Heron Resources Limited
Tarago Operations Pty Limited

Woodlawn Mine

SML 20

Summary of Environmental Monitoring Data

Environmental Protection Licence Number 20821

Project Approval 07_0143MOD2

Record Update – 31 July 2018

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1. Introduction

1.1 Introduction

Tarago Operations Pty Ltd, a wholly owned subsidiary of Heron Resources Limited, holds Environment Protection Licence 20821 (EPL 20821) issued by the Environment Protection Agency (EPA) under the Protection of the Environment operations Act 1997 (the Act) and operates under the conditions of Project Approval 07_0143MOD2 granted by the NSW Department of Planning and Infrastructure for the Woodlawn Mine Project. This report has been prepared to satisfy the reporting requirements of the Act as directed by the EPA and also for Condition 11, Schedule 6 of the Project Approval.

This report summarises environmental monitoring results for the Woodlawn Mine for the period 1 – 31 July 2018. Historical depositional dust results recorded by Veolia since January 2015 are included in Appendix A to this report to provide a background air quality baseline.

A summary of the EPL information is provided in the following tables. Table 1 shows the licence information and Table 2 summarises the frequency and units for monitoring data for the reporting period.

Table 1. Licence information

Environment Protection Licence number	20821
Licensee	Tarago Operations Pty Ltd
Licensee address	Level 7, Suite 702 191 Clarence Street SYDNEY NSW 2000
Premises	Woodlawn Mine Project 507 Collector Road TARAGO NSW 2580
Link to full licence on the EPA website	http://app.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=115339&SYSUID=1&LICID=20821
Link to Notice of Variation of EPA licence	http://app.epa.nsw.gov.au/prpoeoapp/ViewPOEONotice.aspx?DOCID=-1&SYSUID=1&LICID=20821
Complaints Telephone Number	Sydney Office (02) 9119 8111 Woodlawn Office (02) 9119 8140

Table 2. Supporting information of EPL monitoring requirements

Parameter	Monitoring site	Monitoring frequency	Unit of measure
Air quality monitoring: Deposited Dust (insoluble solids)	DG 22*, DG28*, DG33* DG34	Monthly	g/m^2/month
TSP	HVAS-1	24 hours every six days	µg/m^3
PM10	HVAS-2	24 hours every six days	µg/m^3

*Monitoring undertaken by Veolia

1.2 Explanation of units of measurement

- **mg/m^3** = milligrams per cubic metre
- **g/m^2/month** = grams per square metre per month
- **µg/m^3** = micrograms per cubic metre
- **Day** = 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays
- **Evening** = 6pm to 10pm on any day
- **Night** = 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays

1.3 Abbreviations

- TOP – Tarago Operations

2. Meteorological Monitoring

Heron is required to undertake meteorological monitoring on site. Veolia operate an approved weather station (EPA licence 11436, Point 9). As weather may influence monitoring results for dust and noise a summary showing the rainfall, temperature, evaporation and average wind speed for the three months May to July is detailed in Table 3. The July daily weather statistical data is shown in Appendix 2. It is noted that between 9th and 17th May, and on 9th June and 17th July the weather station experienced some outages.

Seasonal conditions have cooled. Soil moisture deficiencies continue with only 5.5mm rain falling in July. The autumn vegetation growth flush did not occur due to low rainfall and higher than normal temperatures so ground cover is low. Cold weather has now become established and the plant growth index is extremely low. Likewise, the soil water index is extremely low. The NSW DPI have reported that the southeast region is in 'drought'. The combined drought indicator conditions for Werriwa Parish at 10 Aug 2018 are as follows:

