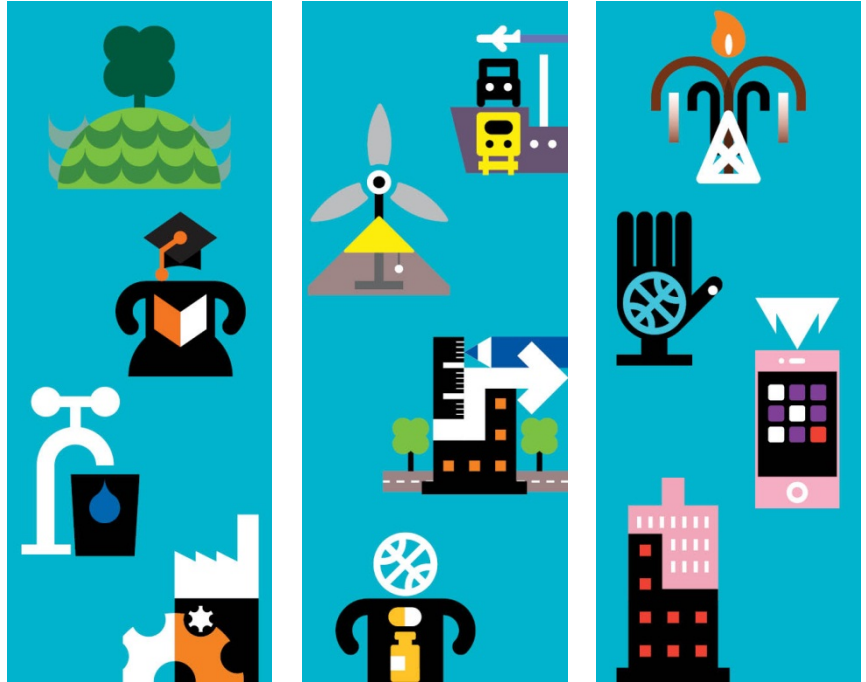




Five Fords AAD

Noise Assessment

June 2016

Dwr Cymru Welsh Water

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Executive Summary

It is proposed to install new advanced anaerobic digestion plant at the Five Fords Sewage Treatment Facility, Wrexham, Wales LL13 0PA.

The purpose of this report is to assess the predicted construction and operational noise impact of these units by applying British Standards relating to these noise sources.

The construction noise calculations have been carried out to predict the noise impact at the closest noise sensitive receptor locations and to determine if there is any significant effect.

The Rating Level of the new plant is predicted to be 37 dB(A) at the closest noise sensitive receptors. The results of the baseline noise survey carried out at the site in March 2016 found that the lowest daytime measured background sound levels L_{A90} at the same location was 42 dB(A), for the daytime and 38 dB(A) for the night-time periods.

The predicted Rating Level is below the lowest background sound levels during the day and the night demonstrating that the predicted noise impact due to the operation of the proposed plant are likely to have a low impact due to noise.

1 Introduction

1.1 Background

Mott MacDonald was commissioned by Mott MacDonald Bentley (MMB) to conduct a noise assessment at the Five Fords sewage treatment facility, Wrexham, Wales, LL130PA, to assess the impact, if any, associated with the installation of new advanced anaerobic digestion plant comprising of a Thermal Hydrolysis Process (THP) and associated equipment immediately to the west of the Solar Phase 2 development within the site. The THP and associated equipment is hereafter referred to as THP in this report.

The site currently includes various items of plant associated with the sewage treatment works including an advanced anaerobic digestion facility.

1.2 Purpose of the Report

This report presents the results of an assessment of the potential noise impact of the proposed THP in accordance with the British Standard (BS) 4142 (2014)¹ and the noise and vibration associated with the construction of these in accordance with BS5228-1: 2014² and BS5228-2: 2014³, respectively.

1.3 Site Description

The site is located at the Five Fords sewage treatment facility in Wrexham, Wales LL130PA. The site is in proximity to the river River Clywedog, which lies to the north west. Immediately to the south lies the village of Marchwiel. The other boundaries to the site are formed by open fields and green areas.

The proposed new THP associated plant locations are shown within Figure 1.

