

Air quality in the Upper Hunter: Spring 2016

Air quality in the Upper Hunter from 1 September to 30 November 2016 was generally good.

- Levels of nitrogen dioxide (NO₂), sulfur dioxide (SO₂) and fine particulate matter PM_{2.5} (particles less than or equal to 2.5 microns in diameter) were all below benchmark concentrations.
- Daily average levels of particulate matter PM₁₀ (particles less than or equal to 10 microns in diameter) were above the 50 µg/m³ benchmark on six days during spring 2016 (10 and 16 October, 5, 7 to 8 and 19 November). Daily PM₁₀ levels on these days ranged from 53.1 to 84.1 µg/m³.
 - Mount Thorley and Singleton NW each recorded two days over the benchmark (8 and 18 November at Mt Thorley and 7 to 8 November at Singleton NW). Camberwell recorded five days (10 and 16 October, 5 and 7 to 8 November).
 - Large bushfires were burning in the Lower Hunter and Port Stephens regions on 7 and 8 November¹.
 - Daily average PM₁₀ levels were below the benchmark during spring 2016 at all the larger population sites.
 - The number of days over the PM₁₀ benchmark was lower in spring 2016 compared to the previous four years. In spring 2012 and 2013 the network recorded nearly five times the number of days over the benchmark compared to 2016.

Annual air quality trends in the Upper Hunter

A comparison of the annual average levels of PM₁₀ and PM_{2.5}, since the Upper Hunter Air Quality Monitoring stations were established, shows the long term trends in particle levels. The benchmarks for annual average particle levels are 25 µg/m³ for PM₁₀ and 8 µg/m³ for PM_{2.5}, based on a calendar year.

Figure 1 shows the PM₁₀ and PM_{2.5} *rolling* annual averages, based on the 12-month periods, from spring to spring for 2012 to 2016. The comparison shows that particle levels generally were lower to the end of spring in 2015 and 2016 than in 2012, 2013 and 2014.

Rolling annual averages are not intended to be compared to the annual benchmarks. The rolling annual averages provide a guide to long term trends, using the most up to date monitoring data.

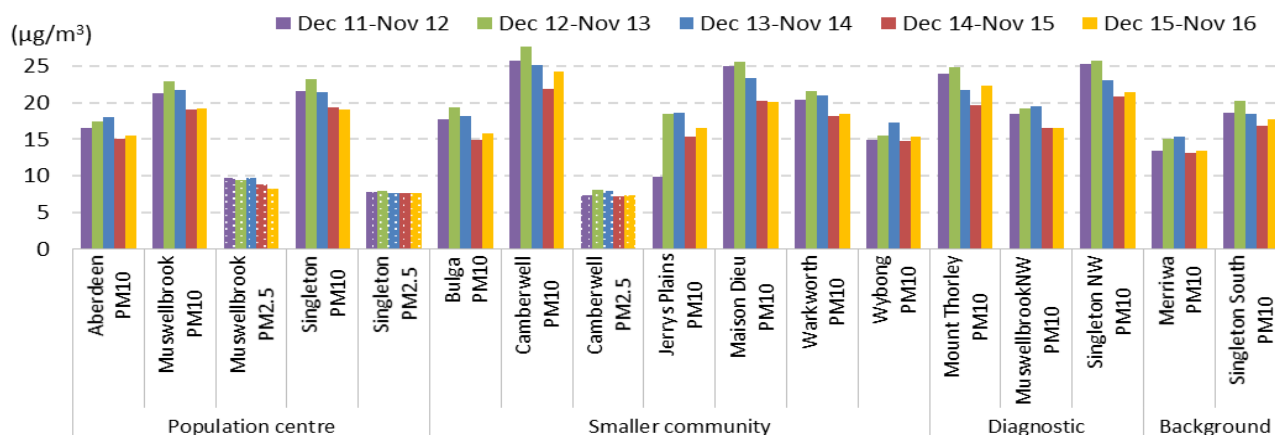


Figure 1: PM₁₀ and PM_{2.5} rolling annual averages to the end of spring - 2012 to 2016

¹ Rural Fire Service ICON database: Port Stephens 9233 ha fire ('Lone Pine Fire') from 4-15 November and Cessnock 1042 ha fire ('Racecourse' fire) from 5-10 November

Daily time series plots

Daily average time series plots for PM₁₀ and PM_{2.5} and daily one hour maximum plots for NO₂ and SO₂ show the daily concentrations throughout the spring season.