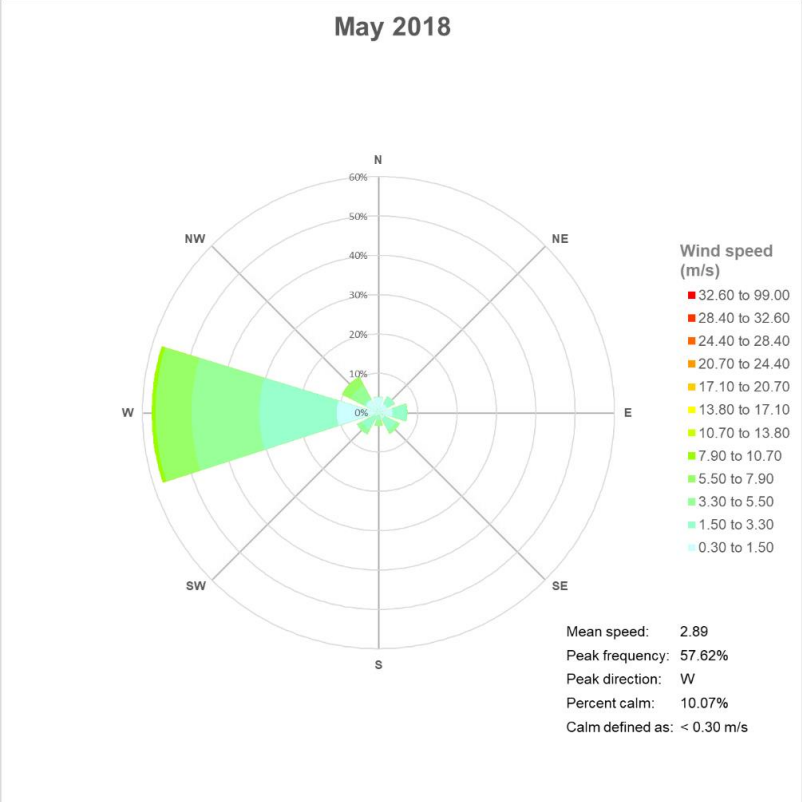
Combined Drought Indicator: Drought
Drought Direction Index: 0.1 (Range -60 to 60)
Plant Growth Index: 2.7 (range 0 – 100)
Rainfall Index: 16.6 (Range 0-100)
Soil Water Index: 2.3 (Range 0-100)

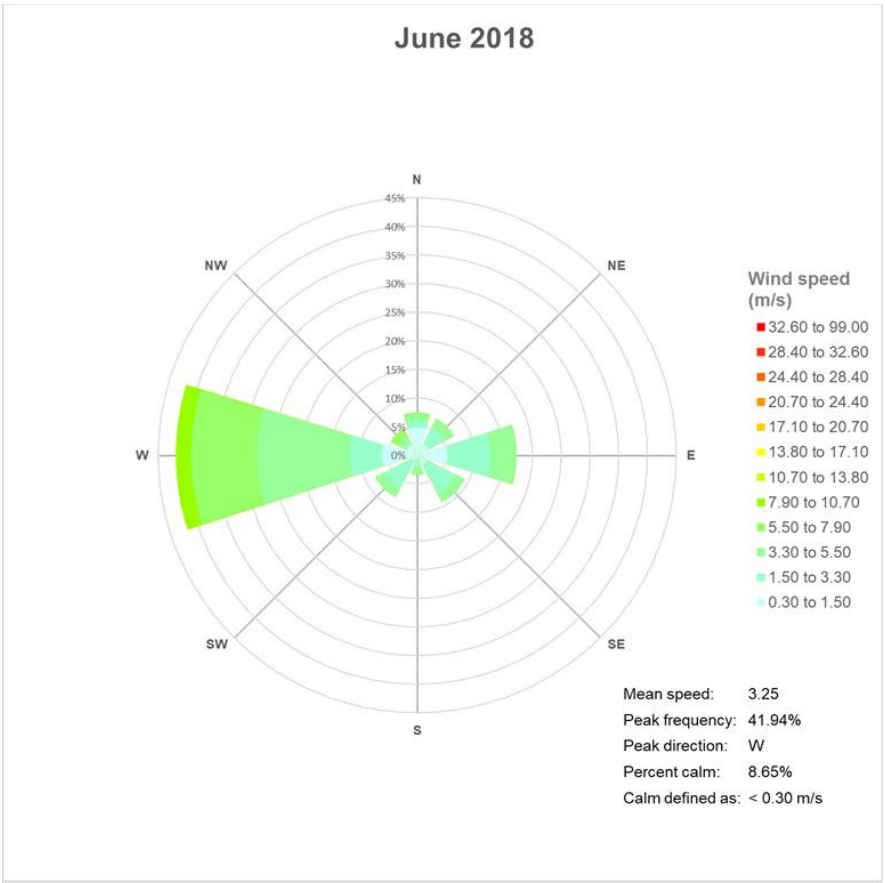
Source: https://edis.dpi.nsw.gov.au/

Table 3. Summary of weather conditions for previous 3 months (May 2018 – July 2018)

	May	June	July
Total rainfall (mm)	15.0	32	5.5
Total number of wet days	5	12	3
Average maximum temperature at 2m (°C)	15.2	10.3	10.5
Average minimum temperature at 2m (°C)	5.2	3.4	1.9
Average wind speed at 10m (m/s)	2.89	3.25	4.24
Evapotranspiration (mm)	50.1	28.9	46.2

The prevailing wind direction trends for the 3 months May – July 2018 is displayed in Figure 1 using wind roses. The wind roses depict the wind speed and direction recorded at 10 m above ground level. During the three months May - July the winds were predominantly from the west, consistent with the seasonal norm when westerlies dominate during the colder months.





