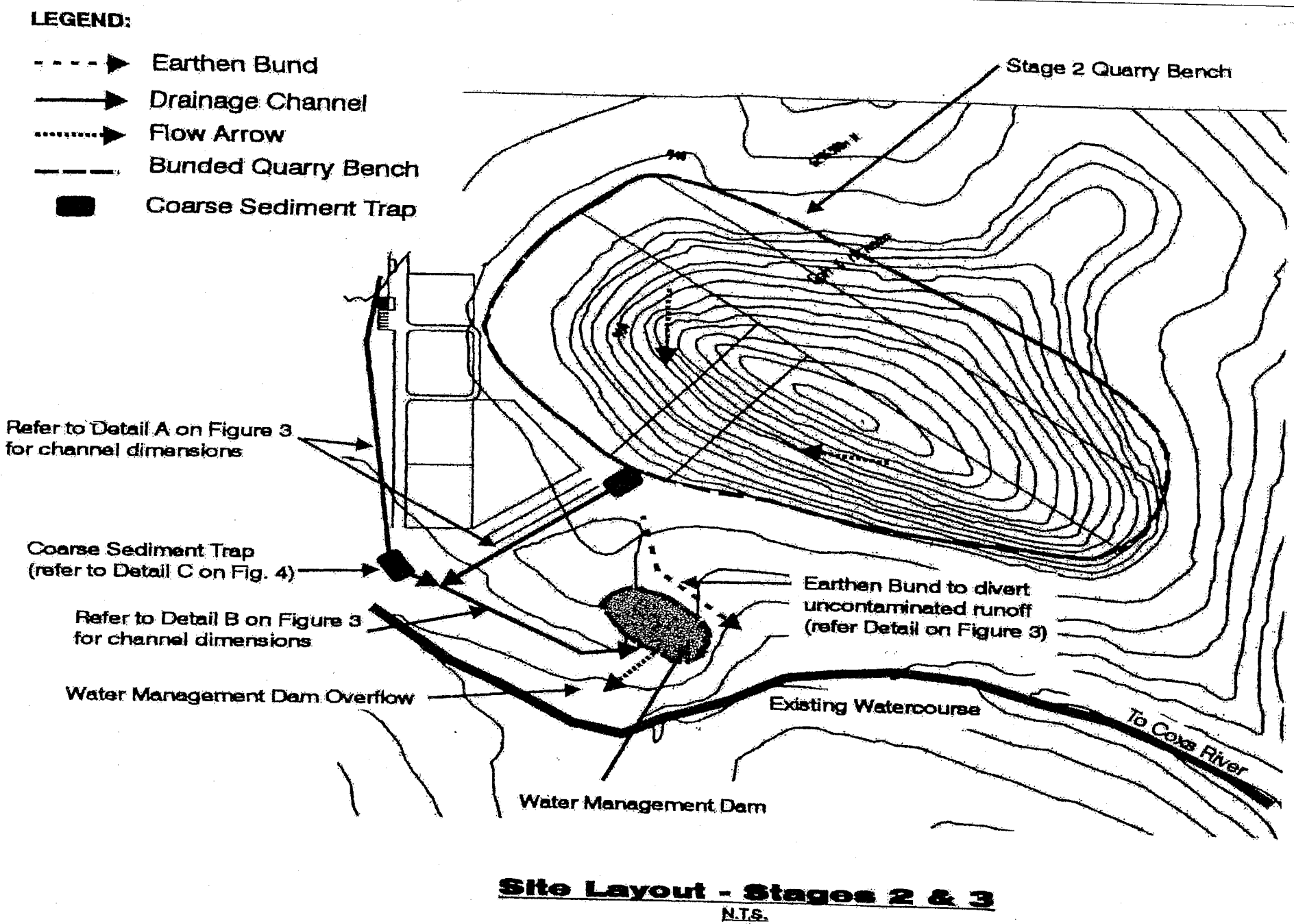


Figure 4.3
SITE DRAINAGE LAYOUT
STAGES 2 AND 3

catch dam will be monitored regularly and if water quality is sufficient it will be discharged directly to the Coxs River. If the water quality in the catch dam is unacceptable, the water will be pumped to the Water Management Dam for further settlement.

To ensure that the water management strategies described here are working effectively, to protect the Coxs River, a water quality monitoring program will be developed and included in the Water Management Plan for the development. Regular monitoring will be undertaken at sites to be determined within the surrounding catchment and on the Coxs River upstream and downstream of the proposed quarry development.

4.2 AIR QUALITY MANAGEMENT

A water truck will operate on-site to ensure roads and machinery manoeuvring areas are maintained in a dampened state. Water will be sprayed at a rate to minimise the generation of dust. Dust suppression systems will be installed and maintained for both the drilling operations, and the product crushing and screening systems.

All trucks hauling product will have their load covered by tarpaulins if the material is expected to result in fugitive dust emission. All vehicles will pass through a wheel wash facility alongside the access road to remove loose dust and grit prior to reaching the Highway. The access road will be sealed along its length, from the wheel wash to the Highway intersection.

Stockpiles will be managed to ensure fugitive dust emissions are minimised. Product stockpiles will be maintained in a dampened state by the operation of a spray irrigation system and/or water cannon on a water truck. Topsoil stockpiles will be seeded with a variety of fast growing grasses.

4.3 NOISE, BLAST AND VIBRATION MANAGEMENT

4.3.1 Objectives

The objective of noise, blast and vibration management at the quarry will be the adherence to guideline levels as outlined in the following NSW EPA documents:

- Industrial Noise Policy (2000);
- Environmental Criteria for Road Traffic Noise (1999); and
- Environmental Noise Control Manual (1994).

Ensuring that noise management activities are incorporated into quarry planning and excavation will achieve these goals. Highwalls will be maintained at both the northern and eastern

boundaries of the quarry to reduce noise emissions. Hours of quarry operation will be limited to daylight hours in the majority of circumstances. Under adverse weather conditions quarry operations may be suspended or altered to meet guidelines, while blast and hammer drill operations will only be conducted at times when environmental conditions are acceptable for noise minimisation.

4.3.2 Noise Management Program

The quarry will be excavated from within a trench oriented NNW to SSE and closed at either end. Access to the trench will be located midway along the western quarry boundary, helping minimise noise emission towards the NNW residential area. This residential area NNW of the proposed quarry is currently zoned 1(c) Small Rural Holdings and 2(v) Village Zoning and may be later developed for more intense residential use. An eastern highwall will be maintained throughout the development in order to limit sound promulgation towards residences to the NE.

Quarrying activities will generally be restricted to the hours of 7am - 5pm Monday to Friday. At times, weekend operations may be required to meet short-term market demand for product. Market demand will also require the earlier dispatch of trucks, as described in **Section 3.7**.

Noise emissions from heavy machinery (dozer, loader) will be measured prior to operation on-site to ensure that they satisfy the required noise levels used in the assessment criteria. If necessary, operating modifications will be undertaken.

Air-blast overpressure and ground vibration impacts will be minimised through the use of a small diameter drill hole (89mm) for the placement of the charge. A Nonel initiation system using in-hole delays will be used to allow for individual hole initiation. Avoiding secondary blasting of source rock will reduce secondary noise activity.

A noise monitoring program will be implemented and undertaken during the initial development phase and thereafter annually at the quarry and nearby residences to ensure that all noise control measures are installed and maintained, and that the environmental noise criteria continue to be satisfied.

4.4 HYDROCARBONS, CHEMICALS AND WASTE MANAGEMENT

Hydrocarbons including diesel fuel, oil and grease will be used in plant and equipment at the quarry. Appropriate measures will be undertaken to ensure the safe and effective storage, handling and use of these materials.

Maintenance and refuelling of plant and equipment will be undertaken within a separate bunded area away from drainage lines and unprotected slopes.

Hydrocarbon spill clean-up kits will be available at the crushing and stockpiling area and the quarry operations area for use in response to an emergency spill. All personnel will be trained in the correct procedures for use of the kits during hydrocarbon spills and emergency pollution events. Contractors with fuelling and servicing trucks will be required to carry a hydrocarbon clean-up kit while on-site.

Fuel and oil will be stored in tanks or drums within a bunded area of the maintenance area. Waste hydrocarbons will be also stored within this area. Hydrocarbon-contaminated soil will be disposed of to a suitably licensed facility or at an on-site bioremediation area.

Office amenities and facilities will be developed concurrent to the establishment of the quarry. During construction works, portable serviced toilets will be provided. The permanent amenities block will include a package Aerated Wastewater Treatment System or similar, with effluent being irrigated within a bunded landscape area. Drainage from the gravel parking area and unsealed section of the access road will be routed to the Water Management Dam.

Waste and recyclable materials will be managed in accordance with best management practice and the provisions of the Protection of the Environment Operations (Waste) Regulation, 1996. Separate disposal bins will be provided for recyclable materials and putrescible waste. Recyclable materials will include materials collected through the local Council's recycling system where practicable. Putrescible garbage wastes will be placed in bins for disposal at the nearest Solid Waste landfill site. Other details of waste management are described in **Section 3.11**.

A surfactant will be required as an additive to dust suppression water for all areas that may emit silica dust, including roads, quarry faces, stockpiles, drilling and crushing/screening. Silica dust is difficult to wet, and the surfactant helps to break the surface tension, allowing water to coat the dust particles and reducing the potential impact of fugitive airborne dust on the health of site employees and the amenity of nearby residents.

An inert, biodegradable surfactant (*eg* "Shell Teepol" household detergent) will be used to avoid impacting nearby land and water resources. The surfactant will be stored, handled and used in accordance with its Material Safety Data Sheet (MSDS).

4.5 SITE REHABILITATION

4.5.1 Objectives

The primary objectives of the rehabilitation program are to:

- minimise erosion;
- maximise the retention of the seed bank during and following quarrying; and
- re-establish progressively a Eucalypt woodland similar to that which currently exists.

4.5.2 Vegetation Management

Prior to disturbance of the quarry site, the extent of required clearing will be defined and suitable trees will be identified and marked, prior to harvesting for use as timber, firewood or fence posts. Trees and shrubs not suitable for other uses will be stockpiled for use in rehabilitation.

Prior to the disturbance of the site, seed material from endemic species will be harvested and stored on site for later use in rehabilitation. Ongoing collection of seed from adjacent vegetation will be undertaken regularly to ensure a suitable supply is available for progressive rehabilitation of the site.

4.5.3 Topsoil Management

Topsoil within the proposed quarry area cannot be stripped by conventional means as it is generally quite thin and in some areas the surface is predominantly rock outcrop. Topsoil may be removed via the use of a combination of dozer and water spray prior to drilling each new area. Runoff from this operation will collect in a catch drain located downslope of the outcrop, with sediment being removed in a series of silt traps.

Soil within the Surface Facilities area has a deeper profile than the quarry area, consisting of "A" and "B" Horizons (refer to **Section 5.2.1**). The "A" Horizon soil is similar to that overlying the quarry area and this soil will be stripped and placed on the topsoil stockpile. The "B" Horizon consists of a clay sub-soil that will be stripped and used in erosion control structures and as lining material for drainage channels and sediment dams. Erosion control practices will be implemented to ensure that the stockpiles remain stable.

4.5.4 Materials Available for Rehabilitation and Post Extractive Land Use

Processing of quarried material for low specification uses will result in a relatively small proportion of fine material being unsuitable for inclusion in the product output. This fine reject material will be stockpiled, along with recovered topsoil and overburden material that has not been sold, for later use in the rehabilitation of the site.

Fine rejects and overburden material will be used as backfill in the void and to decrease the slope of the bench and highwalls. Progressive rehabilitation will occur as areas become available.

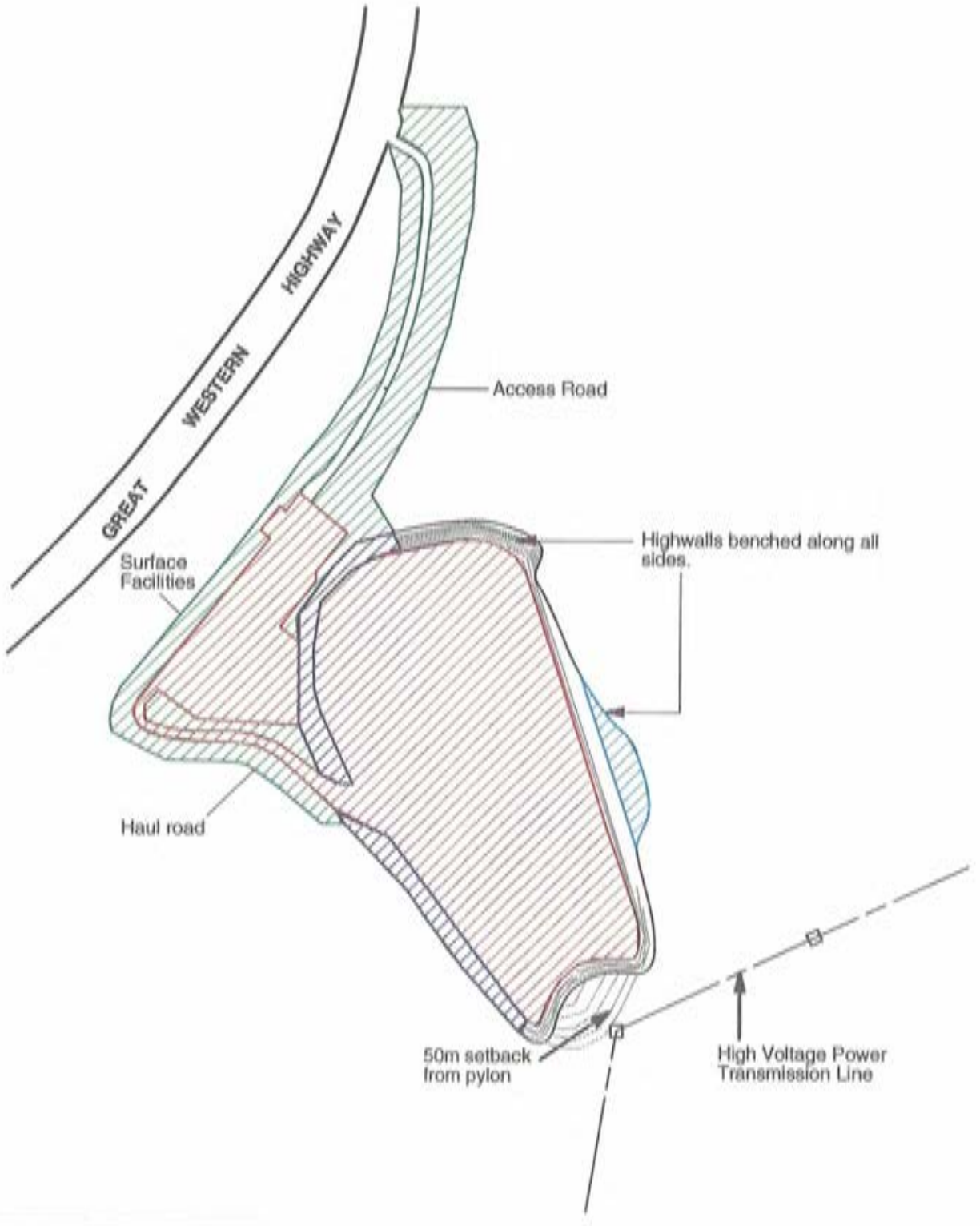
The final void will have a floor sloping gently at 4% towards the NNW. The western-most side of the void will rise 10m to the 950 contour, while the eastern highwall will vary in height, up to approximately 23m. Both walls will remain at a slope of around 50°, not inconsistent with existing slopes in the area. The floor and walls of the void will be in a fractured state as a result of blasting and natural weathering and will be conducive to the establishment of endemic tree, shrub and groundcover species. This will be undertaken through a combination of direct seeding and natural regeneration. Site topsoil will be respread over the floor and slopes of the void.