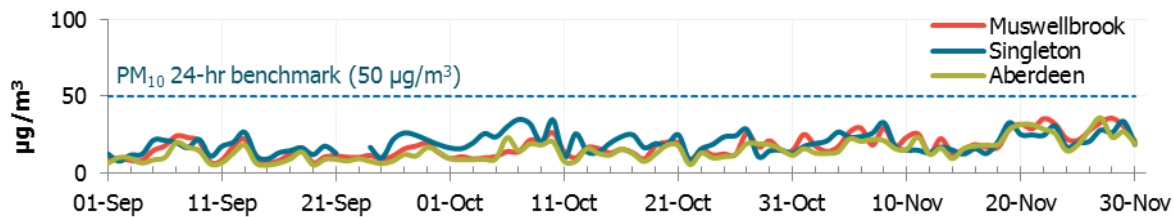


Figure 2: Population centre sites: daily average PM₁₀ – spring 2016

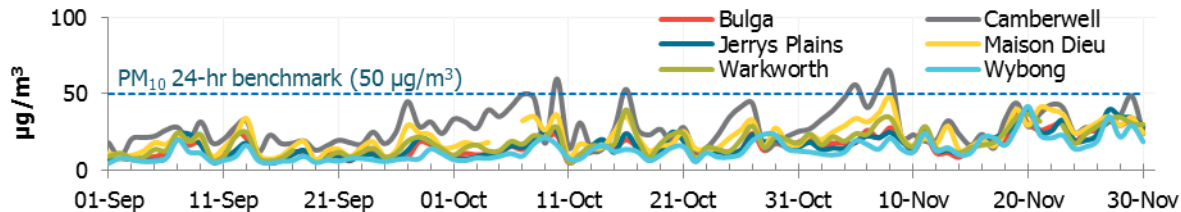


Figure 3: Smaller community sites: daily average PM₁₀ – spring 2016

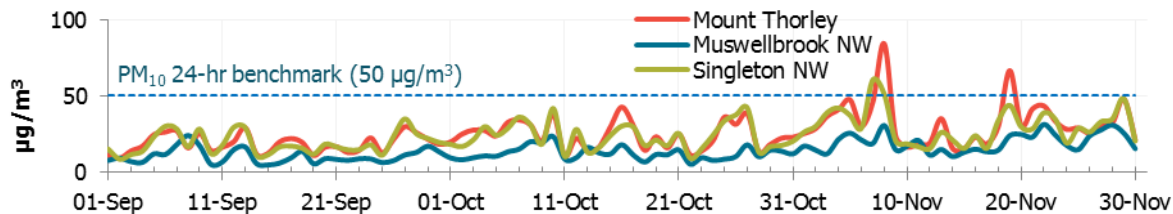


Figure 4: Diagnostic sites: daily average PM₁₀ – spring 2016

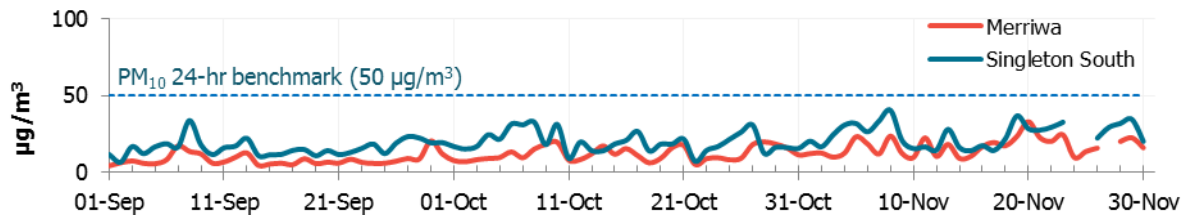


Figure 5: Background sites: daily average PM₁₀ – spring 2016

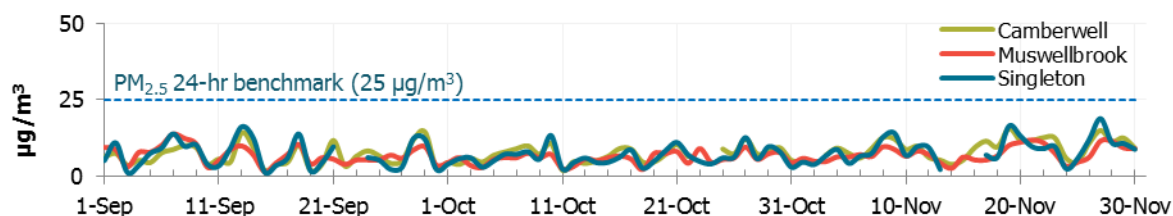


Figure 6: Daily average PM_{2.5} – spring 2016

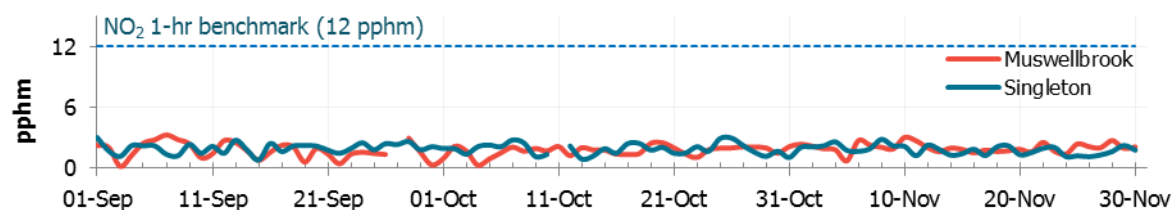


Figure 7: Daily 1-hr maximum NO₂ – spring 2016

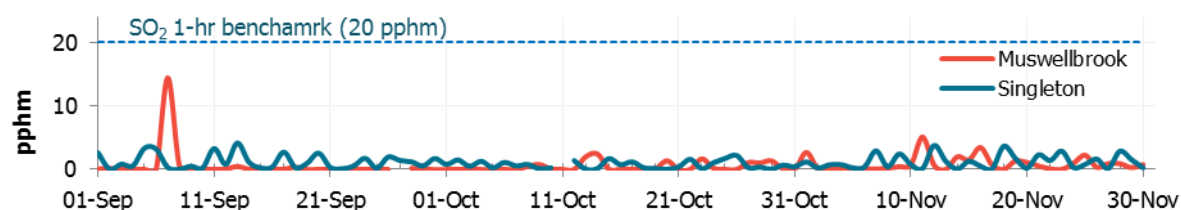


Figure 8: Daily 1-hr maximum SO₂ – spring 2016

Days above benchmark concentrations

There were six days over the PM₁₀ benchmark during spring 2016.

Table 1: Number of days above the relevant benchmarks – spring 2016

| Station type* | Station | PM ₁₀ daily [50 µg/m ³ benchmark] | PM _{2.5} daily [25 µg/m ³ benchmark] | SO ₂ hourly [20 pphm benchmark] | SO ₂ daily [8 pphm benchmark] | NO ₂ hourly [12 pphm benchmark] |
|-------------------|-----------------|--|---|---|---|---|
