OCEANAGOLD
WAIHI OPERATION

Air Quality
Annual Monitoring Report 2020

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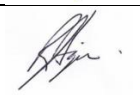
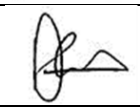
Approvals

OGC Designation	Name	Signature	Date
Environmental Advisor	R Hillyard		28/05/2021
Senior Environmental Advisor	R Squire		31/05/2021
HSE Manager	D Calderwood		28/05/2021

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EXECUTIVE SUMMARY

This report provides a review of the air quality monitoring programme carried out by OceanaGold New Zealand Limited (OGNZL) in and around Waihi, and related matters. The report is produced annually to provide a continuing record of the air quality performance of OGNZL. This report covers the 2020 calendar year and is produced in accordance with the Martha, Favona, Trio and Correnso Mines Air Quality Management Plan, 2019.

The information presented mainly relates to OGNZL's routine ambient air monitoring programme, which has been underway since 1982. The 2020 routine monitoring included measurements of total suspended particulate (TSP) and deposited particulate (DP) at 13 sites. There are 6 monitors for TSP and 10 monitors for DP.

Also included in this report are quality assurance measures, the results of any additional air quality monitoring and complaints received, as required by the consent conditions.

The conclusions of the 2020 review are the following:

- No exceedances of the threshold limits or breaches of the trigger levels occurred for TSP or DP during the year.
- OGNZL received one air quality complaint during 2020 (*cf*. nil in 2019).

1. INTRODUCTION

Several Discharge to Air consents (Consent 109741 for the Favona mine, Consent 121697 for the Trio Mine, and Consent 124859 for the Golden Link Project Area) regulate the site air emissions. The requirement to provide an annual written report is a condition in each of the consents and the condition states:

> *The consent holder shall provide to the Waikato Regional Council a written annual report each year that addresses at least the following:*
>
> *(a) A summary of the results of the monitoring required by this consent.*
> *(b) Any environmentally important trends arising from the monitoring programme.*
> *(c) Comments on compliance with all conditions.*
> *(d) Any reasons for non-compliance or difficulties in achieving compliance with the conditions of this resource consent.*
> *(e) Any works that have been undertaken to improve environmental performance or that are proposed to be undertaken in the up-coming year to improve environmental performance in relation to the activities included in this consent.*

This report is prepared to satisfy that requirement. In particular, it gives a review of the air quality monitoring programme carried out by OGNZL at Waihi. The review covers the 2020 calendar year with reference to earlier years as appropriate.

This report also covers other air quality activities including other (non-routine) air quality monitoring, quality assurance measures and any complaints received.

2. AIR RESOURCE CONSENT & AIR QUALITY MANAGEMENT PLAN

The site's Discharge to Air resource consent (Golden Link Project Area consent 124859) authorises OGNZL to discharge contaminants to the air from the surface project area, mine portal, and vent shafts. This consent requires that OGNZL develops an Air Quality Management Plan (discussed below) to address air quality objectives, management and monitoring and which is reviewed and updated at least once every two years. This report is in accordance with the 2019 Air Quality Management Plan which was approved by Waikato Regional Council (WRC) in September 2020; the 2019 Plan is the latest approved version.

The Air Quality Management Plan is the guiding document for air quality management at OGNZL, the contents of which are defined in the consent. If there is a conflict or inconsistency between the conditions of the consent and the provisions of the Air Quality Management Plan, the Discharges to Air resource consent shall prevail.

The Discharges to Air resource consent prescribes various process-type measures to reduce atmospheric emissions and assessments of environmental impacts. The resource consent also sets down the required content of this report.

A requirement of the Air Quality Management Plan is to specify air quality control measures. To meet this requirement OGNZL have adopted the concept of "trigger levels" as being ambient concentrations of air pollutants of concern, rather than ambient air quality guidelines that were more commonly used previously in air quality management. The trigger levels are set at about two-thirds the level of previous limits, and they are recorded in the Air Quality Management Plan.

When the trigger levels are exceeded OGNZL is required to investigate and report on the reason for the elevated result and identify corrective action(s) to prevent a repeat occurrence where possible. The ambient air "trigger levels" specified in the Air Quality Management Plan are:

Table 1: Air quality parameters & trigger levels

	Total suspended particulate	Deposited particulate
Sample period	7-day average	30-day average
Unit of measure	µg/m^3	g/m^2/month
OGNZL trigger level	45	4

3. ROUTINE MONITORING PROGRAMME

There are two types of dust measurement included in the routine ambient air monitoring programme: total suspended particulate and deposited particulate.

Although not part of the routine monthly/weekly monitoring programme, PM_{10} and silica monitoring has in the past been done biennially. After years of data collection by both OGNZL and WRC (with results within accepted limits), monitoring for PM_{10} and silica has been suspended, with a provision to reinstate a programme if/when considered necessary.

3.1 Monitoring Sites

Details of all 2020 dust monitoring sites are given in Table 2. During the calendar year, there have been a total of 13 sites in use for the routine monitoring programme (Figure 1).

