

## CHAPTER 20: TERRESTRIAL NOISE AND VIBRATION



## **20. TERRESTRIAL NOISE AND VIBRATION**

### **20.1 Introduction**

This chapter, which was prepared by Waterman Infrastructure & Environment Limited (WIE), addresses the likely significant noise and vibration effects of the Aberdeen Harbour Expansion Project on human receptors. In particular, it considers the potential impacts of noise and vibration during the construction works and on completion of the development upon existing sensitive receptors.

This chapter provides a summary of relevant planning policy and a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the site and surrounding area, and an assessment of the likely significant effects of the development during the construction works and once the development is completed and operational. Mitigation measures are identified, where appropriate, to avoid, reduce or offset any significant adverse effects identified, together with the nature and significance of likely residual effects.

This ES Chapter is supported by the following ES Appendices:

- ES Appendix 20-A: Acoustic Glossary;
- ES Appendix 20-B: Baseline Noise Survey;
- ES Appendix 20-C: Construction Noise Assessment;
- ES Appendix 20-D: Operational Noise Level Calculations; and
- ES Appendix 20-E: Road Traffic Noise Assessment.

### **20.2 Legislation and Planning Policy**

#### **20.2.1 Legislation**

##### **20.2.1.1 Control of Pollution Act, 1974**

Part III of the Control of Pollution Act 1974 (CoPA) is specifically concerned with pollution. With regard to noise, the CoPA covers construction sites; noise in the street; noise abatement zones; codes of practice; and Best Practicable Means (BPM).

#### **20.2.2 National Planning Policy**

##### **20.2.2.1 Environmental Noise (Scotland) Regulations, 2006**

The Environmental Noise (Scotland) Regulations 2006 transpose the European Directive 2002/49/EC (the Environmental Noise Directive (END)) into Scottish Law. The Regulations affect large urban areas, major transport corridors and major airports. They require Scottish Ministers and airport authorities to manage noise through a process of strategic noise mapping and noise action plans. In the areas affected by the Regulations, planning authorities have a role in helping to prevent and limit the adverse effects of environmental noise.

#### 20.2.2.2 National Planning Framework, 2014

Scotland's third National Planning Framework (NPF3) (The Scottish Government, 2014) sets out a long term vision for the development of Scotland. NPF3 is the spatial expression of the Scottish Government's Economic Strategy - with a focus on supporting sustainable economic growth and the transition to a low carbon economy. NPF3 will be taken into account in all strategic and local development plans in Scotland.

#### 20.2.2.3 Scottish Planning Policy, 2014

Scottish Planning Policy (The Scottish Government, 2014a) is a statement of the Scottish Government's policy on nationally important land use planning matters. It outlines the Scottish Government's view on the purpose of the planning system, core principles for the operation of, and expected outcomes of the system. Whilst it does not contain policies specifically relating to the control of noise and vibration, it recognises that noise and vibration effects arising as a result of proposed developments should be considered as part of the planning process.

#### 20.2.2.4 Planning Advice Note 1: Planning and Noise, 2011

Planning Advice Note (PAN) 1/2011 (The Scottish Government, 2011) supersedes Circular 10/1999 (The Scottish Office Development Department, 1999) 'Planning and Noise' and PAN 56 (HMSO, 2011) 'Planning and Noise' which are now revoked. PAN 1/2011 is the principal guidance adopted in Scotland for assessing the impact of noise on and from proposed developments. It provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. Information and advice on noise impact assessment (NIA) methods is provided in the associated Technical Advice Note entitled 'Assessment of Noise' (The Scottish Government, 'Technical Advice Note: Assessment of Noise'), which includes details of the legislation, technical standards and codes of practice for specific noise issues.

### **20.2.3 Regional Planning Policy**

#### 20.2.3.1 Aberdeen City and Shire Strategic Development Plan (Proposed Plan), 2014

The Strategic Development Planning Authority (SDPA) is a partnership between Aberdeen City and Aberdeenshire Councils and has a key role in guiding development over the next 25 years. The SDPA was formed in 2008 and is one of four city-region planning authorities in Scotland. The Aberdeen City and Shire Strategic Development Plan (Strategic Development Planning Authority, 2014), which was approved by Scottish Ministers on 28 March 2014, does not contain specific objectives pertaining to noise, although within the Sustainable Mixed Communities section it recognises that road transport can have negative environmental effects such as noise pollution.

### **20.2.4 Local Planning Policy**

#### 20.2.4.1 Aberdeen Local Development Plan, 2012

The Aberdeen Local Development Plan (Aberdeen City Council, 2012) has the following policies pertaining to noise:

Policy BI1 Business and Industrial Land states "where business and industrial areas are located beside residential areas we will restrict new planning permissions to Class 4 Business. Buffer zones

will be required to separate these uses and safeguard residential amenity. Conditions may be imposed regarding noise, hours of operation and external storage”.

## **20.2.5 Guidance**

### **20.2.5.1 Construction Site Noise – A Guide For Contractors, 2011**

Aberdeen City Council (ACC) has developed a guide for contractors about construction site noise (Aberdeen City Council, 2011) outlining which practices may lead to complaint together with restrictions that may be imposed. One of the restrictions is operational hours, which is also stated on ACC’s website. Noisy work on construction sites is restricted by ACC to the following operational hours:

- Monday to Friday: 07:00-19:00
- Saturday: 09:00-16:00

Outside of these times construction noise should not be audible at the site boundary. Under normal circumstances, evening, night-time and Sunday working will not be considered reasonable. Exceptions to this are for reasons of public safety and/or Police requirements. In such cases contractors need to demonstrate that other Authorities require the work to take place at these times.

The guide states that affected residential premises is likely to be restricted to a maximum of 75dB  $L_{Aeq,12\text{ hours}}$  although it further states that different restrictions may apply, e.g., shorter term (1 hour / 3 hours)  $L_{Aeq}$  period limits and/or  $L_{Aeq}$  limit, depending on the nature of the works being undertaken and their effect on neighbouring premises.

### **20.2.5.2 Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Assessment, 2014**

The IEMA Guidelines for Environmental Noise Assessment (IEMA, 2014) address the key principles of noise impact assessment and are applicable to all development proposals where noise effects may occur.

The guidance provides advice with regards to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognises that the effect associated with a particular noise impact will be dependent on a number of factors including, but not limited to, the sensitivity of the receptor, frequency and duration of the noise source and time of day. However, it stops short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis with reference to relevant national and local standards.

### **20.2.5.3 British Standard 5228: - Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2014**

BS 5228 (British Standard, 2009) part one and part two (BRITISH STANDARD, 2009a) provides guidance on the assessment of noise and vibration effects during the development of a site, including procedures for estimating noise levels from construction activities and vibration attributable to vibratory rolling and piling activities.

The guidance does not define acceptable limits. However, it does provide potential methods for assessing the significance of noise and vibration effects, which should be defined on a site-specific basis. BS 5228 also provides guidance on minimising potential effects through the use of mitigation and the adoption of BPM.

20.2.5.4 British Standard BS 6472-1: Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration Sources other than Blasting, 2008

BS 6472-1 (British Standard, 2008) provides guidance on the measurement and assessment of vibration levels affecting humans in buildings resulting from sources such as road and rail traffic or building services systems.

The probability of adverse comment is assessed by considering the vibration dose value (VDV), which quantifies the total exposure to vibration over a specified period.

20.2.5.5 British Standard 4142 Methods for Rating and Assessing Industrial and Commercial Sound, 2014

BS 4142 (British Standard, 2014) provides a method for the rating and assessment of sound of an industrial and/or commercial nature. The assessment method allows the likely effects of sound on people to be determined. The significance of the sound depends upon the margin by which the 'rating level' ( $L_{Ar,Tr}$ ) exceeds the background level ( $L_{A90}$ ). Typically the greater this difference the greater the magnitude of the impact. Table 20.1 presents the significance of impact based on noise difference between the rating level and background level.

**Table 20.1: BS4142 Significance of impact**

Noise Difference (Rating Level – Background)	Significance <sup>[1]</sup>
+≥ 10 dB	Indication of significant adverse impact
+5 dB	Indication of adverse impact
≤0 dB	Indication of low impact
<b>Note:</b> [1] Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact. dB = decibels	

The 'rating level' is equal to the specific sound level if there are no acoustic features present (tonal/impulsive/intermittent). Depending on the acoustic feature an acoustic correction of +2 to +9dB may be applied to obtain the rating noise level. Where a sound has more than one acoustic feature then the appropriate acoustic corrections are summed.

20.2.5.6 Calculation of Road Traffic Noise, 1988

The guidance provided within Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988) provides a method for the calculation of road traffic noise levels, taking into account factors such as distance between the road and receptor, road configuration, ground cover, screening, angle of view, reflection from façades and traffic flow, speed and composition. The noise parameter calculated is the LA10-18 hour and is based on the 18 hour Annual Average Weekday Traffic (18hr-AAWT).

20.2.5.7 DMRB Volume 11, Section 3, Part 7 Noise and Vibration (2011)

The Design Manual for Roads and Bridges (DMRB) (Highway Agency, 2011) provides guidance on the assessment of the impacts that road projects may have on levels of noise and vibration. The latest revision provides updated advice on calculating night-time noise levels, determining the extent of the study area and selecting appropriate traffic speed data. DMRB states where appropriate the standard may be applied to existing roads.

Within the introduction section it states that “the standard must be used forthwith on all road projects for the assessment of noise and vibration impacts associated with construction, improvements, operation and maintenance associated with motorways and trunk roads.”

20.2.5.8 Scottish Government Technical Advice Note – Assessment of Noise, 2011

The Technical Advice Note (TAN) entitled ‘Assessment of Noise’ provides guidance to assist in the technical evaluation of noise assessments. It clearly states that it does not offer prescriptive guidance on noise assessment nor should it be considered as being exhaustive in extent. It aims to assist in assessing the significance of impact of noise on new developments.

In Appendix 1 to the TAN, the document provides a summary of relevant technical standards, guidance and codes of practice which may be used to facilitate the decision making process involving noise issues.

