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Riwaka $PM_{2.5}$ monitoring addendum

May-August 2022

report for:

Tasman District Council

20 February 2023

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Revision History

No.	Date	Author(s)	Reviewer(s)	Details
1	13 Sep 2022	**Paul Baynham**	**Dr. Brett Wells**	V1.0 Draft report completed
2	16 Dec 2022	**Paul Baynham**		V1.1 Revised draft sent to client
3	20 February 2023	**Paul Baynham**		V1.2 Revised draft sent to client

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1.0 EXECUTIVE SUMMARY

A recommendation from the 2021 winter $PM_{2.5}$ investigation in the Riwaka/Brooklyn areas recommended that monitoring be repeated at a representative site to confirm the validity of the data collected and the findings from the 2021 investigation.

This was because ground temperatures in 2021 were higher than that of previous years and there were concerns regarding the impact that COVID restrictions may have had on the data as well as anecdotal comments from some residents that there had been less smoke than in previous years.

The COVID concerns on $PM_{2.5}$ emissions related to potential reductions in land clearing and burning due to restrictions on the movement of people, reduced planting stock availability and reduced labour availability due to immigration restrictions.

For this reason, a monitor of the same type used in the 2021 investigation was again deployed at the Riwaka East site used in the 2021 investigation. Data was collected from 26 May through to 9 August 2022.

A comparison of the data found that the peak 24-hour $PM_{2.5}$ concentrations 2022 and 2021 were very similar (11.8 and 12 $\mu g/m^3$ respectively), when the effects from a vegetation fire from 3 June 2021 were taken into account. Similarly the average $PM_{2.5}$ concentrations over the same period were 6.4 and 6.5 $\mu g/m^3$ respectively.

These results suggest that the 2021 and 2022 $PM_{2.5}$ concentrations were comparable and that the findings from the 2021 investigation are valid.

2.0 PROJECT OUTLINE

During the 2021 winter, Tasman District Council deployed a monitoring network in the Riwaka/Brooklyn area.

The focus of the investigation was to assess the concentration of airborne particulate matter (the term of a mixture of solid particles and liquid droplets found in the air). The particulate size fraction of interest included particles with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). The objective of the investigation was to compare peak 24-hour average $PM_{2.5}$ concentrations with the proposed Ministry for the Environment 2020 Standard for $PM_{2.5}$ of 25 $\mu g/m^3$.

The results of the 2021 study confirmed that the peak concentrations of $PM_{2.5}$ complied with the proposed Ministry for the Environment 2020 standard. However, it was noted that above average ground temperatures during the 2021 winter coupled with a reduction in the number of burning complaints and anecdotal comments from residents suggested that the air quality was better than that of previous years. For this reason, it was recommended that additional monitoring be performed at one site in Riwaka during the 2022 winter to confirm (or otherwise) the validity of the 2021 monitoring report and accompanying conclusions. Mote agreed to supply Tasman District Council with a $PM_{2.5}$ monitor for the duration of the 2022 winter at no cost to Tasman District Council.

This report represents a summary of the data collected during the 2022 winter at the Riwaka East site.

2.1 Particle Instrument Selection

The instrument used during the 2022 study was the same as that used during the 2021 investigation. This was a Met One ES642 near-forward nephelometer which was coupled with a programmable modem.

The ES642 produces 1 second data which was collated to produce 1-minute averaged data. The ES642 unit contains an inlet heater which was controlled using a set point of 35% relative humidity. Sample flow rates of 2 litres per minute were calibrated using a DryCal defender immediately following installation of the instrumentation., The flow rate was confirmed at the conclusion of the project and was found to be within 5% of the original flow rate.

Temperature, pressure, and relative humidity sensors were also calibrated using Vaisala HMT330 and HM70 meters following installation to ensure accurate flow measurement.

The instrument stores data locally if cellular transmission is disrupted. When cellular connectivity is restored, then data transmission will recommence with older data transmitted first.

Figure 1: Photograph of the ES642 units co-located alongside the TDC Partisol in Brightwater.

The instrument was co-located alongside other ES642 units that were part of a separate investigation into air quality in Brightwater and Wakefield. The initial co-location occurred over a 12 day period from 12 to 23 May 2022.

The purpose of this co-location was firstly, to ensure that the optical nephelometer was producing consistent data prior to deployment at Riwaka East (degree of precision). The second reason was to enable the optical concentration data to be corrected to gravimetric equivalent (degree of accuracy).

Following the 12-day co-location, the data was adjusted using a linear correction factor to ensure consistent measurements during the monitoring campaign and to verify that the instrumental concentration was comparable to the reference instrument.

The gain was then adjusted, and the instrumental data checked to verify that the values where within +/-2 µg/m^3. A comparison of the instrument data confirmed that the 24-hour average values were within tolerable thresholds.

Standard practice is to replace any instrument which fails to meet this requirement, however following gain adjustment, the instrument met the required degree of precision (24-hour average +/-2 µg/m^3).

2.2 Site Selection

The Tasman District Council identified their preferred location for the Riwaka instrument during the pre-planning phase of the deployment in conjunction with Mote limited. The instrument was mains powered with an RCD trip device installed in the event of an electrical earth fault developing.

