APPENDIX G

AIR QUALITY ASSESSMENT

Snapper Mineral Sands Project
Environmental Assessment

AIR QUALITY ASSESSMENT: SNAPPER MINERAL SANDS PROJECT

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Prepared for
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G1. INTRODUCTION

This report has been prepared by Holmes Air Sciences for BEMAX Resources Limited (BEMAX). The purpose of this report is to provide a quantitative assessment of the potential air quality impacts associated with the development of the Snapper Mineral Sands Project (the Snapper Mine).

The Snapper Mine involves the construction and operation of a mineral sands mine located approximately 10 kilometres (km) to the south-west of the existing Ginkgo Mineral Sands Project (the Ginkgo Mine) and approximately 170 km south of the Broken Hill Mineral Separation Plant (MSP) in western New South Wales (NSW) (Figure G-1). The Ginkgo Mine and the MSP are operated by BEMAX. The Snapper Mine includes the development of the Snapper Mine mineral deposit, together with the extension/sharing of existing Ginkgo Mine infrastructure (Figure G-2).

The assessment is based on the use of a computer-based dispersion model to predict ground level dust concentrations and deposition levels in the vicinity of the mine.

To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality criteria.

The assessment is based on a conventional approach following the procedures outlined in the NSW Department of Environment and Conservation's (DEC) document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (DEC, 2005).

In summary, the report provides information on the following:

- the way in which mining is to be undertaken, with a focus on describing those aspects that would assist in understanding how the mine would affect air quality;
- air quality criteria that need to be met to protect the air quality environment;
- meteorological and climatic conditions in the area;
- a discussion of the likely existing air quality conditions in the area;
- the methods used to estimate dust emissions and the way in which dust emissions from the mine would disperse and fallout;
- the expected dispersion and dust fallout patterns due to emissions from the operation and a comparison between the predicted dust concentration and fallout levels and the relevant air quality criteria;
- the likely impacts of construction;
- potential cumulative impacts;
- control methods which can be used to reduce dust impacts; and
- the emissions of greenhouse gases from the Snapper Mine.

G2. LOCAL SETTING AND SNAPPER MINE DESCRIPTION

The Snapper Mine is located approximately 70 km to the north of Wentworth and 170 km south of Broken Hill in Western NSW (Figure G-1). The Snapper Mine area comprises the Snapper Mine Mining Lease Application (MLA) area and the electricity transmission line (ETL) and highway access road (HAR) extensions. Terrain in the study area (including the Snapper Mine area and surrounds) is shown in Figure G-3.

The two nearest receptors to the Snapper Mine are the "Manilla" and "Trelega" homesteads (Figure G-2)). The "Manilla" homestead is approximately 3.5 km north of the Snapper Mine MLA boundary. The "Trelega" homestead is approximately 7 km south of the Snapper Mine MLA area.

Construction of the Snapper Mine would commence approximately between Years 3 to 5 of the Ginkgo Mine life. The construction phase would involve the installation and commissioning of surface facilities (including out-of-pit infrastructure, for example, initial overburden emplacements, initial sand residue dam and initial water dam) to allow access to the orebody and the commencement of mining. An approximate 15 month construction period is expected.

The operation phase covers an approximate 16 year period during which the open cut dredge pond would progress through an area approximately 8 km long and approximately 1 km wide. Dredge mining would be the primary method of mining and would involve the same method of mining as the Ginkgo Mine (that is, conventional mineral sands dredge mining). Secondary mining of ore would occur simultaneous to dredge mining as required, and would be undertaken by conventional mobile equipment (i.e. dozers and/or scrapers) depositing ore in front of the dredge.

The Snapper Mine would progress in a single pass from the south-eastern to the north-western end of the MLA area. The surface of the dredge pond would be 20 to 50 metres (m) below natural ground level. Equipment would operate at various levels, from the surface down to approximately 50 m below the natural ground level.

During operation, mining activities would predominantly occur within the following major areas:

- pre-stripped area (vegetation and topsoil/subsoil removal) across the mine path;
- overburden removal area;
- dredge pond;
- sand residue deposition area;
- overburden and topsoil/subsoil replacement area approximately to the rear of the mine; and
- mineral concentrate transport route, including the HAR.

The abovementioned areas are contained within the Snapper Mine MLA area (Figure G-2). Mining would occur up to 24-hours per day, seven days per week.

Major mine components would include:

- floating dredge and primary gravity concentration unit for mining and primary minerals separation;
- borefields supplying water to the overburden slurrying facility, dredge pond, primary gravity concentration unit, water disposal dam and heavy mineral concentrate (HMC) treatment facility;
- overburden slurrying and pumping system;
- reverse osmosis (RO) plant to supply the salt washing facility and potable water;
- salt washing facility;
- Wet High Intensity Magnetic Separators (WHIMS) circuit;

- administration and workshop buildings (including ablutions);
- a wastewater (including sewage) treatment plant;
- laydown area;
- roads and ETL;
- towers and stackers for stockpiling mineral concentrates;
- overburden, soil and mineral concentrate stockpiles;
- fuel and consumables storage facilities;
- initial water supply dam;
- initial sand residue dam;
- initial overburden emplacements;
- water treatment dams;
- water disposal dam; and
- other associated infrastructure, plant, equipment and activities.

The general arrangement of the mine site at Year 1, Year 14 and post-mining is shown in Figure G-4 to Figure G-6.

The mining operation would comprise the following:

- clearance of vegetation and stripping of soils on a campaign basis ahead of the advancing mine operation;
- overburden stripping, slurrying and direct placement;
- predominantly dredge mining of ore by a conventional floating bucket wheel dredge located in the dredge pond;
- adjustment of dredge pond levels to maintain dredge access to the ore;
- supply of water from the borefields;
- disposal of water to the water disposal dam when lowering dredge pond levels;
- secondary mining of ore by conventional mobile equipment (i.e. dozers and/or scrapers), depositing ore in front of the dredge;
- ore concentration in the primary gravity concentration unit to produce HMC;
- stockpiling of HMC;
- supply of desalinated water from the RO plant for HMC salt washing;
- HMC separation via the WHIMS circuit either at the Snapper Mine or at the MSP, to produce three types of mineral concentrates (i.e. ilmenite-rich, leucoxene-rich and non-magnetic [rutile-rich and zircon-rich] concentrates);
- stockpiling of mineral concentrates;
- transport of HMC and/or mineral concentrates to the MSP;
- placement of wastes from the primary gravity concentration unit (i.e. sand residues) at the rear of the dredge pond as mining advances;
- treatment of process water to remove fines material (i.e. particles less than 53 microns in diameter);
- transport and placement of backloaded process waste from the MSP;
- replacement of overburden on top of sand residues; and
- staged replacement of soils and progressive rehabilitation.

A provisional life of mine production schedule is provided in Table G-1. The schedule for the Snapper Mine complements the schedule for the Ginkgo Mine (i.e. operation at the Snapper Mine would increase when ore grades at the Ginkgo Mine start to decline). The schedule shows the combined development of the Snapper and Ginkgo Mines and maximum annual production of approximately 650,000 tonnes per annum (tpa) of concentrate. As shown in Table G-1 the maximum rate of production from the Snapper Mine alone would be approximately 450,000 tpa.

Table G-1 : Provisional Production Schedule*

Snapper Mine Development Year	Mineral Concentrate Production (kt)			Mineral Concentrate Transport (kt)
	Ginkgo Mine	Snapper Mine	Total	Total
-	500	0	500	350
-	550	0	550	385
Construction	475	0	475	333
1	375	250	625	444
2	300	350	650	464
3	200	450	650	735
4	200	450	650	735
5	200	450	650	735
6	250	400	650	735
7	250	400	650	735
8	250	400	650	735
9	250	400	650	735
10	200	400	600	685
11	200	375	575	660
12	200	350	550	609
13	200	350	550	550
14	150	275	425	425
15	0	275	275	275
16	0	250	250	250
Total	**4,750**	**5,825**	**10,575**	**10,575**

* Production and transport rates are indicative only.

Stockpiled ilmenite-rich concentrate would be transported when market conditions are appropriate. This arrangement provides for a conservative transport scenario (i.e. maximum road movements).

The Snapper and Ginkgo Mines would transport up to approximately 735,000 tpa of concentrate to the MSP after an initial period when ilmenite-rich concentrate would be stockpiled. The mineral concentrate transport route is shown on Figure G-1.

The transport of mineral concentrate from the Ginkgo Mine site to the MSP is currently undertaken by a haulage contractor operating a fleet of 55 tonne (t) payload double road trains. Either double road trains or other vehicles approved by the NSW Roads and Traffic Authority (RTA), Wentworth Shire Council (WSC) and Broken Hill City Council (BHCC) would be used to transport mineral concentrate from the Snapper and Ginkgo Mines to the MSP.

During operation of the Snapper Mine, transport of mineral concentrate to the MSP would increase (beyond the existing number of trips from the Ginkgo Mine), given the increase from the approved concentrate haulage of 576,000 pa for the Ginkgo Mine alone, to the combined concentrate haulage of approximately 735,000 tpa from the both mines. The frequency of double road trains would increase to a maximum of approximately 37 trips per day (74 vehicle movements per day). Movement frequencies of larger vehicle types (for example, AB-triple vehicles) would be less than those for double road trains.

The primary dust generating activities during construction and operation at the Snapper Mine would be:

- clearing vegetation in front of the mine using dozers;
- removing and/or stockpiling topsoil, subsoil and overburden using scrapers (note: equipment other than scrapers, for example tractors with scoops, may also be considered for this task);
- general construction activities;
- wind erosion from stockpiles and exposed areas of the site; and
- haulage of materials between the Snapper Mine and the MSP.

G3. AIR QUALITY ASSESSMENT CRITERIA

Table G-2 and Table G-3 summarise the air quality assessment criteria that are relevant to this study. The air quality criteria relate to the total dust concentration in the air and not just the dust generated from the Snapper Mine. In other words, some consideration of background levels needs to be made when using these criteria to assess impacts. This is discussed further in Section G7.

Table G-2 : Air Quality Assessment Criteria for Particulate Matter Concentrations

Pollutant	Criteria	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 µg/m^3	Annual mean	NHMRC[1]
Particulate matter < 10 µm (PM_{10})	50 µg/m^3	24-hour maximum	DEC
	30 µg/m^3	Annual mean	DEC
Particulate matter < 2.5 µm ($PM_{2.5}$)	8 µg/m^3	Annual mean	NEPM*[2]
	25 µg/m^3	24-hour maximum	NEPM*[2]

* Long-term reporting goal. Not applicable to projects in NSW.
[1] National Health and Medical Research Council.
[2] National Environment Protection Measure.

Also included in Table G-2 are the NEPM goals for the fine fraction of PM_{10} namely $PM_{2.5}$. $PM_{2.5}$ has not been assessed as part of the study as NSW has no ambient goal for $PM_{2.5}$ applied on a project basis.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. Table G-3 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts (DEC, 2005).

Table G-3 : DEC Criteria for Dust Fallout

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

The sulphur content of Australian diesel is too low and mining equipment is too widely dispersed over mine sites to cause sulphur dioxide (SO_2) goals to be exceeded even in mines that use large quantities of diesel. For this reason no detailed study of SO_2 emissions from the mine has been undertaken. For the same reason, nitrous oxides (NO_x) and carbon monoxide (CO) emissions have not undergone a detailed modelling assessment.

Thus the main focus of the study is on the potential effects of particulate matter (PM) emissions. PM has the capacity to affect human health and to cause nuisance effects.

The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10 micrometres (µm) from reaching the more sensitive parts of the respiratory system. Particles with an equivalent aerodynamic diameter less than 10 µm are referred to as PM_{10}. Particles larger than 10 µm, while generally not associated with health effects, can deposit on materials and generally degrade aesthetic elements of the environment. For this reason air quality goals make reference to measures of the total mass of all particles suspended in the air. This is referred to as TSP. In practice particles larger than 30 to 50 µm settle out of the atmosphere too quickly to be regarded as air pollutants. The upper size range for TSP is usually taken to be 30µm. TSP includes PM_{10}.

G4. EXISTING ENVIRONMENT

This section describes the dispersion meteorology, local climatic conditions and existing dust levels in the area.

G4.1 Dispersion Meteorology

The Gaussian dispersion model used for this assessment, AUSPLUME, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[1] and mixing height[2]. Meteorological data collected in the study area are discussed below.

A meteorological station is located at the Ginkgo Mine, approximately 10 km to the north-east of the Snapper Mine. The location of the meteorological monitoring station and other monitoring sites are shown in Figure G-7. Data collected from the meteorological station include hourly records of temperature, wind speed, wind direction, relative humidity, solar radiation and rainfall. The data covered a period from 18 June 2005 to 7 September 2006.

For air dispersion modelling purposes the DEC have a requirement that the meteorological dataset is at least 90% complete for one continuous year. On-site data were unavailable for April and May 2006 and there were 7,325 hours of data available from one continuous year which represented an 84% data recovery.

To supplement the on-site data and obtain a full year of meteorological information, data have been generated for the Snapper Mine by the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) model (The Air Pollution Model [TAPM]). TAPM is a prognostic model which has the ability to generate meteorological data for any location in Australia (from 1997 onwards) based on synoptic information determined from the six hourly Limited Area Prediction System (LAPS) (Puri *et al.*, 1997). The model is discussed further in the accompanying user manual (Hurley, 2002). The DEC has previously approved the use of this method for other mining projects in NSW. The data generated by TAPM have been added to the on-site data for use in the dispersion modeling.

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[1] In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[2] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

The Ginkgo Mine data and TAPM generated data have been prepared into a form suitable for the AUSPLUME dispersion model. Annual and seasonal windroses prepared from these data are shown in Figure G-8. It can be seen from Figure G-8 that, annually, the most common winds are from the south or the north. In summer the winds are generally from the south while in winter the winds are typically from the north. Autumn and spring winds exhibit a mix of both summer and winter patterns.

The presence of TAPM generated data is evident from the percentage of calms in each season. In the autumn data, which has been predominantly derived from TAPM, the percentage of calms (that is, when winds are less than or equal to 0.5 metres per second [m/s]) is lower than for the other seasons. TAPM has a tendency to over-predict the very low wind speeds.

To use the wind data to assess dispersion it is necessary to also have available data on atmospheric stability. A stability class was calculated for each hour of the meteorological data using the concurrent cloud cover information from Broken Hill and the method of Turner (Turner, 1970).

Table G-4 shows the frequency of occurrence of the stability categories expected in the area, as well as a summary of statistics for each year of data available from the Ginkgo Mine on-site data supplemented with TAPM-generated data.

Table G-4 : Summary of Ginkgo Mine Meteorological Data

Dataset	Ginkgo Mine data only (18 Jun 05 to 17 Jun 06)	Ginkgo Mine data, supplemented with TAPM (1 Apr 05 to 31 Mar 06 with 1 Apr 05 to 17 Jun 05 by TAPM)
Hours of data available	7,325	8,760
Mean wind speed (m/s)	2.1	2.4
Winds less than or equal to 0.5 m/s (%)	12.1	8.9
Occurrence of A class stabilities (%)	6.8	5.2
Occurrence of B class stabilities (%)	19.8	16.8
Occurrence of C class stabilities (%)	14.0	15.4
Occurrence of D class stabilities (%)	15.4	17.5
Occurrence of E class stabilities (%)	6.4	10.7
Occurrence of F class stabilities (%)	37.5	34.4

For the Ginkgo Mine data alone, the most common stability occurrence was calculated to be F class (37.5%). This suggests that dust emissions would disperse slowly for a significant proportion of the time. When the Ginkgo Mine data are supplemented with 48 days of TAPM simulation the most prevalent stability is still F class, but to a slightly reduced extent (34.4%).

Mixing height was determined using a scheme defined by Powell (1976) for daytime conditions and an approach described by Venkatram (1980) for night-time conditions. These two methods provide a good estimate of mixing height in the absence of upper air data.

Given the proximity of the Ginkgo Mine site to the area of interest, these data are considered to contain meteorological conditions that are representative of the conditions experienced at the Snapper Mine site. Joint wind speed, wind direction and stability class frequency tables for the Ginkgo Mine/TAPM data are presented in Attachment GA.

G4.2 Local Climatic Conditions

The Bureau of Meteorology collects climatic information from Patton Street, Broken Hill. A range of meteorological data collected from this station is presented in Table G-5 (Bureau of Meteorology, 2006), which is indicative of the local climatic conditions at the Snapper Mine. The station has been collecting meteorological information since 1889.

Temperature data show that January is typically the warmest month with a mean daily maximum of 32.7°C. July is the coldest month with a mean daily minimum of 5.3°C. Rainfall data collected at Broken Hill show that October is the wettest month with a mean rainfall of 24.9 millimetres (mm) over 5 rain days. Annually the area experiences, on average, 253 mm of rain per year.

Table G-5 : Climate Information for Broken Hill

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean daily maximum temperature - deg C	32.7	32.2	28.9	23.9	19.1	15.6	15.1	17.2	21	24.9	28.6	31.3	24.2	106.3
Mean no. of days where Max Temp > = 40.0 deg C	2.4	1.4	0.1	0	0	0	0	0	0	0	0.4	1.3	5.7	40.4
Mean no. of days where Max Temp > = 30.0 deg C	20.3	18.1	12.6	3.4	0	0	0	0.1	1.3	4.9	11.2	17.1	88.9	40.4
Highest daily Max Temp - deg C	46.8	46.6	41.1	36.7	31	26.1	26.7	31.5	37.2	39.7	42.7	43.9	46.8	89.3
Mean daily minimum temperature - deg C	18.4	18.2	15.5	11.7	8.5	6.2	5.3	6.3	8.8	11.7	14.6	17.1	11.9	106.4
Mean no. of days where Min Temp < = 2.0 deg C	0	0	0	0	0.1	1.6	2.4	1.1	0.3	0.1	0	0	5.5	40.4
Mean no. of days where Min Temp < = 0.0 deg C	0	0	0	0	0	0.4	0.4	0.1	0	0	0	0	0.8	40.4
Lowest daily Min Temp - deg C	7.7	7.8	4.4	3.1	-1.1	-2.8	-2.2	-2.2	0.3	1.1	1.1	5	-2.8	89.3
Mean 9.00 am air temp - deg C	23.4	22.8	20.2	16.3	12.5	9.4	8.7	10.5	14	17.4	20.2	22.6	16.5	85.3
Mean 9.00 am wet bulb temp - deg C	16	16.2	14.5	12	9.7	7.5	6.7	7.5	9.6	11.5	13.4	15.2	11.6	82.4
Mean 9.00 am dew point - deg C	10.1	10.6	9.3	7.9	6.9	5.3	4	3.7	4.9	5.6	6.7	8.4	6.9	33.7
Mean 9.00 am relative humidity - %	44	48	51	58	69	76	73	64	54	47	43	42	56	83.5
Mean 9.00 am wind speed - km/h	15	13.6	12.8	10.8	9.2	9.4	10.2	11.6	13.6	15.1	15.3	15	12.7	37.5
Mean 3.00 pm air temp - deg C	31	30.5	27.7	22.8	18.1	14.9	14.5	16.4	20.2	23.5	26.8	29.6	23	83.2
Mean 3.00 pm wet bulb temp - deg C	18.8	19	17.5	14.8	12.3	10.3	9.6	10.2	12.1	14	15.8	17.7	14.3	79.3
Mean 3.00 pm dew point - deg C	9.5	10.1	8.7	7.4	6.5	5.3	3.6	2.7	3.6	4.2	5.7	7.5	6.2	33.6
Mean 3.00 pm relative humidity - %	28	30	32	39	48	54	49	41	34	30	27	27	37	78.4
Mean 3.00 pm wind speed - km/h	14.6	14.6	14.1	13.3	12.9	13.9	15.2	15.7	16.1	16.1	15.8	15.2	14.8	37.4
Mean monthly rainfall – mm	23.1	24.6	19.7	17.7	22.8	21.4	18.7	18.7	20.4	24.9	19.8	21.5	253.4	108.8
Median (5th decile) monthly rainfall - mm	9.3	10.6	7.1	7.1	13	14.7	15.4	15.7	12.3	15	10.8	9.1	241.8	108
9th decile of monthly rainfall – mm	73.6	78.3	58.2	43.7	63	48	38.6	40.9	46.1	56.1	49.3	62.8	399.7	108
1st decile of monthly rainfall – mm	0	0	0	0	1	2	2.1	2.5	1.5	1.5	0.8	0	135.2	108
Mean no. of rain days	3.1	3.1	2.8	2.9	4.5	5.2	5.6	5.2	4.4	4.7	3.6	3.4	48.4	108.7
Highest monthly rainfall – mm	215.8	112.4	258.8	219	93.3	143.6	88.7	91	154.8	129.1	122.4	180.4	N/A	108.8
Lowest monthly rainfall - mm	0	0	0	0	0	0	0	0	0	0	0	0	N/A	108.8
Highest recorded daily rainfall - mm	73.6	94.8	139.4	93.5	62.2	54.1	32.8	46.5	91.4	55.1	103.1	87.2	139.4	108.8

Climate averages for Station: 047007 Broken Hill (Patton Street). Commenced: 1889; Last record: 2004; Latitude (deg S): -31.9759; Longitude (deg E): 141.4676; State: NSW.
Source : Bureau of Meteorology (2006).
N/A = Not available

G4.3 Existing Air Quality

The DEC air quality criteria (Table G-2 and Table G-3) refer to total pollutant levels which include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals (Section G3) it is necessary to have information or estimates on existing dust concentration and deposition levels in the area to which the Snapper Mine is likely to contribute to these levels.

