Chapter 5

# DUST IMPACT ASSESSMENT

## 5.1 IMPACT ASSESSMENT

The results from the ISC model are summarised below. Stage 2 development has not been modelled separately because it is in effect an intermediate stage between 1 and 3. Stage 1 has been modelled as the westernmost point of extraction, and Stage 3 has been modelled as the eastern and northern most point of extraction, with emissions from the pit originating closer to the surface than during Stage 4. It was necessary to model Stage 4 because of the increase in haulage emissions (approximately 5,000 kg/yr more than Stage 3). The location of discrete receptors and sources modelled is shown in *Figures 5.1 to 5.3*.

All of the regular quarry activities have been included in the model. Emissions relating to blasting and drilling have not been included due to the short duration of impacts and their episodic nature.

Contours have been developed for $PM_{10}$ 24 hour concentrations. Contours of averaging periods longer than this are not supplied due to the relatively lower impacts of the longer term (ie. annual) averaging periods. TSP 24 hour contours are not provided, as there are no applicable criteria for TSP over short-term averaging periods.

## 5.2 DUST DEPOSITION

*Table 5.1* to *Table 5.4* summarise the highest monthly dust deposition concentrations predicted at discrete receptors from modelling. These predictions do not include drilling and blasting as an emission source due to its episodic nature being incompatible with the model inputs.

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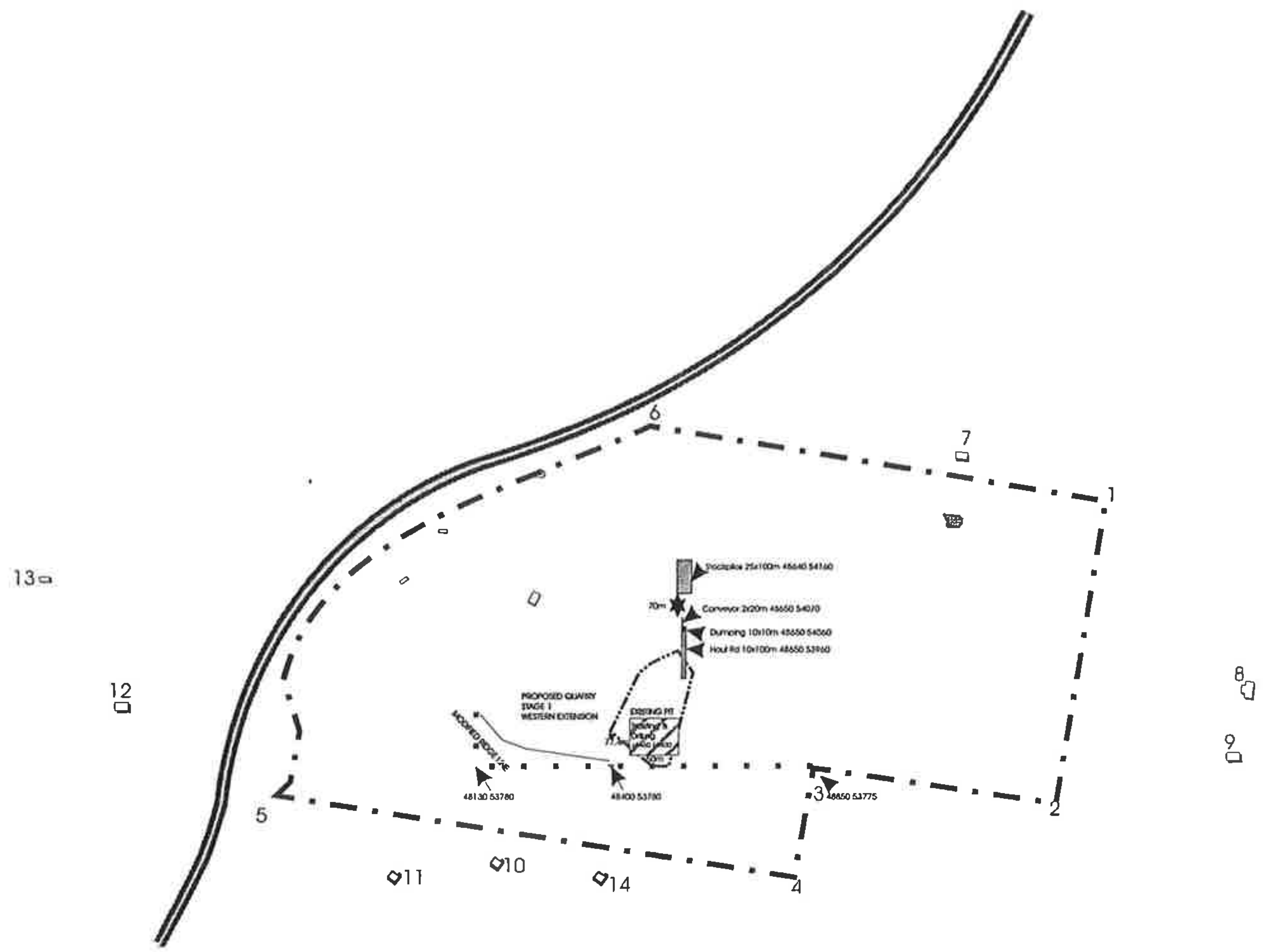


# Legend

| | |
|---|---|
| | Source ID, X & Y Dimensions, AMG Co-ordinates |
| | Modified AMG Co-ordinates |
| 8 | Discrete Receptor Number |
| | Housing |
| | Title Boundary |
| | Existing quarry boundary |
| | Pacific highway |

<u>Discrete Receptors</u>

| | | | |
|---|---|---|---|
| 1 | North East Corner | 8 | 'Jones' |
| 2 | South East Corner | 9 | 'Groves' |
| 3 | 'Middle' Corner | 10 | 'Yala 2' |
| 4 | South Corner | 11 | 'Yala 1' |
| 5 | South West Corner | 12 | 'Middleton' |
| 6 | North West Corner | 13 | 'Dubos' |
| 7 | 'Loveday' | 14 | 'Yala 3' |

NORTH

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*Figure 5.1* CURRENT STAGE LOCATIONS OF DISCRETE RECEPTORS AND SOURCES MODELLED

