- sequential clearing and rehabilitation of the quarry as extraction of the hardrock material proceeds;

- regular monitoring of sediment control dams and the creek downstream of the site; and

- the regular maintenance of erosion and sediment control structures, particularly after rainfall, to ensure their efficiency.

*ii. Asphalt Plant, Pugmill and Pre-coating Operations*

Additional actions to mitigate potential impacts on water quality and runoff from the asphalt plant, pugmill and pre-coating operations will include the following:

- the asphalt plant to be situated on a hardstand pad;

- the pugmill and pre-coating facility to be situated on a concrete pad;

- runoff from the asphalt plant pad to be diverted to sediment/evaporation ponds for treatment;

- runoff from the pre-coating area to be directed through a grease trap;

- a wet scrubber inground lined interceptor pit to be constructed to trap scrubber particulates and recycle water back through the asphalt plant. Solids from the pit will be bioremediated on-site in a clay lined area. The water recycling pit will have a minimum capacity to serve daily usage water and will be kept separate from the general site runoff. Water from these activities will be directed into settling ponds where aggregates will be given time to settle out;

- when either of the asphalt plant, pugmill or pre-coating facilities are in operation, the site facility sediment dam (being downstream of these operations) will be monitored regularly for the following analytes:

  - pH;
  - total dissolved solids;
  - total suspended solids;
  - total petroleum hydrocarbons;
  - polynuclear aromatic hydrocarbons;
  - mononuclear aromatic hydrocarbons; and
  - biochemical oxygen demand.

- additives, fuels, chemicals or oils will be stored in a roofed and bunded area sized to contain spillage of at least 110% of the largest liquid storage container;
- specialist absorbent material will be kept on-site for rapid clean-up of spills. Soiled material is then stored on-site in drums prior to disposal by a licensed contractor; and
- regular inspection and monitoring of the bunded areas would be undertaken to ensure proper maintenance of tanks and containment of any spills.

## 4.4 AIR QUALITY

A detailed air quality assessment is presented in *Appendix K*. A summary of the assessment is provided below.

### *4.4.1 Air Quality Criteria*

The effects of dust on health and amenity were assessed by comparing dust deposition rates and dust concentrations with recognised air quality criteria. To include the full range of potential impacts, reference was made to criteria for long-term (annual average) and short-term (24 hour) periods, and to different particle sizes. The following sections detail appropriate criteria.

*i. Dust Deposition*

Dust deposition criteria developed by the NSW Environment Protection Authority (NSW EPA) are given in *Table 4.3*. These set maximum increases above existing levels. For example, in residential areas with existing annual average deposition of between zero and two g/m²/month, an increase of up to two g/m²/month would be permitted.

*Table 4.3* ASSESSMENT CRITERIA FOR DUST DEPOSITION

| Existing Deposition ($g/m^2$/month) | Maximum Acceptable Increase ($g/m^2$/month annual average) | |
|---|---|---|
| | Residential Suburban Land Use | Rural, Semi-Rural Urban, Commercial & Industrial Land Uses |
| 2 | 2 | 2 |
| 3 | 1 | 2 |
| 4 | 0 | 1 |

Based on these criteria and average deposition rates recorded at three locations around the quarry property boundary the permissible increase at properties around the quarry will be as shown in *Table 4.4*.

*Table 4.4* GUIDELINES FOR INCREASES IN DUST DEPOSITION

| Site | Annual Average Deposition for 1996 - 1997 ($g/m^2$/month) | Permissible increase in deposition ($g/m^2$/month) |
|---|---|---|
| 1 | 1.90 | 2.0 |
| 2 | 1.76 | 2.0 |
| 3 | 2.62 | 2.0 |

*ii. Dust Concentration*

Concentration criteria for long-term annual averages and short-term 24 hour periods were considered. Two size ranges were also addressed: total solid particulate matter (TSP) or particles less than 50 microns (one millionth of a metre) and particles smaller than 10 microns ($PM_{10}$).

$PM_{10}$ particle concentrations are of interest because they can reach the lower parts of the respiratory system and may have health as well as amenity impacts. Most $PM_{10}$ particles are caused by combustion from motor vehicles, bushfires and industrial processes. Some $PM_{10}$ particles are generated by evaporation of sea spray and from vegetation. Most quarrying dust consists of coarser particles which have amenity rather than health effects.

The assessment criteria are as follows.

a. Short-term Criteria

Based on United States Environmental Protection Agency (USEPA) standards, the NSW EPA adopts a 24 hour concentration criterion of 150 $\mu g/m^3$ for $PM_{10}$ which should not be exceeded more than once per year.

b. Long-term Criteria

The National Health and Medical Research Council of Australia (NHMRC) recommends a maximum annual concentration of 90 $\mu g/m^3$ total suspended particulate in a residential environment, which is referred to in the absence of a more suitable standard. For particles smaller than 10 microns, the NSW EPA adopts the USEPA $PM_{10}$ standard of 50 $\mu g/m^3$ annual average.

### *4.4.2 Dust Dispersion Modelling*

The ISC dispersion model was chosen to predict dust deposition rates and airborne concentrations of respirable ($PM_{10}$) and inhalable (TSP) dust resulting from dust emissions. Calculated dust deposition rates were compared against available monitored data in the locality to validate the model's result. No measured values were available for TSP and $PM_{10}$ concentrations in the locality.

Based on the verified model, levels of dust deposition and dust concentrations were predicted. Air quality impacts due to proposed quarry operations were determined by comparing the predicted levels with relevant criteria.

The amount of dust generated has been calculated by applying emission factors for the various processes. Emission factors have been obtained from published data by the former State Pollution Control Commission of New South Wales (SPCC), now the NSW EPA. Emission factors for activities not listed in the SPCC report were taken from United States Environment Protection Agency (USEPA) studies.

### *4.4.3 Dust Impact Assessment*

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).

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 of the highest 24 hour $PM_{10}$ dust concentrations due to quarry operations (excluding drilling and blasting) are shown in *Figures 4.6 to 4.9*. 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.

### *4.4.4 Discussion*

*i. Dust Deposition*

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 $g/m^2/month$.

*ii. Dust Concentration Due To Normal Quarry Operations*

a. $PM_{10}$

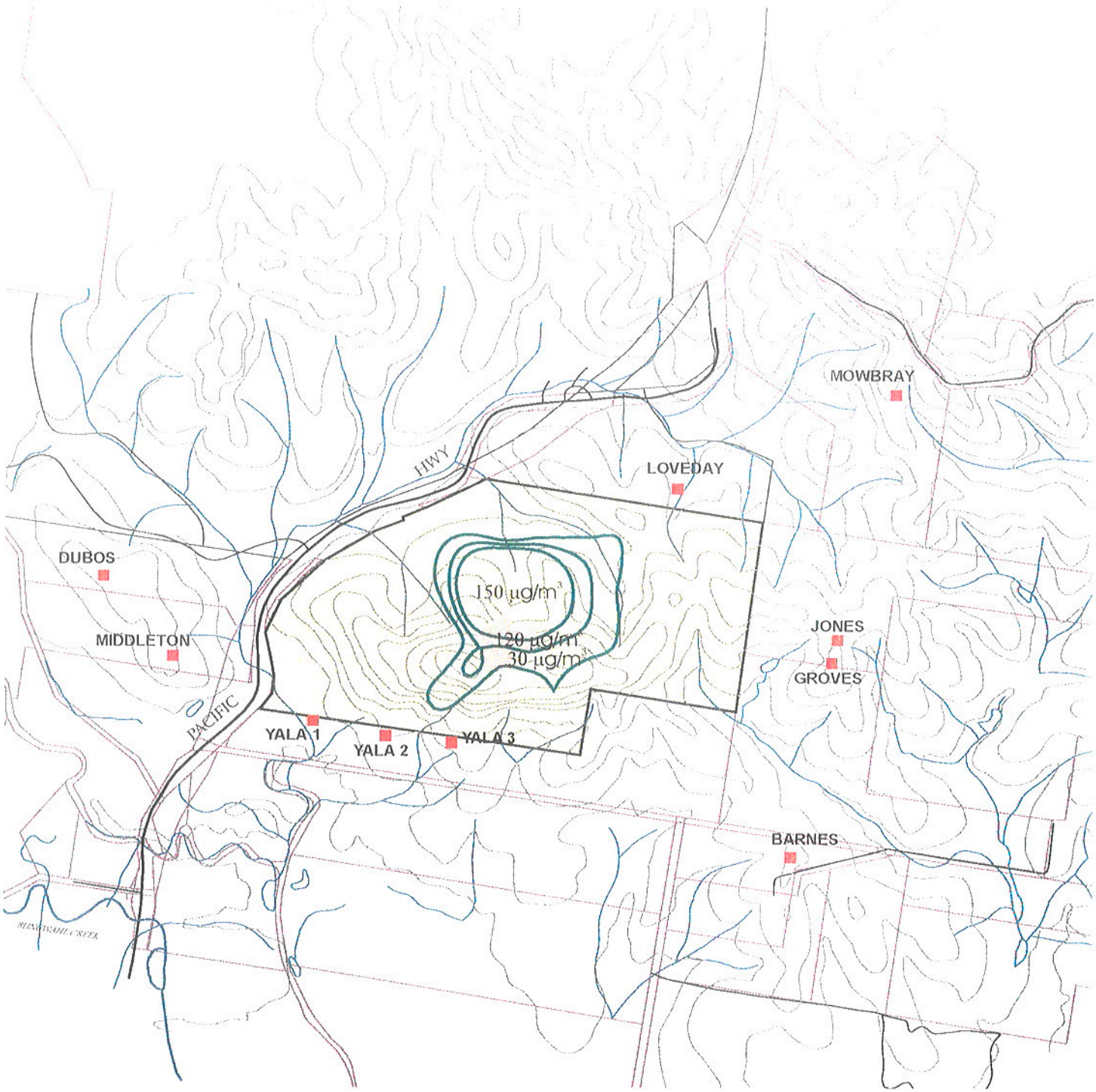
- 24 hour Average

Modelled $PM_{10}$ concentrations are highest at the nearest residence to the south (69.76 $\mu g/m^3$), still well below the NSW EPA adopted USEPA guideline level of 150 $\mu g/m^3$ for a 24 hour concentration.

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

- Annual Average

Modelled $PM_{10}$ concentrations taken as an annual average are also well below the NSW EPA adopted USEPA criteria of 50 $\mu g/m^3$. The highest concentrations calculated at the nearest residence to the south were below 2 $\mu g/m^3$. 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.




