9. NOISE AND VIBRATION

9.1 Introduction

9.1.1 This Chapter details the existing baseline noise and vibration levels together with assessments of the suitability of the site for residential and commercial development and a school. These assessments include noise and vibration from the mainline railway, the realigned Andover Road and Well House Lane.

9.1.2 Assessments of the likely impacts during the construction and operation of the proposed development have been made and mitigation measures are detailed that will minimise noise and vibration where necessary. The significance of the road traffic noise impact associated with the use of the proposed development is assessed and noise criteria for any operational fixed plant on the site are also specified.

9.1.3 The assessments identify the noise and vibration constraints for residential, school and commercial development and the combined heat and power (CHP) plant.

9.1.4 This Chapter is necessarily technical in nature and to assist the reader a glossary of terminology is included at Appendix 9.1.

9.2 Site Description

9.2.1 The site is located to the north of Winchester city centre and is bounded to the north by Well House Lane and fields beyond; to the east by residential properties in Headbourne Worthy; to the south-east and south by the village of Abbotts Barton and to the west by Andover Road and residential properties beyond.

9.2.2 The site is bisected by the London to Southampton railway line which carries both passenger and freight trains. The railway line is on an embankment in the central area of the site and at grade at the northern and southern boundaries.

9.2.3 Andover Road is one of the main routes into Winchester and as such the noise climate in the western area of the site is dominated by road traffic noise. The noise climate in the area of the site adjacent to Well House Lane is dominated by road traffic noise, with the exception of the area adjacent to the railway line which is dominated by noise from the railway.

9.2.4 The development is proposed on the area of the site to the west of the railway line only, with the land to the east remaining as open space.

9.2.5 The proposed development comprises 2,000 residential dwellings, a Neighbourhood Centre, a primary school, retail food store, car parking, community building, health centre, CHP plant and supporting/ancillary uses.

9.3 Assessment Methodology

9.3.1 The Environmental Health Department of Winchester City Council (WCC) was consulted during the preparation of the Scoping Report. It was agreed that noise and vibration measurements undertaken in 2003 for the preparation of a previous Environmental Statement would be valid for use in this assessment. However, the assessment should demonstrate that passenger and freight train movements have not sufficiently changed since the 2003 survey. Where train movements have changed, a revised survey should be undertaken, or allowances should be made by way of revised calculations. WCC has confirmed that traffic movements on the roads adjacent to the site have not increased significantly since the 2003 survey and consider that the road traffic noise levels measured during the 2003 survey should not have changed significantly.

9.3.2 The methodology used for the Noise Assessment submitted in the 2003 Environmental Statement is considered acceptable for use in this assessment and is described in Appendix 9.2. Note that some of the British Standards referenced in the 2003 assessment have been updated, as detailed in Appendix 9.2.

9.4 Planning Policy

9.4.1 The planning policies, British Standards and other guidance documents used in this assessment are described in detail in Appendix 9.2 and summarised below.

9.4.2 The following documents have been used for the assessment of existing noise and vibration sources on the proposed development site:

- Planning Policy Guidance (PPG) Note 24 *Planning and Noise*;
- Department of Transport memorandum *Calculation of Railway Noise* (CRN) 1995;
- BS6472:2008 *Guide to evaluation of human exposure to vibration in buildings* Part 1 *Vibration sources other than piling*;
- Building Bulletin (BB) 93 *Acoustic Design of Schools*; and
- BS8233:1999 *Sound insulation and noise reduction for buildings – Code of Practice*.

9.4.3 The following documents have been used to assess the potential impact of the development to the existing sensitive receptors close to the site:

- Department of Transport and Welsh Office memorandum *Calculation of Road Traffic Noise* (CRTN) 1988; and
- The Highways Agency *Design Manual for Roads and Bridges* (DMRB) Volume 11, 2008.

9.4.4 The following document has been used to assess the potential impact of fixed plant or new commercial development:

- BS4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*.

9.4.5 The following documents have been used for the assessment of construction noise and vibration:

- BS5228:2009 *Code of practice for noise and vibration control on construction and open sites* Part 1 *Noise* and Part 2 *Vibration*.

9.5 Baseline Conditions

9.5.1 Baseline noise measurements were made both on and off the site during February and May 2003 and baseline vibration measurements were made on the site during February 2003. These measurements were undertaken for the Noise Assessment submitted in the 2003 Environmental Statement. Measurements were undertaken adjacent to the railway line, Andover Road and Well House Lane and at various off-site locations.

9.5.2 Since the 2003 survey, some of the passenger trains using the London to Southampton railway line have changed from tread braked to disc braked which typically results in reduced noise levels. In order to account for the difference in train types since the 2003 survey, an additional railway noise survey was undertaken in March 2009, the results of which have formed the basis of the Railway Noise Assessment. With the exception of the railway noise measurements, all other measurements undertaken during the 2003 surveys have been used in this assessment.

9.5.3 Details of the baseline measurements used in this assessment are given below.

Rail Noise Measurements

9.5.4 Measurements of railway noise were undertaken at Position 1 in the south-eastern area of the western parcel of land approximately 10 metres from the nearside track. The part-attended survey was undertaken from Monday 2 to Monday 9 March 2009 to determine the daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) noise levels. The measurements were undertaken at a height of approximately 1.5 metres above the ground in free-field conditions.

9.5.5 The measured noise levels are summarised in Table 9.1 below and shown in full in Appendix 9.3.

Table 9.1 Summary of Measured Railway Noise Levels at Position 1, dB

Date	Period	$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,fast}$	$L_{Amax,slow}$
2– 3 March	Night-time	62.6	31.5	40.6	87.2 to 94.9	85.2 to 91.1
3 March	Daytime	65.3	47.5	54.4	81.5 to 95.7	78.5 to 92.5
3– 4 March	Night-time	62.1	33.7	42.3	78.3 to 92.0	75.8 to 89.4
4 March	Daytime	64.7	42.3	50.4	82.2 to 97.6	80.2 to 94.3
4– 5 March	Night-time	62.7	39.3	45.6	52.5 to 94.2	47.7 to 92.7
5 March	Daytime	65.0	45.6	51.2	83.2 to 95.8	79.7 to 91.9
5– 6 March	Night-time	62.5	38.7	46.7	51.0 to 94.8	49.4 to 90.8
6 March	Daytime	64.8	43.0	50.7	80.5 to 95.0	77.3 to 92.6
6– 7 March	Night-time	60.1	31.2	40.0	47.9 to 92.9	45.7 to 90.4
7 March	Daytime	59.1	41.5	47.1	80.5 to 92.7	78.3 to 90.1
7– 8 March	Night-time	56.1	37.2	48.5	60.8 to 93.0	59.5 to 89.8
8 March	Daytime	59.3	45.6	53.1	78.9 to 89.8	77.2 to 88.4
8–9 March	Night-time	60.4	36.7	45.2	53.8 to 93.3	51.4 to 89.3

Rail Vibration Measurements

9.5.6 A continuous vibration survey was conducted at Position 2 in the south-east of the site approximately 10 metres from the nearside track. The unattended survey was undertaken from 18 February to 19 February 2003.

9.5.7 Vibration measurements were undertaken using a digital seismometer to measure both vibration dose value (VDV) and peak particle velocity (PPV) using a tri-axial geophone. The measured VDV and PPV levels over the daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) period are presented in Table 9.2 below.