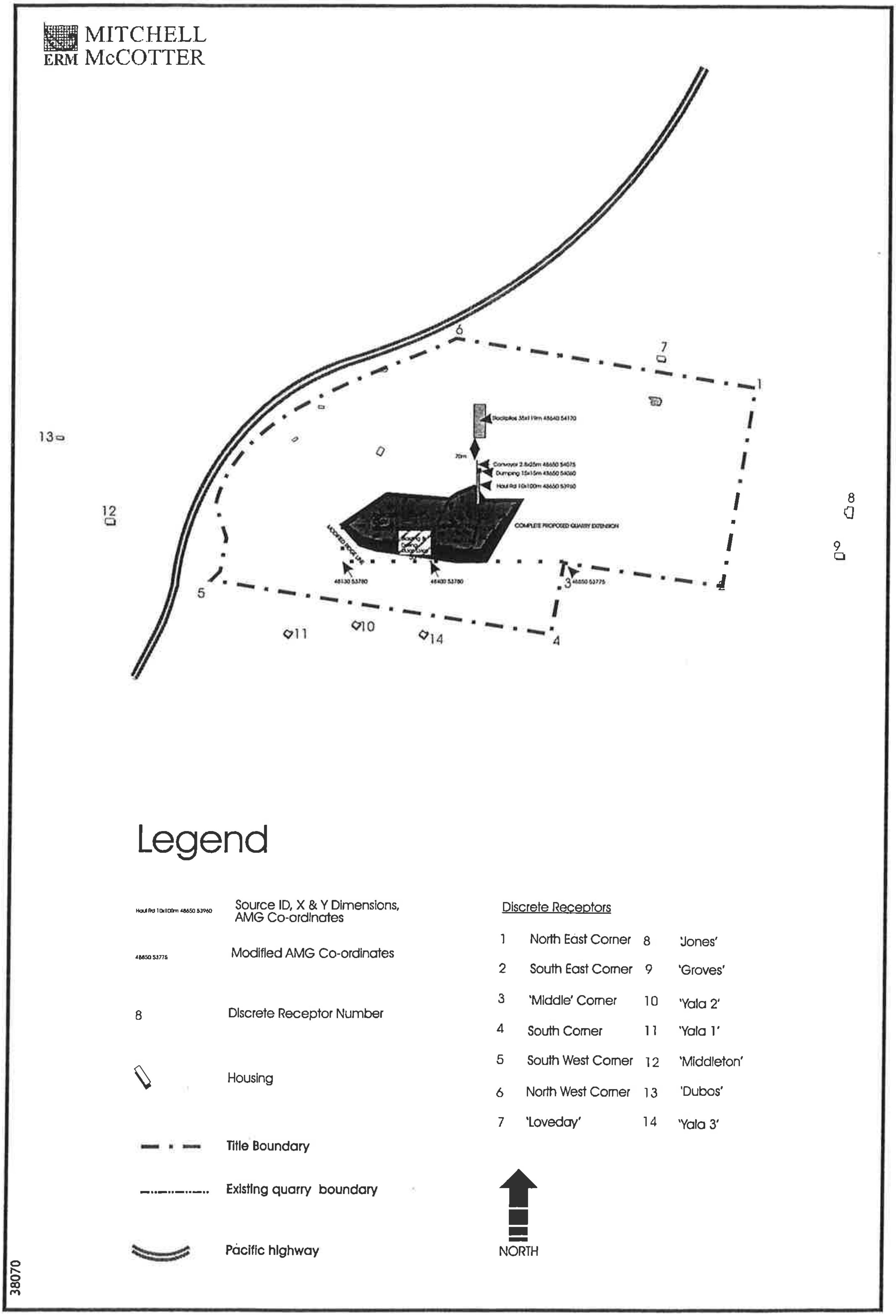


*Figure 5.2* STAGE 1 LOCATIONS OF DISCRETE RECEPTORS AND SOURCES MODELLED

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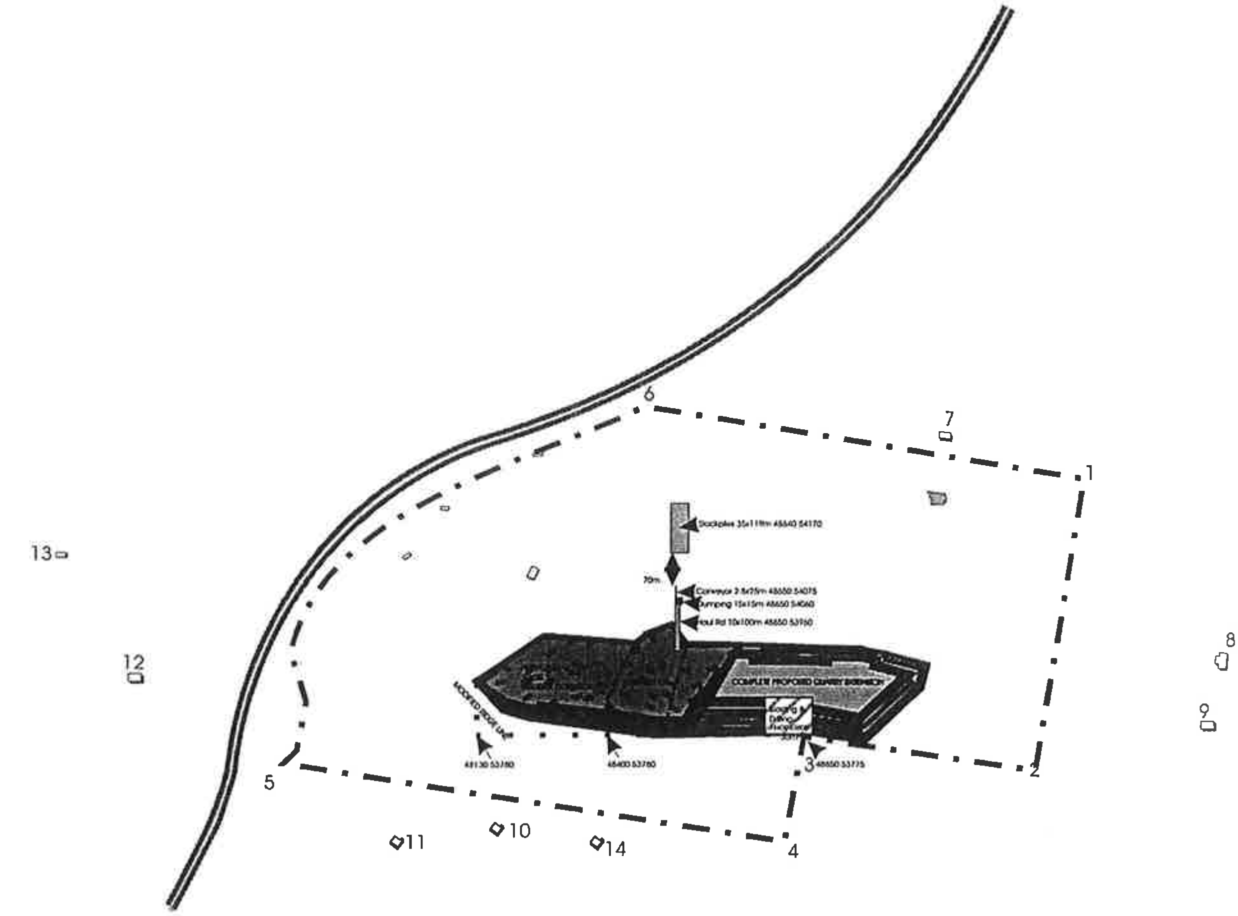


# Legend

| | |
|---|---|
| Haul Rd 10x100m 48650 53960 | Source ID, X & Y Dimensions, AMG Co-ordinates |
| 48650 53775 | Modified AMG Co-ordinates |
| 8 | Discrete Receptor Number |
| | Housing |
| | Title Boundary |
| | Existing quarry boundary |
| | Pacific highway |

<u>Discrete Receptors</u>

| | | | |
|---|---|---|---|
| 1 | North East Corner | 8 | 'Jones' |
| 2 | South East Corner | 9 | 'Groves' |
| 3 | 'Middle' Corner | 10 | 'Yala 2' |
| 4 | South Corner | 11 | 'Yala 1' |
| 5 | South West Corner | 12 | 'Middleton' |
| 6 | North West Corner | 13 | 'Dubos' |
| 7 | 'Loveday' | 14 | 'Yala 3' |

NORTH

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*Figure 5.3* STAGES 3 AND 4 LOCATIONS OF DISCRETE RECEPTORS AND SOURCES MODELLED

*Table 5.1* DUST DEPOSITION RATES FOR THE EXISTING DEVELOPMENT

| Discrete Receptor | Deposition ($g/m^2/mth$) |
|---|---|
| 1. north east corner of property | 0.20 |
| 2. south east corner of property | 0.94 |
| 3. 'middle' corner of property | 2.85 |
| 4. south corner of property | 0.29 |
| 5. south west corner of property | 0.46 |
| 6. north west corner of property | 2.47 |
| 7. 'Loveday' house to north | 0.72 |
| 8. 'Jones' house to east | 0.32 |
| 9. 'Groves' house to east | 0.16 |
| 10. 'YALA 2' house to south | 0.44 |
| 11. 'YALA 1' house to south | 0.65 |
| 12. 'Middleton' house to west | 0.15 |
| 13. 'Dubos' house to west | 0.33 |
| 14. 'YALA 3' house to south | 2.19 |

*Table 5.2* DUST DEPOSITION RATES FOR STAGE 1

| Discrete Receptor | Deposition ($g/m^2/mth$) |
|---|---|
| 1. north east corner of property | 0.30 |
| 2. south east corner of property | 1.17 |
| 3. 'middle' corner of property | 3.69 |
| 4. south corner of property | 0.47 |
| 5. south west corner of property | 0.65 |
| 6. north west corner of property | 2.88 |
| 7. 'Loveday' house to north | 1.01 |
| 8. 'Jones' house to east | 0.45 |
| 9. 'Groves' house to east | 0.22 |
| 10. 'YALA 2' house to south | 0.69 |
| 11. 'YALA 1' house to south | 0.94 |
| 12. 'Middleton' house to west | 0.20 |
| 13. 'Dubos' house to west | 0.42 |
| 14. 'YALA 3' house to south | 2.64 |

*Table 5.3* DUST DEPOSITION RATES FOR STAGE 3

| Discrete Receptor | Deposition (g/m²/mth) |
|---|---|
| 1. north east corner of property | 0.31 |
| 2. south east corner of property | 1.18 |
| 3. 'middle' corner of property | 3.95 |
| 4. south corner of property | 0.46 |
| 5. south west corner of property | 0.65 |
| 6. north west corner of property | 2.90 |
| 7. 'Loveday' house to north | 1.03 |
| 8. 'Jones' house to east | 0.47 |
| 9. 'Groves' house to east | 0.23 |
| 10. 'YALA 2' house to south | 0.60 |
| 11. 'YALA 1' house to south | 0.87 |
| 12. 'Middleton' house to west | 0.20 |
| 13. 'Dubos' house to west | 0.42 |
| 14. 'YALA 3' house to south | 2.55 |

*Table 5.4* DUST DEPOSITION RATES FOR STAGE 4

| Discrete Receptor | Deposition (g/m²/mth) |
|---|---|
| 1. north east corner of property | 0.31 |
| 2. south east corner of property | 1.18 |
| 3. 'middle' corner of property | 3.89 |
| 4. south corner of property | 0.45 |
| 5. south west corner of property | 0.65 |
| 6. north west corner of property | 2.90 |
| 7. 'Loveday' house to north | 1.02 |
| 8. 'Jones' house to east | 0.46 |
| 9. 'Groves' house to east | 0.23 |
| 10. 'YALA 2' house to south | 0.58 |
| 11. 'YALA 1' house to south | 0.87 |
| 12. 'Middleton' house to west | 0.19 |
| 13. 'Dubos' house to west | 0.42 |
| 14. 'YALA 3' house to south | 2.53 |

## 5.3 DUST CONCENTRATION

*Tables 5.5 to 5.8* give annual and 24 hour concentrations predicted for different stages of the quarry. These concentrations do not include blasting and drilling practices as part of the emissions due to their episodic nature. Contours of the highest 24 hour $PM_{10}$ dust concentrations due to quarry operations (excluding drilling and blasting) are shown in *Figures 5.4 to 5.7.*

*Table 5.5* COMPARISON OF DUST CONCENTRATIONS FOR ALL SOURCES EXCEPT DRILLING & BLASTING FOR EXISTING QUARRY

| Discrete Receptor | Max 24 hour $PM_{10}$ ($\mu/m^3$) | Annual Average $PM_{10}$ ($\mu/m^3$) | Annual Average TSP ($\mu/m^3$) |
|---|---|---|---|
| 1 | 4.97 | 0.30 | 0.46 |
| 2 | 19.84 | 0.76 | 1.21 |
| 3 | 54.38 | 2.62 | 4.25 |
| 4 | 4.51 | 0.35 | 0.55 |
| 5 | 20.42 | 0.40 | 0.60 |
| 6 | 57.27 | 2.56 | 3.99 |
| 7 | 16.84 | 0.87 | 1.42 |
| 8 | 6.93 | 0.26 | 0.41 |
| 9 | 2.12 | 0.14 | 0.22 |
| 10 | 12.06 | 0.39 | 0.60 |
| 11 | 20.33 | 0.48 | 0.79 |
| 12 | 5.38 | 0.14 | 0.21 |
| 13 | 15.89 | 0.30 | 0.47 |
| 14 | 69.76 | 1.65 | 2.50 |

