Annex 2 – Correspondence with the Environmental Health Department at the Council

7 June, 2018

Ref: 12604-001 R0

Mr Ian Taylor
Assistant Environmental Health Officer
Shetland Islands Council
Environmental Health & Trading Standards
Infrastructure Services
Charlotte House
Commercial Road
Lerwick
ZE1 0LX

Sent by email only.

Dear Mr Taylor,

VIKING WIND FARM: NOISE ASSESSMENT

TNEI Services Ltd (TNEI) has been appointed by Viking Energy Partnership (VEP) to update the operational noise assessment for the Viking wind farm to bring it up to date with current industry best practice. This is considered appropriate and necessary as changes to best practice have occurred since the consent was originally awarded in April 2012. As part of this update the background noise survey, which involves placing noise monitoring equipment at a number of locations in the vicinity of the proposed wind farm, needs to be repeated.

Accordingly, and prior to commencing this work we would like to agree with you the methodology for the operational noise assessment and proposed background noise monitoring locations. As you may be aware Viking is still considering a number of potential turbines for the project so it follows this updated noise assessment will also be used to inform the turbine selection process.

Operational Noise

In relation to wind turbine noise PAN 1/2011 *'Planning and Noise'* refers to the Scottish Government's 'Onshore Wind Turbines' web based document which states that:

"ETSU-R-97 describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available".

And;

"The Institute of Acoustics (IOA) has since published Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise The document provides significant support on technical issues to all users of the ETSU-R-97 method for rating and assessing wind turbine noise, and should be used by all IOA members and those undertaking assessments to ETSU-R-97. The Scottish Government accepts that the guide represents current industry good practice."

Accordingly, the updated operational noise assessment will be undertaken in accordance with ETSU-R-97 *'The Assessment*

Newcastle
7th Floor, West One
Forth Banks
Newcastle Upon Tyne
NE1 3PA
Tel: +44(0)191 211 1400
VAT Reg. GB 239 0146 20 | Company Reg. 03891836

and Rating of Noise from Wind Farms' (ETSU-R-97) and the Institute of Acoustics document *'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'* (IOA GPG).

The noise limits derived in the assessment would inform appropriate noise related planning conditions and would be used to amend Condition 44 should an application be made and should Scottish Ministers be minded to grant consent for any Variation.

ETSU-R-97

ETSU-R-97 recommends noise limits should be set at 5dB(A) above existing background noise levels, subject to fixed minimum limits (35-40dB for quiet daytime and 43dB for night-time periods), and that these limits should reflect the variation in background noise with wind speed. Higher fixed minimum limits apply to those properties that have a financial interest in the wind farm development.

The choice of daytime fixed minimum limits should be considered in light of the guidance contained within ETSU-R-97 and the IOA GPG. Extracts of the guidance contained within ETSU-R-97 and the IOA GPG are included in Annex 1. We would be very keen to work with the Council with a view to agreeing suitable daytime fixed minimum limits. We would welcome the opportunity to discuss the choice of fixed minimum limits with you once background noise data becomes available to ensure that the limits are derived appropriately in light of data measured at the site and the relevant noise limit assessment criteria outlined in ETSU-R-97.

In order to establish noise limits in accordance with ETSU-R-97 and the IOA GPG it is necessary to determine the relationship between wind speed measured at the wind farm site and background noise levels measured at the closest noise sensitive receptors. This requires the installation of noise monitoring equipment at representative properties surrounding the site as well as the installation of wind monitoring equipment on the site itself.

There are six wind monitoring masts installed on site, five of which have anemometers which have been calibrated in the last two years and those five masts will be used for the noise survey to measure on site wind speed and wind direction data at various heights. Data from the masts will be used to determine the wind speed at turbine hub height which will then be adjusted to a height of 10m using a standardised roughness length of 0.05m to derive 'wind speed as standardised to 10m height'. Wind speed as standardised to 10m height will be used in the assessment. This is consistent with the method as outlined in the IOA GPG (on page 10 of 40). A rain logger will also be installed at least two of the noise monitoring locations to record any periods of rainfall. A series of simultaneous ten-minute measurements will be taken by each piece of equipment over a period of at least two weeks.

Background noise levels will be monitored at a height of between 1.2m and 1.5m above ground, in line with the ETSU-R-97 / IOA GPG guidance. The noise monitoring equipment will be located in a free-field position at least 3.5m away from hard reflective surfaces where practicable and within the residential amenity area.

The following steps summarise the proposed entire noise assessment process:

- Measure the background noise levels at each receptor. This will involve the continuous logging of the $L_{A90,\ 10min}$ values at each receptor for a minimum period of two weeks;
- Obtain simultaneous ten minute average wind speed data from the wind farm site;
- Edit baseline noise data to remove any unrepresentative readings (such as periods of rainfall) and split the data into night-time and quiet daytime hours;

- Determine the quiet day-time and night-time criterion curves (i.e. noise limits) from the measured background noise levels at the nearest neighbours using regression analysis and recommendations within ETSU-R-97;
- Specify the type and noise emission characteristics of a candidate wind turbine suitable for the Development;
- Calculate the predicted noise immission levels of the operational wind farm as a function of on-site wind speed at the nearest noise sensitive receptors; and
- Compare the calculated wind farm noise immission levels with the derived criterion curves to assess compliance with ETSU-R-97.

Prior to commencing the noise survey we would like to agree suitable locations at which to monitor background noise levels in order to provide a representative dataset for the area. Figure 1 shows the indicative predicted wind farm noise contours based on the consented layout and proposed background noise monitoring locations.

We have undertaken initial modelling based on the consented 103 turbine layout. In line with current good practice, noise predictions have been undertaken using the propagation model contained within Part 2 of International Standard ISO 9613:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation. The model assumes mixed ground conditions and data for a candidate turbine, a Siemens DD 120 which was chosen to be representative of the turbine which could be installed at the site. Figure 1 shows which of the neighbouring properties to the proposed wind farm development fall within the 35dB(A) L_{90} contour. It should be noted that the predictions shown on the contour plot do not account for topography which could decrease the predicted level (if the landform blocks the path from the turbines to receptors) or could increase the level (if any concave ground profiles exist). Topographical corrections will be considered in detail and included in the final noise assessment where required. Generally, any property outside the 35dB(A) contour does not need to be considered in the assessment, as protection of the amenity of these properties can be controlled through a simplified noise condition as detailed in ETSU-R-97 (given below). On this occasion TNEI propose to include receptors located outside the 35dB(A) contour to allow for flexibility in the final choice of turbine model and to account for the fact that topographical corrections are yet to be completed.

ETSU-R-97 states that *'For single turbines or wind farms with very large separation distances between the turbines and the nearest properties, a simplified noise condition may be suitable. If the noise is limited to an $L_{90,10min}$ of 35dB(A) up to wind speeds of 10m/s at 10m height, then this condition alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary."*

We believe noise monitoring equipment installed at eleven dwellings would provide a sufficient sample of representative background noise data for the area. A detailed desktop review was undertaken in order to identify the proposed monitoring locations and a figure showing the approximate location is shown on the enclosed Figure 1. The most appropriate location for the noise monitoring will be determined during the site visit to install the equipment, which we hope that you or one of your colleagues will be able to attend.

Monitoring at the locations is subject to consent from the owners/occupiers as well as on site observations to ensure the properties proposed are suitable and representative. VEP are in the process of contacting residents in these areas in order to try to obtain access for the noise monitoring. If we are unable to gain access to monitor at the proposed properties, representative alternative locations will be selected if suitable properties are identified and we will inform you of these alternative locations.

It is understood that Fern (to the east) is derelict and as such we do not consider it to be a noise sensitive property and we will not include it within the assessment. The building at 'Upper Kergord' (located within the southern part of the wind farm) is not used for residential purposes therefore we will not include it within the assessment. This is consistent with the approach taken in the most recent noise assessment for the site; the Environmental Statement Addendum. The location of both properties are identified on Figure 1 as green symbols.

