MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 3, Annex 8.1: Baseline sound survey

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Glossary

Term	Meaning
400 kV grid connection cables	Cables that will connect the proposed Onshore Substations to the existing National Grid Penwortham substation.
400 kV Grid Connection Cable Corridor	The corridor within which the 400 kV grid connection cables will be located.
Ambient sound level, $L_{Aeq,T}$	The steady sound level which, over a period of time *T*, contains the same amount of A-weighted sound energy as the time varying sound over the same period. Also known as the equivalent continuous sound pressure level.
Background sound level, $L_{A90,T}$	The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, *T*, measured using fast time-weighting, F, and quoted to the nearest whole number of decibels.
Decibel	A unit used to measure or compare the intensity of a sound by comparing it with a given reference level on a logarithmic scale.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment process.
Expert Working Group	A forum for targeted engagement with regulators and interested stakeholders through the Evidence Plan process.
Export cable corridor	The specific corridor of seabed (seaward of Mean High Water Springs and land (landward of Mean High Water Springs) from the Generation Assets to the National Grid Penwortham substation.
Free-field	A situation in which the radiation from a sound source is entirely unaffected by the presence of any reflective boundaries.
Landfall	The area in which the offshore export cables make landfall (come on shore) and the transitional area between the offshore cabling and the onshore cabling. This term applies to the entire landfall area at Lytham St. Annes between Mean Low Water Springs and the transition joint bay inclusive of all construction works, including the offshore and onshore cable routes, intertidal working area and landfall compound(s).
Logarithmic averaging	A method by which sound levels in decibels (dB) can be averaged. This allows us to account for the fact that higher levels of sound will always dominate in the presence of lower sound levels.
Mean Low Water Springs	The height of mean low water during spring tides in a year.
Morecambe Offshore Windfarm: Generation Assets	The offshore generation assets and associated activities for the Morecambe Offshore Windfarm.
Morecambe Offshore Windfarm: Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morecambe Offshore Windfarm to the National Grid.

Term	Meaning
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore and onshore infrastructure connecting the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the national grid. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.
Morgan Offshore Wind Project: Generation Assets	The offshore generation assets and associated activities for the Morgan Offshore Wind Project.
Morgan Offshore Wind Project Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morgan Offshore Wind Project to the National Grid.
Noise	An unwanted or unexpected sound.
Onshore export cables	The cables which would bring electricity from the landfall to the onshore substations.
Onshore Export Cable Corridor	The corridor within which the onshore export cables will be located.
Onshore Infrastructure Area	The area within the Transmission Assets Order Limits landward of Mean High Water Springs. Comprising the offshore export cables from Mean High Water Springs to the transition joint bays, onshore export cables, onshore substations and 400 kV grid connection cables , and associated temporary and permanent infrastructure including temporary and permanent compound areas and accesses. Those parts of the Transmission Assets Order Limits proposed only for ecological mitigation/biodiversity benefit are excluded from this area.
Onshore Substations	The onshore substations will include a substation for the Morgan Offshore Wind Project: Transmission Assets and a substation for the Morecambe Offshore Windfarm: Transmission Assets. These will each comprise a compound containing the electrical components for transforming the power supplied from the generation assets to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid.
Study area	This is an area which is defined for each environmental topic which includes the Transmission Assets Order Limits as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each topic is intended to cover the area within which an impact can be reasonably expected.
Sound	Fluctuations of pressure within a medium (gas, solid or fluid) within the audible range of loudness and frequencies which excite the sensation of hearing.
Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.
Temporal averaging	Averaging a dataset over a given time period.
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above)
Transmission Assets Order Limits	The area within which all components of the Transmission Assets will be located, including areas required on a temporary basis during construction and/or decommissioning

Acronyms

Acronym	Meaning
BS	British Standard
dB	Decibels
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
ES	Environmental Statement
EWG	Expert Working Group
LT	Long-Term
MLWS	Mean Low Water Springs
NAMM	Natural and Man-Made
NTM	Natural Tranquillity Method
PONS	Percentage of Natural Sounds
ST	Short-Term

Units

Unit	Description
dB	Decibel
h	Hour
m	Meter
m/s	Meters per second
ms	Millisecond
km	Kilometre
kV	Kilovolt

1 Baseline sound survey annex

1.1 Introduction

1.1.1.1 This document forms Annex 8.1 of Volume 3 of the Environmental Statement (ES) prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (referred to hereafter as 'the Transmission Assets'). The ES presents the findings of the Environmental Impact Assessment (EIA) process for the Transmission Assets.

1.1.1.2 This document provides the methodology and results of a baseline sound survey undertaken for the Transmission Assets. The report informs Volume 3, Chapter 8: Noise and vibration of the ES.

1.1.1.3 The purpose of the baseline sound survey is to quantify the existing sound climate at noise-sensitive receptors within the noise and vibration study area. The measured levels inform the derivation of noise criteria against which operational and construction noise impacts arising from the Transmission Assets may be assessed in accordance with British Standard (BS) 4142:2014+A1:2019 and BS 5228-1:2009+A1:2014, respectively.

1.1.1.4 Whilst the assessment of noise impacts is undertaken relative to the baseline noise environment, the assessment of vibration impacts is undertaken relative to absolute limits. These absolute limits correspond to the level of vibration above which vibration is likely to be perceptible, as outlined in BS 5228-2:2009+A1:2014. As such, no vibration survey is deemed necessary, and this annex only contains details of the baseline sound survey.

1.1.1.5 Two surveys have been undertaken comprising both long-term and short-term monitoring at a total of 23 locations within the Onshore Infrastructure Area. These monitoring locations were presented to the relevant Local Planning Authorities (see Volume 3, Chapter 8: Noise and vibration of the ES) and follows the approach set out in the EIA Scoping Report.

1.2 Methodology

1.2.1 Study area

1.2.1.1 The study area for noise and vibration assessment of the Transmission Assets focuses on receptors landward of Mean Low Spring (MLWS) where potential noise impacts are most likely to occur.

1.2.1.2 The study area relevant to this report is defined as:

- the area of land to be temporarily or permanently occupied during the construction, operation and maintenance, and decommissioning of the Transmission Assets (landward of MLWS);
- noise sensitive receptors located within 1 kilometre (km) of the Landfall and Onshore Substations;

- noise sensitive receptors located within 300 metres (m) of the Onshore Export Cable Corridor and the 400 (kilovolt) kV Grid Connection Cable Corridor; and
- vibration sensitive receptors located within 100 m of onshore construction activities.

1.2.2 Baseline methodology

1.2.2.1 A desktop study was undertaken to identify existing key noise sources and noise-sensitive receptors within the study area and select representative baseline sound survey locations.

1.2.2.2 The baseline sound environment was characterised by undertaking long-term measurements at the locations identified.

1.2.3 Desktop study

1.2.3.1 Information on noise and vibration within the study area was collected through a detailed desktop review of existing studies and datasets. These sources are summarised at **Table 1.1** below.

Table 1.1: Summary of key desktop sources

Title	Source	Year	Author
OS AddressBase Plus	Ordnance Survey	2023	Ordnance Survey
OS_MasterMap_Topography_Layer_780637_1046228.dwg	Ordnance Survey	2022	Ordnance Survey
OS Terrain 5	Ordnance Survey	2022	Ordnance Survey
Google Earth Imagery	Data SIO, NOAA, U.S Navy, NGA, GEBCO	2023	Google

1.3 Desk study – baseline characterisation

1.3.1 Human receptors

1.3.1.1 Noise-sensitive receptors were identified through analysis of OS AddressBase Plus point data which includes detailed information on the address, classification (and thereby use) of properties within a user-defined area.

1.3.1.2 This data was filtered to include address points with a classification deemed to be noise-sensitive within the study area such as:

- residential dwellings;
- educational institutions;
- hotels;
- hospitals; and

- care homes.

1.3.1.3 Subsequently, baseline survey locations were identified which were deemed to be suitably representative of the nearest receptors.

1.3.2 Natural tranquillity

1.3.2.1 Recreational receptors using Public Rights of Way (PRoW) have been considered in the context of noise and natural tranquillity using the Natural Tranquility Method (NTM) as outlined in Tranquil Spaces: Measuring the tranquillity of public spaces (Bentley, 2019).

1.3.2.2 The locations of PRoW and associated recreational receptors have been identified using OS colour raster mapping and detailed review of satellite imagery and Google Street View to identify where natural tranquillity may be affected by the operation of the Transmission Assets.

1.4 Site-specific surveys

1.4.1 Introduction

1.4.1.1 A summary of the surveys undertaken to inform the assessment of noise and vibration is outlined in **Table 1.2** below.

Table 1.2: Summary of survey undertaken to inform the assessment of noise and vibration

Title	Extent of survey	Overview of survey	Survey contractor	Date
Baseline sound survey 1	Long-term measurements: • along Onshore Export Cable Corridor; • near the Onshore Substation sites; and • along 400 kV Grid Connection Cable Corridor.	A total of 14x long-term measurement positions: • 6x positions along the Onshore Export Cable Corridor; • 3x positions near the Onshore Substation sites; and • 5x positions along 400 kV Grid Connection Cable Corridor.	RPS Tetra Tech	14 June 2023
Baseline sound survey 2	Long-term measurements within the boundary of Blackpool Airport for receptors near Landfall.	A total of 3x long-term measurement positions.	RPS	22 June 2023

Title	Extent of survey	Overview of survey	Survey contractor	Date
Baseline sound survey 3	Long-term measurements at additional locations and those for which access was unavailable in June 2023: Long-term measurements: • along the Onshore Export Cable Corridor; • near the Onshore Substation sites; and • along 400 kV Grid Connection Cable Corridor. Short-term measurements at receptors near the temporary construction compound proposed on Blackpool Road North.	A total of 5x long-term measurement positions: • 1x position near Landfall; • 1x position along the Onshore Export Cable Corridor; • 2x positions near the Onshore Substation sites; and • 1x position along the 400 kV Grid Connection Cable Corridor. A total of 2x short-term measurement positions: • 1x position near Landfall; and • 4x positions along the PRoW running from north to south to the west of the Onshore Substation sites.	RPS	13 March 2024

1.4.2 Methodology

1.4.2.1 The baseline sound surveys comprised unattended, long-term (LT) noise measurements at a total of 22 locations across three survey periods (see **Table 1.2** above). The measurement positions are presented graphically in **Figure 1.1** to **Figure 1.4** below.

1.4.2.2 Sound level meters were installed at the locations in **Table 1.3** below for a period of one week. Meteorological equipment was installed adjacent to two of the monitoring positions in baseline sound surveys 1 and 3, and at one location during baseline sound survey 2. This equipment was installed to capture any periods of adverse weather both at Landfall and further in land, defined in this context as precipitation events or wind speeds greater than 5 meters per second (m/s). These conditions can negatively impact the measured noise levels and result in unrealistic noise criteria following analysis.

1.4.2.3 At all locations, measurements were undertaken in the free-field at approximately 1.5 m to 3 m above local ground level and away from any other reflective surfaces.

Table 1.3: Baseline sound survey positions

Position		Location		
		x-coordinate	y-coordinate	Description
Landfall	LT1	330857.3244	431148.3789	Lytham St. Annes
	LT2	331271.735	431552.1495	Blackpool Airport (NE)
	LT3	331996.5989	431627.1519	Blackpool Airport (NW)
	LT4	332395.1838	430881.1903	Blackpool Airport (S)
	ST1	333229.9874	430494.7374	Road Route
Onshore Export Cable Corridor	LT5	334070.6002	431212.3762	Division Lane
	LT6	334259.591	429980.797	Moss Hall Lane
	LT7	336100.8752	430596.5214	Peel Hall Farm
	LT8	336625.9229	429399.3609	Peg's Lane
	LT9	338608.9194	429277.7289	Great Carr Side Farm
	LT10	340489.0202	429334.4816	Bryning Lane
	LT11	341340.4653	430355.7441	Hillock Lane
	LT12	342961.2062	430429.1108	Kirkham Road
Onshore Substations	LT13	343399.4841	429801.6312	Lower Lane
	LT14	343220.7689	431204.558	Freshfield Farm
	LT15	343500.3461	431627.9899	Kirkham Bypass
	LT16	344366.44	430936.13	Parrox Croft
	NTM1-NTM4	343441.5602	430890.7213	PRoW
400 kV Grid Connection Cable Corridor	LT17	346135.8301	430287.8386	Blackpool Road
	LT18	347554.7167	429350.1895	Savick Brook Farm
	LT19	349062.6192	429716.9096	New Hall Farm
	LT20	349400.7014	428058.0636	Marsh Farm
	LT21	350591.4588	427972.8522	Howick Hall Farm
	LT22	350096.4318	427144.1457	Milbrow Farm

1.4.2.4 The long-term measurement equipment was deployed for baseline sound survey 1 on Wednesday 14 June 2023 with measurements commencing at 15:30 hours and concluding between 10:15 hours on Tuesday 20 June 2023 and 14:15 hours on Thursday 22 June 2023.

1.4.2.5 The equipment for baseline sound survey 2 was deployed between 11:15 hours and 11:45 hours on Thursday 22 June 2023, with measurements concluding between 10:15 hours and 11:00 hours on Wednesday 28 June 2023.

1.4.2.6 The equipment for baseline sound survey 3 was deployed between 10:45 hours on Wednesday 13 March 2024 with measurements

concluding between 09:15 hours and 17:00 hours on Tuesday 19 March 2024.

1.4.2.7 The equipment installed at LT16 (Parrox Croft) was installed as part of baseline sound survey 3 and malfunctioned due to an internal system error. Alternative equipment was redeployed at this position with measurements commencing at 16:15 hours on Tuesday 19 March 2024 and concluding at 09:45 hours on Friday 22 March 2024.

1.4.2.8 Measurements of the L_{Aeq}, L_{Amax}, and L_{A90} were undertaken at 100 millisecond (ms) intervals and temporally averaged over 15-minute periods for the duration of the survey period. The equipment listed in **Table 1.4** below was used to undertake the survey.

Table 1.4: Baseline sound survey equipment

Position	Model	Serial number	Calibration (Ref: 94.0 dB)		Last manufacturers' calibration date(1)
			Start	End	
Baseline sound survey 1					
Calibrator	Rion NC-74	110118	N/A	N/A	17/10/2022
LT5	Rion NL-52	1021257	94.0	93.9	27/04/2022
LT6	Rion NL-52	510142	94.0	94.0	10/02/2023
LT8	Rion NL-52	843173	94.0	94.0	18/05/2023
LT9	Rion NL-52	710448	94.0	94.0	08/12/2021
LT10	Rion NL-52	810559	94.0	94.0	08/12/2021
LT11	Rion NL-52	710312	94.0	94.2	14/09/2021
LT12	Rion NL-52	264490	94.0	94.2	16/09/2022
LT13	Rion NL-52	810558	94.0	94.0	08/12/2021
LT14	Rion NL-52	320643	94.0	94.2	28/03/2023
LT17	Rion NL-52	710472	94.0	94.0	31/01/2023
LT18	Rion NL-52	253701	94.0	93.9	14/09/2021
LT20	Rion NL-52	732146	94.0	94.0	30/06/2022
LT21	Rion NL-52	219905	94.0	94.0	26/05/2023
LT22	Rion NL-52	1221576	94.0	93.9	30/06/2022
Baseline sound survey 2					
Calibrator	Rion NC-74	110118	N/A	N/A	17/10/2022
LT2	Rion NL-52	586906	94.0	94.0	29/11/2022
LT3	Rion NL-52	386735	94.0	94.0	26/05/2023
LT4	Rion NL-52	586907	94.0	94.0	17/04/2023
Baseline sound survey 3					
Calibrator	Rion NC-74	110118	N/A	N/A	01/02/2024

Position	Model	Serial number	Calibration (Ref: 94.0 dB)		Last manufacturers' calibration date(1)
			Start	End	
LT1	Rion NL-52	164423	94.0	94.0	14/07/2023
LT7	Rion NL-52	943367	94.0	94.0	14/07/2023
LT15	Rion NL-52	386735	94.0	94.0	13/10/2023
LT16	Rion NL-52	164424	94.0	94.0	14/07/2023
LT19	Rion NL-52	586907	94.0	94.0	
ST1	Rion NL-52	386735	94.0	94.0	29/11/2022
NTM1-NTM4	Rion NL-52	943367	94.0	94.0	14/07/2023

1.4.2.9 The equipment was installed within weatherproof enclosures which includes a Rion WS-15 windshield on the microphone. The equipment was calibrated upon commencement and conclusion of the noise survey to confirm an acceptable degree of accuracy. As shown in **Table 1.4** above, no significant drift (±0.5 dB) was noted to have occurred.

