August 2021

Auckland Air Quality Report

Research and Evaluation Unit | RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Monthly update

Introduction:

This report presents a monthly update on air quality in Auckland. It has four sections: sections A and B present tables and graphics illustrating air quality status in the Auckland region based on the data collected from continuous monitoring sites across the region. Section C provides a synopsis of source apportionment modelling of particulate matter samples collected at four ambient air quality monitoring sites from 2005 to 2016. Section D presents a brief analysis of the impact of COVID-19 alert level 4 lockdown on the concentrations of air contaminants.

Summary:

- No breach of national air quality standards has occurred this year (January to July).
- Overall, air quality has slightly improved in Auckland over the last two years. A key contributor is COVID-19 restrictions.
- Over the past two years, there is a downward trend in nitrogen dioxide (NO_2) concentration in the Auckland CBD.
- $PM_{2.5}$ source apportionment modelling study indicates that 61% of the concentrations come from five common sources across Auckland urban sites; biomass burning (mainly from home heating), motor vehicles, sea salt, marine diesel and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).
- The extent of the impact of the COVID-19 alert level 4 lockdown (week one) depended on the contaminant and the monitoring site. Concentrations of particulates matter (PM_{10} and $PM_{2.5}$), NO_2, and ozone were significantly lower than the previous two years average. Generally, average concentrations of particulate matter, ozone (O_3) and black carbon were slightly higher than the 2020 week one lockdown. However, the average concentration of NO_2 was slightly lower than the 2020 week one lockdown.
- There was no clear impact of the lockdown on SO_2, and CO concentrations.

Read the frequently asked questions about the air quality monitoring in Auckland region.

For more information or questions, please send inquiries to environmentaldata@aucklandcouncil.govt.nz

Section A – Data tables

Table 1. Summary information about Auckland's air quality monitoring programme – January to June 2021

Number of continuous monitoring sites	10
Location of monitoring sites	Queen St, Customs St, Khyber Pass Rd, Penrose, Henderson, Takapuna, Glen Eden, Pakuranga, Papatoetoe, and Patumahoe
Standard contaminants monitored	PM_{10} (fine particles < 10 microns in diameter), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and sulphur dioxide (SO_2)
Other key contaminants monitored	$PM_{2.5}$ (fine particles < 2.5 microns in diameter), and black carbon
Number of exceedances in 2021 (National Environmental Standards for Air Quality) NESAQ	0
Number of exceedances (Auckland Ambient Air Quality Targets)	1 ($PM_{2.5}$)
Maximum PM_{10} 24-hour mean (Jan - July)	31.1 µg m^{-3} (63% of NESAQ) ↔ recorded at Queen Street on 17 July 2021
Maximum $PM_{2.5}$ 24-hour mean (Jan - July)	26.5 µg m^{-3} (106% of Auckland target) ↔ recorded at Pakuranga on 24 June 2021
Maximum NO_2 1-hour mean (Jan - July)	200 µg m^{-3} (100% of NESAQ) ↔ recorded at Customs St on 15 March 2021
Maximum SO_2 1-hour mean (Jan - July)	19 µg m^{-3} (5% of NESAQ) ↔ recorded at Penrose on 24 May 2021
Maximum O_3 1-hour mean (Jan - July)	68 µg m^{-3} (45% of NESAQ) ↔ recorded at Patumahoe on 21 February 2021
Maximum CO running 8-hour mean (Jan - July)	Approximately 2 mg m^{-3} (20% of NESAQ) ↔ recorded at Khyber Pass Rd on 1 July 2021

Table 2. General trends of the key contaminants monitored for the last 7, 19 and 31 months.

indicates an upward trend indicates a downward trend. indicates no trend. **n/a** implies not applicable.

	PM_{10}			$PM_{2.5}$			NO_2			Black carbon			Ozone			CO			SO_2			Air Quality Index(AQI)			
Site	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	*Last 7 months*	*Last 19 months*	*Last 31 months*	**Site**
Customs Street	n/a	n/a	n/a	●	●	n/a	●	●	n/a	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	n/a	n/a	n/a	n/a	**Customs Street**
Glen Eden	●	●	●	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	**Glen Eden**
Henderson	●	●	●	n/a	n/a	n/a	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	**Henderson**
Khyber Pass Road	●	●	●	n/a	n/a	n/a	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	**Khyber Pass Road**
Pakuranga	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**Pakuranga**
Papatoetoe	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**Papatoetoe**
Patumahoe	●	●	●	●	●	●	●	●	●	n/a	n/a	n/a	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	**Patumahoe**
Penrose	●	●	●	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	●	●	●	**Penrose**
Takapuna	●	●	●	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	**Takapuna**
Queen Street	●	●	●	●	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	●	●	**Queen Street**
	PM_{10}			$PM_{2.5}$			NO_2			Black carbon			Ozone			CO			SO_2			Air Quality Index(AQI)			

Notes

PM_{10} is monitored at Glen Eden, Henderson, Khyber Pass Rd, Pakuranga, Papatoetoe, Patumahoe, Penrose, Takapuna, and Queen St.

$PM_{2.5}$ is monitored at Customs St, Glen Eden, Pakuranga, Patumahoe, Penrose, Takapuna, and Queen St.

NO_2 is monitored at Customs St, Glen Eden, Henderson, Khyber Pass Rd, Patumahoe, Penrose, Takapuna, and Queen St.

Black carbon is monitored at Customs St, and Henderson.

CO is monitored at Khyber Pass Rd.

Ozone is monitored at Patumahoe.

SO_2 is monitored at Customs St, and Penrose.