G4.3.1 Dust Deposition

Dust deposition is monitored by BEMAX at 14 locations as part of the existing Ginkgo Mine air quality monitoring programme. Figure G-7 shows the location of the dust deposition gauges. Dust deposition gauges are a simple device consisting of a funnel and bottle to estimate the rate at which dust settles onto the surface over periods approximating one month.

Data collected from the 14 gauges are summarised in Table G-6. These measurements include all background sources relevant to the location, including any contribution which may occur from the existing Ginkgo Mine (which commenced construction in October 2004).

Table G-6 : Summary of Dust Deposition Data in the Snapper Mine Area and Surrounds

Sample Date	Insoluble Solids (g/m²/month)													
	DG01 – Manilla Homestead	DG02 – Woodlands Homestead	DG03 – Ginkgo Camp	DG04 –Manilla HAR	DG05 – Carstairs HAR	DG06 – Roo Roo South HAR	DG07 – Willow Point HAR	DG08 – Roo Roo North HAR	DG09 – Woodlands East HAR	DG10 – Woodlands West HAR	DG11 – Springwood HAR	DG12 – North Lease Fence	DG13 – East Lease Fence	DG14 – Nob Rd Lease Boundary
Dec-04	1.6	1.4	-	0.7	-	-	-	-	-	-	-	-	-	-
Jan-05	2.2	0.6	-	1.6	-	-	-	-	-	-	-	-	-	-
Feb-05	4.4	2.0	-	3.4	-	-	-	-	-	-	-	-	-	-
Mar-05	1.2	0.9	-	1.6	-	-	-	-	-	-	-	-	-	-
Apr-05	1.8	1.1	-	2.1	-	-	-	-	-	-	-	-	-	-
May-05	0.9	1.3	-	1.1	-	-	-	-	-	-	-	-	-	-
Jun-05	1.9	2.0	-	2.3	-	-	-	-	-	-	-	-	-	-
Jul-05	0.3	0.5	-	0.6	0.1	-	-	-	-	-	-	-	-	-
Aug-05	1.0	0.8	-	0.8	0.6	-	-	-	-	-	-	-	-	-
Sep-05	1.6	1.2	-	1.1	1.1	-	-	-	-	-	-	-	-	-
Oct-05	1.5	1.1	-	1.4	1.1	2.1	1.0	0.6	0.4	-	-	-	-	-
Nov-05	0.6	0.5	-	0.9	0.5	1.1	0.7	0.6	0.4	-	-	-	-	-
Dec-05	1.5	1.0	1.6	1.6	1.5	1.1	2.7	2.7	1.1	-	-	-	-	-
Jan-06	1.1	1.3	1.4	1.6	1.0	1.3	1.5	1.3	1.1	-	-	-	-	-
Feb-06	1.0	0.9	1.2	1.2	1.1	1.9	1.3	1.1	1.5	1.3	1.0	-	-	-
Mar-06	1.2	0.8	1.3	2.1	1.5	0.9	1.8	1.6	1.6	1.3	1.0	-	-	-
Apr-06	1.0	0.5	0.9	3.5	1.9	2.2	2.3	2.7	1.4	1.0	1.1	0.9	3.2	0.5
May-06	2.0	0.0	0.2	3.7	1.5	4.8	2.7	3.8	1.7	2.3	1.7	2.2	1.5	2.5
Average	1.5	1.0	1.1	1.7	1.1	1.9	1.7	1.8	1.1	1.5	1.2	1.5	2.4	1.5
Maximum	4.4	2.0	1.6	3.7	1.9	4.8	2.7	3.8	1.7	2.3	1.7	2.2	3.2	2.5
Minimum	0.3	0.0	0.2	0.6	0.5	0.9	0.7	0.6	0.4	1.0	1.0	0.9	1.5	0.5

The data in Table G-6 shows that none of the monitoring locations have reported an average level above the DEC 4 g/m²/month dust fallout criteria. The average deposition ranges between 1 and 2.4 grams per square metre per month (g/m²/month).

G4.3.2 Dust Concentration

Long-term measurements of TSP or PM_{10} concentrations have not been made. There is an approximate relationship between annual dust deposition and annual TSP concentrations that applies in areas where PM is dominated by mining dust. Areas experiencing 4 g/m^2/month typically experience annual TSP concentrations of 90 micrograms per cubic metre ($\mu g/m^3$). Further, in these areas, approximately 40% of TSP would be in the PM_{10} size range. Thus in an area where measured annual average dust deposition rates are up to 2.4 g/m^2/month, the annual TSP concentration would be 54 $\mu g/m^3$ and annual average PM_{10} concentrations would be 22 $\mu g/m^3$. In the absence of dust concentration monitoring these levels have been taken to be applicable for the current study area. These background concentrations adopted for this study are considered to be conservative, since they are based on the highest average dust deposition data recorded for the area (i.e. 2.4 g/m^2/month at DG13 with the Ginkgo Mine MLA). In reality, the background concentrations are likely to be significantly less.

Therefore, in summary, it has been assumed that the following background concentrations apply in the vicinity of the Snapper Mine site:

- Annual average TSP of 54 $\mu g/m^3$;
- Annual average PM_{10} of 22 $\mu g/m^3$; and
- Annual average total dust deposition of 2.4 g/m^2/month.

G5. ESTIMATED DUST EMISSIONS

As discussed in Section G2, dust emissions would arise from a range of activities associated with the Snapper Mine. Total dust emissions have been estimated by analysing the activities that would be taking place at the site during construction and Year 14 of operation. These two scenarios represent the worst-case air quality impacts of the mine since activities would be closest to the nearest receptors.

The activities which apply in each case have been combined with emission factors developed, both locally and by the United States Environmental Protection Agency (US EPA), to estimate the amount of dust produced by each activity. This study draws on US EPA emission factors for mining operations that were subject to significant revisions in 2003. The emission factors applied are considered to be the most up-to-date methods for determining dust generation rates. The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

Snapper Mine activities have been reviewed in order to determine material quantities, equipment locations, stockpile locations and areas, activity operating hours and other details that are necessary to estimate dust emissions.

The most significant dust generating activities from the operation have been identified and the dust emission estimates are presented below in Table G-7. Details of the calculations of the dust emissions are provided in Attachment GB.

Table G-7 : Estimated Dust Emissions from the Snapper Mine

Activity	TSP Emission Rate (kg/year)	
	Construction/Year 1	Year 14
Scrapers loading, transporting and unloading topsoil	11,087	13,053
Dozer(s) stripping overburden	101,250	101,250
Scrapers loading, transporting and unloading overburden	477,849	513,538
Dozer(s) on overburden areas	134,999	134,999
Grading roads and open areas	21,566	21,566
Wind erosion from topsoil stockpiles	13,207	2,738
Wind erosion from overburden dumps	30,720	1,298
Wind erosion from disturbed area around mine	3,751	4,819
Wind erosion from product stockpiles	4,566*#	4,566#
TOTAL	798,995	797,826

* There would not be any product stockpiles during the construction period, however some allowance has been made in this instance to cover transition to early mining operation. This is a conservative approach.

\# Considered to be a conservatively high estimate of wind erosion from product stockpiles given the high moisture level and high density of the material. It is also noted that there is an economic imperative to minimise wind erosion from these stockpiles.

The loading, transporting and unloading of overburden by scrapers has been determined to be the most significant dust generating activity that would occur at the site.

The total annual emission of TSP is therefore estimated to be up to 798,995 kilograms (kg).

Vehicles hauling mineral concentrates and backloaded MSP process waste between the Snapper Mine and the MSP would also be a source of dust, which would occur off-site. It has been estimated that up to two additional vehicle movements per hour would occur with dust emissions spread over the mineral concentrate transport route. Further, the unsealed HAR section of the mineral concentrate transport route is well removed (more than approximately 800 m) from nearest residences, therefore adverse air quality impacts are unlikely to be observed. Nevertheless, dust emissions from this activity have the potential to cause nuisance impacts if not properly managed. Proper dust management would include the use of dust suppression (where practicable) on unsealed roads and the observation of vehicle speed limits.

G6. APPROACH TO ASSESSMENT

In August 2005, the DEC published new guidelines for the assessment of air pollution sources using dispersion models (DEC, 2005). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data to be used in dispersion models, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. The approach taken by this assessment follows as closely as practicable the approaches suggested by the guidelines.

This section is provided so that technical reviewers can appreciate how the modelling of different particle size categories has been carried out.

Off-site dust concentration and dust deposition levels due to the Snapper Mine have been predicted using AUSPLUME. AUSPLUME (Version 6.0) is an advanced Gaussian dispersion model developed on behalf of the Victorian Environmental Protection Agency [VEPA], 1986) and is based on the US EPA's Industrial Source Complex (ISC) model. It is widely used throughout Australia and is regarded as a "state-of-the-art" model. AUSPLUME is the model required for use by the DEC unless project characteristics dictate otherwise (DEC, 2005).

The modelling has been based on the use of three particle-size categories: 0 to 2.5 µm - referred to as $PM_{2.5}$ or fine particles (FP), 2.5 to 10 µm - referred to as CM (coarse matter) and 10 to 30 µm - referred to as the Rest. Emission rates of TSP have been calculated using emission factors derived from US EPA (1985) and National Energy Research Development and Demonstration Council [NERDDC] (1988) work (Attachment GB).

The distribution of particles has been derived from measurements in the State Pollution Control Commission [SPCC] (1986) study. The distribution of particles in each particle size range is as follows:

- $PM_{2.5}$ (FP) is 4.7% of the TSP;
- $PM_{2.5-10}$ (CM) is 34.4% of TSP; and
- PM_{10-30} (Rest) is 60.9% of TSP.

Modelling was done using three AUSPLUME source groups. Each group corresponded to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 µm. The predicted concentration in the three plot output files for each group were then combined according to the weightings in the above dot points to determine the concentration of PM_{10} and TSP.

The AUSPLUME model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions on dust generating industries where wind speed is an important factor in determining the rate at which dust is generated.

For the current study the operation was represented by a series of volume sources located according to where the activities would take place for the modelled scenario. Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the AUSPLUME model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds would correspond with periods of low dust generation (because wind erosion and other wind dependent emissions rates would be low) and also correspond with periods of poor dispersion. If these measures are not taken the model has the potential to significantly overstate impacts.

Dust concentrations and deposition rates have been predicted in the vicinity of the Snapper Mine operation. Receptor heights have been obtained from information on the local terrain.

The modelling has been performed using the meteorological data discussed in Section G4.1 and the dust emission estimates from Section G5. All dust sources have been modelled assuming 24-hour per day operation.

Modelling of the Snapper Mine includes all plant items operating concurrently to simulate the overall maximum dust emissions from the mine.

As an example, an AUSPLUME model output file is provided in Attachment GC.

G7. ASSESSMENT OF IMPACTS

G7.1 Preamble

This section provides an interpretation of the predicted dust concentrations and deposition levels.

Dust concentrations and deposition rates for modelled dust emissions for selected years of assessment have been presented as isopleth diagrams in Figure G-9 to Figure G-11 showing the following:

1. Predicted maximum 24-hour average PM_{10} concentration;
2. Predicted annual average PM_{10} concentration;
3. Predicted annual average TSP concentration; and
4. Predicted annual average dust deposition.

The maximum 24-hour average contour plots do not represent the dispersion pattern for any particular day, but show the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations which can possibly be reached under the modelled conditions.

Model predictions have also been presented in tabular form for each of the nearest residences (Table G-8). Interpretation and analysis of the model predictions for each year of assessment is provided below.

G7.2 Assessment of Impacts

Dispersion model predictions for the construction phase and Year 14 of Snapper Mine operation are shown in Figure G-9 to Figure G-11. These predictions relate only to emissions from the modelled sources and do not include background concentrations or deposition levels. It can be seen from Figure G-9 to Figure G-11 that the highest concentrations and deposition levels are centered around the activities taking place in that year.

Table G-8 summarises the model predictions for the two closest receptors to the Snapper Mine operation (i.e. the "Manilla" and "Trelega" homesteads [Figure G-2]). Results show the contribution of dust emissions from the Snapper Mine as well as the cumulative effect of other dust sources, including the Ginkgo Mine, as estimated from the monitoring data.

Table G-8 : Dispersion Model Predictions at Nearest Receptors

Receptor	Construction	Year 14 Operation	Air Quality Criteria
Predicted maximum 24-hour average PM_{10} concentrations ($\mu g/m^3$) (Refer to text below for predictions with background)			
Manilla	11	34	50
Trelega	11	7	
Predicted annual average PM_{10} concentrations ($\mu g/m^3$) (Predictions with background are shown in parentheses)			
Manilla	1.5 (23.5)	2.7 (24.5)	30
Trelega	0.9 (22.9)	0.6 (22.6)	
Predicted annual average TSP concentrations ($\mu g/m^3$) (Predictions with background are shown in parentheses)			
Manilla	1.5 (55.5)	2.9 (56.9)	90
Trelega	0.9 (54.9)	0.6 (54.6)	
Predicted annual average dust deposition (g/m^2/month) (Predictions with background are shown in parentheses)			
Manilla	0.02 (2.42)	0.06 (2.46)	2 (4 - cumulative)
Trelega	0.02 (2.42)	0.01 (2.41)	

Air quality impacts during construction and operation are predicted to be highest at the "Manilla" homestead.

Maximum 24-hour Average PM_{10} Concentrations

Maximum 24-hour average PM_{10} concentrations are predicted to be up to 34 µg/m^3 at the "Manilla" homestead during Year 14 of operation.

It is not possible to predict the background PM_{10} levels on the day when the maximum contribution from the Snapper mine would occur. There would, on occasions, be exceedances of the 50 µg/m^3 criterion at all residential properties in the area due to natural sources of PM, such as bushfires or dust storms.

From the available dust monitoring data (Section **Error! Reference source not found.**) it has been conservatively estimated that average PM_{10} concentrations would be around 22 µg/m^3 (although, in reality, the background levels are likely to be significantly less). If background concentrations are below this level on the day when the maximum impact from the Snapper mine occurs then compliance with the 50 µg/m^3 criterion would be anticipated. However, if background levels are above 22 µg/m^3 then concentrations from the Snapper Mine plus the background may exceed the 50 µg/m^3 criterion.

Figure G-12 shows a histogram of 24-hour average PM_{10} concentrations at the "Manilla" homestead for Year 14 of operation. For the majority of the year the contribution of the Snapper mine to 24-hour average PM_{10} concentrations is predicted to be less than 5 µg/m^3. There are three days in the modelled year when the 24-hour average PM_{10} concentration is predicted to be above 28 µg/m^3. On this basis, the potential for the Snapper mine to be the cause of exceedances of the 50 µg/m^3 criterion is considered to be very low. Table G-9 lists the number of days where the 24-hour average PM_{10} concentration is predicted to be at a certain level for the "Manilla" homestead.

Table G-9 : Predicted Number of Days at Concentration Level for Closest Receptor

24-hour average PM_{10} concentration	Number of days of 24-hour average PM_{10} concentration at Manilla homestead for Year 14 of operation
Greater than 28 µg/m^3	3
Between 20 and 28 µg/m^3	9
Between 10 and 20 µg/m^3	21
Between 5 and 10 µg/m^3	29
Less than 5 µg/m^3	303

Predicted Annual Average PM_{10} Concentrations

The dispersion model predictions for annual average PM_{10} at the "Manilla" and "Trelega" homesteads are shown in Table G-8 (contour plots are provided in Figure G-9 and Figure G-10). The highest contribution from the Snapper Mine is predicted to be 2.7 µg/m^3 at the "Manilla" homestead in Year 14 of operation. Background annual average PM_{10} concentrations for the area have been estimated to be 22 µg/m^3 which, when added to the model predictions, would demonstrate compliance with the DEC's air quality criterion of 30 µg/m^3.

Predicted Annual Average TSP Concentrations

The dispersion model predictions for annual average TSP at the "Manilla" and "Trelega" homesteads are shown in Table G-8 (contour plots are provided in Figure G-9 and Figure G-10). The highest contribution from the Snapper Mine is predicted to be 2.9 µg/m^3 at the "Manilla" homestead in Year 14. Background annual average TSP concentrations for the area have been estimated to be 54 µg/m^3 which, when added to the model predictions, would demonstrate compliance with the DEC's air quality criterion of 90 µg/m^3.

Predicted Annual Average Dust Deposition

The dispersion model predictions for annual average dust deposition at the "Manilla" and "Trelega" homesteads are shown in Table G-8 (contour plots are provided in Figure G-9 and Figure G-10). The highest contribution from the Snapper Mine is 0.06 g/m^2/month at the "Manilla" homestead in Year 14. Compliance with the DEC air quality criteria is therefore predicted when considering background dust deposition levels of 2.4 g/m^2/month.

G7.3 Cumulative Effects With The Ginkgo Mine

This section examines the potential for cumulative air quality effects from the simultaneous operation of the Snapper Mine and Ginkgo Mines. During Snapper Mine operation in Year 14, the Snapper and Ginkgo Mines have been assumed to have production rates of approximately 400,000 and 250,000 tpa, respectively. This is considered to be a conservative estimate of production during Snapper Year 14, based on the provisional production schedule shown in Table G-1, and accounts for the maximum combined production rate of approximately 650,000 tpa.

Dust emissions from the Ginkgo Mine have been estimated by assuming that the operation would emit the same amount of dust per tonne of mineral concentrate produced as the Snapper Mine. Estimated dust emissions for the Ginkgo Mine are shown in Table G-10.

Table G-10 : Estimated Dust Emissions from Ginkgo Mine

	Snapper Mine operation, Year 14	Concurrent Ginkgo Mine Operation
Mineral concentrate production (t/y)	400,000	250,000
Estimate TSP emission per t of product (kg/t) (from Table G-7)	1.99	1.99
Estimated annual TSP emission (kg/y)	797,826	498,641

Figure G-11 shows the dispersion model predictions for the simultaneous operation of the Snapper Mine and Ginkgo Mines for Year 14 of the Snapper Mine operation. The purpose of this analysis is to examine whether there are any increases to maximum 24-hour average or annual average predictions at nearest receptors by including the Ginkgo Mine emissions in the model.

There is no change to the maximum 24-hour average PM_{10} concentration model prediction calculated for the Snapper Mine (that is, 34 µg/m^3 at the "Manilla" homestead) when dust emissions from the Ginkgo Mine are included.

Similarly, inclusion of the Ginkgo Mine emissions with the Snapper Mine emissions would have a small effect on annual average PM_{10}, TSP and dust deposition levels at the "Manilla" and "Trelega" homesteads (Figure G-10 with Figure G-11). The cumulative effect of these two mining operations would not cause exceedances of annual average air quality criteria.

It can be seen from Figure G-11 that the contribution of the Ginkgo Mine emissions to dust concentrations and deposition levels experienced at the "Trelega" homestead is very small. Given that the Ginkgo Mine is approximately 20 km from the "Trelega" homestead, the influence of the Ginkgo Mine emissions to dust levels experienced at this receptor would be expected to be very low for all stages of the Snapper Mine operation. On this basis the cumulative effects of the simultaneous operation of the two mines would not cause exceedances of relevant air quality criteria at any stage of the Snapper Mine operation, including the construction phase.

G8. GREENHOUSE ISSUES

The *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (World Resources Institute and World Business Council for Sustainable Development, 2004) (the GHG Protocol) provides an international reporting framework for emissions. To help delineate direct and indirect emissions, the GHG Protocol defines three 'Scopes' of emissions for emission accounting and reporting purposes:

> ***Scope 1: Direct GHG emissions***
>
> *Direct GHG emission occur from sources that are owned or controlled by the company, for example emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.*
>
> …
>
> ***Scope 2: Electricity Indirect GHG emissions***
>
> *Scope 2 accounts for GHG emissions from the generation of purchased electricity.*
>
> …
>
> ***Scope 3: Other indirect GHG emissions***
>
> *Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company.*

The Australian Greenhouse Office (AGO) *Factors and Methods Workbook* (the AGO workbook) (AGO, 2006) adopts the emission categories of the GHG Protocol. The AGO workbook (AGO, 2006) provides three 'scopes' of emission categories based on the GHG Protocol:

- *Scope 1 covers direct emission from sources within the boundary of an organisation such as fuel combustion and manufacturing processes.*
- *Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate electricity, steam or heat and do not include emissions associated with the production of fuel.*
- *Scope 3 includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation.*

The AGO workbook (AGO, 2006) also provides a broader definition of Scope 3 emissions, which may include:

- use of products manufactured and sold;
- employees commuting to and from work;
- employee business travel;
- out-sourced activities; and
- transportation of products.

