

7.4 Noise and Vibration Assessment

7.4.1 Introduction

The object of this section is to present data for the noise and vibration aspects of the Environmental Impact Statement.

Baseline noise measurements were made at 19 locations and noise levels have been predicted at 120 locations. The road layouts are shown on Figures 7.10 to 7.18 (Volume 2) with the noise receptors highlighted and the traffic flow rates used are those predicted for the years 2007 and 2022.

The road design process included consideration of an input of initial predicted traffic noise levels and proposed amelioration measures and the land-take required for these has been included in the road design. The amelioration measures are an integral part of the scheme and will be constructed as part the overall road works.

7.4.2 Assessment Methodology

Noise

Sound levels are measured in units called decibels (dB), and noise is defined as unwanted sound. Environmental noise levels are usually assessed in terms of A-weighted decibels, the dB(A), where the A-weighting approximates to the response of the human ear. Road traffic noise may cause annoyance and the parameter most commonly and currently used in Ireland and the UK for the assessment of traffic noise is the L_{10} dB(A) level, i.e. the noise level exceeded for 10% of the relevant time. The criterion used in the UK and by local authorities in Ireland is the L_{10} (18-hour) dB(A) as measured or predicted 1 metre from the relevant facade. This is the mean of the hourly L_{10} levels in the period 06.00 to 24.00 hours and takes into account the reflection of the house facade, which adds 2.5 dB(A) to the calculated sound emission level.

Social surveys in the UK have shown that there is a good correlation of dissatisfaction towards traffic noise with the L_{10} (18-hour) level. Current UK legislation has a limit of 68 dB(A) L_{10} (18-hour) for new road schemes before noise abatement at the point of reception is required. Where roads are already in existence and the existing traffic noise level is in excess of 68 dB(A) L_{10} (18-hour), the UK limit is the existing traffic noise level plus 1 dB(A), (e.g. if the existing noise level was 70 dB(A) the limit would be 71 dB(A)). Although there is no corresponding Irish legislation this level is used as the design limit for residential premises along new or realigned roads.

Traffic noise may also be expressed in a parameter that takes into account the acoustic energy over a specified period, and this is the equivalent continuous level, $L_{Aeq,T}$. It is the notional value that has the same energy as the varying source over the time interval T, and where the facade effect is not taken into consideration, the 'free field' $L_{Aeq,T}$ level due to traffic noise is numerically about 6 dB(A) less than L_{10} (18-hour) level. Industrial and occupational noise is usually expressed in $L_{Aeq,T}$ levels. The criterion for industrial noise outside residential premises during daytime is usually an $L_{Aeq,T}$ of 55 dB(A). Level for level, traffic noise is less objectionable (and railway noise less again) than industrial noise.

The EU Directive 2002/49/EC of the European Parliament and Council relating to the assessment and management of environmental noise will use a parameter based on the 'free field' LAeq,T.

The HMSO "Calculation of Road Traffic Noise", 1988, (CRTN), may currently be used to predict noise levels at distances from 4 to 300 metres from the carriageway. There are 2 major parts in the calculation of road traffic noise. One part is the calculation of the 'basic L10 levels', defined as the noise level at a reference point 10 metres from the nearside carriageway. This is calculated from the traffic flow, the traffic speed, % heavy vehicles and the road gradient. The 'basic L10 levels' are then corrected as appropriate for the effects of distance from the road, nature of the ground surface, intervening obstructions, etc.

The principal parameters that dictate the potential impact from a road are the traffic flow and the distance to the receiver. The traffic rates used are the highest predicted for the years 2007 and 2022. The mainline traffic speed limit used in the calculations was 60 mph and the traffic figures supplied were based on a 12 to 13.3% heavy commercial vehicle (HCV) content.

The distances and terrain involved were obtained from the relevant scheme drawings and site surveys. No allowances have been made for the future reduction of vehicle noise and the prediction method used was that of the HMSO publication "Calculation of Road Traffic Noise", 1988 (CRTN).

The principal road under consideration will consist of a dual carriageway from the existing M9 near Kilcullen to the existing N9 at Powerstown, south of Carlow Town, for which an operating speed of 100kph is applicable. A single carriageway link will be provided from Athy to the dual carriageway.

Noise predictions were made using the road geometry superimposed on the ground mapping. Indicative road levels are included in 7.4 Appendix II; 1 level is indicated opposite the property in question and additional levels are indicated at 250 metres to each side of this point.

Vibration

The parameter used to assess ground vibration in relation to structural response is the peak particle velocity expressed in millimetres per second, mm/s. Ground vibration levels due to continuous sources or road traffic of magnitude 0.2 to 1.0 mm/s can cause disturbance to residents. Structural response is a factor where the vibration level is greater than 5 mm/s. For vibration due to quarry blasting the structural response level is generally taken to be above 10 mm/s. For construction type blasting using lower charges the relevant criterion is usually higher than 20mm/s.

7.4.3 The Receiving Environment

The proposed mainline scheme is dual carriageway approximately 46.2 kilometres long with a 11.2 kilometre single carriageway linking Athy with the existing N9 / R747 near Ballitore whilst connecting to the mainline with a junction at Mullamast. The proposed route passes mainly through agricultural lands with scattered housing. The principal existing noise sources along the route are road traffic, both near and distant along with agricultural activity.

