

Port of Hay Point

Ambient Air, Noise and Weather Monitoring

Validated Report

1st July 2021 – 31st July 2021

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Residential and Control Monitoring Stations

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| Revision History | | | |
|------------------|-----------|------------|--------------|
| Revision | Report ID | Date | Analyst |
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1.0 Introduction

Ecotech Pty Ltd was commissioned by North Queensland Bulk Ports Corporation (NQBP), Dalrymple Bay Coal Terminal Pty Ltd (DBCT P/L) and BMA Hay Point Coal Terminal (HPCT) to provide monitoring and data reporting for the Port of Hay Point environmental monitoring program in Hay Point, Queensland. Ecotech commenced services under the ambient air quality monitoring program Contract SA294.2016 on the 1st of March 2017.

This report presents the data from July 2021.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured.

1.1. Purpose of monitoring

This Ambient Air Monitoring Program has been established to proactively monitor ambient air, noise and meteorological conditions in the community surrounding the Port of Hay Point.

This Ambient Air Monitoring Program has been established to proactively monitor ambient air, noise and meteorological conditions in the community surrounding the Port of Hay Point. The program consists of two control stations (C1 and C2), nine ambient air quality monitoring stations (P1, P2, P3, P4, S1, S2, S3, S5 and S6) and one rain gauge as described in Table 1.

Since the commencement of this monitoring program in 1993, Louisa Creek township has been identified as future strategic port land. NQBP have introduced a voluntary residential buy back scheme and taken steps to prevent residential re-intensification in zones immediately adjacent to the Port. Subsequently the monitoring station - P2 is no longer in as populated residential location as when the program initially began.

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2.0 Monitoring and Data Collection

2.1. Siting Details

The Sites consist of two Control stations (C1 and C2), nine Residential ambient air quality monitoring stations (P1, P2, P3, P4, S1, S2, S3, S5 and S6) and one Rain Gauge. The stations' location and siting details are described in the following table and figures.

Table 1: Port of Hay Point Residential and Control Monitoring Sites Locations

| Site Name | Geographical Coordinates | Height Above Sea Level (m) |
|--|-------------------------------|----------------------------|
| C1 - Grasstree Beach (South) | 21°21'54.71"S, 149°18'25.60"E | 8 |
| C2 - Grasstree Beach (North) | 21°22'3.06"S, 149°18'27.19"E | 10 |
| P1 - Louisa Creek, Edmund Avenue (North) | 21°16'21.43"S, 149°15'47.96"E | 6 |
| P2 - Louisa Creek, Edmund Avenue (South) | 21°16'48.46"S, 149°16'34.64"E | 10 |
| P3 - Half Tide Car Park | 21°17'45.34"S, 149°17'21.76"E | 9 |
| P4 - Salonika Beach | 21°18'29.32"S, 149°17'33.64"E | 12 |
| S1 - Louisa Creek (North) | 21°16'35.88"S, 149°16'14.42"E | 1 |
| S2 - Louisa Creek (South) | 21°16'46.88"S, 149°16'29.00"E | 4 |
| S3 – Osborne's Residence | 21°17'23.20"S, 149°16'10.05"E | 15 |
| S5 - Salonika Beach | 21°18'11.60"S, 149°17'35.24"E | 13 |
| S6 - Half Tide Beach | 21°17'56.83"S, 149°17'31.84"E | 9 |
| Rain Gauge | 21°17'23.52"S, 149°17'17.41"E | 7 |

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Figure 1: Port of Hay Point Residential, Rain Gauge and Control Monitoring Stations Location



Figure 2: Detail of the Port of Hay Point Residential Stations Location and Rain Gauge

2.2. Monitored Parameters

Table 2 on the next page details the parameters monitored and the instruments used at Port of Hay Point Residential and Control monitoring stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

Sampling of all parameters is continuous, with the exception of Deposited dust. Deposited dust is captured over a one-month period and the sample bottles collected once a month.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

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Table 2: Parameters measured at the Port of Hay Point Residential and Control Monitoring Stations

| Site Code | Parameter Measured | Instrument and Measurement Technique |
|--|--|---|
| C1, C2, S1, S2, S3, S5 and S6 | Deposited Particulate Matter | Dust Deposition Gauge |
| P3 | Deposited Particulate Matter | Dust Deposition Gauge |
| | PM ₁₀ | Thermo – TEOM 1405 (Tapered Element Oscillating Microbalance) |
| | Wind Speed (horizontal, elevation 10m) | Vaisala WXT520 Multi-sensor Weather Monitor |
| | Wind Direction (elevation 10m) | Vaisala WXT520 Multi-sensor Weather Monitor |
| | Ambient Temperature (elevation 10m) | Vaisala WXT520 Multi-sensor Weather Monitor |
| | Relative Humidity (elevation 10m) | Vaisala WXT520 Multi-sensor Weather Monitor |
| | Noise | Class 1 Brüel & Kjær 2250 Sound Level Meter |
| | P1, P2 and P4 | Deposited Particulate Matter |
| PM ₁₀ | | Thermo – TEOM 1405 (Tapered Element Oscillating Microbalance) |
| Wind Speed (horizontal, elevation 10m) | | Gill Windsonic Op1 |
| Wind Direction (elevation 10m) | | Gill Windsonic Op1 |
| Noise | | Class 1 Brüel & Kjær 2250 Sound Level Meter |

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| Site Code | Parameter Measured | Instrument and Measurement Technique |
|------------|--------------------|---|
| Rain Gauge | Rainfall | Hydrological Services tipping bucket rain gauge - Model TB3 |

Since the beginning of the project in March 2017 until the 9th of July 2018, the TEOMs at sites P1, P2, P3 and P4 were configured to measure TSP. After this date, measurements were changed to PM₁₀ due to updates to the Dalrymple Bay Coal Terminal Pty Ltd and Hay Point Environmental Authority Permit¹.

2.3. Data Collection Methods

Table 3 below shows the methods used for data collection.

Table 3: Methods

| Parameter Measured | Data Collection Methods Used | Description of Method |
|--|------------------------------|---|
| Deposited Particulate Matter <i>(Sampling by Ecotech)</i> | AS/NZS 3580.10.1 2016 | Methods for sampling and analysis of ambient air. Method 10.1: Determination of particulate matter—Deposited matter—Gravimetric method |
| Deposited Particulate Matter <i>(Analysis by SGS)</i> | AN502(Sydney) /AN503 | The mass deposition rate of deposited matter is calculated from the mass of solids obtained, the funnel cross-section area and the exposure period. |
| PM ₁₀ (TEOM) | AS/NZ 3580.9.8-2008 | Methods for sampling and analysis of ambient air. Method 9.8: Determination of suspended particulate matter - PM ₁₀ continuous direct mass method using a tapered element oscillating microbalance analyser. |
| Vector Wind Speed (Horizontal) | AS/NZS 3580.14 2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| Vector Wind Direction | AS/NZS 3580.14 2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |

¹ Department of Environment and Heritage Protection Environmental Authority Permits EPPR00474413 and EPPR00504513.

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| Parameter Measured | Data Collection Methods Used | Description of Method |
|---|--|---|
| Ambient Temperature | AS/NZS 3580.14 2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| Relative Humidity | AS/NZS 3580.14 2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| Rain (<i>Sampling by external contractor</i>) | AS/NZS 3580.14 2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications. Rainfall by tipping bucket rain gauge |
| Noise (L_{eq} , L_{10} and L_{90}) (<i>Analysis by Marshall Day Acoustics</i>) | DEHP Noise Measurement Manual (2013) and AS 1055.1: 1997 | Acoustics - Description and measurement of environmental noise - Part 1: General procedures |

2.3.1. Data Acquisition

Data acquisition for continuously monitored parameters, with the exception of noise and rain, is performed using an Envista logger situated at each of the monitoring sites. Each logger is equipped with a 4G modem for remote data collection. The recorded data is remotely collected and transferred via FTP at 10-minute intervals (using Airodis™ version 5.1.6) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

2.3.2. Sampling and analysis for Rain

Rain sampling and analysis are conducted by an external contractor. The 5-minute data is sent monthly to Ecotech by Dalrymple Bay Coal Terminal Pty Ltd (DBCT P/L).

2.3.3. Sampling and analysis for Noise

Noise data samples are logged in 5-minute intervals. The data is downloaded monthly by Ecotech field service technicians and sent to Marshall Day Acoustics for analysis.

