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25th July 2014

Hon. Amy Adams
Minister for the Environment
Parliament Buildings
Wellington 6160

Dear Minister,

APPLICATION UNDER NATIONAL STANDARDS FOR AIR QUALITY – REGULATION 16A EXCEPTIONAL CIRCUMSTANCES

The Hawke's Bay Regional Council is seeking a determination that an exceedance of the National Air Quality Standards for PM_{10} in the Awatoto Airshed on 11th June 2014 was an exceptional circumstance. A completed application form and additional supporting information accompany this letter and address the five criteria that define exceedances caused by exceptional or natural events:

1. the event affected air quality,
2. the event was beyond the control of the Council,
3. there is a clear causal relationship between the specific event and the monitored concentration,
4. it was a natural event or was an event caused by human activity that is unlikely to recur at a particular location,
5. there would have been no exceedance or violation if the event had not happened.

If you require any further information or have any questions, please do not hesitate to contact me.

Thank you for your consideration in this matter.

Yours sincerely

Dr Kathleen Kozyniak
Senior Scientist Climate and Air

P 06 833 8055 | F 06 835 3601
kathleen@hbrc.govt.nz | www.hbrc.govt.nz

Ministry for the Environment
Manatū Mō Te Taiao

OFFICE USE ONLY
Application no:
Date received:
Date accepted:

Resource Management (National Environmental Standards for Air Quality) Regulations 2004 – Regulation 16A Exceptional Circumstances

APPLICATION FORM

Before completing this form please read section 3.8 of the 2011 User's Guide to the revised National Environmental Standards for Air Quality.

Need more help? If you have any questions email air@mfe.govt.nz.

Please send your completed application form and all attachments to air@mfe.govt.nz.

Alternatively, if attachments are too large to email, please post hard copies of the application form and all attachments, along with a CD containing all files, to:

Air Quality NES Exceptional Circumstances
Ministry for the Environment
PO Box 10362
Wellington 6143

1. Applicant details	
Name of regional council	Hawke's Bay Regional Council
Contact person	Kathleen Kozyniak
Position	Senior Scientist Climate and Air
Email address	Kathleen@hbrc.govt.nz
Telephone number	06 833 8055
Mobile number	
Postal address	Private Bag 6006, Napier 4142
2. Details of exceedance event	
Contaminant	PM_{10}
Date of exceedance *(must not be >3 months from date this application is received)*	11th June 2014
Relevant airshed	Awatoto
Monitoring station and technical specifications of monitor	Awatoto Air Quality site, 80 Waitangi Road, Awatoto. Site details are provided in Appendix 1. Beta Attenuation Monitor (BAM), approximately 8.5 years old, housed in an air conditioned portacom. BAM make and model: Thermo FH62C14

Summary of monitoring reading showing exceedance event	The 24 hour average PM_{10} concentration on the 11th June 2014 was 55 μgm^{-3}. Graphs of the hourly data, including wind direction and wind speed, are provided in Appendix 2. An excel file containing the hourly data accompanies this application.			
Analysis of baseline data	Please refer to Appendix 3.			
Source speciation or other analysis	Particle speciation has not been undertaken as gravimetric monitoring methods are not routinely used in the Awatoto airshed. $PM_{2.5}$ was not being monitored.			
Explanation of any previous exceedance event/s from this monitoring station in the past 5 years	51 μgm^{-3} on 16th July 2012 – likely source was earthworks. 59 μgm^{-3} on 11th June 2013 – likely source was sea salt. 51 μgm^{-3} on 7th March 2014 – unknown local source. Please refer to Appendix 4 for further detail.			
Monitoring readings covering exceedance event	√☐ Attached		☐ Not attached	
3. Details of exceptional circumstances				
Exceptional circumstances leading to exceedance	☐ Localised impact on a monitor	☐ Anthropogenic extreme event	√☐ Natural disaster or natural extreme event	☐ Other
Explanation of circumstances leading to exceedance event	A combination of high seas and onshore easterly winds are believed to have raised concentrations of sea salt significantly above normal background levels. The levels of natural particulates are considered the primary cause of the exceedance. Please refer to Appendix 5 for further detail.			
Reasons why these circumstances were beyond the reasonable control of the regional council	Natural weather events are beyond the control of regional councils.			
Supporting evidence *(eg, meterological report)*	√☐ Attached		☐ Not attached	

25/7/2014

Dated

Signed

APPENDIX 1 – SITE DETAILS

Site Name

Awatoto AQ

Site Location

88 Waitangi Road, Awatoto

Map Reference

NZMG 2846750E 6176930N

NZTM 1936791E 5615302N

Airshed Type

Industrial

Region & Monitoring Zone

Hawke's Bay – Awatoto airshed

Owner (Operator)

Hawke's Bay Regional Council (HBRC)

Parameters Monitored

PM_{10} (Beta Attenuation Monitor), wind direction and speed, temperature and humidity

Monitoring Period

PM_{10}, wind speed, temperature and humidity – 15th February 2012 to present

Wind direction – 10th May 2012 to present

Height above ground

PM_{10} approximately 4 m
Climate 6 m

(see Figure 1.1 for station configuration)

Nearest SH & Local Road with Direction

SH2 75m E

Waitangi Rd 23m W

Nearest Tree

20 m

Figure 1.1: HBRC's air quality and climate station at Waitangi Road, Awatoto.

Location Map and Additional Notes

The Awatoto airshed lies near the coast south of Napier and comprises industry and rural land. The Hawke's Bay Regional Council's (HBRC) monitoring site is located approximately 200 metres west of the shoreline (Figure 1.2). Ravensdown Limited, a fertiliser manufacturer, monitors PM_{10} on the eastern boundary of the airshed as a requirement of its air discharge consent.

Figure 1.2: An aerial photo of the Awatoto airshed showing the locations of the Hawke's Bay Regional Council's (HBRC) and Ravendown's air quality sites.

APPENDIX 2 – MONITORING RESULTS

On 11th June 2014 the hourly PM_{10} concentrations at the Council's air quality site in Awatoto ranged from 40 to 70 μgm^{-3}. The 24 hour average PM_{10} concentration was 55 μgm^{-3}. Higher concentrations were recorded at Ravensdown's site on the beachfront, where the average PM_{10} concentration was 73 μgm^{-3}. Hourly concentrations at that site ranged between 53 and 86 μgm^{-3}.

The Whirinaki airshed, approximately 20 km north of Awatoto, is another airshed in close proximity to the coast. PM_{10} is monitored in Whirinaki by Pan Pac Forest Products Limited as part of an air discharge consent for its timber processing operations. A BAM is used to monitor PM_{10} and is located approximately 200 m west of the shoreline – similar to the Awatoto air quality site. The 24 hour average PM_{10} concentration at the company's site on the 11th June was 55 μgm^{-3}. The NES for PM_{10} was not exceeded at the Marewa Park air quality monitoring site in Napier, situated 2 km from the coast. The average PM_{10} concentration at Marewa Park on that day was 28 μgm^{-3}.

The wind direction on the 11th June was predominantly easterly and wind speed averaged 32 km h^{-1}. Easterly winds continued into the following day but the speed of the wind eased. The hourly averages of PM_{10}, wind direction and wind speed at HBRC's Awatoto site from 9th June to 13th June 2014 inclusive are shown in Figure 2.1 and the daily averages of PM_{10} for June 2014 are shown in Figure 2.2.

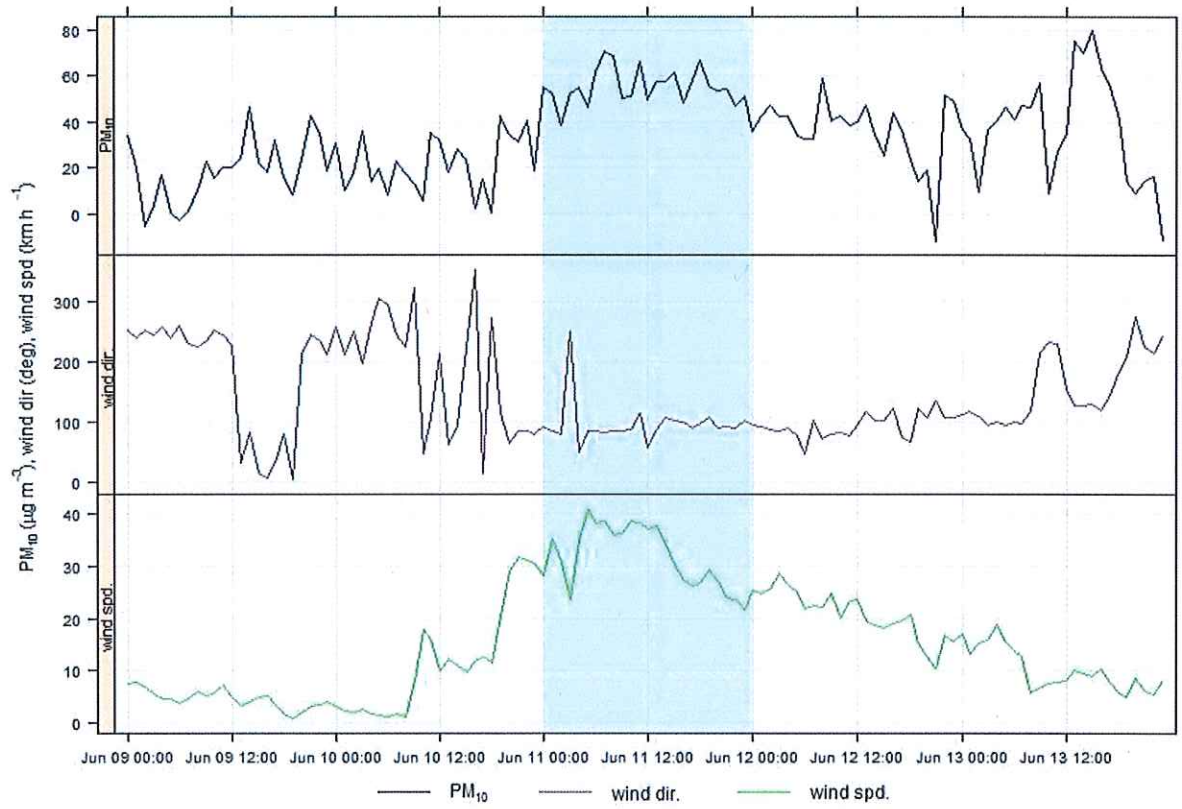

Figure 2.1: Hourly averages of PM_{10} (top), wind direction (middle) and wind speed (bottom) from the 9th to the 13th June 2014. The day the PM_{10} standard was exceeded, the 11th June, is shaded in blue.

