria.

Table 15.23 is comprised of the following:

- Column 1, NSR ID, is the ID number of the relevant NSR location as shown in Figure 15.3 Noise Sensitive Receptor Locations;
- Column 2, Receptors Within 70m of Pipeline Works, is a description of the NSRs that are located 70m or less from the proposed orbital sewer route. St. Francis' Hospice is included in the impact assessment even though it is further removed than 70m from the proposed orbital sewer route, as this location is considered to have an increased sensitivity to noise impacts;
- Column 3, Rock-Breaking Requirement, is a statement of fact as to whether rock-breaking is required or not along the particular section of the pipeline works. 'Limited' and 'very limited' have been used to describe very broken rock which can most likely be removed without any rock-breaking;
- Column 4, Highest Predicted Noise level, is the highest predicted noise level at the NSR location as a result of the construction works along the proposed orbital sewer route and outfall pipeline route (land based section). These predicted noise levels have been calculated by the noise model that has been run for the scenario described;

- Column 5, Comment, describes if standard construction site hoarding is required along the works boundary in order to reduce the noise impacts at the particular NSR. Alternatively, the noise levels are within the noise criteria; and
- Column 6, Compliance with Assessment Criteria, is a statement of fact as to whether the predicted construction noise level in column 4 complies with the appropriate assessment criteria as presented in Section 15.2 of this Chapter. This column shows 'Yes' if the predicted noise level complies with the criteria and 'No' if it does not comply.

Table 15.23: Predicted Noise Levels at Nearest Noise Sensitive Receptors and Impact Assessment for the Proposed Orbital Sewer Route and Outfall Pipeline Route Construction Works

Noise Sensitive Receptor ID	Receptors Within 70m of Pipeline Works	Rock-Breaking Requirement	Highest Predicted Noise Level [Result with Hoarding in Place] (L_{Aeq})	Comment	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R3	Hospice at >200m	Yes	<60dB(A)	Within criterion	Yes
R6	Cottage at 60m	Yes	<65dB(A)	Within criterion	Yes
R7	Premier Business Park at 30m	Yes	72dB(A) [61dB(A)]	Site hoarding required	Yes
R8	Cottage at 45m	Yes	66dB(A)	Within criterion	Yes
9	Veterinary Clinic at 70m	Limited	<65dB(A)	Within criterion	Yes
R11	Cottage at 65m	Very limited	<65dB(A)	Within criterion	Yes
R13	Halting site at 70m	No	<65dB(A)	Within criterion	Yes
R16	Bank Building at 25m	No	71dB(A) [63dB(A)]	Site hoarding required	Yes
R17	Collinstown Cross Industrial Unit at 25m	No	71dB(A) [63dB(A)]	Site hoarding required	Yes
R19	House at 40m	No	66dB(A))	Within criterion	Yes
R20	House at 60m	No	<65dB(A)	Within criterion	Yes
R27	Kinsealy Riding Ring at 50m	No	<65dB(A)	Within criterion	Yes
R28	Emsworth House at 25m	No	71dB(A) [63dB(A)]	Site hoarding required	Yes
R29	Educate Together National School building at 25m	No	71dB(A) [63dB(A)]	Site hoarding required	Yes
R30	St Nicholas Myra National School at 65m	No	<65dB(A)	Within criterion	Yes
R32	Cottage at 70m	No	<65dB(A)	Within criterion	Yes

The proposed construction noise criteria of 70dB $L_{Aeq,1hr}$ will be exceeded at five NSR locations along the proposed pipeline routes for a very short period of time, in the order of days. However, the use of standard construction site hoarding positioned along the proposed pipeline routes boundary, between the works and the NSR, will result in reducing the noise levels experienced at all NSRs to within the proposed criteria level. All other NSRs will be exposed to noise levels that are significantly below the adopted criteria during the construction works associated with the open trench works for the proposed orbital sewer route and outfall pipeline route (land based section).

The Saturday noise criteria of 65dB $L_{Aeq,1hr}$ will also be adhered to by ensuring any works with the potential to exceed this limit will be scheduled to be undertaken on a weekday or will be completed with a construction site hoarding in place if required. This information shall be included in the Noise and Vibration Management Plan (NVMP) as discussed in Section 15.7.

Trenchless Works (Microtunnelling)

Microtunnelling works associated with the proposed orbital sewer route and the proposed outfall pipeline route works will be required during the Construction Phase at a number of different locations. Microtunnelling will be carried out at 19 locations in total including two locations near Connolly Hospital and along the proposed orbital sewer route and outfall pipeline route (land based section) for road crossings, rail-line crossings, watercourse crossings and to cross the Silloge Park Golf Club. These tunnelling events will for the most part be of very short duration, typically just a few days of active tunnelling, and will for the most part have significant distance between the tunnelling activity and the nearest NSRs. The tunnelling works near Connolly Hospital will be more significant, and it is anticipated that works will take up to six months to complete the almost 1km of tunnelling at this location. It is envisaged that the tunnelling works will continue 24-hours per day where possible, once commenced, until the tunnelling is completed.

In general, the microtunnelling construction process involves setting up a proposed temporary construction compound, which will hold the plant and equipment required for the tunnelling works, and another small temporary compound, which will contain the reception shaft for where the tunnel will be completed and join back up to the open trench works. The proposed temporary construction compounds will be set up by excavating the launch and reception shafts for the TBM by using typical excavation plant and machinery. While the precise equipment to be used, exact work methods and the works phasing will be decided by the appointed contractor(s), it is possible to estimate noise emissions associated with the proposed works for the various stages based on data presented in BS 5228-1 (British Standards Institution 2014a).

The construction of the launch shafts was considered the noisiest element of the proposed temporary construction compound works. Therefore, for the purposes of a conservative assessment, the plant items and operating times that would be required for the construction of the launch shafts are those that have been assumed in the model and presented in Table 15.24. It should be noted that the model includes the use of a rock-breaker, which may be required for certain sections of the works west of the N2 National Road, or alternatively the use of a piling rig, which is used for all other locations. These works will only be carried out during daytime hours. The use of a standard construction site hoarding of 2.4m height around the proposed temporary construction compound perimeter is assumed in the model for all tunnelling proposed temporary construction compounds and will be provided for the works.

Table 15.24: Construction Activity Assumed for the Launch Shaft Construction

Construction Works	Plant Details	Number of Plant Items	Sound Power Level (Lw, dB(A))	Operating Time (%)
Excavation of launch shaft and site preparation	Piling rig	1	108	50
	Rock-breaker	1	113	50
	Excavator	2	105	50
	Dozer	2	107	50
	Dump truck	2	107	25
	Lorry	4	108	25
	Water pump	1	93	100

Construction Works	Plant Details	Number of Plant Items	Sound Power Level (Lw, dB(A))	Operating Time (%)
	Mobile crane	1	95	40

Table 15.25 presents the 19 locations along the proposed orbital sewer route and outfall pipeline route where microtunnelling works are proposed and the approximate distance between the nearest NSRs and the boundary of the proposed temporary construction compound works. Refer to Figure 15.3 Noise Sensitive Receptor Locations for the map showing the NSR locations.

Table 15.25: Launch Shaft Construction and Tunnel Boring Machine Noise Impacts Summary Details

Proposed Temporary Construction Compound Location	Nearest Receptor Location	Distance from Tunnel Boring Machine Proposed Temporary Construction Compound Boundary to Nearest Receptor
Connolly Hospital	R1, West Wing of Connolly Hospital	45m
Connolly Hospital	R2, Out-Patient Unit at Front of Hospital	65m
Cappagh Road	R8, Cappagh Road Cottage	110m
R135 Road	R9, Veterinary Clinic on R135	72m
N2 National Road	R9, Veterinary Clinic on R135	72m
R122 Road	R10, Balseskin Reception Centre	220m
Watercourse 1	R12, Sillogue Green Farmhouse	450m
Silloge Park Golf Club	R13, Halting Site	300m
R108 Road	R13, Halting Site	50m
Watercourse 2	R14, Carlton Hotel	500m
Swords Road	R17, Industrial Unit	55m
M1 Motorway	R18, Clayton Airport Hotel	400m
Clonshaugh Road	R19, Redbrick Dwelling	45m
Watercourse 3	R21, St Michael's House & R22 Halting Site	85m
Watercourse 4	R26, Residence at end of cul-de-sac	280m
R107 Malahide Road	R29, Educate Together National School	25m
R124 Road	R31, R124 Road Cottage	80m
Watercourse 5	R31, R124 Road Cottage	155m
Railway Line	R32, Moyne Road Cottage	110m

Predicted noise levels have been calculated for each of the nearest NSR locations that have been identified for each of the 19 locations. The predicted construction noise levels at each tunnelling location for the launch shaft construction and the associated impact rating is presented in Table 15.26.

Table 15.26: Predicted Noise Levels at Nearest Noise Sensitive Receptors and Impact Rating for Launch Shaft Construction Works

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R1	61	68	69	8	Significant	Yes
R2	60	58	62	2	Slight	Yes
R8	55	63	64	9	Significant	Yes
R9	60	53	61	1	Not Significant	Yes
R9	60	53	61	1	Not Significant	Yes
R10	57*	47	58	<1	Imperceptible	Yes
R12	57*	38	57	0	Imperceptible	Yes
R13	61	46	61	0	Imperceptible	Yes
R13	61	55	62	1	Not Significant	Yes
R14	61*	41	61	0	Imperceptible	Yes
R17	68	58	69	<1	Imperceptible	Yes
R18	67	43	67	0	Imperceptible	Yes
R19	67	64	69	2	Slight	Yes
R21	63	57	64	1	Not Significant	Yes
R26	63	46	63	0	Imperceptible	Yes
R29	62	66	68	6	Significant	Yes
R31	62*	58	64	2	Slight	Yes
R31	62*	54	63	1	Not Significant	Yes
R32	62	53	63	1	Not Significant	Yes

* Baseline noise levels from the nearest similar monitoring location were used and are considered representative of this location.

The results of the assessment indicate that predicted daytime launch shaft construction works will meet the noise assessment criteria of 70dB $L_{Aeq,1hr}$ at all of the nearest NSR locations.

The Impact Rating for daytime construction activities at the named NSRs resulted in an Imperceptible rating at seven of the NSR locations, a Not Significant rating at six of the NSR locations, a Slight rating at three of the NSR locations and a Significant rating at three of the NSR locations.

The proposed TBM works near Connolly Hospital will require two proposed temporary minor construction compounds, and it is proposed to tunnel in both directions from each of these compounds.

While the precise TBM equipment to be used and exact work methods and phasing will be decided by the appointed contractor(s), for the purposes of a conservative assessment, the plant items and their estimated operational time

that have been assumed for the key tunnelling activities are presented in Table 15.27. The model input data accounts for the operation of the TBM and the associated plant and also the plant for the handling and removal of the tunnel spoil. There will be no movement of tunnel spoil outside of daytime hours, which will minimise the night-time noise generating activities. Noise data for the plant items used for the TBM works were sourced from the *Ringsend Wastewater Treatment Works Extension Environmental Impact Statement* (CDM & Barry Partners 2012), while the number of plant items required was provided by Jacobs.

The use of a standard construction site hoarding of 2.4m height around the proposed temporary construction compound perimeter is assumed in the model for all tunnelling proposed temporary construction compounds.

Table 15.27: Construction Activity Assumed for the Tunnel Boring Machine Works

Construction Works	Plant Details	Number of Plant Items	Sound Power Level Lw, dB(A)	Operating Time Day (%)	Operating Time Night (%)
TBM works, daytime and night-time	Base tank and pump station	1	99	25	25
	Screens	2	90	100	100
	Desilter	1	92	100	100
	Centrifuge	1	91	100	100
	Cascade	1	92	100	100
	Settling tanks and pumps	2	94	100	100
	Compressor	1	100	100	100
	Generator	1	87	25	25
	Dump truck	1	102	25	0
	Excavator	1	99	25	0
	Water pump	1	93	100	0
	Mobile crane	2	95	20	5

Noise modelling for the TBM works during both daytime and night-time was carried out for all locations presented in Table 15.25. Any works carried out after 19:00 will be assessed against the night-time criterion of 45dB $L_{Aeq,T}$. Noise levels have been calculated for each of the nearest NSR locations, and the predicted construction noise levels at each tunnelling location for the TBM works and the associated impact rating is presented in Table 15.28 for daytime works and Table 15.29 for night-time works.

