Tionscadal Soláthair Uisce
Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 3 of 6: Environmental Assessment

(Chapter 6) Noise & Vibration

Document no: 32105801/EIARC6
Version: Final

December 2025

Uisce Éireann
Irish Water

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TOBIN

Contents

Acronyms and Abbreviations

Acronym/ Abbreviation	Meaning
AADT	Annual Average Daily Traffic
BPS	Booster Pumping Station
BPT	Break Pressure Tank
BESS	Battery Energy Storage System
BS	British Standard
BSI	British Standards Institution
Caltrans	California Department of Transportation
CC	Construction Compound
CEMP	Construction Environmental Management Plan
CNT	Construction Noise Threshold
dB	Decibel – The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS (Root Mean Square) pressure of the sound field and the reference pressure of 20 micro-pascals (20μPa).
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20Hz – 20kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESBN	Electricity Supply Board Networks
FCV	Flow Control Valve
GDA WRZ	Greater Dublin Area Water Resource Zone
HGV	Heavy Goods Vehicle
HLPS	High Lift Pumping Station
Hz	Hertz: The unit of sound frequency in cycles per second.
ISO	International Organization for Standardization
ITM	Irish Transverse Mercator
L_{A10}	The A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic
L_{A90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the 'Fast' time weighting
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T)
L_{Amax}	The instantaneous time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels)
Mld	Megalitres per day
mm/s	Millimetres per second
NSL	Noise Sensitive Location
Pa	Pascal, the SI unit of pressure
PPV	Peak Particle Velocity (PPV) refers to ground vibration in mm/s.
PSD	Pipe Storage Depot
RWI&PS	Raw Water Intake and Pumping Station

Acronym/ Abbreviation	Meaning
RWRM	Raw Water Rising Main
TBM	Tunnel boring machine
TII	Transport Infrastructure Ireland
TPR	Termination Point Reservoir
VDV	Vibration Dose Value
VSL	Vibration Sensitive Location
WTP	Water Treatment Plant

6. Noise & Vibration

6.1 Introduction

1. This chapter reports the assessment of the likely significant effects of the Proposed Project from airborne noise and vibration and groundborne noise and vibration, in accordance with the Environmental Impact Assessment (EIA) Directive.

2. This chapter details the methodology used for the assessment, describes the existing environment and examines the predicted noise and vibration effects of the Proposed Project. The recommended mitigation measures are outlined, and the residual effects are identified and explained. The assessment has been completed in accordance with current relevant best practice standards and guidance.

3. The assessment reported in this chapter has considered the mitigation that has been embedded into the design to avoid or reduce environmental effects. Embedded mitigation is an intrinsic part of the Proposed Project design and therefore the assessment of effects assumes all embedded design measures are in place. Embedded mitigation relevant to this topic is included in Section 6.5.1.

4. Table 6.1 outlines the principal Proposed Project elements. A full description is provided in Chapter 4 (Proposed Project Description), of this Environmental Impact Assessment Report (EIAR).

Table 6.1: Summary of Principal Project Infrastructure

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Permanent Infrastructure	
Raw Water Intake and Pumping Station (RWI&PS) (Infrastructure Site) County Tipperary	• The RWI&PS would be located on a permanent site of approximately 4ha on the eastern shore of Parteen Basin in the townland of Garrynatineel, County Tipperary. In addition, approximately 1ha of land would be required on a temporary basis during construction. • The RWI&PS has been designed to abstract enough raw water from the River Shannon at Parteen Basin to provide up to 300Mld of treated water by 2050. • The RWI&PS site would include a bankside Inlet Chamber, the Raw Water Pumping Station Building, two Microfiltration Buildings, an Electricity Substation and Power Distribution Building, and Dewatering Settlement Basins. The tallest building on the RWI&PS site would be the Microfiltration Buildings which would be 10.9m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power for the RWI&PS would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. • A new permanent access road from the R494 would be constructed to access the proposed RWI&PS site. This access road would be 5m in width and 670m in length. • The RWI&PS site boundary would be fenced with a stock proof fence and a 2.4m high paladin security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
Raw Water Rising Mains (RWRMs) (Pipeline) County Tipperary	• The RWRMs would consist of two 1,500mm underground pipelines made from steel that would carry the raw water approximately 2km from the RWI&PS to the Water Treatment Plant (WTP) at Incha Beg, County Tipperary. The water would be pumped from the pumping station at the RWI&PS to the WTP. • Twin RWRMs have been proposed so that one RWRM can be taken out of service for cleaning and maintenance while still providing an uninterrupted flow of raw water through the other RWRM. • The RWRMs would include Line Valves, a Lay-By, Air Valves and Cathodic Protection. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the RWRMs.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Water Treatment Plant (WTP) (Infrastructure Site) County Tipperary	• The WTP would be located on a permanent site of approximately 31ha at Incha Beg, County Tipperary, 2.6km north-east of the village of Birdhill, and 2km east of the proposed RWI&PS. In addition, approximately 2.5ha of land would be required on a temporary basis during construction. • The WTP would treat the raw water received from the RWI&PS via the RWRMs. Once treated, the High Lift Pumping Station (HLPS) would deliver the treated water onwards from the WTP to the Break Pressure Tank (BPT) at Knockanacree, County Tipperary, via the Treated Water Pipeline. • The WTP would comprise of a series of tanks and buildings including the Raw Water Balancing Tanks, Water Treatment Module Buildings, Sludge Dewatering Buildings, Sludge Storage Buildings, Clear Water Storage Tanks and HLPS, an Electricity Substation and Power Distribution Building, and the Control Building. The tallest building on the WTP site would be the Water Treatment Module Buildings which would be up to 15.6m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • There would also be a potential future water supply connection point at the junction between the permanent access road and the R445. • Power for the WTP would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. Solar panels would be placed on the roofs of the Chemical Dosing Manifold Building, the Water Treatment Module Buildings, Clear Water Storage Tanks and Sludge Storage Buildings, and at a number of locations on the ground to supplement the mains power supply. • A new permanent access road from the R445 would be constructed and would be 6m in width and 640m in length. • The WTP site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
Treated Water Pipeline from the WTP to the BPT (Pipeline) County Tipperary	• The Treated Water Pipeline from the WTP to the BPT would consist of a single 1,600mm underground steel pipeline which would be approximately 37km long. The water would be pumped through this section of the Treated Water Pipeline by the HLPS. • The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection and Lay-Bys. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
Break Pressure Tank (BPT) (Infrastructure Site) County Tipperary	• The BPT would be located on a permanent site of approximately 7ha in the townland of Knockanacree, County Tipperary. In addition, approximately 0.8ha of land would be required on a temporary basis during construction. • The BPT would be located at the highest point of the pipeline. It marks the end of the Treated Water Pipeline from the WTP to the BPT and the start of the Treated Water Pipeline from the BPT to the Termination Point Reservoir (TPR) in the townland of Loughtown Upper, at Peamount, County Dublin. It would act as a balancing tank and would be required to manage the water pressures in the entire Treated Water Pipeline during flow changes, particularly during start-up and shut-down. • The BPT site would include the BPT and a Control Building. The BPT would be a concrete tank divided into three cells covered with an earth embankment. The BPT tanks would be 5m in height and partially buried below finished ground levels. The Control Building would be 7.5m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Access to the BPT site would be via a new permanent access road from the L1064 which would be 5m wide and 794m in length. • Power for the BPT would be supplied via an underground connection from the existing overhead power line. Solar panels would be placed on the south facing side of the control building roof, on the BPT and at ground level to the south of the site to supplement the mains power supply. • The BPT site boundary would be bounded by the existing hedgerow / tree line with a 2.4m high palisade security fence around the permanent infrastructure. The site would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Treated Water Pipeline from the BPT to the TPR (Pipeline) Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• The Treated Water Pipeline from the BPT to the TPR would consist of a single 1,600mm underground steel pipeline, approximately 133km long. • The water would normally travel through the Treated Water Pipeline by gravity; however, flows greater than approximately 165Mld would require additional pumping from the Booster Pumping Station (BPS) in the townland of Coagh Upper, County Offaly. • The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection, Lay-Bys and potential future connection points. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
Booster Pumping Station (BPS) (Infrastructure Site) County Offaly	• The BPS would be located on a permanent site of approximately 2.6ha in the townland of Coagh Upper, County Offaly. It would be located approximately 30km downstream from the BPT. In addition, approximately 3ha of land would be required on a temporary basis during construction. • The BPS would be required when the demand for water causes the flow through the pipeline to exceed approximately 165Mld. • The BPS site would consist of a single-storey Control Building with a basement below. It would have a finished height of 7.6m above finished ground level. There would also be a separate Electricity Substation and Power Distribution Building. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power to the BPS would be supplied from an existing 38 kV electricity substation at Birr, through cable ducting laid within the public road network. There would be ground mounted solar panels on the southern side of the BPS site to supplement the mains power supply. • The site would be accessed directly from the L3003. • The BPS site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence between 5m - 12m inside the boundary. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.
Flow Control Valve (FCV) (Infrastructure Site) County Kildare	• The FCV controls the flows in the Treated Water Pipeline from the BPT to the TPR. It would be a small permanent site of approximately 0.5ha in the townland of Commons Upper in County Kildare. In addition, approximately 0.6ha of land would be required on a temporary basis during construction. • It would consist of three 700mm diameter FCVs and three flow meters installed in parallel with the Line Valve and housed within an underground chamber. • Access to the FCV site would be directly off the L1016 Commons Road Upper. • Power supply to the FCV site would be provided from the existing low voltage network via a combination of overhead lines and buried cables. There would be ground mounted solar panels on the north-eastern side of the site to supplement the mains power supply. • Kiosks at the FCV site would house the Programmable Logic Controller, telemetry and power supply for the Line Valve. There would also be a telemetry mast, the top of which would be 14m above finished ground level. • The site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Termination Point Reservoir (TPR) (Infrastructure Site) County Dublin (within the administrative area of South Dublin County Council)	• The TPR would be located on a permanent site of approximately 8.3ha adjacent to an existing treated water reservoir in the townland of Loughtown Upper, at Peamount, County Dublin (within the administrative area of South Dublin County Council) and would have capacity for 75Ml of treated water supply. In addition, approximately 1.1ha of land would be required on a temporary basis during construction. • It would be located at the downstream end of the Treated Water Pipeline from the BPT to the TPR and would be the termination point for the Proposed Project. It would be at this location that the Proposed Project would connect to the existing water supply network of the Greater Dublin Area Water Resource Zone (GDA WRZ). • The TPR would consist of an above-ground storage structure, associated underground Scour Water and Overflow Water tanks and a Chlorine Dosing Control Building. The TPR would be a concrete tank divided into three cells and covered with an earth embankment. The top of the TPR would be 11.2m above finished ground level. The Chlorine Dosing Control Building would be 8.4m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power for the TPR would be supplied via an underground connection to the existing electricity substation at Peamount Reservoir. There would be solar panels on top of a portion of the northern cell of the TPR to supplement the mains power supply. • A new permanent access road from the R120 would be constructed and would be 5m wide and 342m in length. • The TPR site would be bounded by the existing hedgerow to the west and existing fence to the east with a 2.4m high palisade security fence around the permanent infrastructure. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.
Proposed 38 kV Uprate Works – Power Supply to RWI&PS and WTP	
Proposed 38 kV Uprate Works Ardnacrusha – Birdhill (Power Supply) Counties Clare, Limerick and Tipperary	• The proposed 38 kV Uprate Works would be necessary to deliver adequate electrical power to the RWI&PS and WTP. • The proposed works would include the uprating of the existing Ardnacrusha – Birdhill Line and the replacement of polesets/structures with an underground cable along a section of the Ardnacrusha – Birdhill – Nenagh Line. • There would also be works at the existing Birdhill 38 kV electricity substation including the provision of a new 38 kV modular Gas Insulated Switchgear Modular Building, new electrical equipment and lighting, together with new fencing and associated works.
Temporary Infrastructure – Required for Construction Phase Only	
Construction Working Width Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• A Construction Working Width would be temporarily required for the construction of the RWRMs and the Treated Water Pipeline, and the subsequent reinstatement of the land. • The Construction Working Width would generally be 50m in width but would be locally wider near features such as crossings, access and egress points from the public road network, Construction Compounds and Pipe Storage Depots.
Construction Compounds Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• Eight Construction Compounds would be temporarily required to facilitate the works to construct the Proposed Project. Five Construction Compounds would be located along the route of the Treated Water Pipeline at the following Infrastructure Sites: RWI&PS, WTP, BPT, BPS and TPR, with an additional three Construction Compounds located at Lisgarriff (County Tipperary), Killananny (County Offaly) and Drummond (County Kildare). Construction Compounds would act as a hub for managing the works including plant/material/worker movement, general storage, administration and logistical support. • The Principal Construction Compound at the WTP would require 30ha of land during construction. • The other three Principal Construction Compounds would require land temporarily during construction ranging between approximately 12ha and 16ha. • The four Satellite Construction Compounds at the other permanent Infrastructure Sites (excluding the FCV) would require land during construction ranging between approximately 3ha and 12ha.
Pipe Storage Depots Counties Tipperary, Offaly and Kildare	• Nine Pipe Storage Depots would be temporarily required to supplement the Construction Compounds and would serve the installation of pipe between the WTP and the TPR. • Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the Construction Working Width. • The Pipe Storage Depots would vary in size and require land temporarily during construction generally ranging between approximately 2ha and 7ha but with one site being larger at 11ha.

* Note all land take numbers in this table are affected by rounding to one decimal place.

5. The construction of the Proposed Project is anticipated to run from 2028 through 2032, with the first operational year anticipated to be 2033.

6. This chapter has been prepared in conjunction with the following EIAR chapters and their appendices, which expand upon aspects of the Proposed Project:
    - Chapter 4 (Proposed Project Description)
    - Chapter 5 (Construction & Commissioning)
    - Chapter 7 (Traffic & Transport).

7. This chapter is also supported by the following appendices:
    - Appendix A6.1 (Acoustic Terminology)
    - Appendix A6.2 (Fundamentals of Acoustics)
    - Appendix A6.3 (Construction Noise Plant Lists)
    - Appendix A6.4 (Noise Modelling Details and Assumptions)
    - Appendix A6.5 (Termination Point Reservoir (TPR) Unattended Monitoring Results (N10).

8. Figures referenced within this chapter can be found in Volume 5 of the EIAR.

9. This assessment has been undertaken and reported by a team of competent experts. Refer to Chapter 2 (The Environmental Impact Assessment Process) for a description of the qualifications and expertise of the specialists that have inputted to this chapter.

6.2 Methodology

10. An outline of the methodology adopted for the noise and vibration impact assessment included the following steps:
    - Determine appropriate guidance in order to identify appropriate Construction and Operational Phase noise and vibration (airborne and groundborne) assessment criteria for the Proposed Project
    - Review the prevailing airborne noise environment at and in the study area of proposed Infrastructure Sites by way of environmental noise surveys to identify existing levels of noise at each of the sites
    - Predict the level of noise at the nearest Noise Sensitive Locations (NSLs) for both Construction (including Haul Roads) and Operational Phases
    - Predict the level of groundborne vibration at the nearest Vibration Sensitive Locations (VSLs) during construction activities which create vibration
    - Assess the predicted noise levels and the likely significant effects against the appropriate criteria and existing noise levels and specify mitigation measures where required
    - Assess the predicted vibration levels and the likely significant effects against the appropriate criteria and specify mitigation measures where required.

6.2.1 Scope of the Assessment

11. This assessment considers potential air and groundborne noise and vibration impacts during the Construction and Operational Phases of the Proposed Project and includes the assessment of associated road traffic noise.

12. Any noise generated by the pipeline during the Operational Phase would be imperceptible at any NSLs and the associated effect is therefore not significant. Noise effects from the operation of the pipeline, including the proposed Line Valves, Washout Valves and Air Valves, have therefore been scoped out of the assessment and have not been considered further in this chapter.

13. There are no sources of vibration associated with the Operational Phase of the Proposed Project with the potential for significant vibration effects at any vibration sensitive building or structure considering the types of plant associated with the Proposed Project and the distances to the nearest sensitive locations. Therefore, Operational Phase vibration has been scoped out of the assessment and have not been considered further in this chapter.

14. Haul Roads for construction traffic will use existing public roads. Road traffic along normal maintained surfaces, generates very low levels of vibration that are normally not perceptible to building occupants and are orders of magnitude below any building response levels for cosmetic damage. In terms of vibration impacts, therefore construction traffic would generate very low levels of vibration resulting in no likely significant effects at sensitive buildings. Vibration impacts along Haul Roads have been scoped out of the assessment and have not been considered further in this chapter.

15. The scope of the vibration assessment has been limited to activities anticipated to have the potential to be a source of groundborne noise or vibration. Following a review of the proposed construction techniques and activities this has been determined to be trenchless crossing techniques, piling and rock break out.

16. The Proposed Project would deliver nationally important strategic infrastructure with individual elements designed with a lifespan of 80 to 100 years. The strategic importance of the Proposed Project for the water supply in the Eastern and Midland Region is such that there is no plan to decommission these structures and Uisce Éireann is committed to maintaining and repairing them into the future. On this basis it is not likely that the structures will be decommissioned, and therefore decommissioning of the Proposed Project has not been considered further in this assessment.

6.2.2 Study Area

17. The study area for the noise and vibration impact assessment was defined by the area where there is potential for noise and vibration impacts at NSLs associated with the Proposed Project during the Construction Phase and Operational Phase.

18. NSLs include areas where people spend substantial periods of time and where concentration, sleep and amenity are important considerations. Examples of these sensitive locations include residential dwellings, schools and other educational establishments, hospitals and nursing homes, hotels and other short-term accommodation buildings, buildings of religious sensitivity, recreational and noise-sensitive amenity areas, and offices. VSLs include NSLs but in addition, they include any building or built structure that may be at risk of structural or cosmetic impacts from groundborne noise or vibration.

19. During the Construction Phase, noise effects could occur at any location within the Planning Application Boundary. Therefore, taking account of the typical works associated with the Construction Phase of the Proposed Project, the study area varied for each Infrastructure Site depending on the location and distance of the nearest NSLs to individual work sites. The study area boundary for each specific Infrastructure Site is set out in the following sections. Where construction noise levels from a specific activity are calculated below the adopted significance threshold at a determined distance, this has defined the study area. In certain locations however, the presence of the closest NSL is beyond the distance at which a significant effect will occur, but has been included in the assessment to ensure a robust assessment of potential effects.

6.2.2.1 Airborne Noise and Vibration Assessment Study Area

20. For the Infrastructure Sites the study area was determined to be up to 600m for the main construction works. The distances are representative of the closest identified NSL from the main construction works at the Infrastructure Sites. If the specific noise or vibration impacts at the nearest NSL is determined to be not significant then the impact at any NSLs beyond this distance is also not significant.

21. For the pipeline (including the proposed Line Valves, Washout Valves and Air Valves) and the proposed 38 kV Uprate Works, the study area was determined to be 100m to 220m from the centre of the pipeline. Beyond 220m from these construction elements, the calculated construction noise levels during all periods were below those associated with a significant effect. This approach was adopted to identify the likely construction noise and vibration emissions at various set back distances from the proposed works.

22. The potential impacts of all Haul Roads, as defined in Chapter 7 (Traffic & Transport), have been considered in the noise and vibration impact assessment. The study area for Haul Roads is therefore defined by the extent of the Haul Road network identified in Chapter 7 and the closest NSLs along each.

23. Once operational, noise emissions would be limited to fixed plant associated with the Infrastructure Sites. Therefore, the study area for the Operational Phase extends to the closest NSL from these fixed plant areas or a distances beyond where a significance effect is calculated, whichever is further. The distance from the site boundary to the nearest NSL for each Infrastructure Site is outlined in Table 6.33. Beyond these radii, there is no potential for significant effects as determined in the impact assessment sections.

24. Approximate distances to NSLs for both the Construction and Operational Phases of the Proposed Project have been calculated using the geo-directory database supplied by the design team.

6.2.2.2 Groundborne Nosie and Vibration Assessment Study Area

25. The study area for the groundborne noise and vibration assessment was defined by a 100m buffer distance from the Construction Working Width construction activities. Beyond 100m, vibration effects would be less than the thresholds defined for significant effects as set out in Section 6.2.6.

6.2.3 Relevant Guidelines, Policy and Legislation

26. The assessment has been undertaken with reference to the most appropriate best practice guidance and standards relating to environmental noise and vibration which are set out in the following sections. There are no statutory standards in Ireland relating to noise and vibration limit values for construction works or for environmental noise relating to the Operational Phase. In the absence of specific statutory Irish guidelines, the assessment has made reference to non-statutory national guidelines, where available, in addition to international standards and guidelines relating to noise and/or vibration impact for environmental sources.

27. This chapter has been prepared with regard to the guidance outlined in the following Environmental Protection Agency (EPA) and European Commission documents.

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022) (hereafter referred to as the EPA EIAR Guidelines)
- Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission 2017)
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning & Local Government 2018).

6.2.3.1 Construction Phase

28. In preparing the Construction Phase noise and vibration impact assessment, the following guidelines and standards have been used:

    - Transport Infrastructure Ireland (TII) (previously National Roads Authority) Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII 2004) (hereafter referred to as TII 2004 Noise Guidelines)
    - Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (2014) (hereafter referred to as TII 2014 Noise Guidelines)
    - British Standard (BS) 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise (British Standards Institution (BSI) 2014a) (hereafter referred to as BS 5228-1)
    - BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration (BSI 2014b) (hereafter referred to as BS 5228-2)
    - BS 7385-2:1993: Evaluation and Measurement for Vibration in Buildings. Part 2: Guide to Damage Levels from Groundborne Vibration (BSI 1993) (hereafter referred to as BS 7385-2)
    - Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration Revision 2 (Highways England 2020) (hereafter referred to as DMRB LA 111).

6.2.3.2 Operational Phase

29. In preparing the Operational Phase noise and vibration impact assessment, the following guidelines and standards have been used:

    - BS 4142:2014+A1:2019 Method for Rating and Assessing Industrial and Commercial Sound (BSI 2019) (hereafter referred to as BS 4142)
    - Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities. NG4 (EPA 2016) (hereafter referred to as NG4 2016).

6.2.4 Data Collection Methods

6.2.4.1 Desktop Study

30. As part of the noise and vibration assessment, Google Earth®, design drawings for the Proposed Project (see figures supporting Chapter 4 in Volume 5 of the EIAR) and Geographical Information System data were used to determine the receiving environment and relevant land use at potential NSLs in the areas surrounding the Proposed Project.

6.2.4.2 Field Surveys

31. Data in relation to baseline noise levels have been collected via noise surveys using sound level meters. Baseline noise surveys have been conducted in accordance with International Organization for Standardization (ISO) 1996-2:2017 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2: Determination of Sound Pressure Levels (ISO 2017) (hereafter referred to as ISO 1996-2:2017).

32. Details of the baseline noise surveys are presented in Section 6.3 of this chapter.

6.2.5 Consultations

33. Consultation responses from key stakeholders, landowners and the public were reviewed and considered in compiling this chapter. Chapter 2 (The Environmental Impact Assessment Process) of the EIAR sets out the approach the Proposed Project has taken with regard to environmental scoping, in particular the EIAR Scoping Methodology Report (Uisce Éireann 2023) in respect of the Proposed Project and also the Environmental Impact Statement Scoping Report[1] (Irish Water 2016) relating to a previous iteration of the project.

34. The scoping consultation responses relevant to noise and vibration received from stakeholders are provided in Table 6.2. Further detail on project consultation is included in Chapter 2 (The Environmental Impact Assessment Process) and responses received are in the Water Supply Project: Eastern and Midlands Region – Consultation Report, which forms part of the Strategic Infrastructure Development planning application for the Proposed Project.

35. Scoping submissions were generally relating to the Construction Phase, however some also referred to potential Operational Phase noise. The feedback and suggestions received have been taken into account and incorporated into the development of this chapter.

Table 6.2: Principal Noise and Vibration Issues Raised During Scoping Consultation

Consultee	Comment	Relevant EIAR Section
Inland Fisheries Ireland	Noise-sensitive receptors should include fish populations for the purpose of the environmental assessment. Fish should be included in noise and vibration assessments. Fish should be regarded as sensitive receptors.	This chapter assesses the potential effect of noise and vibration on the human population. Disturbance effects on ecological receptors including aquatic species are considered within the biodiversity assessment. Refer to Chapter 8 (Biodiversity) for further information.
Health Service Executive	The change in noise environment is considered the most relevant factor in a noise impact assessment.	The change in noise environment is considered in this chapter. Section 6.2 details the methodology applied for the noise and vibration assessment.
Tipperary County Council	The assessment needs to consider noise pollution and working hours.	Likely significant noise effects are covered in this chapter which also sets out how proposed working hours have been considered within the assessment (see Section 6.4 and Section 6.5).
Offaly County Council	The assessment needs to consider noise arising from the project and noise from surge/water hammer [2]in the Operational Phase.	The assessment of likely significant operational noise effects is set out in Section 6.4.4 of this chapter. Noise from surge water hammer is not considered an issue in regard to the Operational Phase due to the Proposed Project being designed to eliminate factors such as surge water hammer and is therefore not likely to cause a significant effect.
National Environmental Health Service	To provide adequate protection of population health, fixed noise limits must be complemented by a restriction on hours of construction activity. Irrespective of this, the assessment should also consider particular sensitive receptors when considering the likely significance of construction noise.	The methodology outlined within Section 6.2.6 and the assessment within Section 6.4.2 assess all NSLs within study area of the works, as well as the likely significance of effects. Mitigation measures are outlined within Section 6.5.

[1] As set out in Chapter 2 (The Environmental Impact Assessment Process), the Environmental Impact Statement Scoping Report (Irish Water 2016) was based on a previous iteration of the project. However, feedback received from stakeholders informed future scoping and design development and has been considered in this assessment where relevant to the Proposed Project.

[2] 'Water Hammer' is an alternative name for 'surge' which is more correctly defined as 'transient pressure variations'.

6.2.6 Appraisal Method for the Assessment of Impacts

6.2.6.1 Construction Phase – Noise

36. There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local Authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. In general, higher noise levels are tolerated during a project's construction phase compared with its long-term operational phase, as construction works are temporary to short term and are varied over the course of the work duration. In the absence of specific statutory guidance, reference has been made to the TII 2004 and 2014 Noise Guidelines and BS 5228–1 (BSI 2014a) to review and set appropriate noise construction criteria.

6.2.6.1.1 Linear Infrastructure – TII Guidelines

37. The TII 2014 Noise Guidelines (TII 2014) include the construction noise limits to be applied to the façade of dwellings (which align with the TII 2004 Noise Guidelines). While this document is specifically intended for the purpose of new national road schemes, in the absence of other national guidelines relating to the specific development under consideration, the TII guidelines were considered appropriate to determine the likely significant noise effects of the Proposed Project. This is because the pipeline, the proposed 38 kV Uprate Works and access road constructions consist of long linear structures through environments similar to those in which new national roads are typically constructed (i.e. rural/semi-rural environments). These maximum noise levels for the linear sections of the Proposed Project are set out in Table 6.3.

Table 6.3: Maximum Permissible Noise Levels at the Façade of Dwellings during Construction (Linear Features)

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq,1hr}$	L_{Amax}
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00hrs to 22:00hrs*	60	65
Saturdays 08:00hrs to 16:30hrs	65	75
Sundays and Bank Holidays 08:00hrs to 16:30hrs*	60	65

Source: TII 2014 Noise Guidelines (TII 2014)

* Construction activity at these times, other than that required for emergency works, would normally require the agreement of the relevant Local Authority.

38. The TII Guidelines do not include night-time construction noise criteria. For the Proposed Project, night-time Construction Noise Thresholds (CNTs) are proposed in accordance with BS 5228-1 (BSI 2014a) and are presented within Table 6.4. For this assessment, considering the rural setting of areas where night-time works are proposed along the linear aspects of the Proposed Project, a night-time Category A threshold of 45 decibels (dB) $L_{Aeq,8hour}$ has been applied.

6.2.6.1.2 Infrastructure Sites and Temporary Infrastructure Sites – BS 5228-1: 2009+A1:2014

39. With respect to the permanent Infrastructure Sites (RWI&PS, WTP, BPT, BPS, FCV and TPR), the temporary Construction Compounds, Pipe Storage Depots, and areas where night-time works are scheduled, the 'ABC' method set out in BS 5228-1 (BSI 2014a) is the most appropriate appraisal method. This is because, in contrast to the works associated with the pipeline, proposed 38 kV Uprate Works and access roads, which are extensive linear structures, the Infrastructure Sites are fixed to specific locations, where impacts have the potential to occur over longer durations.

40. The approach adopted requires the designation of a NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at the location, indicates a potential significant noise effect is associated with the construction activities, depending on the context. Table 6.4 sets out the values which, when exceeded at the façades of residential receptors, indicate a potential significant effect.

Table 6.4: BS 5228-1 Example of Thresholds of Potential Significant Effect (Infrastructure Sites)

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value (dB)		
	Category A	Category B	Category C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings & Weekends (19:00 – 23:00hrs weekdays) (13:00 – 23:00hrs Saturdays) (07:00 – 23:00hrs Sundays)	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75
Notes	Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values	Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values	Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values

Source: BS 5228-1 (BSI 2014a)

41. This assessment method is only valid for residential properties, and if applied to commercial premises without consideration of other factors, may result in excessively onerous thresholds being set. It may be appropriate to adopt a higher threshold level at commercial premises. For the purposes of this assessment, the various NSLs under consideration relate to NSLs as defined within Section 6.2.2 that have been identified within the geo directory database provided by the design team.