| Population centre | Aberdeen | 0 | - | - | - | - |
| Population centre | Muswellbrook | 0 | 0 | 0 | 0 | 0 |
| Population centre | Singleton | 0 | 0 | 0 | 0 | 0 |
| Smaller community | Bulga | 0 | - | - | - | - |
| Smaller community | Camberwell | 5 | 0 | - | - | - |
| Smaller community | Jerrys Plains | 0 | - | - | - | - |
| Smaller community | Maison Dieu | 0 | - | - | - | - |
| Smaller community | Warkworth | 0 | - | - | - | - |
| Smaller community | Wybong | 0 | - | - | - | - |
| Diagnostic | Mount Thorley | 2 | - | - | - | - |
| Diagnostic | Muswellbrook NW | 0 | - | - | - | - |
| Diagnostic | Singleton NW | 2 | - | - | - | - |
| Background | Merriwa | 0 | - | - | - | - |
| Background | Singleton South | 0 | - | - | - | - |

µg/m³ = microgram per cubic metre and pphm = parts per hundred million by volume (i.e. parts of pollutant per hundred million parts of air)

- = not monitored * For explanation, refer to the end of the report Definitions: Upper Hunter monitoring station types

Pollution roses

The seasonal PM₁₀ pollution rose map shows that hourly PM₁₀ levels were generally low during spring 2016.

