Change in air pollution levels for week one of Alert Level 2 COVID-19 (14-20 May) seen in the Auckland Council air quality monitoring network.

Summary:

- Pollution concentrations returned to normal or above normal levels (average of previous years) as we moved to Alert Level 2, except for the city centre which remained lower than normal.
- The traffic pollutant nitrogen dioxide (NO_2) increased across all sites compared to the Level 3 period (28 April-13 May), returning to or above normal levels except for the city centre which was only 68% of normal levels.
- Particulate matter (PM_{10} and $PM_{2.5}$) did not show such a consistent pattern with increases at some sites and decreases at others. PM_{10} and $PM_{2.5}$ were at or below normal levels. PM_{10} and $PM_{2.5}$ at the city centre were 80% and 92% of normal levels, respectively.

Air pollution in the Auckland region has been monitored by Auckland Council since the late 1990s at representative monitoring sites across the region. Data from our monitoring network is used to assess compliance with the National Environmental Standards for Air Quality (NES-AQ). Nitrogen dioxide (NO_2) is primarily associated with traffic (vehicle emissions) while PM_{10} and $PM_{2.5}$ (particulate matter with diameters less than 10 and 2.5 microns) have a number of sources such as traffic, road dust, sea salt and smoke from home heating fires (particularly during winter).

As the nation moved into Alert Level 2 from Level 3 from midnight 13 May, NO_2 levels (averaged over a 24-hour period) increased across the region at all monitoring sites. PM_{10} and $PM_{2.5}$ did not show a consistent pattern with increases at some sites and decreases at others. Hourly data showed large increases at some locations, but a 24-hour average provides a more comparable figure. In addition to emissions, other variables, such as weather conditions, can contribute to the changes of pollution levels. To remove the influence of meteorological conditions, we also compared pollution levels averaged over week one of alert level 2 (14 - 20 May) to the same period (i.e., 14 - 20 May) of previous years (up to five years from 2015).

In week one of Alert Level 2 (14 – 20 May), NO_2 concentrations increased across all sites, between 15% at Queen Street and 125% at Takapuna, as compared to the period of Level 3 restrictions (28 April – 13 May). PM_{10} and $PM_{2.5}$ did not show such a consistent pattern with increases at some sites and decreases at others.

Compared to the same period (14 – 20 May) of previous years, NO_2 returned to normal or above normal levels at all sites except for the city centre staying below normal levels, ranging from 68% of normal levels at Queen Street to 167% of normal levels at Penrose. PM_{10} and $PM_{2.5}$ were at or below normal levels, with 80% and 92% of PM_{10} and $PM_{2.5}$ normal levels at Queen Street.

We compared changes in pollution concentrations from Pre-Level 4 (12 – 25 March, two weeks before Level 4 started), Level 4 (26 March - 27 April), Level 3 (28 April – 13 May) and week one of Level 2 (14 – 20 May). At all sites, NO_2 concentrations dropped sharply from Pre-Level 4 to Level 4, then showed a step rise from Level 4, Level 3 to Level 2, returning to above Pre-Level 4 except for Queen Street staying below. PM_{10} and $PM_{2.5}$ did not show such a consistent pattern, as variations were largely site dependent.

Overall, nitrogen dioxide (NO_2) responded to changes of traffic activities consistently, as it is primarily associated with vehicle emissions. Particulate matter (PM_{10} and $PM_{2.5}$) did not demonstrate a similar pattern to NO_2 due to the prevalence of non-traffic sources (e.g., resuspended dust, sea salt and smoke from home heating fires). They were influenced more by other variables, particularly weather conditions.