1.4.2.10 Measurements undertaken in accordance with BS 7445- 2:1991 – 'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data. All sound level meters used meet the 'Class 1' criteria defined within BS EN 61672-2:2013+A1:2017 – 'Electroacoustics. Sound level meters – Pattern evaluation tests'. All calibrators used meet the 'Class 1' criteria defined within BS EN IEC 60942 – 'Electroacoustics. Sound Calibrators'.

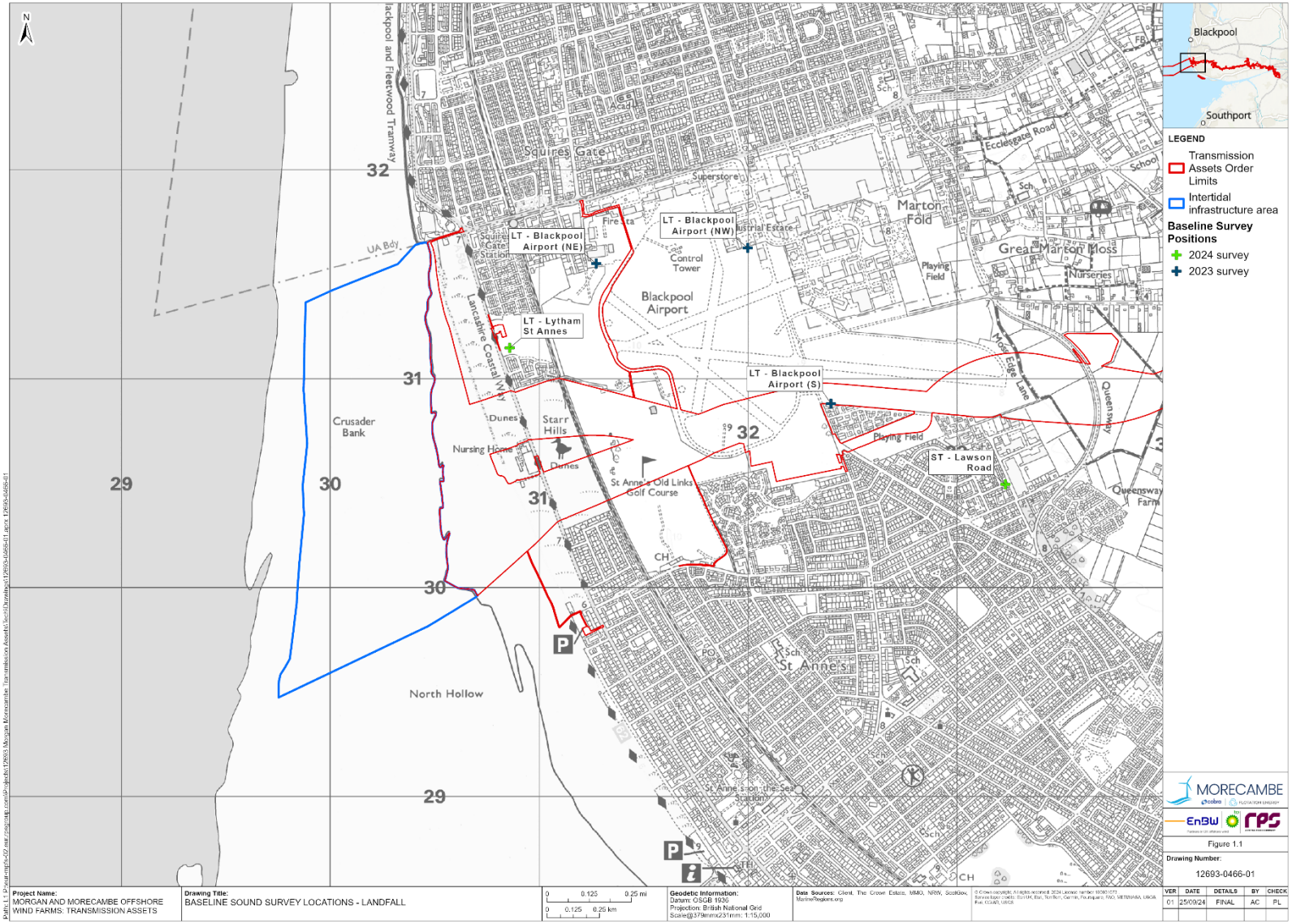


Figure 1.1: Baseline sound survey locations (Landfall)

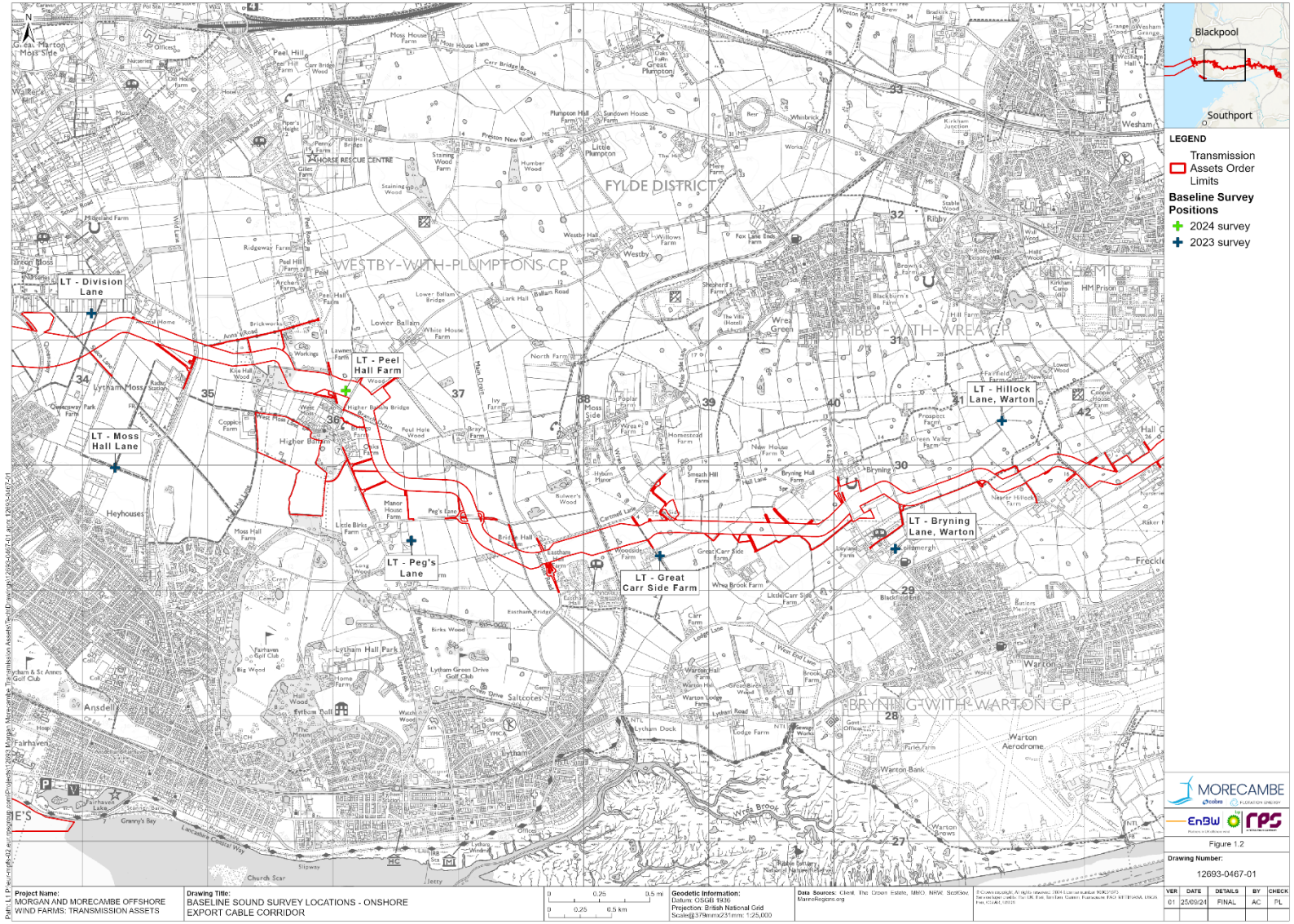


Figure 1.2: Baseline sounds survey locations (Onshore Export Cable Corridor)

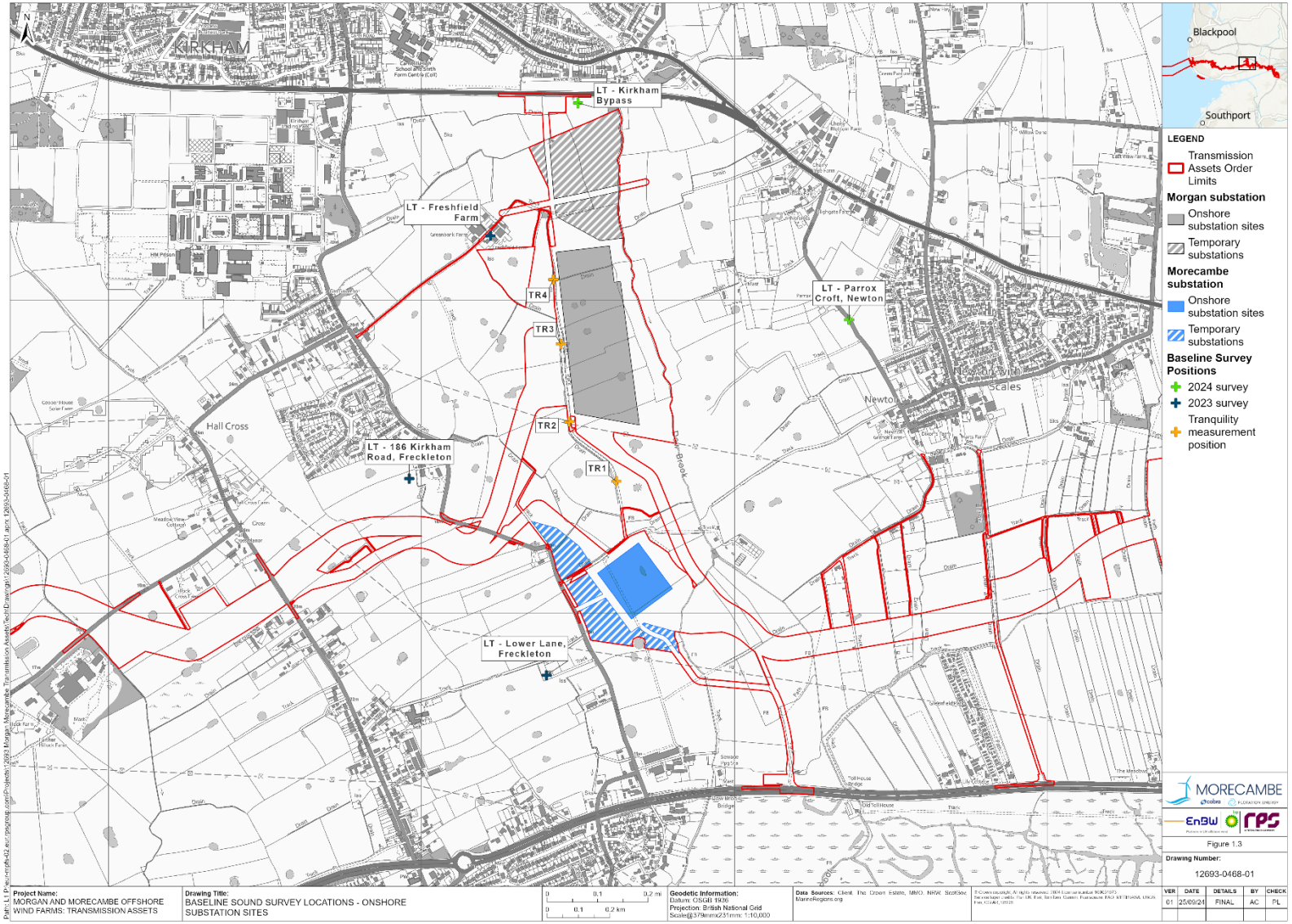


Figure 1.3: Baseline sound survey locations (Onshore Substation sites)

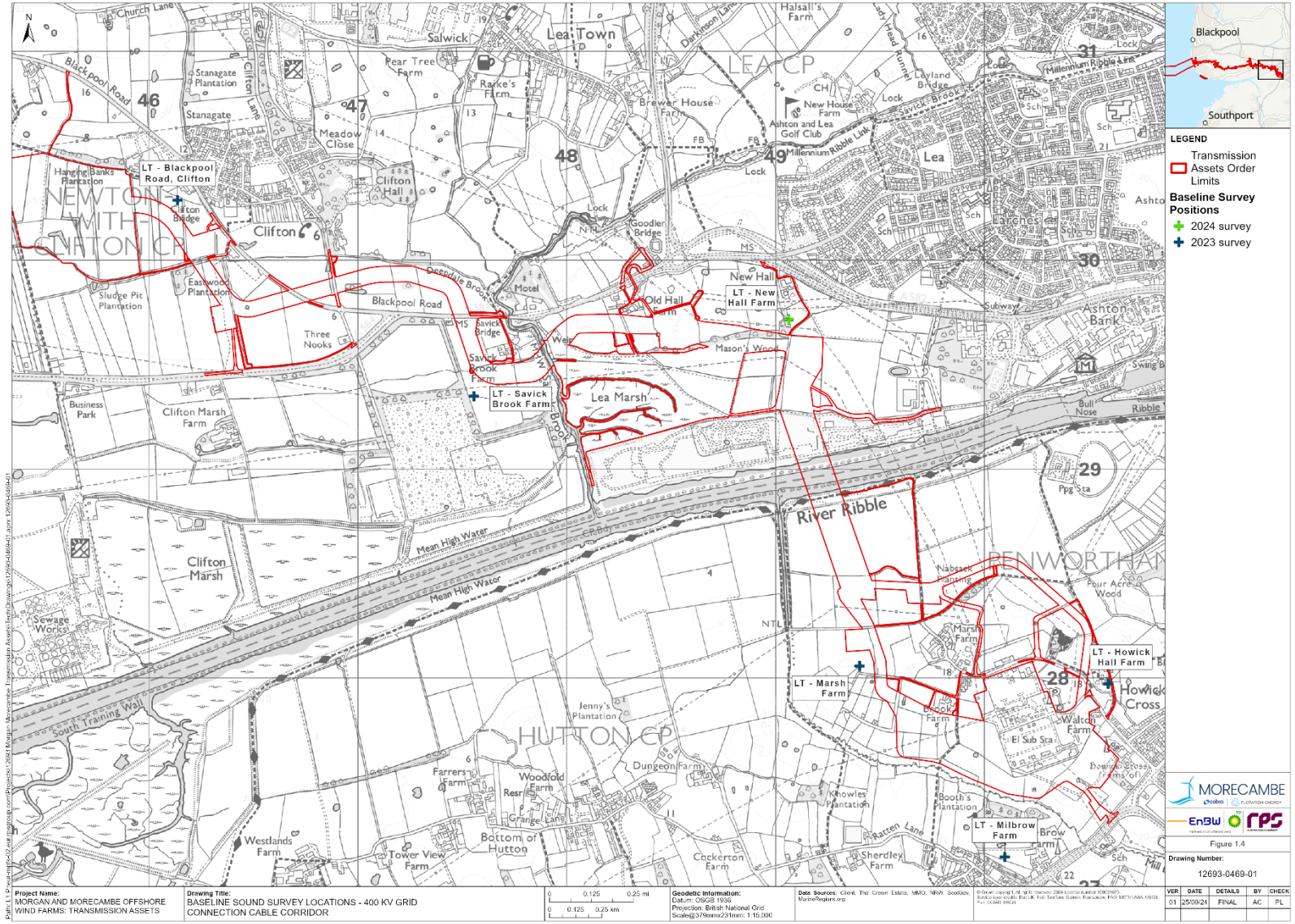


Figure 1.4: Baseline sound survey locations (400 kV Grid Connection Cable Corridor)

1.4.3 Meteorological conditions

1.4.3.1 Weather stations were deployed alongside the survey equipment to monitor the variation in meteorological conditions throughout the survey period.

1.4.3.2 A Davies Instruments Vantage Vue 6250 weather station was deployed at Landfall positions to monitor the conditions closer to the sea.

