Appendix 4

Air Quality Impact Assessment

(Total No. of pages including blank pages = 20)

Note: A complete colour version of this Appendix is available on the Project CD or from the DPE website

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Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

9 November 2015

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RW Corkery & Co Pty Limited

Email: alex@rwcorkery.com

RE: Tomingley Gold Mine Modification – AIR QUALITY

Dear Alex,

1 INTRODUCTION

In 2011 Pacific Environment (formerly PAEHolmes) completed an Air Quality Assessment (AQA), "*Tomingley Gold Project – Air Quality Assessment*" (**PAEHolmes, 2011**), for the Tomingley Gold Project. Tomingley Gold Operations Pty Limited (TGO) is now seeking an application to modify Project Approval (PA) 09_0155 for the Tomingley Gold Mine located south of the village of Tomingley in central western NSW (see **Figure 1.1**). PA 09_0155 has been amended twice previously as outlined below:

- Modification 1 (MOD1) (November 2013) – to adjust a range of commitments made during the original application which were no longer appropriate.
- Modification 2 (MOD2) (April 2015) – to permit enhancement of the approved and constructed amenity bund and a cut back of the approved Caloma 1 Open Cut.

The Mine currently comprises of the following approved components:

- Three open cut mines and one underground mine.
- A processing plant and associated residue storage facility.
- Three waste rock emplacements.
- An underpass under the Newell Highway.
- A range of ancillary infrastructure including; offices, amenity bunds, soil stockpiles, surface water management structures, a water supply pipeline and an electricity transmission line.

The Proposed Modification (MOD3) seeks consent to permit the following:

- An additional cutback of the Caloma (Cal1) Open Cut.
- Establishment of the Caloma Two (Cal2) Open Cut.
- Construction of an alternative decline from the Cal1 Open Cut.
- Mining of additional underground resources below the Cal1 and Cal2 Open Cuts.
- Extension of Waste Rock Emplacement (WRE) 3.
- Backfill of the Wyoming Three (Wyo3) Open Cut with waste rock.
- Modifications to the Central Drainage Channel which diverts clean water runoff from the north through the Mine Site.
- Minor modifications to soil management.

This letter has been commissioned by TGO to assess the potential for any additional air quality impacts related to the Proposed Modification (MOD3).

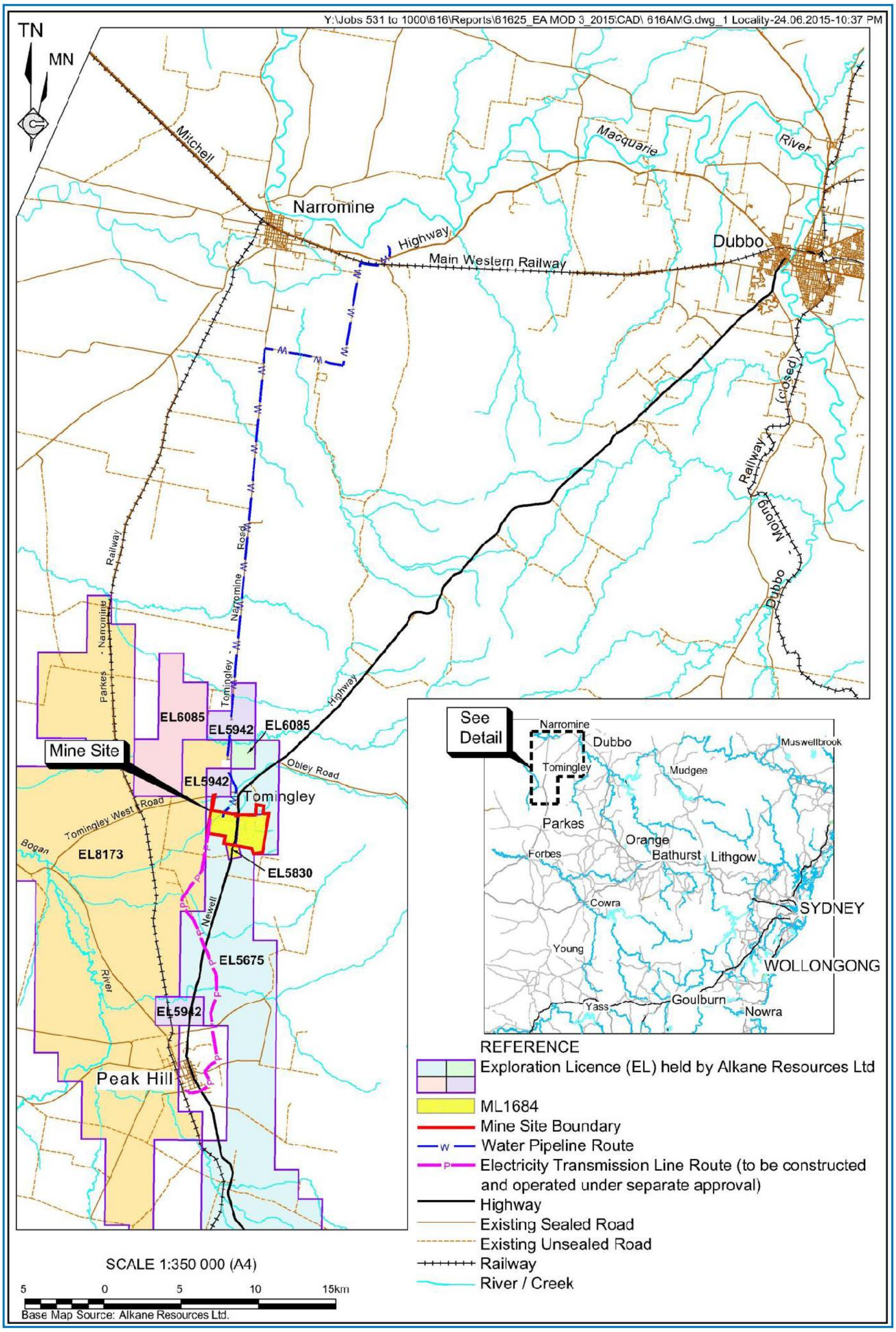

Figure 1.1: Site Location (PAEHolmes, 2011)