Table 15.28: Predicted Noise Levels at Nearest Noise Sensitive Receptors and Impact Rating for Tunnel Boring Machine Construction Works (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise [with mitigation] (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R1	61	61 [55]	62	1	Not Significant	Yes
R2	60	47	60	0	Imperceptible	Yes
R8	55	44	55	0	Imperceptible	Yes
R9	60	46	60	0	Imperceptible	Yes
R9	60	46	60	0	Imperceptible	Yes
R10	57*	39	57	0	Imperceptible	Yes
R12	57*	35	57	0	Imperceptible	Yes
R13	61	38	61	0	Imperceptible	Yes
R13	61	47	61	0	Imperceptible	Yes
R14	61*	34	61	0	Imperceptible	Yes
R17	68	45	68	0	Imperceptible	Yes
R18	67	36	67	0	Imperceptible	Yes
R19	67	57	67	0	Imperceptible	Yes
R21	63	47	63	0	Imperceptible	Yes
R26	63	39	63	0	Imperceptible	Yes
R29	62	55	63	1	Not Significant	Yes
R31	62*	49 [47]	62	0	Imperceptible	Yes
R31	62*	44	62	0	Imperceptible	Yes
R32	62	45	62	0	Imperceptible	Yes

*Baseline noise levels from the nearest similar monitoring location were used and are considered representative of this location.

The results of the assessment indicate that predicted daytime TBM construction works will be within the noise assessment criterion of 70dB $L_{Aeq,1hr}$ at all NSR locations. The Saturday noise criterion of 65dB $L_{Aeq,1hr}$ will also be satisfied at all the NSR locations. Generally, once microtunnelling works have commenced, it is planned to operate continuously throughout the day and night. However, it is possible to stop the microtunnelling works if in rock and to recommence again later, and this option will be considered, where practicable. As the works at Connolly Hospital are in rock, this option can be considered. This information shall be included in the NVMP as discussed in Section 15.7.

The Impact Rating for daytime TBM construction activities at the named NSR locations resulted in an Imperceptible rating at 17 of the NSR locations and a Not Significant rating at two of the NSR locations.

Table 15.29: Predicted Noise Levels at Nearest Noise Sensitive Receptors and Impact Rating for Tunnel Boring Machine Construction Works (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise [with mitigation] (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,1hr}$)
R1	55	60 [51]	56	1	Not Significant	No
R2	56	46	56	0	Imperceptible	No
R8	52	43	53	1	Not Significant	Yes
R9	48	44	49	1	Not Significant	Yes
R9	48	44	49	1	Not Significant	Yes
R10	48*	37	48	0	Imperceptible	Yes
R12	48*	34	48	0	Imperceptible	Yes
R13	54	37	55	1	Not Significant	Yes
R13	54	45	54	0	Imperceptible	Yes
R14	54*	33	54	0	Imperceptible	Yes
R17	67	43	67	0	Imperceptible	Yes
R18	53	35	53	0	Imperceptible	Yes
R19	53	54 [48]	54	1	Not Significant	No
R21	58	46 [42]	58	0	Imperceptible	Yes
R26	41	37	42	1	Not Significant	Yes
R29	53	53	56	3	Moderate	Yes
R31	57*	48 [44]	57	0	Imperceptible	Yes
R31	57*	43	57	0	Imperceptible	Yes
R32	57	43	57	0	Imperceptible	Yes

*Baseline noise levels from the nearest similar monitoring location were used and are considered representative of this location.

The results of the assessment indicate that predicted night-time TBM construction works will be within the noise assessment criterion of 45dB $L_{Aeq,1hr}$ at all locations with the exception of two locations at Connolly Hospital (R1 and R2), a private residence on Clonshaugh Road (R19), St Michael's House (R21), the Educate Together National School on the R107 Malahide Road (R29) and the cottage on the R124 Road (R31).

The West Wing building of Connolly Hospital is considered noise sensitive at night-time, as there are occupied wards located on the ground, first and second floors of this building. Mitigation will be required for these works at this hospital location, and this is discussed in Section 15.7. In summary, the mitigation required to minimise noise impacts includes the locating of the stationary noise generating plant to the most westerly section of the proposed temporary construction compound (i.e. the furthest removed location from the hospital wards) and the use of

localised acoustic screens of 4m height surrounding the stationary noise generating plant on the hospital side of the works. This information shall be included in the NVMP as discussed in Section 15.7.

The mitigation measures proposed for the TBM works near the West Wing building of Connolly Hospital may not result in meeting the proposed noise criteria of 45dB $L_{Aeq,1hr}$ at this location, but the associated impact rating is classified as Not Significant due to the existing high baseline noise level at this location.

There are no specific noise criteria for hospital wards for construction works, but the UK Department of Health's (2013) *Health Technical Memorandum 08-01: Acoustics* sets limits that are applicable for operational hospital noises which, for night-time, are 35dB $L_{Aeq,1hr}$ for multi-bed wards, single-bed wards and recovery rooms. The internal room noise levels generated by the external works can be estimated inside the nearest buildings to the TBM works. The windows at Connolly Hospital will be required to be closed at all times during construction works as part of the air quality mitigation measures in order to control dust intrusion. A closed window will provide a noise reduction value of between 25dB and 40dB depending on the type and quality of window installed. Using the most conservative reduction value of 25dB, the internal noise that will be experienced due to external construction works associated with the TBM is estimated to be 26dB $L_{Aeq,1hr}$. This is well within the Health Technical Memorandum criteria, and in addition to the Not Significant impact rating, it is anticipated that the night-time TBM works will not adversely impact on the sensitive receptors at this location.

The Out-Patient Unit at the front of Connolly Hospital is an out-patient only unit, and there are no patients or hospital personnel in this building during night-time hours. Consequently, this location is not an NSR outside of daytime hours. Similarly, the Educate Together National School on the R107 Malahide Road is not inhabited during night-time hours and therefore is not considered as an NSR outside of daytime hours. The night-time noise assessment criteria of 45dB $L_{Aeq,1hr}$ is therefore not applicable at these locations.

Mitigation is required for the night-time TBM works approaching NSR R19 on the Clonshaugh Road. The mitigation required to minimise noise impacts includes the use of localised acoustic screens of 2.4m height surrounding the stationary noise generating plant on the dwelling house side of the works. This information shall be included in the NVMP as discussed in Section 15.7. The mitigation measures proposed for the TBM works near NSR R19 may not result in meeting the proposed noise criteria of 45dB $L_{Aeq,1hr}$ at this location, but the associated impact rating is classified as Not Significant due to the existing baseline noise level at this location. It is anticipated that the TBM works will be required for approximately five nights, resulting in a temporary impact.

Mitigation is also required for the night-time TBM works approaching NSR R21 (St Michael's House) and NSR 31 on the R124 Road. The mitigation required in order to comply with the proposed noise criteria includes the use of localised acoustic screens of 2.4m height surrounding the stationary noise generating plant on the dwelling house side of the works. This information shall be included in NVMP as discussed in Section 15.7.

The Impact Rating for night-time TBM construction activities at the named NSR locations resulted in an Imperceptible rating at 11 of the NSR locations, a Not Significant rating at seven of the NSR locations and a Moderate rating at one NSR location.

Groundborne Noise

The term groundborne noise refers to a perceived noise that differs from a typical noise source by the fact that it is heard as a result of the propagation of a vibration at acoustic frequencies through the ground or through a structure. Groundborne noise tends to be the same in all rooms in a house or building, with a slight reduction with increasing floor level. Groundborne noise may be observed without passing through air and can cause a greater impact than

would be expected from airborne noise at a similar level, particularly during the night-time. Underground tunnelling has the potential to generate groundborne noise depending on the type of ground being tunnelled, and the foundations of the receiving buildings, amongst other factors, are therefore required to be assessed for this Proposed Project.

Whilst recognising the difficulties of predicting groundborne noise levels due to uncertainties regarding ground conditions, building construction and tunnelling plant, Table E.1 of BS 5228-2 (British Standards Institution 2014b) provides empirical predictors that can be used for estimating groundborne noise levels associated with tunnelling works arising from mechanised construction works. BS 5228-2 provides the following equation:

$$Lp = 127 – 54\log_{10}r$$

Where Lp = the room sound pressure level, in decibels (dB(A)), and r = slope distance from the pile toe or tunnel crown, in metres. The above equation represents an approximation of the potential groundborne noise levels that may be generated.

Using the above equation, it is possible to generate an approximation of the potential groundborne noise levels that may be experienced at the nearest NSRs to the microtunnelling works for all locations where tunnelling will take place. Table 15.30 presents the calculated groundborne noise levels in dB(A), using the above equation, for each location where underground tunnelling will take place. The table also shows the nearest NSRs to the underground tunnel line, the distance between them and the expected ground conditions for the works. The NSR locations are shown in Figure 15.3 Noise Sensitive Receptor Locations and described in Table 15.12.

Table 15.30: Groundborne Noise Levels Associated with the Microtunnelling Activity

Tunnel Location	Nearest Noise Sensitive Receptors to Microtunnelling Works	Ground Conditions	Room Sound Pressure Level (dB L_{pA})
West Wing of Connolly Hospital	R1, Hospital at 28m	Rock	49
Out-Patient Unit at Front of Hospital	R2, Hospital at 68m	Rock	28
Cappagh Road	R8, Cottage at 55m	Rock	33
R135 Road	R9, Veterinary Clinic at 80m	Rock	24
N2 National Road	R9, Veterinary Clinic at 80m	Stiff Clays	24
R122 Road	R10, Balseskin Reception Centre at 225m	Stiff Clays	<1
Watercourse 1	R12, House at 450m	Stiff Clays	<1
Silloge Golf Club	R13, Halting Site at 220m	Stiff Clays	<1
R108 Road	R13, Halting Site at 80m	Stiff Clays	24
Watercourse 2	R14, Hotel at 500m	Stiff Clays	<1
Swords Road	R17, Industrial Unit at 60m R15, Cottage at 75m	Stiff Clays	31 26
M1 Motorway	R18, Hotel at 420m	Stiff Clays	<1
Clonshaugh Road	R19, House at 57m	Stiff Clays	32
Watercourse 3	R22, Halting Site at 100m	Stiff Clays	19
Watercourse 4	R26, House at 290m	Stiff Clays	<1
Malahide Road	R29, School at 40m	Stiff Clays	40
R124 Road	R31, Cottage at 95m	Stiff Clays	20
Watercourse 5	R31, Cottage at 175m	Stiff Clays	6
Railway Line	R32, House at 140m	Stiff Clays	11
R106 Coast Road	R33, House at 100m	Stiff Clays	19
Golf Links Road	R35, House at 15m	Rock	53

The WHO's (1999) *Guidelines for Community Noise* recommends that indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{AMax} for single sound events. The tunnelling activity is planned to operate continuously once commenced until completion and will therefore operate through the night, so the 30dB L_{Aeq} guide value is adopted as the impact assessment criteria for private residences during night-time works.

There are three residences where groundborne noise is predicted to exceed the guide limit of 30dB L_{Aeq}, namely the cottage at Cappagh Road (R8), the house at Clonshaugh Road (R19) and the house on Golf Links Road (R35). The properties at Cappagh Road and the Clonshaugh Road may experience indoor noise levels above 30dB L_{Aeq} for between one to two days, while the property on Golf Links Road may experience indoor noise levels above 30dB

L_{Aeq} for up to 10 days. It is important to note that the predicted groundborne levels are an estimate based on the BS 5228 empirical formula, while in practice it is possible that the impact will be much lower.

The final construction details, specific plant items to be used and the detailed ground conditions are not known at this stage. Once the specific details of the construction methodologies and timings are known, the appointed contractor(s) shall agree a timeframe and approach to complete the microtunnelling works at these locations with the residents of the three properties.