Produced by the Research and Evaluation Unit (RIMU). May 2020.
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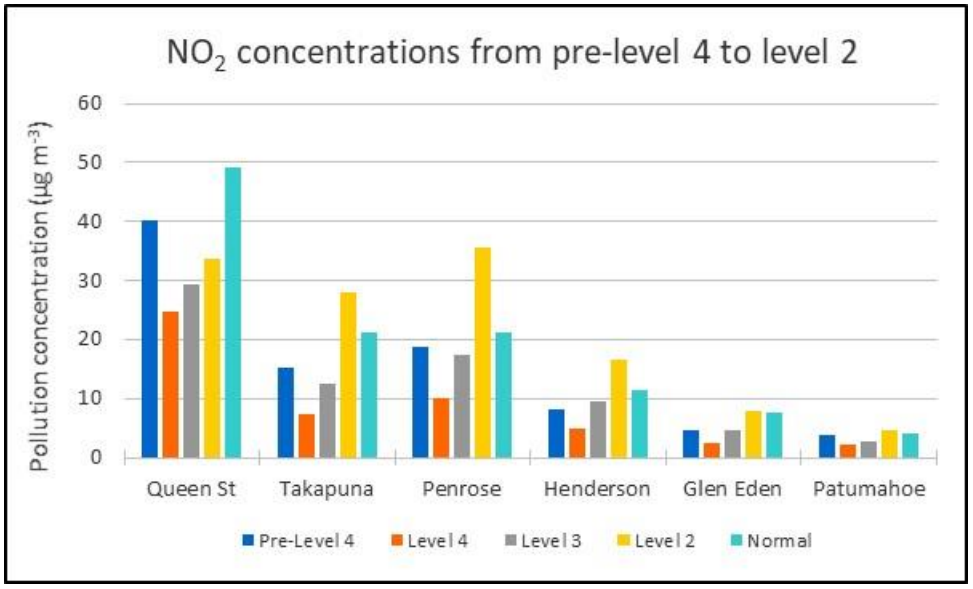

Figure 1. NO_2 levels averaged over week one of alert level 2 (14 – 20 May), as compared to Pre-Level 4 (12 – 25 March), Level 4 (26 March - 27 April), Level 3 (28 April – 13 May) and the same period (i.e., 14 – 20 May) of previous years (normal levels).

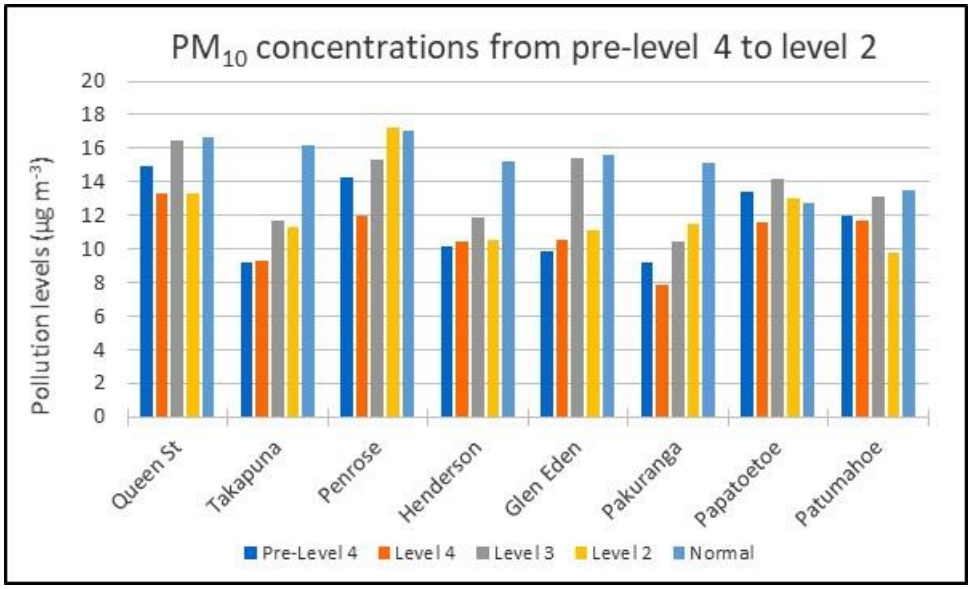

Figure 2. PM_{10} levels averaged over week one of alert level 2 (14 – 20 May), as compared to Pre-Level 4 (12 – 25 March), Level 4 (26 March - 27 April), Level 3 (28 April – 13 May) and the same period (i.e., 14 – 20 May) of previous years (normal levels).