The guidance provided within the TAN advises that assessment of noise impact should be in the context of changes in the acoustic environment resultant from the Development in both quantitative and qualitative terms. The importance of using the appropriate noise metric, together with the assessment period (day, night, relevant hour) are also highlighted. The TAN reports the daytime period as between 07:00 to 23:00 and the night-time period between 23:00 to 07:00.

## **20.3 Assessment Methodology and Significance Criteria**

### **20.3.1 Assessment Methodology**

The assessment reported in this chapter is based on the following:

- Identifying potentially sensitive existing and future noise receptors within the surrounding area of the development;
- Establishing baseline noise conditions currently existing at nearby locations through attended and unattended noise surveys;
- Assessing potential noise and vibration levels generated during the construction works and the significance of these associated with the development;
- Assessing potential noise generated during the operation of the development;
- Assessing the potential effects resultant from changes on the local road network as a result of the development;
- Formulating proposals for mitigation, where appropriate; and
- Assessing the significance of any residual impacts.

This approach is established standard practice for conducting an assessment of noise and vibration impacts relating to noise generating developments.

### 20.3.2 Construction

#### 20.3.2.1 Noise

To assess the likely significant effects of construction works on existing sensitive receptors (SRs) surrounding the site, the 'ABC Method' provided in BS 5228 has been used. This method defines category 'threshold values' which are determined by the time of day and existing prevailing ambient noise levels. The noise generated by construction activities is then compared with the established threshold value. If the construction noise level exceeds the threshold value, a significant effect is deemed to occur.

Noise threshold levels have been established for the relevant existing SRs based upon the prevailing baseline noise levels. Noise levels associated with the construction works have been predicted using the calculation methodology detailed within BS 5228. Calculations representing a worst-case scenario over a 1 hour period with plant operating at the closest point to the nearest SR and in the absence of mitigation are presented. In practice, noise levels would tend to be lower owing to greater separation distances, screening effects and periods of plant inactivity.

#### 20.3.2.2 Vibration

There are two aspects of vibration that require consideration:

- Potential vibration effects on people or equipment within buildings; and
- Potential vibration effects on buildings.

There are currently no British Standards that provide a methodology for predicting levels of vibration from demolition and construction activities other than BS 5228, which relates to percussive, or vibratory, rolling and piling only. As stated in BS 5228, and as generally accepted, the threshold of vibration perception for humans in residential environments is typically in the Peak Particle Velocity (PPV) range 0.15 to 0.3 mm/s at frequencies between 8 Hertz (Hz) and 80Hz with complaints likely at 1 mm/s. Based on historical field measurements undertaken by Waterman and having regard to information contained within BS 5228, Table 20.2 details the distance at which certain activities may give rise to 'just perceptible' levels of vibration.

**Table 20.2: Distance at which vibration may just be perceptible**

Construction Activity	Distance from Activity when Vibration may Just be Perceptible [metres] <sup>1</sup>
Heavy vehicles	5 – 10
Excavation	10 – 15
Continuous Flight Auger (CFA) piling	15 – 20
Rotary bored piling	20 – 30
Vibratory piling	40 – 60
<b>Note:</b>	
<sup>1</sup> Distances for perceptibility are only indicative and dependent upon a number of factors, such as the radial distance between source and receiver, ground conditions, and underlying geology	



It is a widely held belief that if vibration can be felt, then damage to property is inevitable. However, vibration levels at least an order of magnitude higher than those for human disturbance are required to cause damage to buildings. It is generally accepted that building damage would not arise at PPV levels below 12.5 mm/s.

#### 20.3.2.3 Traffic

A qualitative assessment of potential effects resultant from construction traffic has been undertaken by making comparison between the existing base flows with forecast construction traffic flows.

### 20.3.3 **Completed Development**

#### 20.3.3.1 Fixed Mechanical Plant and Building Services

The guidance provided in BS 4142 has been used to assess whether noise from fixed plant and building services associated with the Development would be likely to give rise significant adverse impacts for existing SRs. Regard has also been given to the requirements of Aberdeen City Council (ACC).

#### 20.3.3.2 Operational Noise

The guidance provided in TAN has been used to assess whether operational noise from the development would be likely to give rise to significant adverse impacts for existing SRs.

#### 20.3.3.3 Assessment of Road Traffic Noise

As set out in the CRTN methodology, road traffic noise levels are typically measured and predicted in units of dB  $L_{A10}$  (18 hour). The  $L_{A10}$  is the A-weighted sound level in decibels exceeded for 10% of the measurement period, which in this case is the 18-hour period between 06:00 and 24:00 hours. This noise index has been shown to correlate well with people's subjective annoyance arising from road traffic noise. The potential change in road traffic noise levels on the local highway network as a result of the operation of the proposed development have been calculated using the methodology of CRTN. Assessment of the significance of the change in noise level is in-line with DMRB, Volume 11, Section 7, Part 3 methodology.

The DMRB recommends an assessment of road traffic noise where traffic flows are expected to experience a change of -20% or +25%. The guidance indicates that projected changes in traffic of less than the above criteria create no discernible environmental impacts.

### 20.4 **Significance Criteria**

#### 20.4.1 **Demolition and Construction Noise and Vibration**

As outlined above, to assess the significance of effects from construction noise on existing SRs, 'The ABC Method' provided in BS 5228-1:2009+A1:2014 was used. With regards to vibration, assessment has been made against the criteria for human perception as presented in BS 5228-2:2009.

The criteria in Table 20.3 were adopted to provide transparency in the definition of the significance of identified effects. Full details are provided in ES Appendix 20-D: Operational Noise Level Calculations.

**Table 20.3: Significance criteria for the assessment of construction noise and vibration**

Significance	Level Above Threshold Value dB(A)	Level of Vibration	Definition
Negligible	≤0	≤0	Vibration no effect. Construction noise should be acceptable.
Minor Adverse	>0 to ≤ 3	> 0 to ≤ 0.14 mm/s	The effect is not of concern.
Moderate Adverse	>3 to ≤ 5	>0.14 mm/s to < 1mm/s	The effect is undesirable but of limited concern.
Major Adverse	>5 to ≤ 10	> 1 mm/s to ≤ 3 mm/s	The effect gives rise to some concern but is likely to be tolerable depending on scale and duration.
Very Major Adverse	>10	>3 mm/s	The effect gives rise to serious concern and it should be considered unacceptable.

#### 20.4.1.1 Fixed Mechanical Plant and Building Services

When assessing the significance of likely effects from fixed plant and building service noise on SRs, the criteria presented in Table 20.4 have been used. The criteria recommended by Waterman to safeguard residential amenity is that noise from new plant is controlled to at least 5 dB below the existing background noise level.

ACC do not have a standardised plant noise limit; each application is considered depending on location and potential noise sources. In terms of plant noise for fans, extracts and similar equipment with a frequency component, ACC normally specify a condition requiring internal noise levels, assessed with windows closed, within dwellings or noise sensitive premises “shall not exceed NR25 between 07:00-23:00 and NR25 at all other times”.

**Table 20.4: Significance criteria for fixed external and building services plant noise**

Significance	Difference between Plant Rating and Background Levels [dB(A)]
Neutral	< -5
Negligible	> -5 to 0
Minor Adverse	>0 to ≤5
Moderate Adverse	>5 to <10
Major Adverse	≥ 10

#### 20.4.1.2 Operational Noise

When assessing the significance of likely effects from operational noise associated with the development on the SRs, assessment is made against the predicted change in the prevailing noise level and is drawn from the TAN. Table 20.5 presents the significance of effects based on the predicted change in the prevailing noise level.

**Table 20.5: Operational noise significance criteria**

Significance	Predicted Change in Prevailing Noise Level dB L <sub>Aeq</sub>
Neutral	≤0
Negligible	>0 to 1
Minor Adverse	>1 to ≤3
Moderate Adverse	>3 to <5
Major Adverse	≥ 5

#### 20.4.1.3 Road Traffic Noise

Noise effects arising from road traffic have been assessed in accordance with the significance criteria detailed in Table 20.6 which are drawn from DMRB short-term assessment procedure. For the purpose of this assessment comparison has been made between the with and without development scenario for the forecast year of completion 2019. Both scenarios are based on the Aberdeen Western Peripheral Road (AWPR) being operational.

Where increases are predicted, the significance of effects are adverse, and where reductions in noise are predicted, the significance of effects are beneficial.

**Table 20.6: Significance criteria for road traffic noise assessment**

Significance	Change or Difference in Noise Level, dB L <sub>A10,18h</sub> dB(A)
Neutral	0
Negligible	>0 to <1.0
Minor	1.0 to 3.0
Moderate	>3.0 to <5.0
Major	≥ 5

#### 20.4.2 Limitation and Assumptions

The potential effects resultant from the construction phase are based on details of representative plant, as the exact details on plant, numbers and locations to be used are not known at this stage. Nevertheless, the assessments of noise and vibration impacts during the construction phase have included a series of reasonable assumptions regarding the above factors, based on experience of similar projects throughout the UK, and are therefore considered to provide an accurate representation of potential effects.

Similarly, at this stage of the development, exact operational details are not known. The assessment of operational effects has therefore been based on current operations at the existing Aberdeen Harbour. On this basis, there is considered to be a medium degree of confidence of the predicted potential effects from proposed Harbour Operations. Should operations subsequently differ substantially from those assessed, it is recommended that a reassessment is undertaken.

#### 20.4.3 Consultation

Consultation was undertaken with ACC's Communities, Housing and Infrastructure department to gain agreement on the baseline noise survey strategy and to confirm the noise requirements for fixed plant

and building services. Relevant e-mail communication is reproduced within ES Appendix 20-B: Baseline Noise Survey.

ACC Communities, Housing and Infrastructure department reviewed a draft version of this Chapter and their comments, dated 9 October and 12 October 2015, have been incorporated into the final version of the Chapter as appropriate.

## **20.5 Baseline Conditions**

### **20.5.1 Existing Potentially Sensitive Receptors**

A desk-based study and site walkover was carried out to identify existing SRs that could potentially be affected by noise and vibration arising from the construction works and the operation of the proposed Aberdeen Harbour Expansion Project (AHEP).