2.3.4. Sampling and analysis for Deposited Dust

Deposited dust sampling is conducted by Ecotech field service technicians. Sample bottles are sent to SGS Cairns Environmental Laboratory for analysis. The laboratory is NATA accredited for compliance with ISO/IEC 17025:2005 (Acc. No. 2562, Site No.3146).

2.4. Data Validation and Reporting

2.4.1. Validation

The Ecotech ERS department perform daily data checks on continuously monitored parameters (with the exception of noise and rainfall data) to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g., backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute data.

Note: Validation for noise data is performed by the subcontractor Marshall Day Acoustics.

2.4.2. Reporting

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period. Where data capture is low for a particular parameter, summary values (e.g., monthly maximum and minimum) may be based on less than 75% valid samples.

The reader should use caution when interpreting these values as they may not be representative of conditions for the entire sample period.

Averaging periods of eight hours or less are reported for the end of the period, i.e., the hourly average 02:00am is for the data collected from 1:00am to 2:00am. One-hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

Rain Reporting

Rain results are provided to Ecotech by Dalrymple Bay Coal Terminal Pty Ltd (DBCT P/L) and included in this report.

Deposited Dust Reporting

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Deposited dust results are provided to Ecotech by the SGS Cairns Environmental Laboratory and summarised within this report.

Noise Data Reporting

Noise levels results are provided to Ecotech by Marshall Day Acoustics and summarised within this report.

Wind Data Reporting

Wind speed and wind direction data associated with calm wind conditions are reported in accordance with the requirements of *AS/NZS 3580.14-2014*. Calm wind conditions are defined as wind speeds below the starting threshold of the wind speed/direction sensors.

3.0 Air Quality Objectives

The air quality objectives monitored at the Port of Hay Point monitoring network sites are taken from the Dalrymple Bay Coal Terminal Pty Ltd and Hay Point Environmental Authority Permit².

The air quality objectives are shown in Table 4 below.

Table 4: Port of Hay Point Air Quality Objectives

| Parameter | Time Period | Licence Limit | Units |
|---|----------------------------------|--|------------------------|
| Deposited Dust – Total Insoluble Solids | 1 day: based on 1 month sampling | 120 mg/m ² /day | mg/m ² /day |
| PM ₁₀ | 1 day | 50 µg/m ³ – when generated by port activities and measured at any sensitive or commercial place | µg/m ³ |
| L _{A90} | 15 min | Day level (7am – 7pm) = 55 dB(A) Night level (7pm – 7am) = 53 dB(A) | dB(A) |

² Department of Environment and Heritage Protection Environmental Authority Permits EPPR00474413 and EPPR00504513.

4.0 Results

4.1. Data Capture

Data capture is based on 5-minute data and refers to the amount of available data collected during the report period. The percentage of data captured is calculated using the following equation:

$$\text{Data capture} = (\text{Reported air quality data} / \text{Total data}) \times 100\%$$

Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 5 displays data capture statistics for the reporting period (July 2021). **Bold** values in the table indicate data capture below 90%.

Table 5: P1-P4 Data Capture for July 2021

| Parameter | Data Capture (%) | | | |
|------------------|------------------|-------|-------|-------|
| | P1 | P2 | P3 | P4 |
| PM ₁₀ | 90.9 | 99.6 | 99.8 | 91.2 |
| WS and WD | 94.4 | 100.0 | 100.0 | 99.9 |
| AT ³ | N/A | N/A | 100.0 | N/A |
| RH | N/A | N/A | 100.0 | N/A |
| Noise | 96.0 | 99.9 | 96.7 | 100.0 |

The data capture for all of the parameters at sites P1, P2, P3 and P4 was above 90% for the reporting month.

The overall monthly percentage of data captured for the 11 Dust Deposition Gauges was 100%.

³ AT and RH parameters are only measured at P3 station.

4.2. Complaints

No dust complaints were received by the PoHP terminals during July 2021.

4.3. Air Quality Summary

4.3.1. Air Quality Index (AQI) Rating Assessment

The index value is the pollutant concentration expressed as a proportion of the pollutant goal concentration: dividing the pollutant concentration by the pollutant goal concentration and then multiplying by 100. For Queensland, the 'pollutant goal concentration' used to calculate the index value is defined by the Air National Environment Protection Measure for Ambient Air Quality (Air NEPM) standard and it is equal to 50 µg/m³ for PM₁₀. The air quality index comprises five colour-coded categories shown on the next table.⁴

Table 6: Colour-coded Categories for Air Quality Index

| | | | | | |
|---------------|-------------------|---------------|---------------|-----------------|-------------------|
| Not available | Very good 0-33 | Good 34-66 | Fair 67-99 | Poor 100-149 | Very poor >150 |
|---------------|-------------------|---------------|---------------|-----------------|-------------------|

The PM₁₀ 24 hour average values for the reporting month in the stations P1, P2, P3 and P4 were assessed against the Air Quality Index (AQI) Rating, and the pie chart on the next page presents the percentage of the days for which a specific air quality index category was identified.

⁴ <https://www.qld.gov.au/environment/pollution/monitoring/air-monitoring/air-quality-index/>

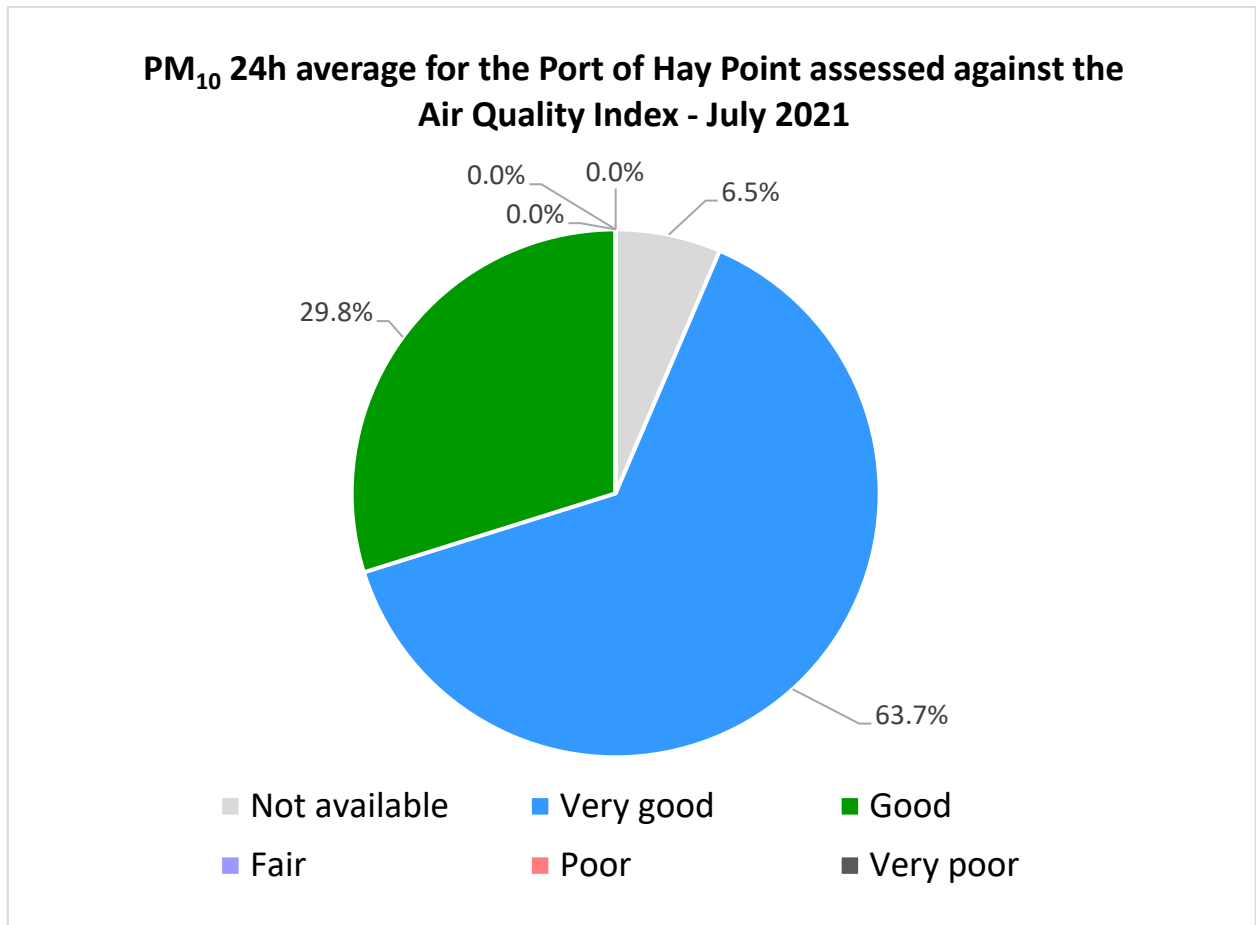


Figure 3: Daily PM₁₀ Averages for the Port of Hay Point Assessed Against the Air Quality Index

The majority of the days during the reporting period (July 2021) presented Air Quality Index classified as Very Good (63.7%) or Good (29.8%).