Operation of the Snapper Mine would result in a number of direct (i.e. Scope 1) and indirect (i.e. Scopes 2 and 3) emissions. The major direct (i.e. Scope 1) emission at the Snapper Mine would be associated with the combustion of diesel fuel used in diesel powered equipment. In addition, the use of electrically-powered mining equipment would result in indirect (i.e. Scope 2) emissions. Other indirect (i.e. Scope 3) emissions (e.g. employees commuting to work) would also be released as a consequence of the Snapper Mine.

A summary of the emissions that were calculated for the Snapper Mine is provided in Table G-11.

Table G-11 : Summary of Potential Snapper Mine CO_2-e Emission Sources

Project Component	Direct Emissions	Indirect Emissions	
	Scope 1	Scope 2	Scope 3
Construction – Diesel	Emissions from the combustion of diesel during construction of the Snapper Mine.	NA	Estimated emissions attributable to the extraction, production and transport of diesel consumed during construction of the Snapper Mine.
Construction – Electricity	NA	Emissions from the generation of the electricity consumed during construction of the Snapper Mine.	Estimated emissions from the extraction, production and transport of fuel burned at generation of electricity consumed and the electricity lost in delivery in the transmission and distribution network.
Operations –Diesel	Emissions from the combustion of diesel during operation of the Snapper Mine.	NA	Estimated emissions attributable to the extraction, production and transport of diesel consumed during operation of the Snapper Mine.
Operations – Electricity	NA	Emissions from the generation of the electricity consumed during operation of the Snapper Mine.	Estimated emissions from the extraction, production and transport of fuel burned at generation and the electricity lost in delivery in the transmission and distribution network.
Mineral Concentrate Haulage to the MSP	Emissions from the combustion of diesel consumed during the transport of mineral concentrate to the MSP.	NA	Estimated emissions attributable to the extraction, production and transport of diesel consumed during the transport of mineral concentrate to the MSP.
Employee Commute to and from the Snapper Mine	NA	NA	Emissions from the combustion of diesel and petrol consumed by employees commuting to and from the Snapper Mine.
Deliveries to the Snapper Mine	NA	NA	Emissions from the combustion of diesel and petrol consumed by contractors delivering goods to the Snapper Mine.
Business Travel	NA	NA	Emissions from the combustion of diesel and petrol consumed by BEMAX employees traveling for business purposes.
MSP Operations	NA	NA	Emissions from the combustion of diesel, coal, and LPG, and emissions from the generation of electricity consumed during the processing of Snapper Mine mineral concentrate at the MSP.
Rail Transport of Mineral Product from the MSP to Port Adelaide	NA	NA	Emissions from the combustion of diesel consumed during the transport of Snapper Mine mineral product from the MSP to Port Adelaide.

To estimate emissions from these sources identified in Table G-11, the electrical and fuel (e.g. diesel and petrol) requirements for each year over the life of the mine (including construction) have been estimated using data supplied by BEMAX.

Relevant emission factors from the AGO workbook (AGO, 2006) have been supplied to estimate the CO_2-equivalent (CO_2-e) emissions. These emission factors have been applied to both direct/point emissions and indirect emissions. Both direct emissions (i.e. Scope 1) and indirect emissions (i.e. Scopes 2 and 3) have been calculated to provide a conservative estimate of greenhouse gas emissions from the Snapper Mine.

The estimated emission of greenhouse gases over the life of the mine is shown in Table G-12. The total lifetime direct (i.e. Scope 1) emission from the Snapper Mine is estimated to be approximately 236,124 t CO_2-e, which is an average of approximately 13,688 t CO_2-e per year over the life of the mine, including construction. The total lifetime full fuel cycle (i.e. Scopes 1, 2 and 3) emission from the Snapper Mine is estimated to be approximately 1,688,865 t CO_2-e, which is an average of approximately 97,905 t CO_2-e per year over the life of the mine, including construction.

Table G-12 : Summary of Estimated CO_2-e Emissions

Project Component	Emissions (t CO_2-e)			
	Direct Emissions	Indirect Emissions		Full Fuel Cycle
	Scope 1	Scope 2	Scope 3	
Construction – Diesel	12,825	NA	1,425	14,250
Construction – Electricity	NA	11,163	2,200	13,363
Operations – Diesel	139,800	NA	15,533	155,333
Operations – Electricity	NA	358,654	70,687	429,341
Mineral Concentrate Haulage to the MSP	83,499	NA	9,278	92,777
Employee Commute to and from the Snapper Mine	NA	NA	12,290	12,290
Deliveries to the Snapper Mine	NA	NA	53,979	53,979
Business Travel	NA	NA	114	114
MSP Operations	NA	NA	804,350	804,350
Rail Transport of Mineral Product from the MSP to Port Adelaide	NA	NA	113,068	113,068
Total	**236,124**	**369,817**	**1,082,924**	**1,688,865**

The estimated annual average full fuel cycle (i.e. Scopes 1, 2 and 3) emission of approximately 97,905 t CO_2-e per year (0.098 million tones [Mt] of CO_2-e) over the life of the mine (i.e. operations and construction) due to mining can be compared with the following 2004 estimates provided by the latest Australian National Greenhouse Gas Inventory report (DEH, 2006):

- current estimate of Australia's 2004 net emissions, 564.7 Mt CO_2-e;
- current estimate of Australia's 2004 net emissions for the energy sector, which is the major contributor to carbon-dioxide emissions, was 387.2 Mt CO_2-e; and
- current estimate of Australia's 2004 net emissions for the industrial sector was 29.8 Mt CO_2-e.

It should be noted that mitigation of greenhouse gas emissions is inherent in the development of the mine plan. For example, reducing fuel usage by mobile plant is an objective of mine planning. Hence, significant savings of greenhouse gas emissions can be attributed to appropriate mine planning.

Additional management/minimisation of greenhouse gas emissions associated with the Snapper Mine would be employed via:

- regular maintenance of plant and equipment to minimise fuel consumption;
- consideration of energy efficiency in plant and equipment selection/purchase; and
- the implementation of a vegetation off-set programme (Appendix E of the Environmental Assessment [EA]).

In addition to the above, BEMAX would investigate the potential conversion of mineral concentrate haulage vehicles to LPG.

G9. CONCLUSIONS

This report has assessed the air quality impacts associated with the Snapper Mine in western NSW. Dispersion modelling has been used to assess the impact of dust emissions on the local air quality. The area is remote and sparsely populated with the closest residence, the "Manilla" homestead, located approximately 3.5 km from the MLA boundary.

It is concluded that air quality impacts would be at acceptable levels and that air quality criteria would not be exceeded at nearest residences due to the Snapper Mine operation. There could, however, be rare occasions when the maximum short-term impacts of the mine coincide with elevated background concentrations, causing exceedances of short-term air quality criteria (although, this prediction is based on a conservative estimate of background concentrations). PM concentrations arising from sources not related to the Snapper Mine, such as bushfires and dust storms, may result in elevated short-term levels on occasions.

The cumulative effects of dust emissions from the Ginkgo Mine, approximately 10 km to the north of the Snapper Mine, are considered to be small and do not change the conclusions presented above.

Finally, greenhouse gas emissions have been estimated. On average, over the life of the mine, it is estimated that mining would result in the release of approximately 236,124 t CO_2-e of direct emissions (i.e. Scope 1). The total full fuel cycle (i.e. Scopes 1, 2 and 3) emission over the life of the mine is estimated to be approximately 1,688,865 t CO_2-e. This full fuel cycle (i.e. Scopes 1, 2 and 3) estimate includes emissions of greenhouse gases from the use of electrical and the various fuels required for construction, mining, processing and transporting of mineral concentrates, processing of mineral concentrate at the MSP and the rail transport of MSP products to Port Adelaide.

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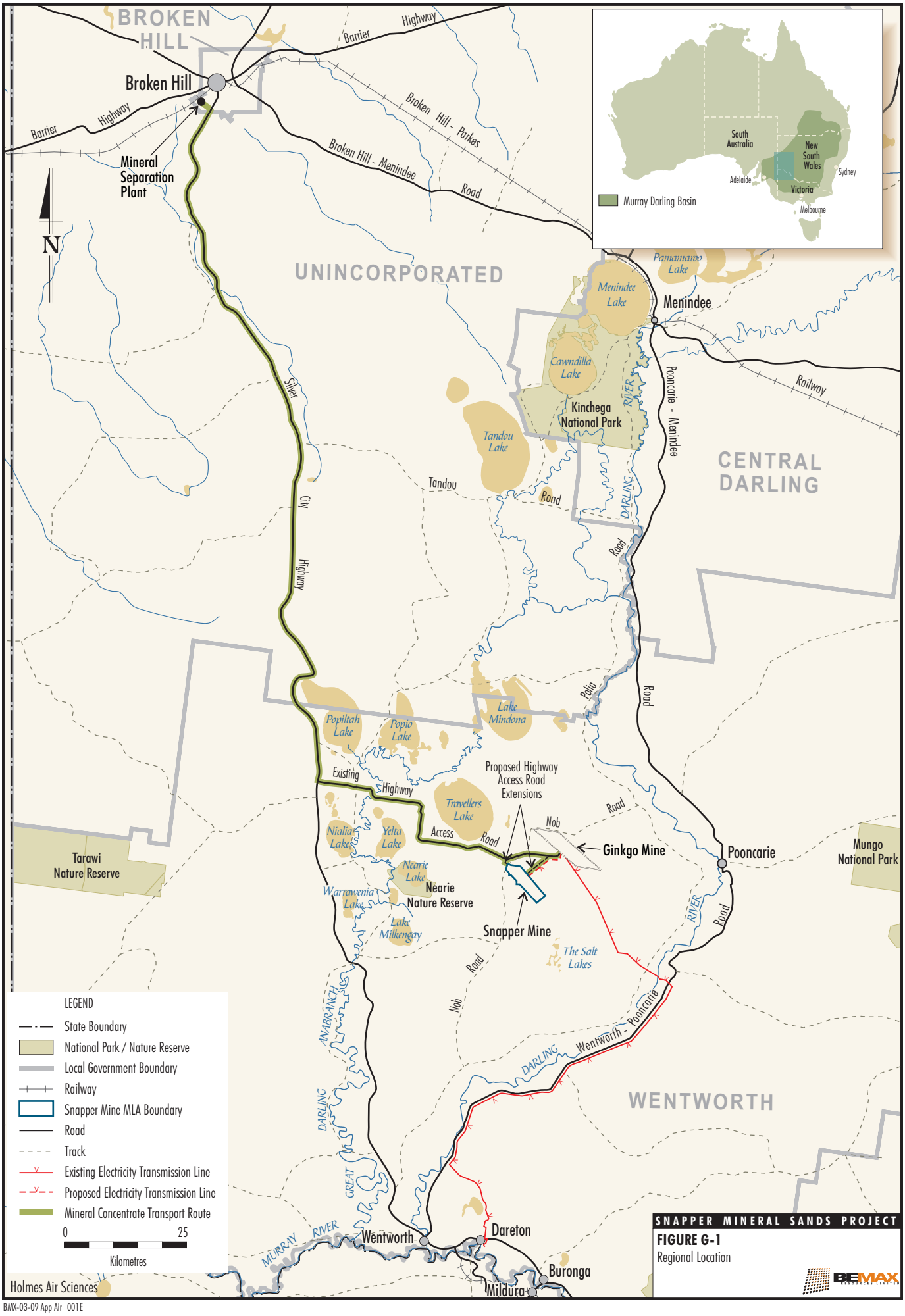
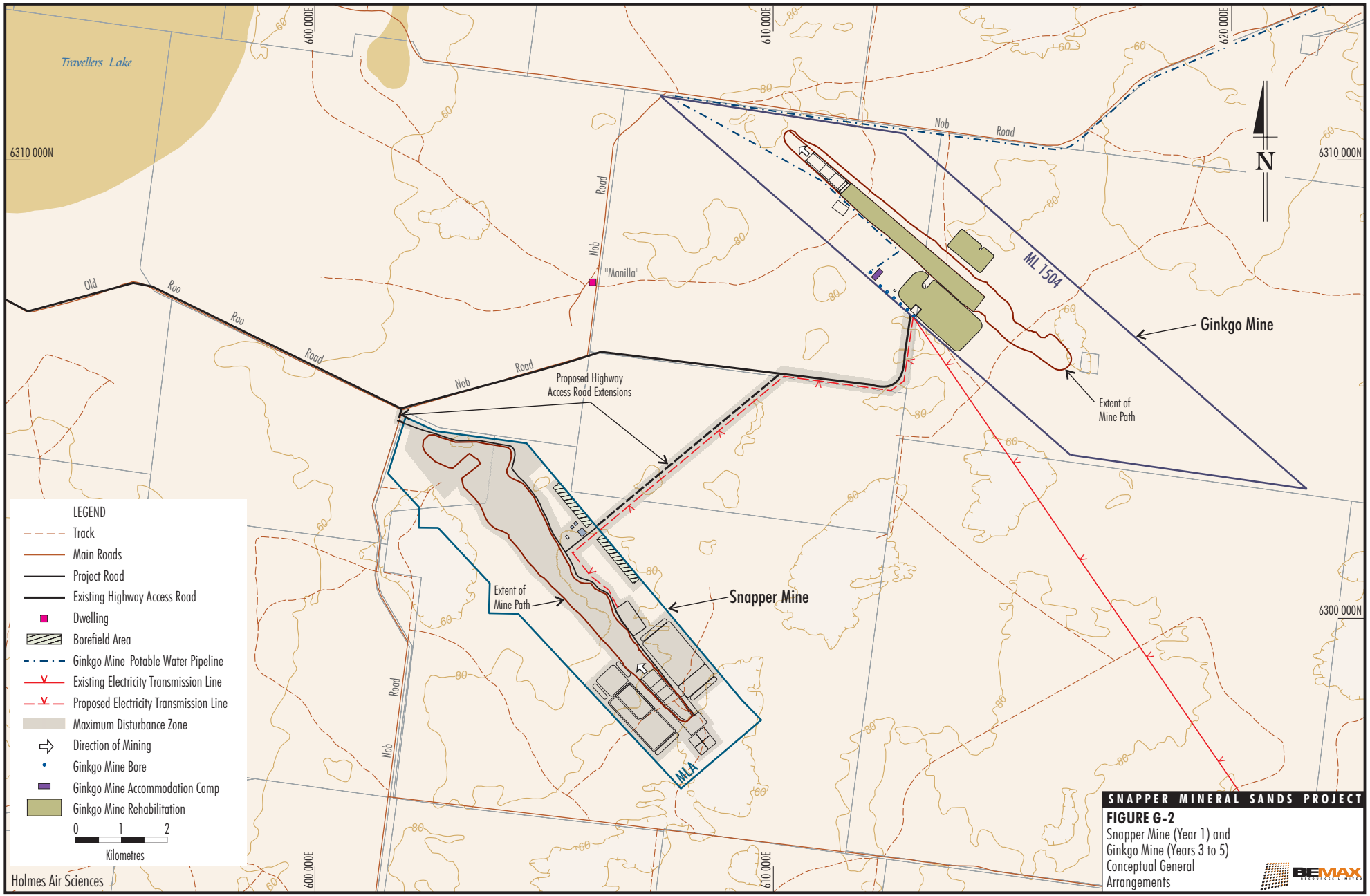
"Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard".

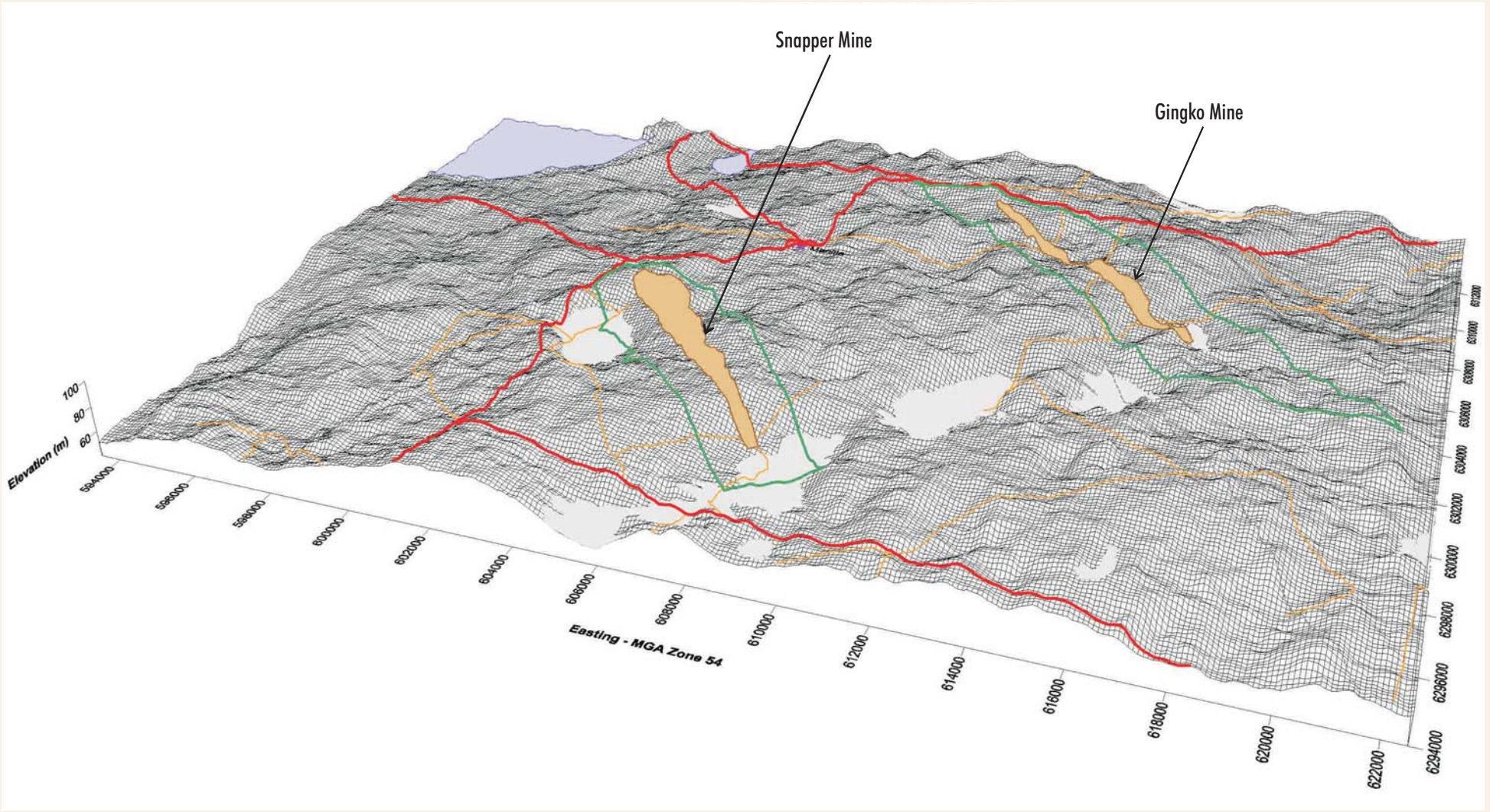
FIGURES



BMX-03-09 App Air_001E



BMX-03-09 App Air_002F



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SNAPPER MINERAL SANDS PROJECT