Cumulative Noise Assessment

TNEI is aware that there are a number of operational cumulative schemes in the area as shown on Figure 2. ETSU-R-97 states that measurements need to be made in the absence of wind turbine noise so we have sought to consider the existing turbines when selecting the proposed noise monitoring location. The proposed noise monitoring location to the south west is close to a few turbines so we will consider that on site, and we will analyse the background noise data in accordance with the recommendations in the IOA GPG.

We would be grateful if you could bring to our attention any other cumulative schemes that you are aware of in the area that may merit consideration with the cumulative noise assessment.

To enable us to progress the assessment I would be very grateful if you confirm whether:

- You are happy with the proposed assessment methods outlined above (ETSU-R-97 and the IOA GPG);
- You agree with the general monitoring locations proposed (subject to exact siting);
- You agree that Fern and Upper Kergord do not need to be considered as noise sensitive receptors;
- You or one of your colleagues can attend the noise kit installation (which it is anticipated will take place in the week commencing 25th June and which we can confirm closer to the time); and
- The Council is aware of any schemes which should be included in the cumulative noise assessment or any other dwellings which should be considered.

If you have any immediate concerns or queries, please do not hesitate to contact me or my colleague James Mackay. We look forward to hearing from you soon.

Yours sincerely,

Gemma Clark
BSc(Hons), MSc, AMIOA

Senior Technical Consultant
gemma.clark@tneigroup.com
Tel: 0191 2111418

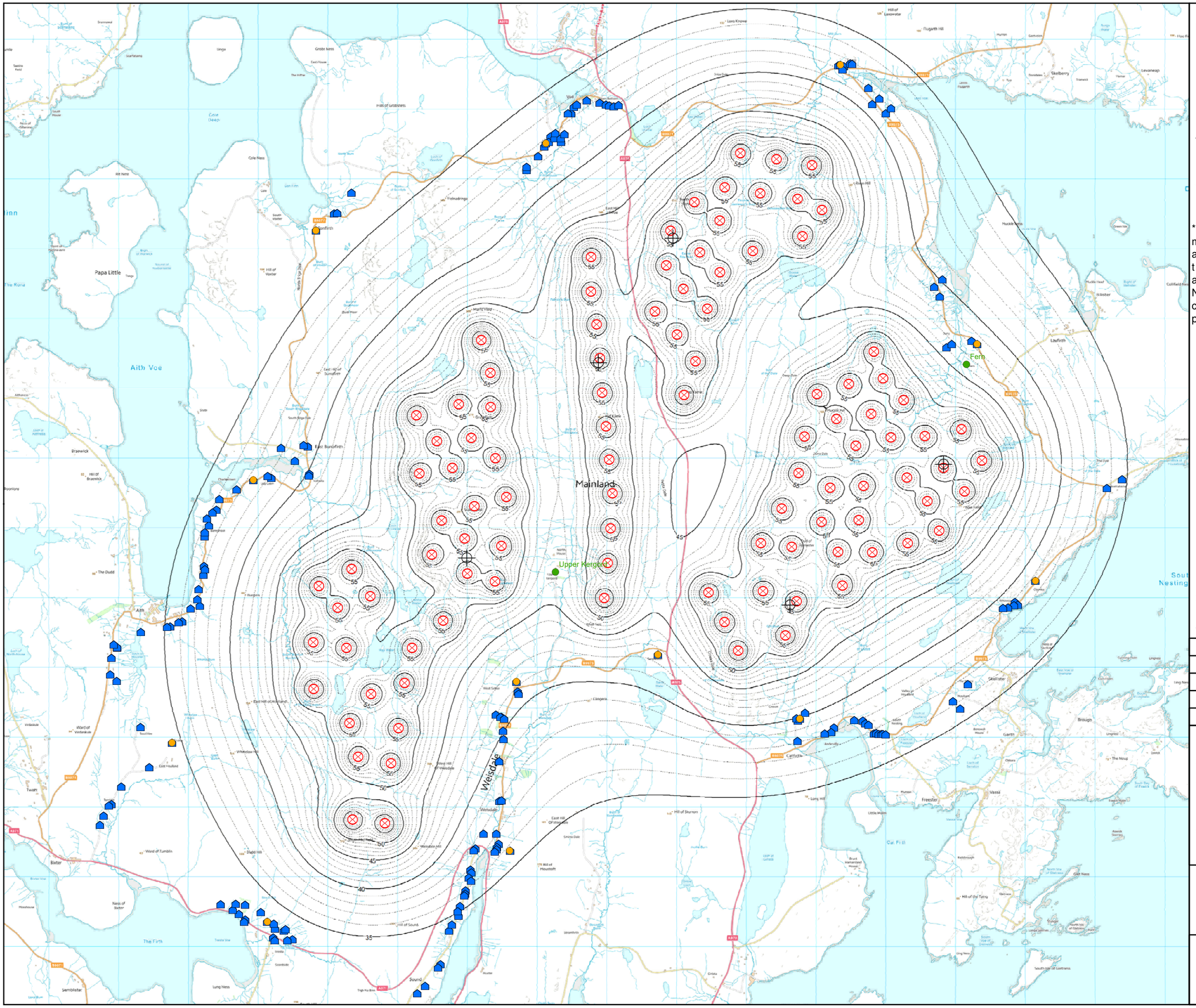
Reviewed and approved by:

James Mackay
BSc(Hons), Dip, MIOA

Head of Technical Services
james.mackay@tneigroup.com
Tel: 0191 2111414

Enc. Figure 1 – Proposed Noise Monitoring Locations

Figure 2 – Cumulative Wind Turbine Locations



Legend

- Wind Turbine
- Mast
- Noise Sensitive Receptor
- Proposed Noise Monitoring Locations
- Predicted Wind Turbine Noise dB(A), L90 based on a Siemens DD120 wind turbine* (5dB increments)
- Predicted Wind Turbine Noise dB(A), L90 based on a Siemens DD120 wind turbine* (1dB increments)

*Noise Predictions have been undertaken using mixed ground (G=0.5) at a receiver height of 4m above ground level. The contour plot models the highest noise output predicted between 0 and 10m/ s as standardised to 10m height. Noise contours do not account for topographical corrections due to terrain, accordingly predictions should be treated as indicative only.

0 750 1,500 Metres

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REV.	DETAILS	DRAWN	CHK'D	APP'D	DATE
R1	FIRST ISSUE	GC	JM	JM	09/04/2018

Project	Viking Wind Farm
Client	Viking Energy Partnership
Title	Proposed Noise Monitoring Locations
Figure No.	1
Scale	1:50,000 @A3
Doc. Ref.	12604-002