42. Based on the results of the baseline noise surveys at the proposed Infrastructure Sites (see Section 6.3), Category A thresholds have been applied to all NSLs. Category A represents the lowest CNT available from the relevant adopted guidance. Therefore, a daytime significance threshold of 65 dB $L_{Aeq,T}$ has been applied for the assessment of construction noise emissions from all Infrastructure Sites at the nearest NSLs. Having regard to the proposed Saturday working hours between 08:00 and 16:30 and the TII guidelines for Saturday working hours, it is proposed to adopt a threshold of 65 dB $L_{Aeq,T}$ (Saturday working period) for all Saturday daytime works. In the event of evening or night-time working at Infrastructure Sites the Category A thresholds of 55 and 45 dB $L_{Aeq,T}$ respectively have been applied at all Infrastructure Sites.

43. All temporary infrastructure sites such as the Construction Compounds and Pipe Storage Depots are assessed against a Category A threshold of 65 dB $L_{Aeq,T}$ due to the rural locations of the sites and the likelihood that the existing baseline noise levels in these areas will also be low.

44. It will be necessary to undertake certain construction activities outside normal working hours. This includes activities associated with trenchless crossings, which may need to operate continuously, 24 hours a day until completion, and works to accommodate directional drilling and open-cut crossings of roads. Some of these works will take place during off-peak periods to reduce traffic disruption due to road closures as far as practicable. For the purposes of this assessment the night-time works have been assessed against the lowest CNT, i.e. Category A (45 dB $L_{Aeq,T}$), to take into account the likelihood that the existing baseline noise levels in these areas will be low due to the rural locations of the majority of these working areas. Night working at open-cut crossings, trenchless crossings and drilling locations are discussed further in Sections 6.4.2.1.11, 6.4.2.1.12 and 6.4.2.1.13.

6.2.6.1.3 Significance of Construction Noise Levels

45. To assist with the interpretation of significance of effect, Table 6.5 includes guidance as to the likely magnitude of impact associated with the construction noise level, relative to the CNT. The CNTs for the linear aspects of the Proposed Project are set out in Table 6.3 and the CNTs for the infrastructure sites are in Table 6.4. The guidance to assist with the interpretation of the significance of effect is derived from Table 3.16 of DMRB LA 111 (Highways England 2020) and adapted to include the relevant significance categories from the EPA EIAR Guidelines (EPA 2022) using professional expertise and judgement.

46. In line with DMRB LA 111, and BS 5228-1 (BSI 2014a), construction noise levels above the CNT are potentially significant depending on baseline noise levels and duration. In accordance with DMRB LA 111, construction noise and construction traffic noise impacts constitute a significant effect where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding:
    - 10 or more days or nights in any 15 consecutive days or nights
    - A total number of days exceeding 40 in any six consecutive months.

Table 6.5: Construction Noise Significance Ratings

Construction Noise Level Range	DMRB Magnitude of Impact	EPA EIAR Significance Effects	Determination of Significance of Effects
Below or equal to baseline noise level	Negligible	Not Significant	Not Significant
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate	Construction noise levels at the upper end of this range will result in higher potential impacts, therefore this range is categorised as Slight to Moderate, acknowledging that values approaching the CNT are greater than Slight. In accordance with DMRB LA 111 Noise and Vibration (Highways England 2020) and BS 5228-1 (BSI 2014a), noise levels at or below the CNT are deemed Not Significant
Above CNT and below or equal to CNT +5 dB	Moderate	Moderate to Significant	Dependent on CNT, duration and baseline noise level. In accordance with the DMRB LA 111 Noise and Vibration (Highways England 2020), construction noise impacts shall constitute a significant effect where it is determined that a moderate or major magnitude of impact will occur for a duration exceeding: Ten or more days or night in any 15 consecutive day or nights; and a total number of days exceeding 40 in any six consecutive months.
Above CNT +5 dB and below or equal to CNT +15 dB	Major	Significant, to Very Significant	
Above CNT +15 dB		Very Significant to Profound [Note 1]	

Note 1: DMRB does not distinguish beyond a 'Major' impact. For the purposes of distinguishing between a Very Significant and Profound effect, construction noise levels exceeding the CNT by +20 dB are categorised as Profound.

47. The adapted DMRB LA 111 (Highways England 2020) guidance is used to assess the overall significance of construction noise at NSLs across the Proposed Project.

6.2.6.1.4 Criteria for Rating Construction Traffic Noise Impacts

48. To assist with the interpretation of construction traffic noise, Table 6.6 includes guidance as to the likely magnitude of impact associated with changes in construction traffic noise levels along an existing road. The table provides magnitude ratings relating to changes in road traffic noise, compiled from Table 3.17 of DMRB LA 111 (Highways England 2020) and the relevant sections of the document. Changes in construction traffic noise levels are assessed against the short-term magnitudes.

Table 6.6: Magnitude of Impact Relating to Changes in Road Traffic Noise Level – Construction Phase

DMRB Magnitude of Impact	Increase in Traffic Noise Level (dB)	Duration	Initial Significance Rating if Duration is Exceeded
Major	Greater than or equal to 5.0	>10 days/nights over 15 consecutive day/nights; or >40 days over six consecutive months	Significant
Moderate	Greater than or equal to 3.0 and less than 5.0		Significant
Minor	Greater than or equal to 1.0 and less than 3.0		Not Significant
Negligible	Less than 1.0		Not Significant

Source: DMRB LA 111 (Highways England 2020); EPA EIAR Guidelines (EPA 2022)

49. If the initial significance rating is 'significant', (i.e. where the 'magnitude of impact' is 'moderate' or 'major'), consideration is given to the overall noise level from construction traffic and the duration which are assessed against the relevant construction noise criteria outlined in Sections 6.2.6.1.2 and 6.2.6.1.3.

6.2.6.2 Construction Phase – Vibration and Groundborne Noise

50. Groundborne noise and vibration can impact on receptors in the form of disturbance to humans and cosmetic or structural damage to buildings. A building or structural response to vibration only occurs at much higher thresholds than disturbance to people. Therefore, the appraisal methodology is different for these two receptors.

6.2.6.2.1 Building Response to Vibration

51. BS 7385-2 (BSI 1993) gives guidance regarding acceptable vibration in order to avoid damage to buildings. BS 5228-2 (BSI 2014b) reproduces the same guidance values.

52. These standards differentiate between transient and continuous vibration. Surface construction activities are generally transient because they occur intermittently and only for a limited period of time at any given location. Both documents recommend that, for soundly constructed residential buildings and similar light-framed structures that are generally in good repair, a threshold for minor or cosmetic damage (i.e. non-structural damage) should be taken as a PPV (in frequency range of predominant pulse) of 15mm/s at 4 Hertz (Hz) increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5mm/s PPV, the risk of damage tends to be zero. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table B.2 of BS 5228-2 (BSI 2014b) might need to be reduced by up to 50%. On a precautionary basis, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges. The recommended construction vibration thresholds are set out in Table 6.7.

Table 6.7: Recommended Construction Vibration Thresholds for Buildings

Vibration Limits for Buildings (PPV) at the Closest Part of Building to the Source of Vibration, at a Frequency of 4Hz		
Building Type	**Transient Vibration**	**Continuous Vibration**
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s	25mm/s
Unreinforced or light-framed structures. Residential or light commercial-type buildings	15mm/s	7.5mm/s

Source: BS 5228-2 (BSI 2014b)

53. The TII 2014 Noise Guidelines (TII 2014) recommend that vibration from construction activities be limited to the values in Table 6.8 to avoid potential for vibration damage during construction.

Table 6.8: Recommended Construction Vibration Thresholds for the Proposed Project

Allowable Vibration (in Terms of PPV) at the Closest Part of Sensitive Property to the Source of Vibration		
Less than 10Hz	**10 to 50Hz**	**50 to 100Hz (and above)**
8mm/s	12.5mm/s	20mm/s

Source: TII 2014 Noise Guidelines (TII 2014)

54. Following a review of the guidance documents set out above, the values in Table 6.8 are the proposed threshold values for building response for the Proposed Project to align with the TII guidelines used for linear projects. These values provide a conservative threshold range. Values above those within Table 6.8 are categorised as potentially significant depending on the structure's condition.

6.2.6.2.2 Human Response to Vibration and Groundborne Noise

55. The effect of building vibration on people inside buildings can be assessed using the Vibration Dose Value (VDV) index, as described in BS 6472-1 (BSI, 2008). However, a simpler approach is often initially taken to establish if there is potential for perceptible effects from construction activities, and this is possible with the peak particle velocity (PPV) index. This approach is described by BS 5228-2 (BSI, 2014B), which states the following:

    'BS 6472, as stated, provides guidance on human response to vibration in buildings. Whilst the assessment of the response to vibration in BS 6472 is based on the VDV and weighted acceleration, for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage. Furthermore, since many of the empirical vibration predictors yield a result in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance'.

56. BS 5228-2 (BSI 2014b) notes that vibration typically becomes perceptible at around 0.15mm/s to 0.3mm/s and may become disturbing or annoying at higher magnitudes. Trenchless crossing construction techniques and surface construction works associated with breaking of ground or piling, have the potential to be perceptible to building occupants, depending on the methodologies involved, and have the potential to cause significant effects if occurring at close distances.

57. Higher levels of vibration are, however, typically tolerated for single events or events of temporary duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5mm/s during the daytime and the evening if those affected are aware of the time-frame and origin of the vibration, and if they have been informed about the limit values relating to the structural integrity of neighbouring properties (TII 2004 Noise Guidelines). Table 6.9 presents the significance criteria relating to effects to building occupants during construction, based on guidance from BS 5228-2 (BSI 2014b), DMRB LA 111 (Highways England 2020), and reference to the Measurement and Assessment of Groundborne Noise and Vibration (Association of Noise Consultants 2020).

Table 6.9: Human Response to Vibration and Significance of Effects

PPV range	Description of Effect	DMRB Magnitude	EPA Significance Ratings
≥10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments	Major	Very Significant
≥1 to <10mm/s	Increasing likelihood of perceptible vibration in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate	Moderate to Significant
≥0.3 to <1mm/s	Increasing likelihood of perceptible vibration in residential environments	Minor	Slight
<0.3mm/s	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction	Negligible	Not Significant

58. Construction vibration constitutes a likely significant effect where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding: 10 or more days or nights in any 15 consecutive days or nights; or a total number of days exceeding 40 in any six consecutive months. Minor or negligible magnitude of vibration impacts are not significant.

59. Groundborne noise levels were predicted during trenchless crossing works using the empirical method available in BS 5228-2, Table E.1. Based on the assessment criteria for groundborne vibration detailed above (with an onset of a potentially significant effect at 1.0mm/s, and a significance threshold for groundborne noise of 45dB LpASmax),[3] and the prediction methods adopted, potential significant groundborne noise effects would only arise in scenarios where significant groundborne vibration effects have already been predicted. Therefore, to simplify reporting of results, groundborne noise predictions for trenchless crossings have not been included and the reporting focuses on vibration. There would be no different or additional significant effects from groundborne noise distinct from those assessed and reported for groundborne vibration.

6.2.6.3 Operational Phase – Noise

6.2.6.3.1 External Noise Levels

60. Once the Infrastructure Sites associated with the Proposed Project are operational, a variety of electrical and mechanical plant would be required to service the sites. Most of this plant will generate noise to some degree. Some of this plant may operate 24 hours a day and hence would be most noticeable during quiet periods (i.e. night-time). Noisy plant with a direct line-of-sight to NSLs would potentially have the greatest impact. Plant contained underground or within plantrooms has the least potential for impact once consideration is given to appropriate design of the building façade elements. For the purposes of this assessment, noise emissions from external plant items and breakout noise from buildings containing plant items with potentially high noise emissions have been considered.

61. All six Infrastructure Sites that are part of the Proposed Project have been assessed in relation to operational noise.

62. For all Infrastructure Sites within the Proposed Project, a fixed noise limit has been set for the Operational Phase. In the absence of any specific noise guidelines for the Proposed Project, the guidance contained in the NG4 2016 (EPA 2016) has been adopted. This is considered to be best practice and offers a robust framework for assessing the Operational Phase of the Proposed Project.

[3] Based on the High Speed 2 Phase One London to Birmingham project (Department for Transport 2013) and has been used on subsequent projects such as Lower Thames Crossing (National Highways 2022).

6.2.6.3.2 EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)

63. The first step in the assessment is to establish appropriate noise thresholds for NSLs surrounding each of the Infrastructure Sites. It is necessary to determine whether the NSLs are located in 'low background noise' areas as defined in the NG4 2016 guidance (EPA 2016). To meet the definition of a low background noise area the noise levels measured during the environmental noise survey need to satisfy the following criteria:

- Arithmetic average of L_{A90} during daytime period[4] ≤40 dB L_{A90}
- Arithmetic average of L_{A90} during evening period ≤35 dB L_{A90}
- Arithmetic average of L_{A90} during night-time period ≤30 dB L_{A90}.

Determining Appropriate Noise Criteria

64. Table 6.10 outlines the noise criteria detailed in NG4 2016 (EPA 2016) for areas of low background noise and all other areas.

Table 6.10: Approach for Determining Appropriate Noise Criteria

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs) Note 1	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night-time Noise Criterion, dB $L_{Aeq,T}$(23:00 to 07:00hrs)
Areas of low background noise	45	40	35
All other areas	55	50	45

Note 1: The operational plant will be required to have no tonal or impulsive components in these instances; the specific noise level, L_{Aeq}, will be equal to the rated noise level $L_{A,Rt}$, i.e. no penalty corrections are applied to the operational noise levels.

65. Based on a review of the measured noise from the background noise survey (Section 6.3.5), the NSLs at varying distances from the assessed Infrastructure Sites largely satisfy the criteria to be classed as areas of low background noise as per the NG4 2016 guidance (EPA 2016). As the proposed Infrastructure Sites will operate on a 24-hour basis, the external night-time criterion of 35 dB $L_{Aeq,T}$ will be adopted as the assessment threshold. Achieving the night-time criterion of 35 dB $L_{Aeq,T}$ will also ensure that the criteria for the day and evening are also achieved. The Proposed Project will be designed so that that the noise emissions from the Infrastructure Sites will not contain any audible tones or impulsive characteristics at any NSL during night-time periods.

66. The proposed night-time criterion of 35 dB $L_{Aeq,T}$ is a relatively low level of external noise. It is important, however, to consider the likelihood of adverse noise impacts when assessing noise from fixed plant. The NG4 2016 guidance (EPA 2016) refers to the assessment method prescribed in BS 4142 (BSI 2019) that can be used to assess the likelihood of complaints from specific plant noise sources.

6.2.6.3.3 BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

67. BS 4142 (BSI 2019) is the industry standard method in Ireland for analysing building services plant noise emissions to residential receptors and is the document used commonly by Irish Local Authorities in planning conditions and in complaint investigations. This standard is also referenced in NG4 2016 guidance (EPA 2016) for dealing with complaint investigations. BS 4142 (BSI 2019) is therefore the best practice guidance and methodology used for assessing noise from fixed plant items.

[4] Daytime, evening and night-time periods defined in Table 6.10.

68. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. These methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

69. For an appropriate BS 4142 assessment, it is necessary to compare the measured external background noise level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

70. The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 (BSI 2019) recommends the application of a 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

71. The following definitions are taken from BS 4142:

- Ambient noise level, $L_{Aeq,T}$ – the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T]
- Residual noise level, $L_{Aeq,T}$ – the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T]
- Specific noise level, $L_{Aeq,T}$ – the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T]
- Rating level, $L_{Ar,T}$ – the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components)
- Background noise level, $L_{A90,T}$ – is the sound pressure level of the residual noise that is exceeded for 90% of the time period [T].

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

73. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source would have an adverse impact or a significant adverse effect. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

74. BS 4142 (BSI 2019) also states that where background levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

75. In light of the above guidance, it is considered appropriate that for the Infrastructure Sites, the proposed absolute criterion for areas of low background noise from NG4 2016 (EPA 2016) is robust and is expected to reduce the risk of any adverse impacts at NSLs in line with BS 4142 (BSI 2019).

76. On this basis, Table 6.11 sets out the adopted noise thresholds for the assessed Infrastructure Sites within the Proposed Project. A significant effect occurs when the noise criteria in Table 6.11 are exceeded.

Table 6.11: Operational Noise Thresholds for Infrastructure Sites

Infrastructure Site	Assessment Location	Proposed Operational Noise Criteria		
		Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night-time Noise Criterion, dB $L_{Aeq,T}$ (23:00 to 07:00hrs)
RWI&PS	Nearest NSL	45	40	35
WTP	Nearest NSL	45	40	35
BPS	Nearest NSL	45	40	35

77. The Proposed Project will be designed so that the operational noise levels will not have clearly audible tonal or impulsive noise characteristics at any NSL during night-time periods.

6.2.6.3.4 Additional Road Traffic on Public Roads

78. To assess the potential for likely significant noise effects associated with the Proposed Project introducing additional traffic onto the existing road networks, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the Proposed Project.

79. To assist with the interpretation of the noise associated with vehicular traffic on public roads and describing the significance of effects from a change in noise levels, reference has been made to DMRB LA 111 (Highways England 2020). This document offers guidance as to the likely effect associated with any change in traffic noise level between the Do Minimum (without the Proposed Project but including future traffic growth) and Do Something (with the Proposed Project including future traffic growth) scenarios.

80. Table 6.12 presents the DMRB magnitude of impacts associated with a change in traffic noise level and the corresponding EPA significance rating. The assessment criteria used here relate to the short-term change in traffic noise which applies a more conservative impact rating against initial changes associated with the opening year scenarios.

Table 6.12: Likely Effects Associated with a Change in Traffic Noise Level – Short-Term

DMRB Magnitude of Impact	Increase in Traffic Noise Level (dB)	EPA Significance of Effect	Initial Significance Rating
Major	Greater than or equal to 5.0	Significant	Significant
Moderate	Greater than or equal to 3.0 and less than 5.0	Slight to Moderate	Significant
Minor	Greater than or equal to 1.0 and less than 3.0	Not Significant	Not Significant
Negligible	Less than 1.0	Imperceptible	Not Significant

Source: DMRB LA 111 (Highways England 2020); EPA EIAR Guidelines (EPA 2022)

81. The assessment criteria in Table 6.12 have been used to assess the significance and likely effects in relation to the predicted increases in operational traffic levels on public roads associated with the Proposed Project. Where changes in traffic noise levels at NSLs along the Proposed Project during the Operational Phase is less than 3 dB, the impact is deemed Not Significant. Where changes in traffic noise levels are greater than 3 dB, the impact is deemed to be potentially Significant, depending on context in line with further guidance from DMRB relating to absolute traffic noise levels.

6.2.6.4 Significance of Effects

82. The significance of effects has been assessed in accordance with the EPA EIAR Guidelines (EPA 2022). Refer to Chapter 2 (The Environmental Impact Assessment Process) for a definition of these descriptions and how these relate to the quality, significance and duration of likely significant effects.

6.2.7 Construction Flexibility

83. At this stage of the development of the Proposed Project there are a number of points of detail which cannot be finalised. This is due to factors such as unknown site constraints or obstacles that may affect the construction of the permanent infrastructure. Although a high level of ground investigation has been obtained to inform the planning application for the Proposed Project, further site investigations will be undertaken following grant of planning permission. This will inform a confirmed design for construction. This is a standard delivery approach and as a result, for a linear project of this nature, scale and complexity, it is typical that a level of construction flexibility is required. This flexibility in construction is necessary to provide a mechanism to overcome these matters during the later stages of the Proposed Project. The elements which are subject to construction flexibility are summarised in Table 6.13 and this also explains how this flexibility has been accounted for within the assessment reported in this chapter. Chapter 4 (Proposed Project Description) and Chapter 5 (Construction and Commissioning) in Volume 2 of this EIAR provides further detail.

84. The assessment reported in this chapter has taken account of this construction flexibility and assessed all the likely significant effects that could arise.

85. For the airborne noise assessment, the likely significant effects reported in this chapter would not change regardless of the alignment or location of infrastructure elements within the defined construction flexibility in Table 6.13 (i.e. the difference in effects would be imperceptible for the purpose of the assessment).

86. For the vibration assessment the difference in construction effects as a result of construction flexibility may be perceptible as the sources of vibration could be further away than the distance assessed and consequently, there could potentially be a reduction in the level of vibration experienced. No assessment has been made of what the reduction could be, rather this has been captured as potential mitigation measures that the contractor may be able to adopt at later stages in the Proposed Project. There would be no additional or different significant adverse effects as a result of this construction flexibility being utilised, as compared with those reported in this chapter.

Table 6.13: Definition of Construction Flexibility

Design Element	Construction Flexibility	How this has been Applied / Assessed in this Chapter
Pipeline	Treated Water Pipeline and RWRMs horizontal alignment – to allow for construction flexibility to overcome site constraints or obstacles the pipeline could be anywhere within a 20m Pipeline Corridor as defined in Chapter 4 (Proposed Project Description).	The Treated Water Pipeline and RWRMs horizontal alignment has been considered through a series of conservative assumptions, as set out in Section 6.2.7. There would be no operational noise effect in relation to the alignment of the Treated Water Pipeline and RWRMs.
Pipeline	Treated Water Pipeline vertical alignment – to allow construction flexibility to overcome site constraints or obstacles, the vertical alignment of the pipeline could vary between 1.2m and 4.4m to the crown of the pipe. Exceptions would be at proposed trenchless crossing locations (which due to the construction approach would be deeper than 4.4m to crown) and where it has been identified that for hydraulic purposes, the crown of the pipeline would need to be deeper than 4.4m. These have been included in the vertical alignment set out in the Planning Application for the Proposed Project and consequently have been assessed for significant environmental effects as reported in this EIAR. These include e.g. TWB 27100 - 27700 and TWC 2600 - 2750. In these instances, the construction flexibility would be the crown of the pipe not being deeper than that shown in the Planning Application Drawings and not shallower than 1.2m. The excavation needed for the pipeline is assumed to be the largest needed for the lowest vertical parameter set out.	The Treated Water Pipeline vertical alignment has been considered through conservative assumptions on there being a direct line of sight to NSLs without any acoustic screening (e.g. from soil that would be stacked in material laydown areas within the Construction Working Width). As the vertical alignment depth increases so does the likelihood of screening from soil and a reduction in the predicted effects from construction plant screened by the soil. A conservative assumption of no screening offers a reasonable worst case assessment. There will be no operational noise effect in relation to the vertical alignment of the Treated Water Pipeline and RWRMs. For groundborne vibration, the construction flexibility has been allowed for to avoid constraints, including, for example, layers of rock that would require rock breaking activities.
Valves	The location of valves, and associated pipeline features, that need to be above the pipeline could change if there is a change in the vertical or horizontal alignment of the pipeline, as a result of the construction flexibility defined in the two rows above. The construction flexibility would allow them to move within the 20m Pipeline Corridor. However, the location of these pipeline features would be limited to remaining within the land parcels as identified and assessed within the EIAR (but still remaining within the 20m Pipeline Corridor).	The installation of valves and associated pipeline features have been considered as part of the assessment of the construction of the pipeline. Once operational, the associated features would not generate any significant noise.
Outfall connections	To construct the smaller connection pipes between washout valves and washout outfalls, a small amount of construction flexibility would be required to overcome onsite obstacles or constraints. To allow for this, the connecting pipe could be anywhere within a 10m corridor.	The pipeline connections between washout valves and washout outfalls have been considered as part of the assessment of the construction the pipeline and are therefore assessed within Section 6.4.2. Once operational the associated features would not generate any significant noise.
Outfall locations	The outfall headwalls and discharge point would have to move with the alignment of the outfall pipeline, as set out above, and so the discharge point could move within the same 10m construction flexibility. To allow for the headwalls to move 10m either side of the current pipeline alignment, a total construction flexibility width of 20m has been allowed for the headwalls.	The outfall headwall and discharge points have been considered as part of the assessment of the construction the pipeline and are therefore assessed within section 6.4.2. Once operational the associated features would not generate any significant noise.

87. The construction works necessary to deliver the permanent design (including the construction flexibility defined in Table 6.13) would take place within the Construction Working Width which defines the extent of the Planning Application Boundary. For the assessment reported in this EIAR this means that the construction works could take place anywhere within the Construction Working Width.

88. For the airborne noise assessment the construction of the Treated Water Pipeline and RWRMs horizontal alignment has been evaluated through a series of conservative assumptions.

89. The centre of the pipeline has been used to determine the set-back buffers for construction calculations relative to the nearest NSLs. This has been used to account for the linear nature of the pipeline construction works whereby plant items during each phase would be operating at varying distances within a linear working area.

90. The calculations assume all plant items are positioned at the closest distance to each NSL from the centre of the pipeline, which is highly conservative. In reality, due to the small available working width of (typically) 25m either side of the pipeline and the dynamic nature of construction works, plant items would be in operation across the full extent of the Planning Application Boundary at any one time. The centreline calculations, therefore, allow for the construction flexibility within the 20m Pipeline Corridor. The calculations also include pneumatic breakers for all excavations and assume a direct line of sight to NSLs without any acoustic screening (e.g. from soil that would be stacked in material laydown areas within the Construction Working Width and any existing structures).

91. The conclusions regarding likely significant effects during the construction of the Proposed Project are based on these conservative assumptions. Where significant effects have been identified, specific mitigation measures will be implemented.

92. For the groundborne noise and vibration assessment the source of the vibration (the piling, rock breaking or trenchless construction technique) was assessed as the closest point within the Construction Working Width, where these types of construction activities would take place, to the nearest VSLs. For the Infrastructure Sites the closest point within the Planning Application Boundary where the source of the vibration would be located was used to assess the VSLs.

6.2.7.1 Variation in Construction Methods

93. In addition to the construction flexibility defined in Table 6.13 there may also be the potential for variation in the method of construction to be used to build the Proposed Project. This variation would be necessary to deal with, for example, uncertainties in ground conditions or on-site constraints. Chapter 5 (Construction & Commissioning) includes further detail on these, including the reasoning why different techniques may be required. This could include:

- Use of raft foundations or concrete piled foundations at the WTP
- Use of auger bore or pipe jacking for trenchless crossings
- Using trenchless crossing or open excavation for the crossing of low voltage power lines
- Different construction techniques for working in poor ground include peat materials.

94. The assessment reported in this chapter has been based on any of these construction techniques being adopted.

95. In addition, as set out in Appendix A5.3 (Methods of Working in Peat), four slightly different methods for constructing the pipeline in areas of peat soils have been defined. To allow for variation in ground conditions it has been assumed for the purpose of the assessment reported in this EIAR that either Method 2, 3 or 4 could be used in areas where the depth of peat is greater than 1m. Where the depth of peat is less than 1m, Method 1 is proposed to be used and it is not expected that there would be any deviation from this methodology. The environmental effects from Methods 2, 3 and 4 would be similar. However, Methods 3 and 4 would result in additional permanent infrastructure in the form of stone pillars (Method 3) or piled supports (Method 4) below the pipeline. Consequently, Method 4 would require piling and as such, would have a slighter greater environmental impact. Therefore, the EIAR is based on the application of Method 4 where the depth of peat is greater than 1m. However, in areas where Methods 2, 3 or 4 could be used, the environmental assessment has considered whether these different methods would result in different likely significant effects and therefore the assessment reported in this chapter has identified the likely significant effects from any of the three techniques. The difference in noise levels generated between the three different methods would not be significant in the context of noise and vibration generated for the Proposed Project as a whole. Therefore, for this assessment, the likely significant effects reported in this chapter would not change regardless of the working in peat method used (i.e. the difference between the methods would be imperceptible for the purpose of the assessment).

6.2.8 Difficulties Encountered in Compiling Information

96. No substantial difficulties were encountered that affected the assessment outcomes and conclusions presented in this chapter in the process of undertaking the noise and vibration assessment for the EIAR. However, detailed design information regarding the operational plant at the assessed Infrastructure Sites is not available. In the absence of sound power data regarding the operational plant, a series of conservative assumptions have been made in the operational noise prediction models. All assumption details are provided within Appendix A6.4 (Noise Modelling Details and Assumptions).

97. The information that has informed the assessment is sufficient to identify the likely significant effects. The limitations described in this chapter are not considered to have a material impact on the conclusions of this assessment. Additional details regarding assumptions and calculations related to the operational plant aspects of this assessment are provided within Appendix A6.4 (Noise Modelling Details and Assumptions). The assumptions and assessment undertaken within this assessment are conservative.

6.2.9 Cumulative Effects

98. As noted in Chapter 2 (The Environmental Impact Assessment Process), intra-project cumulative effects are described within respective topic chapters, while inter-project cumulative effects are described in Chapter 21 (Cumulative Effects & Interactions). The EIA Directive includes the consideration of existing projects within the cumulative effects assessment, and this is addressed through a consideration of the incremental impact of the Proposed Project within the context of the existing baseline as described, and where applicable, the carrying capacity of the environment.