2 ASSESSMENT CRITERIA

2.1 NSW EPA Impact Assessment Criteria/NEPM Advisory Reporting Standards

Table 2.1 summarises the air quality goals for concentrations of particulate matter that are relevant to this study.

Table 2.1: Air quality standards / goals for particulate matter concentrations

Pollutant	Averaging period	Standard / Goal	Agency
Total suspended particulate matter (TSP)	Annual mean	90 µg/m³	• National Health and Medical Research Council
Particulate matter with an equivalent aerodynamic diameter less than 10 µm (PM_{10})	24-hour maximum	50 µg/m³	• NSW EPA impact assessment criteria; • NEPM reporting goal, allows five exceedances per year for bushfires and dust storms;
	Annual mean	30 µg/m³	• NSW EPA impact assessment criteria;

Notes: µg/m³ – micrograms per cubic metre, µm – micrometre.

Table 2.2 shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust fallout levels are set to protect against nuisance impacts (**DECC, 2005**).

Table 2.2: EPA criteria for dust (insoluble solids) fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m²/month	4 g/m²/month

2.2 NSW Department of Planning and Environment Voluntary Land Acquisition and Mitigation Policy

On 15 December 2014, NSW Department of Planning and Environment (DP&E) released a policy relating to voluntary mitigation and land acquisition criteria for air quality and noise (**DP&E, 2014**).

The policy sets out voluntary mitigation and land acquisition rights where it is not possible to comply with the EPA impact assessment criteria even with the implementation of all reasonable and feasible avoidance and/or mitigation measures.

The voluntary mitigation and acquisition criteria are summarised in **Table 2.3** and **Table 2.4**, respectively.

Table 2.3: DP&E particulate matter mitigation criteria

Pollutant	Criterion	Averaging Period	Application
TSP	90 $\mu g/m^3$	Annual mean	Total impact
PM_{10}	50 $\mu g/m^3$	24-hour average	Incremental impact[a]
	30 $\mu g/m^3$	Annual mean	Total impact
Deposited dust	2 g/m^2/month	Annual mean	Incremental impact[a]
	4 g/m^2/month	Annual mean	Total impact

[a] Zero allowable exceedances of the criterion over the life of the development.

Table 2.4: DP&E particulate matter acquisition criteria

Pollutant	Criterion	Averaging Period	Application[a]
TSP	90 $\mu g/m^3$	Annual mean	Total impact
PM_{10}	50 $\mu g/m^3$	24-hour average	Incremental impact[b]
	30 $\mu g/m^3$	Annual mean	Total impact
Deposited dust	2 g/m^2/month	Annual mean	Incremental impact[b]
	4 g/m^2/month	Annual mean	Total impact

[a] Voluntary acquisition rights apply where the Project contributes to exceedances of the acquisition criteria at any residence or workplace on privately-owned land, or, on more than 25% of any privately-owned land, and a dwelling could be built on that land under exiting planning controls.
[b] Up to five allowable exceedances of the criterion over the life of the development.

Total impact includes the impact of the Project Modification and all other sources, whilst incremental impact refers to the impact of the Project Modification considered in isolation.

3 CURRENT AIR QUALITY

3.1 Introduction

Air quality standards and goals refer to pollutant levels that include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the Modification is likely to contribute to these levels. It is important to note that the existing air quality conditions (that is, background conditions) will be influenced to some degree by the existing mining operations.

TGO have been operating a number of air quality monitoring equipment:

- Seven dust gauges to measurements of dust deposition using dust deposition monitors
- One High Volume Air Sampler (HVAS) to measure TSP every sixth day
- One Tapered Element Oscillating Microbalance (TEOM) to measure PM_{10} continuously.

The environmental monitoring sites operated by Tomingley Gold Mine operations are shown in **Figure 3.1**.

The following sections provide a summary of the monitoring results for dust deposition, PM_{10} and TSP in the area surrounding the mine.