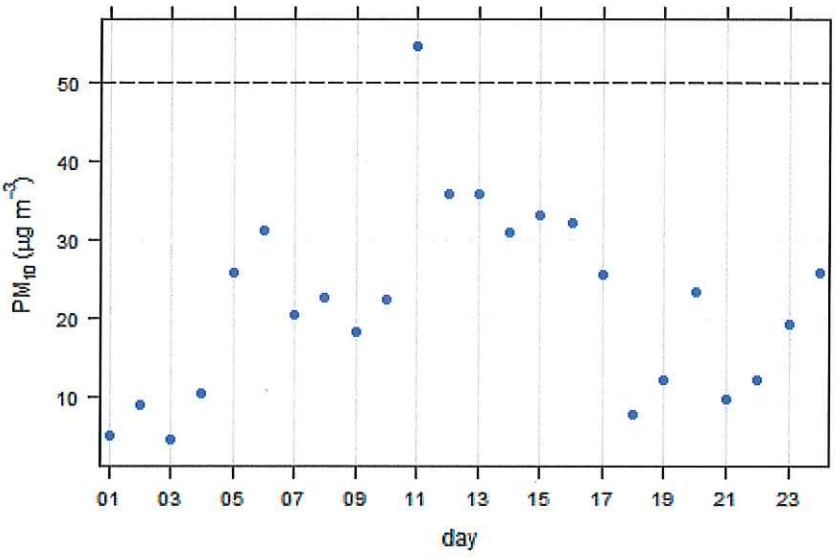

Figure 2.2: The 24 hour average PM_{10} concentrations for June 2014 up to the 24th June.

Weather conditions were overcast with occasional rain (Figure 2.3). Rainfall totalled 29.5 mm on the 11th June, adding to 12.5 mm which fell during the late afternoon and evening of the previous day. Air temperature remained steady, varying between 12 and 14°C throughout daytime and night time hours.

A time lapse of weather conditions on 11th June, as seen looking south across Napier from Hospital Hill, is included with this application.

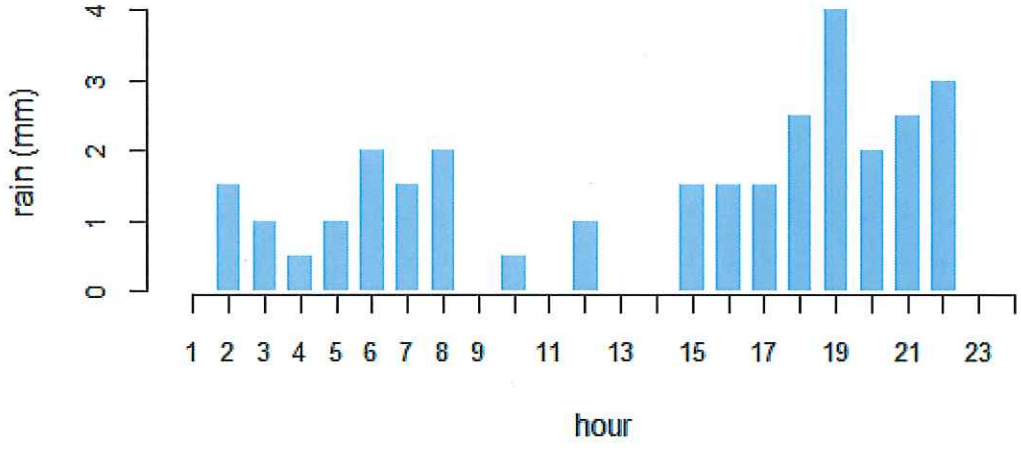

Figure 2.3: Hourly rainfall on 11th June 2014 measured at a HBRC rainfall gauge in Awatoto.

APPENDIX 3 – BASELINE DATA

3.0 Average daily PM_{10} concentrations

PM_{10} has been monitored at the Awatoto site for less than 3 years, making it difficult to confidently characterise patterns or trends in PM_{10} concentrations. Daily PM_{10} concentrations have averaged 19.6 μgm^{-3} since monitoring began and as more data is collected it is likely that annual averages will lie close to the guideline value of 20 μgm^{-3}.

Natural sources may constitute a significant portion of the PM_{10} concentrations measured in Awatoto. A brief study was undertaken in 2010 to estimate salt and soil contributions to daily PM_{10} concentrations at Ravensdown's beachfront monitoring site, using a technique based on measured levels of Na and Si[1]. The study comprised 26 days of valid PM_{10} samples and spanned the months of February to early June. The average contribution of sea spray to the samples collected was estimated to be 31% and the contribution of soil was 27%, together totalling more than half of the particulates. The contribution of sea spray is expected to decrease with distance from the coast and is likely to be slightly lower at the Council's site, which lies 200 m inland.

The average June PM_{10} concentration is marginally below the site average, at 18.2 μgm^{-3}, but two of the four exceedances recorded at the site have occurred during that month (Figure 3.1). The history of exceedances in Awatoto is examined in more detail in Appendix 4.

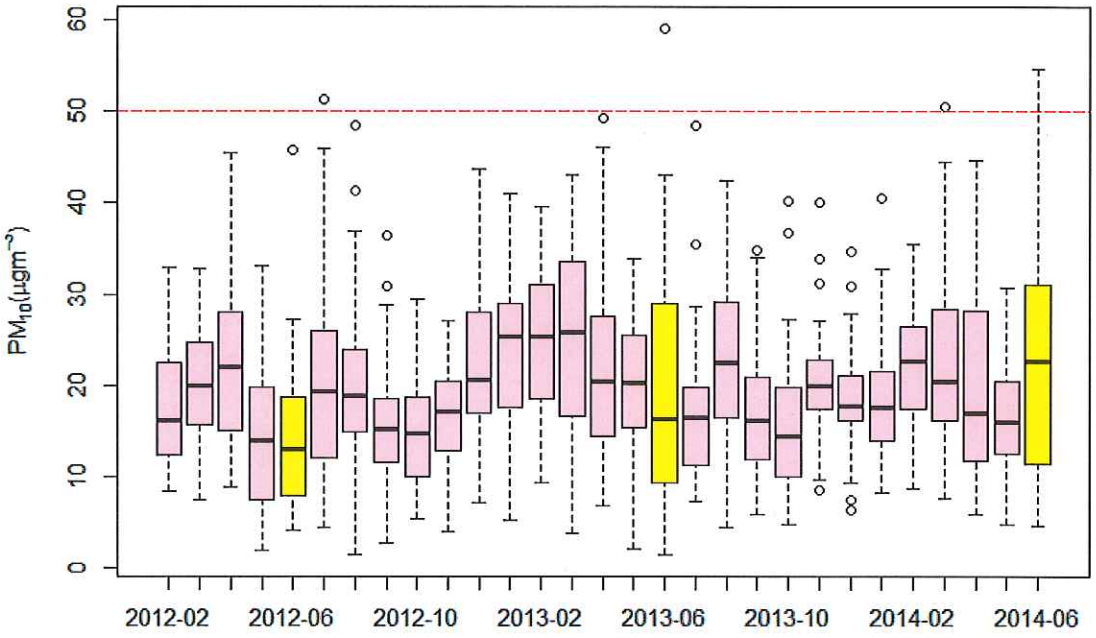

Figure 3.1: Box and whisker plot of 24 hour average PM_{10} concentrations, on a monthly basis, from 15th February 2012 to 24th June 2014. June months are coloured yellow. Median values are shown by thick black lines, the top and bottom sides of the box represent the upper and lower quartiles, dashed black lines extend to maximum and minimum values excluding outliers and outliers are indicated by black circles. The red dashed line represents the NES for PM_{10}.

[1]Wilton, E. 2010: Natural Source Contribution to Background PM_{10} in Awatoto. A report prepared for the Foundation for Science, Technology and Research.

1.1 Average hourly PM_{10} concentrations

Measurements collected to date indicate that hourly PM_{10} concentrations tend to peak between midday and 6 pm when wind speed also peaks (Figure 3.2). This pattern is evident on all days of the week.

