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Noise & Vibration Impact Assessment for Proposed Sand & Gravel Quarry at

Land at Bow Farm Ripple Worcestershire

for

M.C. Cullimore (Gravels) Ltd

Undertaken by:

Noise & Vibration Consultants Ltd

Member of Institute of Acoustics
Member of Association of Noise Consultants
Member of Academy of Experts

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Report No.: R18.1004/DRK

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Summary

1. At the request of David Jarvis Associates Limited acting on behalf of M.C. Cullimore (Gravels) Ltd, Noise & Vibration Consultants ("NVC") Limited were commissioned to provide a noise impact assessment as supportive documentation for a planning application for the proposed Sand & Gravel Quarry on land at Bow Farm located near Ripple, Worcestershire.

2. This assessment has been commissioned by M.C. Cullimore (Gravels) Ltd to determine in detail, the likely range in noise levels and therefore the impact at the nearest existing residential properties associated with the proposed mineral workings.

3. Noise levels have been considered and assessed during different stages of the development including:

- Initial soil stripping, clay and overburden removal and construction of screening mounds.
- Site operation noise during phased mineral extraction.
- Soil replacement and restoration.

4. Appropriate and reasonable noise guidance limits for the proposed activities have been used to determine the noise impact. Best practice has been considered to minimise noise levels to the lowest practicable without imposing unreasonable burden on the mineral operator.

5. To determine any likely impact from noise it was necessary to establish the existing noise climate at the nearest residential property boundaries. This information has helped determine any likely noise impact on nearest receptors to the site during the operation of the proposed development.

7. The results of the noise survey have shown that residual and background noise is generally formed by local and distant road traffic noise and birdsong.

8. The Local Authority was formally consulted prior to the assessment to establish.

9. In order to meet best practice without placing unreasonable burden on the mineral operator, careful consideration of the site extraction area, working methods and a noise mitigation strategy has been considered with the client.

10. The impact of site activity noise at the nearest residential properties to the site has been considered and assessed including the cumulative effect of the processing area of the site and associated mobile plant haul roads and conveyor feed line.

11. The report predicts the impact of noise from fixed and mobile plant that would be used at the proposed site during the operational work activities. The noise assessment concludes the following:

(i) Noise from the use of fixed and mobile plant on site would not exceed the maximum noise limit level of 55dB(A) Leq_{1hr} as required by the National Planning Policy Framework ("NPPF") and Planning Practice Guidance for mineral operations, which is the relevant planning guidance for this type of activity.

(ii) Noise from the use of fixed and mobile plant on site would not exceed the noise limit aim of level of background sound level +10dB $LAeq_{1hr,}$ which is the aim of National Planning Policy Framework ("NPPF") and Planning Practice Guidance for mineral operations. This is based on the implementation of noise amelioration measures using best practice to control site radiated noise.

(iii) The results of the detailed analysis have shown that by implementing best practice the noise levels would be reduced and at all receptors the noise level for the life of the site would be similar to or lower than background noise +10dB(A) or below the 55dB(A) maximum limit advised by planning guidance. Impacts are therefore shown to be of **negligible magnitude and neutral impact significance.**

(iv) The results also show that for temporary noise events, such as soil stripping, overburden removal, construction of mounds, soil replacement and the site restoration would not exceed the short term maximum levels of 70dB(A) $Leq_{1\ hour}$ for 8 weeks per year. Impact magnitude is shown to be **negligible**.

(v) No significant change in road traffic noise onto the local road network is predicted, with impacts shown to be between **negligible to slight impact magnitude and neutral to minor impact significance**.

(vi) Vibration levels from mobile plant and offloading of vehicles based on the closest approach to nearest sensitive receptors would be well within acceptable limits and would produce a **negligible impact**.

(vii) Vibration from the movement of HGVs has been shown to be negligible based on empirical data obtained from measurements at kerbside and the studied concluded that vibration levels were insignificant and of **negligible impact** magnitude.

12. In overall conclusion, the operation of the site would apply `best practice' techniques to control noise. The noise levels are predicted to achieve the required noise limits set by relevant guidance and standards and would not exceed the maximum noise limit or the aim of background noise +10dB(A) for the site life time. The introduction of appropriate earth mound screens would assist in reducing noise levels to achieve the required noise levels.

13. The assessment shows that the proposed development would comply with planning guidance and provide a reasonable level of protection for NSRs relative to this mineral working development.

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PROPOSED SAND & GRAVEL QUARRY

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1.0 INTRODUCTION

1.1 At the request of David Jarvis Associates Limited acting on behalf of M.C. Cullimore (Gravels) Ltd, Noise & Vibration Consultants ("NVC") Limited were commissioned to provide a noise impact assessment as supportive documentation for a planning application for the proposed Sand & Gravel Quarry on land at Bow Farm located near Ripple, Worcestershire.

1.2 This assessment has been commissioned by M.C. Cullimore (Gravels) Ltd to determine in detail, the likely range in noise levels and therefore the impact at the nearest existing residential properties associated with the proposed mineral workings.

1.3 This report assesses the impact of the Proposed Development with regard to noise. It describes the methods used to assess the impacts, the baseline conditions currently existing at the site and the potential affected noise sensitive receptors, the possible direct and indirect impacts arising from the Proposed Development and the mitigation measures required.

1.4 The assessment includes the consideration of:

- information on typical existing sound climate;
- information on the noise impact on existing residential dwellings from site noise sources;
- information and predictions on noise from restoration works;
- an example of noise mitigation measures to comply with current noise standards and guidance.

1.5 The above potential noise impacts are considered in the context of the existing background noise at the site, which is influenced by local and distant road traffic noise.

1.6 Appendix NVC/4 provides details of technical terms within the chapter, for ease of reference. There is also a chart showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels.

1.4 The closest properties that may be potentially affected have been considered in the assessment to determine the highest likely noise levels.

1.5 Appropriate and reasonable noise guidance limits for the proposed activities have been used to determine the noise impact. Best practice techniques have been considered to minimise noise levels to the lowest practicable without imposing unreasonable burden on the mineral operator.

1.6 To determine any likely impact from noise it was necessary to establish the existing sound climate at the nearest residential property boundaries. This information has helped determine any likely noise impact on the nearest receptors to the site during operation of the proposed development.

1.7 The report provides baseline noise data for the nearest sensitive receptors ("NSRs") and examines existing guidance to establish appropriate and reasonable design limits for noise.

1.8 The report provides predicted noise levels at the nearest receptors, which include the following assessments:

- Initial soil stripping and construction of screening mounds.
- Site operational noise during overburden removal and phased extraction of sand and gravel.
- Soil replacement and restoration.

1.9 This assessment provides predicted noise levels from the site and compares these with the proposed noise limits contained within the National Planning Policy Framework and Planning Practice Guidance.

1.10 The guidance and recommendations within BS5228-1:2009+A1:2014 `Code of practice for noise and vibration control on construction and open sites' has also been referenced for consideration of best practice.

1.11 The assessment will also provide a noise mitigation strategy for the site and describe how these measures would ameliorate noise impacts associated with the development.

1.12 The work, which NVC have undertaken includes the following:

(i) Visit to the development site to inspect the area and in particular the locations of the nearest residential properties.

(ii) Visit to the development site to undertake background sound monitoring over a typical weekday period during suitable weather conditions for monitoring.

(iii) Detailed computer-based prediction modelling using site measured noise data for inputs, realistic working methods and operational times for plant and use of phased contour-based layout working plans to maximise accuracy of the noise model.

2.0 SITE DESCRIPTION

2.1 The location of the site showing nearest sensitive receptor locations is provided in Appendix NVC/1.

Site Location

2.2 The proposed mineral site comprises land known at Bow Farm and lies on the border of the administrative boundaries of Worcestershire and Gloucestershire. The overall site extends to approximately 65ha of land, comprising approximately 45ha of land primed for mineral extraction.

2.3 The site lies approximately 3.5km north-west of Tewkesbury. The closest surrounding settlements are Ripple (circa 1km to the north), Church End (circa 1.5km to the east) and Twyning (circa 2km to the north east). The proposed site is bound to the north by the M50 Motorway and to the west by the River Severn. Land also west of the site has previously been worked and restored. To the south is open agricultural land. Hilton Hall Hotel and Golf Course lies to the east of the site. The land is currently in agricultural use.

Nearest Sensitive Receptors (NSRs)

2.4 There are limited residential properties within the catchment of the intended site. The nearest sensitive receptors (NSRs) include the residential dwelling forming part of Bow Farm and Fairfield bungalow located adjacent to the A38 road. Both properties are owned by Moreton C Cullimore (Gravels) Ltd. Beyond this, NSRs are located off Bow Lane (to the east of the proposed extraction area) and to the rear of the nursery on the A38 (east of the proposed plant site location).

2.5 Access to the site is gained via the A38. The route provides direct access onto the M50 motorway to the north, which itself is located just 2.3km west of the M50 motorway.

Plant Schedule

2.6 The plant relevant to the planning application relates to the following equipment:

<u>Mobile Plant</u>:

(i) 1 x 360deg Excavator
(ii) 1 x Bulldozer
(iii) 20T Dump Trucks
(iv) Pump for dewatering
(v) Conveyor system

<u>Processing Plant</u>:

(vi) Loading Hopper and Conveyor
(vii) Screening and wash plant
(viii) Concrete Batching plant
(ix) Front Loader
(x) HGVs

Operating Hours

2.7 It is intended that the facility applicable to this assessment would operate between 0700 to 1800 hours weekdays and 0700 to 1300 hours on Saturdays.

Phased Workings

2.8 The site will utilise the following plant at different phases of the development:

Top Soil Removal and Replacement:
360deg Tracked Excavator
20 Tonne Dump Trucks
Bulldozer

Overburden Removal and Backfilling:
Excavator
20 Tonne Dump Trucks
Bulldozer

Mineral Excavation:
360deg Tracked Excavator
20 Tonne Dump Trucks
Loading hopper and conveyor
Bulldozer

Mineral Processing (main plant area):
Concrete Batching Plant
Power Screen & Wash Plant
Front Loader
HGVs

Final Void Backfilling:
Excavator
20 Tonne Dump Trucks
Bulldozer

Miscellaneous:
De-watering Pump

2.9 Further details of the empirical noise levels for types of plant that would be used for the development works is provided within Appendix NVC/8.

Nearest Noise Sensitive Receptors (NSRs):

2.10 Following study of OS maps and inspection of the areas surrounding the Site, the NSRs that would have been considered for the proposed development would include:

(i) The nearest property to the north of the Site on the opposite side of the M50 Motorway and on the southwest edge of the village of Ripple is Silvermead, located off Bow Lane.

(ii) Bow Farm is located within the eastern area of the Site and is owned by the applicant and tenanted as a working farm.

(iii) Residential properties just east of the development off Bow Lane include Puck Cottage, Bow Cottage, Bowfields, Threshing Bow and The Bow.

(iv) Bowbridge Cottage, Scarecrow Stables and Dadsley Cottage is located east of the Site off Puckrup Lane with Puckrup Hall and other properties located further to the east off Puckrup Lane.

(v) Fairfield Bungalow is located east of the extraction area and adjacent to the A38 road and the proposed access road to the processing site. This property is owned by the applicant.

(vi) Located south east of the Site are the properties associated with Twyning Farm, Owls End and Redpools Farm.

(vii) Properties southwest of the Site at closest approach include those adjacent to Windmill Tump and Bushley Green.

(viii) Nearest receptors west of the Site include The Stalls and Bredon School and Church End Farm.

2.11 Whilst there are additional receptors at similar or greater distance than the above, the above gives a good indication of the spread of noise levels around the extraction and processing areas of the Site and as such these represent the highest likely impact for consideration in this assessment.

3.0 WORKING METHOD

3.1 The working method is organised with the processing area located in the southeast area of the Site on a lower height datum to receptors in a southeast direction. The extraction areas are split into 9 sections running from north to south with additional flexible working in two areas to the southern end of the Site operational during drier months of the year.

3.2 Mineral extracted from the quarry land area would be transported by dump trucks to an on-site conveyor system to the southern land area and would then be stockpiled and moved onto the processing area.

3.3 Initial on-site works will include the removal of top soil, which will be used to create earth mound screens around the eastern site boundary. Removal of overburden would be stored and used to place directly into the mineral void created by the extraction. The processing area would also be formed together with the installation of the associated plant including the conveyor system.

3.4 Phases 1 & 2 of the operations provides for the extraction of mineral along the northern end of the site. These areas would be restored using overburden from phases 1 to 4, top soil from the northern section of the earth mound screen and inert fill.

3.5 Phases 3 to 6 of mineral extraction would continue southwards and commence with the top soil used for restoration of phases 1 to 3. Mineral would be loaded and transported via the conveyor system to an area further south within phase 9 land area of the site. The earth mound screens to the east would remain in place.

3.6 Phases 7 & 8 will bring the extraction area closest to Bow Farm with earth mound screening remaining in place. Conveyor system would be removed as the extraction works head south as the activities are close to the stockpile area in Phase 9 area. The restoration of phases 4 to 6 are carried out using inert fill and overburden from phases A and phases 5 to 8.

3.7 Phase 9 works will involve movement of top soil to restoration of phase A & B and phase 7 restoration using inert fill and overburden from phase 9. Extraction of phase 9 area would complete the mineral extraction phase and restoration of phases 8 to 9 would be completed by inert fill and restored soils.

Assumed Plant Operation

3.8 In terms of noise prediction it is assumed that the processing plant would be in operation at the same time as extraction works are being undertaken.

3.9 To assess the worst-case scenario from the proposed site operations predictions have been modelled for periods when plant is at its closest approach. Additional activities and mobile plant movements are included at different points on site to give an indication of the highest likely noise levels relative to the nearest sensitive receptors.

3.10 Additional noise prediction modelling of mineral working activities at other more distant locations within each phase have also been calculated to give an indication of the reduction in level.

3.11 Noise maps used to assess the range of noise levels from site are provided in Appendix NVC/9.

4.0 RELEVANT NOISE GUIDANCE AND CRITERIA

4.1 General Planning Policy

4.1.1 The previous planning guidance (i.e. MPS2) introduced in 2006 was removed by Government and replaced with the National Planning Policy Framework in March 2012 and subsequently updated in July 2018, which was published by the Department for Communities and Local Government.

National Planning Policy Framework: July 2018 (NPPF)

4.1.2 Chapter 15 of the National Planning Policy Framework (NPPF) relates to 'Conserving and enhancing the natural environment'.

4.1.3 Paragraph 170 e) refers directly to noise and states that: *"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;"*

4.1.4 Paragraph 180 also states: *"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

4.1.5 Section 17.0 of the NPPF `Facilitating the sustainable use of minerals' provides details of the planning policies to be adopted, which includes:

"*203.* It is *essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs. Since minerals are a finite natural resource, and can only be worked where they are found, best use needs to be made of them to secure their long-term conservation.*

204. Planning policies should:

a) provide for the extraction of mineral resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction;

b) so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously;

c) safeguard mineral resources by defining Mineral Safeguarding Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked);

d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place;

e) safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material;

f) set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;

g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction; and

h) ensure that worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place.

205. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy. In considering proposals for mineral extraction, minerals planning authorities should:

a. as far as is practical, provide for the maintenance of landbanks of non-energy minerals from outside National Parks, the Broads, Areas of Outstanding Natural Beauty and World Heritage Sites, scheduled monuments and conservation areas;

b. ensure that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality;

c. ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties;"

Noise Policy Statement for England (NPSE)

4.1.7 The Noise Policy Statement for England (NPSE) was published in March 2010. It specifies the following long-term vision in policy aims: "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.*"

4.1.8 The NPSE introduced three concepts to the assessment of noise, which includes:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

4.1.9 The above categories are however undefined in terms of noise levels and for the SOAEL the NPSE indicates that the noise level will vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research is therefore required to establish what may represent an SOAEL. It is acknowledged in the NPSE that not stating specific SOAEL levels provides policy flexibility until there is further evidence and guidance.

4.1.10 The following commentary is given on the representation of NOEL, LOAEL and SOAEL in relation to existing British Standards/ International guidelines:

NOEL – Inaudibility

LOAEL – The guideline values for community noise in specific environments as set out in table 1 of the WHO Guidelines for Community Noise 1999 and in tables 5 and 6 of BS8233: 1999 - Sound insulation and noise reduction for buildings - Code of Practice.

4.1.11 The NPSE concludes how the LOAEL and SOAEL relate to the three aims listed in paragraph 4.6 above. The initial aim relates to avoiding significant adverse effects on health and quality of life, it then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when:

"*all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."*

4.1.12 The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

4.2 Planning Practice Guidance (PPG)

4.2.1 On March 6th, 2014 the Government updated the Planning Practice Guidance ("PPG") on noise, which provides further information in respect of new developments which may be sensitive to the prevailing acoustic environment.

4.2.2 The PPG includes a table summarising the noise exposure hierarchy, based on the likely average response. Under the heading of `perception' the `noticeable and not intrusive' assessment of noise is defined as `*noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such there is a perceived change in the quality of life'*. The increasing effect level under these conditions is deemed to be `*no observed adverse effect*' and no specific measures are required.

4.2.3 Within PPG there is a section on `*Guidance on the planning for mineral extraction in plan making and the application process'* and under Paragraphs 019 to 021 (Reference ID: 27-019-20140306, 27-020-20140306 and 27-021-20140306) the guidance under `Noise emissions' states:

"Noise emissions
How should minerals operators seek to control noise emissions?
Those making mineral development proposals, including those for related similar processes such as aggregates recycling and disposal of construction waste, should carry out a noise impact assessment, which should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.
Proposals for the control or mitigation of noise emissions should:

- *consider the main characteristics of the production process and its environs, including the location of noise-sensitive properties and sensitive environmental sites;*
- *assess the existing acoustic environment around the site of the proposed operations, including background noise levels at nearby noise-sensitive properties;*
- *estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations;*
- *identify proposals to minimise, mitigate or remove noise emissions at source;*
- *monitor the resulting noise to check compliance with any proposed or imposed conditions.*

How should mineral planning authorities determine the impact of noise?

Mineral planning authorities should take account of the prevailing acoustic environment and in doing so consider whether or not noise from the proposed operations would:

- *give rise to a significant adverse effect;*
- *give rise to an adverse effect; and*
- *enable a good standard of amenity to be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure would be above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.

What are the appropriate noise standards for mineral operators for normal operations?

Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (eg Lmax in specific octave or third-octave frequency bands – and that should not be allowed to occur regularly at night.)

Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed.

What type of operations may give rise to particularly noisy short-term activities and what noise limits may be appropriate?
Activities such as soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance.
Increased temporary daytime noise limits of up to 70dB(A) LAeq 1h (free field) for periods of up to 8 weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.
Where work is likely to take longer than 8 weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dB(A) LAeq 1h (free field) limit referred to above should be regarded as the normal maximum."

BS5228-1:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites

4.2.4 In the forward of this standard it states `*This British Standard refers to the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on, construction and open sites. It recommends procedures for noise and vibration control in respect of construction operations, and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.'*

4.2.5 Under the heading `Use of this document' it states `*As a code of practice, this part of BS5228 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure claims of compliance are not misleading.'*

4.2.6 This scope of the standard is clarified as follows:

`*This part of BS5228 gives recommendations for basic methods of noise control relating to construction sites, including sites where demolition, remediation, ground treatment or related civil engineering works are being carried out, and open sites where work activities/operations generate significant noise levels, including industry-specific guidance."*

4.2.7 The guidance gives specific advice in relation to noise control from mineral extraction workings.

4.2.8 In summary, advice provided within the document to minimise noise from these types of site is set out under the following headings:

a) Site location and layout
b) Choice of equipment
c) Maintenance of plant
d) Site operations
e) Sequencing of activities
f) Acoustic screening

4.3 Guidance on Ground Vibration

4.3.1 Most of the available data relating to the effects of ground vibration on buildings have been obtained during tests using explosives. From these studies, two regimes of building damage have evolved, those of structural damage involving major failures of whole or parts of buildings and architectural damage involving cracking plaster or other brittle materials.

4.3.2 Architectural, sometimes called cosmetic, damage is thought to be more annoying than dangerous and would start to occur at lower levels of vibration than structural damage. Recent International and BS define and categorise building damage under three main headings:

a) Cosmetic - the formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces. In addition, the formation of hairline cracks in mortar joints of brick / concrete block construction.

b) Minor - the formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks.

c) Major - damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

4.3.3 An investigation into the effects of induced vibration undertaken by the British Standards Institution has culminated in BS7385:1993; Part 2 which gives guide values to prevent cosmetic damage to property of 15 to 20mms^{-1} between 4Hz and 15Hz, whilst above 40 Hz the guide value is 50mms^{-1}. The BSI suggests reducing these figures by a factor of 50% for continuous vibration, for example from rail traffic, thus the values become 7.5-10mms^{-1} at 4-15Hz, and 25.0mms^{-1} at 40Hz and above.

4.3.4 With regard to the threshold of cosmetic damage, for continuous vibration such as road or rail traffic, levels below 5.0mms^{-1} are unlikely to be significant. For a given level of vibration the risk of damage decreases as the frequency of that vibration increases.

4.3.5 BS5228-2:2009 Annex B gives guidance on the effects of vibration levels, which is summarised below in Table 4.1.

Table 4.1: Guidance on Effects of Vibration Levels

Vibration Level $mm.s^{-1}$	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be tolerable for any more than a very brief exposure to this level.

4.3.6 In terms of response limits of buildings BS5228-2:2009 (Annex B, Table B.2) refers to BS7385-1 and BS7385-2 and sets out guide values for transient vibration for cosmetic damage, which gives a low frequency limit of 15mm/sec (4Hz) increasing to 20mm/sec at 15Hz for residential or light commercial buildings. For reinforced or framed structures the limit is 50mm/sec at 4Hz and above.

Vibration Nuisance

4.3.7 The fact that the human body is very sensitive to vibration can result in subjective concern being expressed at energy levels well below the threshold of damage.

4.3.8 Guidance on the human response to vibration in buildings may be found in British Standard BS 6472-1:2008. Weighting curves related to human response to vibration of buildings are presented within this document. Estimates are given on the probability of adverse comment, which might be expected, from human beings experiencing vibration in buildings. This is based on a vibration dose value (VDV), assessed from frequency weighted vibration measurements and based on a 16-hour day.

4.3.9 For the purposes of assessing the potential to cause nuisance the guidance in BS6472-1:2008 has been used.

Road Traffic Noise

4.3.10 Access to the quarry would be gained via a haul road route from the processing plant located southeast of the site which would connect to an access road joining the A38 along the eastern site boundary.

4.3.11 To assess the likely impact on noise sensitive receptors from any traffic noise generated as a result of the Proposed Development on the local road network, noise calculations have been undertaken using `Calculation of Road Traffic Noise' ("CRTN") methodology and traffic flow information for the Proposed Development.