FIGURE G-3
Pseudo Three-dimensional Representation of Terrain in the Study Area

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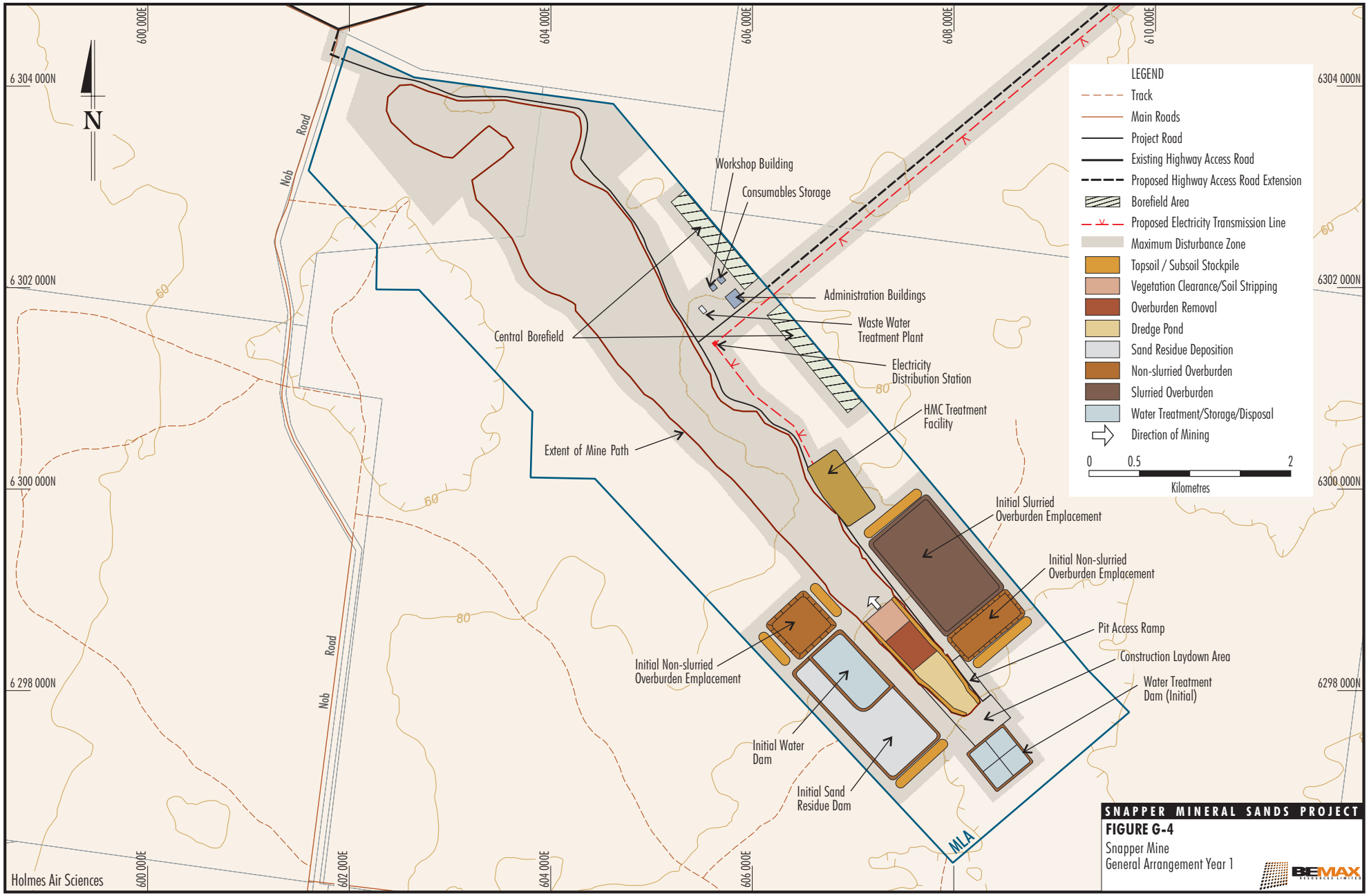
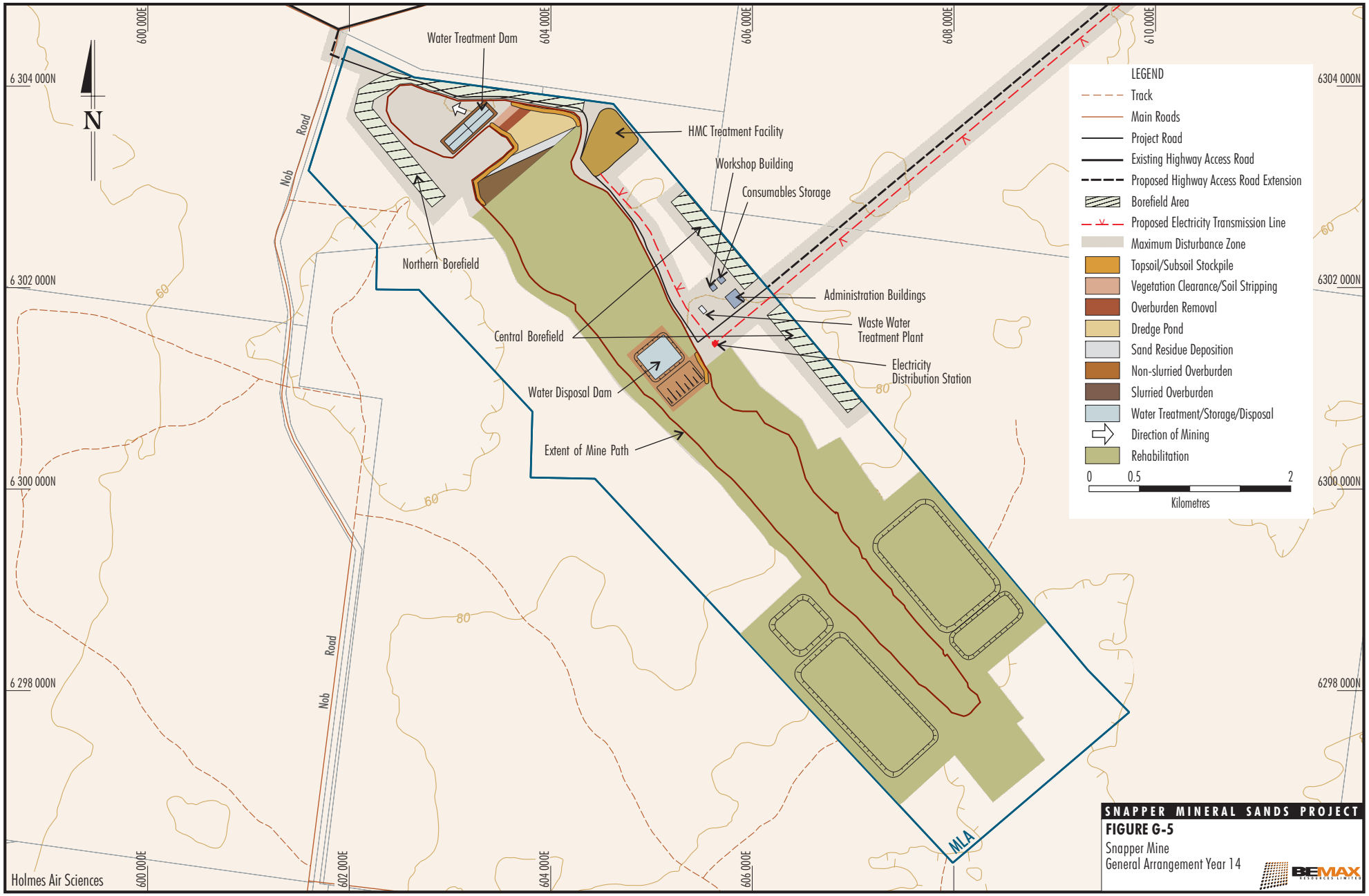


BMX-03-09 App Air_004D



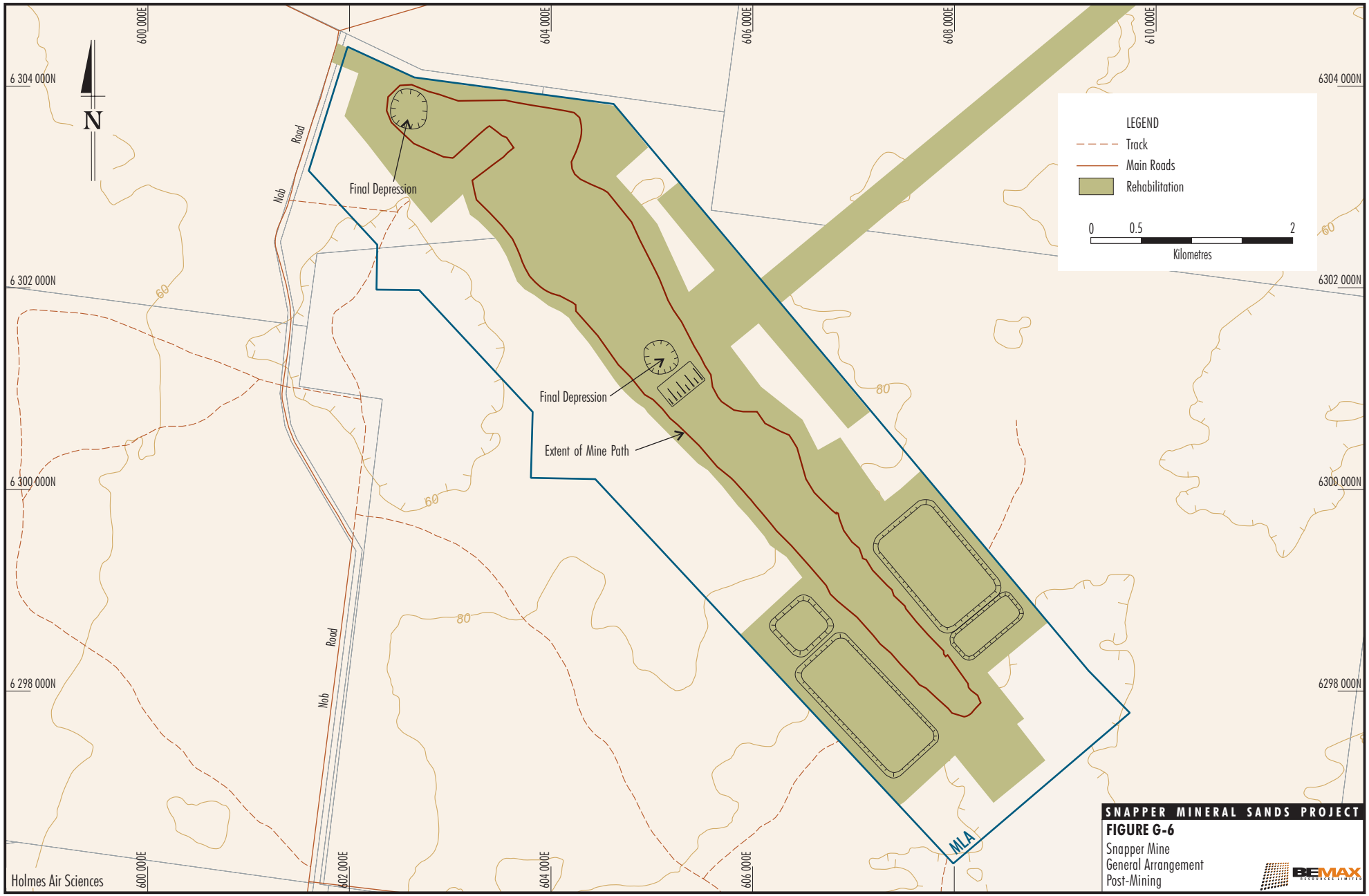
SNAPPER MINERAL SANDS PROJECT

FIGURE G-5

Snapper Mine
General Arrangement Year 14

BEMAX RESOURCES LIMITED

BMX-03-09 App Air_005D



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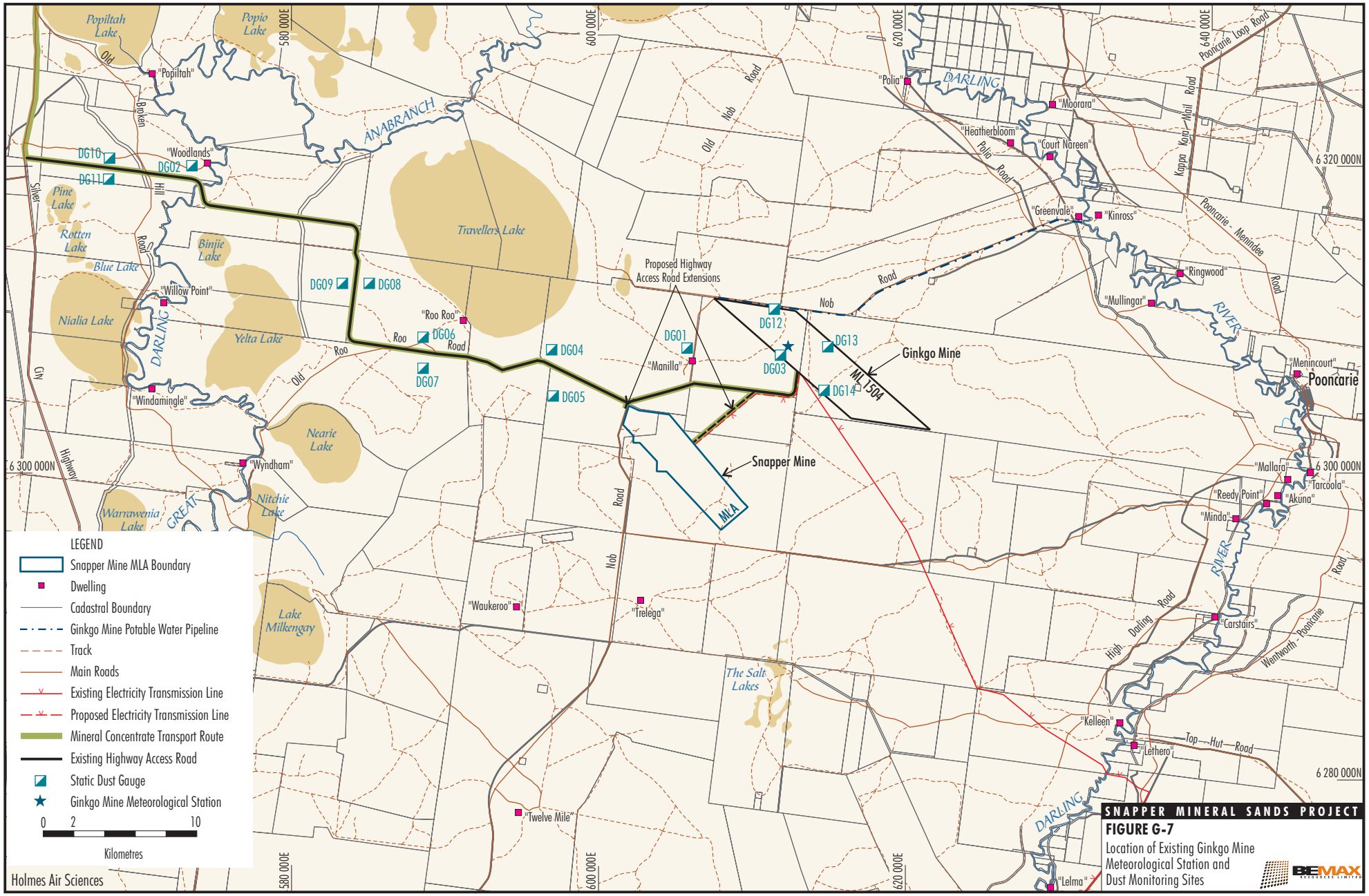
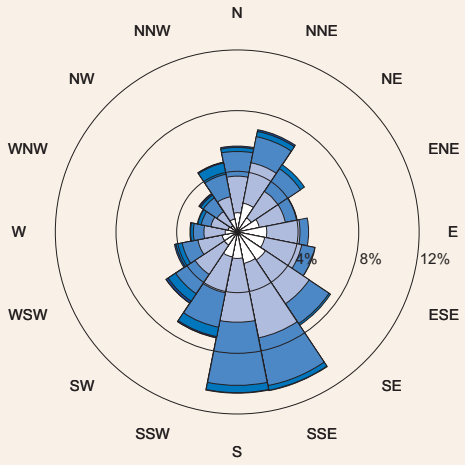
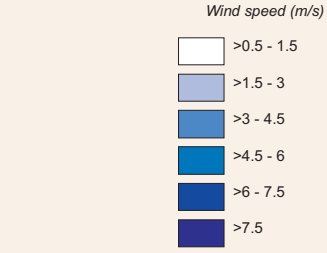
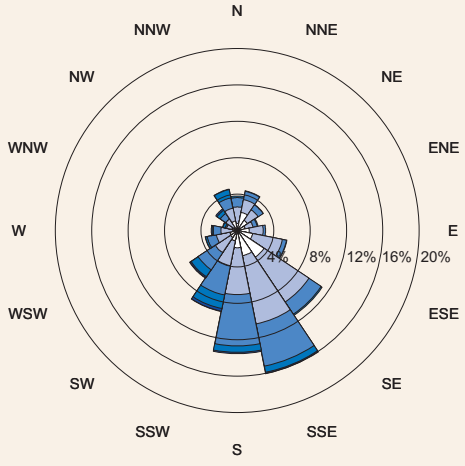


BMX-03-09 App Air_007E

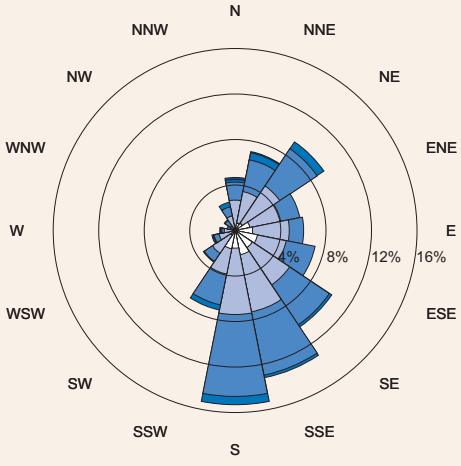


Annual
Calms = 8.9%

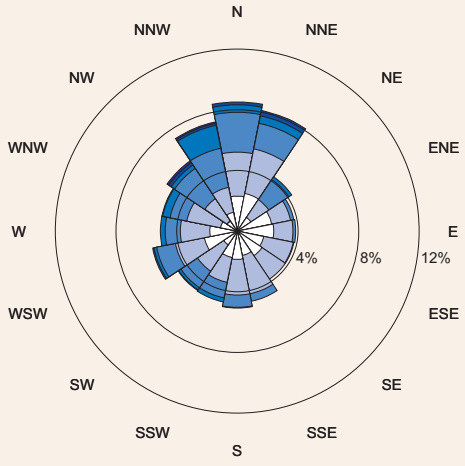




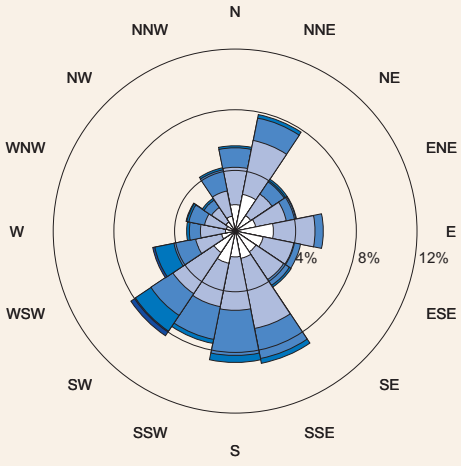
Summer
Calms = 5.6%



Autumn
Calms = 2.9%



Winter
Calms = 15.8%



Spring
Calms = 11.4%

SNAPPER MINERAL SANDS PROJECT

FIGURE G-8

Annual and Seasonal Wind Roses for the Ginkgo Mine - April 2005 to March 2006 (1 April 2005 to 17 June 2005 by TAPM)

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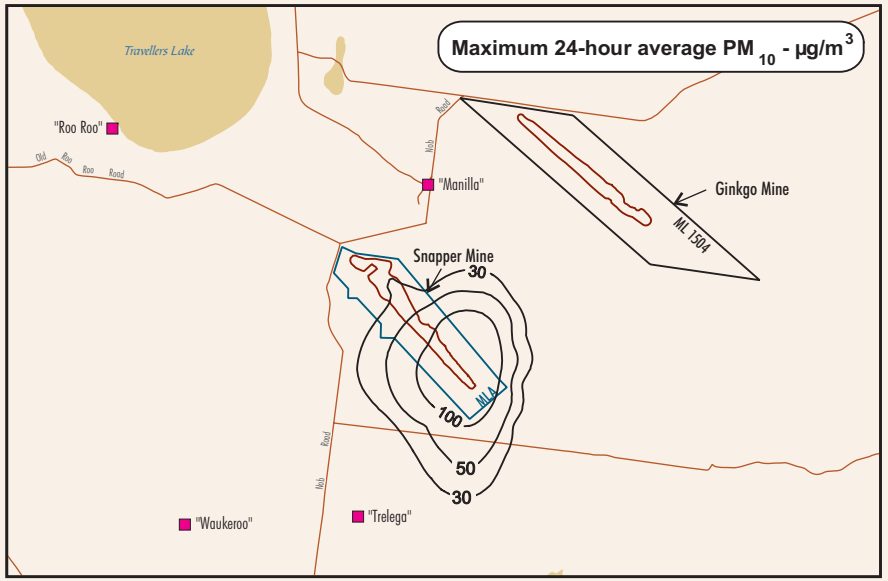

