Wynnum Citizen Science Air Monitoring Project

Final report

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Acknowledgements

This report acknowledges the members of Clean Air Wynnum and Bayside Creeks Catchment Group for their contribution to the Wynnum Citizen Science Air Monitoring Project.

Acknowledgments are also made to the Port of Brisbane for sharing air quality data for this report.

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Introduction

In 2018, the Community Engagement team from the Department of Environment and Science (DES) engaged with community group Clean Air Wynnum to develop a citizen science project with the focus of air quality monitoring and community engagement.

Clean Air Wynnum (CAW) is a community group based in the Wynnum area, consisting of a number of community members across the bayside area of Brisbane. The Wynnum community is in close proximity to a number of industries, specifically bulk handling and shipping at the nearby Port of Brisbane, oil refineries and coal and freight transport along the local Western-Metropolitan Rail System. While Wynnum is situated close to port activities, a primary concern for local community is the Western-Metropolitan Rail System that transports coal to the port from basins in southern Queensland. As this rail system runs directly through the Wynnum area to the port, the community have significant concerns with the transport of coal and other products along the rail system, which is perceived to be significant contributor to black-coloured dust in their homes and low air quality.

To address community concerns, the Wynnum Citizen Science Air Monitoring Project (the project) was developed in collaboration with CAW and Bayside Creeks Catchment Group with the aim of engaging community to investigate air quality and to improve understanding of air quality monitoring and associated standards. The project adopted a citizen science approach, which involves public participation and collaboration in scientific research with the aim to increase scientific knowledge[1]. A collaborative approach to environmental monitoring can be an effective tool to both address the lack of confidence in science and regulation, and to empower the community to address a local environmental concern. Community-based participatory research is undertaken 'with' and 'for' communities, and allows scientists and regulators to listen and respond to the public. By partnering with the local community, DES aimed to directly respond to community concerns while promoting active communication and collaboration between the CAW and scientific experts in all aspects of research design.

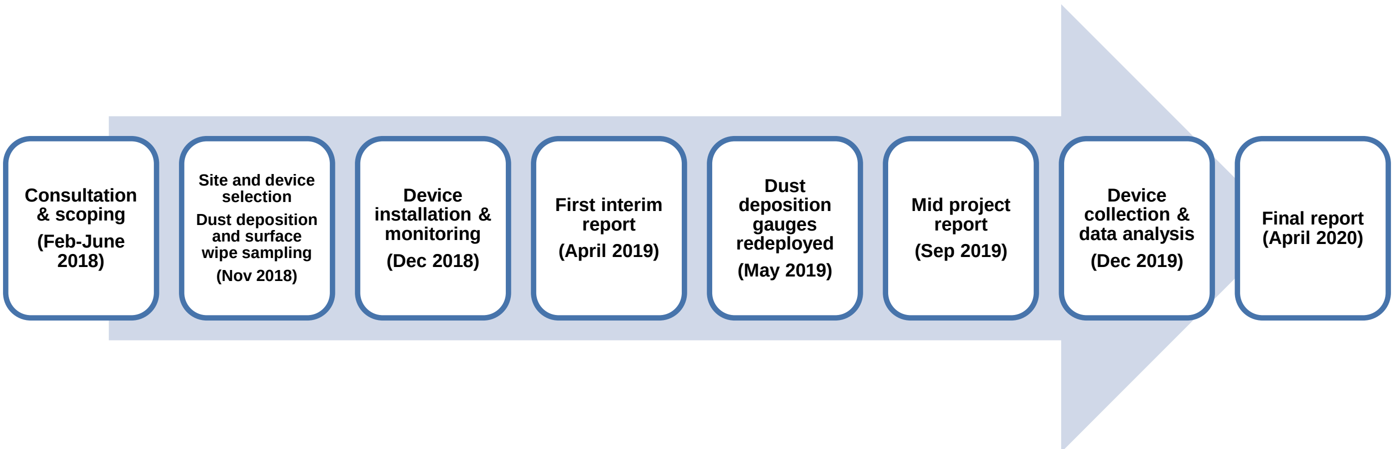
To empower the community, CAW participants were active in project design, sampling methods, and site and device selection with guidance provided by DES air quality experts. By working collaboratively with the community in aspects of project design, methods, site sampling and data analysis, it was also the objective to increase confidence and transparency of DES monitoring processes and environmental regulation.

The project aims to address the following questions in the Wynnum area:

1) Is the air quality considered good?
2) Is the dust present in homes coal dust?
3) Is the dust considered a nuisance?

To address these questions, the CAW participants elected to sample particulate matter, dust composition and dust deposition.

The project involves CAW participants using low-cost particle sensors to measure $PM_{2.5}$ and PM_{10} in real-time and assess against national air quality standards. The participants have also undertaken deposition sampling during November 2018 and May 2019 to assess dust deposition (nuisance), and dust composition analysis using surface wipe and dust deposition samples to determine the types of dust present in Wynnum homes. The project commenced data collection (particulate matter) in December 2018 and concluded in December 2019.



[1]Australian Citizen Science Association, https://citizenscience.org.au/who-we-are/

Particulate matter

A key indicator for air quality is particulate matter (PM), which refers to airborne particles that may be hazardous to human health or cause a nuisance at elevated levels. Adverse health effects are closely associated with particle size; smaller particles pose a greater risk as they are more likely to enter the respiratory system and cause health problems. Airborne particles are therefore commonly measured in two different size distributions, being $PM_{2.5}$ and PM_{10}. These measures refer to particles that are less than 2.5 micrometres (µm) in diameter and less than 10 micrometres respectively. Fine $PM_{2.5}$ particles are generally a result of combustion processes, whereas PM_{10} particles are course and are generated by either combustion or non-combustion processes. To safeguard human health and the natural environment, national air quality standards help to manage short or long-term air quality issues at local, national and regional levels.

To determine any potential health risk, the project measured particulate matter over twelve months and assessed results against standards outlined in the *National Environment Protection (Ambient Air Quality) Measure* (NEPM)[2].

The NEPM outlines national standards for $PM_{2.5}$ and PM_{10} to safeguard human health and are based on 24-hour and 12-month averages (Table 1). While ambient air quality must be compliant with average standards, the NEPM allows for exceedances of the 24-hour averages for exceptional events such as bushfires or continental scale windblown dust that may adversely affect air quality at a particular location.

The concentrations of $PM_{2.5}$ and PM_{10} are reported in **µg/m³** (micrograms per cubic meter of air).

Table 1: NEPM criteria for $PM_{2.5}$ and PM_{10} concentrations.

Particle size	Time period	Standard
$PM_{2.5}$	24 hours	25µg/m³
	12 months	8 µg/m³
PM_{10}	24 hours	50µg/m³
	12 months	25µg/m³

[2]National Environment Protection (Ambient Air Quality) Measure https://www.legislation.gov.au/Details/F2016C00215

Project design

Monitoring sites

The project area consists of twelve monitoring sites across Wynnum, Wynnum West, Hemmant, Tingalpa and Murarrie that housed an air monitoring device (Figure 1). Sites were selected by CAW based on their proximity to local train lines and high traffic areas, where there was particular concern for dust pollution and where there was suitable access to a Wi-Fi and power connection.

Five of the twelve sites undertook dust deposition sampling during either November 2018 or May 2019 to quantify dust deposition rates and dust composition. Another five sites were selected for surface wipe sampling for dust composition, which was conducted in July (one sample) and November 2019 (six samples).

Figure 1: Project area showing twelve device locations in Wynnum and surrounding suburbs.

Air monitoring devices

The project used two types of low-cost, portable laser particle counters that measure $PM_{2.5}$ and PM_{10} from smoke, dust or other particulate air pollution. Ten devices within the project were PurpleAir devices that use a fan to draw air past a fine laser beam, scattering light according to particle size (Figure 2). This scattered light is detected by a photodiode which categorises particles into different sizes with equivalent diameters of 0.3, 0.5, 1.0, 2.5, 5 and 10 micrometres (µm). During the sampling period (80 seconds), the particle number concentration for each optical diameter is recorded and then converted to particle mass concentrations in a cubic metre of air (µg/m³). These concentrations could be viewed in real-time on the PurpleAir webpage[3] for the duration of the project. Two devices are ArcHUB sensors (Figure 3) that also measure $PM_{2.5}$ and PM_{10}, although do not display data in real-time. Device installation commenced in December 2018.

While both device types are considered reliable, given their low cost they are not equipped with additional components and gauges commonly attached to high-cost sensors that increase accuracy and ensure differentiation between aerosols (fog) and particles. In foggy conditions, the PurpleAir devices may measure aerosols or moisture as particles and therefore overestimate $PM_{2.5}$ and PM_{10}. High-cost devices are equipped with 'sample heaters' that heat up the air sample and enable the device to differentiate between aerosols and particulate matter.

[3]available from https://www.purpleair.com/map#11.44/-27.4535/153.1606

Figure 2: PurpleAir device.


Figure 3: ArcHUB device.

Dust deposition

Dust deposition is a measure of how much dust settles over a given area and time under the influence of gravity (dustfall rate) using a dust gauge.

Dust gauges consist of a 2-litre collection bottle and funnel mounted on a PVC stand, designed to collect airborne particles that settle on the internal surface area of the funnel (Figure 4). When samples are collected, insoluble dust is washed from the bottle then filtered, dried and weighed. Dust deposition is measured in **mg/m²/day** (milligrams per square meter per day)**.**

A guideline of **120mg/m²/day** averaged over one month is commonly used as an indication of dust nuisance[4].

Dust deposition sampling was conducted at four monitoring sites during November 2018, and four during May 2019. Dust samples collected from the gauges were also analysed under microscope to identify the particle types, and potential sources of dust.

Figure 4: Dust gauge bottle and funnel.

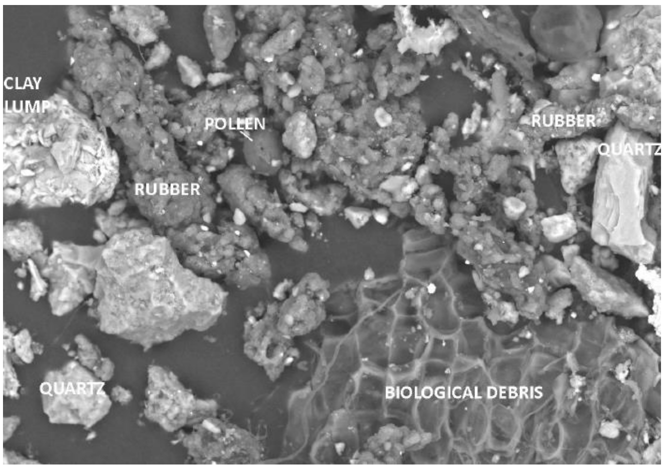
Dust composition

Particle composition analyses using electron or stereomicroscopy assist in identifying particle types and likely sources of dust. Dust samples are examined through a microscope and the proportions of particle types are measured based on their surface area coverage. This analysis method identifies a range of black-coloured particles (e.g. coal, soot and rubber dust), mineral dust particles (e.g. soil, rock, cement and glass), biological particles (e.g. insects and plants) and other general organic particles (e.g. wood, fibres, and plastics). Compositional analyses can also be an indicator of particle source. For example, black dust may consist of various particle types such as rubber dust from tyre wear, diesel or petrol emissions from transport, coal or mould.

Surface wipe samples were collected in July and November 2018 at five of the twelve sites on various surfaces (e.g. table tops, chairs, eaves etc.). This was done by wiping the surface to collect a sample of the particles that had been deposited to determine the composition of the particles. While the sample does help identify what types of particles have settled, the history of the sample is unknown (i.e. how long it has been there).