Table 2: Description of 2020 Permanent Monitoring Sites

SITE NO	Description	Location	Total Suspended Particulate (TSP) and/or Deposited Particulate (DP)
6.59	Alexanders, Golden Valley	N of Devt Site	DP
6.60	Torrens, Golden Valley	N of mill	DP
6.61	OGNZL (Leaches), Grey St	NE of pit	TSP and DP
6.63	OGNZL Met Station, Barry Rd	SE of pit	TSP and DP
6.64	Court House, Haszard Street	S of pit	TSP
6.65	Moresby Avenue	SW of pit	TSP
6.66	Waihi College, Rata Street	W of pit	TSP and DP
6.70	Smith's Farm, Trig Road	E of Devt Site	DP
6.71	Morrisons Farm, Trig Road	SE of Devt Site	DP
6.72	Ruddock's Farm, Baxter Road	W of Devt Site	DP
6.74	Bulltown Road	N of pit	DP
6.75	TSF-East	E of Devt Site	DP
6.78	Cnr Grey & Slevin Streets	E of pit	TSP

NB:

1. Control sites at Katikati and Paeroa have been periodically installed, most recently in 2012/2013. Results have been similar to Waihi.
2. A comparison site (# 6.75) has been monitored throughout 2017-2019 at a location near Site# 6.70, with a view to decommissioning Site# 6.70 and replacing it with the compared site. The results of this monitoring showed that the two sites were comparable and subsequently Site#6.70 was decommissioned in September 2020; Site# 6.75 was established as a permanent monitoring site in its place.

Figure 1: Waihi Dust Monitoring Sites

3.2 Quality Assurance

There are two key aspects of the quality assurance programme – gas meter calibrations and balance calibrations.

- The TSP gas meters at the suspended particulate monitoring sites were replaced with new calibrated units on 26 July 2020.

- OGNZL's Precisa XT220A balance was calibrated on 24 June 2020. "Best accuracies" levels for the balance of up to 0.0009g were determined in the 0-40g calibration range. These are considered satisfactory.

3.3 Quality Control

One TSP monitor was affected during 2020, for two monitoring intervals:

- One pump (TSP 6.65 Martha St) experienced an electrical failure across two monitoring periods (weeks ending 20 March and 27 March 2020, respectively). The faults were repaired by an electrician and no further issues were identified during the reporting period.

Five DP samples were contaminated during the year:

- Five samples were contaminated with organic material (primarily bird droppings, but also including considerable leaves) and were unable to drain through the filter.

3.4 Relocation of DP site

In 2019, OGNZL proposed that DP 6:66 (Waihi College) be relocated to a nearby location as the location no longer met the *AS/NZS 3580.1.1:2007 Guide for Siting Air Quality Monitoring Equipment*. The original DP site is now overshadowed by mature trees and the recommended relocation provided the necessary open-air space to comply with the standard's siting criteria for DP monitors. This proposal was put forward in the 2019 Air Quality Management Plan and was approved in September 2020. The relocation of DP 6:66 took place at the end of the reporting period for November 2020; results for December onwards are generated from the new site.

3.5 Impacts of COVID-19 on TSP and DP Monitoring

During the 2020 reporting period, monitoring for both DP and TSP were disrupted due to the Covid-19 lockdown period from March – May 2020.

- All DP sites were unable to be sampled at the end of March due to the lockdown restrictions. Monitoring across all DP sites recommenced in April 2020.
- All TSP sites were switched off and unsampled from week ending 3 April 2020 to 1 May 2020 due to the lockdown restrictions. Monitoring of TSP sites resumed as scheduled for week ending 8 May 2020.

4. SUMMARY OF RESULTS

4.1 Total Suspended Particulate

The results of the weekly TSP monitoring are given in Figure 2 and Appendix 1.

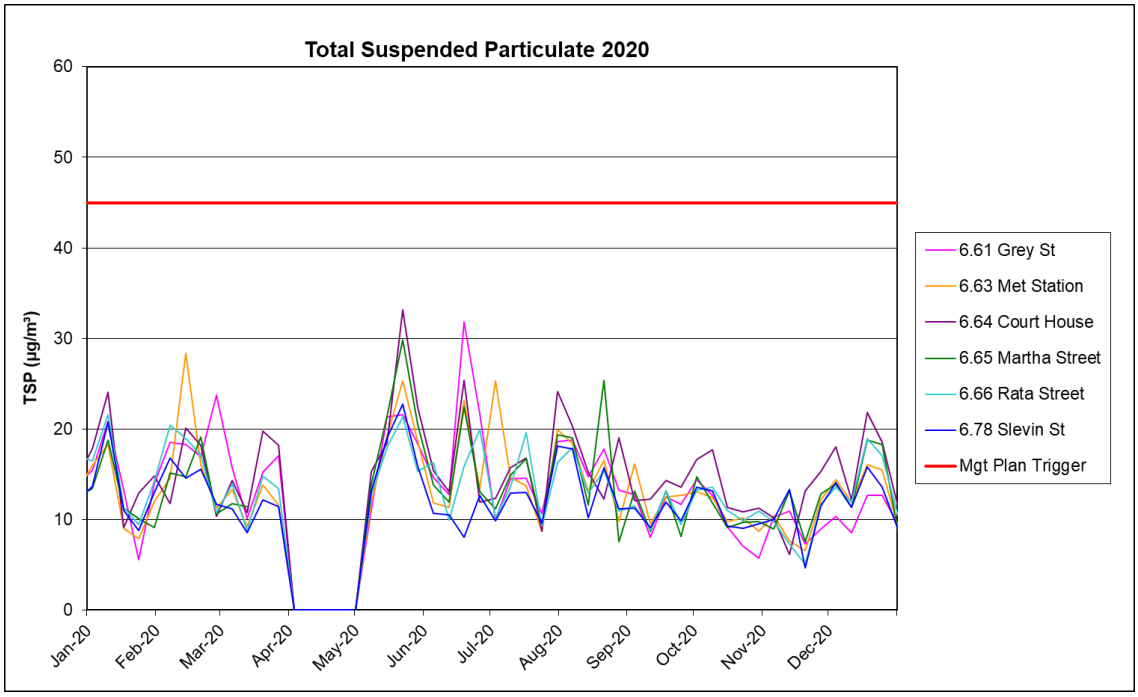

Figure 2: Total Suspended Particulate Results for 2020

No results exceeded the OGNZL TSP trigger level of 45 µg/m^3, seven-day average during 2020. The highest recording during the year was 33.2 µg/m^3 at the 6.64 Courthouse monitor for the week ending 22 May (no other monitor exceeded 30 µg/m^3 during the week concerned). This week showed an increasing trend in TSP concentrations across all monitoring sites which may be related to a sharp drop in temperature compared to with the previous week (mean weekly temperature 8.8˚ C and 13.2˚ C, respectively). This decrease in temperature could have led to an increase in house-hold heating during the monitoring period which may have contributed to these results. Previous year's results show a general trend of higher TSP concentrations during autumn and winter months. The average weekly reading across all sites was 13.9 µg/m^3 (*c.f.* 12.6 µg/m^3 in 2019).