*Table 5.6* COMPARISON OF DUST CONCENTRATIONS FOR ALL SOURCES EXCEPT DRILLING & BLASTING FOR STAGE 1

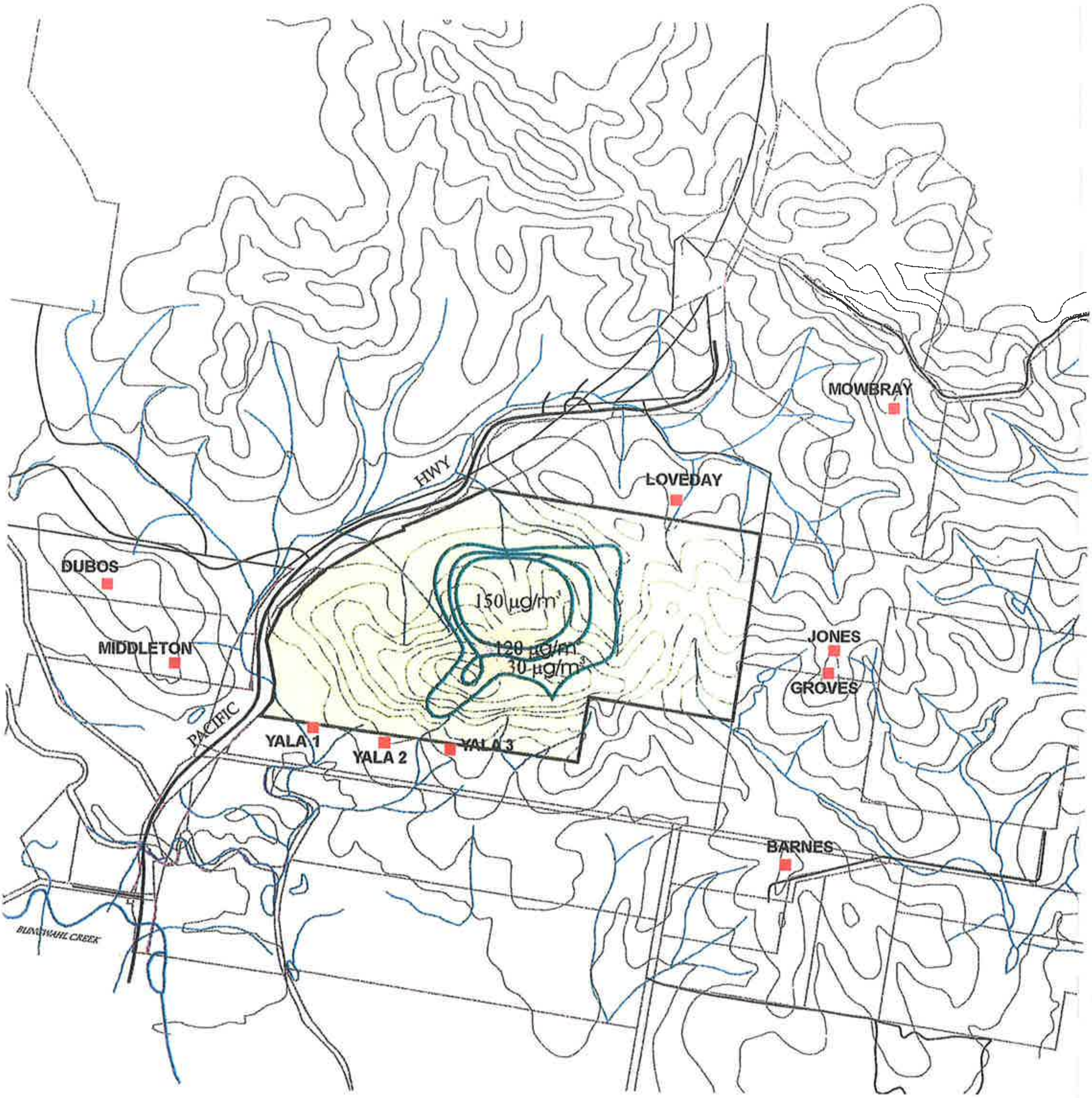
| Discrete Receptor | Max 24 hour $PM_{10}$ (μ/m³) | Annual Average $PM_{10}$ (μ/m³) | Annual Average TSP (μ/m³) |
|---|---|---|---|
| 1 | 3.89 | 0.35 | 0.67 |
| 2 | 17.72 | 0.79 | 1.52 |
| 3 | 54.34 | 2.80 | 5.41 |
| 4 | 4.41 | 0.48 | 0.87 |
| 5 | 23.49 | 0.47 | 0.86 |
| 6 | 45.32 | 2.40 | 4.56 |
| 7 | 21.02 | 1.03 | 1.97 |
| 8 | 7.20 | 0.30 | 0.58 |
| 9 | 1.85 | 0.17 | 0.31 |
| 10 | 9.49 | 0.56 | 0.97 |
| 11 | 24.62 | 0.61 | 1.14 |
| 12 | 5.69 | 0.16 | 0.30 |
| 13 | 14.43 | 0.32 | 0.60 |
| 14 | 59.94 | 1.77 | 3.16 |

*Table 5.7* COMPARISON OF DUST CONCENTRATIONS FOR ALL SOURCES EXCEPT DRILLING & BLASTING FOR STAGE 3

| Discrete Receptor | Max 24 hour $PM_{10}$ (μ/m³) | Annual Average $PM_{10}$ (μ/m³) | Annual Average TSP (μ/m³) |
|---|---|---|---|
| 1 | 4.96 | 0.39 | 0.72 |
| 2 | 17.79 | 0.80 | 1.53 |
| 3 | 56.30 | 3.26 | 6.03 |
| 4 | 4.86 | 0.55 | 0.98 |
| 5 | 23.45 | 0.47 | 0.85 |
| 6 | 46.17 | 2.40 | 4.56 |
| 7 | 19.82 | 1.04 | 1.98 |
| 8 | 7.52 | 0.31 | 0.60 |
| 9 | 2.28 | 0.19 | 0.33 |
| 10 | 9.39 | 0.43 | 0.0 |
| 11 | 21.43 | 0.53 | 1.03 |
| 12 | 5.40 | 0.15 | 0.29 |
| 13 | 14.45 | 0.32 | 0.60 |
| 14 | 58.77 | 1.67 | 3.02 |

*Table 5.8* COMPARISON OF DUST CONCENTRATIONS FOR ALL SOURCES EXCEPT DRILLING & BLASTING FOR STAGE 4

| Discrete Receptor | Max 24 hour $PM_{10}$ (μ/m³) | Annual Average $PM_{10}$ (μ/m³) | Annual Average TSP (μ/m³) |
|---|---|---|---|
| 1 | 4.82 | 0.38 | 0.71 |
| 2 | 17.78 | 0.80 | 1.52 |
| 3 | 55.94 | 3.14 | 5.79 |
| 4 | 4.82 | 0.53 | 0.93 |
| 5 | 23.45 | 0.47 | 0.85 |
| 6 | 46.09 | 2.40 | 4.54 |
| 7 | 19.75 | 1.03 | 1.96 |
| 8 | 7.35 | 0.31 | 0.59 |
| 9 | 2.06 | 0.18 | 0.31 |
| 10 | 9.04 | 0.41 | 0.75 |
| 11 | 21.21 | 0.52 | 1.02 |
| 12 | 5.21 | 0.15 | 0.28 |
| 13 | 14.45 | 0.32 | 0.82 |
| 14 | 58.58 | 1.65 | 2.56 |




RESIDENCE/NOISE RECEPTOR

150 µg/m³ $PM_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

EXISTING QUARRY

57106/38070fig5.4nce.CDR

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

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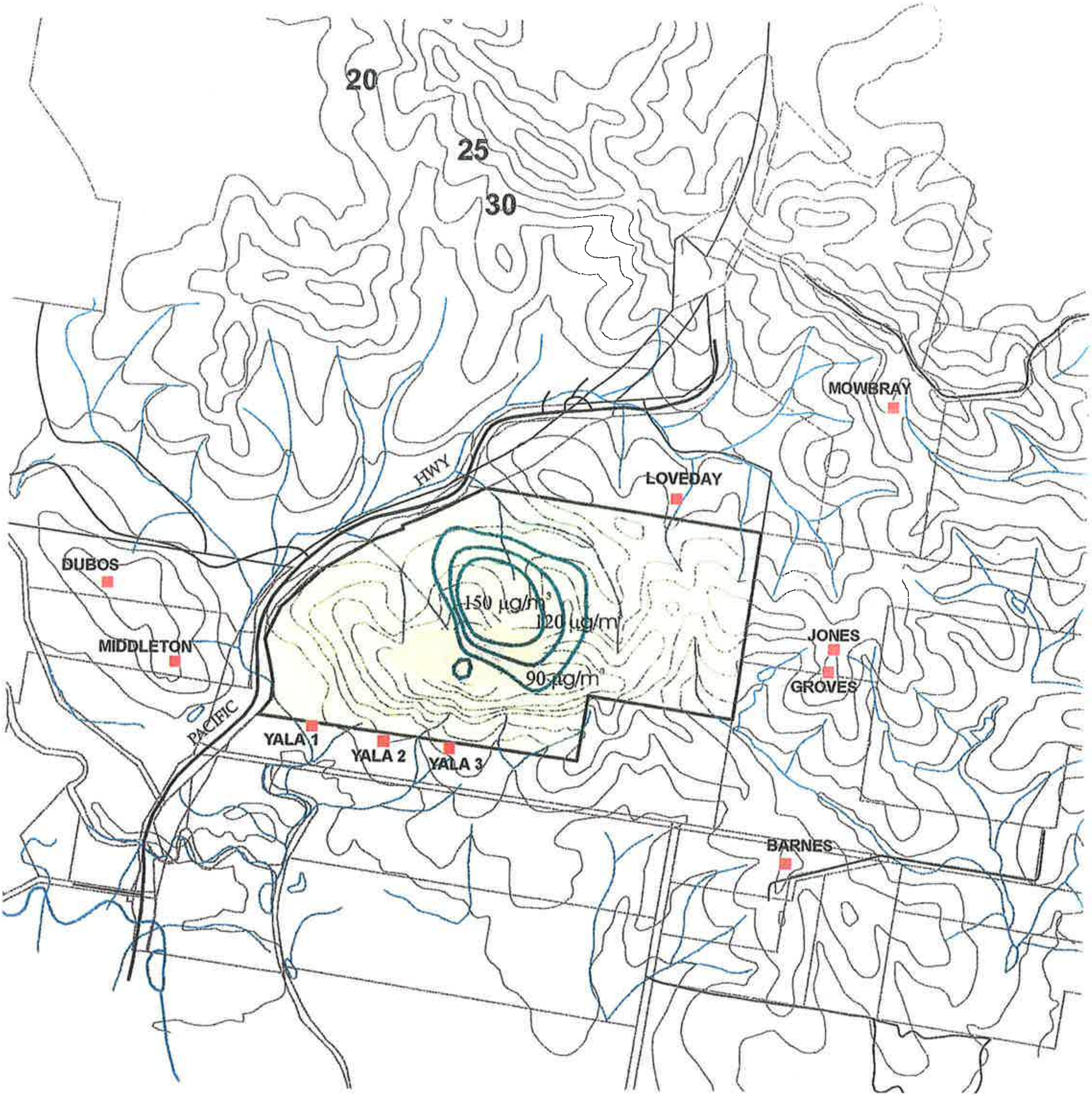
N