There are no extensive residential areas directly adjacent to the site, although there are several isolated properties. Several dwellings are located near to Girdle Ness Lighthouse, being approximately 60 m to 80 m north of the site boundary. Doonies Rare Breeds Farm is located approximately 20 m to the west of the site boundary although approximately 800 metres to the south-west of the main AHEP operations. The residential area of Balnagask, which is bound by St Fittick's Road to the north, is approximately 300 m west of the site boundary.

Those SRs identified as being potentially affected by noise and vibration created during either construction or operation of the development are summarised in Table 20.7 below and indicated on Figure 20.1.

**Table 20.7: Potential sensitive receptors**

<b>Sensitive Receptors</b>	<b>Description</b>	<b>Approximate Distance From Site Boundary of AHEP [m]</b>
SR A	Doonies Rare Breeds Farm, Coast Road	20 m west (800 m south-west of main AHEP operations)
SRs B	Residential dwellings at Girdle Ness Lighthouse, Greyhope Road.	60 to 80m north
SRs C	Balnagask residential area, St Fittick's Road.	270 m west

### **20.5.2 Baseline Noise Surveys**

A baseline noise survey was undertaken between Wednesday 11 and Monday 15 June 2015 to establish the prevailing noise climate within the vicinity of the SRs. This was supplemented by an additional survey conducted on Saturday 27 June 2015.

The baseline strategy, which was agreed in advance with ACC, included unattended long-term noise measurements at SR A (Location ST1) and SR B (Location ST2), with attended noise measurements at SR C (Locations ST1 and ST2). At SR C during the daytime period, the CRTN shortened measurement procedure was followed, consisting of a three hour continuous measurement between 1000-1700 adjacent to St Fittick's, with a one hour attended noise measurement on the eastern boundary of Balnagask residential area at a central location facing the development area. Attended 30

minute noise measurements were undertaken at these locations during the quiet night-time period (01:00 to 03:00) to provide an indication of the prevailing night-time noise.

The selected noise monitoring locations are described in Table 20.8 and illustrated on Figure 20.1. The noise survey results are summarised in Table 20-9 with full details of the baseline survey provided in ES Appendix 20-B: Baseline Noise Survey.

**Table 20.8: Noise monitoring locations**

Monitoring Location	Description	Observations and Predominant Noise Sources
LT1	Doonies Rare Breeds Farm (SR A)	Noise climate dominated by road traffic noise. Other noise noted during set up and take down was helicopter noise.
LT2	Residential properties Girdleness Lighthouse (SR B)	Noise climate dominated by road traffic noise and from the sea (wave noise). Other noise noted during set up and take down was helicopter noise.
ST 1	Balnagask Residential Area, St Fittick's Road	Noise climate dominated by road traffic noise.
ST 2	Balnagask Residential Area, central location on eastern boundary	Noise climate dominated by road traffic noise with contribution from human activity.

**Table 20.9: Summary of baseline noise measurements**

Monitoring Location (Figure 20.1)	Monitoring Period	L <sub>Aeq,T</sub> <sup>1</sup> [dB(A)]	L <sub>AMAX</sub> <sup>2</sup> [dB(A)]	L <sub>A10,T</sub> <sup>1</sup> [dB(A)]	L <sub>A90,T</sub> <sup>1</sup> [dB(A)]
LT1 (SR A)	Week Day (07:00-23:00)	54	75	55	40
	Week Night (23:00-07:00)	48	69	42	31
	Weekend Day (07:00-23:00)	50	73	49	33
	Weekend Night (23:00-07:00)	48	68	41	30
LT2 (SR B)	Week Day (07:00-23:00)	47	66	46	40
	Week Night (23:00-07:00)	41	58	41	38
	Weekend Day (07:00-23:00)	47	63	46	41
	Weekend Night (23:00-07:00)	42	57	43	40
ST1 (SR C)	CRTN (11:30-14:30)	65	87	69	49
	Night (01:35-01:45;02:50-03:05)	47	67	46	41
	TRL Day (07:00-23:00)	65			
ST2 (SR C)	Day (14:50-15:50)	51	73	52	42
	Night (02:00-02:40)	40	62	42	35
<b>Notes:</b>					
1 Average of 5 minute measurements over the survey period (L <sub>Aeq</sub> logarithmically averaged, L <sub>A10</sub> and L <sub>A90</sub> arithmetically averaged.)					
2 Maximum 90 <sup>th</sup> percentile measured over the survey period					

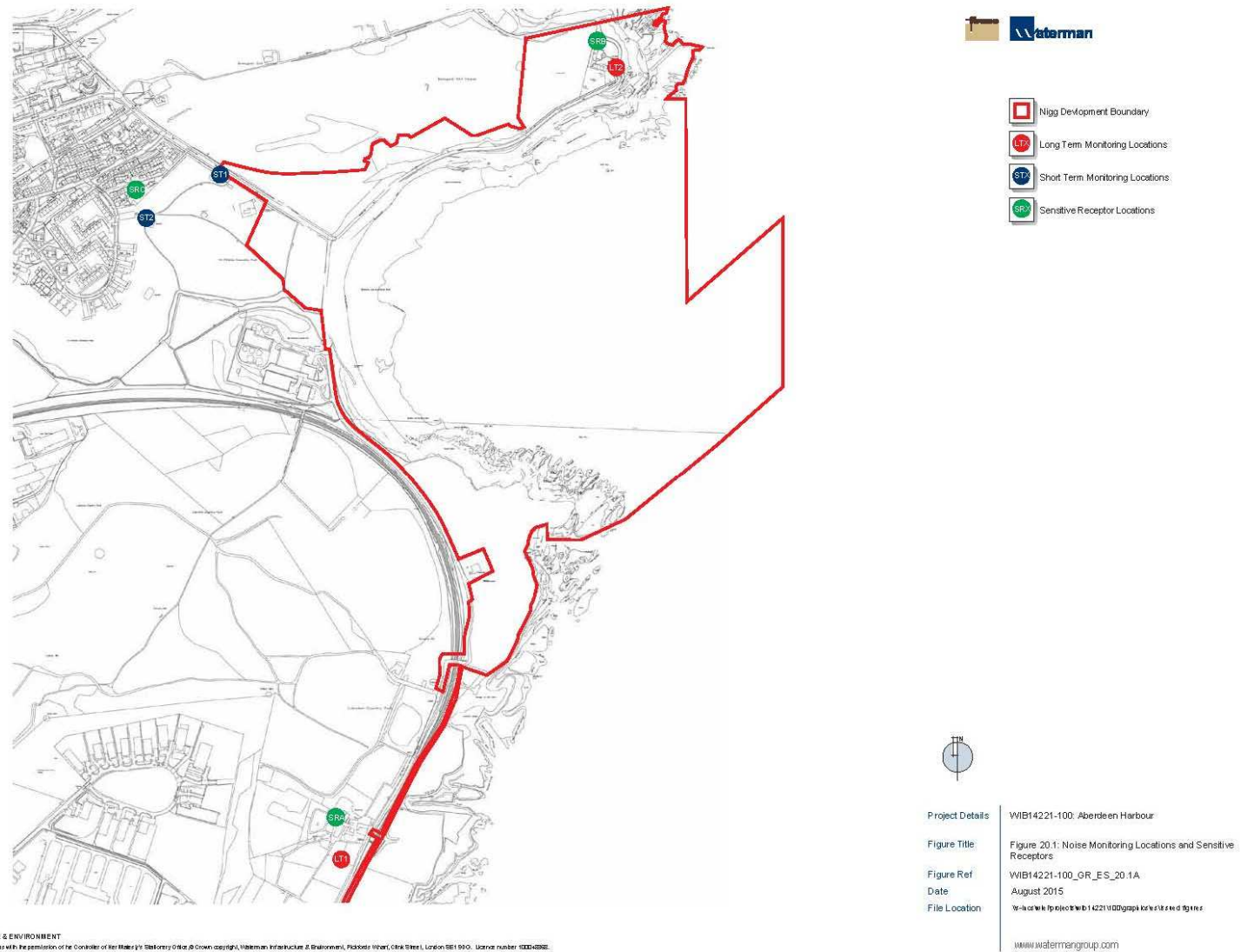


Figure 20.1: Noise monitoring locations and sensitive receptors

The dominant noise source at all locations was noted to be road traffic noise. During the attended night-time noise measurement the road traffic noise was noted as being distant in the direction of the City of Aberdeen. Noise levels during the night-time period were typically lower than those experienced during the day-time as a result of reduced traffic flows and human activity during this period.

At Doonies Rare Breeds Farm, the weekday average noise levels were higher than the weekend measured noise levels. The night-time average values were comparable for the week and weekend periods.

At Girdleness Lighthouse, the average values for both the week and weekend period were comparable.

## **20.6 Assessment of Effects**

### **20.6.1 Construction**

#### **20.6.1.1 Noise**

The calculated worst-case and unmitigated noise levels associated with the harbour construction works are presented in ES Appendix 20-C: Construction Noise Assessment, and summarised in Table 20.10. The significance of the impacts have been assessed against the BS5228 daytime threshold value of 65dB  $L_{Aeq}$ . It is also understood that permission to undertake construction during the evening and night-time period may be sought. The potential impacts have been assessed against the BS5228 evening threshold value of 55dB  $L_{Aeq}$  for all sensitive receptors and BS5228 night-time threshold values of 45dB  $L_{Aeq}$  for SR B and C with 55dB  $L_{Aeq}$  for SR A which had higher measured night-time noise levels.