4.4. Graphic Representations

Validated 5-minute data for PM₁₀, Wind speed, Wind direction, AT, RH, Rainfall and Noise were used to construct the following monthly graphic representations and summary tables.

For PM₁₀, the licence limit is 50 µg/m³ for the 24-hour average measured downwind of site. If the wind is from the South, sites P1 and P2 are downwind of site. If the wind is from the North, sites P3 and P4 are downwind of site. The following graph and table summarise the wind direction and PM₁₀ results for the month compared to the licence limit. Values highlighted in red in the table indicate a PM₁₀ exceedance. Values shaded in dark grey indicate wind direction from the North.

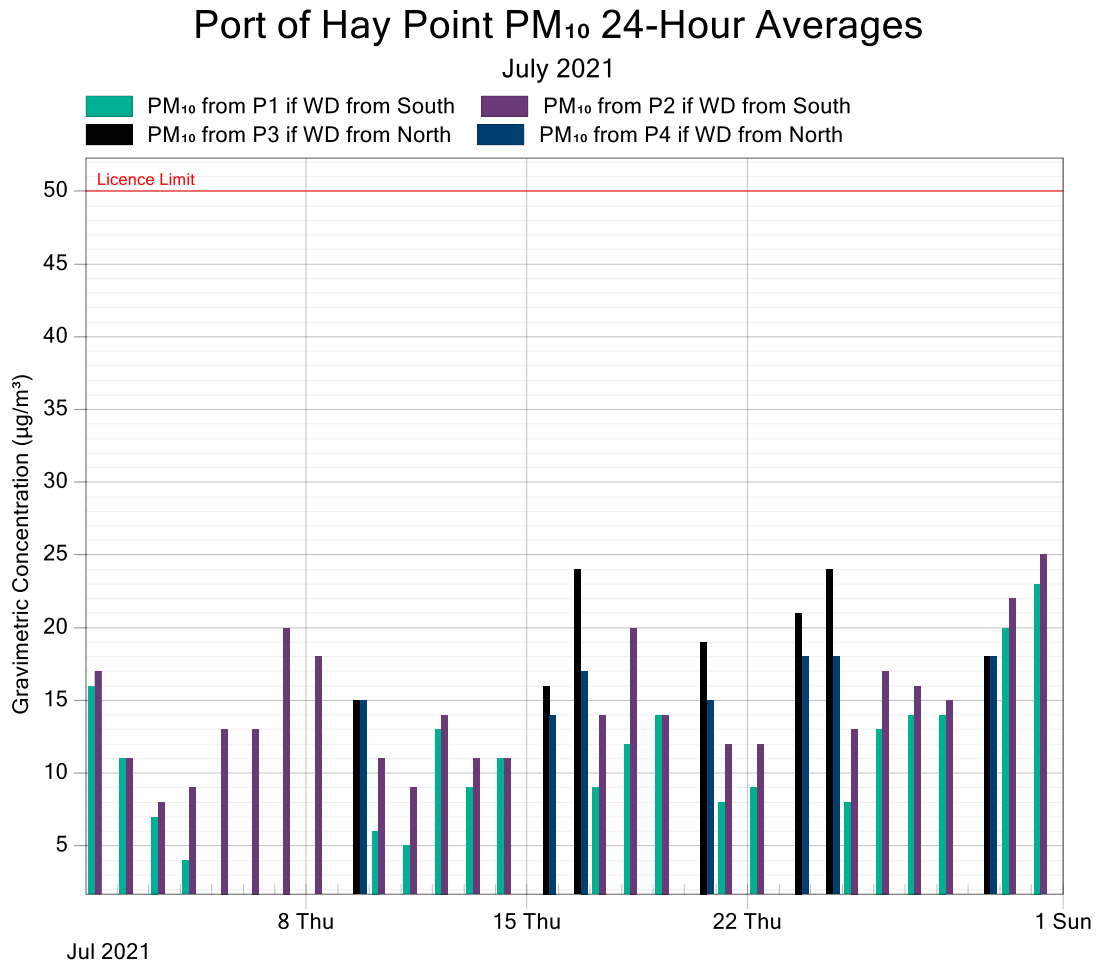


Figure 4: Port of Hay Point PM₁₀ 24Hour Average Data Compared to the Licence Limit for July 2021

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Table 7: Port of Hay Point Wind Direction and PM₁₀ 24h Average Data for July 2021

| Date | PM ₁₀ exceedence limit (µg/m ³) | Wind direction | P1 PM ₁₀ (µg/m ³) | P2 PM ₁₀ (µg/m ³) | P3 PM ₁₀ (µg/m ³) | P4 PM ₁₀ (µg/m ³) |
|------------|--|----------------|--|--|--|--|
| 1/07/2021 | 50.0 | South | 16 | 17 | 17 | 22 |
| 2/07/2021 | 50.0 | South | 11 | 11 | 11 | 13 |
| 3/07/2021 | 50.0 | South | 7 | 8 | 8 | 10 |
| 4/07/2021 | 50.0 | South | 4 | 9 | 7 | 9 |
| 5/07/2021 | 50.0 | South | - | 13 | 9 | - |
| 6/07/2021 | 50.0 | South | - | 13 | 11 | - |
| 7/07/2021 | 50.0 | South | - | 20 | 20 | - |
| 8/07/2021 | 50.0 | South | - | 18 | 19 | - |
| 9/07/2021 | 50.0 | North | 12 | 13 | 15 | 15 |
| 10/07/2021 | 50.0 | South | 6 | 11 | 13 | 14 |
| 11/07/2021 | 50.0 | South | 5 | 9 | 10 | 13 |
| 12/07/2021 | 50.0 | South | 13 | 14 | 14 | 18 |
| 13/07/2021 | 50.0 | South | 9 | 11 | 11 | 12 |
| 14/07/2021 | 50.0 | South | 11 | 11 | 10 | 12 |
| 15/07/2021 | 50.0 | North | 12 | 13 | 16 | 14 |
| 16/07/2021 | 50.0 | North | 15 | 20 | 24 | 17 |
| 17/07/2021 | 50.0 | South | 9 | 14 | 18 | 16 |
| 18/07/2021 | 50.0 | South | 12 | 20 | 21 | 23 |
| 19/07/2021 | 50.0 | South | 14 | 14 | 18 | 14 |
| 20/07/2021 | 50.0 | North | 11 | 12 | 19 | 15 |
| 21/07/2021 | 50.0 | South | 8 | 12 | 18 | 13 |
| 22/07/2021 | 50.0 | South | 9 | 12 | 13 | 13 |
| 23/07/2021 | 50.0 | North | 17 | 19 | 21 | 18 |
| 24/07/2021 | 50.0 | North | 14 | 16 | 24 | 18 |
| 25/07/2021 | 50.0 | South | 8 | 13 | 13 | 11 |
| 26/07/2021 | 50.0 | South | 13 | 17 | 18 | 19 |
| 27/07/2021 | 50.0 | South | 14 | 16 | 16 | 17 |
| 28/07/2021 | 50.0 | South | 14 | 15 | 18 | 15 |
| 29/07/2021 | 50.0 | North | 16 | 18 | 18 | 18 |
| 30/07/2021 | 50.0 | South | 20 | 22 | 22 | 23 |
| 31/07/2021 | 50.0 | South | 23 | 25 | 25 | 26 |

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The next graphs present the deposited dust results for the Total Insoluble Solids in comparison with the licence limit for the reporting month⁵. The results are presented in two different graphs: one for the sites located to the North of the Terminal (S1, S2, S3, P1 and P2) and another for the sites located to the South of the Terminal (S5, S6, P3 and P4).

The Total Insoluble Solids are classified in 4 categories: organic matter (plant and animal material), fine dark particles (dark material), mineral fraction (light material) and other material such as plastics.