1.4.3.3 An additional Lufft WS600-UMB weather station was deployed to monitor the conditions further in-land.

1.4.3.4 Both weather stations were temporally synchronised with the sound survey equipment and any periods, where precipitation events or wind speeds greater than 5 m/s occurred, were omitted during the analysis of the measured data.

1.4.4 Natural tranquility method (PRoW)

1.4.4.1 The NTM has been used to inform the baseline sound survey for recreational receptors along PRoW. The NTM was developed to measure and assess the tranquillity of outdoor spaces.

1.4.4.2 The NTM depends on four key variables:

- NAMM: A number between one and five representing the proportion of natural and man-made sounds;
- PONS: The percentage of time during the survey period where only natural sounds are heard.
- L_{RR}: The contribution of road and rail noise to the tranquillity score. Rail noise must be reduced by 6 dB for this parameter to account for the observed fact that people are less affected by rail noise than road noise at the same level. When both are present, the contributions from road and rail should be added together (logarithmically); and
- L_{AT}: The overall corrected ambient sound level. Generally, this will be the same as the measured $L_{Aeq,T}$ level over the measurement period.

1.4.4.3 A descriptor of the NAMM parameter values is provided in **Table 1.5** below.

Table 1.5: NAMM values

NAMM Parameter Value	Description
1	All or virtually all sound is from man-made sources.
2	Sounds are mainly from man-made sources but natural sounds are also present.
3	NAMM noise sources contribute equally to the overall sound level.
4	Sounds are mainly from natural sources but man-made sounds are also present.
5	All or virtually all sound is from natural sources.

1.4.4.4 Following completion of a detailed site review and on-site measurements, the collected data and information can be used to predict a tranquillity score for each location. The output will be a numerical score and associate description as detailed in **Table 1.6** below.

Table 1.6: Tranquility score

Tranquility Score	Description
1	Frantic/chaotic/harsh
2	Busy/noisy
3	Unsettled/slightly busy
4	Not quite tranquil
5	Just tranquil
6	Fairly tranquil
7	Good tranquillity
8	Excellent tranquillity
9	Perfect tranquillity

1.4.4.5 Measurements were undertaken at four locations along the PRoW running to the west of the Morgan Onshore Substation site. At each location, two sets of 15-minute measurement were undertaken at different times of the day and the relevant NTM parameters recorded at each location.

1.5 Baseline sound climate

1.5.1 Subjective description

1.5.1.1 A subjective description of the existing sound climate at each position is presented in **Table 1.7** below.

Table 1.7: Subjective description of the sound climate the survey positions

Position	Subjective description of sound climate
LT1	Road traffic noise on Clifton Drive North dominates at this position with some influence from helicopters and small aircraft at Blackpool Airport.
LT2	Sound climate influenced primarily by road traffic on local highways surrounding the airport. Some contribution can be seen from incoming and outgoing aircraft and other on-site activities.
LT3	This position was situated further back from local roads and thus traffic was slightly more distant. Some contribution can be seen from incoming and outgoing aircraft and other on-site activities.
LT4	Road traffic was audible at this position however the levels recorded were lower overall due to relative distance to local roads. Some contribution can be seen from incoming and outgoing aircraft and other on-site activities.
LT5	Sound climate primarily influenced by road traffic on Queensway and North Houses Lane with relatively frequent pass-bys noted on Division Lane. There was some influence from aircraft overhead.
LT6	Sound climate primarily influenced by road traffic on Queensway and residential areas to the south. Construction activities were noted to be ongoing nearby which had a minor influence on some of the daytime measurements.
LT7	Frequent vehicular movements were noted on Peel Road. There was also some influence noted from an industrial site situated to the north of the position with heavy vehicles frequently passing along Peel Road.
LT8	This position was situated in a fairly rural area and the sound climate dominated by local traffic on Ballam Road and Pegs Lane.
LT9	This position was situated in a fairly rural area and the sound climate dominated by local traffic on Saltcotes Road and Cartmell Lane.
LT10	This position was situated in a fairly rural area and the sound climate dominated by local traffic on Bryning Lane and surrounding roads.
LT11	This position was situated in a fairly rural area and the sound climate dominated by local traffic on Hillock Lane and surrounding roads.
LT12	This position was situated close to a small residential area and thus the sound climate was primarily influenced by local traffic.
LT13	Road traffic was audible from Preston New Road and Kirkham Road to the south and west, respectively.
LT14	This position was situated in a rural location and was influenced primarily by distant traffic noise from Kirkham Bypass and Blackpool Road. It was noted that farming activity also influenced the levels at this position.
LT15	Distant traffic on Kirkham bypass influenced the sound climate with infrequent vehicle movements noted on Parrox Lane.
LT16	This position was situated close to Kirkham Bypass so road traffic noise dominated the sound climate.
LT17	Road traffic noise on Blackpool Road and Preston Old Road dominated the sound climate at this position.
LT18	Road traffic noise on Blackpool Road and Preston New Road dominated the sound climate at this position.

Position	Subjective description of sound climate
LT19	Road traffic noise on Riversway and Blackpool road were noted to dominate the sound climate with some intermittent influence from farming machinery in nearby fields.
LT20	This position was situated in a rural location and the sound climate noted to be influenced primarily by distant road traffic.
LT21	This position was situated in a rural location and the sound climate noted to be influenced primarily by traffic on local roads to the east and west.
LT22	Liverpool Road is situated to the south of this position running form north-east to south-west and was the dominant noise source.

1.5.2 Long-term survey results

1.5.2.1 The results of the baseline sound survey at the long-term monitoring positions are presented graphically in Appendix A. The range of measured levels is presented in **Table 1.8** below.

1.5.2.2 The ambient noise levels $L_{Aeq,T}$ have been calculated by temporally averaging (logarithmically) the 15-minute periods over the relevant time period. The background sound levels $L_{A90,T}$ represent the noise level which is exceeded for 90% of a 1-hour period during the day and a 15-minute period during the night-time.

Table 1.8: Range of measured sound levels

Location	Measured Sound Level (dB)					
	Day			Evening	Night	
	$L_{Aeq,16h}$ (7am-11pm)	$L_{Aeq,12h}$ (7am-7pm)	$L_{A90,1h}$ (7am-11pm)	$L_{Aeq,4h}$ (7pm-11pm)	$L_{Aeq,8h}$ (11pm-7am)	$L_{A90,15min}$ (11pm-7am)
LT1	73-76	73-76	43-72	69-71	65-66	37-59
LT2	52-61	53-62	32-47	42-54	40-42	30-43
LT3	62-68	63-69	24-61	44-58	40-43	24-44
LT4	50-55	51-63	26-52	38-50	34-41	24-39
LT5	49-55	50-55	28-46	42-49	42-48	26-41
LT6	43-46	45-48	24-42	35-39	37-43	23-42
LT7	67-70	68-71	28-57	64-65	59-61	26-48
LT8	47-51	48-52	29-51	41-47	41-46	27-46
LT9	41-49	41-50	27-46	37-42	37-41	27-39
LT10	47-55	48-56	29-48	43-47	46-56	26-45
LT11	41-55	42-57	27-42	35-42	38-45	26-39
LT12	46-57	46-58	30-47	44-47	44-50	27-43
LT13	58-60	58-61	29-50	54-58	50-54	27-42
LT14	46-59	47-59	27-43	42-53	44-50	21-43
LT15	62-66	63-67	33-58	59-61	55-58	26-52

Location	Measured Sound Level (dB)					
	Day			Evening	Night	
	$L_{Aeq,16h}$ (7am-11pm)	$L_{Aeq,12h}$ (7am-7pm)	$L_{A90,1h}$ (7am-11pm)	$L_{Aeq,4h}$ (7pm-11pm)	$L_{Aeq,8h}$ (11pm-7am)	$L_{A90,15min}$ (11pm-7am)
LT16	44-55	47-56	31-47	41-47	42-46	25-45
LT17	53-57	54-58	34-56	49-55	51-59	28-52
LT18	44-51	45-51	35-50	43-50	48-51	27-49
LT19	53-61	55-63	35-56	49-54	48-50	28-53
LT20	40-44	40-44	28-46	39-42	39-45	26-41
LT21	43-49	43-49	29-49	43-44	38-45	26-42
LT22	46-51	47-52	34-54	43-50	44-50	28-49

1.5.3 Short-term survey results

Landfall

1.5.3.1 The full tabulated results of the short-term measurements at ST1 are presented in Appendix B with a summary of the range of measured levels provided in **Table 1.9** below.

1.5.3.2 Measurements were taken during the daytime only since no night-time works are likely around the location of position ST1. Baseline sound data for night-time works at Landfall has been obtained from position LT1.

Table 1.9: Range of measured sound levels at ST1

Location	Measured Sound Level (dB)		
	Day		
	$L_{Aeq,T}$	L_{AFmax}	$L_{A90,T}$
ST1	59-68	70-96	53-58

PRoW

1.5.3.3 The measured levels at each location are presented in **Table 1.10** below. The results are presented alongside the NAMM and PONS values determined on-site.

Table 1.10: Tranquility survey results

Location	Measurement 1			Measurement 2		
	$L_{Aeq,T}$ (dB)	NAMM Value	PONS	$L_{Aeq,T}$ (dB)	NAMM Value	PONS
NTM1	44	4	20	40	3	30
NTM2	41	3	0	42	2	0
NTM3	41	2	0	43	2	0

Location	Measurement 1			Measurement 2		
	$L_{Aeq,T}$ (dB)	NAMM Value	PONS	$L_{Aeq,T}$ (dB)	NAMM Value	PONS
NTM4	43	2	0	42	2	0

1.5.3.4 The road traffic noise level was noted to be significant but not dominant in terms of the NTM. As per the guidance, a NAMM value of 4 and PONS value of 0 is appropriate for the positions measured.

1.5.3.5 The baseline tranquillity score at each location has been determined using the Natural Tranquility Method Calculator contained in Appendix A of the Tranquil Spaces: Measuring the tranquillity of public spaces (Bentley, 2019). The results are presented in **Table 1.11** below.

Table 1.11: Tranquility scores

Position	Tranquility Score	Description
NTM1	6	Fairly tranquil
NTM2	5	Just tranquil
NTM3	5	Just tranquil
NTM4	5	Just tranquil

1.6 References

Bentley, C (2019), *Tranquil Spaces: Measuring the tranquillity of public spaces,* London, Sharps Redmore Press

British Standards Institution (1991), 'British Standard 7445-2:1991 Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use'.

British Standards Institution (2003), 'British Standard 7445-1:2003. Description and measurement of environmental noise – Part 1: Guide to environmental quantities and procedures'

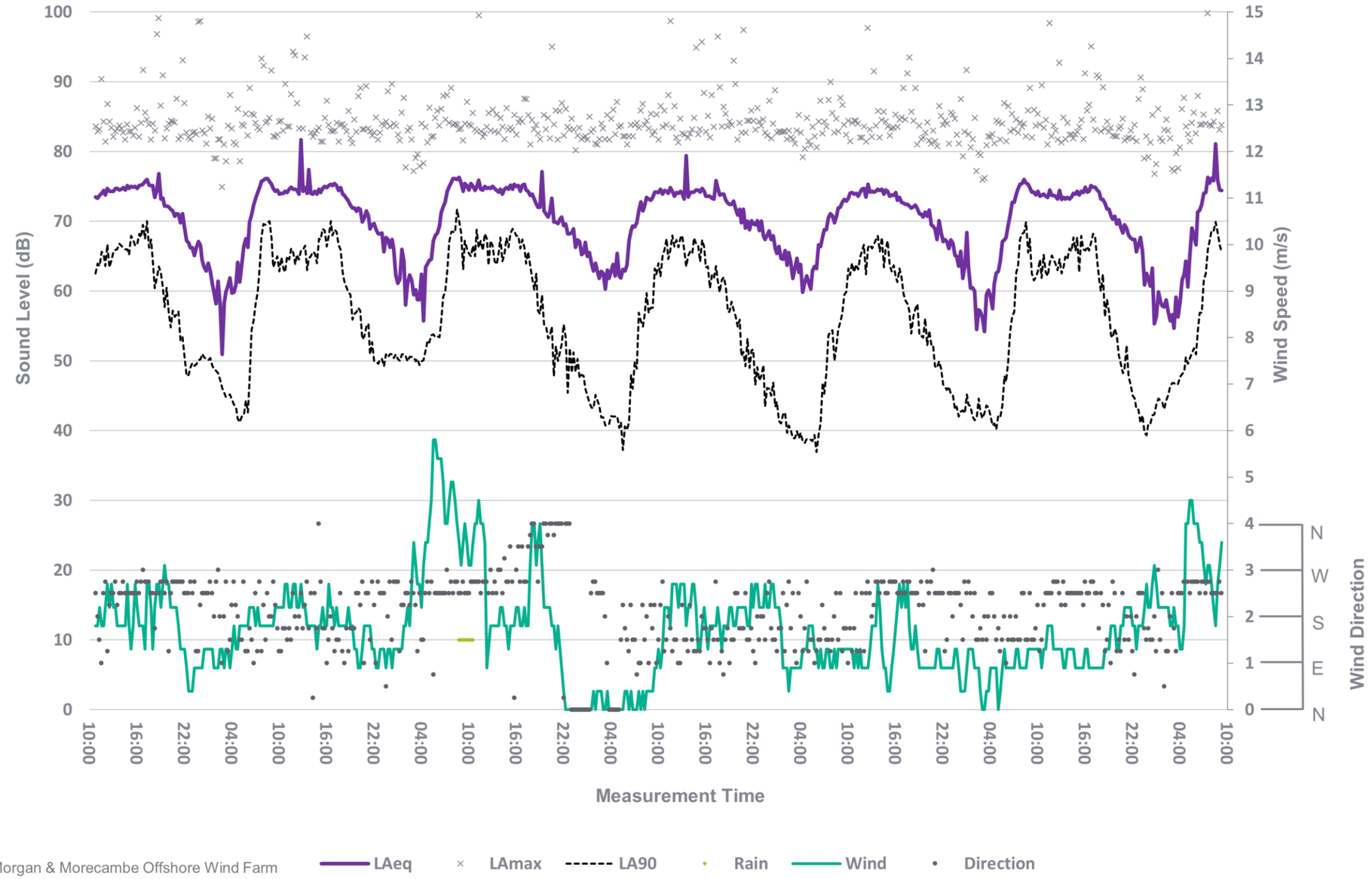
British Standards Institution (2017), 'BS EN 61672-2:2013+A1:2017 – 'Electroacoustics. Sound level meters – Pattern evaluation tests'

British Standards Institution (2018), 'BS EN IEC 60942 – 'Electroacoustics. Sound Calibrators'

