APPENDIX 11.4
CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

CONSTRUCTION NOISE

The assessment of construction noise has been undertaken in accordance with BS 5228-1 and with reference to the results of the baseline noise survey.

Standard construction working hours are assumed to be 07:00 to 19:00 hours, and 07:00 to 13:00 on Saturdays with no working on Sundays or Bank Holidays. Drawing on the results of the baseline noise survey, daytime construction noise thresholds have been determined for each receptor in association with the BS 5228-1 'ABC method'.

Table 11-4.1: Construction Noise Thresholds

Receptor	**Ambient Sound Level $L_{Aeq,\ T}$ dB**		**Construction Threshold $L_{Aeq,\ T}$ dB**	
	Weekday	**Saturday**	**Weekday**	**Saturday**
Carrdus School	62	-	65 (Cat. A)	-
Dwellings on Banbury Lane	65	65	70 (Cat. B)	65 (Cat. C)
T = 12hr for Weekdays and 6hrs for Saturdays				

It should be noted that whilst BS 5228-1 does not typically consider non-residential receptors for assessment. Due to the high noise levels measured during the noise survey, and due to the sensitivity of the receptor, Carrdus School is also considered within this assessment.

At this stage the type and number of construction plant items, the programme and working methodologies to be applied are not known; these would be dependent upon the Contractor, who would be appointed after planning approval. To inform this assessment, it has been necessary to make assumptions regarding the plant likely to be used, their number and 'on-time' (i.e., the percentage of time in operation). These assumptions are based on professional experience of similar developments.

The key construction stages are:

- Site Setup;
- Earthworks;
- Piling;
- Building construction; and
- Roadworks.

Construction phases are assumed to be undertaken separately. It is appreciated that some of the construction phases may overlap, however, the approach adopted is representative of predicting likely significant effects given that in the case of any such overlapping operations, it will be the closest operations to the receptor that will generally dictate the resulting noise levels.

In practice, the plant items identified for each phase will move around the site, operating at different times, for different durations and at different locations on any one day. Consequently, noise levels at any receptor may vary considerably day-on-day. It is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction (and subsequent assessment).

The assumed type and number of plant items associated with key construction working stages are presented in **Table 11-4.2**. The table detailed the source information and sound pressure level attributed to each plant item.

Table 11-4.2: Construction Working Stages and Plant Items

Plant Item	BS 5228-1 Ref.	SPL @ 10m (dBA)	No. of Items Operating in Parallel	On-Time (% of working day)
Site Setup				
Hiab	C2.27	80	1	50
Excavator	C2.5	76	2	50
2T Dumper	C4.9	77	2	50
Fork Lift	M-EC Library	72	2	25
Sweeper	C4.90	76	1	20
Pick Up	M-EC Library	67	2	25
Tractor/Post Hole Digger	D10.199	75	2	40
Wheel-wash	M-EC Library	65	3	10
Excavation				
Tracked Excavator	C1.13	86	1	60
Tipper Lorry	C8.20	80	1	50
Excavator	C2.3	78	1	50
Vibratory Roller	C2.40	67	2	10
Wheel-wash	M-EC Library	65	3	10
Piling				
10T Dumper	C4.7	77	2	50
Mobile Crane	C4.46	67	1	40
Rotary Bored Piling Rig	C3.14	84	1	75
Excavator	C4.64	75	2	50
Concrete Pump	C3.25	78	2	50
Wheel-wash	M-EC Library	65	3	10
Building construction				
Tower Crane	C4.48	77	1	20
Concrete Pump	C3.25	78	2	20
Compressor & Vibrator Poker	C4.33	79	3	10
Goods Hoists	C4.61	68	2	95
Personnel Hoists	C4.62	66	2	55
Mobile Platform	C4.57	67	4	50

Plant Item	BS 5228-1 Ref.	SPL @ 10m (dBA)	No. of Items Operating in Parallel	On-Time (% of working day)
4-tool Compressor	C3.19	75	2	20
Wheel-wash	M-EC Library	65	3	10
Roadworks				
Breaker	C5.3	82	1	33
Surfacer	C5.30	76	2	33
Compactor/Roller	C5.20	75	2	33
Hiab	C2.27	80	1	33
Wheel-wash	M-EC Library	65	1	10

Construction noise level calculations and assessment has been completed at the closest noise sensitive receptors:

- Carrdus School; and
- Dwellings on Banbury Lane

In practice, activities would take place at different times and durations, and would move around the Site; consequently, construction noise at any receptor is likely to vary. It is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction and subsequent appraisal. The most important assumptions relate to the type and number of plant items, operational on-time and location of equipment.

Calculations have been undertaken based on all plant items positioned at the nearest proposed commercial unit, closest to the receptors. This approach is considered to represent a realistic worst-case scenario because due to the size and orientation of the site, the majority of the construction works will occur further away.