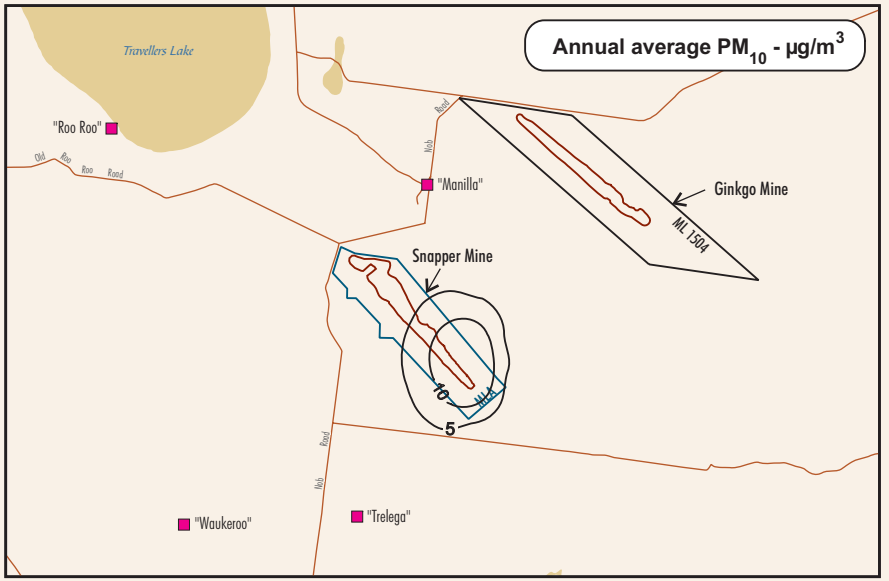

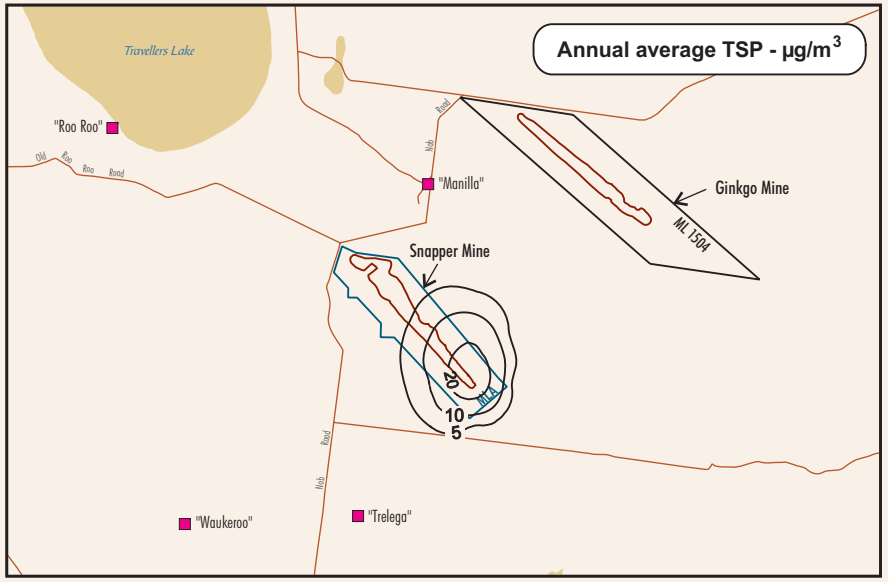

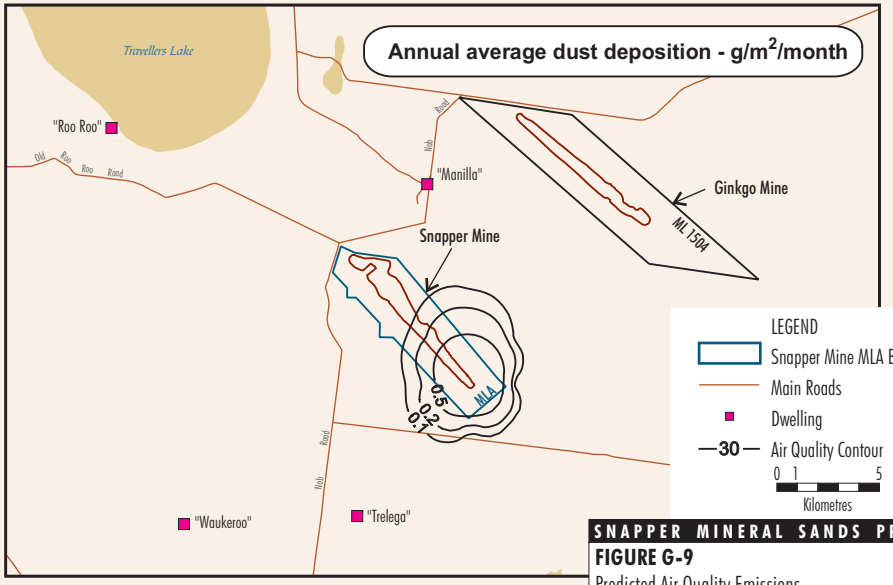

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FIGURE G-9

Predicted Air Quality Emissions from the Snapper Mine - Construction

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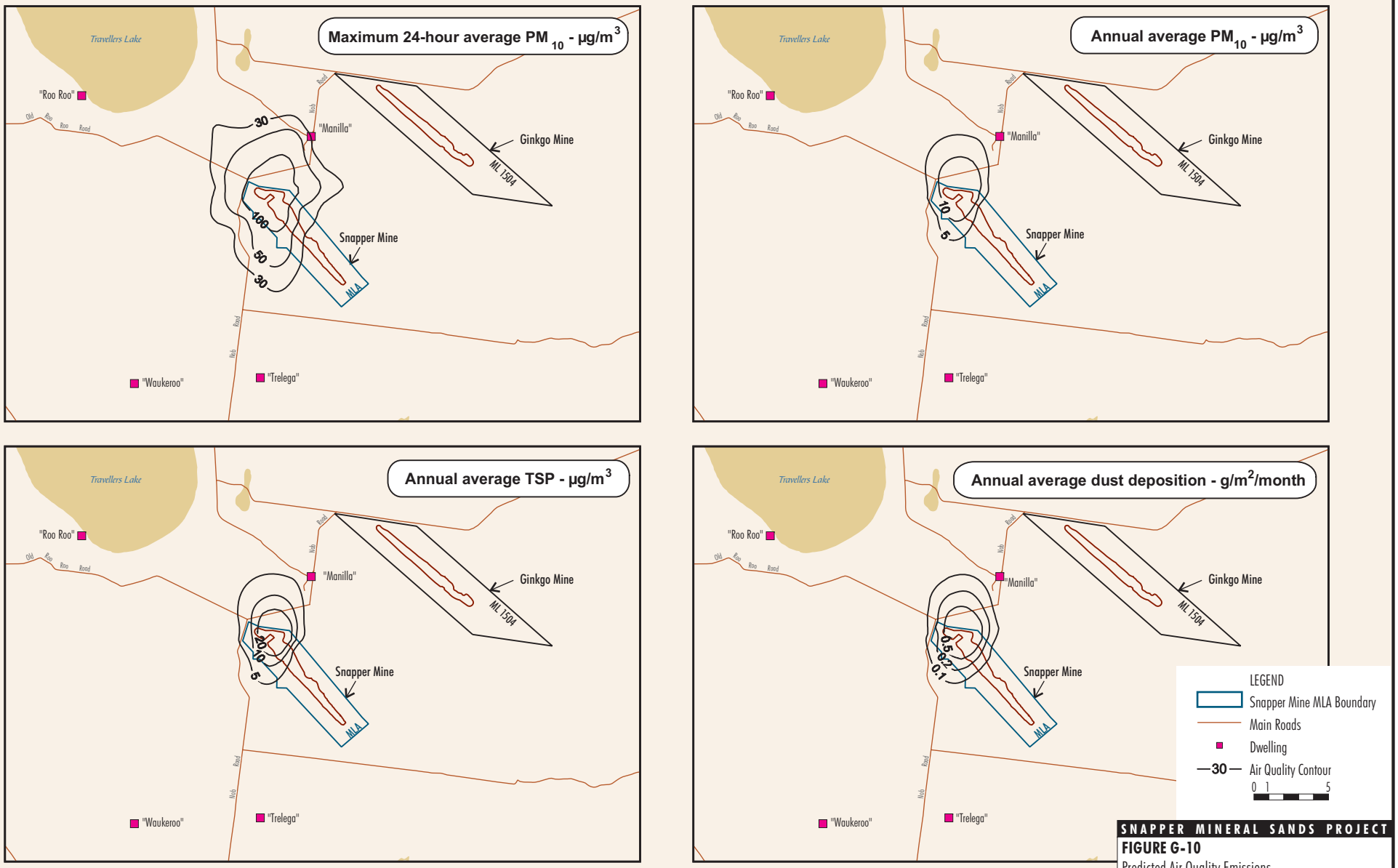
BMX-03-09 App AIr_009C



SNAPPER MINERAL SANDS PROJECT

FIGURE G-10

Predicted Air Quality Emissions from the Snapper Mine - Operations (Year 14)

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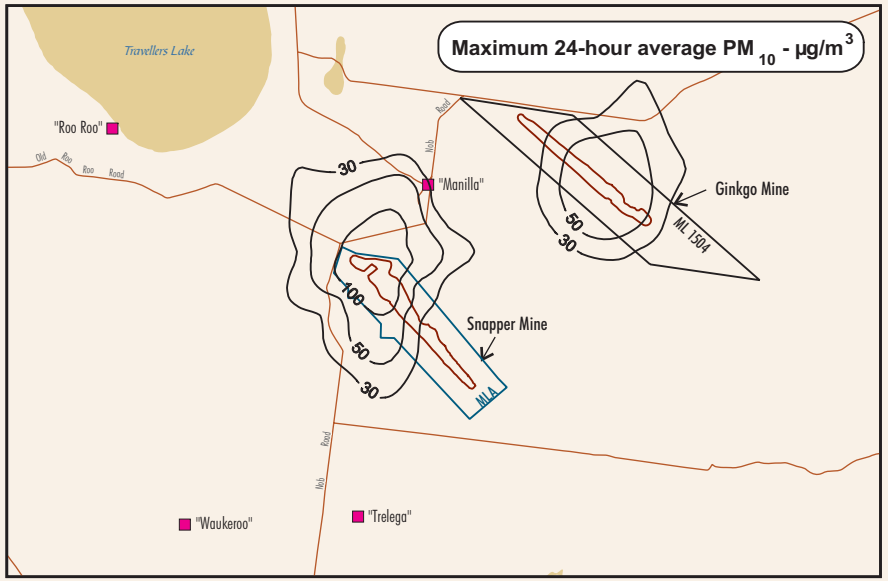
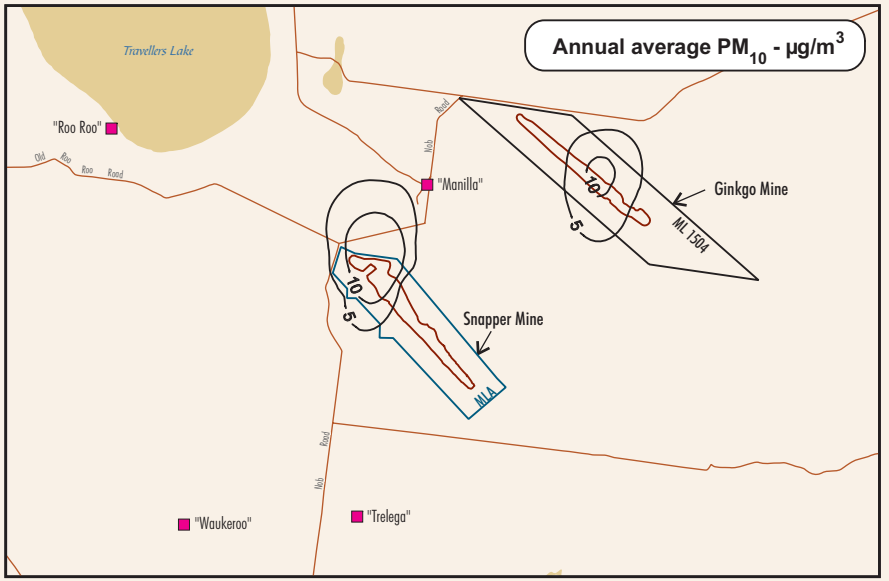
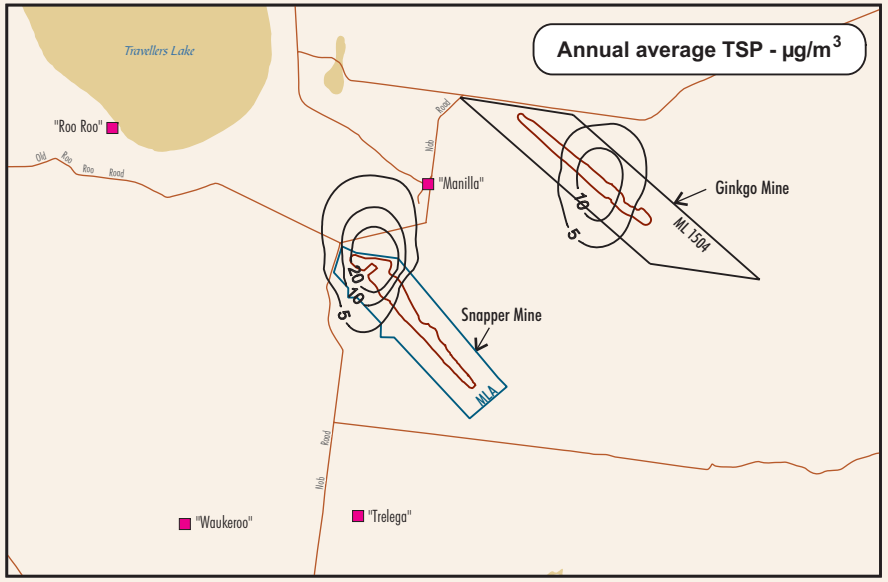
BMX-03-09 App Air_010D







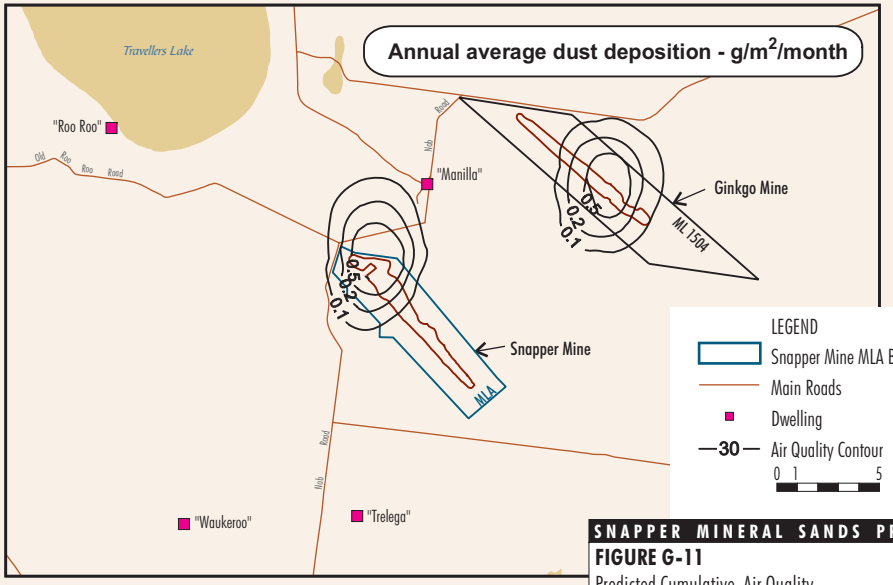


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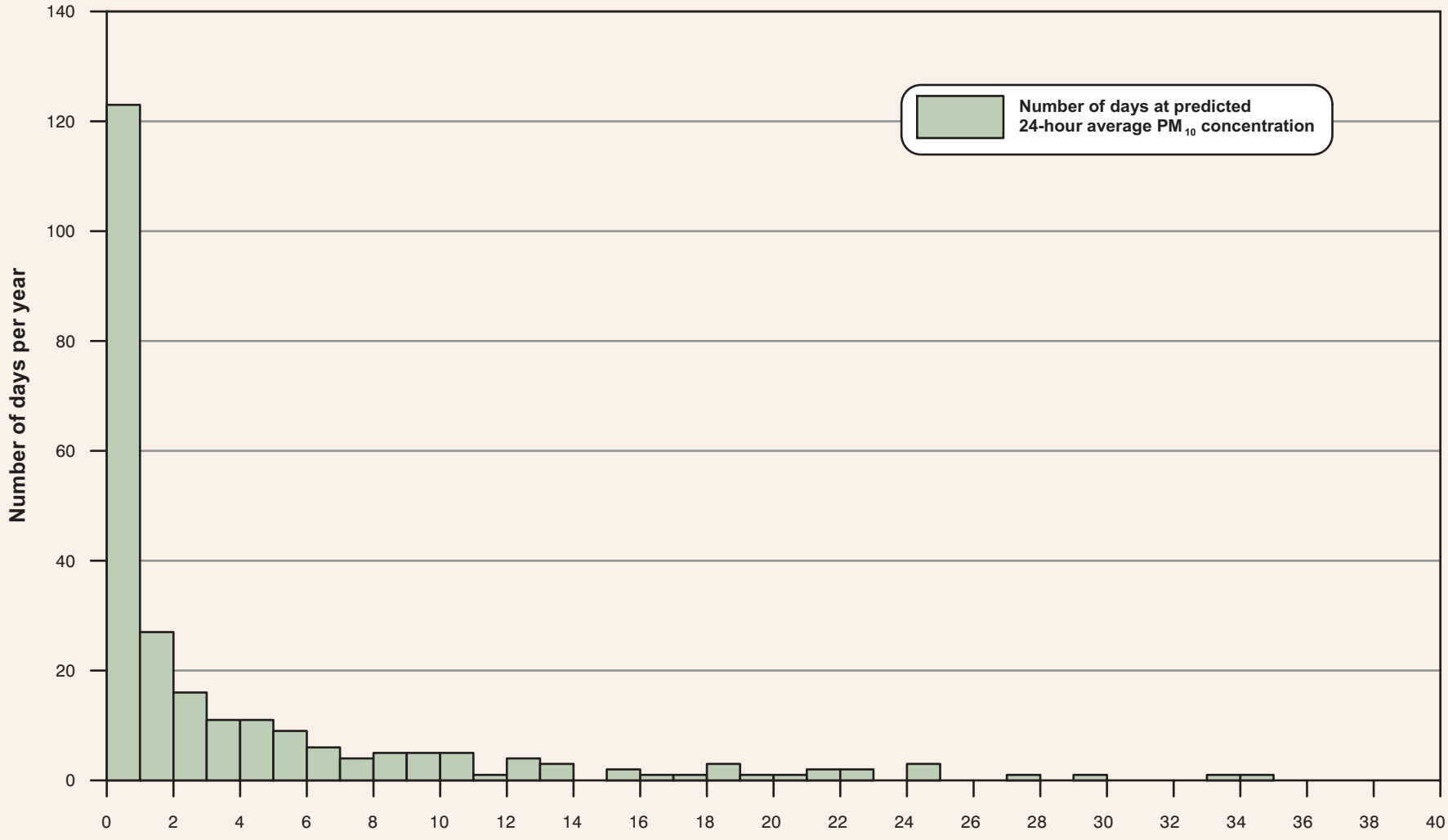
FIGURE G-11

Predicted Cumulative Air Quality Emissions from the Snapper and Ginkgo Mines (Snapper Year 14)

BEMAX RESOURCES LIMITED

BMX-03-09 App Air_011C



SNAPPER MINERAL SANDS PROJECT

FIGURE G-12

Histogram of 24-hour Average PM_{10} Concentrations at the "Manilla" Homestead for Snapper Mine Year 14 Operation

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ATTACHMENT GA

JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES

Ginkgo 2005/2006 (31-5-05 to 17-6-05 by TAPM)

STATISTICS FOR FILE: C:\Jobs\Snapper\metdata\GingTAPM.isc
MONTHS: All
HOURS : All
OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (metres per second [m/s])

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001484	0.001256	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002740
NE	0.001484	0.002626	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004110
ENE	0.001826	0.002169	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003995
E	0.002169	0.003539	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005708
ESE	0.002055	0.003196	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005251
SE	0.001598	0.002397	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003995
SSE	0.000571	0.002740	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003311
S	0.000571	0.001142	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001712
SSW	0.000457	0.001826	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002283
SW	0.000685	0.001826	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002511
WSW	0.001142	0.001598	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002740
W	0.000913	0.001370	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002283
WNW	0.000457	0.001712	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002169
NW	0.000228	0.001598	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001826
NNW	0.000685	0.002169	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002854
N	0.001027	0.001826	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002854
CALM									0.001712
TOTAL	0.017352	0.032991	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.052055

MEAN WIND SPEED (m/s) = 1.72
NUMBER OF OBSERVATIONS = 456

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002511	0.003995	0.002397	0.000000	0.000000	0.000000	0.000000	0.000000	0.008904
NE	0.002055	0.003995	0.001826	0.000342	0.000000	0.000000	0.000000	0.000000	0.008219
ENE	0.002854	0.003881	0.000799	0.000000	0.000000	0.000000	0.000000	0.000000	0.007534
E	0.002055	0.004224	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.006963
ESE	0.003881	0.005251	0.002169	0.000000	0.000000	0.000000	0.000000	0.000000	0.011301
SE	0.003653	0.007192	0.002740	0.000000	0.000000	0.000000	0.000000	0.000000	0.013584
SSE	0.002397	0.007648	0.004110	0.000228	0.000000	0.000000	0.000000	0.000000	0.014384
S	0.002055	0.005936	0.007420	0.000114	0.000000	0.000000	0.000000	0.000000	0.015525
SSW	0.001598	0.003767	0.005137	0.000228	0.000000	0.000000	0.000000	0.000000	0.010731
SW	0.002055	0.005594	0.005936	0.000685	0.000000	0.000000	0.000000	0.000000	0.014269
WSW	0.001712	0.004110	0.003425	0.000228	0.000000	0.000000	0.000000	0.000000	0.009475
W	0.002169	0.003196	0.003196	0.000228	0.000000	0.000000	0.000000	0.000000	0.008790
WNW	0.001712	0.003539	0.001484	0.000000	0.000000	0.000000	0.000000	0.000000	0.006735
NW	0.000799	0.002169	0.002283	0.000114	0.000000	0.000000	0.000000	0.000000	0.005365
NNW	0.001484	0.003196	0.005594	0.001941	0.000000	0.000000	0.000000	0.000000	0.012215
N	0.001598	0.003653	0.004338	0.000000	0.000000	0.000000	0.000000	0.000000	0.009589
CALM									0.004452
TOTAL	0.034589	0.071347	0.053539	0.004110	0.000000	0.000000	0.000000	0.000000	0.168037