It is noted that BS 5228-1 (British Standards Institution 2014a) makes provision for when all reasonable measures have been taken to reduce the noise levels, but levels are still such that community disturbance or interference with activities or sleep is likely to occur. In particular, for short-term impacts, described as '*10 or more days of working in any 15 consecutive days or 40 days in any 6 consecutive months*', BS 5228-1 recommends temporary re-housing as an appropriate mitigation measure be investigated, stating, '*Where construction noise levels are such that noise insulation will not provide sufficient attenuation to prevent disturbance or interference with activities or sleep, then the occupants can be temporarily re-housed away from the construction site.*'

The requirement for temporary re-housing as a form of mitigation shall be confirmed by the appointed contractor(s) in conjunction with Irish Water once the detailed construction methodologies, method statements and programme information are available. This information shall be included in the NVMP as discussed in Section 15.7.

It is noted that it may be agreeable for the appointed contractor(s) to complete the works at the Cappagh Road residence during daytime hours only. However, this option is not available at the Clonshaugh Road and the Golf Links Road residences.

There is one building (West Wing) on the Connolly Hospital grounds where the nearest boundary is located within 28m of the proposed tunnelling works. Potential noise levels of up to 49dB L_{Aeq} are predicted here. Using the BS 5228 empirical formula method, the criteria of 30dB L_{Aeq} in occupied rooms will only be met in sections of this building that are approximately 63m or further removed from the actual underground tunnelling works themselves. There are occupied wards located on the ground, first and second floors of this building, and as such, this building is therefore considered an NSR, particularly at night-time.

In order to comply with the 30dB L_{Aeq} criteria, it will be required that tunnelling works are only carried out during daytime hours once they are within approximately 63m of this hospital building. This option is anticipated to be available, as the tunnelling works within this distance from the hospital will be carried out in rock (where the TBM can be stopped during the microtunnelling works). On-site noise measurements during the construction works will be used to precisely define the distance from the hospital building where night-time works can be carried out to comply with the 30dB L_{Aeq} criteria.

Once the precise equipment proposed to be used for the tunnelling works is known by the appointed contractor(s), and prior to any works commencing on-site, the specific groundborne noise impacts associated with the TBM works shall be presented in detailed method statements and discussed directly with Connolly Hospital as part of the overall management strategy. Informal discussion was carried out with the Health Service Executive (HSE) Estates Department at Connolly Hospital and they indicated that this was a reasonable and agreeable approach. This information shall be included in the NVMP as discussed in Section 15.7.

Predicted groundborne noise sound pressure levels at the the industrial unit on Swords Road (31dB L_{Aeq}) and the school on the R107 Malahide Road (40dB L_{Aeq}) are not required to be assessed against the 30dB L_{Aeq} criterion, as

these locations only house daytime activities, and the indoor guideline value for bedrooms of 30dB L_{Aeq} is not applicable.

Predicted groundborne noise sound pressure levels at all other locations where microtunnelling works will be carried out are within the proposed criterion of 30dB L_{Aeq}.

Proposed Outfall Pipeline Route (Marine Section) Works

The proposed construction methodology for the proposed outfall pipeline route (marine section) is a combination of microtunnelling and subsea pipe laying techniques. For clear assessment, these construction works are separated into the land based construction activities and the marine based construction activities that will result in generating noise emissions.

Land Based Works

The microtunnelled section of the proposed outfall pipeline route (marine section) will commence at the west side of the Baldoyle Estuary, and it is proposed to tunnel beneath Baldoyle Estuary and terminate seaward of the Baldoyle Bay SAC/SPA, a distance of approximately 2km in total. It is proposed to use two separate proposed temporary construction compounds to facilitate the microtunnelling works. Proposed temporary construction compound no. 9 will be located in the fields just north of the junction between the R123 Moyne Road and the R106 Coast Road in Portmarnock, and proposed temporary construction compound no. 10 will be located adjacent to the car park and beach access path just north of Portmarnock Golf Club on the Golf Links Road.

The tunnel section will be a maximum of 2m internal diameter, constructed using a TBM, with pipe sections installed as the TBM progresses. Within this assessment, proposed temporary construction compound no. 9 will be used to construct the access shaft and to hold the tunnelling equipment and tunnel materials. It is estimated that the microtunnelling will progress at a rate of approximately 60m per week and that the microtunnelling will take in the region of 12 months including site mobilisation. It is proposed that tunnelling work will be on a 24 hours per day, seven days per week, basis once commenced.

A launch shaft will be constructed in proposed temporary construction no. 8, from where the microtunnelling works will be undertaken for approximately 1km in both directions. A reception shaft will be constructed in proposed temporary construction compound no. 9 where the TBM machine will complete the land based tunnelling and be removed and replaced back in the launch pit to recommence the seaward microtunnelling works.

For the purposes of a conservative assessment, the works associated with the construction of the launch and reception shafts were considered by modelling the noisiest stage of the construction which will occur when the piling on-site is occurring in conjunction with other construction site activities, including site clearance, material removal and pumping of water from the excavation if required. Table 15.24 presents the plant items, their sound power levels and their estimated on-time which have been assumed in the model for the key construction works. These construction activities will only occur during daytime hours. The noise model has assumed the erection of a 2.4m high construction site hoarding around the complete perimeter boundary of proposed temporary construction compounds no. 9 and 10.

Once the construction of the launch and reception shafts has been completed, the TBM and associated plant will then be set-up and the underground tunnelling works will commence. While the precise TBM equipment to be used and exact work methods and phasing will be decided by the appointed contractor(s), for the purposes of a conservative assessment the TBM plant items and their estimated on-time as presented in Table 15.27 were used

to estimate the potential noise emissions associated with the TBM works. The model input data accounts for the operation of the TBM and the associated plant and also the plant that will be used for the handling and removal of the tunnel spoil. There will be no movement of tunnel spoil outside of daytime hours which will reduce the night-time noise generating activities.

The nearest NSRs to proposed temporary construction compound no. 9 are the houses at the R123 Moyne Road and the R106 Coast Road junction (R33 and R34), while the nearest NSR to proposed temporary construction compound no. 10 is the house at the entrance to the Portmarnock Golf Club on Golf Links Road (R35), as shown on Figure 15.3 Noise Sensitive Receptor Locations.

Noise modelling for the launch and reception shaft construction works during the daytime only and also for the TBM works during both daytime and night-time was carried out, and noise levels have been calculated for each of the nearest NSR locations. The predicted construction noise levels associated with works at each compound location and the associated impact rating is presented in Table 15.31 to Table 15.33.

Table 15.31: Predicted Noise Levels at the Nearest Noise Sensitive Receptor Locations for Proposed Temporary Construction Compound No. 9 and No. 10 Tunnel Shaft Construction (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R33	67	49	67	0	Imperceptible	Yes
R34	67	51	67	0	Imperceptible	Yes
R35	60	55	61	1	Imperceptible	Yes

Table 15.32: Predicted Noise Levels at the Nearest Noise Sensitive Receptor Locations for the Proposed Temporary Construction Compound No. 9 and No. 10 Tunnel Boring Machine Construction Works (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R33	67	24	67	0	Imperceptible	Yes
R34	67	24	67	0	Imperceptible	Yes
R35	60	42	60	0	Imperceptible	Yes

Table 15.33: Predicted Noise Levels at the Nearest Noise Sensitive Receptor Locations for Proposed Temporary Construction Compound No. 9 and No. 10 Tunnel Boring Machine Construction Works (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise [with mitigation] (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,1hr}$)
R33	50	23	50	0	Imperceptible	Yes
R34	50	23	50	0	Imperceptible	Yes
R35	36	41 [38]	42 [40]	6 [4]	Significant [Moderate]	Yes

The Impact Rating for the construction of the launch and reception shafts was classified as Imperceptible and Not Significant at the nearest NSR locations to the proposed works, and these works comply with the proposed noise criteria of 70dB $L_{Aeq,1hr}$ for weekdays and 65dB $L_{Aeq,1hr}$ for Saturdays at the named NSR locations

The operation of the TBM will be continuous, and consequently both the daytime and night-time impacts have been assessed. Marine TBM construction works resulted in an Imperceptible impact at the nearest NSRs (R33 and R34) to proposed temporary construction compound no. 9 for both daytime and night-time works. The significance of the impact of the TBM construction works at proposed temporary construction compound no. 10 resulted in an Imperceptible impact for daytime works and a Significant impact for night-time works at the nearest NSR location (R35) to the proposed works. The use of a localised acoustic screen in front of the stationary noise generating TBM plant in the proposed temporary construction compound will result in the impact rating dropping to Moderate for night-time impacts at R35.

In all cases for the proposed outfall pipeline route (marine section) works which take place up to the low tide mark, the highest predicted construction noise levels are below the daytime construction noise criteria of 70dB $L_{Aeq,1hr}$ for weekdays and 65dB $L_{Aeq,1hr}$ for Saturdays and are also below the night-time construction noise criterion of 45dB $L_{Aeq,1hr}$ for night-time work.

The predicted noise levels referred to in this section are indicative of a conservative scenario and are intended for comparison with the construction noise criteria. Depending upon the number and type of sources operating, the range of construction noise levels will vary from those presented in Table 15.31 to Table 15.33. The use of best practice noise mitigation measures outlined in Section 15.7 of this Chapter will, however, be incorporated into the construction works to ensure the construction noise limits are not exceeded.

Marine Works

It is proposed that the section of the proposed outfall pipeline route (marine section) to be constructed by subsea pipe laying methods will be constructed in a 5m deep trench of approximately 5m width at the base and between 20m and 40m wide at the surface, depending on the materials encountered. It is envisaged that the trench will be constructed with a combination of a backhoe dredger, in shallower areas, and a trailing suction hopper dredger, where the water depths are beyond the limits of the backhoe dredger. Dredging works are expected to commence at a point approximately 700m offshore and continue seaward for approximately 4km in total.

Excavated material will be temporarily stored on the seabed along the length of the trench or in an adjacent temporary storage area. The pipe will then be floated into place and sunk into the trench, with the previously excavated material replaced around and over the pipe.

Noise data associated with the operation of the backhoe dredger and the trailing suction hopper dredger were obtained from the *Southampton Approach Channel Dredge Environmental Impact Statement* prepared for the Associated British Ports (Bureau Veritas 2008). The Bureau Veritas Environmental Impact Statement presented noise data associated with the operation of similar plant that will be used for the marine based works for this Proposed Project.

For the purposes of a conservative scenario, the model assumed a backhoe dredger operating 650m from the coastline with the trailing suction hopper dredger simultaneously operating 2km from the coastline. Both vessels are considered working continuously at the nearest point to the shore, even though the trailing suction hopper dredger will be moving at approximately 2km per hour between two points located at 2km and 4km from the shore. In addition, a grab hopper is assumed to operate adjacent to the backhoe dredger. There will also be a number of support vessels, such as tugs or small barges, but these vessels will not contribute to the overall noise levels due to their low noise emission level. The input data that were used in the model are presented below in Table 15.34.

Table 15.34: Construction Activity Assumed for the Subsea Pipe Laying Works

Marine Vessel	Sound Power Level Lw, dB(A)	Operating Time (%)
Backhoe dredger	117	100
Trailing suction hopper dredger	112	100
Grab-hopper dredging ship	110	100

The nearest NSR location is considered to be the amenity users on the beach (R36), which will be a minimum of 600m away from the nearest vessel. The nearest residence to the proposed activity is the house at the entrance to Portmarnock Golf Club on Golf Links Road (R35), which will be approximately 1km away from the nearest vessel. The NSR locations are shown on Figure 15.3 Noise Sensitive Receptor Locations and described in Table 15.12. The worst-case impacts that will be experienced by amenity users on the beach and the nearest house are shown in Table 15.35 for daytime works and in Table 15.36 for night-time works.