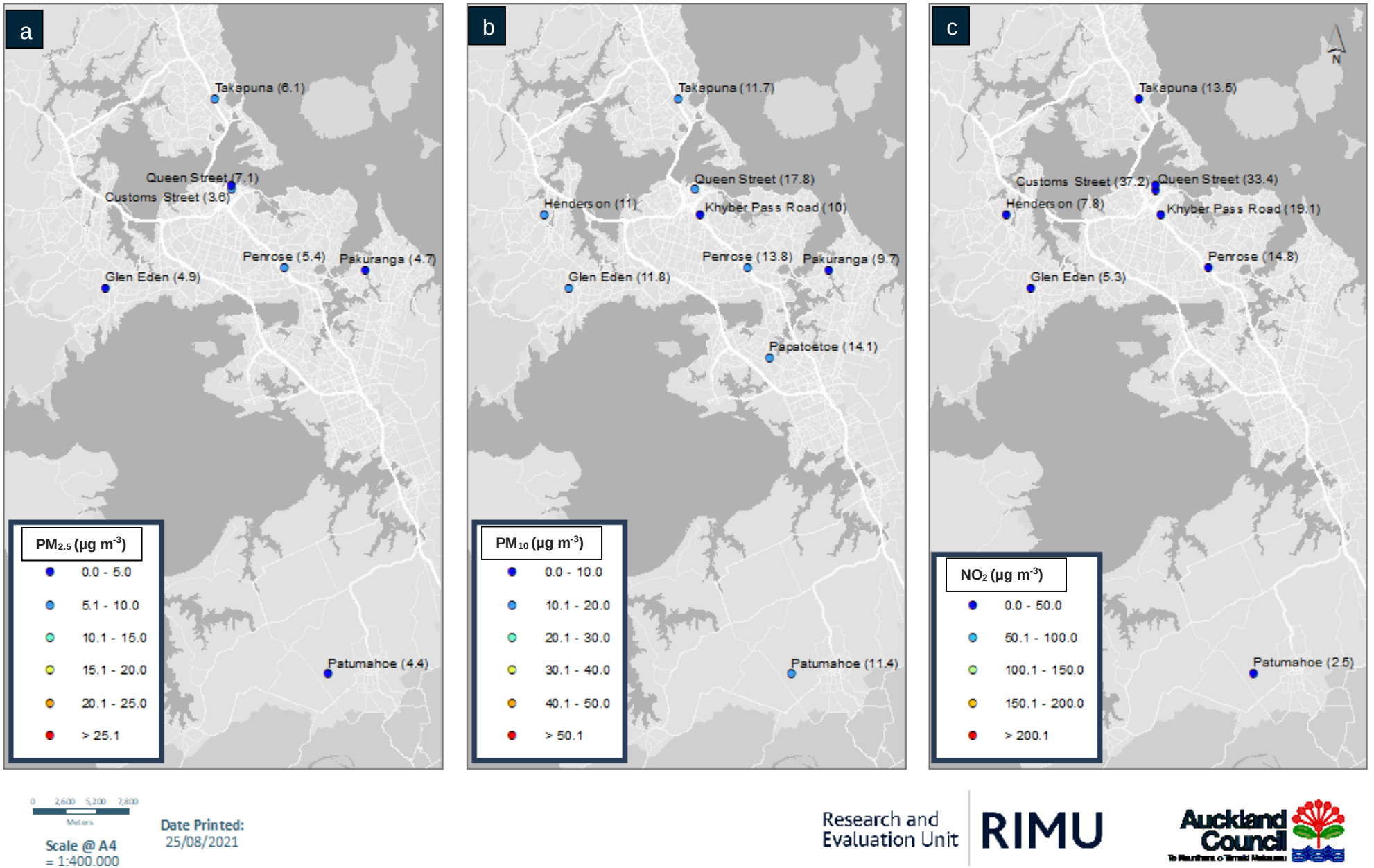

Figure 1. Maps a, b and c show the air quality monitoring sites and their monthly average contaminants concentration (January to July) in brackets

Section B. Key air contaminants across the 10 air monitoring sites (January to July)

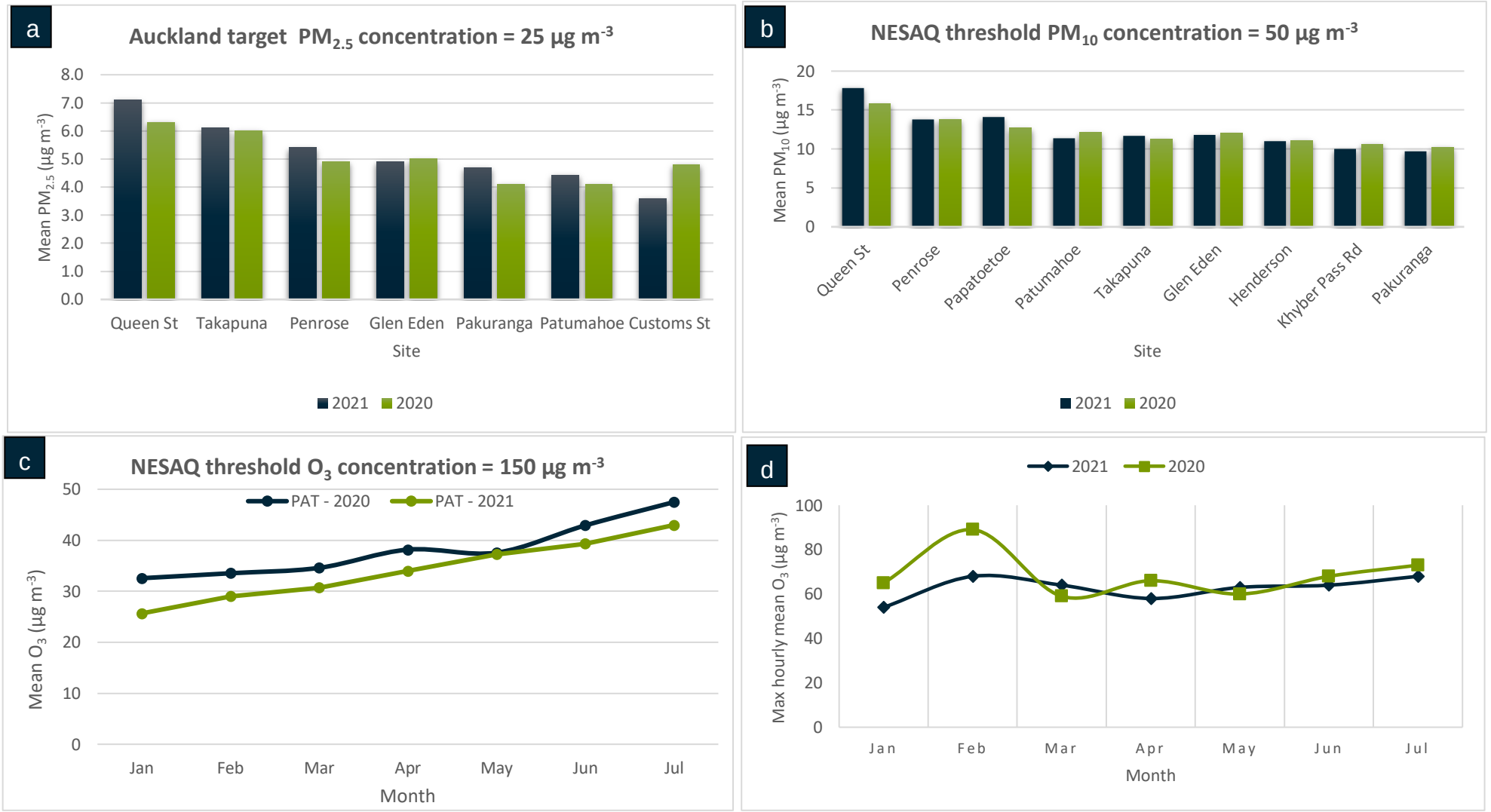

Figure 2. Monthly mean concentration of air contaminants. Plots a, b, c, and d represent $PM_{2.5}$, PM_{10}, O_3, and maximum hourly O_3 concentrations respectively. Note: PAT= Patumahoe.