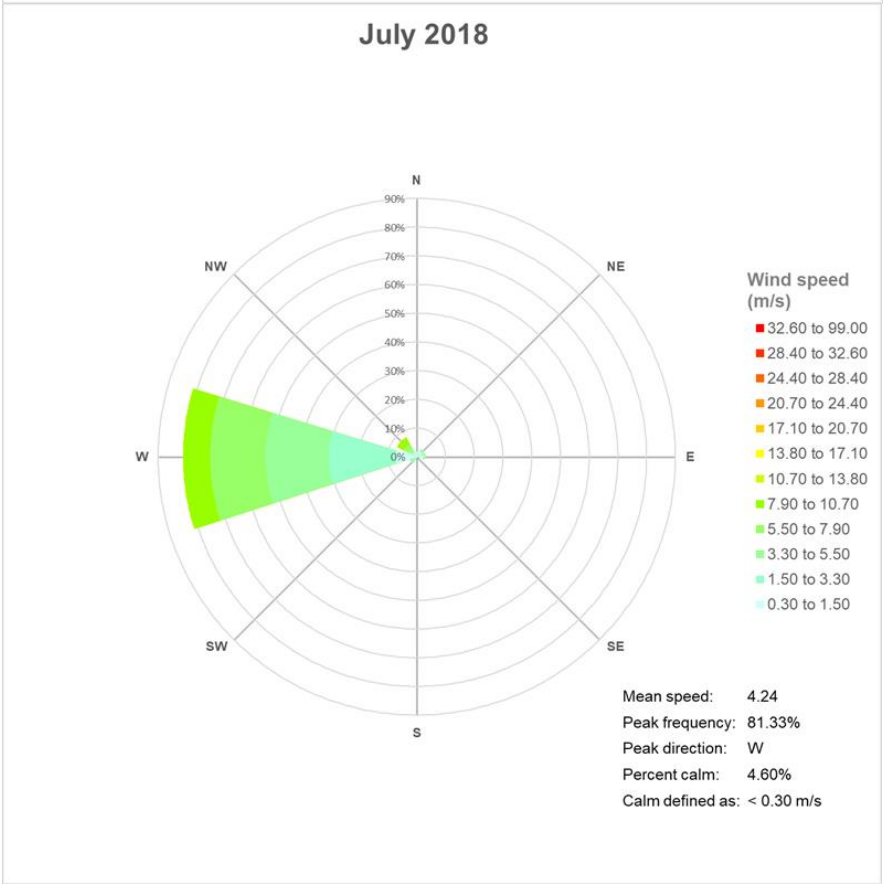


Figure 1. Prevailing wind direction (percentage for month) May - July 2018

3. Air Quality Monitoring

The Air quality monitoring results for Woodlawn Mine are summarised in the following sections.

3.1 Depositional Dust

Depositional dust monitoring around the Woodlawn site is undertaken on a monthly basis. Four depositional dust gauges DG22, DG28, DG33 and DG34 are present to monitor the levels of depositional dust. They are located on Site as follows:

- DG22 – East side of void
- DG28 – Pylara
- DG33 – MBT plant
- DG34 – Behind core shed

DG24, has been used to record dust to the west of the void. Due to construction of the box cut and mine office infrastructure for the new mine the gauge was decommissioned on 31 Jan 2018. The Veolia EPL has been varied accordingly. A new dust gauge, DG34, was installed on 1 Feb 2018. The gauge is positioned west of the void, but in a new location.

Historical monthly raw results for the period January 2015 – Mar 2017 are shown in Appendix A – Historical deposition dust record. The results were recorded by Veolia prior to the issue of Heron's EPL and are presented to provide an indication of the background air prior to commencement of the TOP construction.

The EPA licence for the Woodlawn Mine project was issued on May 2017. The raw results for depositional dust commencing May 2017 are recorded in Table 4.