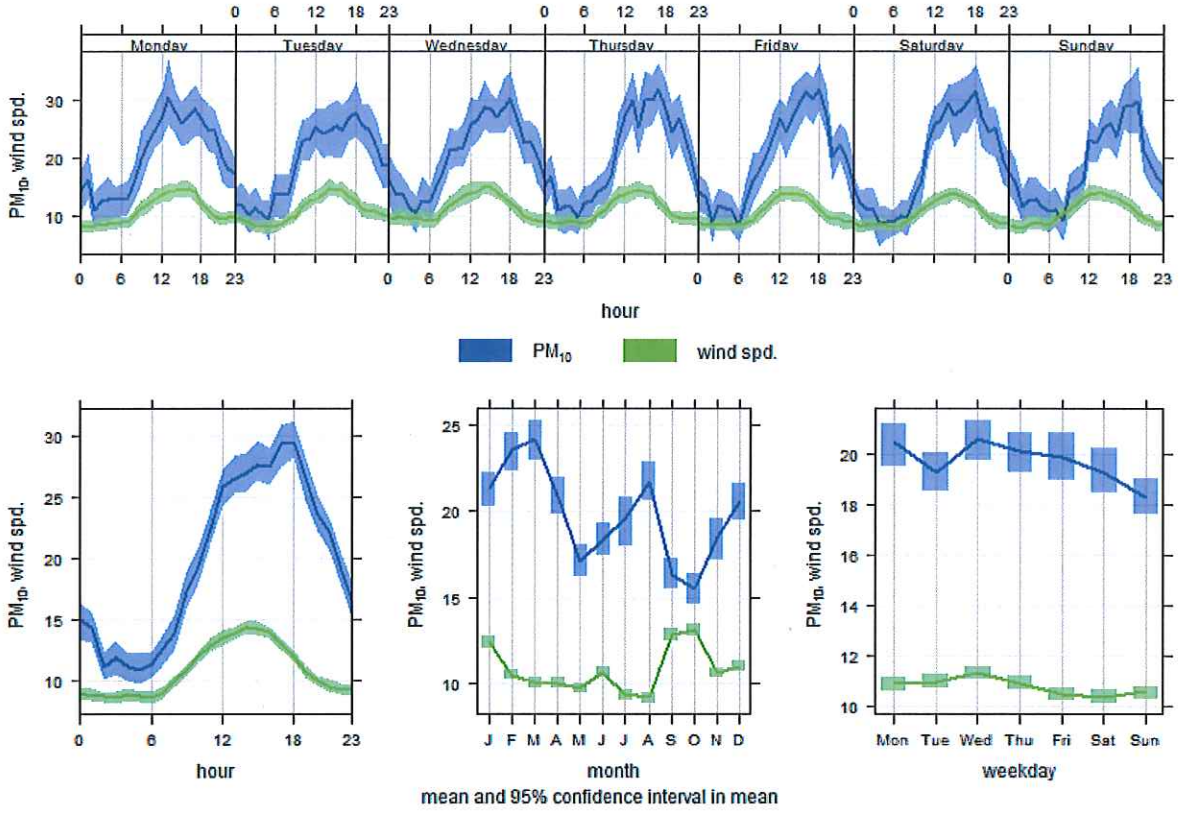

Figure 3.2: The variation of PM_{10} concentrations (μgm^{-3}) and wind speed (km h^{-1}) at the Awatoto site by hour, day and month based on data collected since the site was established in 2012.

The pattern of hourly PM_{10} concentrations remains the same during June (Figure 3.3) and is not characteristic of the winter pattern seen in the region's residential airsheds, where concentrations peak after 6 pm and drop sharply through the early hours of the morning. The hourly PM_{10} concentrations on the 11th June were consistently higher than mean June concentrations (Figure 3.4) and did not display the typical morning and afternoon variations in levels.

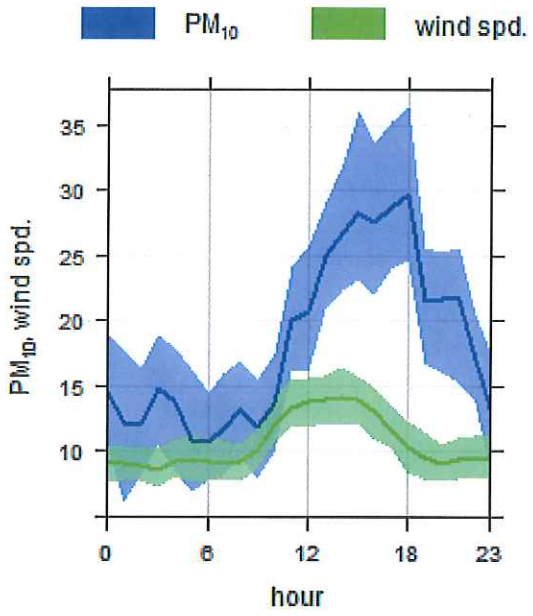

Figure 3.3: Average hourly PM_{10} concentrations (μgm^{-3}) and wind speed ($km\ h^{-1}$) at the Awatoto site for the month of June.

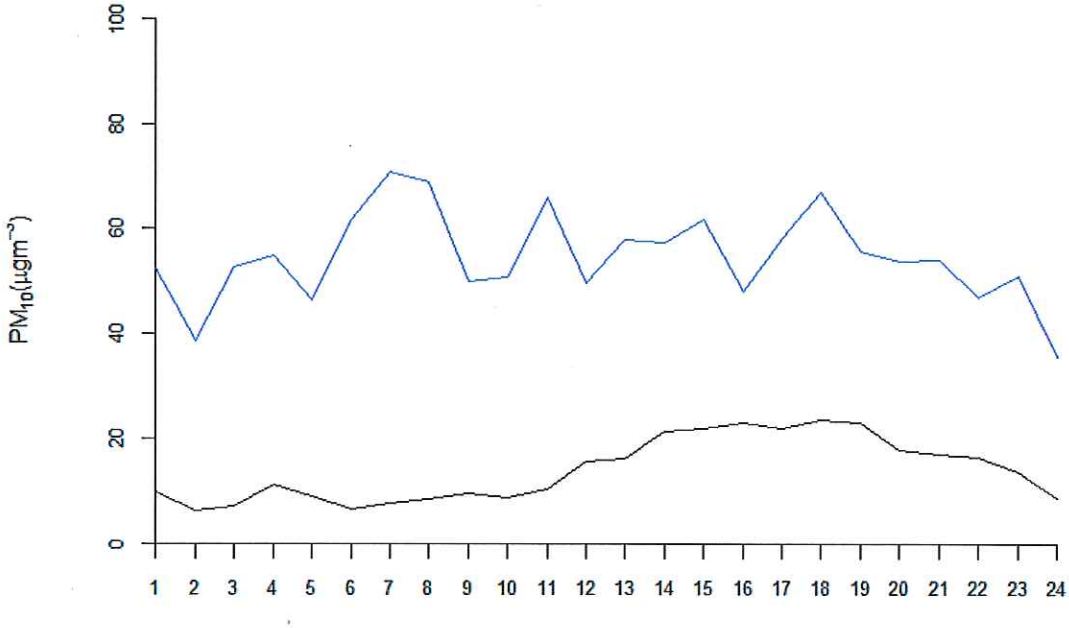

Figure 3.4: Hourly PM_{10} concentrations on the 11th June 2014 (blue line) compared to the mean hourly PM_{10} concentrations for the month of June (black line).

3.2 Wind direction and hourly PM_{10} concentrations

The predominant wind direction at Awatoto is southwest, which is the direction of the nocturnal drainage wind. High PM_{10} concentrations can be sourced from all directions (Figure 3.5) but the highest concentrations arise from the east and northeast in wind speeds of 25-50 km h^{-1} (Figure 3.6).

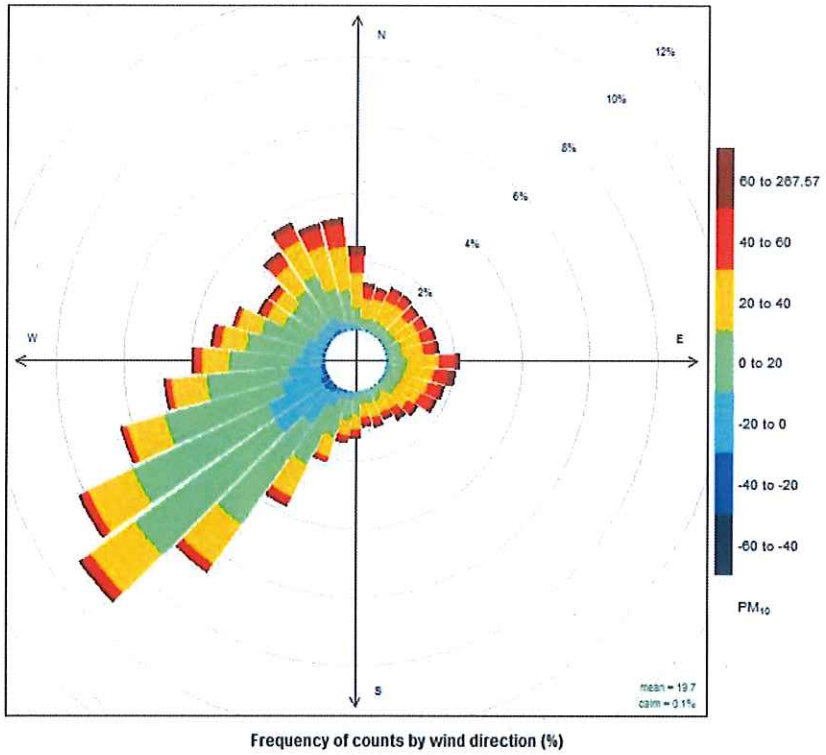

Figure 3.5: Concentration rose for hourly PM_{10} concentrations (μgm^{-3}) by wind direction at the Awatoto air quality site from 2012 to 2014.

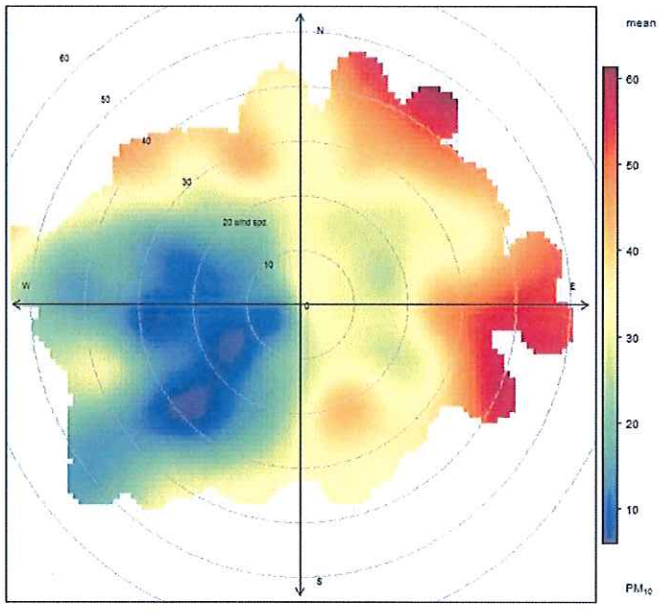

Figure 3.6: Hourly PM_{10} (μgm^{-3}) by wind direction and wind speed (km h^{-1}) at Awatoto, 2012 to 2014.