4.3.12 The Design Manual for Roads and Bridges (DMRB) – November 2011 (Part 7 HD 213/11) states within the 'Scope' section: "*1.2 This Standard sets out the requirements to be adhered to in undertaking noise and vibration assessments, as well as providing guidance on the methodology to be used when assessing the noise and vibration impacts arising from all road projects, including new construction, improvements and maintenance.*" The Summary paragraph of the Standard states "*where appropriate, this standard may be applied to existing roads*".

4.3.13 DMRB Volume 11, Section 3, Part 7 (HD 213/11): November 2011 provides advice on noise and vibration. The procedure for assessing noise impacts advises the use of a LA_{10} measurement index based on an 18-hour time period (i.e. 0600 to 2400 hours). Further assessment of the impact would be required where changes of 1dB(A) or more are expected in the short-term and changes of 3dB(A) in the long term. Tables 3.1 and 3.2 within Part 7 of HD 213/11 are reproduced below as Table 4.2 and 4.3 (the adverse effect level has been added):

Table 4.2: Example of Magnitude of Impact for Changes in Road Traffic Noise in the short term

Noise Change, $L_{A10,18hour}$	Magnitude of Impact
0	No Change
0.1-0.9	Negligible
1-2.9	Minor (Slight)
3-4.9	Moderate
5+	Major (Substantial/Severe)

Table 4.3: Example of Magnitude of Impact for Changes in Road Traffic Noise in the long term

Noise Change, $L_{A10,18hour}$	Magnitude of Impact
0	No Change
1.0-2.9	Negligible
3.0-4.9	Minor (Slight)
5-9.9	Moderate
10+	Major (Substantial/Severe)

4.3.14 The impact magnitude categories can then be correlated with the receptor sensitivity categories provided in Table 4.7 to establish a level of effect as defined in Table 4.8.

4.4 Consultation

4.4.1 The Local Authority EHO was formally consulted via a scoping request report and a scoping response has been provided by Worcestershire and Gloucestershire County Council's.

4.5 Assessment Methodology

General

4.5.1 To establish the impact of the Proposed Development in relation to noise on existing residential areas it is necessary to consider the relevant noise guidance, standards and policy for a mineral extraction site. The following section refers to the relevant guidance and establishes the methodology to be adopted for assessing noise impacts.

4.5.2 Information used in this assessment has been obtained from the following sources:

- ordnance Survey maps of the local area;
- general layout of the Proposed Development provided by David Jarvis Associates;
- National Planning Policy Framework – July 2018;
- Noise Policy Statement for England (NPSE) – March 2010;
- Planning Practice Guidance – 6th March 2014 Department for Communities and Local Government (Ref ID: 30-001-20140306)
- BS5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites
- Department of Transport 'Calculation of Road Traffic Noise': 1988;
- Design Manual for Roads and Bridges, Volume 11, Environmental Assessment: 2011;
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors;
- BS7385:1993, Part 2; Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration;
- BS6472: 2008 `Guide to the evaluation of human exposure to vibration in buildings'; and
- New Zealand Transport Agency research paper entitled `Ground Vibration from Road Construction' in May 2012.

Operational Noise Limits

4.5.3 For general site operations we would refer to PPG for noise limits as they are the most relevant and appropriate for the type of activity i.e. *"Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field)."*

4.5.4 For temporary operations such soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms, restoration work and aspects of site road construction and maintenance a noise limit of up to 70dB(A) LAeq 1h (free field) for periods of up to 8 weeks in a year would be applicable.

4.6 Assessment of Significance

4.6.1 The two principal criteria to predict the significance of potential noise impacts are:

- magnitude of the impact; and
- sensitivity of the receptors.

4.6.2 This assessment combines the PPG criteria to predict the significance of the noise impacts of the proposed development.

4.6.3 To help understand the effects of noise changes, descriptions of subjective response have been added. Table 4.4 below shows the proposed impact magnitude scale.

Table 4.4: Impact Magnitude Scale - Future Noise against Existing (Operational Phase) in accordance with PPG criteria

Site noise relative to background noise dB(A) in accordance with PPG criteria	Subjective Response	Impact Magnitude
<=10dB(A) and <55dB(A) Leq_{1hr}	Complaint unlikely	Negligible
<=10dB(A) and >55dB(A) Leq_{1hr}	Complaint unlikely	Slight
>10dB(A) and <=55dB(A) Leq_{1hr}	Marginal	Moderate
>10dB(A) and >55dB(A) Leq_{1hr}	Complaint likely	Substantial to Severe

4.6.4 The criteria in Table 4.4 reflect key benchmarks of human response to changes in noise level and absolute noise limits, which are deemed to be reasonable. For example, a 3dB change is generally taken to be the smallest change perceptible to the human ear in the general external noise environment and a 10dB change is subjectively heard as a doubling or halving of the loudness of a sound source. An absolute noise level below 55dB(A) is deemed to be acceptable in accordance with other planning guidance (e.g. BS8233: 2014 guidance) for residential development adjacent to transportation noise sources.

4.6.5 The impact magnitude scale in Table 4.5 is used in the assessment of operational noise. The impact scale in relation to restoration and maintenance (e.g. construction of earth screening mounds, soil movement) activity noise is slightly different due to a temporary noise source and therefore the magnitude of impact is different. Table 4.5 below shows the impact scale used to assess temporary noise activities.

Table 4.5: Impact Magnitude Category – Temporary Noise Activities (i.e. Restoration, soil movement for construction of earth mounds etc)

Change in Noise Level dB(A)	Subjective Response	Impact Magnitude
Up to 70dB(A) Leq_{1hr} for 8 weeks, general noise <55dB(A) Leq_{1hr}	Audible, complaint unlikely for short term activity	No significant impact (negligible)
Up to 70dB(A) Leq_{1hr} for more than 8	Audible, potential for complaint	Slight

weeks, general noise <55dB(A) Leq_{1hr}	depending on period of activity	
>70dB(A) Leq_{1hr} for up to 8 weeks, general noise <55dB(A) Leq_{1hr}	Annoying, complaint possible	Moderate
>70dB(A) Leq_{1hr} for more than 8 weeks, general noise >55dB(A) Leq_{1hr}	Annoying, complaint likely	Substantial

Operational Phase - Vibration

4.6.6 Table 4.6 below shows the impact in relation to vibration during the operational phase of the development.

Table 4.6: Impact Magnitude Scale – Operational Phase Ground Borne Vibration for Residential Receptors

Vibration Level PPV (mms^{-1})	Impact Magnitude	Significance Level
0.14 to 0.29	Negligible	Neutral
0.3 to 0.99	Minor	Slight
1.0 to 4.99	Moderate	Moderate
5 to 14.99	Substantial	Moderate/Major
15 or more	Severe	Major

4.6.7 In order to determine the significance of an impact, not only must the magnitude of this impact be determined but also the sensitivity of the receptors to the impact. For this assessment, the categories presented in Table 4.7 have been adopted.

Table 4.7: Receptor Sensitivity

Receptor Sensitivity	Type of Receptor
High	Dwellings/residential properties including houses, flats, old peoples homes, hospitals, schools, churches, caravans and open spaces/conservation areas where the existing noise level is low.
Moderate	Commercial premises including retails and offices etc.
Low	Industrial premises including warehouses and distribution etc.

4.6.8 Based upon the assessment of impact magnitude and the sensitivity of individual receptors, the matrix given in Table 4.8 has been developed in order to provide an indication of the possible significance of each predicted noise impact. Given that there are many factors, which may affect the significance of an impact, not least, the character of the noise and timescales over which the noise operates, the overall significance must be assessed on an individual basis using professional judgement and experience. Therefore, whilst the matrix provides a useful indication of the likely significance it cannot be rigorously applied in all situations.

Table 4.8: Significance Matrix

Impact Magnitude	Receptor Sensitivity		
	High	Moderate	Low
Severe	Major	Major/Moderate	Moderate/Minor
Substantial	Major/Moderate	Moderate	Minor
Moderate	Moderate	Moderate/Minor	Minor/Neutral
Slight	Minor	Minor/Neutral	Neutral

No significant impact (negligible)	Neutral	Neutral	Neutral

4.6.9 Where an impact is defined as Major or Major/Moderate then the impact is considered significant in EIA terms.

5.0 EXISTING SOUND CLIMATE

5.1 Site Sound Survey

5.1.1 An environmental baseline sound survey was carried out in the vicinity of nearest residential receptors to the development site to determine typical details of the existing sound climate. This provides data such that any impact on existing residential properties adjacent to the site can be assessed.

5.1.2 The nearest noise sensitive areas relative to the site excavation and processing activities were chosen for sound monitoring. The monitoring locations related to the following (see Appendix NVC/1):

Fixed Monitoring

A) North of the Site - off Bow Lane
B) East of the Site - off Bow Lane
C) Southwest of the Site - vicinity of Fairfield Bungalow
D) Southwest of the Site - vicinity of Shuthonger in vicinity of Twyning Farm

Spot Roaming Monitoring

E) South of the Site – south of Redpools Farm
F) East of the Site - 10m A38 road (off Cherry Orchard Lane)
G) East of the Site – Puckrup Lane (in vicinity of Puckrup Hall)

5.1.3 The monitoring positions above provide typical data on the variation of the sound climate around the site at key sensitive areas.

5.1.4 The sound monitoring exercise was carried out over a typical weekday period during appropriate weather conditions as defined by BS7445-1: 2003.

5.1.5 The attached plan of site (Appendix NVC/1) shows the location of the static and spot roaming sound measurement positions. Appendix NVC/5 provides further detail of the survey methodology and instrumentation used together with calibration dates.

5.1.6 Mr D. R. Kettlewell of Noise & Vibration Consultants Ltd undertook these measurements on Wednesday 10th October 2018.

5.1.7 Measurements were recorded over approximately 7 hours at the stated fixed locations, as shown on Appendix NVC/1. Data logging of L_{Aeq}, L_{A10}, L_{A90} and L_{Amax} were recorded at 15-minute intervals.

5.1.8 Observations at the site indicated that the noise climate is formed by distant and local road traffic movements and birdsong.

5.2 Baseline Survey Results

5.2.1 The results of sound survey measurements taken at the static and spot roaming noise monitoring positions at the nearest noise sensitive receptors are presented below in Table 5.1 and detailed measurements are provided in Appendix NVC/6.

Table 5.1: Existing Sound Climate

Location	Time Period	LAeq dB	LA10 dB	LA90 dB	Representative LA90 dB	LAmax dB
A) Bow Lane (N)	0700-1400	61	61	55	54	65-85
B) Bow Lane (S)	0715-1415	52	52	48	44	53-83
C) Fairfield Bungalow	0745-1445	56	58	51	50	60-88
D) Southwest	0815-1445	55	53	46	44	64-91
E) South (Redpools)	0841-0921	53	53	47	47	57-87
F) East (A38)	0935-1005	66	68	53	53	64-88
G) Puckrup Lane	1414-1429	50	50	44	43	69-72

5.2.2 Details on the noise levels from mobile and fixed plant to be used at site are presented in Appendix NVC/8.

5.3 Noise Criteria

5.3.1 Based on the above assessment of background sound levels at nearest sensitive receptors the following noise limits are established in respect of the PPG guidance for Mineral Workings:

Table 5.2: Noise Limits in accordance with PPG Guidance

Receptor	Noise limits for general site works $LAeq_{1hr}$ dB	Noise limits for temporary site activities (8 weeks per year) $LAeq_{1hr}$ dB
A. Bow Lane (N)	55	70
B. Bow Lane (S)	54	70
C. Fairfield Bungalow	55	70
D. Southeast (SE)	54	70
E. South (Redpools)	55	70
F. East (A38)	55	70
G. Puckrup Lane (East)	53	70

6.0 NOISE LEVEL PREDICTIONS

6.1 Introduction

6.1.1 Noise has been defined as sound which is undesired by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.

6.1.2 A measure that is in general use and is recommended internationally for the description of environmental noise is the equivalent continuous noise level or L_{Aeq} parameter.

6.1.3 In general, the level of noise in the local environs that arises from a development site will depend on a number of factors. The more significant of which are:-

(a) The sound power levels (SWL's) of the plant or equipment used on site.
(b) The periods of operation of the plant on site.
(c) The distance between the source noise and the receiving receptor
(d) The presence or absence of screening effects due to barriers, ground absorption.
(e) Any reflection effects due to the facades of buildings etc.

6.2 Prediction Methodology

6.2.1 The prediction method used in this study is based on that outlined in British Standard BS5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites". This methodology is referred to in the previous planning guidance (i.e. MPS2) Annex 2 published in 2005.

6.2.2 The prediction methodology utilises computer-based modelling software (i.e. CadnaA) and contour plans of the phased development for an accurate effect of the surrounding changing topography on noise levels at NSRs.

6.2.3 The noise modelling assesses noise from mobile plant at the closest approach to receptors and also assesses the likely change due to the effect of screening attenuation from the change in site topography (i.e. earth mound screens).

6.2.4 The prediction calculations therefore provide the range of likely noise conditions that will be encountered.

6.3 Proposed Plant Complement and Working Practice

6.3.1 A list of plant sound power levels (SWL's) from which the noise predictions were made are presented in Appendix NVC/8. The plant complement is based on information established during the site visit for robustness.

6.3.2 Section 3.0 of the NVC report summarises the proposed working method in summary detail, as advised by the applicant.

6.3.3 The site operational times are 0700 - 1800 (Monday to Friday) and 0700 to 1300 hours on Saturday.

6.4 Noise Prediction Assumptions

6.4.1 The noise prediction exercises are based on a number of assumptions concerning the working of the site, which is provided in section 3 and appendices attached to this report.

6.4.2 For the purposes of this prediction exercise, the highest likely noise generation has been considered where operations are assumed to be undertaken at their realistic minimum distances. The assessment also considers the change in noise levels as the mineral is extracted at greater distance from the nearest receptor.

6.4.3 The predictions also allow for the cumulative effect of plant operating together (where appropriate according to the phased working).

6.5 Results of Noise Predictions

6.5.1 The data obtained at the site of fixed and mobile plant has been utilised to maintain the accuracy of the calculations.

Site Plant Noise Assessment:

6.5.2 The following tables provide a summary of the results of the range of noise levels at each phase of the development over the development period. For detailed analysis of each phase refer to Appendix NVC/9 noise mapping.

Predicted Noise Contribution from Fixed and Mobile Plant on Quarry site

Table 6.1: - Processing Activities (with screening)

Phased Workings	Receptor	Range of likely noise contribution from Site $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Processing activities	1. Silvermead (north)	37	55	None
	2. Bow Farm	45	54	None
	3. Puck Cottage etc (east)	43-45	54	None
	4. Bowbridge Cottage etc (east)	48-50	54	None
	5. Puckrup Lane (Puckrup Hall)	50	53	None
	6. Fairfield Bungalow	51-52	55	None
	7. Southeast (Twyning)	44-48	54	None
	8. South (Redpools)	44	55	None
	9. Southwest (Windmill Tump)	37-39	53*	None
	10. West (The Stalls etc.)	37-38	54*	None

*****Note: Assumed to be similar to other positions due to relative position to M50 Motorway

Table 6.2: Temporary Activities – Soil strip & construction of boundary screening measures

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Temporary Construction Activities	1. Silvermead (north)	35-41	70	None
	2. Bow Farm	44-61	70	None
	3. Puck Cottage etc (east)	43-57	70	None
	4. Bowbridge Cottage etc (east)	41-48	70	None
	5. Puckrup Lane (Puckrup Hall)	35-43	70	None
	6. Fairfield Bungalow	34-35	70	None
	7. Southeast (Twyning)	31-42	70	None
	8. South (Redpools)	34-41	70	None
	9. Southwest (Windmill Tump)	32-40	70	None
	10. West (The Stalls etc.)	33-39	70	None

Note: Assumes processing plant not operating.

Table 6.3: Extraction Phases 1 & 2 (with screening)

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction Activities	1. Silvermead (north)	40-43	55	None
	2. Bow Farm	42-49	54	None
	3. Puck Cottage etc (east)	42-51	54	None
	4. Bowbridge Cottage etc (east)	42-50	54	None
	5. Puckrup Lane (Puckrup Hall)	39-49	53	None
	6. Fairfield Bungalow	34-43	55	None
	7. Southeast (Twyning)	36-48	54	None
	8. South (Redpools)	37-45	55	None
	9. Southwest (Windmill Tump)	35-40	53*	None
	10. West (The Stalls etc.)	35-40	54*	None

Note: Assumes processing plant not operating. *****Assumed to be similar to other positions due to relative position to M50 Motorway

Table 6.4: Extraction Phases 3 to 9 & Flexible Working Areas Phase A & B (with screening)

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction Activities	1. Silvermead (north)	32-36	55	None
	2. Bow Farm	44-52	54	None
	3. Puck Cottage etc (east)	40-47	54	None
	4. Bowbridge Cottage etc (east)	41-47	54	None
	5. Puckrup Lane (Puckrup Hall)	38-42	53	None
	6. Fairfield Bungalow	33-35	55	None
	7. Southeast (Twyning)	36-42	54	None
	8. South (Redpools)	38-42	55	None
	9. Southwest (Windmill Tump)	35-42	53*	None
	10. West (The Stalls etc.)	35-40	54*	None

Note: Assumes processing plant not operating. *****Assumed to be similar to other positions due to relative position to M50 Motorway

Table 6.5: Restoration of Phased Working

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Temporary Restoration Activities	1. Silvermead (north)	35-41	70	None
	2. Bow Farm	44-61	70	None
	3. Puck Cottage etc (east)	43-57	70	None
	4. Bowbridge Cottage etc (east)	41-48	70	None
	5. Puckrup Lane (Puckrup Hall)	35-43	70	None
	6. Fairfield Bungalow	34-35	70	None
	7. Southeast (Twyning)	31-42	70	None
	8. South (Redpools)	34-41	70	None
	9. Southwest (Windmill Tump)	32-40	70	None
	10. West (The Stalls etc.)	33-39	70	None

Note: Assumes processing plant not operating.

6.5.3 The above tables show the range of predicted noise levels from the combined effect of the plant working (excluding the processing plant) at the proposed quarry. The range of levels is based on the plant working at the closest likely approach and working at greater separation distance relative to the nearest receptor property boundary.

6.5.4 The above tables show that with proposed earth mound screening measures, the plant would meet maximum guidance limits for all site operations at the nearest receptor positions. The impact magnitude is shown to be **negligible** according to Tables 4.4 and 4.5.

6.5.5 Further mitigation measures are proposed to minimise the peak impacts as detailed in Section 7.0.

Cumulative Effect of Processing Plant

6.5.6 The cumulative effect of the existing and proposed quarry site operations together with the processing plant is presented below in Table 6.6.

Table 6.6: Cumulative Effect of Mineral Extraction & Processing Plant

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction & Processing Activities	1. Silvermead (north)	38-44	55	None
	2. Bow Farm	47-53	54	None
	3. Puck Cottage etc (east)	45-52	54	None
	4. Bowbridge Cottage etc (east)	49-53	54	None
	5. Puckrup Lane (Puckrup Hall)	50-53	53	None
	6. Fairfield Bungalow	51-53	55	None
	7. Southeast (Twyning)	45-51	54	None
	8. South (Redpools)	45-48	55	None
	9. Southwest (Windmill Tump)	39-44	53*	None
	10. West (The Stalls etc.)	39-42	54*	None

6.5.7 The above results show no change in the conclusions described in paragraph 6.5.4 i.e. negligible impact magnitude.

Operational Road Traffic Noise

6.5.8 The Transport Assessment considers the baseline flows and the traffic demand from the Proposed Development compared to a 'Do-nothing' scenario. Table 6.7 below provide details of the noise impact due to the increased traffic flow along the local road network based on average demand over the operational 10-hour period.

Table 6.7: Predicted Change in Road Traffic Noise on local road network based on Daytime 10-hour Site Vehicle Demand

Road	Baseline Scenario	'Do nothing' $LA10_{10hours}$ (dB)	'Do something' $LA10_{10hours}$ (dB)	Change (with development) $LA10_{10\ hours}$ (dB)
A38 (North)	Opening year	60.3	61.8	+1.5
A38 (South)	Opening year	61.3	61.4	+0.1

* The predicted noise levels are based on a notional 10m distance from the kerbside

6.5.9 Based on a maximum HGV demand the impact shows **negligible to slight** impact magnitude and **neutral to minor** level of effect in respect of traffic movements relative to the nearest local road network and at nearest residential properties. In terms of the DMRB guidance, in relation to short-term effects (refer to Table 4.2) an increase of <3dB(A) is minor and <1dB(A) is negligible.

Operational Phase Vibration Effects

Typical Vibration Levels

6.5.10 The highest levels of vibration generated by plant is likely to include the following:

- Bulldozers
- Loading of HGVs or Dump Trucks

6.5.10 The distance from nearest residential receptors to any likely use of bulldozers and loading of HGVs or Dump Trucks is likely to be a minimum distance of 55 metres based on the nearest existing receptors.

6.5.11 The New Zealand Transport Agency published a research paper entitled `Ground Vibration from Road Construction' in May 2012 (refer to Appendix NVC/10), which includes a table of measured PPV values for different types of plant. The results indicate that a large bulldozer would typically produce a vibration level of 2.3mm/sec at 7.6m distance. Similarly, the report indicates that the loading of trucks produces a vibration level of 1.9mm.sec PPV at 7.6m distance.

6.5.12 Based upon the above information, it is clear that even at the closest approach to existing residential properties, the likely levels of ground-borne vibration would be below perceptible levels of vibration (i.e. 0.3mm/s) at all receptors. The results of empirical measurements of

vibration from vibratory plant at distances greater than 30 metres according to BS6472:2008 would indicate that the vibration levels are unlikely to give rise to an 'adverse comment' from a nuisance aspect.

6.5.13 It should be noted that the type of equipment, ground conditions and structural form could all affect the resultant level of vibration. At this stage, it has been assumed that the highest likely vibration level scenario occurs (i.e. a conservative estimate of potential effects).

6.5.14 The levels of vibration, as a result of the operation of mobile plant or offloading of dump trucks, are likely to result in an impact magnitude classification of **negligible** and a level of effect of **neutral** during general and peak vibration.

Ground Vibration Monitoring – HGVs

6.5.15 Monitoring of ground-borne vibration have been previously undertaken of vehicles travelling along local roads at other sites in the UK. Further detail is provided in Appendix NVC/10 and vibration parameters are presented in Appendix NVC/4.