There are existing residential properties to the south, namely properties along Scotts Close and properties along Marcella Crescent and properties further to the north of the site on Cefn Road.

For the purpose of this assessment, the closest representative noise sensitive residential receptors have been identified as:

- 1 Cefn Road
- 6 Scotts Close
- 16 Marcella Crescent

and are shown in Figure 1

¹ BS4142: 2014 Methods for rating and assessing industrial and commercial sound

² BS5228-1: 2014 Code of practice for noise and vibration control on construction and open sites (noise)

³ BS5228-2: 2014 Code of practice for noise and vibration control on construction and open sites (vibration)

2 Assessment Criteria

2.1 BS4142 2014: Methods for rating and assessing industrial and commercial sound

BS4142: 2014 provides guidance for assessing a new industrial sound source in mixed residential and industrial areas. The methods described in this British Standard assess the likely effects of the new sound source on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The relevant parameters in this instance are as follows:

- Background Sound Level – $L_{A90,T}$ – defined in the standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using 'Fast' time weighting and quoted to the nearest whole number of decibels;
- Specific Sound Level – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, Tr;
- Residual Sound Level - $L_{Aeq,T}$ - the equivalent continuous 'A' weighted sound pressure level at the assessment location in the absence of the specific sound source under consideration, over a given time interval, T; and
- Rating Level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

The standard recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

- Tonality – a correction of 2 dB is applied for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;
- Impulsivity - a correction of 3 dB is applied for impulsivity which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
- Intermittency – a correction of 3 dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions;
- Other sound characteristics – a correction of 3 dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive, but are readily distinctive against the residual acoustic environment.

Once any corrections have been made, the background level is subtracted from the rating level. The standard states that:

- "Typically, the greater the difference, the greater the magnitude of impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.
- The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does

not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context."

The standard specifies the specific sound level as an $L_{Aeq,T}$ with a one-hour assessment period during the day (07:00 – 23:00) and a fifteen-minute assessment period at night (23:00 – 07:00).

2.2 BS5228-1: 2014 Code of practice for noise and vibration control on construction and open sites (noise)

BS 5228-1: provides a methodology for predicting and assessing noise levels generated by fixed and mobile plant used for a range of typical construction activities.

It is proposed that the guidance within Section E3: Example Method 1 – The ABC Method is considered for this assessment.

The assessment is based upon the exceedance of threshold noise limits which will be determined from the current ambient noise at the identified receptor locations. The assessment methodology was agreed with Nick Minshall of Wrexham County Borough Council⁴.

The construction site noise level is predicted and then for the appropriate period (night, evening/weekends or day) the ambient noise level is determined and then rounded to the nearest 5dB.

The Category is chosen as follows:

Category A – threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Category B - threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.

Category C - threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

If the site noise exceeds the appropriate category level (A, B or C) then a significant effect is potentially indicated, depending on factors such as the duration of the construction works and character of the impact.

⁴ Telephone conversation between Nick Minshall – Joseph Mendis 13 May 2016 1045hrs.

Table 2-1: BS5228-1 Assessment categories for the ABC method

Period	Threshold value [dB(A)]		
	Category A	Category B	Category C
Night-time (2300-0700)	45	50	55
Evenings (1900 to 2300) and weekends	55	60	65
Daytime* (0700 to 1900)	65	70	75

* weekdays and 0700 to 1300 on Saturdays.

2.3 BS5228-2: 2014 Code of practice for noise and vibration control on construction and open sites (vibration)

BS 5228 Part 2 provides guidance on the effect of ground-borne vibration and the likelihood that this will cause complaint and cosmetic damage to buildings. The standard does not indicate whether particular vibrations are significant. However, the standard does provide the following guidance on effects:

- At a vibration level of 0.14mm/s “vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction”
- At a vibration level of 0.3mm/s “vibration might be just perceptible in residential environments”
- At a vibration level of 1.0mm/s “it is likely that vibration in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents”, and
- At a vibration level of 10mm/s “vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.”