Table 15.35: Predicted Noise Levels at Nearest Noise Sensitive Receptors for the Subsea Pipe Laying Works (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R35	60	39	60	0	Imperceptible	Yes
R36	63	50	63	0	Imperceptible	Yes

Table 15.36: Predicted Noise Levels at Nearest Noise Sensitive Receptors for the Subsea Pipe Laying Works (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	ImpactSignificance	Compliance with Assessment Criteria (45dB $L_{Aeq,1hr}$)
R35	36	39	41	5	Moderate	Yes
R36	56	50	57	1	Not Significant	Yes

Noise modelling shows that, for a worst-case scenario where the two dredgers and the grab hopper are operating simultaneously at the closest point to the shore, the predicted noise levels experienced by beach users is 50dB $L_{Aeq,1hr}$. The existing baseline noise levels at the beach are higher than the predicted construction works noise due to airplanes on approach to Dublin Airport and non-anthropogenic noise sources. The significance of the noise impacts on the beach users is assessed as Imperceptible for daytime and Not Significant for night-time hours.

The predicted noise level that will be experienced at the nearest house (R35) to the marine based works is 39dB $L_{Aeq,1hr}$, which results in an Imperceptible impact for daytime and a Moderate impact for night-time hours.

The proposed works for the conservative scenario assessed is within the daytime noise criterion of 70dB $L_{Aeq,1hr}$ and the night-time noise criterion of 45dB $L_{Aeq,1hr}$ at the nearest NSR locations. All other NSRs are further removed and will experience lower noise emissions associated withthe subsea pipe laying works.

It is proposed that the TBM may be recovered at the tunnelling-dredging interface from a pre-evacuated trench or a temporary cofferdam structure. The cofferdam option would require sheet piles to be driven into the seabed and is considered the worst-case for noise impact assessment.

Noise data on piling and ancillary operations were sourced from BS 5228-1 (British Standards Institution 2014a) and the noise model assumptions are presented in Table 15.37. Works were assessed at a distance of 650m from the coastline for the purposes of a conservative assessment. There will also be a number of support vessels, such as tugs or small barges, but these vessels will not contribute to the overall noise levels due to their low noise emission level.

Table 15.37: Construction Activity Assumed for the Cofferdam Construction Works

Plant Item	BS 5228 Reference	Sound Power Level Lw, dB(A)	Operating Time (%)
Vibratory piling rig	C3.8	116	66
Wheeled mobile crane	C3.30	98	66

The nearest NSR locations to the interface piling works are the amenity users on the beach (R36) and the house at the entrance to Portmarnock Golf Club on Golf Links Road (R35). The NSR locations are shown on Figure 15.3 Noise Sensitive Receptor Locations (Sheet 6 of 6) and described in Table 15.12. The worst-case impact that will be experienced by amenity users on the beach and the nearest house is shown in Table 15.38 for daytime works and in Table 15.39 for night-time works.

Table 15.38: Predicted Noise Levels at Nearest Noise Sensitive Receptors for the Interface Piling Works (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R35	60	32	60	0	Imperceptible	Yes
R36	63	45	63	0	Imperceptible	Yes

Table 15.39: Predicted Noise Levels at Nearest Noise Sensitive Receptors for the Interface Piling Works (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,1hr}$)
R35	36	32	38	2	Slight	Yes
R36	56	45	56	0	Imperceptible	Yes

The predicted noise level that will be experienced at the nearest house (R35) to the interface piling works is 32dB $L_{Aeq,1hr}$, which results in an Imperceptible impact for daytime and a Slight impact for night-time hours.

The proposed works for the conservative scenario assessed fall within the daytime noise criterion of 70dB $L_{Aeq,1hr}$ and the night-time noise criterion of 45dB $L_{Aeq,1hr}$ at the nearest NSR locations. All other NSRs are further removed and will experience lower noise levels as a result of the proposed works.

The cumulative impact of the proposed outfall pipeline route (marine section) works has been assessed for the nearest residence (R35). The assessment has considered the impact associated with the continued operation of the TBM in proposed temporary construction compound no. 10 combined with the worst-case dredging works in the unlikely scenario that both of these works were to occur simultaneously. Table 15.40 presents the cumulative impact of the proposed outfall pipeline route (marine section) works on the nearest NSR (R35) for both daytime and night-time works.

Table 15.40: Cumulative Impact Assessment for the Proposed Outfall Pipeline Route (Marine Section) Works on Noise Sensitive Receptor Location R35

Measured Baseline (dB L_{Aeq})	Predicted Tunnel Boring Machine Construction Noise (dB L_{Aeq})	Predicted Dredging Construction Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB	Impact Significance	Compliance with Assessment Criteria
Daytime						
60	50	38	61	1	Not Significant	Yes
Night-time						
36	38	38	42	6	Significant	Yes

The cumulative impact assessment of the TBM and the dredging works at the nearest NSR location (R35) shows that the impact rating for daytime works is Not Significant, while the impact rating increases to Significant for night-time works. For both daytime and night-time works, the respective assessment criteria of 70dB $L_{Aeq,1hr}$ and 45dB $L_{Aeq,1hr}$ are satisfactorily met.

Interactions with the proposed Regional Biosolids Storage Facility

Irish Water also proposes to develop an RBSF at Newtown, Dublin 11. The proposed RBSF has been separately assessed in another standalone EIAR, which has been reviewed as part of this impact assessment in order to identify any potential interactions between all other Proposed Project elements and the proposed RBSF. The closest point of Construction Phase noise interaction between the proposed RBSF and all other Proposed Project elements occurs when the TBM works are active at the R135 Road and the N2 National Road, which results in a minimum separation distance of 700m between the two Proposed Project elements.

In the unlikely scenario that the construction works at the proposed RBSF site were to coincide with the TBM construction works at the R135 Road and N2 National Road, the cumulative impacts have been considered in order to assess the potential impacts on the nearest NSR locations with the potential to be impacted. The predicted noise levels for construction works for the proposed RBSF and all other Proposed Project elements are well within the proposed criteria at the nearest NSR locations, which are less than 75m from the proposed works. Given the significant separation distance between the proposed RBSF and all other Proposed Project elements, greater than 700m, there is no potential for cumulative noise impacts to be experienced at any NSR location nearby.

15.4.3 Construction Phase Traffic Impacts

The Construction Phase will result in increased traffic movements which will make use of the local road network to access and egress the various construction sites as well as specific haul routes developed for the Construction Phase. Chapter 13 Traffic and Transport of this EIAR presents the traffic details for the access routes to be used for all of the construction sites. The sites that need to be assessed for construction traffic impacts include the proposed WwTP, Abbotstown pumping station and the proposed temporary construction compound locations.

Construction traffic will access the proposed WwTP via the R139 Road and will exit the site via Clonshaugh Road. The construction traffic for the proposed Abbotstown pumping station site will access a haul route off the R843 Snugborough Road, travel across the NSC and make its way southward to the site, and use the same route for exit. Traffic entering the proposed temporary construction compound no. 2 at Cappagh Road will travel along the R843

Snugborough Road, turn right at the roundabout onto the L3090 Road and access the site off the Cappagh Road roundabout or, alternatively, travel along the Cappagh Road and access the site from here. Proposed temporary construction compound no. 3 at Silloge Golf Course and the R108 Road will be accessed off the R108 Road just north of the M50 Motorway Junction 4. Proposed temporary construction compound no. 4 at the R132 Swords Road will be accessed either from the Old Dublin Road or the R132 Swords Road, and traffic will exit the site via the R132 Swords Road. Proposed temporary construction compound no. 9 at the R106 Coast Road will be accessed along the R123 Moyne Road, and traffic will turn left onto the R106 Coast Road and turn into the site from here. The same route in reverse will be used for the traffic leaving the site. Proposed temporary construction compound no. 10 at the car park for Portmarnock Beach will be accessed by the R106 Coast Road, turning right onto the Golf Links Road and turning left into the site from here.

In order to assess the potential traffic noise level during the peak morning construction period, the specific noise levels associated with passing construction traffic added to the existing baseline has been assessed. This has been done by assessing the noise levels associated with a passing construction vehicle movement by using the method outlined in BS 5228-1, Annex F.2.5 Method, for mobile plant using a well-defined route (e.g. haul roads). The general expression for predicting the L_{Aeq} value alongside a haul road used by single-engine items of mobile plant is:

$L_{Aeq} = L_{WA} - 33 + 10*\log_{10}(Q) - 10*\log_{10}(V) - 10*\log_{10}(d)$

Where:

L_{WA} = the sound power level of the plant in dB;

Q = the number of vehicles per hour;

V = the average vehicle speed (km/h); and

d = distance between centre of haul road and nearest NSR.

The closest NSRs along each route are generally further than 20m away from the centreline of the haul route. However, to ensure a worst-case scenario is considered for all haul routes, a distance of 15m is used for the distance between the NSR and the centre of the haul route. The calculation assumes a worst-case scenario of the HGVs travelling at a speed of 45km/h, with a sound power level of 104dB L_{WA} for the trucks, and the minimum distance of 15m between the centre of the haul road and the nearest NSR.

Using the formula above, traffic noise levels at residential dwellings along the haul routes are calculated using the peak hour morning (two-way flows) data. The findings are presented in Table 15.41.

Table 15.41: Calculated Construction Traffic Impacts Along the Haul Routes

Haul Route (Noise Monitoring Location)	Measured Baseline (dB L_{Aeq})	Calculated Construction Traffic Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R139 Road (N5)	63	53	64	1	Minor	Yes
Clonshaugh Road (N7)	69	53	69	0	Negligible	Yes
R843 Snugborough Road (N1)	58	46	58	0	Negligible	Yes

Haul Route (Noise Monitoring Location)	Measured Baseline (dB L_{Aeq})	Calculated Construction Traffic Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (70dB $L_{Aeq,1hr}$)
R123 Moyne Road (N12)	62	57	63	1	Minor	Yes
L3090 Road (N19)	55	57	59	4	Moderate	Yes
Cappagh Road (N19)	55	57	59	4	Moderate	Yes
R108 Road (N17)	61	57	62	1	Minor	Yes
Old Dublin Road (N16)	68	53	68	0	Negligible	Yes
R132 Swords Road (N16)	68	53	68	0	Negligible	Yes
R123 Moyne Road & R106 Coast Road (N13)	67	49	67	0	Negligible	Yes
R106 Coast Road & Golf Links Road (N14)	60	49	60	0	Negligible	Yes

The construction traffic impact assessment has determined that, during the morning peak hour, noise levels are calculated to increase at some residential properties that are 15m from the haul routes. The highest potential impact is calculated to be an increase in noise levels of 4dB on the L3090 Road and Cappagh Road haul routes. The impact rating for the NSRs on this haul route is classified to be Moderate, as per the criteria listed in Table 15.4. All other impacts are classified as Minor or Negligible, and all predicted construction traffic noise levels are well within the assessment criteria of 70dB $L_{Aeq,1hr}$.

It should be noted that, at all NSR locations, the existing daytime noise environment is dominated by passing road traffic and, to a lesser extent, by passing aircraft. Consequently, the noise levels generated by the construction traffic is not expected to change the character of the existing noise environment in any observable manner.

Interactions with the proposed Regional Biosolids Storage Facility

The R135 Finglas Road will be used as a haul route during Construction Phase works for the proposed RBSF and other Proposed Project elements. In the unlikely scenario that the construction works at the proposed RBSF site were to coincide with the TBM construction works near the R135 Finglas Road, the potential cumulative impacts have been assessed. The proposed RBSF and all other Proposed Projects elements are predicted to make no observable change to the prevailing ambient noise environment along the R135 Road as a result of the additional construction traffic on the route. Consequently, the cumulative impact is also predicted to result in no observable change to the existing noise environment here.

15.4.4 Vibration Impacts

The main potential sources of vibration during the various stages of the Construction Phase are likely to be HGV traffic movements on uneven road surfaces, any rock-breaking and piling activities that may be required for construction works and the microtunnelling works involving the TBM.

Regarding the HGV traffic movements, vibration can be generated in the road, as a vehicle travels along it, and can subsequently propagate or travel towards nearby buildings. These ground vibrations are generated by the impact of a vehicle's wheels and the road surface and generally are a function of the size, weight, shape and speed of the vehicle. Ground vibrations produced by road traffic have a low potential to cause perceptible structural vibration in properties located near well-maintained and smooth road surfaces. Road traffic vibration levels can therefore be largely avoided by maintenance of the road surface.