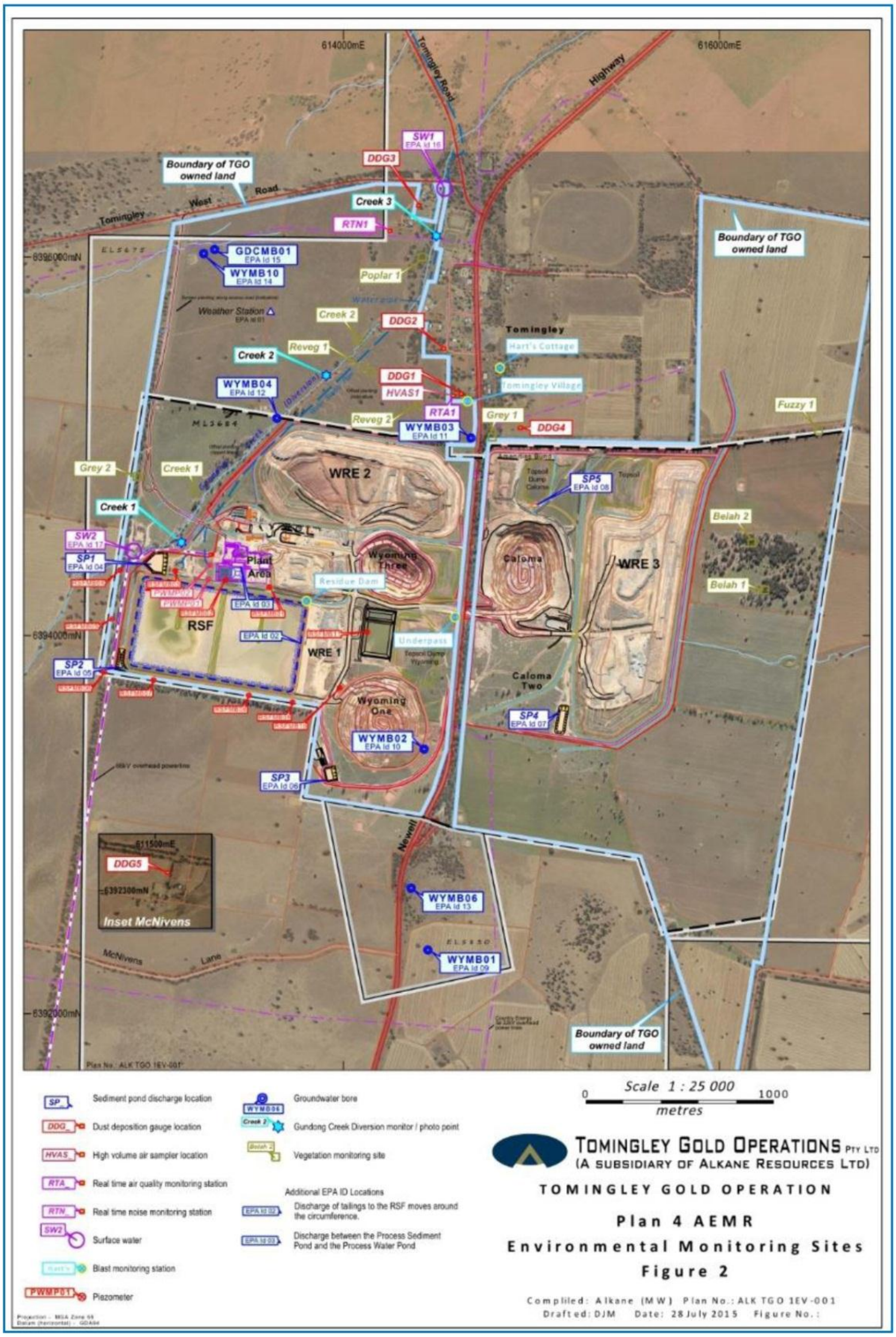

Figure 3.1: Environmental monitoring sites

3.2 Dust Deposition

Dust deposition is monitored using dust deposition gauges at seven locations in the vicinity of the Mine. Additional sources of particulate matter in the area would include traffic on unsealed roads, wind erosion from exposed soils in farmlands and other areas, cereal crop harvesting, animal grazing and to a lesser extent traffic from the Newell Highway.

Dust deposition gauges use a simple device consisting of a funnel and bottle to estimate the rate at which dust settles onto the surface over a period of one month. The measured dust fallout levels include the effects of all existing sources of particulate matter including the existing mining operations.

Data collected from the gauges between June 2013 and October 2015 are summarised in **Table 3.1**. The data indicates that deposition levels are generally low and within the EPA's annual average assessment criteria of 4 g/m^2/month for insoluble solids, with the exception of DDG 4.

Elevated levels were recorded at DDG 4 during 2014 and 2015. DDG 4 is located on the boundary of the mine, where higher levels are anticipated. The next closest gauge (DDG 1) is located approximately 300 m from the boundary and has demonstrated compliance with the criteria. It is therefore apparent that the proximity of DDG 4 to the mining activities has influenced the elevated results.

Table 3.1: Dust deposition data (insoluble solids) (g/m^2/month)

Dust Gauge	2013 Average[1]	2014 Average	2015 Average[2]
DDG 1	0.9	1.2	1.4
DDG 2	1.7	1.2	1.3
DDG 3	0.5	1.2	1.2
DDG 4	1.5	6.1 [(a),(b)]	6.8 [(a), (c), (d)]
DDG 5	0.7	1.6	1.4
DDG BP	3.1	2.7	2.6
DDG Truck Shop	2.0	2.5	2.4

[(a)] Elevated readings at DDG 4 of 34.5 g/m^2 and 31.6 g/m^2 were recorded in March 2014 and June 2015 respectively. These readings were omitted from the data as the paddock north of Caloma in which the dust gauge is located was being ploughed by the land owner during the month.
[(b)] An elevated reading of 26 g/m^2 was recorded in June 2014 at DDG 4. This dust gauge is located on the boundary of the site. Recorded levels were less than 4 g/m^2 at other dust gauges during the same period.
[(c)] An elevated reading of 16.2 g/m^2 was recorded in January at DDG 4. This dust gauge is located on the boundary of the site. Recorded levels were less than 4 g/m^2 at other dust gauges during the same period.
[(d)] An elevated reading of 18.7 g/m^2 was recorded in April at DDG 4. This dust gauge is located on the boundary of the site. Recorded levels were less than 4 g/m^2 at other dust gauges during the same period.