4.5.5 Surface Shaping and Revegetation

Stabilisation works will commence concurrently with the construction of surface facilities including the amenities, parking, processing areas, access and haul roads. Water, erosion and sediment control structures, and revegetation of disturbed areas will assist in providing stability to disturbed portions of the site. Control structures will be seeded with a mixture of suitable grasses.

Benches on the walls of the quarry will be revegetated as soon as practicable using a combination of grass seed and tube stock (trees and shrubs). Species occurring on or near to the quarry site will be selected and will include canopy, understorey and groundcover species, with the aim of restoring the site to the pre-development floristic structure. Species used will be selected from the Flora Species List provided in the "Statement of Effect on Threatened Flora and Fauna", included as **Appendix 4**.

Due to the nature of the quarry extraction, it will not be possible to commence revegetation until after completion of Stage 1. At this stage, disturbance of the natural slope east of the quarry will cease, allowing rehabilitation works to begin. Revegetation of disturbed areas around the access and haul roads, the process and amenities areas can commence following the completion of construction work in those areas. **Table 4.1** and *Figure 4.4* provide a preliminary indication of the rehabilitation schedule and plan.



LEGEND

YEAR 1

YEAR 3

YEAR 15

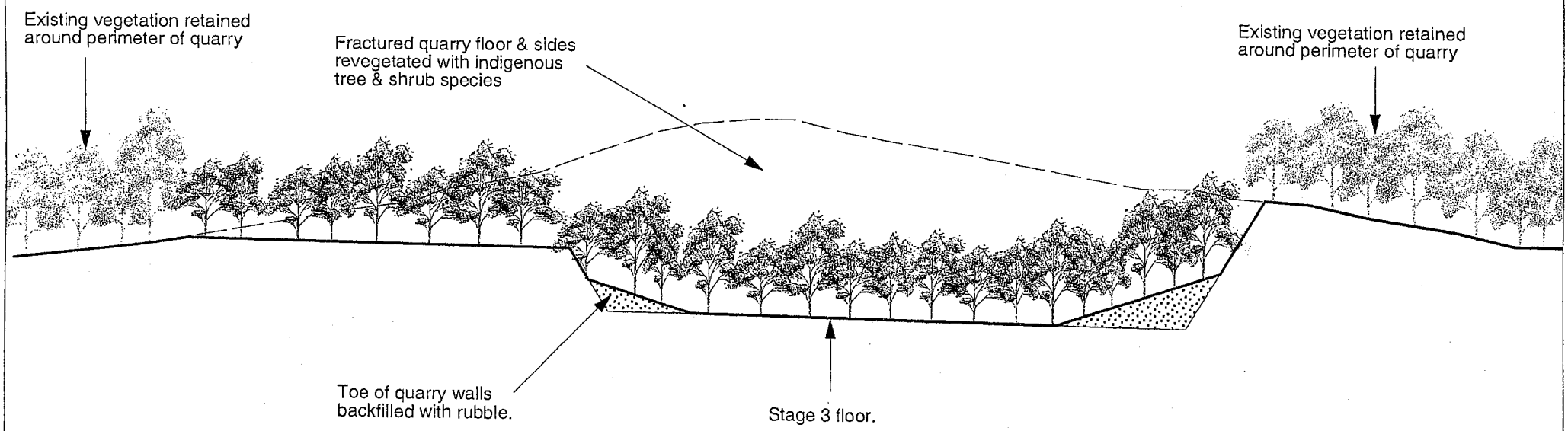
YEAR 20

0 250m

1:5000

Figure 4.4.

REHABILITATION PLAN.



Typical Section 1-1
(Not to scale)

Figure 4.5
FINAL LANDFORM.

4.7 TRANSPORT

It is proposed that the quarry access road will intersect with the Great Western Highway approximately 500m west of Barton Avenue. It is proposed to install a seagull junction adjacent to the quarry on the Great Western Highway (as described in **Section 3.8**) to allow for safe and efficient access and egress from the quarry.

The proposed intersection with the Great Western Highway has been designed in accordance with RTA requirements and allows for safe access and egress to the quarry site from both directions. It is anticipated that the new junction would cause low overall delay on the Great Western Highway and would operate at a high level of service. To ensure that a high level of road safety is maintained, during fog conditions, no heavy vehicles will be allowed to leave the quarry site until visibility has returned to an acceptable level.

5. EXISTING ENVIRONMENT & IMPACT ASSESSMENT

5.1 PHYSIOGRAPHY

5.1.1 Existing Environment

The site is located on undulating land of moderate to high slope class with steeper slopes being located adjacent to the Coxs River. The elevation range of the quarry site is between 940m to 980m AHD, while the surface facilities, crushing and stockpile areas are located at a lower elevation between 930m to 940m AHD. The quarry site is located on an indistinctive hill of oblong shape, orientated approximately north to south. The surface slope of the proposed quarry is predominantly within the range of 10-25% (6-14°) as indicated in **Table 5.1**.

Table 5.1: Distribution of Slope Classes.

Slope Range		Area	Percentage
Degrees	%	(ha)	
6-14	10-25	5.6-6.0 (~4.9ha quarry + 0.7ha stockpile)	71
14-18	25-33	0.9 (quarry only)	9
18-27	33-50	1.5 (quarry only)	20
TOTAL		**8.0-9.0**	

5.1.2 Impact Assessment

The proposal will result in a change in the topography of the hill containing the quartzite deposit. As a result of excavation, the hill will be lowered from a maximum height of 978m AHD to between 960-970m AHD on the western perimeter of the excavation edge and to between 940-950m on the eastern perimeter.

The proposed final landform will result in an elongate and relatively flat area dipping 4% towards the north. This represents the floor of the Stage 3 excavation. The western edge will bench up approximately 10m to another flat area (Stage 2 floor). The eastern edge will be bounded by a highwall of approximately 23m in height. The gradient of the highwall and western bench will remain at around 50°, not dissimilar to other slopes in the area.

A Site Stability Analysis was undertaken by GE Holt & Associates Pty Ltd and is presented in **Appendix 5**. The analysis found that the impact of quarrying on the stability of the surrounding area would be negligible due to the nature of the rock structure and the way in which quarrying operations will be conducted. It was concluded that during quarry operations, blasting vibrations will not affect the integrity of the rock barrier between the quarry and the

Coxs River for more than a few metres from the low wall. After cessation of operations, there will be no long-term stability consequences for the hill.

5.2 SOILS

5.2.1 Existing Environment

A soil survey to assess the suitability and availability of soil for reuse in rehabilitation and the construction of sediment basins was undertaken in July 1999. This survey was carried out in accordance with guidelines set out in *Charman and Murphy (1992).*

Eight soil profiles were exposed and classified in accordance with *Northcote, (1979).* Two different soil types were identified; a yellow Uniform (Lithosol) soil of primary profile form, Um1.21 and an orange Duplex (Podzolic) soil, Dr3.11. The distribution of soil types and the location of profile sites are shown on *Figure 5.1.*

Appendix 6 contains detailed descriptions of the soil profiles examined. The results of laboratory analysis for the Lithosol and the B horizon of the Podzolic soil are also provided.

The uniform soil (siliceous fine sand) was found to occur on the hill and side slopes, covering the total extent of the proposed quarry. Soil depth, ranged from 60cm at the eastern boundary of the quarry to 5cm on the hillcrest, with 10cm being the average soil thickness. The soil contained a large percentage of gravel and fragmented rock that displayed various degrees of weathering. Rock outcrops were common.

The second soil type (podzolic soil) occurs on the lower slopes below the hill. The soil has a distinct boundary between a fine siliceous, sandy A horizon and a heavy red clay B horizon. A significant amount of rock was observed in the A horizon, which had a depth of approximately 20cm. The B horizon had a depth generally exceeding 40cm. This soil type is typical of the proposed crushing and stockpiling site.

No evidence of active soil erosion was found, however, the erodibility of the topsoil samples examined can be considered high due to the high proportion of fine sand and the lack of ped structure.

Site observations of recent disturbance by exploration drilling conducted two years prior to the soil survey indicated that successful rehabilitation of exploration drilling access roads has occurred, without any significant erosion being evident. However, the quarry soils are poorly developed, have low moisture retention and are low in fertility. The low fertility of the topsoil is evident from the lack of understorey vegetation and sparse shrub layer.

5.2.2 Impact Assessment

The soil structure of the site will be altered as a result of quarrying. The proposed soil stripping plan is shown in *Figure 5.1* and the estimated quantities of soil available are listed in **Table 5.2**.

Table 5.2: Soil Volumes

Stripping Depth (cm)	Area (ha)	Volume (m^3)
10	7.3-8.3	7,300-8,300[1]
20	0.7	1,400
TOTAL	**8.0-9.0**	**8,700-9,700**

[1] Topsoil stripping is not possible in the quarry area due to the large proportion of surface rocks. Topsoil will be removed using a high pressure hose and recovered using an initial screening process and a series of secondary silt traps.

An estimated 8,700 to 9,700m^3 of topsoil may be recovered from the site. On completion of operations, this volume may allow up to 10cm of topsoil to be re-spread over high priority sections of the final landform during rehabilitation. Combined with other remedial measures, which may include composted mulch and fertiliser application, the available soil bed should be adequate for the re-establishment of native vegetation cover in the area.

5.3 LAND CAPABILITY

5.3.1 Existing Environment

The NSW Soil Conservation Service (SCS) "Rural Land Capability Mapping" publication was used to classify the site (Emery). Land capability classifications for the proposed quarry site are shown in *Figure 5.2*. From the figure it can be seen that the proposed quarry site comprises a mixture of Class VI (66%) and Class VII (34%) land, whilst the stockpile and crushing site is located on Class VI land exclusively.

The implications of the Land Capability classifications are:

- Class VI land - Generally comprised of least productive grazing land. Not suitable for cultivation.
- Class VII land - Land best protected by green timber.

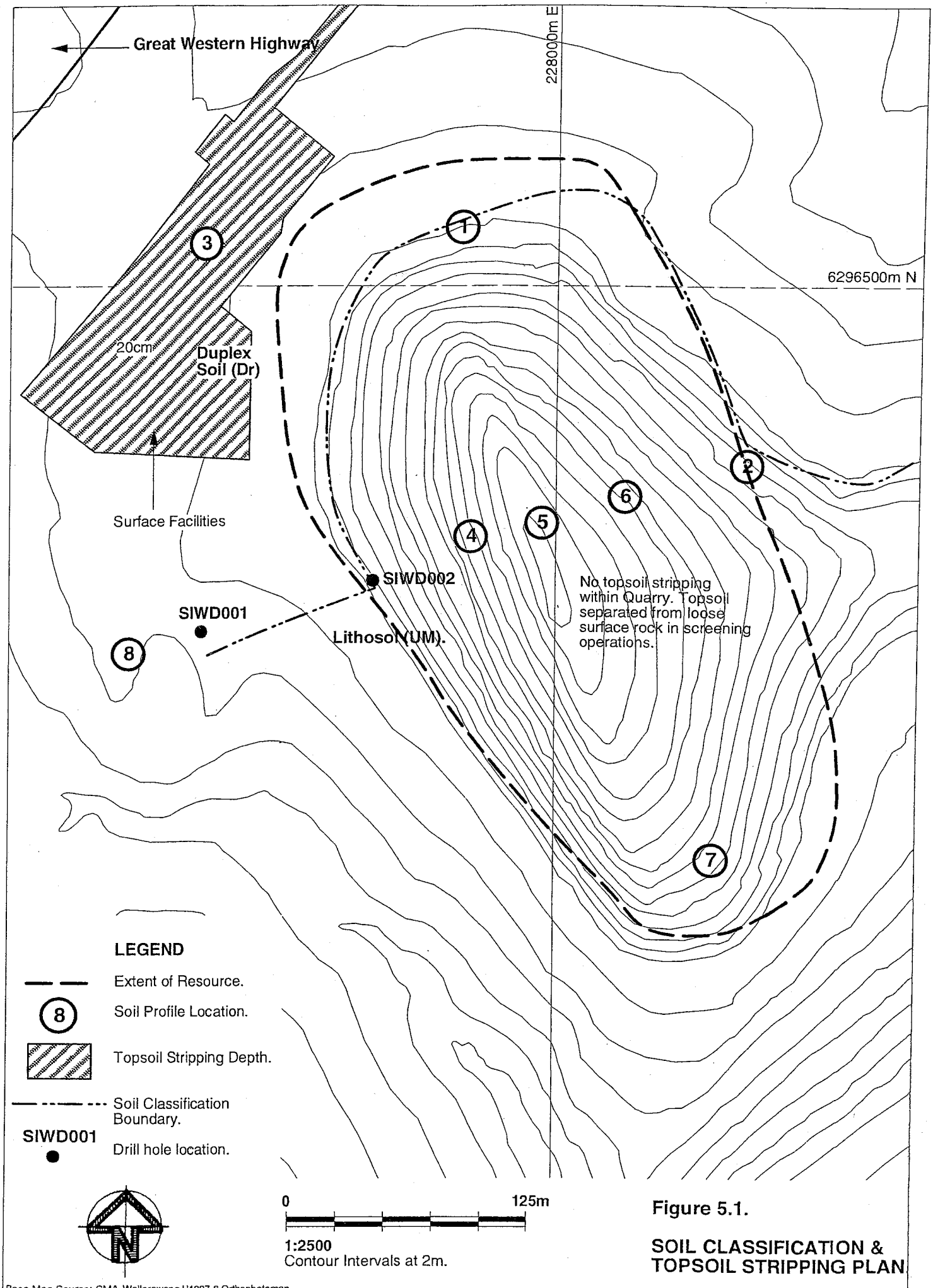


Figure 5.1.