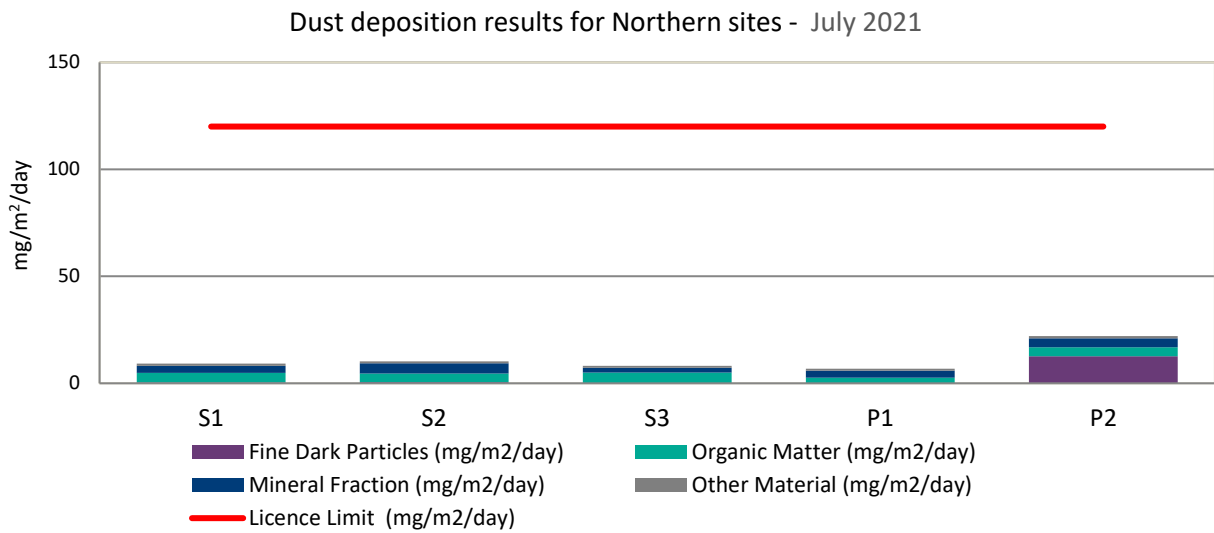


Figure 5: Dust Deposition Results for Northern Sites, July 2021

⁵ Results were provided to Ecotech by the SGS Cairns Environmental Laboratory.

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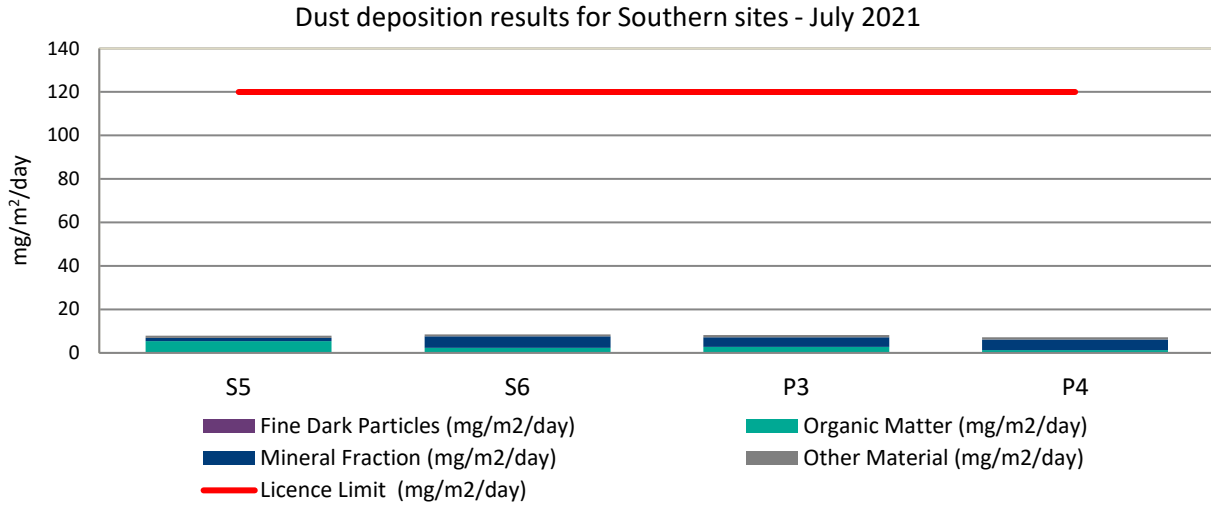


Figure 6: Dust Deposition Results for Southern Sites, July 2021

Total Insoluble Solids concentration for sites P1, P2, P3 and P4 was below the licence. During July 2021, the prevailing wind direction was from the South (77.4 % of the days).

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Table 8 provides a summary of the average L_{A90} values recorded at sites P1, P2, P3 and P4 during July 2021. Result summaries and interpretations below are those provided by Marshall Day Acoustics.

Table 8: Noise Levels (L_{A90}) Measured at P1, P2, P3 and P4 for July 2021

| Location | L_{A90} dB Average 12hr Level* | Standard deviation | Range |
|----------|--|-----------------------|---------|
| P1 Day | 40 | 2.9 | 33 - 55 |
| P1 Night | 42 | 3.9 | 33 - 50 |
| P2 Day | 49 | 3.4 | 36 - 56 |
| P2 Night | 49 | 3.3 | 38 - 57 |
| P3 Day | 45 | 2.3 | 42 - 54 |
| P3 Night | 46 | 2.9 | 41 - 55 |
| P4 Day | 47 | 2.6 | 41 - 61 |
| P4 Night | 47 | 2.3 | 41 - 52 |

*Average of L_{A90} , 15 min for the day and evening periods

Note: The recorded noise levels include extraneous noise and weather-related events, and are not pure component sound levels.

The average L_{A90} sound pressure levels at all monitoring locations (including adverse weather and other extraneous noise sources) were below the corresponding target noise levels or the Day and Night periods.

Sound levels measured throughout July 2021 at monitoring locations P1, P2, P3 and P4 have been plotted in Figures 7 to Figure 10 respectively.