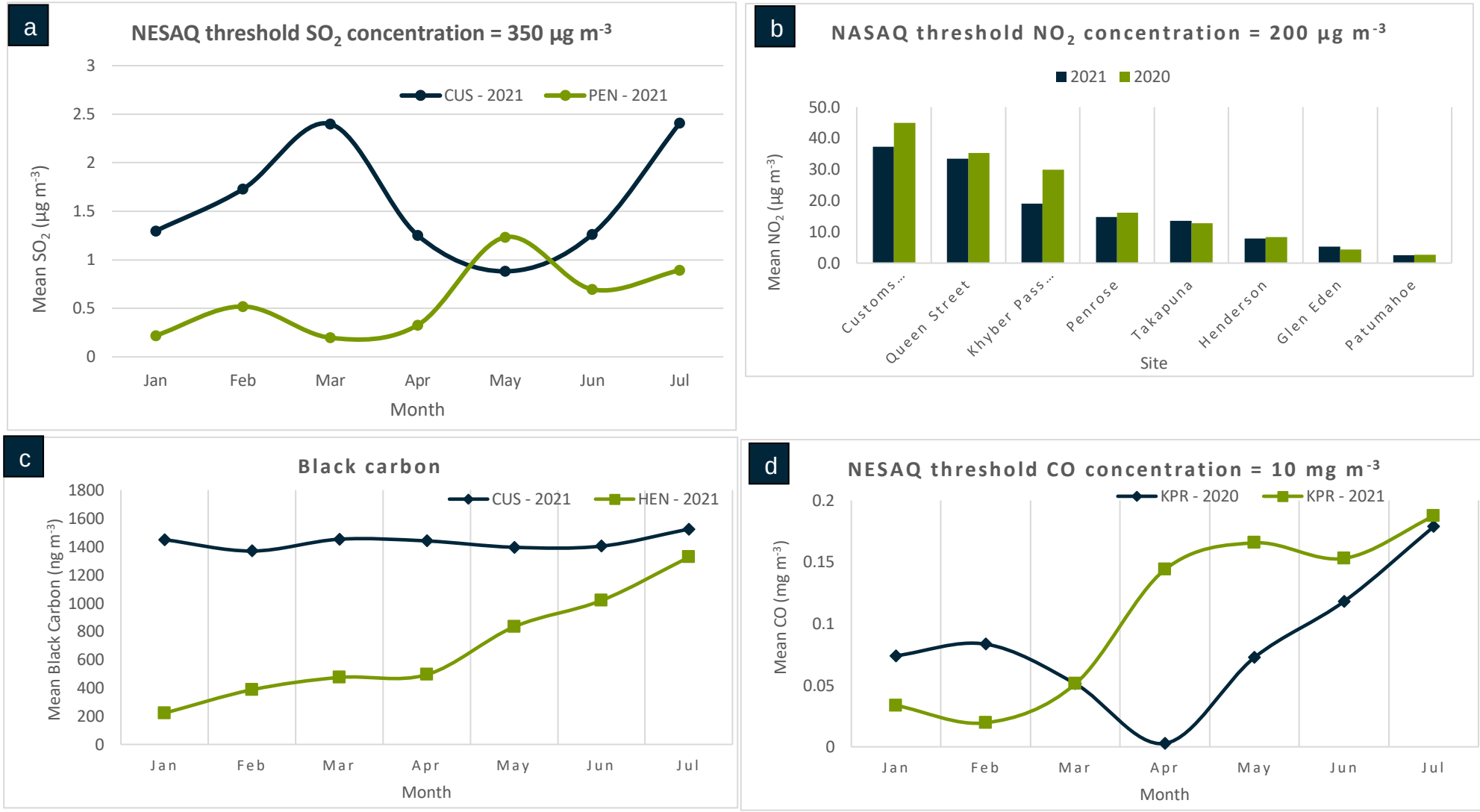

Figure 3. Monthly mean concentration of air contaminants. Plots a, b, c and d represent SO_2, NO_2, Black carbon, and CO respectively: Note: CUS = Customs St, PEN = Penrose, HEN = Henderson, KPR = Khyber Pass Rd.