Table 9.2 Summary of Measured VDV and Maximum PPV Levels at Position 2

Time Period	VDV	PPV
Daytime (0700 to 23:00 hours)	0.254 $ms^{-1.75}$	3.49 mms^{-2}
Night-time (2300 to 0700 hours)	0.069 $ms^{-1.75}$	2.48 mms^{-2}

On-site Road Noise Measurements

9.5.8 The L_{Aeq} road traffic noise levels from Andover Road and Well House Lane have been predicted from traffic flow data as detailed later in this Chapter. The traffic flow data include development generated road traffic and are therefore more appropriate to use than measured existing road traffic noise levels.

9.5.9 In addition to the L_{Aeq} noise levels, PPG24 advises that locations where noise levels greater than 82dB $L_{Amax,slow}$ occur several times in any hour during the night should be classified as NEC C (see Appendix 9.2). Therefore, it was necessary to conduct a noise survey to establish typical $L_{Amax,slow}$ noise levels on the site at representative locations adjacent to Andover Road and Well House Lane.

9.5.10 The attended noise survey was conducted on 19 February 2003 during the daytime period. Although road traffic movements are less at night than during the day, the maximum levels of noise from traffic on these sites will be the same at night as during the day.

9.5.11 Measurements of the maximum levels of free-field noise from road traffic were made at three locations on the western site boundary adjacent to Andover Road and at one location adjacent to the northern site boundary on Well House Lane. Measurements adjacent to Andover Road correspond to the various speed limits adjacent to the western site boundary. The measurement positions are detailed below:

- Position 3: northern section of the western site boundary, 12 metres from the kerb (speed limit 50mph);
- Position 4: central section of the western site boundary, 12 metres from the kerb (speed limit 40mph);
- Position 5: southern section of the western site boundary, 12 metres from the kerb (speed limit 30/40mph); and
- Position 6: on the northern site boundary, 6 metres from the kerb of Well House Lane.

9.5.12 One 15 minute measurement was undertaken at each of the above positions. At each position the microphone was in free-field conditions at a height of approximately 1.5 metres above the ground.

9.5.13 Table 9.3 below shows the maximum noise level measured at each of the above positions.

Table 9.3 Measured Road Traffic Noise Levels, $L_{Amax,slow}$ dB

Position	Description	$L_{Amax,slow}$
3	Northern section of western site boundary, 12 metres from Andover Road	76
4	Central section of western site boundary, 12 metres from Andover Road	72
5	Southern section of western site boundary, 12 metres from Andover Road	72
6	On the northern site boundary, 6 metres from Well House Lane	82

Road Vibration

9.5.14 During the road traffic noise measurements no perceptible levels of vibration were experienced at any of the measurement positions. Consequently, no measurements of baseline vibration from road traffic were made.

Off-Site Noise Measurements

9.5.15 Measurements were undertaken during the daytime and night-time at a number of off-site noise-sensitive receptors between 29 and 30 May 2003.

9.5.16 It is considered that the noise levels measured at the off-site receptors are representative of the noise climate at other nearby noise-sensitive premises.

9.5.17 Attended non-consecutive 15 minute measurements were undertaken at the following positions to total 1½ hours during the daytime period and 30 minutes during the night-time:

- Position 7: to the south-west of the site adjacent to dwellings at the junction of Andover Road and Stoney Lane;
- Position 8: to the north-west of the site adjacent to 127 Andover Road; and
- Position 9: to the north of the site adjacent to Well House Farm.

9.5.18 A continuous measurement was made at the following position between 28 and 30 May 2003.

- Position 10: on the southern site boundary adjacent to the rear gardens of dwellings on Old Gardens, off Park Road.

9.5.19 A summary of the noise levels measured at Positions 7 to 10 is shown in Table 9.4. The daytime (07:00 to 23:00 hours) sample levels at Positions 7 to 9 are considered representative of the daytime period and the night-time (23:00 to 07:00 hours) sample noise levels are considered representative of the night-time period.

9.5.20 The daytime and night-time continuous noise levels measured at Position 10 are presented in full in Appendix 9.3.

Table 9.4 Summary of Measured Off-site Noise Levels, dB

Position	Period	$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	$L_{Amax,slow}$
7– Andover Road/Stoney Lane	Daytime	66	69	51	82
	Night-time	56	50	41	78
8–127 Andover Road	Daytime	66	69	46	82
	Night-time	54	48	41	78
9– Well House Farm	Daytime	64	66	40	85
	Night-time	53	49	40	75
10– Old Gardens	Daytime	55	51	42	80
	Night-time	51	46	38	79

9.5.21 At Positions 7 to 9 road traffic noise was clearly audible at all times. Traffic movements on both Well House Lane and Andover Road were much less during the night-time than during the day. During occasional lulls in road traffic, distant road traffic noise and occasional aircraft noise were audible. When a gap in the flow of road traffic coincided with a rail movement, rail noise was also just audible.

9.5.22 At Position 10 during periods when no train movements took place, road traffic noise was audible, as was very occasional aircraft noise. However, during train pass-bys, rail noise was clearly audible. As the railway is in use throughout the daytime period and at times during the night-time period, rail noise subjectively dominated the noise environment at this location.

9.5.23 All measurement positions are shown in Appendix 9.4.

Meteorological Conditions and Survey Equipment

9.5.24 All noise measurements were made using Type 1 equipment and an accredited laboratory calibrated all equipment not more than two years prior to the surveys and one year for the calibrators. Furthermore, before and after each measurement period the calibration of the sound level meters was checked and was found not to vary. Vibration measurements were made using equipment that had been calibrated not more than two years prior to the survey.

9.5.25 When the noise measurements were made during February 2003 the weather conditions were predominantly dry with light winds that varied between north-east to south-west in direction. For the majority of the survey the wind direction was from the south-east. Weather conditions during the measurements made in May 2003 were dry with calm to light winds. During all surveys in 2003 the weather conditions were conducive to accurate noise measurements.

9.5.26 During the March 2009 survey the weather conditions were predominantly dry with little or no wind and were therefore considered conducive to reliable noise measurements.

9.6 Identification and Evaluation of Key Impacts

9.6.1 The potential impacts resulting from the proposed development have been assessed. The assessments determine the short-term (construction period) and long-term (completed development) impacts of the proposed development.

9.6.2 The key impacts for the completed development are detailed in this section and the potential impacts during the construction period are detailed in Section 9.7.

9.6.3 To identify the areas on the currently open site of the proposed development where road and rail noise levels are above and below the PPG24 criteria that will permit future residential development, noise contours were predicted across the open site. The criteria that define the permitted "build-line" for residential development are given in Appendix 9.2.

9.6.4 Railway noise was modelled in accordance with the methodology advised by the Department of Transport's *Calculation of Rail Noise* (CRN) 1995. In addition to $L_{Aeq,T}$ noise levels, the L_{Amax} levels have also been considered.

9.6.5 Road noise was modelled in accordance with the methodology advised by the Department of Transport's *Calculation of Road Traffic Noise* (CRTN) 1988. CRTN does not provide a prediction methodology for maximum levels of noise from road traffic noise. However, L_{Amax} road traffic noise measurements have been made on the site adjacent to both Andover Road and Well House Lane.