Table 4. Depositional dust (g/m^2/month - insoluble solids) **recorded since May 2017**

Date sampled	DG22	DG24	DG28	DG33	DG34
May 2017	3.3	0.6	0.8	<0.2	
Jun 2017	1.4	0.4	<0.2	<0.2	
Jul 2017	1.7	0.5	2.4	<0.2	
Aug 2017	3.7	0.5	4.0	0.2	
Sep 2017	4.8	0.8	2.1	0.4	
Oct 2017	3.9	3.0	1.0	0.5	
Nov 2017	5.2	1.9	0.8	0.4	
Dec 2017	2.4	1.9	0.4	0.9	
Jan 2018	5.3	4.7	1.8	1	
Feb 2018	2.4	Decommissioned	1.1	1.4	2.8
Mar 2018	3.7		0.4	1.4	0.7
Apr 2018	8.6		2.7	2.4	1.3
May 2018	1.8		1.6	0.3	1
June 2018	1.6		3.2	<0.2	0.2

A graphical representation of raw depositional dust gauge monitoring results since 1 January 2015 is shown in Figure 2.

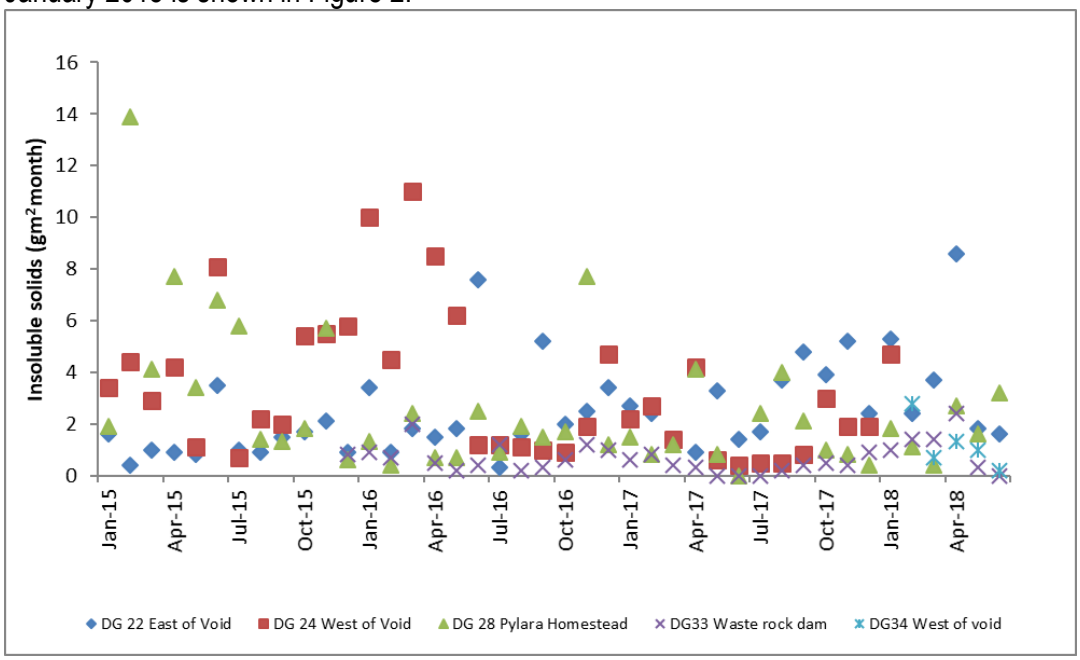


Figure 2. Monthly dust deposition gauge results

Figure 3 shows the annual rolling average for deposited dust (insoluble solids grams per m^2 per month) for the four monitoring sites between Jul 2016 and end Jul 2018.