Appendix A: Time-Histories

Appendix A1

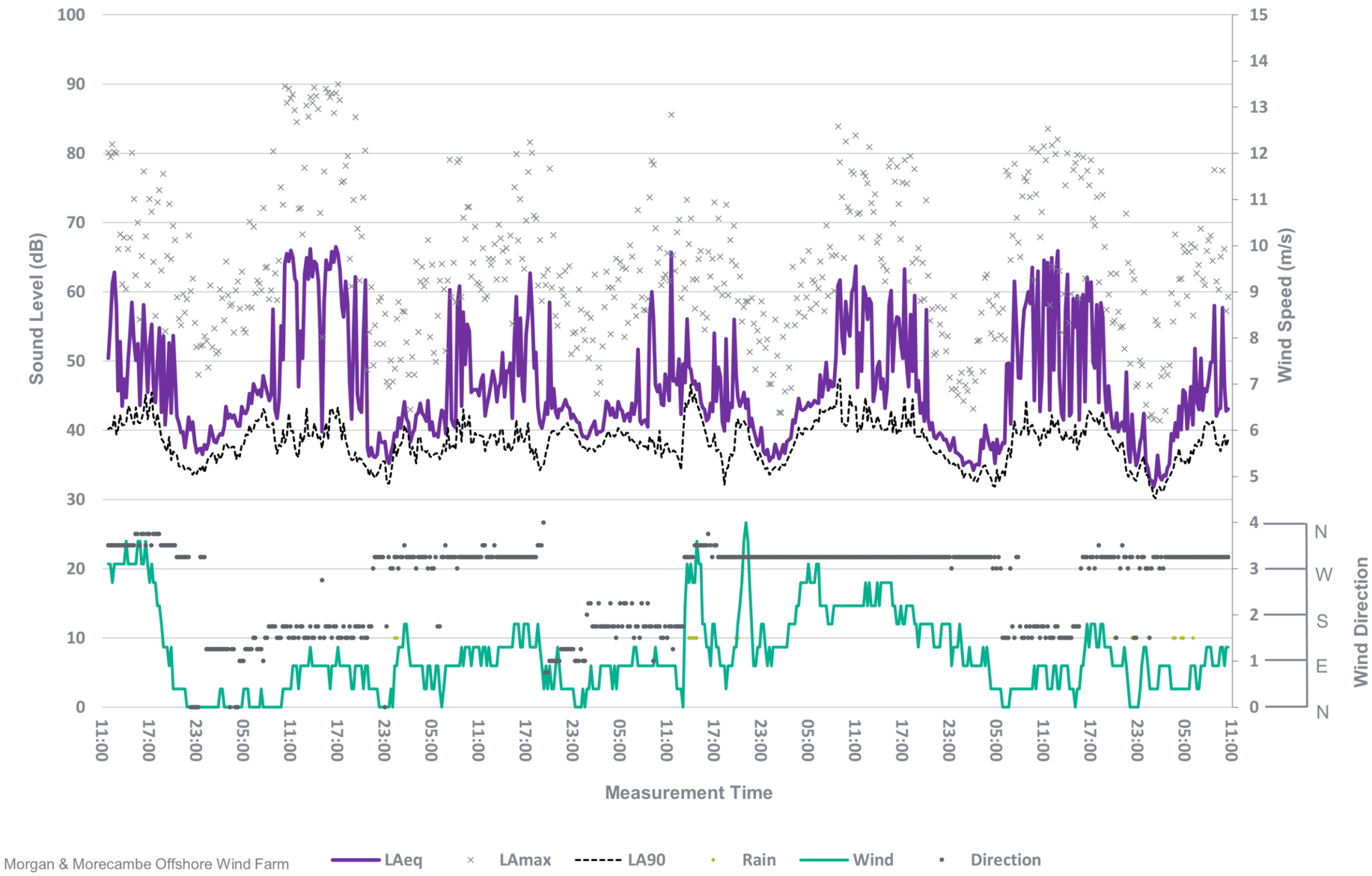
Measured Noise Levels at LT1, 13 to 19 March 2024