57106/380070/fig4.64cco.CDR

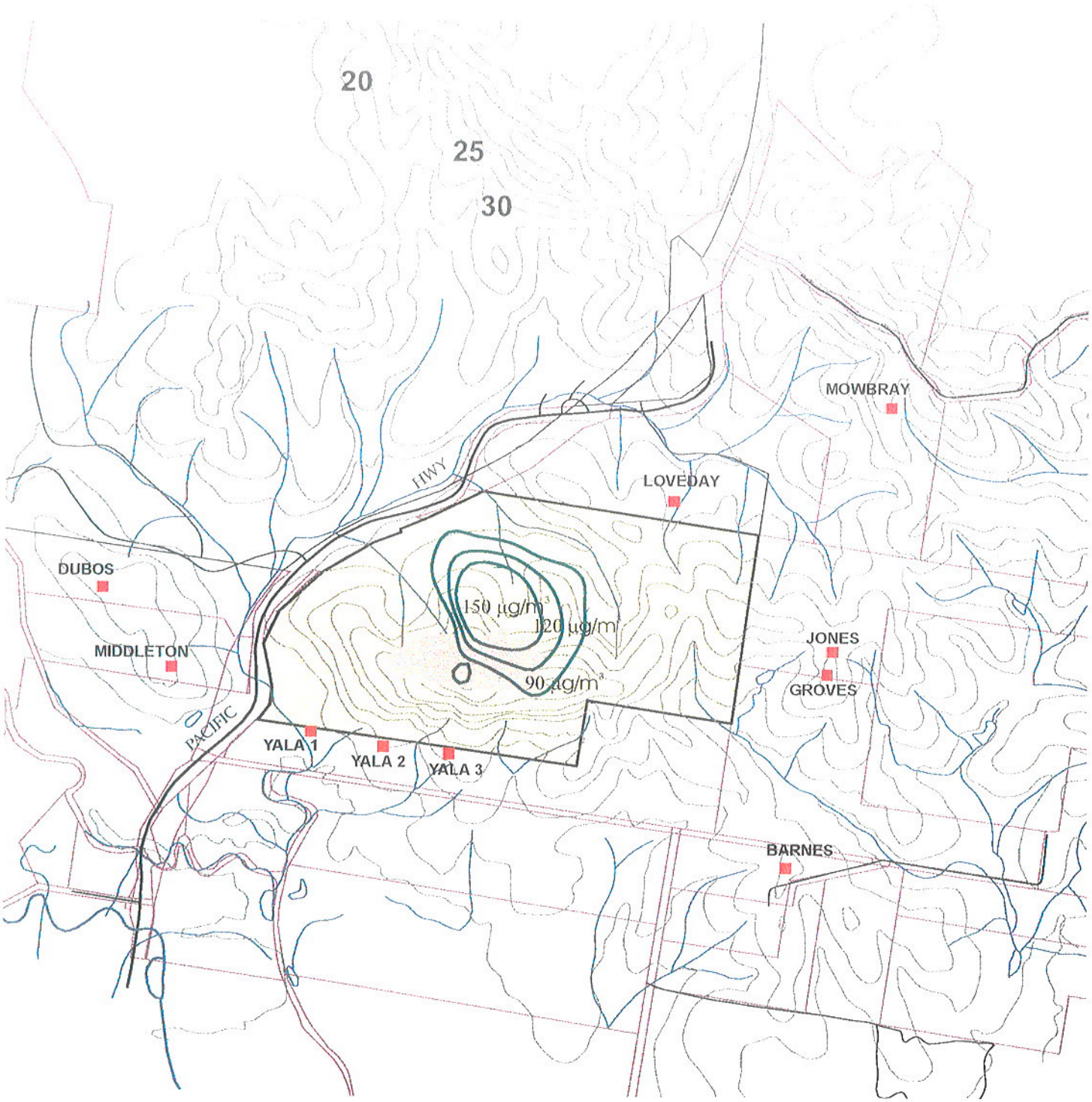
SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

ERM MITCHELL MCCOTTER

*Figure 4.6* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - EXISTING QUARRY

N

400m




57106/38070APP/fig4.7dust1.CDR

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

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*Figure 4.7* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - STAGE 1 QUARRYING

N

0 400m


RESIDENCE/NOISE RECEPTOR

150 µg/m³ $PM_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 3 QUARRYING

S7106/380070APPfig4.8dest3.CDR

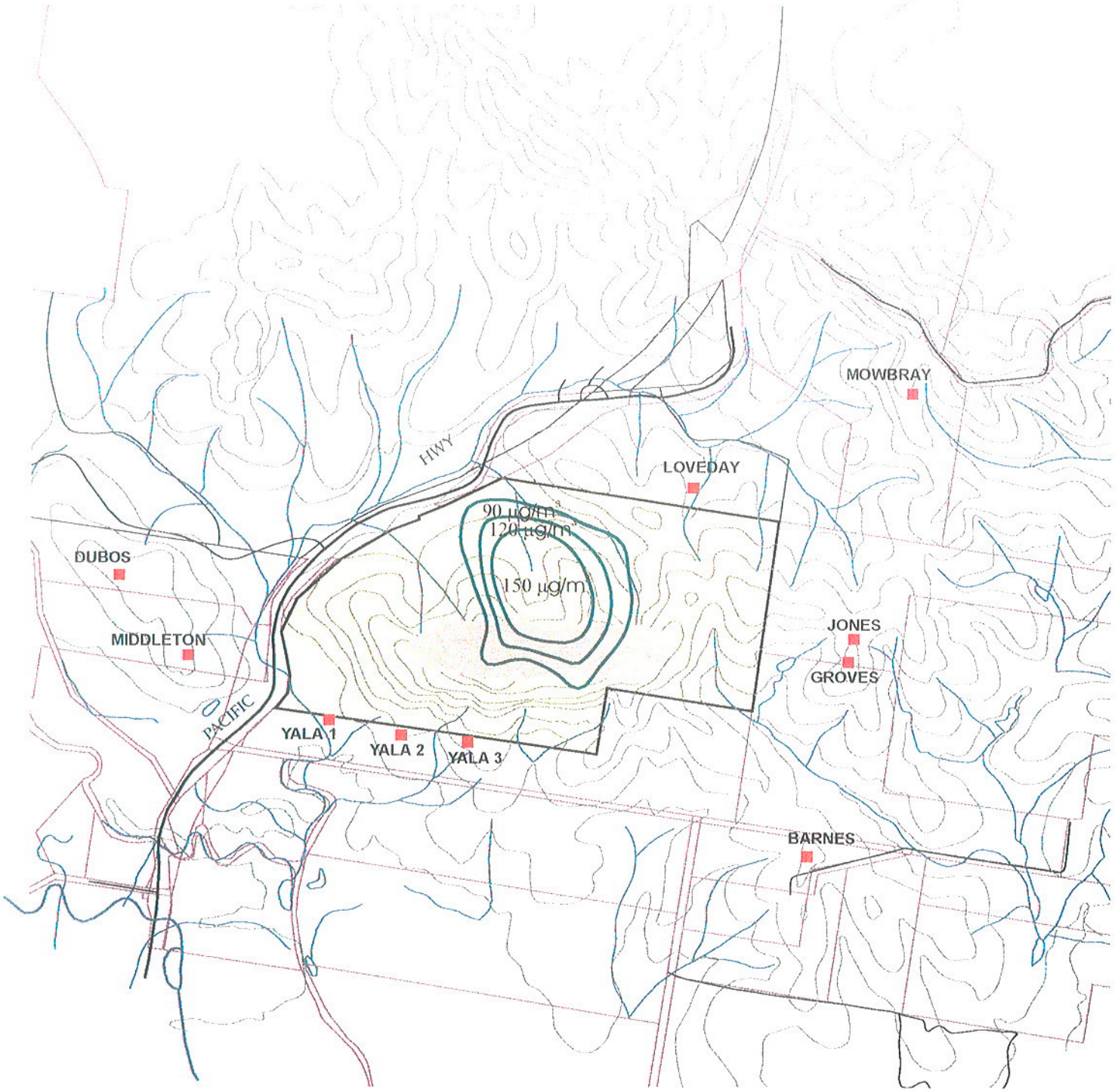
SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

ERM MITCHELL McCOTTER

*Figure 4.8* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - STAGE 3 QUARRYING

N

0 400m




RESIDENCE/NOISE RECEPTOR

150 µg/m³ $PM_{10}$ DUST CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 4 QUARRYING

57106/38070APPfig4.94ctr4.CDR

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

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*Figure 4.9* MAXIMUM 24 HOUR $PM_{10}$ DUST CONTOURS - STAGE 4 QUARRYING

N

0 400m

b. 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 $\mu g/m^3$. 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 nearest residence to the south (less than 3.2 $\mu g/m^3$). 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.

*iii. 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 below and implementation of CSR's guidelines *'Drilling and Blasting Procedures for Jandra Quarry'* provided as *Appendix H*. 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 to the property border 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 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, drill rigs are fitted with dust extractors and blast holes can be capped with stemming, which restricts the upward emission of dust. In addition, shot rock is moistened by 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.

### 4.4.5 *Odour Assessment*

*i. 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 exception to this is the asphalt plant, which has the potential to cause off-site effects.

*ii. 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 plant will not have a significant impact on nearby discrete receptors.

### 4.4.6 *Mitigation Measures*

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

- monitoring of dust deposition on property boundaries to verify dust deposition rates and monitor the effectiveness of control procedures;
- 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 crushing and screening plant to be well maintained;
- dust displaced during silo filling to be controlled by an appropriate filter (i.e. a reverse pulse silo filling filter or equivalent);
- wet scrubber on asphalt plant to be maintained regularly including the regular servicing of the recycling interceptor trap; and
- stack emissions from the asphalt 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, $CO_2$ & $O_2$.

## 4.5 BUSHFIRE

### *4.5.1 Methodology*

The Department of Bushfire Services approach in *Planning for Bushfire Protection* (1992) considers both basic risks and additional factors related to human intervention, including:

*(i) Are bushfires known to occur in the area and if so, to what size and extent?*

*(ii) Do the shrubs and grasses that form the understorey of the vegetation communities and hence the fuel bed, regularly dry out and burn readily?*

*(iii) Is the vegetation pattern such that extensive (rather than localised) native forests, woodlands or grasslands are found in the area (i.e. is it continuous?);*

*(iv) Are any gaps in native vegetation filled with pine plantations or crops? Will these crops burn in the bushfire season? If so, with more or less intensity and with greater or lesser resistance to control than the native vegetation they have replaced?*

*(v) Has recent development had little effect on the existing bushfire pattern?*

*(vi) Where the general fuel loadings are low or locally discontinuous, are aspect and slope likely to worsen the behaviour of any resultant bushfire?* (DBS 1991).

This method does not attempt to assign degrees of risk, rather it directs emphasis towards the overall effect of fire behaviour and site characteristics.

### *4.5.2 Risk Assessment*

The multi-factorial approach described above has been used to determine the risk to bushfire of the proposed quarry operations. Information relating to fire history and characteristics of the area have been obtained from Council's Fire Control Officer.

The relevant factors under the multi-factorial approach are discussed below:

*i. Bushfire History*

During typical bushfire weather, winds with a coastal influence cause the most problems. These are typically north-easterly and south-westerly winds. The study area is largely protected from these winds as a result of the ridges that exist on-site.

There is ample evidence of periodic, but apparently not severe, past bush fires in the area of the quarry (Davies, 1984). Timber cover removal as a pre-requisite to quarry operations should lessen the intensity of any wild fire entering from adjoining areas.

Known ignition sources in the region include private agricultural land to the south and east, as well as the Pacific Highway to the west where fires escape into the timbered parts of the area. The temporary asphalt plant is the only potential ignition source in the area of the quarry itself. The asphalt plant will be located on a cleared hardstand pad within the site facilities area.

Accessibility to the timbered areas surrounding the study area is good, with access to the quarry able to be gained from at least three points from the Pacific Highway. There are a high number of roads and tracks within the perimeter of the quarry property which could be used for emergency fire purposes.

*ii. Vegetation*

The vegetation of the study area and surrounding properties consists of dry open (sclerophyll) forest. To the south, south-east, south-west and north-east lies cleared agricultural land. Extensive forest areas lie to the north-west, with fragmented forests occurring to the north, south and east.

Within the forested communities of the study area, the dominant plant species in the overstorey are spotted gum (*Corymbia maculata*), white mahogany (*Eucalyptus acmenoides*), broad-leaved white mahogany (*E. umbra*), tallowwood (*E. microcorys*), and grey gum (*E. propinqua*). Within the mid and under storey, forest she-oak (*Allocasuarina torulosa*), *Acacia* species, spurge (*Phyllanthus gunnii*), narrow leaved geebung (*Persoonia linearis*), lantana (*Lantana camara*) and blackberry (*Rubus hillii*) are common species. Whisky grass (*Andropogon virginicus*) and kangaroo grass (*Themeda australis*) are a common ground cover species.

*iii. Surrounding Land Uses*

The study area forms a remnant of bushland which has been highly fragmented as a result of clearing for forestry and agricultural purposes as well as the construction of the old and new sections of the Pacific Highway. The overall fragmented nature of the locality has reduced the bushfire risk of the study area. However, the close proximity of a large contiguous tract of native vegetation to the north-west (Kiwarrak State Forest) poses a potential external risk of fire to the quarry.

### 4.5.3 *Bushfire Hazard and Mitigation Measures*

The discontinuous nature of native vegetation surrounding the study area, particularly the cleared agricultural land to the south and east has reduced the bushfire risk. Good access to the site, the presence of numerous water supply dams on site and the low history of bushfires in the immediate area indicate that the area is of relatively low risk to bushfire.