SOIL CLASSIFICATION & TOPSOIL STRIPPING PLAN

Base Map Source: CMA-Wallerawang U1097-8 Orthophotomap
PROJ/DRAFT/206/slope class

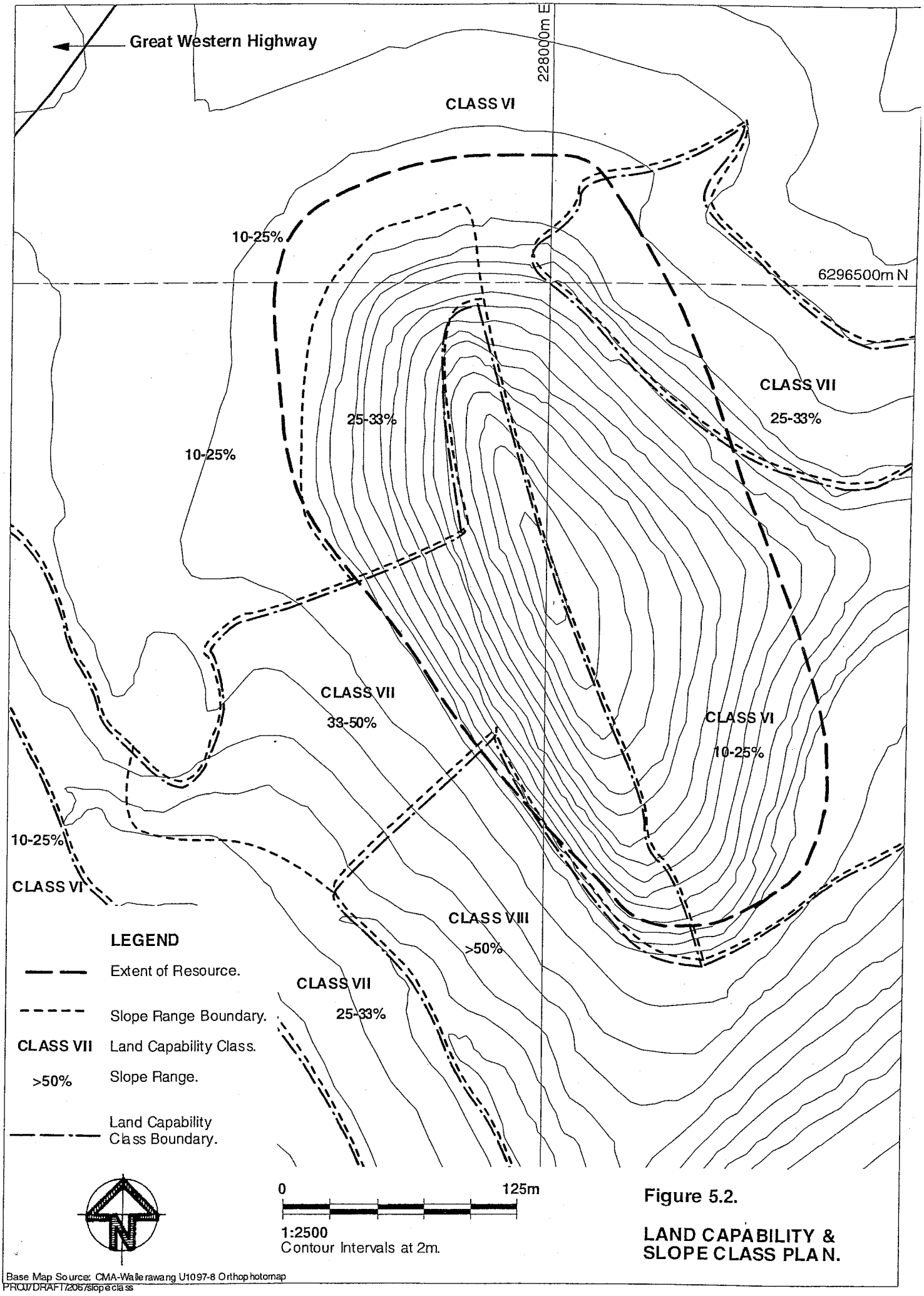


Figure 5.2.

LAND CAPABILITY & SLOPE CLASS PLAN.

Base Map Source: CMA-Wallerawang U1097-8 Orthophotomap

PROJ/DRAFT/2067/slopeclass

5.3.2 Impact Assessment

Quarrying of the proposed site will alter the current land capability, from Class VI and Class VII land to Class M (Mining and quarrying) land during the life of the quarry operation.

The potential for erosion to occur within the area proposed for quarry activity is considered minimal as the majority of the land surface within this area consists of rock debris and outcrop. In the event that some soil movement does occur on the site, the water and soil management structures installed in accordance with **Section 4.1** will prevent downstream impacts.

The post quarry landform at the site will comprise mostly Class VII land, consisting of exposed rock surfaces, thin topsoil profiles and some moderately steep slopes. This classification is compatible with that of the surrounding landscape and it is envisaged that following final rehabilitation, the quarry site will return to a natural forested state.

The potential for post development erosion losses from the site will be minimised by the basin-like shape of the final landform, which will contain sediment within the rehabilitated area. Rehabilitation will also result in lower slopes and shorter slope lengths than presently exist, reducing the risk of water erosion.

5.4 ARCHAEOLOGY

5.4.1 Existing Environment

In February 2000, Consultant Archaeologist, Rex Silcox and a representative of the Bathurst Local Aboriginal Land Council, Richard Peters, conducted an archaeological assessment of the proposed quarry development site and surrounding areas. The Archaeological discipline report for the proposal is attached as **Appendix 7**. A response letter from the representative of the Bathurst Local Aboriginal Land Council is also provided.

The proposed quarry is situated within a region known to contain aboriginal archaeological sites. A search of the NPWS Site Register found a total of 230 sites occurring within an approximate 20km radius of the proposed quarry site.

One aboriginal archaeological site, an open campsite, was found during the site survey. The campsite consists of a variably sparse scatter of artefacts on the northern side of the former Hoskins Quarry (refer to *Figure 1.2* and to **Appendix 7**). Artefacts were found scattered over a shallow eroded exposure within an area of 120m^2 on the edge of the former quarry and extending a further 50m to the north.

The site is considered to be potentially significant due to its location on an extensive area of gently sloping ground considered to have been suitable for long-term occupation.

5.4.2 Impact Assessment

The location of the aboriginal archaeological site identified in the archaeological Site Survey, immediately north of the former Hoskins Quarry, was initially nominated as a topsoil stockpile location. This activity would result in the destruction of the potentially significant site.

Following discussion with the Consultant Archaeologist and the Land Council representative, it was decided that the topsoil stockpile would be located further to the north to avoid impacting the archaeological site.

To protect the aboriginal site and surrounds from disturbance during the life of the quarry operation, the area south of the haulage road to the Water Management Dam will be fenced to exclude access. Employees and contractors will also be made aware of the archaeological significance of the 'open campsite' through an induction program. The site will also be checked periodically as part of an audit program.

The Site Survey concluded that the remainder of the proposed quarry area is considered unlikely to have been suitable for long-term occupation due to its steep slopes and rocky nature, and has little potential as a location for an archaeological deposit. If, however, any material considered to be potentially of aboriginal origin is uncovered during clearing, landscaping or excavation associated with the quarry development, work will cease in that area and the NPWS will be contacted in order to assess the significance of any find.

Given the management strategies detailed above, it is considered that the quarry development will have no significant impact on archaeological sites in the area.

5.5 FLORA AND FAUNA

Wildthing Environmental Consultants conducted flora, fauna and habitat assessments at the proposed quarry development site in early December 1999. The Statement of Effects is included as **Appendix 4**.

5.5.1 Existing Flora

The proposed quarry site forms part of a large homogenous tract of predominantly sub-alpine Eucalypt woodland.

The canopy of the woodland is generally continuous across the site. Dominant species include Ribbon Gum, Snow Gum, Mountain Gum and Black Sally. The trees were noted to be of varied age class, with many containing hollows and other signs of senescence. Individual Radiata Pine trees are also scattered over the site.

The understorey is sparse to non-existent, consisting of younger specimens of the above tree species. The shrub layer is also sparse, containing Broom Heaths, Wattles, Finger Hakea, Narrow Leaved Geebung and Cherry Ballart.

The herb layer is well developed and diverse. Native grasses are common, including Snow Grass, Three-awn Eargrass, Wallaby Grass, Forest Hedgehog Grass and Kangaroo Grass.

A full list of flora identified on the site is included within **Appendix 4.**

The entire assemblage is in relatively intact condition with only minor evidence of past tree removal noted. Evidence suggests it has been a considerable time since the last fire event of any significance occurred on the site.

Referencing the relevant schedules in the Threatened Species Conservation Act 1995, it was found that no species of threatened flora occur within a 10km radius of the proposed quarry site. No plants identified during the flora survey are considered threatened, and it is unlikely that any threatened plants occur on the site.

5.5.2 Existing Fauna

Habitat recorded at the site was consistent with sub-alpine woodland, favouring habitat for a wide range of insect, bird, mammal and reptile species. A search of the NPWS Flora and Fauna Database identified potential suitable habitat for 15 species of threatened fauna within the general vicinity of the proposed quarry site.

During fieldwork the presence of only one species of threatened fauna was confirmed. The Yellow-bellied Sheathtail-bat was identified using echo-location techniques. Although not sighted during the survey, two other threatened species are also recorded in the NPWS Database as occurring within a 10km radius of the site (Koala and the Bathurst Copper Butterfly).

A full list of fauna species observed or expected to use the area around the proposed quarry development is provided in **Appendix 4**. Subsequent to the flora and fauna study, advice was provided by residents at the on-site community briefing that the Spot-tailed Quoll is known to occur on-site and the Platypus within the Coxs River.

5.5.3 Impact Assessment

The Yellow bellied Sheathtail-bat is known to roost predominantly in tree hollows and prefers to hunt above the canopy of wooded areas such as those occurring throughout the region. The Fauna Consultant concluded that while many suitable roosting trees and hunting areas were available at the proposed quarry site, it is unlikely that disturbance will result in adverse impacts to the local population.

To facilitate the relocation of affected animals, potential habitat will be identified prior to clearing for quarry work. While it will not be possible to save trees within the development area, those on the periphery of the works will be protected and a suitably qualified consultant will be present during the removal of habitat trees to recover and relocate any fauna that is discovered.

Consideration of the site under SEPP 44 "Koala Habitat Protection" found that the site was considered "Potential Koala Habitat" due to the extent of Ribbon Gum (*Eucalyptus viminalis*); a Koala feed tree species. However, field investigations found no evidence (scats, scratches *etc*) of use of this site by Koalas and hence concluded that the site does not constitute "Core Koala Habitat".

Due to the abundance of similar habitat both locally and on a regional scale it is considered that the proposal will not significantly affect local populations of any threatened species that potentially use the site.

Also, the highly fractured state of the quarry floor and slopes will be conducive to the establishment of vegetation, and good rehabilitation management will see the site return to a floristic and faunal diversity commensurate with the surrounding area.

5.6 HYDROLOGY AND WATER QUALITY

Consultants, WBM Oceanics Australia, prepared a Water Management Study for the proposed quarry development site. A copy of their report, "Conceptual Water Budget and Management Plan" – November 2000, is provided as **Appendix 3.**

The proposed quarry will be a 'zero discharge' site, except for extreme storm events or extreme periods of rainfall, when dilution of any discharge by wider catchment runoff will occur.

5.6.1 Existing Environment

The project area is situated within a 265ha drainage basin located to the south of Lake Wallace and the Great Western Highway. The proposed 11ha quarry site is located on a hilltop 200m west of the Coxs River. Due to its elevated position, water discharge from the site currently enters the Coxs River either directly or after travelling a short distance down two unnamed watercourses. The Coxs River is a feed source for Warragamba Dam, therefore the requirements of SEPP 58 "Protecting Sydney's Water Supply" are applicable.

Sydney Water, DLWC and Delta Electricity have conducted water quality monitoring of the Coxs River. The nearest sample location to the proposed quarry site is monitored by Delta Electricity and is located approximately 250m downstream from the Lake Wallace dam wall and approximately 1.8km upstream of the quarry. A summary of baseline water quality data for the period April 1999 to September 2000 at this monitoring point is provided in **Table 5.3**.

Table 5.3: Summary of Upstream Water Quality (4/99 - 9/00)

Parameter	No. of Samples	Average Value	Median Value	Maximum Value	Acceptable Criteria*
pH	79	7.79	7.76	8.4	6.5 - 8.5
EC (µS/cm)	79	816	626	1590	1500
Sulfate (mg/L)	79	305	205	1542	250
Non-filterable Residue (NFR) (mg/L)	79	5.03	4	29.2	30

* NSW EPA Clean Water Regulation 1972; Australian Water Quality Guidelines for Fresh and Marine Waters, ANZECC 2000.

Groundwater was not encountered during exploration drilling. Drilling was undertaken to an equivalent elevation of approximately 910m AHD, compared with the proposed lowest point of the quarry of 940m AHD. The water level in the Coxs River below the quarry is at approximately 855m AHD.

5.6.2 Impact Assessment

The hydrology of the natural catchment of the proposed quarry site will be modified by the diversion of water flows in and around the quarry. Water runoff from undisturbed areas will be diverted around the site by way of diversion channels directly into Coxs River. However, this will be minimal as the quarry will occupy the majority of the hill. During Stage 1 development, uncontaminated runoff will be diverted to the north and south of the quarry. During Stages 2 and 3 of quarry development, uncontaminated runoff will be diverted to the south of the quarry. *Figures 4.2* and *4.3* illustrate the water management structures proposed to be incorporated for all three stages.

Runoff generated from disturbed areas of the site will be captured and diverted through trapezoidal-shaped channel structures to the Water Management Dam. Each section of channel will contain a coarse sediment trap, to settle sand and gravel size particles, prior to discharge into the Water Management Dam.

The Water Management Dam will have a storage capacity of 7.7ML and has been designed with 4m of freeboard. Modelling data provided by WBM Oceanics indicate that the storage design will allow the capture and treatment of a 1 in 20 year, 12 hour event and 1 in 50 year, 6 hour event during Stage 1 of quarry development. During Stages 2 and 3, a 1 in 20 year, 3 hour event and 1 in 50 year, 2 hour event will be contained. In extreme cases, such as a large, long duration storm event, water discharge from the site may be required. In this event, discharge from the site will only occur when all opportunities for water reuse are exhausted and the Water Management Dam is nearing capacity. Inspection and sampling as necessary, will be undertaken to confirm that the water quality will be within the agreed discharge limits before discharge occurs.

Water from the Management Dam will be used for all landscaping, vehicle washing and dust suppression activities. To maintain adequate freeboard within the Water Management Dam, excess water will be used to irrigate areas of woodlot vegetation around the proposed quarry site. It is anticipated that during dry years it may be necessary to import additional water onto the site to meet daily requirements. In this case, approximately five 10,000L water trucks would be required to meet the daily on-site water demand.

The project is unlikely to have an impact on groundwater quality at the site. Analysis conducted by the Consultant indicates that sediment-laden water seeping into rock fractures within the quarry would eventually be filtered out naturally by the soil and rock structure before entering the Coxs River. If groundwater is encountered during operations, DLWC will be notified and appropriate action will be undertaken to manage groundwater across the site. However, based upon drilling results this possibility is considered unlikely.

No chemicals will be used during processing of quarry product. However, a biodegradable surfactant (wetting agent) may be used, in conjunction with water from the Water Management Dam, for site dust suppression.

Given the water management strategies proposed for the quarry operation, detailed in this Section, it is considered unlikely that the quarry development will have any significant impact on water quality in the Coxs River.

5.7 CLIMATE AND AIR QUALITY

5.7.1 Existing Climate

The climate of the Wallerawang/Lithgow area is classified as temperate maritime, with warm summers and mild to cool winters. Monthly average temperatures vary from a maximum 25°C in January and February to a minimum 1°C in July and August.

Meteorological data used during the Air Quality Assessment (Holmes Air Science – refer to **Appendix 8**) was obtained from a number of sources as no one site held all the data required. Relevant data providers and collection locations are provided in **Table 5.4.**

Table 5.4: Source of Meteorological Data

Element	Source	Source Location from Quarry	Source Elevation	Length of Records (yrs)
Rainfall	Bureau of Meteorology (BOM) Lithgow (Lithgow Composite) 063 224	10km SE	950m	107 (1889-1996)
Temperature (Mean daily max, min)	BOM Lithgow (Lithgow Composite) 063 224	10km SE	950m	107 (1889-1996)
Relative Humidity	BOM Lithgow (Lithgow Composite) 063 224	10km SE	950m	107 (1889-1996)
Pan Evaporation	Bathurst Agricultural Research Station	50km W	900m approximately	-
Wind Speed and Direction	Mt Piper Weather Station Delta Electricity	7km N	900m approximately	1 (1997)

The data set provided in **Table 5.5** indicate that marginally higher rainfalls are expected during the summer months when compared to the rest of the year. Expected evaporation is five times higher in summer than in winter and exceeds rainfall for eight months of the year. Relative humidity is moderately high in late autumn and early winter. Discussions with RTA staff indicate that fogs are frequent in the vicinity of the proposed quarry development during the winter period.