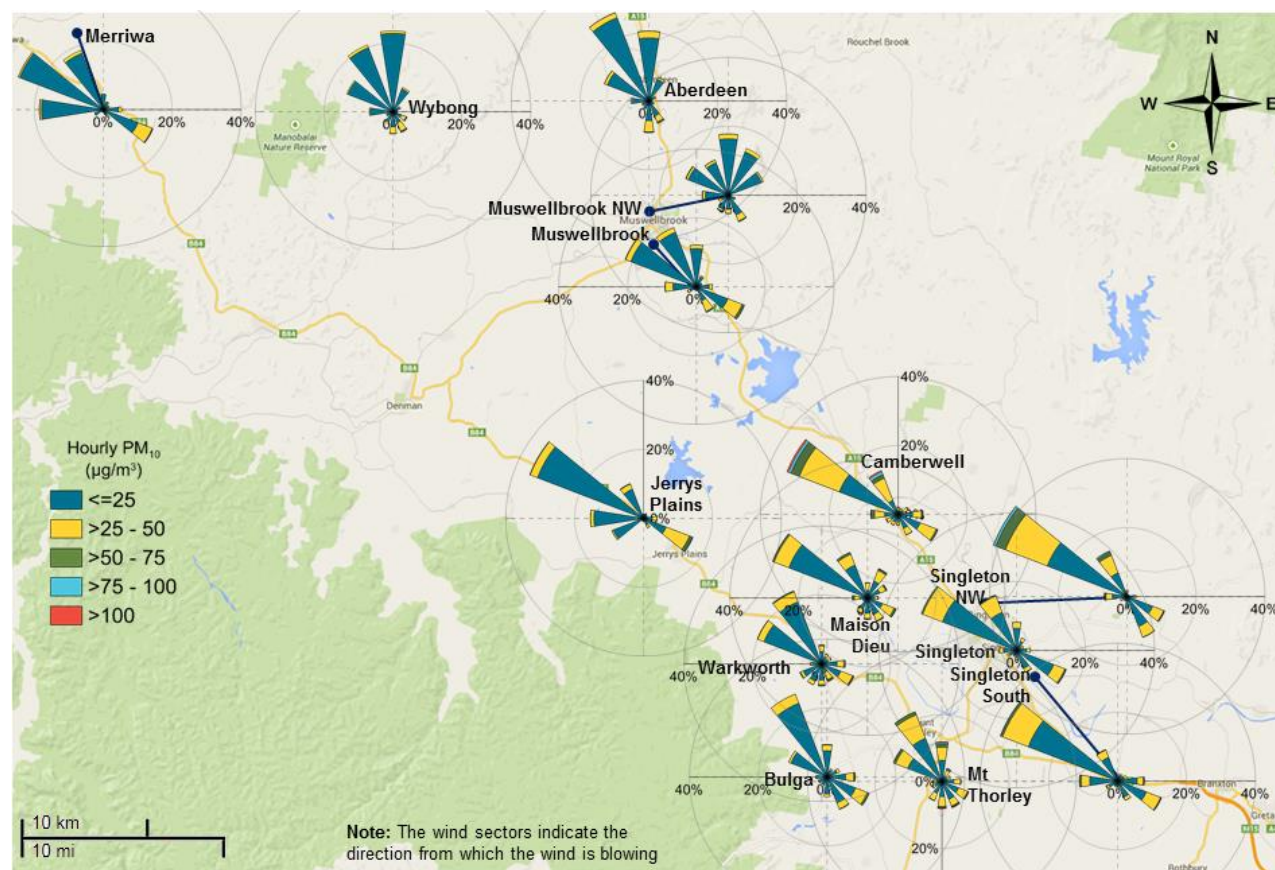


Figure 9: Hourly PM₁₀ pollution rose map for the Upper Hunter region for spring 2016

Seasonal comparisons

This section compares air quality levels in spring 2016 with previous spring seasons, where data were available.

All days were below the benchmark concentrations for NO₂ and SO₂ at all sites in spring during the past five years.

All days were below the daily average PM_{2.5} benchmark concentration at all sites during spring 2016, which is the same as spring 2015. During the previous three spring periods one to two days were recorded over the PM_{2.5} benchmark at sites in the Upper Hunter.

The daily average PM₁₀ concentrations were above the benchmark on six days during spring 2016. The number of days over the PM₁₀ benchmark was lower in spring 2016 compared to the previous four years. Spring 2012 and 2013 had nearly five times the number of days over the benchmark compared to 2016.