**Table 20.10: Construction noise level significance of effects**

SR	Demolition/Construction Activity	Threshold Level (dB(A))	Predicted Site Noise Level (dB(A))	Significance of Effect
<b>DAY</b>				
SR A	Dredging	65	51	Negligible
	Access Road Excavation	65	46	Negligible
	Access Road Paving	65	43	Negligible
	Breakwaters	65	51	Negligible
	Vibro Piling	65	37	Negligible
	Percussive Piling	65	49	Negligible
	Quay Construction Marine	65	45	Negligible
	Quay Construction On-Shore	65	45	Negligible
SR B	Dredging	65	61	Negligible
	Access Road Excavation	65	69	Moderate
	Access Road Paving	65	66	Minor
	Breakwaters	65	74	Major
	Vibro Piling	65	63	Negligible
	Percussive Piling	65	75	Major
	Quay Construction Marine	65	71	Major
	Quay Construction On-Shore	65	75	Major
SR C	Dredging	65	57	Negligible
	Access Road Excavation	65	55	Negligible
	Access Road Paving	65	53	Negligible
	Breakwaters	65	49	Negligible
	Vibro Piling	65	46	Negligible
	Percussive Piling	65	58	Negligible
	Quay Construction Marine	65	52	Negligible
	Quay Construction On-Shore	65	53	Negligible
<b>EVENING</b>				
SR A	Dredging	55	51	Negligible
	Access Road Excavation	55	46	Negligible
	Access Road Paving	55	43	Negligible
	Breakwaters	55	51	Negligible
	Vibro Piling	55	37	Negligible
	Percussive Piling	55	49	Negligible
	Quay Construction Marine	55	45	Negligible
	Quay Construction On-Shore	55	45	Negligible
SR B	Dredging	55	61	Major
	Access Road Excavation	55	69	Very Major
	Access Road Paving	55	66	Very Major
	Breakwaters	55	74	Very Major
	Vibro Piling	55	63	Major
	Percussive Piling	55	75	Very Major
	Quay Construction Marine	55	71	Very Major
	Quay Construction On-Shore	55	75	Very Major



Table 20.10: Construction noise level significance of effects continued

SR	Demolition/Construction Activity	Threshold Level (dB(A))	Predicted Site Noise Level (dB(A))	Significance of Effect
SR C	Dredging	55	57	Minor
	Access Road Excavation	55	55	Negligible
	Access Road Paving	55	53	Negligible
	Breakwaters	55	49	Negligible
	Vibro Piling	55	46	Negligible
	Percussive Piling	55	58	Minor
	Quay Construction Marine	55	52	Negligible
	Quay Construction On-Shore	55	53	Negligible
<b>NIGHT</b>				
SR A	Dredging	55	51	Negligible
	Access Road Excavation	55	46	Negligible
	Access Road Paving	55	43	Negligible
	Breakwaters	55	51	Negligible
	Vibro Piling	55	37	Negligible
	Percussive Piling	55	49	Negligible
	Quay Construction Marine	55	45	Negligible
	Quay Construction On-Shore	55	45	Negligible
SR B	Dredging	45	61	Very Major
	Access Road Excavation	45	68	Very Major
	Access Road Paving	45	66	Very Major
	Breakwaters	45	74	Very Major
	Vibro Piling	45	63	Very Major
	Percussive Piling	45	75	Very Major
	Quay Construction Marine	45	71	Very Major
	Quay Construction On-Shore	45	75	Very Major
SR C	Dredging	45	57	Very Major
	Access Road Excavation	45	55	Major
	Access Road Paving	45	53	Major
	Breakwaters	45	49	Moderate
	Vibro Piling	45	46	Minor
	Percussive Piling	45	58	Very Major
	Quay Construction Marine	45	52	Major
	Quay Construction On-Shore	45	53	Major

The assessment results indicate that due to the distance between the works and sensitive receptors of SR A (Doonies Rare Breeds Farm) **negligible** effects, which are not significant in EIA terms, are predicted during the day, evening and night-time periods.

At NSRs B (Girdleness NSRs) due to the relative close proximity to some of the construction works and operations, temporary, local noise effects ranging from **negligible** to **major adverse** are predicted during the daytime period. During the evening period predicted effects range from **major** to **very major** with all effects predicted to be **very major adverse** during the night-time period.

At SR C (Balnagask residential area), **negligible** effects, which are not significant in EIA terms, are predicted during the daytime period and predominately during the evening period but with temporary local **minor adverse** effects, which are not significant in EIA terms, predicted during dredging and percussive piling operations. During the night-time period construction effects range from **minor** to **very major adverse**.

It should be noted that in reality construction works would be transient in nature, with works for the most part taking place at locations significantly removed from the site boundary. Nonetheless, given that some very major effects have been predicted, mitigation measures would be required and are discussed in the relevant section below.

#### 20.6.1.2 Vibration

The distances at which certain activities are likely to give rise to a just perceptible level of vibration are provided in Table 20.2. Preliminary indications are that 'just' perceptible effects from vibration are unlikely due to the distances between operations and sensitive receptors. On this basis, potential vibration effects resultant from construction operations are considered to be **negligible**, which are not significant in EIA terms.

#### 20.6.1.3 Traffic

In addition to construction plant operating on the site, there would be movement of materials to and from the site by road. The scheme transport engineers, Fairhurst, forecast a maximum number of 218 HGVs per day during breakwater construction which would reduce to 150 HGVs per day if articulated lorries with a 29 ton capacity are used. With regard to daily distribution, Fairhurst forecast 12 HGV movements during the AM/PM hourly peaks with 56 HGV movements per hour between 08:30-16:15.

The distribution of construction traffic beyond the Coast Road and Hareness Road is not known as it will be dependent on the appointed contractor, although the final routing will be agreed with ACC. On this basis, Table 20.11 presents AAWT-18hr baseline flows data for key links together with the predicted change in noise level.

It should be noted that the effects from construction traffic would be temporary and local in nature.

**Table 20.11: Predicted change in noise level construction traffic**

Road Link	AAWT-18h Volume	% HGVs	AAWT-18h with Construction	%HGV	Predicted Noise Level Change	Impact Significance
Coast Road (16)	5035	15.9	5471	22.6	1.4	Minor Adverse
Hareness Road (18)	4139	15.3	4575	23.3	1.7	Minor Adverse
Wellington Road South (10)	28594	14.3	29030	15.6	0.2	Negligible
Wellington Road North (9)	22686	19.2	23122	20.7	0.3	Negligible
West Tulos Road (5)	16248	10.1	16684	12.4	0.5	Negligible

The assessment results indicate that with construction vehicles on the local road network, increases in noise levels are likely to occur on the Coast Road and Hareness Road and to a lesser extent on

Wellington Road and West Tullos Road. Based on AAWT-18 hour base flow data, without AWPR, the significance of effects are minor adverse on the Coast Road and Hareness Road with negligible effects on Wellington and West Tullos Road due to the higher existing baseline flows. Predicted AWPR flows have been excluded because construction of the proposed development is scheduled to take place before AWPR is fully operational. This assessment is indicative as it is based on the AAWT-18 hour parameter, whereas the construction operational period is over a 10 hour period. To account for this the predicted change in noise level has been doubled to take account of the compressed time period in which construction vehicles would operate. On this basis, the significance of effects are likely to remain as **minor adverse**, which are not significant in EIA terms, for the Coast Road with just **moderate adverse** effects on Hareness Road. The predicted effects are likely to remain as **negligible**, which are not significant in EIA terms, on Wellington Road and West Tullos Road due to the existing high volume of vehicles on these links.

It should be noted that there is only one sensitive receptor on this section of the Coast Road, namely Doonies Rare Breeds Farm, and that adjacent land uses to Hareness Road are industrial and as such are considered to be less sensitive to noise and vibration.

With regard to peak levels of noise or vibration arising from construction vehicles, this is not anticipated to be any greater than currently experienced from existing HGV movements. On this basis, effects from construction vibration are considered to be **negligible**, which are not significant in EIA terms.

## **20.6.2 Completed Development**

### **20.6.2.1 Fixed Plant and Building Services**

At this stage in the design, specific detail with regard to potential fixed plant and building services associated with the development is not known. Accordingly, it is not possible to undertake noise predictions to determine the significance of the likely effects from the operation of such plant. A plant noise emission limit has therefore been set based upon the guidance given in BS 4142 and the requirements of ACC.

Proposed plant noise limits are discussed within the Mitigation Section of this chapter.

A preliminary assessment has been undertaken of noise from a vessel generator and grain elevator generator. Based on the measured source data neither were identified as being tonal based on the BS4142 one-third octave method. The specific noise level, based on typical distance values, has however been increased by 3 dB to take account of the sources being readily distinctive against the residual acoustic environment, whilst not being tonal or impulsive.

Table 20.12 presents the predicted rating noise level from potential fixed plant, the prevailing background noise level established through survey and the level difference between these two parameters. The significance of the level difference is also presented.

**Table 20.12: BS4142 Assessment of potential fixed plant**

Period/Location	Prevailing Background Noise Level dB L <sub>A90</sub>	Predicted Rating Noise Level dB L <sub>Ar,Tr</sub>	Level Difference	Significance
<b>Night (23:00-07:00)</b>				
A – Doonies Farm	31	38	+7	Moderate Adverse
B – Girdleness	38	45	+7	Moderate Adverse
C - Balnagask	35	44	+9	Moderate Adverse
<b>Day (07:00-23:00)</b>				
A – Doonies Farm	40	38	-2	Negligible
B – Girdleness	40	45	+5	Minor Adverse
C - Balnagask	42	44	+2	Minor Adverse

During the night-time period, operation of the vessel and grain generators are predicted to give rise to **moderate adverse** effects at all sensitive receptors. During the daytime period **negligible** effects, which are not significant in EIA terms, are predicted at Doonies Rare Breeds Farm (SR A) with **minor adverse** effects, which are not significant in EIA terms, predicted at Girdleness Lighthouse residential dwellings (SR B) and the Balnagask residential area (SR C). This preliminary assessment does not take account of attenuation that may be afforded by the intervening topography or engineered structures.

Notwithstanding the above, the results indicate that mitigation would be required to reduce potential noise emissions from fixed plant and building services associated with the AHEP to safeguard the residential amenity of the surrounding area. This is discussed within the mitigation section of this report.

#### 20.6.2.2 Operational Noise

At this stage in the development the exact operations associated with the AHEP have not been finalised. An assessment has therefore been undertaken based on the current operations at Aberdeen Harbour. Source noise measurements of operations at Aberdeen Harbour were conducted on Monday 15 June 2015. This was supplemented with source data extracted from planning noise assessment reports of proposed harbour extensions. It is on this basis that the assessment of the potential effects from operational noise have been made.