99. For traffic related impacts, the Do-Minimum traffic scenario is representative of the predicted growth in traffic, accounting for local and regional development. Cumulative impacts are implicit in the future Do-Minimum and Do-Something future scenarios because Committed Developments (as defined in Chapter 7: Traffic & Transport) are included in the traffic model. A description of the scenarios considered for the traffic Do Minimum and Do Something scenarios are set out in Chapter 7 (Traffic & Transport). The provision of a high growth rate in the traffic model would cater to the proposed developments which are not granted planning along the Haul Road of the Proposed Project. The traffic model is therefore inherently cumulative as the model factors in these future committed developments.

100. Intra-project effects of note in relation to noise and vibration include the effects of changing noise levels on biodiversity (i.e. on disturbance), on population and communities through a change in community amenity, and on human health. Identified interactions are assessed within the respective topic chapters and summarised in Chapter 21.

6.3 Baseline Environment

101. Environmental noise surveys were conducted in June 2017 with an updated suite of noise surveys undertaken in August 2021. The noise surveys were used to quantify the existing noise environment at NSLs at varying distances from the Infrastructure Sites that may be affected by the Construction Phase and Operational Phase of the Proposed Project. There was a negligible difference in the survey results between 2017 and 2021. This is due predominantly to the rural nature of the survey locations and the main noise sources noted being in relation to road noise which had no significant changes in this period. The most up to date survey results undertaken during 2021 are presented in this report and are deemed valid for the study area. Updated noise surveys are not required for this assessment due to the stable noise environment measured in both 2017 and the updated 2021 surveys with no known, significant changes in the noise environment likely to occur within the timelines of the Proposed Project.

102. Appendix A6.2 (Fundamentals of Acoustics) provides a variety of indicative noise levels on a scale to assist with the interpretation of the baseline noise level results that are presented in the following sections.

103. A baseline survey of vibration was not undertaken due to the absence of any notable vibration sources in the existing environment. Baseline vibration levels in the receiving environment under consideration are below thresholds that are perceptible to humans and are also orders of magnitude below those with the potential to cause any structural damage to property. This assertion was confirmed during the attended noise surveys undertaken, where vibration was not perceptible at any of the surveyed locations during survey periods.

6.3.1 Survey Locations

104. Baseline noise surveys were conducted at locations representative of NSLs within the study area that have the potential to be impacted by construction works and/or during the Operational Phase of the Proposed Project. These surveys were carried out in the receiving environment adjacent to the proposed Infrastructure Sites, namely the RWI&PS, WTP, BPT, BPS, and TPR, as well as at representative NSLs along the proposed 38 kV Uprate Works. A specific baseline noise survey was not undertaken for the FCV Infrastructure Site, as the majority of operational plant associated with this site is predominantly housed internally or below ground. Notwithstanding this, the criteria applied to each of the Infrastructure Sites are conservative for both the Construction and Operational Phases of the Proposed Project, and are considered appropriate given the rural or semi-rural nature of the locations.

105. The extent of the baseline noise surveys was sufficient to characterise the typical noise environments within the study area.

106. Any noise generated by the pipeline during the Operational Phase would be imperceptible in terms of the impact at any NSLs, therefore baseline surveys specifically for this aspect of the Proposed Project were not required for the assessment.

107. For the proposed 38 kV Uprate Works Construction Phase there are no associated construction works proposed during night-time periods. Therefore, baseline noise surveys related to the proposed 38 kV Uprate Works were carried out during daytime hours only.

108. The location reference and a description of each survey position relating to Infrastructure Sites are given in Table 6.14. Details of the proposed 38 kV Uprate Works survey locations are given in Table 6.15. Measurement location maps are provided in Figure 6.1 to Figure 6.5.

Table 6.14: Survey Locations Relating to Infrastructure Sites

Location	Description of Survey Location	ITM Coordinates		Figure
		X	Y	
N1	Adjacent to residential dwellings along the R494 at Birdhill. Residences between abstraction and WTP	570,842	670,264	Figure 6.1
N2		570,926	669,360	Figure 6.1
N3	Adjacent to residential dwellings along the R445. Residence to the south of WTP	572,604	669,817	Figure 6.1
N4	Adjacent to residential dwellings along the local road to the east of WTP at Greenhills	572,941	670,250	Figure 6.1
N5	Adjacent to residential dwellings along the local road to the north-east of WTP at Greenhills	572,617	671,479	Figure 6.1
N6	Adjacent to residential dwellings along the local road to the north-west of BPT at Knockanacree	596,805	690,508	Figure 6.2
N7	Adjacent to residential dwellings along the local road to the south of BPT at Oxpark	597,228	689,237	Figure 6.2
N8	Adjacent to residential dwellings along the local road to the east of BPT at Gortavalla	597,651	690,061	Figure 6.2

Location	Description of Survey Location	ITM Coordinates		Figure
		X	Y	
N9	Adjacent to residential dwellings along the local road to the south-west of TPR at Peamount	700,552	730,542	Figure 6.4
N10	Adjacent to buildings to the rear of the Peamount Hospital Site and to the south of the proposed TPR	700,910	730,792	Figure 6.4
N11	Adjacent to residential dwellings along Peamount Lane to the east of the proposed TPR	701,483	730,981	Figure 6.4
N12	Adjacent to residential dwellings along the local road to the west of BPS at Coagh Upper	614,960	707,235	Figure 6.3
N13	Adjacent to farmland entrance along the local road to the east of BPS at Coagh Upper	616,240	706,986	Figure 6.3

Table 6.15: Survey Locations Relating to 38 kV Uprate Works

Location	Description of Survey Location	ITM Coordinates		Figure
		X	Y	
N14	Adjacent to residential dwellings on unnamed road in area named Blackwater	560,190	664,100	Figure 6.5
N15	Adjacent to residential dwellings on R471	561,846	664,548	Figure 6.5
N16	Adjacent to residential dwellings on unnamed road in area named Cappakea	563,138	665,975	Figure 6.5
N17	Adjacent to residential dwellings on unnamed road in area named Yardfield	564,712	665,887	Figure 6.5
N18	Adjacent to residential dwellings on junction with Old Road	568,447	666,931	Figure 6.5
N20	Adjacent to residential dwellings on unnamed road in area named Gortybrigane	570,955	667,696	Figure 6.5
N21	Adjacent to residential dwellings on unnamed road in area named Lackenavea	571,896	668,022	Figure 6.5

* Previously measured data at location N19 removed from the assessment due to no longer being relevant to 38 kV Uprate Works

6.3.2 Survey Periods and Weather Conditions

109. Details of the survey periods and a description of the weather conditions for each survey position is given in Table 6.16.

Table 6.16: Details of Survey Locations

Location	Date and Time of Survey	Weather Conditions	Figure
N1	Daytime: 12:14 to 14:40 on 17/06/2021 and 12:21 to 12:36 on 18/06/2021. Evening: 22:05 to 22:20 on 17/06/2021. Night-time: 23:54 on 17/06/2021 to 00:09 on 18/06/2021 and 23:02 to 23:17 on 28/06/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.1
N2	Daytime: 12:36 to 15:31 on 17/06/2021 and 12:45 to 13:00 on 18/06/2021. Evening: 22:05 to 22:20 on 17/06/2021. Night-time: 00:15 to 00:30 on 18/06/2021 and 00:42 to 00:57 on 29/06/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.1
N3	Daytime: 13:06 to 15:56 on 17/06/2021 and 13:08 to 13:23 on 18/06/2021. Evening: 22:44 to 22:59 on 17/06/2021. Night-time: 00:35 to 00:50 on 18/06/2021 and 23:24 to 23:39 on 28/06/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.1
N4	Daytime: 13:26 to 16:15 on 17/06/2021 and 11:14 to 11:29 on 18/06/2021. Evening: 21:23 to 21:38 on 17/06/2021. Night-time: 23:03 to 23:18 on 17/06/2021 and 00:00 to 00:15 on 29/06/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.1

Location	Date and Time of Survey	Weather Conditions	Figure
N5	Daytime: 14:00 to 16:37 on 17/06/2021 and 11:56 to 12:11 on 18/06/2021. Evening: 21:43 to 21:58 on 17/06/2021. Night-time: 23:30 to 23:45 on 17/06/2021 and 00:16 to 00:31 on 29/06/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.1
N6	Daytime: 11:33 to 14:05 on 14/06/2021. Evening: 21:57 to 22:12 on 14/06/2021. Night-time: 23:03 on 14/06/2021 to 00:22 on 15/06/2021.	Calm <2m/s Wind Speed, Dry, ~12-16 Degrees Celsius, Part Cloudy	Figure 6.2
N7	Daytime: 11:58 to 14:30 on 14/06/2021. Evening: 22:22 to 22:37 on 14/06/2021. Night-time: 23:25 on 14/06/2021 to 00:43 on 15/06/2021.	Calm <2m/s Wind Speed, Dry, ~12-16 Degrees Celsius, Part Cloudy	Figure 6.2
N8	Daytime: 12:20 to 14:49 on 14/06/2021. Evening: 22:41 to 22:56 on 14/06/2021. Night-time: 23:44 on 14/06/2021 to 01:02 on 15/06/2021.	Calm <2m/s Wind Speed, Dry, ~12-16 Degrees Celsius, Part Cloudy	Figure 6.2
N9	Daytime: 11:33 to 13:19 on 12/07/2021. Evening: 22:44 to 22:49 on 15/07/2021. Night-time: 23:05 to 23:40 on 15/07/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.4
N10	Day/Evening/Night-time: 11:15 on 12/07/2021 to 10:03 on 14/07/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.4
N11	Daytime: 12:00 to 13:39 on 12/07/2021. Evening: 22:23 to 22:38 on 15/07/2021. Night-time: 23:47 on 15/07/2021 to 00:19 on 16/07/2021.	Calm <2m/s Wind Speed, Dry, ~15-18 Degrees Celsius, Part Cloudy	Figure 6.4
N12	Daytime: 15:26 to 17:34 on 14/06/2021. Evening: 22:27 to 22:42 on 16/06/2021. Night-time: 23:18 on 16/06/2021 to 00:11 on 17/06/2021.	Calm <2m/s Wind Speed, Dry, ~12-16 Degrees Celsius, Part Cloudy	Figure 6.3
N13	Daytime: 16:19 to 17:53 on 14/06/2021. Evening: 22:44 to 22:59 on 16/06/2021. Night-time: 23:39 on 16/06/2021 to 00:27 on 17/06/2021.	Calm <2m/s Wind Speed, Dry, ~12-16 Degrees Celsius, Part Cloudy	Figure 6.3
N14-N21	10:30 to 15:50 on 24/07/2019 (Refer to Table 6.29 for specific times)	Calm <4m/s Wind Speed, Dry, ~14-16 Degrees Celsius, Part Cloudy	Figure 6.5

6.3.3 Measurement Procedure

6.3.3.1 Manned Survey Procedure

110. In relation to the Infrastructure Sites of the Proposed Project, 12 specific survey locations were selected, as shown in Figure 6.1 to Figure 6.4. Short-term manned daytime, evening and night-time measurements were conducted at these locations on a cyclical basis with sample periods of 15 minutes each. In relation to the proposed 38 kV Uprate Works, seven survey locations were selected, as shown in Figure 6.5, and two samples were taken at each location. The measurements results were noted onto a survey record sheet immediately following each sample and were also saved to the instrument memory for later analysis. Survey personnel noted all primary noise sources contributing to noise build-up. A microphone was mounted on a tripod and placed at a height of 1.5m above ground.

111. All surveys were performed in accordance with ISO 1996-2:2017 (ISO 2017).

6.3.3.2 Unmanned Survey Procedure

112. Unmanned continuous measurements were conducted at one location (N10, see Figure 6.4). An unmanned monitor was used at this location due to security restrictions that limited personnel access during night-time periods. These measurements were conducted over an approximately 48-hour period. A microphone was mounted on a tripod and placed at a height of 4m above ground to represent the prevailing noise climate at the height of a first floor window.

113. All surveys were performed in accordance with ISO 1996-2:2017 (ISO 2017).

114. The unmanned survey at Location N10 was conducted with due consideration of the location of the proposed TPR (35m at closest location) in relation to the nearby Peamount Hospital.

6.3.4 Equipment

115. Noise measurements were conducted using Brüel & Kjær Type 2250 Sound Level Meters (Serial Numbers 3008402 (Locations N1 to N9 and N11), 164427 (Locations N10, N12 and N13) and 2818091 (Locations N14 to N21)). The unmanned noise monitor at Location N10 was equipped with a Rion NL-52 Sound Level Meter inside a weatherproof microphone housing and environmental enclosure. The sound level meters were calibrated before and after each survey using a Brüel & Kjær Type 4231 Sound Level Calibrator. The results were saved to the instrument memory for later analysis.

6.3.5 Results

116. The survey results are presented in terms of the following parameters:

- L_{Aeq} is the A-weighted equivalent continuous steady sound level during the sample period, and it effectively represents an average value
- L_{A10} is the A-weighted sound level that is exceeded for 10% of the sample period. This parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic
- L_{A90} is the A-weighted sound level that is exceeded for 90% of the sample period. It is generally used to quantify background noise.

117. The results for manned survey locations are presented in Table 6.17 to Table 6.29. The unmanned results for location N10 are presented in Table 6.30.

Table 6.17: Manned Survey Results Location N1 (Representative of NSLs at RWI&PS)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	12:14	62	67	39	Intermittent road traffic noise on R494 dominating the measured L_{Aeq}, birdsong, distant plant or farm machinery audible in the background at a low level.
	14:25	64	69	41	
	12:21	63	69	42	
Evening	22:05	59	62	33	Intermittent road traffic noise on R494 and distant road traffic noise audible in the background.
Night-time	23:54	55	46	25	Occasional road traffic noise along R494. Background noise levels quiet.
	23:02	60	59	29	

118. During the daytime survey period at location N1, road traffic movements were noted to be the dominant noise source with audible birdsong and noise from trees rustling in the background. The survey location was deemed to be representative of NSLs in the area. Daytime noise levels were in the range of 62 to 64 dB $L_{Aeq,\ 15mins}$ and 39 to 42 dB $L_{A90,\ 15mins}$. The lower noise levels during evening and night when compared with the daytime were typically due to reduced traffic volumes.

Table 6.18: Manned Survey Results Location N2 (Representative of NSLs at RWI&PS)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq,\ 15mins}$	$L_{A10,\ 15mins}$	$L_{A90,\ 15mins}$	
Daytime	12:36	68	72	41	Intermittent road traffic noise on R494 dominating the measured L_{Aeq}, birdsong and distant traffic noise audible in lulls of traffic and dominating the background noise environment. During the first round of measurement (daytime), some local activity at a nearby house unloading a trailer resulted in higher measured levels than observed and measured during subsequent rounds.
	15:16	60	65	45	
	12:45	59	62	39	
Evening	22:23	62	67	32	Intermittent road traffic noise on R494 and distant road traffic noise audible in the background.
Night-time	00:15	55	47	27	Occasional road traffic noise along R494. Background noise levels quiet.
	00:42	53	41	23	

119. During the daytime survey period at location N2, road traffic movements were noted to be the dominant noise source. Daytime noise levels were in the range of 59 to 68 dB $L_{Aeq,\ 15mins}$ and 39 to 45 dB $L_{A90,\ 15mins}$. The change in the noise levels during evening and night was typically due to reduced traffic volumes.

Table 6.19: Manned Survey Results Location N3 (Representative of NSLs at WTP)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq,\ 15mins}$	$L_{A10,\ 15mins}$	$L_{A90,\ 15mins}$	
Daytime	13:06	63	67	44	Intermittent road traffic noise on R445 dominating the measured L_{Aeq}, birdsong, nearby stream and distant traffic noise audible in the background noise environment.
	15:41	64	69	41	
	13:08	63	68	37	
Evening	22:44	64	59	29	Occasional road traffic noise on R445 dominated the measured L_{Aeq}. Background noise levels in the absence of traffic were observed to be quiet.
Night-time	00:35	61	47	27	Occasional road traffic noise along R445. Background noise levels quiet.
	23:24	60	50	27	

120. During the daytime survey period at location N3, road traffic movements were noted to be the dominant noise source. Daytime noise levels were in the range of 63 to 64 dB $L_{Aeq,\ 15mins}$ and 37 to 44 dB $L_{A90,\ 15mins}$. The change in the noise levels during evening and night was typically due to reduced traffic volumes.

Table 6.20: Manned Survey Results Location N4 (Representative of NSLs at WTP)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	13:26	43	43	35	Distant road traffic along the R445 was the main source of noise noted in the environment. In the absence of traffic noise, birdsong and wind-generated noise in local foliage were observed.
	16:00	46	48	42	
	11:14	45	48	37	
Evening	21:23	43	41	28	Distant road traffic noise and birdsong.
Night-time	23:03	38	43	24	Occasional distant road traffic noise and birdsong. Background noise levels quiet. Distant dog barks at low level during first round of measurements.
	23:59	35	34	22	

121. Location N4 is located off the main road network and the baseline noise environment was observed to be quiet, however, the location is exposed to noise from the distant R445. Daytime noise levels were in the range of 43 to 46 dB $L_{Aeq, 15mins}$ and 35 to 42 dB $L_{A90, 15mins}$. The noise environment during the evening and night periods was similar, however the measured levels reduced due to the reduction in traffic volumes along the R445.

Table 6.21: Manned Survey Results Location N5 (Representative of NSLs at WTP)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	14:00	48	48	35	Occasional distant road traffic noise from the R496, birdsong and wind-generated noise in local foliage were dominant. Occasional impulsive noises from livestock in adjacent farm shed.
	16:22	49	48	38	
	11:56	46	50	31	
Evening	21:43	36	40	27	Distant road traffic noise, birdsong and wind-generated noise in local foliage.
Night-time	23:30	32	31	22	Occasional distant road traffic noise and birdsong. Background noise levels quiet. Distant dog barks at low level.
	00:16	33	35	19	

122. During the daytime survey period at location N5, occasional distant road traffic noise and birdsong were noted to be the dominant noise sources. Typical daytime noise levels were in the range of 46 to 49 dB $L_{Aeq, 15mins}$ and 31 to 38 dB $L_{A90, 15mins}$. The noise environment during the evening and night periods was similar, however resulted in lower measured noise levels due to the reduction in traffic volumes and birdsong.

Table 6.22: Manned Survey Results Location N6 (Representative of NSLs at BPT)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	11:33	51	42	32	Road traffic from L1064 (very low volume), birdsong, wind, livestock. Fewer vehicle passes during second measurement.
	12:45	46	46	34	
	13:50	54	48	34	
Evening	21:57	44	42	23	Road traffic from L1064 (very low volume), birdsong, leaf rustle, livestock.
Night-time	23:03	38	33	19	Road traffic from L1064 (very low volume), birdsong, leaf rustle livestock.
	00:07	33	23	17	

123. During the daytime survey period at location N6, birdsong, wind and local road traffic were noted to be the dominant noise sources with occasional distant agricultural noise audible in the background. Daytime noise levels were measured in the range of 46 to 54 dB $L_{Aeq, 15mins}$ and 32 to 34 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however due to reduced traffic flows and bird activity the levels measured during these periods were lower.

Table 6.23: Manned Survey Results Location N7 (Representative of NSLs at BPT)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	11:58	48	49	36	Road traffic from L1060 (very low volume), birdsong, and leaf rustle.
	13:30	52	50	38	
	14:15	47	49	36	
Evening	22:22	50	42	24	Road traffic from L1060 (very low volume), birdsong, and leaf rustle.
Night-time	23:25	41	33	23	Road traffic from L1060 (very low volume), birdsong, and leaf rustle.
	00:28	33	27	19	

124. During the daytime survey period at location N7, birdsong, wind and local road traffic were noted to be the dominant noise sources with occasional distant agricultural noise audible in the background. The measured daytime noise levels were in the range of 47 to 52 dB $L_{Aeq, 15mins}$ and 36 to 38 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however lower noise levels were recorded due to reduced traffic flows and less bird activity.

Table 6.24: Manned Survey Results Location N8 (Representative of NSLs at BPT)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	12:20	52	46	31	Road traffic from L5020 (very low volume), birdsong, wind (more prominent at this location).
	13:11	52	47	36	
	14:34	50	43	33	
Evening	22:41	30	32	24	Road traffic from L5020 (very low volume), birdsong, wind (more prominent at this location).
Night-time	23:44	42	25	18	Road traffic from L5020 (very low volume), birdsong, wind (more prominent at this location). Car passing affected first measurement.
	00:47	29	25	20	

125. During the daytime survey period at location N8, birdsong, wind and local road traffic were noted to be the dominant noise sources with occasional distant agricultural noise audible in the background. The measured daytime noise levels were in the range of 50 to 52 dB $L_{Aeq, 15mins}$ and 31 to 36 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however measured levels were lower due to reduced traffic flows and less frequent bird activity.

Table 6.25: Manned Survey Results Location N9 (Representative of NSLs at TPR)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	11:33	61	57	28	Road traffic from Arthur's Way (primary noise contributor) and R120 Peamount Road (distant), birdsong.
	12:23	65	64	28	
	13:04	64	62	30	
Evening	22:44	54	44	21	Road traffic from Arthur's Way (primary noise contributor) and R120 Peamount Road (distant), birdsong.
Night-time	23:05	54	53	24	Road traffic from Arthur's Way (primary noise contributor) and R120 Peamount Road (distant), birdsong.
	23:25	50	38	21	

126. During the daytime survey period at location N9, distant and occasional local road traffic movements dominated the noise environment with birdsong audible in the background. The measured daytime noise levels were in the range of 61 to 65 dB $L_{Aeq, 15mins}$ and 28 to 30 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however during these periods the measured levels were lower due to reduced traffic flows.

Table 6.26: Manned Survey Results Location N11 (Representative of NSLs at TPR)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	12:00	42	45	39	Construction noise approximately 200-300m to the east, faint road traffic from R120 Peamount Road, birdsong.
	12:43	43	45	38	
	13:24	40	43	37	
Evening	22:23	34	32	26	Faint road traffic from R120 Peamount Road, birdsong.
Night-time	23:47	31	32	26	Faint road traffic from R120 Peamount Road, birdsong.
	00:04	31	34	27	

127. During the daytime survey period at location N11, distant construction noise approximately 200-300m from the measurement location was audible with road traffic movements from the R120 dominating the noise environment with birdsong audible in the traffic lulls. The measured daytime noise levels were in the range of 40 to 43 dB $L_{Aeq, 15mins}$ and 37 to 39 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however the measured levels were lower due to the absence of construction during the evening and night-time periods.

Table 6.27: Manned Survey Results Location N12 (Representative of NSLs at BPS)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	15:26	50	49	38	Road traffic from L3003 (very low volume), birdsong, and leaf rustle.
	16:40	51	51	36	
	17:19	51	50	37	
Evening	22:27	29	32	22	Road traffic from L3003 (very low volume), birdsong, leaf rustle, distant dogs. No car passing during this measurement.
Night-time	23:18	50	34	18	Road traffic from L3003 (very low volume), birdsong, leaf rustle, distant dogs. one car passing during first measurement.
	23:56	25	24	15	

128. During the daytime survey period at location N12, birdsong, wind and local road traffic were noted to be the dominant noise sources with occasional distant agricultural noise and dog barking audible in the background. The measured daytime noise levels were in the range of 50 to 51 dB $L_{Aeq, 15mins}$ and 36 to 38 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods; however measured levels were significantly lower during these periods due to reduced traffic flows and bird activity.

Table 6.28: Manned Survey Results Location N13 (Representative of NSLs at BPS)

Period	Start Time	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
Daytime	16:19	54	52	37	Road traffic from L3003 and Kilcormac-Killyon Road (low volume), birdsong, and leaf rustle.
	16:59	54	56	36	
	17:38	53	52	32	
Evening	22:45	43	30	16	Road traffic from L3003 and Kilcormac-Killyon Road (low volume), birdsong, leaf rustle, three car passes.
Night-time	23:39	47	39	18	Road traffic from L3003 and Kilcormac-Killyon Road (low volume), birdsong, leaf rustle, three car passes during first measurement.
	00:12	25	23	16	

129. During the daytime survey period at location N13, birdsong, wind and local road traffic were noted to be the dominant noise sources with occasional distant agricultural noise audible in the background. The measured daytime noise levels were in the range of 53 to 54 dB $L_{Aeq, 15mins}$ and 32 to 37 dB $L_{A90, 15mins}$. A similar noise environment was noted during the evening and night periods, however the noise levels measured were lower due to reduced traffic flows.

130. Table 6.29 presents a summary of the daytime attended measurements related to the proposed 38 kV Uprate Works. The noise environment at each location was typical of a rural monitoring location with noted noise sources relating to traffic movements, birdsong and other wildlife, and pedestrians.

Table 6.29: Manned Survey Results Locations N14 to N21 (Representative of NSLs at 38 kV Uprate Work)

Location	Start Time	Measured Noise Levels (dB re.2x10-5Pa)			Notes
		$L_{Aeq, 15mins}$	$L_{A10, 15mins}$	$L_{A90, 15mins}$	
N14	10:14	64	50	32	Occasional road traffic movements dominant when present. Intermittent distant leaf blower. Distant dog barking. Birdsong and foliage.
	11:04	63	50	37	Occasional road traffic movements dominant when present. Intermittent distant lawn mower. Distant dog barking. Birdsong, aircraft and foliage.
N15	10:43	62	49	34	Occasional road traffic movements dominant when present. Distant road traffic. Intermittent distant leaf blower. Birdsong, aircraft and foliage. Distant construction noise.
	11:23	61	48	34	Occasional local road traffic movements dominant when present. Distant road traffic. Birdsong, aircraft and foliage. Distant construction noise.
N16	12:11	43	46	33	Road traffic from R463 dominant noise source. Birdsong and foliage.
	12:54	46	49	40	Tractor in adjacent field dominant noise source when present. Road Traffic from R463 dominant noise source. Pedestrians. Birdsong and foliage.
N17	11:49	61	45	35	Road traffic movements dominant noise source. Distant road traffic. Intermittent distant hedge trimmers. Birdsong and foliage.
	12:33	44	47	38	Distant road traffic. Intermittent distant hedge trimmers. Birdsong, aircraft and foliage.
N18	13:25	46	49	38	Occasional local road traffic movements dominant when present. Distant road traffic from R445. Birdsong and foliage. Pedestrian conversation. Distant dogs barking.
	14:03	50	53	40	Occasional local road traffic movements dominant when present. Distant road traffic from R445. Birdsong and foliage. Distant dogs barking.
N20*	14:42	52	48	42	Occasional local road traffic movements dominant when present. Distant road traffic from M7. Birdsong and foliage.
	15:18	53	49	43	Occasional local road traffic movements dominant when present. Distant road traffic from M7. Birdsong and foliage.
N21	15:00	52	49	43	Occasional local road traffic movements dominant when present. Distant road traffic from M7. Hammering at nearby house. Pedestrian conversation. Trailer movements. Birdsong and foliage.
	15:36	50	49	43	Occasional local road traffic movements dominant when present. Distant road traffic from M7. Construction noise at nearby house, substantial at times. Birdsong and foliage.

* Previously measured data at location N19 removed from the assessment due to no longer being relevant to 38 kV Uprate Works.

131. The measured noise levels within Table 6.29 related to the proposed 38 kV Uprate Works are typical of a rural setting with noise levels being dictated largely by traffic movements along local road networks. The measured daytime noise levels were in the range of 43 to 64 dB $L_{Aeq, 15mins}$ and 32 to 43 dB $L_{A90, 15mins}$ across the seven locations.

132. Table 6.30 presents a summary of noise levels measured at location N10 during daytime (i.e. 07:00 to 19:00hrs), evening (i.e. 19:00 to 23:00hrs) and night-time (i.e. 23:00 to 07:00hrs) periods. The results of the unattended monitoring position are also presented within Appendix A6.5. The noise environment for this area has been determined largely on the measured noise levels at the N10 monitoring location.

Table 6.30: Unmanned Monitoring Results at Location N10 (Representative of NSLs at TPR)

Date	Period	Measured Noise Levels (dB re.2x10^{-5}Pa)			Notes
		L_{Aeq} [1]	L_{A10} [2]	L_{A90} [3]	
12 July	Day (11:15 – 19:00)	39	40	32	Distant road traffic from R120, leaf rustle and birdsong were noted as the primary noise contributors. Agricultural activities (including tractor movements) also contributed during the morning periods.
12 July	Evening (19:00 – 23:00)	43	45	33	
12/13 July	Night (23:00 – 07:00)	43	40	30	
13 July	Day (07:00 – 19:00)	46	46	36	
13 July	Evening (19:00 – 23:00)	46	46	33	
13/14 July	Night (23:00 – 07:00)	43	39	29	

Table notes:

[1] Represents the logarithmic average of the 15-minute noise measurements over the sample period

[2] Represents the arithmetic average of the 15-minute noise measurements over the sample period

[3] Represents the arithmetic average of the 15-minute noise measurements over the sample period

133. The baseline noise at N10 was mostly influenced by distant road traffic from the R120. Measured average ambient noise levels during the daytime periods ranged from 39 to 46 dB $L_{Aeq,12hr}$ with average background levels of between 32 to 36 dB $L_{A90,12hr}$. Noise levels reduced during the evening and night-time periods with average night-time ambient noise levels in the region of 43 dB $L_{Aeq,\ 8hr}$ and average background levels of between 29 to 30 dB $L_{A90,\ 8hr}$.