3 Measurement Survey

3.1 Methodology

Three unattended noise surveys were carried out by Mott MacDonald between Thursday 7 April and Wednesday 13 April 2016 in order to quantify the background sound levels in the area at the closest noise-sensitive receptors to the site:

The un-attended survey comprised installation of automatic noise monitors at the north eastern aspect and south western aspects of the site in order to measure the ambient noise level of the local area and ascertain the noise climate at the closest noise sensitive properties in these areas over several days.

During the automatic unattended noise survey and the attended noise survey periods the temperature varied between 10°C and 15°C and wind speeds remained less than 5 m/s. These conditions were considered to be suitable for noise measurements.

The proposed work site is shown in Figure 1.

3.2 Instrumentation

Unattended medium term noise measurements were made using three integrating sound level meters type Rion NL32. The microphones were located in free-field conditions (i.e. at least 3.5m from any significant reflecting surface other than the ground) and at an approximate height of 1.5m above ground on which they were mounted.

All personnel conducting the noise measurements were qualified in acoustics and environmental noise monitoring.

Before and after each measurement session, the sensitivity of each measurement system was checked using a CAL 200 calibrator, designed to comply with the Class 1 standard for accuracy.. Variations of no greater than 0.2 dB were noted over the measurement sessions. The sound level meter used have calibration certificates obtained no more than two years before the period of the survey. Details of the noise equipment used are provided in Table 1.



Figure 1 Site Layout Plan – Source -Mott MacDonald Bentley

Table 3-1 Details of noise measurement equipment used during the survey

Item	Make & model	Serial number
Calibrator	Larson Davis CAL 200	5132
Sound Level meter	Rion NL32	2201511
Sound Level meter	Rion NL32	2201641
Sound Level meter	Rion NL32	2202001

3.3 Measurement positions

A plan showing the location of the measurement position is shown in Figure 1 above. The measurement positions were chosen to be representative of the closest sensitive noise receptor locations.

3.3.1 Results

A continuous, unattended measurement of background sound levels was carried out between 7 April and 13 April 2016 at the closest considered noise sensitive receptors to the Five Fords sewage treatment facility. During the installation of the equipment the main sources of noise observed were:

- Existing distant plant noise
- Birdsong
- Local vehicle movements
- Distant road traffic

The results are summarised in Table 2 below. A time history of the results is presented in Appendix A for the medium term measurements.

Table 3-2 Summary of results of the background sound level monitoring

Measurement Location (see Figure 1)	L _{Aeq} (15min), 07:00-23:00 dB	L _{Aeq} (15min), 23:00-07:00 dB	L _{A90} (15min), 07:00-23:00 dB	L _{A90} (15min), 23:00-07:00 dB	Comment
1 Cefn Road	45	44	41	40	Included distant plant noise, and road traffic noise from Cefn Road
6 Scotts Close	42	40	37	33	Included distant road traffic noise from local roads, noise associated with the sewage treatment facility --
16 Marcella Crescent	44	40	42	38	Included birdsong and distant noise associated with the sewage treatment

4 Assessment

4.1 Computer Noise Model

CadnaA noise prediction software has been employed to produce noise contours for operation of the proposed advanced anaerobic plant (AADs).

The following assumptions have been made in generating the noise model.

- Calculations are based on data provided by the project team so there may be additional contribution from other plant items not accounted for in the model.
- Calculation model is based on the methodologies set out in ISO 9613⁵
- No ground heights have been used within the model, this is a worst case scenario and allows free propagation of the noise around the study area;
- Building heights have been either assumed or taken from available project documentation;
- The ground absorption within the calculation area is defined as 50% hard ground;
- The study area was defined by the extent of the available mapping data as per the supplied information by the project team.
- A sound power level of 88 dB (A) is used for the plant operating at maximum load. This was determined from sound pressure levels measured independently⁶ at a distance of 1m from a similar source.

4.2 Noise Contours

Noise contours have been produced to predict the propagation of noise from the operation of the AAD facility. An output of the predicted noise propagation is presented below in Figure 2.

⁵ ISO 9613:1996 Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation

⁶ Email by Mr Ian Horn Mechanical Design Engineer at Mott Macdonald Bentley via an annotated drawing. It is that noise sources were measured at a distance of 1m from the equipment and resulted in a sound pressure level of 80dB(A) which translates into a sound power level of 88dB(A).