viking energy
Harnessing Shetland's natural resources

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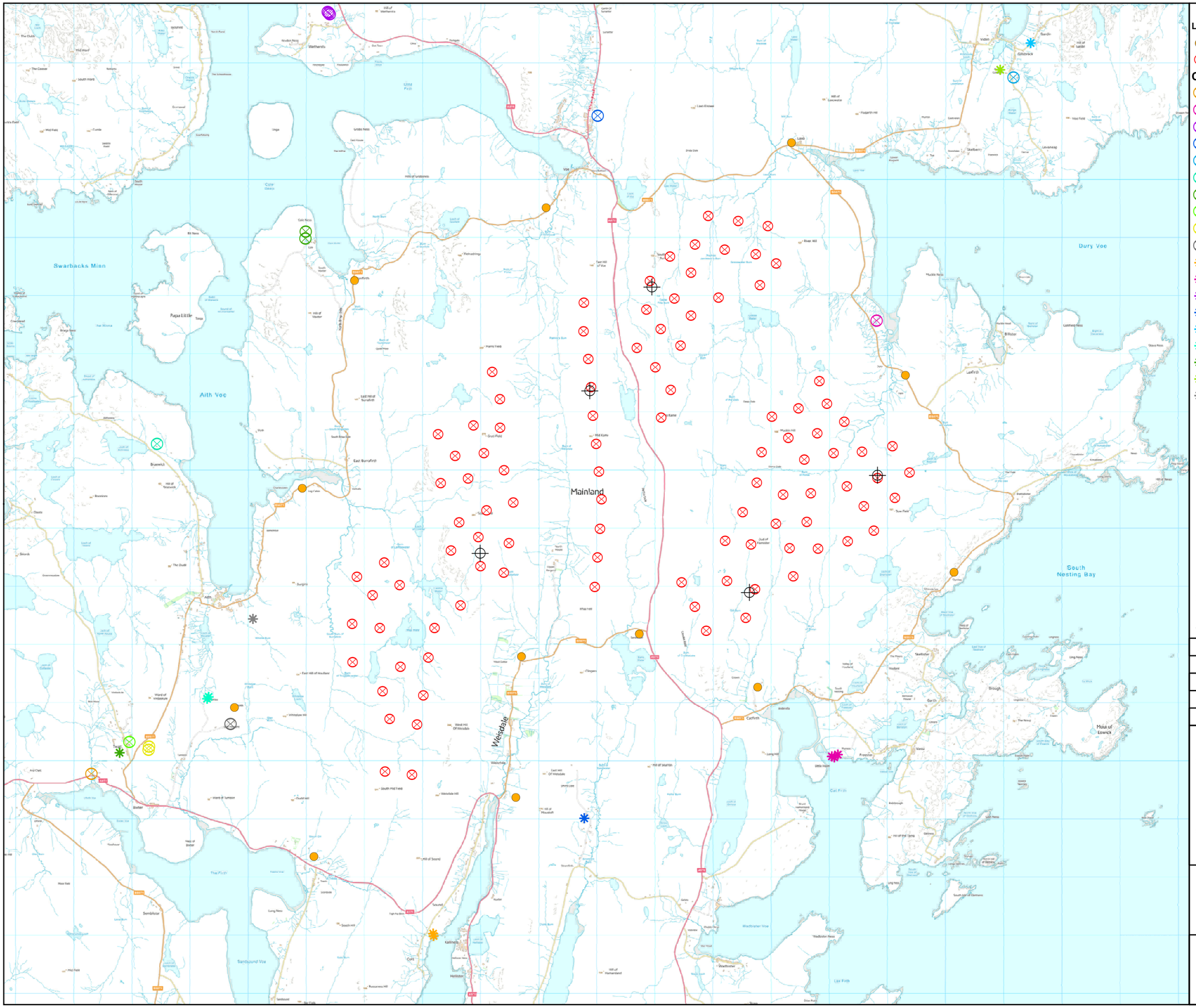

Legend

- Proposed Noise Monitoring Location
- Viking Wind Turbine

Cumulative Turbine Locations

- Bixter (2013/406/PPF)
- Dury (2015/210/PPF)
- East Lynn (2013/228/PPF)
- East of Norbrek, Voe (2010/304/PCD)
- Fairview, Levaneap (2013/212/PPF)
- Land NNW of Aith Mark (2011/226/PPF)
- Land at Cole, South Voxter (2015/342/PPF)
- Lower Langaskule (2013/445/PPF)
- Lwr Langaskule (2014/378/PPF)
- Mid Town (2015/258/PPF)
- Moars Park (2011/251/PPF)
- Muness, South Nesting (2013/276/PPF)
- Norgaet, Voe (2015/400/PPF)
- Parkhead (2013/428/PPF)
- Sandyburn (2011/148/PCD)
- South Lea (2011/205/PPF)
- Twatt, Bixter (2011/307/PPF)
- Vallayre (2013/145/PPF)
- Wirliegert, Aith (2013/109/PPF)

0 1,000 2,000 Metres

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REV.	DETAILS	DRAWN	CHK'D	APP'D	DATE
R2	SECOND ISSUE	SW	JM	JM	06/06/2018
R1	FIRST ISSUE	GC	JM	JM	09/04/2018

Project	Viking Wind Farm
Client	Viking Energy Partnership
Title	Cumulative Turbine Locations
Figure No.	2
Scale	1:60,000 @A3
Doc. Ref.	12604-003

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Annex 1: Determining the Fixed Part of the Daytime Amenity Noise Limit

In relation to determining the fixed part of the Daytime Amenity Noise Limit the ETSU-R-97 notes (on page 65) that:

"The actual value chosen for the day-time lower limit, within the range of 35-40dB(A), should depend upon a number of factors:

• Number of dwellings in the neighbourhood of the wind farm.

The planning process is trying to balance the benefits arising out of the development of renewable energy sources against the local environmental impact. The more dwellings that are in the vicinity of a wind farm the tighter the limits should be as the total environmental impact will be greater. Conversely if only a few dwellings are affected, then the environmental impact is less and noise limits towards the upper end of the range may be appropriate. Developers still have to consider the interests of individuals as protected under the Environmental Protection Act 1990. It is our belief however, in accordance with the report of the Welsh Affairs Committee [23], that there have been no cases of complaints of noise at levels similar to those caused by wind farms leading to a successful prosecution as a statutory nuisance. It should be noted however that the Welsh Affairs Committee also reports that although the noise may not be a statutory nuisance it can clearly be a cause for distress and disturbance, particularly if residents have been promised inaudibility and the noise has a particular quality leading to complaints.

• The effect of noise limits on the number of kWh generated.

Similar arguments can be made when considering the effect of noise limits on uptake of wind energy generated. A single wind turbine causing noise levels of 40dB(A) at several nearby residences would have less planning merit (noise considerations only) than 30 wind turbines also causing the same amount of noise at several nearby residences.

• Duration and level of exposure.

The proportion of the time at which background noise levels are low and how low the background noise level gets are both recognised as factors which could affect the setting of an appropriate lower limit. For example, a property which experienced background noise levels below 30dB(A) for a substantial proportion of the time in which the turbines would be operating could be expected to receive tighter noise limits than a property at which the background noise levels soon increased to levels above 35dB(A). This approach is difficult to formulate precisely and a degree of judgement should be exercised."

The IOA GPG adds some further guidance:

"3.2.2 The day amenity noise limits have been set in ETSU-R-97 on the basis of protecting the amenity of residents whilst outside their dwellings in garden areas. The daytime amenity noise limits are formed in two parts: Part 1 is a simple relationship between the prevailing background noise level (with wind speed) with an allowance of +5 dB; Part 2 is a fixed limit during periods of quiet. ETSU-R-97 describes three criteria to consider when determining the fixed part of the limit in the range of 35 dB to 40 dB L_{A90}, all of which should be considered. They are:

1) the number of noise-affected properties;

2) the potential impact on the power output of the wind farm; and

3) the likely duration and level of exposure.

3.2.3 The rationale for a choice of this limit, or factors which would assist the determining authority in this respect should be set out in the assessment. It is beneficial to the decision maker to display both sets of limits to illustrate the range available and/or the noise limit for the development if agreed previously with the LPA.

3.2.4 Current practice on the three criteria is as follows:

1. The number of neighbouring properties will depend on the nature of the area, (rural, semi-rural, urban) and is sometimes considered in relation to the size of the scheme and study area. The predicted 35 dB L_{A90} contour (at maximum noise output up to 12 m/s) can provide a guide to the dwellings to be considered in this respect.

2. This is in practice mainly based on the relative generating capacity of the development, as larger schemes have relatively more planning merit (for noise) according to the description in ETSU-R-97. In cases when the amenity fixed limit has little or no impact on the generating capacity (i.e. noise is not a significant design constraint) then a reduced limit may be applied.