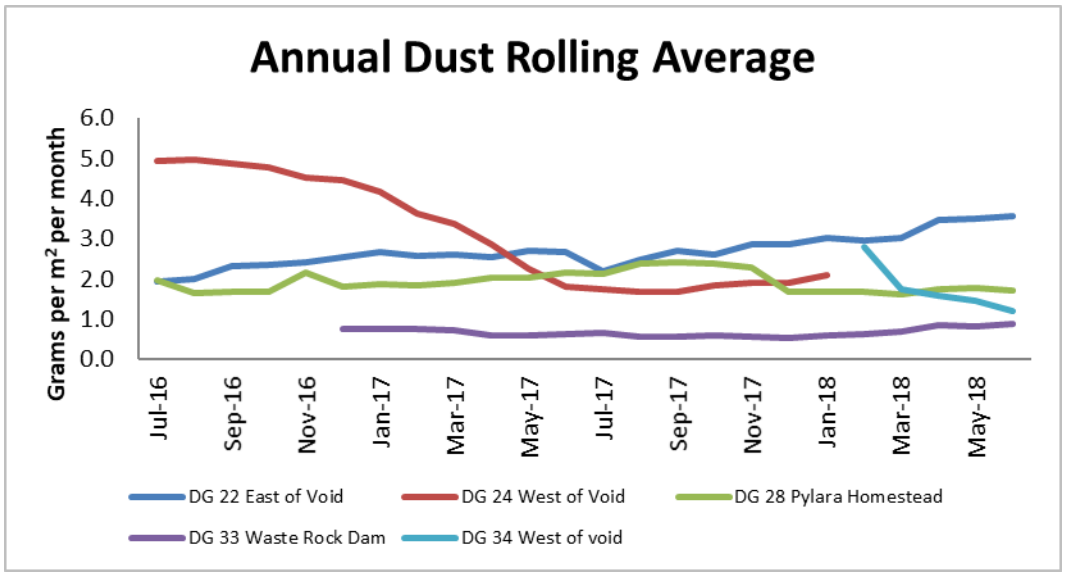


Figure 3. Annual rolling average for insoluble solids (g/m²/month)

The limits for deposited dust are outlined in the Project Approval. The limits are detailed in Table 5.

Table 5. Deposited dust limits

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 g/m²/month	[a]4 g/m²/month

- [a] Total impact (i.e. Incremental increase in concentrations due to the project plus background concentrations due to all other sources).
- [b] Incremental impact (i.e. incremental increase in concentrations due to the project on its own)
- [c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.

Data recorded prior to 14 Sep 2017 is detailed in Appendix A and summarised in Table 6 to show the average background deposited dust levels recorded prior to commencement of construction. The data shows that the annual average for all four depositional dust gauges did not exceed 4 g/m^2/month during the period Jan 2015 to Aug 2017 nor increase the background by more than 2 g/m^2/month.

Table 6. Background deposited dust values for Woodlawn (Jan 2015 – Aug 2017)

	DG22	DG24	DG28	DG33
Individual gauge background average	2.1	3.5	3.0	0.7
Overall background average	2.5			

Average raw deposited dust levels from each gauge for the period since construction commenced (Sep 2017 to June 2018) is shown in Table 7. DG24 was decommissioned on 31 Jan 2018 and DG34 was commissioned on 1 Feb 2018.

Table 7. Average deposited dust values since commencement of construction (Sep 2017 – June 2018)

	DG22	DG24	DG28	DG33	DG34
Individual gauge average	3.97	Decommissioned	1.51	0.97	1.2
Overall average	2.09				

3.2 Atmospheric dust – particulate matter

The Project Approval requires monitoring of total suspended particulate (TSP) matter and particulate matter < 10µm (PM_{10}) to ensure particulate matter emissions generated by the project do not exceed the criteria listed at any residence on privately owned land. High volume air sampling (HVAS) equipment for atmospheric monitoring was installed on 16 October 2017 at Pylara, the nearest residence located to the east of Woodlawn Mine. Monitoring commenced on 17 October 2017 and is undertaken for a 24 hour cycle every 6 days.

Raw results obtained from the HVAS for PM10 and TSP are shown in Table 8 and Figure 4. The rolling 12 month average is shown in Figure 5.

Table 8. Raw results for PM_{10} and TSP

Date start of 24 hour sampling run (7:00am – 7:00am)	PM_{10} µg/m^3	TSP µg/m^3
17 Oct 2017	6.7	14.2
23 Oct 2017	6.7	20.6
29 Oct 2017	8.6	16.8
4 Nov 2017	12.0	22.3
10 Nov 2017	9.5	14.4
16 Nov 2017	13.9	20.6
22 Nov 2017	11.8	20.9
28 Nov 2017	9.1	15.0
4 Dec 2017	8.4	14.5
10 Dec 2017	18.3	27.1
16 Dec 2017	23.7	35.5
22 Dec 2017	18. 6	30.4
28 Dec 2017	22.3	35.5
3 Jan 2018	11.9	17.3
9 Jan 2018	9.5	20.1
15 Jan 2018	8.7	14.2
21 Jan 2018	40.6	69.2
27 Jan 2018	11.4	19.7
2 Feb 18	7.4	13.2
8 Feb 18	19.1	44
14 Feb 18	48.3	102
20 Feb 18	7.3	15.5
26 Feb 18	7.1	10.7
4 Mar 18	8.9	15.9
10 Mar 18	9.2	17.7
16 Mar 18	14.9	31.9
22 Mar 18	6.7	14.4
28 Mar 18	14.9	25.5
3 Apr 18	15	30.1
9 Apr 18	18.5	38.4
15 Apr 18	12.0	42.2
21 Apr 18	18.0	34.1
27 Apr 18	11.6	29.5
3 May 18	19.8	47.5
9 May 18	22.4	40.7
15 May 18	10.1	21.3
21 May 18	8.0	27
27 May 18	24.1	31.9
2 Jun 18	2.7	9.0
8 Jun 18	5.7	12.8
14 Jun 18	4.9	15.8
20 Jun 18	6.6	11.9
26 Jun 18	2.7	4.6
2 Jul 18	6.2	16.8
8 Jul 18	<1.0	3.7
14 Jul 18	5	8.4
20 Jul 18	4.5	14.8
26 Jul 18	6.2	16.8