Morgan & Morecambe Offshore Wind Farm

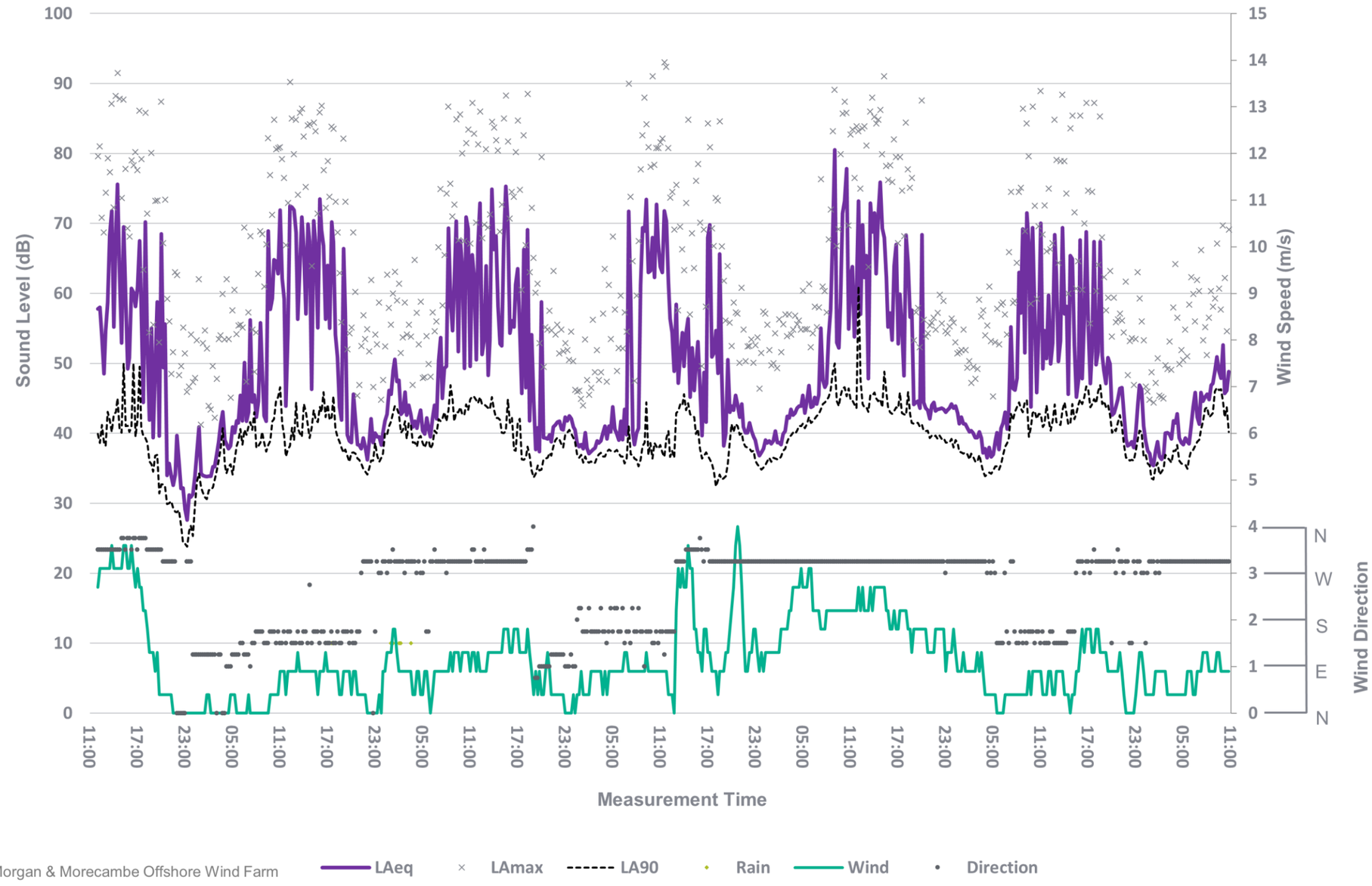
Appendix A2

Measured Noise Levels at LT2, 22 to 28 June 2023



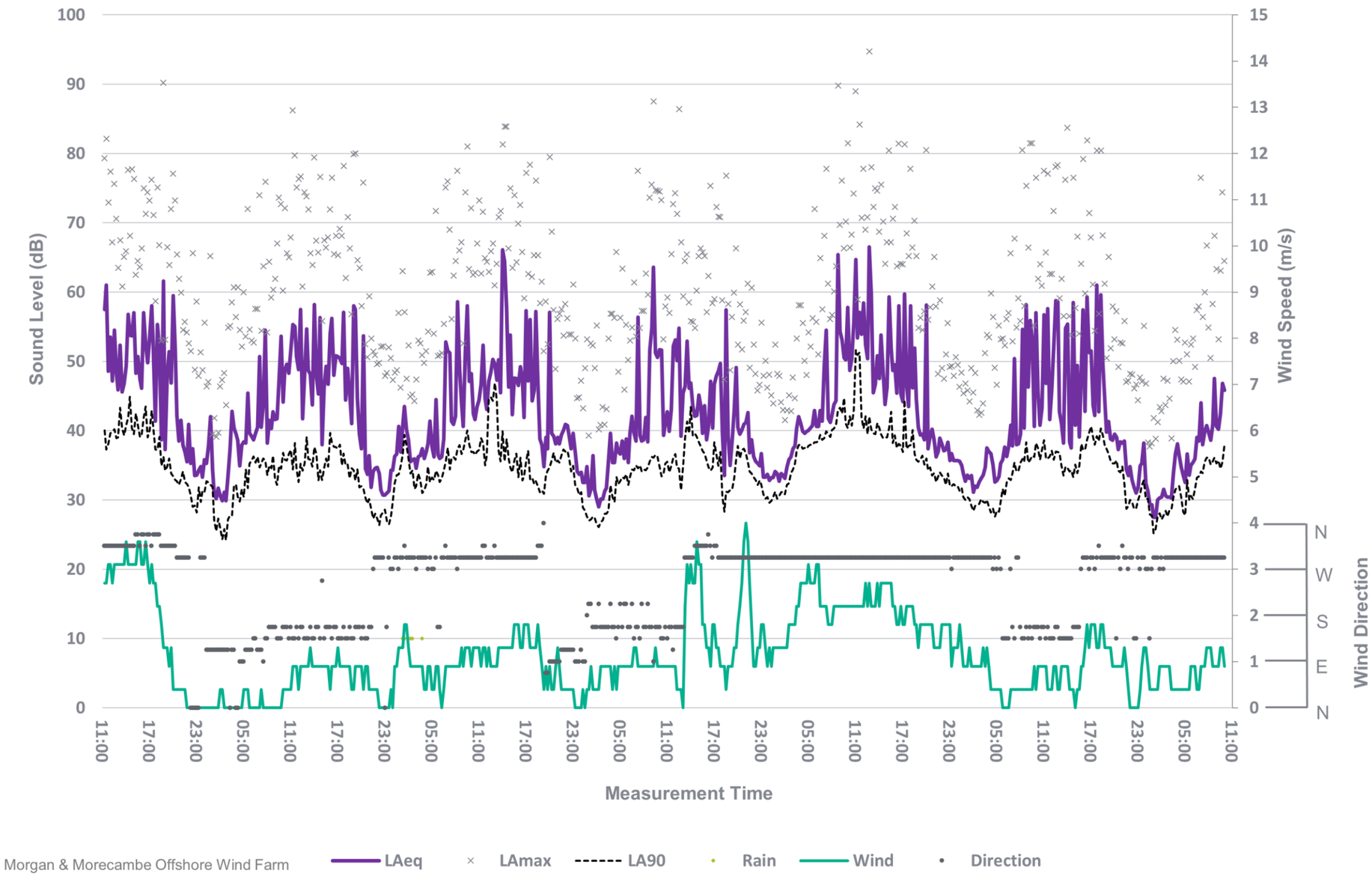
Appendix A3

Measured Noise Levels at LT3, 22 to 28 June 2023



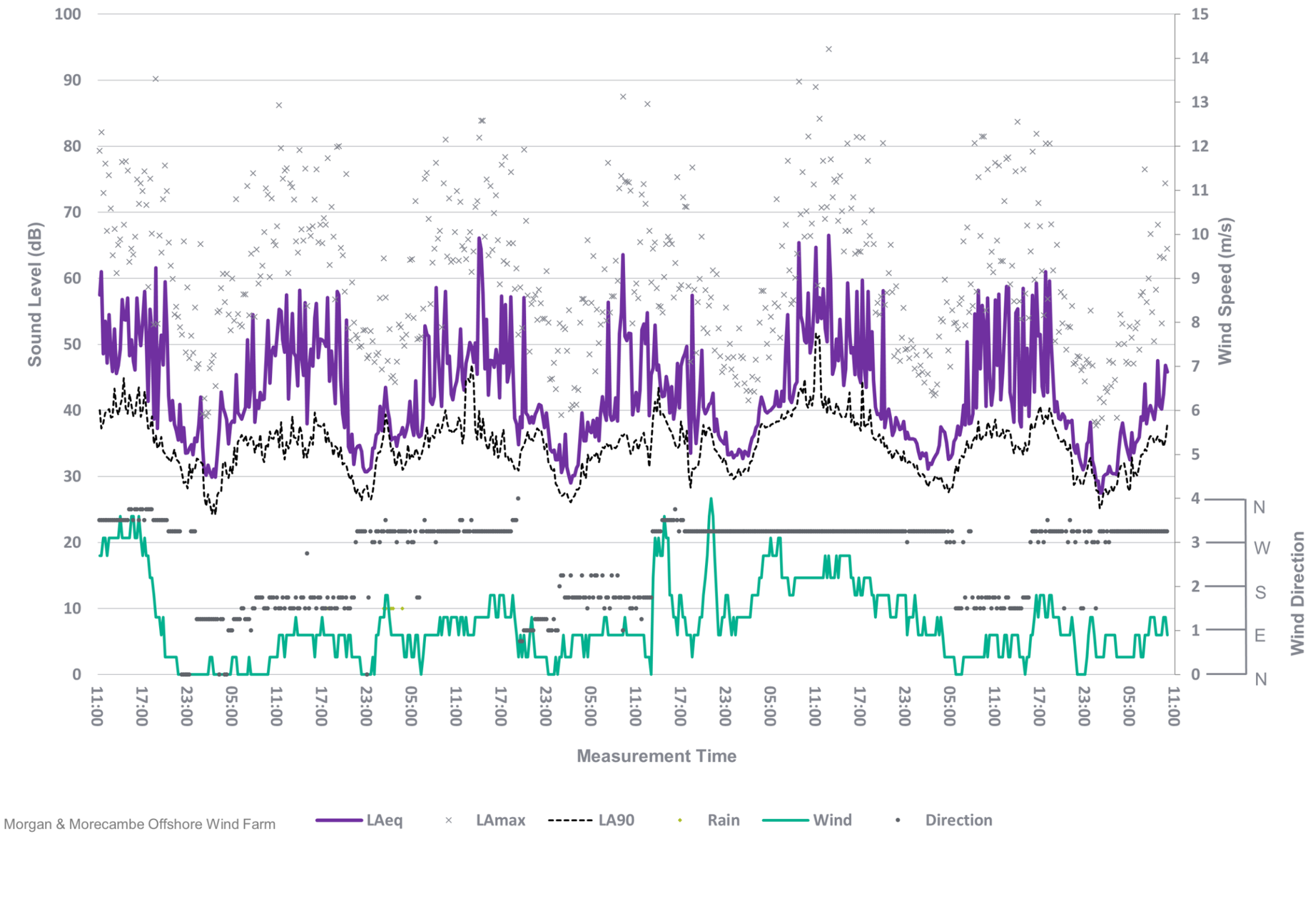
Appendix A4

Measured Noise Levels at LT4, 22 to 28 June 2023



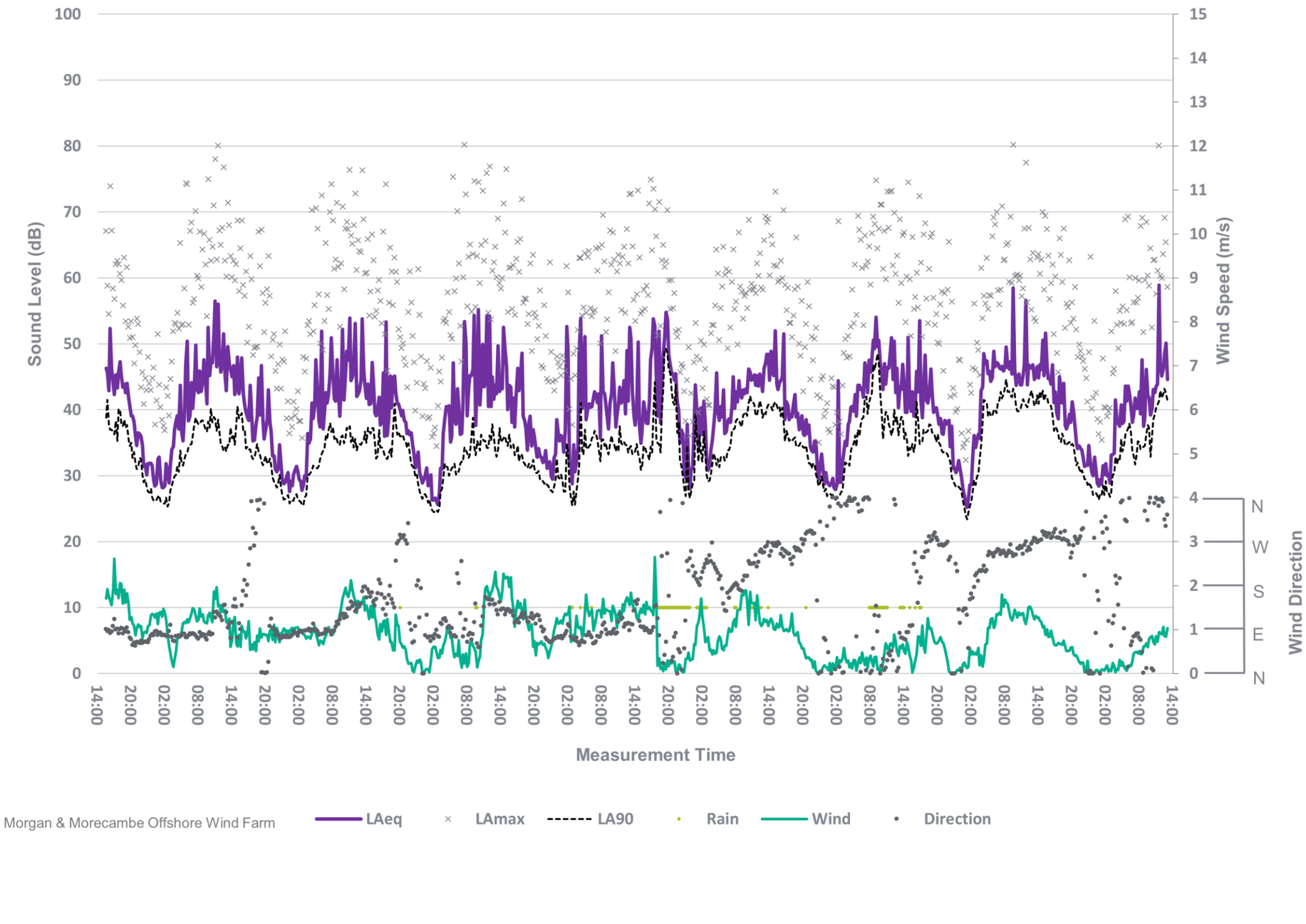
Appendix A5

Measured Noise Levels at LT5, 22 to 28 June 2023



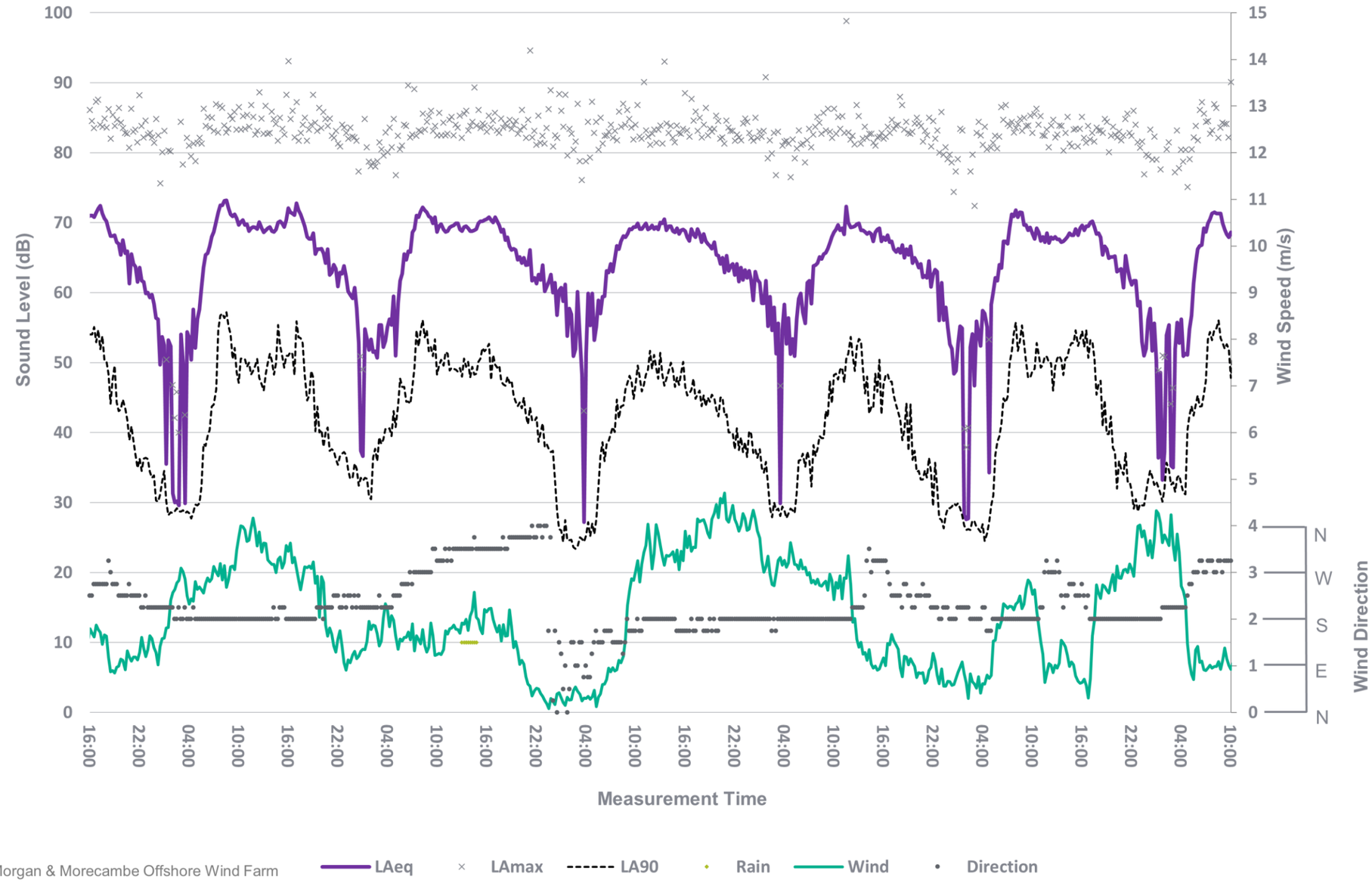
Appendix A6

Measured Noise Levels at LT6, 14 to 22 June 2023



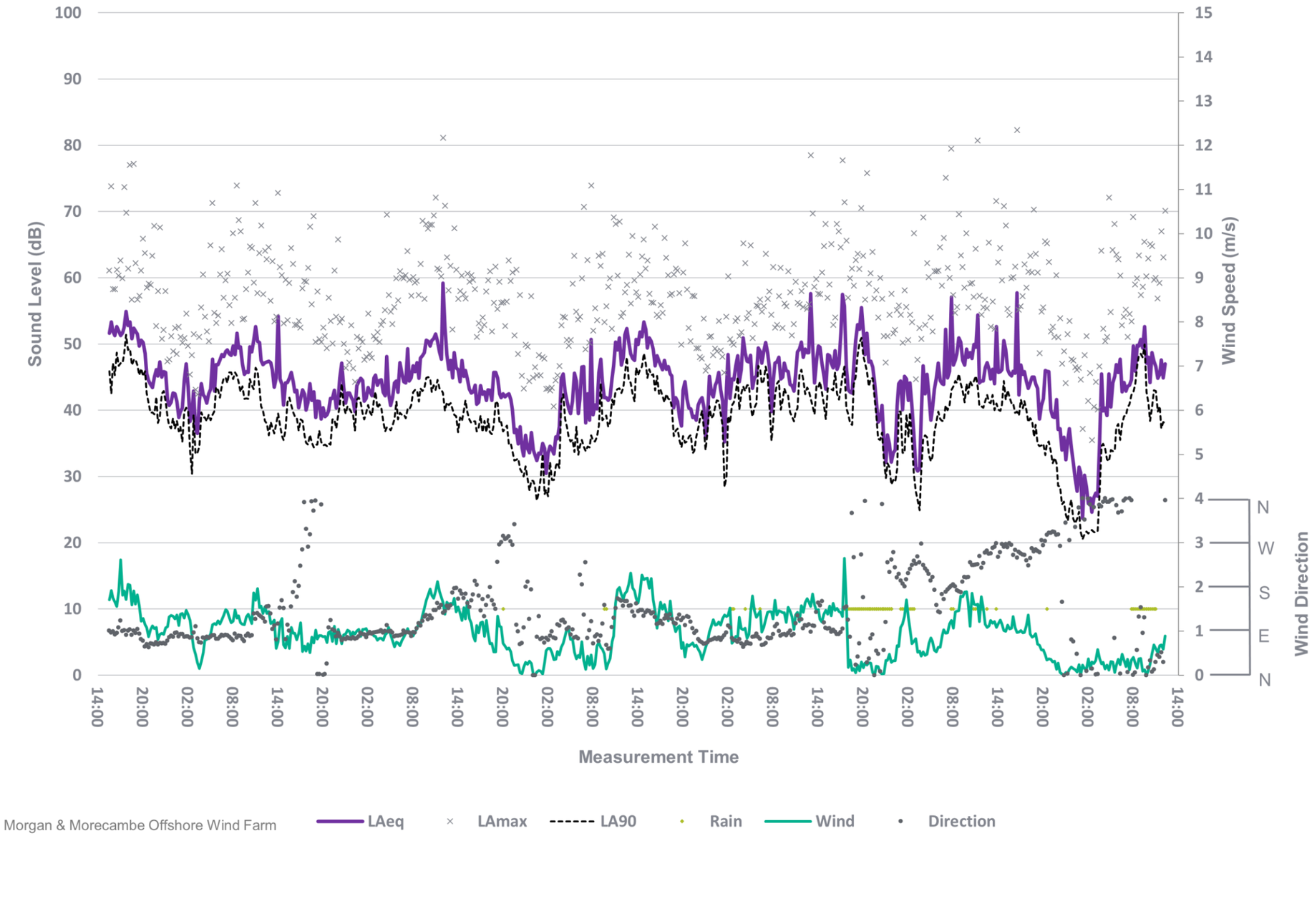
Appendix A7

Measured Noise Levels at LT7, 13 to 19 March 2024



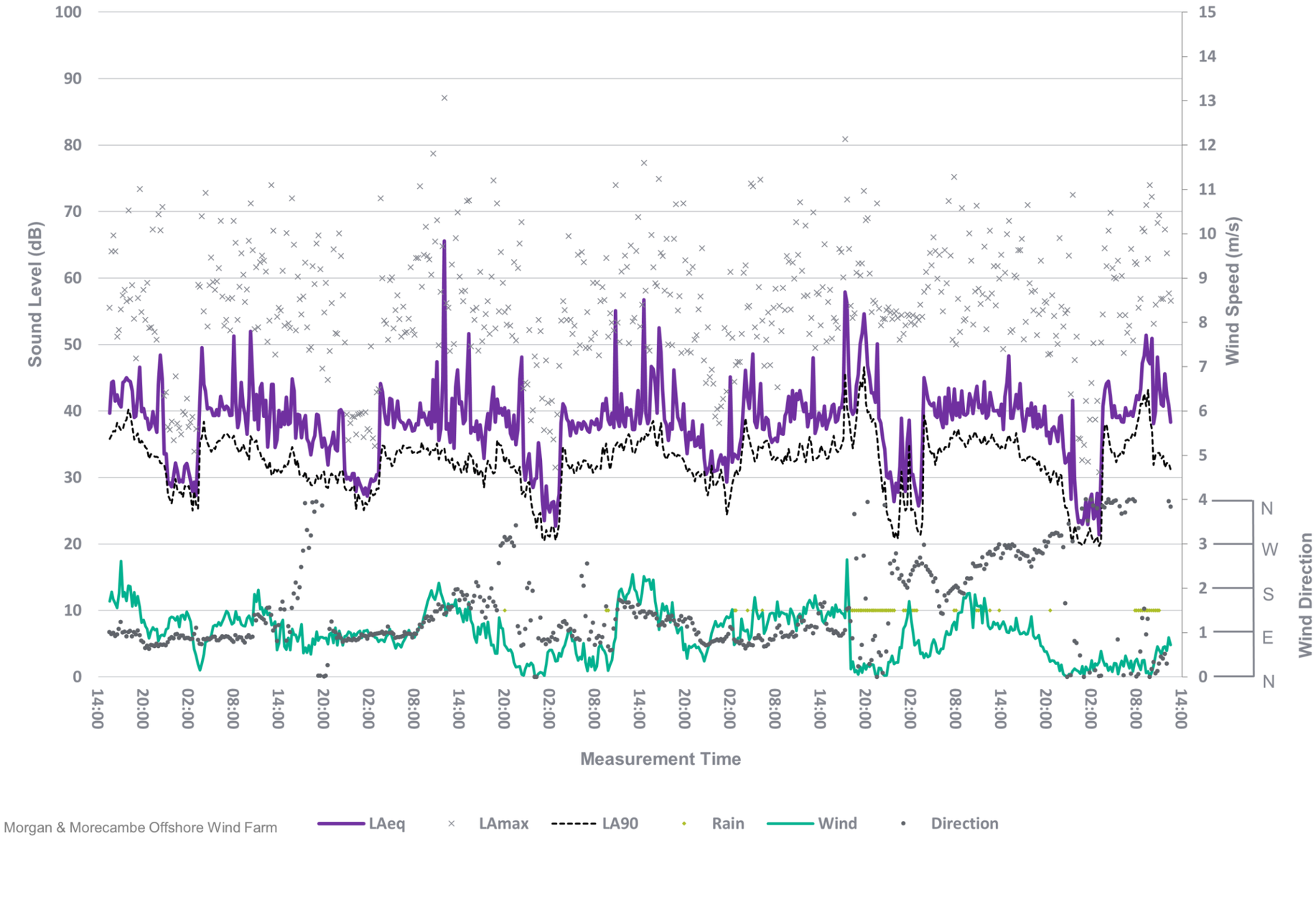
Appendix A8

Measured Noise Levels at LT8, 14 to 20 June 2023



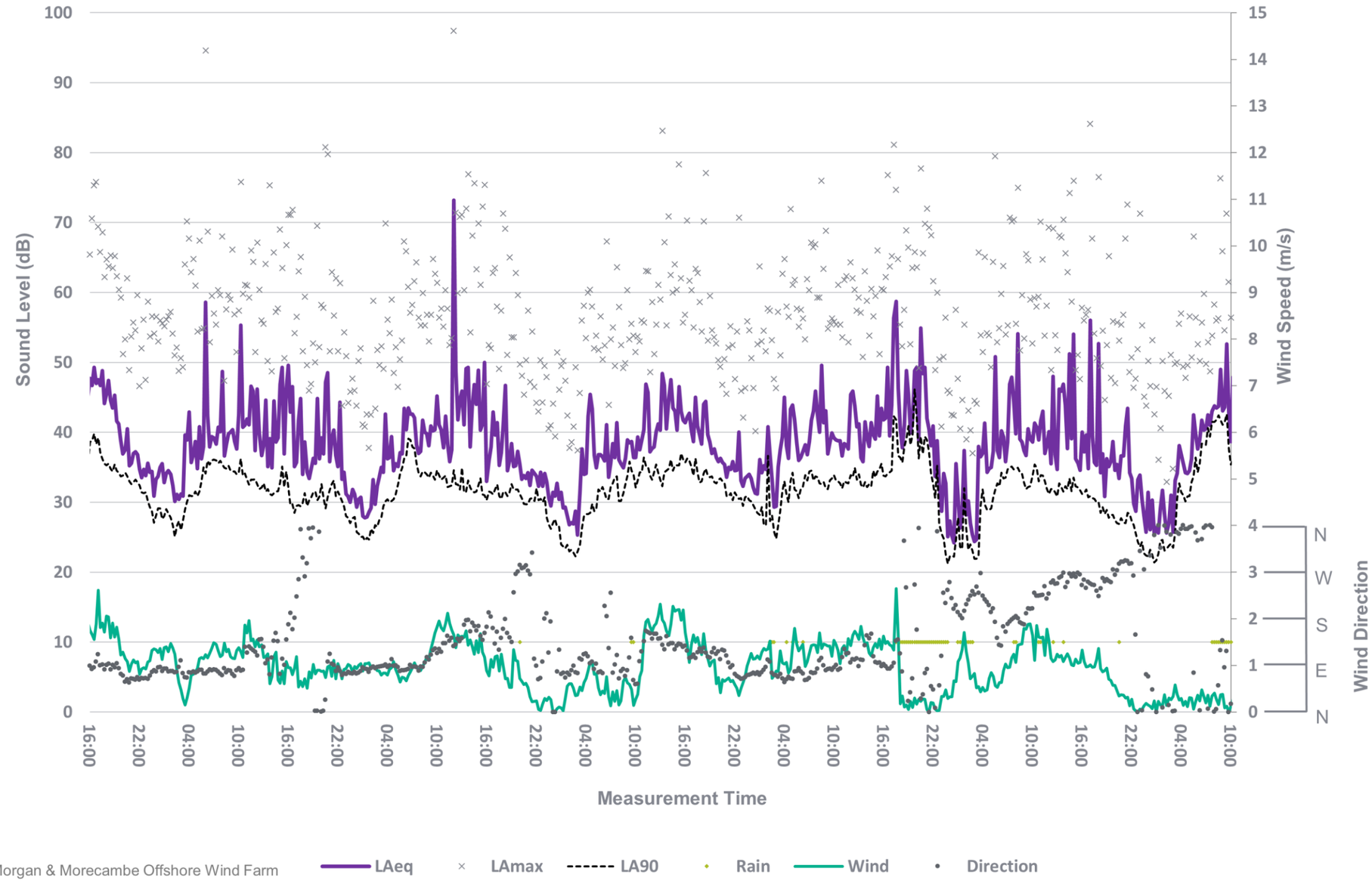
Appendix A9