6.5.16 The results of seismograph monitoring showed that based on a distance of 2m from the kerbside of the road during HGV movements the maximum levels of vibration recorded ranged between 0.2mm/s to 0.5mm/s. This level of vibration is very low (i.e. where 0.3mm/sec is said to be the level below which vibration is imperceptible) and experience has shown that according to BS6472: 2008, even when properties are at this distance, there is normally a 'low probability of adverse comment' over the operating period indicating that nuisance conditions are unlikely.

6.5.17 In view of the separation distance to NSRs it is clear that vibration levels would be imperceptible and therefore produce a **negligible** impact and **neutral** impact significance. In terms of BS6472 this would conclude that vibration levels would be well below a 'low probability of adverse comment' and therefore nuisance conditions are highly unlikely to occur.

7.0 NOISE MITIGATION STRATEGY

7.1 In order to meet best practice without placing unreasonable burden on the mineral operator, careful consideration of the site extraction area, working methods and a noise mitigation strategy has been considered with the client and appointed consultants.

7.2 The peak noise events occur during the following periods:

a) During temporary activities to remove top soil, overburden and construction of earth mound screens when at closest approach to position relative to receptors east of the Development.

b) During Phases 3 to 4 & 7 to 8 mineral excavation northern and central areas of the Development when at closest approach relative to Bow Farm and properties east of the Site.

7.3 Proposed noise mitigation for control of the above periods of activity will require the construction of earth mound screens. The screens should be located along the eastern boundary of the Site including the boundary around Bow Farm. The required screen height would be 3.0 metres. The location of the bunds is indicated in Appendix NVC/2 attached.

7.4 Further mitigation measures would relate to following guidance and advice in BS5228-1: 2009+A1:2014, which would include the following:

a) The mobile plant will be fitted with broadband type reverse alarms to minimise any tonal noise characteristics.

b) Any associated water pumps used at site placed as far as is practicable from NSRs. If pumps are on high ground or within 100m of NSRs they should be fitted with an acoustic screen or enclosure to minimise noise levels.

7.6 Reference is made below to `best practice' guidance, which would be considered in the management of the site:

a) <u>Site location and layout:</u>
The location of plant can assist at time in reducing noise levels by locating behind natural screens formed by stock piles, topography or against lower bench walls to provide additional screening attenuation. Placing haul roads at maximum distance from receptors would also assist in minimising noise.

b) <u>Choice of equipment:</u>
Where practicable the selection of the quietest plant would assist in minimising noise levels. Additionally, it is important to ensure plant reverse alarms have broadband type alarms as opposed to tonal `beeper' alarms.

c) <u>Maintenance of plant:</u>
Regular and effective maintenance of plant and equipment should be maintained including regular lubrication of bearings, sharpness

of cutting edges, ensuring silencers and enclosures are fitted and maintained.

d) Site operations:
Reducing the impact of noisy activities can be undertaken (where practicable) by introducing control measures and techniques such as minimising drop heights to reduce impacts, use of rubber linings on chutes and transfer points, use of baffles and enclosures on fixed plant, limiting un-necessary use of plant, avoid excessive revving of engines, reducing speed of vehicles, maintaining haul roads, keeping lorry tailgates closed and pointing directional noise sources away from sensitive receptor directions etc.

e) Sequencing of activities:
Where practicable working away from the most sensitive receptors will mean that noise will reduce with time rather than increase, liaison with the local community assists in alleviating any complaints and organising the phased work to reduce the cumulative impacts from noise would assist in minimising noise.

f) Acoustic screening:
Introducing earth mound screens (i.e. bunds) at appropriate positions close to the noise activity or receptor will help in reducing noise levels.

8.0 CONCLUSIONS

8.1 All site operational activities have been assessed, which includes soil movement, construction of earth embankments, removal of soils and overburden, extraction of minerals and the restoration of the site. The range of noise levels likely to be generated from site operations with all fixed and mobile plant operating on site under realistic site working methods have been assessed. The highest likely noise levels with plant at the closest practicable approach relative to each phase of the site workings has been provided in detail.

8.2 The data used for the calculations have been taken from measured sound pressure levels of fixed and mobile plant similar to that to be used at the site for robustness.

8.3 The results of the noise prediction calculations using the appropriate methodology (i.e. BS5228) supported by computer software prediction modelling has shown the following:

(i) Noise from the use of fixed and mobile plant on site would not exceed the maximum noise limit level of 55dB(A) Leq_{1hr} as required by the National Planning Policy Framework ("NPPF") and Planning Practice Guidance for mineral operations, which is the relevant planning guidance for this type of activity.

(ii) Noise from the use of fixed and mobile plant on site would not exceed the noise limit aim of level of background sound level +10dB $LAeq_{1hr,}$ which is the aim of National Planning Policy Framework ("NPPF") and Planning Practice Guidance for mineral operations. This is based on the implementation of noise amelioration measures using best practice to control site radiated noise.

(iii) The results of the detailed analysis have shown that by implementing best practice the noise levels would be reduced and at all receptors the noise level for the life of the site would be similar to or lower than background noise +10dB(A) or below the 55dB(A) maximum limit advised by planning guidance. Impacts are therefore shown to be of **negligible magnitude and neutral impact significance.**

(viii) The results also show that for temporary noise events, such as soil stripping, overburden removal, construction of mounds, soil replacement and the site restoration would not exceed the short term maximum levels of 70dB(A) $Leq_{1\ hour}$ for 8 weeks per year. Impact magnitude is shown to be **negligible**.

(ix) No significant change in road traffic noise onto the local road network is predicted, with impacts shown to be between **negligible to slight impact magnitude and neutral to minor impact significance**.

(x) Vibration levels from mobile plant and offloading of vehicles based on the closest approach to nearest sensitive receptors would be well within acceptable limits and would produce a **negligible impact**.

(xi) Vibration from the movement of HGVs has been shown to be negligible based on empirical data obtained from measurements at kerbside and the studied concluded that vibration levels were insignificant and of **negligible impact** magnitude.

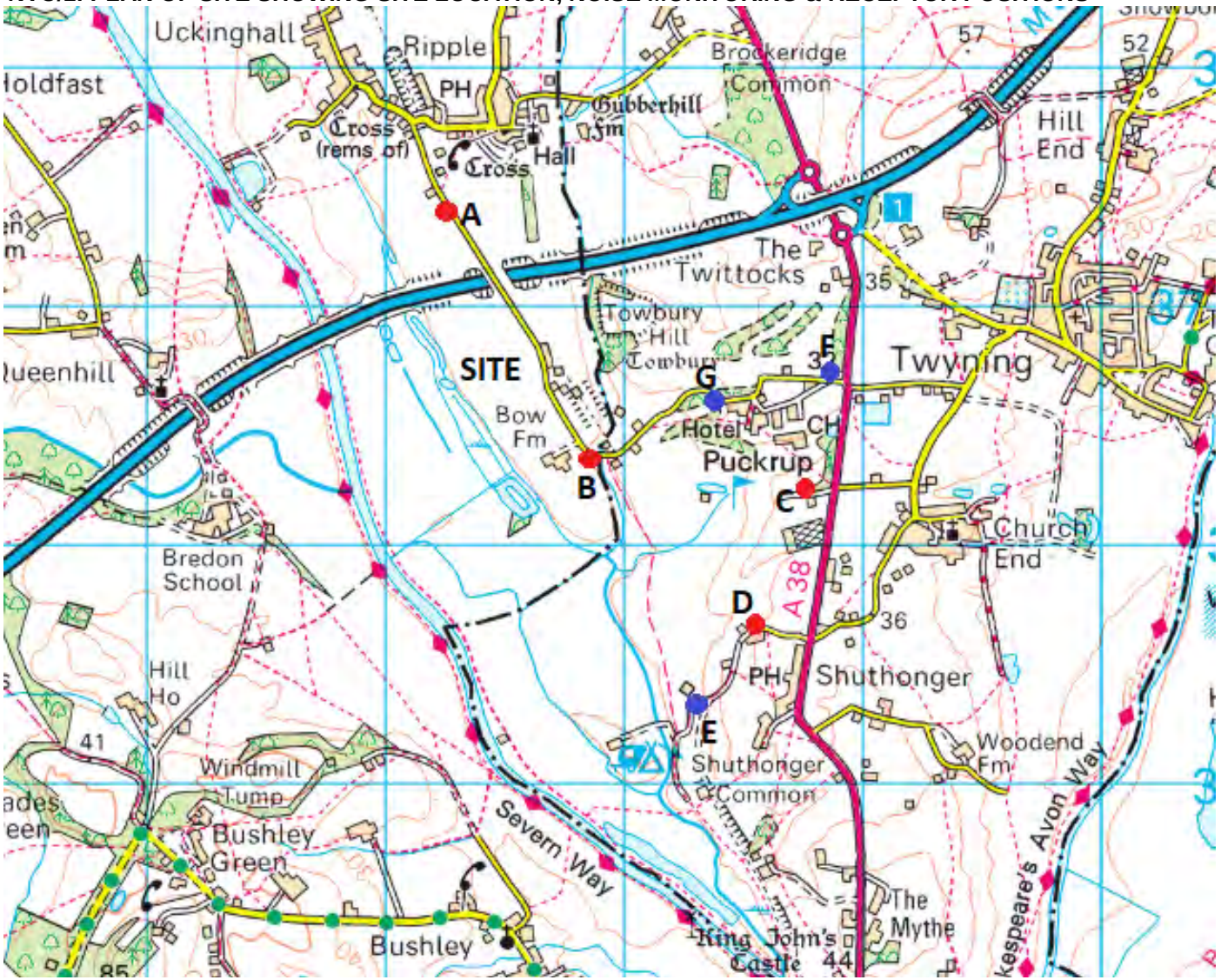
8.4 In overall conclusion, the operation of the site would apply `best practice' techniques to control noise. The noise levels are predicted to achieve the required noise limits set by relevant guidance and standards and would not exceed the maximum noise limit or the aim of background noise +10dB(A) for the site life time. The introduction of appropriate earth mound screens would assist in reducing noise levels to achieve the required noise levels.

8.5 The assessment shows that the proposed development would comply with planning guidance and provide a reasonable level of protection for NSRs relative to this mineral working development.

NVC/1

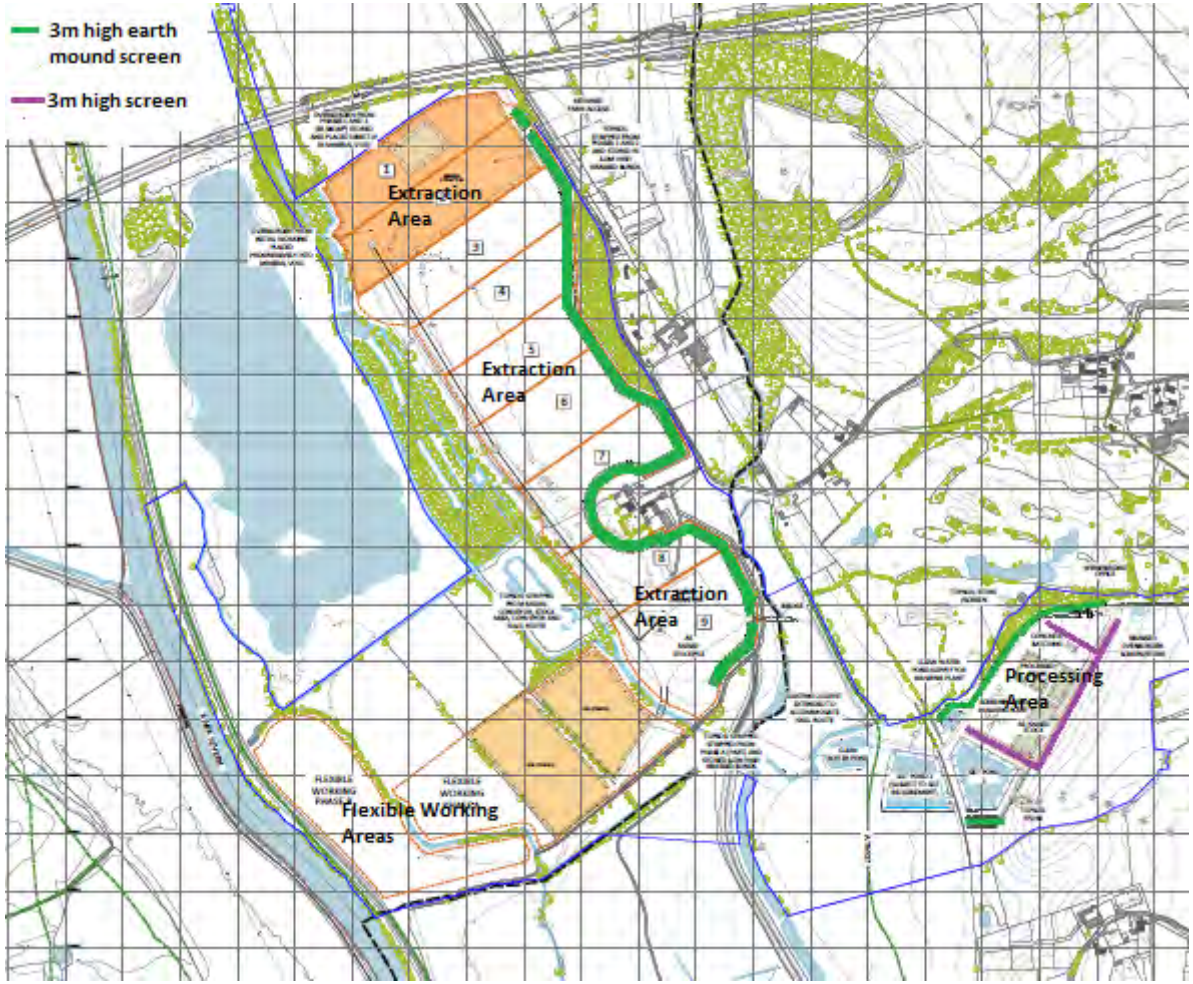
**PLAN OF SITE SHOWING SITE LOCATION,
NOISE MONITORING & RECEPTOR POSITIONS**

NVC/1: PLAN OF SITE SHOWING SITE LOCATION, NOISE MONITORING & RECEPTOR POSITIONS



NVC/2

SITE PLAN SHOWING PROPOSED EARTH MOUND SCREENING



NVC/3

WORKING PLANS SHOWING EXTENT OF EXTRACTION

INITIAL WORKING & PHASE 1 EXTRACTION:

PHASES 3 & 4 EXTRACTION:

PHASES 5 & 6: EXTRACTION

PHASES 7 & 8: EXTRACTION

PHASE 9: EXTRACTION

RESTORATION:

NVC/4

GLOSSARY OF TERMS

GLOSSARY OF NOISE TERMS

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure level. It is because of this wide range that a noise level scale based on logarithms is used in noise measurement. This is the decibel or dB scale.

Audibility of sound covers a range of about 0 to 140 decibels (dB) corresponding to the intensity of the sound pressure level. The ability to recognise a particular sound is dependent on the pitch or frequencies present in the source. Sound pressure measurements taken with a microphone cannot differentiate in the same way as the ear, consequently a correction is applied by the noise measuring instrument in order to correspond more closely to the frequency response of the ear which responds to sounds from 20 Hz to 20000 Hz. This is known as 'A weighting' and written as dB(A).

The use of this unit is internationally accepted and correlates well with subjective annoyance to noise.

The logarithmic basis of noise measurements means that when considering more than one noise source their addition must be undertaken in terms of logarithmic arithmetic. Thus, two noise sources each of 40 dB(A) acting together would not give rise to 40 + 40 = 80 dB(A) but rather 40 + 40 = 43 dB(A). This 3 dB(A) increase represents a doubling in sound energy but would be only just perceptible to a human ear.

The attached chart gives typical noise levels in terms of dB(A) for common situations.

Noise levels can vary with time according to source activity and indices have been developed in order to be able to assign a value to represent a period of noise level variations and to correspond with subjective response.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant, or an indication of the range of noise levels present is required. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a longer period of time is the Equivalent Continuous Sound Level. Normally written as $L_{Aeq,\ T}$ this value takes into account both the level of noise and the length of time (T) over which it occurs. Most commercially available sound level meters are capable of measuring $L_{Aeq,\ T}$ by electronic integration over the measurement period.

The 8 hour equivalent continuous noise level can, for most practical purposes, be regarded as a measure of noise dose received in one working day: it is the same notional sound level which would, during an eight hour period, result in receipt of the same A-weighted sound energy as that due to the actual noise over the actual working day.

The definition in layman's terms is given below for terminology typically used.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Baffle Mound: Temporary dump usually formed from topsoil and subsoil, for the purpose of reducing noise from site and to provide a visual screen.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to `A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

$L_{A10,T}$: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

$L_{A90,T}$: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest A weighted noise level recorded during a noise measurement period.

Noise-sensitive premises (NSPs): Any occupied premises outside a site used as a dwelling (including gardens), place of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level.

Open site: Site where there is significant outdoor excavation, levelling or deposition of material.

Overburden: Material overlying the coal, or mineral or minerals to be extracted, including topsoil and subsoil.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Site noise: Component of the ambient noise in the neighbourhood of a site that originates from the site.

Sound power level: Ten times the logarithm to the base 10 of the ratio of the sound power radiated by a sound source to the reference sound power, determined by use of frequency-weighted network "A" (see BS EN 61672-1) expressed in decibels.

Traverse length: Length of travel of a mobile item of plant operating on a repetitive cycle.

Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

VIBRATION TERMINOLOGY

Ground Borne Vibrations

For any source of vibration on or near the surface of the ground, energy propagates away from the source via:

a) Elastic body (or compression) waves – which radiate energy into the ground in all directions
b) Surface (or shear) waves – which carry energy along the ground surface, caused when body waves are reflected back into the ground at the ground-surface interface

Thus, at any point away from that source, the ground motion is the sum of all the wave motions at that point. When wave motion has been generated, the waves will be attenuated as they travel away from the source. The two main mechanisms for attenuation are:

a) Enlargement of the wavefront as the distance from the source increases, and
b) Internal damping of the transmitting medium (the ground)

Ground borne vibration is therefore made up of a combination of different waves, travelling in different directions, at different speeds and at different frequencies. The frequency component of the vibration will affect the rate at which attenuation occurs since the internal damping of the ground is frequency dependent.

Since vibration enters buildings through the foundations, the hard structure of the building is normally affected to a greater degree than by air borne vibration. Often ground borne vibrations are more noticeable when standing or sitting near the middle of suspended wooden floors.

Ground Borne Vibration Measurement Units

Ground borne vibration is caused when the individual particles making up the strata are caused to oscillate by the passage of a pressure wave. The resulting vibration can be summarized in terms of 4 main parameters:

a) **Velocity** – how fast the particles move when they are oscillating. Since the velocity of these particles continually change as the pressure wave passes the most useful value that is often reported is the maximum or peak particle velocity (PPV). PPVs are usually expressed in terms of ms^{-1} or mms^{-1}.

b) **Acceleration** – is the rate at which the particle velocity changes during oscillation. It is usually measured in ms^{-2} mms^{-2} or “g’s”. 1g is that acceleration imparted to an object by the earth’s gravitational pull and is approximately 9.81 ms^{-2}.
c) **Displacement** – is the distance moved by oscillating particles. This is usually very small and measured in mm or even µm.
d) **Frequency** – is the number of oscillations per second which a particle undergoes due to the passage of a vibration wave. It is measured in cycles per second or Hertz (Hz).

The movement of particles induced to oscillate by vibration waves are usually measured in three mutually perpendicular directions to fully describe the vibration intensity, as particles will be oscillating in three dimensions. These are:

a) **Longitudinal** – back and forth particle movement in the same direction that the vibration wave is travelling.
b) **Vertical** – up and down movement perpendicular to the direction the vibration wave is travelling.

c) **Transverse** – left and right particle movement perpendicular to the direction the vibration wave is travelling.

NVC/5

BASELINE NOISE SURVEY DETAILS

BASELINE SOUND SURVEY DETAILS:

The following instrumentation was used for all noise measurements:

Instrumentation:

Manufacturer	*Description*	*Type*	*Calibration Due date*	*Serial No.*
Cirrus	Real Time Sound Analyser	171B	February 2019	G056142
Cirrus	Real Time Sound Analyser	171A	February 2019	G061253
Cirrus	Real Time Analyser	171A	January 2019	G066350
Cirrus	Integrating Sound Level Meter	116	July 2019	27342
Norsonic	Real time analyser	118	July 2019	31992
Cirrus	Electronic Calibrator	CR: 513A	August 2019	031523

The noise meters used during the survey is a precision grade type 1 meter to IEC 651 standard and accuracy.
Calibration Setting: 94dB @ 1 kHz
Meter Setting: Fast Response

Fieldwork Details:

Site: Bow Farm Quarry Site, Ripple, Worcestershire
Date of test: Wednesday 10th October 2018
Start Time: 0700 to 1500 hours
Calibration: Before and after: 94dB at 1kHz

Survey Description and Procedure:

The noise meter was calibrated prior to and after measurements to ensure accuracy of results.

Background sound measurements were taken in the vicinity of the nearest residential properties during a period when there were no significant farm activities. Refer to Appendix NVC/1 for fixed and spot roaming sound monitoring locations.

Background noise readings were taken at a height of 1.5m from the ground. Readings of LAeq, LA10, LA90 and LAmax were recorded over 15-minute intervals.

Calibration
The noise meter was calibrated with the electronic calibrator prior to commencement and on completion of the survey. No significant drift in calibration was observed.

Meteorological Conditions
Weather details were recorded during the period of the survey and are detailed below:

Wednesday 10th October 2018
Dry, variable cloud, sunny intervals, light east to southeast winds (0-1m/s), temperature ranging between 13deg and 23degC.

Observations at site indicated that the sound climate is formed by local and distant road traffic movements and birdsong.