6.3.6 Summary of Noise Monitoring Data

134. The noise environment in the study area of the Infrastructure Sites and proposed 38 kV Uprate Works has been characterised by a set of noise surveys, comprising observations made on-site by survey personnel and a review of the survey results. The existing noise levels vary from location to location but are typical of the environment commonly experienced in rural/semi-rural areas. Certain locations (i.e. the locations adjacent to busy local/national roads – locations N1, N2, N3 and N9) experienced higher ambient noise levels, whereas the other locations surveyed at positions further from the surrounding road networks experience lower ambient and background noise levels.

135. The measured noise levels have been used to inform the selection of appropriate CNTs and Operational Phase noise criteria for the fixed Infrastructure Sites of the Proposed Project. For construction noise, based on the survey data collected, all Infrastructure Sites fall within the BS 5228-1 Construction Noise Category A as per Table 6.4.

6.3.7 Groundborne Noise and Vibration Baseline

136. For the purpose of the assessment of the potential for groundborne noise or vibration, baseline data was not collected. Rather, it was assumed that any receptors do not currently experience existing groundborne noise or vibration. This is standard practice and ensured a precautionary assessment of the potential effects.

6.3.8 Future Baseline

137. The future baseline, without the Proposed Project in place, has the potential to change over time; however, the overall character of the environment is unlikely to change significantly. The primary noise source at most baseline measurement locations is related to road traffic noise. For the future traffic noise levels to be altered by any perceptible margin, traffic noise levels would need to increase by a substantial volume. For example, an insignificant noise level increase of +1 dB within the assessment area would require a proportional traffic volume increase of 25%. In general, given the rural locations of many of the

monitoring locations, it is considered unlikely that the future baseline noise levels would increase sufficiently to significantly alter the measured baseline noise levels.

6.4 Assessment of Effects

138. The following sections present an assessment of the potential significant noise and vibration effects associated with the Construction and Operational Phases of the Proposed Project with respect to the appraisal methods that have been presented in Section 6.2.

139. This section presents an assessment in the absence of any mitigation measures, with the exception of embedded mitigation that has been incorporated into the design (e.g. avoiding sensitive features through the siting of the Proposed Project during the optioneering stages). Mitigation measures in Section 6.5 have been proposed to prevent or reduce the potential significant identified effects, and the residual effects after the application of mitigation measures are reported in Section 6.6.

6.4.1 Do-Nothing Scenario

140. The Do-Nothing Scenario is the scenario in which the Proposed Project does not go ahead, and no development associated with the Proposed Project occurs. In the event of a Do-Nothing scenario, the baseline noise and vibration environment would remain unchanged, therefore there would be no additional noise and vibration effects.

6.4.2 Construction Phase

6.4.2.1 Noise

141. A variety of items of plant and machinery would be utilised during the Construction Phase. These will include rock breakers, excavators, dump trucks, and generators in addition to other general construction equipment. The Infrastructure Sites would also require substantial ground excavation and piling. The key phases of works that would be likely to give rise to significant noise effects would be ground breaking, earthworks, earthworks haulage, and tunnelling. There would also be noise associated with the movement of machinery and materials within and to and from the Construction Compounds. Due to the nature of the activities undertaken on a construction site, there would be the potential for generation of high levels of noise.

142. As per TII 2004 Noise Guidelines (TII 2004) and the TII 2014 Noise Guidelines (TII 2014), noise levels associated with construction were calculated in accordance with the methodology set out in BS 5228-1 (BSI 2014a). This standard sets out sound power and sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

143. The source noise levels used in the assessment are indicative of the type of plant items and activities that will be associated with the Proposed Project.

144. Noise predictions are presented to highlight noise levels at NSLs, based on conservative assumptions, and to discuss the good practice and specific mitigation measures that can be utilised to reduce effects as far as is reasonably practicable. All plant and associated on-times used within the construction calculations are supplied within Appendix A6.3 (Construction Noise Plant Lists).

145. BS 5228-1 (BSI 2014a) sets out typical noise levels for items of construction plant. The tables in the following sections set out calculated noise levels for the key phases of construction, based on the plant lists provided (refer to Appendix A6.3: Construction Noise Plant Lists). In preparing noise prediction calculations, reference has been made to Chapter 5 (Construction & Commissioning) which provides, amongst other information, the likely construction methods, locations, durations and hours of work.

146. Construction noise predictions are made for the following scenarios:

- Construction of Infrastructure Sites (i.e. RWI&PS, WTP, BPT, BPS, FCV and TPR)
- Construction of temporary infrastructure
- RWRMs and Treated Water Pipeline construction (i.e. construction of terrestrial pipelines from the RWI&PS to the TPR including ancillary pipeline infrastructure comprising the Line Valves, Washout Valves, Air Valves, FCV and potential future connection point locations)
- Trenchless crossings
- Directional drilling
- Construction of the proposed 38 kV Uprate Works
- Road construction
- Construction traffic.

6.4.2.1.1 Temporary Infrastructure

147. Noise and vibration emissions associated with the construction of temporary infrastructure required for the Construction Phase (Working Width, Construction Compounds and Pipe Storage Depots) are assessed in the following section. A full list of the Construction Compounds and Pipe Storage Depots is available within Chapter 5 (Construction & Commissioning). The Construction Compounds (CCs) located at permanent Infrastructure Sites (CC0, CC1, CC3, CC4 and CC7) are assessed within Section 6.4.2.1.3.

148. Table 6.31 presents the results of the noise prediction calculations, considering the typical anticipated methods of construction. Results are provided at varying distances from the construction works relating to the Construction Compounds and Pipe Storage Depots. The calculations are based on the plant utilisation assumptions and percentage on-times provided by the design team (see Appendix A6.3 for details). All calculations are based on the conservative assumption of a direct line of sight from source to receiver assuming no acoustic screening (i.e. barriers, fencing, ground topography) in place between the site works and the nearest NSLs.

Table 6.31: Indicative Noise Calculations for Construction of Construction Compounds and Pipe Storage Depots

Phase of Work (Activity)	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Calculated Construction Noise Level dB $L_{Aeq,1hr}$ at Distance from Works (m)				
		20m	30m	40m	50m	60m
Site clearing and preparation (including fencing)	83	77	69	66	64	62
Excavations/concrete foundations/prefabricated buildings	83	77	69	66	64	62
Temporary laydown area	84	78	70	67	65	63
Site services temporary	82	76	68	65	63	61
Roadworks, landscaping	72	66	58	55	53	51
Reinstatement	84	78	70	67	65	63

149. The predicted noise levels detailed in Table 6.31 indicate that at distances beyond 50m, construction noise levels are below the Category A significance threshold of 65 dB $L_{Aeq,T}$ and will therefore not result in a significant effect at NSLs at 50m or greater from these sites.

150. The following temporary infrastructure sites are proposed within 50m of NSLs and therefore have the potential for construction noise levels exceeding the significance threshold of 65 dB $L_{Aeq,T}$.

Construction Compounds

- **CC6 (Drummond)** – One NSL within 50m at 35m from CC

151. At Construction Compound CC6, there is one NSL within 50m of the Construction Compound. The NSL is 35m to the south-west of the compound site. The effect in the absence of mitigation at the nearest NSL would be temporary, negative and Moderate to Significant (effect is significant).

Pipe Storage Depots (PSDs)

- **PSD1 (Carrigatogher**) – Five NSLs within 50m with nearest NSLs at 20m from PSD

152. At Pipe Storage Depot PSD1, there are five NSLs within 50m of the Pipe Storage Depot at distances ranging from 20m to 40m. The effects in the absence of mitigation at the three nearest NSLs within 30m from the Pipe Storage Depot would be temporary, negative and Significant to Very Significant (effect is significant) and temporary negative and Moderate to Significant (effect is significant) at the remaining two NSLs at distances of 35 to 45m.

- **PSD3 (Boveen)** – One NSL within 50m at 40m from PSD

153. At Pipe Storage Depot PSD3, there is one NSL at approximately 40m to the south-east of the Pipe Storage Depot site. The effect in the absence of mitigation at this nearest NSL would be temporary, negative and Moderate to Significant (effect is significant).

- **PSD8 (Edenderry)** – One NSL within 50m at 40m from PSD

154. At Pipe Storage Depot PSD8, there is one NSL at approximately 40m to the north-east of the Pipe Storage Depot site. The effect in the absence of mitigation at the nearest NSL would be temporary, negative and Moderate to Significant (effect is significant).

- **PSD9 (Graiguepottle)** – Two NSL within 50m with nearest NSL at 30m from PSD

155. At Pipe Storage Depot PSD9, there are two NSLs at distances ranging from approximately 30 to 45m to the north-west of the Pipe Storage Depot site. The effects in the absence of mitigation at the nearest NSLs would be temporary, negative and Moderate to Significant (effect is significant).

- **PSD10 (Barberstown Upper)** – One NSL within 50m at 20m from PSD

156. At Pipe Storage Depot PSD10, there is one NSL at a distance of approximately 20m to the north-east of the Pipe Storage Depot site. The effect in the absence of mitigation at the nearest NSL to PSD10 would be temporary, negative and Significant to Very Significant (effect is significant).

157. Mitigation will be required at all assessed Construction Compounds and Pipe Storage Depots. As the predicted noise levels are likely to exceed 65 dB $L_{Aeq,T}$ for several phases, construction noise mitigation measures (as outlined in Section 6.5) will be employed to reduce the likelihood of significant noise impacts.

158. Notwithstanding the assessed instances, all Construction Compounds and Pipe Storage Depots will be subject to the proposed CNTs outlined in Section 6.2.6.

6.4.2.1.2 Proposed 38 kV Uprate Works and Power Connections

159. The construction works associated with the proposed 38 kV Uprate Works and overhead power connections to Line Valves would occur for short durations at various locations along the Proposed Project. Due to the varying length of the connections, and consequently the length over which construction works would occur, NSLs would be situated at different set back distances from associated plant items and activities.

160. Table 6.32 presents the noise prediction calculations, considering the methods and plant items required for construction as advised by the design team Results are provided at varying distances from the construction works. The calculations are based on the plant utilisation assumptions and percentage on-times provided by the design team (see Appendix A6.3 for details). All calculations are based on the conservative assumption of a direct line of sight from source to receiver assuming no acoustic screening (i.e. barriers, fencing, ground topography) in place between the site works and the nearest NSLs.

Table 6.32: Indicative Noise Calculations for Construction of 38 kV Uprate Works and Power Connections

Phase of Work (Activity)	Cumulative Plant Noise Level at 10m Distance ($dB L_{Aeq,T}$)	Calculated Construction Noise Level $dB L_{Aeq,1hr}$ at Distance from Works (m)				
		25m	40m	50m	100m	150m
Excavations and below ground concrete structures	84	72	67	65	57	53
Pipe installation and backfilling	85	73	68	66	58	54
Reinstatement	83	71	66	64	56	52

161. The predicted Construction Phase noise levels associated with each combined activity are all below the weekday construction noise criterion of 70 dB $L_{Aeq,1hr}$ set out in Section 6.2.6 at distances greater than 25m from the works. The calculations indicate that the relevant Saturday construction noise criterion would just be exceeded in the unlikely event that all construction activities occur within approximately 40m of an NSL and operate simultaneously. In these instances, the appointed Contractor would identify appropriate mitigation measures to ameliorate the noise effects as outlined in Section 6.5.

162. As the works progress along the length of the proposed 38 kV Uprate Works and varying power connections, the effects would be transient in nature and would only occur at specific locations for limited periods of time. It is envisioned that the works would be at the closest position to the nearest NSLs for a duration that does not exceed the durations where a significant effect will occur as per Section 6.2.6.1.3. To reduce effects during the Construction Phase, good practice mitigation measures set out in Section 6.5 would be adopted by the appointed Contractor. Considering the predicted duration of the works in relation the 38 kV Uprate Works and overhead power connections are below that set out within Section 6.2.6.1.3, the noise effects without mitigation would likely be brief to temporary, negative and Slight to Moderate (effect is not significant).

6.4.2.1.3 Infrastructure Sites

163. There are six main sites of fixed infrastructure: the RWI&PS, WTP, BPT, BPS, FCV and TPR. Each site is summarised in Table 6.33 in terms of the approximate site location, distance from the site boundary to the nearest NSLs, expected construction duration and the typical sequence of construction. Full descriptions and sequences of works are provided within Chapter 5 (Construction & Commissioning).

Table 6.33: Infrastructure Site Information Relevant to Construction Noise Impact Assessment

Infrastructure Site	Site Location	Approximate Distance from Site Boundary to Closest NSL	Typical Sequence of Work
RWI&PS	Parteen Basin, Lough Derg	600m	Site clearance. Provision of Construction Compound, offices and fencing. Removal of topsoil. Placing of temporary piling platform in Parteen Basin to allow secant pile and ground anchors construction along Basin shoreline. The platform would be constructed using sheet piles in Parteen Basin to contain the platform. Bank excavation. Formation of basement slab. Concrete pours. Construction of substructure and main floors. Erection of structural steel. Construction of bankside intake. Completion of site roads. Mechanical and electrical installations. Site demobilisation. Landscaping.
WTP	Incha Beg, Birdhill, Co. Tipperary	300m	Site clearance, provision of fencing and access roads. Removal of topsoil. Site grading. Provision of Construction Compound. Excavate foundation for process buildings. Concrete pours. Installation of pipework. Erection of buildings. Mechanical, electrical and pipework fit-out. Erection of steel tanks. Completion of access roads, circulation roads, car parks and footpaths. Erection of permanent fencing. Landscaping. Site demobilisation.
BPT	Knockanacree, Cloughjordan, Co. Tipperary	280m	Provision of Construction Compound, fencing and site access roads. Removal of topsoil. Site excavation. Formation of reinforced concrete tank base. Installation of inlet pipe, backfilled with graded material. Installation of foundations for inlet sump. Construction of concrete floor of BPT. Construction of outer concrete walls and concrete roof. Installation of pipework. Completion of access roads, circulation roads, car parks and footpaths. Mechanical and electrical fit-out. Erection of permanent fencing. Landscaping. Site demobilisation.
BPS	Coagh Upper, Co. Offaly	260m	Site preparation works. Topsoil stripping. Earthworks, excavation and fill of the land to suitable levels for construction of structures on-site. Excavation for BPS substructure and installation of below-ground pipework. Construction of BPS superstructure. Construction of electricity substation including medium voltage room and installation of ESB supply. Site works, landscaping and boundary treatment.
FCV	Co. Kildare	130m	The main construction activity would be excavating and installing the below ground valves. Other construction activities would include landscaping, an access road and internal circulation roads, car parks and walkways, security fencing, mechanical and electrical (M&E) plant, instrumentation and control systems, and building services. In addition, a new mains supply would be provided off the electrical grid, to power the plant and equipment.
TPR	Peamount, South County Dublin	15m	Provision of Construction Compound, fencing and site access roads. Removal of topsoil. Site excavation. Installation of foundations. Installation of pipework. Construction of outer concrete walls and concrete roof. Installation of pipework. Construction of associated structures such as chambers, plinths, buildings. Completion of access roads, circulation roads, car parks and footpaths. Mechanical and electrical fit-out. Erection of permanent fencing. Landscaping. Site demobilisation.

164. The proposed standard construction hours for the Infrastructure Sites are 07:00hrs to 19:00hrs, Monday to Friday; and 08:00hrs to 16:30hrs on Saturdays.

165. Working outside of typical working hours may also be required to carry out, or attend to, an emergency on the works.

166. Table 6.34 to Table 6.39 present noise calculations for each of the Infrastructure Sites, considering the anticipated methods of construction, distance to NSLs and expected noise levels from the chosen construction tools and equipment.

167. The calculations are based on the anticipated plant items that would operate during each phase of construction as well as anticipated percentage on-times and numbers of each plant item which have been provided by the design team for this assessment and have been derived in line with the assumptions outlined within Section 6.2.7. All noise levels are derived from BS 5228-1 (BSI 2014a).

168. It is assumed that all plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario. The calculations do not assume any screening that may be provided by perimeter hoarding and/or the excavations formed when works progress below ground level and are, therefore, conservative predictions. A full list of the plant and assumed on-times and noise levels are provided in Appendix A6.3 (Construction Noise Plant Lists) of this EIAR.

169. Where construction of access roads is required for the Infrastructure Sites, as described in Chapter 5 (Construction & Commissioning), refer to Section 6.4.2.1.10 for the assessment of potential noise impacts associated with construction of roads.

6.4.2.1.4 RWI&PS

170. Table 6.34 presents the results of the noise prediction calculations for the RWI&PS at the nearest NSL.

Table 6.34: Predictive Construction Noise Calculations for RWI&PS

Phase	Cumulative Plant Noise Level at 10m Distance ($dB L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (600m) (Cumulative Per Phase) $dB L_{Aeq,T}$
Site clearing and preparation	82	36
Excavations and below-ground concrete structures	89	43
Construction of above-ground structures	85	39
Construction of building	85	39
Temporary laydown area	84	38
Pipe installation and backfilling	82	36
Roadworks, landscaping	84	38
Reinstatement	85	39
Remove wayleave and fencing	81	35

171. The predicted noise levels detailed in Table 6.34 indicate that for the likely range of works required for the RWI&PS, construction activities would operate under the adopted Category A daytime threshold of 65 dB $L_{Aeq,T}$ outlined in Section 6.2.6 and also below the measured baseline noise levels at survey location N1. No specific noise mitigation measures are necessary. This is primarily because of the distance between the proposed works and the nearest NSL. The effects during construction of the RWI&PS when assessed against the criteria within Table 6.5 would be short term, negative, and Not Significant (effect is not significant).

6.4.2.1.5 WTP

172. Table 6.35 presents the results of the noise prediction calculations for the WTP at the nearest NSL.

Table 6.35: Predictive Construction Noise Calculations for WTP

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (300m) (Cumulative Per Phase) dB $L_{Aeq,T}$
Site clearing and preparation	85	46
Excavations and below-ground concrete structures	88	49
Construction of above-ground structures	86	47
Construction of building	85	46
Temporary laydown area	84	45
Pipe installation and backfilling	82	43
Roadworks, landscaping	83	44
Reinstatement	85	46
Remove wayleave and fencing	81	42

173. The predicted noise levels detailed in Table 6.35 indicate that for the likely range of works required for the WTP, construction activities would operate under the adopted Category A daytime threshold of 65 dB $L_{Aeq,T}$ outlined in Section 6.2.6. The predicted construction levels would however be slightly above the measured baseline levels within Section 6.3.5. The effects during construction of the WTP when assessed against the criteria within Table 6.5 would be short term, negative, and Slight to Moderate (effect is not significant).

6.4.2.1.6 BPT

174. Table 6.36 presents the results of the noise prediction calculations for the BPT at the nearest NSL.

Table 6.36: Predictive Construction Noise Calculations for BPT

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (280m) (Cumulative Per Phase) dB $L_{Aeq,T}$
Site clearing and preparation	82	44
Excavations and below ground structures	88	50
Construction of above ground structures	81	43
Construction of building	85	47
Temporary laydown area	84	46
Pipe installation and backfilling	82	44
Roadworks, landscaping	83	45
Reinstatement	85	47
Remove wayleave and fencing	81	43

175. The predicted noise levels detailed in Table 6.36 indicate that for the likely range of works required for the BPT, construction activities would operate under the adopted Category A daytime threshold of 65 dB $L_{Aeq,T}$ outlined in Section 6.2.6. The predicted construction levels would however be slightly above the measured baseline levels within Section 6.3.5. The effects during construction of the BPT when assessed against the criteria within Table 6.5 would be short term, negative, and Slight to Moderate (effect is not significant).

6.4.2.1.7 BPS

176. Table 6.37 presents the results of the noise prediction calculations for the BPS at the nearest NSL.

Table 6.37: Predictive Construction Noise Calculations for BPS

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (260m) (Cumulative Per Phase) dB $L_{Aeq,T}$
Site clearing and preparation	82	45
Excavations and below ground structures	88	51
Construction of above ground structures	81	44
Construction of building	85	48
Temporary laydown area	84	47
Pipe installation and backfilling	82	45
Roadworks, landscaping	83	46
Reinstatement	85	48
Remove wayleave and fencing	81	44

177. The predicted noise levels detailed in Table 6.37 indicate that for the likely range of works required for the BPS, construction activities would operate under the adopted Category A daytime threshold of 65 dB $L_{Aeq,T}$ outlined in Section 6.2.6. The predicted construction noise levels are likely to be higher than the measured baseline noise levels at survey location N12 which is representative of the closest NSLs to the works. The effects during construction of the BPS when assessed against the criteria within Table 6.5 would be short term, negative, and Slight to Moderate (effect is not significant).

6.4.2.1.8 FCV

178. As part of the pipeline construction, a series of valves would be installed along the pipeline route. Line Valves, Washout Valves and Air Valves installation would occur in conjunction with the construction of the pipeline and the associated noise from the construction of these pipeline features are captured within Table 6.42.

179. The FCV complex, however, would be housed in an underground chamber and would require additional construction processes to those captured within Table 6.42.

180. Table 6.38 outlines the various phases of the construction of the FCV and presents the results of the noise prediction calculations based on the anticipated methods of construction at the nearest NSL.

Table 6.38: Predictive Construction Noise Calculations for FCV

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (130m) (Cumulative Per Phase) dB $L_{Aeq,T}$
Site clearing and preparation (including fencing)	81	51
Excavations and below ground concrete structures	83	53
Construction of building (kiosk)	85	55
Construction of FCV chamber	86	56
Pipe installation and backfilling	86	56
Roadworks, landscaping	83	53
Remove wayleave and fencing	81	51

181. The predicted noise levels detailed in Table 6.38 indicate that for the likely range of works required for the FCV, construction activities would operate under the adopted Category A daytime threshold of 65 dB $L_{Aeq,T}$ outlined in Section 6.2.6.

182. Therefore, during the construction of the FCV, at the nearest NSL within 130m of the construction works, the effects during construction would be temporary, negative, and Slight to Moderate (effect is not significant).

6.4.2.1.9 TPR

183. Table 6.39 presents the results of the noise prediction calculations for the TPR at distances representing the nearest NSLs.

Table 6.39: Predictive Construction Noise Calculations for TPR

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level – dB $L_{Aeq,T}$ Cumulative Noise Level per Phase at Closest NSL Distances	
		35m	70m
Site clearing and preparation	82	66	59
Excavations and below ground structures	88	72	65
Construction of above ground structures	84	68	61
Construction of building	80	64	57
Temporary laydown area	84	68	61
Pipe installation and backfilling	82	66	59
Roadworks, landscaping	83	67	60
Reinstatement	83	67	60
Remove wayleave and fencing	81	65	58

184. The predicted noise levels in Table 6.39 indicate that the majority of construction activities at the TPR site are likely to exceed the Category A threshold of 65 dB $L_{Aeq,T}$ set out in Section 6.2.6 at the nearest NSLs. The TPR site perimeter is approximately 15m from the nearest NSLs (which relate to two buildings within Peamount Hospital). However, construction noise calculations have been undertaken from 35m to

account for the distance from the NSLs to the nearest actual construction works. These calculations are deemed conservative as most of construction works would not be taking place at the immediate site boundary. At distances beyond 70m from the works during the most noise-intrusive excavations phase, noise levels would fall within the thresholds set out in Section 6.2.6. All NSLs beyond the nearest two identified buildings within Peamount Hospital are at distances beyond 70m and therefore no significant effect is likely to occur at any NSLs beyond the buildings identified within Peamount Hospital.

185. Taking this into account and for the purposes of this assessment, the likely construction activities to the south-east of the TPR site, closest to the identified NSLs, has been further examined. Table 6.40 presents the results of the noise prediction calculations for the likely construction activities occurring to the south-east portion of the site at a distance of 35m from the nearest NSLs.

Table 6.40: Predictive Construction Noise Calculations for TPR – South-East Section

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Nearest NSL (35m) (Cumulative Per Phase) dB $L_{Aeq,T}$
Site clearing and preparation	82	66
Excavations and below ground concrete structures	84	68
Temporary laydown area	84	68
Roadworks, landscaping	84	68
Reinstatement	85	69

186. The predicted noise levels in Table 6.40 indicate that the majority of construction activities to the south-east of the TPR site are still likely to exceed the Category A threshold of 65 dB $L_{Aeq,T}$, as set out in Section 6.2.6, at two identified buildings within Peamount Hospital. However, the noise level during the excavation phase is lower than the calculated noise level for this phase within the main portion of the site.

187. Given that the predicted noise levels are likely to exceed 65 dB $L_{Aeq,T}$ for several phases, and due to the distance of the nearest NSLs and the possibility of brief activities close to the site boundary, construction noise mitigation measures (as outlined in Section 6.5) will be employed to reduce the noise effects. The pre-mitigation effects during construction of the TPR when assessed against the criteria within Table 6.5 at the closest NSLs within Peamount Hospital to the north of the hospital grounds would be short term, negative, and Moderate to Significant (effect is significant). At all other NSLs which are at distances beyond 70m, the effect would be short term, negative and Slight to Moderate (effect is not significant).

6.4.2.1.10 Road Construction

188. Construction of several permanent and temporary access roads are planned as part of the Proposed Project. The roads would mainly facilitate safe access to the Infrastructure Sites but also other minor access points would also be required along the length of the Construction Working Width. The assessment looks at the construction method for a permanent road as a conservative assumption, however temporary and minor roads would likely have lower noise emissions associated with their construction due to the nature of these roads. Descriptions of the access roads and their locations are provided in Chapter 4 (Proposed Project Description).

189. A variety of plant and equipment would be required to facilitate the construction of the access roads. The associated construction works would pass at varying distances from NSLs, at various locations along the routes. Table 6.41 presents the noise calculations based on the anticipated plant items that would operate, at varying distances from the construction works. The calculations are based on the conservative assumption of a direct line of sight from source to receiver assuming no acoustic screening (i.e. barriers, fencing, ground topography) in place between the site works and the nearest NSLs.

190. The calculations have been completed using set back distances from the site access roads to Infrastructure Sites and the access and egress locations. At distances beyond 30m, the construction noise levels are calculated to be within the adopted CNT. Along the Proposed Project two NSLs have been identified within 30m of temporary road construction works or access egress locations. The two NSLs identified are approximately 25m to the south-west of Peamount Hospital.

Table 6.41: Predictive Noise Calculations for Road Construction

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at 10m (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at 20m (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at 30m (dB $L_{Aeq,T}$)
Temporary roads and landscaping	83	83	77	69

191. The predicted noise levels indicate that the construction activities have the potential to operate above or close to the threshold of 70 dB $L_{Aeq,1hr}$ set out in Section 6.2.6 where road construction is within 30m of the nearest NSL. As a result, mitigation measures, set out in Section 6.5, will be employed by the appointed Contractor to reduce the likelihood of significant effects. In the absence of mitigation the effects at the two NSLs within 30m at Peamount Hospital would be temporary, negative, and Moderate to Significant (effect is significant).

6.4.2.1.11 Pipeline Construction

192. The RWRMs and Treated Water Pipeline would primarily cross agricultural lands, open fields, and peatlands from Parteen Basin (County Tipperary) to Peamount (South County Dublin). The route of the pipeline has been determined through a route selection exercise which evaluated several environmental considerations (including noise). However, given the length of the Proposed Project and consideration of other environmental constraints along the route, it is unavoidable that the pipeline, and associated construction works including trenchless crossings, will be in close proximity to NSLs at some locations.

193. The Construction Working Width would be nominally 50m wide to accommodate the required trench, construction machinery and excavated material, but would be widened in areas to accommodate the following activities: access and egress to the public road network; construction of trenchless crossings for high voltage power lines, railway, road and watercourse crossings; and areas required for surface water management.

194. The anticipated construction hours for the pipeline would generally be 07:00hrs to 19:00hrs, Monday to Friday; and 08:00hrs to 16:30hrs on Saturdays. However, it is acknowledged in Chapter 5 (Construction & Commissioning) that construction works on the pipeline (subject to planning) would be undertaken during spring, summer and autumn months to take advantage of better weather and longer daylight hours and lessen damage to soils along the route of the pipeline. Section 6.2.6.1.1 sets appropriate construction noise criteria for hours of 19:00hrs to 22:00hrs, Monday to Friday; and 08:00hrs to 16:30hrs on Sundays and Bank Holidays. If construction activity is required outside of the days and times defined in Table 6.3, this would normally require the agreement of the relevant Local Authority.

195. Works relating to the trenchless crossings and directional drilling are discussed within Sections 6.4.2.1.12 and 6.4.2.1.13. The typical sequence of construction activities for the pipeline works that have the potential to generate elevated levels of noise are summarised as follows:

- Site clearing and preparation
- Excavations
- Introduction of temporary construction roads within the Construction Working Width

- Pipeline installation and backfilling
- Installation of valve chambers
- Reinstatement
- Removal of wayleave (fencing, interceptor drains and re-establishing of existing boundaries).

196. Construction of the pipeline is expected to occur over an approximate 5-year period as stated in Chapter 5 (Construction & Commissioning). The duration and phasing of the construction works is outlined within Chapter 5 (Construction & Commissioning) and the order and timeframe for construction will be outlined in a detailed construction schedule that will be prepared prior to the commencement of works.