The instrument was positioned approximately 3 metres above ground level in eastern Riwaka.

A location map depicting the location of the instrument is shown in **Figure 2**.

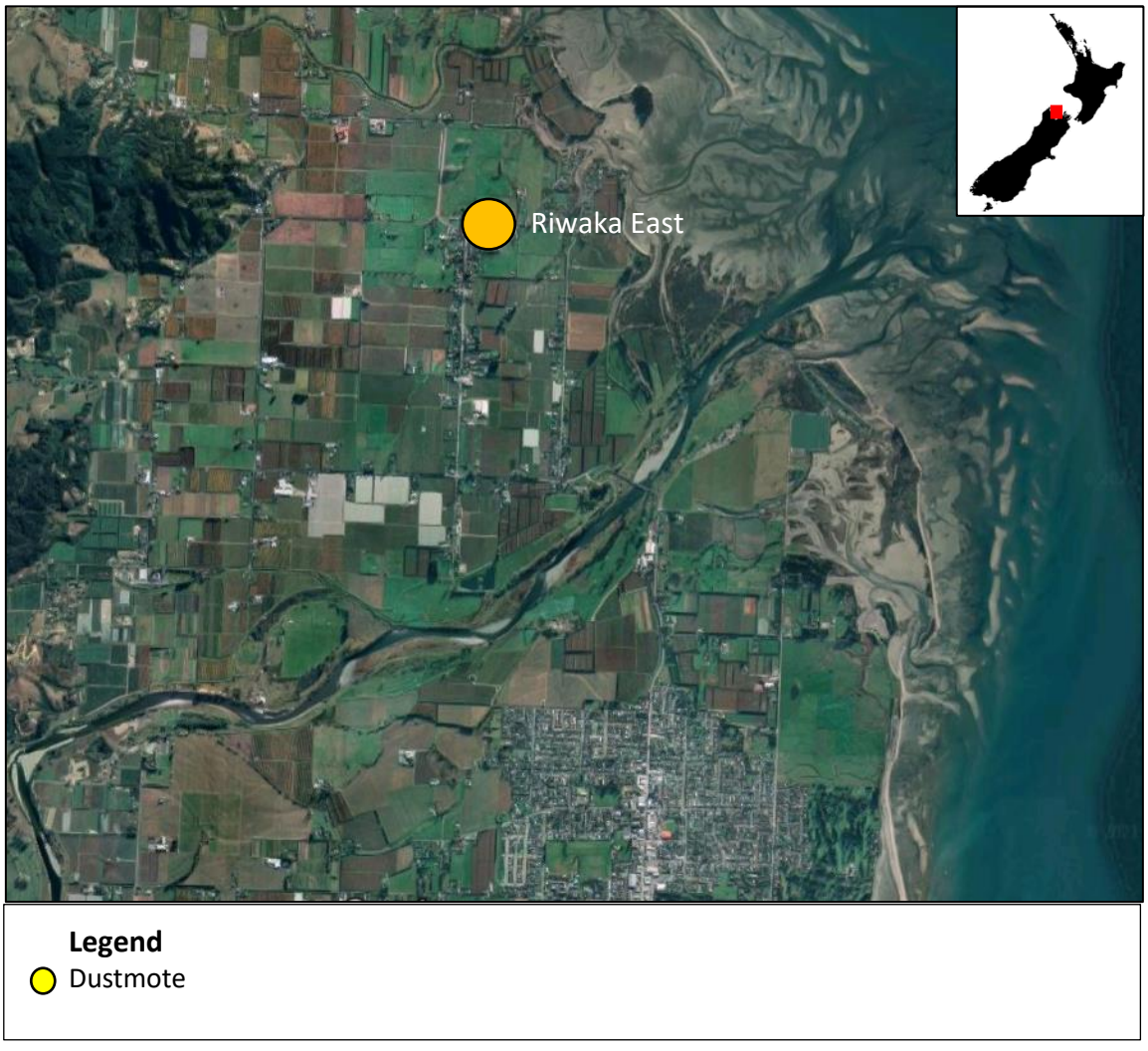


Figure 2: Location map of monitors in the Riwaka area during the winter of 2022.

3.0 RESULTS

The land occupier at the Riwaka East site was given a food voucher for a local supermarket upon the initial installation along with a second food voucher when the instrument was removed.

These vouchers were provided to compensate the landowner for the inconvenience of having an instrument on their property and also in recognition of the small amount of electricity consumed by the device while it was operational.

3.1 Data capture rate

On 26 May, the Dustmote was installed at the designated monitoring location in Riwaka East. The device operated continuously until 9 August when the monitoring concluded.

The overall data capture rate for the investigation was 99.95%.