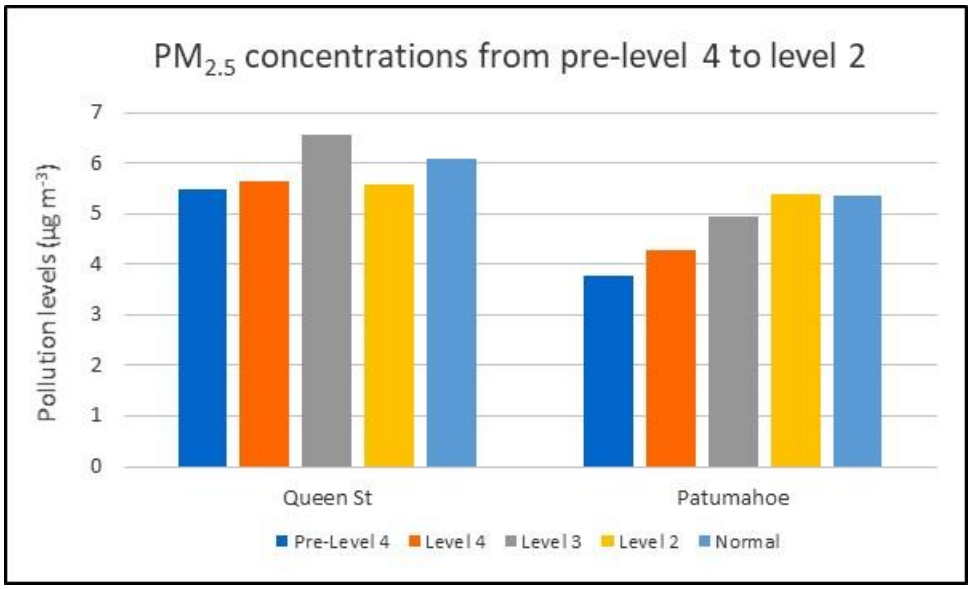

Figure 3. $PM_{2.5}$ levels averaged over week one of alert level 2 (14 – 20 May), as compared to Pre-Level 4 (12 – 25 March), Level 4 (26 March - 27 April), Level 3 (28 April – 13 May) and the same period (i.e., 14 – 20 May) of previous years (normal levels).