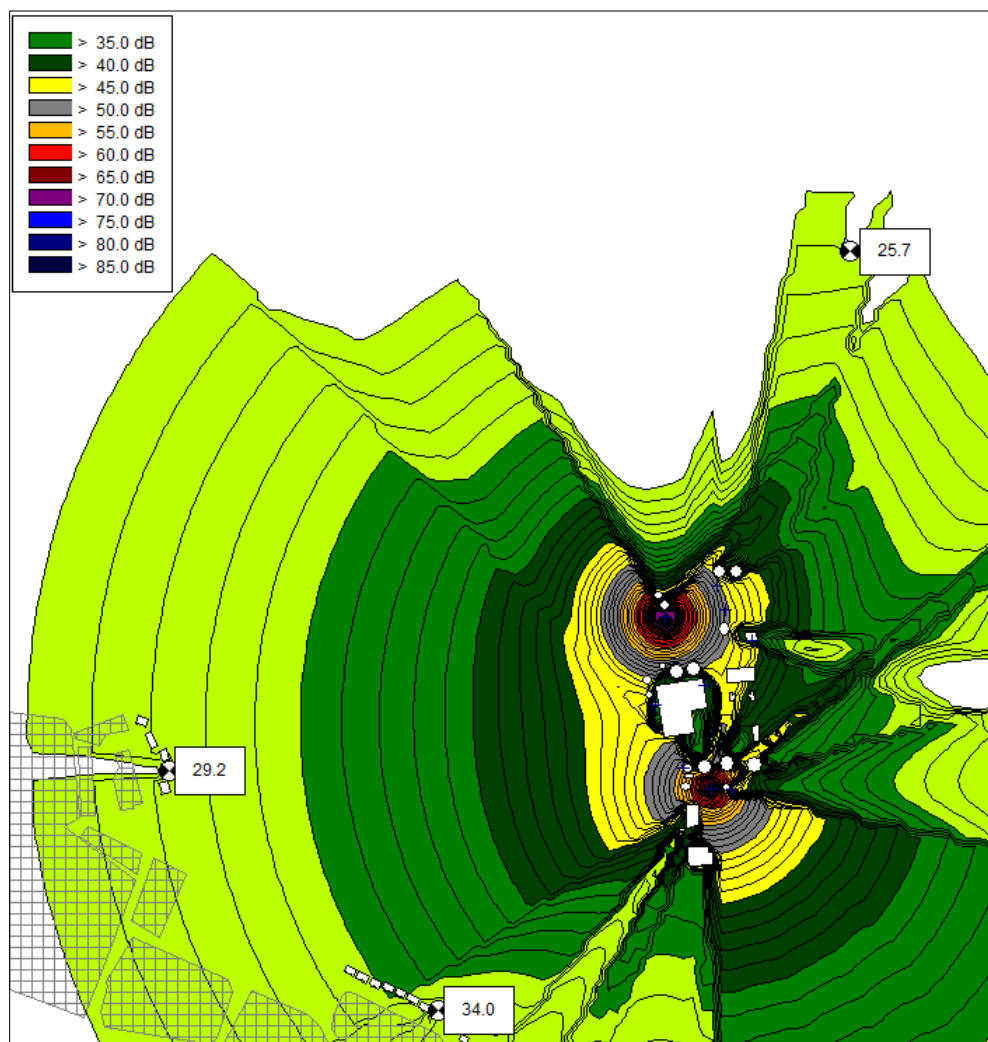


Figure 2 Operational Noise Contours

4.3 BS 4142 – Operational Noise

Table 4-1, below, details the predicted noise levels due to the proposed THP plant and associated equipment compared to the background sound levels measured during the quietest periods of the day and night during the total measurement period.

The results are presented as free-field levels, to enable comparison with the measured free-field background levels.

It is noted that the identified receptors lie more than 200m from the proposed works areas within the site.