Using 1997 Mt. Piper data, wind speed throughout the year is expected to be less than 27km/hr and is predominantly from a south westerly direction. Expected summer wind direction is far less predictable. Seasonal and annual wind roses for Mt. Piper Power Station (1997), 7km north of the proposed quarry site, are provided as *Figure 5.3*.

Table 5.5: Climatic Summary

	J	F	M	A	M	J	J	A	S	O	N	D	YR
TEMPERATURE (°C)													
Mean daily max	25.4	24.6	22.4	18.3	14.2	11.0	10.3	11.9	15.3	18.7	21.5	24.4	18.2
Mean daily min	11.7	11.9	9.9	6.6	3.8	1.7	0.6	1.3	3.2	5.9	7.9	10.3	6.2
RAINFALL (mm)													
Average	94.4	83.0	85.9	65.2	65.4	69.7	68.8	63.7	59.4	65.9	69.0	78.3	868.6
RELATIVE HUMIDITY (%)													
Average 9am	63	69	71	75	80	81	77	72	63	59	58	59	69
Average 3pm	50	55	55	53	61	65	58	52	49	49	47	45	54
EVAPORATION (mm)													
Average	205.7	163.1	139.0	85.6	49.3	32.7	35.4	54.3	78.3	119.2	156.3	203.4	1322.3

5.7.2 Existing Dust Levels

Airborne dust comes from a variety of natural and anthropogenic sources including wind erosion of land surfaces, vehicle and industrial exhausts and emissions, abraded vehicle tyres, agricultural operations and airborne organic material such as pollen. The principal dust sources in the vicinity of the proposed quarry development are most likely unsealed road surfaces and vehicle-related particles (abraded tyres, brake linings *etc.*). Dust deposition data was collected on behalf of the Wallerawang Power Station at four monitoring stations around Wallerawang over the period January 1998 to August 1999. *Plate 1* shows the location of the four monitoring stations in relation to the proposed quarry site. The results from the dust deposition monitoring stations are presented in **Table 5.6.**

Table 5.6: Summary of Dust Deposition Data Collected at Wallerawang

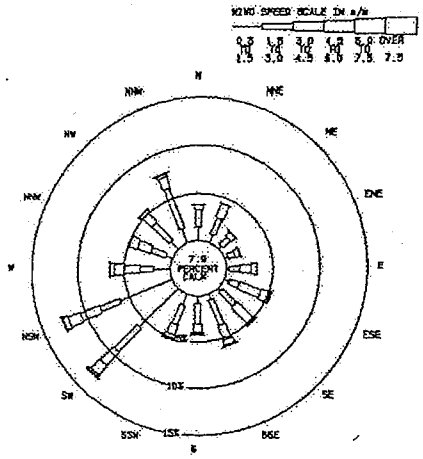
Location	Measurements in g/m²/month			
	D1 North east of proposed quarry	**D2** North of Wallerawang	**D3** Wallerawang	**D4** East of proposed quarry
Average 1998	1.2	1.0	2.6	1.8
Average 1999[a]	0.9	0.6	0.9	1.0
Highest Result	3.2	3.9	17.9[b], 3.5	2.8
Lowest Result	0.1	0.0	0.2	0.4

[a] – The average for 1999 was from January to August (8 months)
[b] – Represents an anomalous result.

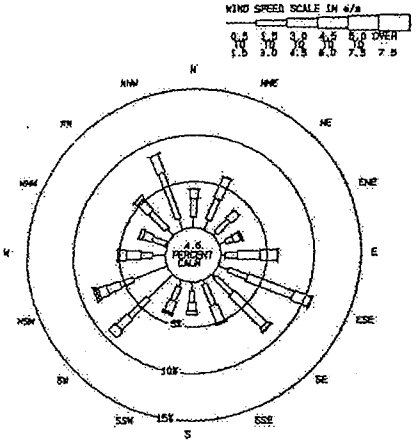
As can be seen from **Table 5.6**, existing dust levels around the Wallerawang area are low. The NSW EPA goals for the deposition of insoluble solids, state that residential areas begin to experience dust related nuisance impacts when dust deposition levels exceed 4g/m²/month

Annual and Seasonal Windroses

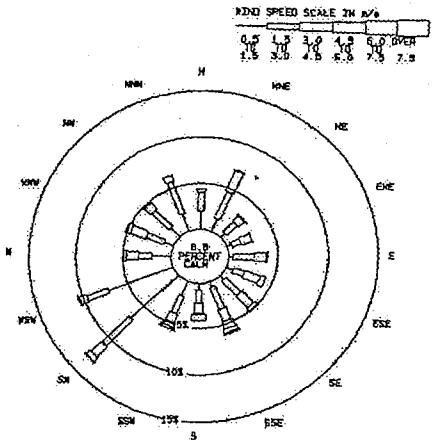
Mt Piper Power Station



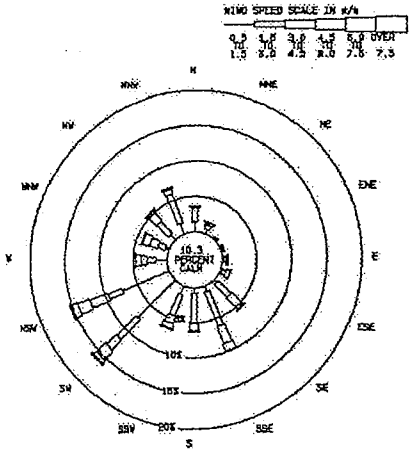
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Mount Piper - Annual 1997



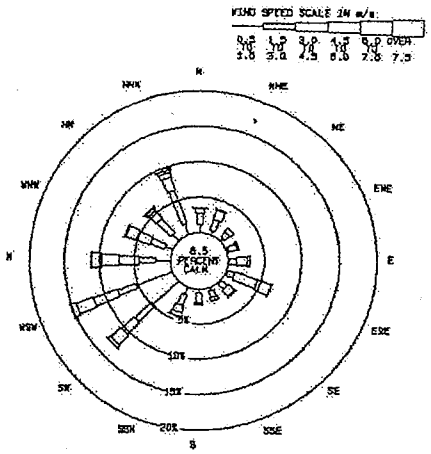
DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Mount Piper - Summer 1997



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Mount Piper - Autumn 1997



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Mount Piper - Winter 1997



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
Mount Piper - Spring 1997

Figure 5.3

WIND ROSES
MT PIPER POWER STATION

(annual average). Unacceptable levels of dust impact are expected to occur at $10g/m^2$/month. The dust monitoring results in **Table 5.6** show that the existing dust levels in the Wallerawang area are well below the EPA criteria.

5.7.3 Quartzite Dust and Human Health

Silica (SiO_2) exists as crystalline and amorphous forms, which relate to the structural arrangement of the oxygen and silicon atoms. Only the respirable particles of the crystalline forms are considered when determining the potential for human health effects. These particles are considered to be less than 5µm (0.005mm) in diameter. Over exposure to respirable crystalline silica may lead to the development of silicosis. This respiratory disease is characterised by scarring and hardening of the lung tissue, reducing the ability of the lungs to extract oxygen from the air.

There is no defined 'safe limit' for ambient quartz dust concentrations with respect to human health. The NSW EPA suggests that an annual average ambient concentration limit of 1 or 2 $\mu g/m^3$ for quartz dust may be calculated as the occupational exposure goal. However, extensive research in the United States suggests that a plausible upper limit of respirable crystalline silica in quarrying areas is 7% of the PM_{10} fraction.

5.7.4 Impact Assessment

Holmes Air Sciences undertook an Air Quality Assessment at the proposed quarry development site. A copy of the Final Report is provided as **Appendix 8.** The study includes an assessment of potential dust impacts from the proposed quarry operation and of the potential for silica dust exposure.

Dust dispersion modelling was undertaken as part of the Air Quality Assessment. It utilised available wind speed, wind direction, atmospheric stability and mixing height data to estimate dust dispersion potential for three operating scenarios:

Scenario 1:	normal production rate (125,000tpa),
Scenario 2:	maximum production rate (500,000tpa), and
Scenario 3:	maximum production rate with a permanent crushing and screening plant (worst case scenario).

Modelling results were assessed against the accepted air quality standards/goals outlined in **Table 5.7**.

Table 5.7 - Air Quality Standards/Goals for Particulate Matter Concentrations

Parameter	Standard / Goal	Agency
Total Suspended Particulate Matter (TSP)	90 $\mu g/m^3$ (annual mean)	NHMRC
Particulate Matter < 10µm (PM_{10})	50 $\mu g/m^3$ (24-hour maximum) 30 $\mu g/m^3$ (annual mean)	NSW EPA
Estimated Respirable SiO_2 (7% PM_{10})	1 - 2 $\mu g/m^3$ (occupational exposure)	NSW EPA
Nuisance Dust Deposition	< 4 g/m^2/month (annual mean)	NSW EPA

Dispersion and deposition modelling results for the proposed quarry development are summarised in *Figures 5.4* to *5.7* (Scenario 1) and *Figures 5.8* to *5.11* (Scenario 3), and discussed as follows.

Scenario 1 represents the most likely operational and production mode for the proposed quarry development. This scenario assumes a production rate of 125,000tpa and would involve the use of a mobile crushing plant located on the quarry floor. Modelling for this scenario predicted the following dust generation and dispersion values:

- PM_{10} (24-hour average) concentrations would not exceed 20$\mu g/m^3$ in areas of existing or potential residential development;
- PM_{10} (annual mean) concentrations would not exceed ~ 2 $\mu g/m^3$ in areas of existing or potential residential development;
- annual mean TSP concentrations would not exceed 1 $\mu g/m^3$ in the vicinity of either existing or future housing developments; and
- increases in dust deposition rates for the surrounding area would not exceed 0.1 g/m^2/month.

Scenario 3 represents the extreme (worst case) for dust emissions in terms of production rate and mode of operation. This scenario assumes the maximum production rate of 500,000tpa and would involve the use of a fixed crushing and screening plant located at a surface facilities site to the west of the proposed quarry development. These results are provided as maximum predicted dust generation and dispersion values for the proposed quarry development:

- PM_{10} (24-hour average) concentrations would not exceed 30$\mu g/m^3$ in areas of existing or potential residential development;
- PM_{10} (annual mean) concentrations would not exceed ~ 2 $\mu g/m^3$ in areas of existing or potential residential development;
- annual mean TSP concentrations would not exceed 2 $\mu g/m^3$ in the vicinity of either existing or future housing developments; and

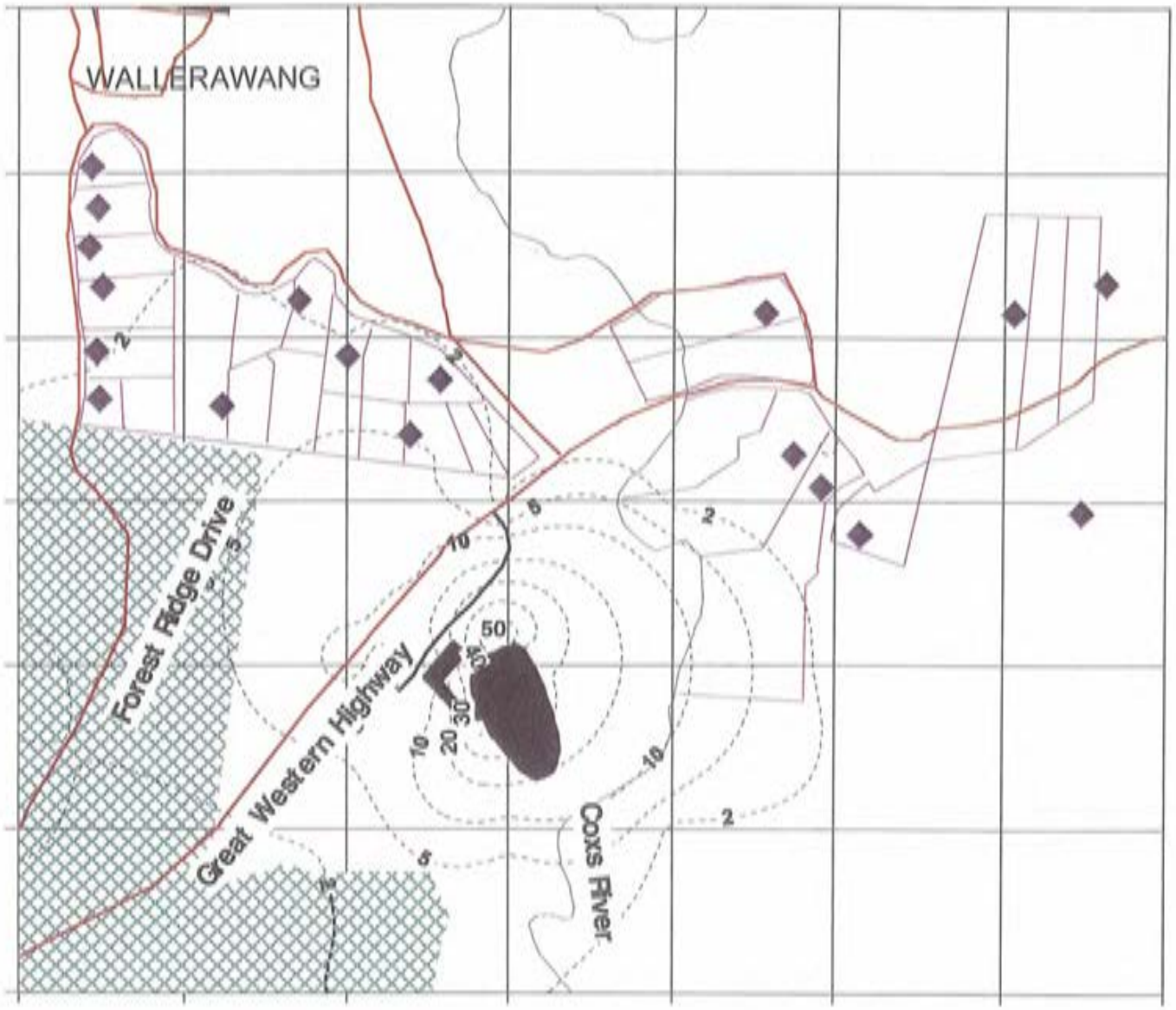


Figure 5.4

SCENARIO 1 - PREDICTED MAXIMUM 24 HOUR AVERAGE GROUND LEVEL PM10 CONCENTRATIONS (µg/m3)
(125,000 tonnes/yr and mobile crushing plant)

Base Map Source: Surveyor-General's Department 1998, NSW4436(M2118)

Figure 5.17

LAND USE & ZONING.

Table 5.11: Reference Points for Visual Impact Assessment

View Point	Location
1 (Refer to Plate 2)	Rocky Waterhole. Nearest residents north-east of the quarry. Elevation approximately 950m AHD.
2 (Refer to Plate 4)	Great Western Highway at Coxs River Bridge. Elevation approximately 870m AHD.
3 (Refer to Plate 6)	Wallerawang Primary School. Elevation approximately 880m AHD.
4 (Refer to Plate 8)	Great Western Highway, west of the site. Elevation approximately 980m AHD.

Helium-filled balloons were used to help delineate the site in photographs and in subsequent impact assessment.

5.10.2 Impact Assessment

Visual impact assessment was undertaken by viewing the site from all surrounding public viewing points and on a number of private properties. The predicted impact of changes to the visual environment as a result of the quarry was assessed using sight line sections from the viewing position towards the proposed quarry development site. The results were depicted graphically using 'Photoshop' computer software and the most representative are included in this report.

The proposed quarry development will result in minor alterations to the visual landscape. These changes will consist of vegetation clearing during pre-quarry development, modifications to topographic features during Stages 1 and 2 of quarry operations as the hill surface is lowered and exposure of rock surfaces during quarry operations. Possible impacts will be limited to Stages 1 and 2 of quarry development as Stage 3 represents a deepening of the area disturbed during Stage 2.