The dams located in the quarry working areas will provide a source of water to fight bushfire in the locality. In addition, the dust suppression water cart and other pumping systems could be used to prevent the spreading of fire from quarry working areas to surrounding bushland, if necessary.

No additional mitigation measures are considered necessary to protect surrounding bushland or the quarry from the occurrence of bushfires.

# JANDRA QUARRY
## EXTENSION

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ENVIRONMENTAL RESOURCE MANAGEMENT

# 5 INTERACTIONS WITH THE BIOLOGICAL ENVIRONMENT

Chapter 5

# INTERACTIONS WITH THE BIOLOGICAL ENVIRONMENT

## 5.1 INTRODUCTION

Ecological investigations undertaken as part of this EIS involved review of relevant literature, search of applicable National Parks and Wildlife Service databases and field surveys. Ecological investigations aimed to map and describe flora, fauna and fauna habitat existing on the site and to identify the likelihood of any threatened species occurring on the site. From this an assessment of potential impacts has been undertaken and mitigation measures have been recommended.

Methodology and results of ecological investigations are provided below and detailed in *Appendix I.*.

## 5.2 METHODOLOGY

Field investigations were conducted on 19 and 20 January and on 11 March, 1999. The weather conditions experienced were favourable for the undertaking of the survey, being mild to warm with little wind and no rain. Field surveys were undertaken for flora, fauna habitats and terrestrial and aquatic fauna species. A further flora survey was undertaken in early spring (20 September 1999) to enable identification of additional species during flowering.

### *5.2.1 Flora*

The random meander technique was used for qualitative flora field surveys. This technique involved walking in a random manner through the study area to identify and classify plant species, vegetation communities and habitats. Targeted searches were also made for significant flora species potentially occurring on the site. The conservation status of all identified communities was determined.

### 5.2.2 *Fauna Habitats*

Field investigations were undertaken to identify the type and quality of fauna habitats occurring within the study area. Assessment of habitat suitability was based on a qualitative assessment of the following factors:

- dominant vegetation type;
- structural vegetation characteristics;
- presence and abundance of hollow-bearing trees;
- level of disturbance;
- density of ground litter; and
- presence of standing or flowing water.

The field survey included a search for the presence of potential and core koala habitat as defined in State Environmental Planning Policy No. 44 - Koala Habitat Protection, described below.

*i. SEPP 44 - Koala Habitat Protection*

The field survey included a search for the presence of *'potential koala habitat'* and *'core koala habitat'* as defined in State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). In SEPP 44 *'potential koala habitat'* is defined as *'areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 percent of the total number of trees in the upper or lower strata of the tree component'*. In addition to tree species listed in Schedule 2 it is also necessary to consider tree species that are recognised to be locally significant as feeding resources to koalas. For the purpose of this study the locally preferred koala food trees included the primary koala food trees identified in Evans and Fitzpatrick (1996).

The methodology used for detecting 'potential koala habitat' was based on that used by the Australian Koala Foundation, described in *Appendix I.*. If *'potential koala habitat'* was identified then further investigations were conducted to assess the presence of *'core koala habitat'*.

In SEPP 44 *'core koala habitat'* means *'an area of land with a resident population of koalas evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population'*. Further investigations to assess the presence of *'core koala habitat'* consisted of searching each potential koala food tree for koalas, koala scratches and scats within two metres of each tree bole. In addition,

scats and scratch marks were also searched for while undertaking other fieldwork activities.

### 5.2.3 *Terrestrial Fauna*

Field surveys were undertaken to identify fauna species occurring on the site and determine their distribution and abundance. The following methods were used:

- spotlighting to determine the assemblage of arboreal mammals occupying the site;
- avifaunal surveys to detect key diurnal bird species;
- anabat detection to detect key bat species;
- hairtube sampling;
- amphibian and reptile surveys; and
- opportunistic fauna surveys during flora surveys including searches for evidence of mammals, birds reptiles and amphibians;

### 5.2.4 *Aquatic Fauna*

The impact of the proposed development on aquatic habitats is regarded as minor because it would not:

- create barriers to fish passage;
- significantly change physical properties of water;
- have chemical effects on water quality; or
- have biological effects on the aquatic environment, such as the introduction of new species.

As a consequence of the expected low impact of the proposed development, field surveys of aquatic fauna were limited to descriptive assessment of the habitats available at each potential impact site. Habitat components documented during the field survey include:

- type of waterbody (permanent or ephemeral);
- presence of a pool/riffle sequence;

- dominant substratum type (rock, gravel, silt, sand, organic material);
- abundance of snags;
- presence of and area of water surface covered by aquatic macrophytes;
- species of aquatic plants present;
- water depth range;
- width of waterbody;
- whether the stream was flowing or not; and
- presence of deep pools.

The ephemeral watercourses occurring in the study area were then graded to assess the availability of fish habitat.

## 5.3 RESULTS

### *5.3.1 Flora*

Based on structural characteristics and floristic composition, two plant communities were identified within the study area, as described below. A full list of plant species identified in the study area is provided in *Appendix L*. No flora species of conservation significance were recorded during the ecological investigations. The extent and distribution of each vegetation community is illustrated in *Figure 5.1*.

The flora survey was as comprehensive as possible, however due to seasonality, some plant species could not be identified due to a lack of flowering or fruiting bodies. Therefore, the species list is unlikely to be exhaustive.

*i. Corymbia maculata/Eucalyptus acmenoides* very tall open forest

This is the dominant plant community in the study area, extending from the ridgetop to the midslope on all aspects. A full description of this plant community is provided in *Appendix L*.

This community is dissected by a number of tracks and roads. It appears to have been extensively logged in the past and possibly subject to recent fires. Weed species including lantana, prickly pear, wild tobacco bush, blackberry and scotch thistle are relatively common. A number of garden varieties of trees have been

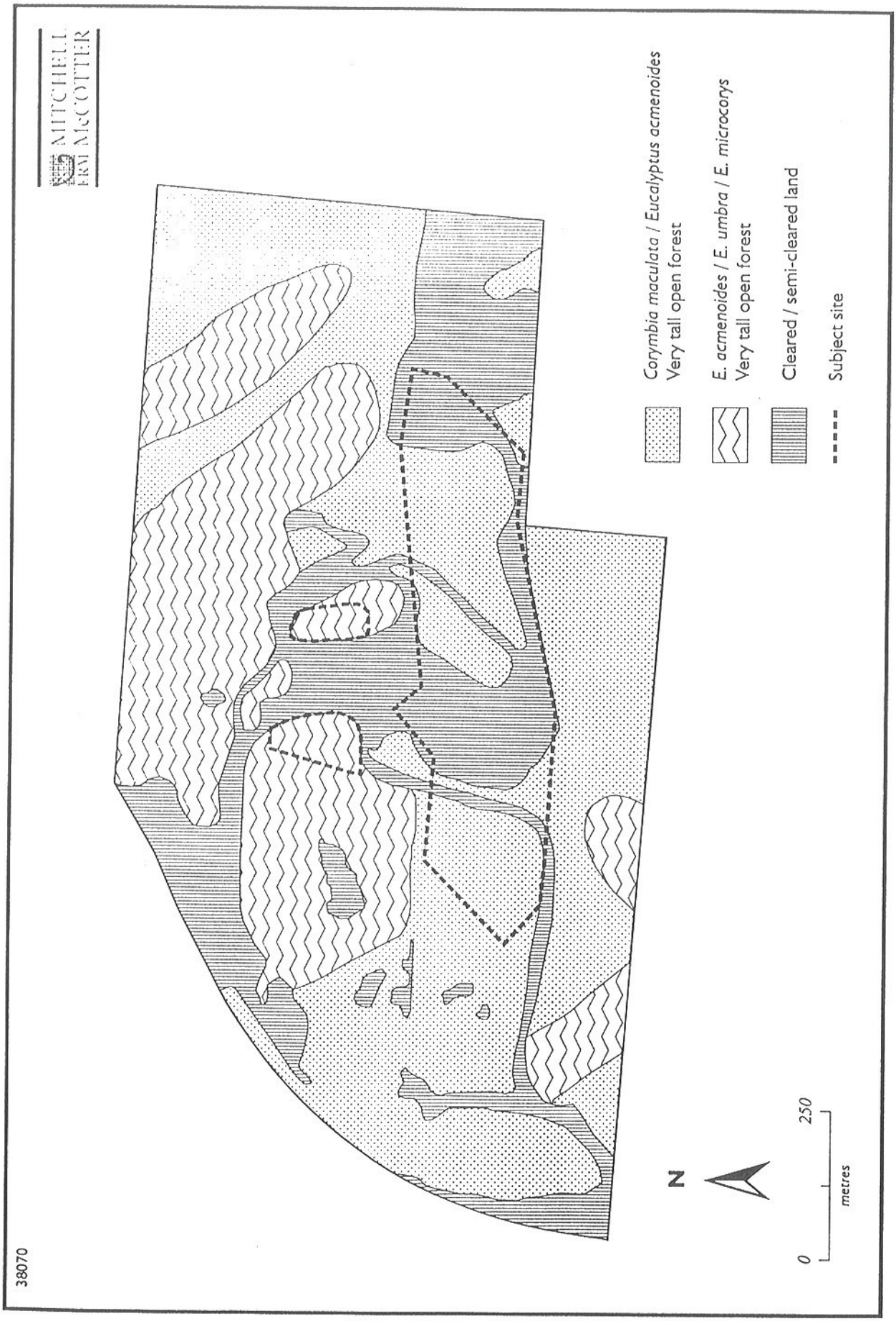


*Figure 5.1* DISTRIBUTION AND EXTENT OF VEGETATION COMMUNITIES WITHIN THE STUDY AREA

planted on the periphery of this community including jacaranda, frangipani and pine trees. This plant community within the study area is in relatively poor condition, and is unlikely to be worthy of conservation due to previous disturbances.

In terms of conservation significance, this forest type is considered to be widespread throughout the coastal districts of NSW (Forestry Commission of NSW, 1989) but poorly conserved in the north coast region. Extensive forest areas have been added to the NPWS estate since 1994. An accurate assessment of the plant community's conservation status cannot be determined until the representativeness of this plant community in new reserve areas has been determined.

*ii. Eucalyptus acmenoides/E. umbra/E. microcorys* very tall open forest;

This open forest type occurs predominantly on the sheltered lower slopes and valley in the study area. A full description of this plant community is provided in *Appendix L*. This community is dissected by a number of tracks and roads. Limited evidence exists of recent low intensity burning. Weeds species are common and include bracken fern, purple top, fireweed and balloon cotton plant.

In terms of conservation significance, this forest type resembles State Forest Type No. 60, which is found in the North Coast and Central Coast regions (Forestry Commission of NSW, 1989), but is inadequately conserved throughout its range. Extensive forest areas have been added to the NPWS estate since 1994. Hence an accurate assessment of the plant community's conservation status cannot be determined at this stage.

*iii. Grassland*

The extent of this vegetation community is limited to the powerline easement and the edges of access roads and the area in the south-east portion of the site. The community is dominated by a variety of native and introduced grasses, including wallaby grass, kangaroo grass and whisky grass. It is in a state of disclimax due to previous clearing activities and regular maintenance slashing. Therefore, it is considered to have low conservation value.

### 5.3.2 *Fauna Habitat*

Four main terrestrial habitat types were found within the study area. These consist of dry open forest, moist open forest, aquatic habitats (dams) and grassland. Each of these habitat types are described in *Appendix L* according to their habitat elements and degree of naturalness.

*i. Dry Open Forest*

Vegetation communities comprise *Corymbia maculata/Eucalyptus acmenoides* very tall open forest. The *Eucalyptus* and *Corymbia* species in the canopy of this habitat type, as well as the *Acacia* species in the understorey would provide a seasonal resource of flowers for nectivorous fauna. The results of the SEPP 44 investigation indicate that there are few suitable foraging resources for koalas in this habitat type. The presence of *Allocasuarina* species may provide a suitable food resource for glossy black cockatoos, although no signs of feeding by this species were observed.