Samples collected in dust gauges during November 2019 and May 2019 were also analysed to determine particle types. Unlike the surface wipe samples, the history of these samples are known as they were collected during a specific month.

Samples were analysed independently by University of Queensland Materials Performance Laboratory (UQMP).



[4]Guideline - Application requirements for activities with impacts to air
https://environment.des.qld.gov.au/assets/documents/regulation/era-gl-air-impacts.pdf

Departmental and industry monitoring

Departmental monitoring

The department is responsible for ambient air monitoring and industry regulation of air quality and emissions in Queensland. DES Science Division has an extensive air monitoring network in South East Queensland, consisting of 17 stations, including two stations near Wynnum[5]. Monitoring stations in the bayside area continually measure $PM_{2.5}$, PM_{10}, nitrogen oxides, sulfur dioxide, total suspended particles, and meteorological data. The closest DES monitoring network to the project area is located in Cannon Hill (Figure 5).

Industry monitoring

The Port of Brisbane is located north-east of Wynnum on Fisherman Island, and handles the import and export of products, including coal. The Port of Brisbane (POB) undertakes a real-time air quality monitoring program to measure $PM_{2.5}$ and PM_{10} concentrations[6]. POB has three monitoring stations with the closest to the project area located on Osprey Drive (Figure 5).

Caltex Refineries operate a network of three monitoring stations in the Wynnum area to assess the impact of refinery emissions on nearby residential areas[7]. These stations monitor pollutants including $PM_{2.5}$, PM_{10} and meteorological data. The closest station to the project area is located in Wynnum North (Figure 5).

Figure 5: Approximate locations of POB, Caltex Refineries and DES monitoring stations near the project area.

[5]available from https://www.qld.gov.au/environment/pollution/monitoring/air/air-monitoring/network-stations/seq#wynnum

[6]available from https://www.portbris.com.au/Environment/Air-Quality/

[7]available from https://apps.des.qld.gov.au/air-quality/stations/?station=wyn

Results

$PM_{2.5}$

$PM_{2.5}$ data collected in the project indicated that air quality in the Wynnum area is of good quality and fluctuated with local and regional events (such as bushfires) and meteorology throughout the year.

During twelve months of data collection, average $PM_{2.5}$ were consistently within NEPM standards except for several days that exceeded the standard likely due to significant bushfire smoke.

During mid-June and July 2019, the devices measured elevated readings of $PM_{2.5}$ which exceeded the 24-hour standard (Figure 6). These elevated readings were likely a result of a perturbations caused by fog or moisture, as the PurpleAir device may overestimate in foggy or moist conditions. These readings also coincided with local fires (Appendix B).

Most notably, significant bushfires across south-east Queensland and northern New South Wales regions in November 2019 resulted in widespread and sustained smoke across the Brisbane area resulting in very high $PM_{2.5}$ readings throughout November and into early December (Appendix B). These results indicate that natural events such as bushfire smoke can have a significant impact on local and regional air quality.

Although Brisbane experienced heavy smoke for a number of weeks at the end of 2019, the $PM_{2.5}$ concentrations did not exceed the 12-month average. $PM_{2.5}$ averaged approximately 7.5$\mu g/m^3$ over twelve months (NEPM standard being 8$\mu g/m^3$).

PM_{10}

PM_{10} data collected throughout the twelve months also indicated that air quality in the Wynnum area is of good quality and fluctuated according to regional events (Figure 7).

Similarly to $PM_{2.5}$, PM_{10} averages were consistently below the NEPM 24-hour standard, with elevated PM_{10} averages correlated with local events such as fires and significant fog.

The significant bushfires across the region during November 2019 also resulted in extremely elevated PM_{10} averages throughout November and early December 2019 (Appendix B), which saw some exceedances of the 24-hour standard.

PM_{10} concentrations also did not exceed the 12-month average despite significant smoke in November 2019. PM_{10} averaged approximately 19$\mu g/m^3$ over twelve months (NEPM standard being 25$\mu g/m^3$).

Average PM_{10} concentrations shown in Figure 7 have been adjusted using a configuration factor to account for potential underestimations of larger particles due to light scattering.

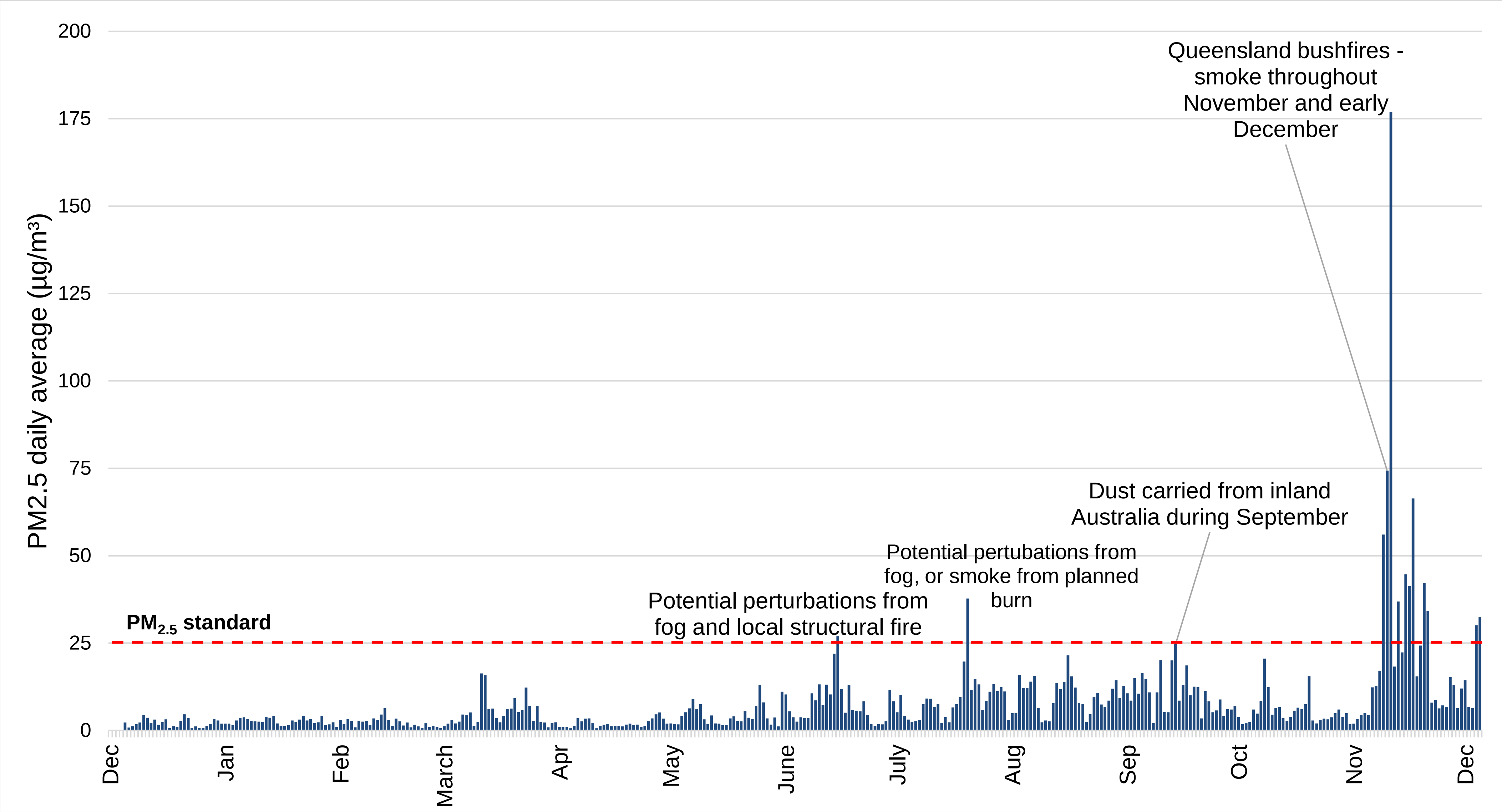


Figure 6: Average daily $PM_{2.5}$ concentrations from December 2018 to December 2019 showing local events that are correlated with elevated readings.

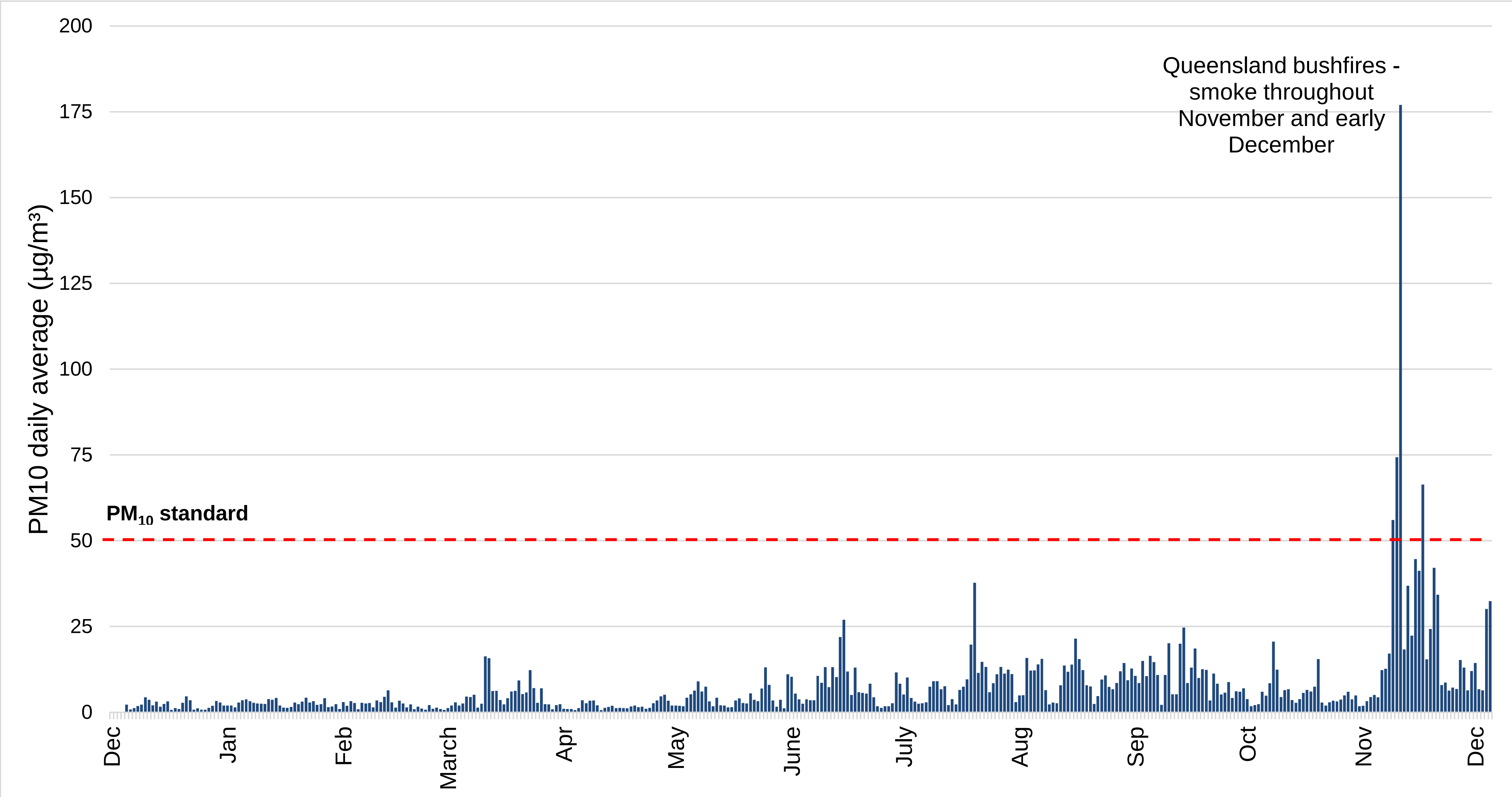


Figure 7: Average daily PM_{10} concentrations from December 2018 to December 2019 showing local events that are correlated with elevated readings.