[1] Data available for May – December 2013
[2] Data available for January – September 2015

3.3 TSP and PM_{10} Concentrations

One HVAS has been installed at 40 Myall Street, Tomingley, (in the yard of the closest receptor) just north of the Mine. TSP data are shown below in **Table 3.2.**

The highest annual average TSP concentration is 59.2 µg/m^3 measured in 2014. The data shows that no location has reported an average level above the NSW EPA TSP criterion of 90 µg/m^3.

Table 3.2: Total suspended particulate data (µg/m³)

Year	Total Suspended Particulates (µg/m³)
Criteria = 90 µg/m³	
2013	43.1
2014	59.2
2015	51.2

One TEOM is installed in co-location with the HVAS to measure PM10 concentrations. As shown in **Figure 3.2**, the TEOM data recorded between May 2013 and October 2015 logged seventeen exceedances of the 24-hour average goal of 50 µg/m^3, however, as outlined below it is unlikely that the Mine was the predominant cause of the majority of these:

- 27th October 2014 (**BOM, 2014**)
  - Strong winds and severe thunderstorms recorded in New South Wales.
- 5th, 10th, 23rd November 2014 (**BOM, 2014**)
  - Numerous bushfires burning around NSW in November period. Strong winds and severe thunderstorms recorded on the 5th, 10th and 23rd November.
- 18th, 19th and 30th December 2014 (**BOM, 2014**)
  - No apparent reason for the exceedances measured.
- 4th – 7th, 20th, 27th March 2015 (**BOM, 2015**)
  - Above average temperatures were recorded in inland New South Wales at the start of March. Further, nationally-averaged rainfall during March was 30% below the long term mean.
- 13th May 2015 (**BOM, 2015**)
  - Nationally-averaged rainfall during May was 22% below the long term mean.

Presented in **Figure 3.2** is the results of the PM_{10} monitoring completed at the Mine over the May 2014 to October 2015 period.

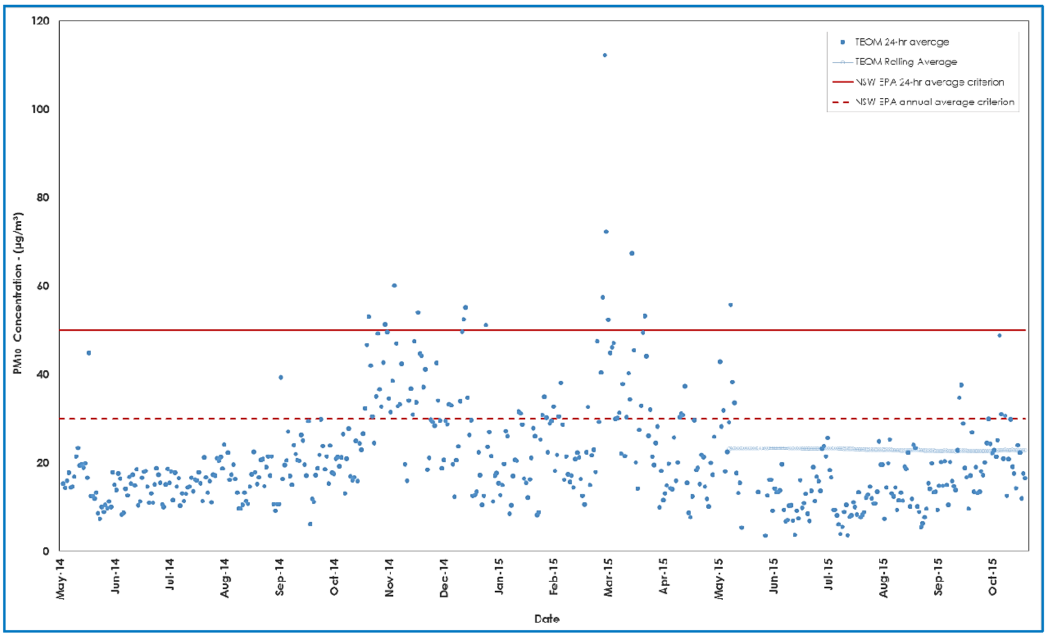

Figure 3.2: Measured PM_{10} concentrations

The resultant annual PM_{10} data are shown below in **Table 3.3**. Of the 2014/2015 data presented, the highest annual average PM_{10} concentration is 21.6 µg/m^3 measured in 2014. The data shows that no location has reported an average level above the NSW EPA's PM_{10} criterion of 30 µg/m^3.

Table 3.3: Annual PM_{10} data (µg/m³)

Year	PM_{10} (µg/m³)
Criteria = 30 µg/m³	
2014	21.6
2015 (to date)	20.4

4 ASSESSMENT METHODOLOGY

4.1 Meteorology

One of the most important factors in determining the transport of dust from emission sources at the Mine to the surrounding area is the frequency of different wind directions and wind speeds.