9.6.6 Train types were determined from observations and the frequency of service was established both from timetables and from the distinct train pass-by events measured by the noise and vibration monitoring equipment. Many different types of passenger and freight vehicles travelling at different speeds were observed on the tracks adjacent to the site. CRN partly relies upon detailed information of train and coach types and accurate speed information. CRN also relies on and takes into consideration topography. When some of this information is variable, such as the speed of passing trains, then predicted levels of noise can vary from actual noise levels on the site. Furthermore, variations between predicted and measured levels of noise can also arise where the mix of trains is large and variable.

9.6.7 Therefore, when the topography of the site and rail height details are known, to take into consideration the variability in the speed of passing trains and their mix, the output of the noise model was adjusted so that the day and night-time $L_{Aeq,T}$ noise levels predicted by the model for the current situation matched those measured at Position 1. The modelled noise levels were matched to the average day and night-time $L_{Aeq,T}$ noise level measured at Position 1 on the site. The same methodology was also employed to predict the night-time maximum levels of noise from passing trains. This methodology ensures that the predicted current day and night-time railway noise levels match those measured on the site and also that the effect of the topography of the site and surrounding area is taken onto consideration.

9.6.8 Pinnacle Transportation Limited forecast future "with development" road traffic movements and these were used to model the road traffic noise contours across the site. These road traffic flows are summarised in the transport assessment.

Dominant Sources of Noise and Criteria that Dictate the Constraint to New Dwellings

9.6.9 Day and night-time noise contours for railway traffic were modelled across the site at ground (1.5m), first (4.5m) and second (7m) floor heights. The modelled noise contours are for an open site and take into account the current topography of the site and the attenuation offered by any current landforms, such as where any road or railway is in cutting. The noise contours correspond to the values that define the NECs for where rail traffic is dominant.

9.6.10 The road traffic noise levels from the realigned Andover Road were calculated for the noise contours applicable to the NECs for road traffic noise.

9.6.11 Figures 9.1 to 9.9 show the contours that take into consideration noise solely from the railway. Appendix 9.2 advises on the implications of building with the different NECs applicable to railway noise.

9.6.12 For railway traffic during the night-time (23:00 to 07:00 hours), passenger timetables advise that there are several (more than three) train movements in any one hour. Furthermore, data from the noise and vibration survey indicate that during the night-time there are several (more than three) freight movements in any one hour. Therefore, in accordance with the advice in PPG24, regard must also be given to the constraint that the maximum levels of rail noise may have upon proposed dwellings.

9.6.13 Calculations were also undertaken that take into consideration solely road traffic noise on the realigned Andover Road. Again, the implications of building within the different NECs for road traffic noise are detailed in Appendix 9.2.

9.6.14 Railway noise is dominant on areas of the site that are adjacent to the railway. For the other parts of the site that are not adjacent to the railway, which include areas adjacent to the realigned Andover Road and Well House Lane, noise emanating from both road and railway sources (mixed sources) will apply. On areas of the site that are adjacent to the realigned Andover Road and adjacent to Well House Lane road traffic noise, rather than rail noise, is likely to dominate. However, at these locations the mixed noise source contours remain valid as the same noise levels that define the PPG24 road source NECs also define the mixed sources NECs.

9.6.15 It is important to remember that Appendix 9.2 Table A9.2/1 shows that the $L_{Aeq,T}$ noise levels that define the constraints to new dwellings presented by railway noise are greater than those that define the constraints arising from road or mixed source noise. The values that define the constraints to road or mixed source noise are the same.

9.6.16 The noise source(s) that dictate the constraints to residential development can be divided geographically into two areas that are described in more detail below, these being:

- the site adjacent to the railway where rail noise dominates. For these parts of the site the PPG24 NEC rail source levels apply, and
- the remainder of the site, including areas adjacent to the realigned Andover Road and Well House Lane, where both road and rail noise must be taken into account. For this part of the site the PPG24 NEC mixed source noise levels apply.

Areas of the Site Affected by Railway Noise (Adjacent to the Railway)

9.6.17 The rail noise contours are shown on the following figures:

- daytime $L_{Aeq,16hour}$ ground to second floor - Figures 9.1 to 9.3;
- night-time $L_{Aeq,8hour}$ ground to second floor - Figures 9.4 to 9.6; and
- night-time L_{Amax} ground to second floor - Figure 9.7 to 9.9.

9.6.18 The proposed residential build-line is depicted by the NEC B/C boundary. NEC B is shown by the light blue area and NEC C is shown by the yellow area in Figures 9.1 to 9.6. The 82 dB $L_{Amax,slow}$ noise contour, that also denotes the permitted residential build-line, is depicted by the boundary between the blue and the red contours in Figures 9.7 to 9.9.

9.6.19 It can be seen from the above figures that the night-time L_{Amax} noise levels are the most onerous and therefore dictate the residential build-line.

9.6.20 In summary, for any residential development that is proposed on the area of the site adjacent to the railway, regard will be given to positioning this development beyond the night-time 82 dB $L_{Amax,slow}$ noise contour.

9.6.21 Conformance with positioning proposed dwellings at and beyond these noise contours will ensure that, with appropriate mitigation, noise at and within the dwellings will be at satisfactory levels. This will ensure that the planning requirements of PPG24 and of WCC's Environmental Health Department will be met. The current Masterplan shows compliance with this.

Area of the Site Affected by Road Noise (Adjacent to Andover Road and Well House Lane)

9.6.22 The remaining area of the site, including that adjacent to Andover Road and Well House Lane, is predominantly affected by road traffic noise with the eastern area of the site adjacent to Well House Lane also being exposed to railway noise.

9.6.23 For the majority of areas of the site that are not adjacent to the railway where rail noise does not dominate, road traffic noise will determine the constraint to residential development.

9.6.24 The Masterplan shows proposed residential areas adjacent to the realigned Andover Road. It is understood that to the north and south of the local centre, the façades are set back approximately 14 metres from the road. The speed limit in these areas in 30 mph.

9.6.25 Although not shown on the Masterplan, there may be ground floor apartments in the local centre adjacent to the realigned Andover Road. For the purpose of this assessment, they have been assumed to be residential. The proposed façades are at a distance of 5 metres from the road and the speed limit in this area is 20 mph.

9.6.26 Table 9.5 shows the predicted noise level at the three locations along Andover Road for which traffic flow information is provided. Note that the noise levels have been derived using flows for the year 2023 when the proposed development would be 100% complete and therefore presents a worst-case.

9.6.27 Traffic flow data is not provided for the section of road adjacent to the local centre but is provided for the sections to the north and south. For the purpose of assessing noise levels at the local centre, the highest of these two flows has been used, which is on the section of road to the south.

9.6.28 The noise levels have been derived using annual average weekday traffic (AAWT) flows for the 18 hour (06:00 to 24:00 hour) period, as supplied by Pinnacle Transport Limited. The 16 hour (07:00 to 23:00 hour) L_{Aeq} levels have been derived by subtracting 2 dB from the $L_{A10,18hour}$ values, as advised in PPG24. It has not been possible to predict the night-time noise levels, however, daytime levels are usually the overriding constraint with road traffic noise.