MEAN WIND SPEED (m/s) = 2.45
NUMBER OF OBSERVATIONS = 1472

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002169	0.004452	0.003767	0.000799	0.000114	0.000000	0.000000	0.000000	0.011301
NE	0.000913	0.002511	0.001941	0.002055	0.000000	0.000000	0.000000	0.000000	0.007420
ENE	0.001712	0.001370	0.000685	0.000228	0.000000	0.000000	0.000000	0.000000	0.003995
E	0.001941	0.002740	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.005251
ESE	0.001256	0.003995	0.000913	0.000000	0.000000	0.000000	0.000000	0.000000	0.006164
SE	0.003082	0.005365	0.003082	0.000799	0.000000	0.000000	0.000000	0.000000	0.012329
SSE	0.002283	0.003881	0.006279	0.001484	0.000000	0.000000	0.000000	0.000000	0.013927
S	0.001712	0.006507	0.006164	0.001256	0.000000	0.000000	0.000000	0.000000	0.015639
SSW	0.001370	0.002283	0.005137	0.001712	0.000114	0.000000	0.000000	0.000000	0.010616
SW	0.001370	0.002854	0.003767	0.002397	0.000000	0.000000	0.000000	0.000000	0.010388
WSW	0.001142	0.002397	0.002511	0.002283	0.000457	0.000000	0.000000	0.000000	0.008790
W	0.000457	0.002854	0.001598	0.000685	0.000228	0.000000	0.000000	0.000000	0.005822
WNW	0.001256	0.001941	0.001826	0.000913	0.000114	0.000000	0.000000	0.000000	0.006050
NW	0.000571	0.001484	0.001712	0.001142	0.000000	0.000000	0.000000	0.000000	0.004909
NNW	0.001826	0.003767	0.002397	0.003311	0.000000	0.000000	0.000000	0.000000	0.011301
N	0.001826	0.005023	0.004338	0.001142	0.000228	0.000000	0.000000	0.000000	0.012557
CALM									0.007192
TOTAL	0.024886	0.053425	0.046689	0.020205	0.001256	0.000000	0.000000	0.000000	0.153653

MEAN WIND SPEED (m/s) = 2.86
NUMBER OF OBSERVATIONS = 1346

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000913	0.005594	0.003881	0.002626	0.001027	0.000000	0.000000	0.000000	0.014041
NE	0.000457	0.003767	0.004909	0.000571	0.000000	0.000000	0.000000	0.000000	0.009703
ENE	0.000799	0.002397	0.002055	0.000114	0.000000	0.000000	0.000000	0.000000	0.005365
E	0.002055	0.004909	0.000799	0.000000	0.000000	0.000000	0.000000	0.000000	0.007763
ESE	0.001941	0.006050	0.001598	0.000114	0.000000	0.000000	0.000000	0.000000	0.009703
SE	0.001370	0.005251	0.002511	0.000228	0.000000	0.000000	0.000000	0.000000	0.009361
SSE	0.001826	0.009589	0.008562	0.000913	0.000342	0.000000	0.000000	0.000000	0.021233
S	0.001598	0.009018	0.008904	0.002055	0.000342	0.000000	0.000000	0.000000	0.021918
SSW	0.000685	0.005479	0.004909	0.002854	0.000571	0.000114	0.000000	0.000000	0.014612
SW	0.000571	0.002854	0.003311	0.002169	0.001598	0.000114	0.000000	0.000000	0.010616
WSW	0.000228	0.003425	0.002854	0.001370	0.000571	0.000000	0.000000	0.000000	0.008447
W	0.000571	0.002055	0.001370	0.000913	0.000228	0.000000	0.000000	0.000000	0.005137
WNW	0.000571	0.002740	0.001712	0.001370	0.000228	0.000000	0.000000	0.000000	0.006621
NW	0.000228	0.002283	0.002968	0.000913	0.000913	0.000342	0.000000	0.000000	0.007648
NNW	0.000799	0.002511	0.002511	0.002169	0.000457	0.000228	0.000000	0.000000	0.008676
N	0.000685	0.004224	0.003653	0.001256	0.000685	0.000000	0.000000	0.000000	0.010502
CALM									0.004110
TOTAL	0.015297	0.072146	0.056507	0.019635	0.006963	0.000799	0.000000	0.000000	0.175457

MEAN WIND SPEED (m/s) = 3.10
NUMBER OF OBSERVATIONS = 1537

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000342	0.003767	0.006050	0.000114	0.000000	0.000000	0.000000	0.000000	0.010274
NE	0.000342	0.002283	0.006621	0.000114	0.000000	0.000000	0.000000	0.000000	0.009361
ENE	0.000457	0.001826	0.002854	0.000000	0.000000	0.000000	0.000000	0.000000	0.005137
E	0.000228	0.001370	0.002055	0.000000	0.000000	0.000000	0.000000	0.000000	0.003653
ESE	0.000114	0.000342	0.002283	0.000000	0.000000	0.000000	0.000000	0.000000	0.002740
SE	0.000114	0.001826	0.003995	0.000228	0.000000	0.000000	0.000000	0.000000	0.006164
SSE	0.000000	0.007420	0.008219	0.000457	0.000000	0.000000	0.000000	0.000000	0.016096
S	0.000000	0.003995	0.011644	0.001370	0.000000	0.000000	0.000000	0.000000	0.017009
SSW	0.000228	0.001598	0.005479	0.001484	0.000000	0.000000	0.000000	0.000000	0.008790
SW	0.000000	0.002511	0.001598	0.000571	0.000000	0.000000	0.000000	0.000000	0.004680
WSW	0.000000	0.001826	0.001142	0.000342	0.000000	0.000000	0.000000	0.000000	0.003311
W	0.000000	0.001027	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.001598
WNW	0.000000	0.000685	0.001027	0.000000	0.000000	0.000000	0.000000	0.000000	0.001712
NW	0.000000	0.001256	0.003767	0.000000	0.000000	0.000000	0.000000	0.000000	0.005023
NNW	0.000000	0.001256	0.003311	0.000114	0.000000	0.000000	0.000000	0.000000	0.004680
N	0.000114	0.003425	0.002740	0.000228	0.000000	0.000000	0.000000	0.000000	0.006507
CALM									0.000000
TOTAL	0.001941	0.036416	0.063356	0.005023	0.000000	0.000000	0.000000	0.000000	0.106735

MEAN WIND SPEED (m/s) = 3.32
NUMBER OF OBSERVATIONS = 935

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.011872	0.008105	0.001484	0.000000	0.000000	0.000000	0.000000	0.000000	0.021461
NE	0.005822	0.005936	0.002626	0.000000	0.000000	0.000000	0.000000	0.000000	0.014384
ENE	0.007078	0.005822	0.001256	0.000000	0.000000	0.000000	0.000000	0.000000	0.014155
E	0.010959	0.005137	0.001598	0.000000	0.000000	0.000000	0.000000	0.000000	0.017694
ESE	0.009132	0.006050	0.001941	0.000000	0.000000	0.000000	0.000000	0.000000	0.017123
SE	0.012443	0.012671	0.003425	0.000000	0.000000	0.000000	0.000000	0.000000	0.028539
SSE	0.014041	0.018721	0.005023	0.000000	0.000000	0.000000	0.000000	0.000000	0.037785
S	0.011530	0.015525	0.007420	0.000000	0.000000	0.000000	0.000000	0.000000	0.034475
SSW	0.012443	0.009132	0.002511	0.000000	0.000000	0.000000	0.000000	0.000000	0.024087
SW	0.005708	0.007534	0.000799	0.000000	0.000000	0.000000	0.000000	0.000000	0.014041
WSW	0.006050	0.002968	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.009589
W	0.003881	0.003539	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.007648
WNW	0.002169	0.001027	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.003653
NW	0.003196	0.002397	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.005708
NNW	0.003881	0.002055	0.001256	0.000000	0.000000	0.000000	0.000000	0.000000	0.007192
N	0.007420	0.005936	0.001256	0.000000	0.000000	0.000000	0.000000	0.000000	0.014612
CALM									0.071918
TOTAL	0.127626	0.112557	0.031963	0.000000	0.000000	0.000000	0.000000	0.000000	0.344064

MEAN WIND SPEED (m/s) = 1.51
NUMBER OF OBSERVATIONS = 3014

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.019292	0.027169	0.017580	0.003539	0.001142	0.000000	0.000000	0.000000	0.068721
NE	0.011073	0.021119	0.017922	0.003082	0.000000	0.000000	0.000000	0.000000	0.053196
ENE	0.014726	0.017466	0.007648	0.000342	0.000000	0.000000	0.000000	0.000000	0.040183
E	0.019406	0.021918	0.005708	0.000000	0.000000	0.000000	0.000000	0.000000	0.047032
ESE	0.018379	0.024886	0.008904	0.000114	0.000000	0.000000	0.000000	0.000000	0.052283
SE	0.022260	0.034703	0.015753	0.001256	0.000000	0.000000	0.000000	0.000000	0.073973
SSE	0.021119	0.050000	0.032192	0.003082	0.000342	0.000000	0.000000	0.000000	0.106735
S	0.017466	0.042123	0.041553	0.004795	0.000342	0.000000	0.000000	0.000000	0.106279
SSW	0.016781	0.024087	0.023174	0.006279	0.000685	0.000114	0.000000	0.000000	0.071119
SW	0.010388	0.023174	0.015411	0.005822	0.001598	0.000114	0.000000	0.000000	0.056507
WSW	0.010274	0.016324	0.010502	0.004224	0.001027	0.000000	0.000000	0.000000	0.042352
W	0.007991	0.014041	0.006963	0.001826	0.000457	0.000000	0.000000	0.000000	0.031279
WNW	0.006164	0.011644	0.006507	0.002283	0.000342	0.000000	0.000000	0.000000	0.026941
NW	0.005023	0.011187	0.010845	0.002169	0.000913	0.000342	0.000000	0.000000	0.030479
NNW	0.008676	0.014954	0.015068	0.007534	0.000457	0.000228	0.000000	0.000000	0.046918
N	0.012671	0.024087	0.016324	0.002626	0.000913	0.000000	0.000000	0.000000	0.056621
CALM									0.089384
TOTAL	0.221689	0.378881	0.252055	0.048973	0.008219	0.000799	0.000000	0.000000	1.000000

MEAN WIND SPEED (m/s) = 2.36
NUMBER OF OBSERVATIONS = 8760

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 5.2%
B : 16.8%
C : 15.4%
D : 17.5%
E : 10.7%
F : 34.4%

ATTACHMENT GB

ESTIMATED DUST EMISSIONS

ESTIMATED DUST EMISSIONS : The Snapper Mine

These dust emission estimates have been formulated from the operation description provided by BEMAX Resources Limited (BEMAX). Estimated emissions are presented for all significant dust generating activities associated with the operation. The relevant emission factors used for the study are described below.

Scrapers (or equivalent) hauling topsoil, subsoil or overburden
After the application of water for dust suppression the emission factor used for scrapers hauling material on unsealed surfaces was taken to be 1 kilograms (kg) per vehicle kilometre travelled (kg/VKT). This represents 75% control efficiency. It should be noted that equipment other than scrapers (such as tractors with scoops) may be used for transporting topsoil, subsoil or overburden. A similar dust emission factor would be applied for other types of vehicles transporting material over unsealed surfaces.

Dozer(s) on overburden
Emissions from dozers on overburden have been calculated using the US EPA emission factor equation (**US EPA, 1985 and updates**). The equation is as follows:

Equation 1

$$E_{TSP} = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \qquad \text{kg/hour}$$

Where,
E_{TSP} = total suspended solids (TSP) emissions
s = silt content (%), and
M = moisture (%)

Grading roads and open areas
Estimates of TSP emissions from grading roads have been made using the US EPA (1985 and updates) emission factor equation (Equation 2).

Equation 2

$$E_{TSP} = 0.0034 \times S^{2.5} \qquad \text{kg/VKT}$$

where,
S = speed of the grader in kilometers per hour (km/h) (taken to be 8 km/h)

Wind erosion from exposed areas and stockpiles
The emission factor for wind erosion is given in Equation 3 below.

Equation 3

$$E_{TSP} = 1.9 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) \qquad \text{kg/ha/day}$$

Where,
s = silt content (%)
p = number of rain days per year, and
f = percentage of the time that wind speed is above 5.4 metres per second (m/s)

ESTIMATED DUST EMISSIONS

ACTIVITY	TSP kg Emission/ Year	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Construction/Year 1 operation											
Scrapers loading, transporting and unload topsoil	11,087	125,656	m^3/y	0.09	kg/m3	34	m^3/load	3	km/return trip	1.0	kg/VKT
Dozer(s) stripping overburden	101,250	26,280	h/y	3.85	kg/t	15	silt content in %	9	moisture content in %		
Scrapers loading, transporting and unload overburden	477,849	4,923,292	t/y	0.10	kg/t	31	t/load	3	km/return trip	1.0	kg/VKT
Dozer(s) on overburden areas	134,999	35,040	h/y	3.85	kg/t	15	silt content in %	9	moisture content in %		
Grading roads and open areas	21,566	35,040	km	0.62	kg/VKT	8	speed of graders in km/h				
Wind erosion from topsoil stockpiles	13,207	31	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from overburden dumps	30,720	71	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from disturbed area around mine	3,751	9	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from product stockpiles	4,566	11	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Year 14 operation											
Scrapers loading, transporting and unload topsoil	13,053	147,929	m^3/y	0.09	kg/m3	34	m^3/load	3	km/return trip	1	kg/VKT
Dozer(s) stripping overburden	101,250	26,280	h/y	3.85	kg/h	15	silt content in %	9	moisture content in %		
Scrapers loading, transporting and unload overburden	513,538	5,290,993	t/y	0.10	kg/t	30.9091	t/load	3	km/return trip	1	kg/VKT
Dozer(s) on overburden areas	134,999	35,040	h/y	3.85	kg/h	15	silt content in %	9	moisture content in %		
Grading roads and open areas	21,566	35,040	km	0.62	kg/VKT	8	speed of graders in km/h				
Wind erosion from topsoil stockpiles	2,738	6	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from overburden dumps	1,298	3	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from disturbed area around mine	4,819	11	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s
Wind erosion from product stockpiles	4,566	11	ha	432	kg/ha/y	253	Average number of rain days	15	silt content in %	1.96	% of winds above 5.4 m/s

Abbreviations:

h/y	hours per year
ha	hectares
kg	kilograms
kg/h	kilograms per hour
kg/ha/y	kilograms per hectare per year
kg/m^3	kilograms per cubic metre
kg/t	kilograms per tonne
kg/VKT	kilograms per vehicle kilometres travelled
km	kilometre
km/h	kilometres per hour
m^3	cubic metres
m^3/y	cubic metres per year
m/s	metres per second
t	tones
t/y	tones per year
TSP	Total Suspended Particulates

A summary of dust emission estimates for each activity, activity type, location of emission sources and activity hours are provided below.

```
----------------------------      13-Nov-2006 14:17
 DUST EMISSION CALCULATIONS V2
 ----------------------------

 Output emissions file  : C:\Jobs\Snapper\ausplume\y09\emiss.src
 Meteorological file    : C:\Jobs\Snapper\metdata\GingTAPM.aus
 Number of dust sources : 1
 Number of activities   : 10
 No-blast conditions    : None
 Wind sensitive factor  : 1.165 (1.165 adjusted for activity hours)
 Wind erosion factor    : 27.131

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Scrapers loading, transporting and unload topsoil
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 13053 kg/y
 FROM SOURCES  : 1
1
 HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Dozer(s) stripping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 101250 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Scrapers loading, transporting and unload O/B
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 513538 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Dozer(s) on overburden areas
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 134999 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Grading roads and open areas
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 21566 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Wind erosion from topsoil stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2738 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Wind erosion from overburden dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1298 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Wind erosion from disturbed area around mine
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 4819 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day

 ACTIVITY NAME : Wind erosion from product stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 4566 kg/y
 FROM SOURCES  : 1
1
HOURS OF DAY  : 24 hours per day
```

ATTACHMENT GC

AUSPLUME MODEL OUTPUT FILE

AUSPLUME MODEL OUTPUT FILE:

Some parts of this file have been deleted to save paper. The complete model input and output files can be provided on request.

```
1                                 _________________

                                    Snapper Mine

                                  _________________

 Concentration or deposition                          Concentration
 Emission rate units                                  grams/second
 Concentration units                                  microgram/m3
 Units conversion factor                              1.00E+06
 Constant background concentration                          0.00E+00
 Terrain effects                                      Egan method
 Plume depletion due to dry removal mechanisms included.
 Smooth stability class changes?                      No
 Other stability class adjustments ("urban modes")    None
 Ignore building wake effects?                        Yes
 Decay coefficient (unless overridden by met. file)   0.000
 Anemometer height                                    10 m
 Roughness height at the wind vane site               0.300 m
 Use the convective PDF algorithm?                    No

                     DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Briggs Rural
 Vertical  dispersion  curves for sources >100m high  Briggs Rural
 Enhance horizontal plume spreads for buoyancy?       Yes
 Enhance  vertical  plume spreads for buoyancy?       Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                     0.300m
 Adjustment for wind directional shear                None

                      PLUME RISE OPTIONS
 Gradual plume rise?                                  Yes
 Stack-tip downwash included?                         Yes
 Building downwash algorithm:                        Schulman-Scire method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?          No
 Disregard temp. gradients in the hourly met. file?   No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:

    Wind Speed                Stability Class
     Category       A      B      C      D      E      F
   ____________________________________________________________
        1         0.000  0.000  0.000  0.000  0.020  0.035
        2         0.000  0.000  0.000  0.000  0.020  0.035
        3         0.000  0.000  0.000  0.000  0.020  0.035
        4         0.000  0.000  0.000  0.000  0.020  0.035
        5         0.000  0.000  0.000  0.000  0.020  0.035
        6         0.000  0.000  0.000  0.000  0.020  0.035

 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

 AVERAGING TIMES
 24 hours
  average over all hours

 ____________________________________________________________________________


1                             _____________________________

                                    Snapper Mine

                              SOURCE CHARACTERISTICS

                              _____________________________

                     VOLUME SOURCE: 1

    X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
  603736  6303449           81m            10m        150m           10m

               (Constant) emission rate = 1.00E+00 grams/second

          Hourly multiplicative factors will be used with
          this emission factor.

                     Particle  Particle  Particle
                       Mass      Size    Density
                     fraction  (micron)  (g/cm3)
                    ____________________________
                       1.0000      1.0      2.50
```

```
                    VOLUME SOURCE: 2

   X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
 603736  6303449            81m            10m        150m           10m

              (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                    ____________________________
                      1.0000      5.0      2.50


                    VOLUME SOURCE: 3

   X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
 603736  6303449            81m            10m        150m           10m

              (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                    ____________________________
                      1.0000     17.3      2.50
```

```
1
                              ________________________

                                   Snapper Mine

                                RECEPTOR LOCATIONS

                              ________________________

 The Cartesian receptor grid has the following x-values (or eastings):
 584000.m  586000.m  588000.m  590000.m  592000.m  594000.m  596000.m
 598000.m  600000.m  602000.m  604000.m  606000.m  608000.m  610000.m
 612000.m  614000.m  616000.m  618000.m  620000.m  622000.m

 and these y-values (or northings):
6294000.m 6296000.m 6298000.m 6300000.m 6302000.m 6304000.m 6306000.m
6308000.m 6310000.m 6312000.m 6314000.m


 DISCRETE RECEPTOR LOCATIONS (in metres)

 No.     X       Y    ELEVN  HEIGHT       No.     X       Y    ELEVN  HEIGHT
  1  605999 6306560    78.0    0.0        16  604983 6302182    78.2    0.0
  2  603648 6303918    81.1    0.0        17  605617 6302683    78.6    0.0
  3  603314 6303684    80.2    0.0        18  605617 6303484    69.0    0.0
  4  603381 6303183    73.9    0.0        19  605083 6304418    74.2    0.0
  5  603782 6302916    72.5    0.0        20  604449 6305152    74.7    0.0
  6  604416 6302783    67.0    0.0        21  603114 6305219    76.9    0.0
  7  604983 6302883    70.9    0.0        22  601479 6303183    71.6    0.0
  8  605050 6303350    67.8    0.0        23  603081 6301214    59.5    0.0
  9  604516 6303684    74.0    0.0        24  605050 6301047    78.0    0.0
 10  604149 6304418    74.4    0.0        25  606785 6303083    78.5    0.0
 11  603481 6304418    83.0    0.0        26  606852 6305052    75.1    0.0
 12  602714 6304084    82.2    0.0        27  604783 6306855    76.5    0.0
 13  602714 6303350    69.4    0.0        28  601011 6304652    70.2    0.0
 14  603214 6302516    67.8    0.0        29  601011 6302783    71.5    0.0
 15  603982 6302316    69.6    0.0        30  601078 6301047    72.4    0.0
```

```
 METEOROLOGICAL DATA : Ginkgo 2005/2006 (31-5-05 to 17-6-05 by TAPM) - ISC2
A

 ------------------------------------------------------------------------

             HOURLY VARIABLE EMISSION FACTOR INFORMATION
             -------------------------------------------

 The input emission rates specfied above will be multiplied by hourly varying
 factors entered via the input file:
 C:\Jobs\Snapper\ausplume\y09\emiss.src
 For each stack source, hourly values within this file will be added to each
 declared exit velocity (m/sec) and temperature (K).

 Title of input hourly emission factor file is:
 AUSPLUME Variable emissions file (Met MANAGER)

             HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION
             ---------------------------------------------

 Prefix 1      allocated: 1
 Prefix 2      allocated: 2
 Prefix 3      allocated: 3
```