Section C. $PM_{2.5}$ source apportionment modelling for Auckland urban sites

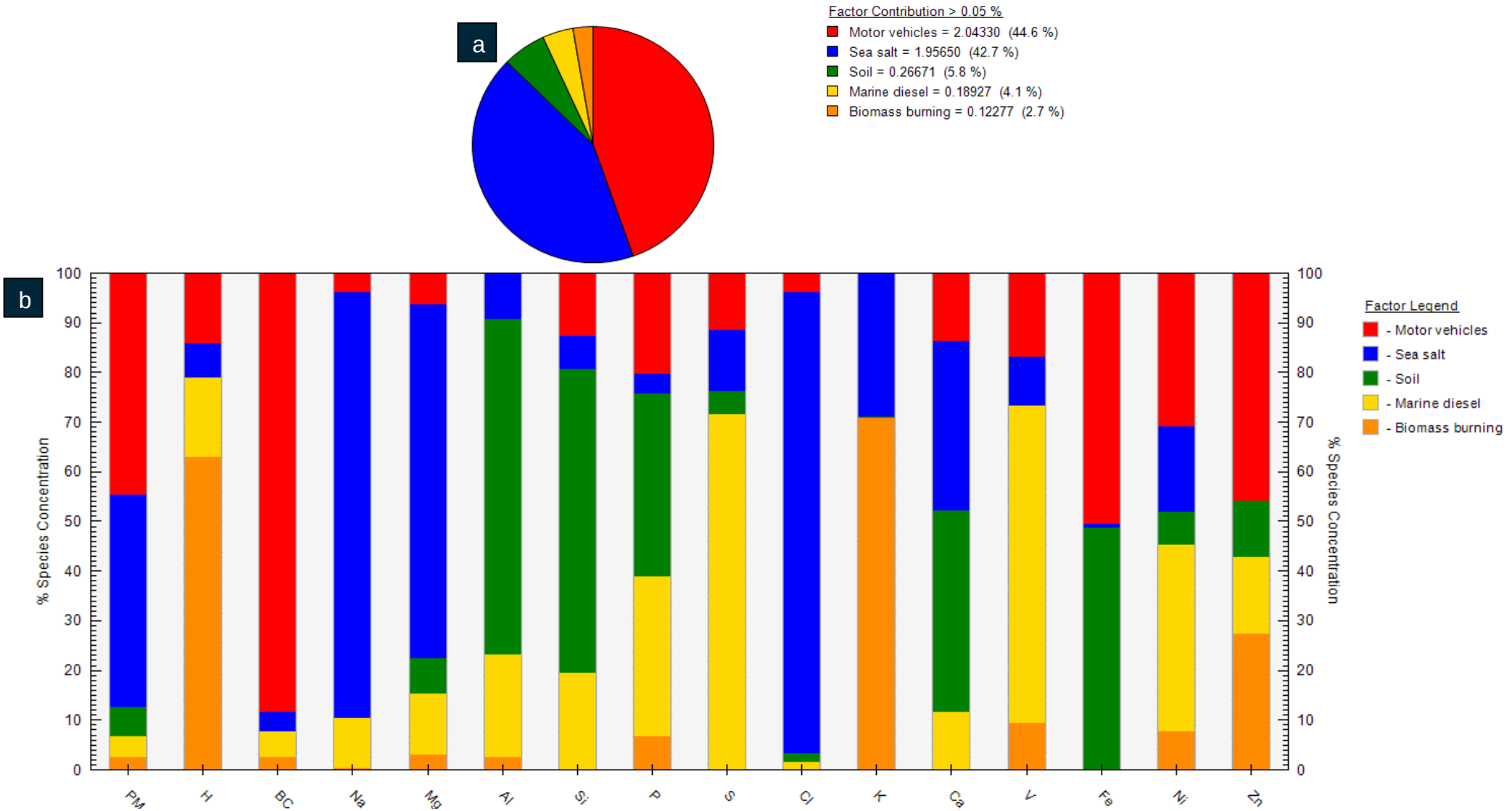

Figure 4. a) Pie chart showing source contributions to $PM_{2.5,}$ b) stacked bar chart displaying 'fingerprints' with per cent source contributions for each species contributing to $PM_{2.5.}$ Samples were collected from Khyber Pass Rd, Penrose, Queen St and Takapuna from 7/12/2005 to 25/06/2016.

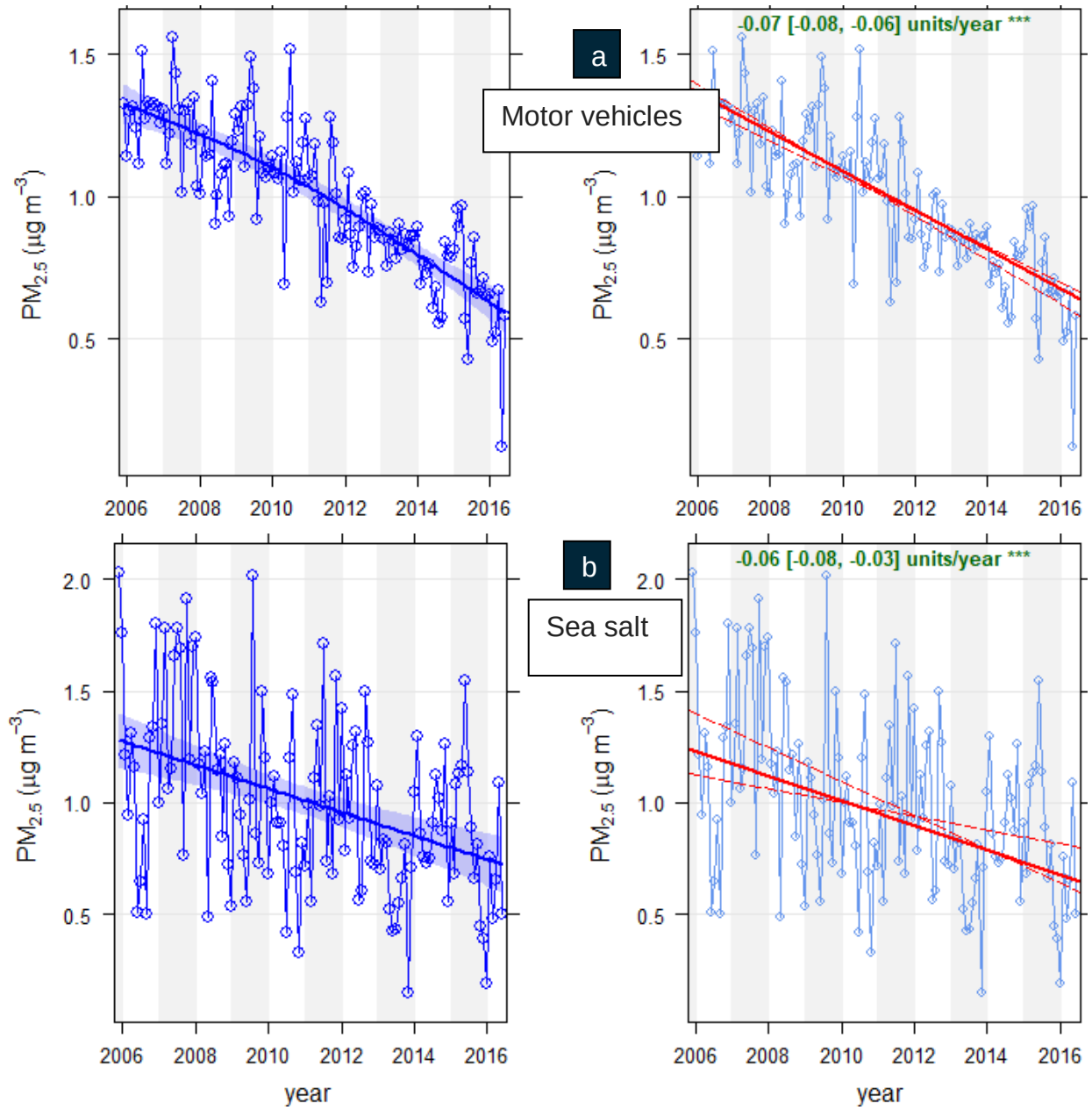

Figure 5. Long-term trends in $PM_{2.5}$ motor vehicles (a) and sea salt (b) source contributions across monitored sites showing that concentrations have decreased.
Plots on the right-hand side show the deseasonalised monthly mean contribution. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. For motor vehicles, the overall trend is -0.07 per year and the 95% confidence intervals in the slope from -0.08 – (-0.06) units/year. The *** show that the trend is significant to the 0.001 level. Plot on the right shows the smooth trend in contributions. The shading shows the estimated 95% confidence intervals.

For sea salt, the overall trend is shown is -0.06 per year and the 95% confidence intervals in the slope from -0.08 – (-0.03) units/year. The *** show that the trend is significant to the 0.001 level. Plot on the right shows the smooth trend in contributions. The shading shows the estimated 95% confidence intervals.