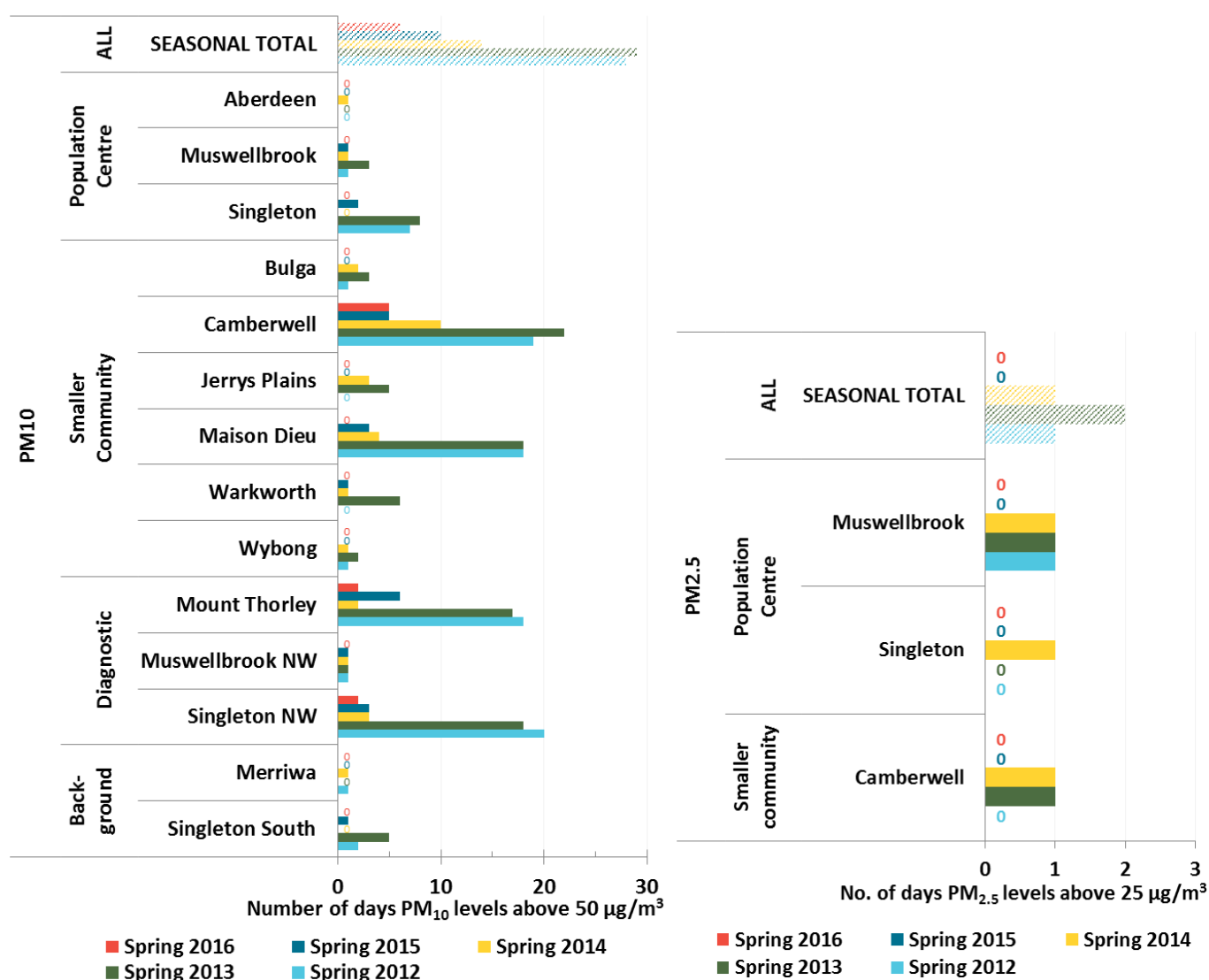


Figure 10: Number of days above the PM₁₀ and PM_{2.5} benchmarks during the 2012 to 2016 spring periods

Spring air quality trends in the Upper Hunter

Figure 11 and Figure 12 show daily average levels of PM₁₀ during spring 2016, compared to the daily maximum and minimum levels from 2011 to 2015, at Singleton and Muswellbrook. These show that daily PM₁₀ levels were predominantly lower in spring 2016 compared to earlier years. Some days recorded the minimum level since the establishment of the network. Days with higher particle levels in the latter half of November coincide with a period of no rain.