View Point 1 is located near the residential properties to the NE of the proposed quarry development site. Situated at approximately 20m below and 1200m away from the proposed quarry site, the visual impacts will be limited to a minor change in topographical outlook from this site (*Plates 2 & 3*). It is anticipated that the quarry operations will not be seen as a result of the tree cover. Topographic alteration will be represented by a lowering of the tree profile from this view point.

View Point 2 is located on the southern side of the Great Western highway at the Coxs River Bridge, NE of the proposed quarry development. Situated at approximately 100m below and 900m away from the proposed quarry site, the visual impacts will be limited to a minor change in topographical outlook from this site (*Plates 4 & 5*). It is anticipated that the quarry operations

will not be seen as a result of the tree cover. Topographic alteration will be represented by a lowering of the tree profile from this view point.

View Point 3 is located adjacent to the Wallerawang Primary School, north of the proposed quarry development site. Situated at approximately 80m below and 1800m away from the proposed quarry site, the visual impacts will consist of a lowering of the surface topography visible from some locations at this site (*Plates 6 & 7*). However, much of the profile will blend with the background landforms.

View Point 4 is located on the northern side of the Great Western Highway, NW of the proposed quarry development site. Situated in a slightly elevated position and approximately 800m away from the proposed quarry site, this view represents the quarry outlook visible to eastbound highway traffic. Visual impacts will consist of a lowering of the topographical landform and a gradual exposure of disturbed rock surface as the Stage 1 and 2 highwall takes shape on the eastern side of the proposed quarry development (*Plates 8 & 9*). *Plate 10* illustrates how the rehabilitation of the land surface to the east of the Stage 2 trench (commencing Year 3) will soften the visual outlook from this view point.

Existing trees of 10-15m in height will largely screen all quarrying operations from view points to the north and east of the site (Viewpoints 1, 2 and 3). Views to the Quarry from View Point 4 will predominantly occur from eastbound vehicular traffic, travelling at a nominal speed of 110km/h.

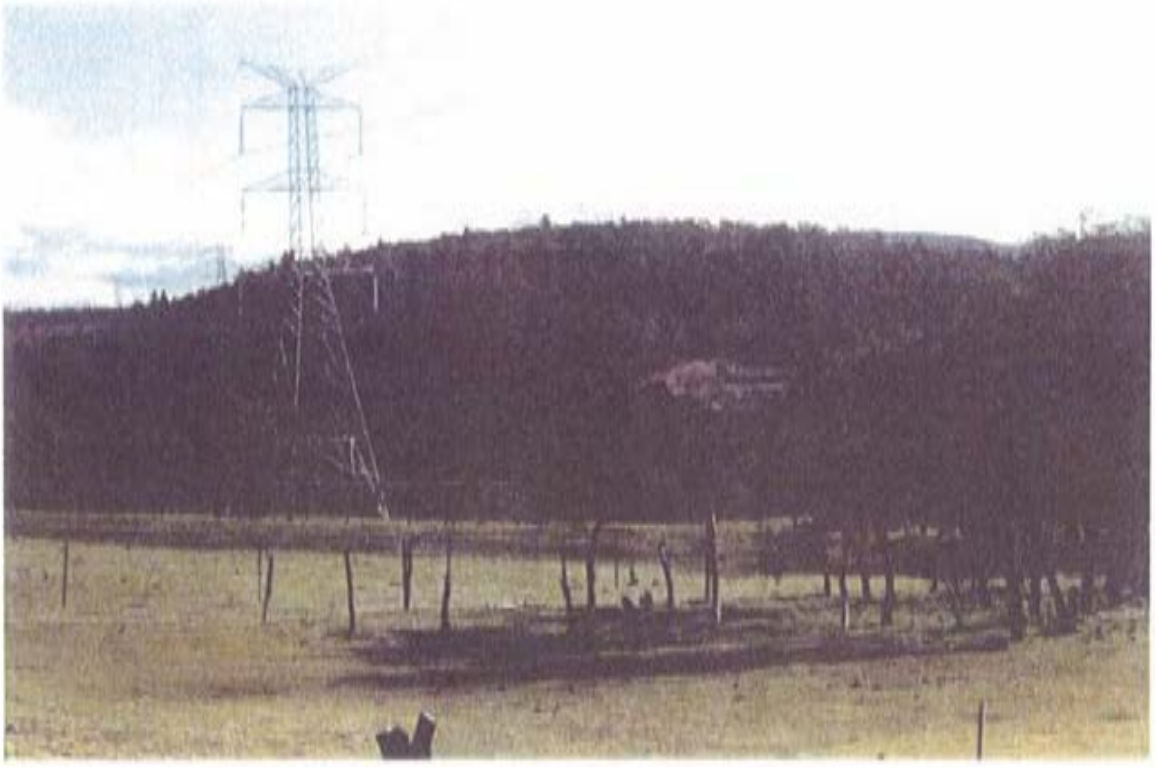
The quarry surface facilities area and stockpiles are not expected to be visible from the Great Western Highway at View Point 4. This view will be below the level of the quarry surface facilities area and filtered by existing trees.

The proposed quarry will operate predominantly during daylight hours. Lighting of the site will occur to a limited extent during winter, for maintenance activities, security purposes and for early morning loading of trucks. Lights will be specified as low glare and will be orientated away from public viewing locations. No visual impacts are expected to occur at night.

5.11 RECREATION

5.11.1 Existing Environment

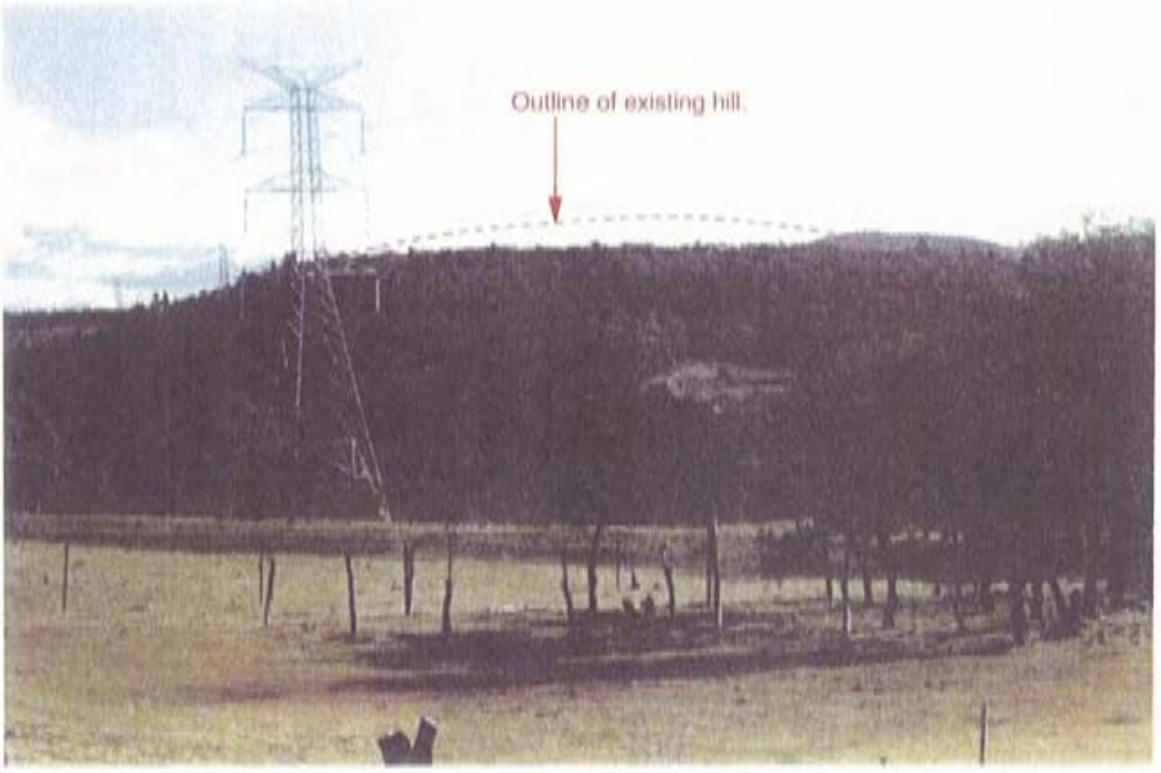
The proposed quarry development site is located upon both private property (Lot 6, Hickman and Goh, for which an option to purchase agreement is available) and State Land, managed by NSW State Forests. Recreational use of the State Forest land is known to occur, with trail bike riding allowable and identified in the area. No bush walking is known to occur within the site



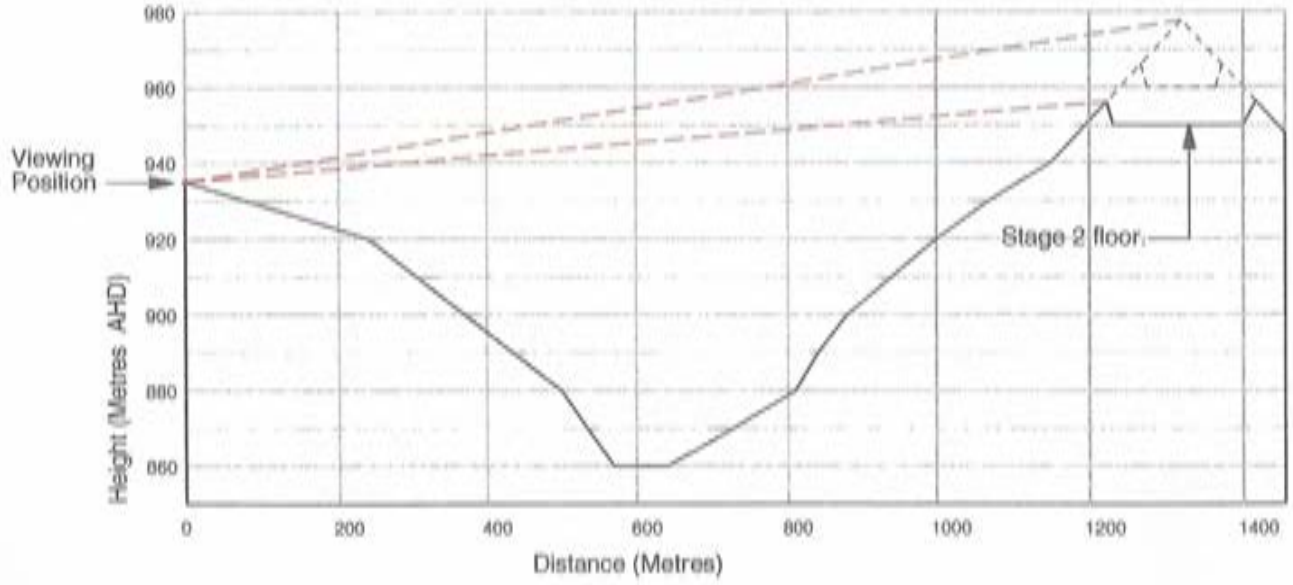
Existing.
70 mm Lens.

Plate 2.

EXISTING VIEW FROM ROCKY WATER HOLE



Stage 2.
70 mm Lens.



Line of Sight Section.
Scale
Vertical 1:2000 (5x exaggeration)
Horizontal 1 : 10000

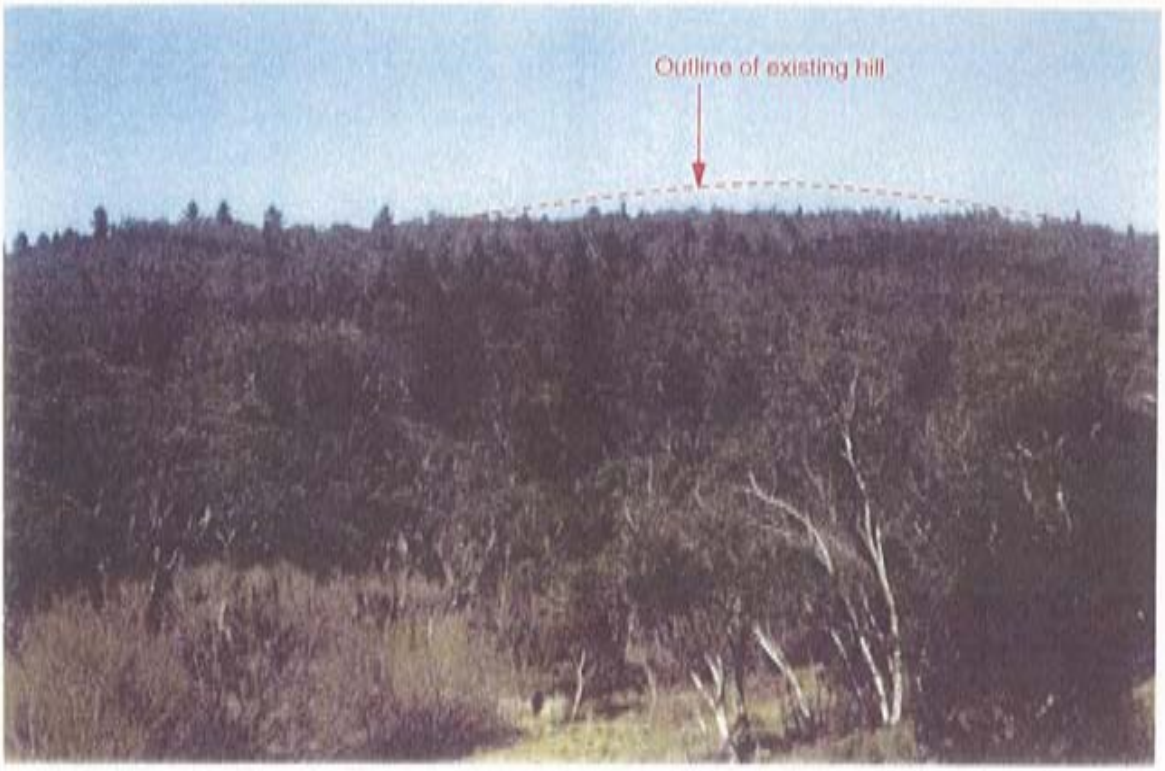
Plate 3.

VIEW TO QUARRY FROM ROCKY WATER HOLE

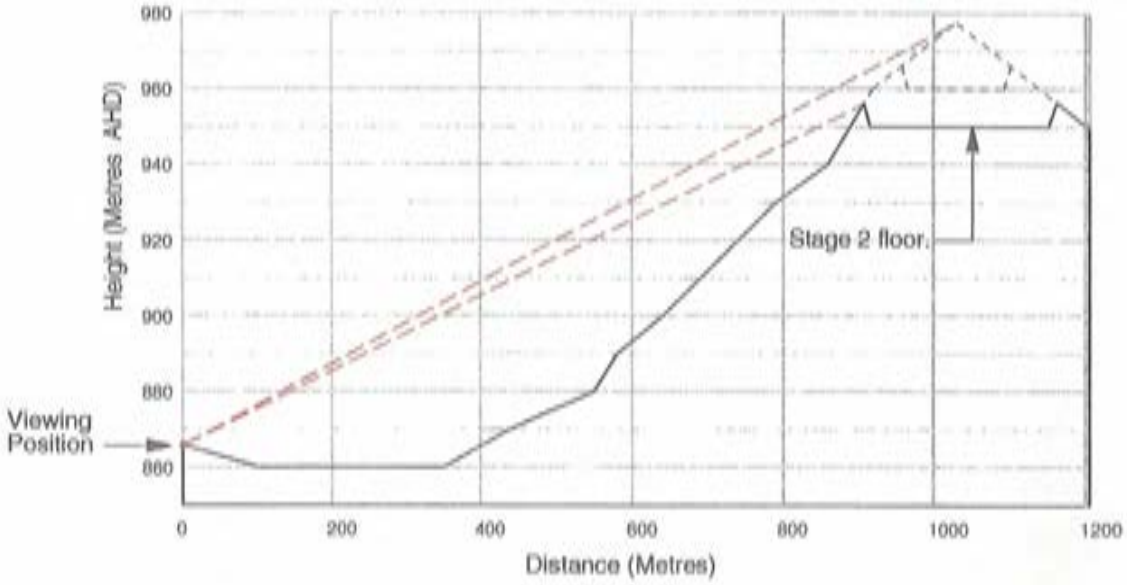
Existing.
70 mm Lens.