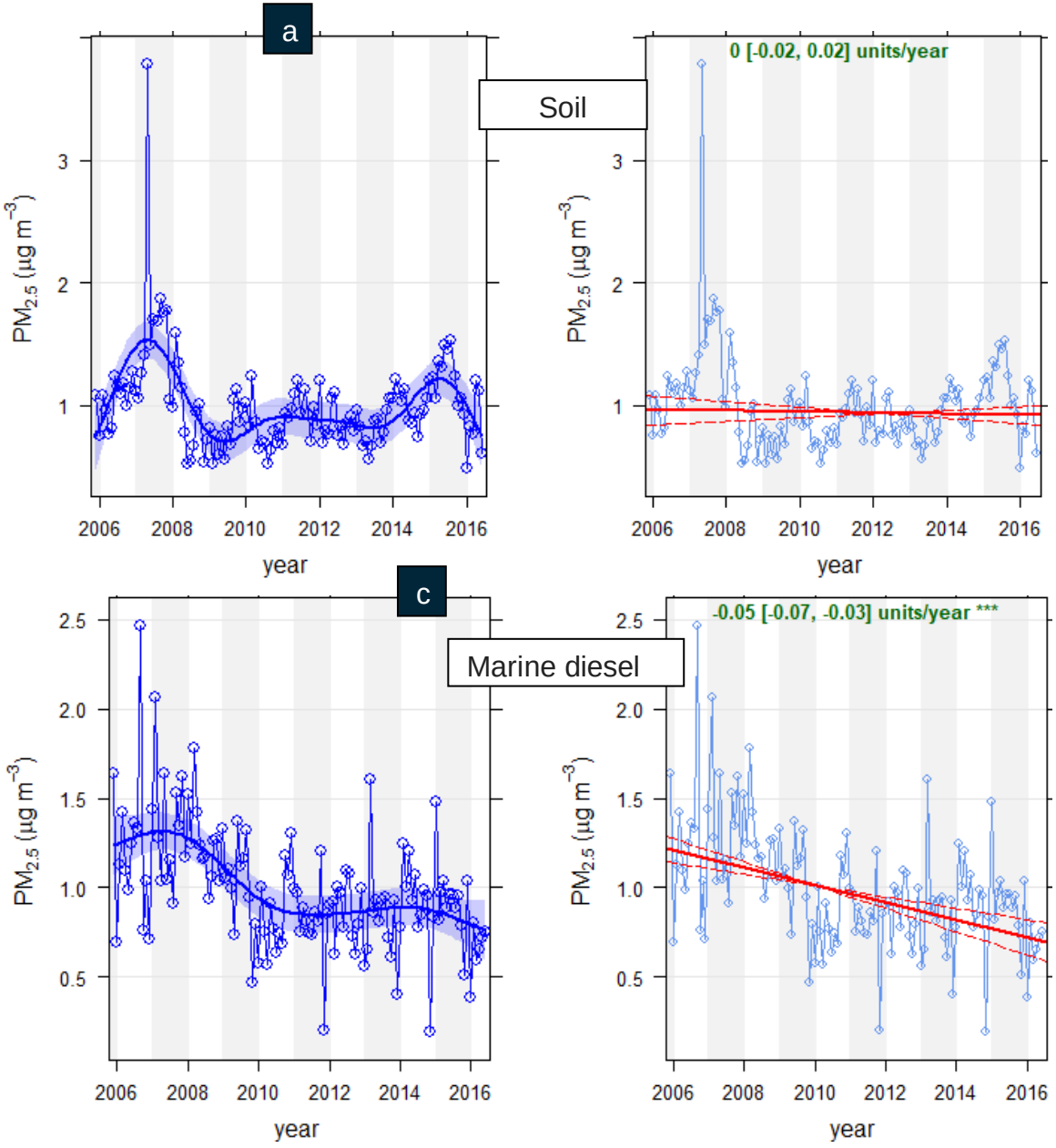

Figure 6. Long-term trends in $PM_{2.5}$ soils, biomass burning and marine diesel source contributions: plots c show that contribution of marine diesel have decreased (statistically significant at the 99.9% confidence interval); Plots b show that concentrations of biomass burning have slightly increased (statistically significant at the 99.9% confidence interval). There is no clear trend in the soil contribution.

Section D. Impact of COVID-19 restriction (alert level 4 lockdown) on air quality – Week one (18-24 August)