4.2 Deposited Particulate

The results of the monthly DP monitoring are given in Appendix 2 and Figure 3.

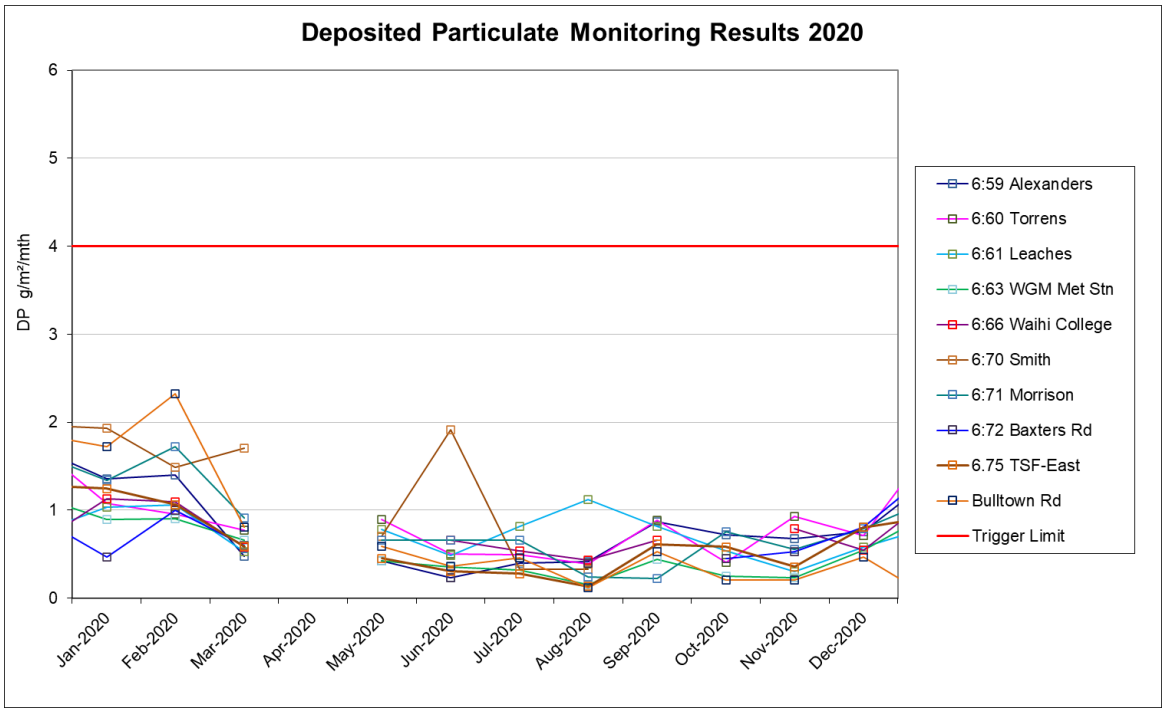

Figure 3: Deposited Particulate Results for 2020

No results exceeded the OGNZL DP trigger limit of 4 g/m^2/month during the reporting period. The highest recording during the year was 2.3 g/m^2/month at the Bulltown Rd monitor (for the month of February) – this site historically shows higher concentrations of dust during the month of February and this value is consistent with past values. No other site exceeded 2.0 g/m^2/month for the reporting period. The average monthly reading across all sites was 0.7 g/m^2/month (*c.f.* 0.9 g/m^2/month in the previous year).

4.3 Trends

The criteria of air quality trigger levels have applied for 23 years and the dust concentrations appear to be below those trigger levels most of the time. It can be concluded that the air quality in and around Waihi is not deteriorating.

Figure 4 shows the long-term results of the TSP monitoring. The phases of active mining activities do not seem to have been reflected in corresponding changes in TSP levels, indicating that control measures during mining have been effective. Since 2005 the Waihi monitoring network has returned a range of 0.2 to 84.9 µg/m^3 with a weekly average of 12.6 µg/m^3.

