



25 February 2024

Research and
Evaluation Unit

RIMU



Auckland Air Quality Report

Monthly update – February

Introduction

Auckland Council's Research and Evaluation Unit (RIMU) collects air quality data to ensure compliance with national standards and inform policy development and evaluation. The data we collect provides a better understanding of ambient air quality in the region, including spatial and temporal variations.

This monthly update is prepared using validated data that is available about one month after raw data collection. This report covers data up to 31 January 2024. This regular update on air quality aims to promote awareness and encourage actions to improve air quality in the region.

This update is divided into four sections, with sections A and B featuring tables and graphics that illustrate air quality status in Tāmaki Makaurau / Auckland, and is based on data collected from continuous monitoring sites across the region.

For this edition, section C focuses on one monitoring site – Takapuna. Section D provides monthly averages for 2024 and the past four to five years of pollutant concentrations (when data is available).

Summary

- No breach of national air quality standards occurred in January 2024.
- Overall, the average PM₁₀ level in January increased by 15% compared to the previous year, whereas the average NO₂ concentration increased by 5%. Air pollutant concentrations vary across different stations within the monitoring network.
- The Customs Street and Penrose sites recorded the highest levels of NO₂ and SO₂ concentrations respectively in January 2024.

It is important to note that air quality at a monitoring site can vary from year to year due to weather and other influences (See [Auckland air quality report, October 2021](#)). For a brief analysis of short-term concentration changes of key pollutants, please see Table 2.

Where to view our data

Data can be viewed on the council's [environmental data portal](#), the LAWA website [LAWA](#) or requested from environmentaldata@aucklandcouncil.govt.nz

Full state and trends analyses and reports are prepared every few years (the most recent report is [Trends in Auckland's air quality 2006-2018](#)).

The [2022 Annual data report](#) is available on the Knowledge Auckland website.

See also, the [frequently asked questions](#) about the Auckland air quality monitoring programme.

Glossary of terms

Term	Meaning
Aerodynamic diameter	Used to describe the behaviour of a particle as it moves around in the air; it compares the behaviour with that of a spherical particle of unit density.
Air pollutant/contaminant	Any substance in the air that could harm humans, animals, vegetation, or other parts of the environment when present in high enough concentrations.
Air pollution	The presence of one or more air pollutants in high enough concentrations to cause harm.
Air quality	Is the degree to which air is suitable or clean enough for humans, animals, or plants to remain healthy.
Ambient air	The external air environment (does not include the air environment inside buildings or structures)
Black carbon (BC)	Is an air pollutant made up of tiny soot-like particles discharged into the atmosphere from combustion processes.
CO	Carbon monoxide, a type of air pollutant.
Exceedance	An exceedance defines a period of time during which the concentration of a pollutant is greater than the appropriate air quality criteria.
Ground-level ozone (O ₃)	At ground level, ozone is considered an air pollutant that can seriously affect the human respiratory system. It is a major component of photochemical smog.
Monitoring site	A facility for measuring the concentration of one or more pollutants in the ambient air; also referred to as 'monitoring station'
NESAQ	National Environmental Standard for Air Quality.
NO ₂	Nitrogen dioxide, a type of air pollutant
PM	Particulate matter is made up of a mixture of various sizes of solid and liquid particles suspended in air.
PM ₁₀	Particulate matter with an aerodynamic diameter of 10 micrometres or less; a type of air pollutant.
PM _{2.5}	Particulate matter with an aerodynamic diameter of 2.5 micrometres or less; a type of air pollutant.
SO ₂	Sulphur dioxide, a type of air pollutant
µg/m ³	Microgram of pollutant (1 millionth of a gram) per cubic metre of air, referenced to temperature of 0°C (273.15 K) and absolute pressure of 101.325 kilopascals (kPa)
n/a	Not applicable

What we monitor		Why we monitor
Air	Particulate matter (PM) – PM ₁₀ and PM _{2.5}	Tiny particles (particulate matter) from polluting sources such as vehicles and smoke get into the air. Breathing them may cause health problems.
	Nitrogen dioxide (NO ₂)	Vehicles are the main source of NO ₂ in Auckland. It can irritate the lungs, increasing susceptibility to asthma and lowering resistance to respiratory infections.
	Other pollutants	Air pollutants ozone, sulphur dioxide, carbon monoxide, black carbon and volatile organic compounds (VOCs) like benzene cause adverse health effects at elevated concentrations.
Greenhouse gas emissions	Carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF ₆) and nitrogen trifluoride (NF ₃)	The climate is warming due to increased greenhouse gas (GHG) levels in the atmosphere caused by human activities. Reducing GHG emissions will limit temperature rise.























































































Section A – Data tables

Table 1. Summary information about Auckland air quality monitoring programme 1 to 31 January 2024



Number of exceedances of NESAQ in 2024	0	
Number of exceedances of Auckland ambient air quality targets in 2023	0	
Maximum PM ₁₀ 24-hours mean (January 2024)	22.1 µg/m ³ (44.2% of NESAQ)	Recorded at Papatoetoe on 31 January 2024
Maximum PM _{2.5} 24-hour mean (January 2024)	9.8 µg/m ³ (39.2% of Auckland target)	Recorded at Takapuna on 20 January 2024
Maximum NO ₂ 1-hour mean (January 2024)	59.0 µg/m ³ (29.5% of NESAQ)	Recorded at Customs Street on 16 January 2024
Maximum SO ₂ 1-hour mean (January 2024)	19.0 µg/m ³ (5.4% of NESAQ)	Recorded at Penrose on 4 January 2024
Maximum O ₃ 1-hour mean (January 2024)	68.0 µg/m ³ (45.3% of NESAQ)	Recorded at Patumahoe on 23 January 2024
Maximum CO running 8-hour mean (January 2024)	0.36 mg/m ³ (3.6% of NESAQ)	Recorded at Khyber Pass Rd on 23 January 2024
Number of continuous monitoring sites	10	
Location of monitoring sites	Queen Street, Customs Street, Khyber Pass Road, Penrose, Henderson, Takapuna, Glen Eden, Pakuranga, Papatoetoe, and Patumahoe	

Table 2. Short-term trends in concentration of key air pollutants monitored for the past 3, 4, and 5 years.

 indicates an upward
  indicates a downward
  upward but not significant
  downward but not significant

	PM ₁₀			PM _{2.5}			NO ₂			Black carbon			Ozone			CO			SO ₂			
Site	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	Past 3 years	Past 4 years	Past 5 years	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	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	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	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	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
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*
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*
	PM ₁₀			PM _{2.5}			NO ₂			Black carbon			Ozone			CO			SO ₂			

Notes

Trend significance was determined using the Theil-Sen method (deseasonalised):  and  arrows indicate trends are statistically significant at the 0.05 level, 95% confidence intervals. n/a means not applicable.