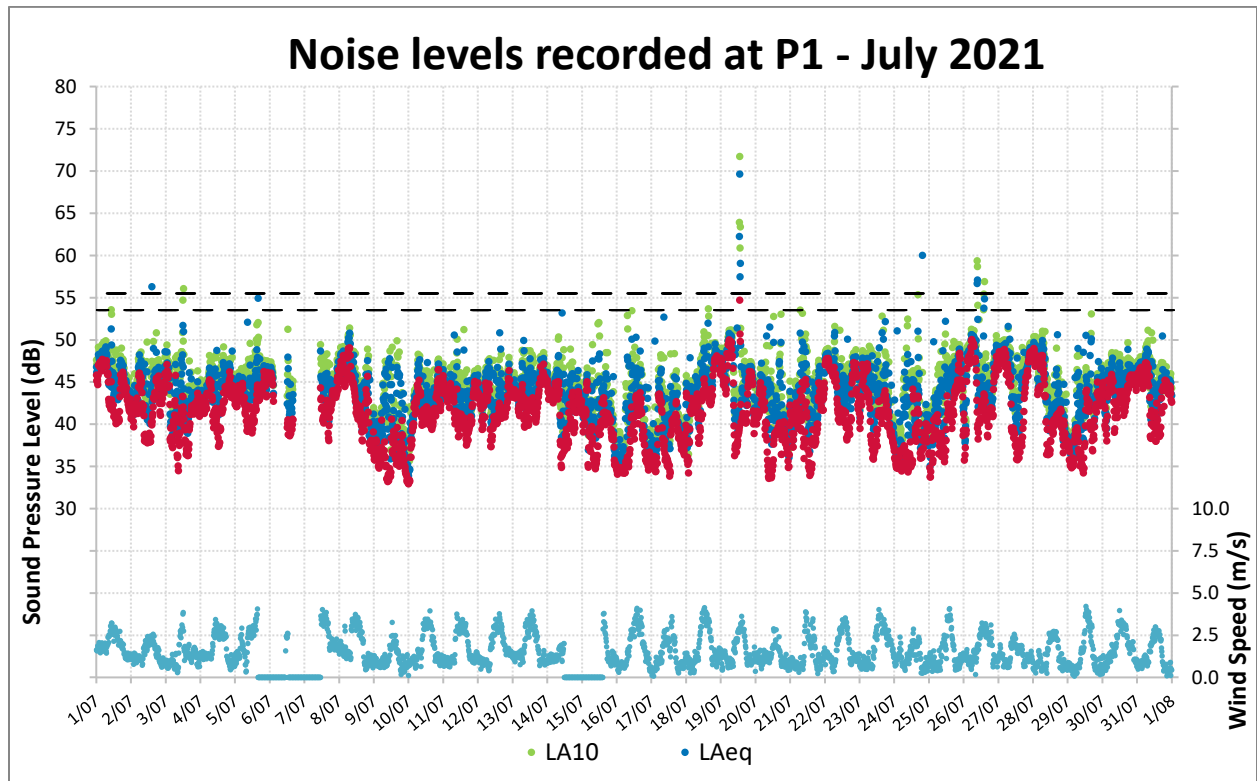


Figure 7: Noise Levels Recorded at P1 for July 2021

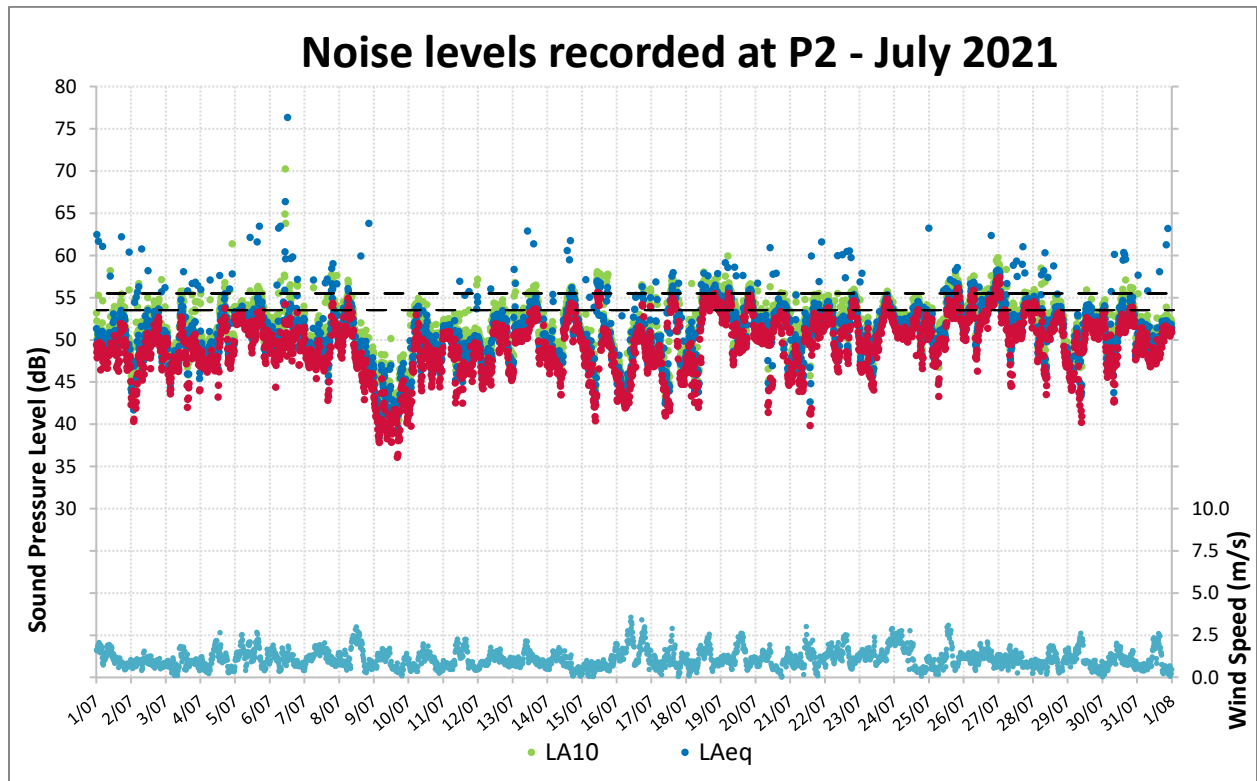


Figure 8: Noise Levels Recorded at P2 for July 2021