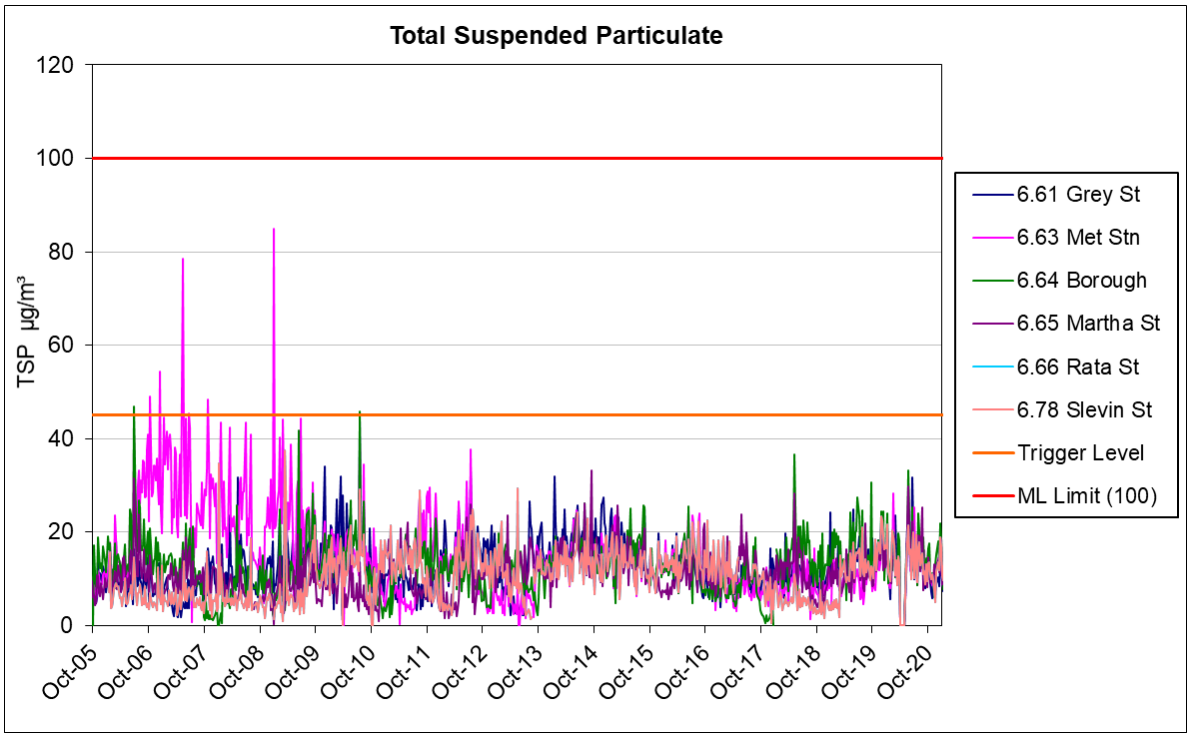

Figure 4: Total Suspended Particulate Trends 2005 to 2020

Figure 5 shows the long-term DP results from the Waihi monitors. The 2020 results show a decreasing trend and compare well with results from the previous years (which range from 0.02 to 4.3 g/m²/month with an average of 0.9 g/m²/month).

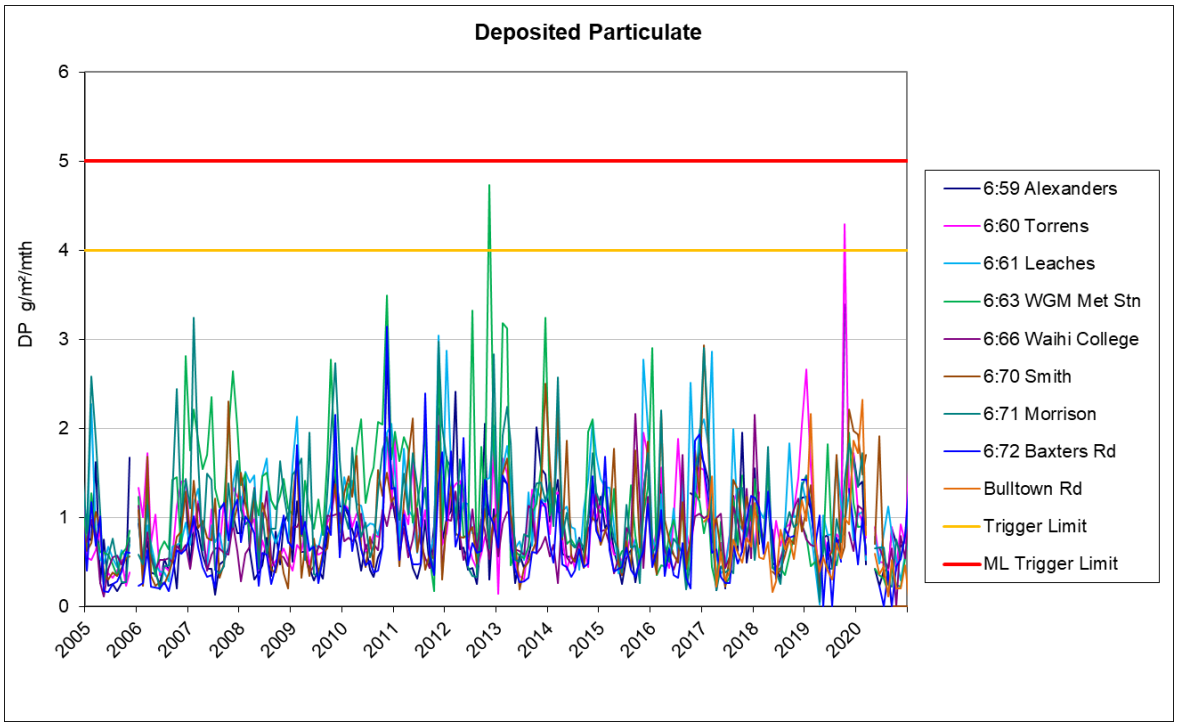

Figure 5: Deposited Particulate Trends from 2005 to 2020

4.4 Discretionary Deposited Particulate Monitoring

One discretionary monitor was in place in 2019 and became a permanent monitoring site in 2020

- A dust bucket (6.75) was maintained near the eastern side of TSF1A to compare data to the Smith's bucket. The revised Air Quality Management Plan submitted in December 2019 discussed the comparative data and proposed to replace the Smith's 6:70 sample site with the new site. This replacement came into effect in September 2020 when Smith's 6:70 sample site was disbanded.

4.5 PM_{10} and Silica Monitoring

PM_{10} and silica community monitoring was not conducted in 2020. Along with the suspension of production mining in the open pit, it has been agreed with WRC that PM_{10} and silica monitoring can be suspended until such time that it is considered necessary.