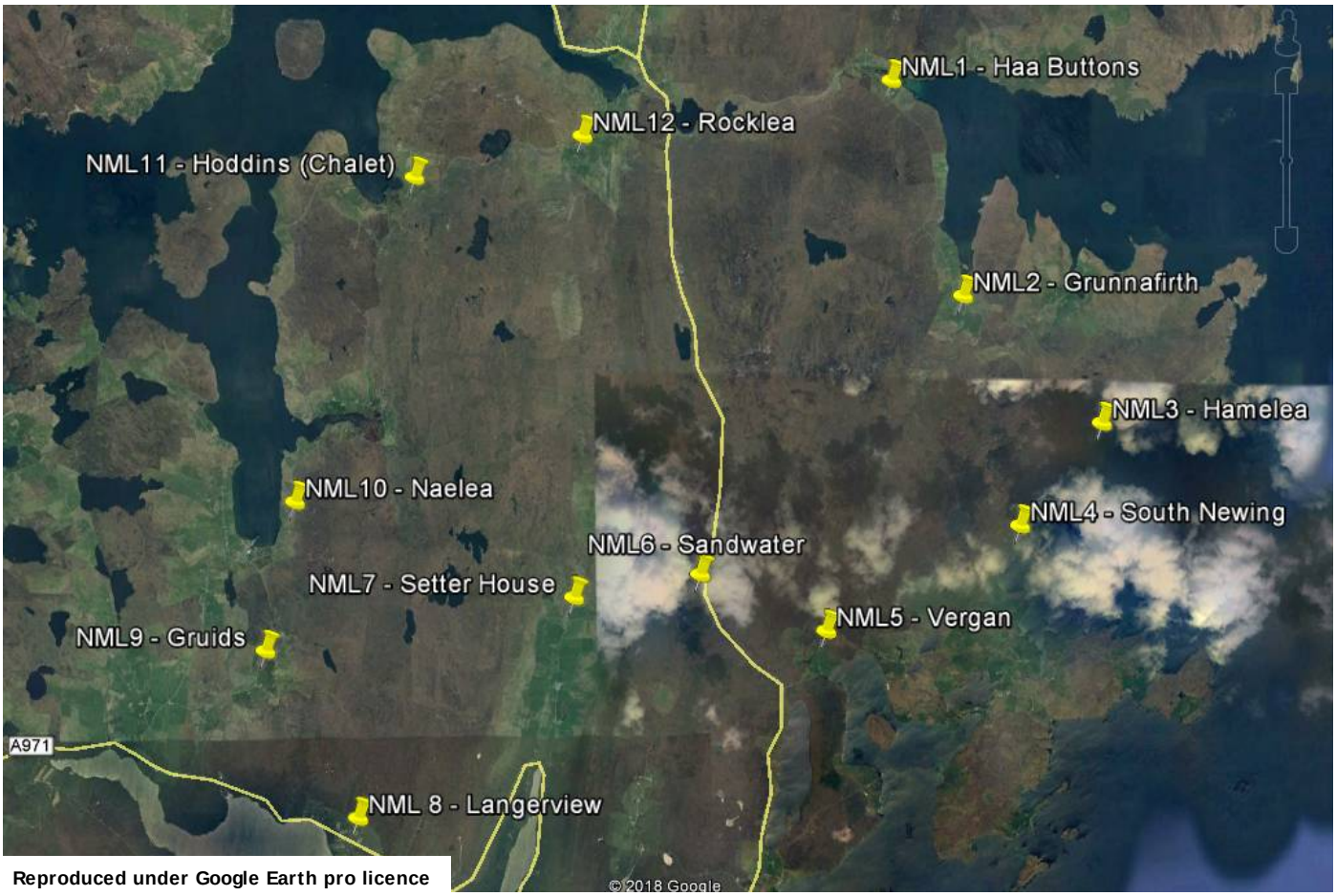
3. This last test is more difficult to formulate. But ETSU-R-97 notes that the likely excess of turbine noise relative to background noise levels should be a relevant consideration. In rural areas, this will often be determined by the sheltering of the property relative to the wind farm site. Account can also be taken of the effects of wind directions (including prevailing ones at the site) and likely directional effects. For cumulative developments, in some cases the effective duration of exposure may increase because of cumulative effects.

3.2.5 It can be argued that assessing these factors do not represent an acoustic consideration but ultimately a planning consideration, and therefore are difficult for noise consultants to fully determine. However this is described as part of ETSU-R-97 and therefore represents a relevant consideration when determining applicable noise limits. Furthermore, it is necessary, as part of the EIA process to evaluate the noise impacts, which is arguably not fully possible without a complete determination of the ETSU-R-97 limits. Finally, consideration of cumulative noise impacts may require the determination of partial noise limits which may be difficult to obtain unless the amenity noise limit is precisely determined.

3.2.6 Other planning considerations, such as the identification in local planning policy of areas of preferred wind farm development, may also influence or determine the choice of the absolute fixed amenity noise limit."

Annex 3 – Field Data Sheets and Installation Report

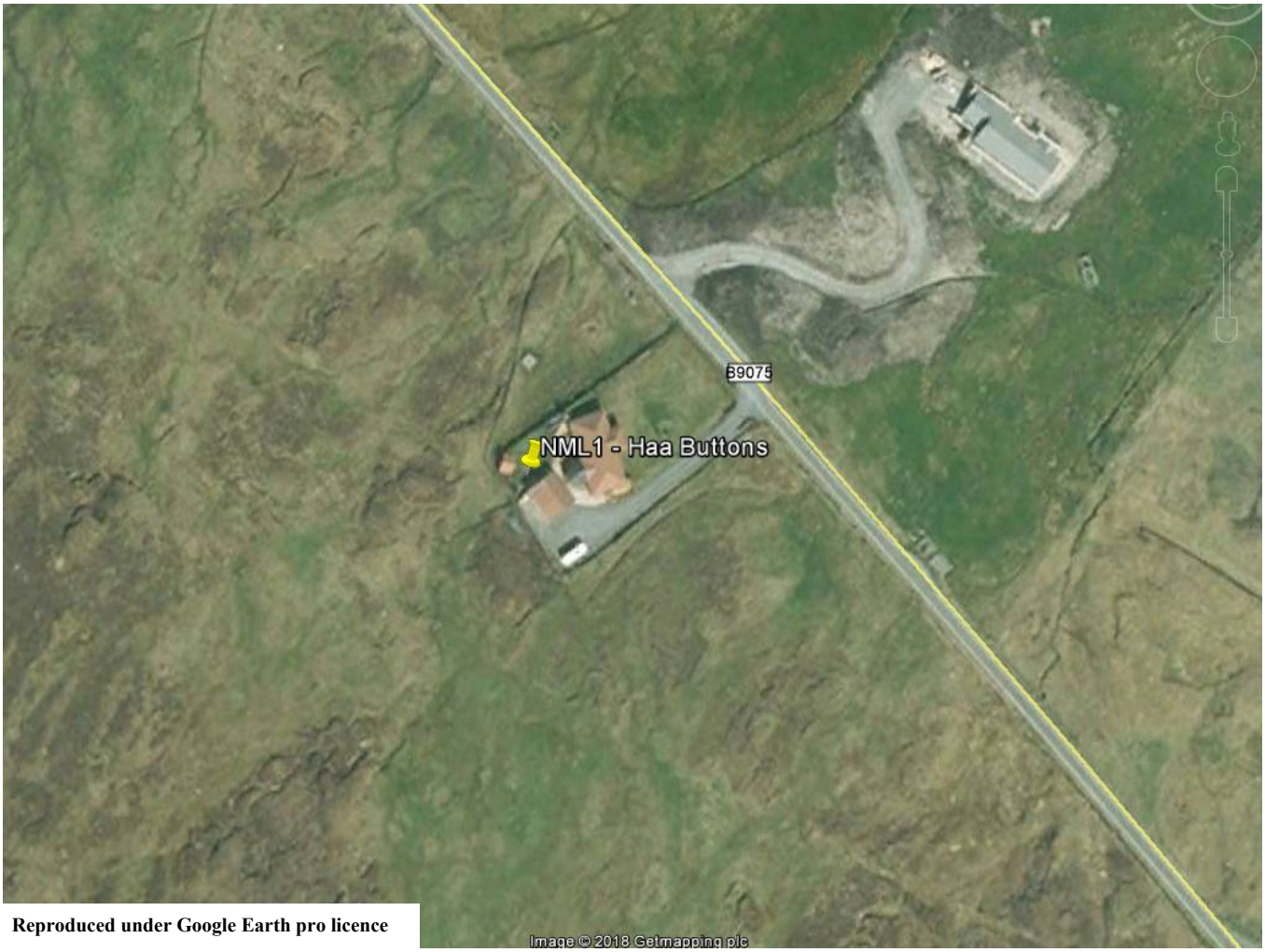
Viking - Installed Noise Monitoring Locations on 27/ 06/ 2018 and 28/ 06/ 2018