Table 9.5 Predicted Noise Levels at Proposed Dwellings on the Realigned Andover Road, dB $L_{A10,18hour}$ and $L_{Aeq,16hour}$

Link	Speed	Distance from road	$L_{A10,18hour}$ (dB)	$L_{Aeq,16hour}$ (dB)
Andover Road (north of local centre)	30 mph	14 metres	62.4	60.4
Andover Road (south of local centre)	30 mph	14 metres	63.2	61.2
	20 mph	5 metres	67.1	65.1
Andover Road (north of Stoney Lane)	30 mph	14 metres	62.5	60.5

9.6.29 It can be seen from Table 9.5 that, the proposed façades at a distance of 14 metres from the realigned Andover Road, will be exposed to noise levels in NEC B of PPG24. The apartments in the local centre at 5 metres from the road will be exposed to noise levels in NEC C.

9.6.30 Due to the realignment of Andover Road and the possibility that this may distribute traffic differently, the road traffic noise levels on Well House Lane have also been derived using traffic flow data. The daytime $L_{Aeq,16hour}$ noise level is 58 dB at 5 metres from the kerb.

9.6.31 Regard must also be given to the constraints posed by the night-time maximum levels of noise from rail movements that are depicted by Figures 9.7 to 9.9.

9.6.32 Furthermore, the maximum levels of noise that were measured from road traffic on Andover Road and Well House Lane should be considered. The measurements of the maximum levels of noise from road traffic shown in Table 9.3 detail typical locations on the site boundary adjacent to both Andover Road and Well House Lane where $L_{Amax,slow}$ free-field noise levels of 82 dB and less were

measured. It is considered that the $L_{Amax,slow}$ noise levels measured on Andover Road can be applied to the realigned Andover Road.

9.6.33 As the maximum level of noise generated by passing traffic is not that sensitive to a change in the traffic flow there will be minimal differences in the maximum noise levels generated by existing and future forecast traffic.

9.6.34 Therefore, in summary, for any residential development that is proposed on the area of the site not adjacent to the railway, regard will be given to positioning this development beyond the night-time 82 dB $L_{Amax,slow}$ noise contour (Figures 9.7 to 9.9). Conformance with positioning proposed dwellings at and beyond this noise contour will ensure that, with appropriate mitigation, noise at and within proposed dwellings will be at satisfactory levels. This will ensure that the planning requirements of PPG24 and of WCC's Environmental Health Department will be met.

Assessment of the Noise and the Noise Contours that Define the Boundary between NEC A and NEC B

9.6.35 The planning guidance for dwellings in the various NECs, including A and B, is detailed in Appendix 9.2 Table 9.2/1. For NEC A the guidance is that noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level. The guidance given for NEC B is that noise should be taken into account when determining planning applications and, where appropriate, Conditions imposed to ensure an adequate level of protection against noise.

9.6.36 Due to the level of detail in the current Masterplan, noise levels have been calculated based on an open site. However, when erected, the perimeter dwellings will act as an effective barrier to road traffic noise from Well House Lane and the realigned Andover Road and from railway noise on areas of the site "behind" these buildings. The effectiveness of these proposed buildings in reducing noise "within" the site will depend on the height of the proposed buildings and the open space between them.

9.6.37 Buildings proposed towards the edge of the site that may be adjacent to the railway will be relatively less effective as a barrier to reduce noise from the railway. This is because the railway is on embankment for an appreciable distance as it passes the site. Again, the effectiveness of these proposed buildings in reducing noise "within" the site will depend on the height of the proposed buildings and the space between them.

9.6.38 Given that much of this detail will not be known until the detailed design stage, the assessment of the boundary between NEC A and NEC B cannot be conducted until those details are available. It is envisaged that these assessments will be conducted as part of any detailed application together with the identification of suitable mitigation measures for any proposed dwellings that are classified within NEC B.

Rail Traffic Vibration at Buildings Adjacent to the Railway

9.6.39 It should be noted that the BS6472:2008 assessment method strictly applies only to measurements at the point of entry into the human body, which for a worst case assessment is usually taken to mean an upper storey floor. Vibration is generally attenuated from the ground to the building foundations whereas vibration is generally amplified through a building from ground to upper floors. In the absence of buildings on the site at which to measure easily in the vicinity of the railway, we have assumed frequency dependent transfer functions that take into consideration the attenuation and amplification of vibration from the ground to first floor level.

9.6.40 If dwellings were erected at the boundary of the site adjacent to the railway then at the first floor the VDVs presented in Table 9.6 are likely.

Table 9.6 Vibration Dose Values (VDVs) at Proposed Dwellings Erected in the Area of the Site Boundary Adjacent to the Railway

Time Period	Predicted First Floor VDV
Daytime (0700 to 2300 hours)	0.527 $ms^{-1.75}$
Night-time (2300 to 0700 hours)	0.166 $ms^{-1.75}$

9.6.41 Comparing the predicted VDV levels shown in Table 9.6 to the criteria detailed in Appendix 9.2 Table A9.2/2, it can be seen that if properties were erected at the eastern boundary of the site adjacent to the railway then, during the daytime, adverse comment regarding vibration is possible. During the night-time the possibility of adverse comment would be less than it is during the daytime.

9.6.42 However, the Masterplan shows that the closest area of development is approximately 30 metres from the nearside track. The predicted VDVs at this distance are shown in Table 9.7 below at upper storey heights.

Table 9.7 Predicted Vibration Dose Values (VDVs) at Proposed Dwellings 30m from the Near-Side Rail of the Up Line

Time Period	Predicted First Floor VDV
Daytime (0700 to 2300 hours)	0.213 $ms^{-1.75}$
Night-time (2300 to 0700 hours)	0.079 $ms^{-1.75}$

9.6.43 Table 9.7 shows that if properties were erected at a distance of 30 metres from the near-side rail of the up line, during both the day and night-time there would be a low probability of adverse comment regarding vibration. This meets the requirements of WCC.

Road Traffic Vibration at Buildings Adjacent to Roads

9.6.44 At positions on the site boundary, existing vibration due to road traffic was not perceptible. Therefore, this is considered to be a neutral impact and will be permanent and local in extent.

Noise Impact on the Proposed School

9.6.45 The school is located approximately 90 metres to the east of the realigned Andover Road and behind the Local Centre that fronts Andover Road. As such is it considered that the school will be screened from road traffic noise by the Local Centre.

9.6.46 The railway line is some 350 metres from the school with residential areas proposed between. As such, railway noise levels will be considerably lower at the school because of the greater separation distance and will also be screened by the proposed residential buildings.

9.6.47 Due to building footprints not being known at this stage, it is not possible to accurately predict noise levels at the school. This assessment will be undertaken at the detailed design stage when this information becomes available.

9.6.48 However, as a guide, the noise level at 10 metres from the realigned Andover Road will be 64 dB $L_{Aeq,16hour}$ (see Table 9.5); therefore, at 90 metres the noise level will be 56 dB $L_{Aeq,16hour}$. This does not include screening from the proposed Local Centre which will attenuate noise levels further.

9.6.49 At the site area where the school is proposed noise levels are likely to be below 55 $L_{Aeq,16hour}$. The internal level of noise has also predicted (based on an external level of 55 dB $L_{Aeq,16hour}$) assuming that windows are open and provide acoustically unattenuated natural ventilation. The predicted internal noise level is 40 dB(A).