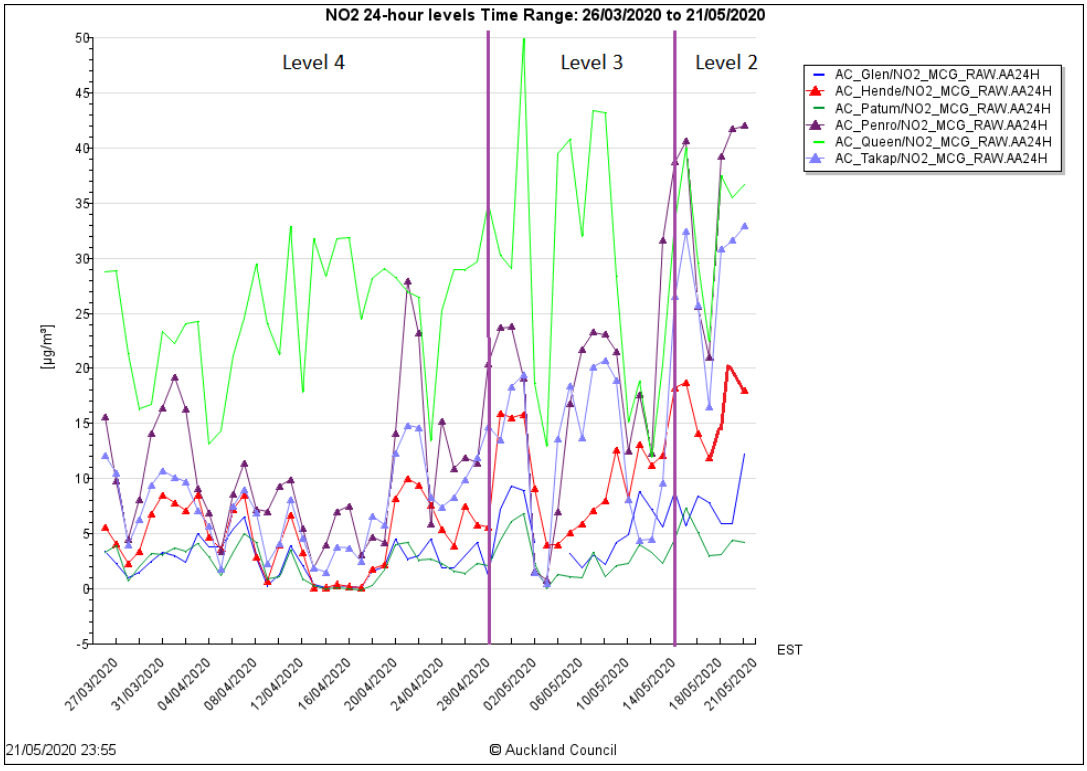

Figure 4. NO_2 24-hour levels from 26 March to 20 May 2020, covering the alert level 4 (26 March - 27 April), level 3 (28 April – 13 May) and week one of level 2 (14 – 20 May) periods.