#### 20.6.2.3 Worst-Case Scenario (Shortest Distance)

Table 20.13 presents the predicted noise level for the assumed operations at the AHEP being conducted on site at the shortest distance to the selected SRs. No account has been taken of mitigation afforded by the intervening landscape or engineered structures such as a boundary wall that would act to lower noise emissions; as such, the predicted noise levels represent the worst-case scenario. Table 20.14 presents the significance of effects from AHEP operations. Full calculation details are presented within ES Appendix 20-D: Operational Noise Level Calculations.

At Doonies Rare Breeds Farm (SR A), due to the relatively large distance to the AHEP the predicted effects are predominantly **neutral** for both the day and night-time periods, on the basis that no

increase in the prevailing noise level is predicted for the operations assessed. During the night-time period, **negligible** effects, which are not significant in EIA terms, are predicted during typical operations with **negligible** and **minor adverse** effects, which are not significant in EIA terms, predicted during the day and night-time period during large mobile crane moving operations.

Should all plant/operations considered within this assessment operate concurrently, then the cumulative effect at SR A is predicted to be **negligible**, which are not significant in EIA terms, during the daytime period and of **moderate adverse** significance during the night-time period. This would, however, reduce to **minor adverse**, which are not significant in EIA terms, during the night-time period should the large crane not operate and only one forklift operate.

At Girdleness Lighthouse dwellings (SR B), based on the shortest distance to the nearest receptor (Sea Breeze Cottage) and with no mitigation, **major adverse** effects are predicted for all operations with the exception of vessel generator and grain elevator generator operation during the daytime period, where **minor adverse** effects are predicted which are not significant in EIA terms, and during tugboat operations where **neutral** effects are predicted during the day and **negligible** effects predicted at night, which are not significant in EIA terms.

Should all plant/operations considered within this assessment operate concurrently, then the cumulative effect at SR B is predicted to be **major adverse** during both the day and night-time periods, based on a worst-case scenario. Although the predicted noise levels would reduce if only one forklift operates with no operations of the large crane, the significance of predicted effects would remain unchanged overall (**major adverse**).

At Balnagask residential area (SR C), the predicted effects are predominantly **neutral to minor adverse** for the daytime period which are not significant in EIA terms, with the exception of **major adverse** effects predicted during large mobile crane movements. During the night-time period, the predicted effects are predominantly **major adverse**. **Moderate adverse** effects are however predicted during night-time crane lifting; forklift reverse alarm and vessel generator operation, with **neutral to minor adverse** effects, which are not significant in EIA terms, during operation of the grain elevator generator and tug boat operations.

Should all plant/operations considered within this assessment operate concurrently, then the cumulative effect at SR C is predicted to be **major adverse** during both the day and night-time periods based on a worst-case scenario. Although predicted noise levels would reduce if only one forklift operates together with no operation of the large crane, the significance of predicted effects would remain unchanged overall (**major adverse**).

#### 20.6.2.4 Typical Scenario (Central Quay Location)

Table 20.15 presents the predicted noise levels from operations being undertaken at a central location on the nearest quay to the SR being considered. The significance of the predicted change in noise level together with the significance of the effect is presented within Table 20.16.

At Doonies Rare Breeds Farm (SR A), predicted effects are predominantly **neutral** for both the day and night-time periods although **negligible** effects, which are not significant in EIA terms, are

predicted during the daytime period during large crane movements, increasing to **minor adverse** significance, which are not significant in EIA terms, during the night-time period.

Should all plant/operations considered within this assessment operate concurrently, then the cumulative effect at SR A is predicted to be **negligible** during the day, which are not significant in EIA terms, increasing to **minor adverse** at night, which are not significant in EIA terms. Should only one forklift operate with no movement of the large crane, effects would reduce to **neutral** during the day but remaining **minor adverse** during night-time, which are not significant in EIA terms.

At Girdleness Lighthouse dwellings (SR B), predicted effects during the daytime period predominantly range from **negligible** to **minor adverse**, which are not significant in EIA terms. **Moderate adverse** effects are however predicted during typical operations and **major adverse** effects during large crane movements. **Neutral** effects are predicted for operation of the grain elevator generator and tug boat operations. During the night-time period, where prevailing noise levels are lower, the predicted effects are predominantly **major adverse**, which are not significant in EIA terms, although **moderate adverse** effects are predicted during crane lifting operations, **minor adverse** effects, which are not significant in EIA terms, during forklift operations and **neutral to negligible**, which are not significant in EIA terms, for grain elevator generator and tug boat operations.

Should all plant/operations considered within this assessment operate concurrently then the cumulative effect is predicted to be **major adverse** during both the day and night-time period at SR B.

At Balnagask central residential area (SR C), predicted effects for the majority of the daytime period range from **neutral** to **negligible**, which are not significant in EIA terms. However, **moderate adverse** effects are predicted during forklift operations with **major adverse** effects during large crane moving. During the night-time period the predicted effects from AHEP operations predominantly range from **moderate** to **major adverse** significance, with the exception of **negligible** effects, which are not significant in EIA terms, from grain elevator generator operations and **neutral** effects from tug boat operations.

Should all plant/operations considered within this assessment operate concurrently, then the cumulative effect is predicted to be **major adverse** during both the day and night-time periods at SR C. Should only one forklift operate together with no movement of the large crane, effects would however reduce to **moderate adverse** during the day although night-time effects would remain **major adverse**.

In summary, results of the preliminary assessment of noise from proposed AHEP operations indicate that mitigation will be required so as not to adversely affect the surrounding residential amenity, as discussed later in this chapter.

Table20.13: Predicted change in noise from AHEP operation noise (shortest distance)

Operation	dB L <sub>Aw</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank Cleaning	108	38	0	0	59	12	18	47	2	8
Loading large pipes onto lorries via mobile forklift	107	38	0	0	59	12	18	47	1	8
Cargo unloading. Moving containers from boat	107	37	0	0	58	11	17	46	1	7
Forklift lifting pipes	110	40	0	1	61	15	20	49	2	10
Crane lifting pipes off boat including dismantling chains from pipes	103	33	0	0	54	8	13	42	1	4
Forklift reverse alarm	103	33	0	0	54	8	13	42	1	4
Forklift reverse alarm	106	37	0	0	58	11	17	46	1	7
Forklift reverse alarm	106	36	0	0	58	11	17	46	1	7
Large forklift reverse alarm	103	33	0	0	54	8	13	42	1	4
Mobile crane lifting	105	35	0	0	56	10	15	44	1	6
Large mobile crane moving	117	47	+1	+2	68	21	27	56	6	16
Vessel generator	104	35	0	0	46	3	6	42	0	4
Grain elevator generator only	94	24	0	0	45	2	6	33	0	1
Waiting tugboat engine	87	17	0	0	29	0	0	25	0	0
Tugboat pulling away from dock	94	26	0	0	37	0	1	32	0	1
<b>Cumulative</b>	-	<b>50</b>	<b>+1</b>	<b>+4</b>	<b>71</b>	<b>+24</b>	<b>+30</b>	<b>59</b>	<b>+9</b>	<b>+19</b>
<b>Cumulative (No large crane and 1 x FLT)</b>		<b>46</b>	<b>+1</b>	<b>+2</b>	<b>67</b>	<b>+20</b>	<b>+26</b>	<b>55</b>	<b>+6</b>	<b>+15</b>

**Table 20.14: Significance of effects from AHEP operational noise (shortest distance)**

Operation	dB L <sub>AW</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night 48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Significance	Significance		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank cleaning	108	38	Neutral	Neutral	59	Major Adverse	Major Adverse	47	2	8
Loading large pipes onto lorries via mobile forklift	107	38	Neutral	Neutral	59	Major Adverse	Major Adverse	47	1	8
Cargo unloading. Moving containers from boat	107	37	Neutral	Neutral	58	Major Adverse	Major Adverse	46	1	7
Forklift lifting pipes	110	40	Neutral	Negligible	61	Major Adverse	Major Adverse	49	2	10
Crane lifting pipes off boat including dismantling chains from pipes	103	33	Neutral	Neutral	54	Major Adverse	Major Adverse	42	1	4
Forklift reverse alarm	103	33	Neutral	Neutral	54	Major Adverse	Major Adverse	42	1	4
Forklift reverse alarm	106	37	Neutral	Neutral	58	Major Adverse	Major Adverse	46	1	7
Forklift reverse alarm	106	36	Neutral	Neutral	58	Major Adverse	Major Adverse	46	1	7
Large forklift reverse alarm	103	33	Neutral	Neutral	54	Major Adverse	Major Adverse	42	1	4
Mobile crane lifting	105	35	Neutral	Neutral	56	Major Adverse	Major Adverse	44	1	6
Large mobile crane moving	117	47	Negligible	Minor adverse	68	Major Adverse	Major Adverse	56	6	16
Vessel generator	104	35	Neutral	Neutral	46	Moderate Adverse	Major Adverse	42	0	4
Grain elevator generator only	94	24	Neutral	Neutral	45	Minor Adverse	Major Adverse	33	0	1
Waiting tugboat engine	87	17	Neutral	Neutral	29	Neutral	Neutral	25	0	0
Tugboat pulling away from dock	94	26	Neutral	Neutral	37	Neutral	Negligible	32	0	1
<b>Cumulative</b>		<b>50</b>	<b>Negligible</b>	<b>Moderate Adverse</b>	<b>71</b>	<b>Major Adverse</b>	<b>Major Adverse</b>	<b>59</b>	<b>Major Adverse</b>	<b>Major Adverse</b>
<b>Cumulative (No large crane and 1 x FLT)</b>		<b>46</b>	<b>Negligible</b>	<b>Minor Adverse</b>	<b>67</b>	<b>Major Adverse</b>	<b>Major Adverse</b>	<b>55</b>	<b>Major Adverse</b>	<b>Major Adverse</b>