Effective dates: 3 years (1 January 2021 to 31 December 2023), 4 years (1 January 2020 to 31 December 2023), and 5 years (1 January 2019 to 31 December 2023)

PM₁₀ 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.

NO₂ 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.

SO₂ is monitored at Customs St, and Penrose.

*PM_{2.5} data coverage for Glen Eden, Customs Street and Pakuranga is less than 75% due to instrument failure between September 2021 and January 2022. No data for Takapuna in January and February 2023 due to the Auckland floods. Queen St data is up to 22 August due to power outage at the site.

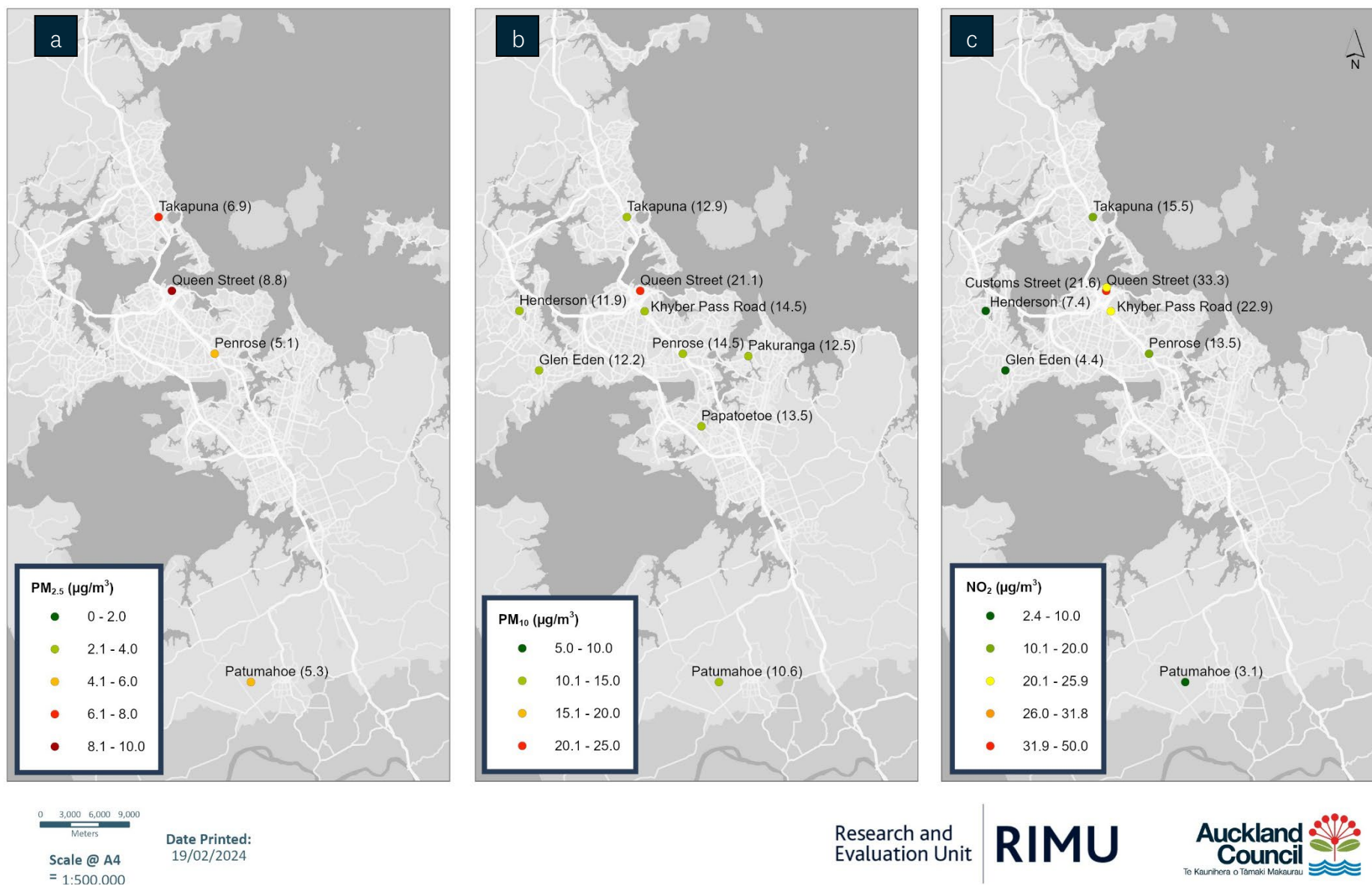


Figure 1. Maps a, b and c show the air quality monitoring sites and their last 12 months (1 February 2023 to 31 January 2024) average PM and NO₂ concentrations in brackets. Auckland city centre monitoring sites recorded the highest PM and NO₂ concentrations.