The original AQA (**PAEHolmes, 2011**) used 2003 meteorological data from the Peak Hill Station (located approximately 15km south the Mine Site), integrated with site-specific, synthetic meteorological data for the Tomingley site using The Air Pollution Model (TAPM) developed by CSIRO. As presented in **Figure 4.1**, on an annual basis winds are predominantly from the north and east with this pattern evident in all seasons to different degrees. The annual average wind speed is 1.8 m/s and on an annual basis there are 8.9% calms.

Recent meteorological data from the Tomingley data were provided to Pacific Environment. Also shown in **Figure 4.1** are wind roses for the 2014 and 2015 periods. When comparing to the meteorology used in the original assessment, it is evident that the wind direction is consistent with the meteorology used in the original AQA.

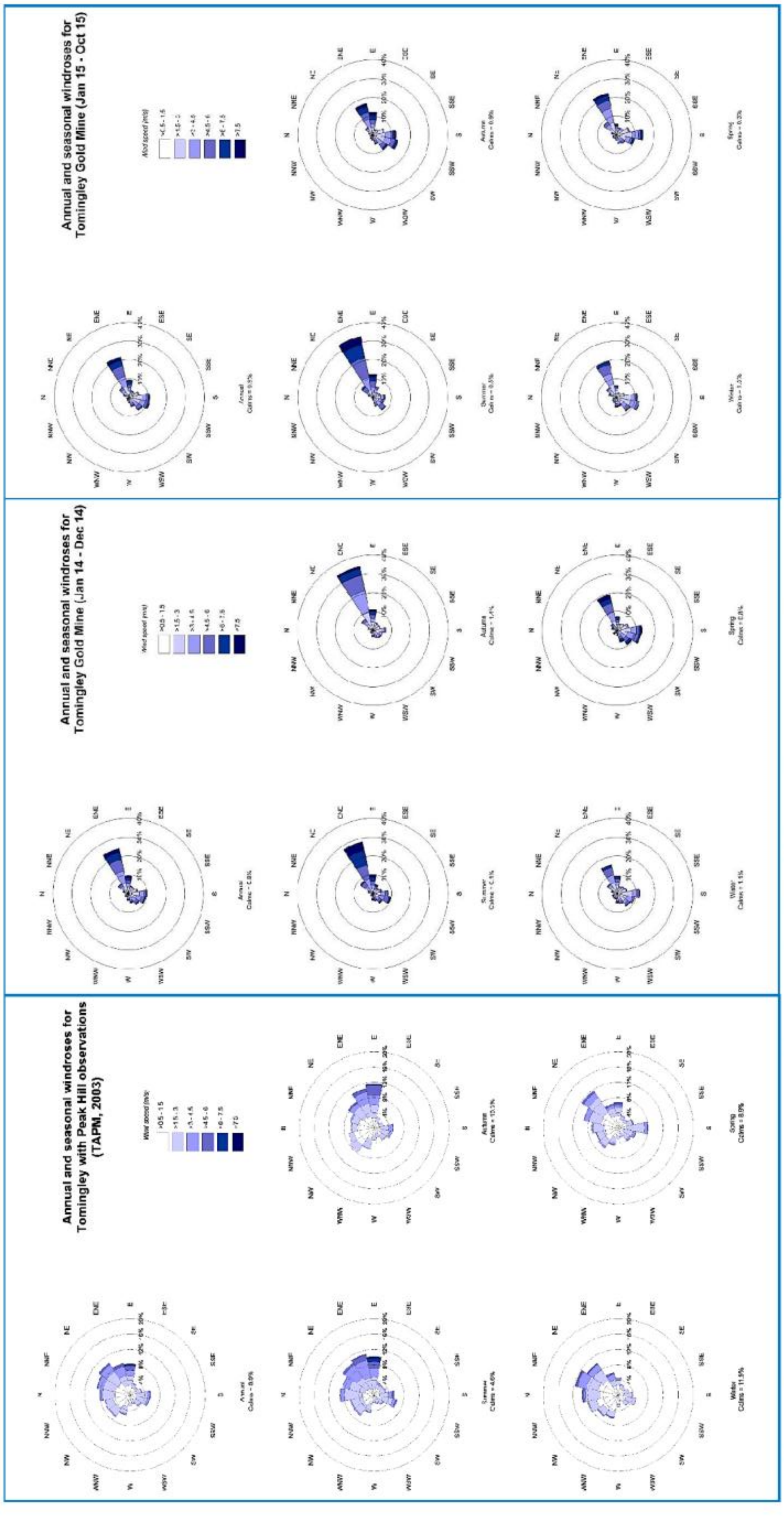

Figure 4.1: Annual and seasonal wind roses for Tomingley Gold Mine (left to right: wind roses used in original AQA, 2014 wind roses and 2015 wind roses)

4.2 Dispersion Modelling

PAEHolmes completed a detailed air quality impact assessment (**PAEHolmes, 2011**) as input to the original Environmental Assessment (EA) prepared for the Mine (**RWC, 2011**).

The dispersion model used was a modified version of the US EPA ISCST3 model (ISCMOD). ISCST3 is fully described in the user manual and the accompanying technical description (**US EPA, 1995a**).

4.3 Estimated Emissions

The emissions estimated for Scenario 3 (as modelled in the AQA) were compared with MOD3 emissions calculated for the 2015/16 period (**Table 4.1**).

The primary cause of the projected increase in TSP emissions is from the more than doubling of anticipated dozer hours on the dump locations (WRE2, WRE3, ROM). Further, presented in **Appendix A** are the anticipated TSP emissions from the original AQA and MOD 3 for Scenario 3.