Measured Noise Levels at LT9, 14 to 20 June 2023



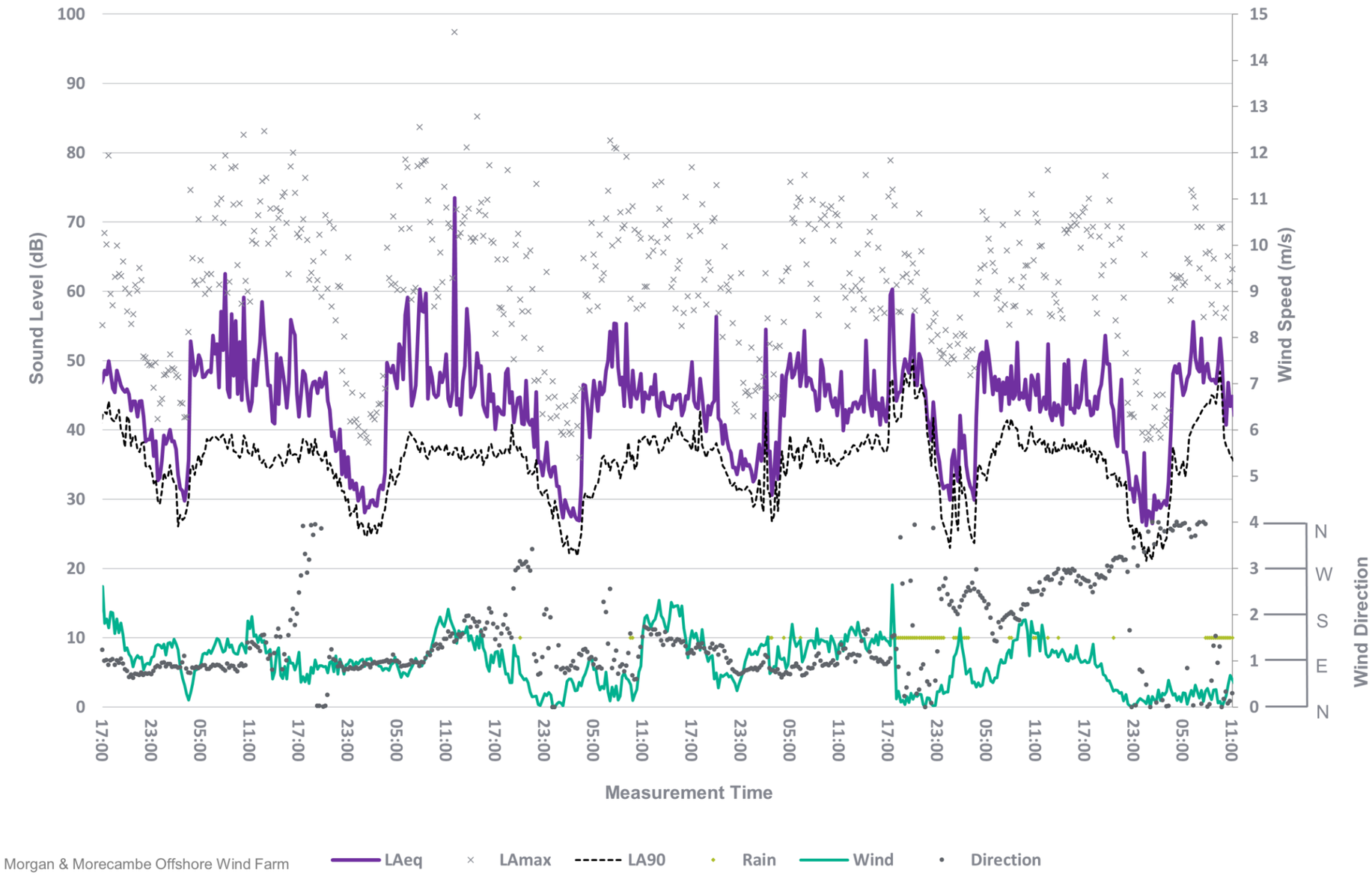
Appendix A10

Measured Noise Levels at LT10, 14 to 20 June 2023



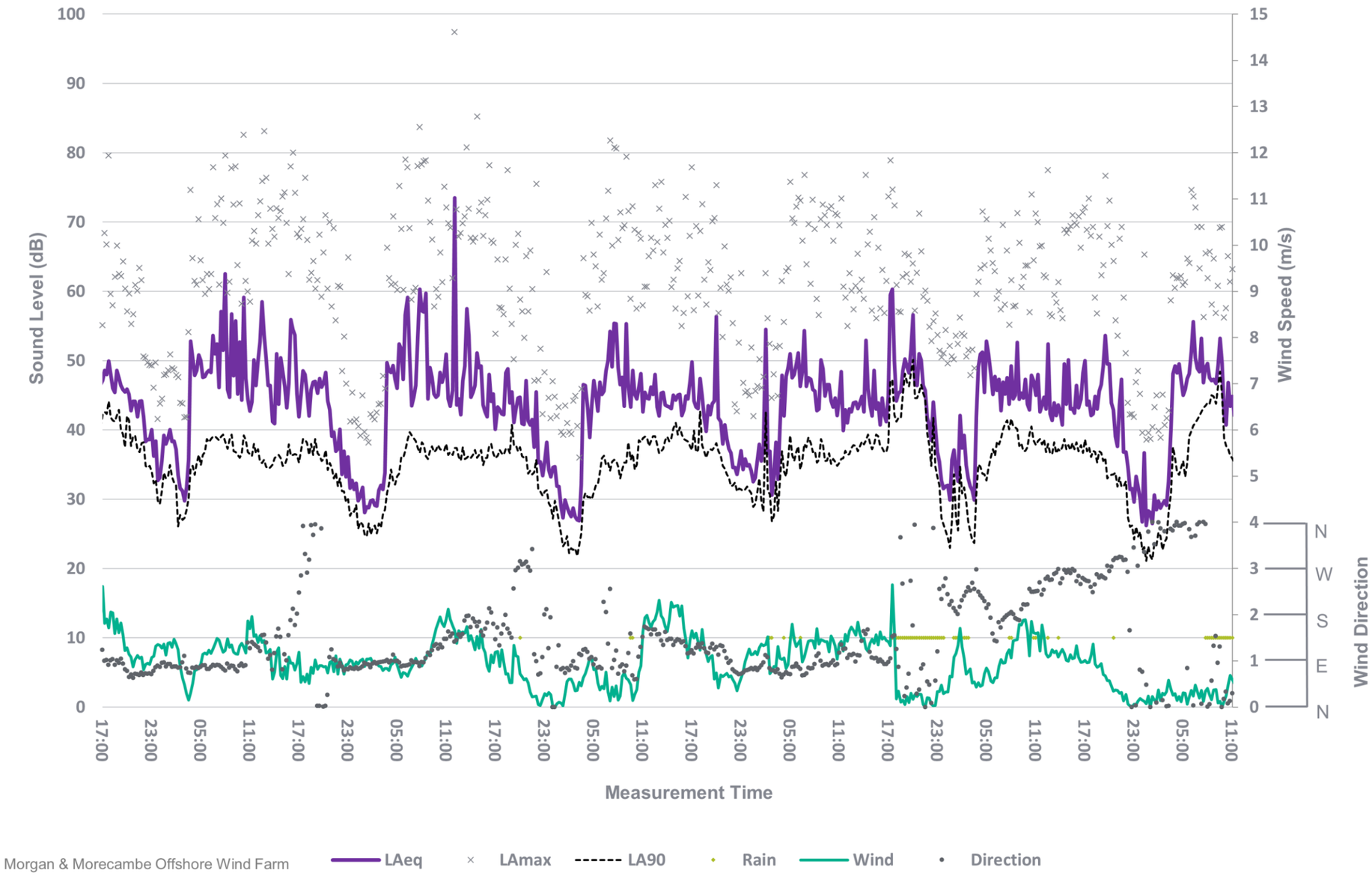
Appendix A11

Measured Noise Levels at LT11, 14 to 20 June 2023



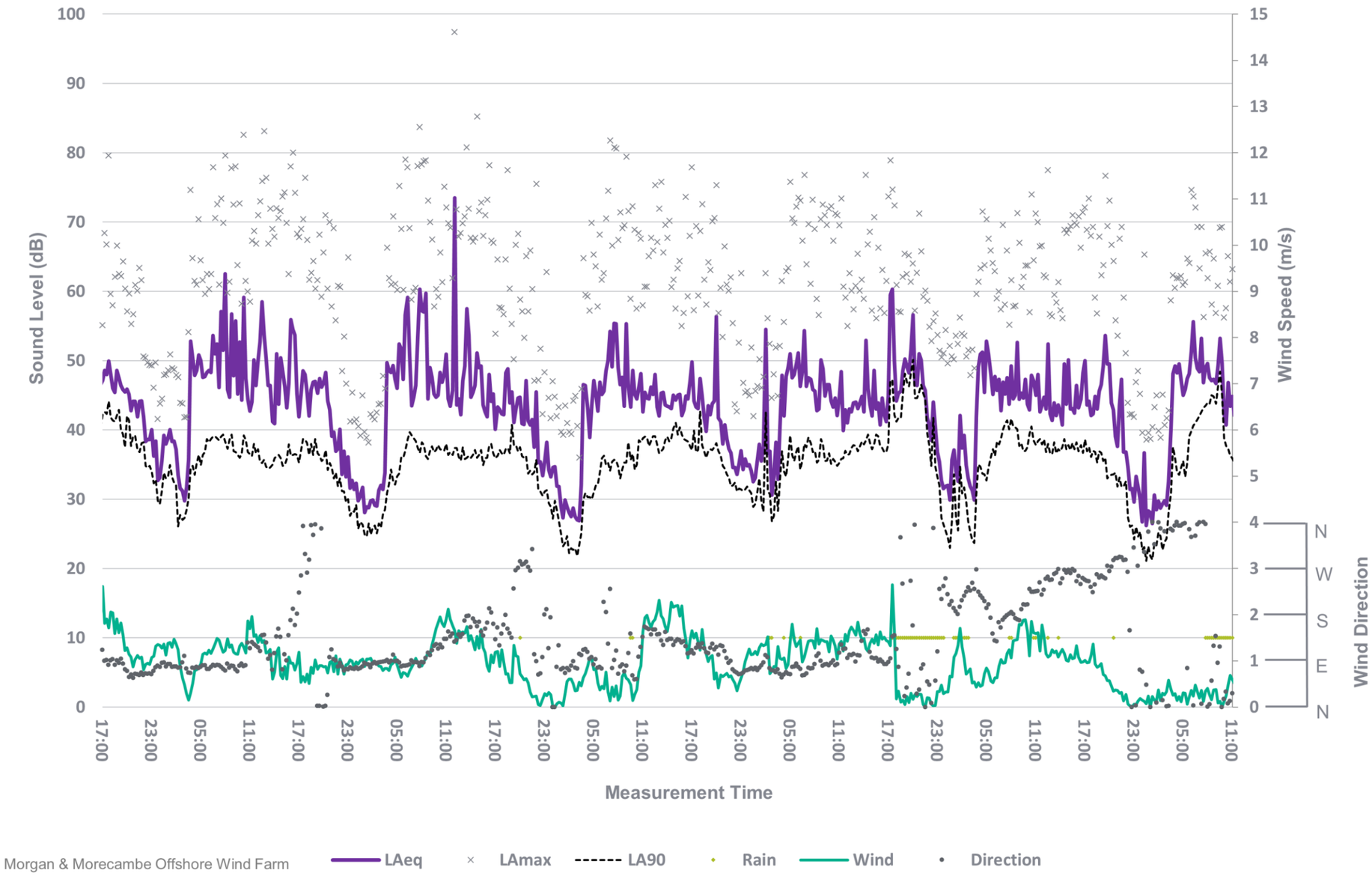
Appendix A12

Measured Noise Levels at LT12, 14 to 20 June 2023



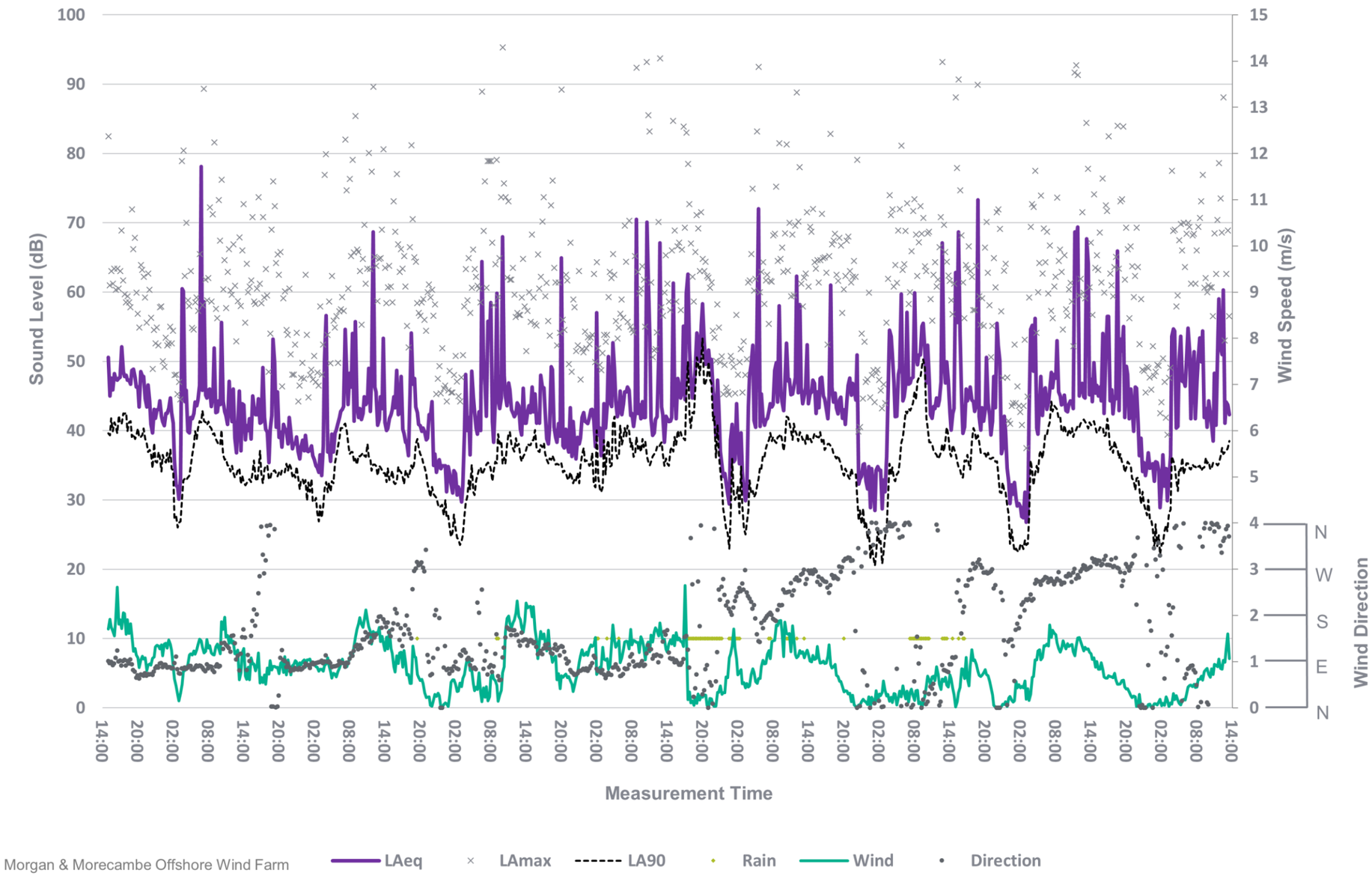
Appendix A13

Measured Noise Levels at LT13, 14 to 20 June 2023



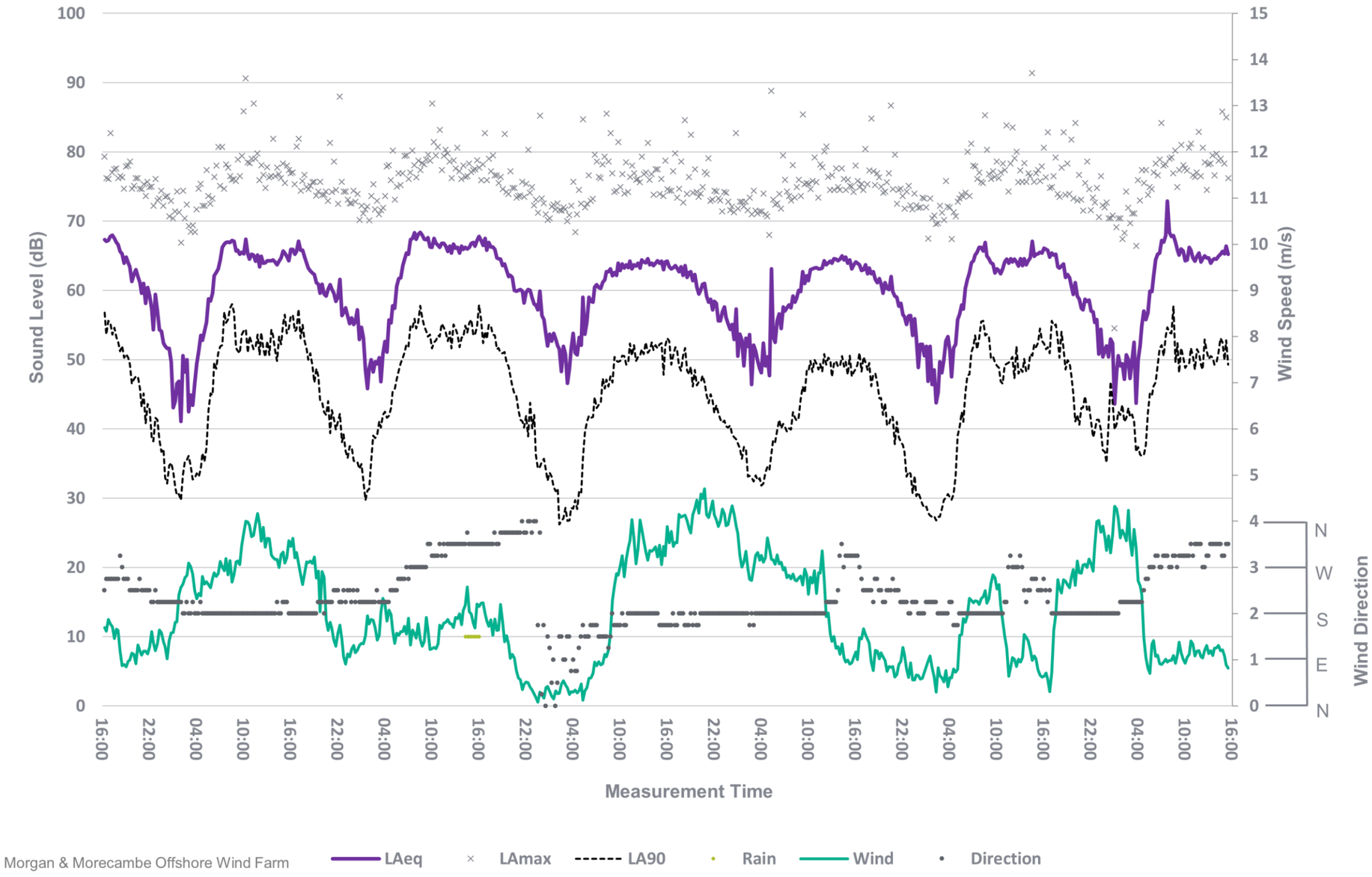
Appendix A14

Measured Noise Levels at LT14, 14 to 22 June 2023



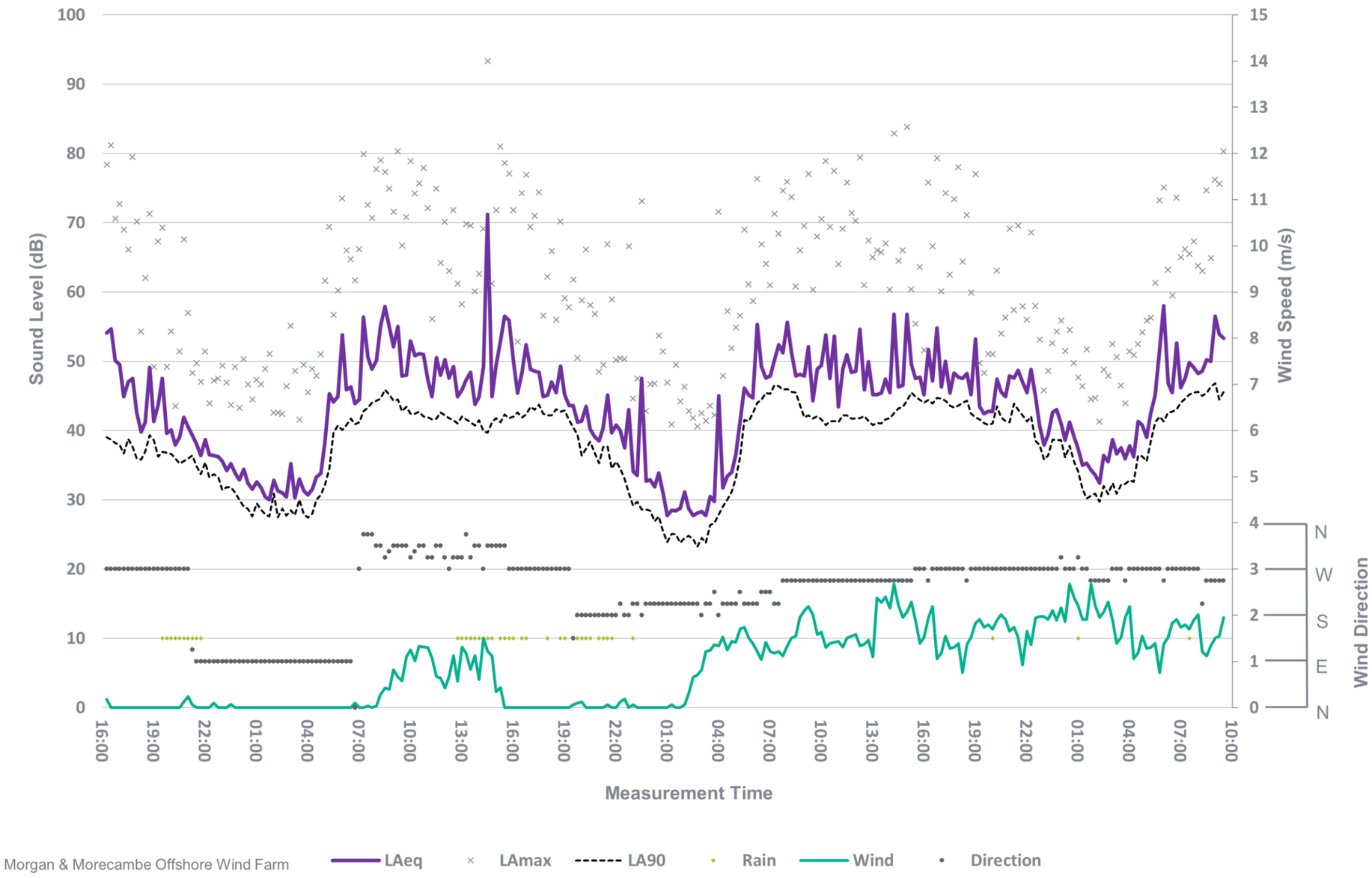
Appendix A15

Measured Noise Levels at LT15, 13 to 19 March 2024



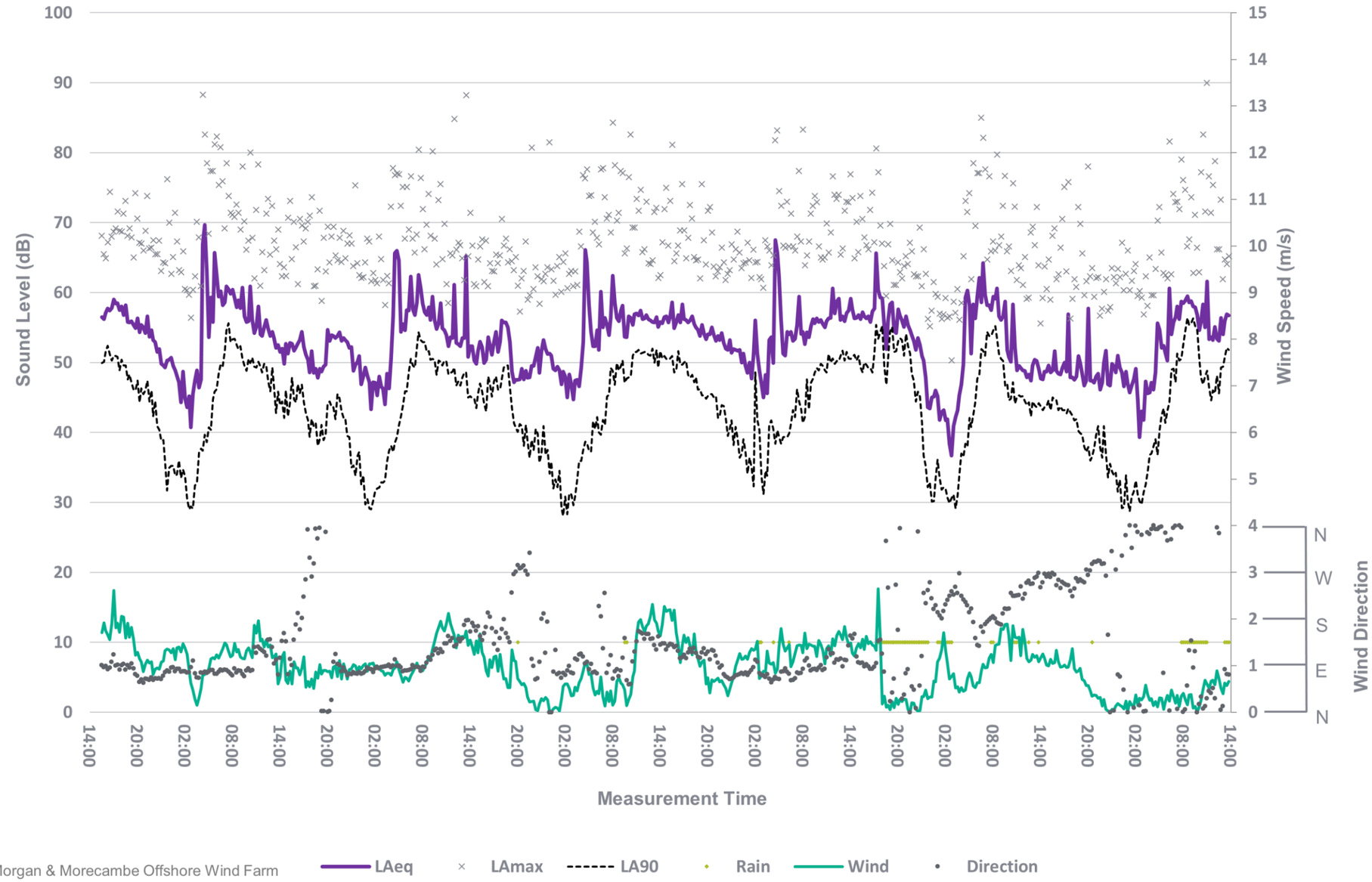
Appendix A16

Measured Noise Levels at LT16, 19 to 22 March 2024



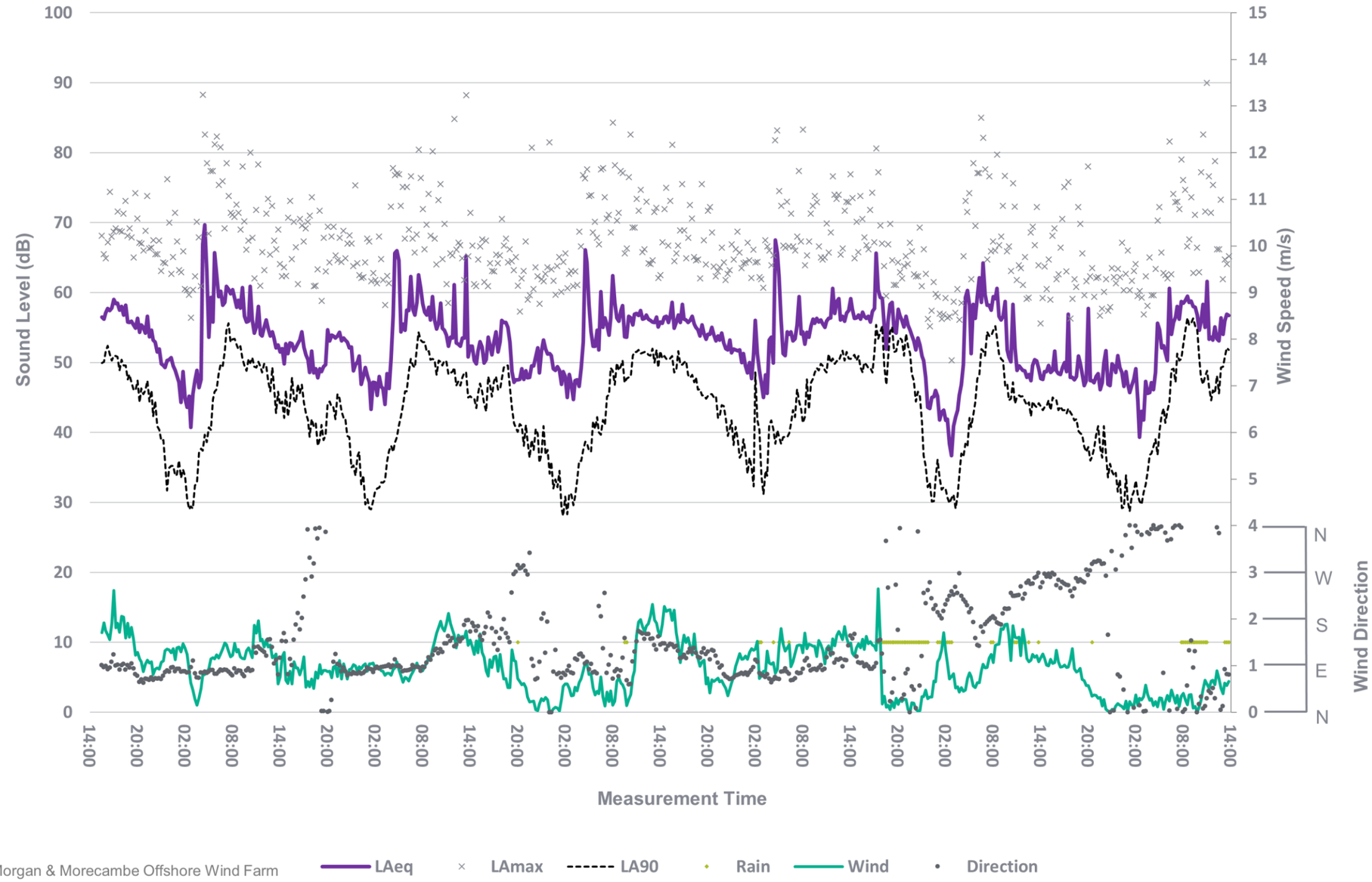