Section B. Key air contaminants levels across the 10 air quality monitoring sites - January 2023 and 2024 compared

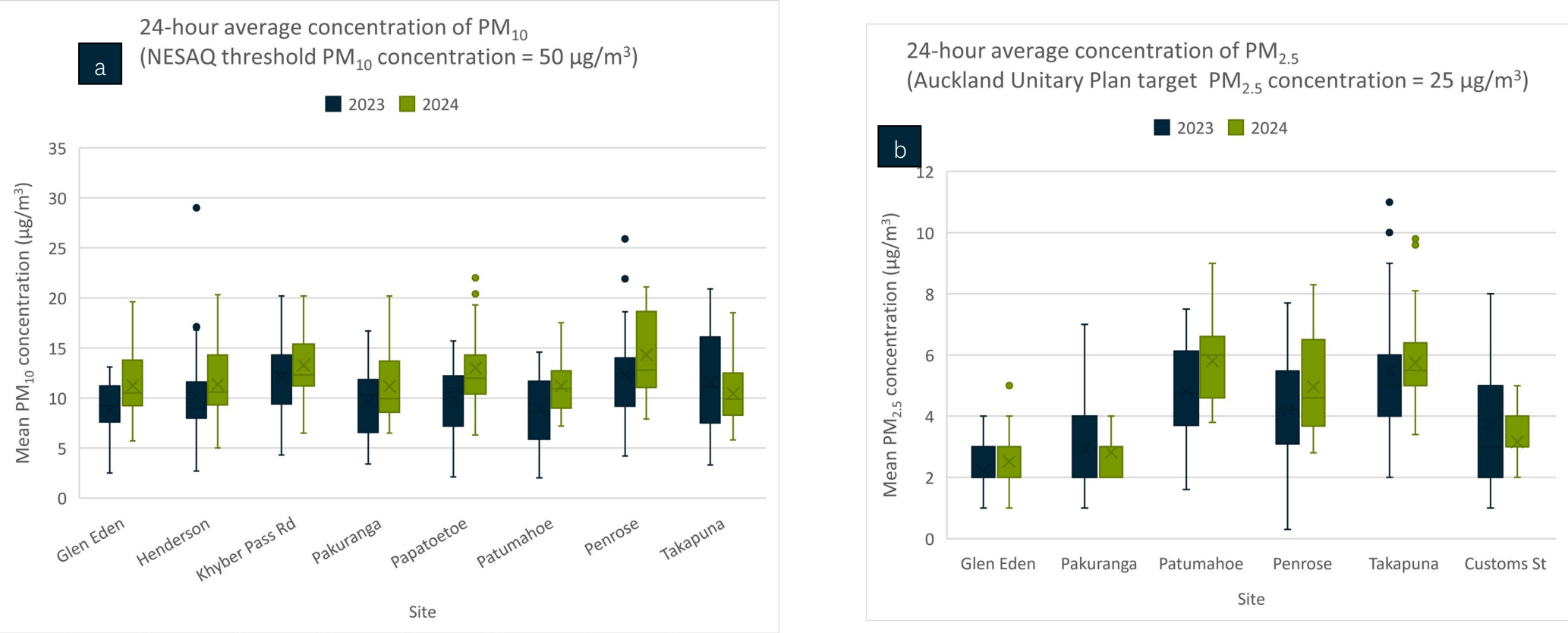


Figure 2. Boxplot of PM hourly mean concentration – January 2024 compared to January 2023. As in the previous year, the highest concentrations of PM₁₀ and PM_{2.5} were recorded at Papatoetoe and Takapuna sites respectively. In January, the average PM₁₀ concentration in Auckland was 12.1 µg/m³, marking a 15% increase compared to January 2023's average of 10.6 µg/m³. Plots a and b represent PM₁₀ and PM_{2.5}, respectively. PM₁₀ and PM_{2.5} have multiple sources including home heating, motor vehicles, sea salt, marine diesel, and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).

Boxes represent 25th (bottom of the box) and 75th (top of box) percentile, central line through the box is the median, bars outside the box (whiskers) represent the 1.5× interquartile range, × markers are the means, and circles are outliers.

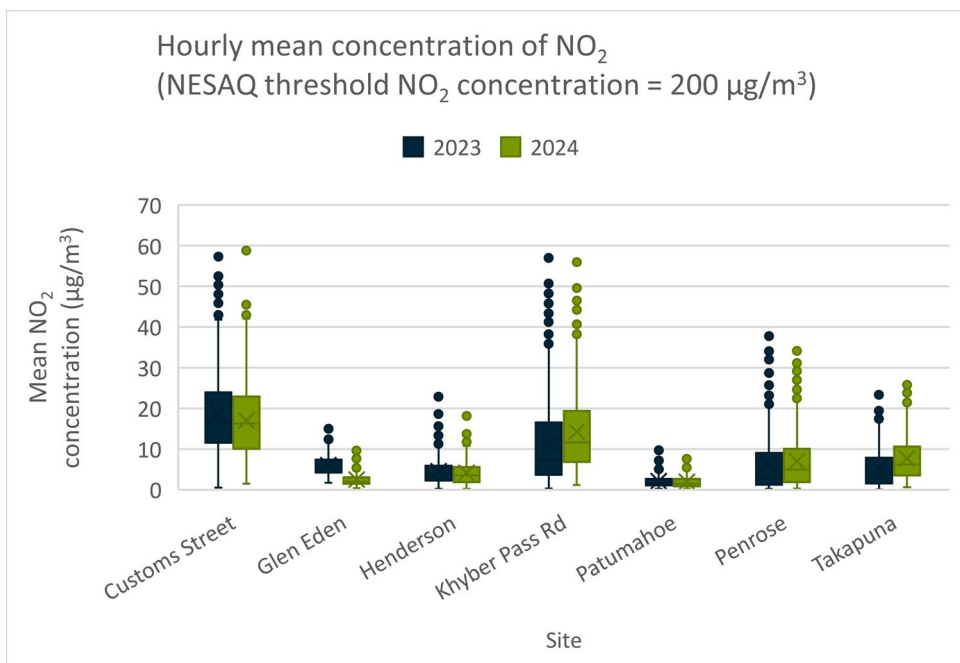


Figure 3. Boxplot of NO₂ hourly mean concentration – January 2024 compared to January 2023. The highest concentrations were recorded at Customs Street monitoring sites in the city centre. In January, the average NO₂ concentration in Auckland was 6.2 µg/m³, representing a 5% increase compared to January 2023's average of 5.9 µg/m³. Motor vehicles are the primary source of NO₂.