PM_{10} concentrations measured in easterly winds stronger than 5 km h^{-1} have been compared to those in all other wind directions and speeds (Figure 3.7). The results show that concentrations are typically higher in the former conditions and lie between 20-40 μgm^{-3} irrespective of the time of day. The concentration rose for the 11th June 2014 (Figure 3.8) shows a predominance of easterly winds and that hourly PM_{10} concentrations were consistently above the mean values that typically occur under easterly wind conditions.

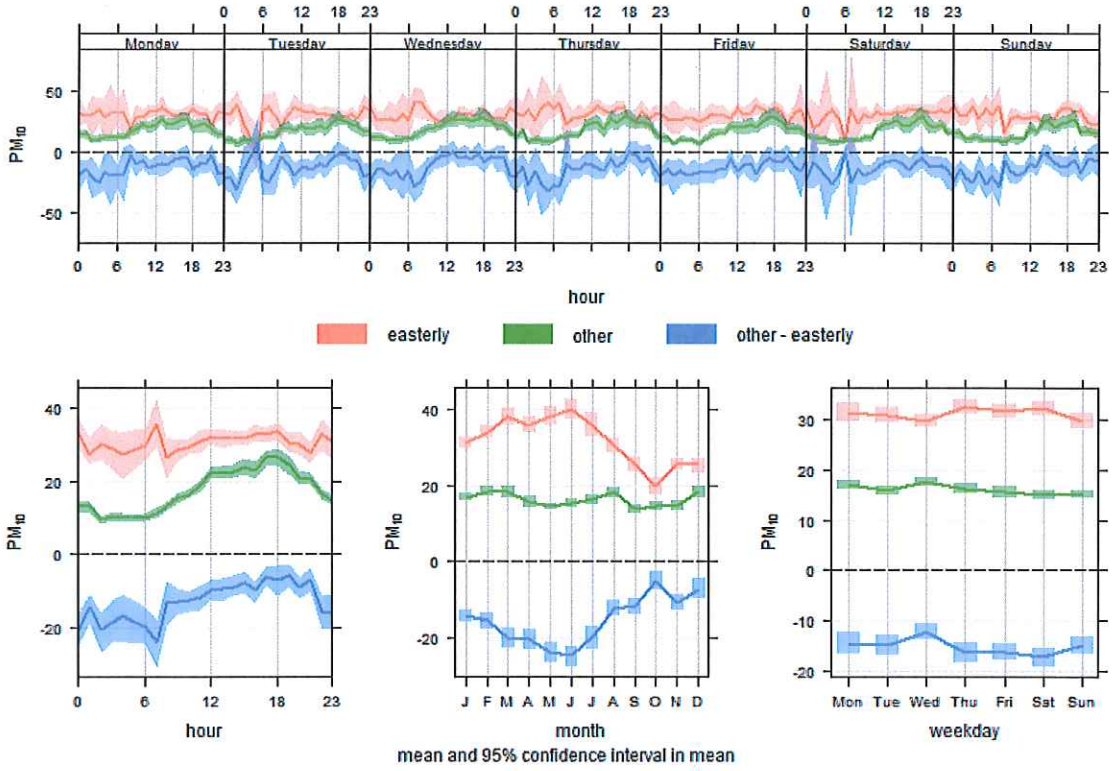

Figure 3.7: The variation of PM_{10} concentrations (μgm^{-3}) at the Awatoto site by hour, day and month based on data collected since the site was established in 2012. Concentrations measured during easterly winds stronger than 5 km h^{-1} are shown in pink and all other wind directions and wind speeds are grouped together and displayed in green. The difference between the two is displayed in blue.

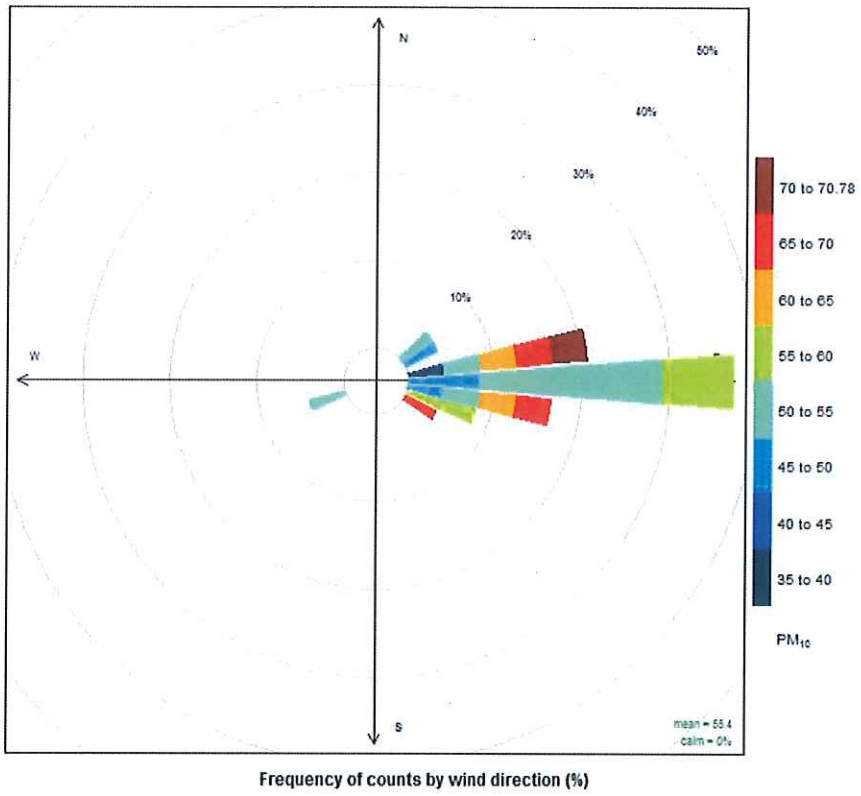

Figure 3.8: Concentration rose showing hourly PM_{10} concentrations (μgm^{-3}) by wind direction at the Awatoto AQ site on 11th June 2014.

APPENDIX 4 – EXCEEDANCE EVENTS

Four exceedances of the NES have occurred since the site was established (Figure 4.1).

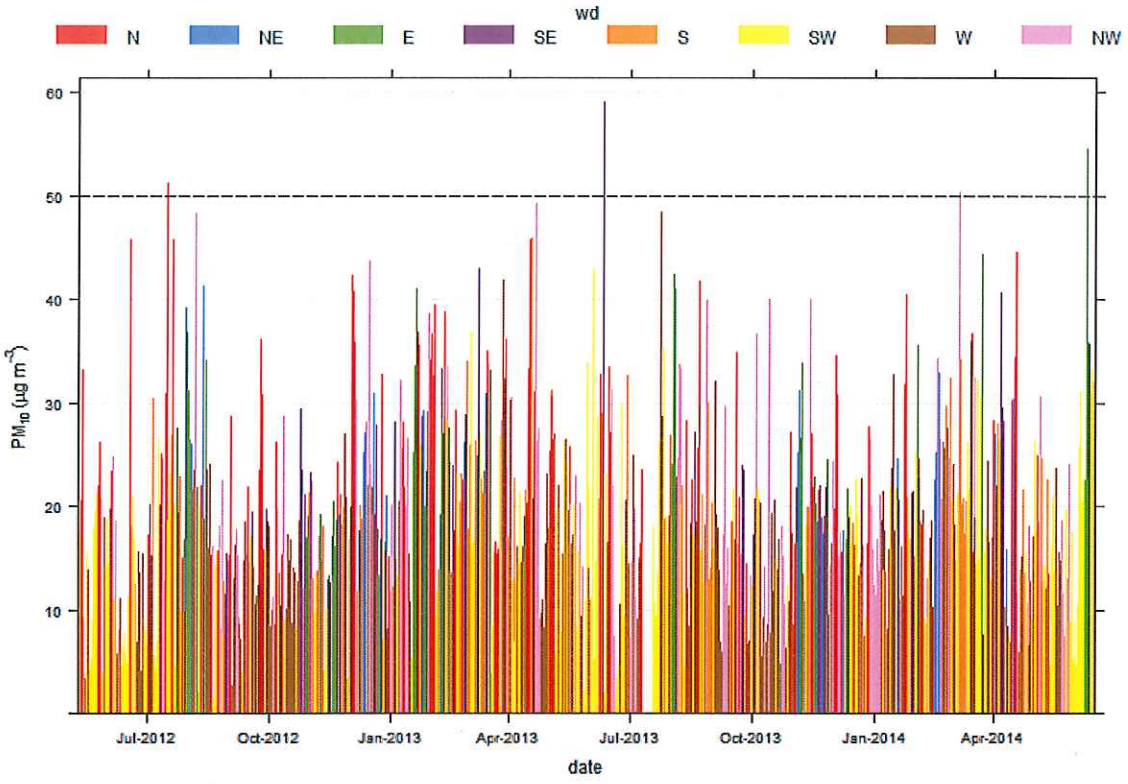

Figure 4.1: Daily PM_{10} concentrations at the Awatoto air quality site, colour coded by the average wind direction on that day.

The first exceedance, measuring 51 μgm^{-3}, was on the 16th July 2012. The wind direction varied from northwest to northeast and gusts reached 43 km h^{-1}. The likely source of the exceedance was earthworks during construction of a sewage treatment plant by the Napier City Council.

The second exceedance, on the 11th June 2013, measuring 59 μgm^{-3}, occurred under similar circumstances to the one on 11th June 2014, for which this application relates, and sea salt is thought to be a significant contributor. Winds on that day were predominantly from the southeast and gusting to 33 km h^{-1}. A swathe of easterly gales extended approximately 3600 nautical miles offshore from Hawke's Bay around that time (Figure 4.2), generating high seas. Significant wave heights measured at the Napier Port buoy were 2-2.5 m. Average PM_{10} concentrations exceeded the NES at both the Council's and Ravensdown's air quality sites.