The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS7445: 2003 `Description and measurement of environmental noise'

NVC/6

BASELINE SOUND LEVEL RESULTS

BASELINE SOUND SURVEY RESULTS

Noise Survey Results

Date: Wednesday 10th October 2018

Location: Bow Farm, Near Ripple, Worcestershire **TABLE 1**

Client: Moreton C Cullimore

Project: Sand & Gravel Quarry

Data: **Baseline Sound Survey: Position 1 - Bow Lane (north)**

Instrumentation: Norsonic 116 Integrating Sound Level Meter (27342)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:00	15:00	62.2	62.0	57.4	84.5	Distant road traffic noise
07:15	15:00	62.4	61.7	57.6	83.2	from M50 Motorway
07:30	15:00	62.1	62.0	57.6	84.3	
07:45	15:00	60.8	62.2	58.0	77.9	
08:00	15:00	60.4	61.0	56.8	81.4	
08:15	15:00	60.1	60.2	56.3	82.4	
08:30	15:00	61.1	59.9	55.2	84.0	
08:45	15:00	61.9	58.7	54.9	83.9	
09:00	15:00	60.5	59.4	54.9	83.6	
09:15	15:00	61.7	61.3	56.1	84.0	
09:30	15:00	59.1	60.6	55.4	75.8	
09:45	15:00	61.2	60.3	54.9	83.3	
10:00	15:00	62.7	60.4	52.8	84.6	
10:15	15:00	60.4	57.6	51.0	82.1	
10:30	15:00	59.7	57.3	48.8	83.9	
10:45	15:00	59.9	60.4	53.9	81.8	
11:00	15:00	59.2	59.5	53.5	81.0	
11:15	15:00	59.6	59.3	53.1	82.9	
11:30	15:00	60.2	58.9	51.1	84.1	
11:45	15:00	60.1	59.2	54.0	81.8	
12:00	15:00	61.1	60.9	54.4	84.6	
12:15	15:00	62.3	60.3	54.5	85.1	
12:30	15:00	61.6	59.5	53.9	84.3	
12:45	15:00	56.4	58.2	53.4	64.5	
13:00	15:00	60.0	61.1	54.6	82.2	
13:15	15:00	62.4	62.5	57.1	83.8	
13:30	15:00	61.3	61.8	56.3	83.4	
13:45	15:00	64.4	68.2	58.0	78.4	
Average 0700-1400		61.1	60.5	54.8	65-85	

Noise Survey Results

Date: Wednesday 10th October 2018

Location: Bow Farm, Near Ripple, Worcestershire **TABLE 2**

Client: Moreton C Cullimore

Project: Sand & Gravel Quarry

Data: **Baseline Sound Survey: Position 2 - Bow Farm (Bow Lane South)**

Instrumentation: Cirrus 171A Real Time Analyser (G056142)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:15	15:00	57.3	57.6	54.6	82.5	Distant road traffic noise
07:30	15:00	56.7	57.6	54.9	67.7	birdsong
07:45	15:00	56.9	58.3	55.1	64.0	
08:00	15:00	56.3	57.6	54.7	61.2	
08:15	15:00	55.7	56.8	53.6	71.5	
08:30	15:00	55.0	56.5	52.8	64.0	
08:45	15:00	53.6	55.3	51.1	64.3	
09:00	15:00	52.4	53.5	49.9	64.2	
09:15	15:00	51.0	52.5	48.1	64.0	
09:30	15:00	51.1	52.4	47.6	67.2	
09:45	15:00	50.7	51.0	46.6	72.7	
10:00	15:00	47.8	49.2	45.1	63.6	
10:15	15:00	49.4	50.9	46.8	65.7	
10:30	15:00	47.3	48.5	44.7	63.8	
10:45	15:00	51.3	54.6	44.6	67.8	
11:00	15:00	46.7	46.5	43.6	64.6	
11:15	15:00	46.7	46.3	44.3	65.6	
11:30	15:00	49.5	52.6	45.6	66.7	
11:45	15:00	50.2	50.2	45.4	75.4	
12:00	15:00	48.8	52.2	47.0	69.4	
12:15	15:00	49.0	51.9	44.1	66.9	
12:30	15:00	46.2	47.2	44.0	65.0	
12:45	15:00	47.2	46.7	45.2	52.9	
13:00	15:00	46.5	48.4	45.3	61.9	
13:15	15:00	46.5	46.4	44.0	62.6	
13:30	15:00	46.5	46.6	44.3	70.3	
13:45	15:00	45.6	51.3	43.8	71.2	
14:00	15:00	50.4	53.9	46.7	66.4	
Average 0715-1415		52.0	51.9	47.6	53-83	

Noise Survey Results

Date: Wednesday 10th October 2018

Location: Bow Farm, Near Ripple, Worcestershire **TABLE 3**

Client: Moreton C Cullimore

Project: Sand & Gravel Quarry

Data: **Baseline Sound Survey: Position 3 - Vicinity of Fairfield Bungalow**

Instrumentation: Cirrus 171A Real Time Analyser (G066350)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
07:45	15:00	62.0	61.1	53.8	87.8	Local road traffic noise
08:00	15:00	57.0	58.8	53.7	77.0	
08:15	15:00	55.8	57.7	52.3	62.2	
08:30	15:00	57.1	59.0	53.4	68.3	
08:45	15:00	55.6	57.7	52.6	61.8	
09:00	15:00	56.5	58.9	52.8	66.4	
09:15	15:00	56.4	58.3	53.4	67.2	
09:30	15:00	56.7	58.6	53.6	64.7	
09:45	15:00	55.0	57.3	50.6	62.3	
10:00	15:00	54.6	57.5	49.3	67.4	
10:15	15:00	53.1	55.7	47.8	66.2	
10:30	15:00	53.6	56.3	48.2	61.5	
10:45	15:00	53.1	55.8	48.2	61.5	
11:00	15:00	54.0	56.1	50.3	61.6	
11:15	15:00	53.3	55.7	48.7	61.9	
11:30	15:00	54.7	56.9	50.7	66.5	
11:45	15:00	54.5	57.3	49.9	69.8	
12:00	15:00	55.2	57.5	50.7	65.5	
12:15	15:00	53.9	56.4	49.3	64.4	
12:30	15:00	53.8	56.3	49.5	61.3	
12:45	15:00	54.2	56.6	50.3	65.4	
13:00	15:00	55.5	58.1	50.2	68.9	
13:15	15:00	55.4	57.4	51.3	65.3	
13:30	15:00	54.0	56.5	49.1	62.5	
13:45	15:00	54.0	56.7	49.5	60.4	
14:00	15:00	56.7	58.6	52.0	70.8	
14:15	15:00	55.8	58.0	51.5	69.2	
14:30	15:00	58.7	59.2	51.0	83.8	
Average 0745-1445		55.8	57.5	50.8	60-88	

Noise Survey Results

Date: Wednesday 10th October 2018

Location: Bow Farm, Near Ripple, Worcestershire **TABLE 4**

Client: Moreton C Cullimore

Project: Sand & Gravel Quarry

Data: **Baseline Sound Survey: Position 4 - South West (Shuthonger)**

Instrumentation: Cirrus 171A Real Time Analyser (G061253)

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
08:15	15:00	63.8	64.5	52.7	88.3	Distant road traffic noise
08:30	15:00	55.2	55.6	51.6	73.6	
08:45	15:00	53.1	54.5	50.5	69.5	
09:00	15:00	51.5	52.8	49.5	63.7	
09:15	15:00	52.5	53.7	48.5	70.2	
09:30	15:00	53.0	55.1	49.4	65.6	
09:45	15:00	51.5	52.3	47.3	71.5	
10:00	15:00	52.7	51.1	46.7	76.3	
10:15	15:00	50.7	51.3	45.3	70.2	
10:30	15:00	54.3	52.4	44.6	77.1	
10:45	15:00	51.0	52.7	43.4	72.6	
11:00	15:00	51.6	51.2	44.4	73.0	
11:15	15:00	61.7	56.5	45.3	90.6	
11:30	15:00	54.4	52.1	45.4	77.6	
11:45	15:00	56.8	54.1	45.6	79.4	
12:00	15:00	55.2	54.3	46.1	79.8	
12:15	15:00	54.3	52.1	44.2	79.0	
12:30	15:00	52.3	51.7	44.3	73.5	
12:45	15:00	51.6	50.2	43.7	75.5	
13:00	15:00	51.9	53.1	43.6	73.0	
13:15	15:00	49.7	49.6	42.5	70.1	
13:30	15:00	47.9	48.5	40.6	72.8	
13:45	15:00	52.0	51.0	43.4	75.1	
14:00	15:00	52.7	55.1	45.0	73.7	
14:15	15:00	53.4	53.7	43.9	75.8	
14:30	15:00	50.5	51.0	43.5	72.8	
Average 0815-1445		55.1	53.1	45.8	64-91	

Noise Survey Results

Date: Wednesday 10th October 2018

Location: Bow Farm, Near Ripple, Worcestershire **TABLE 5**

Client: Moreton C Cullimore

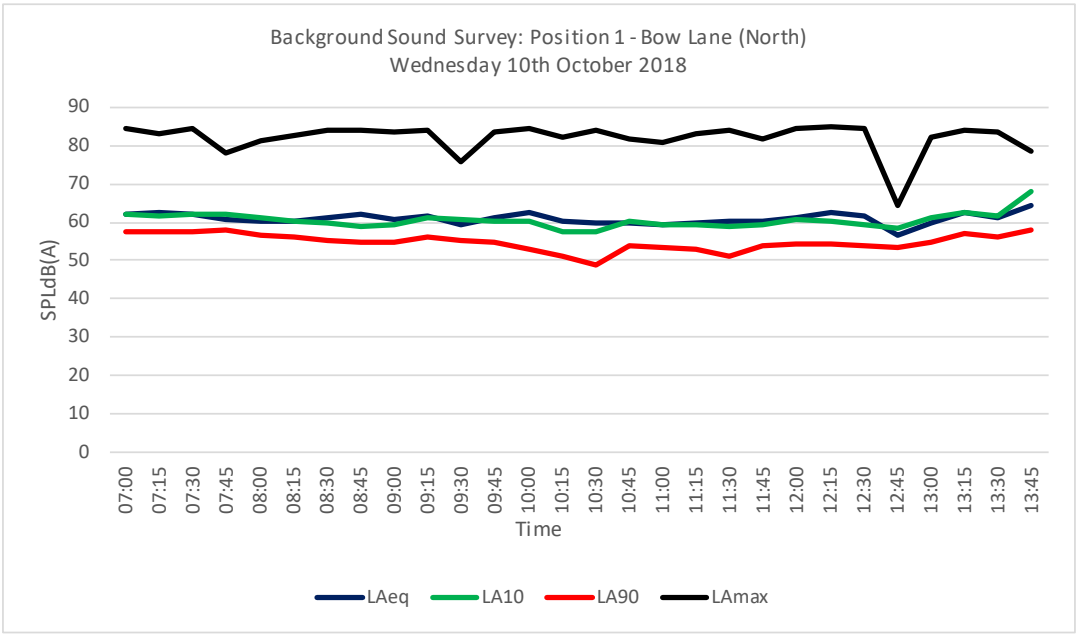
Project: Sand & Gravel Quarry

Data: **Baseline Sound Survey: Roaming Measurements**

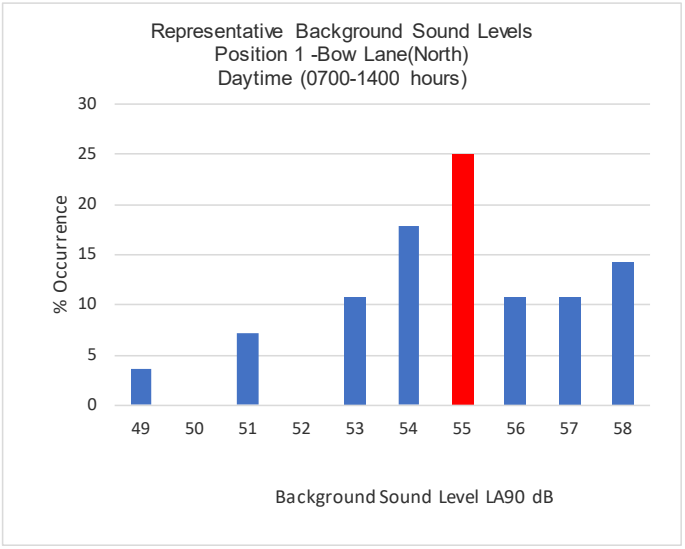
Instrumentation: Norsonic 118 real time analyser (31992)

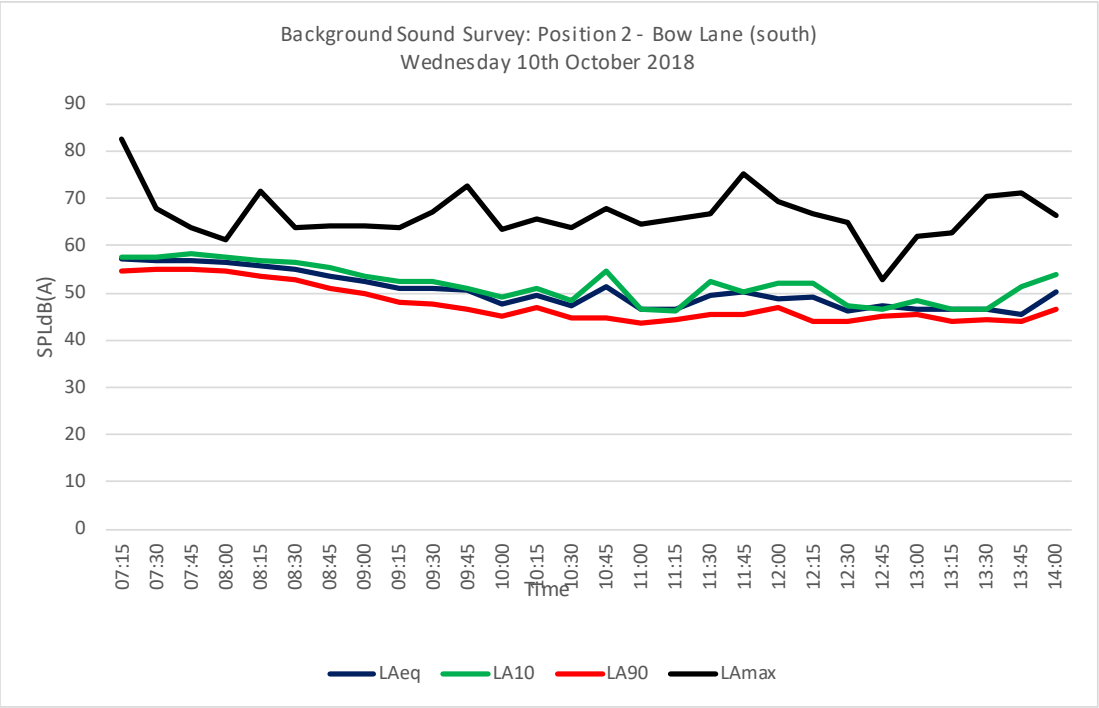
Calibration: 94dB

Start Time	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmax (dB)	Observations
08:41	52.7	53.5	49.6	67.4	South of site - vicinity of Redpools Farm
08:46	56.9	55.3	46.8	86.9	South of site - vicinity of Redpools Farm
08:51	57.4	61.2	46.8	74.1	South of site - vicinity of Redpools Farm
08:56	51.6	51.5	47.7	71.6	South of site - vicinity of Redpools Farm
09:01	48.5	50.4	46.4	57.1	South of site - vicinity of Redpools Farm
09:06	48.1	49.4	46.7	57.0	South of site - vicinity of Redpools Farm
09:11	49.2	49.5	46.5	63.5	South of site - vicinity of Redpools Farm
09:16	50.4	48.8	44.9	77.8	South of site - vicinity of Redpools Farm
Average	53.2	52.5	46.9	57-87	
09:35	65.1	68.9	52.2	83.5	10m A38 off Cherry Orchard Lane
09:40	66.8	69.6	52.6	86.0	10m A38 off Cherry Orchard Lane
09:45	67.8	70.6	52.0	88.2	10m A38 off Cherry Orchard Lane
09:50	65.8	70.3	52.9	80.3	10m A38 off Cherry Orchard Lane
09:55	64.6	68.0	53.1	78.0	10m A38 off Cherry Orchard Lane
10:00	59.6	62.5	55.7	64.3	10m A38 off Cherry Orchard Lane
Average	65.5	68.3	53.1	64-88	
14:14	49.7	49.3	43.1	72.3	Puckrup Lane - near Puckrup Hall entrance
14:19	50.5	50.2	44.1	71.3	Puckrup Lane - near Puckrup Hall entrance
14:24	49.4	49.6	43.4	68.7	Puckrup Lane - near Puckrup Hall entrance
Average	49.8	49.7	43.5	69-72	

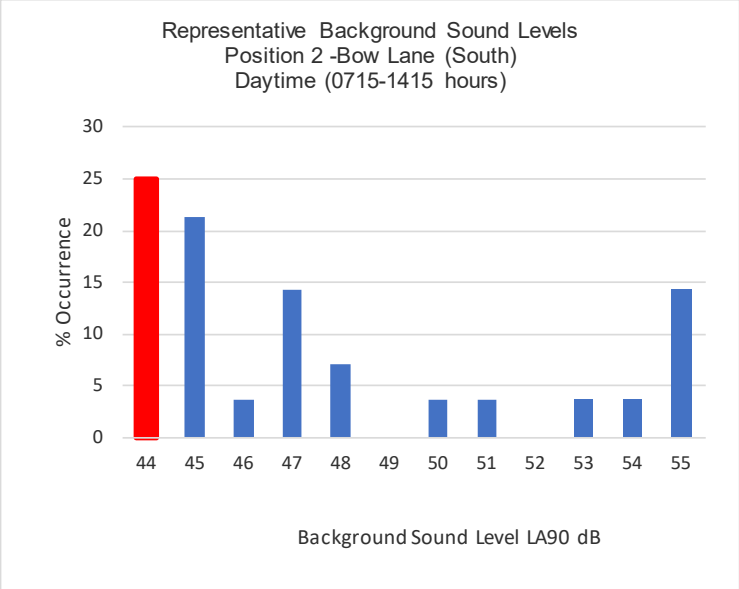


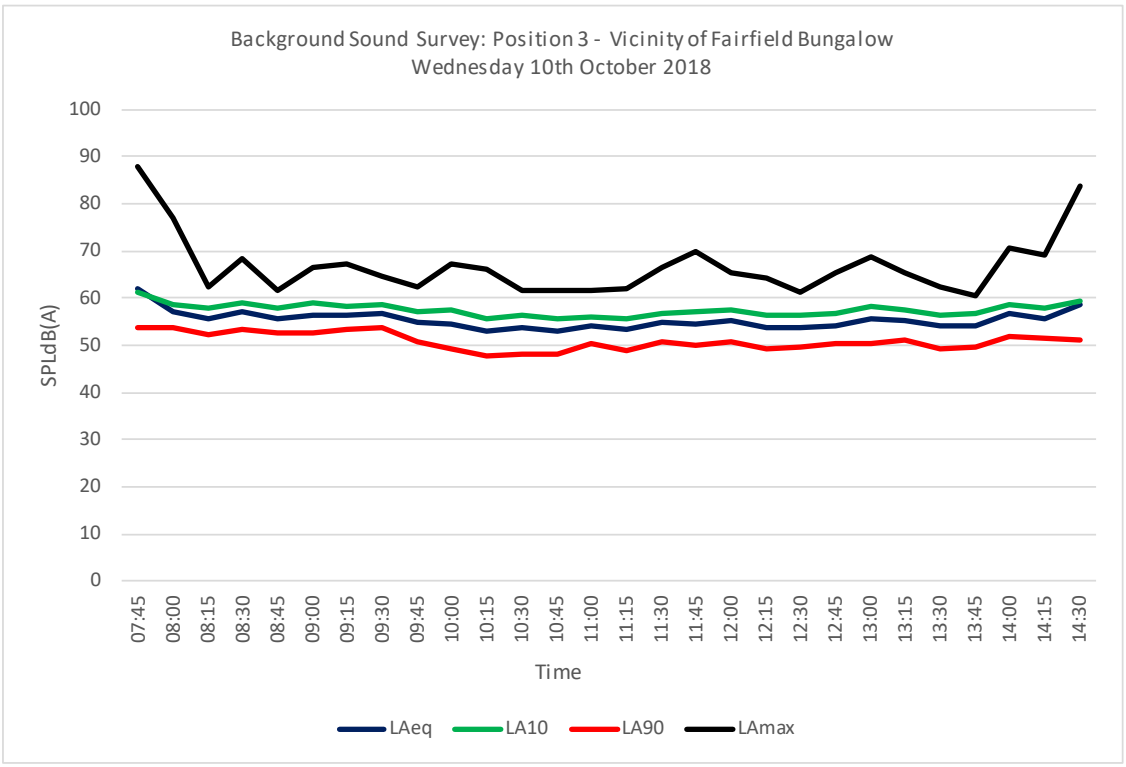
LA90	% Occurrence
49	3.6
50	0
51	7.1
52	0
53	10.7
54	**17.9**
55	25
56	10.7
57	10.7
58	14.3



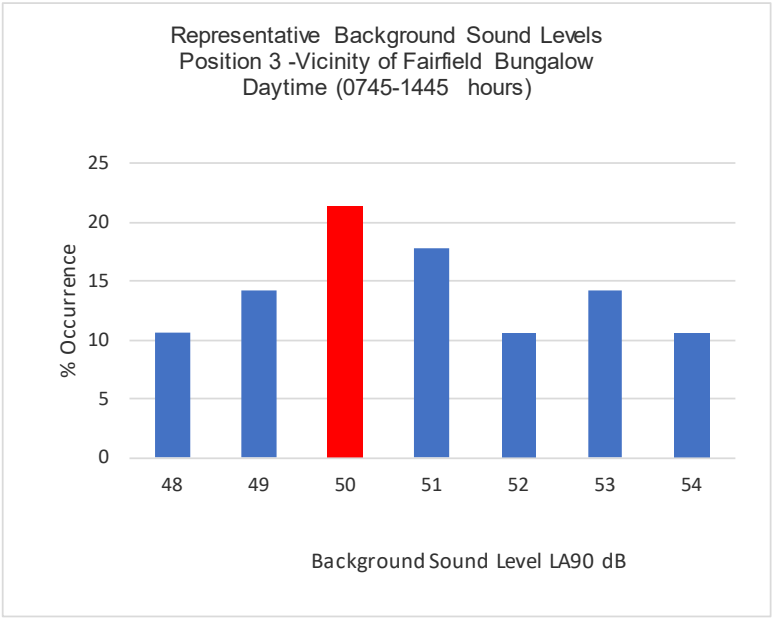


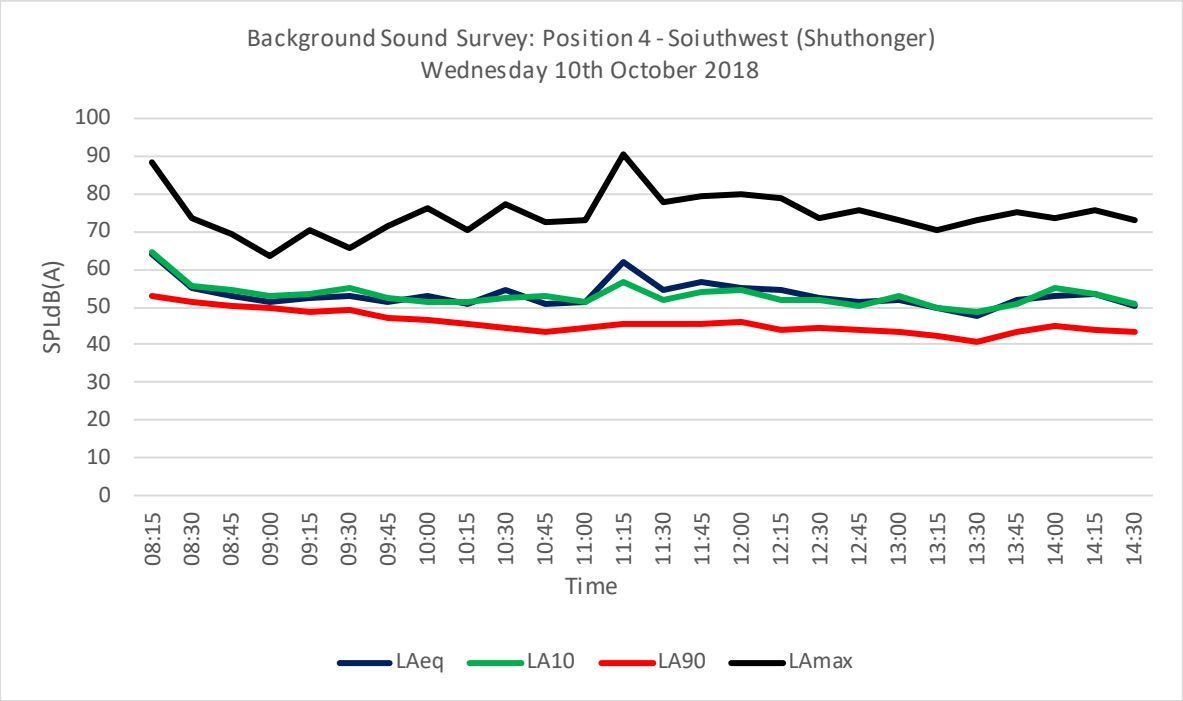
LA90	% Occurrence
44	25
45	21.4
46	3.6
47	14.3
48	7.1
49	0
50	3.6
51	3.6
52	0
53	3.6
54	3.6
55	14.3