Table 4-1 BS4142 assessment of noise levels from plant

Receptor	Rating Level dB(A) incl. penalty 3dB for intermittency	Daytime background sound level L_{A90} dB	Excess of Rating Level over Background Level dB	Night-time background sound level L_{A90} dB	Excess of Rating Level over Background sound level dB
1 Cefn Road	29	41	-12	40	-11
6 Scotts Close	32	37	-5	33	-1
16 Marcella Crescent	37	42	-5	38	-1

The predicted Rating Levels for the THP and associated plant are below the measured daytime and night-time background sound levels expressed as L_{A90} at the closest noise sensitive receptors.

The highest predicted noise contribution from the THP and associated plant at the positions of where the background noise levels were measured is 37 dB(A) at Marcella Crescent. This is below the measured background noise level.

At both other locations the Rating Level including the intermittency correction is lower than the measured respective background noise levels.

An acoustic penalty correction of 3 dB for intermittency has been applied as it is assumed that the noise emitted by the some plant items may include elements of intermittency as discussed in Section 2.1.

BS4142: 2014 states that:

“If the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context.”

Table 4-1 shows that the background noise level exceeds the rating level at all receptors for both day and night indicating that noise from the THP and associated plant will have a low impact.

4.4 BS5228 – Construction Noise

A construction noise assessment has been carried out in accordance with BS5228-1 Example Method 1 – The ABC Method. The construction hours are assumed to be 0700-1900hrs for weekdays and 0700-1300hrs for Saturday. No working on Sunday.

The construction works have been divided into the following phases with the associated likely durations and plant as informed by the project team:

- Earthworks – 1 month
- Foundations – 3 months
- Construction – 2 years

Table 4-2: Construction plant noise levels

Ref - Defra Construction Noise Level Database		Octave Band Sound Pressure Levels (Hz)								
Wrexham STW Five Fords		63	125	250	500	1k	2k	4k	8k	Sound Pressure Level dBA
Earthworks/Number of items										
x3	Tracked Excavator	80	83	76	73	72	70	69	66	78
x5	Articulated Dump Truck (Tipping Fill)	80	76	73	70	69	66	63	58	74
	Wheeled Loader	85	83	76	75	75	72	72	61	80
Foundations										
x2	Large Rotary Bored Piling Rig -	84	92	81	80	78	76	68	61	83
x5	Lorry JK -	73	78	78	78	74	73	68	66	80
x2	Concrete Pump + Cement Mixer Truck (Discharging)	69	64	64	66	63	59	53	47	67
	Tracked Excavator	80	83	76	73	72	70	69	66	78
Construction -general site activities										
x2	Articulated Dump Truck JK	90	87	77	79	75	73	67	63	81
x2	Wheeled Excavator (Idling)	61	59	57	57	58	52	42	34	61
x4	Concrete Pump + Cement Mixer Truck (Discharging)	69	64	64	66	63	59	53	47	67
1	Wheeled Mobile Telescopic Crane	80	79	73	74	73	73	64	55	78
1	Mobile Telescopic Crane	87	82	78	74	71	67	60	52	77
1	Diesel Generator	80	74	57	54	53	48	45	37	61
1	Diesel Generator	70	62	62	57	53	52	48	41	60

The values in the final column (sound pressure level dB(A)) represent the sound levels at 10m from the plant used in each construction phase.

The computer noise model (CadnaA) has been used to predict façade noise levels (1m in front of the most exposed window) at the noise sensitive receptors described above using the reference noise levels in Table 4-2.

Due to the nature of the terrain, soft ground conditions are assumed between the construction noise sources and the receivers. No barrier correction was assumed.

The baseline measurement selected for calculations is generally the lowest $L_{Aeq,T}$ recorded during standard working hours and is corrected to a façade level if the measurement was carried out in the free-field.

The results of this analysis are presented in Table 4-3

Table 4-3: BS5228 analysis

Phase	Distance to works (m)	Measured baseline noise rounded to nearest 5dB (day) $L_{Aeq,T}$	Predicted noise level from construction (day) $L_{Aeq,1h}$	Assessment
1 Cefn Road				
Earthworks	305	50 dB	54 dB	No Significance
Foundations	305	50 dB	60 dB	No Significance
Construction	305	50 dB	60 dB	No Significance
6 Scotts Close				
Earthworks	504	40 dB	53 dB	No Significance
Foundations	504	40 dB	57 dB	No Significance
Construction	504	40 dB	57 dB	No Significance
16 Marcella Crescent				
Earthworks	250	45 dB	56 dB	No Significance
Foundations	250	45 dB	60 dB	No Significance
Construction	250	45 dB	60 dB	No Significance

For all three receptors the measured baseline noise level (rounded to the nearest 5dB) is below the threshold value of 65dB for Category A corresponding to the lowest ambient noise levels. Category A is therefore selected for all three receptors for this assessment.