**Table 20.15: Predicted change in noise from AHEP operation noise (typical distance)**

Operation	dB L <sub>Aw</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night 48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank cleaning	108	36	0	0	46	2	6	45	1	6
Loading large pipes onto lorries via mobile forklift	107	36	0	0	46	2	6	45	1	6
Cargo unloading. Moving containers from boat	107	35	0	0	45	2	5	44	1	6
Forklift lifting pipes	110	38	0	0	48	4	8	48	2	8
Crane lifting pipes off boat including dismantling chains from pipes	103	31	0	0	41	1	3	40	0	3
Forklift reverse alarm	103	31	0	0	41	1	3	40	0	3
Forklift reverse alarm	106	35	0	0	45	2	5	44	1	6
Forklift reverse alarm	106	35	0	0	44	2	5	44	1	5
Large forklift reverse alarm	103	31	0	0	41	1	3	40	0	3
Mobile crane lifting	105	33	0	0	43	1	4	42	1	4
Large mobile crane moving	117	45	1	2	55	8	14	54	5	14
Vessel generator	104	35	0	0	41	1	3	40	0	3
Grain elevator generator only	94	22	0	0	32	0	0	31	0	1
Waiting tugboat engine	87	18	0	0	24	0	0	23	0	0
Tugboat pulling away from dock	94	25	0	0	32	0	1	31	0	0
<b>Cumulative</b>	-	<b>48</b>	<b>+1</b>	<b>+3</b>	<b>58</b>	<b>+11</b>	<b>+17</b>	<b>57</b>	<b>+7</b>	<b>+17</b>
<b>Cumulative (No large crane and 1 x FLT)</b>		<b>44</b>	<b>0</b>	<b>+2</b>	<b>54</b>	<b>+8</b>	<b>+13</b>	<b>53</b>	<b>+4</b>	<b>+13</b>

**Table 20.16: Significance of effects from AHEP operation noise (typical distance)**

Operation	dB L <sub>Aw</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night 48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank cleaning	108	36	Neutral	Neutral	46	Minor Adverse	Major Adverse	45	Negligible	Major Adverse
Loading large pipes onto lorries via mobile forklift	107	36	Neutral	Neutral	46	Minor Adverse	Major Adverse	45	Negligible	Major Adverse
Cargo unloading. Moving containers from boat	107	35	Neutral	Neutral	45	Minor Adverse	Major Adverse	44	Negligible	Major Adverse
Forklift lifting pipes	110	38	Neutral	Neutral	48	Moderate Adverse	Major Adverse	48	Minor Adverse	Major Adverse
Crane lifting pipes off boat including dismantling chains from pipes	103	31	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Moderate Adverse
Forklift reverse alarm	103	31	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Moderate Adverse
Forklift reverse alarm	106	35	Neutral	Neutral	45	Minor Adverse	Major Adverse	44	Negligible	Major Adverse
Forklift reverse alarm	106	35	Neutral	Neutral	44	Minor Adverse	Major Adverse	44	Negligible	Major Adverse
Large forklift reverse alarm	103	31	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Moderate Adverse
Mobile crane lifting	105	33	Neutral	Neutral	43	Negligible	Moderate Adverse	42	Negligible	Moderate Adverse
Large mobile crane moving	117	45	Negligible	Minor Adverse	55	Major Adverse	Major Adverse	54	Major Adverse	Major Adverse
Vessel generator	104	35	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Moderate Adverse
Grain elevator generator only	94	22	Neutral	Neutral	32	Neutral	Neutral	31	Neutral	Negligible
Waiting tugboat engine	87	18	Neutral	Neutral	24	Neutral	Neutral	23	Neutral	Neutral
Tugboat pulling away from dock	94	25	Neutral	Neutral	32	Neutral	Negligible	31	Neutral	Neutral
<b>Cumulative</b>	-	<b>48</b>	<b>Negligible</b>	<b>Minor Adverse</b>	<b>58</b>	<b>Major Adverse</b>	<b>Major Adverse</b>	<b>57</b>	<b>Major Adverse</b>	<b>Major Adverse</b>
<b>Cumulative (No large crane and 1 x FLT)</b>	-	<b>44</b>	<b>Neutral</b>	<b>Minor Adverse</b>	<b>54</b>	<b>Major Adverse</b>	<b>Major Adverse</b>	<b>53</b>	<b>Moderate Adverse</b>	<b>Major Adverse</b>

20.6.2.5 Operational Noise – HGV Vehicles

Noise from HGVs travelling along the new access road to the AHEP have been calculated using the haul road methodology of BS5228 and is based on the current HGV traffic flow to the existing Aberdeen Harbour. Table 20.17 presents a summary of the results together with the predicted change in noise level and associated significance for the average predicted noise level during the day and night-time periods. Full calculation details are presented within ES Appendix 20-D: Operational Noise Level Calculations.

**Table 20.17: Significance of effects from HGVs on access road**

Period/SR	Prevailing Noise Level dB L <sub>Aeq</sub>	Predicted HGV Noise Level dB L <sub>Aeq</sub>	Change in Noise Level dB	Significance
<b>Worst Hour Night 06:00-07:00</b>				
SR A – Doonies Farm	48	35	0	Neutral
SR B – Girdleness	41	41	3	Minor Adverse
SR C - Balnagask	40	41	4	Moderate Adverse
<b>Worst Hour Day 14:00-15:00</b>				
SR A – Doonies Farm	54	44	0	Neutral
SR B – Girdleness	47	50	5	Major Adverse
SR C - Balnagask	51	50	3	Minor Adverse

The predicted significance of effects from movements of HGVs along the AHEP access roads are **neutral** at Doonies Rare Breeds Farm (SR A) due to the relatively large distance between SR A and the AHEP access road. At Girdleness Lighthouse residential receptors (SR B), which are the nearest receptors to the development, **minor adverse** effects, which are not significant in EIA terms, are predicted during the night-time period, with **major adverse** during the daytime period. At Balnagask central residential area (SR C), **moderate adverse** effects are predicted during the night-time period with **minor adverse**, which are not significant in EIA terms, during the daytime period.

With the exception of Doonies Rare Breeds Farm, increases in the prevailing noise level are predicted as a result of HGV movements along the AHEP access road. The preliminary results indicate that mitigation is likely to be required to safeguard the residential amenity of dwellings at Girdleness Lighthouse and Balnagask. This is discussed within the mitigation section of this chapter.

It should be noted that the results are based on the HGV schedule of the existing Aberdeen Harbour and do not take account of any barrier attenuation that may be afforded by the intervening topography and engineered structures.

20.6.2.6 Road Traffic Noise

The assessment has been made for the opening year 2019 with and without the development, but in both instances includes for the forecast changes due to the Aberdeen Western Peripheral Route (AWPR) which is due to be completed in 2017. Table 20.18 presents the predicted change in noise

level together with the significance of effects. Full details of the road traffic noise assessment are provided within ES Appendix 20-E: Road Traffic Noise Assessment.

**Table 20.18: Predicted change in road traffic basic noise level (BNL), dB L<sub>A10,18hr</sub>**

Road Link	Difference in dB L <sub>A10,18hr</sub> BNL			Significance of Effect
	2019 Without Development	2019 With Development	Change	
Great Southern Road - north (1)	71.9	71.9	0.0	Neutral
Great Southern Road - west (2)	73.3	73.3	0.0	Neutral
West Tullos Road North (3)	73.2	73.3	0.1	Negligible
Provost Watt Drive (4)	65.6	65.6	0.0	Neutral
West Tullos Road South (Redmoss Road) (5)	71.3	71.4	0.0	Neutral
Riverside Drive (6)	68.7	68.6	-0.1	Negligible
Wellington Road 1 (7)	72.1	72.3	0.2	Negligible
Wellington Road 2 (8)	73.4	73.5	0.1	Negligible
Wellington Road 3 (9)	74.2	74.0	-0.2	Negligible
Wellington Road 4 (10)	74.5	74.7	0.2	Negligible
Wellington Road 5 (11)	73.3	73.7	0.4	Negligible
Market Street (12)	73.4	73.6	0.2	Negligible
Victoria Road 1 (13)	65.8	66.0	0.2	Negligible
St Fittick's Road 1 (14)	62.2	62.6	0.4	Negligible
St Fittick's Road 2 (15)	62.2	62.6	0.4	Negligible
Coast Road North Hareness Road (16)	66.3	67.9	1.5	Minor Adverse
Coast Road (17)	59.8	59.8	0.0	Neutral
Hareness Road (18)	61.3	62.1	0.8	Negligible
St Fittick's Road North of Victoria Road (19)	56.2	56.2	0.0	Neutral

For all roads assessed, the predicted effects range from **neutral** to **negligible**, which are not significant in EIA terms, with the exception of the Coast Road North of Hareness Road where permanent, local effects of **minor adverse significance**, which are not significant in EIA terms, are predicted. It should be noted that there is only one noise sensitive receptor adjacent to this section of the Coast Road, namely Doonies Rare Breeds Farm.

## 20.7 Mitigation Measures

### 20.7.1 Construction

Measures to control the construction noise and vibration effects would be implemented. The control measures would be finalised prior to the commencement of the works, through liaison with ACC, but is likely to include the following measures:

- Noise and vibration monitoring on-site, where necessary, which would assist in controlling levels at SRs;

- The occupants of nearby residential properties potentially most affected by noise or vibration from on-site activities will be informed when specific noisy and vibration borne activities are likely to take place over a long period of time. A 24 hour contact telephone number for the public will be provided to allow identification of any noise problems and enabling concerns to be resolved at an early stage;
- Impact piling will be restricted to day-time hours only (Monday to Friday 0700 to 1900; Saturday 0900 to 1600; no impact piling on Sunday At all times, where possible, static items such as generators shall be sited away from sensitive receptors and, where practical, noise control means, such as barriers, enclosures or silencers, will be utilised to further reduce noise;
- If possible, operate dredgers with excavator and hydraulic cooling fans pointing away from residential areas;
- Reviewing construction techniques as required, especially in response to exceedences of the Noise Action Level and/or complaints;
- Regular communications held between the contractors, AHB and ACC officers;
- Implementing specific mitigation measures such as:
  - Using efficient, well maintained plant and equipment;
  - Switching-off plant and equipment when not in use.