AVERAGE OVER ALL HOURS FOR SOURCE GROUP No. 1
in microgram/m3

Y (km)	X (km): 584.000	586.000	588.000	590.000	592.000	594.000
6314.000	9.27E-01	1.12E+00	1.39E+00	1.72E+00	1.95E+00	2.15E+00
6312.000	8.77E-01	1.03E+00	1.25E+00	1.59E+00	2.09E+00	2.53E+00
6310.000	8.06E-01	9.51E-01	1.15E+00	1.42E+00	1.84E+00	2.59E+00
6308.000	8.17E-01	9.18E-01	1.06E+00	1.28E+00	1.63E+00	2.21E+00
6306.000	9.05E-01	1.02E+00	1.15E+00	1.34E+00	1.60E+00	1.99E+00
6304.000	1.08E+00	1.23E+00	1.42E+00	1.67E+00	2.02E+00	2.54E+00
6302.000	9.42E-01	1.05E+00	1.19E+00	1.37E+00	1.63E+00	2.00E+00
6300.000	7.64E-01	8.66E-01	1.00E+00	1.18E+00	1.44E+00	1.80E+00
6298.000	7.45E-01	8.47E-01	9.74E-01	1.13E+00	1.30E+00	1.50E+00
6296.000	7.22E-01	8.03E-01	8.87E-01	9.75E-01	1.07E+00	1.21E+00
6294.000	6.63E-01	7.13E-01	7.66E-01	8.23E-01	9.27E-01	1.19E+00

Y (km)	X (km): 596.000	598.000	600.000	602.000	604.000	606.000
6314.000	2.70E+00	3.39E+00	3.85E+00	3.81E+00	3.43E+00	4.10E+00
6312.000	2.91E+00	3.86E+00	4.89E+00	5.15E+00	4.60E+00	5.24E+00
6310.000	3.49E+00	4.28E+00	6.18E+00	7.38E+00	6.69E+00	6.37E+00
6308.000	3.28E+00	5.25E+00	7.41E+00	1.16E+01	1.13E+01	7.51E+00
6306.000	2.71E+00	4.36E+00	9.11E+00	1.90E+01	2.66E+01	8.89E+00
6304.000	3.34E+00	4.75E+00	7.85E+00	2.20E+01	1.42E+02	9.47E+00
6302.000	2.59E+00	3.72E+00	6.16E+00	1.25E+01	2.51E+01	4.27E+00
6300.000	2.28E+00	2.85E+00	4.25E+00	1.13E+01	9.73E+00	3.62E+00
6298.000	1.72E+00	2.39E+00	4.62E+00	7.08E+00	5.86E+00	2.72E+00
6296.000	1.61E+00	2.65E+00	4.07E+00	4.89E+00	3.94E+00	1.97E+00
6294.000	1.77E+00	2.58E+00	3.29E+00	3.62E+00	2.93E+00	1.55E+00

Y (km)	X (km): 608.000	610.000	612.000	614.000	616.000	618.000
6314.000	2.88E+00	2.09E+00	1.44E+00	1.15E+00	8.62E-01	6.40E-01
6312.000	3.24E+00	2.11E+00	1.55E+00	1.08E+00	7.55E-01	6.27E-01
6310.000	3.47E+00	2.21E+00	1.38E+00	9.67E-01	8.31E-01	7.29E-01
6308.000	3.79E+00	1.92E+00	1.38E+00	1.16E+00	9.36E-01	7.56E-01
6306.000	3.36E+00	2.22E+00	1.60E+00	1.16E+00	8.80E-01	7.18E-01
6304.000	4.15E+00	2.52E+00	1.78E+00	1.36E+00	1.09E+00	9.17E-01
6302.000	2.01E+00	1.29E+00	9.94E-01	8.34E-01	7.31E-01	6.36E-01
6300.000	1.61E+00	1.05E+00	7.91E-01	6.06E-01	4.87E-01	4.16E-01
6298.000	1.48E+00	9.14E-01	6.78E-01	5.69E-01	4.86E-01	3.98E-01
6296.000	1.41E+00	8.62E-01	6.37E-01	4.98E-01	4.14E-01	3.72E-01
6294.000	1.23E+00	9.08E-01	5.91E-01	4.72E-01	3.92E-01	3.24E-01

Y (km)	X (km): 620.000	622.000
6314.000	5.19E-01	4.64E-01
6312.000	5.73E-01	5.28E-01
6310.000	6.40E-01	5.55E-01
6308.000	6.28E-01	5.34E-01
6306.000	6.07E-01	5.31E-01
6304.000	7.79E-01	6.75E-01
6302.000	5.71E-01	5.17E-01
6300.000	3.63E-01	3.26E-01
6298.000	3.29E-01	2.85E-01
6296.000	3.35E-01	2.92E-01
6294.000	2.92E-01	2.76E-01

Concentrations at the discrete receptors (No. : Value):

1:8.63E+00	2:2.69E+02	3:1.86E+02	4:1.23E+02	5:1.06E+02	6:2.08E+01	7:1.06E+01	8:1.66E+01
9:4.08E+01	10:7.18E+01	11:1.05E+02	12:5.57E+01	13:4.20E+01	14:5.33E+01	15:3.27E+01	16:8.90E+00
17:6.24E+00	18:1.16E+01	19:1.75E+01	20:3.45E+01	21:4.26E+01	22:1.49E+01	23:2.24E+01	24:6.90E+00
25:5.14E+00	26:5.43E+00	27:1.67E+01	28:1.19E+01	29:1.02E+01	30:6.85E+00		

AVERAGE OVER ALL HOURS FOR SOURCE GROUP No. 2
in microgram/m3

Y (km)	X (km): 584.000	586.000	588.000	590.000	592.000	594.000
6314.000	3.73E-01	4.72E-01	6.03E-01	7.54E-01	8.90E-01	1.05E+00
6312.000	3.59E-01	4.44E-01	5.73E-01	7.66E-01	1.03E+00	1.29E+00
6310.000	3.57E-01	4.33E-01	5.43E-01	7.10E-01	9.88E-01	1.45E+00
6308.000	3.77E-01	4.48E-01	5.44E-01	6.83E-01	9.14E-01	1.32E+00
6306.000	4.12E-01	4.94E-01	6.03E-01	7.50E-01	9.60E-01	1.28E+00
6304.000	4.57E-01	5.56E-01	6.92E-01	8.82E-01	1.17E+00	1.60E+00
6302.000	4.11E-01	4.93E-01	6.01E-01	7.47E-01	9.59E-01	1.28E+00
6300.000	3.47E-01	4.15E-01	5.06E-01	6.33E-01	8.21E-01	1.10E+00
6298.000	3.24E-01	3.86E-01	4.69E-01	5.78E-01	7.21E-01	8.92E-01
6296.000	3.02E-01	3.56E-01	4.21E-01	4.94E-01	5.78E-01	7.03E-01
6294.000	2.75E-01	3.14E-01	3.58E-01	4.11E-01	4.94E-01	6.56E-01

X (km): 596.000 598.000 600.000 602.000 604.000 606.000

Y (km)						
6314.000	1.39E+00	1.87E+00	2.27E+00	2.32E+00	2.06E+00	2.18E+00
6312.000	1.59E+00	2.26E+00	3.06E+00	3.39E+00	2.99E+00	3.04E+00
6310.000	2.03E+00	2.67E+00	4.16E+00	5.27E+00	4.74E+00	4.15E+00
6308.000	2.11E+00	3.54E+00	5.37E+00	9.00E+00	8.77E+00	5.51E+00
6306.000	1.85E+00	3.19E+00	7.18E+00	1.60E+01	2.23E+01	7.05E+00
6304.000	2.31E+00	3.62E+00	6.57E+00	1.99E+01	1.35E+02	8.10E+00
6302.000	1.80E+00	2.79E+00	5.03E+00	1.09E+01	2.25E+01	3.48E+00
6300.000	1.51E+00	2.05E+00	3.27E+00	8.79E+00	7.75E+00	2.73E+00
6298.000	1.10E+00	1.62E+00	3.23E+00	5.03E+00	4.02E+00	1.84E+00
6296.000	9.81E-01	1.64E+00	2.53E+00	3.12E+00	2.42E+00	1.24E+00
6294.000	9.86E-01	1.46E+00	1.85E+00	2.08E+00	1.60E+00	9.19E-01

X (km): 608.000 610.000 612.000 614.000 616.000 618.000

Y (km)						
6314.000	1.50E+00	1.01E+00	7.03E-01	5.54E-01	4.17E-01	3.03E-01
6312.000	1.82E+00	1.14E+00	8.26E-01	5.71E-01	3.92E-01	3.05E-01
6310.000	2.16E+00	1.35E+00	8.28E-01	5.44E-01	4.20E-01	3.38E-01
6308.000	2.58E+00	1.30E+00	8.43E-01	6.33E-01	4.80E-01	3.72E-01
6306.000	2.51E+00	1.54E+00	1.01E+00	6.87E-01	4.94E-01	3.71E-01
6304.000	3.18E+00	1.74E+00	1.11E+00	7.63E-01	5.52E-01	4.15E-01
6302.000	1.52E+00	9.22E-01	6.61E-01	5.05E-01	3.97E-01	3.18E-01
6300.000	1.20E+00	7.25E-01	4.94E-01	3.54E-01	2.74E-01	2.22E-01
6298.000	1.03E+00	6.36E-01	4.34E-01	3.25E-01	2.50E-01	1.97E-01
6296.000	8.86E-01	5.50E-01	4.00E-01	2.96E-01	2.27E-01	1.86E-01
6294.000	6.77E-01	5.16E-01	3.47E-01	2.74E-01	2.17E-01	1.71E-01

X (km): 620.000 622.000

Y (km)		
6314.000	2.35E-01	1.97E-01
6312.000	2.52E-01	2.11E-01
6310.000	2.75E-01	2.28E-01
6308.000	2.96E-01	2.38E-01
6306.000	2.93E-01	2.37E-01
6304.000	3.25E-01	2.61E-01
6302.000	2.61E-01	2.17E-01
6300.000	1.86E-01	1.58E-01
6298.000	1.61E-01	1.37E-01
6296.000	1.53E-01	1.28E-01
6294.000	1.43E-01	1.22E-01

Concentrations at the discrete receptors (No. : Value):

1:6.65E+00	2:2.57E+02	3:1.80E+02	4:1.20E+02	5:1.02E+02	6:1.90E+01	7:9.52E+00	8:1.52E+01
9:3.82E+01	10:6.63E+01	11:9.67E+01	12:5.09E+01	13:4.01E+01	14:4.98E+01	15:3.01E+01	16:7.66E+00
17:5.34E+00	18:1.03E+01	19:1.55E+01	20:3.01E+01	21:3.76E+01	22:1.33E+01	23:1.94E+01	24:5.60E+00
25:4.20E+00	26:4.37E+00	27:1.31E+01	28:1.02E+01	29:8.86E+00	30:5.61E+00		

AVERAGE OVER ALL HOURS FOR SOURCE GROUP No. 3
in microgram/m3

X (km): 584.000 586.000 588.000 590.000 592.000 594.000

Y (km)						
6314.000	7.79E-03	9.29E-03	1.12E-02	1.36E-02	1.69E-02	2.13E-02
6312.000	8.34E-03	1.01E-02	1.24E-02	1.55E-02	1.98E-02	2.58E-02
6310.000	8.75E-03	1.07E-02	1.34E-02	1.72E-02	2.27E-02	3.09E-02
6308.000	9.02E-03	1.12E-02	1.42E-02	1.85E-02	2.51E-02	3.58E-02
6306.000	9.08E-03	1.13E-02	1.45E-02	1.91E-02	2.65E-02	3.91E-02
6304.000	8.93E-03	1.11E-02	1.42E-02	1.89E-02	2.62E-02	3.90E-02
6302.000	8.58E-03	1.06E-02	1.35E-02	1.78E-02	2.44E-02	3.55E-02
6300.000	8.08E-03	9.94E-03	1.25E-02	1.63E-02	2.18E-02	3.10E-02
6298.000	7.53E-03	9.19E-03	1.15E-02	1.46E-02	1.93E-02	2.69E-02
6296.000	6.94E-03	8.38E-03	1.03E-02	1.30E-02	1.69E-02	2.31E-02
6294.000	6.33E-03	7.58E-03	9.23E-03	1.15E-02	1.48E-02	1.95E-02

X (km): 596.000 598.000 600.000 602.000 604.000 606.000

Y (km)						
6314.000	2.73E-02	3.56E-02	4.49E-02	5.00E-02	4.74E-02	3.91E-02
6312.000	3.47E-02	4.84E-02	6.84E-02	8.53E-02	8.09E-02	6.10E-02
6310.000	4.41E-02	6.68E-02	1.08E-01	1.69E-01	1.65E-01	1.04E-01
6308.000	5.47E-02	9.29E-02	1.81E-01	3.96E-01	4.47E-01	1.99E-01
6306.000	6.36E-02	1.20E-01	2.99E-01	1.09E+00	2.00E+00	4.65E-01
6304.000	6.51E-02	1.31E-01	3.79E-01	2.55E+00	4.63E+01	7.54E-01
6302.000	5.72E-02	1.10E-01	2.82E-01	1.40E+00	3.32E+00	4.09E-01
6300.000	4.78E-02	8.58E-02	1.95E-01	4.67E-01	4.57E-01	1.93E-01
6298.000	4.03E-02	6.72E-02	1.22E-01	1.62E-01	1.50E-01	9.48E-02
6296.000	3.32E-02	5.01E-02	7.02E-02	7.75E-02	7.14E-02	5.35E-02
6294.000	2.66E-02	3.58E-02	4.29E-02	4.48E-02	4.15E-02	3.38E-02

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   X (km): 608.000  610.000  612.000  614.000  616.000  618.000
  ------------------------------------------------------------------------------
  Y (km)
6314.000     2.96E-02 2.25E-02 1.75E-02 1.39E-02 1.12E-02 9.21E-03
6312.000     4.16E-02 2.95E-02 2.17E-02 1.65E-02 1.30E-02 1.03E-02
6310.000     6.12E-02 3.94E-02 2.70E-02 1.95E-02 1.47E-02 1.13E-02
6308.000     9.60E-02 5.22E-02 3.27E-02 2.21E-02 1.57E-02 1.18E-02
6306.000     1.38E-01 6.31E-02 3.55E-02 2.28E-02 1.60E-02 1.18E-02
6304.000     1.52E-01 6.26E-02 3.44E-02 2.20E-02 1.54E-02 1.15E-02
6302.000     1.13E-01 5.21E-02 3.03E-02 2.00E-02 1.42E-02 1.07E-02
6300.000     8.02E-02 4.29E-02 2.67E-02 1.80E-02 1.30E-02 9.85E-03
6298.000     5.50E-02 3.18E-02 2.11E-02 1.52E-02 1.14E-02 8.84E-03
6296.000     3.75E-02 2.47E-02 1.67E-02 1.23E-02 9.57E-03 7.65E-03
6294.000     2.59E-02 1.94E-02 1.39E-02 1.03E-02 8.02E-03 6.50E-03


   X (km): 620.000  622.000
  ------------------------------------------------------------------------------
  Y (km)
6314.000     7.66E-03 6.43E-03
6312.000     8.37E-03 6.86E-03
6310.000     8.87E-03 7.14E-03
6308.000     9.11E-03 7.27E-03
6306.000     9.12E-03 7.24E-03
6304.000     8.86E-03 7.05E-03
6302.000     8.35E-03 6.69E-03
6300.000     7.73E-03 6.23E-03
6298.000     7.03E-03 5.72E-03
6296.000     6.22E-03 5.14E-03
6294.000     5.39E-03 4.54E-03


 Concentrations at the discrete receptors (No. : Value):

   1:3.57E-01    2:1.16E+02    3:8.39E+01    4:6.91E+01    5:4.34E+01    6:6.16E+00    7:2.06E+00    8:2.87E+00
   9:1.16E+01   10:1.33E+01   11:2.27E+01   12:9.22E+00   13:1.06E+01   14:1.14E+01   15:5.77E+00   16:1.34E+00
  17:7.49E-01   18:1.25E+00   19:2.39E+00   20:3.19E+00   21:5.01E+00   22:1.33E+00   23:1.62E+00   24:5.36E-01
  25:3.05E-01   26:3.03E-01   27:6.62E-01   28:7.65E-01   29:7.33E-01   30:4.59E-01
 ------------------------------------------------------------------------------


1           Peak values for the 100 worst cases  (in microgram/m3)
                 Averaging time = 24 hours;  Source group No. 1

  Rank      Value    Time Recorded          Coordinates
                       hour,date        (* denotes polar)