The results of the calculations from the assumed plant indicate that daytime noise impacts at the closest noise sensitive receptors are expected not to exceed the 65dB (A) threshold at any considered receptor.

There is no potentially significant effect at any of the considered receptors.

4.5 Construction Traffic

Noise effects that may arise due to construction traffic flows have been assessed based on assumed average HGV traffic numbers and a likely construction traffic route utilizing the Cefn Road. Worst case daily construction movements of approximately 8 vehicles movements per day (4 movements each way) have been used to assess potential construction traffic noise effects.

A qualitative analysis suggests that a worst case construction traffic activity will be negligible in comparison to the current traffic frequenting the site. Thus predicted construction traffic noise is to be of negligible impact magnitude.

4.6 Construction Vibration

BS 5228 –2: provides empirical relationships describing vibration impacts arising from various activities (in terms of peak particle velocity). Some of these values and those from Department for Transport (DfT) Report 53 have been plotted in Figure 5 as a function of distance from the source.

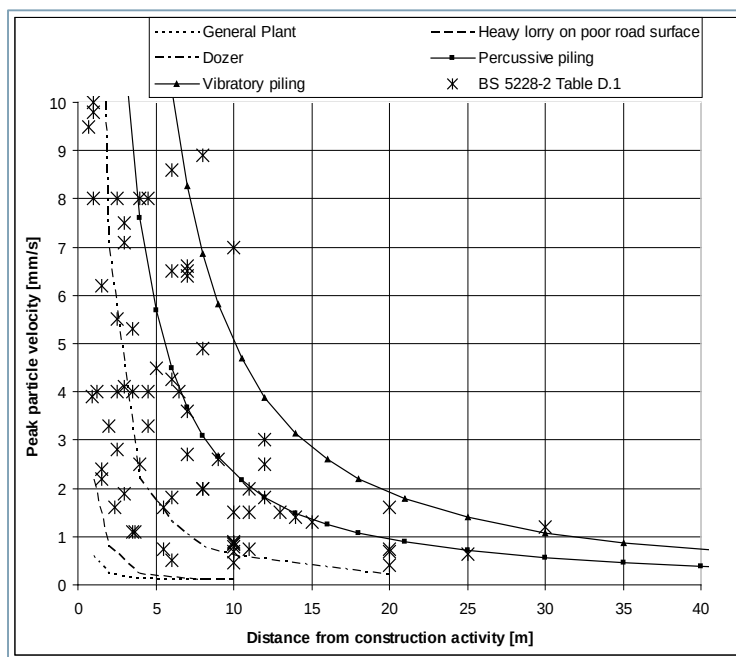


Figure 3 Vibration levels for construction plant using data in BS 5228 and DfT Report 53

Vehicle movements (within close proximity to 1 Cefn Road) such as plant deliveries, tracked crane deliveries and wheeled tippers within the site for the supply and removal of spoil could be, at their closest, approximately 50m from the sensitive receptors. Consideration of Figure 5 above indicates that transient vibration levels are likely to be below 0.14 mm/s during the passage of these vehicles and also any other operating plant such as dozers and are thus likely to be below the perceptibility threshold.

5 Conclusions

A noise impact assessment has been conducted for the proposed new THP Plant at the Five Fords sewage treatment facility.

The operational noise assessment in accordance with BS4142:2014 has indicated that the proposed THP will have a low impact at the nearest noise sensitive receptors.

The construction noise assessment has demonstrated that no potential significant effect is expected at any of the noise sensitive receptors.