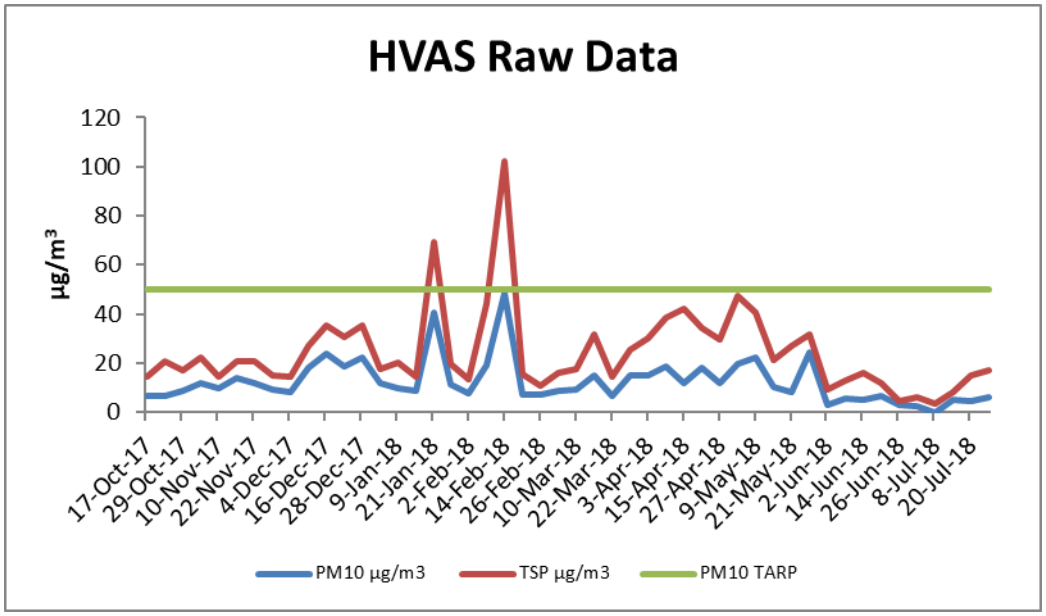


Figure 4. PM_{10} and TSP raw data results

Annual rolling average results for both PM_{10} and TSP are shown in Figure 5.

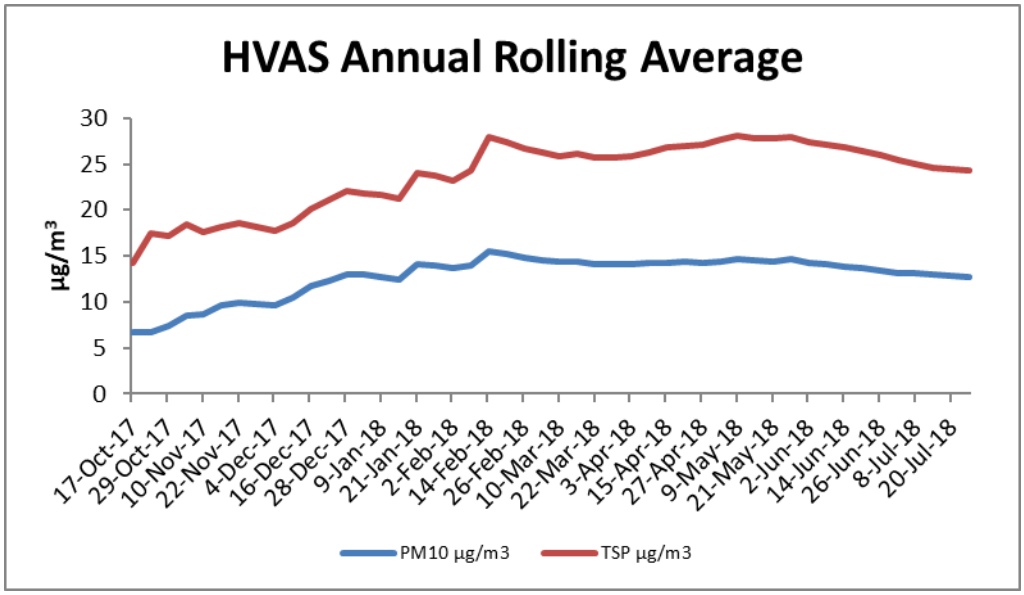


Figure 5. PM_{10} and TSP annual rolling average results

The limits for TSP and PM_{10} are outlined in the Project Approval. The limits are detailed in. Table 9.