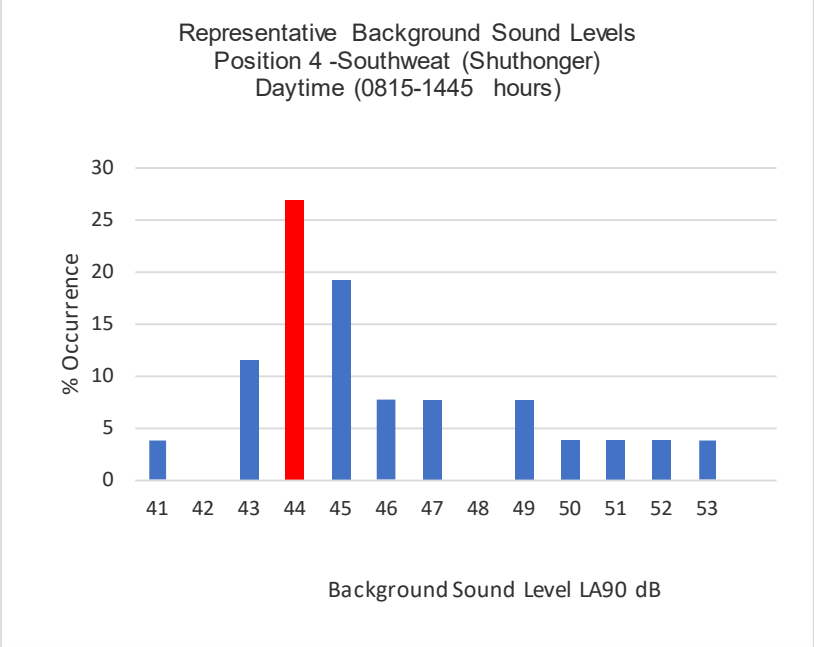


LA90	% Occurrence
48	10.7
49	14.3
50	**21.4**
51	17.9
52	10.7
53	14.3
54	10.7





LA90	% Occurrence
41	3.8
42	0
43	11.5
44	**26.9**
45	19.2
46	7.7
47	7.7
48	0
49	7.7
50	3.8
51	3.8
52	3.8
53	3.8



NVC/7

**PREDICTED NOISE FROM
FIXED AND MOBILE PLANT ON SITE
AT NOISE SENSITIVE RECEPTORS**

Predicted Noise Contribution from Fixed and Mobile Plant on site

Processing Plant Noise

Phased Workings	Receptor	Range of likely noise contribution from Site $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Processing activities	1. Silvermead (north)	37	55	None
	2. Bow Farm	45	54	None
	3. Puck Cottage etc (east)	43-45	54	None
	4. Bowbridge Cottage etc (east)	48-50	54	None
	5. Puckrup Lane (Puckrup Hall)	50	53	None
	6. Fairfield Bungalow	51-52	55	None
	7. Southeast (Twyning)	44-48	54	None
	8. South (Redpools)	44	55	None
	9. Southwest (Windmill Tump)	37-39	53*	None
	10. West (The Stalls etc.)	37-38	54*	None

Extraction Activities (with mitigation measures)

Soil strip & construction of boundary screening measures

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Temporary Construction Activities	1. Silvermead (north)	35-41	70	None
	2. Bow Farm	44-61	70	None
	3. Puck Cottage etc (east)	43-57	70	None
	4. Bowbridge Cottage etc (east)	41-48	70	None
	5. Puckrup Lane (Puckrup Hall)	35-43	70	None
	6. Fairfield Bungalow	34-35	70	None
	7. Southeast (Twyning)	31-42	70	None
	8. South (Redpools)	34-41	70	None
	9. Southwest (Windmill Tump)	32-40	70	None
	10. West (The Stalls etc.)	33-39	70	None

Note: Assumes processing plant not operating.

Extraction Phases 1 & 2 (with screening)

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction Activities	1. Silvermead (north)	40-43	55	None
	2. Bow Farm	42-49	54	None
	3. Puck Cottage etc (east)	42-51	54	None
	4. Bowbridge Cottage etc (east)	42-50	54	None
	5. Puckrup Lane (Puckrup Hall)	39-49	53	None
	6. Fairfield Bungalow	34-43	55	None
	7. Southeast (Twyning)	36-48	54	None
	8. South (Redpools)	37-45	55	None
	9. Southwest (Windmill Tump)	35-40	53*	None
	10. West (The Stalls etc.)	35-40	54*	None

Note: Assumes processing plant not operating. *****Assumed to be similar to other positions due to relative position to M50 Motorway

Extraction Phases 3 to 9 & Flexible Working Areas Phase A & B (with screening)

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction Activities	1. Silvermead (north)	32-36	55	None
	2. Bow Farm	44-52	54	None
	3. Puck Cottage etc (east)	40-47	54	None
	4. Bowbridge Cottage etc (east)	41-47	54	None
	5. Puckrup Lane (Puckrup Hall)	38-42	53	None
	6. Fairfield Bungalow	33-35	55	None
	7. Southeast (Twyning)	36-42	54	None
	8. South (Redpools)	38-42	55	None
	9. Southwest (Windmill Tump)	35-42	53*	None
	10. West (The Stalls etc.)	35-40	54*	None

Note: Assumes processing plant not operating. *Assumed to be similar to other positions due to relative position to M50 Motorway

Restoration of Phased Working

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Temporary Restoration Activities	1. Silvermead (north)	35-41	70	None
	2. Bow Farm	44-61	70	None
	3. Puck Cottage etc (east)	43-57	70	None
	4. Bowbridge Cottage etc (east)	41-48	70	None
	5. Puckrup Lane (Puckrup Hall)	35-43	70	None
	6. Fairfield Bungalow	34-35	70	None
	7. Southeast (Twyning)	31-42	70	None
	8. South (Redpools)	34-41	70	None
	9. Southwest (Windmill Tump)	32-40	70	None
	10. West (The Stalls etc.)	33-39	70	None

Note: Assumes processing plant not operating.

Cumulative Effect of Mineral Extraction & Processing Plant

Activity	Receptor	Range of likely noise contribution from activities $LAeq_{1hr}$ dB	Maximum Noise Criteria $LAeq_{1hr}$ dB	Increase above maximum noise criteria
Extraction & Processing Activities	1. Silvermead (north)	38-44	55	None
	2. Bow Farm	47-53	54	None
	3. Puck Cottage etc (east)	45-52	54	None
	4. Bowbridge Cottage etc (east)	49-53	54	None
	5. Puckrup Lane (Puckrup Hall)	50-53	53	None
	6. Fairfield Bungalow	51-53	55	None
	7. Southeast (Twyning)	45-51	54	None
	8. South (Redpools)	45-48	55	None
	9. Southwest (Windmill Tump)	39-44	53*	None
	10. West (The Stalls etc.)	39-42	54*	None

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PLANT INVENTORY & NOISE LEVELS

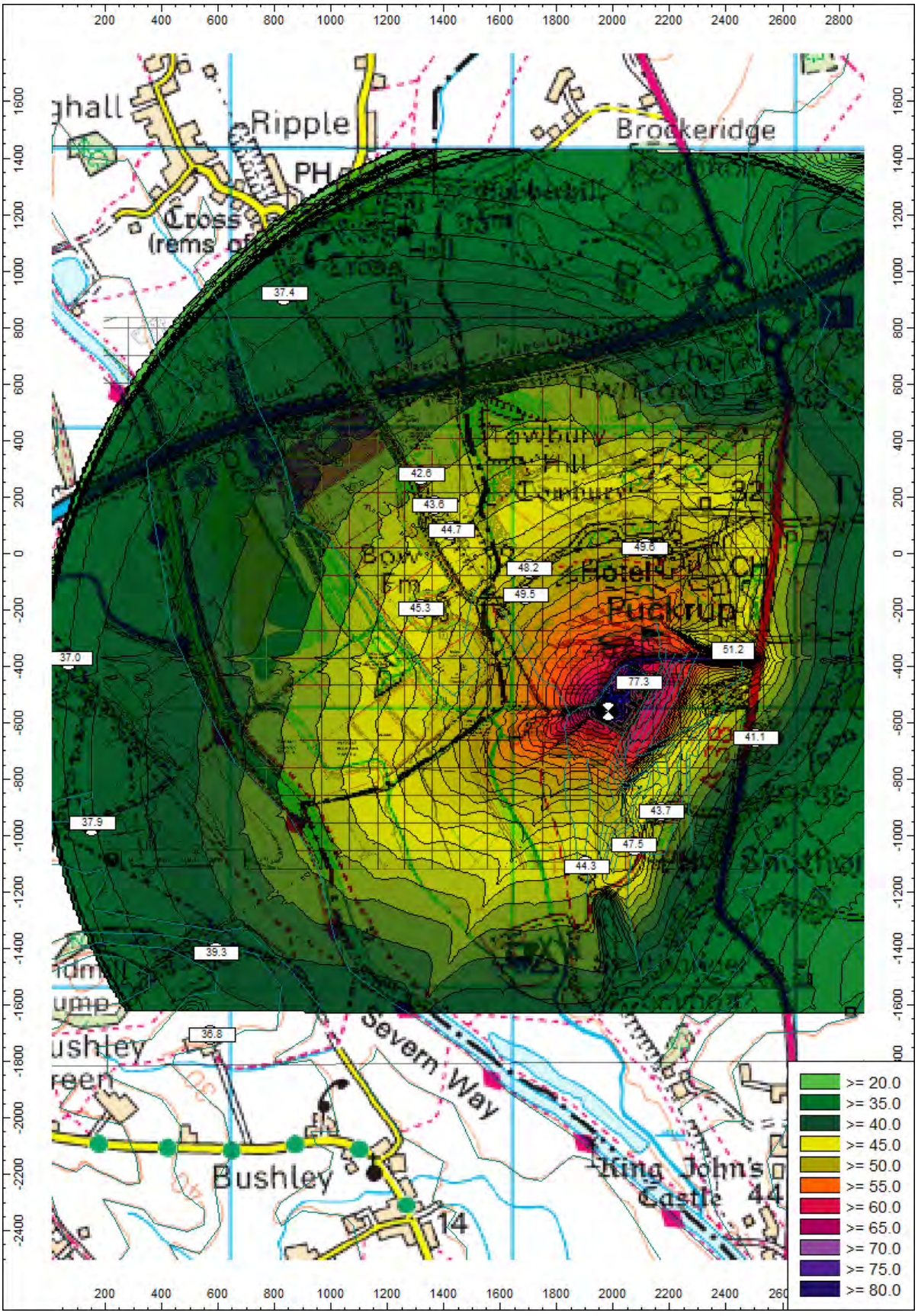
PLANT INVENTORY
NOISE LEVELS

Plant	**Measured Sound Pressure Levels LAeq dB**	**Assumed Sound Power Levels dBA**
Tracked Excavator	77 @ 10m	105
Loading Hopper & Conveyor	52-62 @ 10m	80-90
De-watering Pump	75 @10m	103
Front Loader	74 @ 10m	102
Dump Truck	78 @ 10m	106
Power Screen & Wash Plant	81 @ 10m	109
Bulldozer	78 @ 10m	106
HGV	73 @ 10m	101

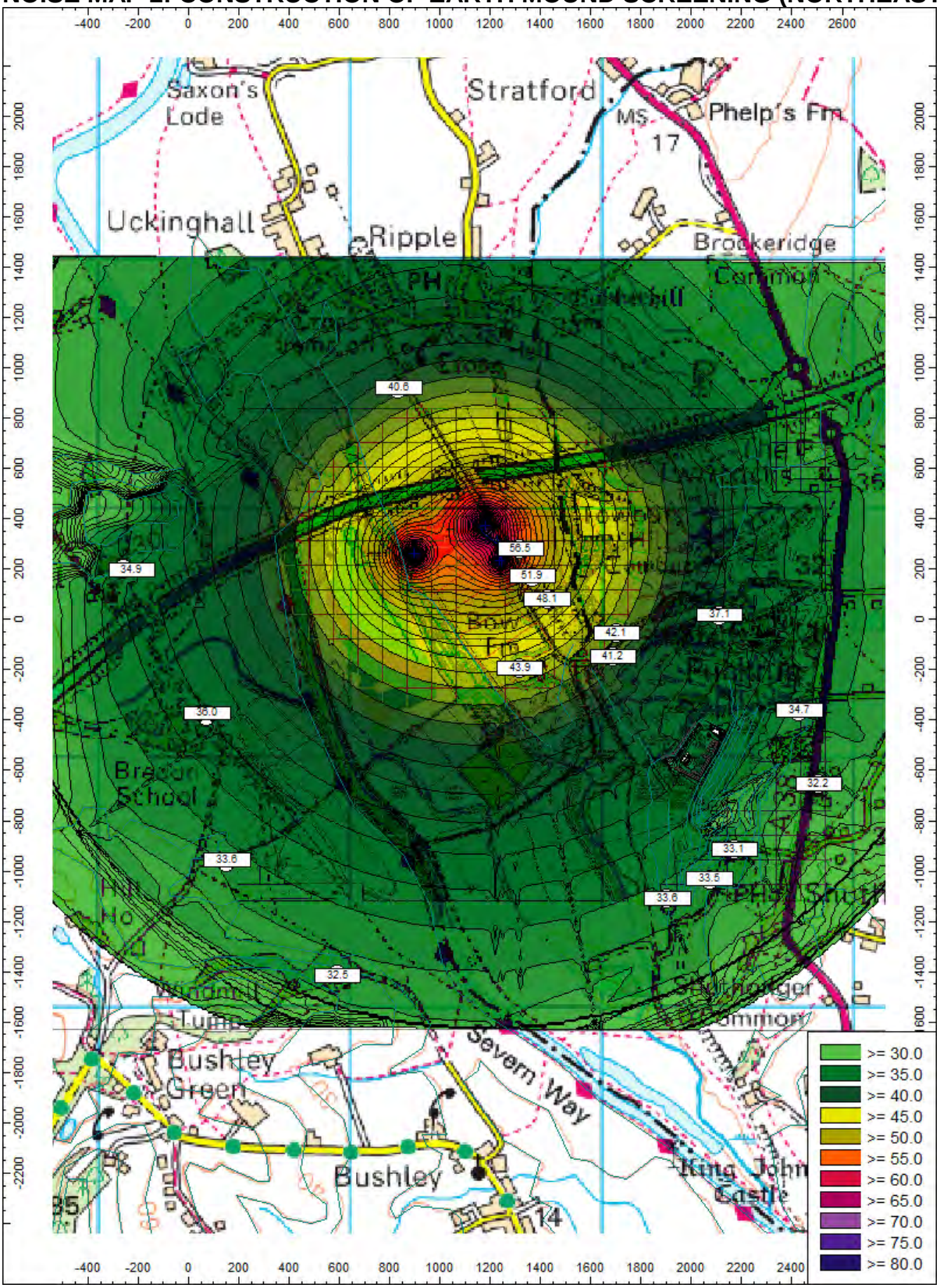
NVC/9

NOISE PREDICTION MAPPING
SITE EXTRACTION AREA

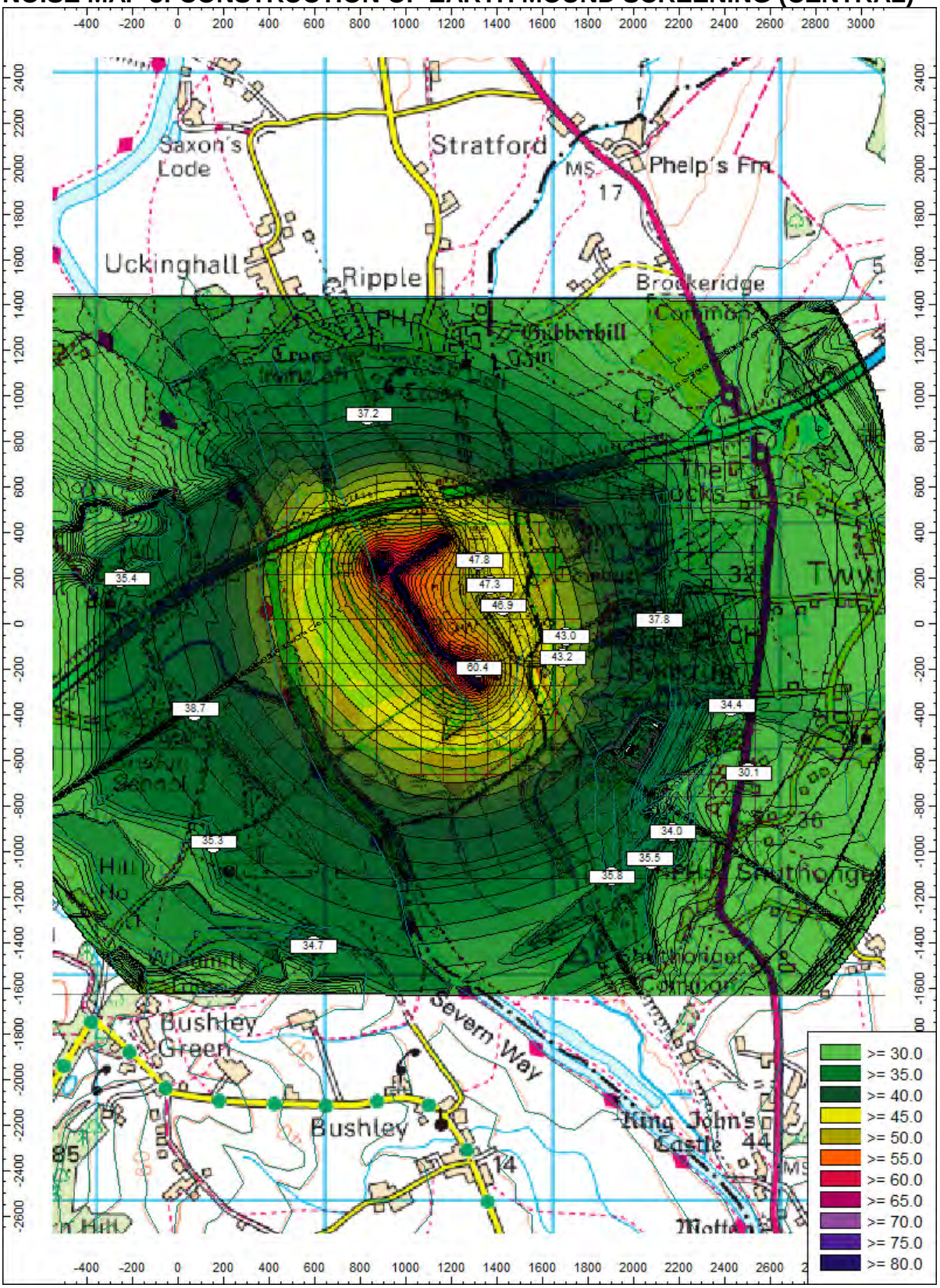
NOISE MAP 1: PROCESSING PLANT



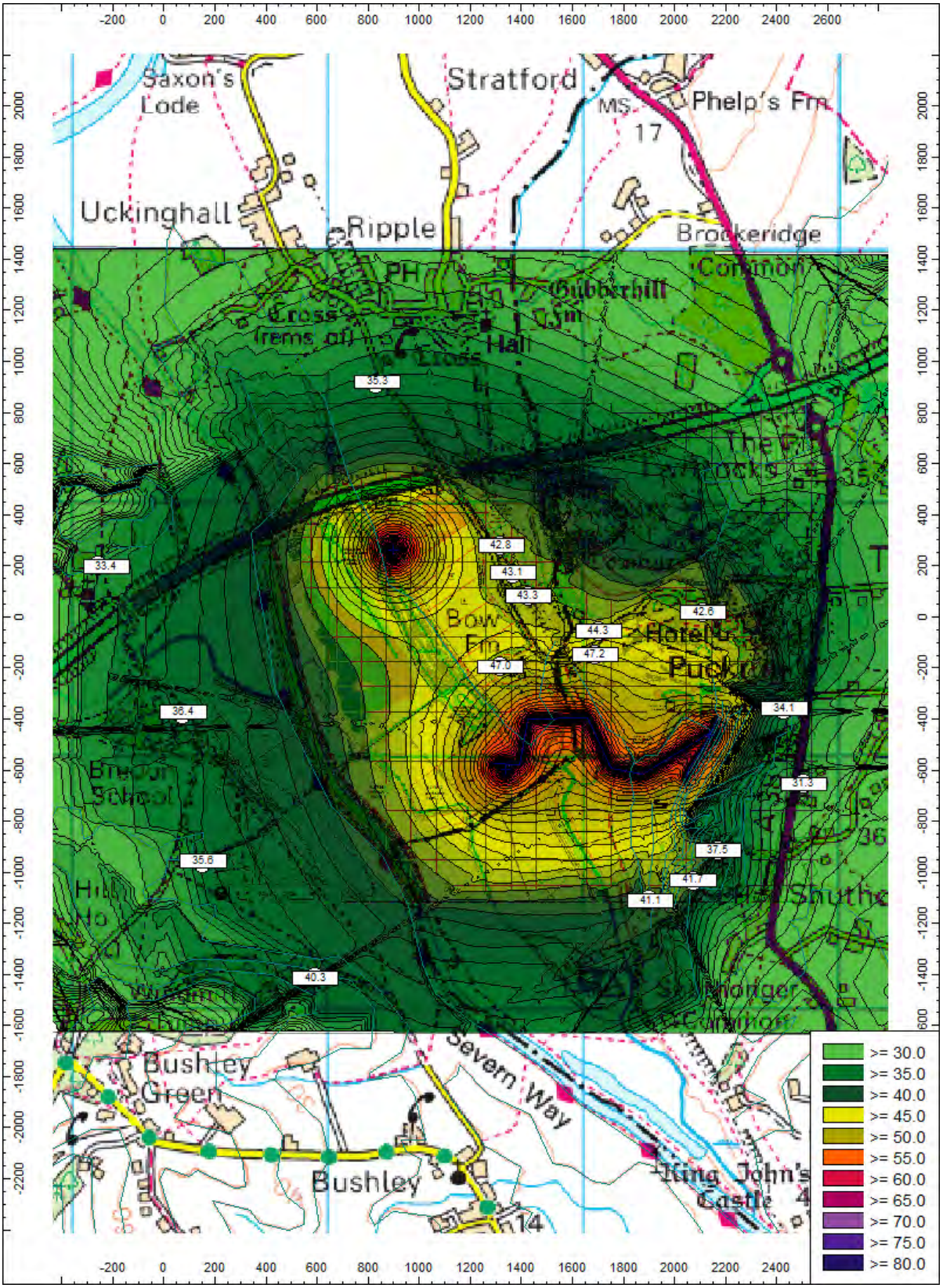
NOISE MAP 2: CONSTRUCTION OF EARTH MOUND SCREENING (NORTHEAST)