5. COMPLIANCE WITH CONSENT CONDITIONS

5.1 Complaints

Complaints about dust, smoke and blasting odour are matters of concern to OGNZL. No complaints were received in relation to the above parameters; however, one complaint in relation to air quality was received in 2020. The complainant was concerned about the use of glyphosate herbicide (Round-Up) being sprayed to remove weed species around the Pit Rim Walkway. Signs were placed in the working area to inform public of the activity, however the complainant advised that these were not seen. As a mitigating action for future works, extra signage is used at entry and exist points of the walkway to ensure the public are aware of spraying in the area.

Details of any complaints or concerns received by OGNZL are recorded in a complaints/concerns register, along with information about any follow-up action. The register covers complaints on all operational matters, not just air quality, and has been in use since 1987.

The number of complaints received about air quality each year are recorded in the register and listed in Table 3.

Table 3: Air Quality Complaints Recorded in the Company's Register

Year	Number	Year	Number
1987	15	2004	18
1988	6	2005	2
1989	0	2006	3
1990	0	2007	8
1991	2	2008	7
1992	4	2009	5
1993	5	2010	6
1994	6	2011	26
1995	1	2012	11
1996	0	2013	10
1997	0	2014	5
1998	1	2015	7
1999	5	2016	4
2000	10	2017	5
2001	2	2018	2
2002	10	2019	0
2003	5	2020	1

5.2 Mitigation

The 2020 annual rainfall (1639 mm) was significantly less than the historical average of 2110mm. The site was subjected to a prolonged drought in the first half of the year (251mm for the first five months) (Figure 6).

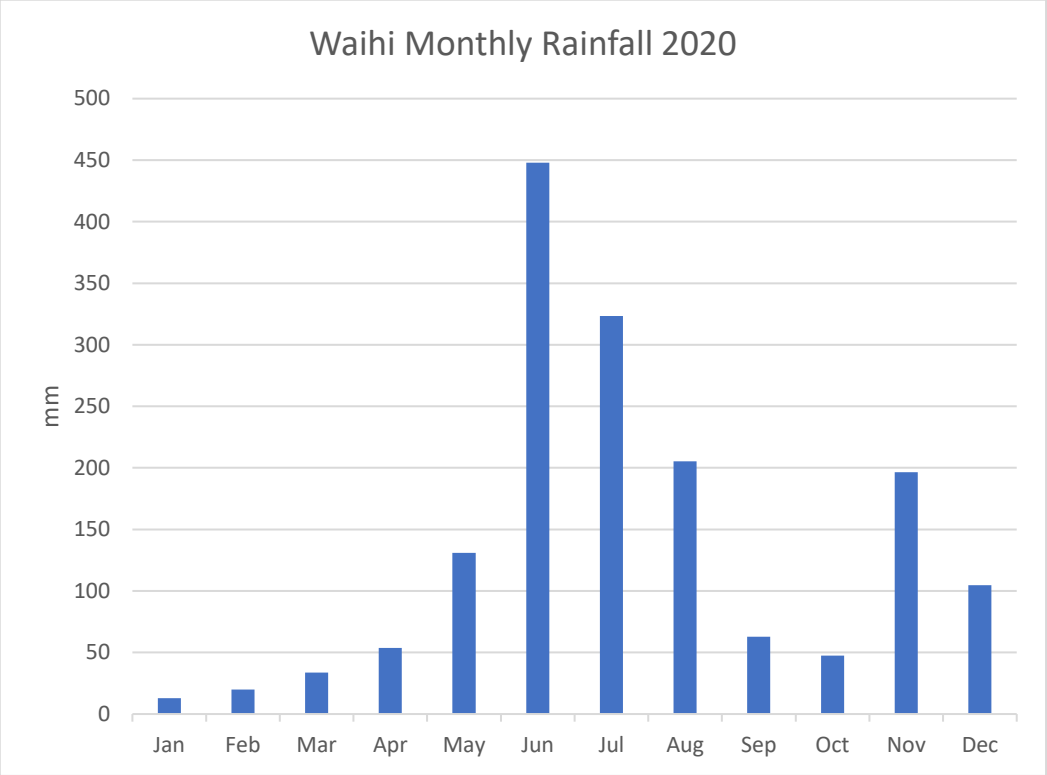

Figure 6: Waihi Monthly Rainfall 2020

The dry periods require OGNZL to be proactive with mitigating any dust emissions occurring from operating areas.

Actions taken to mitigate dust emissions, particularly during dry summer periods, included the use of the sprinklers, watering roads and high activity areas, and the use of irrigation spray systems on stockpiles. Speed restrictions on unsealed roads also reduced dust generation.

5.3 Hydro-seeding, tarsealing and rehabilitation

Hydro-seeding and pasture establishment is normally carried out in response to new earthworks (e.g. pit cutbacks, TSF crest raising). No significant new surface earthworks were carried out in 2020, which resulted in no new hydro-seeding or pasture planting being required.

Minor tarseal repairs occurred on the access road and around the mill; no significant new areas were sealed.

6. OTHER MONITORING

6.1 Personnel Monitoring

Personnel monitoring is also conducted by OGNZL Waihi Mine health & safety team under the guidance of a contract Hygienist as part of the site's occupational health programme. Staff from various departments across site are monitored for personal and atmospheric samples including respirable & inhalable dust, quartz silica, diesel particulate matter (elemental carbon), inhalable silver, gold and selenium, mercury vapour, weld fume, nitrogen dioxide, hydrogen cyanide, volatile organic compounds, ammonium, carbon monoxide, carbon dioxide and sulphur dioxide. No sampling was undertaken in relation to the open pit personnel due to the low level of activity. Exceedances of guidelines that have been measured have undergone an investigative process and statistical analysis is now

part of the risk assessment for air quality. While this monitoring is conducted primarily for health and safety purposes, personnel monitoring for air quality provides additional environmental data and shows due-diligence to the environmental reporting process. A total of 185 personal air samples were achieved during 2020.