Construction noise at sensitive receptors is calculated using the BS 5228-1 method, using the following assumptions:

- 100% soft ground between source and receiver;
- No screening between source and receiver;
- Source height 1.5m above ground;
- Receiver height 4.0m above ground (first floor height); and
- Predicted levels are quoted as free-field (i.e. 3dB façade reflection correction is not added).

Table 11-4.3 sets out the resulting construction noise levels calculated for each receptor.

Table 11-4.3: Predicted Construction Noise Levels

Receptor	Construction working stage noise level ($L_{Aeq, 1hr}$ dB)				
	Site Setup	Excavation	Piling	Building construction	Roadworks
Carrdus School	40	43	42	38	39
Dwellings on Banbury Lane	46	49	48	44	45

The predicted construction noise levels have been compared against the lowest threshold criteria (Saturdays) for each receptor. The results are given in **Table 11-4.4**, a negative value represents compliance, a positive value represents exceedance.

Table 11-4.4: Construction Noise Compliance

Receptor	Construction working stage compliance level (dB)				
	Site Setup	Excavation	Piling	Building construction	Roadworks
Carrdus School	-25	-22	-23	-27	-26
Dwellings on Banbury Lane	-19	-16	-17	-21	-20

It can be seen from **Table 11-4.4** that for all working stages and receptors, the construction noise assessment criteria are met

Therefore, it can be concluded that during all works, at all identified receptors, there will be a direct, temporary, local **negligible** impact. This effect is **not significant.** In addition, the NPSE classification is NOEL.

Furthermore, to give confidence to the Local Authority, M-EC has conducted a further assessment which assumes that:

- Double the amount of plant items listed in **Table 11-4.2** are required during the assessment period; and
- All plant items listed in **Table 11-4.2** are utilised for 100% of the assessment period.

In reality, this would not occur, however, the results are presented in **Table 11-4.5** with compliance demonstrated in **Table 11-4.6**.

Table 11-4.5: Worst-Case Predicted Construction Noise Levels

Receptor	Construction working stage noise level ($L_{Aeq,\ 1hr}$ dB)				
	Site Setup	Excavation	Piling	Building construction	Roadworks
Carrdus School	47	48	47	48	47
Dwellings on Banbury Lane	53	54	53	54	53

Table 11-4.6: Worst-Case Assessment Construction Noise Compliance

Receptor	Construction working stage compliance level (dB)				
	Site Setup	Excavation	Piling	Building construction	Roadworks
Carrdus School	-18	-14	-18	-17	-18
Dwellings on Banbury Lane	-12	-11	-12	-11	-12

It is recognised that occasionally, higher construction noise levels could arise, for example, if works are required closer to the sensitive receptors than the distance between the proposed access road/units closest to the receptors. However, such works would be occasional, of short duration and therefore not significant.

It is also recognised that the noise levels would be dependent upon the final masterplan that is brought forward. For example, higher noise levels could arise if buildings are moved closer to the receptors or if extended night-time working is required.

Mitigation

Significant adverse effects are not predicted; however, consideration has been given to mitigation measures to reduce impact of construction noise and which would allow greater margins of compliance.

The adoption of Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act 1974, is usually the most effective means of controlling noise from construction sites. Such measures would be included within a Construction Environmental Management Plan (CEMP), to which the appointed contractor will be required to comply. Appropriate measures include:

- The contractor and their sub-contractors will at all times apply the principle of BPM as defined in Section 72 of the Control of pollution act 1974 and carry out all work in such a manner as to avoid or reduce any disturbance from noise (and vibration) as far as is practicable.
- Guidance given in BS 5228-1 (Section 8: Control of noise and Annex B: Noise sources, remedies and their effectiveness) will be followed as far as is practicable and advice and training on noise minimisation given to staff during Site induction procedures.
- All plant brought on to Site will comply with the relevant EC/UK noise limits applicable to that equipment or should be no noisier than would be expected based on the noise levels quoted in BS 5228-1. Each plant item will be well maintained and operated in accordance with manufacturers' recommendations and in such a manner as to minimise noise emissions.
- Electrically powered plant will be preferred, where practicable, to mechanically powered alternatives.
- The use of sound reduced plant fitted with suitable silencers, or operated within enclosures will be preferred.
- Pneumatic tools will be fitted with silencers or mufflers.
- Deliveries to Site will be programmed and routed to minimise disturbance to local residents.
- Items of plant operating intermittently will be shut down in the periods between use.
- Where feasible, all stationary plant will be located so that the noise effect at receptors is minimised and, if practicable, every item of static plant, when in operation, will be noise attenuated using methods based on the guidance and advice given in BS 5228-1.
- Careful selection of construction methods and plant will be implemented and utilised, for example, breaking-out of concrete structures using, where possible, low noise methods such as munching or similar, rather than percussion breaking.
- Temporary acoustic barriers and other noise containment measures such as screens, sheeting and acoustic hoarding at the Site boundary (and where required around individual plant) will be erected where appropriate to minimise noise breakout and reduce noise levels at potentially affected receptors.
- There will be a considerate and neighbourly approach to relations with local residents.
- The site manager, or other appointed site representative, will be responsible for logging all received environmental noise and vibration

comments/complaints, as well as the action that is taken in response to each point raised, and whether this was successful. Where not successful, supplementary actions will be carried out and resulting effects logged. The contact details for the site representative will be openly advertised so that local residents have a point of contact in case of any issues arising. The site representative will be responsible for keeping an open line of contact with local residents and advising the timing and programming of potentially noisy works.