Present during the course of the installation day on 27/ 06/ 2018 & 28/ 06/ 2018:

-Jason Baldwin and James Mackay (TNEI)

NML1 – Haa Buttons



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N	NE
	
SE	**SW**
	

NML1

Rationale for choosing location - This NML was chosen as it was set back and screened from the road and also away from local watercourses.

Rationale behind kit location at property – The NML was chosen as the garden area was screened by the house and other buildings, reducing wind induced noise and screening noise from local noise sources like the road.

NML2 – Grunnafirth

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N	E
	
S	W

NML2

Rationale for choosing location - This NML was chosen as it was set back from the road and away from vegetation.

Rationale behind kit location at property – The NML was chosen to be on the wind farm side of the property away and as far as possible from the road. There are a number of derelict properties to the south and south west. During the site visit noise from nearby watercourses was not audible at the NML.

NML3 – Hamelea

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N	E
	
S	W

NML3

Rationale for choosing location - This NML was chosen as it was set back from the sea.

Rationale behind kit location at property – The NML was chosen so that the house itself would provide some screening from wind and noise from the sea.

A rain gauge was also installed at this location.

NML 4 – South Newing

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N	E
	
S	W

NML4

Rationale for choosing location - This NML was chosen to represent the group of properties set down in this sheltered location.

Rationale behind kit location at property – The NML was chosen as the garden area is well screened from the wind and noise from the road.

NML5 – Vergan

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N	E
	
S	W

NML5

Rationale for choosing location - This NML was chosen as it was more sheltered than some of the other properties in this area. The buildings also provided some screening to noise from the A970 which was audible at some of the other properties (when the wind was blowing in the right direction), particularly at the dwelling to the north east which is at a higher altitude.

Rationale behind kit location at property – The NML was chosen as the garden area was screened by the houses and other buildings reducing wind induced noise and screening noise from local noise sources like the road.

NML6 - Sandwater

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N	E
	
S	W

NML6

Rationale for choosing location - This NML was chosen as there is only one property in this area.

Rationale behind kit location at property – The NML was chosen as the garden area was screened (to an extent) from the road by the house.

NML7 – Setter House

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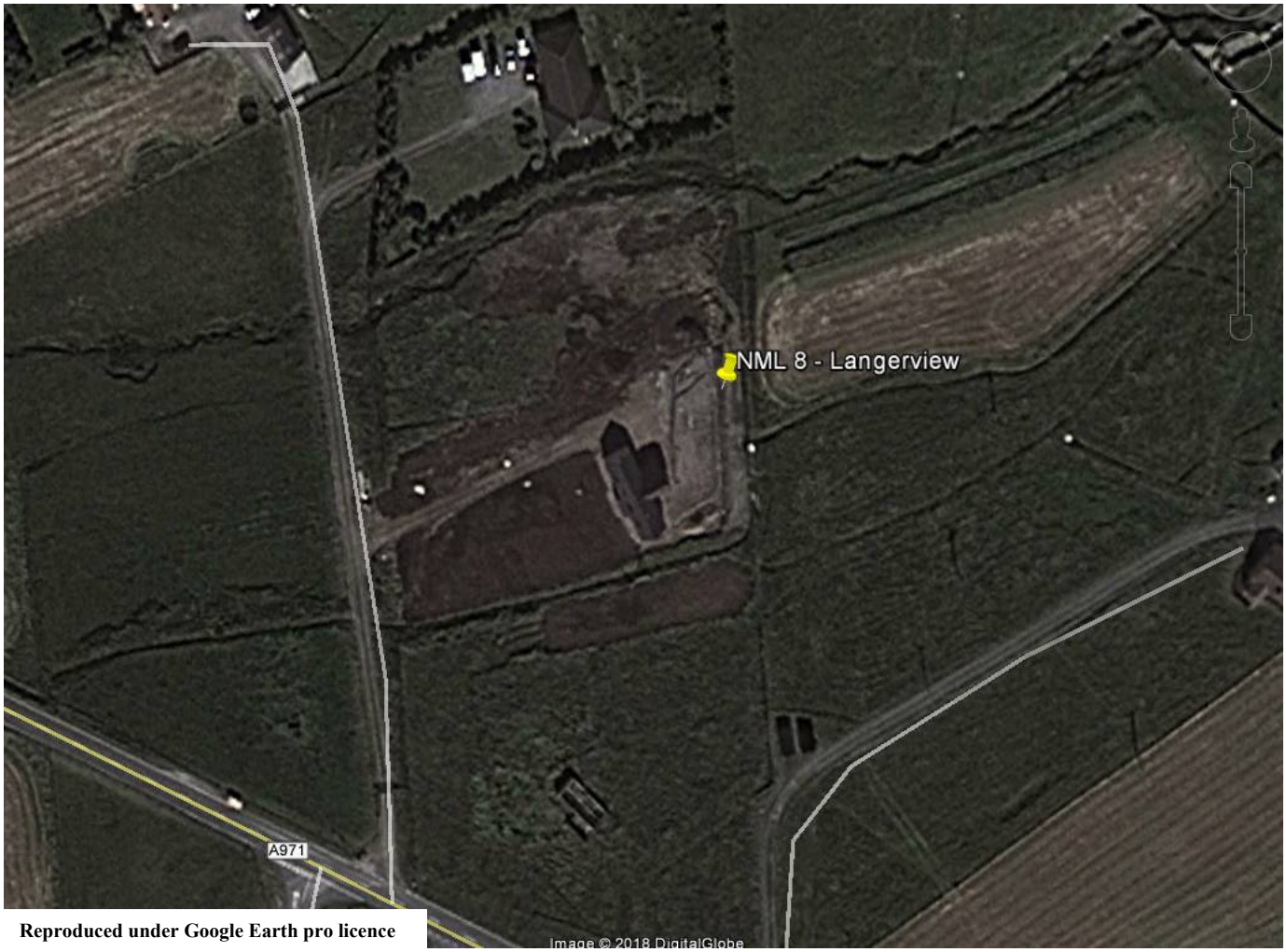
N	E
	
S	W

NML7

Rationale for choosing location - This NML was chosen as it was away from trees and vegetation (which is likely to increase background noise levels at some properties to the south) and the A971 (also to the south).

Rationale behind kit location at property – The NML was chosen as the garden area is open and away from the larger vegetation to the west of the dwelling.