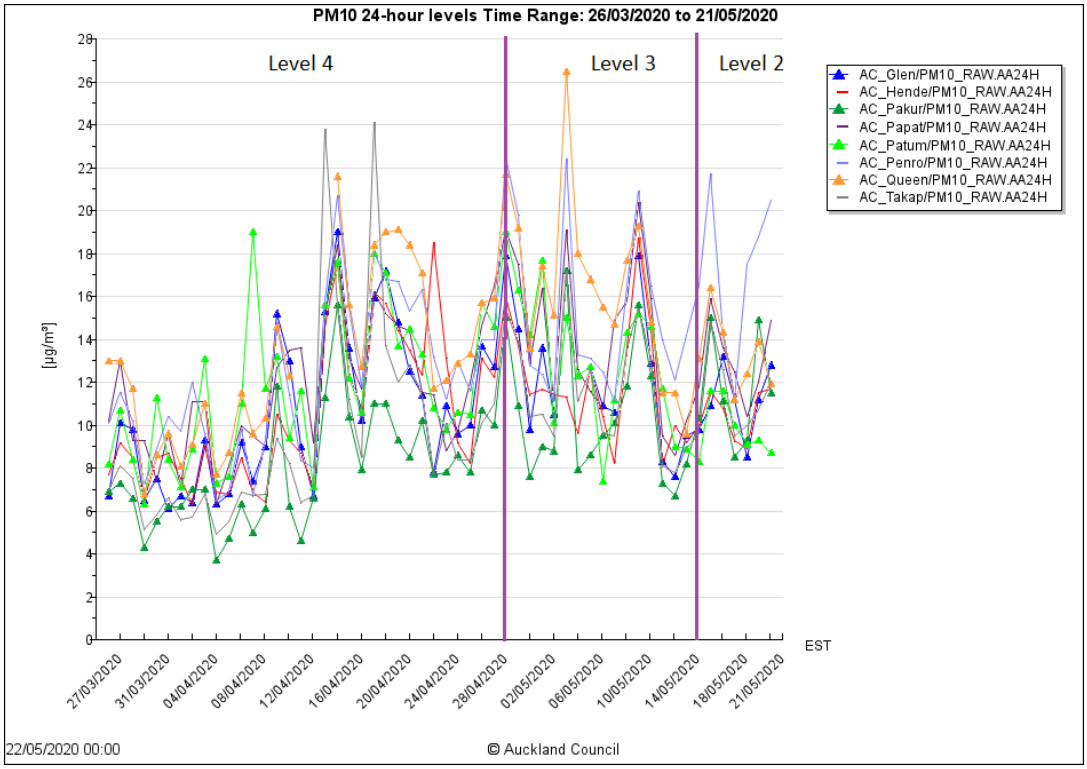

Figure 5. PM_{10} 24-hour levels from 26 March to 20 May 2020, covering the alert level 4 (26 March - 27 April), level 3 (28 April – 13 May) and week one of level 2 (14 – 20 May) periods.

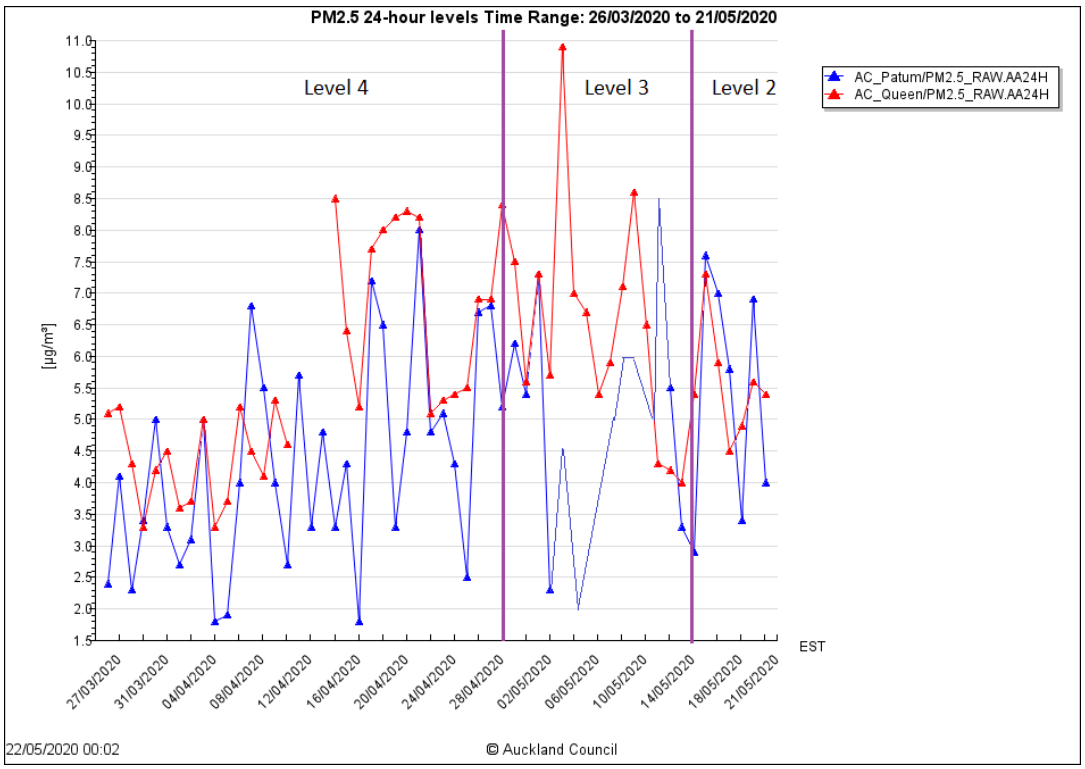

Figure 6. $PM_{2.5}$ 24-hour levels from 26 March to 20 May 2020, covering the alert level 4 (26 March - 27 April), level 3 (28 April – 13 May) and week one of level 2 (14 – 20 May) periods.