All of the above measures could be implemented through the Construction Environment Management Plan (CEMP) which would be prepared and submitted to the Local Authority for approval. If necessary, this could also include a requirement for the undertaking of a revised construction noise assessment once the construction contractor has been appointed and the final confirmed construction working methods and programme are known. The results of this re-assessment would be used to identify any areas where construction noise has the potential to give rise to significant effects as defined within this Appendix.

Residual

The impacts arising as a result of construction noise have been identified to be **negligible** without mitigation measures. The application of BPM will increase the margin it is predicted that noise levels at the receptors will be reduced further. A **negligible** impact will remain with mitigation measures in place.

As construction activities will result in noise levels not giving rise to the background sound levels at the receptor locations, an impact of **no change** is likely.

At all receptors, there is likely to be a direct, temporary, local, **negligible** impact. This effect is considered not significant.

CONSTRUCTION VIBRATION

The assessment of construction vibration has been undertaken in accordance with BS 5228-2. The construction vibration criteria, which are independent of time, are presented in **Table 11-4.7.**

Table 11-4.7: Construction Vibration Criteria

Construction Vibration (x) in PPV, mm/s	Magnitude of Impact	NPSE Classification
x < 0.3	Negligible to Minor	NOEL
0.3 < x < 1.0	Minor to Moderate	LOAEL to SOAEL
1.0 < x	Moderate to Major	Above SOAEL

The criteria are based on BS 5228-2 guidance on the effects of vibration levels:

- 0.3 mm/s - vibration might be just perceptible in dwellings;
- 1.0 mm/s - vibration will cause complaint in dwellings but can be tolerated if prior warning and explanation has been given; and
- 10.0 mm/s - vibration is likely to be intolerable for any more than a very brief exposure to this level.

At this stage, the type and number of vibration generating construction plant items, the programme and working methodologies to be applied are not known; these would be based on the final design, the ground conditions, and selected by the Contractor, who would be appointed after planning approval.

Groundborne vibration calculations have been performed for construction activities typically required for similar developments. The calculations are based on the empirical prediction procedures presented within BS 5228-2. **Table 11-4.8** presents the distances at which vibration levels are predicted to meet the criteria thresholds, based on a specified confidence limit (where applicable).

Table 11-4.8: Predicted Groundborne Vibration Levels

Vibration generating activity	Confidence Limit	PPV (mm/s)	Minimum distance between receptor and works (m) before PPV (mm/s) exceeded.
Vibratory Rollers - start & end[(a)]	95	0.3	80
	95	1.0	30
	95	10	5
Vibratory Rollers - Steady State[(1)]	95	0.3	60
	95	1.0	25
	95	10	5
HGV Movement[(b)]	N/A	0.3	8
	N/A	1.0	2
	N/A	10	N/A
Percussive Piling[(c)]	N/A	0.3	85

Vibration generating activity	Confidence Limit	PPV (mm/s)	Minimum distance between receptor and works (m) before PPV (mm/s) exceeded.
- driven through soft ground	N/A	1.0	35
	N/A	10	N/A
Percussive Piling[d] – driven to refusal	N/A	0.3	N/A
	N/A	1.0	120
	N/A	10	15
Excavation	N/A	0.3	9
	N/A	1.0	3
	N/A	10	N/A

[a] Assumes 2 rollers, 0.5mm amplitude, drum width of 1.3m, e.g. heavy-duty ride on roller.

[b] Assumes PPV of 1 mm/s at 2m, referenced within TRL Report 53.

[c] Assumes piles driven through soft soil and not to refusal, pile power of 10kJ and a pile depth of 10m.

[d] Assumes piles driven to refusal, pile power of 10kJ and a pile depth of 10m

The data presented in **Table 11-4.8** is general in nature and not site specific. In addition, different vibration generating activities may be employed other than those listed. The groundborne vibration calculations assume percussive piling, which is the most vibratory generative piling method, and is therefore considered a worst-case scenario.

Residual

Due to the separating distances of approximately 430m from Carrdus School and 250m from Dwellings on Banbury Lane to the nearest proposed unit/access road, it is unlikely that Carrdus School or Dwellings on Banbury Lane would be subject to construction vibration and therefore it is considered that there would be a direct, temporary, local **negligible** effect. This effect is **not significant.**