197. A variety of plant and equipment would be required to facilitate the pipeline construction. In general, trenching would be predominantly open-cut using tracked excavators. Rock breaking would be carried out where ground conditions necessitate this activity. Piled foundations may be required to support pipelines in areas of deep poor ground material. Tunnelling would be required under major crossings such as roadways, railways, canals and watercourses. Trench backfilling would commence as soon as practicable after pipe testing; reinstatement of subsoil and topsoil would then be carried out. Site Construction Compounds, Pipe Storage Depots and Haul Roads would be necessary at regular intervals along the pipeline and there would be regular heavy vehicle movements and deliveries to and from the Construction Working Width.

198. The distance between construction works and NSLs would vary depending on the location along the route. Table 6.42 presents outline noise calculations based on the anticipated methods of construction and anticipated operating time per day as provided by the design team, at distances of 10m, 20m, 30m and 35m from the construction works. The centre of the pipeline has been used to the determine the set-back buffers for construction calculations to the closest NSLs. This has been used to account for the linear nature of the pipeline construction works whereby plant items during each phase will be operating at varying distances along a linear working area at any one time. The calculations therefore assume a linear working area is confined to 25m which is highly conservative.

199. The calculations presented here assume the following, which is highly conservative:

- All plant items per phase of work would operate simultaneously at each of the distances calculated
- Pneumatic breakers would be required for all excavations
- There would be a direct line of sight to NSLs without any acoustic screening (e.g. from soil that would be stacked in material laydown areas within the Construction Working Width).

Table 6.42: Predictive Noise Calculations for Pipeline Construction

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level – dB $L_{Aeq,T}$ Cumulative Noise Level per Phase at Closest NSL Distances			
		10m	20m	30m	35m
Site clearing and preparation	81	81	75	67	65
Excavations and below ground concrete structures	84	84	78	70	68
Pipe installation and backfilling	86	86	80	72	70
Cathodic Protection system	83	83	77	69	67
Roadworks, landscaping	84	84	78	70	68
Installation of valve chambers	81	81	75	67	65
Reinstatement	85	85	79	71	69
Remove wayleave and fencing	81	81	75	67	65

200. The predicted noise levels detailed in Table 6.42 indicate that, for the provided range of activities required for the construction of the pipeline without mitigation, there is the potential to exceed the daytime construction noise of 70 dB $L_{Aeq,1hr}$ outlined in Section 6.2.6 at distances up to 35m from the works during pipe installation and backfilling and reinstatement phases. Although the defined phases of construction are not distinct and may overlap, it is considered reasonable and robust to present the assessment as distinct phases.

201. The construction noise emissions presented in Table 6.42, are deemed conservative as discussed above. In reality, due to the nature of the works, construction plant items would be active within a linear section of works during each phase and would operate at a variety of distances from NSLs at any one time compared to those assumed in Table 6.42. As work progresses along the pipeline length, the noise sources would move further away from the NSL with resulting lower construction noise levels. The distances to all NSLs along the pipeline route are greater than 35m from the centreline and are therefore calculated to not experience construction noise levels above the adopted construction thresholds.

202. Construction noise mitigation measures (as outlined in Section 6.5.1) would be employed where necessary to control construction activity within the noise criteria outlined in Section 6.2.6 and to reduce the likelihood of significant noise effects associated with the pipeline construction.

203. Given the absence of identified NSLs within 35m from the centre of the pipeline, the potential noise effects without mitigation for all NSLs along the pipeline route would be temporary, negative, and Slight to Moderate (effect is not significant).

Comments on Piling within Pipeline Construction

204. Piling is likely to occur during the construction of the Proposed Project in areas where peat may be encountered. Appendix A5.3 (Methods of Working in Peat) outlines the various approaches for working within peat.

205. Method 1 techniques are expected to be used in areas where peat depths are less than 1m. In these locations, the associated noise levels are anticipated to be similar to those already assessed in Table 6.42 of the pipeline assessment.

206. To ensure a conservative approach, further assessment has been carried out for areas where Methods 2, 3, or 4 are proposed. This includes consideration of piling activities along relevant chainages, particularly to account for the potential impacts of Method 4 techniques, and any variations in the construction methods for working in peat where peat depths are 1m or greater.

207. Table 6.43 presents the results of the noise prediction calculations based on the anticipated working methods of construction in peat at distances of 10m, 20m, 30m, 40m and 50m from the construction works. A highly conservative 100% operating time per day has been assumed for the purposes of this assessment.

Table 6.43: Indicative Noise Calculations for Piling along Pipeline Construction

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level – dB $L_{Aeq,T}$ Cumulative Noise Level per Phase at Closest NSL Distances				
		10m	20m	30m	40m	50m
Piling along Pipeline Construction (Methods 2, 3 and 4)	89	89	83	75	72	70

208. The predicted noise levels detailed in Table 6.43 indicate that, for the areas where piling may be required along the pipeline without mitigation, there is the potential to exceed the daytime construction noise of 70 dB $L_{Aeq,1hr}$ outlined in Section 6.2.6 at distances up to 50m from the works.

209. Review of the areas where Methods 2, 3 or 4 are proposed for working in peat indicate that there is one NSL where there is potential for a significant effect to occur. The NSL is 40m to the south of an area of the pipeline where working Method 2 is indicated to take place between chainages TWB – 24500 and TWB – 25000. At this NSL, the construction noise effect would be temporary, negative and Moderate to Significant (effect is significant). In all other areas along the pipeline where Methods 2, 3 or 4 are proposed, the resulting effect would be temporary, negative and Slight to Moderate (effect is not significant).

210. Construction noise mitigation measures (as outlined in Section 6.5.1) will be employed at areas of piling in proximity to the identified NSL to control construction activity within the noise criteria outlined in Section 6.2.6 and to reduce the noise effects associated with piling along the pipeline construction.

211. The noise and vibration impacts of Methods 2, 3 and 4 of the working in peat methods assessed would be similar in nature in relation their potential noise impact, and therefore the likely significant effects reported in this chapter would not change regardless of the working in peat method used.

Comments on Night-time Open-Cut Crossings within Pipeline Construction

212. Chapter 5 (Construction & Commissioning) refers to the potential for some open-cut crossings to be undertaken on a 24-hour basis to minimise the duration of road closures and reduce disruption to road users.

213. Due to the nature of these works, there is the potential for elevated noise levels during night-time periods, which may exceed the adopted CNT. However, the likelihood of these works exceeding the construction duration thresholds outlined in Section 6.2.6.1.3 is considered highly unlikely. Therefore based on the duration of the works not exceeding the DMRB LA 111 (Highways England 2020) duration thresholds outlined within Section 6.2.6.1.3 the resultant effect at NSLs during these construction activities is expected to be temporary, negative, and Not Significant (effect is not significant).

214. Notwithstanding the above, mitigation measures outlined in Section 6.5. will be employed to reduce noise during night-time works.

6.4.2.1.12 Trenchless Crossings

215. Trenchless construction would involve tunnelling under major crossings such as roadways, railways, canals, watercourses, and possibly high voltage overhead power lines. The adopted daytime construction threshold for the trenchless crossings is 70 dB $L_{Aeq,1hr}$ as described in Section 6.2.6.1.1.

216. Work at trenchless crossings is likely to occur during night-time hours. In the absence of any night-time CNTs in the TII 2004 Noise Guidelines (TII 2004), the night-time thresholds in BS 5228-1 (BSI 2014a) would apply to NSLs. These thresholds are set relative to the ambient noise level measured at the nearest NSLs. Night-time construction works have a greater potential for significant effects compared to other periods and require special consideration. For the purposes of this assessment, all trenchless crossing points would adopt a night-time construction threshold of 45 dB based on the collected survey data and the adopted thresholds from BS 5228-1 and Table 6.4.

217. Supplied plant items and construction techniques taken from Chapter 5 (Construction & Commissioning) and plant lists within Appendix A6.3 (Construction Noise Plant Lists) have been used for indicative calculations related to the tunnel pipe jacking to be used at the trenchless crossings. Indicative construction calculations based on these data are provided below in Table 6.44 for various set back distances.

Table 6.44: Predictive Noise Calculations for Trenchless Crossing (Daytime)

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at Closest NSL (Cumulative per Phase) dB $L_{Aeq,T}$							
		10m	20m	30m	35m	70m	140m	200m	220m
Site clearing and preparation	81	81	75	67	65	58	50	46	45
Excavations and below ground concrete structures	86	86	80	72	70	63	55	51	50
Temporary laydown area	84	84	78	70	68	61	53	49	48
Pipe installation and backfilling	86	86	80	72	70	63	55	51	50
Reinstatement	85	85	79	71	69	62	54	50	49
Remove wayleave and fencing	81	81	75	67	65	58	50	46	45

218. As indicated in Table 6.44, during daytime working hours, the construction noise level related to trenchless crossings are predicted to be within the adopted construction criteria of 70 dB $L_{Aeq,1hr}$ at distances beyond 35m. On this basis there are no NSLs located within these distances and therefore effects during the daytime construction of the trenchless crossings when assessed against the daytime criteria within Table 6.3 at all NSLs would be temporary, negative, and Slight to Moderate (effect is not significant).

219. Construction activities relating to trenchless crossings would be restricted during the night-time hours to only incorporate the pipe installation and backfilling with restricted Heavy Goods Vehicle (HGV) movements and no use of circular saws during these periods. The other phases described in Table 6.44 are predicted to take place only during the daytime hours. Full plant lists for the various phases are supplied in Appendix A6.3 (Construction Noise Plant Lists). Table 6.45 presents the noise calculations for the night-time trenchless crossings works.

Table 6.45: Predictive Noise Calculations for Trenchless Crossing (Night-time)

Phase	Cumulative Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at closest NSL (Cumulative Per Phase) dB $L_{Aeq,T}$							
		10m	20m	30m	35m	70m	140m	200m	220m
Pipe installation and backfilling	81	81	75	67	65	58	50	46	45

220. As indicated in Table 6.45, noise levels associated with trenchless crossings during night-time working hours have the potential to exceed the construction criteria of 45 dB $L_{Aeq,T}$ at NSLs within 220m. The impact of night-time construction from trenchless crossings reduces as the distance from the works increases. Within 140m of the works, the effect would be temporary, negative, and Significant to Very Significant. Beyond 140m but within 220m, the effect would be temporary, negative, and Moderate to Significant (effect is significant). Beyond 220m, the effect related to night-time trenchless crossing works would be temporary, negative, and Slight to Moderate (effect is not significant).

221. Chapter 5 (Construction & Commissioning) identifies the locations where trenchless crossings are proposed. The identified trenchless crossing locations are adapted below in Table 6.46 with the addition of the approximate distance of these crossings to the nearest NSL and a comment on the works being completed within the construction duration thresholds within Section 6.2.6.1.3 as advised by the design team.

Table 6.46: Location of Construction by Trenchless Construction Techniques

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Approximate Distance to Nearest NSL	Under Construction Duration Thresholds
Road	RDX001	R494 and steep terrain	RW – 810	Figure 4.7	20m	No
Road	RDX003	R445 – Boher	TW – 1870	Figure 4.8	150m	Yes
Terrain	N/A	Steep side slope	TW – 3520	Figure 4.8	100m	No
Road	RDX007	M7 – Kilnacranna	TW – 5460	Figure 4.9	145m	No
Power	OHX001	220 kV Network	TW – 7310	Figure 4.9	300m	No
Power	OHX002	400 kV Network	TW – 10480	Figure 4.10	165m	No
Road	RDX013	R445	TW – 12670	Figure 4.11	40m	No
Road	RDX015	M7 – Carrigatogher	TW – 13050	Figure 4.11	200m	No
Water	WCX016	Nenagh_070	TW – 19450	Figure 4.13	400m	No
Power	OHX003	220 kV Network	TW – 24780	Figure 4.15	120m	Yes
Power	OHX004	220 kV Network	TW – 26170	Figure 4.15	115m	Yes
Road	RDX026	N52 – Ardcrony, County Tipperary	TW – 28840	Figure 4.16	130m	No
Terrain	N/A	BPT	TWA – 0	Figure 4.18	260m	No
Water	WCX026	Little Brosna	TWA – 12880	Figure 4.22	850m	No
Road	RDX044	N62	TWA – 14100	Figure 4.22	30m	Yes
Power	OHX005	38 kV Network	TWA – 21650	Figure 4.25	100m	Yes
Water	WCX031	Breaghmore	TWA – 25950	Figure 4.26	500m	No
Water & Road	WCX032 & RDX053	Camcor and R440	TWA – 27540	Figure 4.27	110m	No
Power	OHX006	110 kV Network	TWB – 1700	Figure 4.27	280m	No
Power	OHX007	110 kV Network	TWB – 11210	Figure 4.33	200m	No
Water	WCX036	Silver	TWB – 12530	Figure 4.33	380m	No
Water	WCX039	Clodiagh (Tullamore)	TWB – 24770	Figure 4.37	90m	No
Power	OHX008	38 kV Network	TWB – 27760	Figure 4.38	240m	No
Road	RDX071	N80	TWC – 90	Figure 4.38	100m	Yes
Rail	RYX005	Railway – Galway Service	TWC – 4780	Figure 4.39	340m	No

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Approximate Distance to Nearest NSL	Under Construction Duration Thresholds
Road	RDX077	L1020	TWC – 8920	Figure 4.40	35m	No
Power	OHX024	38 kV Network	TWC – 11740	Figure 4.41	400m	No
Water	WCX056	Figile	TWD – 4120	Figure 4.46	400m	No
Water	WCX057	Figile	TWD – 6390	Figure 4.47	2500m	No
Water	WBX078	Grand Canal	TWD – 14990	Figure 4.49	380m	No
Power	OHX009	110 kV Network	TWD – 15460	Figure 4.49	460m	No
Power	OHX010	38 kV Network	TWD – 15660	Figure 4.50	500m	No
Power	OHX011	38 kV Network	TWD – 22260	Figure 4.51	360m	No
Power	OHX012	110 kV Network	TWD – 25700	Figure 4.53	140m	Yes
Power	OHX013	110 kV Network	TWD – 29260	Figure 4.54	100m	Yes
Power	OHX014	110 kV Network	TWE – 2760	Figure 4.56	280m	No
Power	OHX015	220 kV Network	TWE – 2840	Figure 4.56	280m	No
Power	OHX016	220 kV Network	TWE – 5240	Figure 4.56	160m	Yes
Power	OHX017	220 kV Network	TWE – 6190	Figure 4.57	180m	No
Road	RDX107	R403	TWE – 8380	Figure 4.57	110m	No
Water, Road & Power	WCX076, WCX073, RDX108 and OHX018	Unnamed Watercourse, Liffey River, Ardrass Road and 110 kV Network	TWE – 9530	Figure 4.58	110m	No
Power	OHX019	38 kV Network	TWE – 10110	Figure 4.58	540m	No
Rail	RYX006	Dublin – Newbridge railway line	TWE – 12280	Figure 4.59	190m	No
Water	WBX088	Grand Canal	TWE – 14100	Figure 4.59	510m	No
Terrain	N/A	Yard	TWE – 15300	Figure 4.59	90m	No

222. Due to the potential for a significant effect to occur at NSLs within 220m of trenchless crossings during night-time periods, the design team has undertaken a further assessment of the above list. This assessment determines which crossings have NSLs within 220m which will experience noise levels above the CNT and which crossings exceed the duration outlined in Section 6.2.6.1.3. If NSLs are within 220m but the duration of the works is confirmed to be below the threshold for significance, they will not have a significant effect. Table 6.47 below outlines the crossings assessed for night-time works from trenchless crossings on this basis.

Table 6.47: Night-Time Noise Assessment Locations for Construction by Trenchless Construction Techniques

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Approximate Distance to Nearest NSL	No. of NSLs within Significant to Very Significant effect	No. of NSLs within Moderate to Significant effect
Road	RDX001	R494 and steep terrain	RW – 810	Figure 4.7	20m	4	4
Terrain	N/A	Steep side slope	TW – 3520	Figure 4.8	100m	3	3
Road	RDX007	M7 – Kilnacranna	TW – 5460	Figure 4.9	145m	0	1
Power	OHX002	400 kV Network	TW – 10480	Figure 4.10	165m	0	1
Road	RDX013	R445	TW – 12670	Figure 4.11	40m	6	1
Road	RDX015	M7 – Carrigatogher	TW – 13050	Figure 4.11	200m	0	1
Road	RDX026	N52 – Ardcrony, County Tipperary	TW – 28840	Figure 4.16	130m	1	2
Water & Road	WCX032 & RDX053	Camcor and R440	TWA – 27540	Figure 4.27	110m	2	2
Water	WCX039	Clodiagh (Tullamore)	TWB – 24770	Figure 4.37	90m	2	0
Road	RDX077	L1020	TWC – 8920	Figure 4.40	35m	2	1
Power	OHX017	220 kV Network	TWE – 6190	Figure 4.57	180m	0	3
Road	RDX107	R403	TWE – 8380	Figure 4.57	110m	1	0
Water, Road & Power	WCX076, WCX073, RDX108 and OHX018	Unnamed Watercourse, Liffey River, Ardrass Road and 110 kV Network	TWE – 9530	Figure 4.58	110m	1	1
Rail	RYX006	Dublin - Newbridge railway line	TWE – 12280	Figure 4.59	190m	0	2
Terrain	N/A	Yard	TWE – 15300	Figure 4.59	90m	2	1

223. A review of the nearest NSLs to each site confirms that construction activities could occur within 140 metres of NSLs at 10 trenchless crossing locations. These activities are expected to have a Significant to Very Significant effect on 24 NSLs located within that 140m range. Additionally, 15 NSLs situated between 140m and 220m from these same crossings would experience a Moderate to Significant effect (effect is significant).

224. There are also five other crossing locations where NSLs are located beyond 140m but within 220m of the works. At these sites, construction activities are expected to have a Moderate to Significant effect (effect is significant) on eight NSLs.

225. The total number of NSLs experiencing a Significant to Very Significant effect (effect is significant) in relation to night-time trenchless crossings is 24 and the number of NSLs experiencing a Moderate to Significant effect (effect is significant) is 23.

226. Due to the risk of significant noise effects associated with night-time works at trenchless crossing locations, mitigation measures are required to control construction activities within the recommended thresholds. The extent of mitigation will be dependent on the distance from the plant to the NSLs and the duration of the proposed works. Where NSLs are within 140m to the construction works, noise monitoring would be required to determine the noise emissions at the NSLs and may help to evaluate the

effectiveness of various mitigation measures. Mitigation measures are outlined in Section 6.5. The locations of effected NSLs are further explored within Section 6.6.

6.4.2.1.13 Directional Drilling Locations

227. In addition to night-time tunnelling, there would also be directional drilling during the night-time hours for the provision of power connections along the Proposed Project. Table 6.48 provides indicative calculations at various distances from the directional drilling.

Table 6.48: Predictive Noise Calculations for Directional Drilling

Phase	Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Construction Noise Level at closest NSL dB $L_{Aeq,T}$									
		30m	35m	50m	70m	80m	100m	145m	200m	250m	300m	350m
Directional drilling (Table C.6, Item Ref: 35)	86	72	70	67	63	61	59	55	51	49	47	45

228. As indicated in Table 6.48, there is the potential for an exceedance of the daytime construction threshold at distances up to 35m and an exceedance of the night-time construction threshold at distances up to 350m.

229. Table 5.28 within Chapter 5 (Construction & Commissioning) identifies the locations where directional drilling is proposed. This table is adapted below in Table 6.49 with the addition of the approximate distance of these works to the nearest NSL.

Table 6.49: Location of Directional Drilling for Power Connections

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Distance to Nearest NSL
Rail	RYX003	Railway – Limerick via Nenagh Service	Power connection along R494	Figure 4.6	145m
Rail	RYX004	Railway – Limerick via Nenagh Service	Power connection along R445	Figure 4.7	77m
Water	WCX001	Kilmastulla	Power connection along R445	Figure 4.7	80m
Water	WCX077	Kilmastulla	Power connection along R494	Figure 4.7	70m
Road	RDX117	Birdhill Roundabout (R445)	Power connection off the roundabout on the R445	Figure 4.6	66m
Road	RDX118	Birdhill Roundabout	Power connection at roundabout	Figure 4.6	66m
Road	RDX119	Birdhill Roundabout (R494)	Power connection off the roundabout on the R494	Figure 4.6	36m
Road	RDX120	R494	Power connection at interface of R494 and access road to RWI&PS	Figure 4.7	52m
Road	RDX121	R445	Power connection at interface of R445 and access road to WTP	Figure 4.7	75m

230. A review of these locations indicates that there is potential for construction activities to occur at distances less than 350m at all nine directional drilling locations. The closest of these directional drilling locations to a NSL is at crossing RDX119, in which instance, works would occur within 36m of the NSL.

231. Directional drilling that occurs during the daytime hours would exceed the daytime CNT at distances up to 35m. There are no NSLs within 35m of any directional drilling location. In the absence of specific mitigation, the daytime effects at all NSLs would be temporary, negative and Slight to Moderate (effect is not significant).

232. Directional drilling that occurs during the night-time hours has been confirmed by the design team as being below a duration where there is the potential for significant effects to occur in line with the criteria outlined in Section 6.2.6.1.3. Therefore based on the duration of the works not exceeding the DMRB LA 111 (Highways England 2020) duration thresholds outlined within Section 6.2.6.1.3 the resultant effect at NSLs during these construction activities is expected to be temporary, negative, and Not Significant (effect is not significant).

233. However, whilst being below the duration thresholds where a significant effect will occur directional drilling at night will still likely give rise to elevated levels of noise above the adopted CNT at NSLs within 350m.

234. Due to the risk of elevated noise levels associated with night-time works at directional drilling locations, mitigation measures will be required for the duration of the proposed works. Mitigation measures are outlined in Section 6.5.

6.4.2.1.14 Construction Traffic on Public Roads

235. Traffic data in relation to the Proposed Project have been reviewed to assess the likely significant noise effects associated with peak construction traffic on the local road network. The information presented in Chapter 7 (Traffic & Transport) has been used to inform this aspect of the assessment.

236. For the purpose of assessing likely significant noise effects, it is appropriate to consider the relative increase in noise level associated with traffic movements on the local road networks and Haul Roads used during the construction of the Proposed Project using the Annual Average Daily Traffic (AADT).

237. Calculations have been undertaken to determine the magnitude of change in traffic noise with consideration of the AADT and percentage of HGVs for each of the construction traffic routes provided, with and without construction traffic. If traffic noise levels due to construction traffic are increased by less than 3 dB, then the impacts can be considered minor and the associated effects Not Significant.

238. This review identified a total of 12 routes that are predicted to give rise to increases in traffic noise levels of 3 dB or greater during the period of peak construction traffic associated with the Proposed Project. This peak period relates to the highest flow projected which will typically occur for a duration of between 4 and 28 weeks depending on the specific Haul Road. Figures 7.22 to 7.26 within Chapter 7 (Traffic & Transport) identify the relevant Haul Roads in relation to AADT. Table 6.50 presents the detail of these routes.

Table 6.50: Construction Traffic Assessment Initial Significance Rating

Link Label	Route ID	Do Nothing AADT	% HGV	Construction Peak Do Something AADT	% HGV	Calculated Relative Increase in Traffic Noise Levels (dBA)	Predicted Duration of Peak Construction Traffic along Road Link (Weeks)
J	L1064	308	11%	485	20%	+3.9	9
Q	L4004	1,033	5%	1,233	16%	+4.1	5
R	L8014	288	12%	386	26%	+3.9	9
T	L3003	348	14%	637	26%	+4.7	28
U	L2027	347	10%	525	26%	+4.7	9
X	Unknown Local Road	158	15%	303	29%	+5.2	4
Y	R421	1,251	11%	1,946	28%	+4.9	9
Z	L2002	680	11%	938	21%	+3.4	4
AH	Church Road	1,909	3%	2,110	11%	+3.4	4
AL	R400 SW	1,021	6%	1,581	34%	+7.5	5
AO	L5025	1,691	4%	1,904	12%	+3.4	9
AQ	Unknown Local Road	268	21%	406	40%	+4.2	5

239. The predicted increase in AADT traffic flows associated with the Construction Phase of the Proposed Project is expected to have varying increases in noise level along 12 Haul Roads where a moderate to major change in noise level is determined in line with DMRB. The increases in the traffic noise levels are predominantly due to the HGV numbers associated with the peak construction traffic.

240. The initial determination of potential effects is in the context of the associated change in traffic noise level (see Section 6.2.6.1.4). However, the specific traffic noise level is considered when determining the overall effect. The Haul Roads are located within rural settings and hence to undertake a conservative assessment, the lowest CNT of 65 dB $L_{Aeq,T}$ has been adopted with reference to the ABC criteria from BS 5228-1 (BSI 2014a) within Table 6.4 for construction traffic movements on roads.

241. Calculations have been undertaken to determine the traffic noise associated with construction traffic along the 12 Haul Roads set out in Table 6.50 predicted at a distance of 5m from the roadside. This represents the closest distance a property façade would be from a road edge when considering the road width and is therefore a conservative assumption for assessing the effects along each of the assessed Haul Roads. The assessment is set out in Table 6.51.

Table 6.51: Construction Traffic Assessment Significance against Construction Threshold

Link Label	Route ID (Label)	Calculated Relative Increase in Traffic Noise Levels (dBA)	DMRB Magnitude of Change (Short Term)	Calculated Construction Traffic Noise Level at 5m from Road Carriageway dB $L_{Aeq,12hour}$	EPA EIAR Significance Rating
J	L1064	+3.9	Moderate	57	Slight to Moderate (effect is not significant)
Q	L4004	+4.1	Moderate	60	Slight to Moderate (effect is not significant)
R	L8014	+3.9	Moderate	57	Slight to Moderate (effect is not significant)
T	L3003	+4.7	Moderate	60	Slight to Moderate (effect is not significant)
U	L2027	+4.7	Moderate	59	Slight to Moderate (effect is not significant)
X	Unknown Local Road	+5.2	Major	57	Slight to Moderate (effect is not significant)
Y	R421	+4.9	Moderate	65	Slight to Moderate (effect is not significant)
Z	L2002	+3.4	Moderate	60	Slight to Moderate (effect is not significant)
AH	Church Road	+3.4	Moderate	61	Slight to Moderate (effect is not significant)
AL	R400 SW	+7.5	Major	65	Slight to Moderate (effect is not significant)
AO	L5025	+3.4	Moderate	61	Slight to Moderate (effect is not significant)
AQ	Unknown Local Road	+4.2	Moderate	59	Slight to Moderate (effect is not significant)

242. The predicted increases in traffic flows associated with the Construction Phase of the Proposed Project would result in a subjective audible increase in noise levels along the Haul Roads identified in Table 6.51. Taking into account the change in noise level in the context of the specific construction traffic noise level along these Haul Roads, the overall effect is determined to be short term, negative and Slight to Moderate (effect is not significant). On all other Haul Roads, the effects would be short term, negative and Not Significant (effect is not significant).

6.4.2.1.15 Night-time Construction Traffic on Public Roads

243. During the construction of the Proposed Project, road link BA through Celbridge will only be utilised by construction traffic during the night-time hours at the request of Kildare County Council. This road link is assessed below in Table 6.52 against the criteria within Section 6.2.6.1.4. The peak flow assessed relates to the peak hourly flow during the night-time period of between 06:00 and 07:00 am.

Table 6.52: Night-Time Construction Traffic Assessment Initial Significance Rating

Link Label	Route ID	Do Nothing AADT	% HGV	Construction Traffic Peak Hour Do Something AADT	% HGV	Calculated Relative Increase in Traffic Noise Levels (dBA)	Predicted Duration of Peak Construction along Road Link (Weeks)
BA	R403 Dublin Road	462	5%	526	13%	+3.0	1

244. The predicted increase in traffic flows associated with the Construction Phase of the Proposed Project along Link BA through Celbridge during the assessed peak night-time hour is expected to result in an increase in noise levels of + 3 dB. This increase is classified as a moderate change in accordance with the DMRB. The increase in traffic noise level is primarily attributed to the elevated numbers of HGVs during the assessed peak hour construction traffic period.

245. The initial determination of potential effects is in the context of the associated change in traffic noise level (see Section 6.2.6.1.4). However, the specific traffic noise level must be considered when determining the overall effect. The Haul Road through Celbridge is located within rural settings and hence to undertake a conservative assessment, the lowest CNT for night-time of 45 dB $L_{Aeq,T}$ has been adopted for construction traffic movements on roads with reference to the ABC criteria from BS 5228-1 (BSI 2014a) presented in Table 6.4.

246. Calculations have been undertaken to determine the traffic noise associated with construction traffic along the Haul Road predicted at a distance of 5m from the roadside. This represents the closest distance a property façade would be from a road edge when considering the road width. The assessment is set out in Table 6.53.

Table 6.53: Night-Time Construction Traffic Assessment Significance against Construction Threshold

Link Label	Route ID (Label)	Calculated Relative Increase in Traffic Noise Levels (dBA)	DMRB Magnitude of Change (Short Term)	Calculated Construction Traffic Noise Level at 5m from Road Carriageway dB $L_{Aeq,1hour}$	Significance Rating
BA	R403 Dublin Road	+3.0	Moderate	66	Not Significant based on the duration thresholds within DMRB LA 111 not being exceeded.