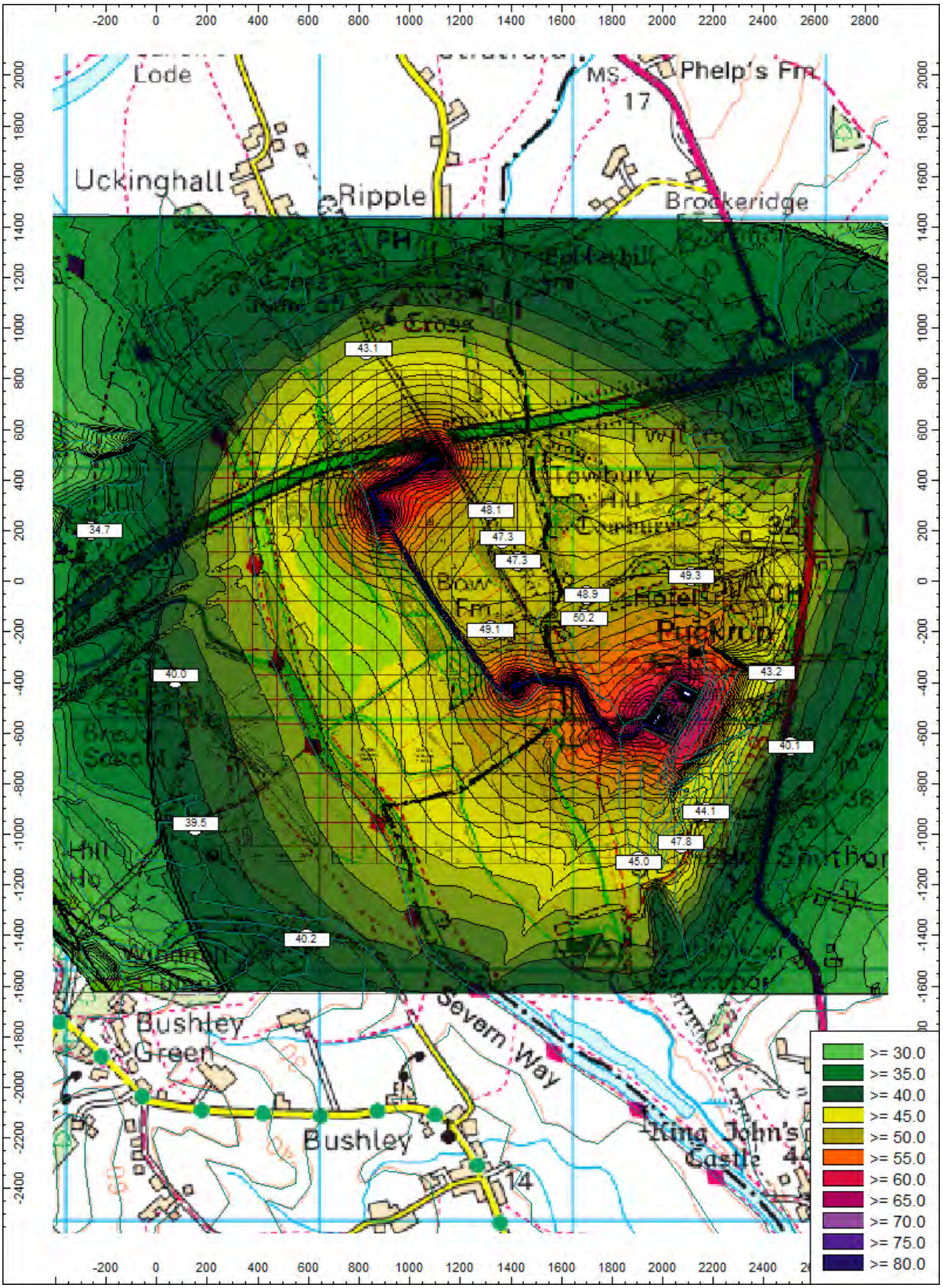
NOISE MAP 3: CONSTRUCTION OF EARTH MOUND SCREENING (CENTRAL)



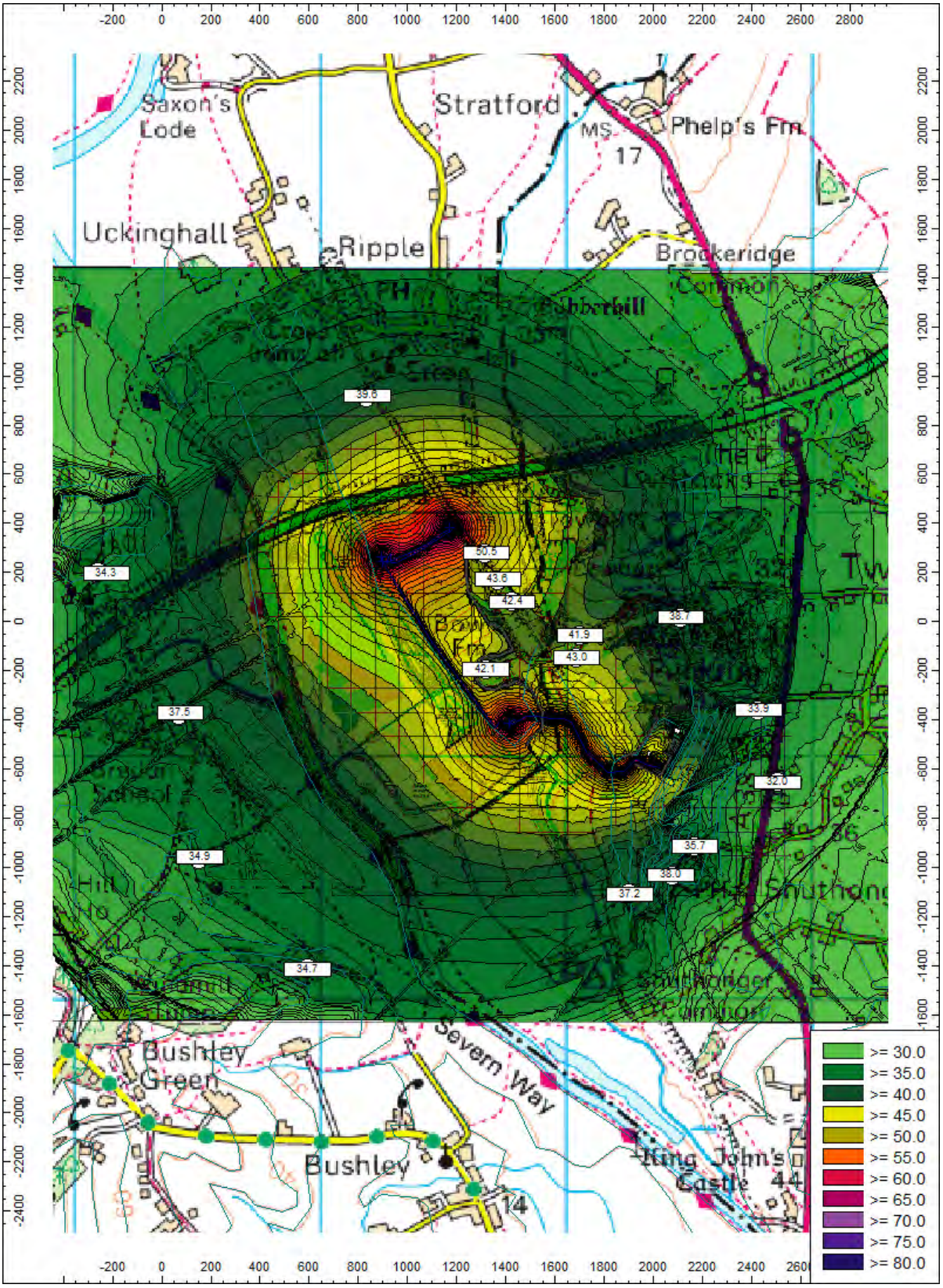
NOISE MAP 4: CONSTRUCTION OF EARTH MOUND SCREENING (SOUTH)



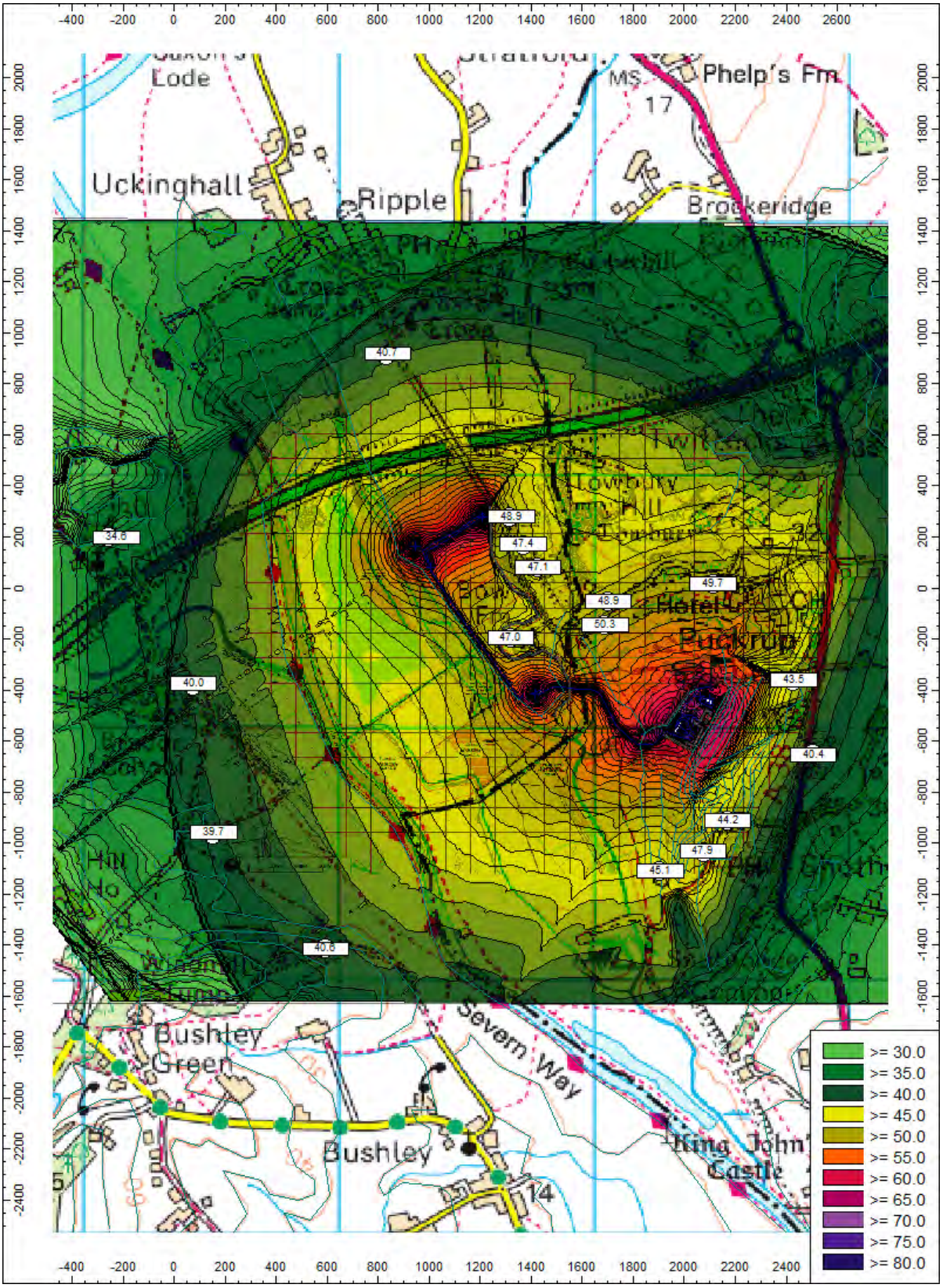
NOISE MAP 5: EXTRACTION ACTIVITIES PHASES 1 & 2



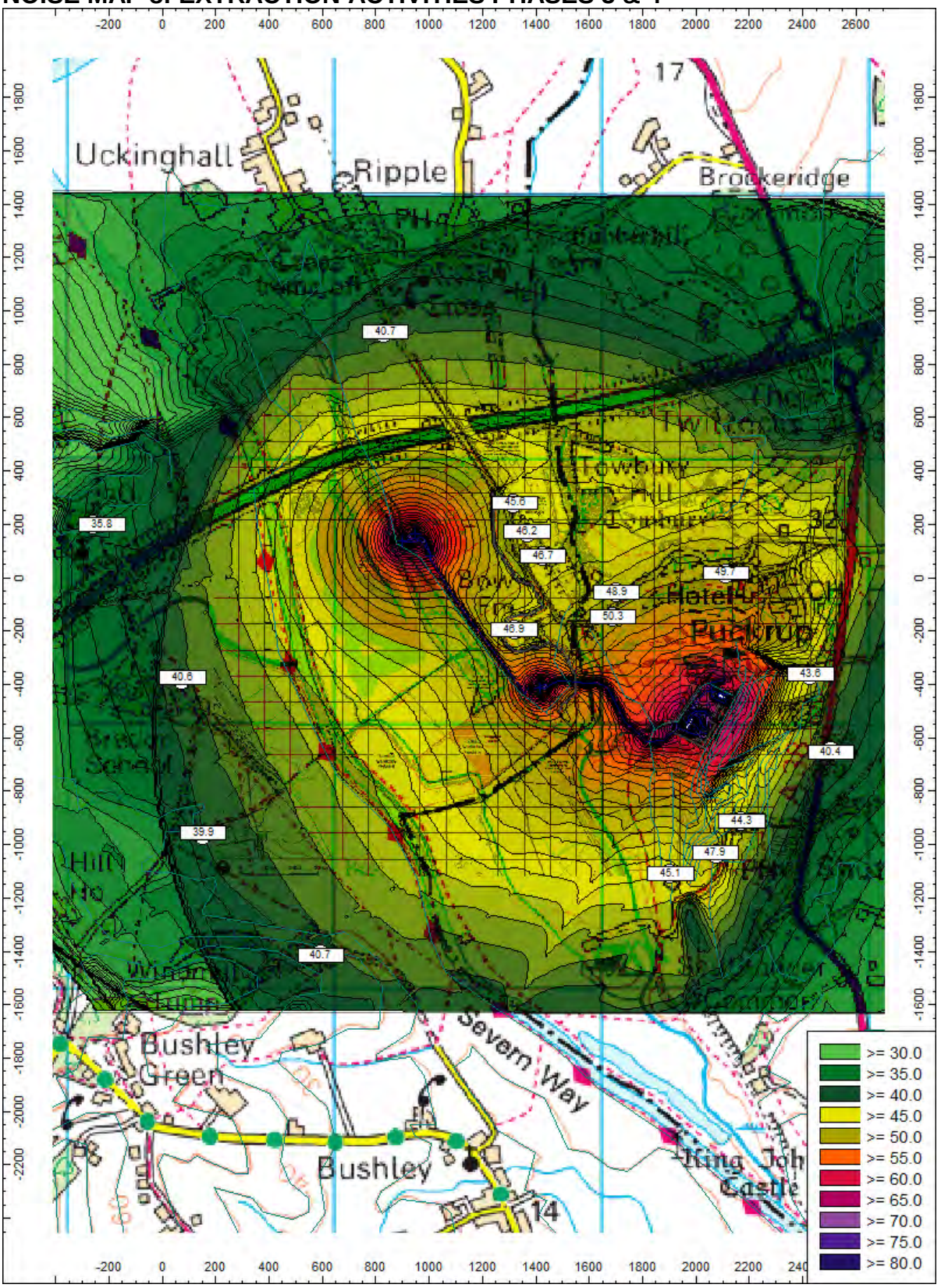
NOISE MAP 6: EXTRACTION ACTIVITIES PHASES 1 & 2



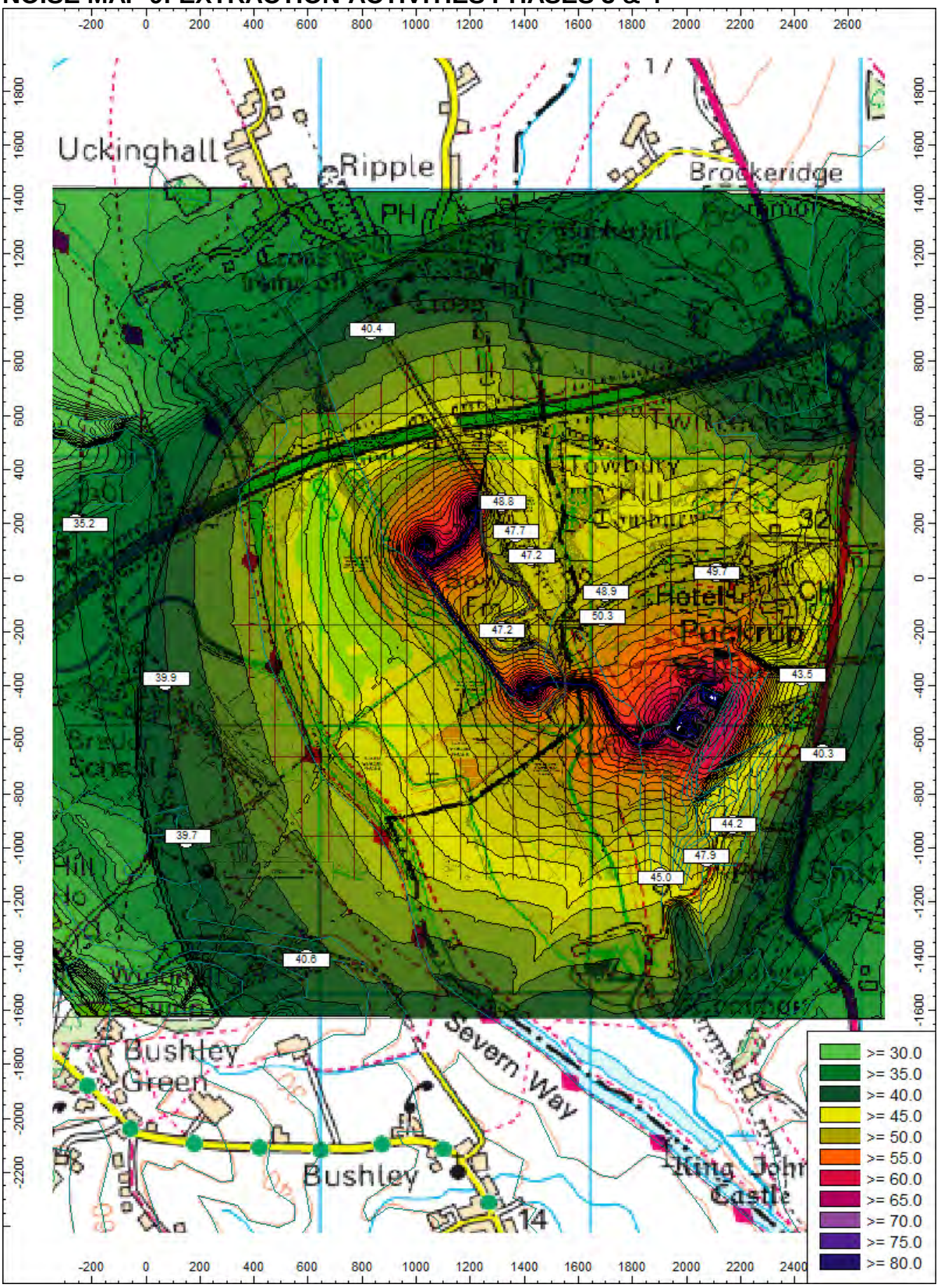
NOISE MAP 7: EXTRACTION ACTIVITIES PHASES 3 & 4