The study area contains a moderate abundance of leaf litter that may provide suitable shelter for reptiles, as well as suitable foraging habitat for ground-dwelling birds. Rocks and fallen logs are sparse in this habitat type, hence there are minimal sheltering resources for small ground-dwelling mammals and reptiles. The sparse understorey strata would provide limited suitable habitat for small passerine birds. Mature trees with hollows are generally absent, hence there is limited roosting habitat for large hollow-roosting avifauna and arboreal mammals. Nevertheless, the presence of small hollows and decorticating bark may provide suitable roosting resources for microchiropteran bats, small hollow-roosting avifauna and arboreal mammals able to utilise small hollows (e.g. squirrel gliders, sugar gliders and eastern pygmy-possums). There is unlikely to be any suitable foraging or breeding resources in this habitat type for amphibians due to a lack of permanent or ephemeral waterbodies in the vicinity.

This habitat type has been disturbed by previous logging and quarrying practices. Access tracks associated with the powerline and residential dwellings along the ridgeline are common within this habitat type. Weeds are common throughout.

*ii. Moist Open Forest*

Vegetation communities comprise *Eucalyptus acmenoides/E. umbra/E. microcorys* very tall open forest

The *Eucalyptus, Syncarpia, Lophostemon, Melaleuca* and *Callistemon* species in the canopy and midstorey of this habitat type would provide a seasonal resource of flowers for nectivorous fauna. The SEPP 44 investigation revealed some areas of potential koala habitat within this habitat type. However, despite a thorough search for scats and scratches, there was no evidence of this species' presence in the study area.

This habitat type contains a moderate abundance of leaf litter that may provide suitable shelter for amphibians and reptiles, as well as suitable foraging habitat for ground-dwelling birds. There is a moderate abundance of small to medium sized

fallen logs that may provide suitable shelter for small ground-dwelling mammals and reptiles. The sparse understorey vegetation would provide limited suitable habitat for small passerine birds. Mature trees with hollows are generally absent, however, the presence of small hollows and decorticating bark may provide suitable roosting resources for microchiropteran bats, small hollow-roosting avifauna and arboreal mammals able to utilise small hollows (e.g. squirrel gliders, sugar gliders and eastern pygmy-possums). There are two ephemeral drainage lines that run through this habitat type that would provide suitable foraging and breeding habitat for several amphibian species.

This habitat has been impacted on previously by logging practices and road construction activities. One of the ephemeral creeks has been dammed. Past logging has resulted in canopy thinning and reduction in the density and abundance of hollow logs. Weeds are common on the forest fringe.

*iii. Aquatic Habitats*

Of the five main dams within the study area, two contain abundant emergent and floating vegetation that provide suitable habitat for a variety of amphibian species. These dams may also provide suitable foraging habitat for a variety of waterbird species.

Ephemeral drainage lines were investigated for potential aquatic fauna habitat. It was found that the ephemeral drainage lines on the southern side of the ridgeline represent only minimal fish habitat, while the two ephemeral drainage lines in the northern section of the study area could potentially represent intermittent fish habitat. However, only the drainage line in the north-eastern section of the study area appears to retain pools along the watercourse for any sustained time period. These pools could also provide suitable breeding and foraging habitat for amphibian species. The rocky substrate within the ephemeral drainage lines may also provide suitable shelter for a variety of reptile and amphibian species. The results of the aquatic habitat assessment are provided in *Appendix L*.

### *5.3.3 SEPP 44 - Koala Habitat Survey*

The koala habitat assessment results indicate that the moist open forest habitat in the study area contains *'potential koala habitat'* as outlined by Clause 7 of SEPP 44. This is based on the percentage of koala food trees found in the upper and lower canopy as detailed in *Appendix L*.

Although the study area contains areas of *'potential koala habitat'* under SEPP 44, no koala scats were found during fieldwork exercises. No scratches resembling those of

koalas were identified. Evidence from the fieldwork undertaken for the core koala habitat assessment indicates that the study area does not contain *'core koala habitat'*. Nevertheless, koalas have been recorded within five kilometres of the study area in Kiwarrak State Forest.

### 5.3.4 *Terrestrial Fauna*

*Table 5.1* provides terrestrial fauna species that were identified through field surveys.

*Table 5.1* TERRESTRIAL FAUNA SURVEY RESULTS

| Method | Native Species Found | Significance of Native Species |
|---|---|---|
| Spotlighting | • common brush-tailed possum<br>• common ringtail possum<br>• grey headed flying fox<br>• fox (feral species)<br>• cat (feral species) | common[1] |
| Avifaunal Surveys | • 31 species - see *Appendix L* | no species of conservation significance recorded |
| Bat Detection | • gould's wattled bat<br>• chocolate wattled bat<br>• eastern broadnosed bat<br>• *Vespadelus* sp.<br>• eastern falsistrelle | eastern falsistrelle is vulnerable on Schedule 2 of the TSC Act |
| Hairtube Sampling | • common brushtail possum | common[1] |
| Amphibian Survey | • 9 species - see *Appendix L* | common[1] |
| Reptile Survey | • lace monitor<br>• skinks<br>• eastern brown snake[2]<br>• red-bellied black snake[2] | common[1] |

*Notes:* *1. Species not listed on the schedules of the TSC Act*

*2. Anecdotal evidence only through discussions with site manager*

### 5.3.5 *Threatened Species*

The eastern falsistrelle (*Falsistrellus tasmaniensis*) was the only threatened species recorded (tentatively) during the field surveys, as shown in *Table 5.1*. In addition, potential habitat exists within the study area for a variety of threatened species. *Appendix L* outlines the threatened species found to potentially occur in the study area based on the presence of suitable habitat and for some species previous records in the locality.

## 5.4 EIGHT PART TESTS

The Threatened Species Conservation Act 1995 (TSC Act) made substantial amendments to the EP&A Act. Section 5A of the EP&A Act sets out eight factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats.

A number of flora and fauna species have been considered in an Eight Part Test undertaken as part of this assessment. *Appendix L* sets out species considered and the results of eight part tests. Overall, it has been found that the extent of proposed habitat removal associated with proposed quarry development is unlikely to significantly impact on threatened species likely to occur on-site.

In regard to aquatic ecology, an Eight Part Test as defined in Section 5A of the EP&A Act was undertaken to assess the likelihood of significant impact on threatened fish species, populations or ecological communities or their habitats that may occur in the study area. Based on the eight factors considered, as set out in *Appendix L*, it is highly unlikely that the proposed development would cause any adverse effect on the threatened fish species, populations or habitats.

## 5.5 IMPACT ASSESSMENT

The proposed development may have a variety of direct impacts upon threatened flora and fauna that potentially occur in the study area. These impacts documented below include consideration of the cumulative and indirect impact and likely contribution of the proposal to the threatening processes acting on existing species in the locality. The impact assessment also takes into account existing impacts on the study area, particularly those arising from the existing quarry operations and other activities which have altered the composition of vegetation communities and fauna habitats and ultimately, the composition of flora and fauna within the study area. Further details are provided in *Appendix L*.

### 5.5.1 *Habitat Loss or Modification*

The direct effect of the quarry extension is the destruction and modification of wildlife habitats. Approximately 14 hectares of dry open forest and 2 hectares of moist open forest would be removed from the study area. Potential impacts of habitat modification and fragmentation on each terrestrial vertebrate class are discussed below.

#### *i. Amphibians and Reptiles*

The proposed quarry expansion would remove approximately eight hectares from the catchment area of Bungwahl Creek (ie. four hectares removed from the two northern ephemeral creeks) which is likely to be suitable habitat for amphibians. One small artificial dam within the existing quarry area which may be currently suitable habitat for amphibians would also be removed.

The proposed quarry extension is expected to cause rapid displacement of a variety of common reptile species within the 2 hectares of forest to be cleared for the asphalt plant and expanded stockpile area. Reptile species would also be progressively displaced from the remainder of the quarry expansion area over a 66 year period (minimum expected life span of the quarry).

#### *ii. Avifauna*

A relatively small loss of habitat for most bird species known to occur on the site is expected. Some small hollow resources would be lost for those bird species capable of using them. A relatively small extension of edge effect influences into previously unaffected forest areas may lead to changes in bird species composition by creating habitats that favour species capable of invading and colonising disturbed habitats (Goosem & Marsh, 1997; Laurance, 1997; Andrews, 1990).

#### *iii. Non-flying Mammals*

The proposed quarry extension would remove nectar resources for arboreal species, and tree and ground hollow resources for those species capable of using them. Very few large hollows would be removed.

The development is also likely to displace some small terrestrial mammal species with relatively small home ranges. However, proposed revegetation east of the study area would most likely provide some compensatory habitat for these species.

The encroachment of edge effects (degradation due to weeds, rubbish, sedimentation etc.) into previously undisturbed forest areas may cause permanent displacement of some forest species by more competitive edge specialist species. However, due to the current level of disturbance and open nature of the vegetation communities in the study area such effects are not expected to be significant.

*iv. Megachiropteran and Microchiropteran Bats*

All habitats within the study area are likely to represent foraging habitat for bats, particularly microchiropteran species. The proposed quarry extension has the potential to cause a slight reduction in foraging resources for open forest/woodland foragers.

The open forest types in the study area contain a moderate abundance of small tree hollows and bark shedding tree species. The proposed quarry extension would result in the loss of sheltering habitat for those species that utilise tree hollows and shedding bark for roosting purposes.

### 5.5.2 *Interference with Fauna Movement*

A potential wildlife corridor currently extends in a north to south direction between the existing quarry area and the semi-cleared farmland in the east of the study area. The proposed development would progressively remove a proportion of this potential wildlife corridor over a minimum 66 year period. Fauna movement between these areas would then be restricted to either semi-cleared vegetation east of the study area, or to a relatively long narrow strip of remnant vegetation between the quarry and the Pacific Highway.

Therefore, in order to minimise the loss of wildlife corridor function in this area, the strip of semi-cleared vegetation retained in the east of the study area would be revegetated (minimum width 220 metres). The first stage of the quarry expansion would be in the western portion of the subject site, hence the revegetation program would be at an advanced stage prior to the existing potential habitat corridor being reduced in size.

### 5.5.3 *Road Strike*

The roads within the existing quarry site are unlikely to have a significant impact on the major fauna groups due to the low speed of traffic using the roads and limited operating hours of the quarry. No new roads would be constructed within the study area. The following potential impacts associated with roads on-site have been identified:

- Bats and most bird species are highly mobile and can usually cross roads with minimal chance of injury from moving vehicles. The incidence of road strike is unlikely to significantly increase due to the proposal;

- A few bird mortalities could potentially result from individuals being attracted to additional food sources associated with the roads (e.g. seeding grasses) (Bennett, 1991);

- Arboreal mammal species that do not travel on the ground would still be capable of crossing roads in forests within the study area due to narrow road widths, retention of mature trees and limited hours of quarry operation resulting in no night traffic;

- High rates of amphibian mortality have been recorded when local populations are isolated from breeding sites by roads (Gibbs, 1998). The proposed quarry expansion would not result in further isolation of potential breeding sites within the study area; and

- Due to the low speed of quarry traffic and limited hours of operation very few medium to large terrestrial mammals are likely to be struck on the quarry roads.

### *5.5.4 Noise*

Noise associated with the existing quarry operation, mainly from the use of machinery, may cause a significant reduction in habitat use and foraging times for feeding in the immediate vicinity of the quarry by shy individuals or species. The effects of noise on habitats further away are possibly of a more temporary nature due to species becoming habituated to background noises.

The proposed quarry expansion would result in increased noise levels due to the operation of machinery and blasting within previously undisturbed areas. However, such increases are unlikely to cause a significant disruption to the life cycle of any species utilising habitats within the study area as this area currently experiences noise impacts from the existing operations.

### *5.5.5 Water Quality*

Quarry operations will meet the current EPA requirements for creek sediment loads. Consequently, no impact on aquatic ecosystems is anticipated from the proposed development.