0 400m

*Figure 5.4* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - EXISTING QUARRY




RESIDENCE/NOISE RECEPTOR

150 µg/m³ PM$_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 1 QUARRYING

*SOURCE: CMA 1:25,000 TOPO NABIAC SHEET*

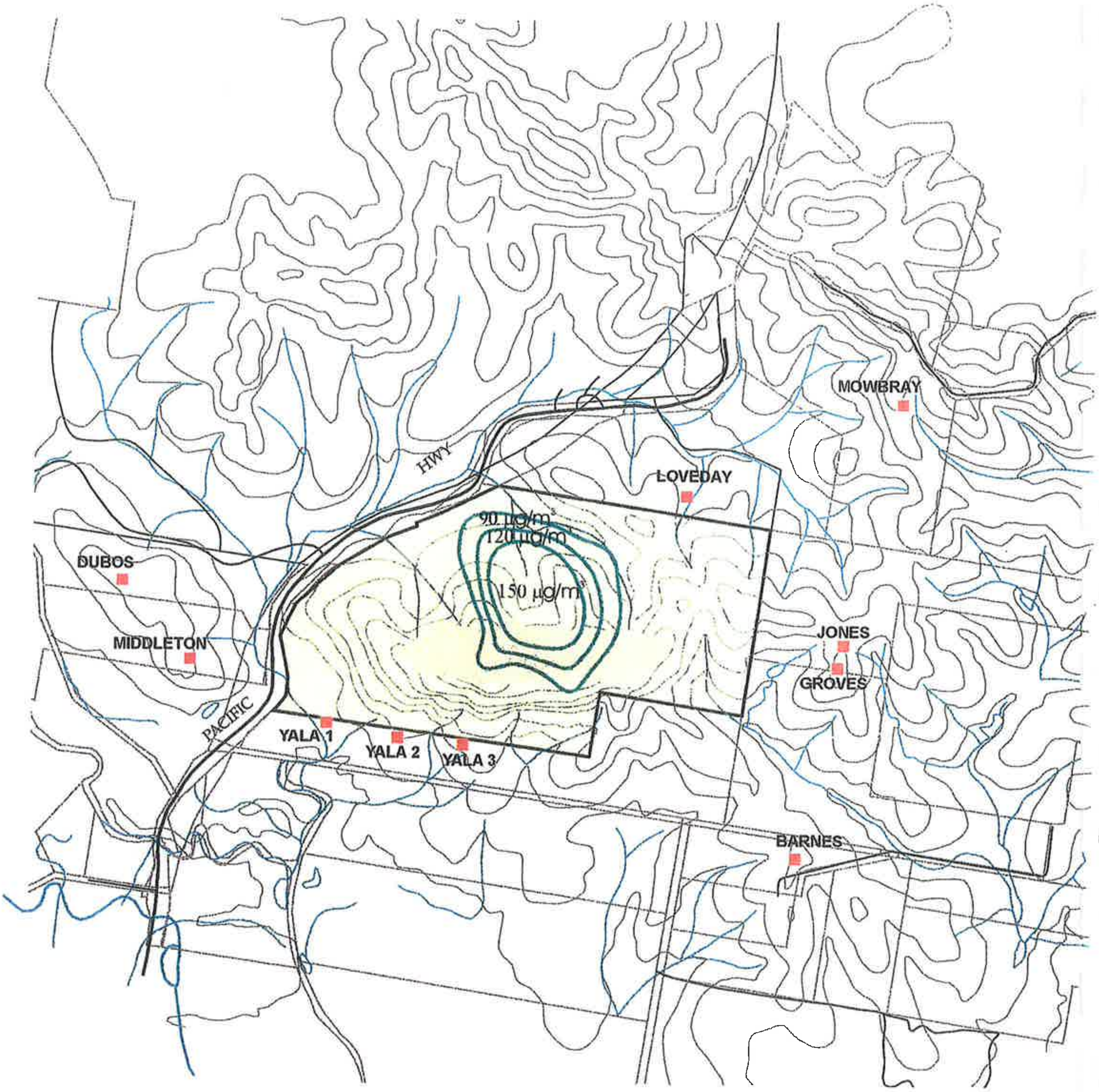
*57106/38070APPfg5.5ncst1.CDR*

ERM MITCHELL McCOTTER

N

400m

*Figure 5.5* MAXIMUM 24 HOUR PM$_{10}$ DUST CONTOURS - STAGE 1 QUARRYING




RESIDENCE/NOISE RECEPTOR

150 µg/m³ PM$_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 3 QUARRYING

57106/38070APPfg5.6dcst3.CDR

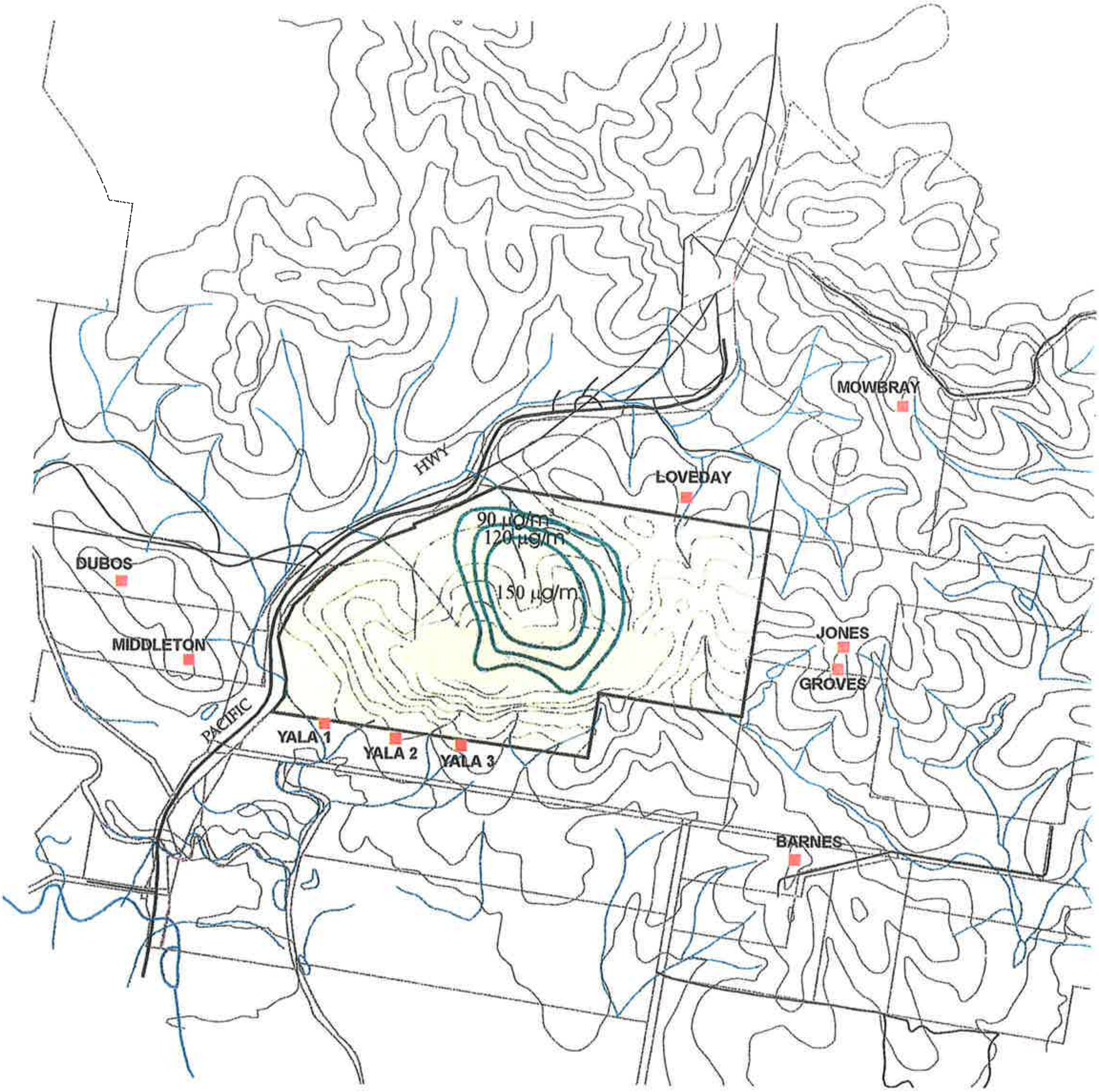
SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

ERM MITCHELL McCOTTER

*Figure 5.6* MAXIMUM 24 HOUR PM$_{10}$ DUST CONTOURS - STAGE 3 QUARRYING

N

400m




RESIDENCE/NOISE RECEPTOR

150 µg/m³ $PM_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 4 QUARRYING

57106/38070APPfig5.7dust4.CDR

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

ERM MITCHELL McCOTTER

*Figure 5.7* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - STAGE 4 QUARRYING

N

0 400m

Chapter 6

# DISCUSSION

## 6.1 DUST DEPOSITION

The current dust deposition values have been correlated against existing measurements. They show that predicted concentrations are within the range of the measured concentrations. The concentrations of dust deposition predicted by the model for Stages 1,3 and 4 show that concentrations will not significantly change.