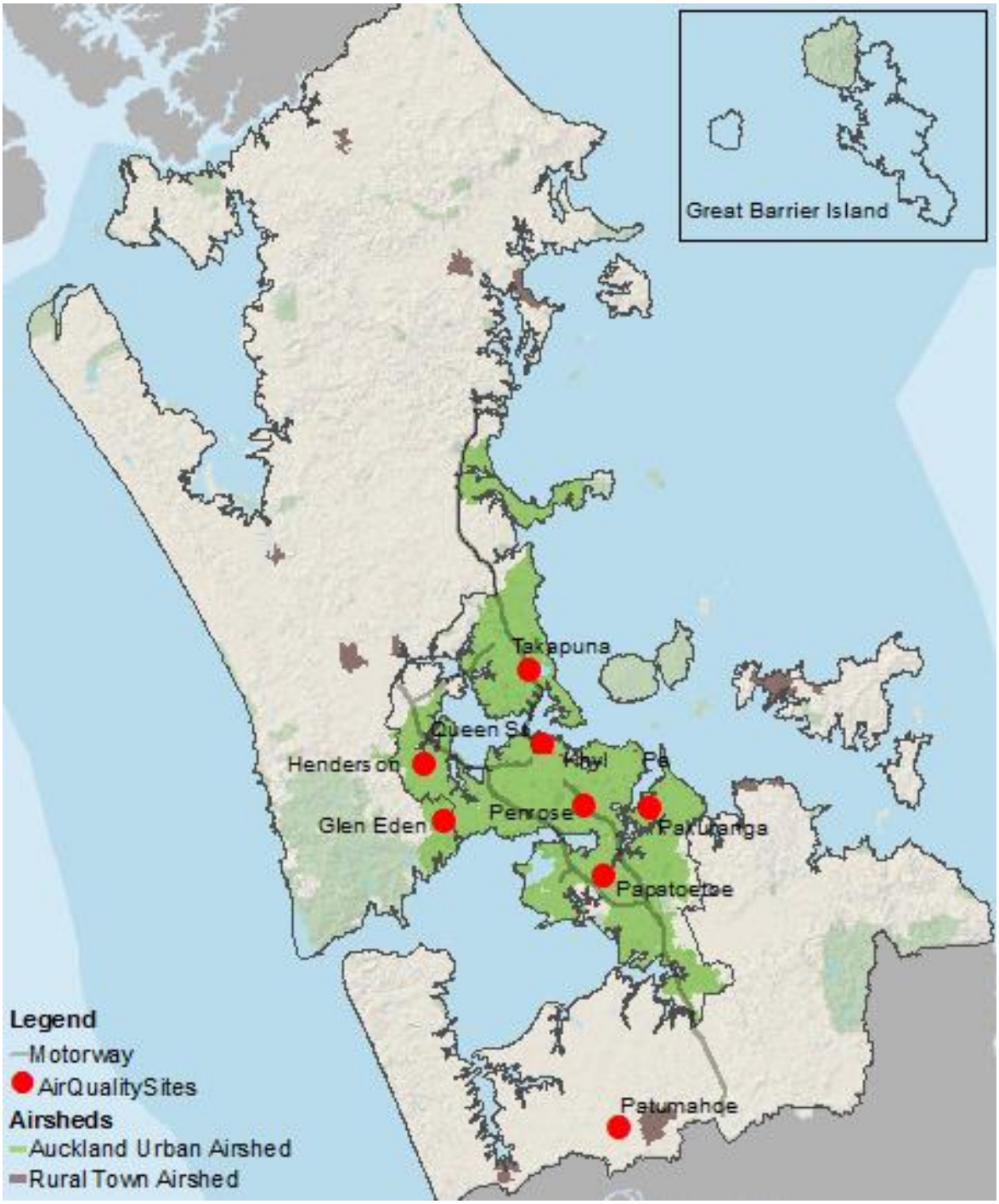

Figure 7. Auckland Council air quality monitoring sites.