Some piling may be required on the various construction sites, but the specific requirement has not yet been defined. Construction by piling and excavation is one of the construction techniques proposed for the proposed Abbotstown pumping station. In this instance, the structure boundaries are constructed by sheet piling or secant piles. An assessment of the potential vibration levels associated with this activity has been carried out in accordance with the guidance provided in BS 5228-2 (British Standards Institution 2014b), which presents measured vibration levels for piling activities.

Whilst recognising the difficulties of predicting vibration levels due to uncertainties regarding ground conditions, source vibration data have been taken from BS 5228-2 to facilitate the estimation of vibration levels at various distances from the potential vibration source. Annex C and Annex D of BS 5228-2 provide measured vibration levels for piling, which were measured during case studies for a wide variety of ground conditions for the various forms of piling and kindred operations. These figures can be used in conjunction with the percussive piling and vibratory piling equations provided in Table E.1 of BS 5228-2 to estimate the likely potential vibration levels that may be experienced at similar ground conditions using the same piling methods.

The precise piling technique that will be used at the proposed Abbotstown pumping station is not yet defined, but a conservative assessment can be made by referencing the highest likely vibration level associated with driven sheet steel piling for both air-hammer and drop-hammer techniques. A PPV level of 10mm/s at 1m from the piling source has been used for the air-hammer driving sheets (Reference C.8 of Table D.8 of BS 5228-2), while a PPV level of 16mm/s at 11m from the piling source has been used for the drop-hammer driving sheets (Reference C.12 of Table D.8 of BS 5228-2), to ensure a conservative assessment is undertaken.

Table 15.42 illustrates the estimated vibration levels at various distances from the piling activity for both air-hammer and drop-hammer sheet steel piling.

Table 15.42: Estimated Vibration Levels Associated with Potential Piling Activities

Air-Hammer Sheet Piling		Drop-Hammer Sheet Piling	
Distance (m)	Estimated PPV (mm/s)	Distance (m)	Estimated PPV (mm/s)
1	10	11	16
5	3	26	12.5
10	2	54	2.6
20	1	75	1.5
>20	<1	>100	<1

The proposed Abbotstown pumping station site is well removed from the NSRs, which will ensure that no adverse vibration impacts are experienced as a result of the proposed piling activities. The nearest NSR to the proposed Abbotstown pumping station site is St. Francis' Hospice, which is located more than 220m from the nearest construction site boundary. Using the data presented in Table 15.42 as a reference guide, it can be estimated that for a conservative scenario, the piling activities will result in vibration levels well below 1mm/s PPV at the nearest sensitive buildings to the activity. Furthermore, any piling activities will only be carried out during daytime working hours and will be of very short duration. It is therefore considered that piling related vibration may be just perceptible in residential environments but will be well within the levels that can be tolerated if prior warning and explanation has been given to the residents.

There will be some rock-breaking required at the proposed Abbotstown pumping station site. The nearest NSR to is more than 220m away from the site boundary and will not be negatively impacted by potential piling activities, as shown above. Rock-breaking activities have lower potential vibration impacts on sensitive receptors than the piling activities assessed, and it is therefore considered that the potential vibration impacts associated with rock-breaking at the proposed Abbotstown pumping station site will have a negligible impact on the nearest receptors.

In terms of building damage, predicted vibration levels are significantly lower than those at which cosmetic damage might reasonably be expected to occur, as per Table 15.7. Some rock-breaking may be required during the open trench works along the proposed orbital sewer route between Abbotstown and the N2 National Road, as per Table 15.23. The rock most likely to be encountered will be interbedded limestones and mudstones, so rock-breaking requirements are likely to be minimal. The closest buildings to any potential rock-breaking works will be the industrial unit in the Premier Business Park (R7), at a minimum distance of 30m, and the Cappagh Road cottage (R8), at a minimum distance of 45m. Ground vibrations associated with rock-breaking of the type proposed would be significantly lower than those generated by piling activities, and the maximum vibration levels predicted at the nearest buildings are predicted to be well within the limits presented in Table 15.7.

Levels are also well below the underground services damage threshold of 15mm/s PPV. All other construction plant and construction activities at the various construction sites are considered to carry significantly less risk of elevated vibration levels. Potential impacts as a result of the proposed construction activities at the various construction sites are therefore assessed as Not Significant and Temporary, both in terms of human annoyance and building damage, and no significant adverse impacts are predicted.

Groundborne Vibration

Microtunnelling will be required during the construction phase at a number of different locations. Microtunnelling will be carried out at 19 locations in total for road crossings, waterbody crossings, rail crossings, at Connolly Hospital and also for the proposed outfall pipeline route (marine section) works. These tunnelling events will for the most part be of very short duration, typically just a few days of active microtunnelling, and generally will have significant distance between the tunnelling activity and the nearest sensitive receptors. The tunnelling works proposed at Connolly Hospital and at the proposed outfall pipeline route (marine section) will be longer in duration, ranging from six to 12 months to complete.

Table E.1 of BS 5228-2 (British Standards Institution 2014b) provides empirical predictors that can be used for estimating groundborne vibration levels arising from mechanised construction works. Specifically, in relation to groundborne vibration associated with tunnelling activities, BS 5228-2 provides the following equation:

$$V_{res} <= 180/x^{1.3}$$

Where Vres = the resultant PPV in mm/s and x = the distance measured along the ground surface in meters. This equation can be used to calculate an approximation of the groundborne vibration levels that may be generated as a result of the underground tunnelling activity.

Table 15.43 presents the calculated groundborne vibration levels that may be experienced at the nearest receptors to the microtunnelling activity for all locations where tunnelling will take place.

Table 15.43: Calculated Groundborne Vibration Levels for the Microtunnelling Works

Location	Nearest Receptors to Microtunnelling Works	Ground Conditions	Resultant Peak Particle Velocity (mm/s)
West Wing of Connolly Hospital	R1, Hospital at 28m	Rock	2.37
Out-Patient Unit at Front of Hospital	R2, Hospital at 55m	Rock	0.98
Cappagh Road	R8, Cottage at 55m	Rock	0.98
R135 Road	R9, Veterinary Clinic at 80m	Rock	0.60
N2 National Road	R9, Veterinary Clinic at 80m	Stiff Clays	0.60
R122 Road	R10, Balseskin Reception Centre at 225m	Stiff Clays	0.16
Watercourse 1	R12, House at 450m	Stiff Clays	0.06
Silloge Golf Club	R13, Halting Site at 220m	Stiff Clays	0.16
R108 Road	R13, Halting Site at 80m	Stiff Clays	0.60
Watercourse 2	R14, Hotel at 500m	Stiff Clays	0.06
Swords Road	R17, Industrial Unit at 60m R15, Cottage at 75m	Stiff Clays	0.88 0.66
M1 Motorway	R18, Hotel at 420m	Stiff Clays	0.07
Clonshaugh Road	R19, House at 57m	Stiff Clays	0.94

Location	Nearest Receptors to Microtunnelling Works	Ground Conditions	Resultant Peak Particle Velocity (mm/s)
Watercourse 3	R22, Halting Site at 100m	Stiff Clays	0.52
Watercourse 4	R26, House at 290m	Stiff Clays	0.11
R107 Malahide Road	R29, School at 40m	Stiff Clays	1.49
R124 Road	R31, House at 95m	Stiff Clays	0.48
Watercourse 5	R31, House at 175m	Stiff Clays	0.21
Railway Line	R32, House at 140m	Stiff Clays	0.29
R106 Coast Road	R33, House at 100m	Stiff Clays	0.45
Golf Links Road	R35, House at 15m	Rock	5.32

The vibration impacts on buildings associated with the microtunnelling works are assessed against the limits for continuous vibrations, set out in Table 15.7, to ensure a conservative approach is undertaken. The estimated vibration levels are significantly lower than those at which cosmetic damage to buildings could reasonably be expected to occur for all receptors. Predicted vibration levels are well below the underground services damage threshold of 15mm/s PPV for all microtunnelling locations. Potential impacts as a result of the proposed microtunnelling are therefore assessed as negligible in terms of building damage, and no significant adverse impacts are predicted for all buildings as per the criteria in Table 15.7.

The impact assessment predicts that the tunnelling activity will cause vibration levels to exceed the 1mm/s value at three locations, which, as per Table 15.7, is likely to cause complaint from residential environments, but can be tolerated if prior warning and explanation has been given to the occupants.

The UK Department of Health's (2013) *Health Technical Memorandum 08-01: Acoustics* addresses acoustic design criteria that are important for healthcare premises and discusses issues such as the provision of temporary healthcare facilities, refurbishments and the control of noise and vibration at healthcare facilities such as Connolly Hospital. Construction vibration is addressed in the document by referring to BS 5228 for guidance. No vibration criteria are presented for construction vibration impacts on existing clinical areas, but the Technical Memorandum does provide criteria for continuous operational vibrations that may be experienced in differing healthcare accommodations. The Technical Memorandum states that continuous vibration should be assessed in terms of the root mean square value (averaged over one second) of the frequency-weighted acceleration on the floors of occupied areas. Table 15.44 presents the allowable continuous vibration levels as frequency-weighted accelerations as presented in the Technical Memorandum. Also contained in Table 15.44 is the approximate equivalent PPV that has been estimated, using the following approximation which is applicable for frequencies greater than 10Hz:

velocity (mm/s) = 28.4 times acceleration (m/s^2)

Table 15.44: Continuous Vibration Criteria for Healthcare Facilities

Health Care Accommodation	Frequency Weighted Acceleration (m/s^2)	Approximate Velocity (mm/s)
Operating theatre, precision laboratory, audiometric testing booth	0.005	0.14

Wards	0.01	0.28
General laboratories, treatment areas	0.02	0.57
Offices, consulting rooms	0.04	1.14

The closest approach point of the microtunnelling activity to Connolly Hospital is 28m, which is part of the hospital building that houses the Rotunda Hysteroscopy Service. Consequently, this section of the building is potentially vibration sensitive. The predicted vibration levels show that the Health Technical Memorandum criteria will be exceeded for certain accommodations at Connolly Hospital. It is important to note that these are not specific construction vibration criteria but are operational levels that should be met for sensitive equipment to ensure its security. The maximum vibration level measured at the monitoring location adjacent to the Magnetic Resonance Imaging (MRI) room at Connolly Hospital during the baseline vibration monitoring survey was well in excess of the criteria presented in Table 15.44, showing that vibration levels in excess of those proposed in Table 15.44 are currently being tolerated at Connolly Hospital.

The appointed contractor(s) will be required to provide detailed method statements prior to any works commencing at Connolly Hospital, which will show how the required standards will be met during the works. Once the appointed contractor(s) knows the precise equipment to be used for the microtunnelling works, the specific vibration impacts associated with the works shall be presented in detailed method statements and discussed directly with Connolly Hospital as part of the overall management strategy. Informal discussion was carried out with the HSE Estates Department at Connolly Hospital, and they indicated that this was a reasonable and agreeable approach and was also the approach that they had undertaken for the construction works that were being undertaken at the hospital during the baseline vibration monitoring. This information shall be included in the NVMP as discussed in Section 15.7.

The maximum predicted vibration impact at the Connolly Hospital building is 2.37mm/s and, as per Table 15.7, vibrations at this level are likely to cause complaint from residential environments, but can be tolerated if prior warning and explanation has been given. Similarly, it is expected that complaint from Hospital staff and patients may be possible, but the detailed method statements that will be prepared and agreed between the appointed contractor(s) and the Hospital will ensure that all stakeholders are fully informed of planned works and potential impacts well in advance of commencement of works.