9.6.50 As detailed in Appendix 9.2, the criterion for teaching rooms is 35 dB $L_{Aeq,30mins}$.

Noise Impact to the Proposed Local Centre Development

9.6.51 The proposed Local Centre is adjacent to the realigned Andover Road. However, at this stage, the precise location, orientation and height of the buildings are unknown.

9.6.52 To accord with the internal noise criteria given by BS8233:1999, appropriate levels of noise attenuation must be provided by the external building fabric of the proposed Local Centre.

Rail and Road Traffic Vibration Impact on the Proposed School and Local Centre Development

9.6.53 At the proposed school and Local Centre development, rail and road traffic vibration is anticipated to be at levels that will be imperceptible. Ground-borne vibration from rail and road traffic will be significantly below the level that will cause damage to the proposed school and Local Centre development.

9.6.54 This is considered to be a neutral impact and will be permanent and local in extent

Operational Noise Impact of the Completed Development on Existing and New Noise-sensitive Receptors

9.6.55 The criteria used to specify and limit the level of noise arising from fixed plant associated with the proposed development is outlined in Appendix 9.2. Items such as heating, ventilation and any air conditioning may be classified as fixed plant. Consideration must be given to the operation of any new commercial elements associated with the proposed development so that they will not affect new and existing residential premises.

9.6.56 Table 9.8 shows the noise design criteria that must be achieved at each representative noise-sensitive receptor.

Table 9.8 Noise Design Criteria to Minimise Operational Noise at Existing and Proposed Noise-Sensitive Receptors

Representative Receptor	Daytime free-field external $L_{Ar,1hour}$	Night-time free-field external $L_{Ar,5mins}$
Existing noise-sensitive development in the area of Andover Road/Stoney Lane junction (position 9) and proposed noise-sensitive development opposite this location.	46	36
Existing noise-sensitive development in the area of 127 Andover Road (position 10) and proposed noise-sensitive development opposite this location.	41	36
Well House Farm (position 11) and proposed noise-sensitive development adjacent to this location.	35	35
Existing noise-sensitive development in the area of Old Gardens (position 12) and proposed noise-sensitive development adjacent to this location.	37	33
Proposed noise-sensitive development in the area of position 3.	39	36

All levels dB.
$L_{Ar,T}$ Rating Noise Level as defined in BS 4142: 1997.

9.6.57 In accordance with the criteria detailed in Appendix 9.2, the overall or "cumulative" level of noise from all operating fixed plant must be less than or equal to the noise design criteria specified in Table 9.8.

9.6.58 Consideration of these criteria must be given during the detailed design of the proposed development. This will ensure that at existing and future noise-sensitive premises, noise from the completed development will not give rise to complaint. To minimise the levels of operational noise

associated with the completed development, the mitigation measures outlined in this chapter must be considered.

Noise Impact of the Combined Heat and Power Plant on Existing and New Noise-sensitive Receptors

9.6.59 In accordance with the requirements of WCC, the noise levels from the plant must not exceed the guidance in the WHO *Guidelines for Community Noise*, i.e. 55 dB $L_{Aeq,16hour}$ during the daytime and 45 dB $L_{Aeq,8hour}$ at night at the external façade of the closest noise-sensitive receptors.

9.6.60 At this stage, there are no noise emission levels for the proposed plant therefore it is not possible to determine compliance with the above levels. However, at the detailed design stage, an assessment will be undertaken to ensure that the above noise levels are not exceeded.

Road Traffic Noise Impact of the Completed Development on Existing Noise-sensitive Receptors

9.6.61 In accordance with the criteria detailed in Appendix 9.2, the operational assessment of road traffic noise from the completed development considers the change in road traffic noise at existing representative noise-sensitive receptors. The change in the level of road traffic noise predicted at receptors included in Table 9.9 will be indicative of the change in traffic noise at adjacent locations.

9.6.62 Table 9.9 details the comparisons between the completion year (2023) with and without development road traffic noise levels. These detail the changes in traffic noise levels that are due solely to the development.

9.6.63 The change in road traffic noise levels was calculated using the traffic flows produced by Pinnacle Transportation Limited.

Table 9.9 Difference between the Future With and Without Development Road Traffic Noise Levels, the Subjective Scale of the Change in and the Significance of the Road Traffic Noise impact

Receptor	Difference between 2023 future No Development and 2023 future With Development.
Andover Road south of Three Maids Hill Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.6 dB(A) **No change** **Insignificant**
Andover Road north of Well House Lane Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.7 dB(A) **No change** **Insignificant**
Andover Road north of Harestock School Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	-25.1 dB(A) **Severe change** **Significant positive**
Andover Road north of Stoney Lane Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	-18.7 dB(A) **Severe change** **Significant positive**
Andover Road south of Stoney Lane Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.9 dB(A) **No change** **Insignificant**
Andover Road north of Bereweeke Road Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.8 dB(A) **No change** **Insignificant**
Andover Road south of Bereweeke Road Change in traffic noise level	0.7 dB(A) **No change**

Subjective scale of change in noise level **Significance of Impact**	**Insignificant**
Harestock Road west of Andover Road Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	1.0 dB(A) **Minor change** **Insignificant**
Well House Lane east of site access Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	1.1 dB(A) **Minor change** **Insignificant**
Stoney Lane west of Andover Road Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.5 dB(A) **No change** **Insignificant**
Bereweeke Road west of Andover Road Change in traffic noise level **Subjective scale of change in noise level** **Significance of Impact**	0.8 dB(A) **No change** **Insignificant**

All changes dB $L_{A10,18hour}$.

9.6.64 Table 9.9 shows a minor insignificant change at Harestock Road west of Andover Road and at Well House Lane east of the site access. At all other locations there will be no change with the exception of the section of Andover Road that is being realigned where a severe significant positive impact is predicted.

Road Traffic Vibration Impact of the Completed Development to Existing Noise-sensitive Receptors

9.6.65 Either with or without the development, ground-borne vibration from future road traffic is extremely unlikely to be at levels that will cause damage to existing buildings. Furthermore, the small differences in the $L_{A10,18hour}$ noise levels between the future with development and the future without development scenarios indicates that the change in the percentage of people bothered very much or quite a lot by air-borne traffic vibration will be negligible. This is considered to be a neutral impact and will be permanent and local in extent.

9.7 Assessment of Construction Phase

9.7.1 An assessment of the impacts of noise and vibration during the construction phase has been carried out in accordance with the assessment criteria that are detailed in Appendix 9.2.

9.7.2 With any major development it is inevitable that there will be some degree of disturbance caused to those nearby during the construction phase. However, disruption due to construction is a localised phenomenon and is temporary in nature.

9.7.3 In conformance with the criteria detailed in Appendix 9.2, noise levels and the likely noise impact during different construction phases were predicted at existing noise-sensitive premises and Appendix 9.3 shows these locations. The noise levels and impacts at these locations will be representative of the levels of noise at adjacent locations and other noise-sensitive premises in the vicinity of those positions.

9.7.4 The predictions are based on the methodology contained within BS5228-1:2009 and consider the equivalent continuous sound level, $L_{Aeq,T}$ over the core working day. Table 9.10 details the predicted noise levels solely from the construction works, the noise descriptors and the noise impacts during the different generic construction phases.