Correlations between CAW, DES and industry data

Data collected by CAW follows similar trends and correlations to data collected by nearby DES and industry monitoring stations. Comparisons were undertaken using $PM_{2.5}$ data supplied by POB from their Osprey Drive station, Caltex Refineries at the Wynnum North station and DES at the Cannon Hill station. Data was compared from April 2019 (when all devices had been installed) to December 2019.

$PM_{2.5}$ concentrations across all devices follow similar trends (Figure 8), indicating that fluctuations in readings are likely to be influenced by regional particle levels, local events (e.g. fires) and meteorology. Most notably, all networks captured significantly greater readings in November and December 2019 at the time of the south-east Queensland and northern New South Wales bushfires.

The correlations between departmental, industry and project data indicate that data collected in the Wynnum area by project participants is valid and supports data from nearby high-cost monitoring networks. These correlations also indicate that community monitoring can be a reliable and suitable method for low-cost air quality monitoring.

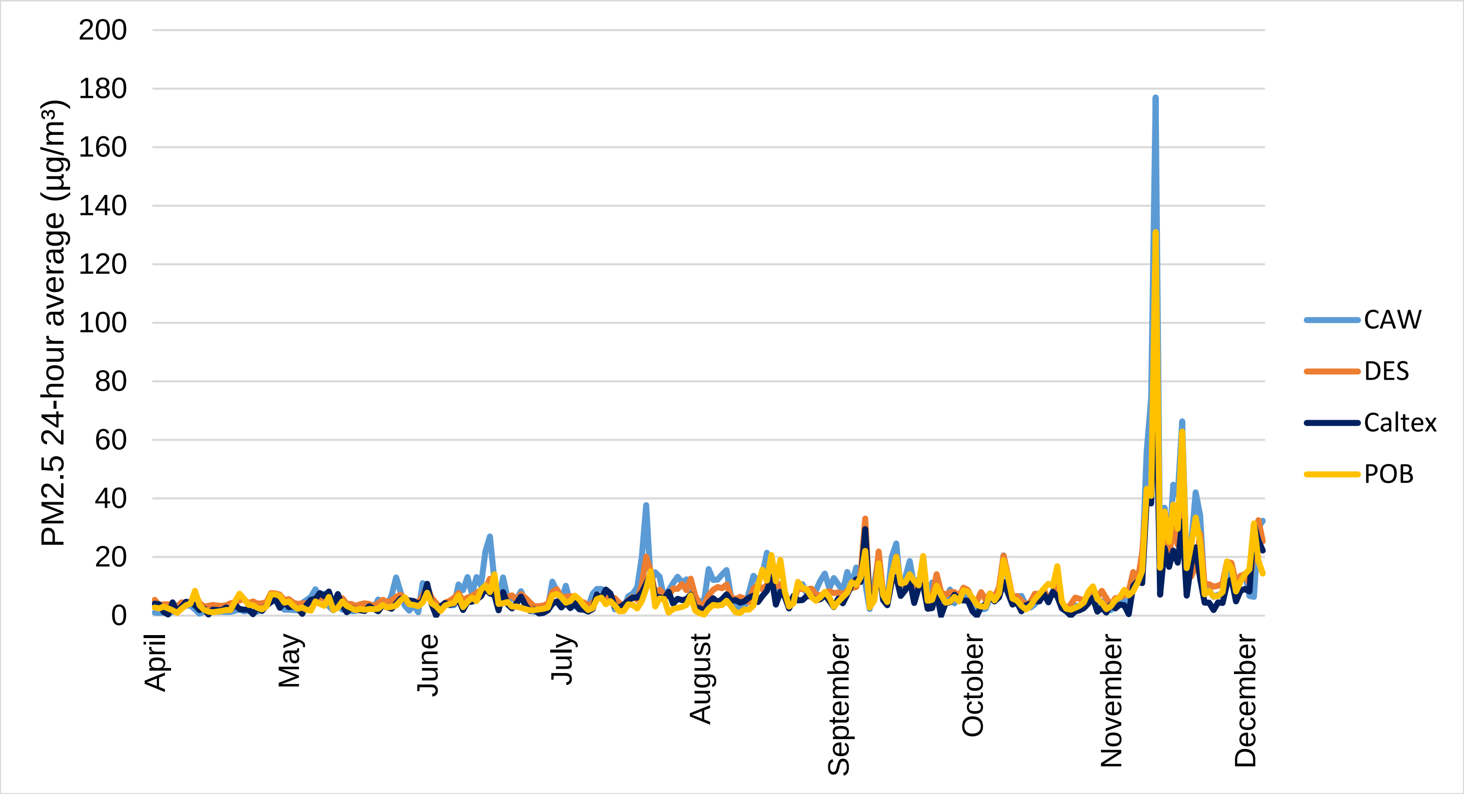


Figure 8: Average $PM_{2.5}$ concentrations measured by CAW, POB, DES and Caltex Refinery during April to December 2019.

Dust deposition

Dustfall rate

Deposited dust is characterised by insoluble solids, ash and combustible matter (Table 2). Insoluble solids refer to the fraction of total particles deposited which are not water-soluble, and are typically responsible for dust nuisance impacts. The guideline of 120mg/m²/day over one month refers to insoluble solids. Ash refers to the insoluble dust fraction that remains after heating the sample (850°C for 30 minutes), and combustible matter refers to the part of the insoluble fraction which is lost on heating the sample.

The average dustfall rate across four gauges during May 2019 was **20mg/m²/day**, and **75mg/m²/day** during November 2018 (Table 2). It is likely that November received a greater deposition due to drier conditions and potentially wind conditions.

Dustfall rates did not exceed the guideline of 120 mg/m²/day over one month for dust nuisance.

Figure 9 shows dustfall rates for five sites during November 2018 and May 2019 sampling rounds. Site CAW7 replaced site CAW4 in May 2019.

Table 2: Dustfall rates during November 2018 (4 sites) and May 2019 (4 sites).

		Dustfall rate (mg/m²/day)		
Month	**Gauge location**	**Ash**	**Combustible matter**	**Insoluble solids**
November 2018	**CAW2**	59	27	86
	CAW3	46	24	70
	CAW5	52	23	74
	CAW4	53	14	67
Average dustfall rate				**75**
May 2019	**CAW2**	10	7	16
	CAW3	12	6	17
	CAW5	10	4	14
	CAW7	20	13	33
Average dustfall rate				**20**

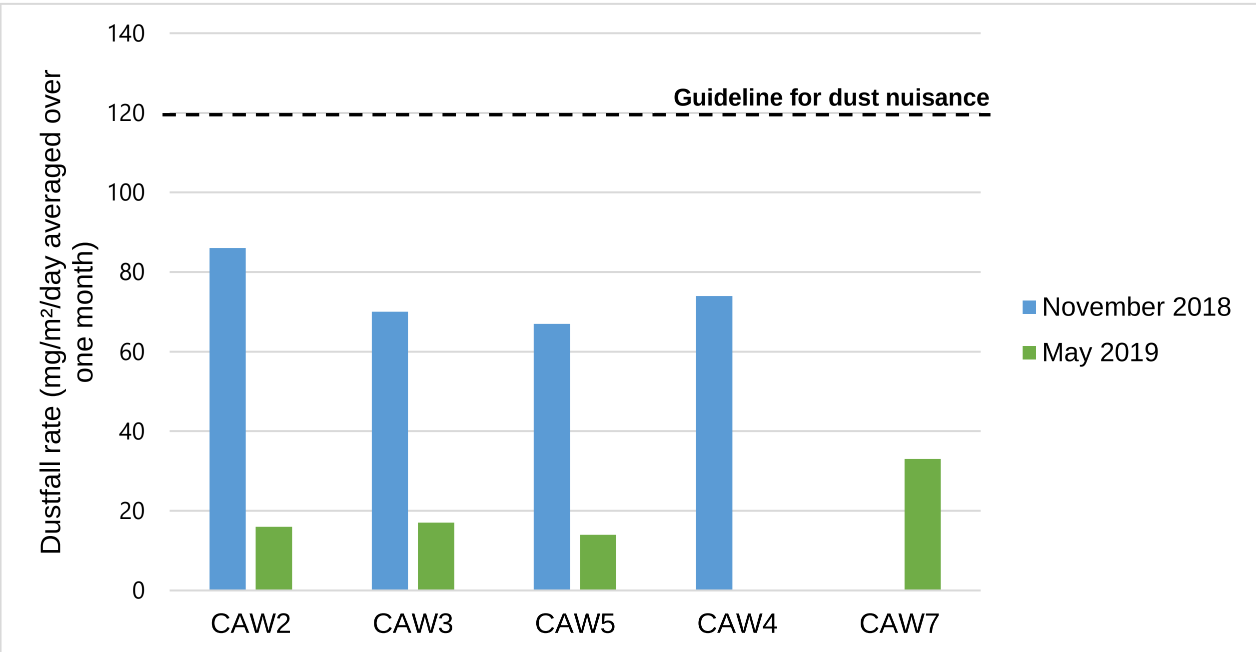


Figure 9: Dustfall rates during November 2018 and May 2019.

Dust composition

Surface wipe samples

Seven surface wipe samples were taken at five sites during July and November 2018. Mineral dust and black rubber dust were identified in the highest average proportions (Figure 10).

Five out of seven samples consisted mostly of **mineral dust from soil or rock (34-71%)**. Soil or rock dust can be a result of events such as roadworks or windblown dust from unsealed roads. The remaining two samples mostly consisted of a combination of soil or rock dust with either rubber dust or fibres. Rubber dust was also a significant component in four samples (25-40%), with small proportions detected in all other samples. Black rubber dust from tyre wear is common near roadways, and can be windblown into residential areas. Under microscope, rubber dust (elongated, irregular black particles) can be differentiated from other black coloured particles such as coal.

No significant coal particle proportions were detected, with only trace amounts (less than 1%) of coal identified in samples at a Wynnum Esplanade property.

Small proportions of insect and plant debris, cement dust and fibres were also detected across samples, which is common in domestic environments.

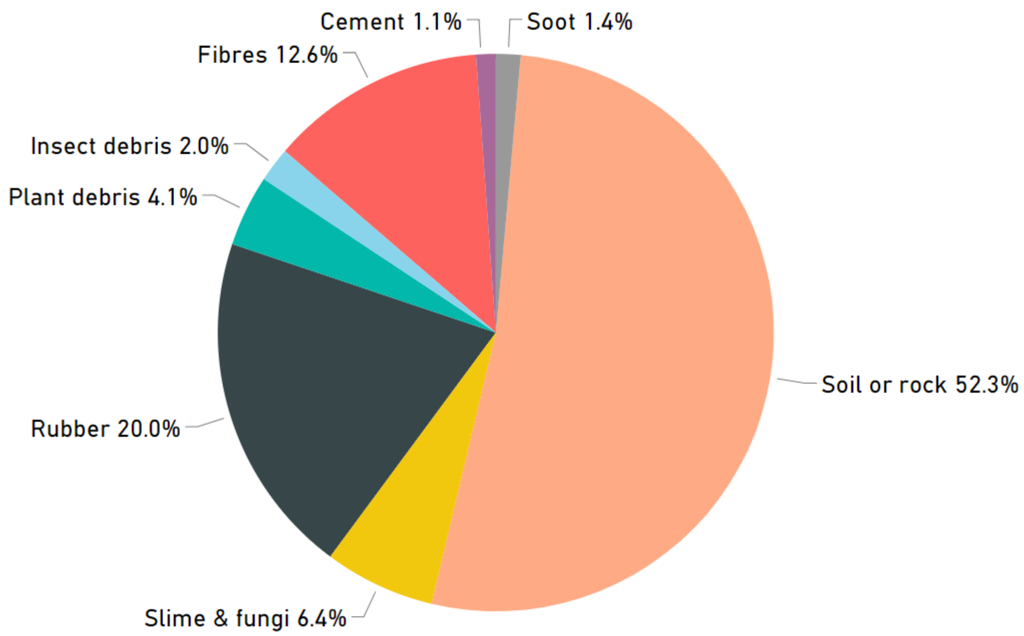


Figure 10: Average particle types of seven surface wipe samples across the Wynnum area.