247. The predicted increases in traffic flows would result in a subjective audible increase in noise levels along the identified Haul Road where traffic will occur during the night-time identified in Table 6.53.

248. Whilst the change in noise level in the context of the specific construction traffic noise level along this Haul Road is above the adopted construction threshold of 45 dB $L_{Aeq,T}$, the overall effect is determined with reference to the duration thresholds within DMRB LA 111 (Highways England 2020). Due to the peak construction along this Haul Road only taking place for one week and not being above the durations outlined within Section 6.2.6.1.3, the significance of night-time traffic through Celbridge along link BA is determined to be short term, negative and Not Significant (effect is not significant).

249. On all other Haul Roads, night-time construction traffic will be confined to certain construction activities outlined within Chapter 5 (Construction & Commissioning). However, the levels of traffic associated with these works will likely be negligible and the resulting effects from night-time construction traffic would be short term, negative and Not Significant (effect is not significant).

6.4.2.2 Vibration – Piling

250. The potential for elevated levels of vibration at VSLs would arise during construction where piling works are proposed. The primary use of piling would be at the Infrastructure Sites where secant piling, sheet piling and cast concrete piling methodologies would be used in order to construct the foundation of the structures and buildings, in particular at the WTP. In addition, extensive piling would also be required at the RWI&PS including:

- Secant piling for the construction of the intake, pumping station and microfiltration building
- Vibratory sheet piling either side of the intake structure to retain the bank
- Vibratory sheet steel piling to retain the temporary piling platform.

251. Piling would also be likely to occur during the construction of the Proposed Project in areas where peat may be encountered. Appendix A5.3 (Methods of Working in Peat) outlines the various approaches for working within peat. Method 1 techniques would not require the use of piling, however for locations where Methods 2, 3 or 4 are proposed piling has been considered. This is to account for the effects associated with Method 4 techniques, and to allow for any potential variations in the methods used where peat depths are 1m or more for the purposes of a conservative assessment. After an initial review of the Methods 2, 3 and 4, potential receptors were identified and then borehole data on peat depths nearest these properties was reviewed. Where it was not considered likely based on the depth of the measured peat that piling would be required, within sufficiently close proximity of receptors, to create a risk of a vibration level above 1mm/s PPV (i.e. threshold for significant effects for human response – see Table 6.9) those receptors were screened out. Below 1mm/s PPV all likely effects would not be significant.

252. The vibration predictions for pilling were made using the empirical method presented in BS 5228-2, Table E.1 (BSI 2014b). Factor A1.3 was adopted to represent ‘all operations’.

253. Calculations were undertaken to determine the vibration associated with piling for all receptors within 100m. Beyond 100m there would not be the potential for vibration effects at a level that would be likely to be above 1mm/s which is the threshold for a ‘moderate’ effect for human disturbance as defined in Table 6.9. Below 1mm/s PPV all likely effects would not be significant. Table 6.54 sets out the summary of the assessment and identifies those receptors with the potential for a vibration effect above 1mm/s PPV due to piling.

Table 6.54: Piling Vibration Assessment Above 1mm/s PPV for Residential or Business Receptors

Ref	Receptor Type	Approximate Chainage	Piling Requirement	Approximate Distance to Nearest VSL	PPV above 1mm/s	PPV above 8mm/s	Potential for Structural Effect	Potential for Disturbance Effect	DMRB Magnitude of Change (Short Term)	EPA EIAR Significance Rating
VP.1	Business	TWD – 29000	Working in peat method potentially requires use of piled foundations and temporary piling	35	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VP.2	Residential			49	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VP.3	Business			72	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)

6.4.2.2.1 Piling Associated with the Construction of Infrastructure Sites

254. There would be no residential receptors or buildings likely to experience a significant vibration effect due to piling works at the Infrastructure Sites. This is because there would be no receptors in close proximity to those locations. The closest occupied sensitive buildings would be over 70m from any piling works required at the Infrastructure Sites. For example, at the TPR there would be receptors that would be in close proximity to the Planning Application Boundary but there would be no piling works proposed at this site.

255. Based on the prediction methodology used and the 8mm/s PPV threshold for buildings defined in Table 6.8, vibration levels capable of causing cosmetic or structural damage would not occur at distances greater than 15 m from the source. Similarly, disturbance effects on people, from piling above the threshold of 1mm/s PPV would not be likely to occur at distances more than 70m.

256. Based on the distance to the nearest receptor, there would not be any significant disturbance effects from piling at the Infrastructure Sites because the level of vibration would be below 1mm/s PPV (the threshold for a Moderate effect for human disturbance as defined in Table 6.9). This would also mean that there would not be a risk of structural / cosmetic damage to properties due to piling work at the Infrastructure Sites.

257. Consequently, the human disturbance response to piling at the Infrastructure Sites would be a short term, negative, Not Significant to Slight effect and consequently, the effect would not be significant.

258. The secant piling works for the RWI&PS, specifically for the Pumping Station and Microfiltration Building, would be located in close proximity to the Fort Henry Embankment, which is a Category A earthen embankment dam adjacent to Parteen Basin. A review of historic case history data on vibration levels measured during rotary bored piling is presented in Table D.6 of BS 5228-2 (BSI 2014b). The measured levels were made at eight locations at plan distances of between 3.5m and 20m between piling works site and measurement location. The data shows that all measurements made at a distance of between 14m and 20m were below 1.0 mm/s PPV, with a maximum of 0.8 mm/s PPV measured in soil conditions described as fill/sand/clay when installing ‘dolly casing’, rather than augering. The highest measured level was 3.2 mm/s PPV at a distance of 7m and when working in fill/gravel/London clay soil conditions and when ‘driving casing’. Based on the measurement data presented in Table D.6 of BS 5228-2 (BSI 2014b), and the minimum distance of 20m between the secant piling and the embankment, significant effects during piling are not anticipated at the Fort Henry Embankment. In addition to the secant piles, vibratory piles would be used at the Intake Chamber for the retaining walls and for the temporary piling platform. These activities would be further away from Fort Henry Embankment, compared with the secant piling, and the vibration level would be predicted to above 1mm/s PPV but less than 8mm/s PPV (relating to the threshold for a Moderate effect for human disturbance as defined in Table 6.9 and the building response threshold in Table 6.8). There is no threshold in guidance regarding the vulnerability of an earth embankment to vibration. The embankment has historically been subject to slippage, due to a drop in groundwater, and so is known to be vulnerable. However, it does not act as a functioning flood embankment until further from the Planning Application Boundary for the Proposed Project and therefore, further from the proposed piling works. As a result, the vibration effect on the functioning embankment would be closer to the 1mm/s PPV level. On this basis the vibration effect at the Fort Henry Embankment would be temporary, negative and Not Significant. As set out in Chapter 5 (Construction & Commissioning), prior to construction works commencing on-site a monitoring plan for the works will be implemented. This will include:

- Installing, in agreement with ESB, piezometers to monitor groundwater during the Construction Phase and into the Operational Phase of the Proposed Project. These would be connected individually to a modem logger and this would allow the data to be transferred over a mobile phone network to a shared platform for relevant stakeholders
- Ground movement monitoring and vibration monitoring

- Further ground investigation would also be undertaken to inform the detailed design process.

259. The potential for any impacts on the Fort Henry earth embankment will be subject to live risk assessment and a monitoring programme during construction, as described in Section 5.17 of Chapter 5 (Construction & Commissioning) and Section 6.5.2.1.6 to avoid any likelihood of a significant effect.

6.4.2.2.2 Piling Associated with the Construction of the Pipeline in Peat Soils or Poor Material

260. Along the length of the pipeline the locations where piling would be likely, due to ground conditions, specifically peat soils, have been reviewed. Where Methods 2, 3 or 4 are proposed for working in peat, (as defined in Appendix A5.3: Methods of Working in Peat) there would be three VSL where there would be the potential for a significant effect to occur, as set out in Table 6.54. Two of these are business premises and one of these is residential.

261. The nearest of the VSL in Table 6.54 would be 35m to the south of an area of the pipeline where Method 2 is indicated to take place at chainage TWD – 29000. One other property would be closer than this to potential locations of piling, however, this property is not occupied and so was only assessed for a cosmetic/structural effect. This receptor would be further than 15m from the location of the potential piling and consequently there would not be an impact above 8mm/s PPV (relating to the building response threshold in Table 6.8).

262. The disturbance on the occupiers of the three VSLs reported in Table 6.54 would be temporary, negative and of a Moderate to Significant level and consequently the effect, without specific mitigation (set out in Section 6.5) would be significant, as it would be above 1mm/s PPV.

263. In all other areas along the pipeline where Methods 2, 3 or 4 are proposed, the resulting effect would be temporary, negative and Not Significant to Slight and consequently, the effect would not be significant.

6.4.2.3 Vibration – Rock Breaking

264. During construction works there would be the potential for significant adverse vibration effects on receptors impacted by hydraulic rock breaking. Therefore, rock depths along the length of the pipeline have been reviewed and compared with the proposed vertical alignment of the pipeline in order to identify potential effects.

265. As described in Section 6.2.7, there would be construction flexibility which would allow the pipeline alignment to be raised or lowered within defined levels. However, it is not likely that the pipeline would be lowered where to do so would be to introduce the need to break out rock. The construction flexibility has been allowed for specifically to avoid these types of constraints not to introduce them. Therefore, it is not considered likely that the pipeline would be lowered into a layer of rock, where the indicative alignment would not be within rock, even if the construction flexibility described in Section 6.2.7 would allow for this.

266. The rock breaking vibration predictions were based on the California Department of Transportation (Caltrans) method (Caltrans 2013). The use of a large excavator mounted hydraulic breaker was assumed, a JCB HM380 with 22,469 J impact energy.

267. Calculations have been undertaken to determine the vibration associated with rock break out for all receptors within 100m. Beyond 100m there would not be the potential for vibration effects at a level that would likely be above 1mm/s which is the threshold for a Moderate effect for human disturbance as defined in Table 6.9. Below 1mm/s PPV all likely effects would be at a level that would not be significant. Table 6.55 sets out the summary of the assessment and identifies those receptors with the potential for a vibration effect above 1mm/s PPV due to rock breaking.

Table 6.55: Rock Breaking Vibration Assessment Above 1mm/s PPV for Residential or Business Receptors

Ref	Receptor Type	Approximate Chainage	Rock Breaking Requirement	Approximate Distance to Nearest VSL	PPV above 1mm/s	PPV above 8mm/s	Potential for Structural Effect	Potential for Disturbance Effect	DMRB Magnitude of Change (Short Term)	EPA EIAR Significance Rating
VR.1	Residential	TW – 9500	Excavation for pipeline	28m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.2	Radio Mast and associated Building (2 no. VSL)	TWA – 100	BPT ground re-profiling	7m	Yes	Yes	Yes	N/A	N/A (Structural)	Significant (Structural)
VR.3	Residential	TWC – 2500	Excavation for pipeline	42m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.4	Residential	TWC – 20000		48m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.5	Business	TWC – 20000		35m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.6	Business	TWC – 20000		19m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.7	Residential	TWC – 20000		18m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VR.8	Business	TWC – 20000		32m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)

6.4.2.3.1 Rock Breaking Associated with the Construction of the Infrastructure Sites

268. In general, there would be no residential receptors or buildings likely to experience a vibration effect due to rock breaking at the Infrastructure Sites. This is because there are no receptors in close proximity to those locations.

269. There would be receptors within 50m of the Planning Application Boundary at the TPR on the eastern side, including Peamount Hospital. There is also shallow rock adjacent to these receptors. However, the pipeline and the TPR structures would all be to the west and north-west and would be significantly further away from the receptors such that the construction of these would not result in significant vibration effects on these receptors adjacent to the eastern side of the Planning Application Boundary. In the south-eastern part of the TPR there would be proposed works to support drainage and utility connections. However, given the sensitivity of the receptors adjacent to this area, embedded mitigation has been incorporated into the design of the Proposed Project so that no works would be undertaken that would require rock breaking to be undertaken within the land adjacent to the hospital and other receptors along the eastern side of the site.

270. Therefore, the disturbance to humans from vibration arising at the Infrastructure Sites would be short term, negative and Not Significant to Slight and consequently, the effect would not be significant.

271. At the BPT there is an existing radio mast and associated building on the northern boundary of the site. These buildings are not occupied and so have not been assessed for human disturbance. However, they have been considered for the building response to vibration and the potential for cosmetic or structural effects. The rock break out for the launch of the trenchless crossing would be within 10m of the receptors. Given the close proximity, the predicted effect, without specific mitigation (set out in Section 6.5), would be above the 8mm/s PPV threshold, set out in Table 6.8 for light-framed and potentially vulnerable structures and therefore, would be Significant.

272. Additionally, at the RWI&PS there would be rock break out required for the foundations of the intake and the pumping station that would be located in close proximity to the Fort Henry Embankment, which is a Category A earthen embankment dam adjacent to the Parteen Basin. The vibration level would be above 1mm/s PPV but less than 8mm/s PPV (relating to the threshold for a Moderate effect for human disturbance as defined in Table 6.9 and the building response threshold in Table 6.8). There is no threshold in guidance regarding the vulnerability of an earth embankment to vibration. The embankment has historically been subject to slippage, due to a drop in groundwater, and so is known to be vulnerable. However, it does not act as a functioning flood embankment until further from the Planning Application Boundary for the Proposed Project and therefore, further from the proposed rock breaking works. As a result, the vibration effect on the functioning embankment would be closer to 1mm/s PPV and so the vibration effect at this receptor would be temporary, negative and Not Significant.

6.4.2.3.2 Rock Breaking Associated with the Construction of the Pipeline

273. Along the route of the pipeline the closest sensitive buildings to the rock breaking works would be approximately 7m, however, this building is unoccupied and so was only assessed for a cosmetic/structural effect. It was determined that there would not be an impact above 8mm/s PPV (the relevant threshold for building response set out in Table 6.8) and therefore, it is not reported in Table 6.55. For the receptors that are reported in Table 6.55, the predicted effects would not be above the building response threshold of 8mm/s PPV, as set out in Table 6.8, either. Consequently, the impact to buildings and structures for this activity would be short term, negative and Not Significant in terms of building response.

274. The vibration magnitudes would, however, be above a level which would cause disturbance to occupants of buildings, at these distances from the works, for seven properties (four residential, three business). It would be above 1mm/s PPV but below 10mm/s PPV (the relevant thresholds as defined in Table 6.9 for

human disturbance). Based on the criteria in Table 6.9, the effect in relation to vibration from rock breaking would be short term, negative and Moderate to Significant and consequently the effect, without specific mitigation (set out in Section 6.5), would be significant.

6.4.2.4 Vibration – Trenchless Crossings

275. Tunnel boring machines (TBM) and drilling can give rise to appreciable levels of vibration under certain circumstances. BS 5228-2 (BSI 2014b) states that the mechanisms which give rise to the propagation of vibration through media such as soil are complex. The magnitude of vibration is determined by the characteristics of the vibration source, the properties of the excavated ground, and the ground between the vibration source and VSL. Multi-layered soils and/or the presence of deep-piled building foundations can further complicate and modify magnitudes.

276. The impact of groundborne vibration from the TBM would be transient in nature. It would therefore be within range of any particular location for a very limited duration. The implementation of a consultation and public relations programme and thresholds for groundborne vibration in advance of the works would form part of the mitigation and monitoring programme for the Proposed Project to inform all adjacent properties of the works programme.

277. As set out in Table 6.46, there would be a number of trenchless crossings that would be under the construction duration threshold for 10 or more days or nights in any 15 consecutive days or nights and so there would not be significant effects as a result of disturbance on humans from these trenchless crossings. These crossings were assessed in order to identify whether there could be the potential for structural effects on buildings.

278. The vibration and groundborne noise predictions for mechanised bored tunnelling as part of trenchless construction technique were made using empirical methods presented in BS 5228-2, Table E.1 (BSI 2014b).

279. Calculations have been undertaken to determine the vibration associated with trenchless crossing for receptors within 100m. Beyond 100m there would not be the potential for vibration effects at a level that would be likely to be above 1mm/s which is the threshold for a Moderate effect for human disturbance as defined in Table 6.9. Below 1mm/s PPV all likely effects would not be significant. Table 6.56 sets out the summary of the assessment and identifies those receptors with the potential for a vibration effects above 1mm/s PPV due to trenchless crossings.

280. The closest buildings to a proposed trenchless crossing would be at the BPT. This is the same radio mast and associated building as considered for the rock breaking effect in Section 6.4.2.3. These activities (the trenchless crossing and the rock breaking) would not occur at the same time, in proximity to the receptors, and so there would not be the potential for a cumulative effect. The horizontal distance between the trenchless crossing and the buildings would be less than 10m, however, the trenchless crossing would be more than 10m below ground, and therefore, the combined distance between the source of the vibration and the receptor (vertical and horizontal) would mean the predicted vibration level would be below 8mm/s PPV and therefore, there would not be a structural/cosmetic effect on these receptors.

281. There would be two VSLs that would experience potential vibration effects at a level that would be significant, as reported in Table 6.56. These two residential properties would experience potential vibration effects above 1mm/s PPV but below 10mm/s PPV (the relevant thresholds as defined in Table 6.9 for human disturbance). No structural/cosmetic damage would occur for these buildings as the vibration would be below 8mm/s PPV building response threshold, as set out in Table 6.8,. However, the occupants of buildings, the human receptors, may experience disturbance due to vibration at these distances. Based on the criteria in Table 6.9, the effect in relation to vibration from trenchless construction techniques would be short term, negative and Moderate to Significant and consequently the effect, without specific mitigation (set out in Section 6.5), would be significant.

Table 6.56: Trenchless Construction Technique Vibration Assessment Above 1mm/s PPV for Residential or Business Receptors

Ref	Receptor Type	Approximate Chainage	Trenchless Crossing Requirement	Approximate Distance to Nearest VSL	PPV above 1mm/s	PPV above 8mm/s	Potential for Structural Effect	Potential for Disturbance Effect	DMRB Magnitude of Change (Short Term)	EPA EIAR Significance Rating
VT.1	Residential	RW – 1000	RWRM crossing	13m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)
VT.2	Residential	TWC – 9000	Geashill crossing	22m	Yes	No	No	Yes	Moderate (Human)	Moderate – Significant (Human) (effect is significant)

6.4.3 Summary of Construction Phase

282. Table 6.57Table 6.57: provides a summary of the likely effects from noise and vibration during construction. In the absence of mitigation measures, there is the potential for significant noise effects from the construction of the proposed temporary infrastructure sites, TPR, road construction, directional drilling and night-time trenchless crossings. There are also potential significant effects from vibration on VSLs close to piling, rock breaking, and trenchless crossing activities.

Table 6.57: Summary of the Likely Effects from Noise and Vibration During Construction

Element	Pre-Mitigation				
	Duration of Effects	Quality of Effects	Significance of Effects	NSLs Affected	Description of Likely Effects
Temporary Infrastructure	Temporary	Negative	Significant to Very Significant	Four NSLs - Significant to Very Significant Seven NSLs - Moderate to Significant (effect is significant)	Construction works related to the Construction Compounds and Pipe Storage Depots can cause significant effects within 50m of these sites. There is one Construction Compound and five Pipe Storage Depots with NSLs within this range. Significant to Very Significant effects occur at NSLs within 30m of the construction works. Beyond 30m but within 50m, the effect reduces to Moderate to Significant (effect is significant), with NSLs beyond 50m experiencing a Slight to Moderate effect (effect is not significant).
Proposed 38kV Uprate Works and Power Connections	Brief to Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Works at closest position to NSLs for no more than three days not triggering duration required for a Significant effect.
RWI&PS	Short term	Negative	Not Significant	All NSLs Not Significant	Nearest NSL approximately 600m from works resulting in a Not Significant effect.
WTP	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 300m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate effect (effect is not significant).
BPT	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 280m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate effect (effect is not significant).
BPS	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 260m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate effect (effect is not significant).
FCV	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 130m from works, construction noise levels within CNT resulting in a Slight to Moderate effect (effect is not significant).
TPR	Short term	Negative	Moderate to Significant (effect is significant)	Two NSLs at northern perimeter of Peamount Hospital	Nearest NSLs are within 35m of the works and Moderate to Significant effects (effect is significant) relate to the buildings to the north of Peamount Hospital. At all other NSLs which are beyond 70m from the works, the predicted effect would be Slight to Moderate (effect is not significant).
Road construction	Temporary	Negative	Moderate to Significant (effect is significant)	Two NSLs at south-west perimeter of Peamount Hospital	Moderate to Significant effect (effect is significant) predicted at two NSLs within 30m of road construction. All NSLs beyond this would experience a Slight to Moderate effect (effect is not significant).

Element	Pre-Mitigation				
	Duration of Effects	Quality of Effects	Significance of Effects	NSLs Affected	Description of Likely Effects
Pipeline	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	All NSLs at distances beyond where a significant effect will occur resulting in a Slight to Moderate effect (effect is not significant). Piling associated with the pipeline would result in a Slight to Moderate effect (effect is not significant).
Pipeline (piling along pipeline)	Temporary	Negative	Moderate to Significant (effect is significant)	One NSL to the south of a Method 2 working area is Moderate to Significant (effect is significant)	One identified NSL within 50m of the works to the south of a Method 2 working area between chainages TWB – 24500 and TWB – 25000 which will result in a Moderate to Significant (effect is significant). All other NSLs beyond distances where a significant effect is likely to occur.
Pipeline (night-time working at open-cut crossings)	Temporary	Negative	Not Significant	Not Significant at all NSLs due to duration of works. However, mitigation to be employed in order to reduce night-time noise levels	Night-time works at open-cut crossings will result in elevated noise levels above the adopted CNT, however they will occur for durations below that of which a significant effect will occur. Resultant effect is Not Significant, however mitigation outlined within Section 6.5 will be implemented to reduce works taking place within night-time periods.
Daytime works at trenchless crossings	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	CNT not exceeded during the daytime hours resulting in a Slight to Moderate effect (effect is not significant).
Night-time works at trenchless crossings	Temporary	Negative	Significant to Very Significant	24 NSLs - Significant to Very Significant 23 NSLs - Moderate to Significant effect (effect is significant)	Significant to Very Significant effect at 10 crossings with 24 NSLs within 140m of works. Moderate to Significant effect (effect is significant) at 13 crossings with 23 NSLs between 140 and 220m of works. At all remaining crossings, NSLs would experience a Slight to Moderate effect (effect is not significant). Potential for a temporary, negative and Significant effect.
Daytime works at directional drilling locations	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	No directional drilling locations within 35m of NSLs resulting in a Slight to Moderate effect (effect is not significant) at all NSLs.
Night-time works at directional drilling locations	Temporary	Negative	Not Significant	Not Significant at all NSLs due to duration of works. However, mitigation to be employed in order to reduce night-time noise levels	Night-time directional drilling will result in elevated noise levels above the adopted CNT, however it is confirmed that it will occur for durations below that of which a significant effect will occur. Resultant effect is Not Significant, however mitigation outlined within Section 6.5 will be implemented to reduce night-time directional drilling noise.
Construction traffic	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	All identified links would have a Slight to Moderate effect (effect is not significant) as the predicted noise level would be below the adopted CNT.
Vibration (piling – buildings)	Short term	Negative	Not Significant	Not Significant at all VSLs	The effect of piling works would occur at distances where the effect to buildings is deemed Not Significant because it would be below 8mm/s PPV.

Element	Pre-Mitigation				
	Duration of Effects	Quality of Effects	Significance of Effects	NSLs Affected	Description of Likely Effects
Vibration (piling – human response)	Short term	Negative	Moderate to Significant (effect is Significant)	Three VSLs	Piling works would occur at distances where the effect on humans would be above 1mm/s PPV (but below 10mm/s PPV) and would be Moderate to Significant (effect is Significant).
Vibration (rock breaking – buildings)	Permanent	Negative	Significant	Two VSL	Rock breaking works would occur at distances where the effect to buildings could be above 8mm/s PPV and would be Significant.
Vibration (rock breaking – human response)	Short term	Negative	Moderate to Significant (effect is significant)	Seven VSLs affected	Rock breaking works would occur at distances where the effect on humans would be above 1mm/s PPV (but below 10mm/s PPV) and would be Moderate to Significant (effect is Significant).
Vibration (trenchless construction techniques – buildings)	Short Term	Negative	Not Significant	Not Significant at all VSLs	Trenchless works would occur at distances where the effect to buildings is deemed Not Significant because it would be below 8mm/s PPV.
Vibration (trenchless construction techniques – human response)	Short term	Negative	Moderate to Significant (effect is significant)	Two VSLs	Trenchless works would occur at distances where the effect on humans would be above 1mm/s PPV (but below 10mm/s PPV) and would be Moderate to Significant (effect is Significant).

6.4.4 Operational Phase

6.4.4.1 Noise

6.4.4.1.1 Proposed 38 kV Uprate Works and Power Connections

283. In relation to the proposed 38 kV Uprate Works and power connections, the operation of both the uprated line and power connections would not be expected to emit any noise that would be perceptible at nearby NSLs.

284. Operational Phase noise that may occur from power lines can be characterised as buzzing, humming or crackling sounds which are associated with ‘corona noise’. A research document published titled Literature Review and Evidence Based Field Study on the Noise Effects of High Voltage Transmission Development (EirGrid 2016) found that corona noise only becomes a significant issue at higher voltages i.e. 350–500 kV and above and is unlikely for 110 kV and 220 kV transmission lines.

285. Furthermore, the phenomenon is less likely with new components as it can be associated with dirty, damaged, or cracked insulators. Any noise of this nature associated with the proposed 38 kV Uprate Works is considered to form part of the existing noise environment. It is not possible to predict corona noise from the operation of the line, however, based on research within the EirGrid document it is considered that audible corona noise is unlikely to be associated with the Proposed Project. In this instance, the Operational Phase noise impact from the proposed 38 kV Uprate Works would be neutral.

286. Once constructed and operational, it is anticipated that any noise generated by the power line would not be audible at any NSL and the baseline noise environment is expected to remain unchanged. The associated effects would therefore be neutral, long term, and Imperceptible (effect is not significant).

6.4.4.1.2 Pipeline

287. The pipeline, including Line Valves, Washout Valves and Air Valves, once constructed, would not generate any significant noise in the Operational Phase. The associated effects would therefore be neutral, long term, and Imperceptible (effect is not significant).

6.4.4.1.3 Building Services Noise

288. All of the Infrastructure Sites within the Proposed Project have the potential to generate noise during the Operational Phase. This is due to mechanical plant items that would be required to serve the processes carried out within each site.

289. There would be several plant items associated with the operation of the RWI&PS, WTP and BPS. Most of the plant would have the ability to generate noise to some degree. Noisy plant items located externally would potentially have the greatest impact on the receiving environment. At the BPT, TPR and FCV the only items of external plant likely to generate noise to the receiving environment is the proposal for both solar and Battery Energy Storage System (BESS) located at each site.

290. Table 6.10 outlines the proposed operational noise criteria for the Infrastructure Sites to be achieved at all NSLs. For the purposes of this assessment, the operational noise has been assessed against the period with the most stringent criterion (i.e. the night-time criterion of 35 dB $L_{Aeq,T}$ set out in Table 6.10).

291. Noise from any operational plant items associated with the Proposed Project would be designed and/or controlled so as not to give rise to likely significant effects at the nearest NSLs. Furthermore, plant items would not emit significant tonal or impulsive characteristics that would be audible at any NSL.

292. The relationship between operational noise levels and the levels at the nearest NSLs would ultimately depend on the location and sound power noise emissions of on-site plant. At the detailed design phase of the Proposed Project, mechanical plant items will be designed such that the cumulative noise does not exceed the criteria outlined in Section 6.2.6.3. Typical noise mitigation measures that will be employed to keep the building services plant emissions below the prescribed limits are outlined in Section 6.5.2.3.

293. Noise prediction models have been generated to assess the potential operational noise associated with the Infrastructure Sites. The locations, preliminary layouts and types of operational plant have been considered in the calculations. In the absence of specific noise data for the items of plant within each of the Infrastructure Sites, a series of conservative assumptions have been made in relation to the assessment. Appendix A6.4 (Noise Modelling Details and Assumptions) outlines the assessment assumptions and calculation methodology data used for the operational noise models of the Infrastructure Sites. Commentary on the three sites and their predicted associated operational noise is presented in the following sections.

RWI&PS Operational Noise

294. There are three main buildings within the RWI&PS site that house mechanical plant with the potential to emit noise to the surrounding environment. In addition, the site has provision for a 20 kV electricity substation and power distribution building. A noise model for the site has been produced considering the positions of the buildings on-site as well as the electricity substation and the likely breakout noise to the surrounding environment. Noise prediction calculations assume that all plant would operate continuously, 24 hours per day. Figure 6.6 presents the predicted 24-hour operational noise contours for the RWI&PS.

295. The operational noise related to the RWI&PS is predicted to produce noise levels during the night-time period at the closest NSL, approximately 600m away, in the order of 29 dB $L_{Aeq,8hr.}$ This level is below the thresholds presented within Table 6.11 and in line with the measured night-time noise background levels at survey location N1 which is the closest survey location representative of the nearest NSL. This indicates that the significance of effects related to the operational noise of the RWI&PS would be long term, negative and Not Significant.