Noise measurements were made with fine weather conditions and no adverse wind

effects at 16 locations along the scheme and 3 locations along the existing N9 (See Figure 7.10 to 7.18 in Volume 2). Noise measurements were generally made for a period of 24 hours but at some locations the 3 hour shortened method was used. The instrumentation used on site consisted of CEL and Larson-Davis Environmental Noise Analysers with associated microphones and calibrator.

The following parameters were measured at each site:

L_{A01} the sound level equalled or exceeded for 1% of the measurement period, the maximum levels.

L_{A10} the sound level equalled or exceeded for 10% of the measurement period,

L_{A90} -the sound level equalled or exceeded for 90% of the measurement period. This level is taken to represent the background noise level.

L_{Aeq} - the equivalent continuous sound level for the measurement period.

For the 3 hour shortened method the current value of $L_{10}(18\text{ hour})$ can be calculated from the relationship:

$$L_{10}(18\text{-h}) = L_{10}(3\text{-h}) - 1 \text{ dB(A)} \text{ (CRTN, HMSO)}$$

The measurement results are shown in Tables 7.4.1 to 7.4.5, and also in Tables 7.4.7 to 7.4.10.

Table 7.4.1 Baseline Ambient Noise Levels for Section A – Kilcullen to Mullamast Ch. 78,500 to Ch. 62,000

	Location	Approx. Chainage	$L_{10,(18h)}$ dB(A)
A02	Bungalow, front facade (N9)	77,860 W	81
A02a	Bungalow, rear facade (N9)	77,860 W	62
A06	Bungalow, rear facade	76,960 E	48
A14	Bungalow rear facade	76,310 W	48
A32	Bungalow, front facade	70,390 E	(58)
A34	2-storey, front facade	69,980 E	59
A38	2-storey, front facade (R415)	66,520 W	51
A43	Bungalow, front facade	64,500 E	(42)

(Values in brackets are based on 3-hour measurements)

Table 7.4.2 Baseline Ambient Noise Levels for Section B – Mullamast to Prumplestown Ch. 62,000 to Ch. 50,000

	Location	Approx. Chainage	$L_{10,(18h)}$ dB(A)
B02	Bungalow (Broomfield)	61,580 E	(48)
B04	Bungalow (Stoat Cottage)	56,400 W	(45)
B07	Bungalow (R418)	54,450 E	63

(Values in brackets are based on 3-hour measurements)

Table 7.4.3 Baseline Ambient Noise Levels for Section C – Prumplestown to Powerstown Ch. 50,000 to Ch. 32,300

	Location	Approx. Chainage	L _{10,(18h)} dB(A)
C13	Johnstown (R726)	43,440 E	69
C22	2-storey, front facade	36,950 E	51
C35	Powerstown (N9) (N9-3)	32,370 W	76

Table 7.4.4 Baseline Ambient Noise Levels for Section D to Athy to R747 Link Road

	Location	Approx. Chainage	L _{10,(18h)} dB(A)
D09	Montessori School	6,100 N	(60)
D12	Bungalow at crossroads	6,380 S	(51)
D13	Bungalow	8,250 N	(58)

(Values in brackets are based on 3-hour measurements)

Noise measurements were also made on the existing N9 and the results are:

Table 7.4.5 Ambient Noise Levels near the existing N9

	Location	L _{10,(18h)} dB(A)
N9-1	Carlow, Barrack Street, 1 st floor	76
N9-2	Castledermot, Main Street, 1 st Floor	78
N9-3 (C35)	Powerstown (near N9)	76

7.4.4 Potential Impacts and Amelioration Measures

Traffic Noise

Each stage of the noise prediction is calculated to one decimal place but the resultant is reported to the nearest whole number, 0.5 and greater being rounded upwards.

The construction and use of the road is in principal expected to transfer traffic from the existing N9, and divert it onto the proposed route, thereby increasing the noise along the proposed scheme and abating the existing relatively high levels in the bypassed towns.

The measured ambient sound levels, which contain the total noise environment, are principally controlled by noise from existing road traffic, near and distant. The noise levels at residences near the realigned road will be significantly increased above the existing ambient levels and at some locations will be expected to exceed the normal criterion for new roads without amelioration levels in place. The traffic noise levels predicted at a number of locations would be significantly above the 68 dB(A) criterion due to the scheme. However, amelioration measures have been included in the scheme design, and the predicted noise levels in year 2022 will in all cases be either less than the existing recorded levels or less than 68dB(A) with the amelioration measures in place. For residences near Powerstown traffic noise levels were predicted with and without the continuation of the scheme southwards. The predicted noise levels are shown in Table 7.4.7 to 7.4.10.

The application of a pervious road surface would be expected to reduce traffic noise emission by 3.5 dB(A), but as this requires greater maintenance than normal road surfaces, noise control barriers are to be constructed with the scheme to ameliorate the noise impacts. For noise reduction by barriers there are a large number of barrier height, distance, and length combinations that will reduce the noise to a particular level. The effective use of barriers is reduced where the receiver is above the level of the road. Embankments, walls or proprietary screens are used in noise control and for the proposed scheme barriers that would reduce the traffic noise levels from the scheme to less than 68 dB(A) are shown in Tables 7.4.7 to 7.4.10. Where a barrier wall is built on one side of a road, account is taken of the reflection of traffic noise to any houses on the opposite side of the road. There are no reflection effects with earth embankments or absorption type barriers. The specific noise amelioration measures, which have been included in the design of the scheme, are included in 7.4 Appendix I.

Traffic Vibration

As a vehicle moves along vibrations are generated in the road and in adjacent buildings by the interaction of the wheels and the road surface and by direct acoustic transmission through the air. The vehicle movement generates waves in the road, which are transmitted through the ground to adjacent buildings. These waves enter a building via the windows, etc. It has been found that ground vibrations produced by road traffic are unlikely to cause perceptible structural vibrations in buildings located near to well-maintained and smooth road surfaces.

Typical ground vibration levels 5 metres from national primary routes due to passing traffic are indicated in Table 7.4.6:

Table 7.4.6 Ambient Vibration Levels, 5 metres from Road

Location	Peak Particle Velocity, mm/s		
	Radial	Vertical	Transverse
5 metres from carriageway	0.3	0.4	0.2

The ground vibration from the operation of the new road would be expected to be orders of magnitude less than that required to cause disturbance or structural damage. The relevant values used in engineering are about 0.5 mm/s and greater than 5 mm/s respectively. The vibration will be less than that caused by the surfaces of the existing roads.

7.4.5 Construction

Construction – General

The construction of the proposed works will as with any modern human activity, increase the ambient noise level in the immediate vicinity of the site. This work will be of a temporary nature, and appropriate restrictions will be imposed on the contractor, by time of day to minimise any disturbance. This issue is addressed in greater detail in Chapter 11, which includes indicative maximum noise levels (see Table 11.5).

British Standard BS 5228: 1997 "Noise Control on Construction and Demolition Sites" provides guidance on the methods available to control noise from road construction. The application of this Standard in sensitive areas of this project would be expected to minimise disturbance.

The implementation of good working practice in conjunction with the restrictions imposed on the construction generated noise should ensure that the higher noise levels associated with the excavation and movement of material, and road contractor using heavy machinery, is restricted to an acceptable standard.

Machinery compounds shall not be sited close to residential areas in order to avoid undue disturbance.

Construction Traffic

Fill material will be required to be brought onto and hauled along the site and this is likely to take place within the first 2 to 3 years of construction. Assuming a 42 month construction period the average delivery rate would be 30 truck movements per day. In addition, road pavement material deliveries would require, on average, an additional approximately 10 truck movements per day. The delivery of material will be to all sections of the road and will be distributed along the route. Only suitable access sites will be used and the truck route on site will be controlled in order to minimise disturbance to local residents.

Bridge Construction

Forty three bridges are required and at this time it is considered that 35 of these are likely to be founded on piles driven to the underlying rock with the remainder supported on pad foundations. However, these assessments are based on the findings of the preliminary site investigation and are subject to detailed assessment of the final site investigation. The noise and vibration shall be controlled by the use of piling method selection in order to minimise the temporary disturbance. The distance involved will ensure that there will be no structural effects.

Appropriate methods of piling will be required to be selected in order that these activities are conducted within the overall noise limits that will be imposed on the contractor, for further details refer to Chapter 11 Section 4.

Vibration

Vibration can arise from a number of site activities. With the exception of vibration induced by blasting, it is unlikely that any significant vibration will be noticeable at properties adjacent to the site due to the distances between buildings and the construction site, which are typically in excess of 50 metres.

Blasting

If blasting is required the vibration emanating from the site will depend on two principal factors, the distance involved and the maximum instantaneous explosive charge. As the distance is generally fixed the resulting vibration will be controlled by the amount of explosive used. The explosive charge will be controlled in order to minimise disturbance due to vibration and air overpressure. There will be no significant structural effects due to blasting.

There are 2 principal acoustic effects in relation to blasting; the airblast associated with the explosion that has a potential for damage in extreme circumstances, and the associated audible noise. The acoustic emissions are controlled by the explosive charge weight and stemming the boreholes. Typical air overpressure values are 6 Pascals or 110dB and these values have no implications for structural response. The associated noise levels are typically in the range 80 to 95 dB(A) and these have no significant subjective effects due to prior notification of blasting

to any nearby residents.

Advance notice of blasting will be given to the local population and farmers in the vicinity of the blasts. By vacating nearby properties and the removal of farm animals from nearby fields, it should be possible to ensure these are no significant impacts to humans or animals.

In addition the construction contract will impose maximum values for peak particle velocities at houses and other structures to ensure there is no material damage from blasting.

**Table 7.4.7 Predicted Noise Levels for Section A – Kilcullen to Mullamast
Ch. 78,500 to Ch. 62,000**

	Location / Facade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
A 01	Bungalow, rear	78140 E		65	66	
A 02	Bungalow, front to N9	77860 W	81	63	64	
A 02a	A02 rear	(N78 Link)	62	60	61	
A 03	Bungalow, rear	77490 W		64	65	
A 04	Bungalow, front	77390 E		67	69	66
A 05	2 storey, gable	77320 E		62	63	
A 06	Bungalow, rear	76960 E	48	59	60	
A 07	Bungalow, rear	76790 E		63	64	
A 08	Cottage, rear	76690 E		66	67	
A 09	Dormer, roof, rear	76660 E		67	68	64
A 10	Bungalow, front	76630 W		61	62	
A 11	Dormer, roof, rear	76630 E		67	68	64
A 12	Bungalow, rear	76590 E		66	67	
A 13	2 storey, rear	76540 E		63	64	
A 14	Bungalow, rear	76310 W	48	71	72	64
A 15	Bungalow, rear	76280 W		70	72	64
A 16	Bungalow, gable	76260 W		64	65	
A 17	2 storey, front	76200 W		67	68	62
A 18	Cottage, rear	76050 E		65	66	
A 19	2 storey, rear	75900 E		68	69	63
A 20	Bungalow, gable	75890 E		70	71	63
A 21	2 storey, rear	75790 E		62	63	
A 22	Bungalow, front	74270 E		66	67	
A 23	Bungalow, front	74260 E		63	64	
A 24	2 storey, gable	74080 E		63	64	
A 25	2 storey, front	73350 W		62	63	
A 26	Dormer, roof, rear	72100 E		58	59	

**Table 7.4.7 Predicted Noise Levels for Section A – Kilcullen to Mullamast
Ch. 78,500 to Ch. 62,000 (contd.)**

	Location / Facade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
A 27	Bungalow, rear	71660 E		62	63	
A28	Bungalow, gable	71620 W		69	70	67
A 29	2 storey, front	71590 W		61	62	
A 30	2 storey, rear	71490 E		64	65	
A 31	Bungalow, front	70630 W		60	61	
A 32	Bungalow, gable	70390 E	(58)	70	71	65
A 33	Bungalow, rear	70340 E		66	67	
A 34	2 storey, rear	69980 E	59	70	71	67
A 35	2 storey, front	68440 W		62	64	
A 36	2 storey, rear	68100 W		63	64	
A 37	Bungalow, front	67250 W		66	68	64
A 38	Glebe, 1s gable	66520 W	51	65	63	
A 39	Glebe, 2s rear	rear		64	65	
A 40	2 storey, front	66420 E		58	59	
A 41	Bungalow, front	65100 W		63	65	
A 42	2 storey, gable	64530 W		63	64	
A 43	Bungalow, front	64500 E	(42)	61	62	
A 44	2s rear	64450 E		69	70	67
A 45	Bungalow, front	63520 E		56	57	
A 46	Bungalow, front	63250 W		58	59	
A 47	2 storey, gable	62110 E		61	62	

(Baseline values in brackets are based on 3-hour measurements)

**Table 7.4.8 Predicted Noise Levels for Section B – Mullamast to Prumplestown
Ch. 62,000 to Ch. 50,000**

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
B 01	2-storey	61580 W		59	60	
B 02	Bungalow, gable	60700 E	(48)	61	62	
B 03	Bungalow, gable	57270 E		59	60	
B 04	Bungalow, gable (Stoat)	56400 W	(45)	61	62	
B 05	2-storey, gable	54850 W		62	63	
B 06	Bungalow, rear	54610 W		60	61	
B 07	Bungalow, rear	54450 E	63	61	62	
B 08	2 storey house	54160 W		53	54	
B 09	Bungalow,	53520 W		54	55	
B 10	Bungalow, rear	53150 W		53	54	

**Table 7.4.8 Predicted Noise Levels for Section B – Mullamast to Prumplestown
Ch. 62,000 to Ch. 50,000 (contd.)**

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
B 11	Bungalow, rear	53030 W		55	56	
B 12	Bungalow, rear	51760 E		61	62	
B 13	Dormer, roof	51500 W		62	63	
B 14	Bungalow, gable	51460 W		60	61	
B 15	2 storey house, front	51100 E		61	62	
B 15a	2 storey house, rear	rear		63	64	

(Baseline values in brackets are based on 3-hour measurements)

**Table 7.4.9 Predicted Noise Levels for Section C –Prumplestown to Powerstown
Ch. 50,000 to Ch. 32,300**

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
C 01	Bungalow, front	48180 E		62	63	
C 02	2 storey, front	48050 E		57	59	
C 03	Bungalow, rear	47940 W		56	57	
C 04	2 storey house site, front	46020 E		62	64	
C 05	2 storey, front	46000 E		60	61	
C 06	Bungalow, rear	45930 E		61	62	
C 07	2 storey, front	45620 E		58	59	
C 08	Bungalow, rear	45490 E		60	61	
C 09	Bungalow, front	45450 E		57	58	
C 10	Dormer, rear	45000 W		59	61	
C 11	Bungalow, rear	43580 E		59	61	
C 12	Bungalow, rear	43540 E		60	61	
C 13	Bungalow, front (R726)	43440 E	69	62	63	
C 14	Bungalow, front	43400 E		64	65	
C 15	Busherstown, rear, 3 s.	42660 W		58	59	
C 16	2 storey, gable	41710 E		58	60	
C 17	2 storey, gable	40590 W		56	57	
C 18	Cottage, derelict	39025 W		64	65	
C 19	Rathcrogue, 2 storey	39000 W		63	64	
C 20	Bungalow, gable	38820 E		60	61	
C 21	Bungalow, rear (+N80)	38600 W		67	68	
C 21a	Bungalow, front	38600 W		67	68	
C 22	2 storey, front	36950 E	51	63	64	
C 22a	2 storey, gable	side		58	60	

**Table 7.4.9 Predicted Noise Levels for Section C – Prumplestown to Powerstown
Ch. 50,000 to Ch. 32,300 (contd.)**

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
C 23	Dormer, rear	36860 E		61	62	
C 24	Dormer, gable	36840 E		60	61	
C 25	2 storey, rear	36000 W		57	58	
C 26	1 storey @ gable	35960 W		53	54	
C 27	Bungalow, rear	35770 E		59	60	
C 28	Bungalow, rear	35760 E		56	57	
C 29	2 storey, rear	35740 E		57	59	
C 30	2 storey, rear	34170 W		54	55	
C 31	Bungalow, rear	34130 W		51	52	
C 32	Cottage, front	34070 W		57	59	
C 33	Dormer, gable	32750 W		58	60	
C 34	Bungalow, (N9)	32380 W		69	70	
C 35	2 storey, front (N9)	32370 W	76	72	73	
C 36	Dormer, front (N9)	At end		62	63	

The predicted noise levels at locations C34 and C35 are principally due to traffic on the realigned existing N9, which will link the Powerstown interchange with Carlow. The volume of traffic on this section of road will be reduced with a corresponding reduction in noise emissions.

Table 7.4.10 Predicted Noise Levels for Section D – Athy to R747 Link Road

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
D 01	Bungalow, rear	2600 N		59	60	
D 02	Bungalow, rear	4380 N		58	59	
D 03	Front façade, 2 storey	5020 S		65	66	
D 03a	Rear Section, 1 s	rear		66	67	
D 04	Bungalow, gable	5040 S		58	59	
D 05	Bungalow, front	5120 S		63	64	
D 06	Bungalow, retained wall	5800 N		67	68	65
D 07	Bungalow, front	5970 S		65	66	
D 08	Bungalow, rear	6010 N		63	65	
D 09	Montessori	6100 N	60	70	71	66
D 10	Cottage, rear	6340 S		58	59	
D 11	New house, Velux	6380 N		61	62	
D 12	Cottage, gable window	6380 S	51	67	68	64

**Table 7.4.10 Predicted Noise Levels for Section D
 Athy to R747 Link Road (contd.)**

	Location / Façade	Approx. Chainage	L ₁₀ , (18h) dB(A)			Residual Noise Level
			Baseline	2007	2022	
D 13	Cottage front	8250 N	58	66	67	
D 14	Bungalow, rear	8500 N		61	62	
D 15	Cottage, rear	8560 N		60	61	

The predicted noise levels shown above are due to the proposed scheme. At some locations these noise levels are additive to the traffic noise levels on minor roads. At location C13 on the R726 the predicted level without amelioration is 69.4 dB(A) (due to traffic on the R726, baseline level) plus 63.2 dB(A) (predicted N9) giving a resultant of 70.3 dB(A). Amelioration measures are to be provided on the N9 and will give a predicted overall increase of 0.5 dB(A).

7.4.6 Residual Impacts

Section 50 of the Roads Act, 1993, requires information on significant effects on the environment to be described. In relation to noise these are as follows:

- The likely significant direct or indirect interactions will be between noise and human beings. There will be significant beneficial effects for most residences involved but there will also be a significant adverse effect for some other residences; and,
- The likely significant direct or indirect interactions will also be between noise and fauna, flora, soil, water, air, climate and landscape. The adverse effect between noise and human beings would be minimised by the use of noise control barriers or other amelioration measures. The adverse effect on the fauna due to the noise from the construction and use of the road will be less than the impact of the intrusion of the construction workers, construction machinery and traffic.

The residual impact with amelioration measures in place will be a significant adverse impact due to an increase in noise levels at all residential locations near the scheme. However the noise due to the scheme will not exceed the criterion of 68 dB(A). The noise due to traffic in the bypassed towns will be significantly reduced due to traffic using the scheme.

If the actual road traffic volumes are different than that used in the predictions the effect is not very significant. A plus or minus 25 % change in traffic will cause a change of plus or minus 1 dB(A).

Do-Nothing Scenario

In the do nothing situation at locations remote from primary or arterial roads the noise levels would remain relatively constant. Where traffic noise is predominant the increase would be 3 dB(A) per doubling of traffic. This could occur due to housing or other developments.

At the locations of existing relatively high noise levels in the baseline survey, Table 7.4.11, for the ‘do minimum’ situation, the following noise levels are predicted:

Table 7.4.11 'Do Nothing' Noise Levels

Location	L ₁₀ ,(18h) dB(A)		
	2002/2003	2022	
	Baseline	With Scheme	'Do Minimum'
N9-1 Carlow, Barrack Street,	76	75	75
N9-2 Castledermot, Main Street	78	75	81
N9-3 Powerstown (C35)	76	73	78

The very high noise levels along the existing N9 corridor will be reduced due to the scheme, particularly in Castledermot. However, within Carlow Town the predicted reduction in noise levels in Barrack Street with the scheme in 2022 will not be significant due to the redistribution of traffic that is anticipated once construction of the Inner and Southern Relief Roads within the town is complete.

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section A
 Kilcullen to Mullamast Ch. 78,500 to Ch. 62,000**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
A 01	78140 E		66	Bund / Landscape Area	
A 02	77860 W	81	64		
A 02a	(N78 Link)	62	61		
A 03	77490 W		65	2 metre bund Ch. 77,325 – 77,520	
A 04	77390 E		69	2 metre bund Ch. 77,320 – 77,520	66
A 05	77320 E		63		
A 06	76960 E	48	60	2 metre bund Ch. 76,500 – 77,000	
A 07	76790 E		64	2 metre bund Ch. 76,500 – 77,000	
A 08	76690 E		67	2 metre bund Ch. 76,500 – 77,000	
A 09	76660 E		68	2 metre bund Ch. 76,500 – 77,000	64
A 10	76630 W		62		
A 11	76630 E		68	2 metre bund Ch. 76,500 – 77,000	64
A 12	76590 E		67	2 metre bund Ch. 76,500 – 77,000	
A 13	76540 E		64	2 metre bund Ch. 76,500 – 77,000	
A 14	76310 W	48	72	2 metre bund Ch. 76100 - 76380	64
A 15	76280 W		72	2 metre bund Ch. 76100 - 76380	64
A 16	76260 W		65		
A 17	76200 W		68	2 metre bund Ch. 75900 - 76380	62
A 18	76050 E		66	Bund / Landscape Area	
A 19	75900 E		69	2 metre bund Ch. 75,680 – 76,380	63
A 20	75890 E		71	2 metre bund Ch. 75,680 – 76,380	63
A 21	75790 E		63		
A 22	74270 E		67	Bund / Landscape Area	
A 23	74260 E		64	Bund / Landscape Area	
A 24	74080 E		64	Bund / Landscape Area	
A 25	73350 W		63		
A 26	72100 E		59	Bund / Landscape Area	
A 27	71660 E		63	Bund / Landscape Area	
A28	71620 W		70	2 metre barrier Ch. 71590 – 71660 (barrier at land take line)	67
A 29	71590 W		62		
A 30	71490 E		65	1.5 metre bund Ch. 71,360 – 71,550	
A 31	70630 W		61		

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section A
 Kilcullen to Mullamast Ch. 78,500 to Ch. 62,000 (contd.)**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
A 32	70390 E	(58)	71	1 metre barrier Ch. 70350 - 70600	65
A 33	70340 E		67	1 metre barrier Ch. 70350 – 70600	
A 34	69980 E	59	71	2.2 metre barrier Ch. 69,850 – 70,150	67
A 35	68440 W		64	1.5 metre bund Ch. 68,400 – 68,700	
A 36	68100 W		64	1.5 metre bund Ch. 67,850 – 68,150	
A 37	67250 W		68	1 metre barrier Ch 67,100 – 67,400	64
A 38	66520 W	51	63	Bund / Landscape Area	
A 39	rear		65	1 metre bund Ch. 66,450 – 66,600	
A 40	66420 E		59		
A 41	65100 W		65	1 metre bund above cutting from Ch. 65,100 plus 1.5 metre bund to Ch. 65,300	
A 42	64530 W		64	1 metre bund Ch. 64,280 to Ch. 64,500 plus 1 metre bund above cutting to Ch. 64,530	
A 43	64500 E	(42)	62	2 metre bund Ch. 64,280 to Ch. 64,480 plus 1 metre bund above cutting	
A 44	64450 E		70	2 metre bund Ch. 64,280 to Ch. 64,480 plus 1 metre bund above cutting	67
A 45	63520 E		57		
A 46	63250 W		59		
A 47	62110 E		62	Bund / Landscape Area	

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section B
Mullamast to Prumplestown Ch 62,000 to Ch. 50,000**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
B 01	61580 W		60		
B 02	60700 E	(48)	62	Bund / Landscape Area	
B 03	57270 E		60		
B 04	56400 W	(45)	62		
B 05	54850 W		63	Bund / Landscape Area	
B 06	54610 W		61	Bund / Landscape Area	
B 07	54450 E	63	62		
B 08	54160 W		54		
B 09	53520 W		55		
B 10	53150 W		54		
B 11	53030 W		56	Bund / Landscape Area	
B 12	51760 E		62		
B 13	51500 W		63		
B 14	51460 W		61		
B 15	51100 E		62	Bund / Landscape Area	
B 15a	rear		64	Bund / Landscape Area	

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section C
Prumplestown to Powerstown Ch. 50,000 to Ch. 32,300**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
C 01	48180 E		63	Bund / Landscape Area	
C 02	48050 E		59	Bund / Landscape Area	
C 03	47940 W		57		
C 04	46020 E		64	Bund / Landscape Area	
C 05	46000 E		61	Bund / Landscape Area	
C 06	45930 E		62	Bund / Landscape Area	
C 07	45620 E		59	Bund / Landscape Area	
C 08	45490 E		61	Bund / Landscape Area	
C 09	45450 E		58		
C 10	45000 W		61	Bund / Landscape Area	
C 11	43580 E		61		

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section C
Prumplestown to Powerstown Ch. 50,000 to Ch. 32,300 (contd.)**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
C 12	43540 E		61	1.0m barrier, Ch. 43,200 to 43,500	
C 13	43440 E	69	63	1.0m barrier, Ch. 43,200 to 43,500	
C 14	43400 E		65	1.0m barrier, Ch. 43,200 to 43,500	
C 15	42660 W		59		
C 16	41710 E		60	Bund / Landscape Area	
C 17	40590 W		57		
C 18	39025 W		65	1.0m barrier adjacent to Junction 4 Slip Road 4-1 Ch. 60 to Ch. 500.	
C 19	39000 W		64	1.0m barrier Ch. 60 to Ch. 500 adjacent to Junction 4 Slip Road 4-1.	
C 20	38820 E		61	Bund / Landscape Area	
C 21	38600 W		68	1m bund Ch. 38,400 to Ch. 38,900 and Ch. 450 to 630 adjacent to Junction 4 Slip Road 4-4. Property being acquired.	
C 21a	38600 W		68	1m bund Ch. 38,400 to Ch. 38,900 and Ch. 450 to 630 adjacent to Junction 4 Slip Road 4-4. Property being acquired.	
C 22	36950 E	51	64	1m bund above cutting	
C 22a	side		60		
C 23	36860 E		62	Bund / Landscape Area	
C 24	36840 E		61	Bund / Landscape Area	
C 25	36000 W		58	Bund / Landscape Area	
C 26	35960 W		54	Bund / Landscape Area	
C 27	35770 E		60		
C 28	35760 E		57		
C 29	35740 E		59		
C 30	34170 W		55	Bund / Landscape Area	
C 31	34130 W		52	Bund / Landscape Area	
C 32	34070 W		59	Bund / Landscape Area	
C 33	32750 W		60	Bund / Landscape Area	
C 34	32380 W		70	Bund / Landscape Area	
C 35	32370 W	76	73	Bund / Landscape Area	
C 36	At end		63		

**7.4 Appendix I: Proposed Noise Amelioration Measures – Section D
 Athy to R747 Link Road**

Noise Ref.	Approx. Chainage	L ₁₀ , (18h) dB(A)		Amelioration	
		Baseline	2022 (without amelioration)	Action	Residual Noise Level
D 01	2600 N		60	Bund / Landscape Area	
D 02	4380 N		59	Bund / Landscape Area	
D 03	5020 S		66	1.5m high boundary wall at back of verge	
D 03a	rear		67	1.5m high boundary wall at back of verge	
D 04	5040 S		59	1.5m high boundary wall at back of verge	
D 05	5120 S		64	1.5m high boundary wall at back of verge	
D 06	5800 N		68	1.5m high wall at back of verge Ch 5,800 – 5,980	65
D 07	5970 S		66	1.5m high boundary wall at back of verge	
D 08	6010 N		65	1.5m high boundary wall at back of verge	
D 09	6100 N	60	71	1.8m high wall at back of verge Ch 5,920 – 6,800	66
D 10	6340 S		59	1.5m high boundary wall at back of verge	
D 11	6380 N		62	Bund / Landscape Area	
D 12	6380 S	51	68	1.8m high wall at back of verge Ch 6,315 – 6,365	65
D 13	8250 N	58	67	Bund / Landscape Area	
D 14	8500 N		62	Bund / Landscape Area	
D 15	8560 N		61	Bund / Landscape Area	

**7.4 Appendix II: Road Levels Used in Noise Measurements – Section A
 Kilcullen to Mullamast Ch. 78,500 to Ch. 62,000**

Noise Ref.	Mainline Level			
	Chainage	-250m	0m	+250m
A01	78,136	119.2	117.6	114.4
A02	77,857	117.8	119.2	117.9
A03	77,483	114.8	116.3	118.9
A04	77,347	114.1	115.3	117.6
A05	77,331	114.0	115.2	117.4
A06	76,950	112.6	113.3	114.6
A07	76,780	114.1	112.5	114.7
A08	76,683	114.9	112.7	113.3
A09	76,663	115.1	112.9	113.2
A10	76,633	115.4	113.1	113.0
A11	76,625	115.4	113.1	113.0
A12	76,594	115.7	113.5	112.8
A13	76,537	116.2	114.0	112.6
A14	76,313	117.3	116.0	113.8
A15	76,278	117.2	116.3	114.1
A16	76,259	117.2	116.5	114.2
A17	76,191	116.8	117.0	114.9
A18	76,047	115.7	117.3	116.2
A20	75,890	115.3	116.4	117.2
A19	75,895	115.3	116.4	117.2
A21	75,808	115.5	115.8	117.3
A22	74,268	118.3	117.2	117.0
A23	74,261	118.4	117.2	116.9
A24	74,084	119.3	118.0	116.8
A25	73,961	119.9	118.7	117.4
A26	72,092	115.0	116.2	117.5
A27	71,638	114.3	113.9	115.2
A28	71,622	114.4	113.9	115.1
A29	71,569	114.7	113.6	114.8
A30	71,494	115.0	113.8	114.5
A31	70,620	113.3	116.3	116.8
A32	70,385	108.6	113.5	116.4
A33	70,332	107.7	112.6	116.0
A34	70,002	105.0	106.7	111.0
A35	68,441	104.3	103.1	101.8
A36	68,110	106.0	104.7	103.4
A37	67,252	101.1	104.3	106.5
A38/A39	66,559	104.4	102.3	100.6

**7.4 Appendix II: Road Levels Used in Noise Measurements – Section A
 Kilcullen to Mullamast Ch. 78,500 to Ch. 62,000 (contd.)**

Noise Ref.	Mainline Level			
	Chainage	-250m	0m	+250m
A40	66,416	105.6	103.5	101.4
A41	65,107	130.1	125.9	118.8
A42	64,524	127.2	130.2	130.7
A43	64,504	127.1	130.1	130.8
A44	64,461	127.0	129.6	130.9
A45	63,520	130.3	133.2	132.7
A46	63,252	123.9	129.9	133.1
A47	62,122	96.9	106.0	113.4

**7.4 Appendix II: Road Levels Used in Noise Measurements – Section B
 Mullamast to Prumplestown Ch. 62,000 to Ch. 50,000**

Noise Ref.	Mainline Level			
	Chainage	-250m	0m	+250m
B01	61,550	88.6	89.9	94.7
B02	60,705	86.1	86.8	87.6
B03	57,241	84.2	83.0	81.7
B04	56,384	83.0	82.5	84.8
B05	54,829	91.8	94.4	94.3
B06	54,602	89.3	92.1	94.5
B07	54,445	87.6	90.3	93.1
B08	54,124	84.0	86.8	89.6
B09	53,507	77.4	80.0	82.8
B10	53,127	74.9	76.4	78.6
B11	53,031	74.3	75.8	77.6
B12	51,761	70.0	69.0	69.5
B13	51,489	68.4	69.9	69.1
B14	51,456	68.3	69.8	69.3
B15	51,094	70.9	68.4	69.0

**7.4 Appendix II: Road Levels Used in Noise Measurements – Section C
 Prumplestown to Powerstown Ch. 50,000 to Ch. 32,300**

Noise Ref.	Mainline Level			+250m
	Chainage	-250m	0m	
C01	48,175	81.5	80.7	80.0
C02	48,047	81.9	81.1	80.4
C03	47,942	82.2	81.4	80.7
C04	46,041	72.6	74.3	81.4
C05	46,001	72.4	73.8	80.1
C06	45,937	72.1	73.4	78.0
C07	45,656	70.7	72.0	73.2
C08	45,477	70.7	71.0	72.3
C09	45,437	70.9	70.9	72.1
C10	45,012	73.4	71.9	70.6
C11	43,587	92.5	90.6	85.6
C12	43,540	92.5	91.2	86.7
C13	43,435	92.0	92.2	88.0
C14	43,399	91.7	92.3	89.6
C15	42,661	80.3	84.3	88.4
C16	41,710	66.7	69.6	73.0
C17	40,609	64.4	61.9	60.4
C18	39,015	78.2	76.6	75.0
C19	38,987	78.3	76.8	75.2
C20	38,824	78.2	77.9	76.3
C21	38,595	76.2	78.3	77.7
C22	36,952	64.6	65.9	67.1
C23	36,863	64.2	65.4	66.7
C24	36,838	64.1	65.3	66.6
C25	36,001	57.8	60.1	63.1
C26	35,962	57.6	59.8	61.3
C27	35,776	56.8	58.0	60.3
C28	35,763	56.8	57.9	60.2
C29	35,743	56.7	57.8	60.0
C30	34,184	52.9	50.0	52.2
C31	34,133	53.7	50.2	51.6
C32	34,072	54.6	50.8	50.7
C33	32,746	47.0	50.4	53.1
C34	32,376	44.9	45.3	48.8
C35	32,367	44.9	45.2	48.6

**7.4 Appendix II: Road Levels Used in Noise Measurements – Section D
 Athy to R747 Link Road**

Noise Ref.	Mainline Level			
	Chainage	-250m	0m	+250m
D01	2541	67.2	68.4	69.7
D02	4334	68.9	70.8	71.6
D03	4965	71.5	70.3	70.4
D04	4985	71.4	70.2	70.5
D05	5064	71.1	69.8	70.8
D06	5733	71.7	72.9	76.4
D07	5913	72.6	74.5	82.7
D08	5961	72.8	75.8	84.8
D09	6048	73.3	78.1	88.0
D10	6284	77.7	87.5	92.8
D11	6321	78.8	88.7	93.1
D12	6327	79.0	88.9	93.1
D13	8186	95.0	96.5	100.9
D14	8451	96.6	101.5	110.2
D15	8524	97.1	104.2	112.4