Dust deposition will not exceed EPA criteria under the conditions modelled. All discrete receptors will have a maximum increase of less than 1.1 kg/m$^2$/month, well below guideline criteria for air quality amenity, 2 g/m$^2$/month.

## 6.2 DUST CONCENTRATION DUE TO NORMAL QUARRY OPERATIONS

### 6.2.1 *PM$_{10}$*

*i. 24 hour Average*

Modelled PM$_{10}$ concentrations are highest at YALA 3 residence (69.76 µg/m$^3$), still well below the NSW EPA adopted USEPA guideline level of 150 µg/m$^3$ for a 24 hour concentration.

The emissions originating from quarry operations (including various open-pit sources) have a negligible effect on the surrounding discrete receptors as concentrations predicted at these locations differ only slightly between Stages 1-4. This is primarily because the emission which dramatically increase between Stages 1-4, are open-pit sources (see *Table 4.4*). Lower values have been predicted at receptors from these sources as the pit walls act as wakes (thus minimising PM$_{10}$ emission from the cavity), as opposed to area sources, where there are no wakes (and more dispersion occurs).

The concentrations predicted at discrete receptors for all stages are primarily due to area emissions which do not emanate from the actual quarry pit.

*ii. Annual Average*

Modelled $PM_{10}$ concentrations taken as an annual average are also well below the NSW EPA adopted USEPA criteria of 50 μg/m³. The highest concentrations calculated at the YALA 3 residence and at the southern and north-western quarry property boundary were below 3 μg/m³. It is not expected that impacts from the proposed increase in quarry area will have a significant effect on amenity or health relating to $PM_{10}$ dust concentrations.

### 6.2.2 *Total Suspended Particulate*

For total suspended particulate (TSP) the NSW EPA adopt only an annual criteria being the National Health and Medical Research Council's recommended maximum annual concentration of 90 μg/m³. The predicted concentrations for TSP between each of the proposed quarry stages also do not vary significantly and are well below this criteria. As for $PM_{10}$ the highest concentrations calculated were at the YALA 3 residence and at the southern and north-western quarry property boundaries (less than 6.03 μg/m³). It is not expected that impacts from the proposed increase in quarry area will have a significant effect on amenity or health relating to TSP dust concentrations.

## 6.3 EPISODIC IMPACTS

Episodic impacts relate to drilling and blasting as emission sources. Due to their nature it is difficult to accurately assess their impact with the ISC model. These impacts relate only to emissions which will typically occur around once or twice a month.

Impacts from drilling and blasting can be reduced through standard blasting and drilling mitigation measures as outlined in Chapter 7 - *Mitigation Measures* and CSR's guidelines *'Drilling and Blasting Procedures for Jandra Quarry'*. Primarily, it is important to consider the meteorological conditions, in particular wind speed and direction and any inversion layer before conducting drilling and blasting. Consideration must be made with all available meteorological information before each session occurs. Particular attention is required when blasting near the southern and eastern extent of the quarry where blast locations are close the property boundary and some nearby residences.

Depending on the meteorological conditions at the time of the blast, the volume of dust emanated may settle in the surrounding area in a very short period of time, travel via 'plug flow' downwind or in high wind conditions may be dispersed rapidly. As the duration of the blast is extremely short, these factors can be assessed on-site and significant impacts off-site can be avoided.

As a precursor to minimising the impact of the dust generated, blast holes can be capped with stemming, which restricts the upward emission of dust. In addition, shot rock is moistened with water sprays prior to loading into dump trucks.

Therefore, as long as standard drilling and blasting practices are followed it is anticipated that blasting and drilling will not have a significant impact on dust levels at nearby residences.

Chapter 7

# ODOUR ASSESSMENT

## 7.1 ODOUR SOURCES

It is anticipated that most activities at the quarry will not produce odours that may have off-site effects. This is because of the relatively low concentrations of odour produced combined with the large area for dispersion to occur. The exclusion of this is the asphalt plant, which has the potential to cause off-site effects.

## 7.2 ASPHALT PLANT

A mobile asphalt plant is to be located on-site on an as needs basis, based on market demand. The plant will be capable of producing approximately 100 to 200 tonnes an hour. Air emissions from the asphalt plant will be directed though a wet scrubber to remove both particulate and odour emissions. The plant will be fitted with a wet scrubber flow meter with an audible and visual alarm. Lime or flyash will be contained in a filler silo reducing the potential for fugitive air emissions from these process inputs.

The process of producing hot mix asphalt involves drying and heating the aggregate before addition of the bitumen. The drying process involves the aggregate moving through a rotating, slightly inclined, direct fired drum drier. After drying the aggregate is generally heated to temperatures ranging from 150°C - 200°C and then coated with bitumen. Odour emissions from this process are associated with volatile organic compounds (VOC's) from the bitumen.

A number of process modifications such as drum rearrangement, adjustment of the asphalt injection point and optimising the combustion process will reduce the VOC's and therefore odour.

Fugitive VOC emissions from the asphalt tanks will be routed back to the combustion unit which will serve as an afterburner reducing the concentration of fugitive VOC's to atmosphere.

In addition to these mitigation measures, the exhaust stack will ensure that adequate dispersion of the emission plume takes place. It is expected that with the distance to the nearest receptor from the proposed asphalt plant site being approximately 600 metres, adequate dispersion will occur. Plume dispersion will be enhanced by the heavily vegetated nature of the area.

Plume dispersion in conjunction with the appropriate control technologies will ensure that odour emissions from the asphalt batching plant will not have a significant impact on nearby discrete receptors.

Chapter 8

# MITIGATION MEASURES

As part of standard CSR's quarrying practices mitigation measures are conducted during daily activities. These have been developed through CSRs long association with quarrying. Mitigation measures to control air quality at the quarry include:

- regular watering of haul roads and stockpiles;
- limiting speeds of vehicles on unsealed surfaces to 40 kph;
- minimising vehicle kilometres travelled on unpaved roads;
- rehabilitating disturbed areas;
- where practical/possible conduct drilling and blasting during suitable meteorological conditions (ie. not during high winds or temperature inversions);
- adequate stemming of drill holes;
- dust extraction units on drill rigs and crushing and screening plants to be well maintained;
- seals and mist sprays on quarry equipment to be well maintained;
- dust displaced during silo filling to be controlled by an appropriate filter (ie a reverse pulse silo filling filter or equivalent);
- wet scrubber on asphalt bathing plant to be maintained regularly including the regular servicing of the recycling interceptor trap; and
- stack emissions from the asphalt batching plant to be monitored for:
  - VOCs;
  - semi VOCs;
  - $CH_4$, $H_2$, $N_2$, CO, $CO_2$ and $O_2$;
  - particulate;
  - Stack gas moisture, velocity and temperature; and
  - mass flow rate of exhaust gases, water, particulates, $N_2$, CO, $CO_2$ & $O_2$.

Chapter 9

# CONCLUSION

The proposed extension of Jandra quarry from 150,000 tpa to 250,000 tpa should not significantly impact on the air quality of the surrounding area. The proposed impacts have been predicted using the ISC model.

The predictions show that a minimal increase in $PM_{10}$ concentrations may occur over 24 hour averaging periods. Predicted annual concentrations of $PM_{10}$ and TSP are also expected to raise slightly however all are expected to be well below the criteria nominated by the NSW EPA. It is anticipated that dust deposition criteria nominated by the NSW EPA will be complied with.

Potential short-term dust impacts due to drilling and blasting, whilst only predicted to occur once or twice a month, can be mitigated through the use of standard mitigation measures which are detailed in this assessment. CSR needs to be especially prudent when drilling and blasting practices occur near their southern property boundary during Stage 3.

Odour impacts emanating from the asphalt plant are proposed to be mitigated through the use of appropriate control technologies and an exhaust stack to produce sufficient dispersion.