WTP Operational Noise

296. The WTP site is situated approximately 300m from the nearest NSL and has several buildings and processes within the site that house mechanical plant with the potential to emit noise to the surrounding environment. In addition, the site has provision for a 38 kV electricity substation, switch gear building and external pumping stations. A noise model for the site has been produced considering the buildings and plant on-site as well as the electricity substation. Figure 6.7 presents the predicted noise contours for the WTP.

297. The WTP is predicted to produce operational noise levels at the closest NSL in the order of 35 dB $L_{Aeq,8hr}$ during the night-time period. This level is in line with the thresholds presented within Table 6.11.

298. Whilst the predicted level is in line with the thresholds set within Table 6.11, the calculations undertaken are conservative and are based on the assumptions outlined in Appendix A6.4 (Noise Modelling Details and Assumptions).

299. At the WTP, the significance of effects related to the operational noise would be long term, negative and Not Significant.

BPT Operational Noise

300. The BPT site is located approximately 280m from the nearest NSL. It includes provisions for both solar infrastructure and BESS, which have the potential to generate noise to the surrounding environment. A noise model has been developed for the site, incorporating the buildings within the site and the proposed solar and BESS installations. Figure 6.9 illustrates the predicted noise contours for BPT.

301. During the night-time assessment period, the BPT is predicted to generate operational noise levels of approximately 30 dB $L_{Aeq,8hr}$ at the nearest NSL. This level falls below the thresholds outlined in Table 6.11. The BPT would therefore operate within acceptable noise limits, resulting in a long-term, negative, and Not Significant effect.

BPS Operational Noise

302. The BPS site is situated approximately 260m from the nearest NSL and has one main building within the site that houses mechanical plant with the potential to emit noise to the surrounding environment. In addition, the site has provision for a 38 kV electricity substation. A noise model for the site has been produced considering the buildings on-site and the electricity substation. Figure 6.8 presents the predicted noise contours for the BPS.

303. The BPS is predicted to produce operational noise levels during the night-time period at the closest NSL in the order of 34 dB $L_{Aeq,8hr}$. This level is below the thresholds presented within Table 6.11. The BPS would operate within the noise thresholds within Table 6.11 indicating a long-term, negative and Not Significant effect.

FCV Operational Noise

304. The FCV site lies approximately 130m from the closest NSL. Whilst most of the sites operational plant is housed internally or situated below ground level, the site also includes solar and BESS components that may contribute to environmental noise. A noise model has been prepared, taking into account the site layout and the inclusion of solar and BESS infrastructure. Figure 6.10 presents the predicted noise contours for FCV.

305. Predicted operational noise levels during the night-time period at the nearest NSL are approximately 32 dB $L_{Aeq,8hr}$. These levels are within the thresholds defined in Table 6.11. The FCV would therefore operate within the adopted operational limits, resulting in a long-term, negative, and Not Significant effect.

TPR Operational Noise

306. The TPR site is situated north of Peamount Hospital, approximately 15m from the nearest NSL. The site layout indicates that any plant with the potential to emit noise to the external environment is located within the northern section of the site. A noise model has been developed to reflect the site layout and the proposed solar and BESS installations. Figure 6.11 shows the predicted noise contours for TPR.

307. Operational noise levels during the night-time period are predicted to be around 31 dB $L_{Aeq,8hr}$ at the closest NSL. These levels are within the thresholds specified in Table 6.11. As such, the TPR would operate within the adopted operational noise limits, indicating a long-term, negative, and Not Significant effect.

6.4.4.1.4 Car Parking

308. There would be facilities for car parking and vehicular access to the Infrastructure Sites. Car parking facilities would be provided by means of surface level spaces located around the site. Given the distance from the site car parking facilities to NSLs and typical noise levels from car parks during peak periods, the likely noise impact of car parking activities on the local environment would be minor.

309. The associated effects would therefore be long term, negative and Not Significant.

6.4.4.1.5 Additional Vehicular Traffic on Public Roads

310. The nature of the Proposed Project is such that the additional traffic generated during the Operational Phase would primarily relate to the employee and personnel vehicle movements between shift changes and also the transportation of sludge from the WTP.

311. For a significant effect to occur, an increase of +3 dB in traffic noise levels would have to occur. The operation of the Proposed Project would not generate sufficient traffic to result in an increase of + 3 dB or more on all of the assessed links and would therefore result in a negligible to minor impact when assessed against Table 6.12.

312. Traffic associated with the operational movements on the roads surrounding the Infrastructure Sites has been assessed in Table 6.58 against the assessment criteria in Table 6.12.

Table 6.58: Operational Traffic Assessment Significance

Link Label	Route ID	Do Nothing 2032 Opening Year AADT	% HGV	Do Something 2032 Opening Year AADT	% HGV	Calculated Relative Increase in Traffic Noise Levels (dBA)	EPA Significance of Effect with Change in Traffic Noise Level
B	R494 NNW	4,371	8%	4,405	8%	0.0	Imperceptible (effect is not significant)
C	R445	3,937	12%	4,215	17%	+1.4	Not Significant
K	L1064	313	11%	335	11%	0.1	Imperceptible (effect is not significant)
U	L3003	354	14%	360	14%	0.0	Imperceptible (effect is not significant)
BE	R120 Main Street	14,262	5%	14,284	5%	0.0	Imperceptible (effect is not significant)
BF	L2008N	3,681	9%	3,683	9%	0.0	Imperceptible (effect is not significant)

313. The associated effects in relation to operational traffic movements would therefore be long-term negative and Imperceptible (effect is not significant) to Not Significant (effect is not significant) for the roads identified within Table 6.58. The roads identified in Table 6.58 are the only roads within the Proposed Project area where an increase in traffic has been identified in relation to the operation of the Proposed Project.

6.4.5 Summary of Operational Phase

314. Table 6.59 provides a summary of the likely effects from noise and vibration during operation. There are no likely significant noise effects from the operation of the Proposed Project.

Table 6.59: Summary of the Likely Effects from Noise During the Operational Phase

Element	Pre-Mitigation		
	Duration of Effects	Quality of Effects	Significance of Effects
Proposed 38 kV Uprate Works	Long term	Neutral	Imperceptible (effect is not significant)
Pipeline	Long term	Neutral	Imperceptible (effect is not significant)
RWI&PS	Long term	Negative	Not Significant (effect is not significant)
WTP	Long term	Negative	Not Significant (effect is not significant)
BPT	Long term	Negative	Not Significant (effect is not significant)
BPS	Long term	Negative	Not Significant (effect is not significant)
Car parking	Long term	Negative	Not Significant (effect is not significant)
Traffic	Long term	Negative	Imperceptible to Not Significant (effect is not significant)

6.5 Mitigation and Monitoring Measures

6.5.1 Embedded Mitigation

315. The environment team has worked in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the Proposed Project design. This is referred to as embedded (or design) mitigation. Embedded mitigation is inherent to the Proposed Project design, and forms part of the project description and construction methodology described in Chapters 4 (Proposed Project Description) and 5 (Construction & Commissioning) of the EIAR. As such, embedded mitigation is considered in the assessment of pre-mitigation effects in Section 6.4. Chapter 3 (Consideration of Reasonable Alternatives) of the EIAR details the reasonable alternatives that have been considered throughout the design development of the Proposed Project, including the environmental factors which have influenced the decision making.

316. The following has been adopted as embedded mitigation for the Construction and Operational Phases of the Proposed Project:

- Selection of Haul Roads to avoid sensitive settlements, in agreement with Local Authorities (see Chapter 7: Traffic & Transport)
- Site selection during optioneering avoided dense settlements with high numbers of NSLs
- Restriction of night-time HGV movements at trenchless crossings and directional drilling locations
- Restriction of night-time circular sawing at trenchless crossing locations
- Construction duration of all directional drilling locations being below the construction duration thresholds within Section 6.2.6.1.3
- Construction duration of identified trenchless crossings being below the construction duration thresholds within Section 6.2.6.1.3
- Restriction on where rock breaking activities can be undertaken at the TPR. Rock breaking cannot be undertaken between the permanent access road and the Planning Application Boundary within the south-eastern corner of the site adjacent to sensitive receptors. Proposed utility works relocated to avoid the need for rock break out for these works.

6.5.2 Specific Mitigation and Monitoring Measures

317. Specific mitigation measures are outlined below to prevent or reduce significant adverse effects. Where appropriate, consideration has been given to the appropriateness of monitoring measures, the purpose of which is to check that the mitigation measures required to prevent or reduce significant adverse effects are delivered and perform as intended, in accordance with the requirements of the EIA Directive.

318. General standard, good practice mitigation and monitoring measures for noise and vibration are described in Section 6.5.2.1 and are included in the Noise and Vibration Management Plan, part of the Construction Environmental Management Plan (CEMP) which has been produced to support this EIAR (refer to Appendix A5.1). Sections 6.5.2.2 and 6.5.2.3 then describe how these measures would be specifically applied to the construction and operation activities of the Proposed Project assessed in this chapter. Specific mitigation measures are included in the Register of Environmental Actions and Commitments, which forms part of the CEMP (Appendix A5.1).

6.5.2.1 Construction Phase Mitigation

319. The contract documents will clearly specify that the appointed Contractor undertaking the construction works will be obliged to take specific noise abatement measures where necessary and comply with the recommendations of BS 5228-1 (BSI 2014a) and the European Communities (Noise Emission by Equipment for Use Outdoors) (Amendment) Regulations, 2006.

320. Various mitigation measures will be applied (where appropriate) during the construction of the Proposed Project. The specific details will be set out in the Construction Noise and Vibration Management Plan to be adopted by the appointed Contractor. Specific examples of such measures are offered in the following sections.

6.5.2.1.1 Selection of Quiet and Low Vibration Plant

321. The potential for any item of plant to generate noise will be assessed by the contractor prior to the item being brought onto the site. Wherever practicable, the quietest available plant will be selected to minimise noise emissions. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not the item can be replaced with a quieter alternative.

322. For static plant such as compressors and generators used at work areas such as construction site compounds, the units will be supplied with manufacturers' proprietary acoustic enclosures where feasible.

323. The appointed Contractor will evaluate the choice of excavation, piling, breaking or other working method taking into account various ground conditions and site constraints. Where practicable and available, alternative lower noise generating equipment that will provide the required structural/excavation/breaking results will be selected to reduce potential disturbance.

324. Measures will be taken to reduce as far as reasonably practicable, vibration due to plant and machinery on the site. In terms of piling and rock breaking, low-vibration methods will be selected over percussive-type piling, where ground conditions permit. This piling method substantially reduces the levels of both noise and vibration generated as it is a non-percussive piling technique.

6.5.2.1.2 Noise Control at Source

325. If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control at source. This refers to the modification of an item of plant, the application of improved sound reduction methods in consultation with the supplier, or the good practice use of equipment and materials handling, to reduce noise.

326. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, installation of an acoustic exhaust and/or ensuring enclosure panels are closed during operation can reduce noise levels by up to 10 dB
- Mobile and stationary plant will be switched off when not in use and not left idling (engines, motors, generators, etc.)
- For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy, to replace the normal engine cover
- For percussive tools such as pneumatic and excavator-mounted breakers, a number of noise control measures will be applied, including fitting muffler or sound-reducing equipment to the breaker tool and ensuring any leaks in the air lines are sealed. Erection of localised screens around breaker or drill bits when in operation in close proximity to NSL boundaries are other suitable forms of noise reduction
- For all materials handling, the appointed Contractor will implement best practice site noise control measures including prohibiting materials from being dropped from excessive heights and using drop chutes/dump trucks that are lined with resilient materials. This is an important consideration for site compounds where materials are loaded and unloaded

- Construction site compounds in close proximity to NSLs will incorporate a strict noise control policy relating to materials handling. The layout of noisy items of plant within construction site compounds will be considered as appropriate
- Where compressors, generators and pumps are located in areas in close proximity to NSLs and have the potential to exceed noise criteria, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation
- Resonance effects in panel work or cover plates will be reduced through stiffening or application of damping compounds; rattling and grinding noises will be controlled by fixing resilient materials in between the surfaces in contact
- Demountable enclosures will also be used to screen operatives using hand tools (e.g. pneumatic breakers and circular saws) and will be moved along the linear work area as necessary
- All items of plant will be subject to regular maintenance. Such maintenance will prevent unnecessary increases in plant noise and will serve to prolong the effectiveness of noise control measures.

6.5.2.1.3 Screening

327. Screening is typically an effective method of reducing the noise level at a NSL location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and NSL.

328. The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the noise source.

329. BS 5228-1 (BSI 2014a) states that on level sites the screen should be placed as close as feasible to either the noise source or the NSL. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice, screens constructed of materials with a mass per unit of surface area ≥10kg/m^2 will give adequate sound insulation performance. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and NSL.

330. Annex B of BS 5228-1 (BSI 2014a) (Figures B.1, B.2 and B.3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on-site from standard materials. These items are recommended for locations where high noise generating activities are occurring in proximity to NSLs. A well placed and designed mobile temporary screen around a breaker or excavation can effectively reduce noise emissions by 10 dB(A). Localised screening will be required in areas identified within Section 6.4.2 relating to night-time works and also to the north of Peamount Hospital which borders the TPR.

331. In addition, careful planning of the construction site layout will also be considered. Within construction site compounds, the placement of site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening. Site hoarding will be used around construction site compounds along noise-sensitive boundaries. Similarly, in some instances materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the NSL.

6.5.2.1.4 Hours of Work

332. Normal working times will be 07:00hrs to 19:00hrs Monday to Friday; and 08:00hrs to 16:30hrs on Saturdays. Works other than the pumping out of excavations, trenchless crossings, directional drilling, testing and commissioning, and security and emergency works will not be undertaken outside these working hours without the written consent of the relevant planning authority. There is also a restriction on one Haul Road through Celbridge which construction traffic can only use during night-time hours (see Section 7.5.2 in Chapter 7: Traffic & Transport). Consent for night-time working is usually only granted in circumstances where other alternatives have been assessed and deemed to be impractical. If granted, consent can be withdrawn at any time should the consent be breached.

333. Night-time and Sunday working would likely be required in relation to trenchless crossings and directional drilling. The planning of such works will take consideration of identified NSLs.

334. Consideration will be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity will be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control. In situations where a particularly noisy activity is scheduled e.g. trenchless crossings and directional drilling or other activities of similar noise level, the use of other on-site activities will be scheduled to control cumulative noise levels.

335. The emergency works referred to above may include the replacement of warning lights, signs and other safety items on public roads; the repair of damaged fences, water supplies and other services which have been interrupted; repair to any damaged temporary works; and all repairs associated with maintaining safety on the site of the Proposed Project and on adjacent public roads.

6.5.2.1.5 Liaison with the Public

336. For the Proposed Project, the major sources of noise are essentially mobile and the noise received at any NSL would therefore vary from day to day as the work proceeds. The duration of excavation, breaking, drilling and other high noise or vibration activities works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period. It is important, therefore, that clear forms of communication are established between the appointed Contractor and NSLs in proximity to the works so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration.

337. A designated noise liaison officer will be appointed by the appointed Contractor during construction works. All noise complaints will be logged and followed up in a prompt fashion by the liaison officer.

6.5.2.1.6 Vibration

338. The TII Guidelines recommend that in order to avoid potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in Table 6.8.

339. Specific slope stability control measures will be incorporated into the mitigation design at the Fort Henry Embankment, which will include controlled trials to establish a safe method of working, slope stability monitoring, phasing of works and ongoing risk analysis. These measures will be incorporated into a specific risk management method statement for the embankment and will be embedded into the contract documents.

340. The contractor will evaluate the choice of piling, excavation, breaking or other working method taking into account various ground conditions and site constraints. Where alternative lower noise or vibration generating equipment would be practicable taking account of matters including, for example, ground conditions, equivalent structural / excavation / breaking results, cost and programme, these will be selected to reduce potential disturbance. In practice, a balance may need to be struck between the use of all available techniques and other factors.

341. The decision regarding the type of pile, excavation technique or rock breaking to be used on a site will normally be governed by other engineering, environmental constraints. In these instances, it may not be possible for technical reasons to replace a high noise or vibration process by a quieter / less vibration intrusive alternative. However, even if it is possible, the adoption of a quieter method may prolong the overall process, the net result being that the overall disturbance to the community will not necessarily be reduced. Therefore, a balance will need to be struck between all factors including the duration of the works and the level of likely disturbance.

342. In the case of groundborne vibration activities giving rise to human disturbance, to reduce such impacts as far as practicable, the following measures will be implemented during the construction period:

- A pre-construction assessment will be carried out during the detailed design stage to confirm the predicted vibration levels at VSLs, as set out in this chapter, and identify if additional mitigation is required as set out in Sections 6.5.2.1.7 to 6.5.2.1.9
- A clear communication programme will be established to inform adjacent building occupants in advance of any potential intrusive works which may give rise to levels likely to exceed identified perceptible levels. The nature and duration of the works will be clearly set out in all communication circulars
- Activities capable of generating perceptible groundborne vibration and or vibration magnitudes likely to cause adverse significant effects will be restricted to daytime hours only, as far as reasonably practicable
- Alternative less intensive working methods and/or plant items will be employed, as far as reasonably practicable
- Appropriate vibration isolation will be applied to plant, as far as reasonably practicable.

343. Construction vibration monitoring will be undertaken where vibration generating activities would occur in close proximity to sensitive properties and the potential for significant effects have been identified.

344. A monitoring strategy with appropriate trigger level limits will be put in place. This will take account of the nature of the works, the duration and the proximity of receptors. In the event of an exceedance, works will be halted, and working methods and /or mitigation measures reviewed alternative work methods identified before works recommence. A trigger level limit for structural effects will generally be set at 8mm/s PPV.

345. For a property identified as being at risk of a structural impact (due to a predicted vibration level above 8mm/s PPV) a structural survey will be undertaken prior to any works commencing. The structural surveys will be undertaken by an independent structural engineer. The surveys will be used to determine whether a building is in any way structurally unsound, inform construction working methods and to identify potential structural damage (including cosmetic damage) resulting from the proposed works.

6.5.2.1.7 Vibration from Piling

346. For the locations where the potential for significant effects has been identified from piling (that may be required for working in peat), then an alternative construction approach will be considered.

347. The methodology adopted would include, where reasonably practicable to avoid a vibration level above 1mm/s PPV for 10 consecutive days or nights within any 15 consecutive day or night period, measures such as:

- Moving the piling further from the receptors using the construction flexibility set out in Section 6.2.7
- Reducing the duration of piling below 10 or more days or nights in any 15 consecutive days or night period
- Adopting press in piling techniques for the installation of the piles. This involves pushing in the piles into the soft ground (peat) and thereby avoiding the generation of vibration.

348. The contractor will be required to demonstrate through a pre-construction assessment that the selected construction technique would not result in a significant effect on receptors.

6.5.2.1.8 Vibration from Rock Breaking

349. Where rock breaking is proposed by the contractor a pre-construction assessment will need to be undertaken to confirm that the selected methodology would not result in significant effects at receptors. If this identifies that there would be 10 or more days or nights in any 15 consecutive days or night period of a vibration impact above 1mm/s PPV then an alternative methodology will be considered. This will include consideration of alternative equipment options, such as using a rockwheel trencher (e.g. the Vermeer T655-III Trencher) instead of an excavator-mounted hydraulic breaker.

350. AWN Consulting Ltd has previously conducted vibration measurements under controlled conditions, during trial construction works on a sample site where breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- Three tonne hydraulic breaker on small CAT tracked excavator.
- Six tonne hydraulic breaker on large Liebherr tracked excavator.

351. Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the three tonne breaker ranged from 0.48mms / PPV to 0.25mm/s PPV at distances of 10m to 50m respectively from the breaking activities.

352. In comparison, within the same test, for the same distances (10m to 50m) a six tonne breaker generated 1.49 mm/s PPV to 0.24 mm/s PPV.

353. While these measurements relate to breaking of concrete, the range of values recorded provides some context in relation to typical ranges of vibration reduction that can be achieved for receptors in close proximity to works through the plant selection for the rock breaking activity.

354. The methodology adopted would include, where reasonably practicable to avoid a vibration level above 1mm/s PPV for 10 consecutive days or nights within any 15 consecutive day or night period, measures such as:

- Moving the rock breaking further from the receptors using the construction flexibility set out in Section 6.2.7
- Reducing the duration of rock breaking below 10 or more days or nights in any 15 consecutive day or night period
- Using non-hydraulic rock breaking methods close to sensitive properties. This will include the use of conventional excavators with toothed buckets or ‘ripping’ tools where practical
- Using of lower vibration emitting breakers when working in close proximity to sensitive properties.

6.5.2.1.9 Vibration from Trenchless Construction Techniques

355. For the proposed trenchless crossing in close proximity to receptors, the Contractor will undertake a pre-construction assessment to demonstrate that measures to reduce the vibration effects have been adopted, where reasonably practicable. Such measures will include the following:

- Moving the alignment of the trenchless crossing further from the receptors using the construction flexibility set out in Section 6.2.7
- Reducing the duration of trenchless effects on receptors below 10 or more days or nights in any 15 consecutive day or night period
- Designing the cutting face of the tunnel boring machine (or equivalent) so that the level of vibration generated at source is reduced.

6.5.2.1.10 Monitoring

356. During the Construction Phase, noise monitoring will be undertaken at the NSLs to monitor the construction noise emissions at NSLs. Particularly at locations where a potential significant noise effect has been identified or where specific noise mitigation measures have been implemented. Noise monitoring will be conducted in accordance with ISO 1996-1:2016 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures (ISO 2016); and ISO 1996-2:2017 (ISO 2017). The selection of monitoring locations will be based on the nearest NSLs to the working area which will progress along the length of the Proposed Project.

357. Where noise monitoring indicates an exceedance of the applied construction thresholds, the adopted mitigation on-site will be reviewed and improved where feasible.

6.5.2.2 Construction Phase Specific Mitigation

358. The provision of specific construction mitigation measures is outlined within the following sections for the various elements of the assessment where potential significant effects have been identified pre-mitigation.

359. Specific mitigation measures are also included in the Register of Environmental Actions and Commitments, which forms part of the CEMP (Appendix A5.1).

6.5.2.2.1 Temporary Infrastructure Sites

360. During the Construction Phase of the temporary infrastructure sites, specific mitigation measures are required at Construction Compound CC6 and Pipe Storage Depots PSD1, PSD3, PSD8, PSD9 and PSD10. General standard mitigation as set out in sections above, including selection of plant with low generation of noise and the situation of noisy plant as far away from sensitive properties, will be employed as good practice as well as the implementation of site hoarding and screening as outlined within Section 6.5.2.1.3.

6.5.2.2.2 Infrastructure Sites

361. During the Construction Phase of the Proposed Project, no specific mitigation measures are required at the RWI&PS, WTP, BPT, BPS and FCV as the assessment presented in Section 6.4.2.1 indicated compliance with the adopted construction thresholds. However, general standard mitigation as set out above, including selection of plant with low generation of noise and the situation of noisy plant as far as practicable from sensitive properties, will be employed as good practice.

362. Regarding the TPR, the pre-mitigation effects predicted in Section 6.4.2 would be short term, negative and Moderate to Significant (effect is significant). Specific mitigation will be required at this location to mitigate the most significant of effects. The nearest NSLs relate to two buildings within Peamount Hospital. Site hoarding of a sufficient height and mass will be erected along the boundary of the hospital alongside localised screening around noisy items of plant and other good practice noise control measures discussed in Section 6.5.2.1 to reduce construction noise to within the adopted criteria.

6.5.2.2.3 Pipeline

363. In relation to the construction of the pipeline, the pre-mitigation effects predicted in Section 6.4.2 at the nearest NSLs to the works would be temporary, negative, and Slight to Moderate (effect is not significant) at all NSLs along the Proposed Project.

364. Mitigation will be utilised to further reduce the predicted noise levels within Section 6.4.2.1.11. Section 6.5.2.1 outlines various mitigation methods that will be deployed to reduce the noise levels at these NSLs. Due to the linear nature of these works, attention will be focused on the selection of quiet plant and noise control at source and the implementation of localised screening.

365. Where piling is likely to take place in relation to working methods within peat, one NSL has been identified as being within a distance where a significant effect is likely to occur. This NSL is to the south of works between chainages TWB – 24500 and TWB – 25000. The effect at this NSL is temporary negative, Moderate to Significant (effect is significant).

366. Specific mitigation will be required at this working area to mitigate the most significant of effects. Site hoarding of a sufficient height and mass as per Section 6.5.2.1.3 will be erected along the boundary of the construction working width alongside localised screening around noisy items of plant and other good practice noise control measures discussed in Section 6.5.2.1 to reduce construction noise to within the adopted criteria.

6.5.2.2.4 Night-time Works at Trenchless Crossings

367. In relation to the night-time works at trenchless crossings, the pre-mitigation effects predicted in Section 6.4.2 at the six crossing locations with NSLs within 140m of the works would be temporary, negative, and Significant to Very Significant. There are also eight crossing locations with NSLs between 140m and 220m that would experience a potential Moderate to Significant pre-mitigation effect.

368. The calculated noise levels associated with night-time works at trenchless crossings within Section 6.4.2.1.12 include assumptions of embedded mitigation. This includes restricting HGV movements within the trenchless crossing works sites during the night-time hours as far as practicable. Activities with the highest noise emissions will be scheduled during daytime periods and/or daytime shifts will set up the relevant sites for night-time periods to avoid unnecessary use of mobile plant, cranes, and material handling to occur during night-time periods. The assessment also incorporates that circular sawing during the pipe installation and backfilling phase of works, does not require night-time working periods.

369. Noise emissions during the night-time works at trenchless crossings would be reduced by employing the mitigation methods outlined within Section 6.5.2.1. Particular attention will be given to the selection of quiet plant (i.e. the use of electric cranes and low noise emission separation pumps) as well as the implementation of screening, monitoring and liaison with the public during the planned night-time works. A clear communication programme relating to the programming of any tunnel works at nearby NSLs will be undertaken at all trenchless crossing sites.

370. Mitigation in the form of further reducing the duration of the works where feasible will be explored during the detailed design stage. The effects relating to the night-time works at trenchless crossings can be reduced to Not Significant so long as they do not exceed the DMRB LA 111 (Highways England 2020) thresholds outlined within Section 6.2.6.1.3.

6.5.2.2.5 Works at Directional Drilling Locations

371. In relation to the night-time works at directional drilling locations, the pre-mitigation effects predicted in Section 6.4.2 at all drilling locations were temporary, negative, and Not Significant. The significance however is based on the duration of the night-time directional drilling works not exceeding the DMRB LA 111 (Highways England 2020) duration thresholds outlined within Section 6.2.6.1.3.

372. Mitigation will be needed during the night-time works at directional drilling locations. Noise levels would be reduced by employing the mitigation methods outlined within Section 6.5.2.1. Particular attention will be given to localised screening as well as the implementation of monitoring and liaison with the public during the planned night-time works.

373. Mitigation in the form of further reducing the duration of the works where feasible will be explored further during the detailed design stage.

6.5.2.2.6 Road Construction

374. In relation to the construction of access roads, the pre-mitigation effects predicted in Section 6.4.2 at the nearest NSLs to the works would be temporary, negative, and Moderate to Significant. Mitigation will be required to reduce noise levels at the nearest NSLs. This mitigation will include the selection of quiet plant as well as screening where works occur within a distance of 30m from NSLs.

6.5.2.2.7 Proposed 38 kV Uprate Works

375. The effects associated with the construction of the proposed 38 kV Uprate Works would be brief to temporary, negative and Slight to Moderate. Mitigation will be used at distances within 30m from the site boundary. The various methods outlined within Section 6.5.2.1 would reduce noise levels depending on the degree of mitigation. Due to the linear nature of these works, attention will be focused on the selection of quiet plant and noise control at source.

6.5.2.2.8 Construction Traffic on Public Roads

376. The predicted increases in traffic flows associated with the Construction Phase of the Proposed Project indicated that all assessed road links would operate within the adopted construction criteria and no specific mitigation would be required in relation to construction traffic.

6.5.2.3 Operational Phase

377. At the detailed design stage, consideration will be given to the selection of plant and façade elements so that the Infrastructure Sites will operate within the proposed criteria set out in Section 6.2.6.3.

6.6 Residual Effects

6.6.1 Construction Phase

378. Based on the mitigation measures outlined in the preceding sections, it has been assumed that a reduction of 10 dB would be achieved (unless stated otherwise) particularly through the use of robust localised screening around high noise generating plant items. The following paragraphs outline the residual effects after the implementation of the appropriate mitigation measures.

6.6.1.1 Temporary Infrastructure Sites

379. During the construction of the temporary infrastructure sites, the pre-mitigation effects predicted in Section 6.4.2 are likely to be temporary, negative and Significant to Very Significant within 30m of the works, and Moderate to Significant up to 50m from the works.

380. Once the relevant mitigation measures set out in Section 6.5.2.2.1 are employed, it is expected that predicted noise levels at the nearest NSLs would be reduced by approximately 10 dB. After the implementation of mitigation, the CNT of 65 dB $L_{Aeq,T}$ would be exceeded at distances of up to 30m, with a Significant to Very Significant effect occurring up to distances of 15m, and a Moderate to Significant effect occurring up to 30m.

381. At CC6 there is one NSL at a distance of 35m from the construction works. This is beyond the distance where a residual significant effect is likely to occur. The residual effect post mitigation would be temporary, negative and Slight to Moderate (effect is not significant).