Table 9. TSP and PM_{10} limits

Pollutant	Averaging Period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m^3
Particulate matter < 10 µm	24 hour	[a] 50 µg/m^3

- [a] Total impact (i.e. Incremental increase in concentrations due to the project plus background concentrations due to all other sources).
- [d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fog, fire incidents or any other activity agreed by the Director-General.

Compliance summary:
The PM_{10} and TSP results for 24 hour period are within the criteria set out in the PA.

The annual average emissions are within the criteria set out in the PA with the PM_{10} annual average concentration up to 26 June 2018 of 12.68 µg/m^3 and TSP of 24.28 µg/m^3.

4. Noise Monitoring

The noise criteria to be met at any residence on privately owned land is contained in the project approval and described in Table 10.

The EPL requires that the premises must not emit noise exceeding an L_{Aeq}, 15 minute noise level of 35 dB(A) at any sensitive receivers during the operational phase. There are no specified limits covering the construction phase however the Interim Construction Noise Guideline allows for construction activities being undertaken during daytime to be 10 dB(A) above background.

The meteorological conditions to be met during noise monitoring include:

a) Wind speeds up to 3 m/s at 10 m above ground level; or
b) Temperature inversion conditions of up to 3°C/100m and wind speeds up to 2 m/s at 10m above ground level

Table 10. Noise criteria (dB(A)

Receivers	Day/Evening/Night ($L_{Aeq(15minute)}$)	Night ($L_{A1(max)}$)
All residential receivers	35	45

Attended noise surveys were unable to be carried out due to wind exceeding the speed criteria for noise monitoring.

Table 11. Monitoring locations for noise monitoring

Monitoring location	Description
NM1	Pylara - Residence owned by Veolia
NM2	Cowley Hills – Residence owned by Veolia
NM3	Woodlawn – Residence owned by Veolia

Attended noise measurements were undertaken using a calibrated Type 1, Castle Group Ltd dBAir environmental monitor. The noise monitor was run using two measurement profiles as follows:

Measurement 1 – Frequency weighting A, time weighting F
Measurement 2 – Frequency weighting C, time weighting F.

Real time meteorological conditions were obtained at each location using a BL-300 Anemo-thermometer and hygrometer and validated using the authorised Woodlawn on-site weather station. Readings are routinely taken at the Pylara, Woodlawn and the Cowley Hills residences. All locations represent the nearest receptors and are owned by Veolia. The results show that the construction activities have little noise impact on any of the receptor locations.

Compliance statement: The construction program complies with the nominated construction noise guidelines.

5. Blasting

Airblast overpressure and the ground vibration level are required to be monitored for all blasts undertaken during operations. EPL and Project Approval limits at any residence on privately owned land are detailed in Table 12.

Table 12. EPL & Project Approval limits for airblast and ground vibration

Time of blasting	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Any time	120	10	0%
Day	115	5	5% of the total number of blasts over a period of 12 months
Evening	-	2	5% of the total number of blasts over a period of 12 months
Night, and all day on Sundays and public holidays	-	1	0%

No blasting was undertaken during the month of July 2018.

The first blasting operation was carried out on 20 April 2018. This was a test blast. The second operation was carried out on 24 April 2018. Four blast monitors were set up to monitor the blast events. The monitors were located at the following sites:

- Mine High wall
- Mechanical Biological Treatment facility (MBT)
- Pylara homestead
- SW SML boundary

Blast results for each monitoring location are detailed in Table 13.

Table 13. Blast Monitoring Results

Date	Time	Monitor Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)
20/4/18	16.52 hrs	Mine High wall	101	1.25
20/4/18	16.52 hrs	MBT	Nil	Nil trigger
20/4/18	16.52 hrs	Pylara Homestead	Nil	Nil trigger
20/4/18	16.52 hrs	SW Boundary	Nil	Nil trigger
24/4/18	16.52 hrs	Mine High Wall	115.1	2.3
24/4/18	16.52	MBT	106.0	0.58
24/4/18	16.52 hrs	Pylara Homestead	Nil	Nil trigger
24/4/18	16.52 hrs	SW Boundary	Nil	Nil trigger

Compliance statement: Airblast overpressure and ground vibration monitoring results during the two surface blasting operations were recorded below the project limits.