7. FUTURE MONITORING

7.1 Deposited and Total Suspended Particulates

Ongoing operational activities followed by rehabilitation activities at Waihi will require dust control activities to be maintained and monitored for some time. There is no current consideration for altering the current DP and TSP programmes.

Two 'real-time' TSP monitors around the open pit are being deployed to provide prompt feedback on TSP levels and, should any triggers levels be activated, will help indicate any mitigating actions to be taken. These are to both be operational in 2021 such that future earthworks in the open pit will have an established real-time system ready in advance. The monitors can also analyse for specific dust fractions (PM_{10}, $PM_{2.5}$, using special cyclones), should the need arise in future.

7.2 PM_{10} and Silica

OGNZL has been undertaking biennial monitoring for PM_{10} and silica and WRC also conducted a continuous monitoring programme for PM_{10} from 2008-2011. Data has indicated that the mine is complying with standards and that Waihi is regarded as a 'complying airshed'. In consultation with WRC, it was agreed that PM_{10} and silica monitoring can be suspended until such time that it is considered necessary. Future decisions will be based on any trends from the ongoing air quality monitoring programmes, as well as the implications of future mining activity.

8. REFERENCES

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Ministry for the Environment, 2004: Updated Users Guide to Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and Other Toxics) Regulations 2004.

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Sinclair Knight Mertz, October 2003: Favona Underground Mine, Waihi, Report to: Environment Waikato – Assessment of Air Quality Aspects. Unpublished report for Environment Waikato.

Watercare Services Limited, February 2012: Newmont Waihi Gold Ltd, Selected Metals (Gold Room Stack) Emission Testing, December 2011. Unpublished report for Newmont Waihi Gold.

Watercare Services Limited, July 2014: Newmont Waihi Gold Ltd, Ambient Air Quality Monitoring Summary Report Jan-April 2014. Unpublished report for Newmont Waihi Gold.

Appendix 1: Total Suspended Particulate Monitoring Results 2020 (µg/m³)

AIR QUALITY
TOTAL SUSPENDED PARTICULATE (TSP) RESULTS
Co-ordinates refer to NZMS 260 T13 Paeroa
All Measurements in µg/m^3

	Above trigger limit (45)
	Near trigger limit (40-45)

Period Ending Date	Year	6.61 Grey St	6.63 Met Station	6.64 Court House	6.65 Martha Street	6.66 Rata Street	6.78 Slevin St
3-Jan-20		15.4	16.0	17.8	13.4	16.5	13.6
10-Jan-20		20.8	18.3	24.1	18.7	21.6	20.7
17-Jan-20		13.3	9.1	9.1	11.3	11.4	11.1
24-Jan-20		5.5	7.9	13.0	10.1	9.5	8.8
31-Jan-20		14.0	12.0	14.8	9.1	14.2	13.0
7-Feb-20		18.6	14.6	11.8	15.1	20.5	16.8
14-Feb-20		18.3	28.3	20.1	14.7	18.9	14.5
21-Feb-20		17.0	16.0	18.2	19.1	17.1	15.5
28-Feb-20		23.7	11.3	10.4	10.6	10.7	11.7
6-Mar-20		15.7	13.3	14.3	11.8	13.9	11.1
13-Mar-20		10.1	9.2	10.8	11.4	8.7	8.6
20-Mar-20		15.3	13.8	19.8	G	14.8	12.2
27-Mar-20		17.0	11.6	18.2	G	13.4	11.4
3-Apr-20		Unsampled due to COVID-19 lockdown					
10-Apr-20							
17-Apr-20							
24-Apr-20							
1-May-20							
8-May-20		11.1	11.8	15.4	13.9	12.7	13.1
15-May-20		21.4	19.2	18.4	21.4	18.0	19.0
22-May-20		21.6	25.3	33.2	29.8	21.4	22.8
29-May-20		18.4	18.6	22.4	20.5	15.3	15.9
5-Jun-20		14.6	11.8	15.4	13.8	16.3	10.7
12-Jun-20		12.7	11.4	13.1	12.0	9.9	10.5
19-Jun-20		31.8	23.2	25.4	22.4	15.9	8.0
26-Jun-20		21.6	13.4	11.9	13.1	19.9	12.7
3-Jul-20		10.0	25.3	12.4	11.2	10.2	9.9
10-Jul-20		14.5	14.7	15.7	14.9	13.6	12.9
17-Jul-20		14.5	13.8	16.8	16.7	19.6	13.0
24-Jul-20		10.7	8.7	8.7	9.3	9.3	9.6
31-Jul-20		18.6	19.9	24.1	19.4	16.3	18.1
7-Aug-20		18.8	18.3	20.2	19.1	17.9	17.8
14-Aug-20		14.7	13.2	15.2	11.6	12.9	10.2
21-Aug-20		17.8	16.5	12.2	25.4	15.4	15.7
28-Aug-20		13.3	9.8	19.0	7.6	10.9	11.2
4-Sep-20		12.7	16.2	12.1	13.2	11.5	11.3
11-Sep-20		8.0	9.5	12.3	8.7	8.9	9.1
18-Sep-20		12.5	12.5	14.3	13.2	13.1	12.0
25-Sep-20		11.7	12.7	13.6	8.1	9.5	9.9
2-Oct-20		14.4	13.0	16.6	14.7	13.3	13.5
9-Oct-20		12.6	12.5	17.7	11.9	13.6	13.2
16-Oct-20		9.2	9.8	11.4	9.1	11.0	9.3
23-Oct-20		7.0	10.2	10.8	9.7	9.9	9.0
30-Oct-20		5.8	8.7	11.2	9.7	10.9	9.5
6-Nov-20		10.3	10.5	10.2	8.9	9.7	10.0
13-Nov-20		11.0	7.6	6.1	13.1	7.3	13.4
20-Nov-20		7.3	6.5	13.1	7.6	5.1	4.6
27-Nov-20		9.0	12.2	15.3	12.9	11.7	11.5
4-Dec-20		10.4	14.4	18.1	13.9	13.6	14.1
11-Dec-20		8.5	11.9	12.2	11.4	11.9	11.4
18-Dec-20		12.7	16.0	21.8	18.8	19.0	15.8
25-Dec-20		12.7	15.5	18.5	18.3	17.1	13.6
1-Jan-21		9.4	9.2	11.4	8.8	10.5	8.9