Appendix A17

Measured Noise Levels at LT17, 14 to 20 June 2023



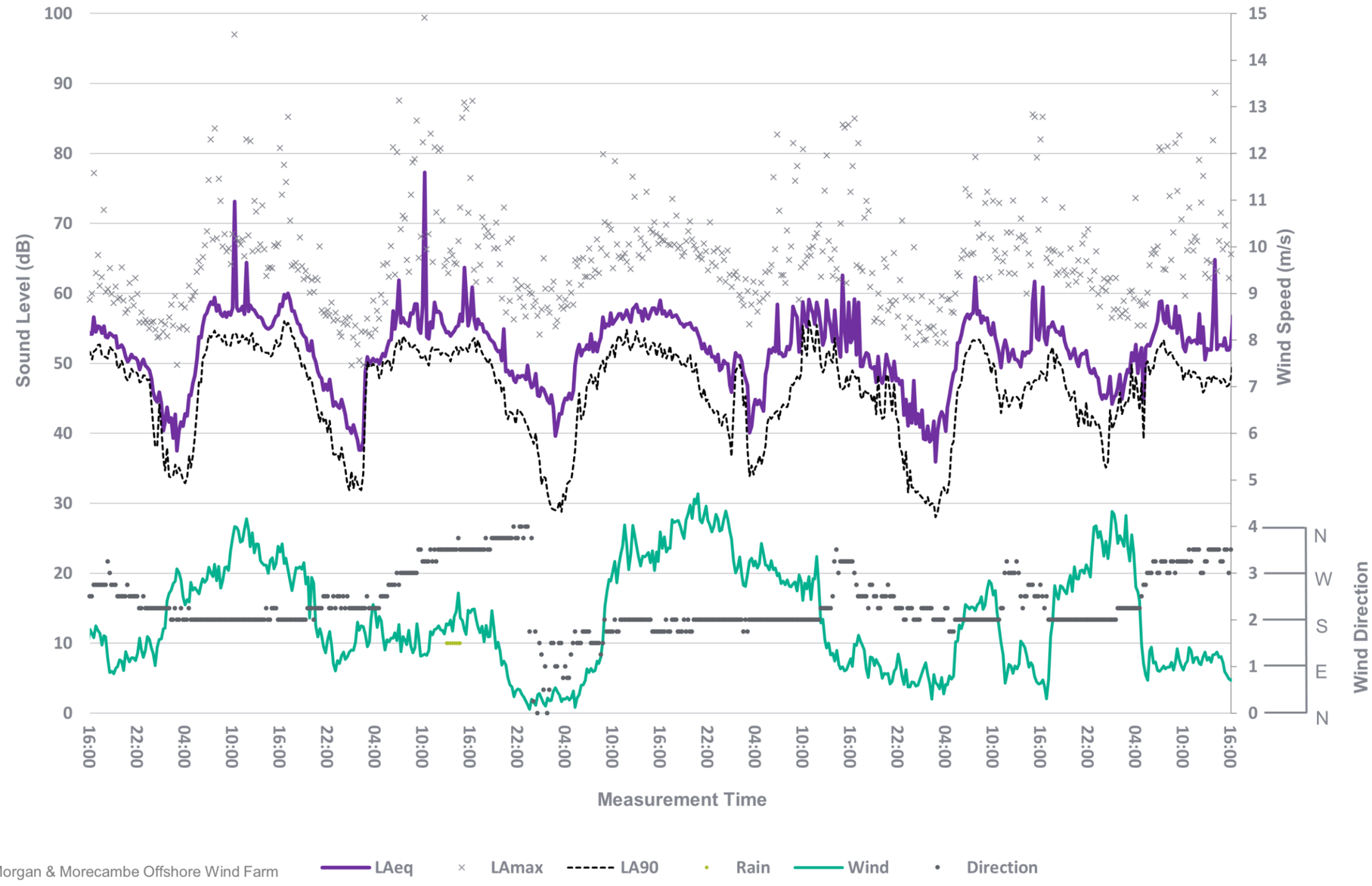
Appendix A18

Measured Noise Levels at LT18, 14 to 20 June 2023



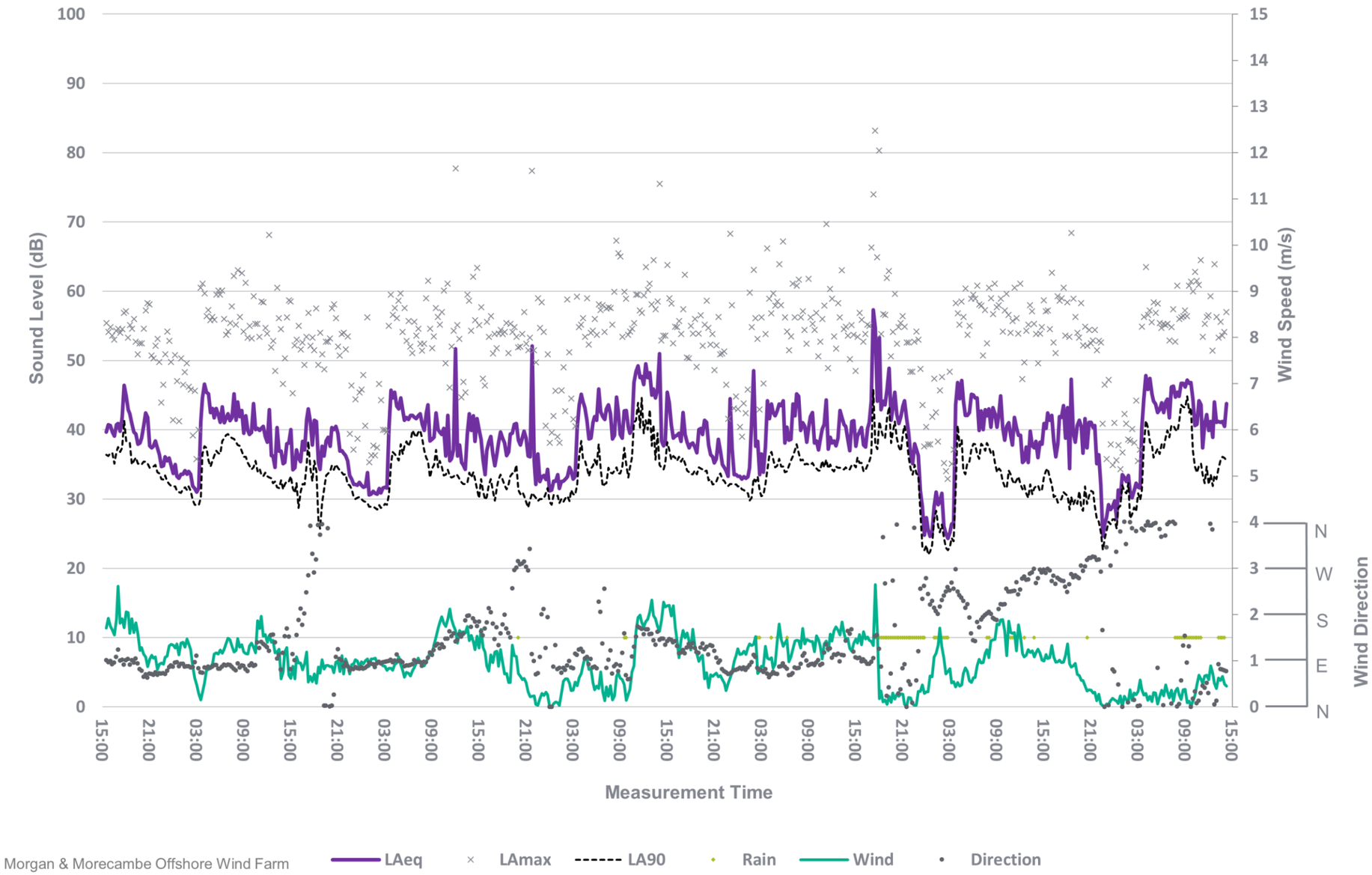
Appendix A19

Measured Noise Levels at LT19, 13 to 19 March 2024



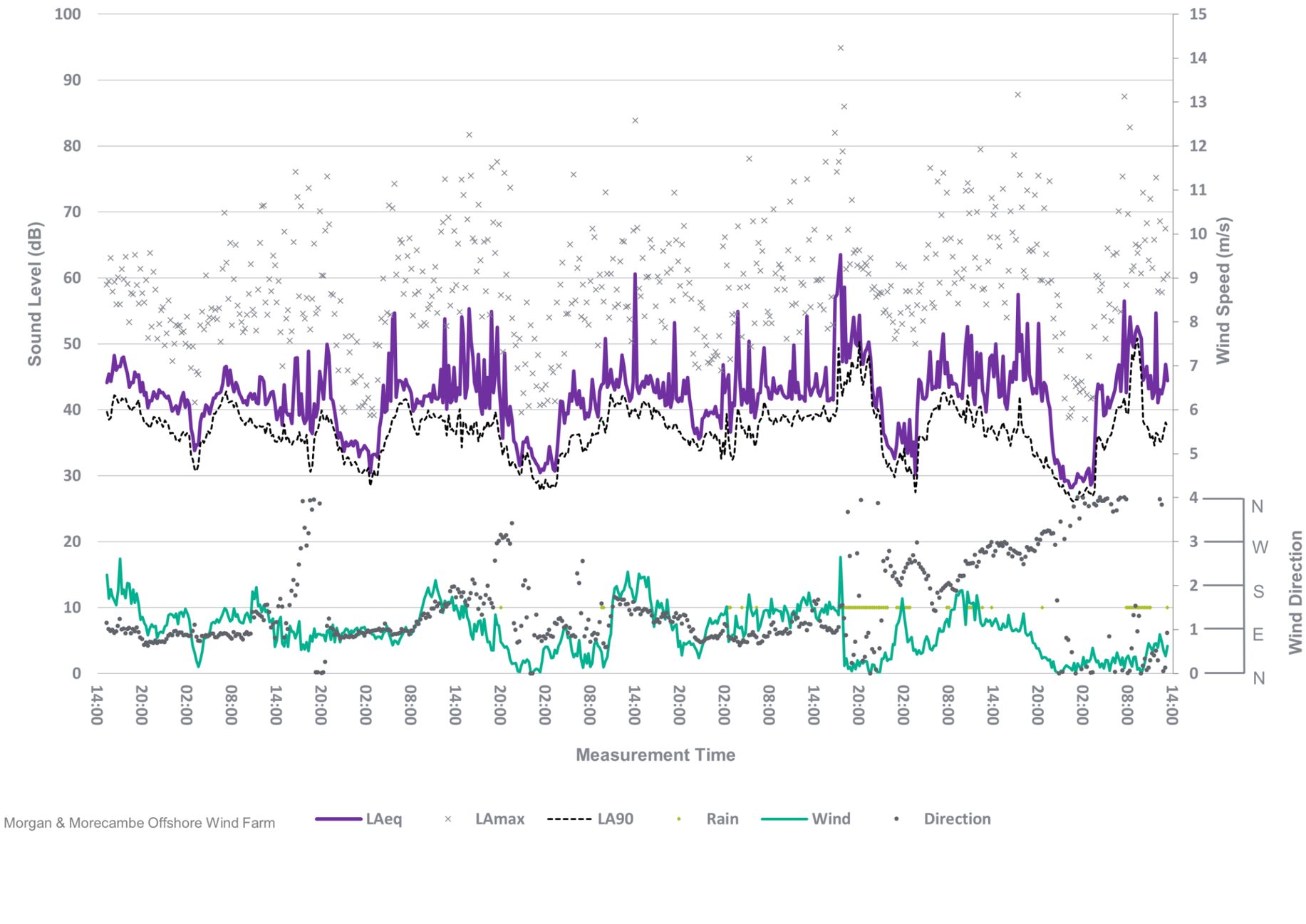
Appendix A20

Measured Noise Levels at LT20, 14 to 20 June 2023



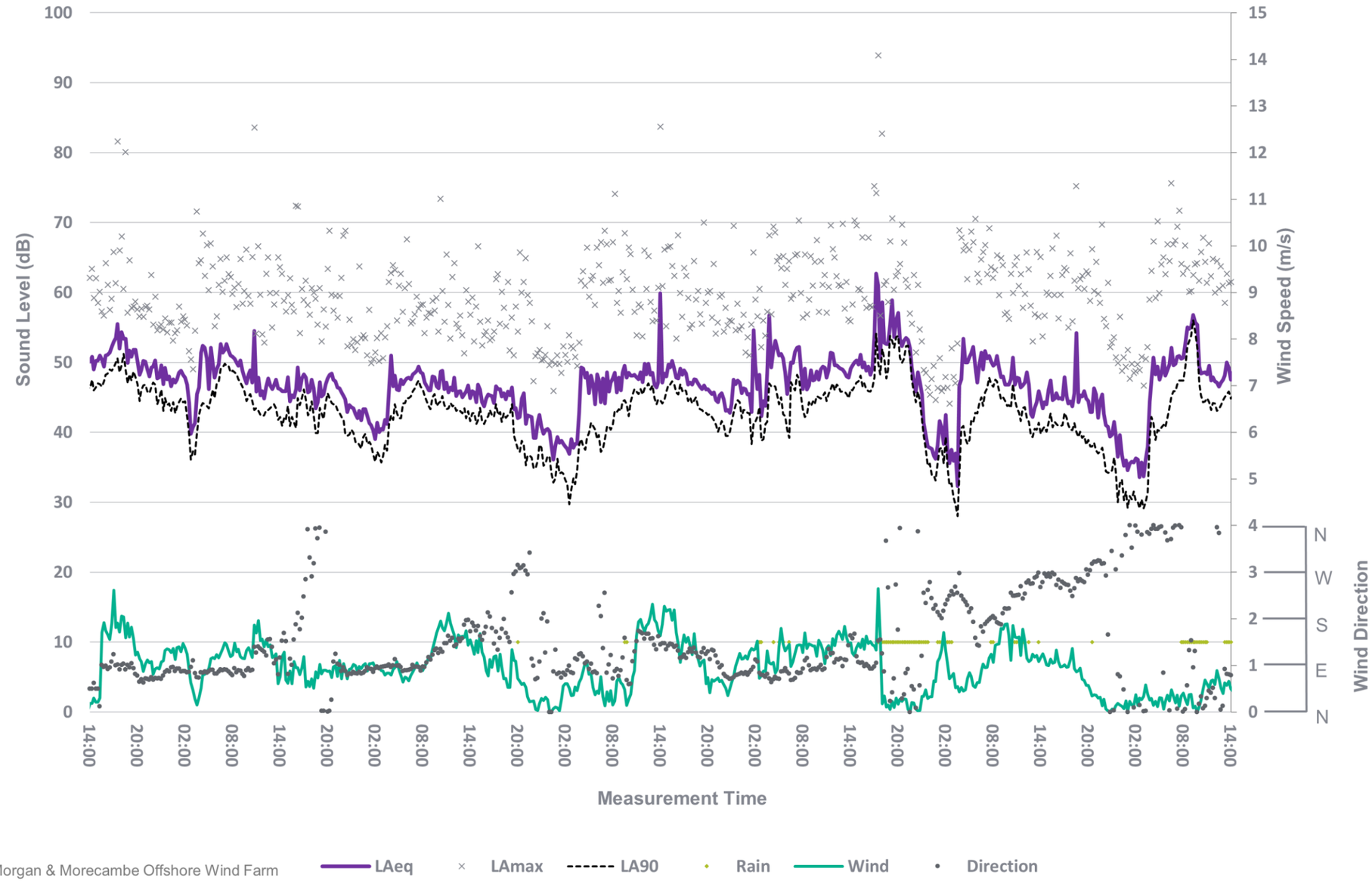
Appendix A21

Measured Noise Levels at LT21, 14 to 20 June 2023



Appendix A22

Measured Noise Levels at LT22, 14 to 20 June 2023



Appendix B: Short-term survey results

Measured noise levels at ST1

Start Time	Measured Noise Level, dB(A)		
	$L_{Aeq,T,}$	$L_{AF,max}$	$L_{A90,T}$
13/03/2024 10:45	62	82	53
13/03/2024 11:00	59	69	52
13/03/2024 11:15	68	96	53
13/03/2024 11:30	59	71	54
13/03/2024 11:45	62	86	54