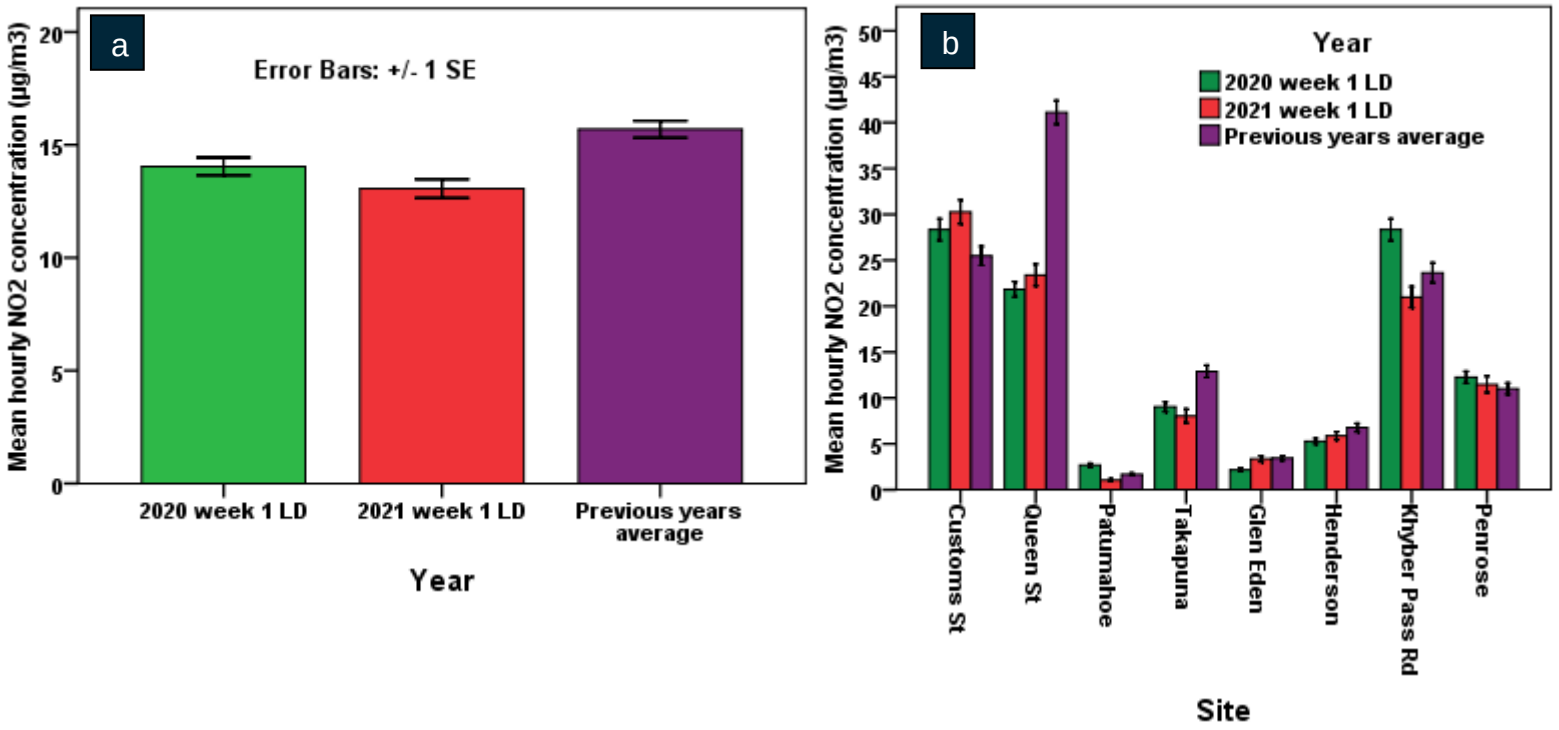

Figure 7. Mean hourly concentration of NO_2 during COVID-19 alert level 4, week one lockdown (18 - 24 August) compared with 2020 lockdown (26 March - 1 April 2020) and mean concentrations of the previous two years (18 - 24 August 2019 and 2020). Plots a and b represent Auckland wide and each monitoring sites respectively. Error bars represent the standard errors of the mean. Due to the lockdown, NO_2 levels declined across seven of the eight monitoring sites.

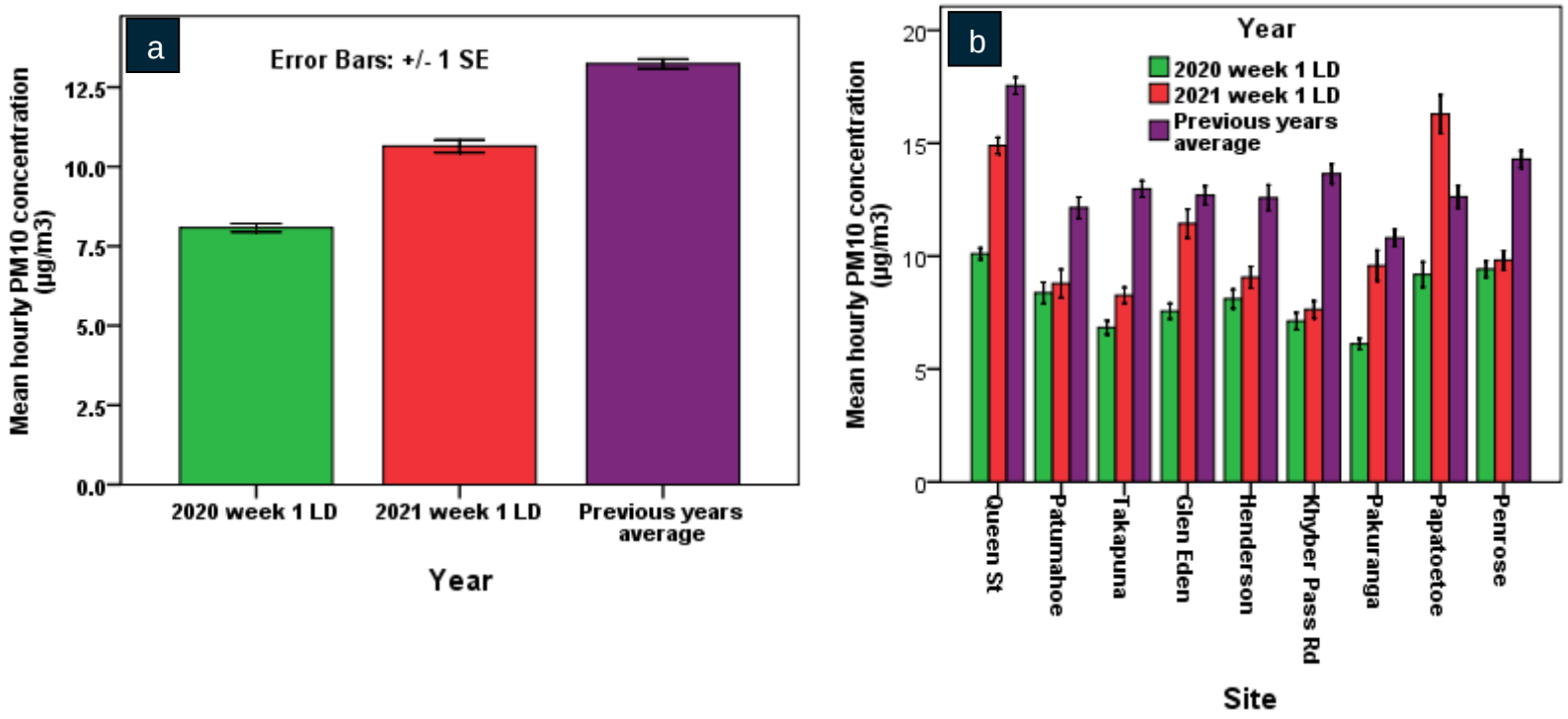

Figure 8. Mean hourly concentration of PM_{10} during COVID-19 alert level 4, week one lockdown (18 - 24 August) compared with 2020 lockdown (26 March - 1 April 2020) and mean concentrations of the previous two years (18 - 24 August 2019 and 2020). Plots a and b represent Auckland wide and each monitoring sites respectively. Error bars represent the standard errors of the mean. Due to the lockdown, PM_{10} levels declined across all the monitoring sites.