Table 4.1: Increase in total TSP emissions resulting from the proposed Modification 3

TSP Emissions (original AQA)	Original AQA	MOD 3
Waste- Drilling	66,050	37,170
Waste- Blasting	15,775	20
Waste- Excavator loading Waste to haul truck	3,977	1,649
Waste- Hauling from Caloma 1 OC to WRE 3	69,137	22,745
Waste- Hauling from Wyoming 1 OC to WRE 1	4,749	6,203
Waste- Hauling from Wyoming 3 OC to WRE 2	15,922	310
Waste- Hauling from Caloma 2 OC to WRE 3	-	5,686
Waste - Emplacing at WRE 3	1,790	589
Waste - Emplacing at WRE 1	676	883
Waste - Emplacing at WRE 2	1,511	29
Waste - Emplacing at WRE 3	-	147
Waste- Dozers on Waste	36,640	24,131
ORE - Drilling	928	700
ORE - Blasting	589	0
ORE - Dozers ripping/pushing/clean-up	109,963	282,439
ORE - Excavators/FELs loading open pit ore to trucks	106,550	105,955
ORE - Hauling open pit ore from Caloma 1 to ROM pad	12,352	9,748
ORE - Hauling open pit ore from Wyoming 1 to ROM pad	6,575	20,604
ORE - Hauling open pit ore from Wyoming 3 to ROM pad	5,689	266
ORE - Hauling open pit ore from Caloma 2 to ROM pad	-	2,437
ORE - Unloading ROM to ROM stockpiles	355	353
ORE - FEL unloading ROM from stockpiles to ROM bin	355	353
ORE - Primary Crushing	24,135	24,000
ORE - Conveying to Screen Building	46	46
ORE - Unloading ore from conveyor to Screen Building	355	353
ORE - Screening	1,508	1,500
ORE - Conveying oversized material to Crushing Building	46	46
ORE - Unloading oversized ore from conveyor to Crushing Building	101	101
ORE - Secondary Crushing	68,784	68,400
ORE - Conveying oversized material to Screen Building	46	46
ORE - Conveying undersized material to Surge Bin	27	27
ORE - Unloading undersized ore from conveyor to Surge Bin	5	5
ORE - Conveying undersized material from Surge Bin to ball mill	44	44
ORE - Unloading undersized ore from conveyor to ball mill	18	18
REHAB - Dozers on rehab	3,861	3,861
WE – Waste dump areas	223,730	230,901
WE - Residue Storage	51,824	51,824
WE - Open pit	198,677	225,663
WE - ROM stockpiles	1,402	27,349
Grading roads	86,264	86,264
Total	**1,120,458**	**1,242,865**

4.4 Impact Assessment

The results of the MOD3 emission assessment indicate that the proposed Modification is predicted to increase overall TSP emissions by 10.9%, from 1,120,458 kg/yr to 1,242,865kg/yr.

Based upon previous air quality assessments completed by Pacific Environment, a total increase in TSP emissions of less than 20% will have a negligible impact on the ground level concentrations recorded at the assessed sensitive receptors.

Therefore, it is anticipated that the air quality impacts resulting from MOD3 will be similar to those predicted in the original AQA.

5 MANAGEMENT AND MITIGATION MEASURES

Tomingley Gold Mine is currently following an Air Quality Management Plan (**TGO, 2013**) for the Mine. It incorporates practical management measures to ensure dust emissions are minimised and that regulatory criteria are met at the sensitive receptors as outlined below.

5.1 Visible Dust Monitoring

The site supervisor uses visual monitoring on a daily basis to assess the effectiveness of dust suppression on site. Additional measures to control dust will be implemented by the site supervisor if excessive visible dust is noted.

5.1 Dust Deposition Monitoring

Seven dust deposition gauges are installed in the community surrounding the Mine and in the vicinity of the nearest and most affected private receptors.

The dust deposition gauges are installed and will be used in accordance with the following guidelines:

- AS 2922:1987 Ambient Air - Guide for the Siting of Sampling Units (NSW DECCW Method AM-1), and the NSW DECCW Approved methods for the sampling and analysis of air pollutants in NSW (**DECC, 2005**).
- The dust deposition gauges are sampled in accordance with AS/NZS 3580.10.1:2003 Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method (AM-19).

Dust deposition is measured and reported on a monthly basis. Exposed gauges are replaced on a monthly basis with analysis conducted at a NATA accredited laboratory for insoluble solids.

5.1 HVAS Monitoring

The HVAS measures TSP on a 24-hour, one day- in-six frequency and is co-located with the TEOM.

The HVAS unit is operated in accordance with the following guidelines:

- AS 29221987 Ambient Air - Guide for the Siting of Sampling Units (NSW DECCW Method AM-1), and the NSW DECCW Approved methods for the sampling and analysis of air pollutants in NSW (**DECC, 2005**).
- The HVAS shall be sampled in accordance with AS/NZS 3580.9.3:2003 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method (AM-15).

5.1 TEOM Monitoring

The TEOM measures PM_{10} on a continuous basis where data can be accessed at any location via the internet.

The TEOM is operated in accordance with the following guidelines:

- The TEOM shall be located and installed by a qualified professional in accordance with AS 29221987 Ambient Air - Guide for the Siting of Sampling Units (NSW DECCW Method AM-1), and the NSW DECCW Approved methods for the sampling and analysis of air pollutants in NSW (**DECC, 2005**).
- The TEOM shall be sampled in accordance with AS/NZS 3580.9.8:2008 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM_{10} continuous direct mass method using a tapered element oscillating microbalance (AM-22).