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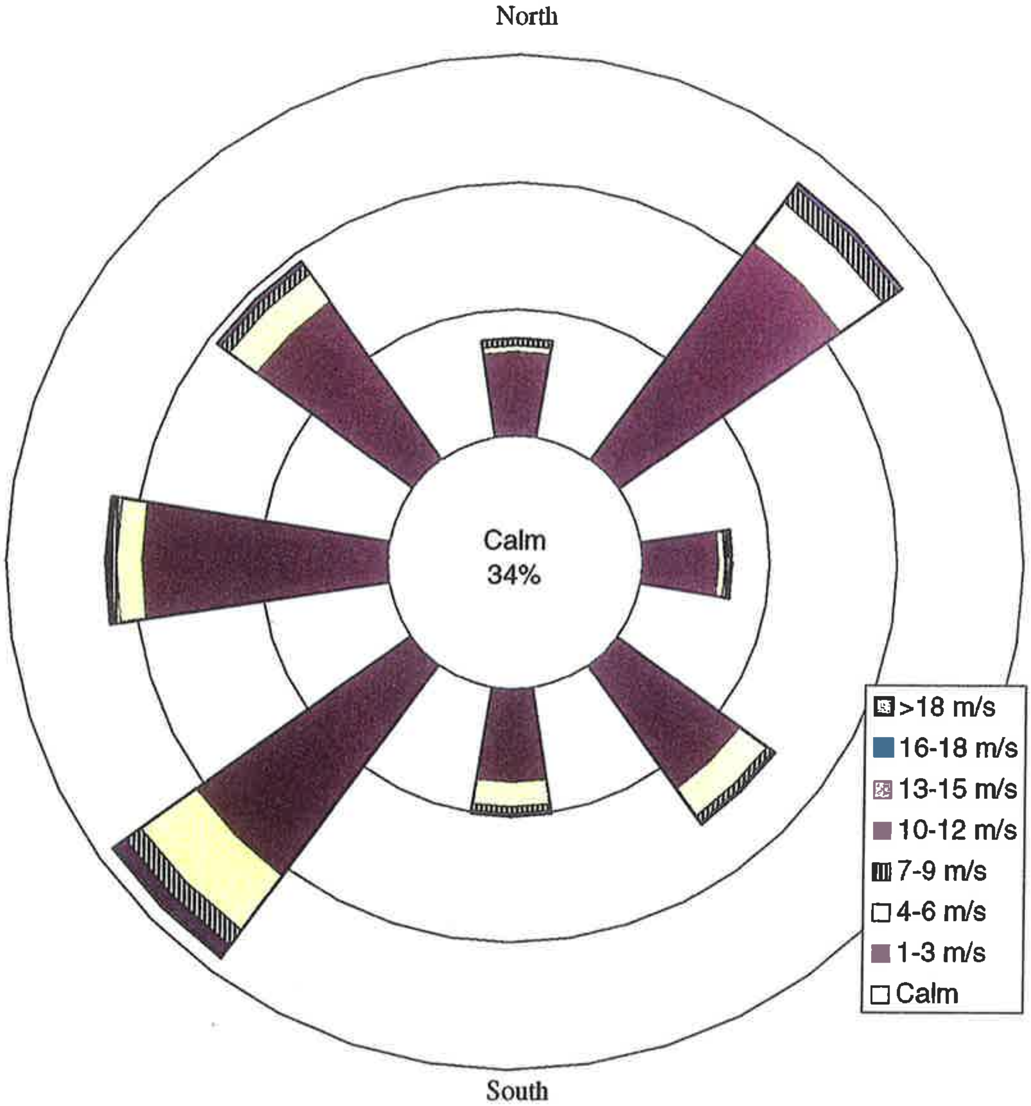
# APPENDICES

Appendix A

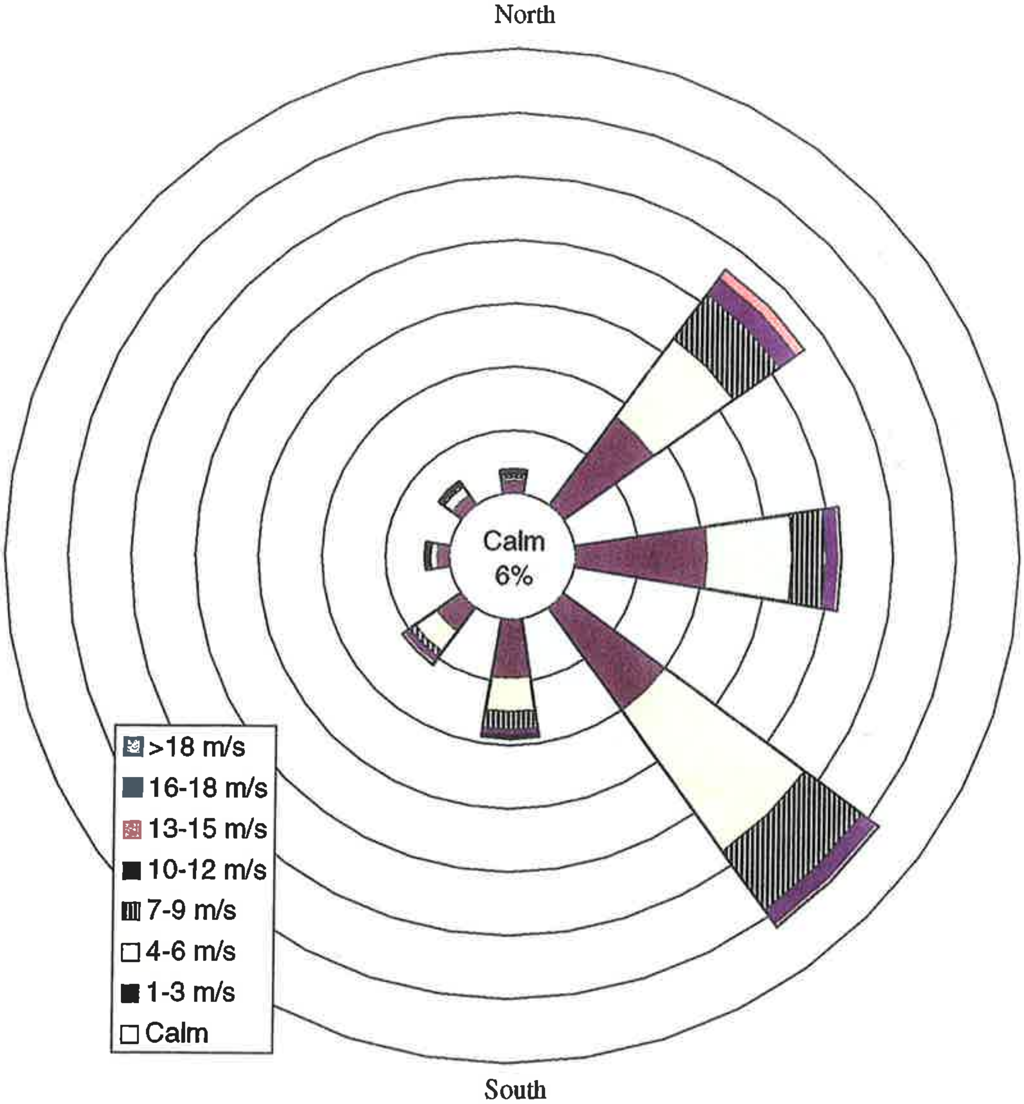
# WINDROSES

Windrose for Summer
9am



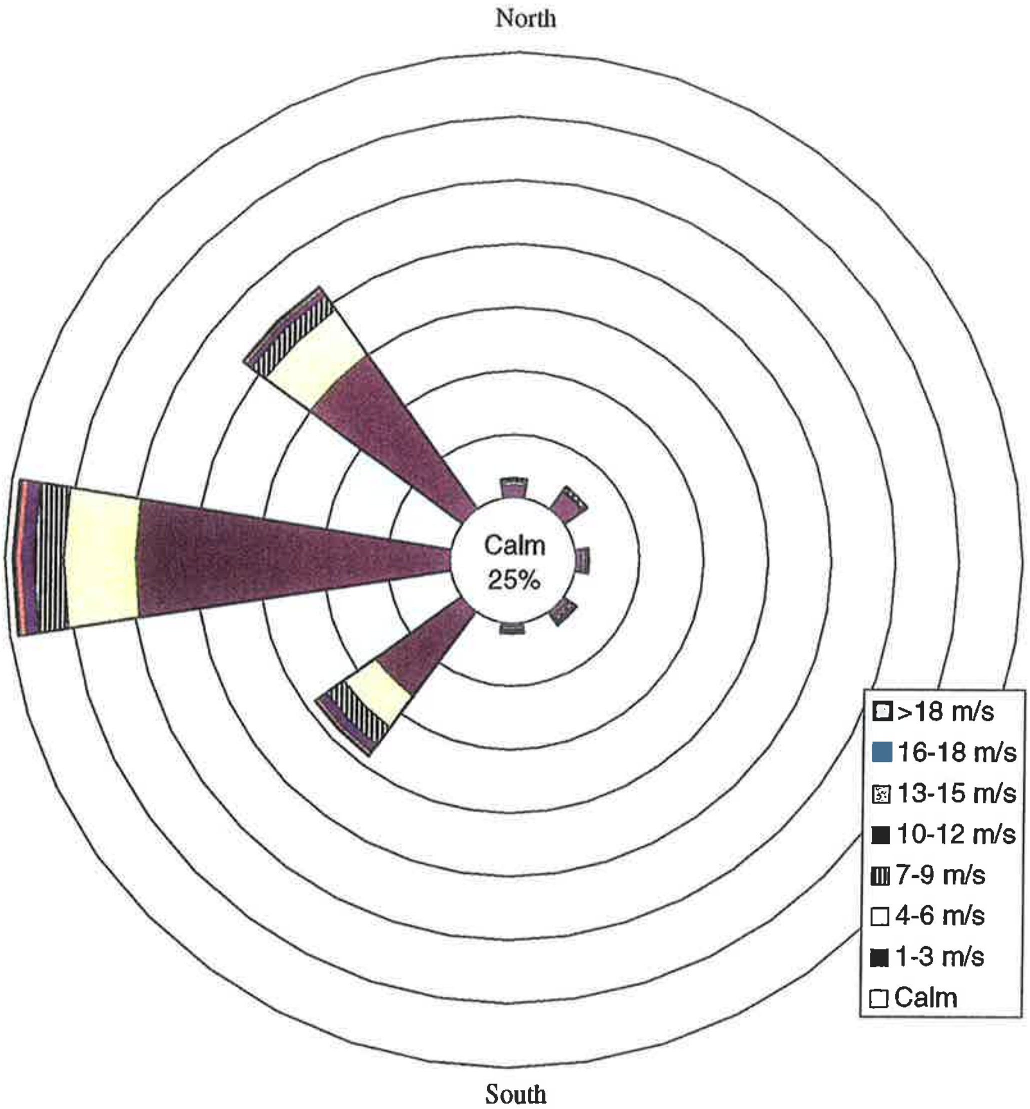

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circlular grid represents a contour interval of five percent.