Water quality monitoring results collected downstream of the quarry generally complies with EPA requirements. As part of the proposed quarry expansion, additional measures will be implemented to maintain required water quality standards. Proposed measures would include the construction of a sump in the floor of the quarry to catch all water from the quarry pit, an increase in the size (retention time) of the main sediment control dam and construction of an additional sediment control dam. Water overflows from the site will comply with current EPA requirements. No impacts associated with water overflows are anticipated.

## 5.6 MITIGATION MEASURES

The following mitigation measures have been developed to reduce potential impacts of the proposed development on flora, fauna and habitats.

*i. General*

- revegetation of the quarry which will be undertaken progressively wherever possible to minimise the impact of loss of habitat;
- speed limits of 40 kilometres per hour are to be imposed on internal roads;
- wildlife crossing signs are to be erected to alert drivers that fauna may be crossing the road;
- as part of the proposed development, the company is applying to extend general operating hours to 6.00 am to 6.00 p.m. Monday to Friday and 6.00 am to 3.00 p.m. on Saturdays. Ancillary operations such as refuelling, servicing and maintaining plant will be undertaken between 6.00 am and 9.00 p.m. Monday to Saturday. Operation should be limited to these hours to reduce impact on fauna;
- timed clearing will be implemented to reduce direct mortality of hollow-dependant fauna;
- to minimise the loss of existing wildlife corridor function, the strip of semi-cleared vegetation retained on the farmland in the east of the study area should be revegetated (approximate width 220 metres) as well as the relatively long narrow strip of remnant vegetation between the quarry and the Pacific Highway. A detailed description of the revegetation program would be provided in the site's Environmental Management Plan. The first stage of the quarry expansion would be in the western portion of the subject

site, hence the revegetation program in the east would be at an advanced stage prior to the potential habitat corridor being reduced in size;

- to maintain wildlife corridors, during revegetation suitable sheltering resources should be placed within the proposed revegetated corridor to encourage recolonisation by displaced individuals;

- habitat enhancement involving such measures as fencing off semi cleared areas undergoing revegetation, baiting programs for feral animals and the provision of nest boxes will be undertaken to increase the capacity of bushland remaining in the study area; and

- a monitoring program will be included in the quarry EMP to determine the effectiveness of mitigation measures and the suitability of revegetation techniques.

*ii. Sediment Control*

A series of mitigation measures to address sediment control would be implemented. These mitigation measures are detailed in section 3.10.3 and include:

- installation of erosion and sediment controls prior to any soil disturbance, including clean water diversion drains and sediment dams downstream of disturbed areas;

- installation of erosion and sediment controls around the overburden stockpile area; and

- the stockpiling of vegetation removed during construction activities for later use in erosion control and stabilisation of disturbed areas.

# JANDRA QUARRY
## EXTENSION

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# 6 INTERACTIONS WITH THE HUMAN ENVIRONMENT

Chapter 6

# INTERACTIONS WITH THE HUMAN ENVIRONMENT

## 6.1 NOISE AND BLASTING

A noise and blasting impact assessment has been undertaken for the proposed quarry extension and provided as *Appendix M*. A summary of the assessment is provided below.

### *6.1.1 Noise Assessment Methodology*

For the acoustic assessment undertaken as part of this EIS, the following study methodology was adopted:

- existing background levels were determined using continuous noise logging at three locations surrounding the quarry. Correlation of atmospheric parameters and measured noise levels was made using weather data from Taree Airport;

- equipment sound power data was obtained from measurements of existing or similar equipment used at the quarry. This allowed predictive noise modelling;

- noise level modelling was undertaken for existing operations and proposed development Stage 1 and Stage 3 with equipment located in the worst case scenario locations and operated simultaneously at maximum power. The EPA approval Environmental Noise Model (ENM) was used. Topographical information was used to prepare noise contours around the quarry and single point calculations at the ten nearest residences to the quarry;

- weather data supplied from the Bureau of Meteorology for Taree Radio Station 2RE was used to assess general wind characteristics of the area and noise levels under adverse weather conditions; and

- predicted noise levels were compared to EPA noise criteria, specifically the "intrusiveness criterion" set out in the Environmental Noise Control Manual (EPA, 1994) and Draft Stationary Noise Source Policy (EPA, 1998).

EPA guidelines were followed in all stages of the acoustical assessment. Assessment of temperature inversions was not undertaken as no night time operations are proposed.

Traffic noise due to quarry transport trucks, staff vehicles and other site traffic was not assessed as the quarry directly accesses the Pacific Highway which carries significantly higher volumes of heavy and light vehicle traffic. The access road is not utilised by the public and does not pass close to any residence not associated with the quarry.

### 6.1.2 *Noise Criteria*

*i. Neutral Atmospheric Conditions*

Noise emissions from the proposed development are compared to criteria determined using the Environment Protection Authority's *Environmental Noise Control Manual* (ENCM) (EPA, 1994). Criteria described in the Environment Protection Authority's recently-released Draft Stationary Noise Source Policy (EPA, 1998) are also considered.

The EPA lists objectives for environmental noise in its Environmental Noise Control Manual (EPA, 1994). These are that:

- noise from any single source should not intrude greatly above the prevailing background noise level, generally by more than 5 dB; and
- background noise should not exceed an appropriate level for the particular locality and land use. Similarly, the Draft Policy discusses maintaining noise level amenity in the long-term.

The "intrusiveness criterion" is designed to achieve the first objective, and is expressed as:

$$L_{A10,15minute} \leq (*L_{90}) + 5$$

where $L_{A10,15minute}$ is the $L_{10}$ noise level from the source, measured over a 15-minute period and $*L_{90}$ is the minimum repeatable background level.

To satisfy the second EPA objective, background noise levels should be kept within the "maximum acceptable" noise levels suggested in the EPA's Environmental Noise Control Manual. For residences in a rural area these are a night-time background noise level of 35 dB(A) and a daytime level of 45 dB(A).

Similarly, the Draft Policy (EPA, 1998) states that total $L_{eq}$ noise levels from stationary sources should be kept within the "amenity criteria". For residences in a rural area these are $L_{eq}$ levels of 50, 45 and 40 dB(A) for day, evening and night periods respectively.

*ii. Adverse Weather Conditions*

The "intrusiveness" noise criterion has traditionally been applied under still-isothermal (SI) conditions. Experience indicates that if the criterion is met under these conditions, noise under more adverse conditions is generally (but not always) acceptable.

Experience in similar rural areas such as the Hunter Valley, demonstrates that people become more noise sensitive if night-time noise levels exceed about 40 dB(A) on a regular basis. This is 5 dB above the level which would be set as a noise criterion under SI atmospheric conditions. Hence, one possible formulation for additional criteria would be that noise should not exceed the SI criterion by more than 5 dB on more than ten per cent of occasions throughout a year. This goal would relate to all meteorological conditions.

For this proposal, the following procedure has been used to provide an assessment under the complete range of meteorological conditions, which supplements the assessment under SI conditions:

- an additional "intrusiveness" criterion is used, that under prevailing meteorological conditions, noise levels should not exceed the standard intrusiveness criterion by more than 5 dB(A) for more than 10 per cent of the operating period during a year; and

- additional calculations are performed to define the probability of occurrence of various noise levels accounting for the range of wind speeds and wind directions (and the interactions between these parameters) which are found at the site.

The production of "tenth percentile" noise levels involves detailed and complex noise level calculations. However, this level of detail of the likely noise environment provides regulatory bodies and residents with a more comprehensive and representative understanding of the extent and level of potential noise impacts from the development. This assessment describes the range of noise levels at each potentially affected residence under prevailing meteorological conditions, as well as graphically indicating the tenth percentile noise level.

Using the probability of occurrence of wind speed and wind direction requires more calculation than would a procedure involving a single set of meteorological parameters. This method of assessment represents best available technology and is among the most comprehensive methods to estimate actual noise levels received at a receptor as a percentage of time accounting for atmospheric effects.

### 6.1.3 *Noise Results*

#### *i. Adopted Noise Criteria for Jandra Quarry Operations*

Results of background noise measurements and adopted intrusiveness criteria are shown in *Table 6.1.*

*Table 6.1* BACKGROUND NOISE LEVELS AND INTRUSIVENESS CRITERIA

| Location | Minimum Repeatable $L_{90}$ dB(A) | "Intrusiveness" Noise Criteria, $L_{10}$ dB(A) |
|---|---|---|
| YALA 3 | 37.0 | 42.0 |
| Loveday | 36.8 | 41.8 |
| Jones | 35.0 | 40.0 |

#### *ii. Neutral Atmospheric Conditions*

Results of modelling, provided in *Appendix M,* indicate that there are no exceedences of the adopted intrusiveness noise criteria at any residence during any stage of the quarry development. This is due to natural topographic shielding and distance attenuation.

Operations during the existing operations and Stages 1 and 3 of the proposed development represent worst case noise exposures for surrounding residences. Noise calculations were not performed for Stage 4 as this stage is primarily the lowering of the pit floor that will increase barrier attenuation for workface equipment. Stage 2 was also not modelled because in Stage 3, equipment is located at the most eastern extremity of extraction resulting in worst case noise exposures for residence to the east.

$L_{10}$ noise contours (noise level which is exceeded for 10 percent of the time and is approximately the average of maximum noise levels) for existing operations and for Stage 1 and 3 have been calculated. These are mapped in *Figure 6.1*, *Figure 6.2* and *Figure 6.3*.

*iii. Adverse Atmospheric Conditions*

Modelling of noise levels with wind data supplied by the Bureau of Meteorology was used to determine the percentage of time that a given noise level is exceeded. Calculations were based on neighbouring residences. Modelling was undertaken only for existing operations, Stage 1 and Stage 3 development for the reasons outlined above. Results are outlined below and provided graphically in *Appendix M*.

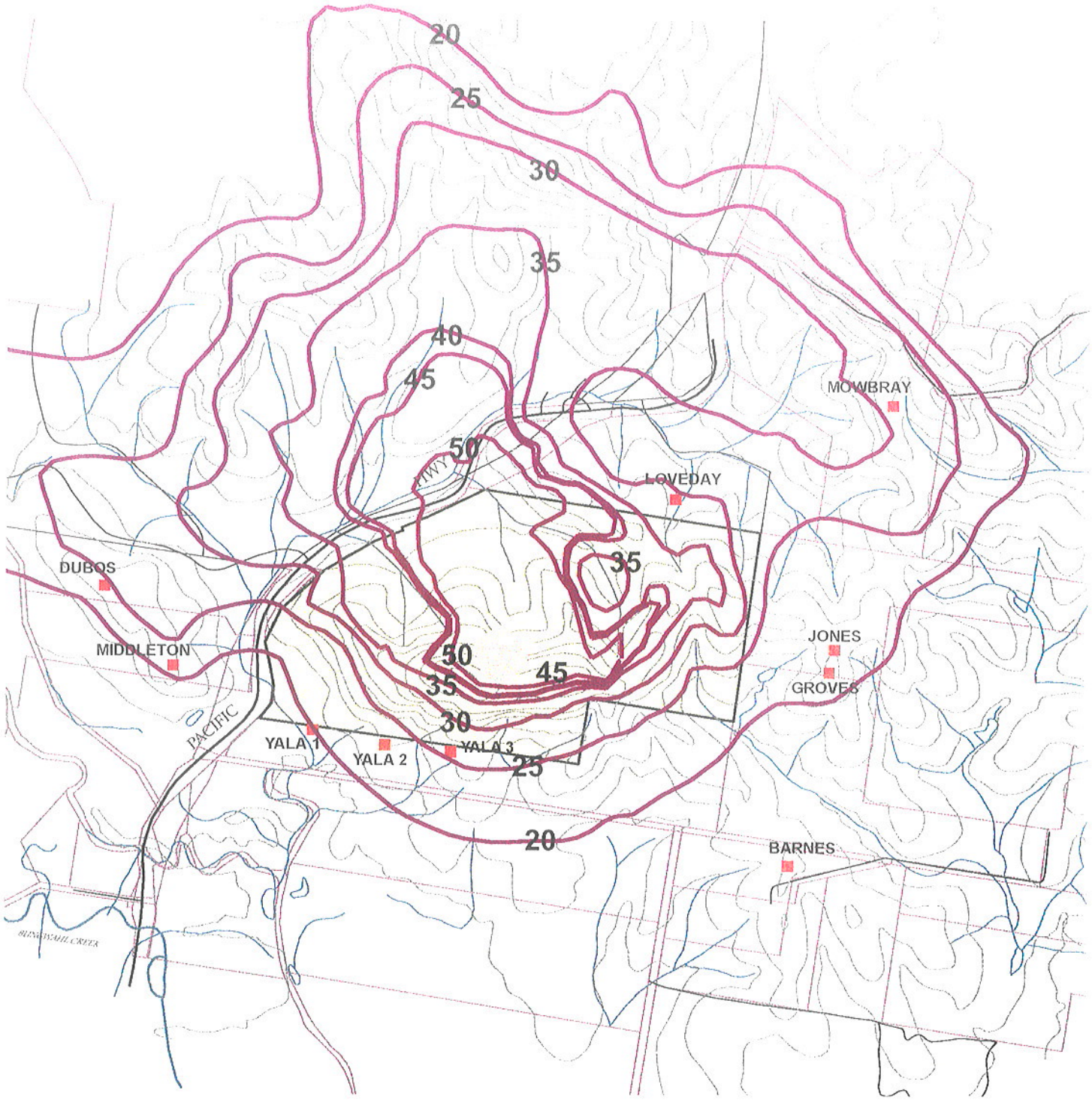
- existing noise levels are within the EPA criteria of 10 percent of the time;
- noise levels for Stage 1 are within the criteria with no exceedences of the adopted criteria at the 10 percent of the time level at any residence; and
- noise levels for Stage 3 exceed the criteria level by two dB(A) at two residences located east of the site for the worst case scenario modelled;