Boxes represent 25th (bottom of the box) and 75th (top of box) percentile, central line through the box is the median, bars outside the box (whiskers) represent the 1.5× interquartile range, × markers are the means, and circles are outliers.

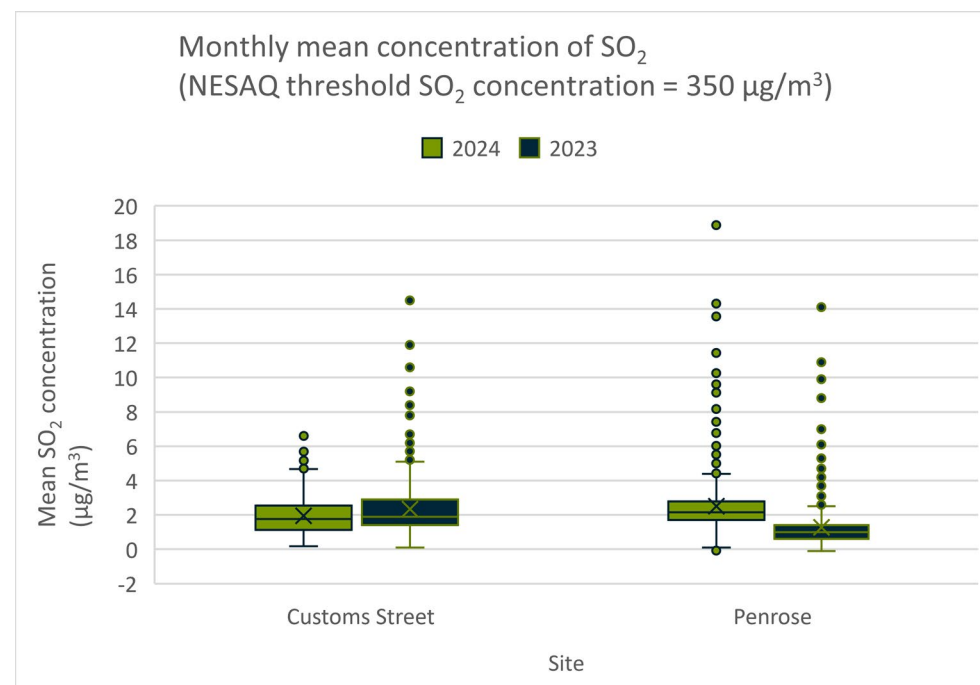


Figure 4. Boxplot of SO₂ hourly mean concentration – January 2024 compared to January 2023. The highest average concentration was recorded at the Penrose site. SO₂ is produced from the combustion of fossil fuels that contain sulphur, such as coal and oil (used for home heating, industry, and shipping). Motor vehicles also contribute to SO₂ levels in urban air.