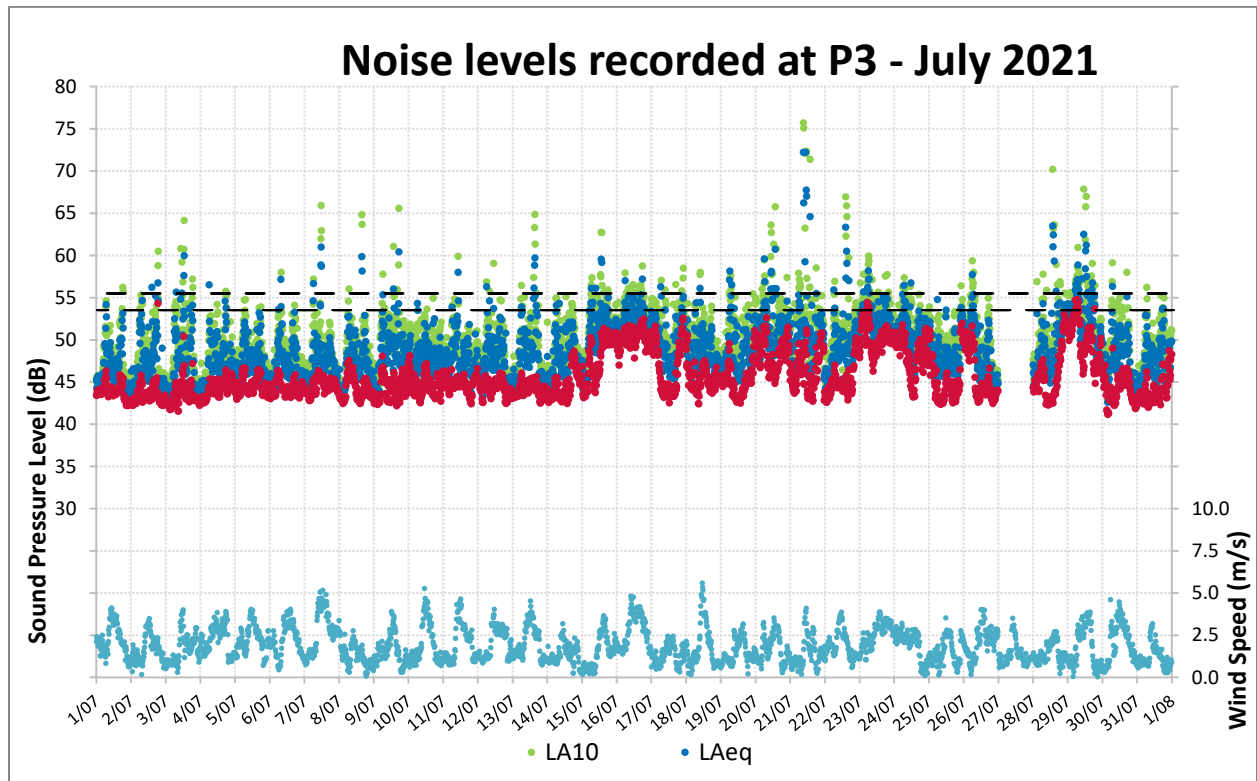


Figure 9: Noise Levels Recorded at P3 for July 2021

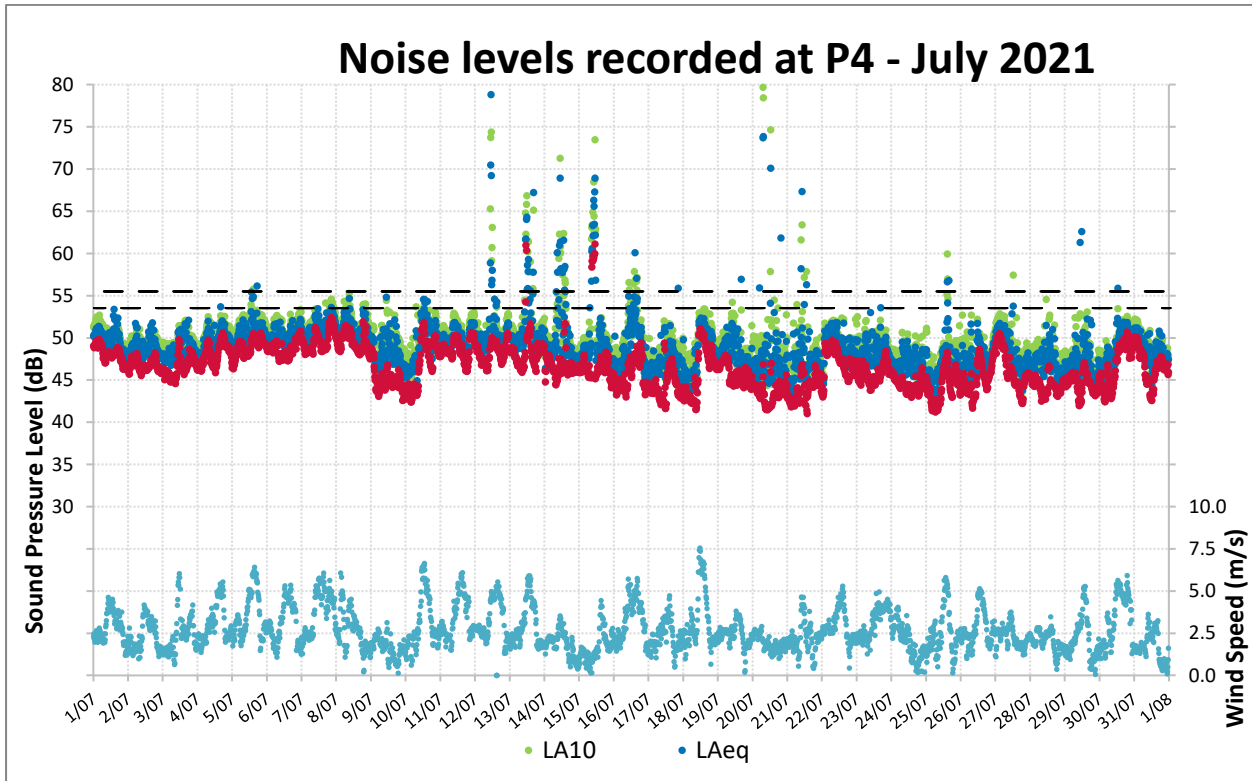
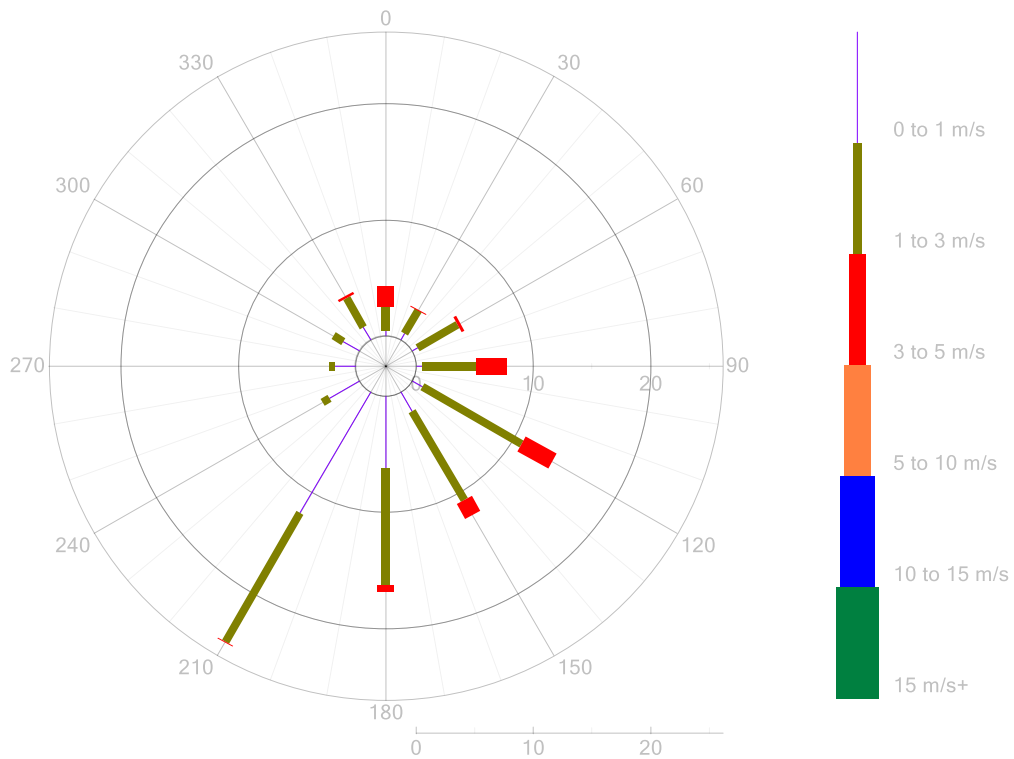