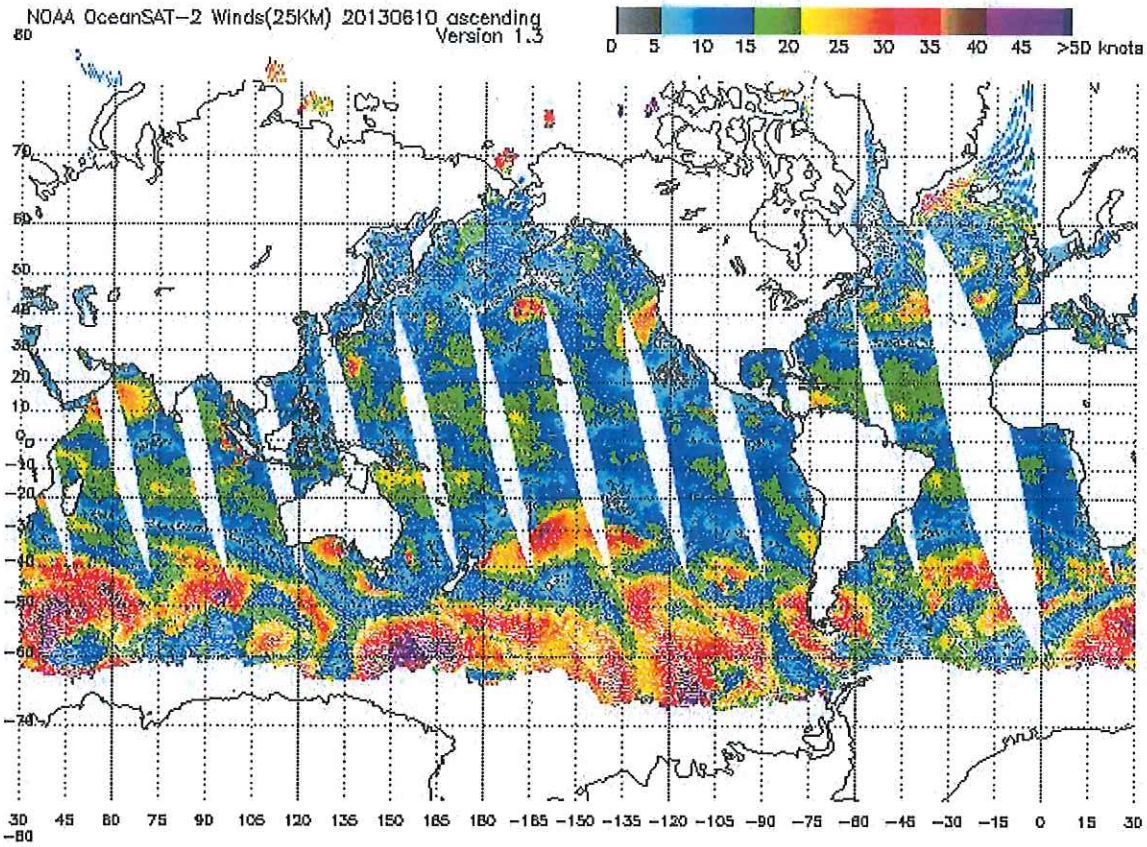

Figure 4.2: Ocean surface winds from OceanSAT-2. The satellite passed over New Zealand around midnight of the 10th June.

The third exceedance, measuring 51 μgm^{-3} was on the 7th March 2014. Concentrations were high from midday to 11 pm when wind speed was at least 8 km h^{-1} from the northerly quarter. The likely source of the high PM_{10} concentrations has not been identified.

The most recent exceedance occurred on the 11th June 2014 and is the subject of this application. The main contributor to this exceedance is thought to be natural sources, predominantly sea salt, based on the weather conditions on the day. The conditions that led to this conclusion have been outlined in Appendix 2 are discussed in more detail in Appendix 5.

APPENDIX 5 – CIRCUMSTANCES LEADING TO THE EXCEPTIONAL EVENT

The exceedance at Awatoto on the 11th June 2014 is believed to have resulted from a natural event and that the particulate being measured consisted mainly of sea salt. On the day of the exceedance, a ridge of high pressure extended over the South Island while an area of low pressure and a number of slow moving fronts affected the North Island (Figure 5.1). Together these systems directed easterly winds and swell over the coast of Hawke's Bay.

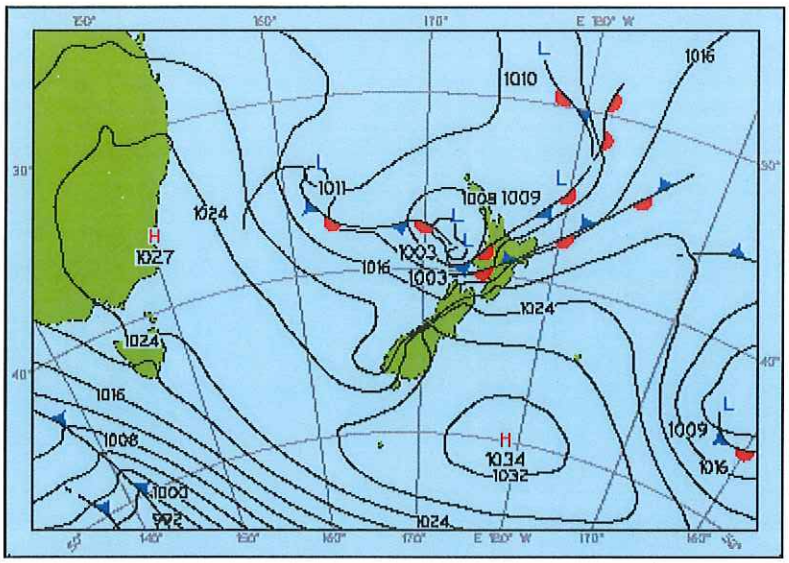

Figure 5.1: The mean sea level pressure chart for noon on the 11th June 2014. The image is provided courtesy of NZ Metservice.

Winds reached gale force in the "squash zone" between the ridge and the low centre lying to the northeast of the country (Figure 5.2). Additionally, strong to gale force winds around the southwest flank of the low centre to the east of the ridge, near 160°W, directed swell waves towards eastern coasts of the North Island.

Significant wave heights at the Port of Napier reached 3 m and maximum wave heights over 7 m on the 11th June and then eased the next day (Figure 5.3). While heights of this magnitude have occurred in the past, they are relatively uncommon (Figure 5.4). Waves of 3 m with a period of 7.5 s can be considered a high outlier amongst observations collected during the period from 2000 to 2010 (Figure 5.5).

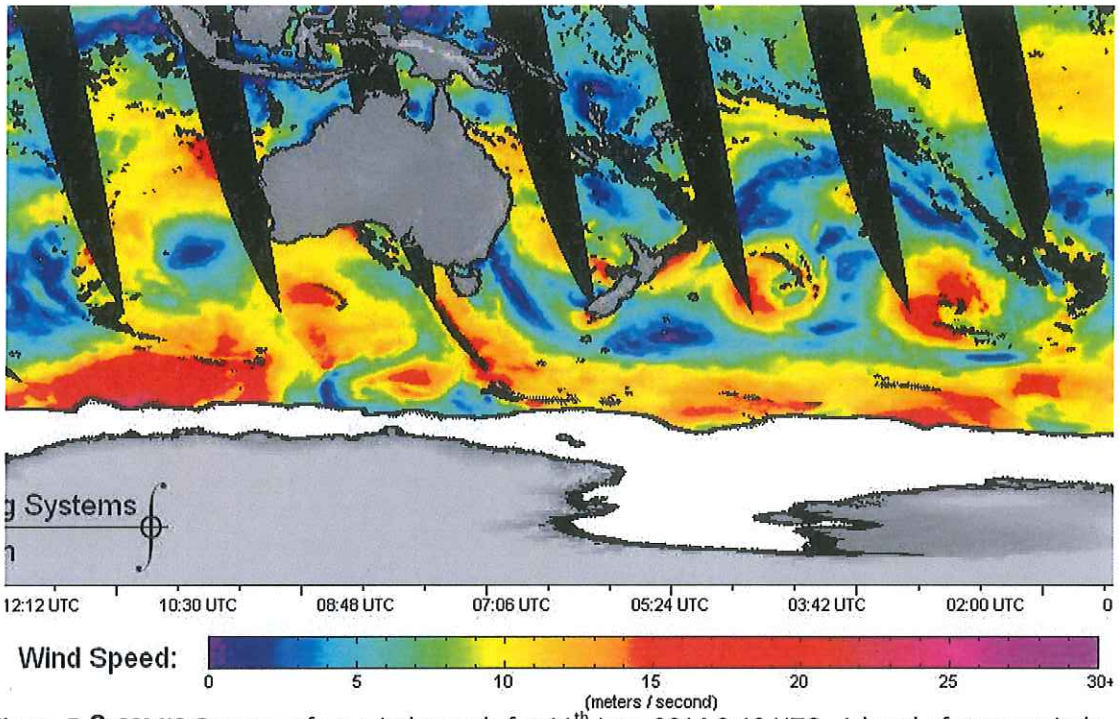

Figure 5.2: SSMIS Ocean surface wind speeds for 11th June 2014 0-12 UTC. A band of strong winds extends across the North Island and another band wraps around a low centre located to the east of New Zealand. Gale force winds have speeds of 17 ms^{-1} (33 knots) or more. Black areas indicate where valid measurements are not available.