In addition, Contractors will be required to use Best Practicable Means (BPM) throughout the duration of the site works and will register with the Considerate Contractors Scheme.

Development of a Construction Traffic Management Plan would be agreed with ACC to minimise the temporary and intermittent adverse impacts that may arise from construction traffic.

#### 20.7.1.1 Monitoring

Locations for noise and vibration monitoring will be agreed with ACC prior to works commencing. Sample noise and vibration monitoring will be undertaken on a continuous basis by the Contractor. Such monitoring will require specialist noise and vibration monitoring equipment.

Noise and vibration monitoring record sheets will be completed.

Where the results of the monitoring exercises indicate that the Action Levels have been exceeded, the following actions should be undertaken:

- The activity or activities causing the Action Levels to be exceeded will be identified through discussions with the Environmental Monitoring Co-ordinator;
- Investigations will be made to determine whether the activities could be easily changed or other simple actions taken to substantially reduce noise or vibration levels;
- If simple and effective remedial measures are not identified, consideration will be given to the implementation of alternative techniques and/or additional mitigation measures; and

- In all cases where Action Levels are anticipated to be exceeded, neighbourhood liaison will be carried out to the degree that is appropriate for the levels likely to be reached and their estimated duration.

#### 20.7.1.2 Equipment

Noise monitors will comply with BS 61672-1 (2003). The vibration monitors must continuously sample the vibration levels and record the maximum vertical PPV every second for sample vibration monitoring and every 5 minute period for continuous vibration monitoring. The vibration monitors will be capable of measuring 3-dimensional levels of vibration.

### 20.7.2 **Completed Development**

#### 20.7.2.1 Fixed Plant And Building Service

Table 20.19 presents recommended plant noise limits to safeguard the residential amenity of the surrounding area. The recommended noise limits are based on advice contained within BS4142.

**Table 20.19: Recommended fixed plant and building services noise limits**

Location/Period	Prevailing Background Noise Level dB L <sub>A90</sub>	Recommended Plant Noise Limit dB L <sub>Ar,Tr</sub> <sup>1</sup>
<b>Night (23:00-07:00)</b>		
SR A – Doonies Farm	31	35
SR B – Girdelness	38	35
SR C - Balnagask	35	35
<b>Day (07:00-23:00)</b>		
SR A – Doonies Farm	40	35
SR B – Girdelness	40	35
SR C - Balnagask	42	37
<b>Note:</b> A minimum plant noise limit of 35dB L <sub>Ar,Tr</sub> is recommended		

It should be noted that a minimum plant noise limit, expressed as a rating noise level, is recommended where prevailing noise levels are 'low'. This should safeguard the residential amenity of the surrounding area. The recommended plant noise limit applies to the cumulative level of all operational fixed external plant and building services.

Where the plant is considered to have a tonal element, then in line with the requirements of ACC, internal noise levels, assessed with windows closed, within dwellings or noise sensitive premises "shall not exceed NR25 between 07:00-23:00 and NR25 at all other times".

Preliminary calculations indicate that mitigation will be required to satisfy the recommended plant noise limits. It is considered that at this stage of the development there is sufficient flexibility to control noise emissions from sources which are part of the AHEP. This may include the procurement of 'quiet' plant, provision of acoustic louvres, enclosures and induct-silencers, where required.

To control noise emissions from plant which are not permanent to the AHEP, then mitigation in the form of zoning of operations, to maximise the distance from noise source to SR and provision of

mitigation, such as a boundary wall or acoustic grade fence to sections of the AHEP to attenuate noise emissions, could be employed.

#### 20.7.2.2 Operational Noise

Reduction in operational noise emissions from plant permanently located at the AHEP could be achieved through the procurement of 'low' noise plant and strategic zoning and scheduling of operations. In addition to this, it is likely that some form of barrier attenuation will be required, through the provision of a boundary wall or acoustic grade fence, although the extent of this will need to be determined once details on AHEP operations are known. This is most likely to be applicable for Sea Breeze Cottage (part of the Girdleness Lighthouse dwellings) which has a window directly overlooking the proposed AHEP.

Control of noise emissions from vessels visiting the AHEP will be more challenging. Measures could include scheduling of 'noisy' operations to less sensitive periods, where possible, together with zoning of operations/berthing. This, combined with on-site measures such as a boundary wall or acoustic fence around sections of the AHEP, would act to reduce overall noise emissions.

#### 20.7.2.3 Operational Noise – HGV Movements

Noise emissions from HGV movements along the AHEP access road will be dependent on the hourly flow (number of vehicles per hour). Based on the current HGV schedule at Aberdeen Harbour, this is considered likely to result in minor adverse effects for SR B (Girdleness Lighthouse dwellings) and SR C (Balnagask central residential area). On this basis, some form of mitigation may be required in the form of a boundary wall or acoustic grade fence, providing some barrier attenuation between the noise source and SRs. Mitigation could also include implementation of an operations logistics plan which would include strategic routing and timings of HGV operations.

Exact mitigation requirements would need to be established once HGV scheduling detail for the AHEP is known.

#### 20.7.2.4 Road Traffic Noise

Neutral to negligible effects have been predicted as a result of road traffic noise, with the exception of the Coast Road, where a +1.5 dB(A) increase is predicted which is of **minor adverse** significance. Such a change in noise levels would be imperceptible at nearby receptors and as such mitigation is not proposed for a change in noise level of this magnitude and significance.

### 20.8 **Residual Effects**

#### 20.8.1 **Construction**

##### 20.8.1.1 Construction Plant Noise

Appropriate measures to mitigate and control noise from construction works are available and would be implemented in accordance with relevant planning conditions and controlled via measures agreed with ACC. It is anticipated that a noise reduction of 10 dB should be achievable as a result of the mitigation proposed. Table 20.19 presents the predicted mitigated noise levels together with their respective significance for SR B, Girdleness Lighthouse dwellings. Residual effects are not presented for SR A (Doonies Rare Breeds Farm) and SR C (Balnagask) given that **negligible** effects, which are

not significant in EIA terms, were predicted for these receptor in the absence of mitigation for all periods, with the exception of dredging operations for SR C, with **minor adverse** effects, which are not significant in EIA terms, predicted during the evening period and **very major adverse** effects during the night-time period.

**Table 20.20: Significance of residual predicted construction noise levels SR B**

SR	Demolition/Construction Activity	Threshold Level [dB(A)]	Predicted Site Noise Level [dB(A)]	Significance of Effect
<b>Day</b>				
SR B	Dredging	65	51	Negligible
	Access Rd Excavation	65	58	Negligible
	Access Road Paving	65	56	Negligible
	Breakwaters	65	64	Negligible
	Vibro Piling	65	53	Negligible
	Percussive Piling	65	56	Negligible
	Quay Construction Marine	65	61	Negligible
	Quay Construction On-Shore	65	65	Negligible
<b>Evening</b>				
SR B	Dredging	55	61	Major
	Access Rd Excavation	55	59	Moderate
	Access Road Paving	55	56	Minor
	Breakwaters	55	64	Major
	Vibro Piling	55	53	Negligible
	Percussive Piling	55	65	Major
	Quay Construction Marine	55	61	Major
	Quay Construction On-Shore	55	65	Major
<b>Night</b>				
SR B	Dredging	45	61	Very Major
	Access Rd Excavation	45	59	Very Major
	Access Road Paving	45	56	Very Major
	Breakwaters	45	64	Very Major
	Vibro Piling	45	53	Major
	Percussive Piling	45	65	Very Major
	Quay Construction Marine	45	61	Very Major
	Quay Construction On-Shore	45	65	Very Major

During daytime construction works, increases in the prevailing ambient noise levels are predicted to occur at SR B. With mitigation in place, however, it is envisaged that the construction works would proceed with the minimum disturbance to local residents resulting in **negligible** effects, which are not significant in EIA terms, when compared against the construction threshold limit of 65 dB L<sub>Aeq</sub>. During the evening period due to the lower threshold value, residual temporary local effects are predicted to range from **negligible** to **major adverse**. During the night-time period residual effects are predicted to be predominately of **very major adverse** significance with **major adverse** during vibro piling operations.



It should be borne in mind that the predicted residual effects are based on a mitigated level of 10 dB lower than the un-mitigated scenario and when works are being undertaken at the shortest distance to the receptor. Should more than 10 dB reduction be achieved then significance of effects may be lower than those reported.

In summary, the results of the construction noise assessment indicates that 24/7 construction operations should be acceptable at both SR A (Doonies Rare Breeds Farm) and SR C (Balnagask) due to the distance between the receptors and the works. At SR B (Girdle Ness Lighthouse), the results indicate that with mitigation, potential effects from daytime and evening construction operations should be acceptable, although additional mitigation is recommended during dredging and access road excavation works when these are being undertaken at the closest distance to SR B. During the night-time period, however, due to the low prevailing noise levels and assignment of the category A 'threshold value' (the lowest noise level), mitigated levels will need to achieve additional reductions to those reported in order for them to be acceptable.

#### 20.8.1.2 Vibration

Vibration limits would be set to ensure compliance with national standards and, hence, minimise the risk of complaints or building damage during construction. These limits could be controlled through the implementation of an EMP. Following the implementation of appropriate mitigation measures, construction-generated residual vibration effects are anticipated to be **negligible**, which are not significant in EIA terms, due to the distances between vibration sources and SRs.

#### 20.8.1.3 Construction Traffic

A Construction Traffic Management Plan, including a construction traffic routing plan, would be agreed to minimise the temporary and intermittent effects that traffic can cause (see Chapter 18: Traffic and Transport for further details). It is therefore considered that, following mitigation, there would be temporary, local **negligible to minor adverse** residual effects, which are not significant in EIA terms, on nearby existing SRs as a result of construction traffic noise and vibration.

### 20.8.2 **Completed Development**

#### 20.8.2.1 Fixed Plant and Building Services

Provided the cumulative noise from fixed plant and building services achieve the recommended noise limits, **negligible** residual effects, which are not significant in EIA terms, are predicted with regards to noise from fixed plant and building services.