In regard to equipment use during Stage 3, analysis of the relative contribution to total noise indicates that the D8 dozer removing topsoil is dominant. The dozer is used periodically and is not permanently on-site. Removal of the dozer from modelling results in noise levels in compliance at all stages. Use of the dozer will therefore need to be co-ordinated with wind conditions to minimise the likelihood of excessive noise being generated.

### *6.1.4 Blasting Assessment Background*

The overpressure and ground vibration assessment resulting from blasting is provided in *Appendix M*.

Noise and vibration criteria for blasting are proposed in the EPA's Environmental Noise Control Manual. However, the EPA has indicated that these have been superseded by values from the Australian and New Zealand Environment Conservation Council's (ANZECC) *"Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration"* (ANZECC, 1990). The ANZECC guidelines are the same as the Environmental Noise Control Manual except for blasting times. Blast overpressure levels should not exceed 115 dB(Lin) at any residence not associated with the quarry, and ground vibration levels should not exceed five millimetres per second (5 mm/s) peak particle velocity. However, it is accepted that some limited exceedance of the criteria may occur on infrequent




RESIDENCE/NOISE RECEPTOR

30 $L_{10}$ NOISE CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

EXISTING QUARRY

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

57106/38070/fge6.1nzen.CDR

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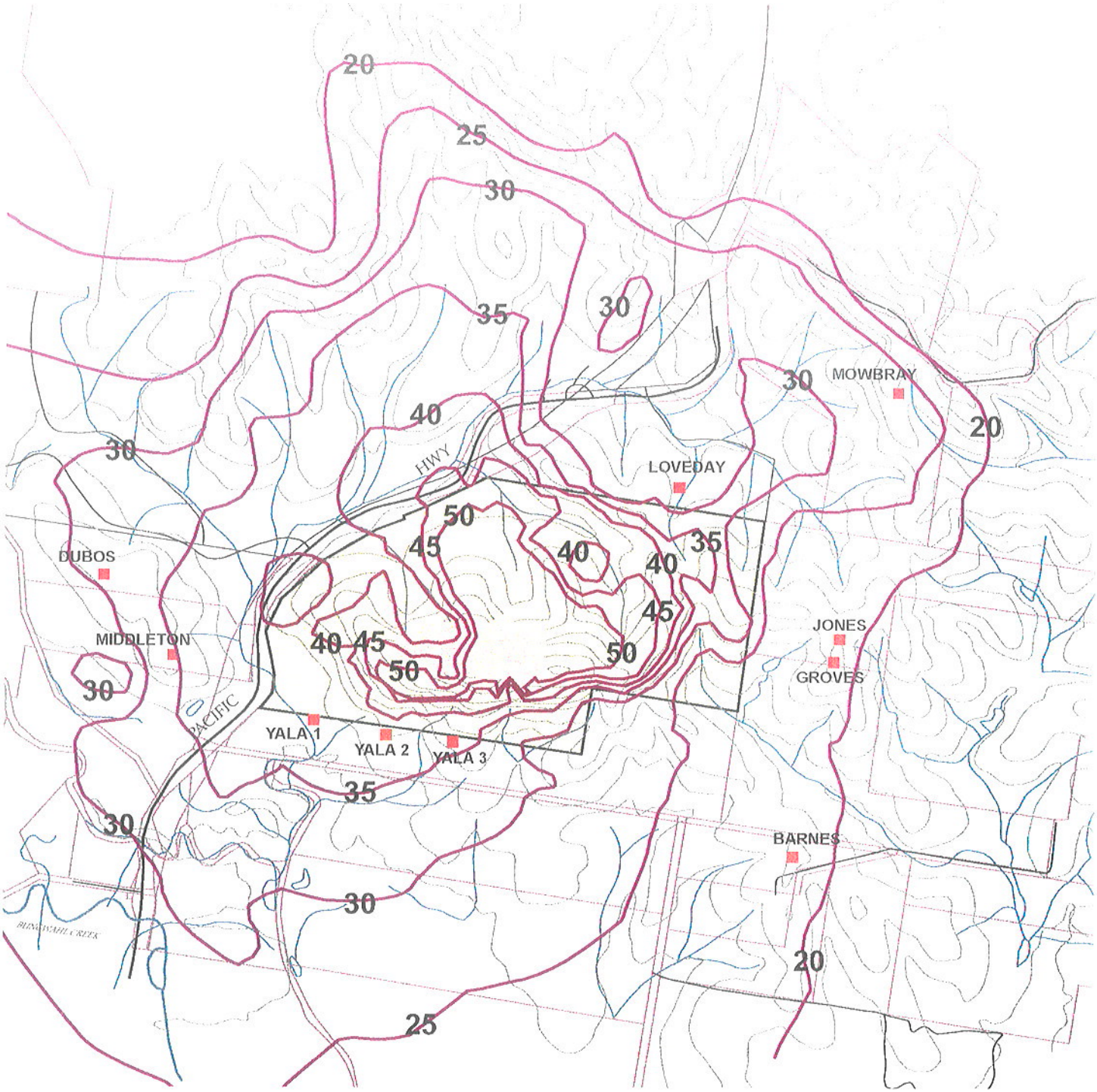
*Figure 6.1* STABLE ISOTHERMAL $L_{10}$ NOISE CONTOURS - EXISTING QUARRY

N

400m

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SOURCE: CMA 1:25,000 TOPO NAMAC SHEET

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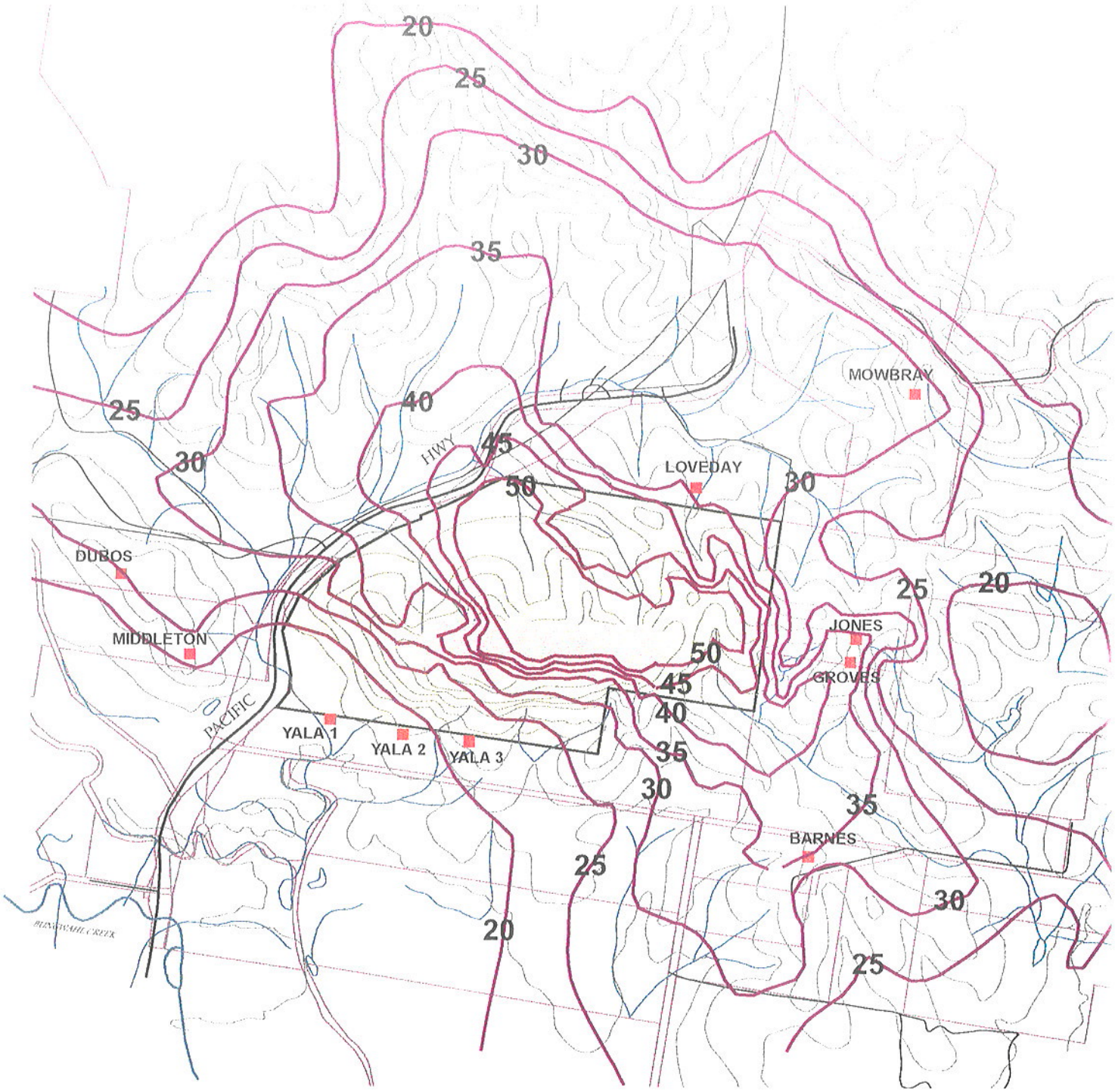
*Figure 6.2* STABLE ISOTHERMAL $L_{10}$ NOISE CONTOURS - STAGE 1 QUARRYING

N

400m




RESIDENCE/NOISE RECEPTOR

30 $L_{10}$ NOISE CONTOUR

CSR PROPERTY BOUNDARY

CADASTRAL BOUNDARIES

STAGE 3 QUARRYING

57106/38070fg6.3nost3.CDR

SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

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*Figure 6.3* STABLE ISOTHERMAL $L_{10}$ NOISE CONTOURS - STAGE 3 QUARRYING

N

400m

occasions. This should be limited to not more than 5 per cent of the total number of blasts, and should not exceed 120 dB(Lin) overpressure and 10 mm/s peak particle velocity at any time.

The ANZECC guidelines recommend that blasting should occur only between 9 am and 5 p.m., Monday to Saturday, and there should be no blasting on Sundays and public holidays. In addition, it is recommended that blasting occur not more than once a day (Note: occasionally more than one blast per day may be required, for instance, the need for a 'corrective shot').