Plate 4.

EXISTING VIEW FROM THE COXS RIVER BRIDGE.



Stage 2.
70 mm Lens.



Line of Sight Section.
Scale
Vertical 1:2000 (5x exaggeration)
Horizontal 1 : 10000

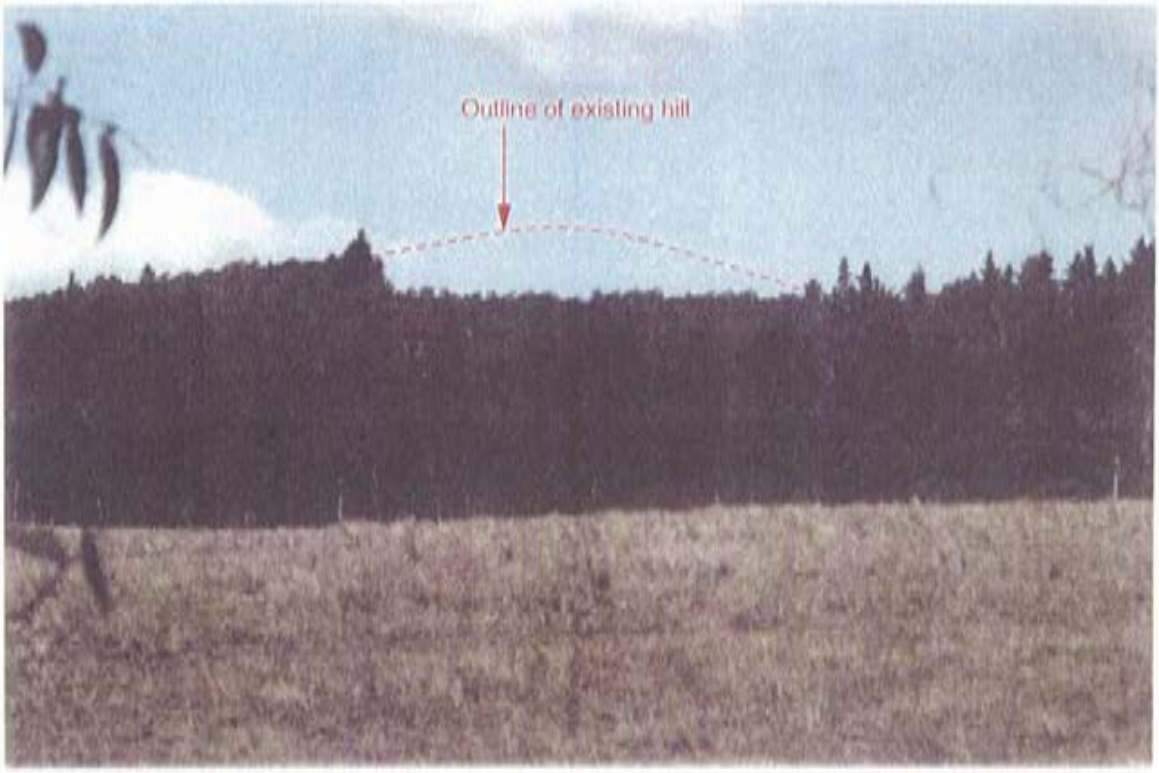
Plate 5.

VIEW TO QUARRY FROM THE COXS RIVER BRIDGE.

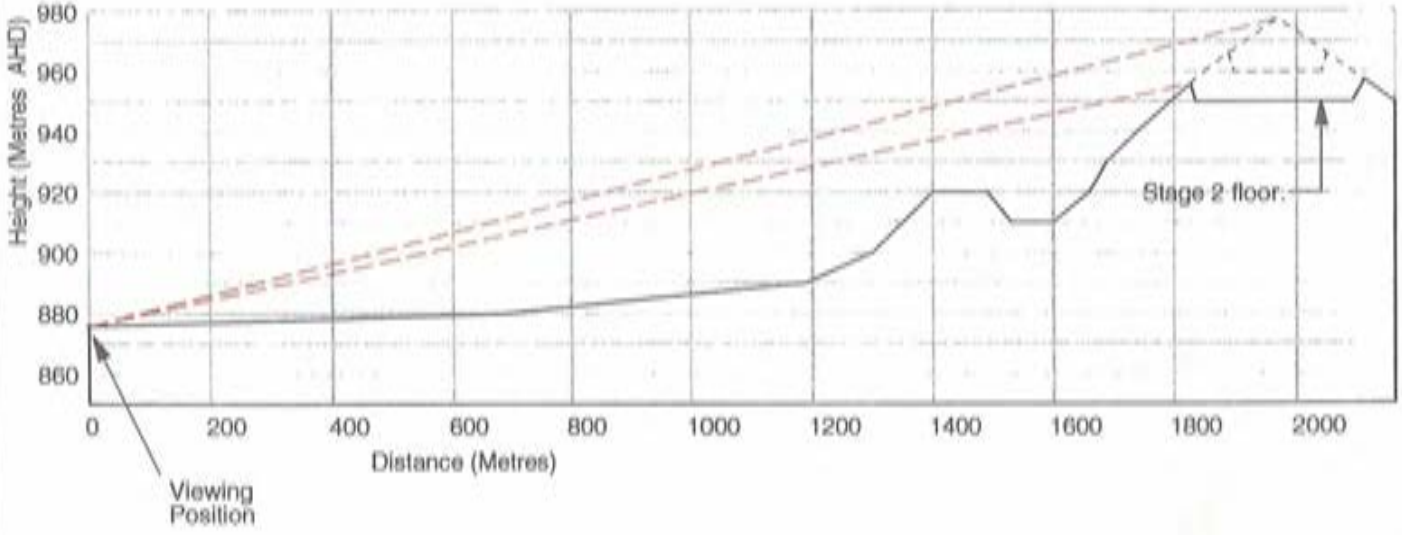
Existing.
210 mm Lens.

Plate 6.

EXISTING VIEW FROM THE WALLERAWANG PRIMARY SCHOOL.



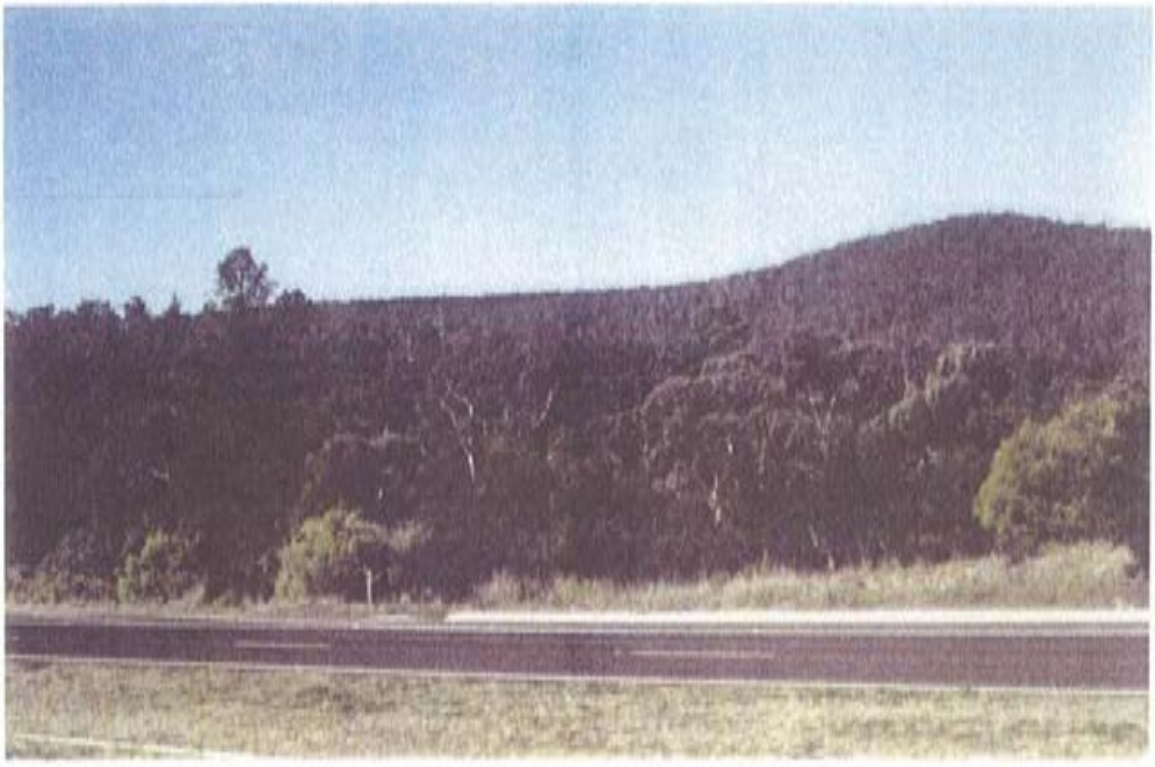
Stage 2.
210 mm Lens.



Line of Site Section.
Scale
Vertical 1:2500 (5x exaggeration)
Horizontal 1 : 12500

Plate 7.

VIEW TO QUARRY FROM THE WALLERAWANG PRIMARY SCHOOL.

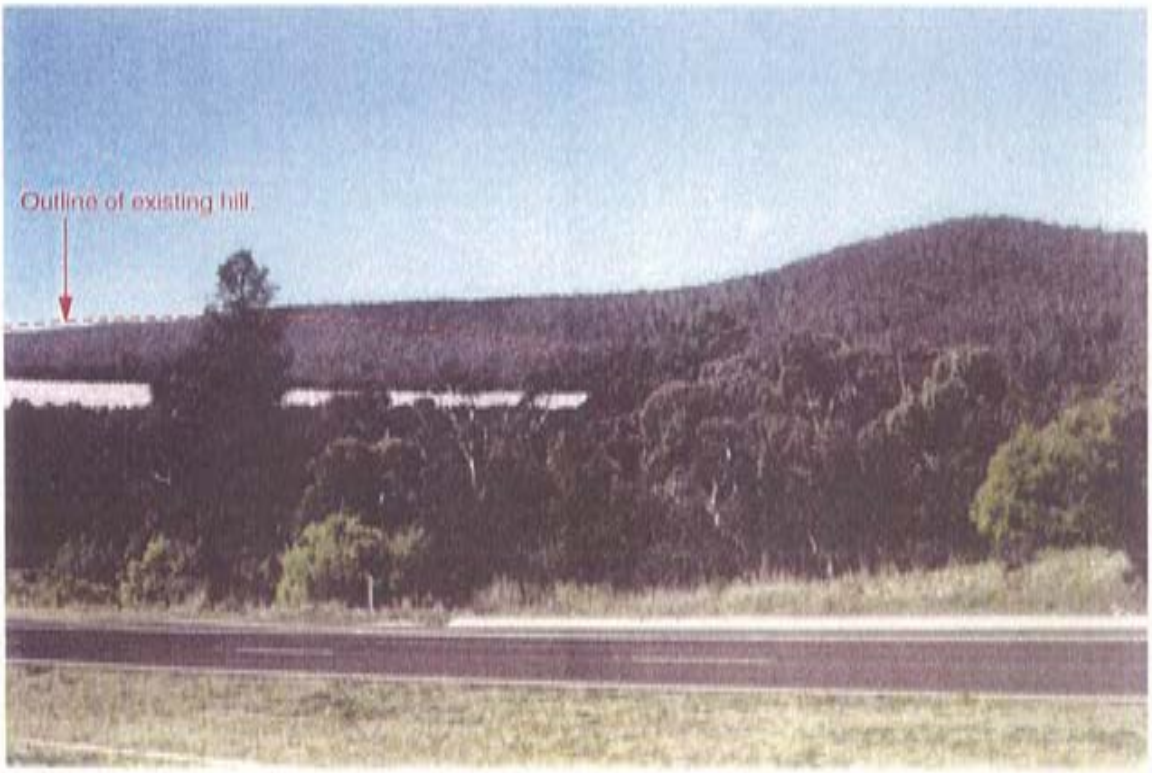


Existing.
70 mm Lens.

Plate 8.

EXISTING VIEW FROM THE GREAT WESTERN HIGHWAY.

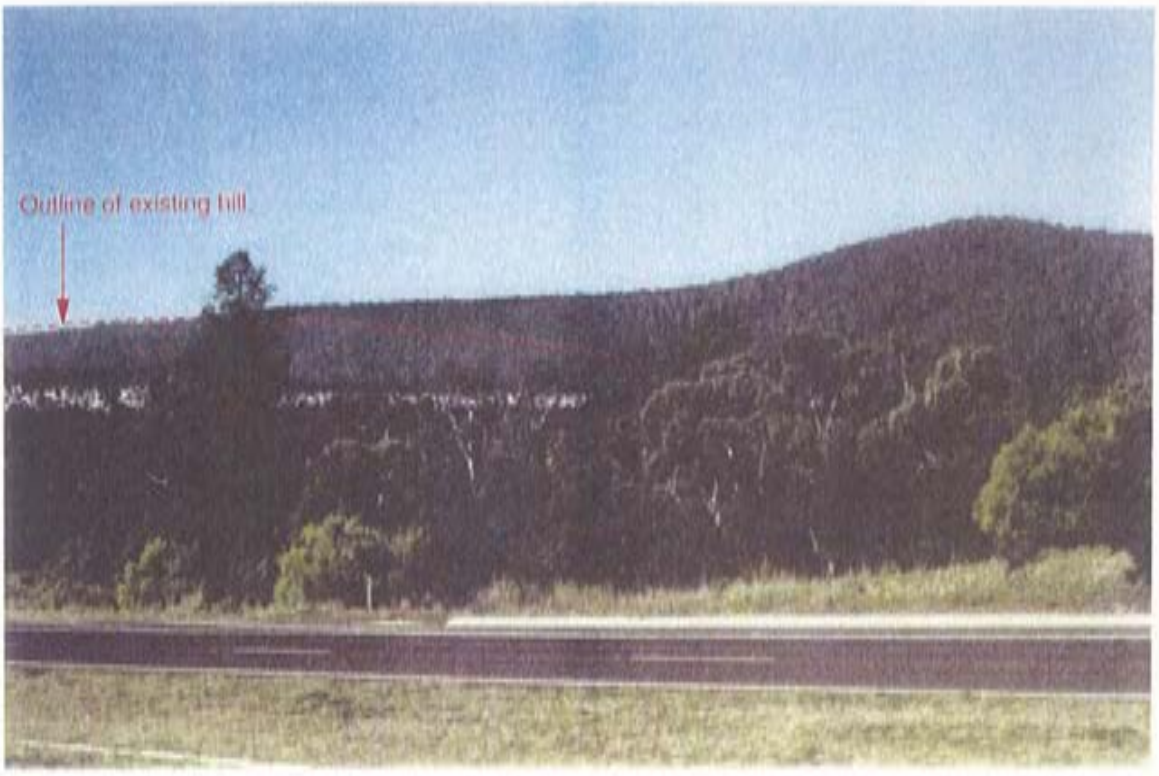
Stage 1.
70 mm Lens.