Figure 10: Noise Levels Recorded at P4 for July 2021

P1 Windrose

Wind Rose

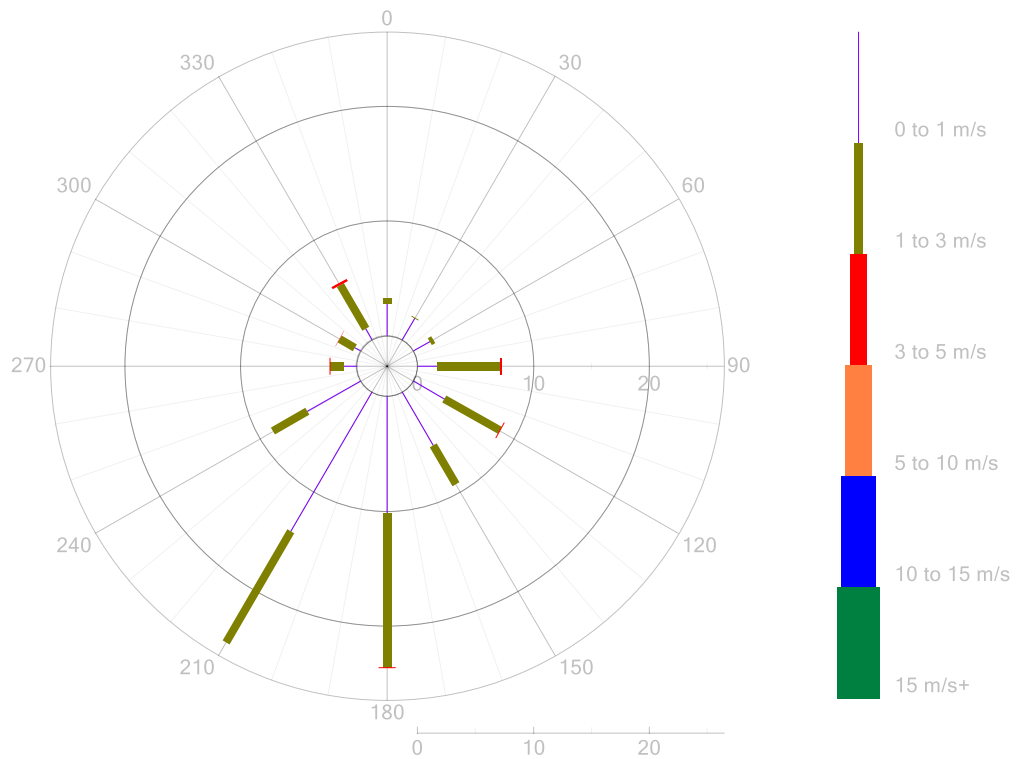
July 2021



94.4% valid data present

Figure 11: P1 Wind Rose 5-Minute Data for July 2021

Wind Rose P2 Windrose July 2021



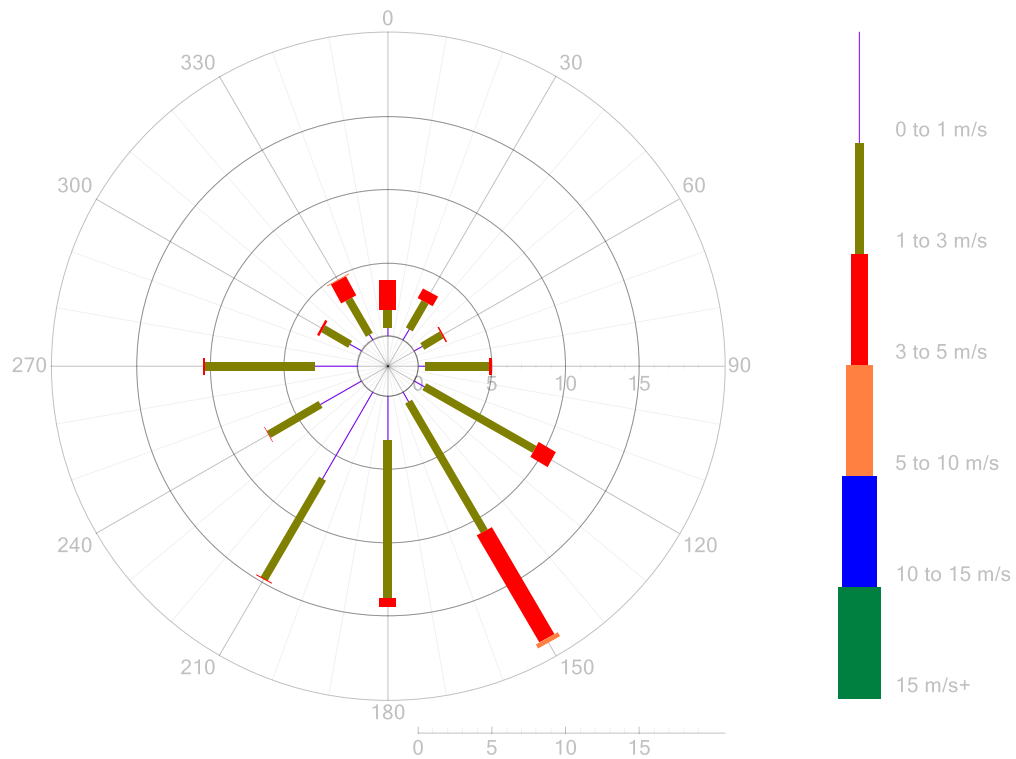
100.0% valid data present

Figure 12: P2 Wind Rose 5-Minute Data for July 2021

P3 Windrose

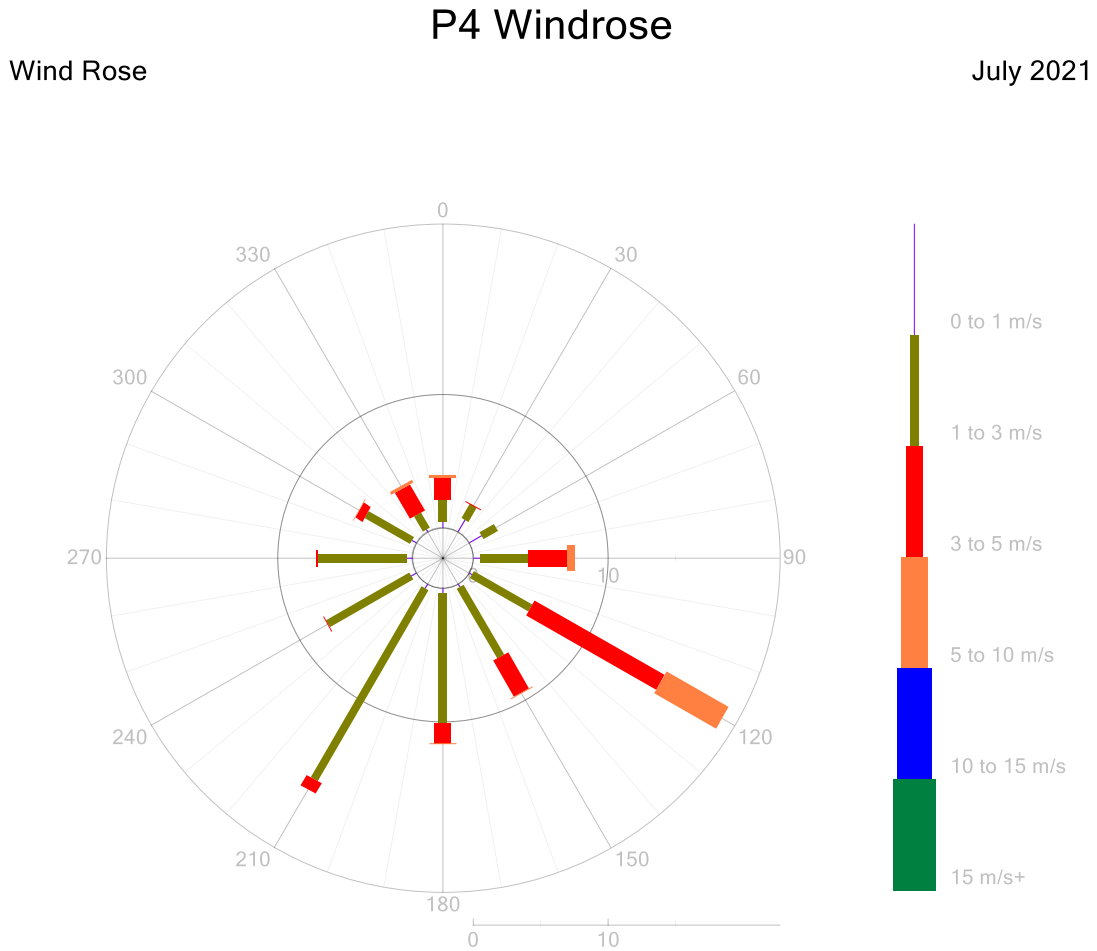
Wind Rose

July 2021



98.8% valid data present

Figure 13: P3 Wind Rose 5-Minute Data for July 2021



99.9% valid data present

Figure 14: P4 Wind Rose 5-Minute Data for July 2021

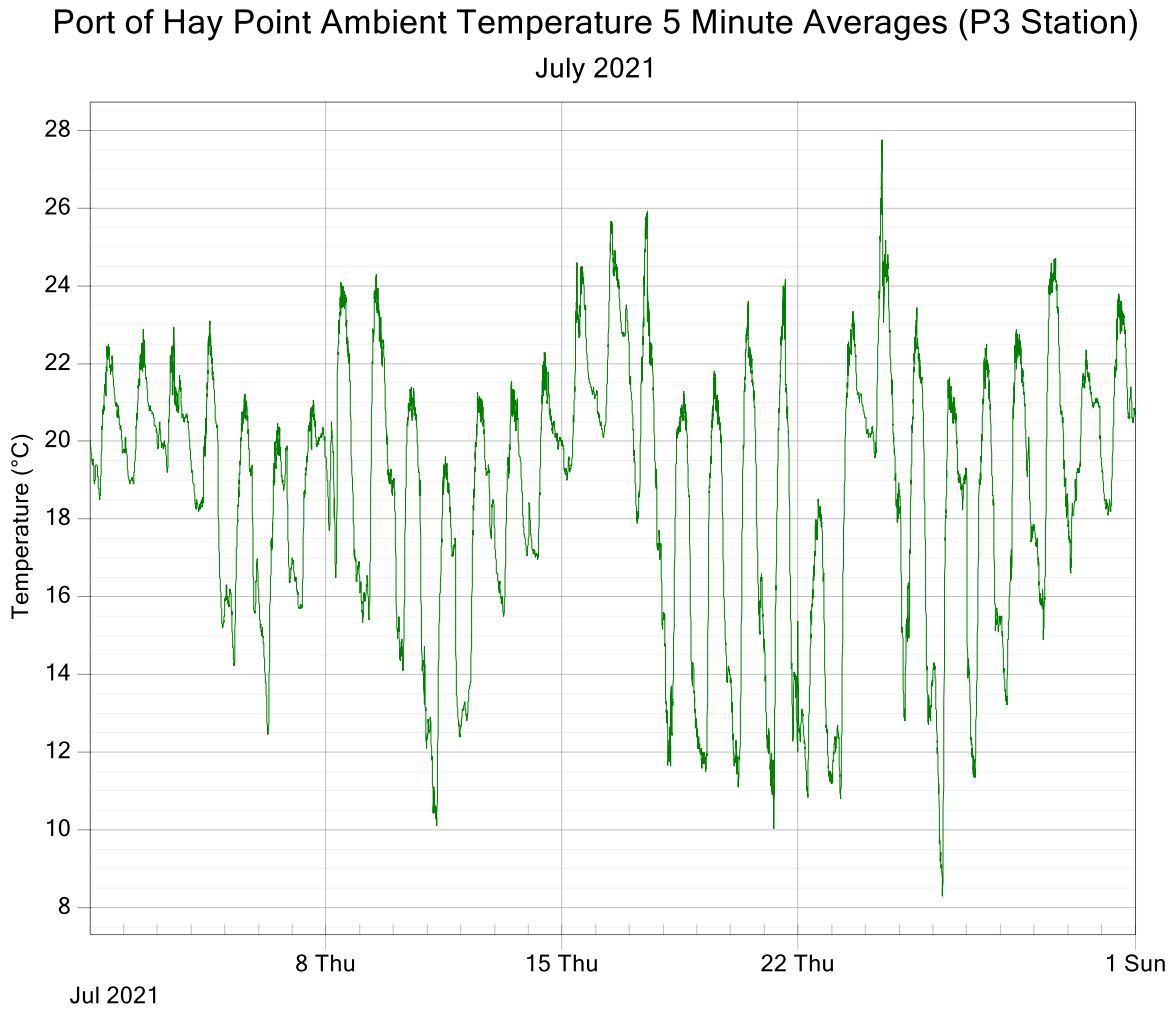


Figure 15: Port of Hay Point AT 5-Minute Averages Data for July 2021

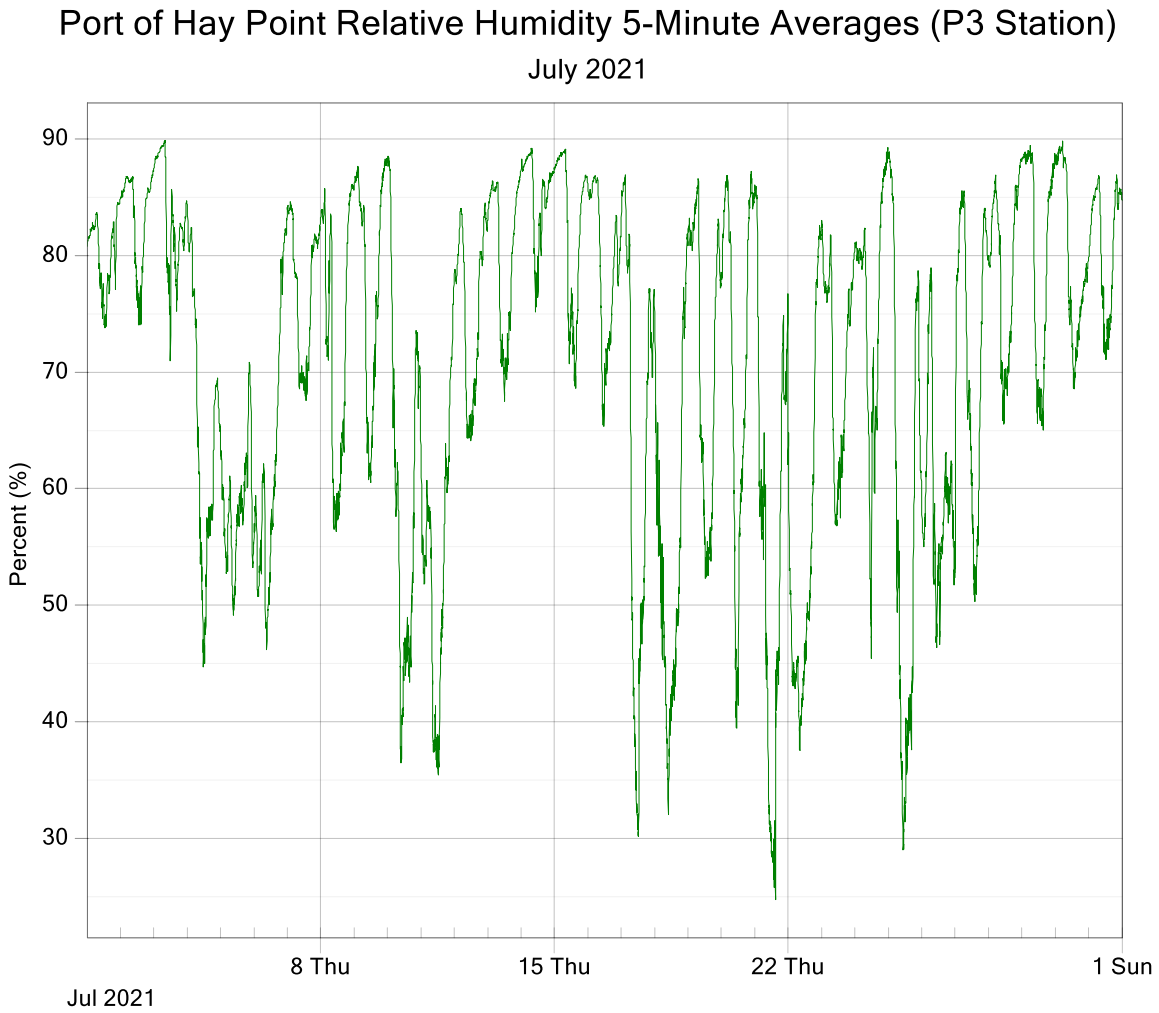


Figure 16: Port of Hay Point RH 5-Minute Averages Data for July 2021

Port of Hay Point Rain Daily Totals

July 2021

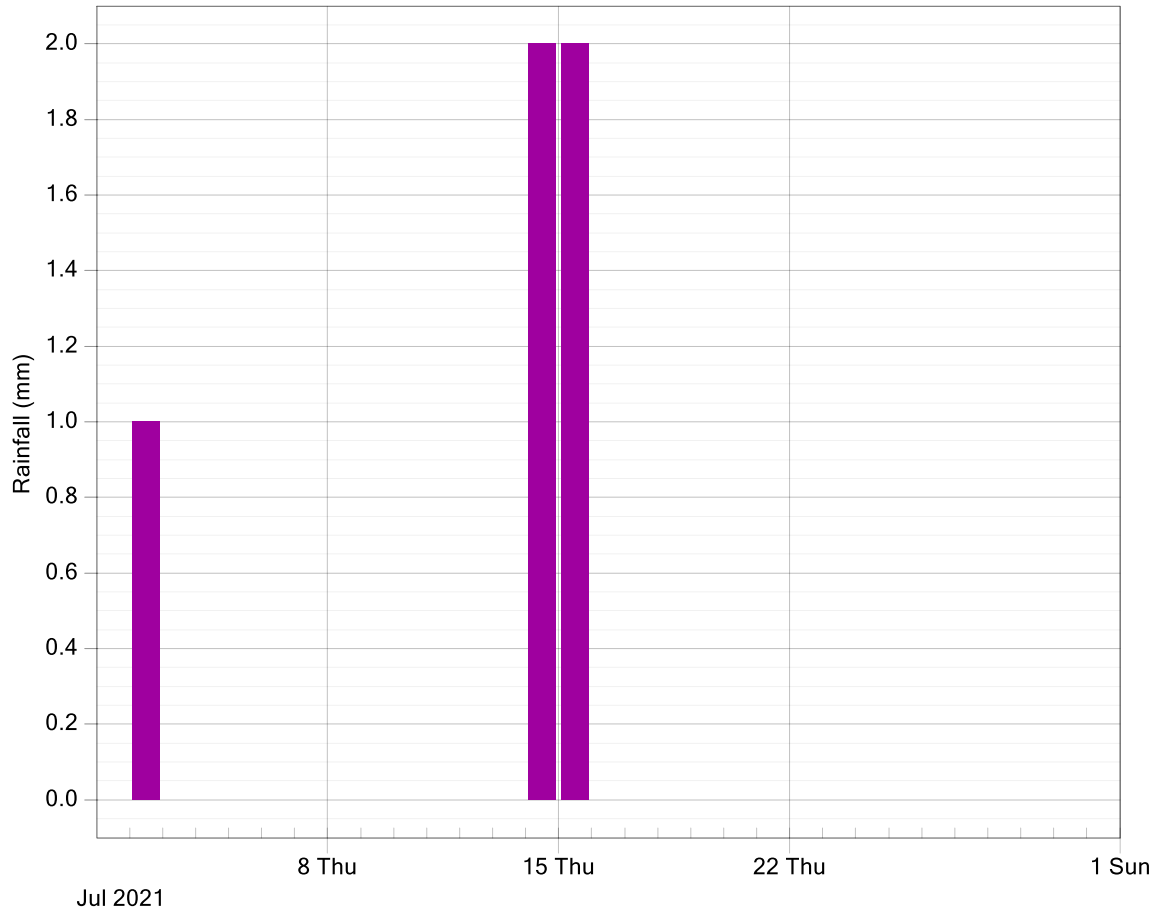


Figure 17: Port of Hay Point Rain Daily Totals for July 2021

----- END OF REPORT -----

Appendix 1 - Definitions & Abbreviations

| | |
|-------------------|--|
| °C | Degrees Celsius |
| µg/m ³ | Micrograms per cubic meter at standard temperature and pressure (0°C and 101.3 kPa) |
| AT | Ambient Temperature |
| atm | Atmosphere |
| calm | Wind conditions where the wind speed is below the operating range of the wind sensor |
| dBa | A-weighted decibels |
| deg | Degrees (True North) |
| m/s | Meters per second |
| mg/m ² | Milligrams per square meter |
| PM ₁₀ | Particulate less than 10 microns in equivalent aerodynamic diameter |
| RH | Relative Humidity |
| TSP | Total suspended particulates |
| WD | Vector Wind Direction |
| WS | Vector Wind Speed |

Appendix 2 - Explanation of Exception Table

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilization period before normal operation commences.

Data affected by environmental conditions – wind speed spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was switched off due to maintenance.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Stabilisation following power interruption refers to the start up period of an instrument after power has been restored.