Windrose for Summer
3pm



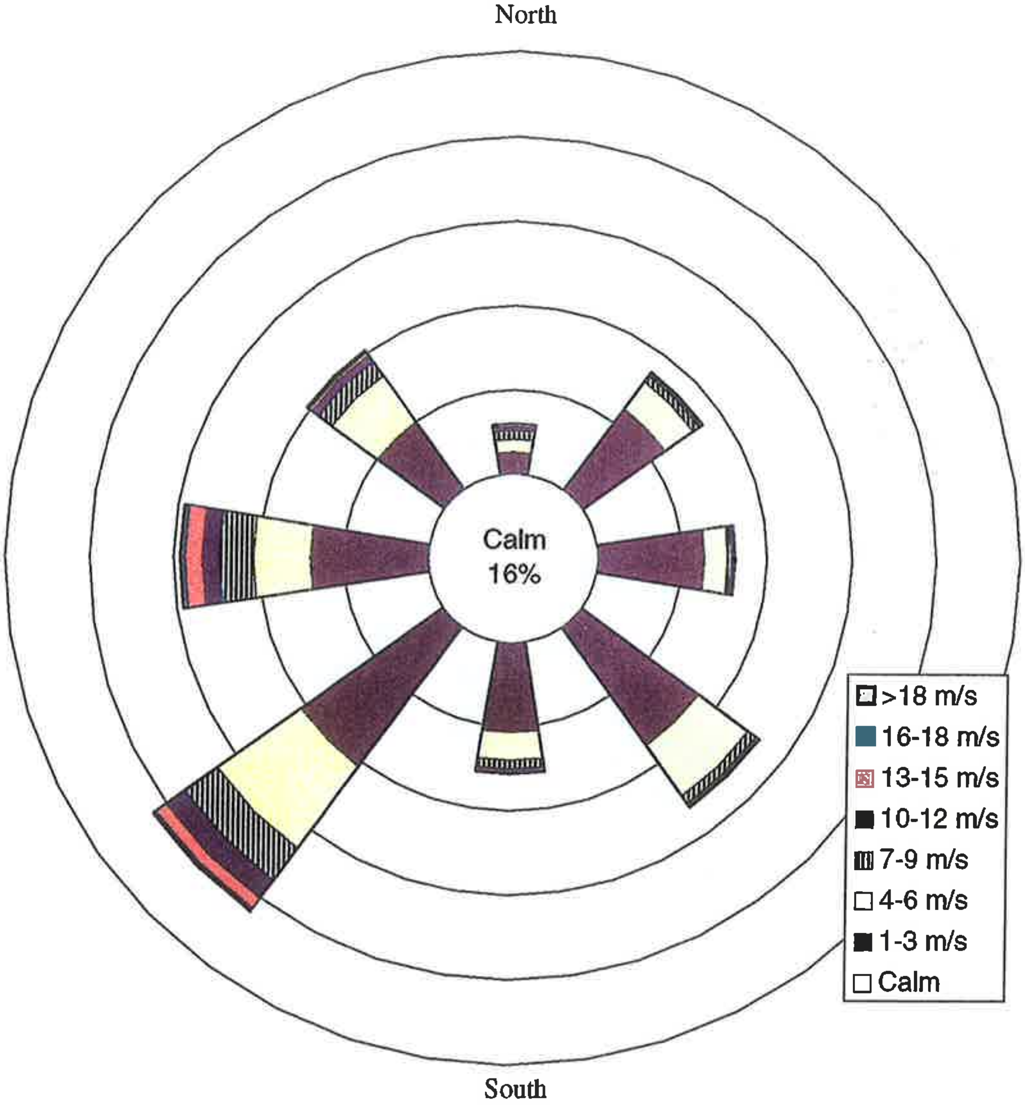

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circular grid represents a contour interval of five percent.

Windrose for Winter
9am



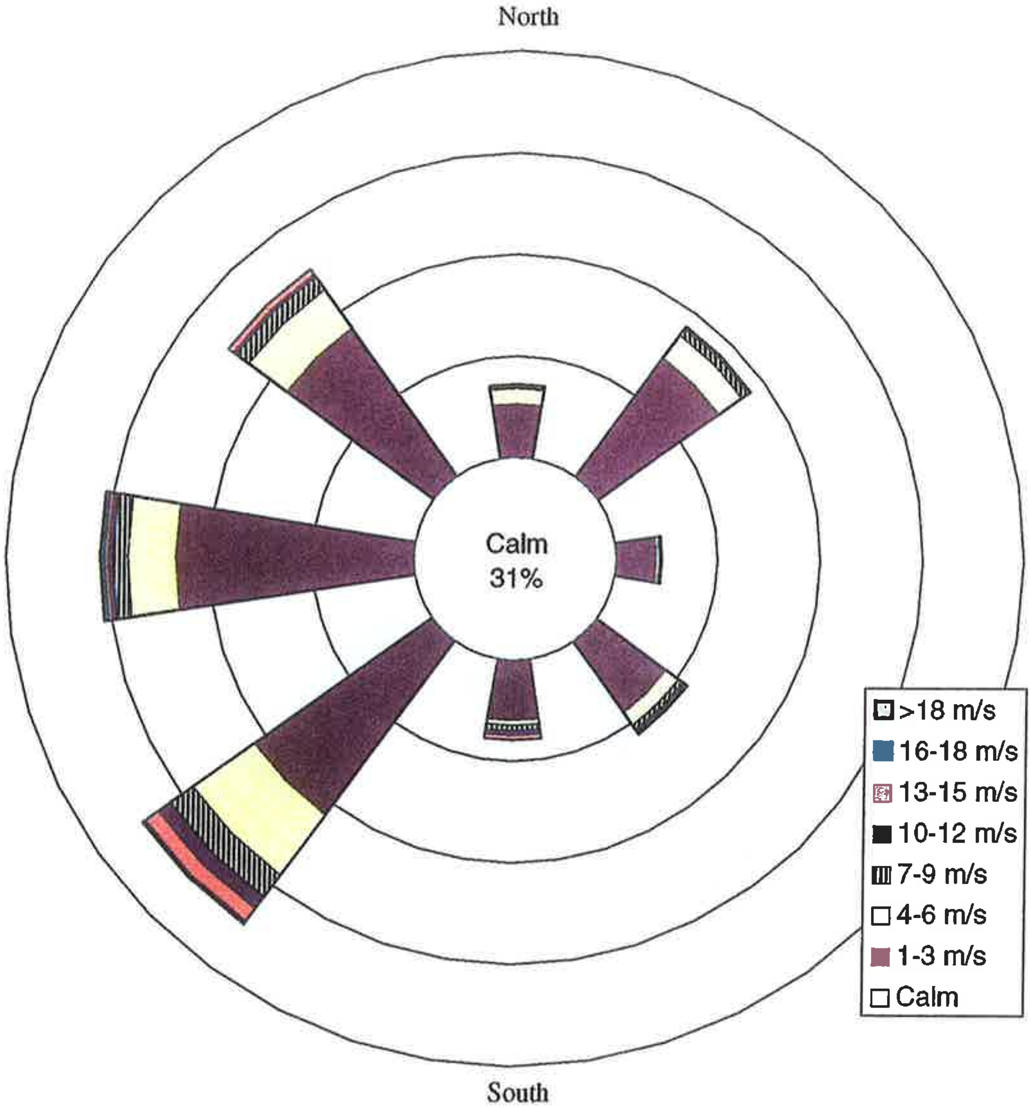

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circlular grid represents a contour interval of five percent.