13/03/2024 12:00	59	71	53
13/03/2024 12:15	61	78	54
13/03/2024 12:30	61	75	55
13/03/2024 12:45	61	72	55
13/03/2024 13:00	61	74	56
13/03/2024 13:15	61	73	55
13/03/2024 13:30	62	78	56
13/03/2024 13:45	62	70	55
13/03/2024 14:00	61	72	55
13/03/2024 14:15	62	71	54
13/03/2024 14:30	61	70	55
13/03/2024 14:45	62	78	56
13/03/2024 15:00	62	73	56

Measured noise levels at ST2-5 (Round 1)

Position	Start Time	Measured Noise Level, dB(A)		
		$L_{Aeq,T,}$	$L_{AF,max}$	$L_{A90,T}$
ST2	19/03/2024 12:27	44	64	40
ST3	19/03/2024 12:47	41	54	39
ST4	19/03/2024 13:06	41	55	38
ST5	19/03/2024 13:25	43	59	40

Measured noise levels at ST2-5 (Round 2)

Position	Start Time	Measured Noise Level, dB(A)		
		$L_{Aeq,T,}$	$L_{AF,max}$	$L_{A90,T}$
ST2	19/03/2024 13:50	40	55	37
ST3	19/03/2024 14:09	42	60	38
ST4	19/03/2024 14:27	43	62	37
ST5	19/03/2024 14:47	42	57	40