NML8 – Langerview



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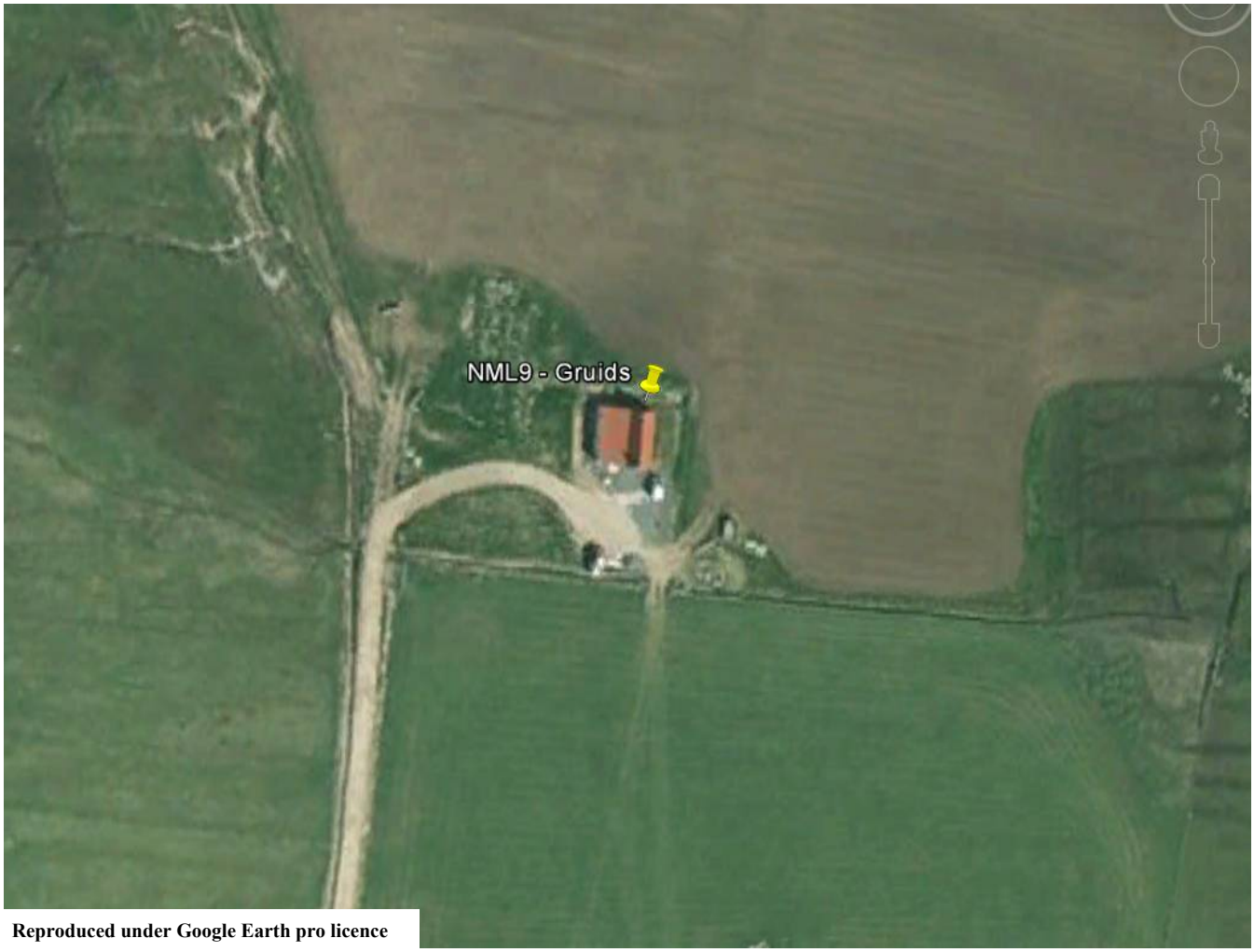
N	E
	
S	SW

NML8

Rationale for choosing location - This NML was chosen as it was set back from the road, away from large vegetation and nearby watercourses.

Rationale behind kit location at property – The NML was chosen as it provided more screening from the road compared to the main amenity area (which was to the south east of the dwelling). The additional screening was considered necessary to ensure the NML would be representative of the amenity areas of other properties in the area, some of which do not have line of sight to the road.

NML9 – Gruids



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N	E
	
S	W

NML9

Rationale for choosing location - This NML was chosen as it was away from the existing wind turbines in the area and other noise sources in the area (like working farms and vegetation).

Rationale behind kit location at property – The NML was chosen as the property itself provided screening to an existing Provan wind turbine located to the south of the NML. The small turbine was not audible at the NML during the installation.

NML10 – Naelea

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N	E
	
S	W

NML10

Rationale for choosing location - This NML was chosen as it set back from the road and away from the ocean (which could be heard at some of the other nearby properties).

Rationale behind kit location at property – The NML was chosen as the house provided additional screening from road and ocean noise and was on the wind farm side of the property.

It should be noted that building work is ongoing at the property (which is being undertaken by the resident during their spare time). The resident agreed to log periods when work was occurring, in addition, the sound level meter was set to record audio data (2 mins ever 10 mins) so that any loud periods could be investigated and, if necessary, atypical data could be discarded. There is a Provan turbine to the south (which was just visible at the curtilage of the property) but it was not audible during the installation of the kit.

NML 11 – Hoddins

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N	E
	
S	W

NML11

Rationale for choosing location - This NML was chosen as there was minimal vegetation at this property and the dwelling provided some shelter in an area where the properties were relatively exposed.

Rationale behind kit location at property – The NML was chosen as the dwelling provided some shelter and the location was considered to be representative of the amenity area.

Viking - Installed Noise Monitoring Locations on 18/07/2018 and 19/07/2018

Present during the course of the installation day on 18/07/2018 & 19/07/2018:

-Jason Baldwin

NML12 – Setter

N	E
	
S	**W**
	

NML12

The noise monitoring equipment was initially installed at Rocklea to the north but was moved to Setter following a site visit by SIC AEHO who suggested it be moved.

Rationale for choosing location - This NML was chosen as it was set back from the road in a relatively sheltered valley.

Rationale behind kit location at property – The NML was chosen to minimise the influence of the boiler flue and was more sheltered from the wind.

NML13 – Moustoft

N	E
	
S	**W**
	

NML13

Rationale for choosing location - This NML was chosen as it was set back from the road and also away from the sea.

Rationale behind kit location at property – The NML was chosen as it was screened by the house reducing wind induced noise and screening noise from local noise sources like the road and sea.

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML1 – Haa Buttons
Description	The noise monitoring equipment was installed in the amenity area to the north west of the dwelling. The equipment was sited away from local noise sources (road and watercourses) within a sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	444790, 1163069
Noise sources noted during installation, weekly inspection and removal	Birdsong, occasional road traffic, livestock, rain and vegetation noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM019	NL-31	00593595	14/03/2018
Pre Amplifier	SLM019	NH-21	30357	14/03/2018
Microphone	SLM019	UC-53A	316120	14/03/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0201	10:40 27/06/2018	09:32 17/07/2018	94.0	93.9	-0.1	Installation – birdsong, occasional road traffic and livestock noises. Sheltered on three sides by buildings. Maintenance – rain noise and distant road traffic.
0202	09:50 17/07/2018	09:25 15/08/2018	94.0	93.8	-0.2	Maintenance – distant road traffic and rain noise.
0203	09:40 15/08/2018	13:20 20/09/2018	94.0	94.0	0.0	Maintenance – Audible sounds were wind induced noise through foliage and distant traffic. Weather was overcast with low winds. Kit removed 27/09/2018 – very windy

PHOTOGRAPHS

NML1 – N

NML1 – NE

NML1 – SE

NML1 – SW

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML2 – Grunnafirth
Description	The noise monitoring equipment was installed in the amenity area to the south of the dwelling. The equipment was sited away from local noise sources (road and watercourses) within a sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	445939, 1159620
Noise sources noted during installation, weekly inspection and removal	Birdsong, wind induced, very occasional road traffic, livestock and rain noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM044	NL-52	00386739	20/06/2018
Pre Amplifier	SLM044	NH-25	76889	20/06/2018
Microphone	SLM044	UC-59	12362	20/06/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0701	17:30 27/06/2018	10:09 18/07/2018	94.0	93.9	-0.1	Installation – birdsong, wind induced noise and very occasional road traffic noise. Maintenance – rain noise, slight wind induced noise, sheep and birdsong.
0702	10:20 18/07/2018	10:06 15/08/2018	94.0	94.1	0.1	Maintenance – birdsong, geese, sheep, rain noise and slight wind induced noise.
0703	10:20 15/08/2018	15:50 17/09/2018	94.0	93.9	-0.1	Maintenance – Sounds audible were geese, sheep, and wind induced noise. Kit removed 27/09/2018 - windy.