Table 3: Compositional analysis for seven surface wipe samples across five sites.

PARTICLE IDENTITY		PERCENTAGE (%)							
CATEGORY	**PARTICLE TYPE**	**CAW2**	**CAW3**	**CAW3**	**CAW4**	**CAW5**	**CAW5**	**CAW8**	**Average**
BLACK	Coal	-	Trace	Trace	-	-	-	-	0
	Soot	Trace	-	Trace	Trace	Trace	Trace	10	1.43
	Black rubber dust	**40**	**35**	Trace	**25**	**30**	5	5	20
INORGANICS & MINERALS	Mineral dust (Soil/rock)	**25**	**50**	**65**	**70**	**51**	**34**	**71**	**52.29**
	Mineral dust (fly ash)	Trace	-	-	-	-	Trace	-	0
	Mineral dust (cement)	-	4	Trace	-	-	-	4	1.14
	Glass fragments	Trace	-	Trace	-	-	-	-	0
BIOLOGICAL	Slime & fungi	15	7	10	Trace	-	3	10	6.43
	Insect debris	5	2	Trace	2	2	3	Trace	2
	Plant debris	10	2	7	3	2	5	Trace	4.14
GENERAL ORGANIC TYPES	Wood dust	Trace	Trace	Trace	Trace	Trace	Trace	-	0
	Fibres	5	Trace	18	Trace	15	**50**	Trace	12.57
	Paint	-	-	-	-	Trace	-	-	0
	Plastic fragments	Trace	Trace	Trace	-	-	-	-	0
*Trace amounts refer to proportions less than 1%.									

Dust deposition samples

Dust composition was analysed for four samples collected in dust deposition gauges during November 2018 and May 2019. Particle types identified in both dust deposition sampling rounds were similar in nature and are consistent with types common in domestic environments.

During November 2018, the majority of each sample consisted of **mineral dust from soil or rock (>70%)**, with small amounts of plant and insect debris, rubber dust, slime and fungi occurring in all samples (Figure 11). Minor to trace amounts of coal were detected in samples, with an average of 2% across the four dust gauge samples. These minor amounts of coal are potentially a result of windblown soil dust already containing trace amounts of coal from ground surfaces outside the rail corridor and surrounding areas.

Samples from May 2019 also consisted mostly of **soil or rock dust (59%) and black rubber dust (22%)** (Figure 12). Other particle types present in the samples were insect debris (11%), plant debris (5%) with minor proportions of fibres, slime and fungi. Trace amounts of coal were detected in three out of the four dust gauge samples.

A small proportion of copper sludge was identified in all gauge samples, although is not present in the air environment but is formed from a copper sulfate algaecide added to the gauge to prevent the growth of algae. For this reason, the copper sludge particle component was removed from the averages shown in Figures 11 and 12 (other particle averages were proportionally recalculated). Proportions of copper sludge found in each sample are presented in Tables 4 and 5.

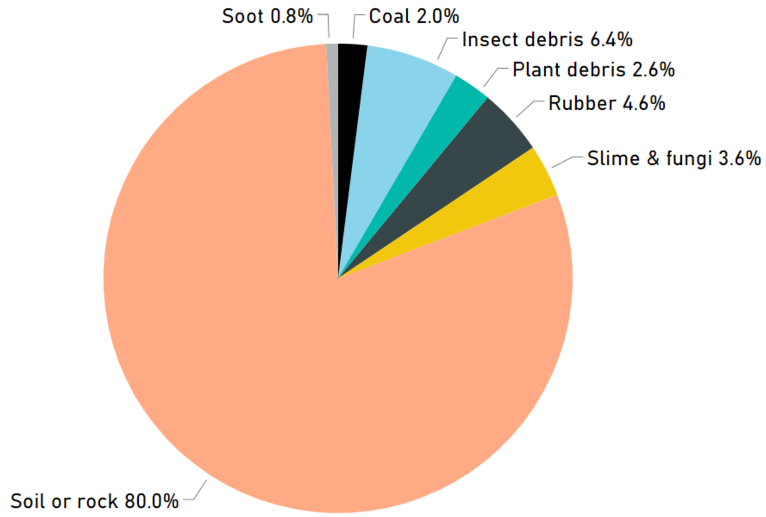


Figure 11: Average particle types of dust deposition samples collected in November 2018.

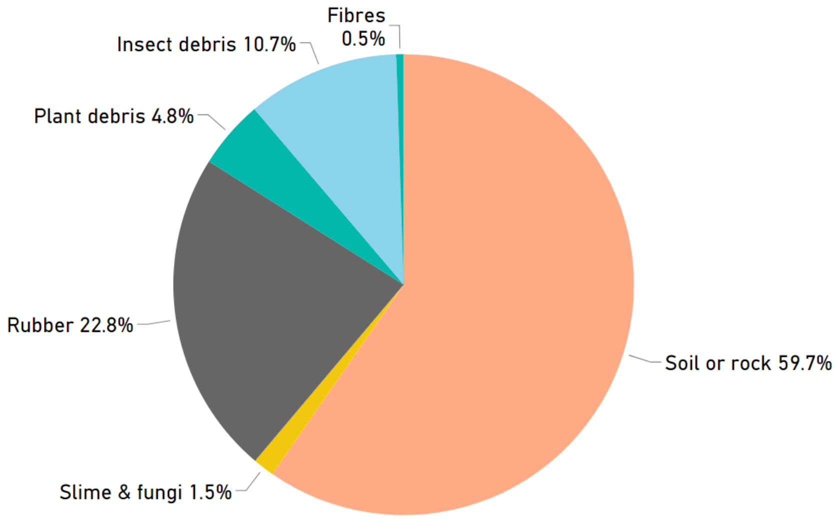


Figure 12: Average particle types of dust deposition samples collected in May 2019.

Table 4: Compositional analysis for four dust gauge samples collected in November 2018, inclusive of copper sludge.

PARTICLE IDENTITY		PERCENTAGE (%)				
CATEGORY	**PARTICLE**	**CAW2**	**CAW3**	**CAW4**	**CAW5**	**Average**
BLACK	Coal	4	1	3	Trace	2
	Soot	2	Trace	Trace	1	0.75
	Black rubber dust	9	5	2	2	4.5
INORGANICS & MINERALS	Soil or rock dust	**70**	**80**	**83**	**79**	**78**
	Fly ash	Trace	-	-	-	0
	Copper sludge	3	2	2	3	2.5
BIOLOGICAL	Slime & fungi	5	3	3	3	3.5
	Insect debris	5	7	5	**8**	6.25
	Plant debris	2	2	2	4	2.5
GENERAL ORGANIC	Wood dust	-	-	Trace	-	0
	Fibres	Trace	Trace	Trace	Trace	0
	Paint	-	Trace	-	-	0
	Plastic fragments	Trace	-	Trace	Trace	0
*Trace amounts refer to proportions less than 1%.						

Table 5: Compositional analysis for four dust gauge samples collected in May 2019, inclusive of copper sludge.

PARTICLE IDENTITY		PERCENTAGE (%)				
CATEGORY	**PARTICLE**	**CAW2**	**CAW3**	**CAW5**	**CAW7**	**Average**
BLACK	Coal	-	Trace	Trace	Trace	0
	Soot	Trace	Trace	Trace	Trace	0
	Black rubber dust	**55**	7	8	20	22.5
INORGANICS & MINERALS	Soil or rock dust	30	**78**	**68**	**58**	**58.5**
	Fly ash	-	Trace	Trace	-	0
	Glass fragments	-	-	-	Trace	0
	Copper sludge	1	2	2	2	1.75
BIOLOGICAL	Slime & fungi	3	-	3	Trace	1.5
	Insect debris	7	10	10	15	10.5
	Plant debris	4	4	8	4	4.75
	Plant debris (char)	-	-	-	Trace	0
GENERAL ORGANIC	Fibres	Trace	Trace	1	1	0.5
	Plastic fragments	-	Trace	-	Trace	0
*Trace amounts refer to proportions less than 1%.						

Conclusions

Data collected by CAW participants is indicative that air quality in the bayside area is of good quality, and fluctuates in response to regional influences, local events and meteorology. During twelve months of data collection, air quality was influenced most significantly by large regional bushfires. Coal was not found to be a significant contributor to air quality or dust pollution in Wynnum.

Project data identified some exceedances of the $PM_{2.5}$ and PM_{10} 24-hour standards throughout the year that were a result of heavy and sustained bushfire smoke present around south east Queensland. Despite significant smoke over a number of weeks in 2019, the 12-month standards for $PM_{2.5}$ and PM_{10} were not exceeded.

Variations across CAW, DES and industry data highlights the differences between low-cost and high-cost devices under various conditions. Comparisons between project data and data collected by DES and local industries demonstrates strong correlations between devices and with regional particle levels, despite some overestimations by CAW devices.

Dust deposition samples showed that dustfall rates fell below the guideline for dust nuisance during both November 2018 and May 2019 rounds. Samples collected from deposition gauges and surface wipe sampling also identified particle types common in domestic areas such as soil or rock dust, plant and insect debris and rubber dust from tyre wear.

As a citizen science project, the outcomes also demonstrated the value of community collaboration and empowering communities in environmental projects. By involving the community in all aspects of project design and management, it resulted in a change in community sentiment and perception. Most significantly, the project findings resulted in changed perceptions of black-coloured dust; black dust did not necessarily provide evidence of coal dust. Additionally, the project also improved knowledge and understanding of ambient air monitoring and regulation.