6. Complaints

No complaints occurred during the reporting period.

Table 14. Complaints register

Date and time	Complainant	Nature of complaint	Recorded by	Corrective action	Date closed

Appendix A – Historical deposition dust record

Date sampled	DG22	DG24	DG28	DG33
Jan 2015	1.6	3.4	1.9	
Feb 2015	0.4	4.4	13.9	
Mar 2015	1.0	2.9	4.1	
Apr 2015	0.9	4.2	7.7	
May 2015	0.8	1.1	3.4	
Jun 2015	3.5	8.1	6.8	
Jul 2015	1.0	0.7	5.8	
Aug 2015	0.9	2.2	1.4	
Sep- 2015	1.5	2.0	1.3	
Oct 2015	1.7	5.4	1.8	
Nov 2015	2.1	5.5	5.7	
Dec 2015	0.9	5.8	0.6	0.8
Jan 2016	3.4	10	1.3	0.9
Feb 2016	0.9	4.5	0.4	0.7
Mar 2016	1.8	11	2.4	2.0
Apr 2016	1.5	8.5	0.7	0.5
May 2016	1.8	6.2	0.7	0.2
Jun 2016	7.6	1.2	2.5	0.4
Jul 2016	1.2	0.3	23	1.2
Aug 2016	1.1	0.6	1.9	0.2
Sep 2016	1.0	1.2	6.0	0.3
Oct 2016	0.9	2.0	3.2	0.6
Nov 2016	1.9	2.2	2.6	1.2
Dec 2016	4.7	1.1	1.7	1.0
Jan 2017	2.2	2.3	4.7	0.6
Feb 2017	2.7	2.0	1.1	0.8
Mar 2017	1.4	0.9	3.9	0.4
Apr 2017	4.2	0.9	0.09	0.3

Appendix B – Daily weather statistics

Date (July 2018)	Temp min (oC)	Temp max (oC)	Rain (mm)	Number of wet days (total)	Weather station - Hours recorded (n)	Avg wind speed (m/s)	Avg wind direction (deg)	Evapo-transpiration
1	-0.7	9.6	0.0		24.0	1.5	179.6	1.2
2	-0.2	9.9	0.0		24.0	1.2	63.5	0.9
3	0.2	11.9	0.0		24.0	1.4	250.7	0.9
4	3.8	14.4	0.0		24.0	2.9	267.9	1.0
5	8.0	16.1	0.0		24.0	5.3	280.5	1.6
6	4.9	13.5	1.5		24.0	8.6	288.0	2.1
7	3.3	5.5	0.0		24.0	7.3	279.2	1.3
8	2.9	7.5	0.0		24.0	7.9	275.8	0.9
9	0.9	10.7	0.0		24.0	2.5	247.6	1.2
10	-1.0	9.7	0.0		24.0	1.4	270.6	1.3
11	-2.5	10.8	0.0		24.0	1.4	241.4	1.1
12	-0.8	8.5	0.0		24.0	1.6	215.2	1.2
13	0.2	8.9	0.0		24.0	2.8	257.6	1.0
14	-0.7	9.3	0.0		24.0	2.0	268.8	1.2
15	-1.1	8.0	0.0		24.0	3.6	262.7	1.3
16	0.7	7.8	0.0		24.0	4.1	270.2	1.4
17	3.0	13.4	0.0		19.0	7.4	285.5	1.4
18	2.7	9.4	0.0		24.0	4.8	273.4	3.0
19	3.4	12.5	0.0		24.0	5.6	285.7	1.7
20	2.9	11.1	0.0		24.0	6.4	283.3	2.3
21	1.8	8.7	0.0		24.0	4.6	274.4	1.4
22	-2.7	8.6	0.0		24.0	1.8	260.3	1.5
23	-1.9	10.4	0.0		24.0	4.1	266.5	1.2
24	6.5	11.6	0.0		24.0	7.7	276.4	1.9
25	6.6	12.2	0.0		24.0	5.4	273.8	2.4
26	2.7	11.2	0.0		24.0	3.6	269.2	2.0
27	1.7	12.5	0.0		24.0	2.4	258.6	1.8
28	5.6	13.9	1.5		24.0	2.2	262.3	1.7
29	5.3	11.4	2.5		24.0	7.2	269.9	1.3
30	2.9	6.6	0.0		24.0	6.7	275.1	1.6
	2.2	10.8	0.0		24.0	6.7	273.6	1.6
Avg / Total	1.9	10.5	5.5	3		4.26		46.2