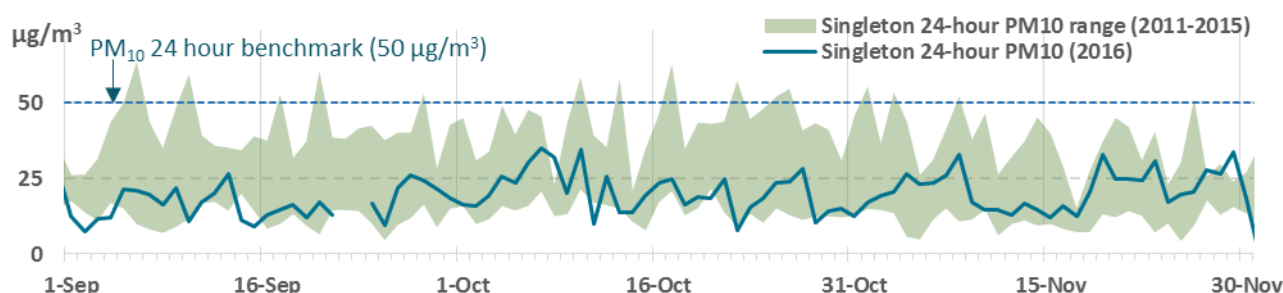


Figure 11: Singleton daily average PM₁₀ during spring 2016 plotted against the daily maximum and minimum PM₁₀ levels recorded from 2011 to 2015

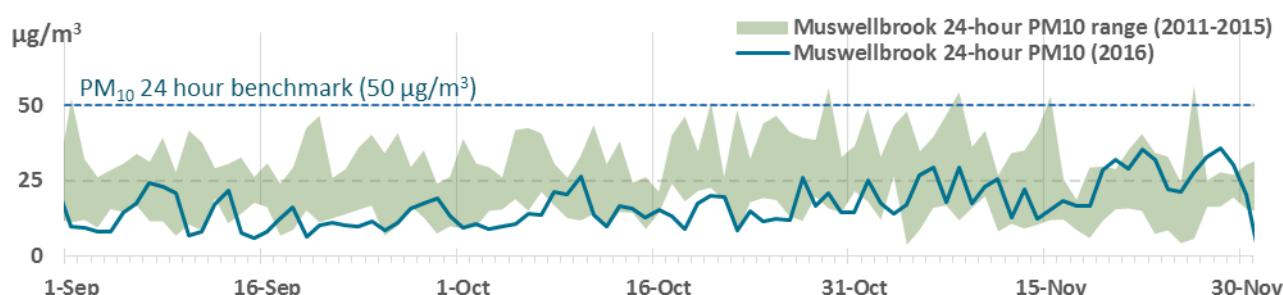


Figure 12: Muswellbrook daily average PM₁₀ during spring 2016 plotted against the daily maximum and minimum PM₁₀ levels recorded from 2011 to 2015

Figure 13 and Figure 14 show daily average levels of PM_{2.5} during spring 2016, compared to the daily maximum and minimum levels from 2011 to 2015, at Singleton and Muswellbrook. These show that daily PM_{2.5} levels were generally lower in spring 2016 compared to earlier years, although there is some variability at Singleton.

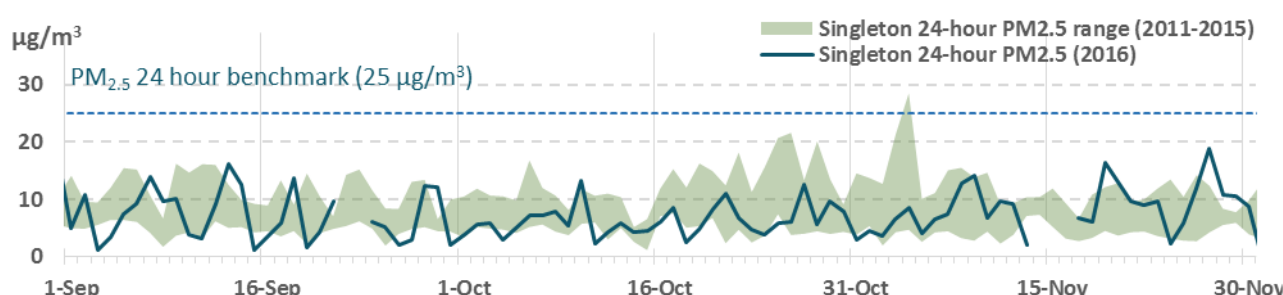


Figure 13: Singleton daily average PM_{2.5} during spring 2016 plotted against the daily maximum and minimum PM_{2.5} levels recorded from 2012 to 2015