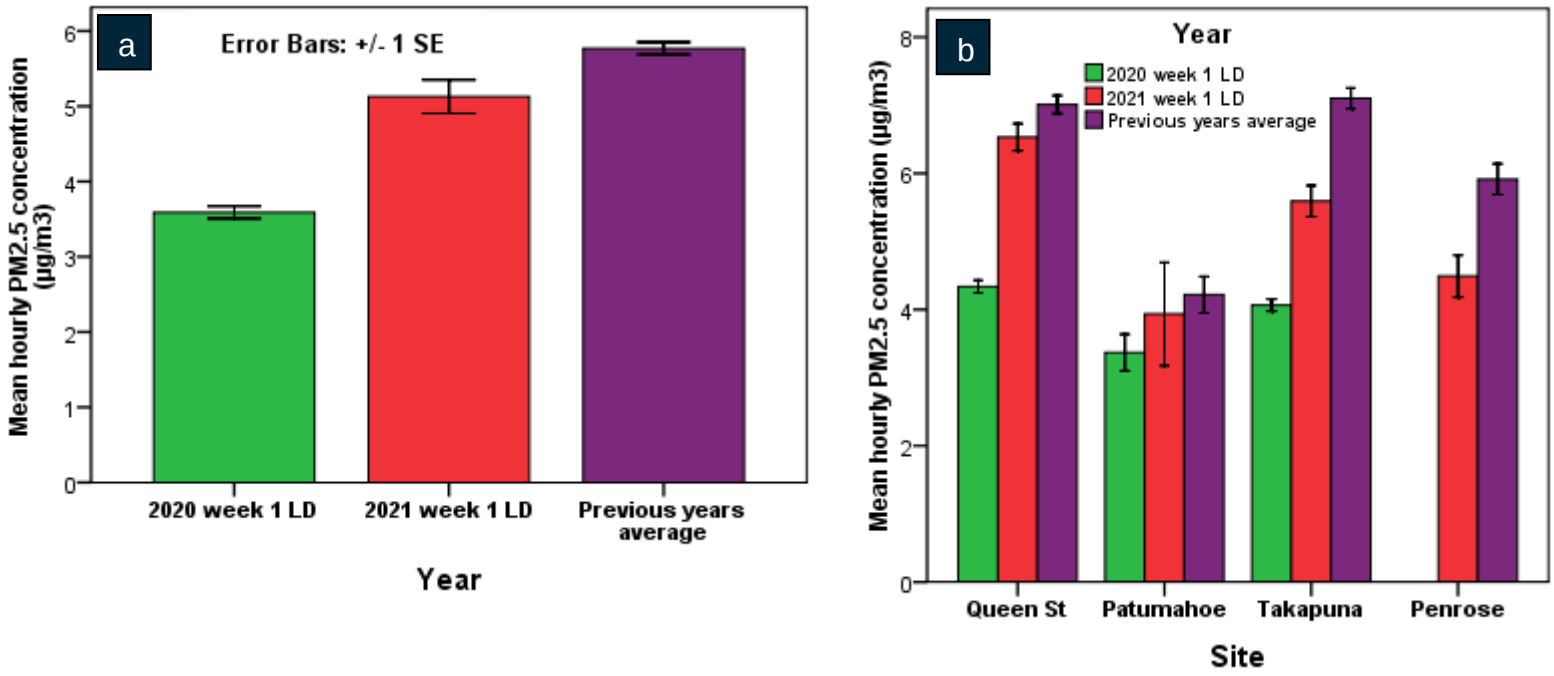

Figure 9. Mean hourly concentration of $PM_{2.5}$ during COVID-19 alert level 4, week one lockdown (18- 24 August) compared with 2020 lockdown (26 March - 1 April 2020) and mean concentrations of the previous two years (18 - 24 August 2019 and 2020). Plots a and b represent Auckland wide and each monitoring sites respectively. Error bars represent the standard errors of the mean. Due to the lockdown, $PM_{2.5}$ levels declined across all the monitoring sites.

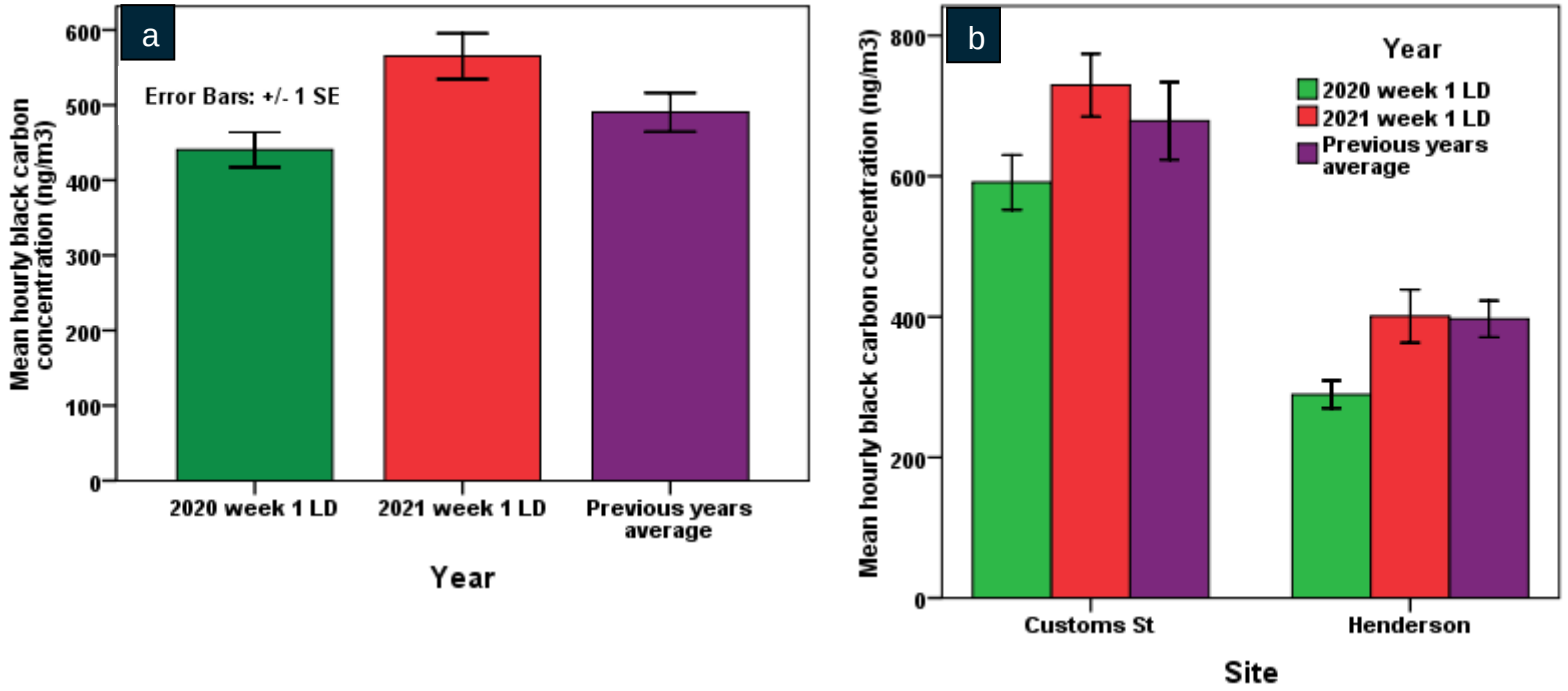

Figure 10. Mean hourly concentration of black carbon during COVID-19 alert level 4, week one lockdown (18 - 24 August) compared with 2020 lockdown (26 March - 1 April 2020) and mean concentrations of the previous two years (18 - 24 August 2019 and 2020). Plots a and b represent Auckland wide and each monitoring sites respectively. Error bars represent the standard errors of the mean. The impact of the lockdown on black carbon is not clear due to home heating contribution to this contaminant.