Section C. Focus on a monitoring site: Takapuna

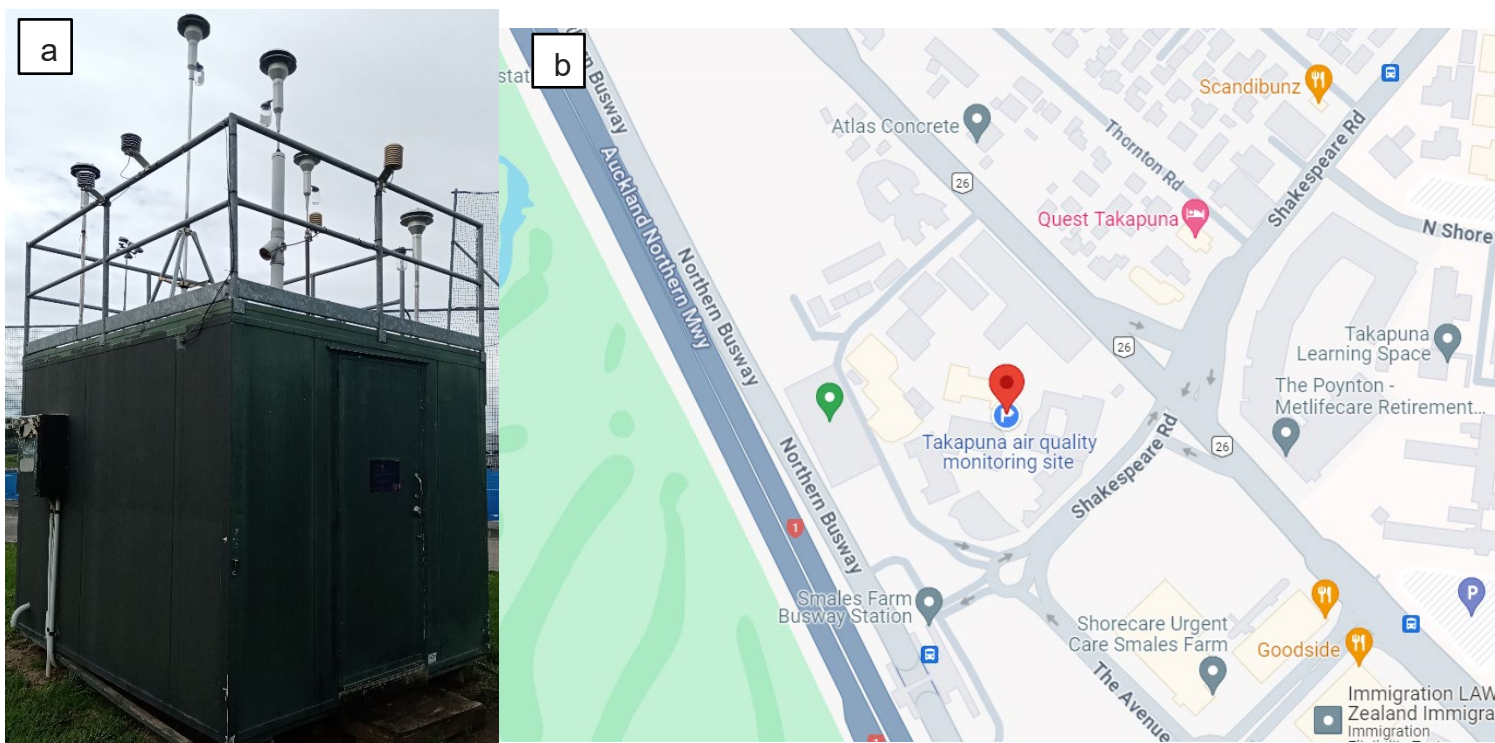


Figure 5. The Takapuna air quality monitoring site is located at Westlake Girls High School (2 Wairau Road). Image a shows the air quality monitoring shed. Image b is an aerial view of the monitoring site and surroundings taken in January 2024 (Source: Google Maps). Air quality monitoring at this site commenced on 31st May 1995. PM₁₀, PM_{2.5}, NO₂, and ambient meteorological parameters are monitored at this site. The main sources of air contaminants are motor vehicles, home heating (during winter) and roadside dust.

Key findings:

- Overall, Takapuna site average PM_{2.5}, PM₁₀ and NO₂ concentrations are approximately similar to Auckland's average, but higher than Patumahoe site (rural site).
- This monitoring site is classified as residential 'peak' for particulate matter (PM₁₀ and PM_{2.5}) and NO₂ exposure. Therefore, it is expected that the average concentrations will be close to Auckland's average but higher than the rural background site.
- Deseasonalised long-term trend analysis results at the Takapuna site show that there is a downward trend in PM₁₀, PM_{2.5}, and NO₂ average concentrations.

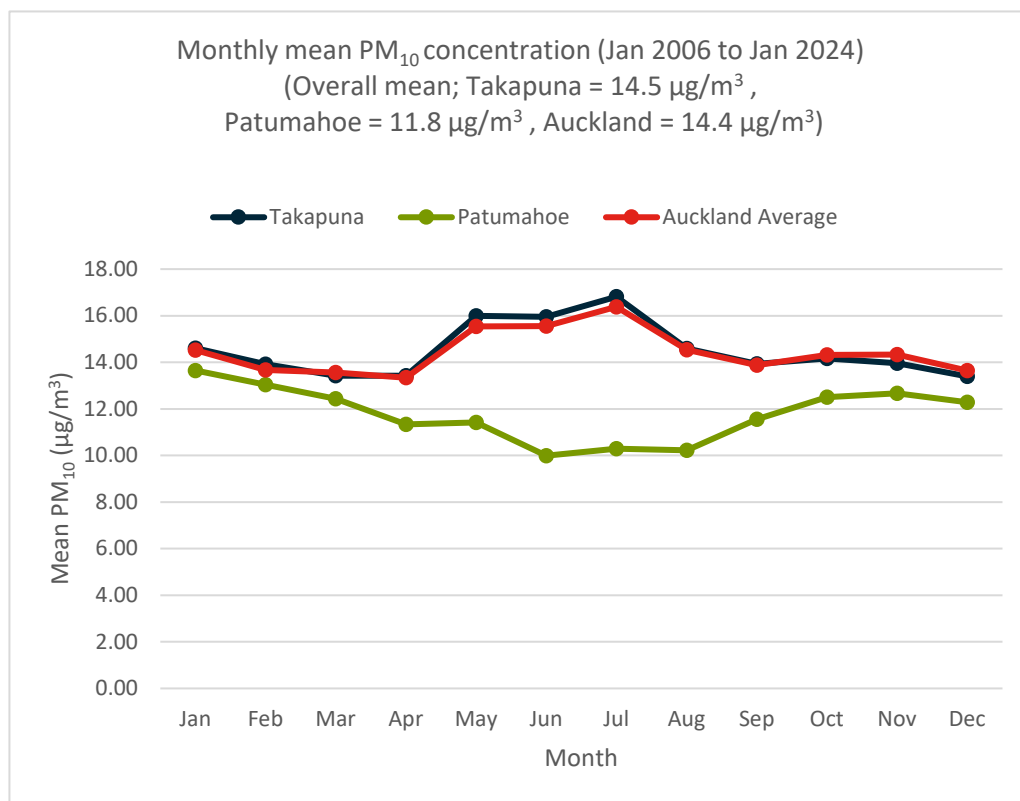


Figure 6. Temporal variation in monthly PM₁₀ concentrations – Takapuna site compared to Patumahoe (rural site) and Auckland average. Takapuna site average PM₁₀ concentration is approximately the same as Auckland’s average and 23% more than Patumahoe site. The Takapuna site is located at an urban residential peak exposure to PM₁₀. Therefore, PM₁₀ average concentration is expected to be close to the Auckland’s average and above the rural/background site.

