ENVIRONMENTAL IMPACT STATEMENT

for proposed

Railway Ballast Quarry

at Martins Creek

in the Shire of Dungog

prepared for

State Rail Authority of N.S.W.

by

D.P.JAMES

July 1990

STATE RAIL AUTHORITY OF N.S.W.
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Form 4.

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT,
1979(Section 77(3)(d))

ENVIRONMENTAL IMPACT STATEMENT

This Statement has been prepared on behalf of
The State Rail Authority of New South Wales.
Freight & Country Passenger Group,
P.O.Box 121, GREENACRE, 2190
being the applicant making the development application referred to below.

This Statement accompanies the development application made in respect of the development described as follows:

Extraction of rock.

The development application relates to land described as follows:

Folio Identifiers 5/242210 and 6/242210 being lots 5 and 6 in DP 242210 in the parish of Barford in the county of Durham in the shire of Dungog

The contents of this Statement, as required by Clause 34 of the Environmental Planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

I, Derek Patrick JAMES, of Kogarah, hereby certify that I have prepared the contents of this statement in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

Dated: 26 July 1990.

D.P.James, ARMIT, FIQ, MEIA.
11/62 Warialda Street,
KOGARAH, 2217.

APPENDICES

ATTACHED PLANS

1. INTRODUCTION

1.1 General Introduction.

Martins Creek is about 25 km north of Maitland on the North Coast Railway line. The quarry at Martins Creek, see Figure 1, is one of three railway quarries within the State producing as their main product railway ballast. The Martins Creek quarry has been operational since before 1915, some 75 years and supplies rail balast to the Hunter and surrounding districts. The reserves of quality stone for balast have almost been completely depleated and additional reserves are required for the quarry to continue. The proposed development will ensure that the existing quarrying operation at Martins Creek is retained.

1.2 Summary of Proposed Development.

The proposal is to develop a "new" quarry on land adjacent to the existing "old" Martins Creek quarry. The existing infrastructure at the "old" quarry, that is crushing plant, other fixed plant, mobile plant, haul roads and staff will be retained. Haul roads will connect the "new" quarry with the "old" quarry. The "new" quarry will occupy about 5 ha and another 5 ha will be required for haul roads and setbacks.

The land has a thin layer of topsoil; this will be removed and stockpiled to be used later in rehabilitation of the quarry. The rock will be broken by drilling and blasting and then loaded into haul trucks for removal to the crushing plant. Products will be stored in bins and stockpiles prior to dispatch by rail and road.

Estimated annual production is 250,000 to 300,000 tonnes. Some 70 % of the production will be removed by rail and the balance by road. About 12 truck loads, thus 24 truck movements per day are required to remove 80,000 tonnes per annum based on 50 weeks at 5.5 days per week and average loads of 23 tonnes. The destination of these trucks will depend on regional demand, however the majority of truck deliveries are to the south. The 24 truck movements per day can be expected to vary with the development of the operation. Rail balast is supplied to the rail system north to Coffs Harbour, west to Muswellbrook and Ulan and south to Sydney.

The reserves on the land are estimated to be in excess of 3,500,000 tonnes, sufficient for more than 10 years extraction. Progressive rehabilitation will take place concurrent with extraction so that the land will conform to a final landform.

The development will maintain the employment of the present staff of 17 persons and the indirect employment of some 34 or more persons. The development will continue to supply rail balast and quarry products for use by the S.R.A., and also locally and regionally to local councils, other state government bodies and private industry.

The existing quarrying operation is a significant factor in the local and regional economy as a source of direct and indirect employment and as a supplier of quarry products. The proposed development will ensure that this economic position is retained.