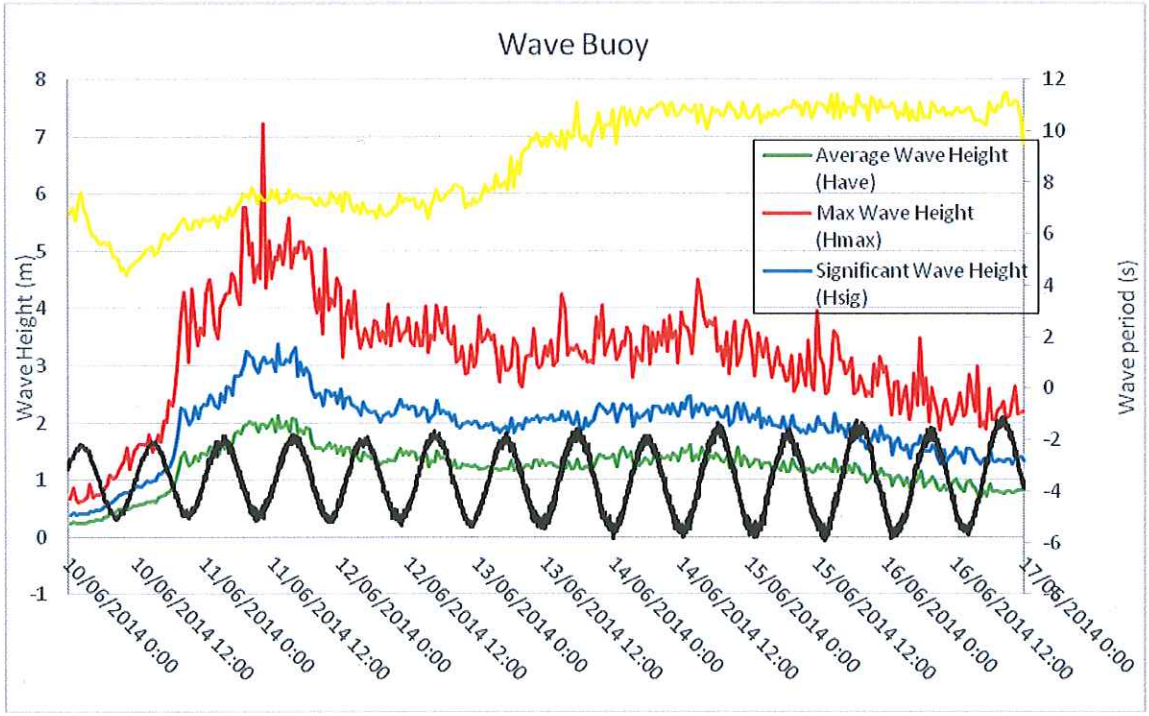

Figure 5.3: Average, significant and maximum wave heights recorded at the Port of Napier's buoy. Tide levels are shown in black and wave period is shown in yellow.

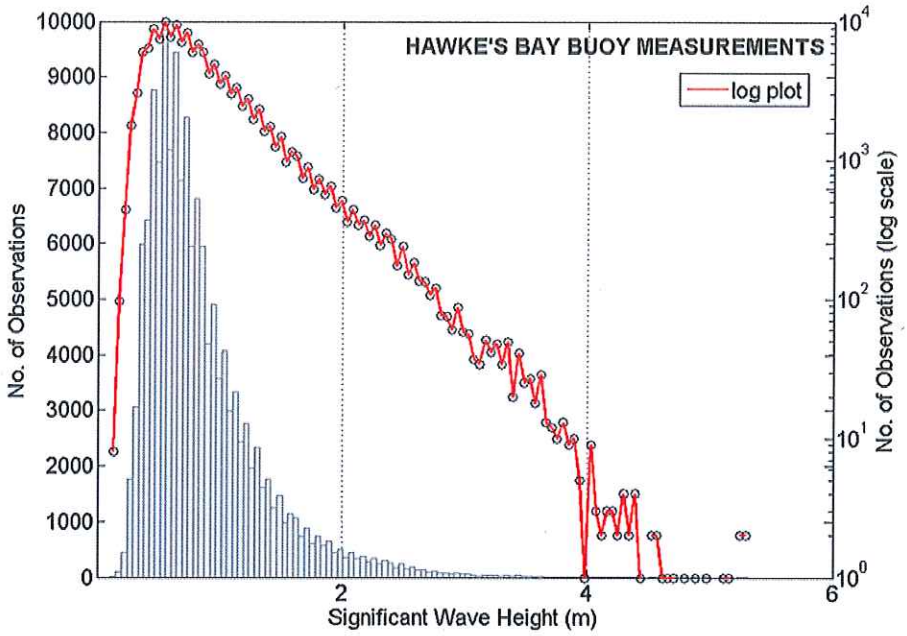

Figure 5.4: Histogram of significant wave heights measured by the Port of Napier's buoy from 2000 to 2010 (Komar and Harris, 2014).

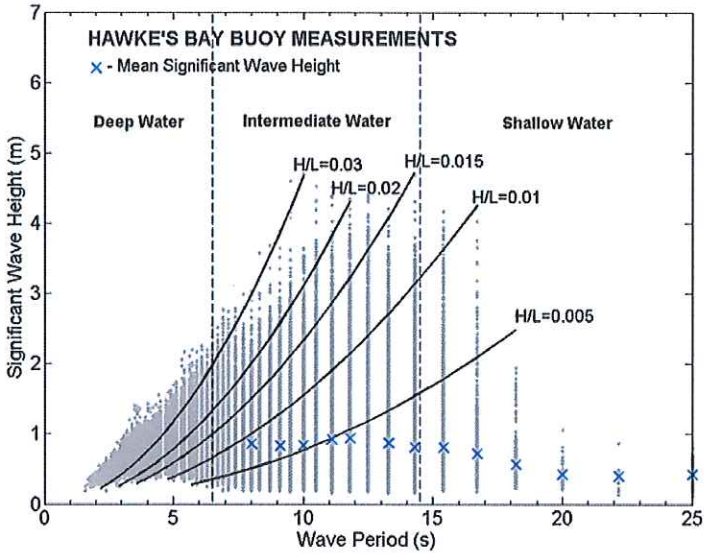

Figure 5.5: Scatter diagram of significant wave heights versus periods measured in 16 metres water depth by the Port of Napier's buoy from 2000 to 2010.

The air quality monitor in the Awatoto airshed lies approximately 200 m west of the shoreline. Backward trajectories from the monitor for 11th June and the preceding 24 hours, computed using HYSPLIT, all extend directly east and originate over the Pacific Ocean (Figure 5.6). Moderate to strong easterly winds persisted at the site all day, narrowing potential sources to properties between the monitor and the beach, as well as the beach itself and the sea.

Lying to the east of the monitor, in order of proximity, are Site Engineering – a specialist engineering firm providing on-site services to various industries, a railway track, State Highway 1 and disused warehouses on properties currently for sale. No significant point-source air discharges or air discharge consents are associated with the properties. On the day of the exceedance, high particulate concentrations were not limited to typical working hours and were observed from midnight to midnight. An exceedance of the PM_{10} standard also occurred at Ravensdown's monitoring site on the beach front. The wind direction limits the sources of particulates at the Ravensdown site to surrounding shingle piles and sea salt.

Intermittent rain fell throughout 11th June and also in the evening hours of the preceding day. The resulting damp ground decreases the likelihood that loose debris or soil blew from nearby properties towards the monitor.

A number of factors suggest that natural sources were the main contributor to the exceedance observed at the Awatoto air quality monitoring site on 11th June –

1. The coincidence of exceedances at three independent monitors in two airsheds separated by 20 km.

2. The close proximity of all three monitors to the coast which limits the number of potential terrestrial sources for the particulates.

3. The three monitors located within the sea spray zone recorded exceedances while monitors outside this zone did not. The sea spray zone, for the purposes of building standards, is defined as any area within 500 m of the coast[2].

4. Winds were directed onshore and were of moderate strength. Sea conditions were not exceptional but wave heights were uncommonly high throughout the day of the exceedance.

5. Occasional rain fell throughout the day of the exceedance and during the previous day. The damp conditions would have limited material being blown from land surfaces.

The exceedance at the Awatoto air quality site meets the five criteria used to assess applications for exceptional events –

1. The event affected air quality within the immediate vicinity of the coast as recorded by three monitors.

[2]Department of Building and Housing, 2010: Simple House Acceptable Solution. Department of Building and Housing, Wellington

2. The cause of the exceedance is believed to be salt spray generated from high seas and carried onshore by easterly winds therefore it was not preventable and it was beyond the control of the Regional Council.

3. A causal relationship between the sea state and the monitored concentrations has been established by showing that the exceedance was common to all coastal monitoring stations, the exceedance was limited to coastal monitors and PM_{10} concentrations declined the following day when both wave heights and onshore winds eased.

4. The cause of the exceedance was a natural event. The event is uncommon but not exceptional. An event of a similar nature occurred exactly one year previously resulting in similarly elevated PM_{10} concentrations.

5. The event would not have occurred in the absence of high seas generated by the weather systems in place at the time. PM_{10} concentrations were 20 μgm^{-3} or more above levels typically observed during easterly wind conditions.