PHOTOGRAPHS

NML2 – N

NML2 – E

NML2 – S

NML2 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML3 – Hamelea
Description	The noise monitoring equipment was installed in the amenity area to the north of the dwelling. The equipment was sited such that the dwelling would provide shelter from the sea. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	448168, 1157589
Noise sources noted during installation, weekly inspection and removal	Birdsong, dogs barking, wind induced, livestock, road and overhead traffic and rain noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM018	NL-31	01283554	22/05/2018
Pre Amplifier	SLM018	NH-21	29311	22/05/2018
Microphone	SLM018	UC-53A	315581	22/05/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0301	12:10 27/06/2018	10:33 17/07/2018	94.0	93.9	-0.1	Installation – birdsong, dogs barking and wind induced noise. Maintenance – sheep noise, distant road traffic noise, rain induced noise
0302	10:50 17/07/2018	10:38 15/08/2018	94.0	93.9	-0.1	Maintenance Visit – dogs barking, occasional road traffic noise, aircraft overhead and slight wind induced noise.
0303	10:50 15/08/2018	18:40 20/09/2018	94.0	94.1	0.1	Maintenance – Sounds audible were occasional cars passing by, a plane passing over head and dogs barking, as well as wind induced noise. Weather was dry and cloudy. Kit removed 27/09/2018 – very windy and raining.

PHOTOGRAPHS

NML3 – N

NML3 – E

NML3 – S

NML3 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML4 – South Newing
Description	The noise monitoring equipment was installed in amenity area to the north of the dwelling. The equipment was sited away from local noise sources (road and watercourses) within a sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	446854, 1155947
Noise sources noted during installation, weekly inspection and removal	Birdsong, animal, wind induced and livestock noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM045	NL-52	00386758	20/08/2018
Pre Amplifier	SLM045	NH-25	76908	20/08/2018
Microphone	SLM045	UC-59	12755	20/08/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
1201	17:20 28/06/2018	11:06 18/07/2018	94.0	93.9	-0.1	Installation – birdsong, animal noises and wind induced noise. Maintenance - dominant birdsong, livestock noise and slight wind induced noise.
1202	11:20 18/07/2018	11:10 15/08/2018	94.0	94.0	0.0	Maintenance – wind induced noise and sheep.
1203	11:20 15/08/2018	05:20 17/09/2018	94.0	93.9	-0.1	Maintenance – Sounds audible were wind induced noise through grass and sheep. Kit removed 27/09/2018 – very windy.

PHOTOGRAPHS

NML4 – N

NML4 – E

NML4 – S

NML4 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML5 – Vergan
Description	The noise monitoring equipment was installed in amenity area to the north east of the dwelling. The equipment was sited away from local noise sources (road and watercourses) .The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	443753, 1154259
Noise sources noted during installation, weekly inspection and removal	Birdsong, aircraft overhead, wind induced noise through foliage and very occasional road traffic noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM016	NL-31	00593593	01/12/2017
Pre Amplifier	SLM016	NH-21	30355	01/12/2017
Microphone	SLM016	UC-53A	316118	01/12/2017
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
1101	14:10 28/06/2018	11:45 18/07/2018	94.0	93.8	-0.2	Installation – birdsong, aircraft overhead, wind induced noise and very occasional road traffic noise. Maintenance - birdsong, wind induced noise and distant road traffic noise.
1102	12:00 18/07/2018	11:53 15/08/2018	94.0	94.0	0.0	Maintenance – distant birdsong/ road traffic noise, noise from wind passing through vegetation
1103	12:10 15/08/2018	07:50 23/09/2018	94.0	93.7	-0.3	Maintenance – Sounds audible were wind induced noise through trees and grass in the vicinity, birdsong, distant road traffic noise. Kit removed on 27/09/2018 – very windy.

PHOTOGRAPHS

NML5 – N

NML5 – E

NML5 – S

NML5 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML6 – Sandwater
Description	The noise monitoring equipment was installed to the west of the dwelling. The equipment was sited to maximise screening from the road (A970) to the east. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	441728, 1155164
Noise sources noted during installation, weekly inspection and removal	Road traffic, livestock, bird and wind induced noise through foliage.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM040	NL-52	01176428	08/03/2018
Pre Amplifier	SLM040	NH-25	76447	08/03/2018
Microphone	SLM040	UC-59	12471	08/03/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0401	14:10 27/06/2018	12:26 18/07/2018	94.0	93.8	-0.2	Installation – road traffic noise, sheep, birdsong and wind in foliage. Maintenance – road traffic noise, sheep, birdsong and wind in foliage. Slight rain.
0402	12:40 18/07/2018	15:48 16/08/2018	94.0	94.1	0.1	Maintenance – wind in foliage, distant road traffic noise, occasional aircraft overhead.
0403	16:00 16/08/2018	14:40 24/09/2018	94.0	93.8	-0.2	Maintenance – Sounds audible were wind induced noise through foliage, distant road traffic noise (single cars) and the occasional plane passing overhead. Weather was dry, sunny with moderate winds. Kit removed on 27/09/2018 – very windy.

PHOTOGRAPHS

NML6 – N

NML6 – E

NML6 – S

NML6 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML7 – Setter House
Description	The noise monitoring equipment was installed in amenity area to the east of the dwelling. The equipment was sited away from local noise sources (road and watercourses). The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	439713, 1154799
Noise sources noted during installation, weekly inspection and removal	Birdsong, road traffic, wind induced, aircraft, livestock and tractor noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM011	NL-31	01273082	01/12/2017
Pre Amplifier	SLM011	NH-21	26001	01/12/2017
Microphone	SLM011	UC-53A	313385	01/12/2017
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0501	14:50 27/06/2018	12:57 18/07/2018	94.0	93.9	-0.1	Installation – birdsong, road traffic noise and wind induced noise. Maintenance - birdsong, slight road traffic noise, wind induced noise and aircraft overhead.
0502	13:10 18/07/2018	12:31 15/08/2018	94.0	93.7	-0.3	Maintenance – wind passing through foliage, agricultural noise, sheep
0503	12:50 15/08/2018	09:30 27/09/2018	94.0	94.0	0.0	Maintenance – Sounds audible were wind induced noise through the nearby bushes, tractor in the adjacent field and sheep noise. Kit removed 27/09/2018 – windy and raining.