6 CONCLUSIONS

This letter report has investigated the likely effects on air quality from the proposed Modification (MOD3). MOD3 is predicted to have a similar (albeit slightly larger) particulate emission inventory to that described for Scenario 3 of the original Tomingley Gold Mine AQA (**PAEHolmes, 2011**).

Based on the original dispersion modelling completed for Scenario 3 and the negligible increase in total TSP emissions, the assessment concluded that the proposed Modification is unlikely to result in exceedances of the EPA's impact assessment criteria for annual average PM_{10}, TSP or dust deposition at any private properties in the vicinity of the site.

Please do not hesitate to contact me should you require any further information.

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7 REFERENCES

BOM (2014). *Monthly Weather Review – October 2014*, http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201410.pdf

BOM (2014). *Monthly Weather Review – November 2014*, http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201411.pdf

BOM (2014). *Monthly Weather Review – December 2014*, http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201412.pdf

BOM (2014). *Monthly Weather Review – March 2015*, http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201503.pdf

BOM (2014). *Monthly Weather Review –May 2015*, http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201505.pdf

DECC (2005). Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, August 2005.

DP&E (2014). *Voluntary Land Acquisition and Mitigation Policy*, 15 December 2014

PAEHolmes (2011). *Tomingley Gold Project – Air Quality Assessment*, September 2011.

RWC (2011). *Tomingley Gold Project – Environmental Assessment*, November 2011.

TGO (2013). *Tomingley Gold Project – Air Quality and Greenhouse Gas Management Plan*, May 2013

US EPA (1995a). Compilation of Air Pollutant Emission Factors, AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

APPENDIX A: MODIFICATION 3 – EMISSION INVENTORY

Table A.1: TSP Emissions for Scenario 3 – Original AQA

ACTIVITY	TSP emission/Scenario 3 in (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Drilling	66,050	111,950	holes/y	0.59	kg/hole												
OB - Blasting	15,775	1,120	blasts/y	14	kg/blast	1600	Area of blast in square metres	100	holes/blast								
OB - Excavator loading OB to haul truck	3,977	13,509,385	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
OB - Hauling from Caloma 1 OC to WRE 3	69,137	6,079,223	t/y	0.0114	kg/t	90.9	t/load	119	Vehicle gross mass (t)	1.1	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
OB - Hauling from Wyoming 1 OC to WRE 1	4,749	2,296,595	t/y	0.0021	kg/t	90.9	t/load	119	Vehicle gross mass (t)	0.2	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
OB - Hauling from Wyoming 3 OC to WRE 2	15,922	5,133,566	t/y	0.0031	kg/t	90.9	t/load	119	Vehicle gross mass (t)	0.3	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
OB- Emplacing at WRE 3	1,790	6,079,223	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
OB- Emplacing at WRE 1	676	2,296,595	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
OB- Emplacing at WRE 2	1,511	5,133,566	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
OB - Dozers on OB	36,640	6,833	h/y	5.362	kg/h	10	silt content in %	4.8	moisture content in %								
ORE - Drilling	928	9,281	holes/y	0.1	kg/hole												
ORE - Blasting	589	42	blasts/y	14	kg/blast	1600	Area of blast in square metres	222	holes/blast								
ORE - Dozers ripping/pushing/clean-up	109,963	1,752	h/y	62.7642	kg/h	10	silt content in %	4.8	moisture content in %								
ORE - Sh/Ex/FELs loading open pit ore to trucks	106,550	1,206,742	t/y	0.08830	kg/t	4.8	moisture content in %										
ORE - Hauling open pit ore from Caloma 1 to ROM pad	12,352	543,034	t/y	0.0227	kg/t	90.9	t/load	119	Vehicle gross mass (t)	2.2	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Hauling open pit ore from Wyoming 1 to ROM pad	6,575	205,146	t/y	0.0321	kg/t	90.9	t/load	119	Vehicle gross mass (t)	3.1	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Hauling open pit ore from Wyoming 3 to ROM pad	5,689	458,562	t/y	0.0124	kg/t	90.9	t/load	119	Vehicle gross mass (t)	1.2	km/return t	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Unloading ROM to ROM stockpiles	355	1,206,742	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
ORE - FEL unloading ROM from stockpiles to ROM bin	355	1,206,742	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
ORE - Primary Crushing	24,135	1,206,742	t/y	0.2	kg/t					0.1	%control						
ORE - Conveying to Screen Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading ore from conveyor to Screen Building	355	1,206,742	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	%control						
ORE - Screening	1,508	1,206,742	t/y	0.0125	kg/t					0.1	%control						
ORE - Conveying oversized material to Crushing Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading oversized ore from conveyor to Crushing Building	101	1,146,405	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	%control						
ORE - Secondary Crushing	68,784	1,146,405	t/y	0.6	kg/t					0.1	%control						
ORE - Conveying oversized material to Screen Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Conveying undersized material to Surge Bin	27	0.0078	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading undersized ore from conveyor to Surge Bin	5	60,337	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	%control						
ORE - Conveying undersized material from Surge Bin to ball mill	44	0.0125	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading undersized ore from conveyor to ball mill	18	60,337	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.1	%control						
REHAB - Dozers on rehab	3,861	720	h/y	5.362	kg/h	10	silt content in %	4.8	moisture content in %								
WE - OB dump areas	223,730	128	ha	0.4	kg/ha/h	8760	h/y			0.5	%control						
WE - Residue Storage	51,824	49	ha	0.4	kg/ha/h	8760	h/y			0.3	%control						
WE - Open pit	198,677	57	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	1,402	1	ha	0.4	kg/ha/h	8760	h/y			0.5	%control						
Grading roads	86,264	140,160	km	0.6155	kg/VKT	8	speed of graders in km/h										