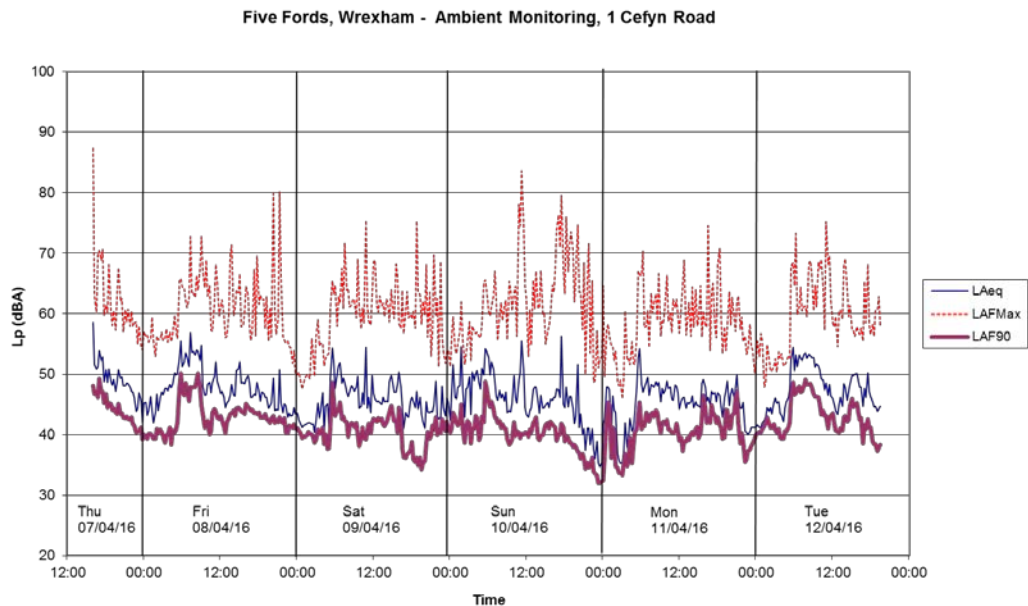
On the basis of this assessment, the proposed THP are not considered likely to give rise to a significant adverse impact on health and quality of life in relation to noise.

Appendices

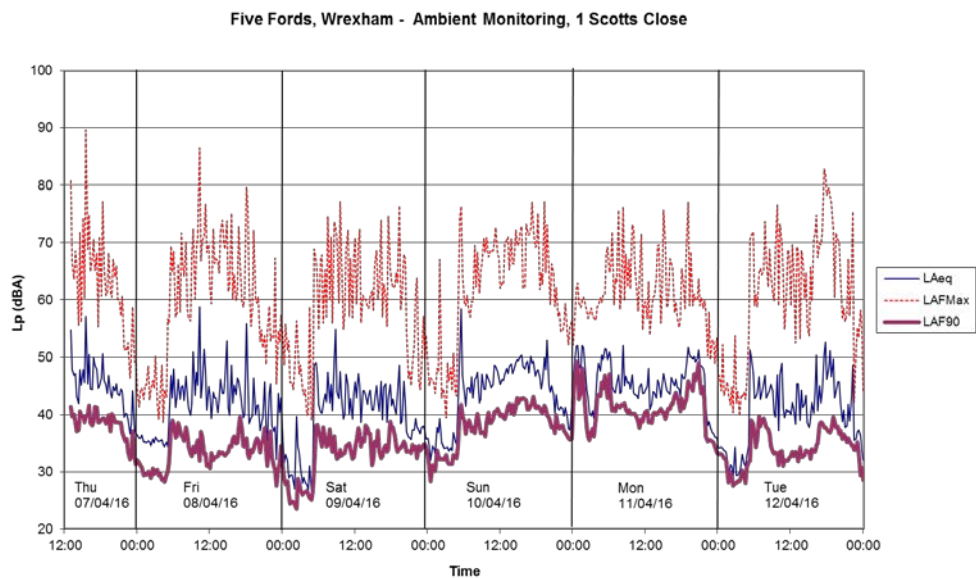
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Appendix A. Medium term measurement data

Results of the medium-term unattended noise monitoring at 1 Cefn Road



Results of the medium-term unattended noise monitoring at 6 Scotts Close



Results of the medium-term unattended noise monitoring at 16 Marcella Crescent