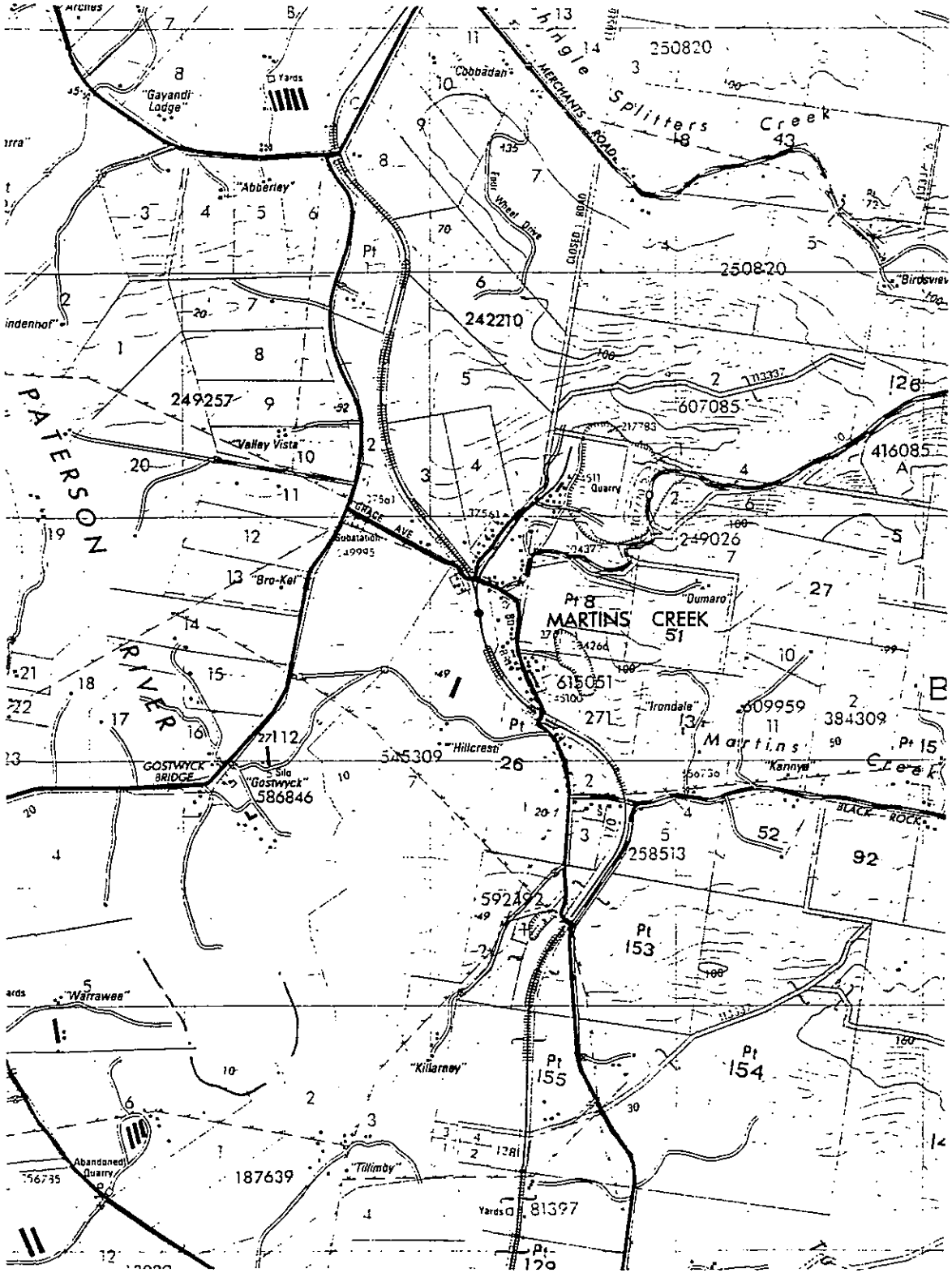


Figure 1. Location of Martins Creek quarry. Derived from CMA map Paterson, 9232-4-N, scale 1:25000.

1.3 Development Objectives.

The objectives of the development are :

1] to establish a rail ballast quarry adjacent to the existing Martins Creek quarry,
2] to supply raw material for processing at the existing quarry plant,
3] to maintain the existing Martins Creek quarry infrastructure,
4] to ensure the supply of rail ballast for the safe and efficient operation of the rail system,
5] to carry out the development in an environmentally sensitive manner.

2. EXISTING ENVIRONMENT

2.1 Zoning and Planning Instruments

The current planning instrument is the Dungog Local Environmental Plan 1990, dated 6 April 1990 , vide Government Gazette N0.46, 6 April 1990 folio 2905. The land is zoned Rural 1b, a zoning in which extractive industry is a permitted development. The land is within the Upper Hunter Sub-Region of the Hunter Region as defined in the Hunter Regional Environmental Plan No.1 (1).

2.2 Landform.

The land consists of wooded grasslands and can be located at grid reference 701975 on CMA map Paterson (2). The land has an elevation of 90 metres AHD and is a uniform, rounded hill. The top soil covering of the land is thin and incomplete and in many places the rock substrate is exposed. Vegetation cover is estimated to be 80% covered and 20% bare rock.