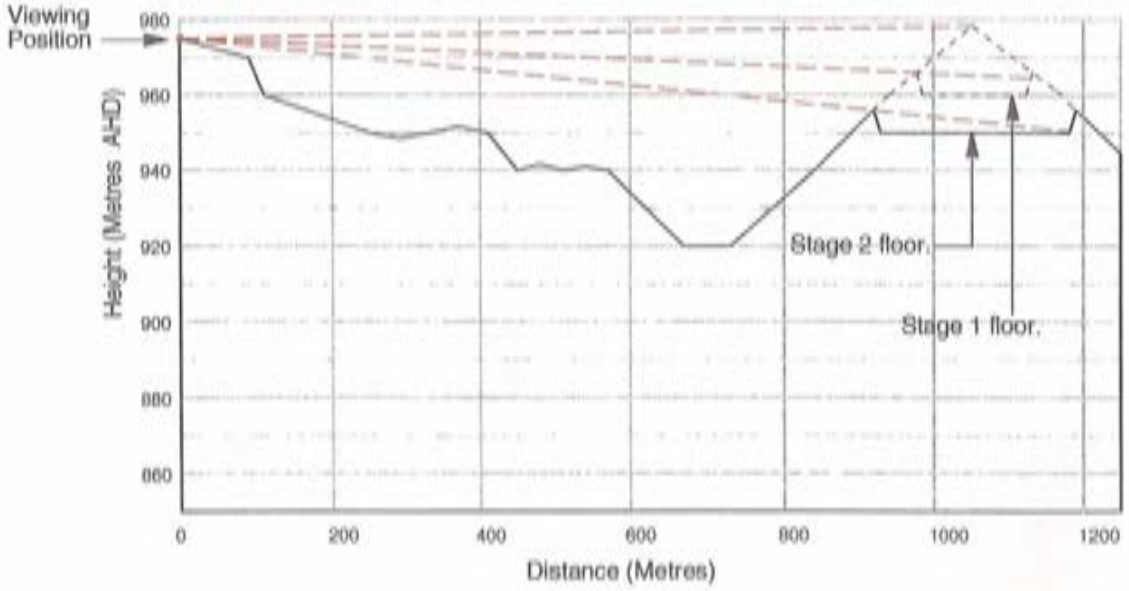
Stage 2.
70 mm Lens.

Plate 9.

VIEW TO QUARRY FROM THE GREAT WESTERN HIGHWAY.



Rehabilitation.
70 mm Lens.



Line of Sight Section.
Scale
Vertical 1:2000 (5x exaggeration)
Horizontal 1 : 10000

Plate 10.

VIEW TO REHABILITATED QUARRY FROM THE GREAT WESTERN HIGHWAY.

proposed for development. The Coxs River is an active trout fishing river, popular with a small number of local enthusiasts and visitors.

5.11.2 Impact Assessment

The development of the proposed quarry will result in a number of tracks within the site vicinity being closed to trail bike riding. This is not expected to have a significant impact on amenity, as the area of restriction is only a small fraction of the trail area available within the adjoining Lidsdale State Forest.

Strict water management controls, including a nil discharge policy (except under extreme circumstances), will be implemented to ensure that quarrying operations do not adversely affect the water quality and hence fishing potential of the Coxs River. As part of the Water Management Plan for the site, a water quality monitoring program will be implemented to monitor the success of on-site water management controls.

Access to the River will not be impeded during quarry development and operation, as several alternative access routes exist.

5.12 LAND USE, TENURE AND SERVICES

5.12.1 Existing Environment

Land uses within the vicinity of the proposed quarry development site are shown in *Figure 5.17*. The two major land use zones to the south of the Great western highway are Rural Forestry, zoned 1(f), and general agriculture, zoned 1(a) Rural General. The area to the north of the Great Western Highway and adjacent to the proposed development is comprised of predominantly small rural holdings, zoned 1(c) and Rural Forestry 1(f).

The proposed quarry development site is located upon land zoned both 1(a) and 1(f). The majority of the site is located on State land, operated and managed by NSW State Forests (Lidsdale State Forest), while the remainder of the proposed quarry site is privately owned. The proponent has acquired an option to purchase the privately owned portion of the site, pending development approval for the project.

The main agricultural land use in the area is forestry within the Lidsdale State Forest. The Marrangaroo Quartzite Quarry, established in 1912, is located 3km SE of the proposed quarry development site.

Nineteen dwellings are located within 2km of the proposed quarry development site. The majority are located to the NW of the site along Forest Ridge Drive and adjacent roads.

Table 5.12 lists all nearby residents and their relative distances from the proposed quarry site. *Figure 5.18* identifies the location of each dwelling.

Table 5.12: Nearest Residents

Residence No.*	Resident	Minimum Distance and Direction from Quarry	Land use
1	Mr DJ and Mrs KL McGrath	1.8 km NW	Rural Residential
2	Mr LW and Mrs CJ Bird	1.7 km NW	Rural Residential
3	Mr DA and Mrs LM Doonan	1.6 km NW	Rural Residential
4	Mr JW and Mrs CA Stevens	1.4 km NW	Rural Residential
5	Mr JW and Mrs JK Brew	1.2 km NW	Rural Residential
6	Mr RD and Mrs DJ Martin	1.2km NW	Rural Residential
7	Mr WJ and Mrs R Edwards	1.0km NW	Rural Residential
8	Mr G and Mrs RM Partridge	1.2km NW	Rural Residential
9	Mr JR and Mrs SG Paine	1.0km NNW	Rural Residential
10	Mr MA and Mrs TL Nolan	650m NNW	Rural Residential
11	Mr BH Skelton and Ms JA Egan	750m NNW	Rural Residential
12	Mr RW Barker	1.2km NE	Rural residential
13	Mr and Mrs Booker	1.6km NE	Rural Residential
14	Mr GD and Mrs SL Williams	2.0km NE	Rural Residential
15	Mr GR and Mrs KS Brown	1.6km NE	Rural Residential
16	Mr MC Wilson	1.1km ENE	Rural residential
17	Mr E and Mrs R Hussein	1.1km NE	Rural residential
18	Mr M Griffiths and Mrs NI Wright	1.0km NE	Rural residential
19	Mr RC Hickman and Mrs PP Goh	250m NE	Rural residential

A power supply easement is located adjacent to the southern extremity of the proposed quarry development site. As part of Delta Electricity's power supply infrastructure, the easement, as shown in *Figure 1.2*, contains high-tension overhead power transmission lines and associated towers.

The proposed quarry development site is not serviced by water, sewerage, power or telephone.

5.12.2 Impact Assessment

The proposed quarry development will not result in any changes to potential land use in the vicinity of the site. Forestry operations in the Lidsdale State Forest will not be affected by the development as the site is considered too steep for timber harvesting and not included in any compartment. It is not likely that other agricultural activities in the area will be impacted by the proposed development.

Base Map Source: Surveyor-General's Department 1990. NSW4430(M2116)

6 Residence

18 Caravan

13 Block number in subdivision

0 1000m

1:15 000

Figure 5.18

ADJACENT LAND SUBDIVISIONS AND RESIDENCES

The amenity of nearby residents is unlikely to be significantly impacted by the proposed quarry development. Previous sections (**Section 5.7**-Air Quality, **Sections 5.8** & **5.9**-Noise and Blasting respectively, **Section 5.10**-Visual and **Section 5.11**-Recreation) have outlined the potential impacts of the quarry proposal and provided management proposals for each item.

To avoid any potential impact, a 50m set back will be maintained from the power pylon located at the southern end of the proposed quarry development.

With the exception of power and telephone, no other services will be connected to the site. Potable water will be purchased off-site as required, while all other water requirements (dust suppression, vehicle washing, landscaping *etc.*) will be met by on-site storage in the Water Management Dam. Wastewater services will be provided by the installation of a packaged Aerated Wastewater Treatment System (AWTS) to service the office and amenities. All treated water from the system will be irrigated onto a managed landscape area.

5.13 PLANNING AND ZONING

5.13.1 Existing Environment

The project is an integrated development under the provisions of the EP&A Act, 1994, as it requires approvals from other statutory approvals as prescribed in the POEO Act, 1997.

The proposal is a State Significant Development because the initial extraction rate at the proposed quarry will exceed 200,000tpa. As such, the Minister for Urban Affairs and Planning is the Determining Authority for the proposal.

The provisions of SEPP No 44 - Koala Habitat Protection apply to this development as the proposal comprises a parcel of land greater than 1ha, that lies within a Local Government Area specified in Schedule 1 of SEPP 44.

The provisions of State Environmental Planning Policy No 58 - Protecting Sydney's Water Supply (SEPP 58) apply to developments in this area, as the Lithgow area is within one of the hydrologic catchments supplying water to the Greater Sydney region. The aims of SEPP 58 are:

- to provide a notification system whereby the Sydney Water Catchment Authority is informed of development within these catchments;
- to ensure consistency in approach to assessment and control of development within these catchment; and

- to ensure that development within Sydney's water catchments does not have a detrimental impact on water quality.

The zoning of land in the area of the proposal is a combination of Rural General 1(a) and Rural Forestry 1(f). Land within the proposed quarry development site is considered unsuitable for forestry activities and the encroachment of other agricultural activities is considered unlikely given the nature of the terrain. Current land zoning within the vicinity of the site is not expected to change within the foreseeable future.

5.13.2 Impact Assessment

As a Designated, Integrated and State Significant Development, the EIS phase of this development proposal has included a comprehensive community and statutory consultation process (**Section 3.10**). The comments and feedback from all approval authorities has been integrated into the content of this document. **Tables 1.1 and A1.1** (**Appendix 1**) highlight the major concerns raised about the project and **Table 1.1** identifies the relevant section of the document addressing the concern.

Consideration of the proposed quarry site under SEPP 44 "Koala Habitat Protection" was undertaken by a qualified consultant; refer to **Section 5.5** and **Appendix 4**. The assessment described in **Section 5.5.3**, determined that the site does not constitute "Core Koala Habitat".

SEPP 58 requires the proponent to implement measures so as to ensure the protection of Sydney's water catchment to the satisfaction of the SCA. The management strategies proposed in **Sections 4.1, 4.4 and 4.5** will be implemented to ensure the protection of Coxs River and hence meet the requirements of SEPP 58.

As described in **Section 4.5**, the proponent is committed to rehabilitating the quarry site to a state similar in species diversity and density to that which currently exists. **Section 5.3** states that the land capability post quarrying will be reduced from a mixture of Classes VI and VII to mostly Class VII because of the shallow soil profile in rehabilitation areas. Class VII land is best protected by green timber and the rehabilitation of the site with endemic trees, shrubs and groundcovers is an acceptable consequence of the project.

Extractive industry represents permitted development under the existing site zoning, provided development consent is received from the Determining Authority. Council needs to be aware of the assessed Quarry impacts when considering future development applications in the vicinity of the Quarry, so as to avoid future conflicts.

5.14 TRANSPORT

5.14.1 Existing Environment

The Great Western Highway, passing directly north of the site, is classified as a State Highway and provides the major access route between Sydney and the NSW Central West. It is constructed as a dual carriageway, with a sign-posted speed limit of 110km/h. In the vicinity of the proposed quarry development, the Great Western Highway comprises a long uphill gradient (6-8%) towards the west.

Existing traffic loads on the Great Western highway consist primarily of:

- local traffic from the Lithgow and Wallerawang districts;
- NSW regional traffic; and
- Intra-State freight transport.

Presently there is no direct access to the proposed quarry development site from the Great Western Highway. However, there are several at-grade junctions in the vicinity of the proposed quarry including:

- Barton Avenue – approximately 500m east of the quarry site;
- Forest Ridge Road – approximately 1km west of the quarry site; and
- Gemalong Close – approximately 2km east of the quarry site.

RTA statistics, reported in the Traffic Assessment Study (**Appendix 2**), indicate that truck movements comprise approximately 10% of total traffic volumes on the Great Western Highway and Mudgee Road, while vehicle movement on Barton Avenue is dominated by light traffic (**Table 5.13**).

Table 5.13: Existing Traffic Volumes

Road Name	AADT (Year of Count)	Average Vehicles per Day		
		Light Vehicles	Rigid Trucks	Articulated Trucks
Great Western Highway	9,550 (1999)	6,900	430	570
Barton Avenue	2,300 (1998)	2,170	80	10
Mudgee Road	4,375 (1999)	3,655	160	220

Source: RTA

5.14.2 Impact Assessment

Three access alternatives for the proposed quarry development site were investigated and modelled for traffic impacts during the Traffic Assessment Study. The level of service and operational condition of each alternative was modelled using the INTANAL traffic systems program and measured against accepted performance standards.

The Traffic Assessment Study recommended that a new seagull junction, as shown in *Figure 3.11*, be constructed at the intersection of the proposed quarry access road and the Great Western Highway, approximately 500m west of Barton Avenue. The RTA also concurs with this decision, citing the new seagull junction as the preferred option. RTA correspondence is included in **Appendix 1**. *Figure 1.2* illustrates the location of the seagull junction in relation to the proposed quarry development. Modelling results indicate that the proposed seagull junction would operate with very low overall delays and a high level of service in terms of intersection operating conditions.

It is predicted that the market for quarry product towards the west will be negligible, with most of the quarry traffic travelling in an easterly direction on the Great Western Highway, towards Lithgow, the Blue Mountains and Sydney.

To minimise disruption to existing eastbound traffic flow on the Great Western Highway, an eastbound acceleration lane will be constructed along the existing depressed median (see *Figure 3.11*). The eastbound acceleration lane will be shielded from the fast-lane along its length and will allow laden eastbound traffic leaving the proposed quarry site to safely accelerate prior to entering highway traffic. Acceleration of eastbound truck traffic would be assisted by the downhill gradient, resulting in reduced impact on existing traffic flows. The provision of deceleration lanes for trucks entering the quarry from both the east and west will minimise the impact slower moving trucks may have on traffic on the Great Western Highway.

The predicted impact of quarry vehicles on traffic flow on the Great Western highway and Mudgee Road is shown in **Table 5.14**. Traffic generated by the Quarry will be predominantly heavy vehicles. For the Great Western Highway, the percentage increase in heavy vehicles will vary from 7% at the lower production rate (125,000tpa/150,000tpa) to 28% at the maximum production rate of 500,000tpa. For Mudgee Road, assuming that intensive development occurs on the Wallerawang Industrial Park, the percentage increase in heavy vehicles will vary from 18% at the lower production rate (125,000tpa/150,000tpa) to 73% at the maximum production rate of 500,000tpa.

Table 5.14: Predicted Truck Traffic Volumes

Road Name	Production Level	Average Movements Per Day		
		Existing Truck Traffic	Predicted Truck Traffic	Percentage Change (%)
Great Western Highway	125,000tpa	570	610	7
	500,000tpa	570	730	28
Mudgee Road	125,000tpa	220	260	18
	500,000tpa	220	380	73

The predicted hourly truck traffic movements on the Great Western Highway at the proposed seagull intersection are shown diagrammatically in *Figure 5.19*. Contributions arising from the proposed quarry development are shown in bold.