Furthermore, as part of the groundborne noise mitigation measures proposed, tunnelling works within approximately 63m of the Hospital will only be carried out during daytime hours. This will result in predicted vibration levels of greater than 0.8mm/s only occurring during daytime hours. These levels are below those likely to cause complaint but within the range where vibration levels might be just perceptible in residential environments. On-site vibration measurements during the construction works shall be used to precisely define the distance from the hospital building where night-time works can be carried out to comply with the <1mm/s PPV criteria. This information shall be included in the NVMP as discussed in Section 15.7.

The Educate Together National School (R29) on the R107 Malahide Road is also predicted to experience vibration levels up to 1.49mm/s at the closest point to the microtunnelling works. Again, the school building occupants will be informed of any works before the tunnelling commences, and consideration shall be given to completing the works along here during holiday term when there are no occupants of the school building. This information shall be included in the NVMP as discussed in Section 15.7.

The residential property located at the Golf Links Road (R35) may experience vibration levels up to 5.32mm/s PPV when tunnelling works are 15m from the house. The mitigation measures required for this location are discussed in Section 15.7. In summary, this residence shall receive prior warning of the tunnelling activities proposed. As this vibration is elevated and potentially continuous, albeit within the vibration assessment criteria, it is proposed to carry out a structural integrity survey of the house before and after tunnelling works are completed here, which will be shared with the property owner. The survey shall be completed by a certified structural engineer and tell-tale crack monitors shall be used on any building faults identified during the initial survey. Vibration monitoring shall also be carried out at the house while underground tunnelling works are within 30m of the property boundaries. This information shall be included in the NVMP as discussed in Section 15.7.

The microtunnelling activity is expected to proceed at a rate of 10m per day, and this will result in minimising the duration of any negative impacts. For the Golf Links Road residence (R35), where the worst vibration impacts are predicted, it is anticipated that vibration levels likely to cause complaint would be perceptible for up to eight days before dissipating completely.

Considering the minimum distances between the microtunnelling activity and the NSRs, the activity will not have the potential to generate vibration levels with potential to cause damage to buildings. Vibration nuisance to house occupants is anticipated to occur at one residence (R35) where levels may cause complaint, but can be tolerated if prior warning and explanation has been given to occupants.

Vibration impacts associated with the microtunnelling works beneath the railway line have been considered, and the tunnelling activity will likely have no observable vibration impact on the railway line. The vibration levels generated by the train movements along this line are likely to be several orders of magnitude greater than any construction related vibration levels. Irish Rail do not have any specific requirements for acceptable vibration levels that can be permitted on the rail line but require a minimum depth of 4.5m between the rail line and the crown of the underground pipe, which will be satisfied in this case.

The construction works do not approach any main gas line to a sufficient degree to have any observable vibration impact upon the line.

Interactions with the proposed Regional Biosolids Storage Facility

The closest point of interaction between the proposed RBSF and all other Proposed Project elements is greater than 700m. Considering the low vibration impacts associated with both the proposed RBSF and all other Proposed Project elements, there is no potential for cumulative vibration impacts from construction works at any NSR location near both the RBSF and any other Proposed Project element.

15.5 Impact of the Proposed Project – Operational Phase

15.5.1 Introduction

The noise levels associated with the operation of the proposed WwTP, Abbotstown pumping station and the Dubber OCU have been calculated using the Bruel and Kjaer 7810 Predictor software package, as described in Section 15.4.1. The calculations have accounted for relevant noise input data for plant that would be associated with the operation of the proposed WwTP, Abbotstown pumping station and Dubber OCU. Building layout and heights from the current design have been used in the model, with sound power levels sourced from a combination of existing data from other similar sites and from plant and equipment manufacturers. Ground topography has been considered as flat, as there are no hills, mountains, valleys or notable geographical features near the subject sites.

This Section of the report presents the predicted sound pressure levels associated with the Operational Phase of the proposed WwTP, Abbotstown pumping station and Dubber OCU during the day, evening and night periods.

15.5.2 Proposed Wastewater Treatment Plant

A noise model of the proposed WwTP facility was developed to assess the noise contribution from all noise generating sources that will be in operation on the site and the associated internal traffic movements. Some plant items will operate 24 hours per day, while some of the plant will operate from 08:00 to 24:00, with a small number of plant items operating between 08:00 and 20:00. Most of the plant items are operational for 100% of the time during their active period, while some items will only operate intermittently. Intermittent items will typically activate and run for a few minutes and then cut out again, and may only activate a few times a day. However, to assume a worst-case scenario, all intermittent items were assumed to operate for 25% of the time for all active time periods.

There are a series of flowing organic embankments which will be densely planted with approximately 15m to 20m width of hedgerow tree species, proposed for the east, north and west boundaries. The embankments will rise to a maximum height of 4m and will provide both visual and acoustic screening. These screening effects have been included in the model.

The noise input data for the key items of plant included in the noise model are presented in Appendix A15.4 in Volume 3 Part B of this EIAR. In order to incorporate noise emissions relating to on-site traffic into the operational noise model, information relating to the traffic generation to and from the site has been provided from Chapter 13 Traffic and Transport. Using the calculated worst-case HGV traffic movements to and from the site over a typical day, the number of HGV movements entering the site was assessed.

Under a worst-case scenario, a total of 60 HGVs are calculated to access the facility over the operational day, resulting in a total of 60 HGV movements into the facility and 60 HGV movements out of the facility. All HGV movements will occur during the daytime hours of 07:00 to 19:00.

Table 15.45 shows the sound power emission data used for the HGVs in the noise model. This value is highly conservative, as it assumes all HGVs entering the site are heavy duty articulated dump trucks.

Table 15.45: Sound Power Data Used for Heavy Goods Vehicle Noise

BS 5228-1 Reference	Plant Description	Sound Power Level (Lw, dB(A))
Table C7.14	Articulated dump truck	108

In order to assess the noise levels that will be generated for the Operational Phase of the proposed WwTP, the following scenarios have been modelled:

- Daytime operation with HGV movements included;
- Evening time operation; and
- Night-time operation.

The predicted operational noise levels for the daytime, evening time and night-time periods, and their associated impact rating at the nearest NSRs, are presented in Table 15.46 to Table 15.48. The noise contour results of the three modelled Operational Phase scenarios are presented in Figure 15.4 Calculated Noise Contours for the Proposed Wastewater Treatment Plant Operational Phase (Daytime), Figure 15.5 Calculated Noise Contours for the Proposed Wastewater Treatment Plant Operational Phase (Evening Time) and Figure 15.6 Calculated Noise

Contours for the Proposed Wastewater Treatment Plant Operational Phase (Night-Time). The predicted results are calculated at 1.75m height and at 4m height for two-storey dwellings, with the highest predicted result reported in the tables. The noise contour grid was set at 4m height for the noise contours presented in the Figures. For an explanation of the impact assessment tables, see Section 15.4.2. The NSR locations are described in Table 15.12 and presented in Figure 15.3 Noise Sensitive Receptor Locations.

Table 15.46: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Wastewater Treatment Plant Operational Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (55dB $L_{Aeq,T}$)
R20	67	38	67	0	Imperceptible	Yes
R21	63	35	63	0	Imperceptible	Yes
R22	63	40	63	0	Imperceptible	Yes
R24	69	36	69	0	Imperceptible	Yes
R25	69	35	69	0	Imperceptible	Yes
R26	63	32	63	0	Imperceptible	Yes

The results of the assessment indicate that daytime operational noise levels predicted at the nearest NSR locations range from 32dB $L_{Aeq,1hr}$ to 40dB $L_{Aeq,1hr}$, which is significantly below the daytime criterion of 55dB $L_{Aeq,T}$. The results of the assessment indicate that the operation of the proposed WwTP is calculated to make no measurable change to the prevailing daytime ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

Table 15.47: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Wastewater Treatment Plant Operational Phase (Evening Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (50dB $L_{Aeq,T}$)
R20	65	32	65	0	Imperceptible	Yes
R21	62	30	62	0	Imperceptible	Yes
R22	62	29	62	0	Imperceptible	Yes
R24	64	32	64	0	Imperceptible	Yes
R25	67	33	67	0	Imperceptible	Yes
R26	61	31	61	0	Imperceptible	Yes

The results of the assessment indicate that evening time operational noise levels predicted at the nearest NSR locations range from 29dB $L_{Aeq,1hr}$ to 33dB $L_{Aeq,1hr}$, which is significantly below the evening time criterion of 50dB $L_{Aeq,T}$. The results of the assessment indicate that the operation of the proposed WwTP is calculated to make no measurable change to the prevailing evening time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

Table 15.48: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Wastewater Treatment Plant Operational Phase (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,T}$)
R20	53	32	53	0	Imperceptible	Yes
R21	58	28	58	0	Imperceptible	Yes
R22	58	26	58	0	Imperceptible	Yes
R24	62	32	62	0	Imperceptible	Yes
R25	51	32	51	0	Imperceptible	Yes
R26	41	30	41	0	Imperceptible	Yes

The results of the assessment indicate that night-time operational noise levels predicted at the nearest NSR locations range from 26dB $L_{Aeq,1hr}$ to 32dB $L_{Aeq,1hr}$, which is significantly below the night-time criterion of 45dB $L_{Aeq,T}$. The results of the assessment indicate that the operation of the proposed WwTP is calculated to make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

BS 4142 Impact Assessment at the Proposed Wastewater Treatment Plant

Noise levels from fixed plant operating at the proposed WwTP site have also been assessed against BS 4142 (British Standards Institution 2014c). The BS 4142 standard is based on the measurement of background noise using L_{A90} noise measurements which are compared to the specific source noise levels measured in L_{Aeq} units. The differential between the two measurements, once any corrections have been applied for source noise tonality, distinct impulses or other noise characteristics, determines the likelihood of complaints.

If the rated plant noise level is +10dB or more above the pre-existing background noise level, then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

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 a 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.

Predicted noise levels associated with the Operational Phase of the proposed WwTP and the impact assessment are presented in Table 15.49, which also accounts for a +5dB correction for impulsive noise with the corrected results shown in brackets.

Table 15.49: BS 4142 Assessment Calculations for the Proposed Wastewater Treatment Plant Site

Noise Sensitive Receptor	Measured Background Noise Level (dB L_{A90})	Predicted Noise Level (dB L_{Aeq}) (+5dB Penalty)	Difference of Rating Level and Background Level (dB)
Daytime			
R20	52	38 (43)	-14 (-9)
R21	59	35 (40)	-24 (-19)
R22	59	40 (45)	-19 (-14)
R24	52	35 (40)	-17 (-12)
R25	52	35 (40)	-17 (-12)
R26	48	32 (37)	-16 (-11)
Evening Time			
R20	54	32 (37)	-22 (-17)
R21	57	29 (34)	-28 (-23)
R22	57	29 (34)	-28 (-23)
R24	52	32 (37)	-20 (-15)
R25	55	33 (38)	-22 (-17)
R26	43	31 (36)	-12 (-7)
Night-time			
R20	42	32 (37)	-10 (-5)
R21	49	28 (33)	-21 (-16)
R22	49	26 (31)	-23 (-18)
R24	52	32 (37)	-20 (-15)
R25	48	32 (37)	-16 (-11)
R26	37	30 (35)	-7 (-2)

The predicted noise levels at the nearest NSR locations are below the existing background (L_{A90}) levels for normal conditions, even with a +5dB penalty for acoustic features included (results shown in brackets).

The nearest NSR locations are all significantly more than 200m from the nearest proposed WwTP noise source. Considering the existing background noise levels at the NSRs, and the distance from the nearest noise source, it is considered highly unlikely that any acoustic feature correction would be required.

The noise rating level does not exceed the background sound level at any NSR location. This shows that the predicted operational noise (or specific sound source) will have a very low impact and that the noise contribution from the subject site will be Imperceptible at the nearest NSRs.

15.5.3 Proposed Abbotstown Pumping Station

A noise model, incorporating the building layout and associated plant items for the proposed Abbotstown pumping station, was developed to assess the noise contribution from all noise generating sources that will be in operation at the site.

There are four pumps proposed for the proposed Abbotstown pumping station facility: three duty and one standby. All noise generating items will be housed in the buildings, and there will be no external noise sources at the proposed Abbotstown pumping station. The noise model has assumed that all plant will operate 24 hours per day, and to assume a worst-case scenario, all items including standby pumps and the back-up generator were assumed to be in continuous operation. The input noise data for the items of plant included in the noise model are presented in Table 15.50.