382. At PSD1 there are three NSLs beyond 15m but within 30m from the construction works where a significant effect is likely to occur these are shown within Figure 6.14. The residual effect post mitigation at these NSLs would be temporary, negative and Moderate to Significant (effect is significant).

383. At PSD3 there is one NSL at approximately 40m from the construction works this is beyond the distance where a residual significant effect is likely to occur. The residual effect post mitigation would be temporary, negative and Slight to Moderate (effect is not significant).

384. At PSD8 there is one NSL at approximately 40m from the construction works. This NSL is beyond the distance where a residual significant effect is likely to occur. The residual effect post mitigation would be temporary, negative and Slight to Moderate (effect is not significant).

385. At PSD9 there is one NSL beyond 15m but within 30m from the construction works where a significant effect is likely to occur, this NSL is shown within Figure 6.20. The residual effect post mitigation at this NSLs would be temporary, negative and Moderate to Significant (effect is significant).

386. At PSD10 there is one NSL beyond 15m but within 30m from the construction works where a significant effect is likely to occur, this NSL is shown within Figure 6.21. The residual effect post mitigation at this NSLs would be temporary, negative and Moderate to Significant (effect is significant).

6.6.1.2 Infrastructure Sites

387. During the Construction Phase of the Proposed Project, the residual effects relating to RWI&PS, BPT, WTP, BPS and FCV would remain the same as those described in Section 6.4.2 since no mitigation measures were identified as being necessary to prevent significant effects. With reference to Table 6.5, the residual effects at the RWI&PS would be short term, negative, and Not Significant, while the residual effects at the WTP, BPT, BPS and FCV would be short term, negative, and Slight to Moderate (effect is not significant).

388. Regarding the TPR, the pre-mitigation effects predicted in Section 6.4.2 would be short term, negative and Moderate to Significant. Once the relevant mitigation measures set out in Section 6.5.2.2.2 are employed, predicted noise levels at the nearest NSLs 35m from construction works associated with the TPR would be reduced by the order of 10 dB. The resultant residual effect post-mitigation at the nearest NSLs at Peamount Hospital would be short term, negative, and Slight to Moderate (effect is not significant). At the remainder of NSLs which are at further set back distances from the construction works, the residual effect would be short term, negative and Slight to Moderate (effect is not significant).

6.6.1.3 Pipeline

389. In relation to the construction of the pipeline, the pre-mitigation effects predicted in Section 6.4.2 would be temporary, negative, and Slight to Moderate (effect is not significant).

390. After the implementation of mitigation measures outlined within Section 6.5.2.2.3, noise levels would be reduced by the order of 10 dB. The residual effects at the identified NSLs would remain temporary, negative, and Slight to Moderate (effect is not significant).

391. One NSL was identified as being within distances of where a significant effect is likely to occur in relation piling along the pipeline. After the implementation of mitigation measures outlined within Section 6.5.2.2.3, noise levels would be reduced by the order of 10 dB. The residual effects at the identified NSL would reduce to temporary, negative, and Slight to Moderate (effect is not significant).

6.6.1.4 Night-time Works at Trenchless Crossings

392. In relation to the night-time works at trenchless crossings, the pre-mitigation effects predicted in Section 6.4.2 at the 10 crossing locations with NSLs within 140m of the works would be temporary, negative, and Significant to Very Significant. Five crossing locations with NSLs between 140m to 220m of the works are identified as having a temporary, negative and Moderate to Significant effect.

393. After the implementation of mitigation measures including localised screening and site hoarding outlined within Section 6.5.2.1.3, it is expected that noise levels would be reduced by the order of 10 dB.

394. The residual effects at these NSLs during the most intrusive pipe installation and backfilling phases would vary depending on the distance from the works and its duration at any one NSL. Residual Significant to Very Significant effects are likely to occur at distances up to 110m from night-time trenchless crossings, with Moderate to Significant effects occurring between 110 and 190m. Table 6.60 outlines the crossings within these distances where a residual effect is likely to occur.

Table 6.60: Residual Night-Time Noise Assessment Locations for Construction by Trenchless Construction Techniques

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Approximate Distance to Nearest NSL	No of NSLs within Significant to Very Significant Effect	No of NSLs within Moderate to Significant Effect
Road	RDX001	R494 and steep terrain	RW – 810	Figure 4.7	20m	4	2
Terrain	N/A	Steep side slope	TW – 3520	Figure 4.8	100m	2	1
Road	RDX007	M7 - Kilnacranna	TW - 5460	Figure 4.9	145m	0	1
Road	RDX013	R445	TW – 12670	Figure 4.11	40m	6	1
Road	RDX026	N52 – Ardcrony, County Tipperary	TW – 28840	Figure 4.16	130m	0	3
Water & Road	WCX032 & RDX053	Camcor and R440	TWA – 27540	Figure 4.27	110m	0	4
Water	WCX039	Clodiagh (Tullamore)	TWB – 24770	Figure 4.37	90m	2	0
Road	RDX077	L1020	TWC – 8920	Figure 4.40	35m	1	2
Power	OHX017	220 kV Network	TWE – 6190	Figure 4.57	180m	0	3
Road	RDX107	R403	TWE – 8380	Figure 4.57	110m	0	1

Crossing Type	Crossing ID	Crossing Reference	Approximate Starting Chainage	Project Component Overview Figure	Approximate Distance to Nearest NSL	No of NSLs within Significant to Very Significant Effect	No of NSLs within Moderate to Significant Effect
Water, Road & Power	WCX076, WCX073, RDX108 and OHX018	Unnamed Watercourse, Liffey River, Ardrass Road and 110 kV Network	TWE – 9530	Figure 4.58	110m	0	1
Terrain	N/A	Yard	TWE – 15300	Figure 4.59	90m	2	0

395. There are 17 NSL within 110m of six crossing locations that have the potential to experience a temporary, negative, Significant to Very Significant effect (effect is significant) due to night-time works at trenchless crossings. Additionally, six NSLs situated between 110m and 190m from these same crossings would experience a Moderate to Significant effect (effect is significant). There are also six other crossing locations where NSLs are located beyond 110m but within 190m of the works. At these sites, construction activities are expected to have a Moderate to Significant effect (effect is significant) on 13 NSLs. The location of these significant residual effects is shown on Figure 6.12 to 6.24.

396. At the remaining crossing locations NSLs will be beyond 190m of the night-time trenchless crossing works and also below a duration where a significant would occur. The remainder of NSLs are therefore predicted to experience a residual effect that is temporary, negative, and Slight to Moderate (effect is not significant).

397. Where the NSLs identified above are predicted to experience a residual significant effect, locations of NSLs are provided within Figures 6.12 to 6.24.

398. All residual effects within the table above are assessed assuming that durations of works exceed those outlined within Section 6.2.6.1.3. As per DMRB LA 111 (Highways England 2020), in cases of moderate to major magnitude of impacts, the duration of works determines the overall significance rating. As part of the mitigation measures, the durations advised in DMRB LA 111 would be followed, where feasible, to reduce the overall significance of effects for night-time activities (i.e. scheduling works to occur for periods of less than 10 days/nights over 15 consecutive day/night periods and less than 40 days over six consecutive months where significant effects are identified). Once the construction noise level and duration of works is considered in line with DMRB LA 111, night-time works associated within this activity at any one location can be reduced to Not Significant in line with the adopted guidance as outlined within Section 6.2.6.1.3.

6.6.1.5 Works at Directional Drilling Locations

399. In relation to the night-time works at directional drilling locations, the pre-mitigation effects predicted in Section 6.4.2 at the eight drilling locations with NSLs within 100m of the works were temporary, negative, and Not Significant due to the duration of the works not exceeding the construction duration thresholds set out within Section 6.2.6.1.3.

400. After the implementation of mitigation measures outlined within Section 6.5.2.2.5, noise levels would be reduced by the order of 10 dB. The residual effects at these NSLs would remain temporary, negative, and Not Significant.

401. All residual effects are assessed assuming that durations of works do not exceed those outlined within Section 6.2.6.1.3. As per DMRB LA 111 (Highways England 2020), as part of the mitigation measures, the durations advised in DMRB LA 111 will be followed, to reduce the overall significance of effects for night-time activities (i.e. scheduling works to occur for periods of less than 10 days/nights over 15 consecutive day/night periods and less than 40 days over six consecutive months where significant effects are identified). Once the construction noise level and duration of works is considered in line with DMRB LA 111, night-time works associated within this activity at any one location can be reduced to Not Significant.

6.6.1.6 Road Construction

402. In relation to the construction of access roads, the pre-mitigation effects predicted in Section 6.4.2 at the nearest two NSLs to the works would be temporary, negative, and Moderate to Significant. After the implementation of mitigation measures outlined within Section 6.5.2.2.6, noise levels would be reduced by the order of 10 dB. The residual effects after mitigation at these NSLs would be temporary, negative, and Slight to Moderate (effect is not significant).

6.6.1.7 Proposed 38 kV Uprate Works and Power Connections

403. The residual effects relating to the proposed 38 kV Uprate Works and power connections along the Proposed Project would remain the same as those described in Section 6.4.2 since no mitigation measures were identified as being necessary to prevent significant effects. Residual effects associated with the 38 kV Uprate Works and power connections would be brief to temporary, negative and Slight to Moderate (effect is not significant).

6.6.1.8 Construction Traffic on Public Roads

404. The predicted increases in traffic flows associated with the Construction Phase of the Proposed Project indicated that all assessed road links would operate within the adopted construction criteria and no specific mitigation would be required in relation to construction traffic. The residual effect is short term, negative and Slight to Moderate (effect is not significant).

6.6.1.9 Vibration – Piling

405. In relation to the risk of vibration during construction from piling activities, the pre-mitigation effects predicted in Section 6.4.2 were temporary, negative and Moderate to Significant disturbance effects, which would be significant for the occupiers of three properties (two business and one residential property).

406. After the implementation of mitigation measures outlined within Section 6.5.2.1.7, and set out in Table 6.61, the predicted vibration levels due to piling would be below 1mm/s PPV (the threshold for Moderate disturbance effects on humans as defined in Table 6.9) and as a result, with the adoption of mitigation, these human receptors would not experience significant residual adverse effects. The mitigation approach is to adopt a piling technique that would not generate significant levels of vibration adjacent to these receptors. The residual effects are summarised in Table 6.61. Following the adoption of mitigation, the residual effect would be temporary, negative and Slight and the effect would not be significant.

Table 6.61: Piling Assessment of Residual Vibration Effects

Ref	Receptor Type	Approximate Chainage	Pre-mitigation DMRB Magnitude of Change (Short Term)	Pre-mitigation EPA EIAR Significance Rating	Mitigation Measure	Effect of Mitigation	Post-mitigation DMRB Magnitude of Change (Short Term	Residual EPA EIAR Significance Rating
VR.1	Business	TWD – 29000	Moderate (Human)	Moderate to Significant (effect is significant)	Press in technique / equivalent measure	The press in (or equivalent) technique will reduce vibration emissions and the residual level of vibration would be less than 1mm/s PPV.	Minor (Human)	Slight (effect is not significant)
VR.2	Residential		Moderate (Human)	Moderate to Significant (effect is significant)	Press in technique / equivalent measure		Minor (Human)	Slight (effect is not significant)
VR.3	Business		Moderate (Human)	Moderate to Significant (effect is significant)	Press in technique / equivalent measure		Minor (Human)	Slight (effect is not significant)

6.6.1.10 Vibration – Rock Breaking

407. In relation to the risk of vibration during construction from rock breaking activities, the human effects predicted in Section 6.4.2 were temporary, negative and Moderate to Significant disturbance effects, which, without specific mitigation, would be significant for the occupiers of seven properties (three business properties and four residential).

408. In addition, the pre-mitigation assessment identified there was a risk of a significant effect due to a structural/cosmetic building response to vibration at the radio mast and associated building at the BPT.

409. After the implementation of mitigation measures outlined within Section 6.5.2.1.8, and set out in Table 6.62, the predicted vibration levels due to rock breaking would be below 8mm/s PPV (the threshold for structural effects on buildings as defined in Table 6.8) and as a result, with the adoption of mitigation, cosmetic/structural effects at the receptors at the BPT would be avoided. The mitigation approach is to use smaller size rock breaking equipment that would generate lower vibration emissions. The residual effects are summarised in Table 6.62. The residual effect on the two receptors at the BPT, with the adoption of mitigation, would be temporary, negative and Not Significant.

410. For six of the properties with human receptors potentially experiencing disturbance (three business and three residential), the predicted vibration levels due to rock breaking after the implementation of mitigation measures would be below 1mm/s PPV (the threshold for Moderate disturbance effects for human receptors as defined in Table 6.9). The mitigation approach is to use smaller size rock breaking equipment that would generate lower vibration emissions. The residual effects are summarised in Table 6.62. Following the adoption of mitigation, the residual effect would be temporary, negative and Slight and the effect would not be significant.

411. For one of the properties (residential), with human receptors potentially experiencing disturbance, the residual vibration level with the adoption of mitigation would remain above 1mm/s PPV. This is because of the proximity of the property to the works. As a result, following the adoption of mitigation, the residual effect for this receptor would be temporary, negative and Moderate to Significant and the effect would be significant. The residual effects are summarised in Table 6.62, and the significant residual effect for the one VSL is shown on Figure 6.26. It may be possible during subsequent phases of the Proposed Project to avoid this effect but it is not certain at this stage and so on a precautionary basis a residual significant effect is being reported.

Table 6.62: Rock Breaking Assessment of Residual Vibration Effects

Ref	Receptor Type	Approximate Chainage	Pre-mitigation DMRB Magnitude of Change (Short Term)	Pre-mitigation EPA EIAR Significance Rating	Mitigation Measure	Effect of Mitigation	Post-mitigation DMRB Magnitude of Change (Short Term)	Residual EPA EIAR Significance Rating
VR.1	Residential	TW – 9500	Moderate (Human)	Moderate to Significant (effect is significant)	Low hydraulic rock break out techniques	The level of potential vibration would be below 1mm/s PPV.	Minor (Human)	Slight (effect is not significant)
VR.2	Radio Mast and associated Building (2 no. VSL)	TW – 100	N/A structural	Significant (Structural) (effect is significant)		The level of potential vibration would be below 8mm/s PPV.	N/A structural	Not Significant (Structural) (effect is not significant)
VR.3	Residential	TWC – 2500	Moderate (Human)	Moderate to Significant (effect is significant)		The mitigation may not be sufficient to reduce the residual vibration level below 1mm/s PPV and so a residual Moderate to Significant effect would remain.	Moderate (Human)	Moderate to Significant (effect is significant)
VR.4	Residential	TWC – 20000	Moderate (Human)	Moderate to Significant (effect is significant)		The level of potential vibration would be below 1mm/s PPV.	Minor (Human)	Slight (effect is not significant)
VR.5	Business	TWC – 20000	Moderate (Human)	Moderate to Significant (effect is significant)			Minor (Human)	Slight (effect is not significant)
VR.6	Business	TWC – 20000	Moderate (Human)	Moderate to Significant (effect is significant)			Minor (Human)	Slight (effect is not significant)
VR.7	Residential	TWC – 20000	Moderate (Human)	Moderate to Significant (effect is significant)			Minor (Human)	Slight (effect is not significant)
VR.8	Business	TWC – 20000	Moderate (Human)	Moderate to Significant (effect is significant)			Minor (Human)	Slight (effect is not significant)

6.6.1.11 Vibration – Trenchless Construction Technique

412. In relation to the risk of vibration during construction from trenchless construction techniques, the pre-mitigation effects predicted in Section 6.4.2 were temporary, negative and Moderate to Significant disturbance effects, which would be significant, at two residential properties.

413. After the implementation of mitigation measures outlined within Section 6.5.2.1.9, and set out in Table 6.63, the level of vibration experienced would be reduced at all properties/receptors set out in Table 6.63. However, the level of the reduction in vibration that would be achieved is uncertain and so on a precautionary basis the residual effect has not been altered, as summarised in Table 6.63. Therefore, on this basis there would remain the potential for a disturbance effect on two residential properties that would be temporary, negative, and Moderate to Significant which would be significant. These significant residual effects on the two VSLs are shown on Figures 6.25 and 6.27. It may be possible during subsequent phases of the Proposed Project to avoid this effect but it is not certain at this stage and so on a precautionary basis a residual significant effect is being reported.

Table 6.63: Trenchless Construction Techniques Assessment of Residual Vibration Effects

Ref	Receptor Type	Approximate Chainage	Pre-mitigation DMRB Magnitude of Change (Short Term)	Pre-mitigation EPA EIAR Significance Rating	Mitigation Measure	Effect of Mitigation	Post-mitigation DMRB Magnitude of Change (Short Term)	Residual EPA EIAR Significance Rating
VT.1	Residential	RW – 1000	Moderate (Human)	Moderate to Significant (effect is significant)	Reduced vibration tunnel	There is uncertainty over whether the mitigation could be adopted at this location until detailed design and so the residual effect has been left unchanged from the pre-mitigation assessment on a precautionary basis.	Moderate (Human)	Moderate to Significant (effect is significant)
VT.2	Residential	TWC – 9000	Moderate (Human)	Moderate to Significant (effect is significant)			Moderate (Human)	Moderate to Significant (effect is significant)

6.6.1.12 Summary of Construction Residual Effects

414. Table 6.64 provides a summary of the residual construction effects after the application of mitigation measures.

415. After the application of mitigation measures, the Proposed Project would result in likely significant residual effects at the identified NSLs at various distances from the temporary infrastructure sites and the NSLs identified during night-time trenchless crossings. There would also be significant residual effects on one VSL near rock breaking activities, and two VSL near trenchless crossings. There are no likely significant residual effects anticipated from the other construction processes in relation to the Proposed Project.

Table 6.64: Summary of the Residual Effects from Noise and Vibration During Construction

Element	Pre-Mitigation Effect	Mitigation	Post-Mitigation Residual Effect				
	Significance of Effect		Duration of Effect	Quality of Effect	Significance of Effect	NSLs Affected by Residual Effects	Description of Effects
Temporary Infrastructure Sites	Significant to Very Significant	Section 6.5.2.2.1	Temporary	Negative	Moderate to Significant (effect is significant)	Three NSLs at PSD1, one NSL at PSD 9 and one NSL at PSD10. Shown within Figures 6.14, 6.20 and 6.21.	After implementing mitigation measures, construction works related to the Construction Compounds and Pipe Storage Depots will cause Significant to Very Significant effects at distances up to 15m and Moderate to Significant effects between 15m and 30m of these sites. There are three Pipe Storage Depots with NSLs within this 15 to 30m range. Residual Moderate to Significant effects occur at the three Pipe Storage Depots identified in Figures 6.14, 6.20 and 6.21. The other two Pipe Storage Depots and one Construction Compound previously identified as having significant effects reduce from a Moderate to Significant effect to Slight to Moderate (effect is not significant) after the implementation of mitigation.
Proposed 38 kV Uprate Works	Slight to Moderate (effect is not significant)	Section 6.5.2.2.7	Brief to Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Works at closest position to NSLs for no more than three days, not triggering duration required for a significant effect.
RWI&PS	Not Significant	Section 6.5.2.2.2	Short term	Negative	Not Significant	All NSLs Not Significant	Nearest NSL approximately 600m from works resulting in a Not Significant residual effect.
WTP	Slight to Moderate (effect is not significant)	Section 6.5.2.2.2	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 350m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate residual effect.

Element	Pre-Mitigation Effect	Mitigation	Post-Mitigation Residual Effect				
	Significance of Effect		Duration of Effect	Quality of Effect	Significance of Effect	NSLs Affected by Residual Effects	Description of Effects
BPT	Slight to Moderate (effect is not significant)	Section 6.5.2.2.2	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 280m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate residual effect.
BPS	Slight to Moderate (effect is not significant)	Section 6.5.2.2.2	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	Nearest NSL approximately 260m from works, construction noise levels within CNT but above the measured baseline noise levels resulting in a Slight to Moderate residual effect.
FCV	Slight to Moderate (effect is not significant)	Section 6.5.2.2.2	Short-term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant	Nearest NSL approximately 130m from works, construction noise levels within CNT resulting in a Slight to Moderate effect (effect is not significant).
TPR	Moderate to Significant	Section 6.5.2.2.2	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	After the implementation of mitigation, the NSLs identified approximately 35m from the works at Peamount Hospital would experience construction noise levels below the adopted CNT during all phases of the construction and therefore the effect is not significant, all NSLs beyond the nearest NSL at 35m from the TPR site are predicted to result in a residual Slight to Moderate effect (effect is not significant).
Road construction	Moderate to Significant	Section 6.5.2.2.6	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	After the application of mitigation, the effect on the two NSLs within 30m of the road construction would reduce to a Slight to Moderate (effect is not significant) residual effect.
Pipeline	Slight to Moderate (effect is not significant)	Section 6.5.2.2.3	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	After the application of mitigation, all NSLs within vicinity of the pipeline construction would experience a Slight to Moderate (effect is not significant) residual effect.

Element	Pre-Mitigation Effect	Mitigation	Post-Mitigation Residual Effect				
	Significance of Effect		Duration of Effect	Quality of Effect	Significance of Effect	NSLs Affected by Residual Effects	Description of Effects
Pipeline (piling along pipeline)	Moderate to Significant (effect is significant)	Section 6.5.2.2.3	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	After the application of mitigation, all NSLs within vicinity of piling along the pipeline construction would experience a Slight to Moderate (effect is not significant) residual effect.
Pipeline (night-time working at open-cut crossings)	Not Significant	Section 6.5.2.2.3	Temporary	Negative	Not Significant	All NSLs Not Significant	After implementing mitigation measures, all open-cut crossings work at night will remain not significant.
Daytime works at trenchless crossings	Slight to Moderate (effect is not significant)	Section 6.5.2.1	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant	CNT not exceeded pre and post mitigation during the daytime hours resulting in a residual Slight to Moderate (effect is not significant) effect.
Night-time works at trenchless crossings	Significant to Very Significant	Section 6.5.2.2.4	Temporary	Negative	Significant to Very Significant	17 NSLs within 110m of night-time trenchless crossing locations with Significant to Very Significant effects; and 19 NSL between 110m and 190m with Moderate to Significant effects (shown within Figures 6.12 to 6.24).	After implementing mitigation measures, 17 NSLs within 110m of the identified crossing locations would experience a Significant to Very Significant effect (effect is significant), whilst a further 19 NSLs located between 110m and 190m from the trenchless crossing works would experience a Moderate to Significant residual effect (effect is significant). The remaining crossing locations will have NSLs beyond 190m which would experience a Slight to Moderate (effect is not significant) or Not Significant residual effect dependent on the construction duration.
Daytime works at directional drilling locations	Slight to Moderate (effect is not significant)	Section 6.5.2.2.5	Temporary	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	After the application of mitigation, the effect on the one drilling location with NSLs within 35m of directional drilling during daytime hours would reduce to a residual Slight to Moderate effect.

Element	Pre-Mitigation Effect	Mitigation	Post-Mitigation Residual Effect				
	Significance of Effect		Duration of Effect	Quality of Effect	Significance of Effect	NSLs Affected by Residual Effects	Description of Effects
Night-time works at directional drilling locations	Not Significant	Section 6.5.2.2.5	Brief to Temporary	Negative	Not Significant due to no exceedance of duration of works – Refer to Section 6.6.1.5 for further commentary	All NSLs Not Significant	After implementing mitigation measures, all directional drilling locations at night will remain not significant.
Construction traffic	Slight to Moderate (effect is not significant)	Section 6.5.2.2.8	Short term	Negative	Slight to Moderate (effect is not significant)	All NSLs Slight to Moderate (effect is not significant)	No specific mitigation identified resulting in a residual Slight to Moderate effect.
Vibration (piling – buildings)	Not Significant	Section 6.5.2.1.7	Short term	Negative	Not Significant	Not Significant at all VSLs	The effect of piling works would occur at distances where the effect to buildings is deemed not significant.
Vibration (piling – human response)	Moderate to Significant (effect is significant)	Section 6.5.2.1.7	Short term	Negative	Slight (effect is not significant)	Three VSLs	The effect of piling works would be reduced by the mitigation measures to less than 1mm/s PPV and the residual effect would be Slight (effect is not significant).
Vibration (rock breaking – buildings)	Significant	Section 6.5.2.1.8	Short term	Negative	Not Significant	Two VSLs	The effect of rock breaking works would be reduced by the mitigation measures to less than 8mm/s PPV and the residual effect would not be significant.
Vibration (rock breaking – human response)	Moderate to Significant (effect is significant)	Section 6.5.2.1.8	Short term	Negative	Moderate to Significant (effect is significant)	One VSLs affected	The effect of rock breaking works could remain above 1mm/s PPV and the residual effect would be Moderate to Significant (effect is significant).
Vibration (rock breaking – human response)	Moderate to Significant (effect is significant)	Section 6.5.2.1.8	Short term	Negative	Slight (effect is not significant)	Six VSLs affected	The effect of rock breaking works would be reduced by the mitigation to less than 1.0mm/s PPV and the residual effect would be Slight (effect is not significant).

Element	Pre-Mitigation Effect	Mitigation	Post-Mitigation Residual Effect				
	Significance of Effect		Duration of Effect	Quality of Effect	Significance of Effect	NSLs Affected by Residual Effects	Description of Effects
Vibration (trenchless construction techniques – buildings)	Not Significant	Section 6.5.2.1.9	Short Term	Negative	Not Significant	Not Significant at all VSLs	Trenchless works would occur at distances where the effect to buildings is deemed not significant because it would be below 8mm/s PPV.
Vibration (trenchless construction techniques – human response)	Moderate to Significant (effect is significant)	Section 6.5.2.1.9	Short term	Negative	Moderate to Significant (effect is significant)	Two VSLs	Trenchless works would occur at distances where the effect on humans could be above 1mm/s PPV and the residual effect would be Moderate to Significant (effect is significant).

416. The residual effects within Table 6.64 represent a conservative assessment at the closest NSLs during the most noise-intrusive phases of each of the works. The residual effect at NSLs would vary based on their distance from the works and also the duration of the works. Every care will be taken during the Construction Phase to mitigate construction noise as far as practicable following the mitigation methods outlined within Section 6.5.2.1.

6.6.2 Operational Phase

417. Noise from any operational plant items associated with the Proposed Project will be designed to not exceed the Proposed Project's Operational Phase noise criteria in Section 6.2.6.3, to avoid significant effects at the nearest NSLs. During the night-time period, no tonal or impulsive noise from the facility would be clearly audible or measurable at any NSL. Any uncertainty over the presence of audible tones will be assessed using the methodology set out in NG4 2016 (EPA 2016).

418. No potential significant effects were identified in the pre-mitigation assessment (Section 6.4.4). The residual effects relating to the Operational Phase remain the same as those described in Section 6.4.4 and Table 6.59. The residual effects from the Operational Phase of the Proposed Project are assessed as negative, long-term and Not Significant.

6.7 References

Association of Noise Consultants (2020). Measurement and Assessment of Groundborne Noise and Vibration. Third Edition.

British Standards Institution (1993). BS 7385-2:1993 Evaluation and Measurement for Vibration in Buildings. Part 2: Guide to Damage Levels from Groundborne Vibration.

British Standards Institution (2008). BS 6472. Guide to evaluation of human exposure to vibration in buildings, Part 1: Vibration sources other than blasting. British Standards Institution (2014a). BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise.

British Standards Institution (2014b). BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration.

British Standards Institution (2019). BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound.

California Department of Transportation (Caltrans) (2013). Technical Noise Supplement to the Traffic Noise Analysis Protocol. Sacramento, CA: Caltrans.

Department of Housing, Planning & Local Government (2018). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

Department for Transport (2013). HS2 Phase One Environmental Statement: Volume 5, Technical Appendices, Methodology, Assumptions and Assessment (Route-wide), Sound, Noise and Vibration (SV-001-000). ES 3.5.0.10. Accessed gov.uk on March 11, 2025.

EirGrid (2016). Evidence Based Environmental Studies Study 8: Literature Review and Evidence Based Field Study on the Noise Effects of High Voltage Transmission Development.

Environmental Protection Agency (2016). Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities. (NG4).

Environmental Protection Agency (2022). Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

European Commission (2017). Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report.

Highways England (2020). Design Manual for Roads and Bridges, LA 111 Noise and Vibration, Revision 2.

International Organization for Standardization (2016). ISO 1996-1:2016 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures.

International Organization for Standardization (2017). ISO 1996-2:2017 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2: Determination of Sound Pressure Levels.

Irish Water (2016). Water Supply Project Eastern and Midlands Region, Environmental Impact Statement Scoping Report.

Lora Aranda, O., White, M., & Goose, T (2023). Review of Impact of Vibration Techniques on Flood Defence Structures (FDS). Proceedings of the Institute of Acoustics, Vol. 45, Pt. 3. Retrieved from ioa.org.uk on January 22, 2025.

National Highways (2022). Lower Thames Crossing: Environmental Statement Appendices, Appendix 12.6 – Assessment of Groundborne Noise and Vibration.

Transport Infrastructure Ireland (2004). Guidelines for the Treatment of Noise and Vibration in National Road Schemes.

Transport Infrastructure Ireland (2014). Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes.

Uisce Éireann (2023). Water Supply Project Eastern and Midlands Region, EIAR Scoping Methodology Report.