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Appendix A

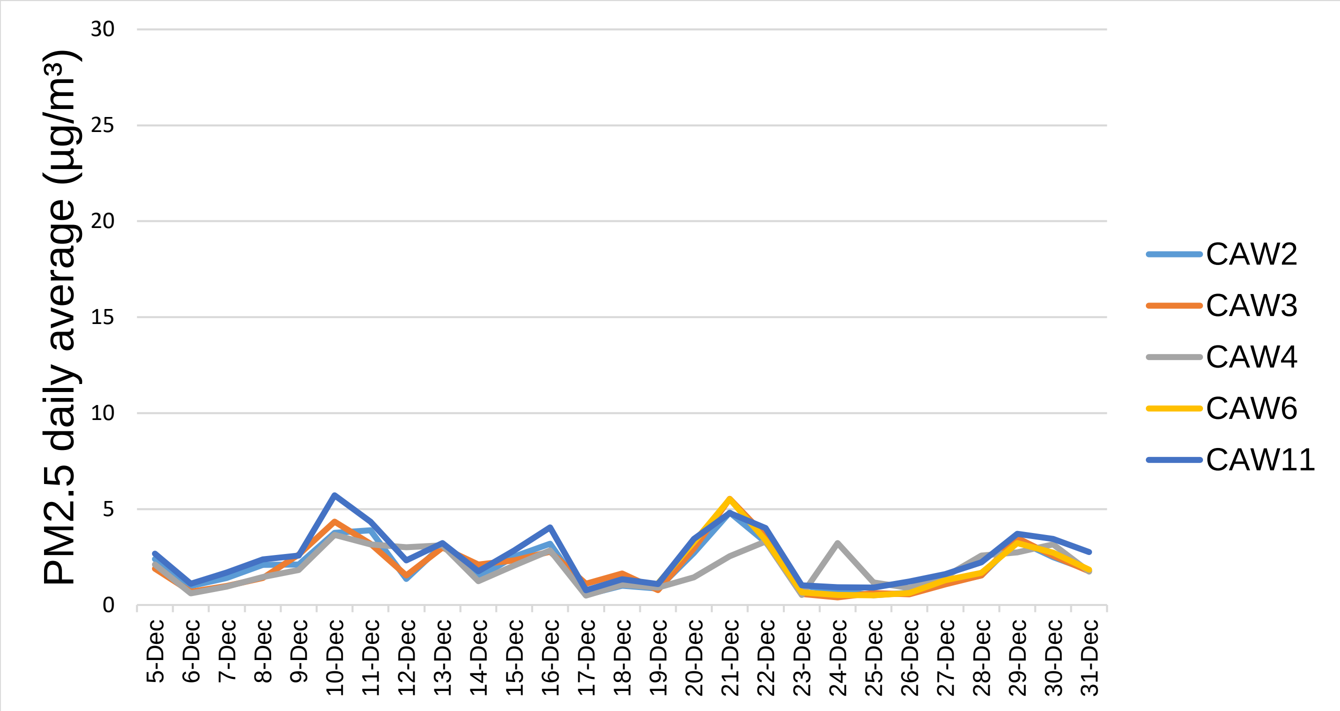


Figure A.1: Average daily $PM_{2.5}$ concentrations during December 2018.

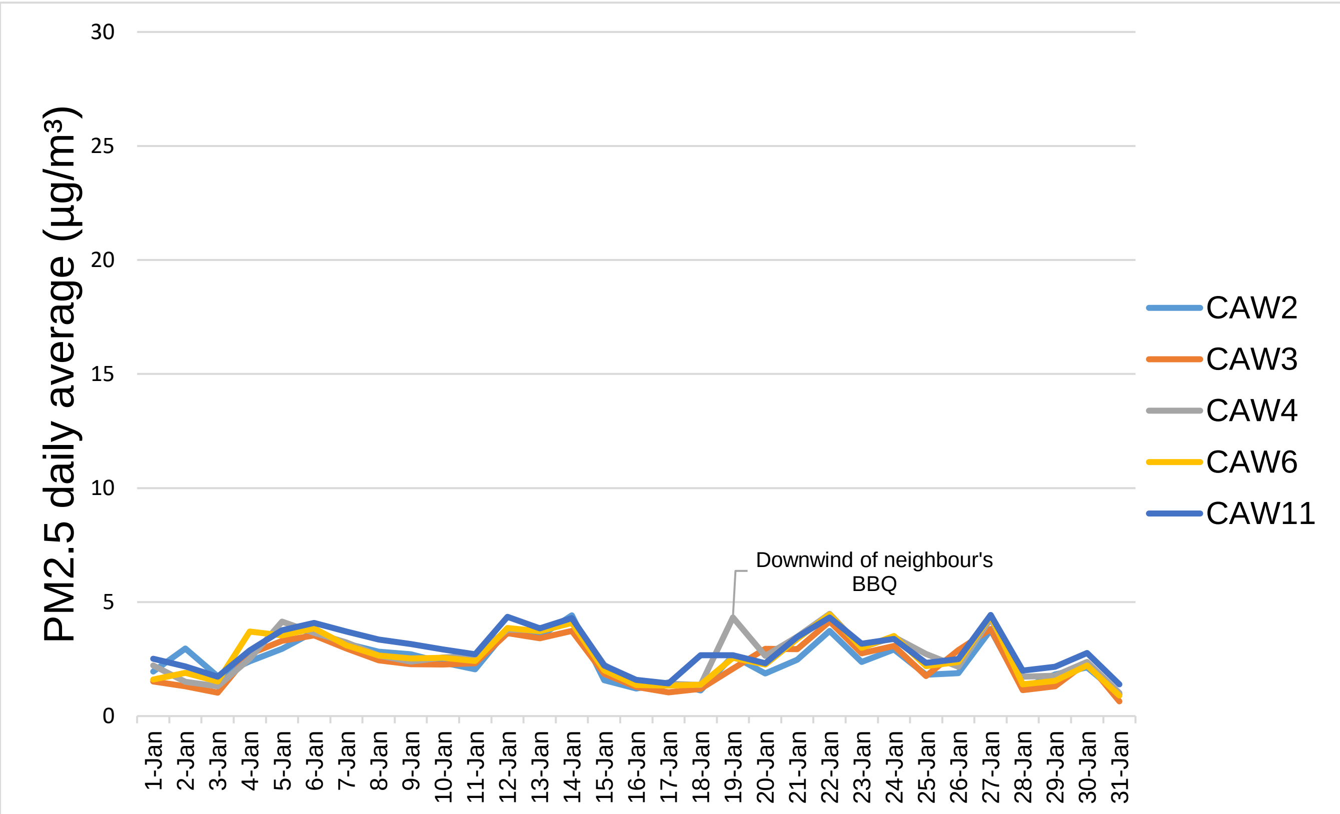


Figure A.2: Average daily $PM_{2.5}$ concentrations during January 2019.

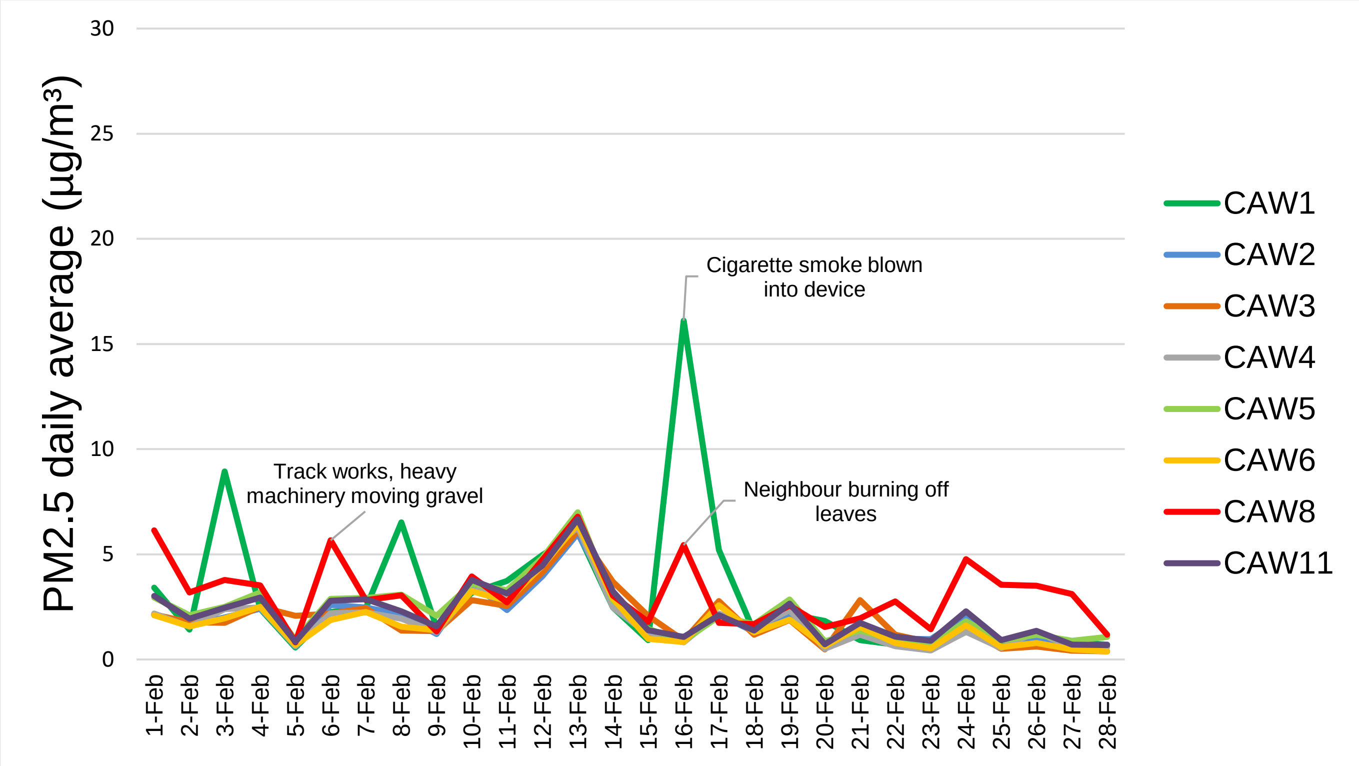


Figure A.3: Average daily $PM_{2.5}$ concentrations during February 2019.

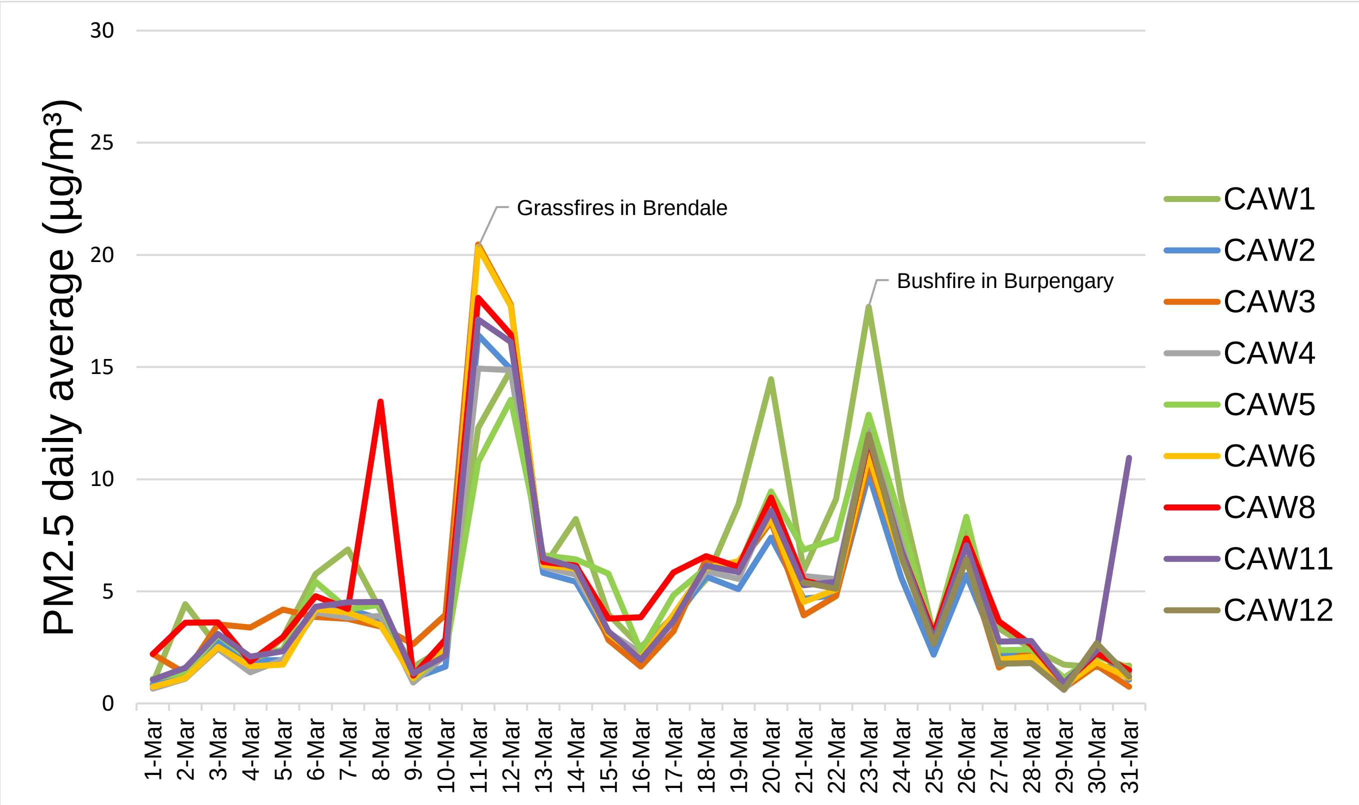


Figure A.4: Average daily $PM_{2.5}$ concentrations during March 2018.