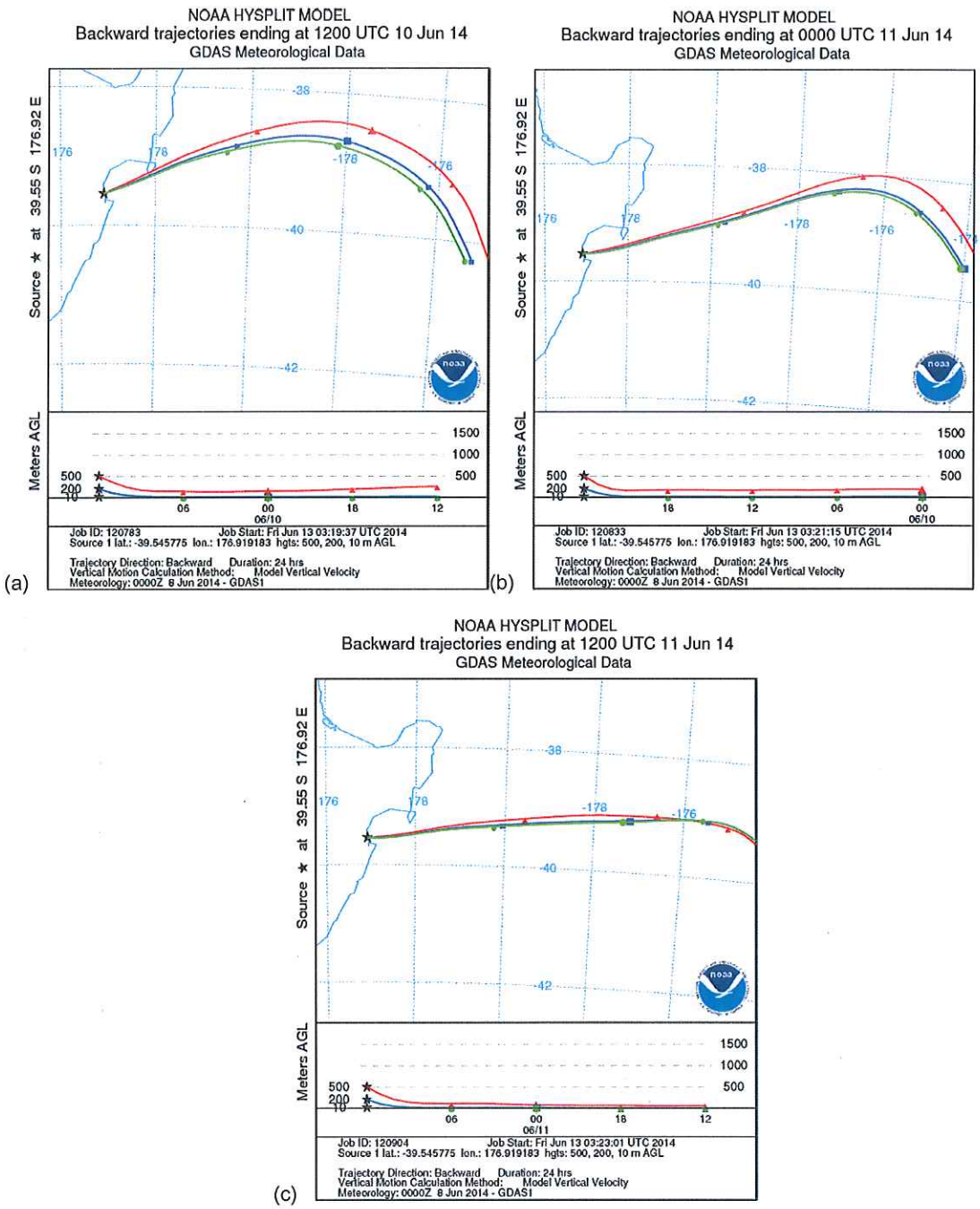

Figure 5.6: HYSPLIT backward trajectories from the Awatoto air quality site for 24 hour periods ending at (a) 10th June 2014 1200 UTC or midnight of 10th June NZLT (b) 11th June 2014 0000 UTC or midday of 11th Jun NZLT and (c) 11th June 2014 1200 UTC or midnight of 11th June NZLT. Trajectories are shown at heights of 500 m (red), 200 m (blue) and 10 m (green) above ground level.

21st August 2014

Additional notes to HBRC's Exceptional Event application with respect to the PM_{10} exceedance in the Awatoto Airshed on 11th June 2014 (submitted on 25th July 2014).

The following information is provided in response to the Ministry for the Environment's request, dated 20th August 2014, for further detail on average wind and PM_{10} conditions at Awatoto and the reasoning behind the location of the monitor.

1. Average June wind speeds and PM_{10} concentrations

The Awatoto site has been operating for less than three years so any reference to "June averages" covers only three June periods. The daily mean wind speed, averaged across all June months, is 11 kmh^{-1}, which is substantially lower than 32 kmh^{-1} observed on the 11th June 2014. Monthly site averages, i.e. averages since records began, for both wind speed and PM_{10} are presented graphically in the bottom middle chart of Figure 3.2 of the original application and are shown again below on a larger scale (Figure 1). The normal daily PM_{10} concentration in June is 18.2 μgm^{-3}.

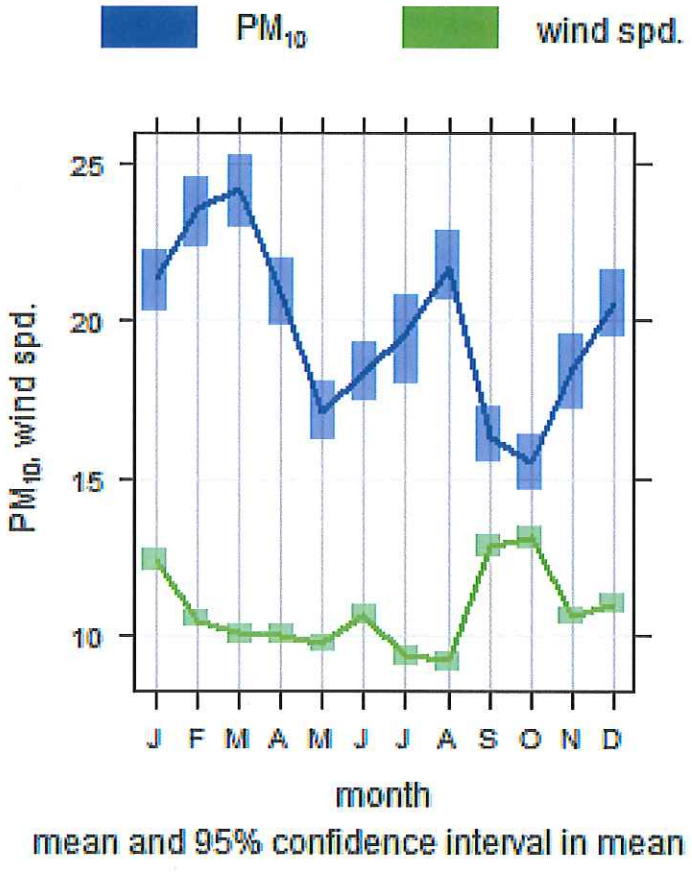

Figure 1: Monthly averages of PM_{10} (μgm^{-3}) and wind speed (kmh^{-1}) at Awatoto since monitoring began in 2012.

A point of clarification regarding the original application - the hourly values of PM_{10} and wind speed shown in Figure 3.3 of the application are averages for all June months and not just 2014. Likewise

in Figure 3.4, the hourly PM_{10} measurements on the 11th June are compared with all June averages, not just June 2014.

The mean wind speed on the 11th June is the second highest measurement recorded at Awatoto and the highest from an easterly direction (Figure 2). The highest reading overall is 34 kmh^{-1} recorded in June 2013, when the average wind direction was from the southwest.

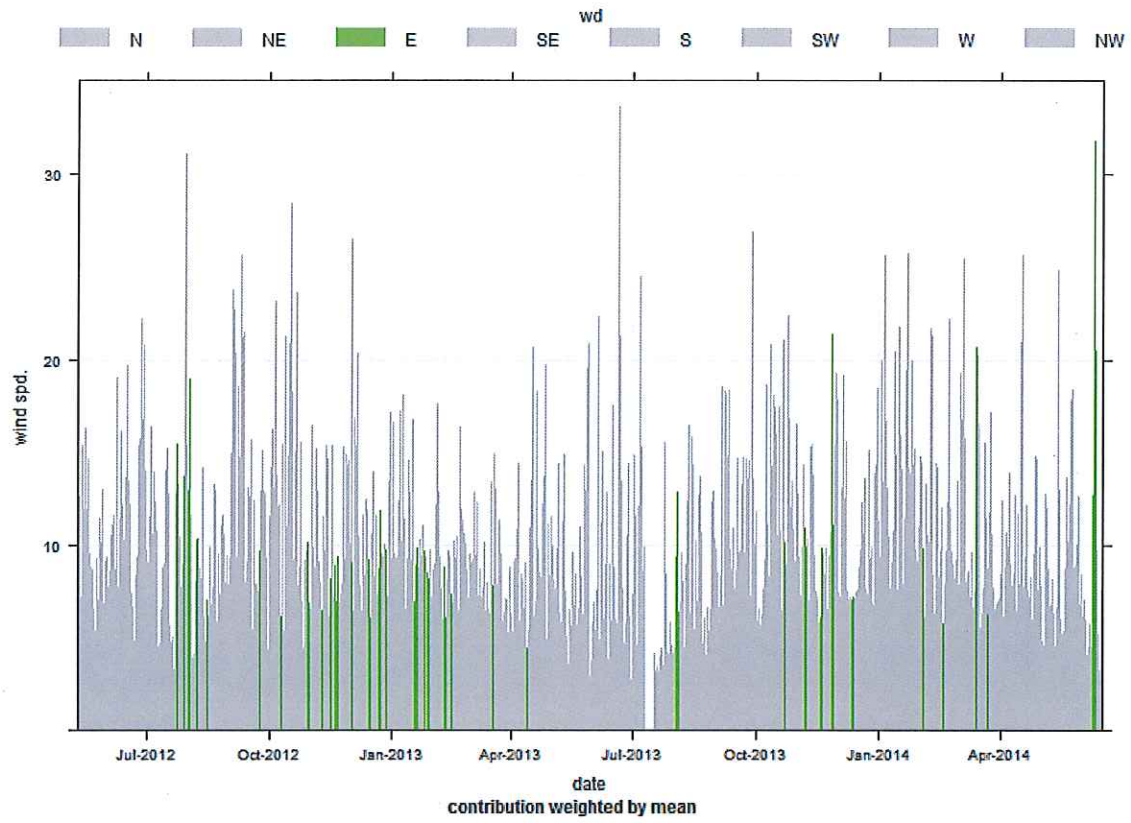

Figure 2: Daily mean wind speed (kmh^{-1}) from 11th May 2012 to 16th June 2014. Days when the average wind direction was easterly are highlighted in green and all other directions are coloured grey.