G	Electrical failure

Appendix 2: Deposited Particulate Monitoring Results 2020 (g/m²/month)

AIR QUALITY

DUST DEPOSITED PARTICULATE (DP) RESULTS 2020

4 g/m²/month	above trigger limit
>3 g/m²/month	Near limit

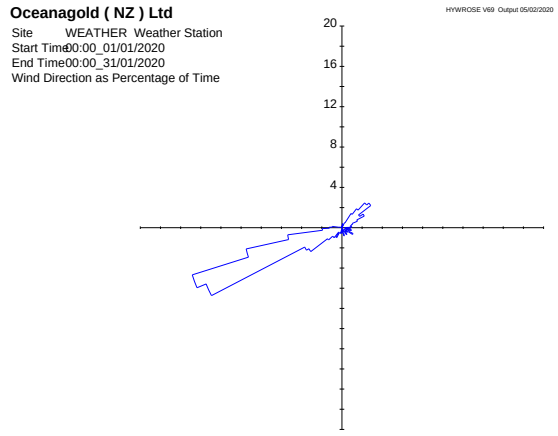
All measurements in g/m²/month

YEAR		Site 6:59	Site 6:60	Site 6:61	Site 6:63	Site 6:66	Site 6:70	Site 6:71	Site 6:72	Site 6:74	Site 6:75
		Alexanders	Torrens	Leaches	Met Station	Waihi College	Smith	Morrison	Baxters Rd	Bulltown Rd	SSPSP RU10
2020	Jan-20	1.4	1.1	1.0	0.9	1.1	1.9	1.3	0.5	1.7	1.2
	Feb-20	1.4	1.0	1.1	0.9	1.1	1.5	1.7	1.0	2.3	1.1
	Mar-20	COVID									
	Apr-20	0.5	0.8	0.5	0.7	0.6	1.7	0.9	0.6	0.8	0.6
	May-20	0.4	0.9	0.8	0.4	O	0.7	0.7	O	0.6	0.5
	Jun-20	0.2	0.5	0.5	0.4	0.7	1.9	0.7	0.2	0.4	0.3
	Jul-20	0.4	0.5	0.8	0.3	0.5	0.3	0.7	O	0.5	0.3
	Aug-20	0.4	0.4	1.1	0.2	0.4	0.3	0.2	0.4	0.1	0.1
	Sep-20	0.9	0.9	0.8	0.4	0.7	DB	0.2	O	0.5	0.6
	Oct-20	0.7	0.4	0.5	0.2	O	DB	0.8	0.5	0.2	0.6
	Nov-20	0.7	0.9	0.3	0.2	0.8	DB	0.6	0.5	0.2	0.4
	Dec-20	0.8	0.7	0.6	0.5	0.5	DB	0.8	0.8	0.5	0.8

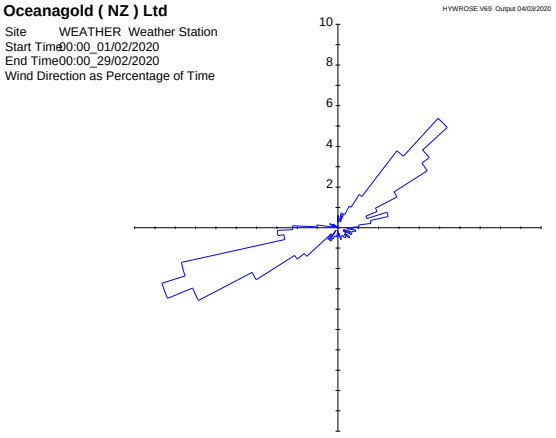
CODE	DEFINITION
O	Organics, unable to filter
DB	Disbanded