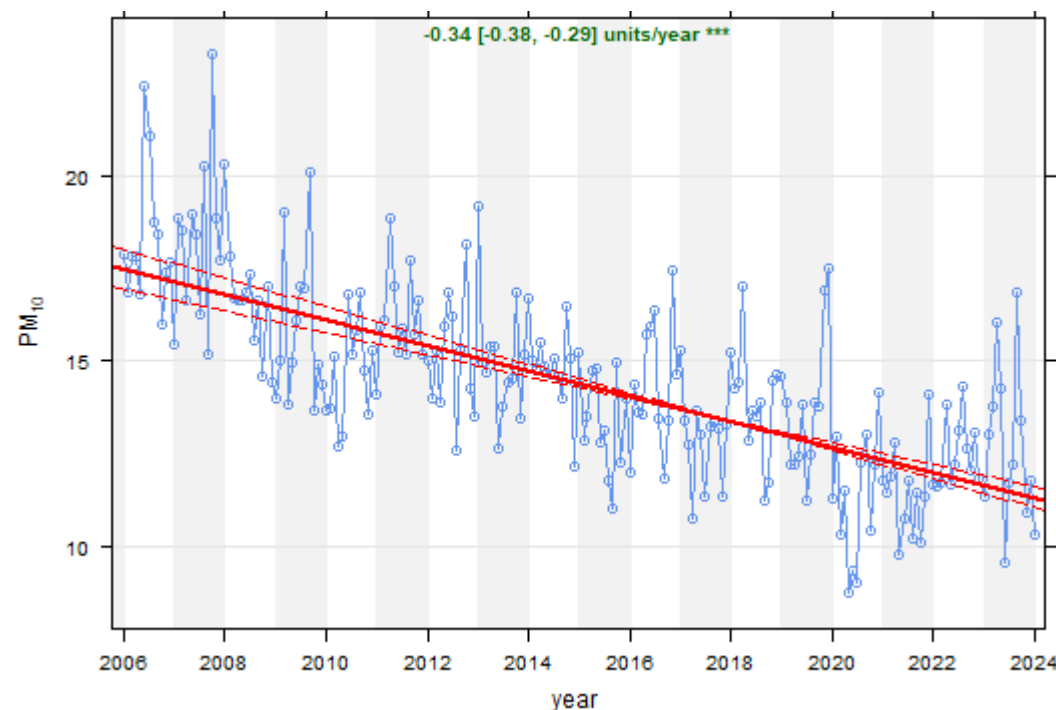


Figure 7. Trends in PM₁₀ at Takapuna site – January 2006 to January 2024. The plot shows the deseasonalised monthly mean concentrations of PM₁₀. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as - 0.34 (µg/m³) per year and the 95% confidence intervals in the slope from -0.38 - (-0.29) µg/m³/year. The ‘***’ show that the trend is significant to the 0.001 level.

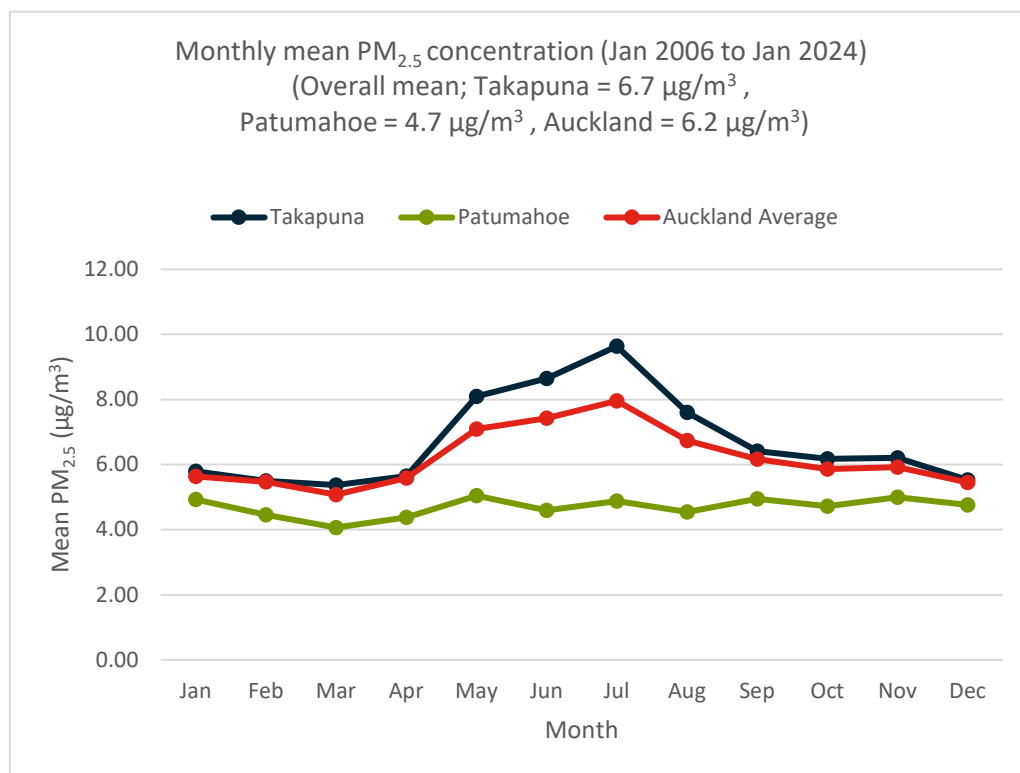


Figure 8. Temporal variation in monthly PM_{2.5} concentrations – Takapuna site compared to Patumahoe (rural site) and Auckland average. Overall, Takapuna site average PM_{2.5} concentration is slightly higher than Auckland’s average, but 43% more than Patumahoe site.

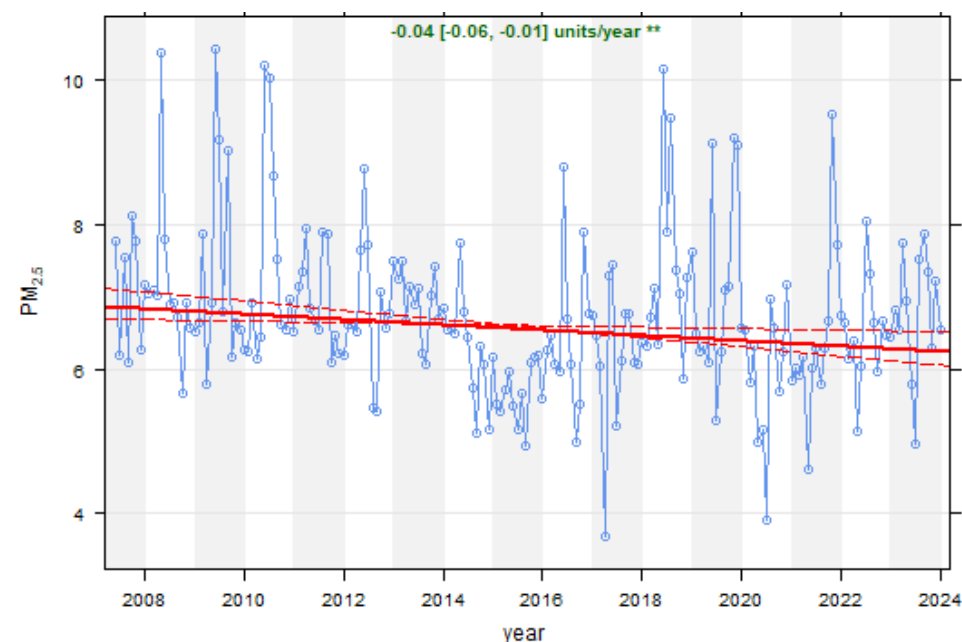


Figure 9. Trends in PM_{2.5} at Takapuna site – June 2007 to January 2024. The plot shows the deseasonalised monthly mean concentrations of PM_{2.5}. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as - 0.04 (µg/m³) per year and the 95% confidence intervals in the slope from -0.06 - (-0.01) µg/m³/year. The ‘**’ show that the trend is significant to the 0.05 level.