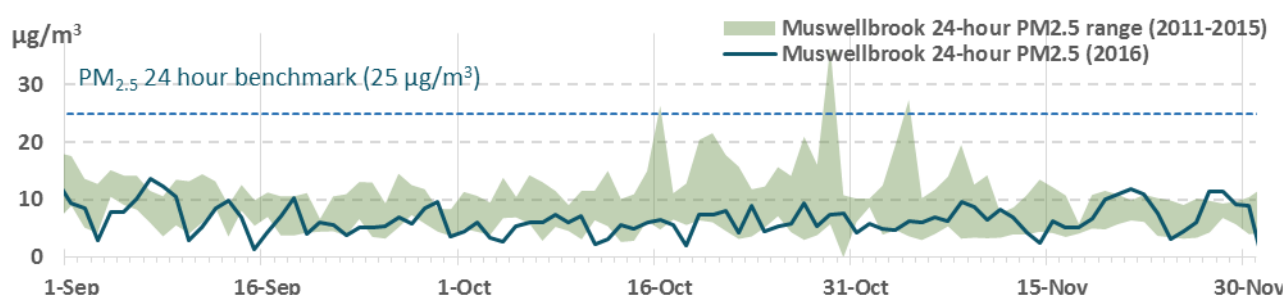


Figure 14: Muswellbrook daily average PM_{2.5} during spring 2016 plotted against the daily maximum and minimum PM_{2.5} levels recorded from 2012 to 2015

Meteorological summary

Rainfall and temperature²

The Upper Hunter experienced average rainfall overall during spring 2016, however above average rainfall during September. NSW experienced a cool, wet season overall. Rainfall was higher than the previous two spring periods. Spring 2016 received 25 to 100 millimetres more rainfall than spring 2015 and 50 to 200 millimetres more than spring 2014. Rainfall was up to 100 millimetres less in some parts of the region in spring 2016 compared to spring 2013.

Maximum temperatures were average, while minimum temperatures were average to 'above average' during the season.

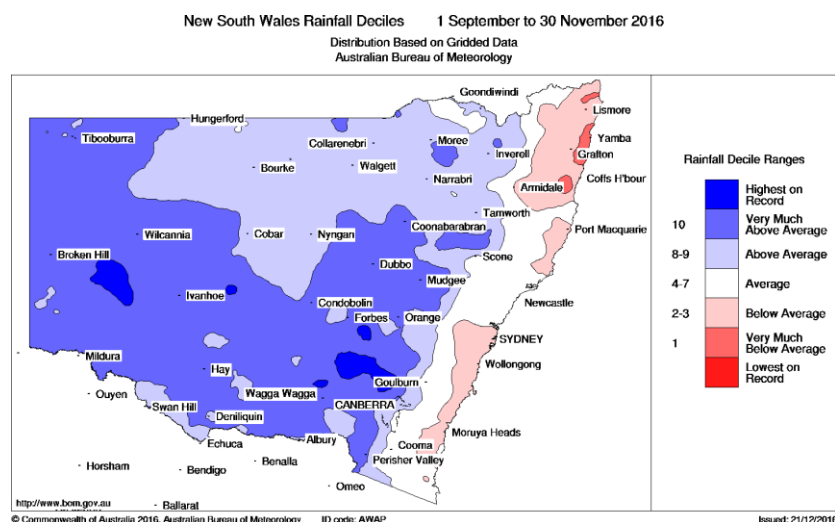


Figure 15: NSW rainfall deciles – spring 2016

Wind

The winds were predominantly from the northwest throughout the region during spring 2016, with less variability than is typical during this transitional season. During spring, winds generally change from north-westerly to south-easterly as conditions warm. Wind speeds in spring 2016 were generally higher than previous spring seasons.