Table 15.50: Input Data for Noise Model at the Proposed Abbotstown Pumping Station Site

Equipment Item	Number of Items	Operating Hours	Operating time (%)	Sound Power Level Lw, dB(A)
Pump	4	00:00 to 24:00	100	97
Odour control fan	2	00:00 to 24:00	100	83
Generator	1	00:00 to 24:00	100	95

The predicted operational noise levels for the daytime, evening time and night-time periods, and their associated impact rating at the nearest NSRs, are presented in Table 15.51 to Table 15.53 for the proposed Abbotstown pumping station. The noise contour results of the modelled Operational Phase scenario for the proposed Abbotstown pumping station is presented in Figure 15.7 Calculated Noise Contours for the Proposed Abbotstown Pumping Station Operational Phase, with the noise contour grid set at 4m height. The NSR locations are described in Table 15.12 and presented in Figure 15.3 Noise Sensitive Receptor Locations.

Table 15.51: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Abbotstown Pumping Station Operational Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (55dB $L_{Aeq,T}$)
R2	60	19	60	0	Imperceptible	Yes
R3	58	23	58	0	Imperceptible	Yes
R4	65	23	65	0	Imperceptible	Yes
R5	65	15	65	0	Imperceptible	Yes

The results of the assessment indicate that daytime operational noise levels predicted at the nearest NSR (R3) is 23dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the daytime criterion of 55dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed Abbotstown pumping station is calculated to make no measurable change to the prevailing daytime ambient noise environment. Since there will be

no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

Table 15.52: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Abbotstown Pumping Station Operational Phase (Evening Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (50dB $L_{Aeq,T}$)
R2	56	19	56	0	Imperceptible	Yes
R3	57	23	57	0	Imperceptible	Yes
R4	62	23	62	0	Imperceptible	Yes
R5	62	15	62	0	Imperceptible	Yes

The results of the assessment indicate that evening time operational noise levels predicted at the nearest NSR (R3) is 23dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the evening time criterion of 50dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed Abbotstown pumping station is calculated to make no measurable change to the prevailing evening time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, impact is classified as being of Imperceptible significance and long-term duration.

Table 15.53: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Abbotstown Pumping Station Operational Phase (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,T}$)
R2	56	19	56	0	Imperceptible	Yes
R3	54	23	54	0	Imperceptible	Yes
R4	61	23	61	0	Imperceptible	Yes
R5	61	15	61	0	Imperceptible	Yes

The results of the assessment indicate that night-time operational noise levels predicted at the nearest NSR (R3) is 23dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the night-time criterion of 45dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed Abbotstown pumping station is calculated to make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

BS 4142 Impact Assessment at the Proposed Abbotstown Pumping Station

Noise levels from fixed plant operating at the proposed Abbotstown pumping station site have also been assessed against BS 4142 (British Standards Institution 2014c).

Predicted noise levels associated with the Operational Phase of the proposed Abbotstown pumping station and the impact assessment are presented in Table 15.54, which also accounts for a +5dB correction for impulsive noise with the corrected results shown in brackets.

Table 15.54: BS 4142 Assessment Calculations for the Proposed Abbotstown Pumping Station Site

Noise Sensitive Receptor	Measured Background Noise Level (dB L_{A90})	Predicted Noise Level (dB L_{Aeq}) (+5dB Penalty)	Difference of Rating Level and Background Level (dB)
Daytime			
R2	58	19 (24)	-39 (-34)
R3	54	23 (28)	-31 (-26)
R4	62	23 (28)	-39 (-34)
R5	62	15 (20)	-47 (-42)
Evening Time			
R2	54	19 (24)	-35 (-30)
R3	54	23 (28)	-31 (-26)
R4	59	23 (28)	-36 (-31)
R5	59	15 (20)	-44 (-39)
Night-time			
R2	54	19 (24)	-35 (-30)
R3	51	23 (28)	-28 (-23)
R4	59	23 (28)	-36 (-31)
R5	59	15 (20)	-44 (-39)

The predicted noise levels at the nearest NSR locations are below the existing background (L_{A90}) levels for normal conditions, even with a +5dB penalty for acoustic features included (results shown in brackets).

The nearest NSR locations are all more than 200m from the nearest proposed Abbotstown pumping station noise source. Considering the existing background noise levels at the NSRs and the distance from the nearest noise source, it is considered highly unlikely that any acoustic feature correction would be required.

The noise rating level does not exceed the background sound level at any NSR location. This shows that the predicted operational noise (or specific sound source) will have a very low impact and that the noise contribution from the subject site will be Imperceptible at the nearest NSRs.

15.5.4 Proposed Odour Control Unit at Dubber

A noise model for the proposed OCU to be situated at Dubber was developed to assess the noise impacts at the nearest NSR locations. The noise generating plant for the operation of the OCU include two fans: one duty and one

standby. The noise model has assumed that both fans will operate 24 hours per day to assume a worst-case scenario. The nearest NSRs to the OCU are the cottages situated along Dubber Road (represented by R11), approximately 450m east of the OCU, and Balseskin Reception Centre (R10), approximately 275m south of the OCU.

The predicted operational noise levels for the daytime, evening time and night-time, and their associated impact rating at the nearest NSRs, are presented in Table 15.55 to Table 15.57 for the Dubber OCU. The noise contour results of the modelled Operational Phase scenario for Dubber OCU is presented in Figure 15.8 Calculated Noise Contours for the Proposed Dubber Odour Control Unit Operational Phase, with the noise contour grid set at 4m height. The NSR locations are described in Table 15.12 and presented in Figure 15.3 Noise Sensitive Receptor Locations.

Table 15.55: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Dubber Odour Control Unit Operational Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (55dB $L_{Aeq,T}$)
R10	57	27	57	0	Imperceptible	Yes
R11	57	14	57	0	Imperceptible	Yes

The results of the assessment indicate that daytime operational noise levels predicted at the nearest NSR (R10) is 27dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the daytime criterion of 55dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed OCU is calculated to make no measurable change to the prevailing daytime ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

Table 15.56: Predicted Noise Levels at the Named Noise Sensitive Receptor Locations for the Proposed Dubber Odour Control Unit Operational Phase (Evening Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (50dB $L_{Aeq,T}$)
R10	52	27	52	0	Imperceptible	Yes
R11	52	14	52	0	Imperceptible	Yes

The results of the assessment indicate that evening time operational noise levels predicted at the nearest NSR (R10) is 27dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the evening time criterion of 50dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed OCU is calculated to make no measurable change to the prevailing evening time ambient noise environment. Since there will be no

increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

Table 15.57: Predicted Noise Levels at the named Noise Sensitive Receptor Locations for the Proposed Dubber Odour Control Unit Operational Phase (Night-Time)

Noise Sensitive Receptor	Measured Baseline (dB L_{Aeq})	Predicted Operation Noise (dB L_{Aeq})	Cumulative Noise Level (dB L_{Aeq})	Cumulative L_{Aeq} Minus Baseline L_{Aeq} (dB)	Impact Significance	Compliance with Assessment Criteria (45dB $L_{Aeq,T}$)
R10	48	27	48	0	Imperceptible	Yes
R11	48	14	48	0	Imperceptible	Yes

The results of the assessment indicate that night-time operational noise levels predicted at the nearest NSR (R10) is 27dB $L_{Aeq,1hr}$, and operational noise levels are significantly below the night-time criterion of 45dB $L_{Aeq,T}$ at all NSR locations. The results of the assessment indicate that the operation of the proposed OCU is calculated to make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

BS 4142 Impact Assessment at Dubber Odour Control Unit

Noise levels from fixed plant operating at the proposed Dubber OCU site have also been assessed against BS 4142 (British Standards Institution 2014c).

Predicted noise levels associated with the Operational Phase of the Dubber OCU and the impact assessment are presented in Table 15.58, which also accounts for a +5dB correction for impulsive noise with the corrected results shown in brackets.

Table 15.58: BS 4142 Assessment Calculations for the Proposed Dubber Odour Control Unit Site

Noise Sensitive Receptor	Measured Background Noise Level (dB L_{A90})	Predicted Noise Level (dB L_{Aeq}) (+5dB Penalty)	Difference of Rating Level and Background Level (dB)
Daytime			
R10	48	27 (32)	-21 (-16)
R11	48	14 (19)	-34 (-29)
Evening Time			
R10	46	27 (32)	-19 (-14)
R11	46	14 (19)	-32 (-27)
Night-time			
R10	45	27 (32)	-18 (-13)
R11	45	14 (19)	-31 (-26)

The predicted noise levels at the nearest NSR locations are below the existing background (L_{A90}) levels for normal conditions, even with a +5dB penalty for acoustic features included (results shown in brackets).

The nearest NSR locations are all significantly more than 200m from the nearest OCU noise source. Considering the existing background noise levels at the NSRs and the distance from the nearest noise source, it is considered highly unlikely that any acoustic feature correction would be required.

The noise rating level does not exceed the background sound level at any NSR location. This shows that the predicted operational noise (or specific sound source) will have a very low impact and that the noise contribution from the subject site will be Imperceptible at the nearest NSRs.

Interactions with the proposed Regional Biosolids Storage Facility

The closest point of interaction between the proposed RBSF and all other Proposed Project elements for the Operational Phase is the proposed OCU at Dubber and the proposed RBSF site, which are approximately 1km apart. Operational Phase noise for the proposed RBSF and the proposed OCU at Dubber is predicted to be Imperceptible at the nearest NSRs to both Proposed Project elements. Consequently, there is no potential for cumulative noise impacts to be experienced at any NSR near either Proposed Project element.

15.5.5 Traffic Impacts

A detailed traffic impact assessment has been prepared and is presented in Chapter 13 Traffic and Transport of this EIAR. Information from the traffic report has been used to determine the predicted change in noise levels near the roads and junctions that pass the entrance route to and exit route from the proposed WwTP site.

For the purposes of assessing potential noise impacts, the relative increases in noise level associated with traffic movements on existing roads and junctions with and without the proposed development are considered. The two-way traffic flows for the PM peak period used in the assessment are taken from the Traffic Impact Assessment report. Traffic accessing the site will approach along the R139 Road and turn left into the site from here. Traffic departing the site will exit to the left via Clonshaugh Road. The NSRs situated along the R139 Road and Clonshaugh Road require to be assessed for traffic noise impacts by looking at the calculated change in noise level associated with the increase in overall traffic movements along these routes. Calculations were completed to determine the noise levels associated with the traffic numbers for the 'with' and 'without' scenarios to determine the change in noise level.

Table 15.59 presents the two-way PM peak period traffic volumes and the associated change in noise level that will be experienced by the NSRs situated along the surrounding road network for the year of opening.

Table 15.59: Change in Noise Level due to Traffic for the Year of Opening (2025)

Road	Traffic Volume PM Peak Without Development	Traffic Volume PM Peak With Development	Change in Noise Level (dB)
Clonshaugh Road	982	1,009	0.1
R139 Road	5,219	5,233	<0.1

The predicted increase in noise levels at the NSRs along Clonshaugh Road and the R139 Road due to additional traffic associated with the Proposed Project is 0.1dB. Table 15.6 offers guidance as to the likely impact associated

with a change in traffic noise level. The predicted increase in traffic noise at the NSRs along these routes is 0.1dB(A), which is barely perceptible and the associated noise impact is classified as Negligible.

There is no traffic of note associated with the operation of the proposed Abbotstown pumping station.

Interactions with the proposed Regional Biosolids Storage Facility

There is no potential for Operational Phase traffic interaction between the proposed RBSF and all other Proposed Project elements. Consequently, there is no cumulative impact to be considered.