For this assessment, a number of blasts at the site were analysed. Where no blast data was available, standard calculation coefficients and formulae were used to calculate likely vibration and overpressure levels. Preliminary results indicated that actual blast impacts are less then those predicted using the standard methods.

### *6.1.5 Blasting Impacts*

Five recent blasts have been monitored on both the open face side of the quarry (at the site office) and behind the face, on the other side of the southern ridge line, at the nearest residence to any potential blast site (YALA 3). The monitoring data given in *Table 6.2* shows the intervening ridge attenuates blast overpressure to YALA 3 by an average 12 dB. This attenuation is likely to increase for blasts located on the proposed benches below RL 50

Although only five blasts have been monitored to date, the results indicate that vibration is likely to be the limiting criteria for determining a suitable design for blasts located along the southern face of the quarry near the YALA residences. The results indicate that blasts at the southern face close to YALA 3 using current blast designs do not exceed the relevant criteria.

*Table 6.2* RECENT BLAST MONITORING DATA

| Date | Distance metres | Peak particle velocity millimetres per second | Overpressure dB(Lin) |
|---|---|---|---|
| 19/04/99 | 300 shielded side (YALA 3) | 4.58 | 106.1 |
| 07/05/99 | 300 open side (site office) | 2.02 | 118.0 |
| | 300 shielded side (YALA 3) | 4.65 | 101.0 |
| 15/06/99 | 300 open side (site office) | 4.33 | 116.9 |
| | 300 shielded side (YALA 3) | 4.88 | 108.9 |
| 9/08/99 | 300 open side (site office) | 4.9 | 114.5 |
| 30/08/99 | 300 shielded side (YALA 3) | 1.5 | 97.8 |
| 13/10/99 | 300 open side (site office) | 2.25 | 99.5 |
| | 300 shielded side (YALA 3) | 1.69 | 83.2 |

*Note: The site office is not a residence and being associated with the quarry EPA criteria is not applicable.*

Predicted vibration and overpressure levels for most residences using standard formulae for the proposed typical blast MICs are below the criteria of 115 dB(Lin) and 5 mm/s respectively. These calculations are for unshielded blasts (i.e. line of sight between blast and receptor) using a conservative methodology. The criteria is predicted to be exceeded at the nearest residences located on the YALA property which are actually shielded from quarry faces by the ridge line running along the southern boundary of the site. However, as shown by the monitoring data provided in *Table 6.2* above, specific blast designs can be formulated to ensure EPA criteria is not exceeded when blasting close to the YALA residences.

The proposed quarry plans indicate that potential blast locations cover an estimated area of approximately 900 m by 250 m with distances of up to 900 m from the YALA 3 residence. With significant variations in distances to receptors it is extremely inefficient to limit blasts to a specific MIC. It is CSR's intention to monitor several blasts at multiple locations to gather data sufficient for confident impact predictions. The design of blasts nearest the YALA residences can then be optimised to limit the possibility of criteria exceedences and preferred blast designs can be used for blast locations with adequate distances to residences.

CSR has developed a specific set of standard procedures to control blasting at Jandra blasting (CSR Construction Materials, 1999). These procedures are amended by CSR to reflect best management practices as they arise. It should be noted that there will be no secondary blasting.

The primary measure to ensure blast impacts are within acceptable limits is through good design and accurate monitoring. Use of specific blast MIC is only one of a number of tools used in the design process. CSR's experience indicates that current practices such as undertaking face surveys and borehole deviation measurements are an even more important component of the design process. This allows optimisation of blast loading and control of vibration and overpressure.

All blasts will be monitored for both overpressure and vibration levels to ensure statutory limits are not exceeded. If blast overpressure and vibration are found to be in exceedance the cause will be identified and blast design or control procedures modified to prevent recurrence.

### *6.1.6 Mitigation Measures*

The blasting impact assessment indicates that the quarry can effectively undertake blasting operations such that blasting impacts at nearby receptors will meet ANZECC guideline limits. The following mitigation measures will be implemented to control blasting activities:

- all blasting to be undertaken in accordance with Department of Mineral Resources regulations;
- whenever possible, blasting to be limited between 9 am and 5 p.m., Monday to Friday and 9.00 am to 3.00 p.m. Saturday, with no blasting on Sundays and public holidays;
- all blasts to be monitored to ensure that at the closest residence EPA overpressure and ground vibration criteria are not exceeded. Blast design to be modified if criteria are exceeded;
- blasting to be avoided in adverse meteorological conditions (ie. not during high winds or temperature inversions); and
- nearby residents on Lot 10 DP 790056 (currently YALA) and Lot 4 DP 790058 (currently Loveday) to be advised verbally (or by other mutually agreed method) of specific blast times.

## 6.2 VISUAL IMPACTS

A study of the existing visual catchment of the quarry and a visual assessment of potential impacts associated with the proposed quarry development has been undertaken as part of this EIS. The study has been based on qualitative analysis of

photographs at sensitive viewpoints of the existing site and assessment of visual changes that will occur at each viewpoint. Viewpoints considered in the assessment were from nearby houses, nearby tourist destinations and the perspective of road travellers. The objectives of the visual assessment were as follows:

- to assess the impact of the proposed development on the landscape character of the locality;
- to assess the visual impacts of the proposed development from sensitive view points outside the quarry boundary; and
- to determine a landscape strategy to mitigate significant impacts and to integrate the proposed quarry development into the existing landscape.

The visual assessment report is provided in *Appendix N*.

### *6.2.1 Existing Visual Environment*

Topography of the site area is generally undulating with rolling hills and plains. The existing quarry is cut into the northern face of the hillside and extends from the ridgeline in a north-easterly direction. The existing working face is visible, however equipment and structures associated with current quarry operations are not visible from surrounding areas. The existing quarry is a dominant visual element within the landscape.

The visual exposure of the quarry to motorists passing was increased as a result of realignment of the Pacific Highway in 1991. The realignment directed motorists' views to the cut faces which have since been excavated close to their maximum capacity. The existing quarry is clearly visible from the Highway to motorists travelling in a south westerly direction from Taree.

In regard to tourist destinations, the Taree Lookout facility and Fire Tower is located approximately five kilometres north west of the quarry at an elevation of 299 metres. Jandra Quarry is visible from the lookout, however due to its distance, the quarry blends with the surrounding environment and does not disrupt views from this location.

Land surrounding the quarry is well vegetated to the perimeter of the property. Beyond this, the landscape is modified with the following features contributing to the visual quality of the area:

- cleared farming land to the south and east of the site;

- Pacific Highway west of the site and other minor roads that provide access to surrounding properties;
- transmission easements on the around the site that have required vegetation clearing; and
- residential houses located within an approximate radius of two kilometres from the site perimeter, as described below.

Dense vegetation remains to the south-east and north of the site.

*i. Residential Properties*

Residential properties are located north, north-east, east, south and west of the quarry site. Generally views to the quarry are shielded by dense vegetation, natural topography and ridgelines. The existing visual environment from these residences are as follows:

- three residential properties located east of the site are well shielded from views of the quarry by vegetation and natural topography;
- one residential house located north of the site is well shielded from the quarry as it is situated within dense bushland;
- one residence is located north-east of the site. Views from this property are filtered by foreground vegetation so that the quarry is barely visible;
- three residential properties are located south of the site. Views from the closest of these (YALA dwellings) are effectively screened from the quarry due to the separating ridgeline which is heavily vegetated. Existing quarry operations are not visible from any of the southern properties as excavation works are restricted to the northern face of the hill below the ridgeline; and
- three properties are located west of the site. The existing quarry is not visible from these properties as excavation works are limited to the eastern face of the western ridgeline.

### 6.2.2 *Visual Impact*

The proposed quarry extension will encroach on the remaining natural landscape and expand the current view. Works will significantly alter the existing landform due to excavation of the hillside in an easterly and westerly direction. Excavation would be primarily located on the northern face of the hill below the ridgeline and

would not be wider then the existing pit. In some areas, the southern face of the quarry would extend marginally over the ridgeline. Visual changes associated with the proposed extension would be primarily viewed by a small number of nearby residents and motorists travelling in a southerly direction from Taree.

Potential visual impacts in relation to these viewpoints are set out below.

*i. Residential Housing*

Minor impacts have been identified to existing residential properties as a result of the proposed quarry development, as follows. Further details and photographs are provided in *Appendix N*.

Three residential properties lie east of the site. The greatest visual impact (from the Groves residence) will be exposure of approximately five metres of cut face at the highpoint of the ridgeline of approximately 50 metres width. Although this cut face will be excavated during Stage 1 of the quarry plan, it will be exposed only once an intervening ridgeline is excavated during Stage 3 at least 40 years later, a long enough period for vegetation screening of rock faces to be effective. In the context of the existing modified environment, the degree of this visual impact is considered minimal.

One residential house located north of the site will not be visually impacted by the proposed quarry extension as is it well shielded within dense bushland.

The Mowbray residence is located north-east of the site. The proposed quarry development will have a minimal visual impact when viewed from this site due to screening by existing foreground vegetation.

The quarry is currently visible from an access track to the north of the Mowbray residence. Proposed quarry expansion in an east west direction will increase this visibility from the access track. However, the access track is used predominantly by only a small number of residents and the visual impact to these users is considered low.

To the south, the proposed quarry development will not impact on the YALA property due to the angle of view and close proximity of vegetation on the northern property boundary. Only a minor impact will result from modification to the hill ridgeline when viewed from properties further south (Smith and Barnes properties). Approximately two metres will be cut from the top of the ridge, however the new curvature will be such that the skyline will reflect the natural curvature of the hill. This impact will be minor.

The proposed quarry development will involve modification to the ridgeline when viewed from properties to the west. Excavation of the northern face of the hill will expose the top 20 metres of face, at a width of 100 metres when viewed from the Dubos property. This equates to less then 4.76 degrees of the field of view. Lesser impact will occur from the other western properties (Middleton and Stennett properties). The majority of the cut face will be screened by the ridgeline in the foreground. Excavations will not be visible from the dwellings due to dense vegetation screening these views. However, views to the quarry extension from other areas within the properties will be more apparent. As these areas of largest potential impact are not frequented as regularly, and the degree of visual change is relatively small, the impact is considered not significant.

*ii. Major Roads*

The proposed development will increase the exposure of the quarry face when viewed from vehicles travelling in a southerly direction along the Pacific Highway. The quarry will be visible for only a short period. This impact is considered minor as the quarry expansion does not alter the character of the existing view which is dominated by the quarry.

*iii. Tourist Destinations*

The proposed quarry expansion will have negligible visual impact from the Taree lookout facility and Fire Tower. The distance of the viewpoint from the quarry will allow exposed rock faces to be absorbed within the landscape.

### *6.2.3 Mitigation Measures*

The following specific mitigation measures are recommended to ameliorate visual impacts associated with the proposed quarry extension.

- retention of vegetation at the top of cut faces;
- immediate revegetation of exposed benches at the high point of the ridgeline to ensure effective screening is in place prior to excavations exposing the quarry to residents to the east and west. This is proposed by the excavation of 'slots' as discussed in Section 3.6 of this EIS; and
- subject to consultation with relevant land owners, provide supplementary planting:

- in the foreground of the Mowbray and Dubos residences, within the Dubos and Middleton properties and along the Pacific Highway near the intersection with Blackbutt Road; and

- along the southern boundary of the road reserve of the access track linking the Mowbray property (and other properties to the north-east) to the Pacific Highway.

## 6.3 LAND USE

The occupied land in the area of Jandra Quarry is primarily cleared rural land on the lower slopes. Whilst the surrounding hilly country is primarily moderately to heavily timbered private rural land. Residences are located north, north-east, south, east and west of the site. Rural activities in the locality are mainly cattle grazing and hobby farming.

CSR own the quarry site including the area proposed for expansion. The quarry is bounded by privately owned land to the south, north and east. To the west lies the Pacific Highway. A power transmission line and easement is located on the quarry site, which will be relocated to give way to quarry expansion.