Table 9.10 Predicted Noise Levels from the Construction Works

Position	Noise Level during Generic Construction Phase, dB $L_{Aeq,T}$			
	Grading	Foundation	Erection	Services
9 - Andover Rd/Stoney Lane	63	65	59	61
10–127 Andover Road	59	61	55	57
11 – Well House Farm, Well House Lane	63	64	58	60
12 – Old Gardens, north-side	67	70	64	66
13 – Courtenay Road, west-side	30	30	29	31
14 – Harestock School, Andover Road	49	50	45	47

All noise levels façade dB.

9.7.5 By comparing Table 9.10 with the criteria detailed in Appendix 9.2, it can be seen that there will be a negligible impact at all receptors ranging from slight to insignificant.

9.7.6 A daytime construction noise limit of 70 dB $L_{Aeq,T}$ is used as the indicator above which a significant construction noise impact is registered. This slight but negligible noise impact at Old Gardens and the negligible noise impact at all other representative receptors is temporary in nature. Furthermore, for most of the time when these construction activities are taking place at locations further from these positions, construction noise levels significantly lower than those presented in Table 9.10 will prevail.

9.7.7 For the majority of representative receptors, noise levels solely from the works will be less than the existing levels of noise. However, during all phases of the works the level of construction noise is anticipated to be greater than the existing levels of noise at representative receptors in the area of Old Gardens that is to the south of the site. For most of the time when the works will be taking place on the site at locations further from Old Gardens, construction noise levels will be below existing levels of noise.

9.7.8 Consideration must also be given to the construction noise and vibration impact on dwellings that are constructed and occupied during the early phases of the development. Construction works taking place in close proximity to new occupied dwellings have the potential to generate a significant noise impact. Depending on the exact construction activity being undertaken, works within a distance of approximately 25 to 45 metres from occupied dwellings will generate a noise level greater than 70 dB $L_{Aeq,T}$ that will give rise to a significant noise impact.

9.7.9 With regard to vibration at the representative receptors during the works, the generic construction activities are anticipated to take place at distances greater than those detailed in Table A9.2/5. Therefore, vibration from the works will not perceptible at any of the representative receptors and, consequently, vibration impacts are considered to be insignificant. Furthermore, vibration from piling activities will be significantly below the building damage criterion referred to in Appendix 9.2.

9.7.10 Movement information relating to construction traffic and routes is not yet known. Construction traffic movements on adjacent roads are most unlikely to change existing traffic flows by the +25% or -20% that, all other factors remaining similar, are equivalent to a just perceptible change in the level of noise.

9.7.11 Construction traffic movements in close proximity to existing and proposed dwellings on the site have the potential to generate a significant noise impact. However, to minimise the noise impact from construction related traffic the mitigation measures outlined in this Chapter may be adopted.

9.7.12 By careful site planning, programming and phasing of the occupation of new dwellings it is anticipated that construction noise and vibration levels experienced at sensitive receptors will be kept to a minimum throughout the works. To minimise construction noise and vibration the mitigation measures outlined in this chapter may be adopted.

9.7.13 Mitigation measures for the construction impacts described above are shown in Section 9.8 below.

9.8 Enhancement and Mitigation Proposals

Operation

Noise Mitigation for Proposed Dwellings in NEC C

9.8.1 Although noise levels in NEC C of PPG24 should not be regarded as desirable, there are only a few dwellings in the area of the local centre exposed to noise levels in NEC C; the remainder of the site being designed to be within NEC A or B. It should be noted that the realignment of the road has resulted in significant positive benefits for the existing dwellings on Andover Road, as detailed in Table 9.9.

9.8.2 The dwellings in NEC C are exposed to road traffic noise levels of 65 dB $L_{Aeq,16hr}$ from the realigned Andover Road and, as such, it is appropriate to recommend mitigation measures to ensure a suitable internal noise climate.

9.8.3 To ensure adequate protection against noise, WCC advised that with appropriate mitigation measures, the internal criteria within dwellings should seek to achieve the guideline noise values advised by the World Health Organisation (WHO) *Guidelines for Community Noise*, assuming that windows are closed. For proposed dwellings, this is in accordance with guidance within PPG24 (Annex 2) that advises that the minimum amelioration measure available to occupants will be to close windows.

9.8.4 The WHO internal criteria that the proposed development should be designed to achieve with windows closed are summarised in Table 9.11. This table also provides the BS8233:1999 "reasonable" criteria.

Table 9.11 The WHO Internal Criteria That Will be Sought to Achieve Within New Dwellings in NEC C With Windows Closed

Time period	Room	WHO Internal Guideline Values	BS8233 Internal "Reasonable" Criteria
Daytime (0700 to 2300 hours)	Living rooms	35 $L_{Aeq,16hours}$	40 $L_{Aeq,16hours}$
Night-time (2300 to 0700 hours)	Bedrooms	30 $L_{Aeq,8hours}$	35 $L_{Aeq,8hours}$

All levels dB

9.8.5 For residential buildings it is the windows that are invariably the weakest element in the façade in terms of the overall sound insulation performance and PPG24 Annex 6 specifically identifies windows as the main path through which noise enters a building.

9.8.6 PPG24 Annex 6 provides a set of data relating to the typical noise reduction performance of a dwelling façade to different sources of noise with different types of glazing units set in a brick/block wall. Table 9.12 details the sound reduction performance figures quoted in PPG24 for railway and road traffic noise and provides the average sound insulation performance that is based on the mixture of electric and diesel trains on the railway adjacent to the proposed site.

Table 9.12 Sound Insulation Performance of Different Glazing Types

Noise Source	Sound Insulation Performance dB(A)		
	Well Sealed Single Glazing	Thermal Double Glazing	Secondary Glazing
Railway Noise			
Electric trains	30	36	41
Diesel trains	28	32	35
A mix of electric and diesel trains	29	34	38
Road Noise	28	33	34

9.8.7 To achieve the criteria that will ensure satisfactory internal amenity within residential development exposed to noise levels in NEC C, the overall composite sound insulation performance that must be achieved by the building façade (that includes the glazing element) is detailed in Table 9.13 below.

Table 9.13 Assessments to Derive the Composite Sound Insulation Performance of the External Building Façade for Dwellings in NEC C

Position	Façade Noise Level (dB)	Room	Internal Criterion (dB)	Composite Sound Insulation Performance Required of the Building Façade in dB(A)
5m from realigned Andover Road	68 $L_{Aeq,16hour}$	Living/Dining	35 $L_{Aeq,8hour}$	33

All levels dB(A)

9.8.8 In undertaking these assessments the predicted daytime noise levels were compared with the internal criterion for living rooms. As mentioned previously, it has not been possible to calculate the night-time road traffic noise level, however, daytime levels are usually the overriding constraint with road traffic noise.

9.8.9 By relating the composite sound insulation performance levels detailed in Table 9.13 to the performance data shown in Table 9.12, it can be seen that for residential façades exposed to noise levels in NEC C, thermal double glazing will provide sufficient attenuation to ensure satisfactory internal noise levels within habitable rooms of those dwellings.

9.8.10 For the living rooms and bedrooms exposed to noise levels in NEC C, alternative means of ventilation must be installed to these rooms and WCC has stated that this should be via a mechanically ventilated system.