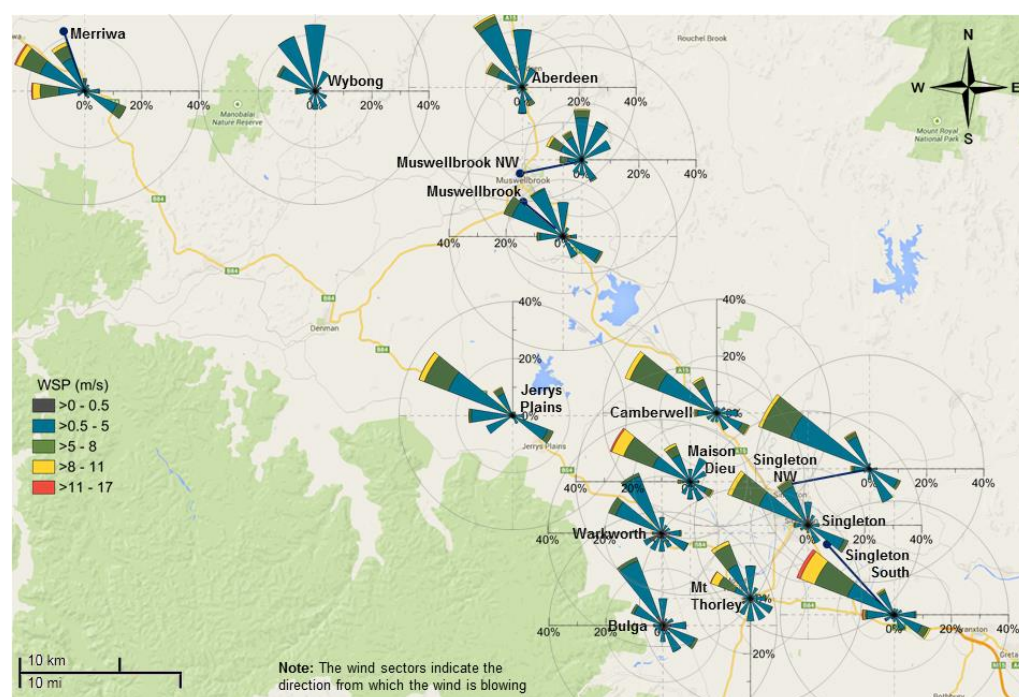


Figure 16: Wind rose map for the Upper Hunter region for spring 2016

² Rainfall and temperature information are from the Bureau of Meteorology [New South Wales spring 2016 climate statement and climate maps](#) (accessed January 2017)

Network performance

The target network performance is at least 95% available data for all parameters. The maximum online time that can be attained for NO₂ and SO₂ is 96%, due to daily calibrations.

Table 2: Online performance (%) during spring 2016

| Station | Particles PM ₁₀ daily | Particles PM _{2.5} daily | Gases SO ₂ hourly | Gases NO ₂ hourly | Meteorology Wind hourly |
|-----------------|--|---|------------------------------------|------------------------------------|-------------------------------|
| Aberdeen | 100 | - | - | - | 100 |
| Bulga | 100 | - | - | - | 100 |
| Camberwell | 100 | 97 | - | - | 100 |
| Jerrys Plains | 100 | - | - | - | 100 |
| Maison Dieu | 98 | - | - | - | 100 |
| Merriwa | 99 | - | - | - | 100 |
| Mount Thorley | 100 | - | - | - | 100 |
| Muswellbrook | 100 | 100 | 94 | 94 | 100 |
| Muswellbrook NW | 100 | - | - | - | 98 |
| Singleton | 98 | 95 | 94 | 94 | 99 |
| Singleton NW | 100 | - | - | - | 100 |
| Singleton South | 98 | - | - | - | 98 |
| Warkworth | 97 | - | - | - | 98 |
| Wybong | 100 | - | - | - | 100 |

- = not monitored

Definitions: Upper Hunter monitoring station types

The 14 monitoring stations in the Upper Hunter serve different purposes:

Larger population: stations near the larger population centres monitor the air quality in these centres.

Smaller communities: stations in smaller communities monitor the air quality at those locations.

Diagnostic: provide data that can help to diagnose the likely sources and movement of particles across the region as a whole; they do not provide information about air quality at population centres.

Background: the stations near Merriwa and Singleton South are at both ends of the valley and provide background data, measuring the quality of air entering and leaving the Upper Hunter Valley under predominant winds (south-easterlies and north-westerlies).

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Published by: Office of Environment and Heritage, 59–61 Goulburn Street, Sydney South 1232. Ph: 131 555 (environment information and publications requests). TTY: (02) 9211 4723.

Email: info@environment.nsw.gov.au;

Web: www.environment.nsw.gov.au.

ISSN 2206-0391 OEHL 2017/0078 February 2017