     1   1.58E+03   24,18/07/05   (603648, 6303918,    0.0)
     2   1.34E+03   24,26/08/05   (603314, 6303684,    0.0)
     3   1.34E+03   24,05/08/05   (604000, 6304000,    0.0)
     4   1.31E+03   24,28/07/05   (603782, 6302916,    0.0)
     5   1.27E+03   24,20/07/05   (603314, 6303684,    0.0)
     6   1.26E+03   24,08/03/06   (603648, 6303918,    0.0)
     7   1.18E+03   24,20/09/05   (603648, 6303918,    0.0)
     8   1.18E+03   24,06/07/05   (603648, 6303918,    0.0)
     9   1.14E+03   24,24/06/05   (603648, 6303918,    0.0)
    10   1.14E+03   24,25/06/05   (603314, 6303684,    0.0)
    11   1.10E+03   24,01/08/05   (603314, 6303684,    0.0)
    12   1.09E+03   24,19/07/05   (603648, 6303918,    0.0)
    13   1.02E+03   24,05/09/05   (603648, 6303918,    0.0)
    14   1.01E+03   24,09/03/06   (603648, 6303918,    0.0)
    15   9.91E+02   24,25/08/05   (603314, 6303684,    0.0)
    16   9.65E+02   24,05/07/05   (603381, 6303183,    0.0)
    17   9.41E+02   24,01/11/05   (603648, 6303918,    0.0)
    18   9.36E+02   24,29/07/05   (603648, 6303918,    0.0)
    19   9.04E+02   24,10/07/05   (604000, 6304000,    0.0)
    20   8.84E+02   24,24/08/05   (603648, 6303918,    0.0)
    21   8.83E+02   24,21/07/05   (603381, 6303183,    0.0)
    22   8.75E+02   24,15/02/06   (604000, 6304000,    0.0)
    23   8.64E+02   24,05/11/05   (603314, 6303684,    0.0)
    24   8.63E+02   24,31/07/05   (603314, 6303684,    0.0)
    25   8.57E+02   24,11/07/05   (603314, 6303684,    0.0)
    26   8.56E+02   24,18/03/06   (603648, 6303918,    0.0)
    27   8.48E+02   24,11/11/05   (603648, 6303918,    0.0)
    28   8.38E+02   24,17/07/05   (603648, 6303918,    0.0)
    29   8.34E+02   24,07/08/05   (604000, 6304000,    0.0)
    30   8.20E+02   24,02/09/05   (603381, 6303183,    0.0)
    31   8.18E+02   24,19/03/06   (603648, 6303918,    0.0)
    32   8.12E+02   24,12/11/05   (603648, 6303918,    0.0)
    33   8.11E+02   24,12/08/05   (603648, 6303918,    0.0)
    34   7.78E+02   24,06/08/05   (603782, 6302916,    0.0)
    35   7.73E+02   24,21/11/05   (603648, 6303918,    0.0)
    36   7.67E+02   24,13/08/05   (603314, 6303684,    0.0)
    37   7.62E+02   24,27/08/05   (603381, 6303183,    0.0)
    38   7.53E+02   24,16/08/05   (603648, 6303918,    0.0)
    39   7.50E+02   24,30/09/05   (603782, 6302916,    0.0)
    40   7.49E+02   24,27/06/05   (603648, 6303918,    0.0)
    41   7.42E+02   24,26/06/05   (603314, 6303684,    0.0)
    42   7.40E+02   24,07/03/06   (603648, 6303918,    0.0)
    43   7.40E+02   24,02/08/05   (603381, 6303183,    0.0)
    44   7.36E+02   24,14/02/06   (603648, 6303918,    0.0)
    45   7.35E+02   24,24/07/05   (603782, 6302916,    0.0)
    46   7.34E+02   24,04/03/06   (603314, 6303684,    0.0)
    47   7.26E+02   24,13/11/05   (603314, 6303684,    0.0)
    48   7.24E+02   24,16/02/06   (603314, 6303684,    0.0)
    49   7.19E+02   24,11/02/06   (603648, 6303918,    0.0)
    50   7.19E+02   24,11/03/06   (603648, 6303918,    0.0)
    51   7.14E+02   24,08/07/05   (603314, 6303684,    0.0)
    52   7.11E+02   24,23/07/05   (603782, 6302916,    0.0)
    53   7.06E+02   24,10/02/06   (603648, 6303918,    0.0)
    54   7.02E+02   24,24/09/05   (603314, 6303684,    0.0)
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55	6.97E+02	24,08/08/05	(604000, 6304000, 0.0)
56	6.93E+02	24,22/07/05	(603782, 6302916, 0.0)
57	6.86E+02	24,23/08/05	(603648, 6303918, 0.0)
58	6.86E+02	24,18/06/05	(603381, 6303183, 0.0)
59	6.85E+02	24,05/03/06	(603314, 6303684, 0.0)
60	6.85E+02	24,21/09/05	(603381, 6303183, 0.0)
61	6.79E+02	24,06/10/05	(603648, 6303918, 0.0)
62	6.78E+02	24,20/11/05	(603648, 6303918, 0.0)
63	6.75E+02	24,19/09/05	(604000, 6304000, 0.0)
64	6.74E+02	24,31/10/05	(603314, 6303684, 0.0)
65	6.73E+02	24,26/03/06	(603381, 6303183, 0.0)
66	6.66E+02	24,21/02/06	(603648, 6303918, 0.0)
67	6.64E+02	24,05/01/06	(603648, 6303918, 0.0)
68	6.60E+02	24,12/10/05	(603314, 6303684, 0.0)
69	6.49E+02	24,16/10/05	(603314, 6303684, 0.0)
70	6.49E+02	24,06/09/05	(603381, 6303183, 0.0)
71	6.45E+02	24,04/07/05	(603381, 6303183, 0.0)
72	6.39E+02	24,05/02/06	(603648, 6303918, 0.0)
73	6.27E+02	24,07/07/05	(604000, 6304000, 0.0)
74	6.22E+02	24,17/03/06	(603648, 6303918, 0.0)
75	6.19E+02	24,10/03/06	(603648, 6303918, 0.0)
76	6.18E+02	24,30/10/05	(603648, 6303918, 0.0)
77	6.09E+02	24,12/09/05	(604000, 6304000, 0.0)
78	6.04E+02	24,23/06/05	(604516, 6303684, 0.0)
79	5.97E+02	24,09/08/05	(603782, 6302916, 0.0)
80	5.93E+02	24,23/11/05	(603314, 6303684, 0.0)
81	5.91E+02	24,02/10/05	(603314, 6303684, 0.0)
82	5.86E+02	24,30/11/05	(603782, 6302916, 0.0)
83	5.84E+02	24,15/01/06	(603314, 6303684, 0.0)
84	5.84E+02	24,11/08/05	(604000, 6304000, 0.0)
85	5.79E+02	24,23/03/06	(603314, 6303684, 0.0)
86	5.78E+02	24,01/07/05	(603782, 6302916, 0.0)
87	5.75E+02	24,27/07/05	(604000, 6304000, 0.0)
88	5.57E+02	24,16/04/05	(603648, 6303918, 0.0)
89	5.55E+02	24,30/12/05	(603381, 6303183, 0.0)
90	5.53E+02	24,10/08/05	(604000, 6304000, 0.0)
91	5.48E+02	24,17/08/05	(603381, 6303183, 0.0)
92	5.47E+02	24,25/12/05	(604000, 6304000, 0.0)
93	5.40E+02	24,09/10/05	(603314, 6303684, 0.0)
94	5.38E+02	24,16/03/06	(604000, 6304000, 0.0)
95	5.38E+02	24,13/09/05	(603648, 6303918, 0.0)
96	5.37E+02	24,21/08/05	(604516, 6303684, 0.0)
97	5.37E+02	24,03/07/05	(604516, 6303684, 0.0)
98	5.37E+02	24,20/12/05	(603648, 6303918, 0.0)
99	5.37E+02	24,19/05/05	(603648, 6303918, 0.0)
100	5.36E+02	24,13/12/05	(603648, 6303918, 0.0)

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1 Peak values for the 100 worst cases (in microgram/m3)
Averaging time = 24 hours; Source group No. 2

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	1.53E+03	24,18/07/05	(603648, 6303918, 0.0)
2	1.30E+03	24,28/07/05	(603782, 6302916, 0.0)
3	1.30E+03	24,26/08/05	(603314, 6303684, 0.0)
4	1.30E+03	24,05/08/05	(604000, 6304000, 0.0)
5	1.23E+03	24,20/07/05	(603314, 6303684, 0.0)
6	1.23E+03	24,08/03/06	(603648, 6303918, 0.0)
7	1.14E+03	24,20/09/05	(603648, 6303918, 0.0)
8	1.14E+03	24,06/07/05	(603648, 6303918, 0.0)
9	1.11E+03	24,25/06/05	(603314, 6303684, 0.0)
10	1.11E+03	24,24/06/05	(603648, 6303918, 0.0)
11	1.07E+03	24,01/08/05	(603314, 6303684, 0.0)
12	1.05E+03	24,19/07/05	(603648, 6303918, 0.0)
13	9.97E+02	24,05/09/05	(603648, 6303918, 0.0)
14	9.77E+02	24,09/03/06	(603648, 6303918, 0.0)
15	9.64E+02	24,25/08/05	(603314, 6303684, 0.0)
16	9.59E+02	24,05/07/05	(603381, 6303183, 0.0)
17	9.07E+02	24,01/11/05	(603648, 6303918, 0.0)
18	9.02E+02	24,29/07/05	(603648, 6303918, 0.0)
19	8.82E+02	24,21/07/05	(603381, 6303183, 0.0)
20	8.76E+02	24,10/07/05	(604000, 6304000, 0.0)
21	8.64E+02	24,24/08/05	(603648, 6303918, 0.0)
22	8.47E+02	24,15/02/06	(604000, 6304000, 0.0)
23	8.44E+02	24,31/07/05	(603314, 6303684, 0.0)
24	8.42E+02	24,05/11/05	(603314, 6303684, 0.0)
25	8.34E+02	24,18/03/06	(603648, 6303918, 0.0)
26	8.30E+02	24,11/07/05	(603314, 6303684, 0.0)
27	8.25E+02	24,11/11/05	(603648, 6303918, 0.0)
28	8.16E+02	24,02/09/05	(603381, 6303183, 0.0)
29	8.11E+02	24,17/07/05	(603648, 6303918, 0.0)
30	8.04E+02	24,07/08/05	(604000, 6304000, 0.0)
31	8.04E+02	24,19/03/06	(603648, 6303918, 0.0)
32	7.90E+02	24,12/08/05	(603648, 6303918, 0.0)
33	7.90E+02	24,12/11/05	(603648, 6303918, 0.0)
34	7.70E+02	24,06/08/05	(603782, 6302916, 0.0)
35	7.55E+02	24,27/08/05	(603381, 6303183, 0.0)
36	7.54E+02	24,21/11/05	(603648, 6303918, 0.0)
37	7.44E+02	24,13/08/05	(603314, 6303684, 0.0)
38	7.37E+02	24,27/06/05	(603648, 6303918, 0.0)
39	7.36E+02	24,02/08/05	(603381, 6303183, 0.0)
40	7.36E+02	24,30/09/05	(603782, 6302916, 0.0)
41	7.28E+02	24,26/06/05	(603314, 6303684, 0.0)
42	7.28E+02	24,16/08/05	(603648, 6303918, 0.0)
43	7.28E+02	24,24/07/05	(603782, 6302916, 0.0)
44	7.20E+02	24,14/02/06	(603648, 6303918, 0.0)
45	7.20E+02	24,07/03/06	(603648, 6303918, 0.0)

46	7.13E+02	24,04/03/06	(603314, 6303684,	0.0)
47	7.08E+02	24,13/11/05	(603314, 6303684,	0.0)
48	7.05E+02	24,16/02/06	(603314, 6303684,	0.0)
49	7.04E+02	24,11/02/06	(603648, 6303918,	0.0)
50	7.03E+02	24,23/07/05	(603782, 6302916,	0.0)
51	6.99E+02	24,11/03/06	(603648, 6303918,	0.0)
52	6.93E+02	24,08/07/05	(603314, 6303684,	0.0)
53	6.87E+02	24,22/07/05	(603782, 6302916,	0.0)
54	6.84E+02	24,10/02/06	(603648, 6303918,	0.0)
55	6.84E+02	24,24/09/05	(603314, 6303684,	0.0)
56	6.77E+02	24,21/09/05	(603381, 6303183,	0.0)
57	6.74E+02	24,08/08/05	(604000, 6304000,	0.0)
58	6.71E+02	24,26/03/06	(603381, 6303183,	0.0)
59	6.70E+02	24,23/08/05	(603648, 6303918,	0.0)
60	6.66E+02	24,05/03/06	(603314, 6303684,	0.0)
61	6.60E+02	24,18/06/05	(603381, 6303183,	0.0)
62	6.59E+02	24,06/10/05	(603648, 6303918,	0.0)
63	6.56E+02	24,31/10/05	(603314, 6303684,	0.0)
64	6.54E+02	24,20/11/05	(603648, 6303918,	0.0)
65	6.54E+02	24,19/09/05	(604000, 6304000,	0.0)
66	6.49E+02	24,05/01/06	(603648, 6303918,	0.0)
67	6.46E+02	24,21/02/06	(603648, 6303918,	0.0)
68	6.44E+02	24,12/10/05	(603314, 6303684,	0.0)
69	6.44E+02	24,06/09/05	(603381, 6303183,	0.0)
70	6.43E+02	24,04/07/05	(603381, 6303183,	0.0)
71	6.27E+02	24,16/10/05	(603314, 6303684,	0.0)
72	6.24E+02	24,05/02/06	(603648, 6303918,	0.0)
73	6.13E+02	24,17/03/06	(603648, 6303918,	0.0)
74	6.10E+02	24,10/03/06	(603648, 6303918,	0.0)
75	6.04E+02	24,07/07/05	(604000, 6304000,	0.0)
76	5.92E+02	24,09/08/05	(603782, 6302916,	0.0)
77	5.90E+02	24,30/10/05	(603648, 6303918,	0.0)
78	5.89E+02	24,23/06/05	(604516, 6303684,	0.0)
79	5.85E+02	24,12/09/05	(604000, 6304000,	0.0)
80	5.82E+02	24,23/11/05	(603314, 6303684,	0.0)
81	5.79E+02	24,30/11/05	(603782, 6302916,	0.0)
82	5.72E+02	24,02/10/05	(603314, 6303684,	0.0)
83	5.72E+02	24,15/01/06	(603314, 6303684,	0.0)
84	5.69E+02	24,11/08/05	(604000, 6304000,	0.0)
85	5.66E+02	24,01/07/05	(603782, 6302916,	0.0)
86	5.63E+02	24,23/03/06	(603314, 6303684,	0.0)
87	5.59E+02	24,27/07/05	(604000, 6304000,	0.0)
88	5.49E+02	24,30/12/05	(603381, 6303183,	0.0)
89	5.47E+02	24,17/08/05	(603381, 6303183,	0.0)
90	5.42E+02	24,16/04/05	(603648, 6303918,	0.0)
91	5.32E+02	24,10/08/05	(604000, 6304000,	0.0)
92	5.30E+02	24,19/05/05	(603648, 6303918,	0.0)
93	5.26E+02	24,25/12/05	(604000, 6304000,	0.0)
94	5.24E+02	24,09/10/05	(603314, 6303684,	0.0)
95	5.20E+02	24,16/03/06	(604000, 6304000,	0.0)
96	5.19E+02	24,12/07/05	(603381, 6303183,	0.0)
97	5.18E+02	24,20/12/05	(603648, 6303918,	0.0)
98	5.18E+02	24,24/03/06	(603314, 6303684,	0.0)
99	5.16E+02	24,13/09/05	(603648, 6303918,	0.0)
100	5.16E+02	24,03/07/05	(604516, 6303684,	0.0)

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1 Peak values for the 100 worst cases (in microgram/m3)
Averaging time = 24 hours; Source group No. 3

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)	
1	5.40E+02	24,05/07/05	(603381, 6303183,	0.0)
2	5.38E+02	24,02/09/05	(603381, 6303183,	0.0)
3	5.11E+02	24,19/03/06	(603648, 6303918,	0.0)
4	4.78E+02	24,27/06/05	(603648, 6303918,	0.0)
5	4.74E+02	24,04/07/05	(603381, 6303183,	0.0)
6	4.66E+02	24,08/03/06	(603648, 6303918,	0.0)
7	4.56E+02	24,04/03/06	(603314, 6303684,	0.0)
8	4.46E+02	24,31/07/05	(603314, 6303684,	0.0)
9	4.44E+02	24,25/06/05	(603314, 6303684,	0.0)
10	4.42E+02	24,18/06/05	(603381, 6303183,	0.0)
11	4.37E+02	24,19/07/05	(603314, 6303684,	0.0)
12	4.35E+02	24,21/02/06	(603648, 6303918,	0.0)
13	4.32E+02	24,24/08/05	(603648, 6303918,	0.0)
14	4.31E+02	24,05/09/05	(603648, 6303918,	0.0)
15	4.29E+02	24,20/07/05	(603314, 6303684,	0.0)
16	4.28E+02	24,18/07/05	(603648, 6303918,	0.0)
17	4.23E+02	24,26/06/05	(603314, 6303684,	0.0)
18	4.19E+02	24,17/08/05	(603381, 6303183,	0.0)
19	4.11E+02	24,26/03/06	(603381, 6303183,	0.0)
20	4.11E+02	24,17/03/06	(603648, 6303918,	0.0)
21	4.07E+02	24,05/08/05	(603648, 6303918,	0.0)
22	4.07E+02	24,21/07/05	(603381, 6303183,	0.0)
23	4.03E+02	24,10/03/06	(603648, 6303918,	0.0)
24	3.81E+02	24,24/06/05	(603648, 6303918,	0.0)
25	3.75E+02	24,23/11/05	(603314, 6303684,	0.0)
26	3.71E+02	24,02/08/05	(603381, 6303183,	0.0)
27	3.70E+02	24,25/08/05	(603314, 6303684,	0.0)
28	3.63E+02	24,23/08/05	(603648, 6303918,	0.0)
29	3.57E+02	24,20/09/05	(603648, 6303918,	0.0)
30	3.57E+02	24,11/03/06	(603314, 6303684,	0.0)
31	3.56E+02	24,27/08/05	(603381, 6303183,	0.0)
32	3.56E+02	24,18/03/06	(603648, 6303918,	0.0)
33	3.55E+02	24,14/02/06	(603648, 6303918,	0.0)
34	3.54E+02	24,28/07/05	(603782, 6302916,	0.0)
35	3.52E+02	24,03/06/05	(603381, 6303183,	0.0)
36	3.51E+02	24,05/01/06	(603648, 6303918,	0.0)

37	3.42E+02	24,11/02/06	(603648, 6303918, 0.0)
38	3.37E+02	24,25/03/06	(603381, 6303183, 0.0)
39	3.36E+02	24,16/08/05	(603381, 6303183, 0.0)
40	3.33E+02	24,21/09/05	(603381, 6303183, 0.0)
41	3.30E+02	24,24/03/06	(603314, 6303684, 0.0)
42	3.29E+02	24,21/11/05	(603648, 6303918, 0.0)
43	3.27E+02	24,16/10/05	(603314, 6303684, 0.0)
44	3.25E+02	24,12/11/05	(603648, 6303918, 0.0)
45	3.22E+02	24,12/08/05	(603648, 6303918, 0.0)
46	3.22E+02	24,05/11/05	(603314, 6303684, 0.0)
47	3.16E+02	24,20/11/05	(603648, 6303918, 0.0)
48	3.12E+02	24,19/12/05	(603648, 6303918, 0.0)
49	3.10E+02	24,04/11/05	(603648, 6303918, 0.0)
50	3.09E+02	24,15/10/05	(603381, 6303183, 0.0)
51	3.09E+02	24,23/09/05	(603648, 6303918, 0.0)
52	3.07E+02	24,05/02/06	(603648, 6303918, 0.0)
53	3.06E+02	24,09/03/06	(603648, 6303918, 0.0)
54	3.03E+02	24,26/08/05	(603314, 6303684, 0.0)
55	3.02E+02	24,30/12/05	(603381, 6303183, 0.0)
56	3.01E+02	24,28/08/05	(603381, 6303183, 0.0)
57	2.99E+02	24,07/03/06	(603648, 6303918, 0.0)
58	2.98E+02	24,11/07/05	(603314, 6303684, 0.0)
59	2.98E+02	24,28/02/06	(603648, 6303918, 0.0)
60	2.98E+02	24,19/05/05	(603648, 6303918, 0.0)
61	2.97E+02	24,06/09/05	(603381, 6303183, 0.0)
62	2.96E+02	24,11/11/05	(603648, 6303918, 0.0)
63	2.95E+02	24,09/01/06	(603381, 6303183, 0.0)
64	2.94E+02	24,10/12/05	(603314, 6303684, 0.0)
65	2.87E+02	24,14/08/05	(603782, 6302916, 0.0)
66	2.86E+02	24,15/01/06	(603314, 6303684, 0.0)
67	2.86E+02	24,17/05/05	(603648, 6303918, 0.0)
68	2.84E+02	24,02/03/06	(603381, 6303183, 0.0)
69	2.84E+02	24,06/07/05	(603648, 6303918, 0.0)
70	2.82E+02	24,27/02/06	(603648, 6303918, 0.0)
71	2.80E+02	24,29/03/06	(603648, 6303918, 0.0)
72	2.79E+02	24,01/08/05	(603314, 6303684, 0.0)
73	2.78E+02	24,28/06/05	(603648, 6303918, 0.0)
74	2.77E+02	24,31/10/05	(603648, 6303918, 0.0)
75	2.77E+02	24,13/11/05	(603314, 6303684, 0.0)
76	2.76E+02	24,12/10/05	(603314, 6303684, 0.0)
77	2.74E+02	24,01/09/05	(603314, 6303684, 0.0)
78	2.72E+02	24,03/07/05	(603381, 6303183, 0.0)
79	2.71E+02	24,08/02/06	(603314, 6303684, 0.0)
80	2.71E+02	24,24/09/05	(603314, 6303684, 0.0)
81	2.70E+02	24,14/05/05	(603381, 6303183, 0.0)
82	2.68E+02	24,14/10/05	(603314, 6303684, 0.0)
83	2.67E+02	24,22/02/06	(603648, 6303918, 0.0)
84	2.67E+02	24,19/02/06	(603648, 6303918, 0.0)
85	2.67E+02	24,27/09/05	(603381, 6303183, 0.0)
86	2.66E+02	24,06/10/05	(603648, 6303918, 0.0)
87	2.66E+02	24,16/02/06	(603314, 6303684, 0.0)
88	2.65E+02	24,01/03/06	(603314, 6303684, 0.0)
89	2.65E+02	24,26/12/05	(603314, 6303684, 0.0)
90	2.64E+02	24,20/03/06	(603648, 6303918, 0.0)
91	2.62E+02	24,04/09/05	(603648, 6303918, 0.0)
92	2.61E+02	24,22/03/06	(603381, 6303183, 0.0)
93	2.58E+02	24,05/06/05	(603314, 6303684, 0.0)
94	2.58E+02	24,23/06/05	(604516, 6303684, 0.0)
95	2.58E+02	24,07/01/06	(603314, 6303684, 0.0)
96	2.56E+02	24,22/07/05	(603381, 6303183, 0.0)
97	2.55E+02	24,06/01/06	(603648, 6303918, 0.0)
98	2.54E+02	24,13/02/06	(603648, 6303918, 0.0)
99	2.53E+02	24,28/11/05	(603648, 6303918, 0.0)
100	2.51E+02	24,24/11/05	(603314, 6303684, 0.0)