A validated spreadsheet containing the 1 minute and 24-hour average data from Riwaka accompanies this report. The spreadsheet is named **Riwaka_Data_2022_V1.1.xlsx.**

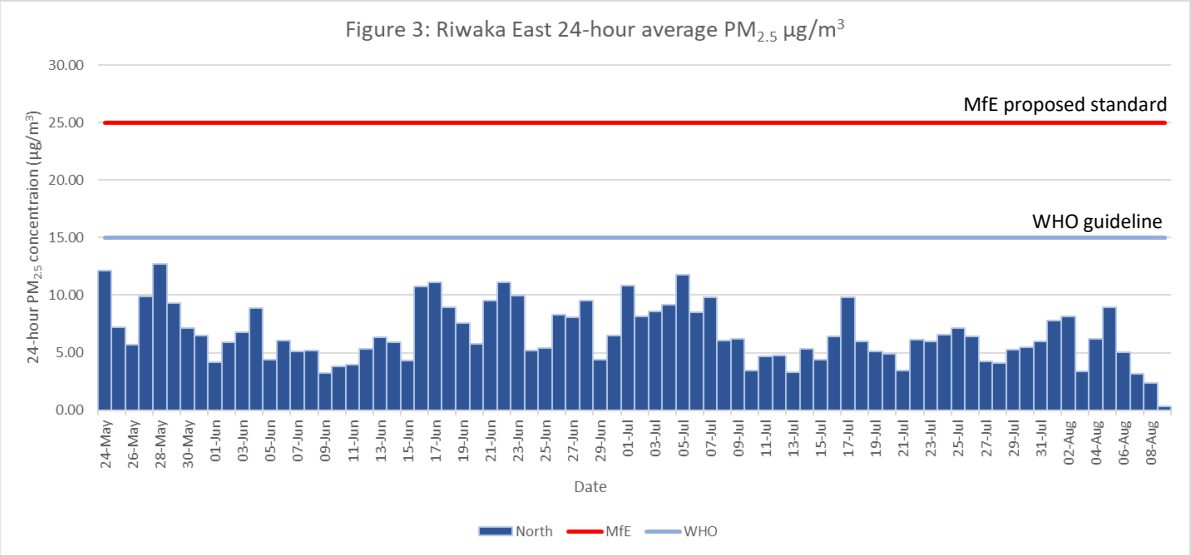
3.2 $PM_{2.5}$ results

Figure 3 below depicts the daily maximum 24-hour $PM_{2.5}$ concentration for the monitoring station at Riwaka. Comparisons are made against the proposed 2020 National Environmental Standard for $PM_{2.5}$ of 25 µg/m3 (24-hour) and the more recent 2021 World Health Organisation guideline of 15 µg/m^3 (24-hour).

The 2022 monitoring confirmed the findings from the 2021 investigation which concluded that the air quality in Riwaka complied with both the Ministry for the Environment proposed 2020 standard for $PM_{2.5}$ as well as the WHO guideline.

The peak 24-hour average $PM_{2.5}$ concentration measured during the 2022 study of 11.8 µg/m^3 which occurred on 5 July 2022 was lower than the 2021 peak concentration of 14.8 µg/m^3 which occurred on 3 June 2021. However, the author understands that there was some vegetation burning around 3 June 2021 which may have impacted upon this peak concentration. For this reason, we note that the 2021 second highest 24-hour average $PM_{2.5}$ concentration of 12.0 µg/m^3 compares favourably with the peak 2022 value measured during the same period (11.8).

Similarly, the average $PM_{2.5}$ concentration for the period (26 May – 9 August) in 2022 was 6.4 µg/m^3 again compares favourably with the average concentration for the same period in 2021 which was 6.5 µg/m^3.



Figures 3. Plot of 24-hour average $PM_{2.5}$ concentration for Riwaka East instrument. The red line indicates the proposed 24-hour National Environmental Standard for $PM_{2.5}$ (25 µg/m^3) while the blue line indicates the World Health Organisation 2021 guideline (15 µg/m^3).

This suggests that the 2021 investigation was representative of typical winter air quality emissions in the Riwaka and Brooklyn areas and the findings from the 2021 investigation were valid.

4.0 CONCLUSION

An additional monitor was deployed in Riwaka East during the winter of 2022 to compare against the data collected in 2021. The purpose of the monitoring was to determine whether the findings from the 2021 study was valid due to concerns regarding warmer weather, the impact of COVID and anecdotal evidence suggesting a reduction in the amount of vegetation being burnt during the 2021 winter.

The result from the winter 2022 monitoring were very similar to that of 2021. The highest 2021 24-hour average $PM_{2.5}$ of 14.8 µg/m^3 concentration which occurred on 3 June 2021 was influenced by a large vegetation fire. The next highest 2021 value of 12.0 µg/m^3 compares favourably with the peak concentration measured during 2022 of 11.8 µg/m^3.

Similarly, the average $PM_{2.5}$ concentration for the period (26 May – 9 August) in 2022 was 6.4 µg/m^3. This compares favourably with the average concentration for the same period in 2021 which was 6.5 µg/m^3.

The results of the 2022 survey confirms that the data from 2021 Riwaka/Brooklyn investigation was comparable to that of 2022 and that the findings in this report are valid. It also reaffirms the accuracy and precision of the monitoring techniques used in the 2021 investigation.

5.0 REFERENCES

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