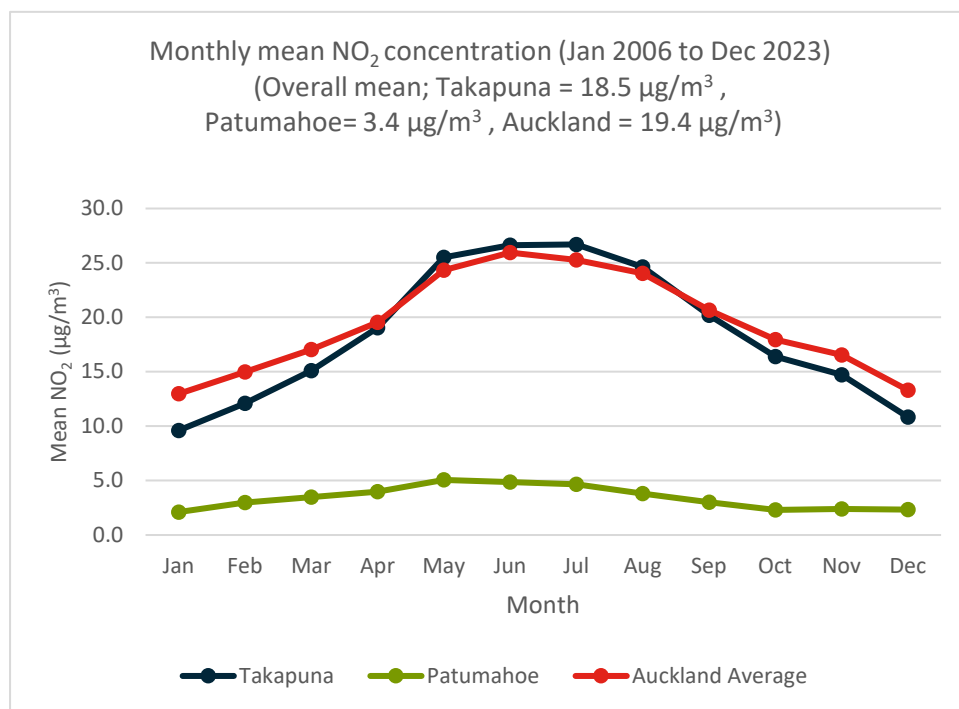


Figure 10. Temporal variation in monthly NO₂ concentrations – Takapuna site compared to Patumahoe (rural site) and Auckland average. Overall, Takapuna site average NO₂ concentration is approximately the same as Auckland’s average, but five times higher than Patumahoe site.

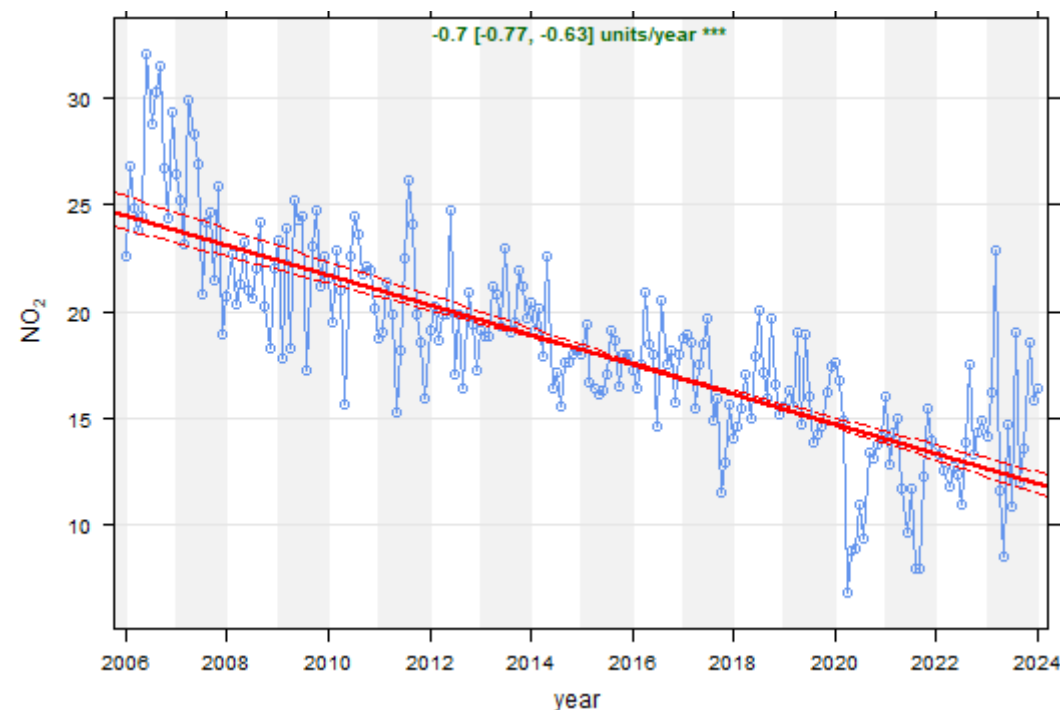


Figure 11. Trends in NO₂ at Takapuna site – January 2006 to January 2024. The plot shows the deseasonalised monthly mean concentrations of NO₂. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.7 (µg/m³) per year and the 95% confidence intervals in the slope from -0.77 - (-0.63) µg/m³/year. The ‘***’ show that the trend is significant to the 0.001 level.