9.8.11 It is understood that no amenity spaces for the dwellings exposed to NEC C will front the road.

9.8.12 During the detailed design stage, regard must be given to orientation of the dwellings to minimise the noise impact within the properties and to the positioning of buildings themselves to act as noise barriers. The glazing specification should also be revisited when detailed floor plans and elevations are available.

Noise Mitigation for Dwellings and their Gardens in NEC B

9.8.13 Appropriate mitigation measures for dwellings in NEC B were discussed with WCC. For dwellings in NEC B, mitigation may take the form of appropriate glazing and sound attenuating passive ventilation devices; orientation of the dwellings to minimise the noise impact within the properties; orientation of the dwellings to minimise the noise impact at the primary leisure area of properties (usually the rear garden) and the positioning of buildings themselves to act as noise barriers.

9.8.14 To achieve the criteria that will ensure satisfactory internal amenity within residential development erected at the boundary of NEC B and C, the overall composite sound insulation performance that must be achieved by the building façade (that includes the glazing element) is detailed in Table 9.14 below.

Table 9.14 Assessments to Derive the Composite Sound Insulation Performance of the External Building Façade for Dwellings Erected at the Boundary of NEC B and C

Position	Façade Noise Level (dB)	Room	Internal Criterion (dB)	Composite Sound Insulation Performance Required of the Building Façade in dB(A)
Adjacent to the railway	69 $L_{Aeq,16hour}$	Living room	35 $L_{Aeq,16hour}$	34
Adjacent to the railway	62 $L_{Aeq,16hour}$	Bedroom	30 $L_{Aeq,8hour}$	32
Adjacent to the road	66 $L_{Aeq,16hour}$	Living room	35 $L_{Aeq,16hour}$	31
Adjacent to the road	60 $L_{Aeq,16hour}$	Bedroom	30 $L_{Aeq,8hour}$	30

All levels dB(A)

9.8.15 By relating the composite sound insulation performance levels detailed in Table 9.14 to the performance data shown in Table 9.12, it can be seen that for residential elevations erected at the boundary of NEC B and C, secondary glazing will provide sufficient attenuation to ensure satisfactory internal noise levels within habitable rooms of those dwellings.

9.8.16 For the living rooms and bedrooms of properties in NEC B, alternative means of ventilation must be installed to these rooms. Passive ventilators that accord with the guidance given in The Noise Insulation Regulations 1975 should be installed to these rooms.

9.8.17 Tables 9.13 and 9.14 show that with appropriate sound insulation measures the levels of noise at dwellings on the proposed site that are within NEC B will accord with the noise levels recommended by WCC, the WHO and the "good" criteria of BS8233:1999. Therefore, acceptable internal levels of noise will be ensured at all proposed residential development on the site.

9.8.18 Regard must also be given to minimising the noise impact at the gardens (the primary leisure areas – usually rear gardens) of properties in NEC B. WCC will not permit gardens in NEC C or D. BS8233:1999 advises that in gardens it is desirable that the steady noise level does not exceed 50 dB $L_{Aeq,T}$ and that 55 dB $L_{Aeq,T}$ should be regarded as the upper limit. It is assumed that the $L_{Aeq,T}$ that relates to gardens is $L_{Aeq,16hour}$ (07:00 to 23:00 hours). The extent of the 55 dB $L_{Aeq,16hour}$ noise contour adjacent to the railway is shown by Figure 9.1 and for the remainder of the site, including parts adjacent to the roads, should be calculated at the detailed design stage, once the building footprints and orientation are known.

9.8.19 If residential development were proposed right up to the boundary between NEC B and NEC C adjacent to the railway or roads (that are defined by a level of 66 dB $L_{Aeq,16hour}$ and 63 dB $L_{Aeq,16hour}$ respectively) then to achieve 55 dB$L_{Aeq,16hour}$ or less in the primary leisure areas of those dwellings it may be necessary to position such areas "behind" the dwellings themselves. In such a position the "first row" of dwellings will act as a barrier to rail and/or road noise and will minimise the noise levels in the main garden areas behind.

9.8.20 Alternatively, in some areas of the site, with the use of solid garden fences of a height in the order of 1.8m to 2.2m above local ground level, noise levels within main gardens located in NEC B adjacent to either Andover Road or Well House Lane may be less than the 55 dB $L_{Aeq,16hour}$ "garden" criterion. However, studies as to the optimum garden fence height necessary to achieve the primary leisure noise criteria must be conducted at the detailed design stage.

9.8.21 The use of garden fences to minimise the noise impact within main gardens in NEC B on areas of the site adjacent to the railway will be of limited use as the railway is on embankment for an appreciable distance as it passes the site. As such, the primary leisure area of dwellings positioned in

NEC B adjacent to the railway should be “behind” the properties so that the dwellings themselves act as a noise barrier and minimise rail noise in the gardens of these dwellings.

9.8.22 During the detailed design stage, for properties in NEC B regard must also be given to orientation of the dwellings to minimise the noise impact within the properties and to the positioning of buildings themselves to act as noise barriers.

Rail Vibration

9.8.23 Due to the set back distances required for achieving a suitable noise climate, rail vibration should not need to be considered further and no mitigation measures are necessary.

The Noise Impact to the Proposed School

9.8.24 The detailed consideration of noise within the proposed school must be undertaken during the detailed design stage. Mitigation measures, such as acoustically attenuated natural ventilation, may be necessary so as to achieve the internal 35 dB $L_{Aeq,30mins}$ noise criterion within classrooms.

The Noise Impact to the Proposed Local Centre Development

9.8.25 Appendix 9.2 summarises the acoustic design criteria relevant to the use of different spaces. To accord with the design criteria for various rooms and spaces, where appropriate, the mitigation measures outlined below must be considered during the detailed design of these facilities:

- Consideration should be given to positioning noise-sensitive rooms and areas so that they “face away” from the dominant noise source. Where appropriate, less noise-sensitive uses, such as corridors, bathrooms/toilets, kitchens and plant rooms may be sited on the elevation facing the dominant noise source.
- Where appropriate, buildings must be designed to minimise the break-in of noise. These measures may include the use of sound insulation quality glazing and giving detailed consideration to the sound insulation qualities of the materials used in the construction of the buildings.
- Such measures must ensure that noise would be minimised within the proposed Local Centre development and that compliance with the criteria recommended in BS8233:1999 would be achieved.

The Operational Noise Impact of the Completed Development to Existing and New Noise-Sensitive Receptors

9.8.26 In order to achieve the noise design criteria specified in Table 9.8 and to minimise operational noise, where appropriate, relevant acoustic mitigation measures may be incorporated into the design of the site buildings and structures, for example these may include:

- Plant selected and sited at locations to minimise the noise impact at adjacent noise sensitive areas.
- Acoustic enclosures around specific items of equipment.
- Buildings and structures must be designed to minimise the transmission and breakout of noise. These measures may include specifying acoustically rated doors to plant rooms, the use of acoustic louvers, items of stationary equipment located on anti-vibration mounts and giving detailed consideration to the sound insulation qualities of the structure and materials used in the construction of the buildings, including the use of sound insulation quality glazing in appropriate circumstances.