Wind roses for each month, using the complete record of hourly data (Figure 3) and daily data (Figure 4), show that southwest winds dominate during June and the winter months. Easterlies increase in frequency in warmer months when sea breezes are more prevalent.

As noted in Appendix 5 of the application, the "exceptional" nature of the conditions leading to the PM_{10} exceedance was due to the combination of easterly swell and onshore winds. Several weather systems were directing swell waves into Hawke Bay and offshore gales contributed to the generation of heavy seas and uncommonly high wave heights. Local winds carried the resultant sea spray some distance onshore.

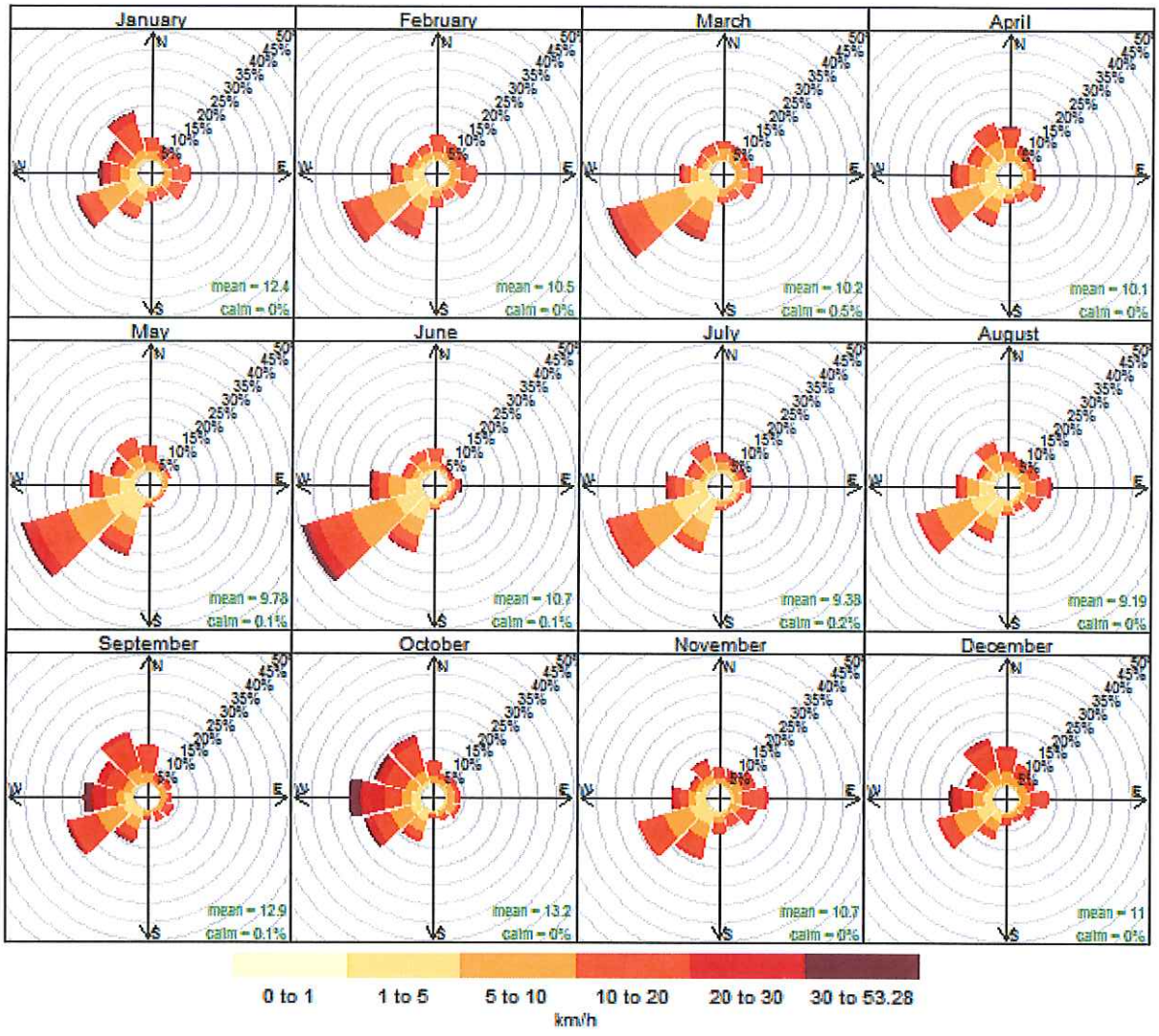

Figure 3: Wind roses for each month, based on hourly data from May 2012 to June 2014.

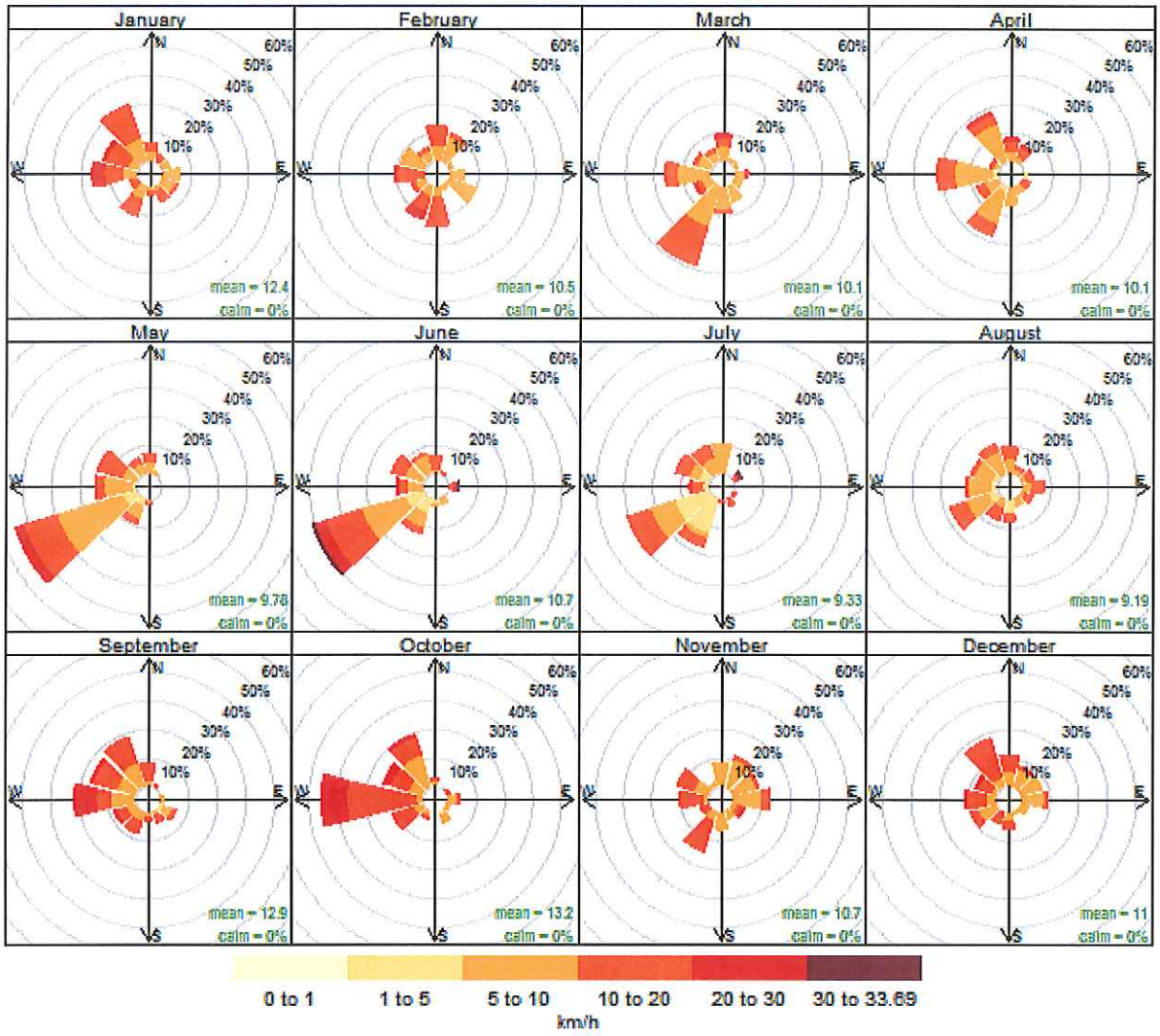

Figure 4: Wind roses for each month, based on daily averages from May 2012 to June 2014.

2. The location of the Awatoto air quality monitor

The Awatoto airshed is a narrow, coastal airshed, as depicted in Figure 1.2 of the original application. The airshed stretches almost 3 km along the coast and for the most part lies within 800 m from the shoreline, but extends to 1km from the coast at its widest point. Rural land takes up most of the airshed's area, while industry is concentrated on its eastern border in a strip less than 300 m wide. The air quality monitor in Awatoto is located approximately 200m from the coast and slightly more than 1 km from the northern end of the airshed. The area immediately to the south of the monitor is dominated by Ravensdown Ltd's operations.

The location was chosen because the section of land upon which the monitor is sited is:

- situated amongst the exposed population,
- otherwise unused,
- relatively free of obstacles,

- easily accessible and has an available power supply,
- fairly centrally located within the narrow strip of industrial activity,
- able to capture at least some industrial sources of PM_{10} in most wind directions.

When installing the monitor, consideration was given to the predominant and strongest winds on average in the airshed, which come from directions having a westerly component. It could be argued that the monitor should be located closer to the coast to better capture concentrations in the most common wind conditions.

Positioning the monitor further to the west has been considered, but such a move would take it outside the zone of industry. Industrial contributions to PM_{10} could only be measured in easterly winds and concentrations would still have a sizeable component of natural sources. A main reason for not locating the monitor further east is simply because no one is there - only unoccupied rural land where human exposure is negligible. This would be particularly so if the monitor was moved in excess of 500 m from the coast to place it beyond the 'sea spray zone'.

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