Section D. Table 3. Monthly averages: 2024 and past four to five years (when data is available)

Pollutant	Site	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PM ₁₀ (µg/m ³)	Glen Eden	2024	11.3	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	11.4	11.0	9.7	11.3	13.0	14.4	14.7	13.6	12.1	11.1	11.5	12.6
	Henderson	2024	11.4	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	11.6	11.6	11.0	11.4	12.5	12.3	12.8	11.5	11.7	11.1	11.9	12.3
	Khyber Pass Road	2024	13.3	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	11.8	12.2	11.6	12.5	12.3	11.3	12.9	12.1	12.3	11.9	12.8	13.6
	Pakuranga	2024	11.1	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	11.6	11.3	10.2	10.6	12.7	12.4	14.0	13.1	11.9	11.2	11.9	12.3
	Papatoetoe	2024	13.0	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	14.0	13.5	12.4	12.7	14.0	13.0	14.9	14.2	14.5	13.6	13.8	14.5
	Patumahoe	2024	11.1	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	13.7	13.0	12.3	11.6	11.2	9.3	10.5	10.5	11.7	11.0	12.3	14.0
	Penrose	2024	14.3	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	14.8	15.1	14.2	14.4	15.6	13.5	14.8	13.8	14.3	13.3	14.2	15.4
Queen Street	2024	ND	-	-	-	-	-	-	-	-	-	-	-	
	Past 5 years	17.4	17.3	16.7	17.0	18.0	17.2	19.9	19.1	18.6	18.4	19.6	20.1	
Takapuna	2024	10.5	-	-	-	-	-	-	-	-	-	-	-	
	Past 5 years	12.3	11.9	10.8	12.2	13.1	12.5	13.7	12.5	12.8	11.6	12.3	12.9	
PM _{2.5} (µg/m ³)	Customs Street	2024	3.1	-	-	-	-	-	-	-	-	-	-	-
		Past 4 years	4.1	3.8	3.2	4.1	4.3	4.4	4.8	5.3	5.3	4.0	3.5	3.6
	Glen Eden	2024	2.5	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	2.5	2.6	2.1	3.1	5.8	9.0	9.2	7.8	4.8	3.3	3.2	3.1
	Pakuranga	2024	2.8	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	2.9	2.9	2.6	3.7	5.5	6.4	7.8	5.8	4.3	3.3	3.6	3.4
	Patumahoe	2024	5.7	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	5.1	4.8	4.4	4.9	5.3	4.8	4.9	5.0	5.0	4.7	5.2	5.3
	Penrose	2024	4.9	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	6.0	5.8	4.8	5.4	6.2	6.6	6.6	5.9	5.4	5.0	6.0	5.6
	Queen Street	2024	ND	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	7.1	6.8	6.4	7.0	7.7	7.5	8.5	8.1	7.5	7.6	8.0	8.2
	Takapuna	2024	5.8	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	5.9	5.4	4.9	5.9	7.0	7.4	8.3	7.5	6.8	6.2	6.8	6.3
NO ₂ (µg/m ³)	Customs Street	2024	17.0	-	-	-	-	-	-	-	-	-	-	-
		Past 4 years	30.8	31.9	34.3	28.5	33.7	46.7	33.7	34.4	28.7	27.6	23.5	22.1
	Glen Eden	2024	2.5	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	2.7	3.4	4.0	4.6	7.2	7.8	7.0	6.1	4.6	4.4	3.7	2.9
	Henderson	2024	4.2	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	4.0	6.8	8.1	8.7	11.6	12.9	10.7	9.4	7.7	6.4	6.1	4.5
	Khyber Pass Road	2024	14.2	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	19.0	19.2	23.3	22.4	30.4	33.2	33.2	32.5	28.7	23.9	28.2	19.0
	Patumahoe	2024	1.9	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	1.6	2.3	3.1	3.3	4.1	4.3	3.9	3.6	2.6	2.3	2.3	1.9
	Penrose	2024	7.0	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	9.1	10.6	13.6	15.4	20.2	21.4	20.5	18.2	14.6	11.3	12.2	7.9
	Queen Street	2024	ND	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	25.1	24.8	30.4	30.7	33.3	36.2	40.5	41.2	34.9	33.1	30.2	26.3
Takapuna	2024	7.7	-	-	-	-	-	-	-	-	-	-	-	
	Past 5 years	6.6	8.4	12.2	13.8	18.9	20.6	20.3	18.8	14.4	11.5	12.2	8.1	
SO ₂ (µg/m ³)	Customs Street	2024	2.0	-	-	-	-	-	-	-	-	-	-	-
		Past 4 years	1.8	1.8	2.4	1.9	2.0	4.1	2.5	2.9	2.5	2.2	2.0	1.9
		2024	2.5	-	-	-	-	-	-	-	-	-	-	-
	Penrose	Past 5 years	0.6	1.0	1.2	0.9	1.2	1.3	1.1	0.9	0.9	0.9	1.2	0.9
O ₃ (µg/m ³)	Patumahoe	2024	27.6	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	26.7	28.3	30.5	36.6	39.7	42.1	47.6	50.5	51.9	47.3	39.6	31.1
		2024	0.006	-	-	-	-	-	-	-	-	-	-	-
CO (mg/m ³)	Khyber Pass Road	Past 5 years	0.032	0.039	0.044	0.058	0.126	0.134	0.167	0.119	0.056	0.023	0.021	0.011
		2024	1160	-	-	-	-	-	-	-	-	-	-	-
		Past 4 years	1365	1437	1426	1178	1381	3075	1317	1481	1090	1070	1205	1088
Black carbon (ng/m ³)	Customs Street	2024	186	-	-	-	-	-	-	-	-	-	-	-
		Past 5 years	244	406	523	524	906	1084	912	700	458	334	339	286
		ND = No data: station has been temporarily closed due to the renovation of the building hosting the site.												

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