Appendix 3: 2020 Monthly Wind Roses, Waihi

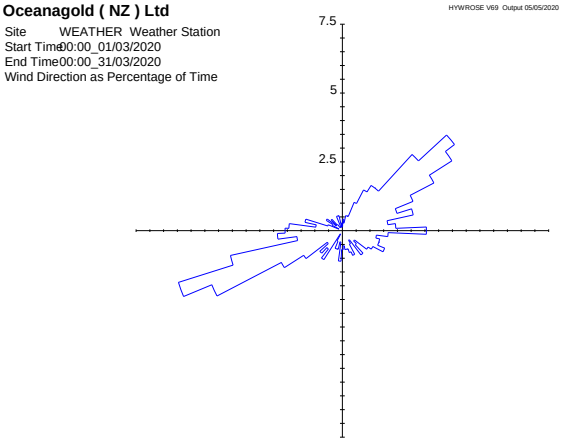
Jan 20



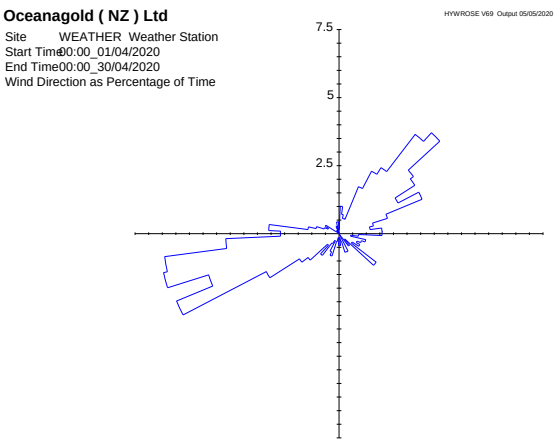
Feb 20



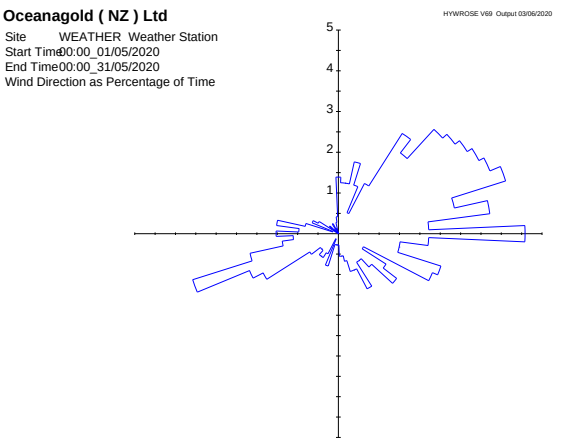
Mar 20



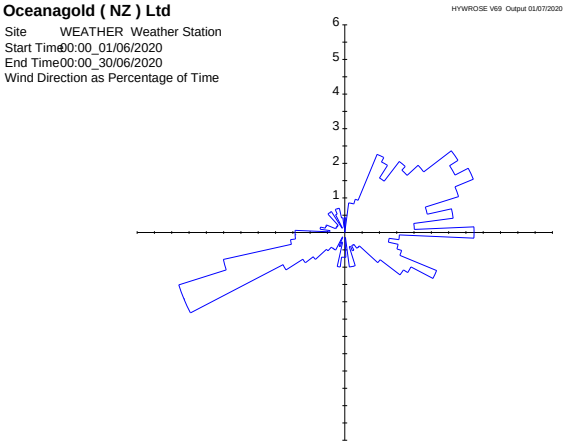
Apr 20



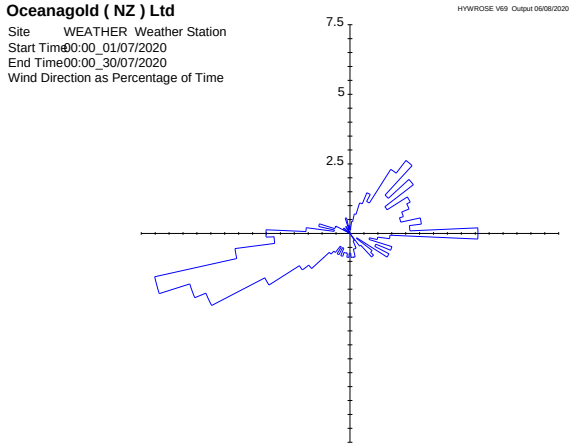
May 20



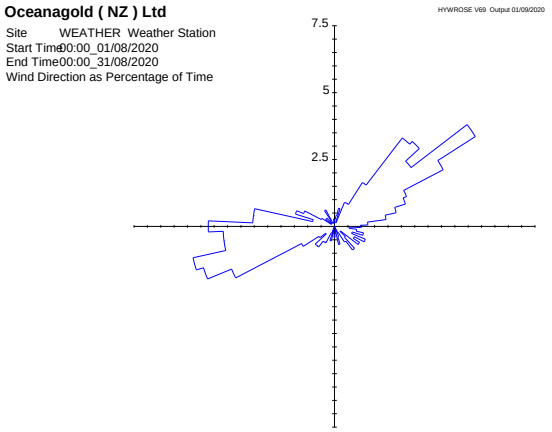
Jun 20



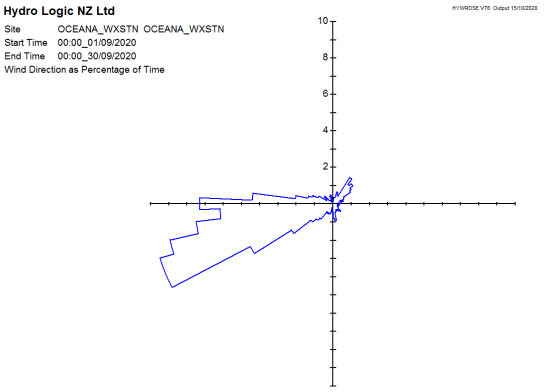
Jul 20



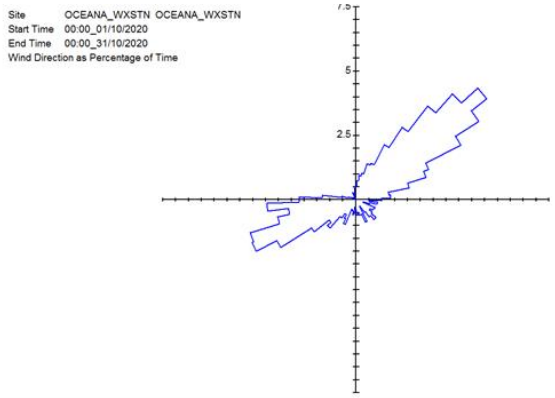
Aug 20



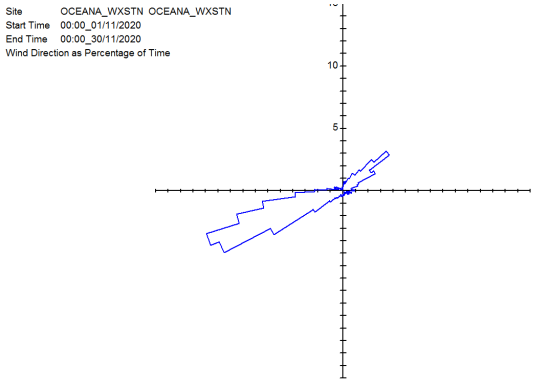
Sep 20



Oct 20



Nov 20



Dec 20