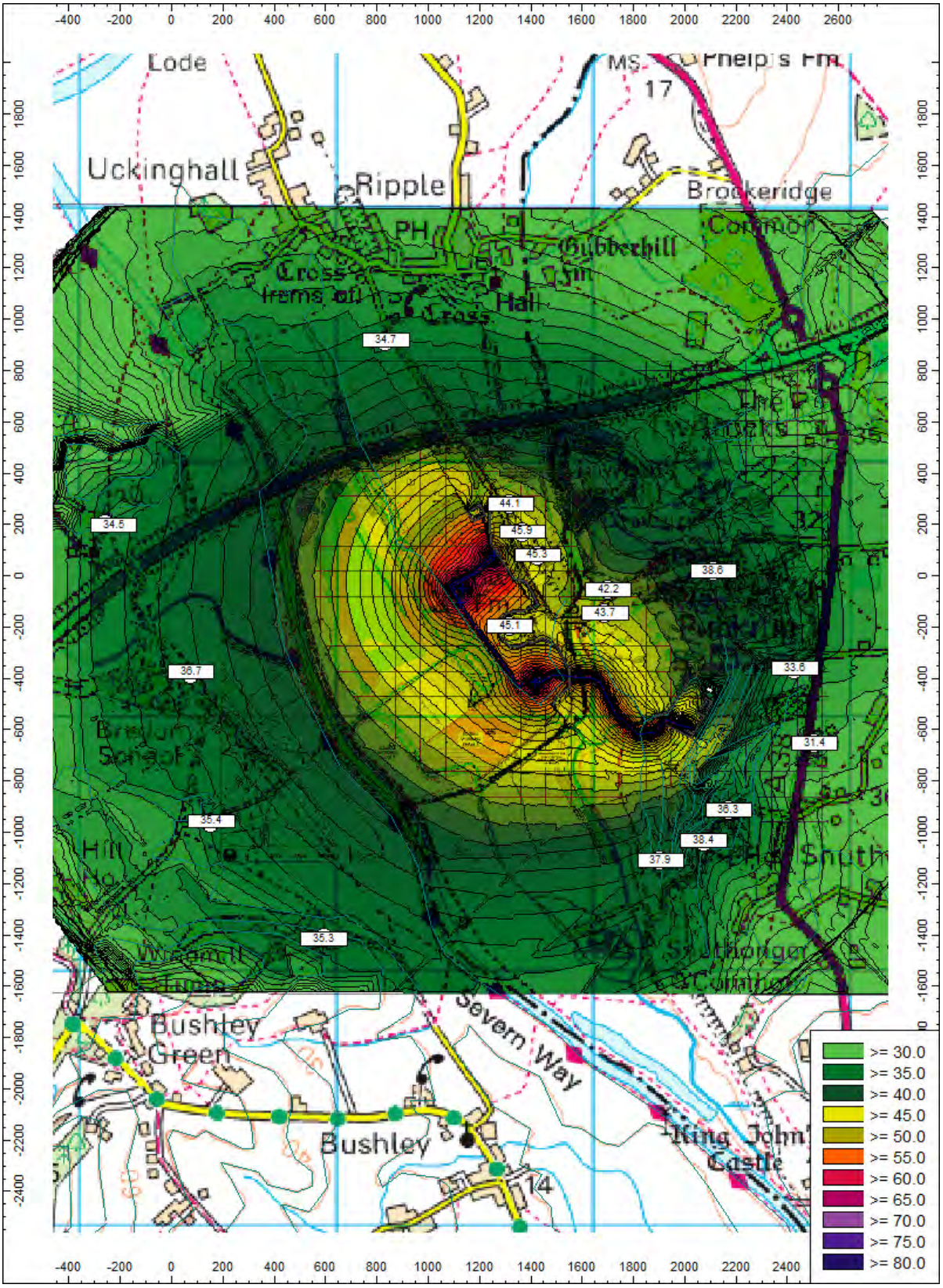
NOISE MAP 8: EXTRACTION ACTIVITIES PHASES 3 & 4



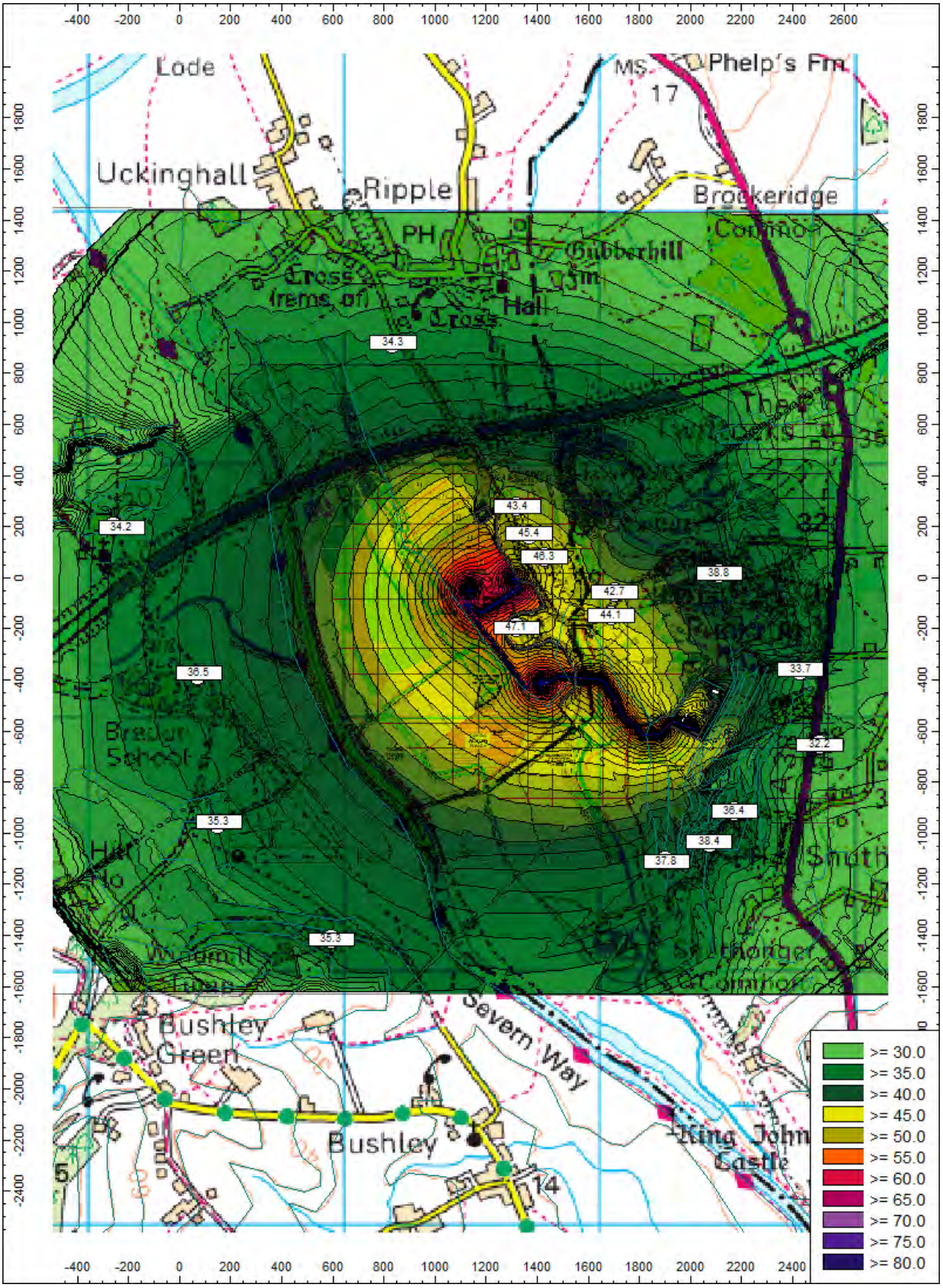
NOISE MAP 9: EXTRACTION ACTIVITIES PHASES 3 & 4



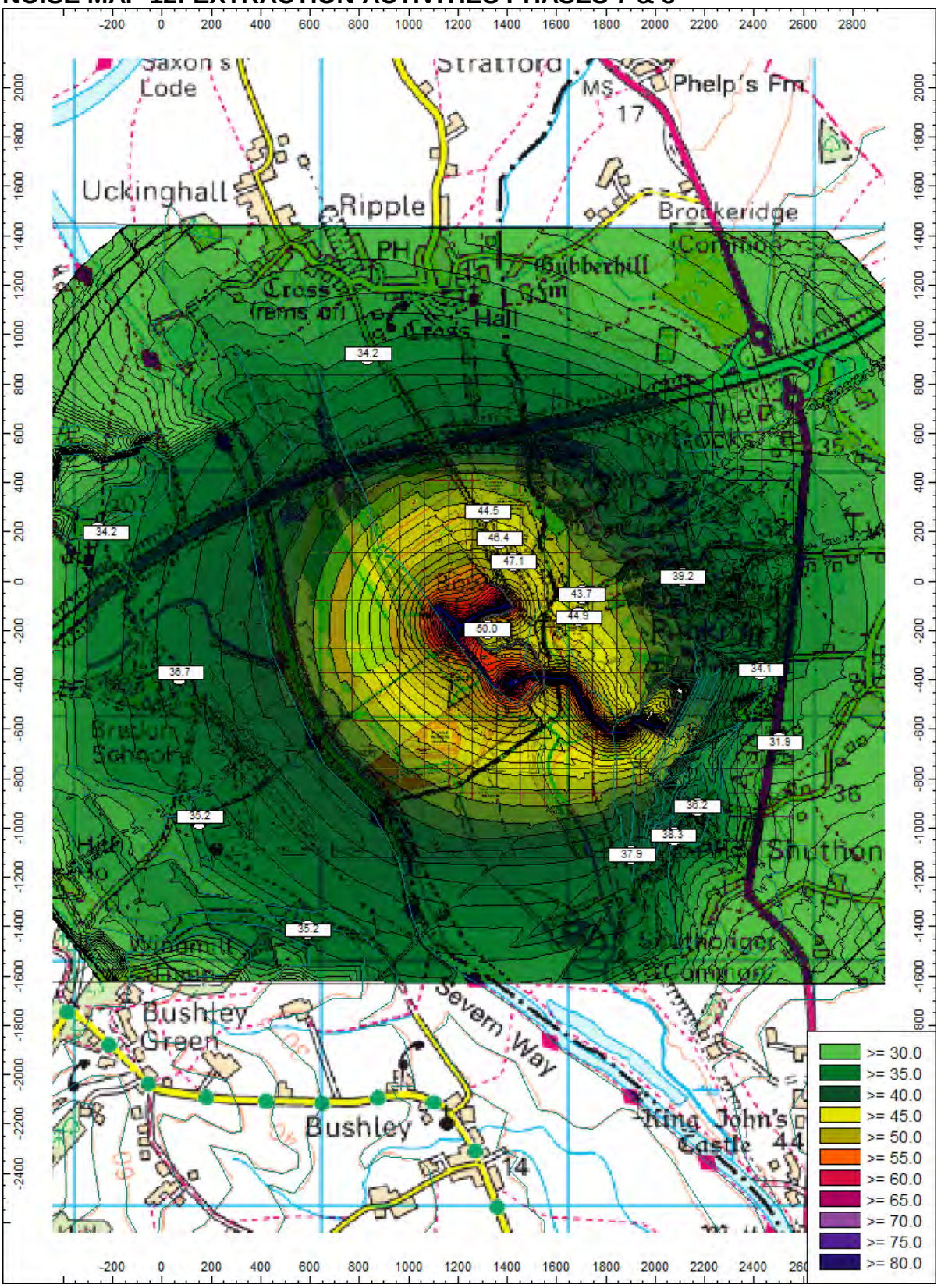
NOISE MAP 10: EXTRACTION ACTIVITIES PHASES 5 & 6



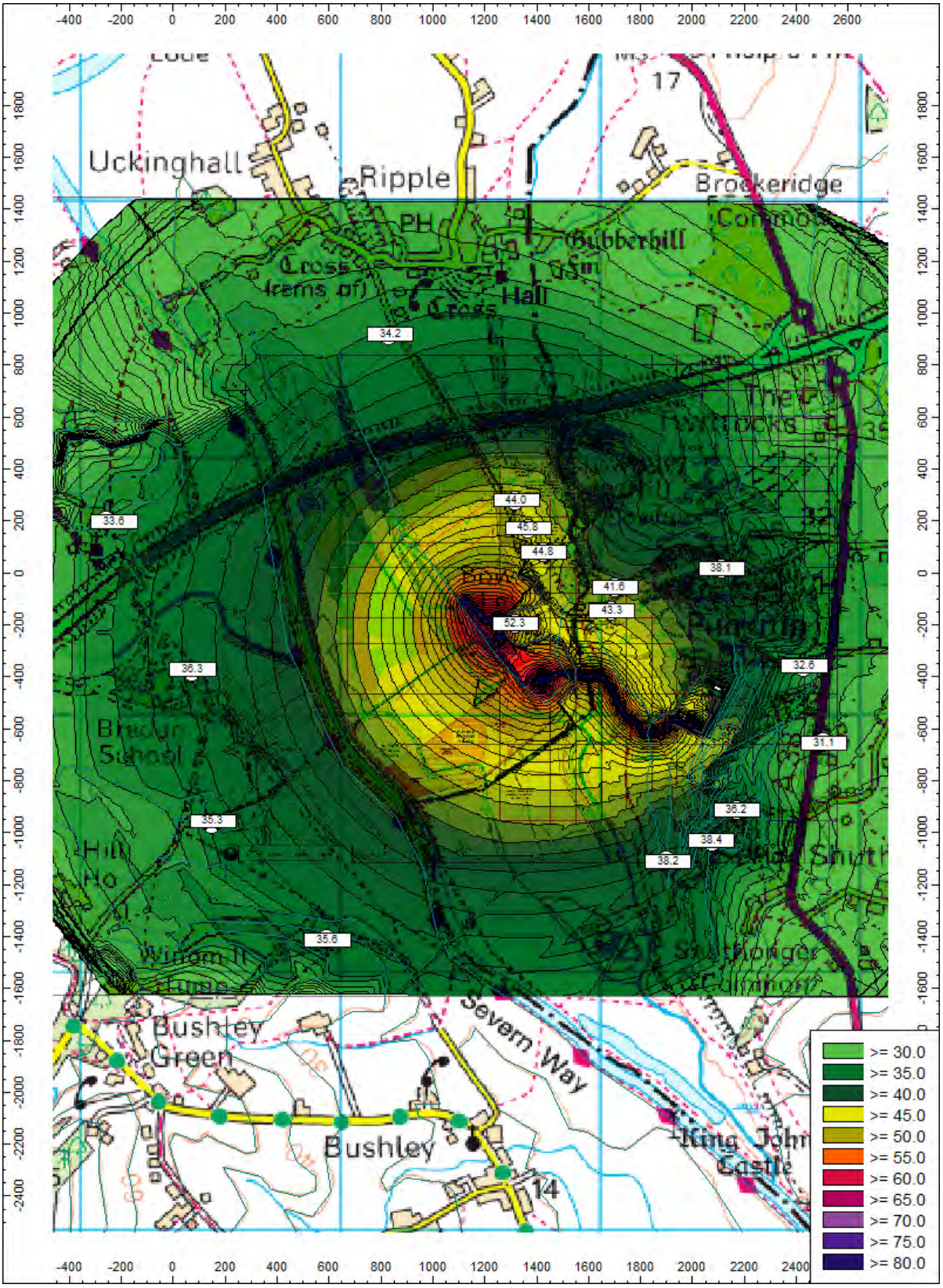
NOISE MAP 11: EXTRACTION ACTIVITIES PHASES 5 & 6



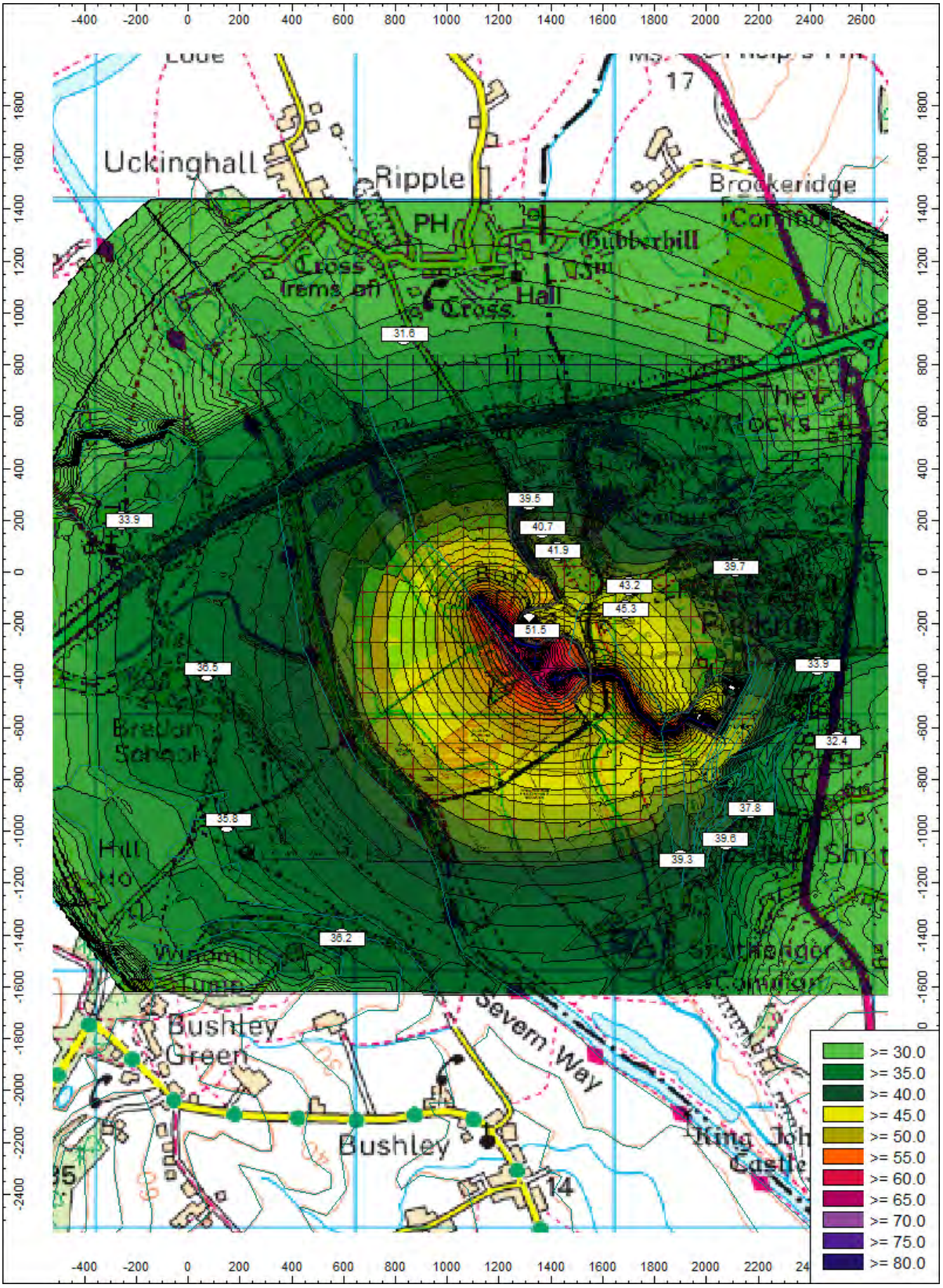
NOISE MAP 12: EXTRACTION ACTIVITIES PHASES 7 & 8



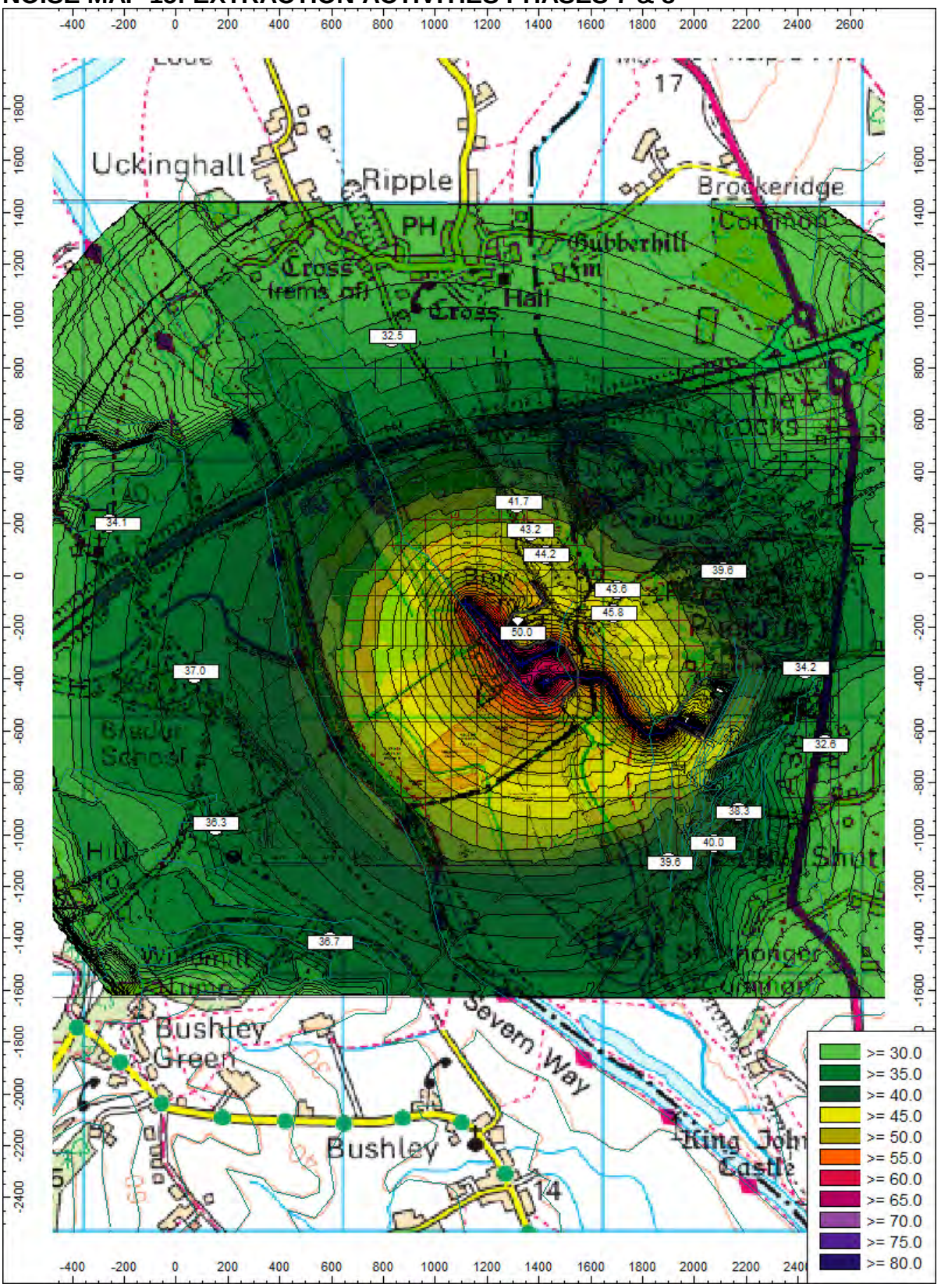
NOISE MAP 13: EXTRACTION ACTIVITIES PHASES 7 & 8