Table A.2: TSP Emissions for Project Modification (MOD 3)

ACTIVITY	TSP emission/Scenario 3 in (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
Waste- Drilling	37,170	63,000	holes/y	0.59	kg/hole												
Waste- Blasting	20	130	blasts/y	0	kg/blast	78	Area of blast in square metres	485	holes/blast								
Waste- Excavator loading Wasteto haul truck	1,649	5,600,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
Waste- Hauling from Caloma 1 OC to WRE 3	22,745	2,000,000	t/y	0.0114	kg/t	90.9	t/load	119	Vehide gross mass (t)	1.1	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
Waste- Hauling from Wyoming 1 OC to WRE 1	6,203	3,000,000	t/y	0.0021	kg/t	90.9	t/load	119	Vehide gross mass (t)	0.2	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
Waste- Hauling from Wyoming 3 OC to WRE 2	310	100,000	t/y	0.0031	kg/t	90.9	t/load	119	Vehide gross mass (t)	0.3	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
Waste- Hauling from Caloma 2 OC to WRE 3	5,686	500,000	t/y	0.0114	kg/t	90.9	t/load	119	Vehide gross mass (t)	1.1	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
Waste - Emplacing at WRE 3	589	2,000,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
Waste - Emplacing at WRE 1	883	3,000,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
Waste - Emplacing at WRE 2	29	100,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
Waste - Emplacing at WRE 3	147	500,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
Waste- Dozers on Waste	24,131	4,500	h/y	5.362	kg/h	10	silt content in %	4.8	moisture content in %								
ORE - Drilling	700	7,000	holes/y	0.1	kg/hole												
ORE - Blasting	0	10	blasts/y	0	kg/blast	6	Area of blast in square metres	700	holes/blast								
ORE - Dozers ripping/pushing/dean-up	282,439	4,500	h/y	62.7642	kg/h	10	silt content in %	4.8	moisture content in %								
ORE - Sh/Ex/FELs loading open pit ore to trucks	105,955	1,200,000	t/y	0.08830	kg/t	4.8	moisture content in %										
ORE - Hauling open pit ore from Caloma 1 to ROM pad	9,748	428,571	t/y	0.0227	kg/t	90.9	t/load	119	Vehide gross mass (t)	2.2	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Hauling open pit ore from Wyoming 1 to ROM pad	20,604	642,857	t/y	0.0321	kg/t	90.9	t/load	119	Vehide gross mass (t)	3.1	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Hauling open pit ore from Wyoming 3 to ROM pad	266	21,429	t/y	0.0124	kg/t	90.9	t/load	119	Vehide gross mass (t)	1.2	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Hauling open pit ore from Caloma 2 to ROM pad	2,437	107,143	t/y	0.0227	kg/t	90.9	t/load	119	Vehide gross mass (t)	2.2	km/return trip	3.76	kg/VKT	5	% silt conte	75	% control
ORE - Unloading ROM to ROM stockpiles	353	1,200,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
ORE - FEL unloading ROM from stockpiles to ROM bin	353	1,200,000	t/y	0.00029	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %								
ORE - Primary Crushing	24,000	1,200,000	t/y	0.2	kg/t					0.1	% control						
ORE - Conveying to Screen Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading ore from conveyor to Screen Building	353	1,200,000	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	% control						
ORE - Screening	1,500	1,200,000	t/y	0.0125	kg/t					0.1	% control						
ORE - Conveying oversized material to Crushing Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading oversized ore from conveyor to Crushing Building	101	1,140,000	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	% control						
ORE - Secondary Crushing	68,400	1,140,000	t/y	0.6	kg/t					0.1	% control						
ORE - Conveying oversized material to Screen Building	46	0.0132	ha	0.4	kg/ha/h	8760	h/y										
ORE - Conveying undersized material to Surge Bin	27	0.0078	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading undersized ore from conveyor to Surge Bin	5	60,000	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.3	% control						
ORE - Conveying undersized material from Surge Bin to ball mill	44	0.0125	ha	0.4	kg/ha/h	8760	h/y										
ORE - Unloading undersized ore from conveyor to ball mill	18	60,000	t/y	0.0003	kg/t	0.847	average of (wind speed/2.2)^1.3	4.8	moisture content in %	0.1	% control						
REHAB - Dozers on rehab	3,861	720	h/y	5.362	kg/h	10	silt content in %	4.8	moisture content in %			1					
WE - Wastedump areas	230,901	132	ha	0.4	kg/ha/h	8760	h/y			0.5	% control						
WE - Residue Storage	51,824	49	ha	0.4	kg/ha/h	8760	h/y			0.3	% control						
WE - Open pit	225,663	64	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	27,349	16	ha	0.4	kg/ha/h	8760	h/y			0.5	% control						
Grading roads	86,264	140,160	km	0.6155	kg/VKT	8	speed of graders in km/h										

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