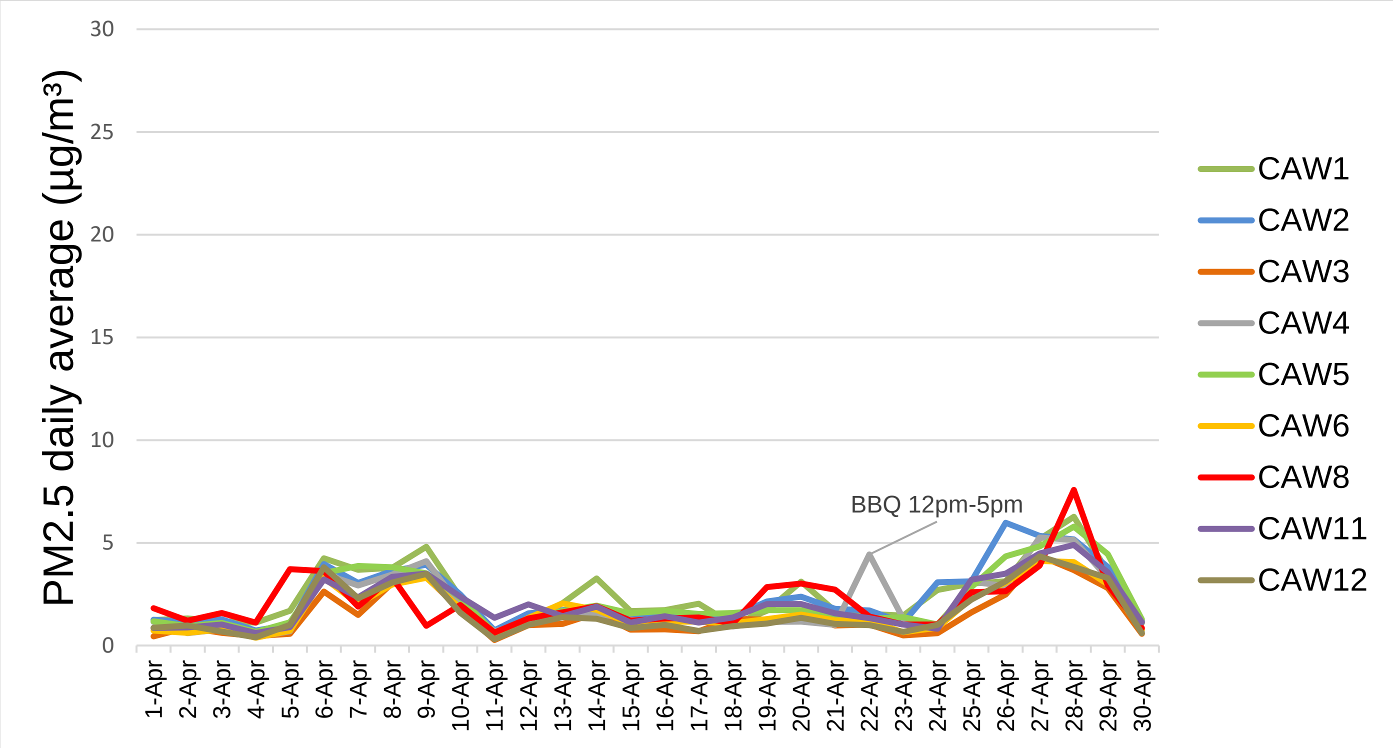


Figure A.5: Average daily $PM_{2.5}$ concentrations during April 2019.

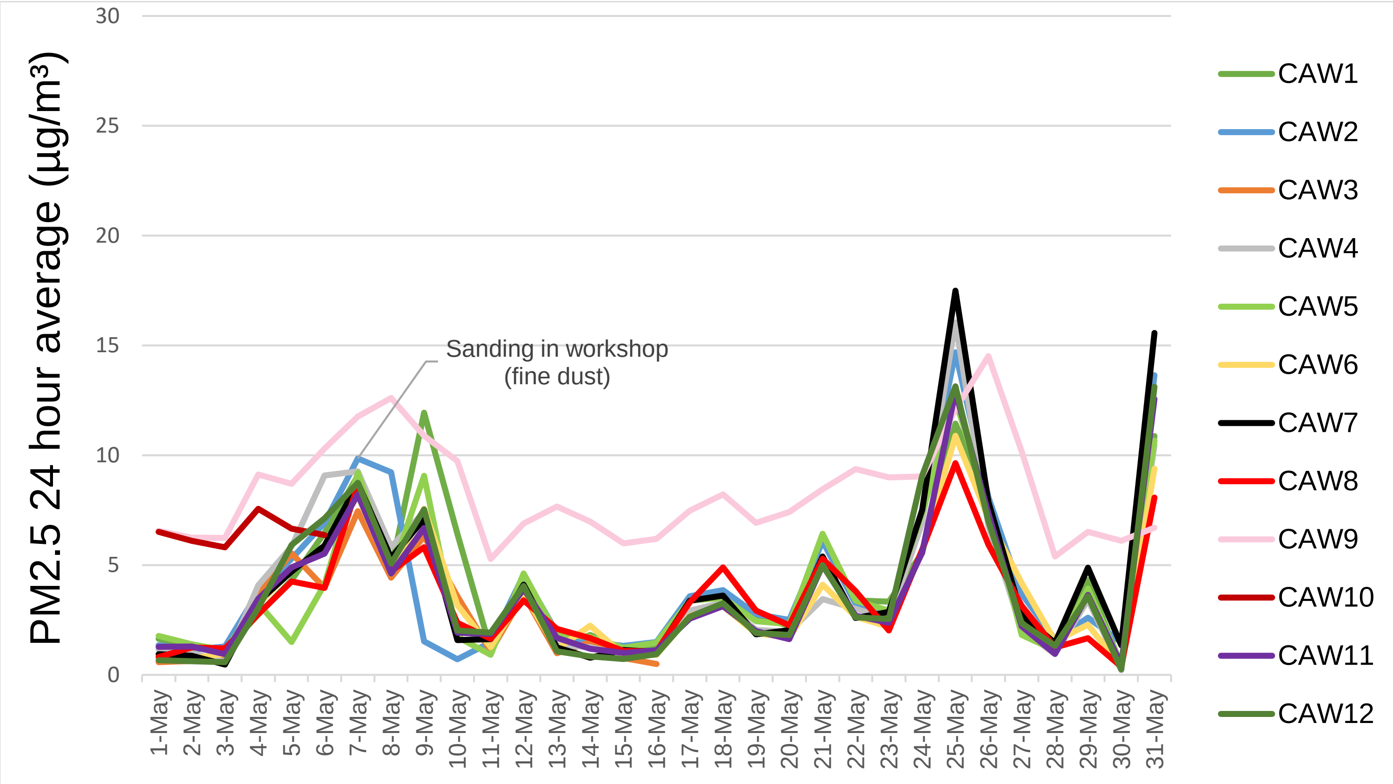


Figure A.6: Average daily $PM_{2.5}$ concentrations during May 2019. CAW10 in for repairs from 7 May 2019.

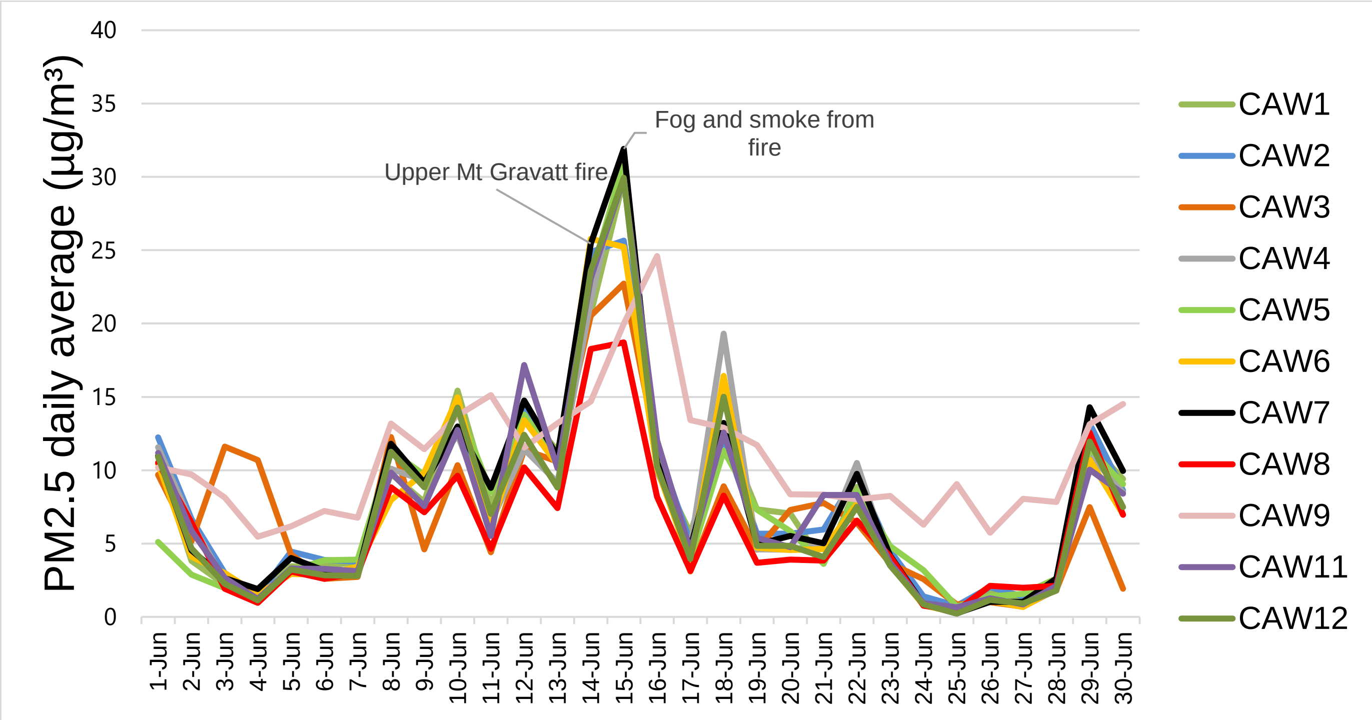


Figure A.7: Average daily $PM_{2.5}$ concentrations during June 2019. CAW10 in for repairs during June 2019.