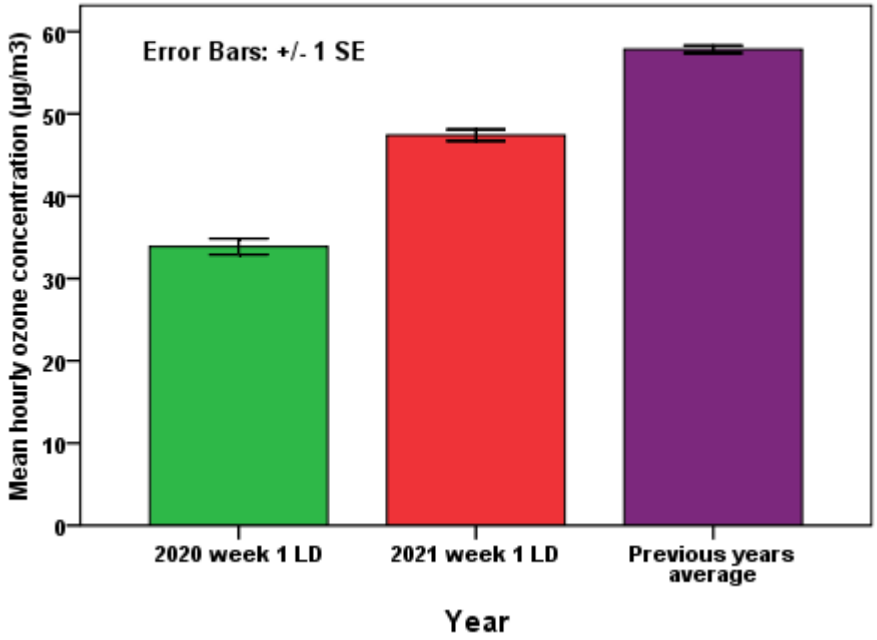

Figure 11. Mean hourly concentration of ozone (O_3) during COVID-19 alert level 4, week one lockdown (18 - 24 August) compared with 2020 lockdown (26 March - 1 April 2020) and mean concentrations of the previous two years (18 - 24 August 2019 and 2020). Error bars represent the standard errors of the mean. Due to the lockdown, ozone levels dropped.

\

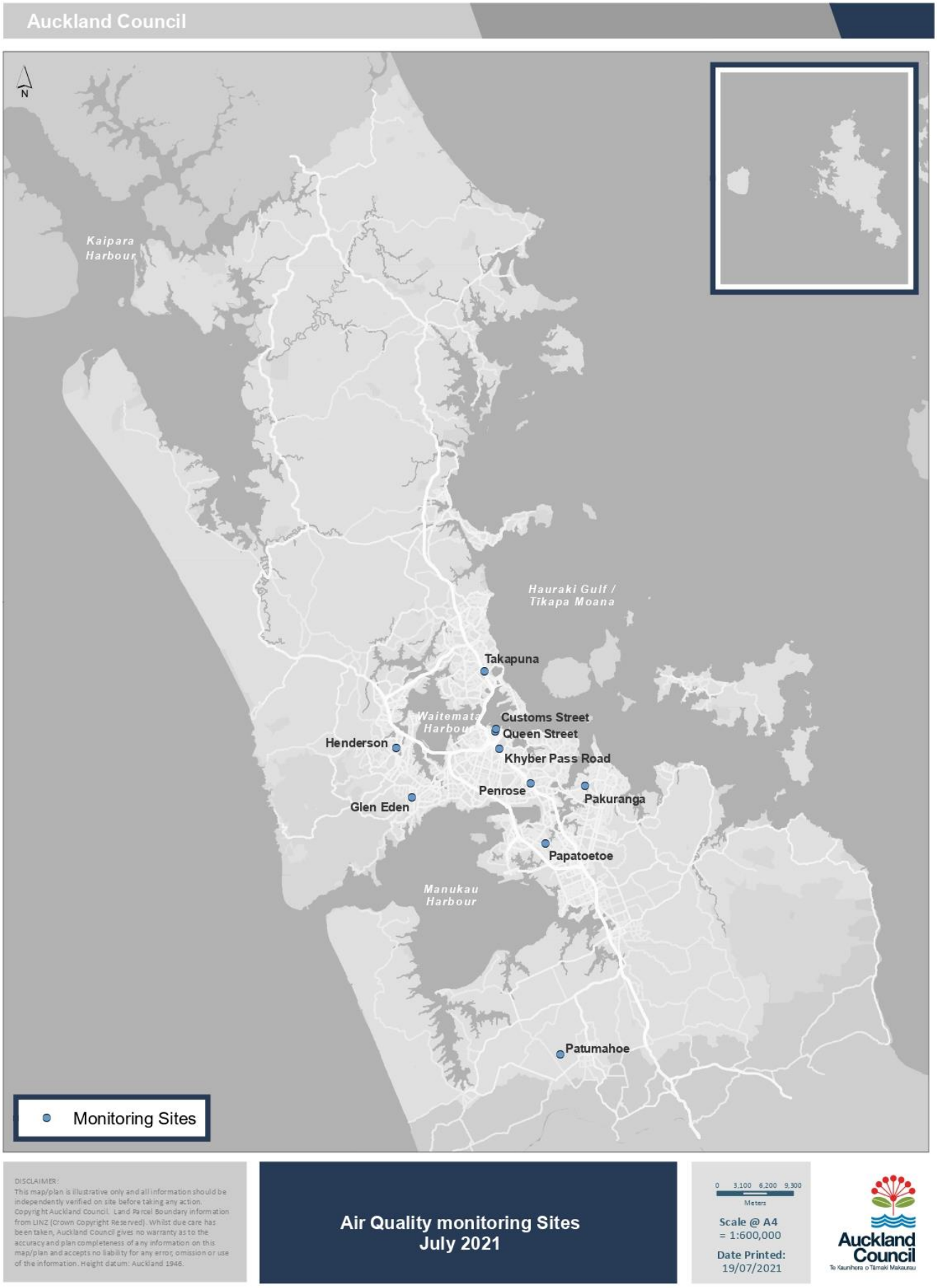

Figure 12. Auckland Council air quality monitoring sites

Disclaimer

Auckland Council disclaims any liability whatsoever in connection with any action taken in reliance of this document for any error, deficiency, flaw or omission contained in it.

Find out more: EnvironmentAuckland.org.nz

Research and Evaluation Unit RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau