APPENDIX 13.4: CONSTRUCTION NOISE ASSESSMENT

1. CONSTRUCTION NOISE ASSESSMENT

1.1.1 A draft construction schedule with planned activities and proposed equipment has been provided by the Principal Contractor. This information is presented in **Table 1.-1-1: Assumed Construction Activity Sequence.**

Table 1.-1-1: Assumed Construction Activity Sequence

Construction Activity Phase	Commence	Complete	Durations (approx. days)	Equipment
Earthworks	Oct-26	Aug-27	300	13t Roller
				32T Dump Truck
				34T Tracked Excavator
				18.5T D6 Bulldozer
				24t Long reach Excavator
Earthworks/foundations/Drainage	Oct-26	Jun-28	600	22T Tracked Excavator
Earthworks/Drainage	Oct-26	Jun-28	600	14t Dump truck
Earthworks/capping	Oct-26	Aug-28	660	Tipper lorries
General activities	May-27	Feb-28	275	13t wheeled excavator
Drainage/ducting/foundations	Mar-27	Jun-28	450	14T Tracked Excavator
Foundations/Building works	May-27	Jun-28	400	50t mobile telescopic crane
				Concrete wagons

1.1.2 Each activity is analysed to determine the percentage of the construction time each piece of equipment is being used and how many are in use. Using this information, a total equivalent noise level at 10 m for each activity is calculated. Utilisation is assumed as 80%, which is conservative.

Table 1.-1-2: Construction Activity Noise Levels

Construction Activity Phase	Number of Items	Utilisation	SPL at 10m (dB)	SWL (dB)	Corrected SWL (dB)	Corrected SPL @ 10
13t Roller	6	0.8	84	111	118	90
32T Dump Truck	8	0.8	85	112	120	92
34T Tracked Excavator	5	0.8	77	104	110	82
18.5T D6 Bulldozer	2	0.8	81	108	110	82
24t Long reach Excavator	2	0.8	76	103	105	77
22T Tracked Excavator	5	0.8	75	102	108	80
14t Dump truck	3	0.8	80	107	111	83
Tipper lorries	10	0.8	80	107	116	88
13t wheeled excavator	2	0.8	70	97	99	71
14T Tracked Excavator	6	0.8	70	97	104	76
50t mobile telescopic crane	1	0.8	67	94	93	65
Concrete wagons	10	0.8	80	107	116	88
Total			91	118	125	97

1.1.1 The proposed construction route reported in **Chapter 10: Traffic and Access** have been used as the basis for the assessment. The traffic data is described as 'peak' traffic and therefore is conservative. Traffic routes 1 – 3 have been assessed as haul routes in accordance with BS5228 and noise levels incorporated into overall construction noise assessment. Construction traffic noise calculations have followed guidance from BS 5228-1 Annex F.2.5 'Method for mobile plant using a regular well-defined route (e.g. haul roads)' using formula:

$$L_{Aeq} = L_{WA} - 33 + 10\log_{10}Q - 10\log_{10}V - 10\log_{10}d + A - \text{air absorption} - \text{ground absorption}$$

Where:

- LWA = Sound power level of plant item, taken as a single engine vehicle of sound power 110 dB(A)
- Q = Number of plant item journeys per hour
- d = Distance to centre of haul road route segment
- A = 10log10(α/180)
- α = Angle of view of the haul road
- V = Speed of vehicle, taken as 32 km per hour
- Air absorption is taken as 0.0035 dBm-1 and attenuation due to ground absorption is assumed negligible.

1.1.3 The combined calculated construction and traffic noise for main NSRs are presented below.

Table 1.-1-3: BS 5228-1 Assessment Calculated Construction Noise – All Activities

NSR	Easting	Northing	Distance from Construction (m)	Construction Equipment Noise (dBA)	Traffic Noise (dBA)	Total Noise (dBA)
NSR 1.1	338326	738264	568	58	31	58
NSR 1.2	339177	738092	203	68	41	68
NSR 1.3	339005	736724	817	55	42	55
NSR 1.4	338276	737015	540	59	32	59
NSR 1.5	337596	738030	966	53	26	53
NSR 2.1	338744	738288	494	59	34	60
NSR 2.2	339537	738145	453	60	31	60
NSR 2.3	339839	737787	626	57	45	57
NSR 2.4	339909	737318	736	56	43	56
NSR 2.5	339468	736737	908	54	50	55
NSR 2.6	337636	736966	1136	51	27	51
NSR 2.7	337560	738237	1087	52	25	52

1.1.3 The calculated total values do not exceed the 65 dB daytime limits, with the exception of NSR 1.2. For the closest property NSR 1.2, additional consideration is required for the above activity items to meet the daytime 65 dB limit. The minimum distance to the substation platform is assessed as 203 m. A minimum 270 m distance is required for the identified activity items. If works are to be conducted at closer distance, other methods to reduce noise should be identified in the CNMP. Other NSRs are shown to exceed the 55 dB evening and weekend limit. If the following plant items are limited to construction times during daytime hours (Daytime is defined to be 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays) it can be demonstrated that this limit is met.

Table 1.14: Construction Mitigation Requirements

Construction Activity Phase	Equipment
Earthworks	13t Roller
	32T Dump Truck
	34T Tracked Excavator
	18.5T D6 Bulldozer
Earthworks/Drainage	14t Dump truck
Earthworks/capping	Tipper lorries
Foundations/Building works	Concrete wagons

1.1.4 The results with these items removed from the schedule show compliance with the 55 dB limit. This is to demonstrate possible compliance using a construction noise management plan.

Table 1.-1-5: BS 5228-1 Assessment Calculated Construction Noise – Limited Activities

NSR	Easting	Northing	Distance from Construction (m)	Construction Equipment Noise (dBA)	Traffic Noise (dBA)	Total Noise (dBA)
NSR 1.1	338326	738264	568	45	31	45
NSR 1.2	339177	738092	203	52	41	52
NSR 1.3	339005	736724	817	41	42	45
NSR 1.4	338276	737015	540	45	32	45
NSR 1.5	337596	738030	966	39	26	40
NSR 2.1	338744	738288	494	46	34	46
NSR 2.2	339537	738145	453	47	31	47
NSR 2.3	339839	737787	626	44	45	47
NSR 2.4	339909	737318	736	42	43	46
NSR 2.5	339468	736737	908	40	50	50
NSR 2.6	337636	736966	1136	38	27	38
NSR 2.7	337560	738237	1087	38	25	39

1.1.5 Other NSRs along the haul route have been assessed and presented in **Table 2.1 BS 5228-1 Assessment – Haul Road Traffic - Additional NSRs**. Only 1 NSR exceeds the 55 dB evening and weekend limit but does not exceed the 65 dB daytime limit. As the values are peak levels, and it is assumed the majority of this traffic will be during daytime the impact is predicted as low.

1.1.6 Construction related traffic impacts for other routes (routes 4 – 8 on Figure 13.3: Haul Road Assessment) have been assessed by calculating the relative increase in road traffic noise level adjacent to public roads used by construction traffic. The standard UK calculation method CRTN was used to calculate the noise level, at a nominal distance of 10 m from each road, using baseline traffic flows and also accounting for the addition of construction traffic as reported in Chapter 3: Description of the Proposed Development and Chapter 10: Traffic and Access.

1.1.4 The 24 hour average daily traffic flows have been converted to 18 hour traffic flows for the purposes of the noise calculation as is required by CRTN.

1.1.7 Noise levels for the baseline 2027 traffic scenario are presented in below, for both cars and Heavy Goods Vehicles (HGVs).

Table 1.-1-6: Predicted 2027 Traffic Flow Noise

Site Ref.	Survey Location	18hr Cars	18hr HGV	18hr Total	HGVs (%)	Noise Level (L_{10})
4	A90 Forfar	19,018	4,964	23,982	0.208	73.9
5	A90 south of Moathill Road	18,500	3,239	21,739	0.148	72.5
6	A90 south of Emmock Roundabout	25,123	3,169	28,292	0.112	72.9
7	A90 Kingsway West	34,179	6,558	40,738	0.161	75.4
8	A972 Kingsway East	21,273	3,039	24,312	0.125	72.7

1.1.8 Noise levels Including peak construction traffic are presented below, where the change in noise levels and impact magnitude have been determined.

Table 1.-1-7: Peak Construction Traffic Flow Noise

Site Ref.	Survey Location	18hr Cars	18hr HGV	18hr Total	HGVs (%)	Noise Level (L_{10})	Change (dB)	Impact magnitude
4	A90 Forfar	19,026	4,989	24,014	0.208	73.9	0	No Impact
5	A90 south of Moathill Road	18,548	3,299	21,847	0.151	72.6	0.1	Negligible
6	A90 south of Emmock Roundabout	25,195	3,265	28,459	0.115	73.2	0.3	Negligible
7	A90 Kingsway West	34,215	6,578	40,793	0.161	75.5	0.1	Negligible
8	A972 Kingsway East	21,309	3,116	24,425	0.127	72.7	0	No Impact

2. CONSTRUCTION TRAFFIC NOISE ASSESSMENT

Table 2.1 BS 5228-1 Assessment – Haul Road Traffic - Additional NSRs

NSR ID	X	Y	Traffic Noise Level (dBA)
1	338277.2	737020.3	32
5	340769	736671	48
8	340207	735686	40
12	337557	738240	25
19	339911	737321	43
21	341608	735929	41
24	338958	736679	41
25	340952	735729	41
26	337595	738032	26
30	341434	735914	41
31	340927	735697	42
37	340899	735401	47
45	338986	736720	42
50	340140	735758	40
52	340172	735735	40
53	339850	737623	44
55	340906	735401	47
67	338735	738302	34
70	337497	738163	25
81	339007	738209	37
82	340994	736660	44
86	339689	736704	48
90	340801	736679	46
93	337616	736881	27
94	341590	735929	41
96	339459	736736	50
98	339784	737845	46
101	338836	738314	35
103	341103	736689	44
112	337547	738234	25
113	340760	736673	49
118	338323	738277	31
127	339536	738153	31
128	340164	735702	40
129	338746	738304	34
130	340196	735686	40
133	339431	736738	50

NSR ID	X	Y	Traffic Noise Level (dBA)
134	341391	735717	40
137	339175	738095	41
142	340172	735670	41
143	341388.5	735930.3	41
148	339812	737880	45
164	339824	737915	44
170	339499	736740	50
172	339426	736577	59
190	339447	736705	51
193	339839.5	737788.5	45
198	337633	736971	27
204	339816	737897	44
208	338794.8	738306.3	34
215	339661	735423	49
216	340195.5	734984.4	38
217	340231.3	734981	39
218	340192.1	734947	38
219	340230.5	734946.6	39
220	340209.9	734914.4	38
221	340620.1	735092.3	47
222	340697.7	735096.7	48
223	340843.8	735076.7	51
224	340889.5	735069.9	51
225	340915.5	735065.9	50
226	341142.5	735007.8	45
227	341090.4	734981.8	46
228	341246.6	735028.3	44
229	341327	735016.2	43
230	341495	734971.2	42
231	341507	734933.6	41
232	342128.7	734588.1	46
233	342186.3	734626.1	42
234	342233.1	734704.2	41
235	342210.3	734703.4	42
236	342174.7	734663.8	41
237	341691.9	736464.6	48
238	341772.8	736553.7	46
239	338934	738309.3	35