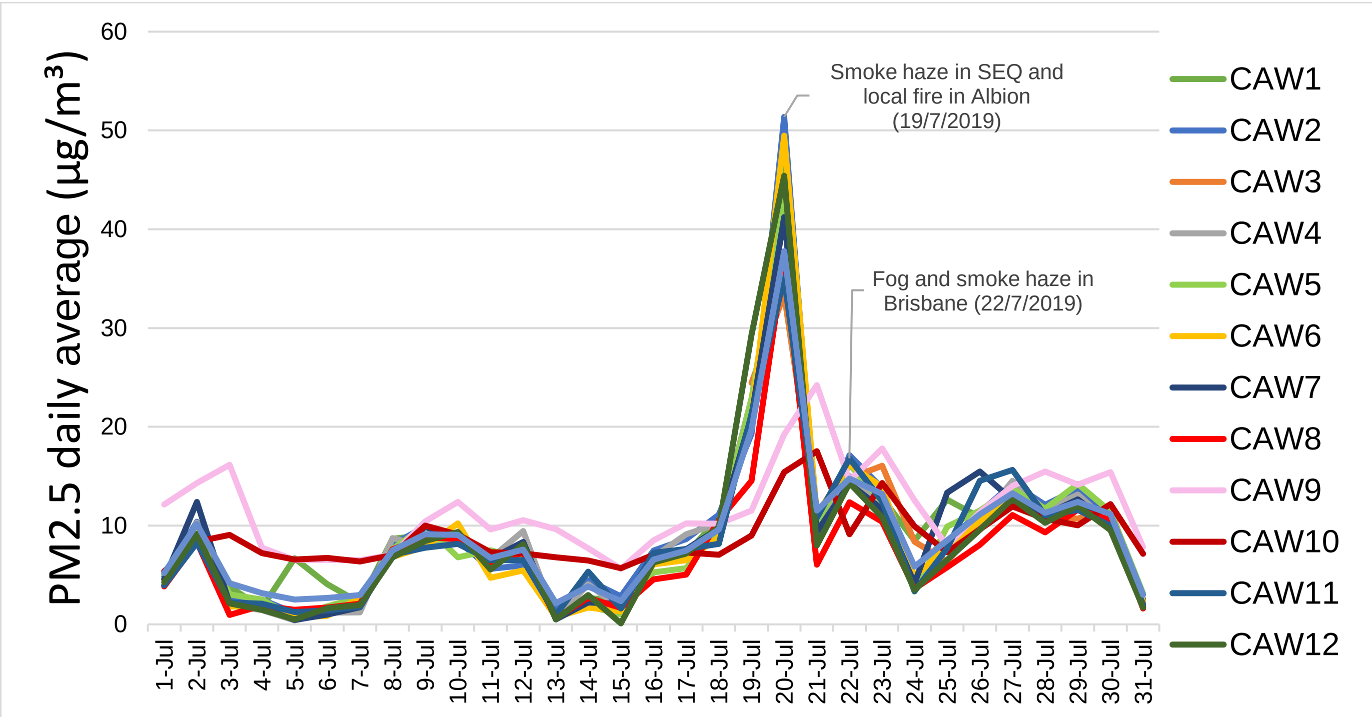


Figure A.8: Average daily $PM_{2.5}$ concentrations during July 2019. CAW3 offline during 1-18 July 2019.

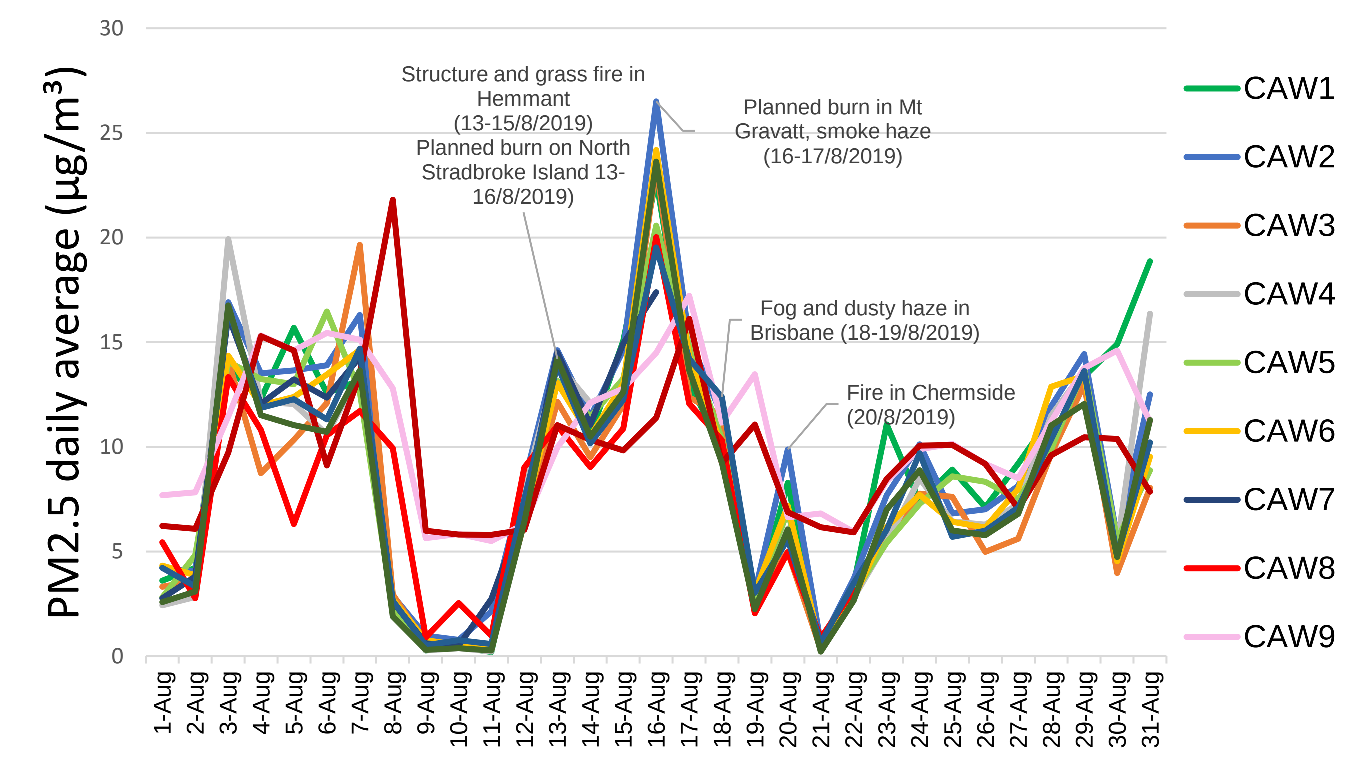


Figure A.9: Average daily PM2.5 concentrations during August 2019. CAW7 offline during 17-31 August and CAW 8 offline during 23-31st August due to internet connection issues.

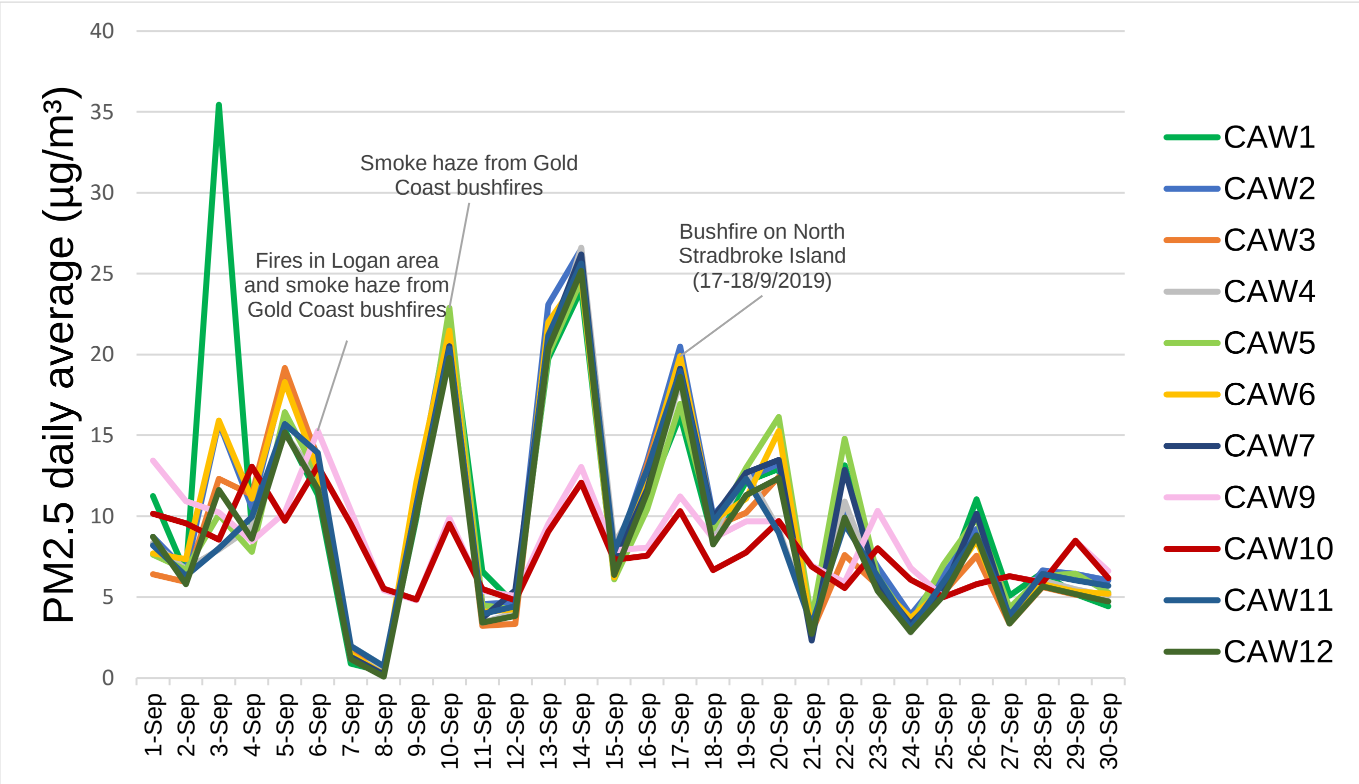


Figure A.10: Average daily PM2.5 concentrations during September 2019. CAW 7 offline during 1-6 and 28-30 September. CAW 8 offline due to internet connection issues.

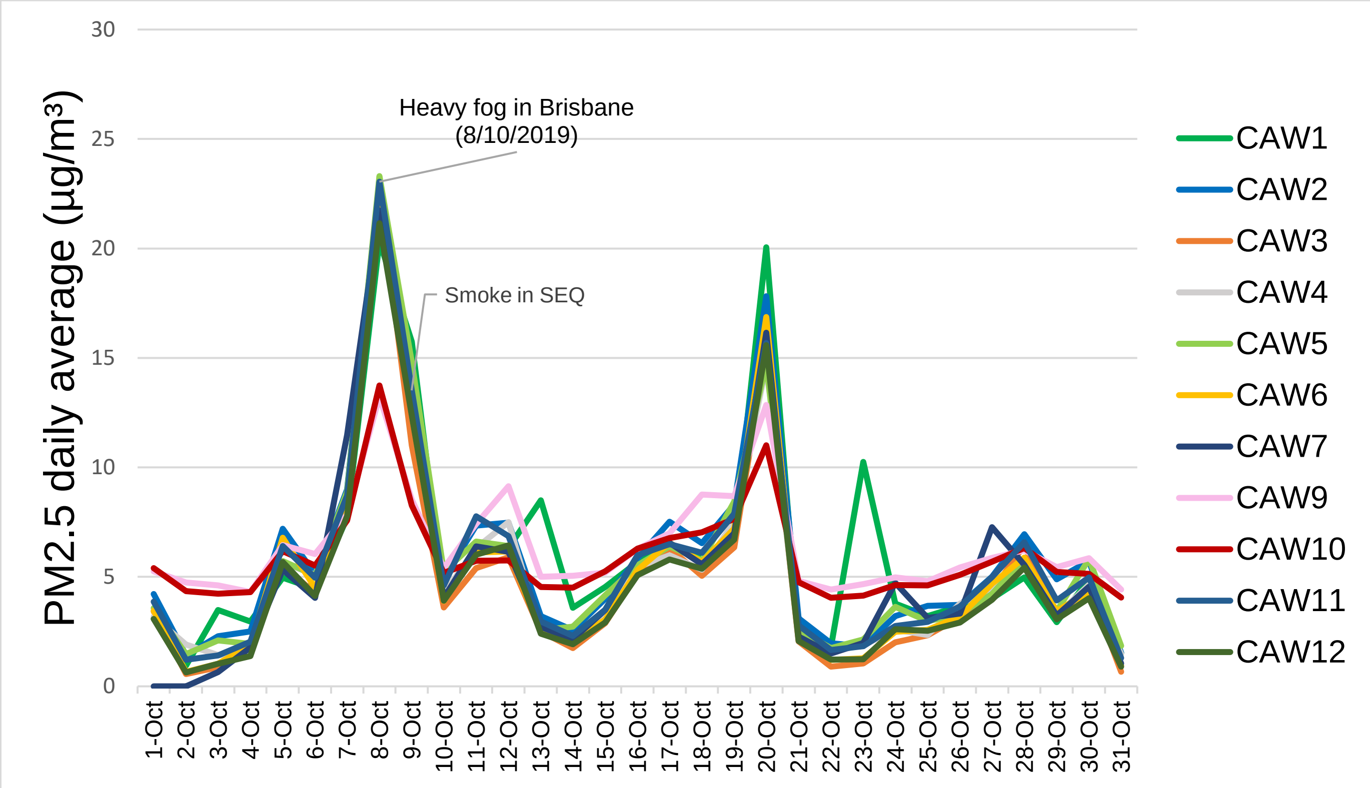


Figure A.11: Average daily $PM_{2.5}$ concentrations during October 2019. CAW 8 offline due to internet connection issues.