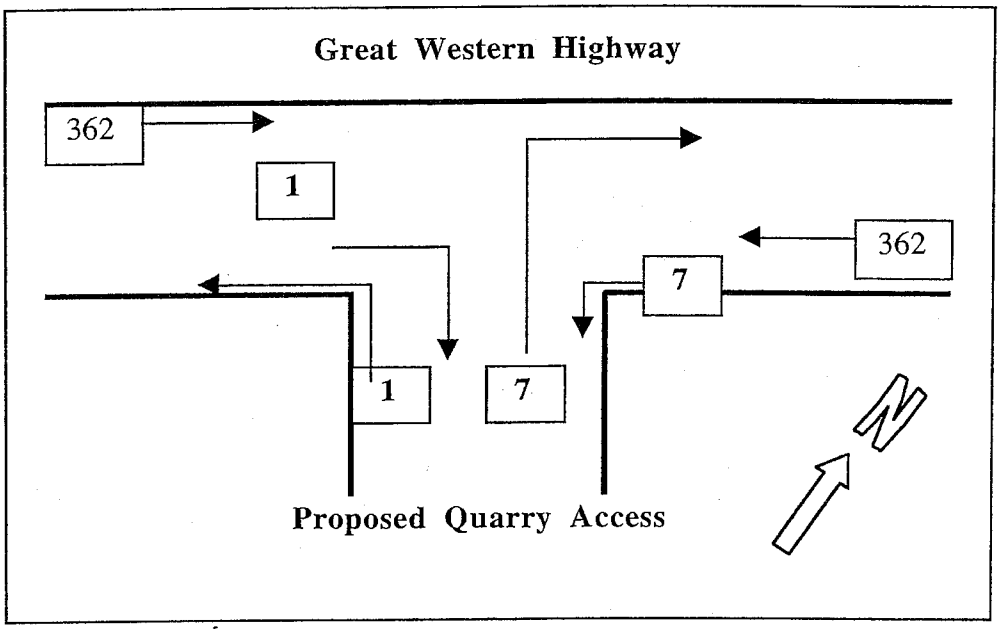


Figure 5.19. Estimated Hourly Truck Movements Associated with the Proposed Quarry Development (500,000tpa).

At times it will be necessary to suspend traffic on the Great Western Highway for short periods of time during blasting operations. DMR safety regulations require that the Highway be closed temporarily when blasting operations are to occur within 500m of the traffic corridor. This action will be necessary during the majority of blasting within the quarry except when operations are at the southern extremity of the quarry.

To ensure that transport disruptions are minimised, blasting operations will be planned in co-ordination with RTA advice and assistance. This action is necessary to ensure that the safety of the transport corridor is protected during blasting operations.

5.15 SOCIO-ECONOMICS

5.15.1 Existing Environment

The proposed quarry development site is located in a region dominated by forestry and agricultural operations. The principal employers in the region include coal mining (Newcom and Angus Place Collieries), power generation (Wallerawang and Point Piper Power Stations) and rural/industrial operations.

The total population of the Greater Lithgow Local Government Area is estimated at 19,719 (Lithgow City Council, *pers. comm.*, 2000) and is expected to increase to around 21,600 by the year 2004 and 25,900 by 2018 (ABS, 1996). Unemployment in the region is approximately 11% and is typical for many regional communities in NSW.

5.15.2 Impact Assessment

The proposal will result in a number of positive socio-economic impacts for Wallerawang and the Greater Lithgow region. During development and operation of the project, the opportunity exists for continued employment of up to four employees. Additional direct employment will also result from the use of subcontract hauliers and machinery hire.

The output value from the quarry will be approximately $3.85M per annum at an average production rate of 175,000tpa, or $77M for the life of the quarry. Direct annual expenditure will include wages, taxes, materials and services, with the majority being expended in the local area. Increased overall employment and expenditure resulting from the development of the project will occur through both indirect and induced multiplier effects.

The development of the proposed quarry is not likely to alter the demand for housing, facilities or services in the local region.

5.16 HAZARD ANALYSIS

State Environmental Planning Policy No. 33-Hazardous and Offensive Development (SEPP 33) requires that potential hazards or offensive impacts of a proposal are identified and addressed as part of the development application process.

The proposed quarry will involve several activities and operations, which may have the potential for hazardous or offensive impacts.

The primary hazard identified will be the transport and use of explosives for blasting purposes. To minimise the risk of hazardous impact from this activity the following actions will be undertaken:

- detonators and initiating systems will be stored on-site in a bunded and secure storage magazine as prescribed by the requirements of the Dangerous Goods Act 1975;
- bulk ANFO explosive material will be stored off-site and delivered, prepared and used at the site only on specified blasting days. Excess material will be removed from the site on completion; and
- blasting will be undertaken by qualified contractors on a periodic basis. For each blasting campaign, enough raw material will be won for one to two months processing and marketing.

The operation of the proposed quarry development may also result in several other potentially hazardous or offensive activities. Each of these has been identified and described, along with proposed mitigation measures, in **Table 5.15**.

Table 5.15: Hazard Analysis for Proposed Quarry Activities

Environmental Hazard	Environmental Risk Potential	Mitigation Measures
Site Contamination • Risk of operations contaminating site	Low	• Chemicals and waste materials will be stored in appropriately protected areas as described in **Section 4.4**. • Fuel to be delivered to the site by a licensed contractor who will be required to carry a hydrocarbon clean up kit. • Hazardous chemicals are not used in the process.
Surface Water Contamination • Risk of disturbed water discharge to the Coxs River	Low	• Appropriate Water Management Plan as described in **Section 4.1**. • Maximum re-use of water generated on-site. • Water quality monitoring program to be included in Water Management Plan for site. Sampling will be undertaken within adjacent catchment area. • Regular maintenance of water management structures.
Disturbance of Archaeological Material	Low	• Fencing provided around identified aboriginal archaeological site. • Employee/Contractor induction program. • Management strategies in case of further archaeological discoveries, as per **Section 5.4**.
Air Quality • Respirable silica - health	Low	• Predicted amount of silica to be generated is well below accepted standards.
Noise • Risk of excessive noise impacts to residents	Low to Medium	• Restriction of operations during adverse wind or weather conditions. • Noise monitoring to be undertaken.

Table 5.15: Hazard Analysis for Proposed Quarry Activities (Cont)

Environmental Hazard	Environmental Risk Potential	Mitigation Measures
Blast • Risk to Transmission Line pylon • Risk of flyrock damage	Low	• Vibration monitoring to be undertaken at base of pylon. • Minimum 50m set back established for quarry operations. • All blasts will be monitored. • Utilisation of small diameter drill holes and delayed initiation blasts. • Temporary highway closure during blast operations.
Bush Fire Management • Risk of bushfire at site	Low	• Fuel reduction program undertaken around quarry area as necessary. • Water Truck fitted with fire fighting appliances. • Extinguishers provided on-site.
Transport • Safe access to proposed quarry development site • Risk to existing highway traffic	Low	• New access junction as per RTA recommendation (**Section 5.14**). • Acceleration lane separated from highway traffic. • No truck movements allowed during poor visibility conditions. • RTA approved signage will be prominently displayed in both directions along the Highway warning motorists to be aware of truck movements.

5.17 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Ecologically Sustainable Development (ESD) relates to the use, conservation and enhancement of "the community's resources so that ecological processes are maintained and the total quality of life, now and in the future, can be increased". The Environmental Planning and Assessment Regulation 2000, lists the principles of ESD as:

(i) The Precautionary Principle

The EP&A Act, 1994, states that "if there are threats of serious or irreparable damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation".

The potential environmental impacts of the proposed development have been thoroughly analysed and appropriate mitigation and control measures have been incorporated into the project for pre-development, construction and operational phases. Threats of serious or irreparable damage to nearby environmental resources were assessed and mitigation methods detailed.

(ii) Social Equity

Social issues have been assessed throughout the EIS process, particularly when addressing flora and fauna, archaeology, visual amenity, noise and air quality, and economics.

Mitigation measures, including revegetation and rehabilitation of the site, the preservation of aboriginal archaeological relics, and the minimisation of impacts on surrounding residents over the life of the quarry will ensure that the proposal does not impact significantly on current or future generations.

The quarry has the potential to generate approximately $77M over its operating life. As preference will be given to local suppliers, contract hauliers and machinery hire, increased employment and expenditure resulting from the quarry operation will occur both directly and indirectly in the region.

(iii) Conservation of Biological Diversity

Biological diversity includes genetic, species, population, community, habitat and ecosystem diversity. The flora and fauna assessment (**Appendix 4**) found that floral and faunal species/habitat occurring on or near the proposed quarry site are not unique to the site and are not threatened by the proposed development. Impacts on species off-site will be minimised by careful establishment and maintenance of environmental controls including air quality, water and erosion controls. Rehabilitation of the site will aim to reproduce the species density and diversity present on the site prior to development of the quarry.

(iv) Valuation of Environmental Resources

To ensure the protection of environmental resources at the site and to mitigate against any potential or perceived environmental effect of the proposal, this EIS outlines an ongoing program of prevention, management and remediation for the proposed quarry site and surrounding areas.

Establishment will include installing water protection and erosion control measures. Revegetation, noise, air pollution and visual amenity controls will be in place throughout the life of the quarry, and the final landform will be seeded with endemic tree, shrub and groundcover species to produce a vegetative cover at a density similar to that which currently exists.

5.18 CUMULATIVE IMPACTS

The proposed quarry development site is located within an area of predominantly rural land uses. Comparable development within the project vicinity includes the Marrangaroo Quartzite quarry, located approximately 3km SE, the Wallerawang Power Station and the former coal loading facility, located approximately 5km NNE of the quarry development site. Although these developments produce similar emissions (dust, noise *etc.*) to those identified for the proposal, they are considered to be sufficiently distant from the proposed quarry, so as not to result in cumulative impacts to the surrounding environment.

Potential dust, noise and water quality impacts of the proposal were assessed using existing data for the area (including emissions from existing development) as the baseline for analysis. In all cases, predicted impacts were found to be minimal under most weather conditions. Under adverse weather conditions, mitigation and management options were identified and prescribed.

The proposal is expected to result in an increase in truck traffic volumes on the Great Western Highway and Mudgee Road. However, this increase is not likely to reduce the level of service available to existing road users. Modifications to the Great Western Highway at the proposed quarry access intersection will ensure the continued safety of all road users.

6. PROJECT JUSTIFICATION AND ALTERNATIVES

This section describes the need for the Wallerawang Quartzite Quarry, in the context of the availability of coarse aggregate within the Sydney Planning Region. Alternatives to the project and its justification are also discussed.

6.1 PROJECT JUSTIFICATION

Quartzite, quartz gravel and reef quartz deposits are the major source of coarse silica in New South Wales. Across the State however, there are only four deposits currently being worked.

Quartzite is quarried at Marrangaroo, near Lithgow, by Metromix Pty Ltd, for use as a flux in steel-making and as coarse aggregate. This quarry is located approximately 3km SE of the proposed development site.

At Bolivia, near Tenterfield, Tenterfield Silica Pty Ltd has mined a pipe-like body of extremely high purity quartz. This material has previously been exported to Japan to produce high-grade fused silica, it has been used as a filler in semi conductors for the electronics industry, in addition to its use as a refractory medium.

In the vicinity of Cowra, gravel deposits composed predominantly of high purity quartz pebbles are quarried at two locations - at "Glenella" by Glenella Aggregates Pty Ltd and at "Mulyan" by TJ Bryant Pty Ltd - principally for use as decorative aggregate and filtration gravels.

A report on potential supply and demand for coarse aggregate in the Sydney Planning Region (Pienmunne, 2000) found that currently identified resources within the planning region are sufficient to supply aggregate at present levels for the next ten years, after which significant shortages will occur as established supplies are exhausted. The report found that it is imperative that a strategy for sourcing and developing identified coarse aggregate resources outside the Sydney Planning Region be adopted. The proposed Wallerawang Quartzite Quarry has the potential to reduce the predicted shortfall in coarse aggregate resources in the long-term while also providing consistent local product in the shorter term.

The proposed quarry has been planned such that impacts to the surrounding environment have been minimised, where possible, through operational and design alternatives. Where impacts have been predicted to occur, mitigation and management strategies have been designed and proposed. These strategies will be supported by a set of Management Plans for the operation of the proposed quarry development.

6.2. CONSIDERATION OF ALTERNATIVES

6.2.1 Not Proceeding

The alternative of not proceeding with the proposed Wallerawang Quartzite Quarry requires analysis of the value of the resource and estimated tonnages. This has been undertaken prior to and during the development of this EIS. If this proposal does not proceed an estimated 3.5Mt of high quality quartzite (aggregate) will be lost to the Western Sydney/Lithgow construction industry. This equates to $77M over the life of the project.

In this case, alternative resources in the regions surrounding Sydney will need to be developed and aggregate for development in the Lithgow region will need to be imported.

6.2.2 Alternative Quarry Areas

Quarrying in the area surrounding the proposal is limited by the extent of similar resources, environmental factors and economic issues.

Sampling undertaken within the area covered by Exploration Licence EL 4473 has shown that the proposed quarry is the most appropriate location for extraction of the quartzite resource. Other quartzite bodies identified in the immediate area have been rejected for one or more reasons including:

- inaccessibility due to the presence of the Coxs River;
- steep slopes providing little or no opportunity for water diversion and treatment;
- proximity to the Coxs River, the Lidsdale State Forest, Great Western Highway and the power transmission easement; and
- inferior reserves of quartzite.

6.2.3 Alternative Quarrying Methods

Quartzite is a difficult material to extract due to its hardness. For this reason, drilling and blasting is the most appropriate means of extraction. The small (89mm) drill holes proposed will reduce the levels of vibration, overpressure and the chance of fly rock. No alternative methods are considered economically and environmentally acceptable.

6.2.4 Alternative Access Modes and Routes

A detailed assessment was undertaken of alternative access routes to the Quarry (**Appendix 2**). The assessment was able to discount a number of alternatives due to cost and/or safety issues. Of the remaining acceptable access routes, the proposed access is considered superior in that it requires less construction between the quarry and the Great Western Highway and a high level of safety. The RTA concurs with this decision.

6.2.5 Alternative Waste and Water Management Practices

Waste

The main wastes expected at the site are production wastes – unsold overburden and fines. The current proposal is to use these materials in the rehabilitation process, for backfill and construction of erosion/water management structures.

The alternative of transporting these wastes off-site is not acceptable for economic and environmental reasons. Off-site disposal would incur transport and disposal costs, and would require similar material to be purchased for construction works and rehabilitation at the quarry.

Water

The water and erosion control system proposed for this development is based on DLWC's "Erosion and Sediment Control Plans for Extractive Industries" guideline, and includes best practice techniques recommended in DLWC's "Urban Erosion and Sediment Control" and the NSW Department of Housing guideline "Managing Urban Stormwater: Soils and Construction". It is not considered practical or prudent to adopt an alternative strategy.

6.2.6 Final Landform Options

In determining the most appropriate post-quarrying landform, environmental issues such as noise, air quality and rehabilitation were considered. Leaving the eastern highwall as it is, is considered the most appropriate alternative as it helps limit noise and dust emissions during the operational phase, and will provide a final slope of around 50°, similar to existing gradients in the area.

The alternative of filling the Quarry to its original landform with clean fill is not economically viable. The alternative of filling the void with waste is not recommended due to the proximity of the site to the Coxs River and the potential for leachate transfer.

6.2.7 Alternative Product Transport Option

The proximity of the proposed quarry development to the Great Western Highway makes road transport of product to the Sydney market, the preferred option. Due to the nature of the market, product transport needs to be as versatile as possible to meet demand at a variety of locations.

The use of rail transport has been identified as an alternative product transport option. The Main Western Railway passes through Wallerawang to the north of the proposed quarry development site. The existing Wallerawang coal loader, currently used for the loading of timber, would enable rail transport to constitute an alternative transport option for the quarry product. However, significant limitations exist with this alternative. The product would have

to be moved to a bulk supplier within the Sydney market for this option to be considered economically viable. Truck transport provides the versatility to service a wide range of small markets at diverse geographical locations.

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