Noise Impact of the Combined Heat and Power Plant Existing and New Noise-Sensitive Receptors

9.8.27 The detailed consideration of noise from the CHP plant must be undertaken during the detailed design stage. Where necessary, mitigation measures should be specified to ensure that the external noise criteria of 55 dB $L_{Aeq,16hour}$ during the daytime and 45 dB $L_{Aeq,8hour}$ at night are achieved.

Construction

9.8.28 An assessment of the impacts of noise and vibration during the construction phase has been carried out in accordance with the assessment criteria that are detailed in Appendix 9.2.

9.8.29 A Code of Construction Practice must be agreed between the contractor(s) and WCC setting out the measures that must be taken to minimise site noise. In order to control the duration of noise and vibration from the construction activities, construction working hours must be agreed with WCC and strictly adhered to.

9.8.30 During the construction of the proposed development Best Practicable Means as defined in Section 72 of The Control of Pollution Act 1974 must be employed to minimise noise and vibration from the construction operations. Furthermore, the guidance given in BS5228:2009: Parts 1 and 2 may be followed. Such measures may include controlling the noise and vibration at source by using appropriate plant, effective acoustic enclosures, temporary screens and barriers and ensuring regular maintenance of machinery.

9.8.31 Best construction practices and methods should be used in executing the construction works so as to avoid or reduce noise and vibration as far as possible. These practices and methods must be a contractual requirement.

9.8.32 Delivery vehicles that arrive prior to the site opening must be prevented from waiting on the local roads adjacent to the site. Deliveries that may arrive prior to the site opening must wait away from the site and adjacent residential properties.

9.8.33 Liaison with WCC's Environmental Health Department must be maintained throughout the construction process. The main contractor should nominate a representative (ie the Site Manager) to act as a point of contact with WCC, the construction team and the local community to ensure that any noise and/or vibration related issues that occur during the construction period can be dealt with effectively and promptly.

9.8.34 All other site sub-contractors should also nominate or appoint a suitable team member responsible for liaison with the lead contractor's representative and to ensure that sub-contractor construction activities are managed effectively.

Commitment to Mitigation

9.8.35 During the construction phase of the development the mitigation measures outlined in this Section must be adopted. For the operation of the completed development, due regard to the above mitigation measures must be given during the detailed design of the proposed development.

Residual Impacts and Effects

Construction

9.8.36 The residual impacts and effects with regards to noise and vibration during the construction of the proposed development will be insignificant and will be temporary and local in extent.

Operation

9.8.37 The railway noise contours and road traffic noise calculations have determined the extent of residential development that may be undertaken on the site whilst still satisfying the planning requirements of PPG24 and WCC's Environmental Health Department.

9.8.38 With the employment of mitigation measures, the predicted internal day and night-time noise environment and external daytime noise environment at the position of dwellings are considered to represent a neutral impact and will be permanent and local in extent.

9.8.39 Due regard to the constraints determined for vibration from the railway affecting residential development will also ensure that vibration levels experienced at proposed dwellings will be acceptable. This is considered to be a neutral impact and will be permanent and local in extent.

However, for development adjacent to the railway up to first floor height, noise rather than vibration dictates the permitted build-line to dwellings.

9.8.40 With the employment of appropriate mitigation measures, the internal noise environment at the proposed school will be at acceptable levels. This is considered to be a neutral impact and will be permanent and local in extent.

9.8.41 With the employment of appropriate mitigation measures, the internal noise environment at the proposed local centre development will be at acceptable levels. This is considered to be a neutral impact and will be permanent and local in extent.

9.8.42 Consideration of the operational noise design criteria during the detailed design of the proposed development will ensure that at existing and future noise-sensitive areas operational noise from the completed development will be at acceptable levels and will not give rise to complaint. This is considered to be a neutral impact and will be permanent and local in extent.

9.8.43 With the employment of appropriate mitigation measures, the noise from the CHP plant will be at acceptable levels. This is considered to be a neutral impact and will be permanent and local in extent.

9.9 Summary

9.9.1 Table 9.15 summarises the potential noise and vibration effects, mitigation measures and residual effects of the completed development.

Table 9.15 Summary Impact Table for Noise and Vibration Issues

Potential Impact	**Nature of Impact** (Permanent or Temporary)	**Significance** (Major/Moderate/Minor/Neutral) (Positive/Negative)	**Mitigation / Enhancement Measures**	**Residual Effects** (Major/Moderate/Minor/Neutral) (Positive/Negative)
Noise and vibration associated with the construction of the proposed development	Temporary	It is likely that construction noise will give rise to a neutral to a minor (negative) impact and vibration from construction will be a neutral impact	Agree a Code of Construction Practice with WCC and conduct works within specified hours during the day To minimise noise and vibration, employ Best Practicable Means as defined in Section 72 of The Control of Pollution Act 1974 Best construction practices and methods must be employed so as to avoid or reduce construction noise and vibration as far as reasonably practicable	Neutral to minor noise impact (negative) Neutral vibration impact
Rail and road traffic noise and vibration impact at proposed residential development	Permanent	Not applicable	Regard must be given to predicted railway and road traffic noise contours. Dwellings must be confined to areas where noise and vibration will be at acceptable levels For dwellings in NEC C, thermal double glazing and mechanical ventilation must be fitted to habitable rooms For dwellings proposed in NEC B, thermal double-glazing and sound attenuating	Neutral noise and vibration impact

Potential Impact	**Nature of Impact** (Permanent or Temporary)	**Significance** (Major/Moderate/Minor/Neutral) (Positive/Negative)	**Mitigation / Enhancement Measures**	**Residual Effects** (Major/Moderate/Minor/Neutral) (Positive/Negative)
			passive ventilation must be fitted to habitable rooms Primary leisure area (rear gardens) of dwellings must not be positioned in NEC C or D. Minimise noise levels by orientation of garden and/or the erection of solid garden fences	
Rail and road traffic noise and vibration impact at the proposed school	Permanent	Neutral to slight (negative) noise impact and neutral vibration impact	Install sound attenuated natural ventilation where appropriate	Neutral noise and vibration impact
Rail and road traffic noise and vibration impact at proposed local centre development	Permanent	Neutral noise and vibration impact	Consideration should be given to position less sensitive rooms at elevations facing the dominant noise source Detailed consideration of the sound insulation qualities of the materials used in the construction of these buildings	Neutral noise and vibration impact
Operational noise impact of the proposed development to existing and new noise-sensitive receptors	Permanent	Not applicable	Noise design criteria are specified to limit the overall and cumulative level of noise. Adherence to these criteria will ensure that noise from the development will not give rise to complaint	Neutral noise impact.

Potential Impact	**Nature of Impact** (Permanent or Temporary)	**Significance** (Major/Moderate/Minor/Neutral) (Positive/Negative)	**Mitigation / Enhancement Measures**	**Residual Effects** (Major/Moderate/Minor/Neutral) (Positive/Negative)
Noise Impact of the Combined Heat and Power Plant Existing and New Noise-sensitive Receptors	Permanent	Not applicable	Noise level limits are specified for the plant. Adherence to these criteria will ensure that the requirements of WCC are achieved	Neutral noise impact.
Road traffic noise and vibration impact of the proposed development to existing noise-sensitive areas	Permanent	Neutral noise and vibration impact.	No noise mitigation proposed	Neutral noise and vibration impact