15.6 'Do Nothing' Impact

In the event that the Proposed Project does not proceed, the existing noise environment near the proposed WwTP site and proposed Abbotstown pumping station site is expected to remain largely unchanged, assuming no additional development in the areas. The current noise environment at each location is dominated by passing traffic on the surrounding road networks and passing aircraft into and out of Dublin Airport. This will continue to be the case if the Proposed Project does not proceed. It is likely that there will be an increase in aircraft traffic using Dublin Airport in the future if the second runway is built, which will have a corresponding increase in ambient noise levels within the Zone of Influence of the flight paths. There may be a slight increase in traffic levels to the south of the proposed WwTP if the proposed new road is developed here, which will see a small increase in traffic noise levels at NSRs in this area.

15.7 Mitigation Measures

15.7.1 Construction Phase Mitigation Measures

The impact assessment for the Construction Phase works has shown that construction activities can be undertaken within the proposed noise criteria at the nearest NSRs for the vast majority of works. It is possible that there may be some short-term instances where elevated noise levels may be experienced due to the type of works being undertaken and the proximity of works to NSRs. However, with good noise management practices and the appropriate noise mitigation measures, the number and duration of these incidents will be minimised.

Noise and Vibration Management Plan

Prior to the commencement of any works, the appointed contractor(s) will prepare an NVMP. The NVMP will be developed as part of the overall Outline Construction and Environmental Management Plan developed by the appointed contractor(s) and approved by Irish Water.

The NVMP will detail how the appointed contractor(s) will comply with the noise criteria set out in this EIAR and will deal specifically with construction activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the Construction Phase works.

The NVMP will detail the provision and installation of localised acoustic screens, the best practice noise measures that the appointed contractor(s) will be required to adhere to for construction activities and the noise and vibration monitoring programme that the appointed contractor(s) will be required to undertake during the construction works.

The NVMP will specifically address the following required mitigation measures as discussed in the report above.

Open Trench Works on the Proposed Orbital Sewer Route and Outfall Pipeline Route (Land Based Section)

A standard construction site hoarding of 2.4m height will be used for open trench tunnelling works at the Premier Business Park, the former bank building at Collinstown Cross, Collinstown Cross Industrial Park, Emsworth House and the Educate Together National School as detailed in Table 15.23.

The Saturday noise criteria of 65dB $L_{Aeq,1hr}$ will be adhered to for the open trench tunnelling works by ensuring that the noisier elements of the open trench works (excavation with rock-breaking and backfilling) are not carried out on Saturdays when works are within 60m of any NSR.

Microtunnelling Works

A site hoarding of 2.4m height will be erected around the boundary of all proposed temporary construction compounds before the main noise generating works commence.

Localised acoustic screens of 2.4m height shall be used within the proposed temporary construction compound for the TBM works at Clonshaugh Road, opposite St. Michael's House and at the R124 Road. The stationary noise generating plant shall be positioned in the proposed temporary construction compound as far away as possible from the nearest NSRs (R19, R21 and R31). The screens will be placed adjacent to the stationary noise generating plant on the dwelling house side of the works.

The appointed contractor(s) shall prepare a detailed method statement regarding the likely groundborne noise and vibration levels that will be generated as a result of the microtunnelling works once the specific details of the proposed plant items and construction methodologies are known.

The appointed contractor(s), in liaison with Irish Water, shall determine an agreeable mitigation approach with the residents at the Cappagh Road cottage (R8), the house on Clonshaugh Road (R19) and the house on Golf Links Road (R35) once the detailed construction methodology and phasing is determined and the method statements are available. This may include measures such as stopping works at night-time or providing for temporary re-housing for the residents during works.

The occupiers of these properties shall also receive prior warning, written and verbal, of the microtunnelling activities proposed by the appointed contractor(s).

A structural integrity survey of the house at the Golf Links Road (R35) shall be completed before and after microtunnelling works are completed and will be shared with the property owner. The survey shall be completed by a certified structural engineer, and tell-tale crack monitors shall be used on any building faults identified during the initial survey. Vibration monitoring shall also be carried out at the house while microtunnelling works are within a minimum of 30m of the property boundaries.

The Educate Together National School (R29) on the R107 Malahide Road shall receive prior warning, written and verbal, of the microtunnelling activities proposed and the potential impacts that the occupiers of the building may experience. The appointed contractor(s) shall investigate if the microtunnelling works can be completed during the holiday term when there are no occupants of the school building.

Construction Works at Connolly Hospital

Before any construction works commence at Connolly Hospital the appointed contractor(s) will be required to set up a dedicated contact, in agreement with Irish Water, to communicate with the HSE Estates Department at

Connolly Hospital. The appointed contractor(s) will be required to provide detailed method statements prior to any works commencing at Connolly Hospital which will show how the required standards will be met during the works.

Once the precise equipment proposed to be used for the microtunnelling works is known by the appointed contractor(s), the specific noise and vibration impacts associated with the microtunnelling works shall be presented in detailed method statements and discussed directly with Connolly Hospital as part of the overall management strategy. Preliminary discussions with the HSE Estates Department indicated that this was a reasonable and agreeable approach and was also the approach that they had undertaken at the hospital for previous construction works.

The method statements shall detail the permitted hours of work and the number of plant items that can operate simultaneously for microtunnelling works once within specified distances from the Hospital buildings.

The appointed contractor(s) shall conduct attended and unattended noise and vibration monitoring at Connolly Hospital with the number of monitoring locations to be agreed with the HSE Estates Department. This monitoring data shall be used to assess compliance with the proposed criteria for all the construction works to be carried out near Connolly Hospital. The data shall also be used to assist the appointed contractor(s) to schedule work times and the intensity of plant items that will be permitted to operate simultaneously in close proximity to the Hospital buildings.

All proposed temporary construction compounds shall have a 2.4m high site hoarding around their perimeter. In addition, the proposed temporary minor construction compound near the West Wing of Connolly Hospital will locate all stationary noise generating plant along the most north-westerly section of the compound as far away from the hospital buildings as possible. There will be local acoustic screens of 4m height positioned adjacent to all stationary noise generating plant on the hospital side of the plant items.

Best Practice Noise Management Procedures

The construction works will be managed through the use of construction noise limits as detailed in Section 15.2.5 of this Chapter which the appointed contractor(s) will work within. Best practice control measures, including choice of plant, scheduling of works on-site, provision of temporary acoustic screening, on-site noise monitoring and other measures, will be employed in order to ensure noise limits are not exceeded.

Best practice noise management procedures for the control of noise and vibration from construction activities as presented in BS 5228 will be followed. Such measures include the following.

On-Site Work Practices

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start-up plant and vehicles sequentially rather than all together;
- Site equipment should be located away from noise sensitive areas, as much as is feasible;
- Regular and effective maintenance by trained personnel should be carried out to reduce noise and/or vibration from plant and machinery; and

- Limit noisy construction works to 07:00 to 19:00 weekdays with Saturday working from 08:00 to 16:30 unless otherwise agreed with the Local Authority. Relatively quiet construction activities could be carried out outside these hours, subject to controls in place. The TBM works which will be carried out outside of these hours will generate low impact noise levels, and the built-in mitigation measures will ensure that the relevant noise criteria are met for the TBM works outside normal working hours.

Selection of Quiet Plant

In accordance with best practicable means, plant and activities to be employed on the Proposed Project will be reviewed to ensure that they are the quietest available for the required purpose.

Acoustic Screens and Barriers

Acoustic screens will need to be erected in certain locations for some of the Construction Phase works as discussed above. These screens shall be carefully positioned to be as effective as possible. In general, the screen shall have no gaps or openings in the joins of the barrier material and the screen material shall have a minimum mass per unit area of 7kg/m^2. The minimum height of the screen shall typically be such that no part of the noise source will be visible from the receiving point. This may not always be possible, and therefore the minimum recommended height of the acoustic screen is prescribed at 2.4m. Localised screens of 2.4m and 4m height are required at various locations as described above, and these screens shall be placed as close as possible to the noise source to maximise their effectiveness.

Noise Control

Noise reducing technologies, such as attenuators or enclosures, shall be used where practicable:

- Ensure that noise control measures are maintained as per the manufacturers requirements;
- Minimise the number of vehicles/heavy plant on the Proposed Project sites at any one time;
- Maintain vehicles in good order and employ the principles of preventive maintenance;
- Ensure that noisy vehicles are parked as far as possible from noise sensitive areas;
- Ensure that drivers are aware of the potential for noise to cause annoyance/disturbance to local residents and they shall show due regard to this, particularly when entering and leaving the Proposed Project (e.g. no unnecessary horn blowing); and
- Consider the use of alternative varieties of reversing alarm with reduced noise output, such as ambient noise sensing alarms with variable volume or directional modulated alarms – these must be evaluated on a case-by-case basis and regard must be had to any health and safety issues that may arise.

Communications

A dedicated contact shall be appointed by the appointed contractor(s), in agreement with Irish Water, for all communications in relation to noise and vibration for the duration of the Proposed Project construction works and any queries, complaints or other formal correspondence regarding noise and vibration.

The appointed contractor(s) shall ensure good communication and engagement with local residents and stakeholders and will notify them before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works.

Any complaints relating to Construction Phase noise and vibration for the Proposed Project from local residents or other stakeholders shall be recorded, immediately addressed and notified to Irish Water. A record of how the complaint was addressed, the follow-up actions and outcome shall be maintained.

Monitoring

Continuous unattended noise and vibration monitoring shall be carried out at the sensitive receptor locations including Connolly Hospital and the Golf Links Road house during the TBM construction works and any other works with the potential to impact these locations. The number of monitoring units required at each location shall be agreed by the appointed contractor(s) with Irish Water. The monitoring equipment shall be set up to show a live display of the measurement levels and also provide remote access to the real-time data. The system shall allow a text message or email alert for exceedance of any limit values or threshold values.

The unattended noise and vibration monitoring shall be supported by attended measurements completed on a regular basis. The attended noise measurements shall be completed at least monthly and weekly for the most sensitive works.

Noise monitoring shall be carried out for L_{Aeq}, L_{A90} and L_{Amax} noise parameters over 15-minute and 1-hour measurement intervals.

Vibration monitoring shall be carried out for the vibration parameter PPV in mm/sec over 1-hour measurement intervals.

On-site noise and vibration monitoring during the actual works will be a key part in the mitigation programme for the proposed works. As discussed above, monitoring of the noise and vibration levels at NSR locations for comparison with the limits during the different construction works will be critical, and the live measurement results will be used by the appointed Construction Manager to assist the scheduling of works to ensure that the noise and vibration emissions from the various works are kept within the limits.

Noise Audits

Noise audits shall be carried out by a suitably qualified auditor, appointed by Irish Water in advance, at routine intervals to ensure that the mitigation measures discussed above are being correctly implemented at the various construction sites, including operating hours, use of local screens, siting of plant items, scheduling of works, communications with stakeholders and noise control measures.

15.7.2 Operational Phase Mitigation Measures

There are no adverse noise impacts associated with the Operational Phase of the Proposed Project, and the noise impact assessment has shown that mitigation measures are not required at the proposed WwTP or Abbotstown pumping station.

15.8 Residual Impacts

15.8.1 Construction Phase

During the Construction Phase of the Proposed Project, there will be an Imperceptible to Significant short-term impact on nearby NSRs due to noise emissions from construction works. Due to a combination of the mitigation measures proposed and the extended distances between the construction works and the nearest NSR locations, the calculated noise impacts are within the relevant criterion proposed for these works in virtually all cases.

For the Connolly Hospital location (R1) and the three residences where groundborne noise levels may be experienced over the proposed criteria levels (R8, R19 and R35), appropriate mitigation will be undertaken to ensure the temporary impact is minimised and effectively managed.

The impact assessment has shown that, with correct implementation of appropriate noise and vibration mitigation measures, the resultant noise and vibration impacts will be sufficiently controlled to within the relevant criteria.

15.8.2 Operational Phase

The impact assessment carried out has shown that the Proposed Project can easily operate within the adopted day, evening and night-time noise limit values.

The overall noise and vibration impact from the operation of the Proposed Project is expected to be long-term and Imperceptible considering the existing noise environment and the predicted impact of the Proposed Project.

15.9 Difficulties Encountered in Compiling Required Information

There were no specific difficulties encountered when carrying out this assessment.

15.10 References

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