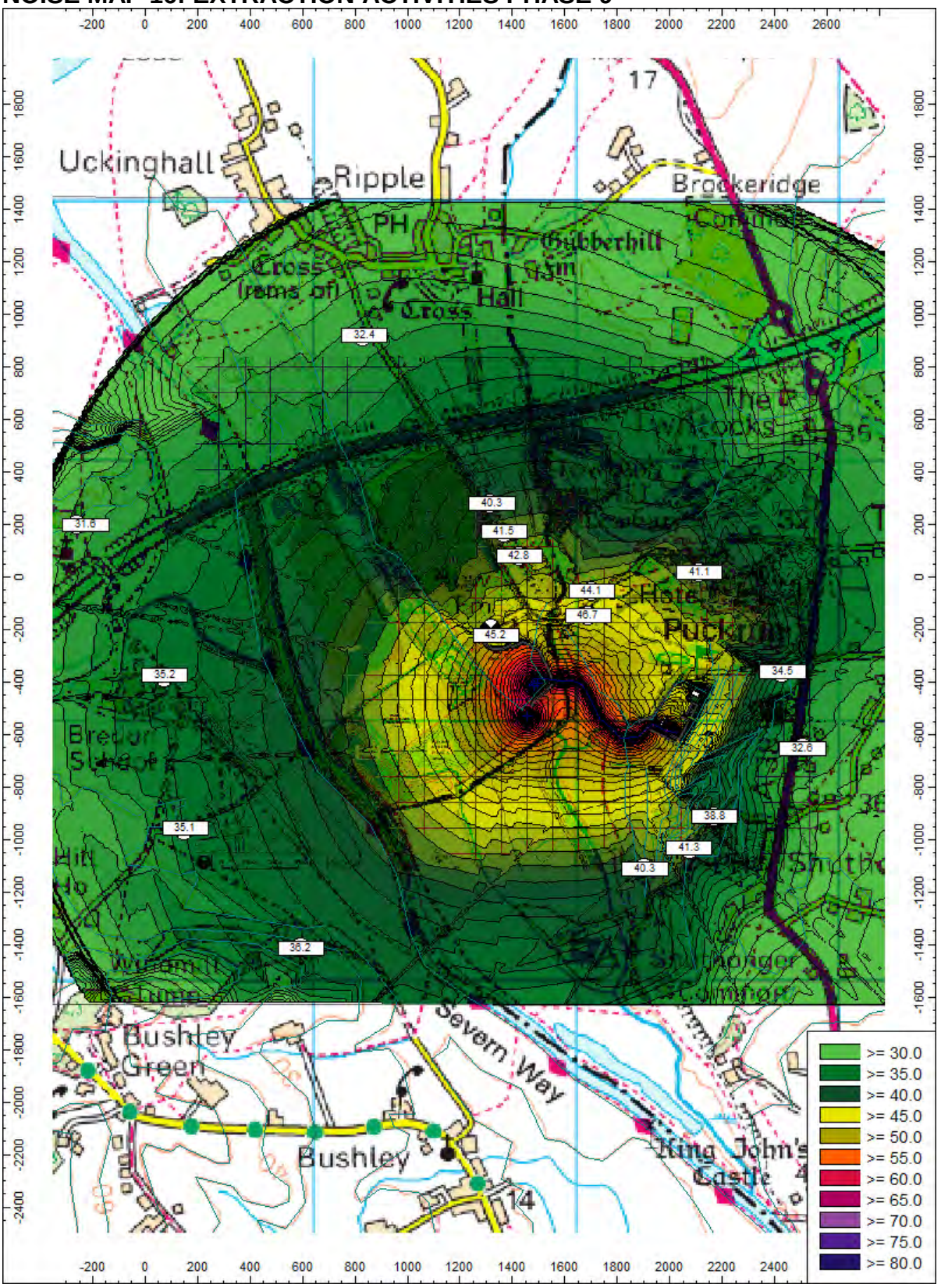
NOISE MAP 14: EXTRACTION ACTIVITIES PHASES 7 & 8



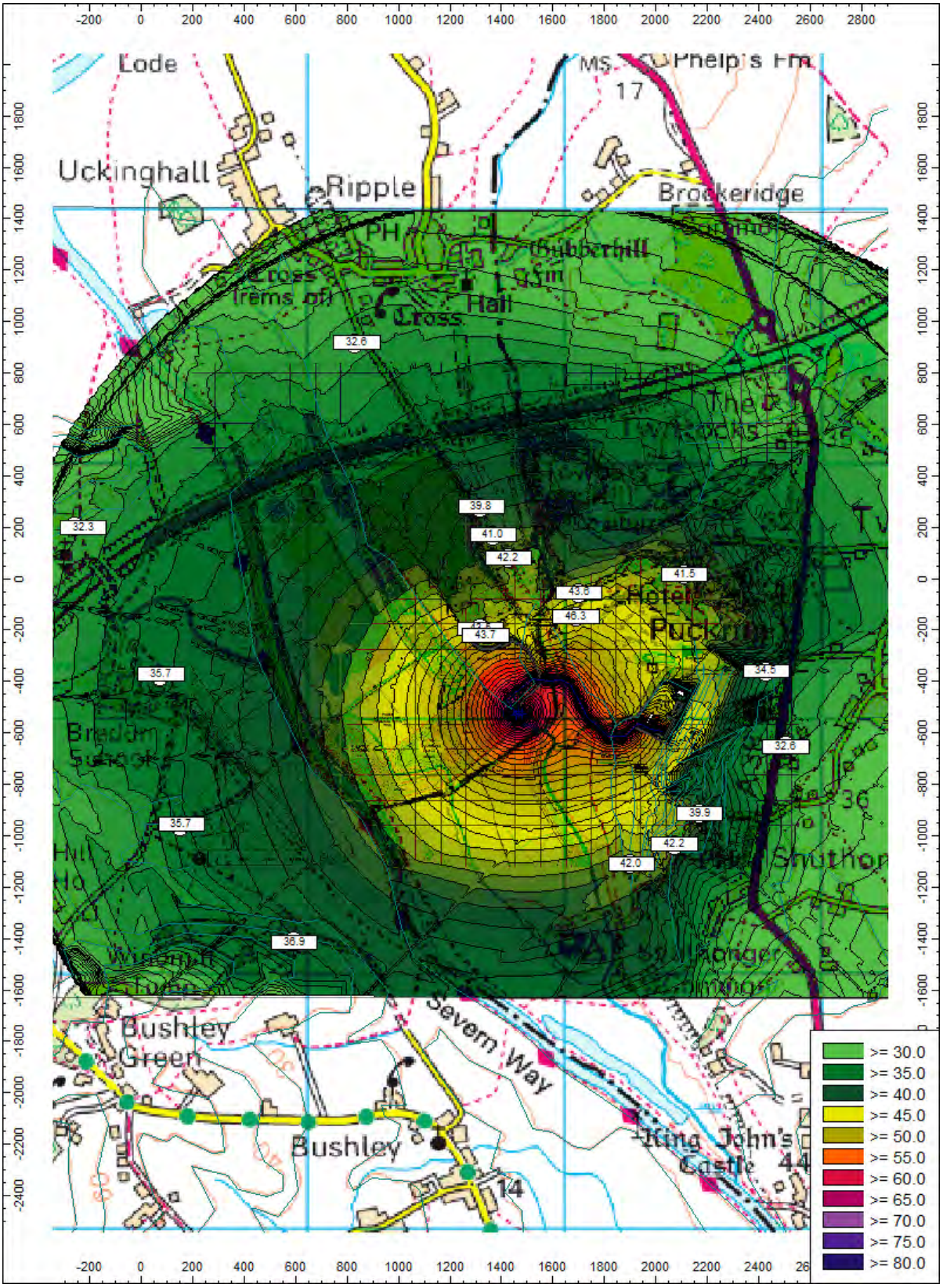
NOISE MAP 15: EXTRACTION ACTIVITIES PHASES 7 & 8



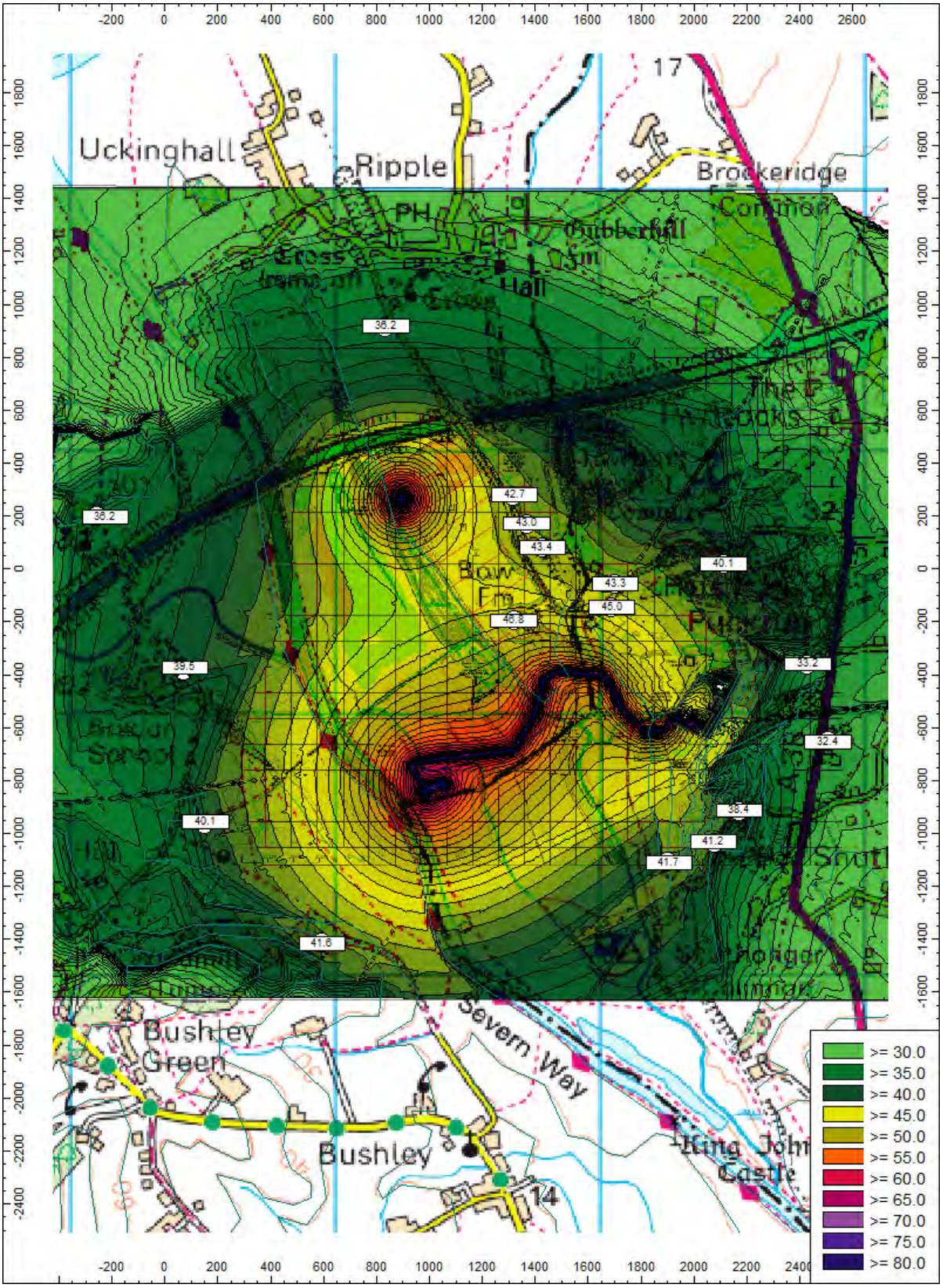
NOISE MAP 16: EXTRACTION ACTIVITIES PHASE 9



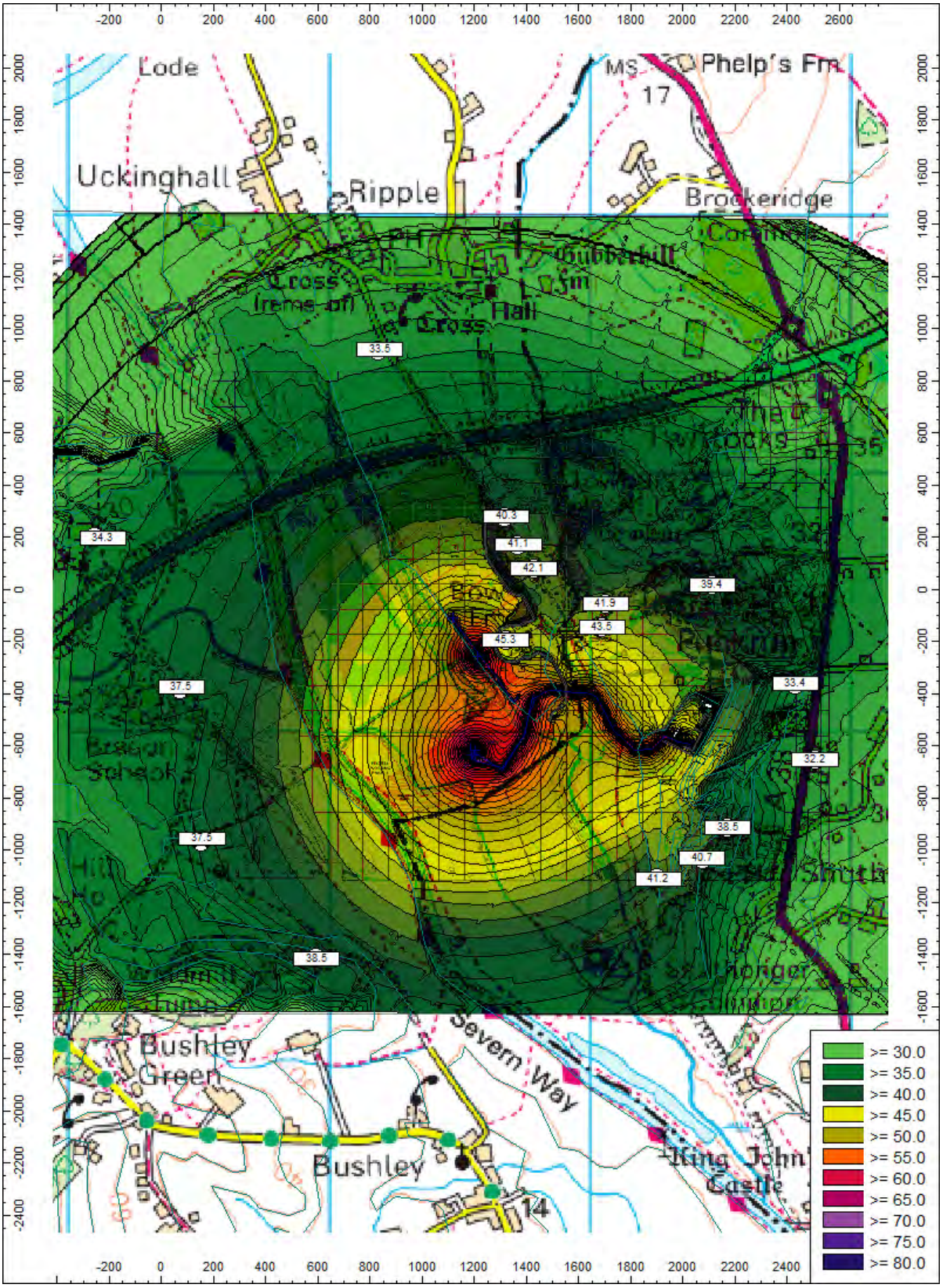
NOISE MAP 17: EXTRACTION ACTIVITIES PHASE 9



NOISE MAP 18: EXTRACTION PHASE 1 FLEXIBLE WORKING



NOISE MAP 19: EXTRACTION PHASES 7 & 8 FLEXIBLE WORKING



NVC/10

GROUND VIBRATION LEVELS

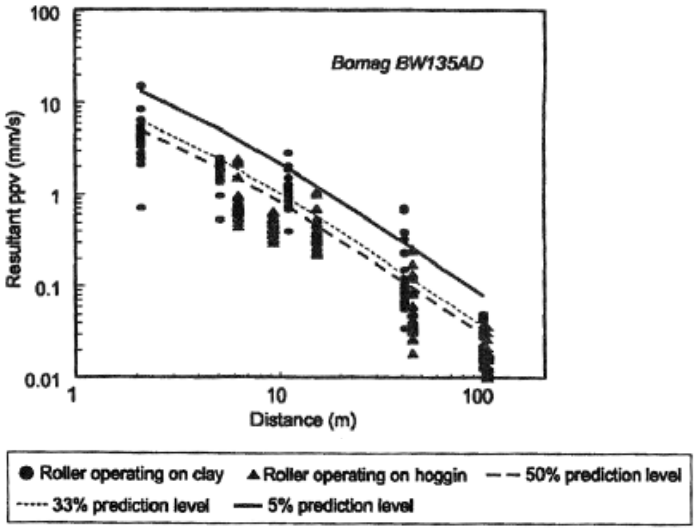
Ground Vibration Research

The New Zealand Transport Agency published a research paper entitled `Ground Vibration from Road Construction' in May 2012, which includes a table of measured PPV values for different types of plant. The results have been provided below as an extract from the paper for ease of reference.

Measured vibration source levels for construction equipment (adapted from Hanson et al 2006)

Equipment	PPV at 7.6m (mm/s)
Pile driver (impact)	38.6 (upper range)
	16.4 (typical)
Pile driver (sonic)	18.6 (upper range)
	4.3 (typical)
Clam shovel drop (slurry wall)	5.1
Hydromill (slurry wall)	0.2 (in soil)
	0.4 (in rock)
Vibratory roller	5.3
Hoe ram	2.3
Large bulldozer	2.3
Caisson drilling	2.3
Loaded trucks	1.9
Jackhammer	0.9
Small bulldozer	0.1

Measured vibration levels from Bomag vibratory compactor and probability of exceedance curves (Hiller & Crabb 2000)



Vehicle Vibration Monitoring Details

Monitoring of HGVs and other vehicles at kerbside

Date of Tests: 23 September 2010

The seismograph only triggered when some of the vehicles passed the monitoring positions. The following tables detail the results of the ground vibration survey.

Position 1:

Date: 23rd September 2010
Scawby Road Ground Vibration Measurements

Time:	Location:	Position:	Vibration level X (m/s2)	Y (m/s2)	Z (m/s2)
08:26	Scawby Road (corner) (2m from kerbside)	Cars near & farside	0.191	0.127	0.318
08:26	Scawby Road (corner) (2m from kerbside)	HGV far side	0.191	0.127	0.254
08:38	Scawby Road (corner) (2m from kerbside)	Cars near & farside	0.191	1.27	0.254
08:39	Scawby Road (corner) (2m from kerbside)	Car far side Car	0.191	1.27	0.254
08:39	Scawby Road (corner) (2m from kerbside)	near side	0.254	0.127	0.254
08:43	Scawby Road (corner) (2m from kerbside)	Tractor far side	0.318	0.127	0.254
08:44	Scawby Road (corner) (2m from kerbside)	Car near side	0.191	0.127	0.254
08:45	Scawby Road (corner) (2m from kerbside)	HGV near side	0.318	0.254	0.508
08:46	Scawby Road (corner) (2m from kerbside)	Car near side	0.254	0.191	0.254
08:56	Scawby Road (corner) (2m from kerbside)	Straw Trailer (empty) near side	0.381	0.318	0.381
08:57	Scawby Road (corner) (2m from kerbside)	Car near side	0.254	0.127	0.318
08:57	Scawby Road (corner) (2m from kerbside)	HGV near side	0.381	0.254	0.445
08:58	Scawby Road (corner) (2m from kerbside)	HGV Double Trailer nearside	0.254	0.191	0.445
08:59	Scawby Road (corner) (2m from kerbside)	HGV far side	0.191	0.127	0.254
08:59	Scawby Road (corner) (2m from kerbside)	Car near side	0.254	0.127	0.254
09:00	Scawby Road (corner) (2m from kerbside)	HGV Double Trailer far side	0.254	0.127	0.254
09:01	Scawby Road (corner) (2m from kerbside)	HGV far side	0.445	0.191	0.381
09:03	Scawby Road (corner) (2m from kerbside)	Articulated HGV Far side	0.254	0.127	0.254
09:08	Scawby Road (corner) (2m from kerbside)	Straw Trailer (empty) far side	0.254	0.127	0.254
09:09	Scawby Road (corner) (2m from kerbside)	HGV (Brian Plant) far side	0.191	0.127	0.254
09:11	Scawby Road (corner) (2m from kerbside)	HGV (Brian Plant) near side	0.254	0.127	0.318
09:12	Scawby Road (corner) (2m from kerbside)	Straw Trailer (loaded) near side	0.254	0.127	0.254
09:16	Scawby Road (corner)	HGV Tanker	0.254	0.127	0.254
	Highest Levels	Cars	0.254	0.127	0.318
	Highest Levels	HGVs	0.445	0.254	0.508
	Highest Levels	Straw Trailer	0.381	0.318	0.381
	Highest Levels	HGV near side	0.381	0.318	0.508
	Highest Levels	HGV far side	0.445	0.191	0.381

Position 2

Date: 23rd September 2010

Access Road

Time:	Location:	Position:	Vibration level X (m/s2)	Y (m/s2)	Z (m/s2)
09:29	Access Road (2-3m)	Straw Trailer (loaded) far side	0.254	0.127	0.254
09:30	Access Road (2-3m)	HGV (Tanker) far side	0.318	0.318	0.254
09:31	Access Road (1m)	Straw Trailer (loaded) near side	0.318	0.318	0.318
09:31	Access Road (5m)	Straw Trailer (loaded) leaving junction	0.191	0.127	0.254
09:33	Access Road (1m)	Car near side	0.191	0.127	0.254
	Highest levels	Cars	0.191	0.127	0.254
	Highest levels	HGVs	0.318	0.318	0.254
	Highest levels	Straw Trailer	0.318	0.318	0.318

Position 3:

Date: 23rd September 2010

193 Scawby Road (on pavement)

Time:	Location:	Position:	Vibration level X (m/s2)	Y (m/s2)	Z (m/s2)
10:59	Pavement (1-2m from Scawby Road)	HGV Far Side	0.254	0.127	0.254
11:02	Pavement (1-2m from Scawby Road)	Car near side	0.191	0.127	0.254
11:03	Pavement (1-2m from Scawby Road)	HGV Far Side	0.254	0.127	0.254
11:05	Pavement (1-2m from Scawby Road)	Car near side	0.254	0.127	0.254
11:05	Pavement (1-2m from Scawby Road)	HGV (flatbed) loaded near side	0.445	0.318	0.381
11:06	Pavement (1-2m from Scawby Road)	Car near side	0.191	0.127	0.254
11:07	Pavement (1-2m from Scawby Road)	Car near side	0.191	0.127	0.254
11:07	Pavement (1-2m from Scawby Road)	HGV Near Side	0.445	0.381	0.445
11:07	Pavement (1-2m from Scawby Road)	Car near side	0.191	0.127	0.254
11:07	Pavement (1-2m from Scawby Road)	HGV Near Side	0.254	0.254	0.254
	Highest levels	Cars	0.254	1.270	0.254
	Highest levels	HGVs	0.445	0.381	0.445
	Highest levels	HGV near side	0.445	0.381	0.445
	Highest levels	HGV far side	0.254	0.127	0.254