Once extraction has been completed, the quarry will be rehabilitated. Benches of the lower quarry void will be stabilised. Rehabilitation of the upper quarry area will provide similar vegetation communities and fauna habitats, as previously occurred over the site. The establishment of a dense shrub understorey in the quarry area will be planned to function as a sustainable ecosystem which reflects the natural ecology of the area.

Opportunities to develop the quarry area for more intensive agricultural uses are limited by the agricultural suitability of the land. In the Agricultural Land Suitability Study prepared for GTCC by the Department of Agriculture (1982), the quarry site has been described as Class IV land, in a grading of Class I to Class V (Class V is of poorer agricultural quality than Class IV). Class IV being land suitable for grazing but not suitable for cultivation.

There nearest urban residential development area is the village of Nabiac which has a population of approximately 450 and is located approximately 8 km to the south-west of the quarry. The village is screened from the quarry by the ridgelines located at Possum Brush as well as other topographical features.

The properties that have the potential to be directly impacted by quarry activities are all located within the buffer area identified in Greater Taree Development Control Plan 1995. This buffer ensures that any proposed development that is permissible

under the provisions of LEP 1995 is required to consider the impacts that the quarry will have upon the development and that the development would have on the resources that exist in the Jandra Quarry by ensuring that land use conflicts do not occur as a result of new development.

The neighbouring property to the south is owned by Youth Care and Life Style Centre Incorporated (YALA) who have recently obtained development consent to commence youth care and life style programs which include the construction of two additional dwellings, outdoor adventure and personnel development programs which will be conducted at various locations on the property including the area close to the southern boundary of the quarry site. A formal agreement between CSR and YALA restricting activities on the adjoining land during blasting is currently being negotiated. There will be no additional adverse impacts upon surrounding land uses as a result of extended quarry operations.

## 6.4 SOCIO-ECONOMIC ISSUES

### *6.4.1 Population*

The quarry supplies aggregate south beyond Bulahdelah and north into Kempsey shire. Market information in the coastal region from Johns River to Bulahdelah indicates the demand for quarry product will be related largely to the main markets for hardrock quarry products. These are roadbase, asphalt aggregate, spray-seal aggregate and concrete aggregate.

The Hunter Coastal Urban Settlement Strategy (Department of Planning, 1994) identifies projected growth trends within the Hunter Region The Greater Taree Local Government Area (LGA) is located in the upper part of the coastal area of the Hunter region. The Strategy notes that the coastal area is the strongest growing part of the region. The improvements in transport accessibility to the Sydney Region such as the Pacific Highway upgrading and perceived lifestyle advantages are predicted to result in continued strong growth trends.

Population growth projections for the coastal area of the Hunter Region are shown in *Table 6.3.*

*Table 6.3* POPULATION PROJECTIONS FOR THE HUNTER REGION

| | 1991 ERP[2] | 2016 Medium | 2016 High | Range of Increase 1991 to 2016 |
|---|---|---|---|---|
| Greater Taree | 41,620 | 60,300 | 64,200 | 18,700 to 22,600 |
| Great Lakes | 25,500 | 49,200 | 51,400 | 23,700 to 25,900 |
| Port Stephens | 45,130 | 79,200 | 82,900 | 34,100 to 37,800 |
| Newcastle | 136,170 | 144,000 | 150,600 | 7,800 to 14,400 |
| Lake Macquarie | 169,710 | 202,600 | 211,900 | 32,900 to 42,200 |
| TOTAL | 418,180 | 535,300 | 561,000 | 117,200 to 142,900 |

*Notes:* *1. Source: Hunter Coastal Urban Settlement Strategy 1995*

*2. Estimated Resident Population*

As indicated in *Table 6.3* substantial population growth is expected in the Greater Taree LGA over the next 17 years. Such a population growth will result in demand for infrastructure that will require quarry products.

Greater Taree LGA experiences large seasonal increases in population. The demand for tourist development and its associated infrastructure will create greater demand for extractive resources than is reflected in resident population growth statistics.

### 6.4.2 *Employment*

Employment in the Greater Taree LGA is dominated by the Manufacturing, Retail/Wholesale and Community Services industries. These account for 53 percent of total employment. It is expected that these industries will continue to dominate as Taree establishes itself as a regional centre providing a diverse range of services and facilities. Traditional areas of employment in the rural sector have diminished substantially with a swing towards secondary and tertiary industry (GTCC, 1996).

Upgrading of the Pacific Highway and development of the tourism industry will significantly benefit the local government economy through direct employment of people from the area and use of associated industries. The quarry will support construction industries by providing essential construction materials. In addition the quarry will employ nine full time employees.

## 6.5 HERITAGE AND CULTURAL ISSUES

An archaeological and heritage assessment of the proposed works has been undertaken as part of this EIS. A detailed report of the investigations is provided in *Appendix O*. The study aimed to assess potential impacts on existing archaeological and heritage sites in the study area. Identification of archaeological sites required survey of the study area based on existing records of archaeological patterns within the broader area and use of subsurface probes where necessary. Work was in conjunction with the appropriate Aboriginal community representatives.

Archaeology and heritage investigations involved a review of previous archaeological investigations in the region, followed by field surveys. From this an assessment of potential impacts has been undertaken and mitigation measures have been recommended.

### *6.5.1 Background*

Review of previous archaeological investigations indicated that ridgelines, saddles, spurs adjacent to water and river terraces are areas likely to contain material of Aboriginal cultural heritage. Within the study area, small sites such as small artefact scatters may occur along the ridgelines and within the saddles. Other heritage items relating to the timber cutting industry and banana farm phase of past land use may also be found. As the site is predominantly a ridgeline, the survey concentrated on the ridgetops, crests, spurs and saddles. The slopes in the study area are considered too steep to have been suitable for camp sites.

### *6.5.2 Methodology*

Field work was undertaken in conjunction with Taree-Purfleet Local Aboriginal Land Council and Forster Local Aboriginal Land Council. The study area was examined on foot along the ridgelines. Other vehicles tracks were also inspected by vehicle and re-inspected where reasonable exposure was found. In addition, the surrounds of the two houses on-site were inspected. One of these had been partly demolished at the time of the field work.

Visibility on site ranged from 80 percent near saddles and ridgetop down to between ten and fifty percent on the slopes. This in addition to the high impact of quarry operations was recognised as 'limited visibility'. The assessment also used the current understanding of the nature of Aboriginal land use in relation to topography in the Hastings Region.

A preliminary research permit was granted by NPWS for the conducting of subsurface probes to test the areas of insufficient surface visibility considered to

have archaeological potential and which would be subject to destruction by the proposed development (test areas shown in *Figure 6.4*). Both ridgeline and slope landforms were tested.

### 6.5.3 *Study Results*

A total of seven sites were recorded during the initial field survey (see *Figure 6.4*). Sites J1 - J5 contained artefacts. Sites J1, J3 and J5 are small open artefact scatters, site J2 contained potential midden material and J4 is a historic scared tree. Sites J6 and J7 were identified as potential archaeological deposits (PADs).

Sites were located in all landforms other than steeper slopes. It was noted that although no sites were found on the level area of the spur, heavily grassed areas have potential to retain material under the layers of imported soil associated with the houses and soil moved down slope from the spur shoulder.

All the sites located were disturbed to a degree which reduces the potential significance of the material.

Three areas, including PAD1, were selected for the installation of subsurface probes. Five small artefacts were found at PAD1 (site J6). PAD2 (site J7) remained untested as it will not be disturbed by the proposed extension.

### 6.5.4 *Archaeological and Heritage Significance*

The seven sites identified through field investigations have been assessed for significance according to *The Australian International Council on Monuments and Sites (ICOMOS) Charter for the Conservation of Places of Cultural Significance; The Burra Charter* and its associated guidelines. Significance is based upon several criteria including scientific or archaeological significance, significance to Aboriginal people, aesthetic value and value as an educational resource. Sites are also assessed for their cultural or historical importance and whether they are rare, representative or characteristic, or whether they exhibit historic or cultural connections.

Given the disturbed nature of sites, it is considered unlikely that they would contribute to the scientific records and that they would retain little or no integrity. The small artefact scatters are unlikely to be rare. Significance of the sites has been assessed as follows:

- the sites have limited scientific value to the general community due to poor visibility. Three identified sites can be conserved for educational purposes (site J6, site J4 and site J7 PAD 2);

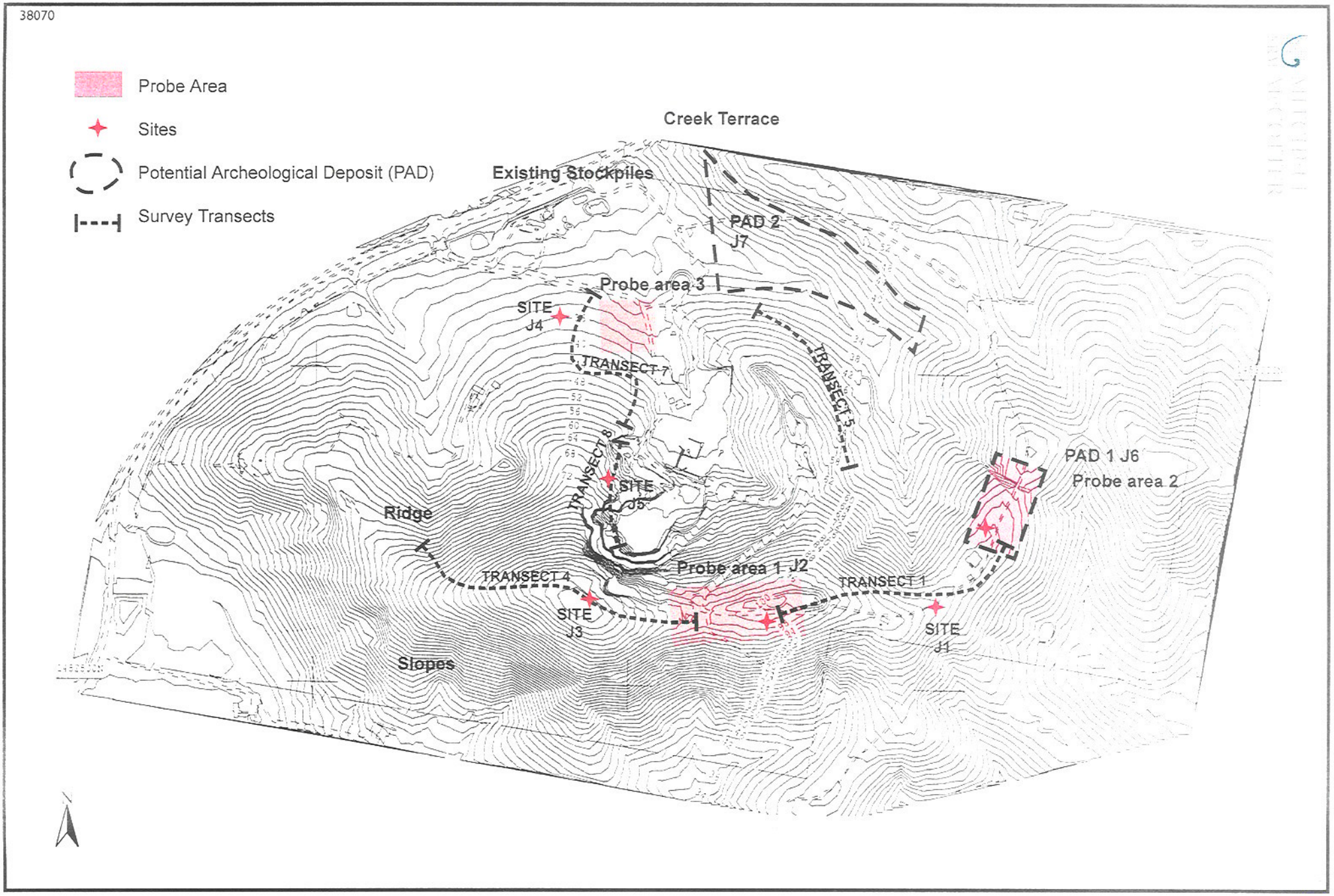


*Figure 6.4* AREA SURVEYED AND IDENTIFIED SITES