PHOTOGRAPHS

NML7 – N

NML7 – E

NML7 – S

NML7 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML8 – Langerview
Description	The noise monitoring equipment was installed in amenity area to the north east of the dwelling. The equipment was sited away from the road within a more sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	436258, 1151269
Noise sources noted during installation, weekly inspection and removal	Road traffic noise, birdsong, strimmer in distance and wind induced noise through foliage.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM009	NL-32	00972337	16/02/2018
Pre Amplifier	SLM009	NH-21	25122	16/02/2018
Microphone	SLM009	UC-53A	313228	16/02/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0601	19:10 27/06/2018	13:57 18/07/2018	94.0	94.0	0.0	Installation – road traffic noise, birdsong and strimmer in far distance. Maintenance - road traffic noise, birdsong and slight wind induced noise.
0602	14:10 18/07/2018	14:43 15/08/2018	94.0	94.1	+0.1	Maintenance – slight wind induced noise, distant road traffic noise and birdsong
0603	15:00 15/08/2018	00:30 23/09/2018	94.0	93.8	-0.2	Maintenance – Sounds audible were slight wind induced noise, distant road traffic and some birdsong. Kit removed 27/09/2018 - raining

PHOTOGRAPHS

NML8 – N

NML8 – E

NML8 – S

NML8 – SW

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML9 – Gruids
Description	The noise monitoring equipment was installed in amenity area to the north of the dwelling. The dwelling is not currently occupied. The equipment was sited away from local noise sources (road and watercourses) within a sheltered location, and to provide screening from the nearby wind turbine. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground). A rain gauge was also installed at the property.
Approximate National Grid Reference	434764, 1153930
Noise sources noted during installation, weekly inspection and removal	Birdsong, livestock, wind in foliage, wind induced and occasional wind turbine noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM046	NL-52	00386759	20/06/2018
Pre Amplifier	SLM046	NH-25	76909	20/06/2018
Microphone	SLM046	UC-59	12756	20/06/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
1001	12:30 28/06/2018	14:57 18/07/2018	94.0	94.0	0.0	Installation – birdsong, livestock noises and very occasional wind in foliage. Maintenance – very windy. Wind turbine to the south slightly audible, birdsong and sheep.
1002	14:50 18/07/2018	15:28 15/08/2018	94.0	94.1	0.1	Maintenance – birdsong, sheep and wind induced noise. Wind turbine noise slightly audible.
1003	15:40 15/08/2018	07:40 18/09/2018	94.0	93.8	-0.2	Maintenance – Sounds audible were wind induced noise through foliage, sheep and occasionally the small turbine to the south. Kit removed on 27/09/2018. Small turbine not audible.

PHOTOGRAPHS

NML9 – N

NML9 – E

NML9 – S

NML9 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML10 – Naelea
Description	The noise monitoring equipment was installed in amenity area to the south east of the dwelling. The equipment was sited away from local noise sources (road and watercourses) within a sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	435227, 1156313
Noise sources noted during installation, weekly inspection and removal	Livestock, occasional road traffic, wind induced and rain noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM033	NL-52	00643025	05/09/2017
Pre Amplifier	SLM033	NH-25	43053	05/09/2017
Microphone	SLM033	UC-59	06805	05/09/2017
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	Yes

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0901	11:10 28/06/2018	12:25 18/07/2018	94.0	94.1	+0.1	Installation – sheep and wind induced noise. Maintenance – sheep, occasional road traffic noise and wind induced noise. Construction material (covered by plastic) lying in driveway.
0902	15:40 18/07/2018	16:13 15/08/2018	94.0	94.0	0.0	Maintenance – rain and wind induced noise.
0903	16:30 15/09/2018	05:40 18/09/2018	94.0	93.8	-0.2	Maintenance – Wind and rain induced noise dominant. Kit removed on 27/09/2018.

PHOTOGRAPHS

NML10 – N

NML10 – E

NML10 – S

NML10 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/JM/ MT

MONITORING LOCATION

Location Name	NML11 – Hoddins
Description	The noise monitoring equipment was installed in amenity area to the south east of the dwelling. The equipment was sited away from local noise sources (watercourses to the south) within a sheltered location. The equipment was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	437146, 1161508
Noise sources noted during installation, weekly inspection and removal	Birdsong, wind induced, aircraft overhead, farming activity, road traffic, livestock and residence noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM001	NL-32	00661767	16/02/2018
Pre Amplifier	SLM001	NH-21	19771	16/02/2018
Microphone	SLM001	UC-53A	310458	16/02/2018
Calibrator	001	NC-74	34762316	16/02/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0801	09:40 28/06/2018	16:01 18/07/2018	94.0	94.1	+0.1	Installation – birdsong, wind induced noise, aircraft overhead and farming activity to south. Maintenance - birdsong, wind induced noise, occasional road traffic noise and sheep.
0802	16:10 18/07/2018	10:16 16/08/2018	94.0	94.1	+0.1	Maintenance –. Wind induced noise, children playing
0803	10:30 16/08/2018	06:20 16/09/2018	94.0	94.0	0.0	Maintenance – Sounds audible were wind induced noise, and kids playing. Kit removed on 27/09/2018 – wind induced noise.

PHOTOGRAPHS

NML11 – N

NML11 – E

NML11 – S

NML11 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/MT

MONITORING LOCATION

Location Name	NML12 – Setter
Description	The noise monitoring equipment was installed in amenity area to the north west of the dwelling. The kit was placed greater than 3.5m away from any reflective surfaces (excluding the ground). A rain gauge was also installed at the property.
Approximate National Grid Reference	439845, 1162139
Noise sources noted during installation, weekly inspection and removal	Wind induced, birdsong, occasional distant road traffic, boiler flue and wind in foliage noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM047	NL-52	00386760	20/06/2018
Pre Amplifier	SLM047	NH-25	76910	20/06/2018
Microphone	SLM047	UC-59	12778	20/06/2018
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
0201	16:50 18/07/2018	10:45 16/08/2018	94.0	94.1	0.1	Installation – birdsong, occasional distant road traffic noise, boiler flue and wind induced noise. Maintenance – wind in foliage
0202	11:00 16/08/2018	01:40 17/09/2018	94.0	94.0	0.0	Maintenance – Sounds audible were wind induced noise through foliage. Kit removed on 27/09/2018 – wind induced noise dominant.

PHOTOGRAPHS

NML12 – N

NML12 – E

NML12 – S

NML12 – W

Noise Monitoring Field Data Sheet

Project Title	Viking Wind Farm	**Project Number**	12604
Client	Viking Energy Wind Farm LLP	**Surveyor**	JB/MT

MONITORING LOCATION

Location Name	NML13 - Moustoft
Description	The noise monitoring equipment was installed in amenity area to the north east of the dwelling. The equipment was sited away from local noise sources (road and sea) within a sheltered location. The kit was placed greater than 3.5m away from any reflective surfaces (excluding the ground).
Approximate National Grid Reference	439619, 1152385
Noise sources noted during installation, weekly inspection and removal	Birdsong, road traffic, livestock and wind induced noise.

NOISE MONITORING EQUIPMENT DETAILS

	Kit Number	Model	Serial Number	Last Calibrated/ Conformance Checked
Sound Level Meter	SLM048	NL-52	00386761	20/06/2017
Pre Amplifier	SLM048	NH-25	76911	20/06/2017
Microphone	SLM048	UC-59	12788	20/06/2017
Calibrator	001	NC-74	34762316	02/01/2018

NOISE MONITORING EQUIPMENT SETTINGS

	Network (A,B,Z)	Index and Time	Time Weighting (Slow, Fast)	Range (dB)	Audio
Parameters Recorded	A	$L_{A9010min}$, $L_{Aeq10min}$	Fast	20-110	No

DATA

File Name	Start Time	End Time	Cal. at Start	Cal. at End	Drift	Observations
1301	10:50 19/07/2018	14:05 15/08/2018	94.0	94.1	+0.1	Installation – birdsong and road traffic noise. Maintenance – road traffic noise, sheep, wind induced noise.
1302	14:20 15/08/2018	23:30 17/09/2018	94.0	94.0	0.0	Maintenance – Sounds audible were bird song and road traffic noise. Kit removed on 27/09/2018 - raining.

PHOTOGRAPHS

NML13 – N

NML13 – E

NML13 – S

NML13 – W