#### 20.8.2.2 Operational Noise

It is considered that, with the proposed mitigation measures in place, it should be possible to reduce operational noise levels by between 5 dB to 10 dB depending on the measures adopted and final details regarding operation of the AHEP. However, even with mitigation in place, increases in the prevailing noise levels at Girdleness Lighthouse dwellings (SR B) are still likely. Table 20.21 presents the predicted typical operational noise levels with a conservative 5 dB reduction in noise emission from each source.

**Table 20.21: Typical operational noise levels with mitigation and predicted change in noise level**

Operation	dB L <sub>Aw</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night 48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank cleaning	108	31	0	0	41	1	3	40	0	3
Loading large pipes onto lorries via mobile forklift	107	31	0	0	41	1	3	40	0	3
Cargo unloading. Moving containers from boat	107	30	0	0	40	1	2	39	0	3
Forklift lifting pipes	110	33	0	0	43	1	4	43	1	4
Crane lifting pipes off boat including dismantling chains from pipes	103	26	0	0	36	0	1	35	0	1
Forklift reverse alarm	103	26	0	0	36	0	1	35	0	1
Forklift reverse alarm	106	30	0	0	40	1	2	39	0	3
Forklift reverse alarm	106	30	0	0	39	1	2	39	0	2
Large forklift reverse alarm	103	26	0	0	36	0	1	35	0	1
Mobile crane lifting	105	28	0	0	38	0	2	37	0	2
Large mobile crane moving	117	40	0	1	50	5	9	49	2	10
Vessel generator	104	30	0	0	36	0	1	35	0	1
Grain elevator generator only	94	17	0	0	27	0	0	26	0	0
Waiting tugboat engine	87	13	0	0	19	0	0	18	0	0
Tugboat pulling away from dock	94	20	0	0	27	0	0	26	0	0
<b>Cumulative</b>	-	<b>43</b>	<b>0</b>	<b>+1</b>	<b>53</b>	<b>+7</b>	<b>+12</b>	<b>52</b>	<b>+4</b>	<b>+12</b>
<b>Cumulative (No large crane and 1 x FLT)</b>		<b>39</b>	<b>0</b>	<b>+1</b>	<b>49</b>	<b>+4</b>	<b>+9</b>	<b>49</b>	<b>+2</b>	<b>+9</b>

**Table 20.22: Significance of effects from AHEP operation noise (typical distance with mitigation)**

Operation	dB L <sub>AW</sub>	Doonies Farm Predicted Noise Level dB L <sub>Aeq</sub>	Doonies Farm Prevailing Noise Levels		Girdleness SRs Predicted Noise Level dB L <sub>Aeq</sub>	Girdleness SRs (Sea Breeze Cottage)		Balnagask SRs Predicted Noise Level dB L <sub>Aeq</sub>	Balnagask Prevailing Noise Levels (Central Location)	
			Day 54dB L <sub>Aeq</sub>	Night 48dB L <sub>Aeq</sub>		Day 47dB L <sub>Aeq</sub>	Night 41dB L <sub>Aeq</sub>		Day 51dB L <sub>Aeq</sub>	Night 40dB L <sub>Aeq</sub>
			Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB		Change in Noise Level Day dB	Change in Noise Level Night dB
Tank cleaning	108	31	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Minor Adverse
Loading large pipes onto lorries via mobile forklift	107	31	Neutral	Neutral	41	Negligible	Minor Adverse	40	Neutral	Minor Adverse
Cargo unloading. Moving containers from boat	107	30	Neutral	Neutral	40	Negligible	Minor Adverse	39	Neutral	Minor Adverse
Forklift lifting pipes	110	33	Neutral	Neutral	43	Negligible	Moderate Adverse	43	Negligible	Moderate Adverse
Crane lifting pipes off boat including dismantling chains from pipes	103	26	Neutral	Neutral	36	Neutral	Negligible	35	Neutral	Negligible
Forklift reverse alarm	103	26	Neutral	Neutral	36	Neutral	Negligible	35	Neutral	Negligible
Forklift reverse alarm	106	30	Neutral	Neutral	40	Negligible	Minor Adverse	39	Neutral	Minor Adverse
Forklift reverse alarm	106	30	Neutral	Neutral	39	Negligible	Minor Adverse	39	Neutral	Minor Adverse
Large forklift reverse alarm	103	26	Neutral	Neutral	36	Neutral	Negligible	35	Neutral	Negligible
Mobile crane lifting	105	28	Neutral	Neutral	38	Neutral	Minor Adverse	37	Neutral	Minor Adverse
Large mobile crane moving	117	40	Neutral	Negligible	50	Major Adverse	Major Adverse	49	Minor Adverse	Major Adverse
Vessel generator	104	30	Neutral	Neutral	36	Neutral	Negligible	35	Neutral	Negligible
Grain elevator generator only	94	17	Neutral	Neutral	27	Neutral	Neutral	26	Neutral	Neutral
Waiting tugboat engine	87	13	Neutral	Neutral	19	Neutral	Neutral	18	Neutral	Neutral
Tugboat pulling away from dock	94	20	Neutral	Neutral	27	Neutral	Neutral	26	Neutral	Neutral
<b>Cumulative</b>	-	<b>43</b>	<b>Negligible</b>	<b>Negligible</b>	<b>53</b>	<b>Major Adverse</b>	<b>Major Adverse</b>	<b>52</b>	<b>Moderate Adverse</b>	<b>Major Adverse</b>
<b>Cumulative (No large crane and 1 x FLT)</b>		<b>39</b>	<b>Negligible</b>	<b>Negligible</b>	<b>49</b>	<b>Moderate Adverse</b>	<b>Major Adverse</b>	<b>49</b>	<b>Minor Adverse</b>	<b>Major Adverse</b>

The results indicate that with mitigation in place, the noise effects from individual sources/operations would typically be **neutral** to **negligible**, which are not significant in EIA terms, during the daytime period at Girdleness Lighthouse dwellings. **Major adverse** effects are still predicted however, for large crane operations with a sound power level 117 dB(A). Even if the large crane is not in operation and only one forklift truck is in operation, with all other plant/operation operating cumulatively, the effect is predicted to be **moderate adverse** during the daytime period. It should be noted, however, that this is indicative only and actual effects will be dependent on final location of plant/operations, together with the sound power of the plant/operations used.

The results demonstrate that with the implementation of mitigation measures, increases in the prevailing noise level at Girdleness Lighthouse dwellings (SR B) are still likely but can be effectively reduced to an acceptable level by controlling which operations are occurring at which times. During the night-time period, the noise effects of individual plant/operations are predicted to be predominantly **minor adverse**, which are not significant in EIA terms, albeit increasing to **major adverse** should all operations occur concurrently. The results indicate that even with mitigation measures in place, control of which operations occur during the night-time period would be required to ensure noise effects are acceptable at the nearest SR (Girdleness Lighthouse).

With regard to the other SRs it is considered that with mitigation measures in place, effects will be predominantly **negligible**, albeit increasing to **minor adverse** during noisier operations, which are not significant in EIA terms. In the event that all operations occur concurrently, including the large crane and two fork lift trucks, the cumulative effects are predicted to be **negligible** at SR A during both the day and night-time periods which are not significant in EIA terms, **major adverse** at SR B during both the day and night-time periods, and **moderate adverse** and **major adverse** at SR C during the day and night-time periods respectively.

With regards to the above, all residual effects will be permanent, intermittent and local.

#### 20.8.2.3 Operational Noise – HGV Vehicles

It is considered that with mitigation measures in place it should be possible to reduce residual noise effects to SRs B and C to **negligible** to **minor adverse**, which are not significant in EIA terms. Residual effects at SR A (Doonies Rare Breeds Farm) following mitigation are anticipated to be **neutral**.

#### 20.8.2.4 Road Traffic Noise

No mitigation has been proposed therefore residual effects are unchanged from the potential effects, namely ranging from **neutral** to **negligible** which are not significant in EIA terms, albeit with permanent, local **minor adverse** effects, which are not significant in EIA terms, likely to be experienced on the Coast Road.

### 20.9 **Conclusion**

A summary of potential effects, mitigation measures and resulting residual effects is presented in Table 20.23 below.

**Table 20.23: Summary of potential impacts, mitigation measures and residual impacts**

Issue	Potential Effect	Mitigation Measures	Residual Impact/ Significance
<b>Construction</b>			
Construction plant noise	SR A (Doonies Rare Breeds Farm) Negligible to temporary, local very major adverse.	Implementation of a site-specific noise control measures to be agreed with ACC, which may include: Selecting inherently quiet plant; The use, where necessary and practicable, of enclosures and screens around noisy fixed plant; Strategic planning of works; and Adherence to relevant British Standards.	Negligible
	SR B (Girdle Ness Lighthouse) Negligible to temporary, local very major adverse.		Negligible to temporary, local very major adverse.
	SR C (Balnagask) Negligible to temporary, local very major adverse.		Negligible (except dredging evening temporary, local minor with very major at night-time)
Construction vibration	Negligible	Implementation of a site-specific mitigation measures to be agreed with ACC.	Negligible
Construction traffic noise	Negligible to temporary, local moderate adverse	Implementation of Construction Logistics Plan; and Implementation of site-specific control measures.	Negligible to temporary, local moderate adverse
<b>Completed Development</b>			
Fixed Plant And Building Services	Negligible to permanent, local moderate adverse	Control through noise condition. Procurement of 'quiet' plant and use of localised mitigation where required; acoustic louvres, enclosures, barriers.	Negligible
Operational	Neutral to permanent, intermittent, local major adverse	Implementation of BPM to reduce noise levels from plant and operations.	Neutral to permanent, intermittent, local moderate adverse
Operational HGVs	Neutral to permanent, intermittent, local major adverse	Implementation of operations logistics plan and localised mitigation measures.	Neutral to permanent, intermittent, local minor adverse
Road traffic	Neutral to permanent, local minor adverse	None Required	Neutral to permanent, local minor adverse

## 20.10 References

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