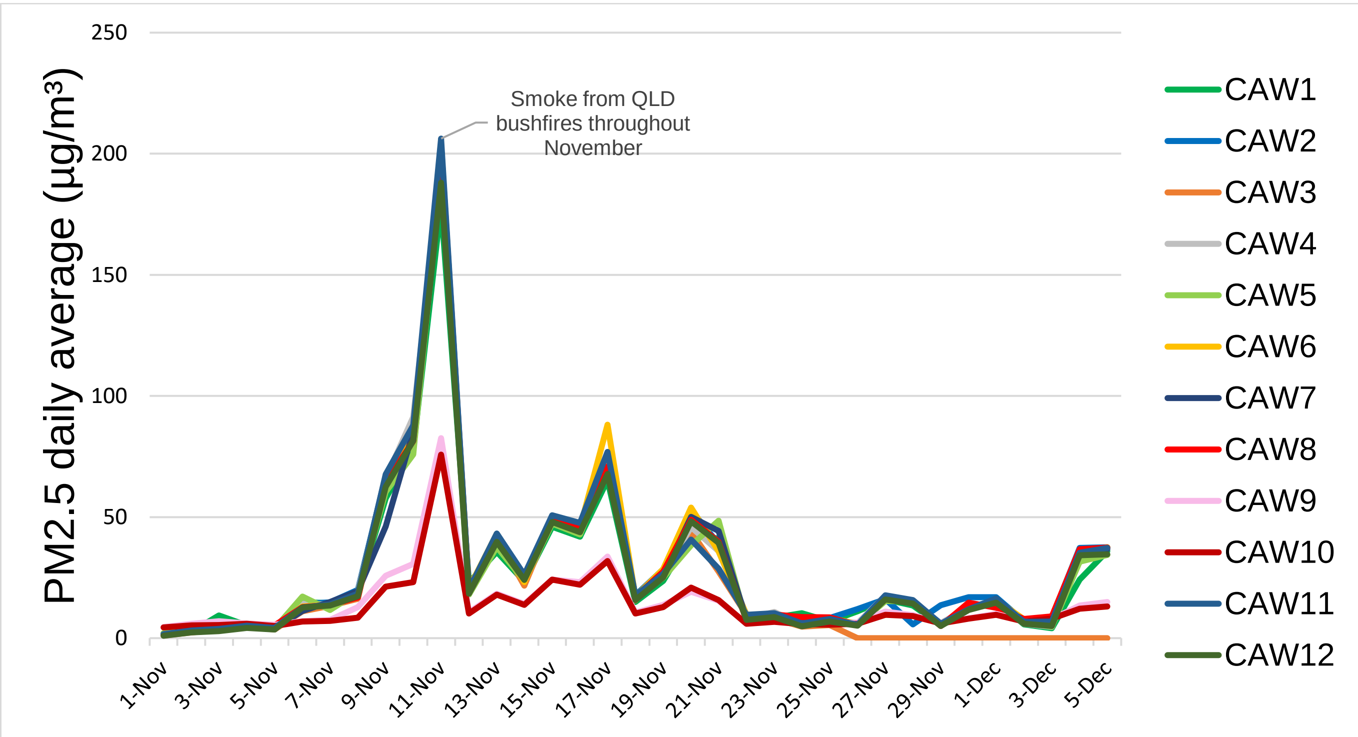


Figure A.12: Average daily $PM_{2.5}$ concentrations from November 2019 to 5 December 2019. CAW 3 offline from 26 November – 5 December.

Appendix B

Brendale – grass fire as at 9.20am Wed 13 Mar

13th March 2019 9:20 AM

** Queensland Fire and Emergency Services (QFES) crews are no longer required on scene at this incident. **

Earlier...

Brendale – grass fire as at 3.15pm Tue 12 Mar

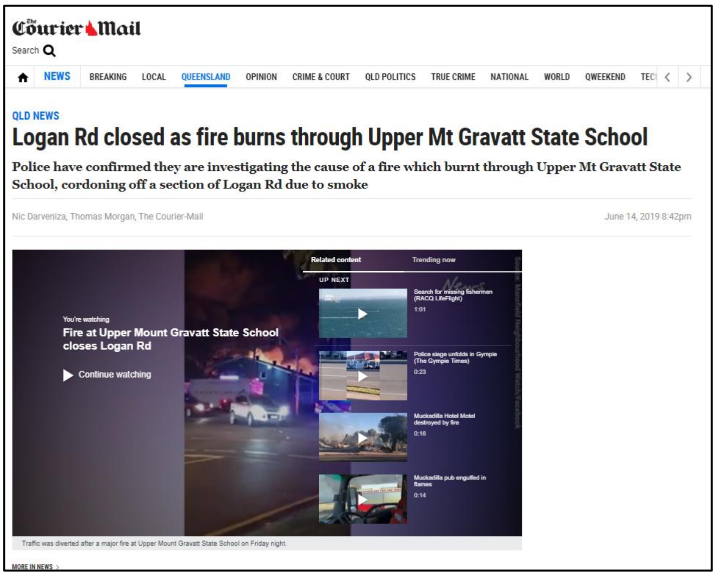
Queensland Fire and Emergency Services (QFES) crews are on scene at a grass fire burning near Old North Road, South Pine Road and Kremzow Road at Brendale. Crews are working to contain the fire, which is posing no threat to property at this time. Smoke may affect the area, so motorists are advised to drive with caution and to conditions. Smoke may also affect residents in nearby areas. If affected, close windows and doors and keep respiratory medications close by. If residents are concerned their property is under threat they are advised to call Triple Zero (000) immediately.

Earlier...

Brendale – grass fire as at 2.45pm Tue 12 Mar

Queensland Fire and Emergency Services (QFES) crews are on scene at a grass fire burning near Bald Hills Road and Strathpine Road, Brendale. Crews are working to contain the fire, which is posing no threat to property at this time. Smoke may affect Old North Road and South Pine Road, so motorists are advised to drive with caution and to conditions. Smoke may also affect residents in nearby areas. If affected, close windows and doors and keep respiratory medications close by. If residents are concerned their property is under threat they are advised to call Triple Zero (000) immediately.

Figure B.1: Brendale grass fire report on 13 March 2019 (Source: Queensland Fire and Emergency Services, https://newsroom.psba.qld.gov.au/Content/Home/Home/Article/Brendale-grass-fire-as-at-3-15pm-Tue-12-Mar/-2/-2/14681)



The Courier Mail

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QLD NEWS

Logan Rd closed as fire burns through Upper Mt Gravatt State School

Police have confirmed they are investigating the cause of a fire which burnt through Upper Mt Gravatt State School, cordoning off a section of Logan Rd due to smoke

Nic Darveniza, Thomas Morgan, The Courier-Mail

June 14, 2019 8:42pm

Traffic was diverted after a major fire at Upper Mount Gravatt State School on Friday night.

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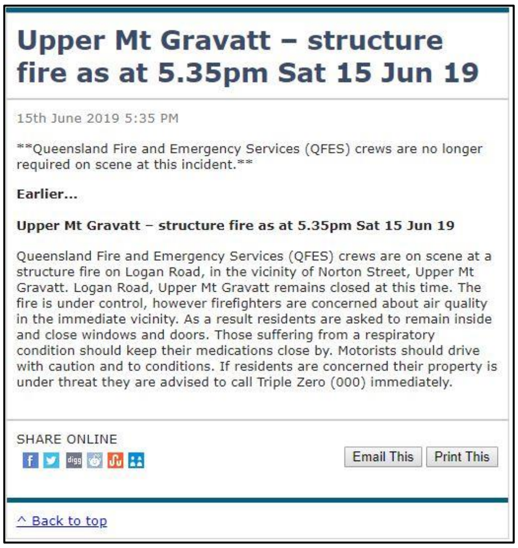
Figure B.2: Upper Mt Gravatt structural fire report on 14 June 2019. (Source: Courier Mail, https://www.couriermail.com.au/subscribe/news/1/?sourceCode=CMWEB_WRE170_a_GGL&dest=https%3A%2F%2Fwww.couriermail.com.au%2Fnews%2Fqueensland%2Flogan-rd-closed-as-fire-burns-through-upper-mt-gravatt-state-school%2Fnews-story%2Fbf316bf8f068d7cf290982211dac05e5&memtype=anonymous&mode=premium)



Upper Mt Gravatt – structure fire as at 5.35pm Sat 15 Jun 19

15th June 2019 5:35 PM

Queensland Fire and Emergency Services (QFES) crews are no longer required on scene at this incident.

Earlier...

Upper Mt Gravatt – structure fire as at 5.35pm Sat 15 Jun 19

Queensland Fire and Emergency Services (QFES) crews are on scene at a structure fire on Logan Road, in the vicinity of Norton Street, Upper Mt Gravatt. Logan Road, Upper Mt Gravatt remains closed at this time. The fire is under control, however firefighters are concerned about air quality in the immediate vicinity. As a result residents are asked to remain inside and close windows and doors. Those suffering from a respiratory condition should keep their medications close by. Motorists should drive with caution and to conditions. If residents are concerned their property is under threat they are advised to call Triple Zero (000) immediately.

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Figure B.3: Upper Mt Gravatt structural fire report on 15 June 2019. (Source: Queensland Fire and Emergency Services, https://newsroom.psba.qld.gov.au/Content/Home/Home/Article/Upper-Mt-Gravatt-structure-fire-as-at-5-35pm-Sat-15-Jun-19/-2/-2/14718)

Figure B.4: Significant fog over Brisbane area on 15 June 2019. (Source: Bureau of Meteorology Twitter, https://twitter.com/bom_qld?lang=en)

Figure B.5: Bushfire smoke affecting air quality on 11 November 2019. (Source: ABC News, https://www.abc.net.au/news/2019-11-11/queensland-fires-see-brisbane-air-quality-worse-than-beijing/11691860)

Figure B.6: Bushfire smoke across Queensland and New South Wales during November. (Source: Bureau of Meteorology Twitter, https://twitter.com/BOM_Qld/status/1194094402391740416)

Figure B.7: Bushfire smoke continuing into December 2019. (Source: Bureau of Meteorology Twitter, https://twitter.com/BOM_Qld/status/1202331159797080065)