Windrose for Winter
3pm



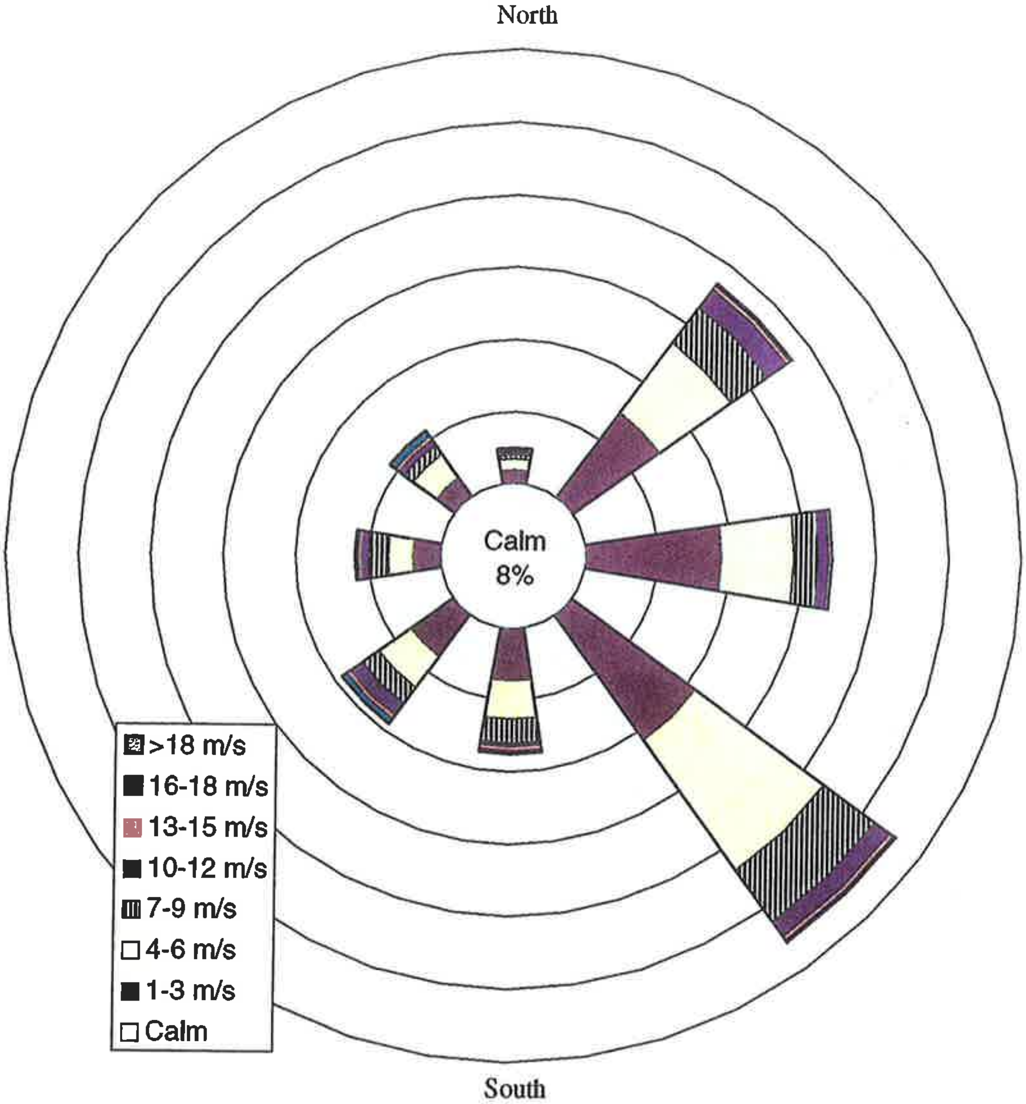

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circular grid represents a contour interval of five percent.

Windrose for Spring
9am



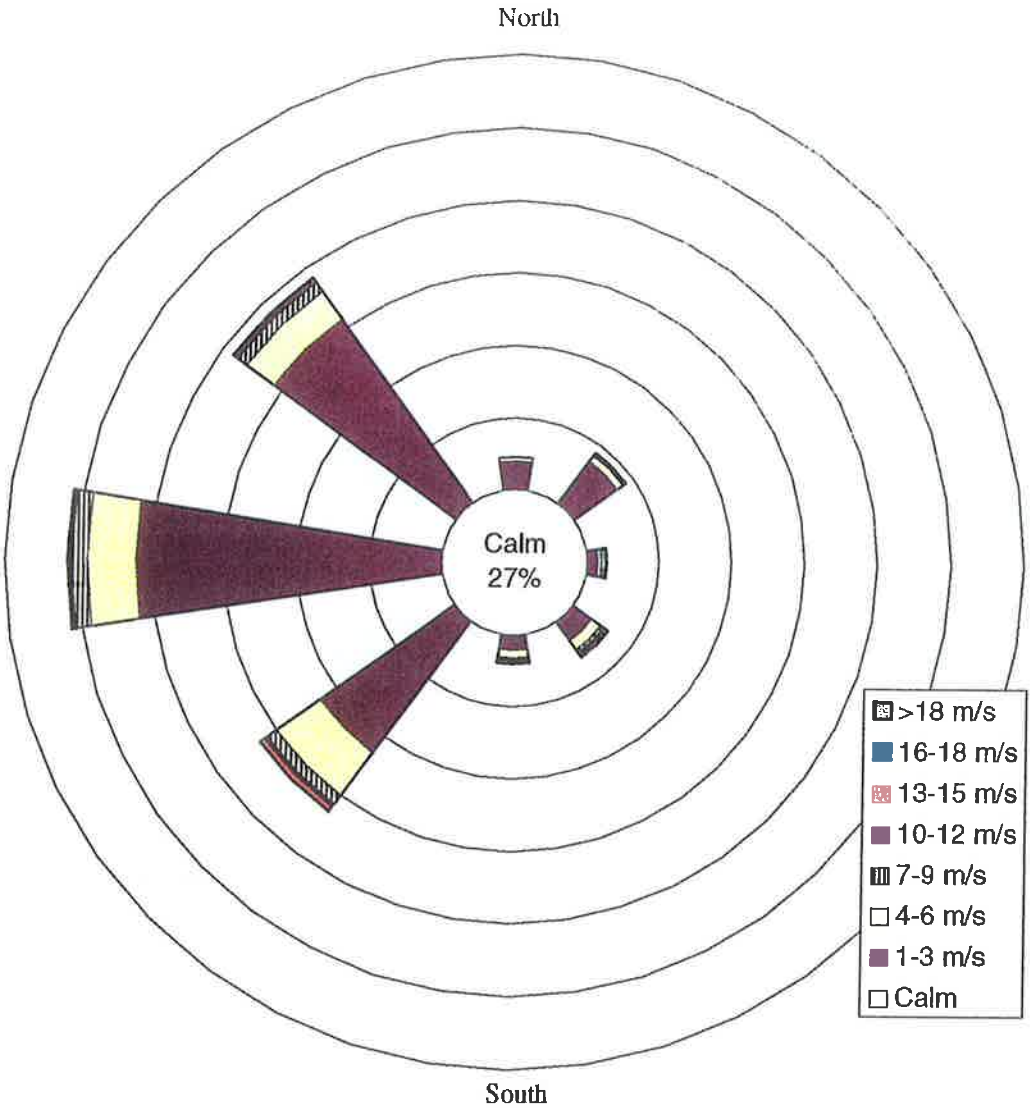

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circular grid represents a contour interval of five percent.

Windrose for Spring
3pm



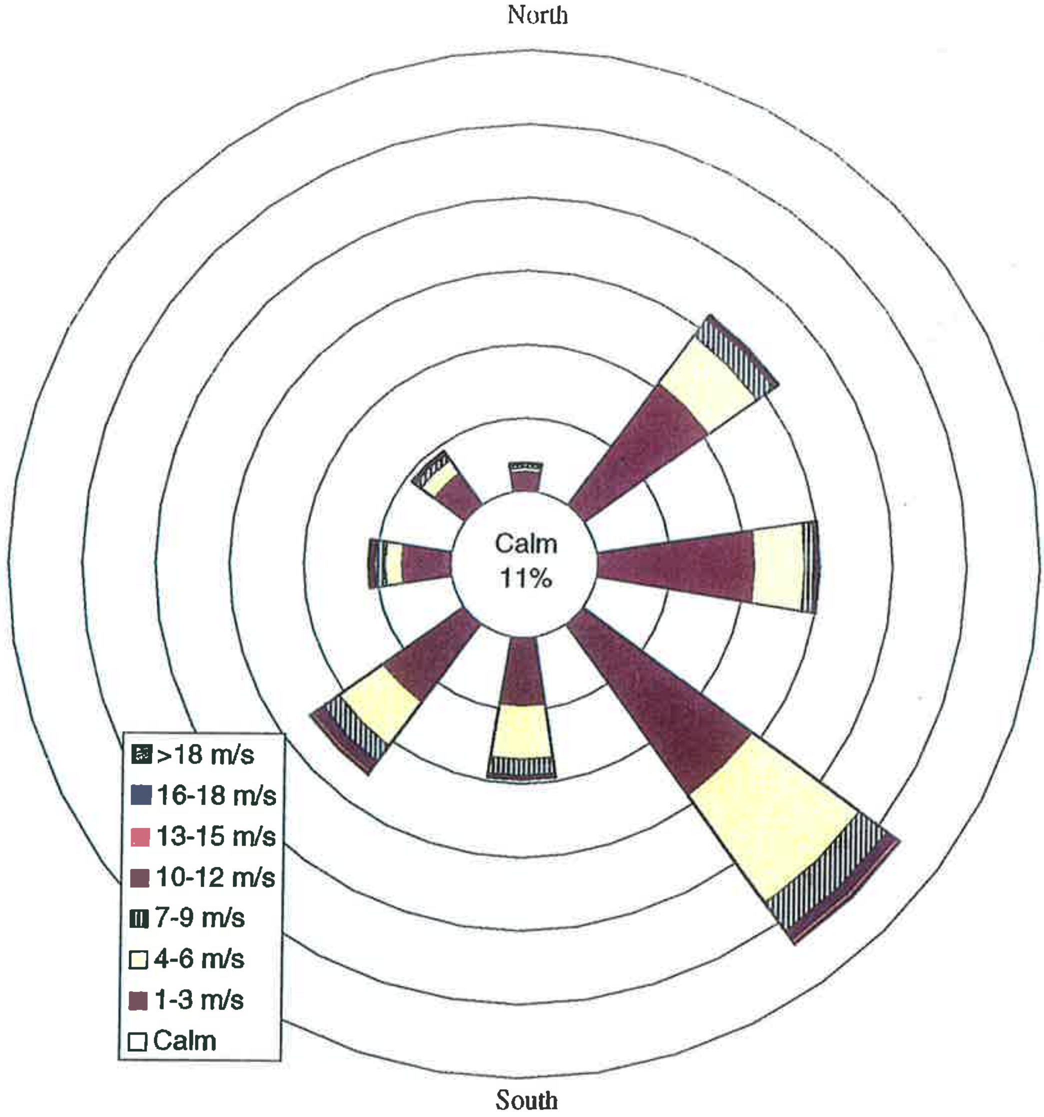

The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circular grid represents a contour interval of five percent.

Windrose for Autumn
9am




The segments of each arm represent the seven wind speed classes, with increasing windspeed from the centre outwards.The length of each arm represents the proportion of the total wind that blew from that direction. The value in the central circle represents the proportion of calm conditions. The circular grid represents a contour interval of five percent.

Windrose for Autumn
3pm

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