2.3 Land Use.

The land is currently unused. At one stage the land was cleared of timber; evidence of a previous use for grazing. The land quality is extremely poor being only partly vegetated with a thin layer of soil. A small quarry has been developed in the northwestern corner of the land.

The land conforms to Class VIII of the Soil Conservation Service rural land capability classification being land not suitable for agricultural or pastoral production because of severe physical limitations to the land. The land conforms to Class 5 of the Department of Agriculture agricultural suitability classes being land unsuitable for agriculture.

2.4 Climate.

The land is within the Hunter Weather Forecast District about 40 km northwest from the coast and hence has a coastal weather pattern. Climatic data for the nearest weather station are summarised in Table 1. From Table 1 it can be seen that the land has an annual rainfall of about 950 mm over 110 days and that average mean temperatures vary between 5.7 and 29.3 degrees celcius.

Rainfall data, ie intensity-frequency-duration, for the specific location is included in Appendix 6: Soil and Water Management.

Specific temperature inversion data for the land are not available. Meteorological reports for Jervis Bay and Sydney (3,4) give the following frequency of inversions expressed as a percentage of nights per season.

	Jervis Bay	Sydney
summer	30%	50%
autumn	50%	
winter	50%	100%
spring	50%	

Since the land is only about 40 km from the coast the inversion data above may be applied to the land. Thus it may be assumed that temperature inversions would occur on about 50 % of the nights per year. Such temperature inversions should disperse within about 1 hour of sunrise.

row	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1	153	96	127	64	78	73	37	40	41	81	93	78	952
2	117	62	112	62	66	51	30	24	28	68	78	76	971
3	11	11	11	8	9	9	8	7	7	11	11	8	114
4	17.5	17.5	15.6	12.4	9.4	7.3	5.7	6.2	8.5	11.3	13.6	16.0	
5	29.1	28.4	27.0	24.2	20.4	17.3	16.9	18.9	21.7	24.3	26.1	29.3	

row	item	station identification		period
1	mean rainfall in mm	061258	GOSTWYCK HOUSE	1967 1987
2	median rainfall in mm	061258	GOSTWYCK HOUSE	1967 1987
3	mean no.of rain days	061258	GOSTWYCK HOUSE	1967 1987
4	average mean min.temp.	061250	TOCAL AG.COL.	1967 1986
5	average mean max.temp.	061250	TOCAL AG.COL.	1967 1986

TABLE 1. Summary of weather data for Martins Creek locality.

Wind data are not available for the locality. Air drainage can be expected at night to flow from the hills down along the valley northeast following the railway line or south following the Paterson River.

2.5 Air Quality.

The land is located in part natural bushland and part regrown bushland and has an adequate vegetation cover of grass and trees. Generally dust is not a problem and air quality is high.

2.6 Water Quality.

The land is within the Hunter River Basin, Basin No.210. Three un-named creeks, one at the northern end, one on the western side and one at the southern end of the land flow into the Paterson River. The north creek flows west from the land passes under the railway line and enters the Paterson at grid reference 683974 (2). The western creek flows west from the land and joins with the north creek on the western side of the Dungog road. The south creek flows south from the land passes under the railway line and enters the Paterson downstream of the north creek at grid reference 687965 (2). Other minor drainage channels flow west from the land pass under the railway line and enter the drainage system on the west side of the railway line. The railway line intercepts the natural surface water drainage north, west and south from the land. This water is passed under the line through a series of culverts.

Martins Creek after which the township is named is located about 1.5 km south of the land and enters the Paterson River downstream of Gostwyck Bridge.

Fourteen stream gauging stations have been located on the Paterson River, of these six have been discontinued. The gauging station closest to the development is Station No. 210902 at Gostwyck Bridge, Martins Creek.

Although the vegetative cover of the land is incomplete (about 80% covered, 20% bare rock) the sediment pick-up by surface run-off water is minimal and water quality in the three un-named creeks is visually high.

2.7 Noise.

The land is vacant rural land located about 1 km north of Martins Creek township. The existing noise environment consists of the present SRA quarry, rail traffic on the North Coast Railway line and local and regional road traffic. The nearest residence to the land is located about 200 metres to the west. This residence is separated from the land by the North Coast Railway line. A Noise Impact Statement is included here as Appendix 5.

2.8 Flora & Fauna.

The surface of the land is covered with a thin layer of soil supporting a vegetation of trees, scrub and grasses. The soil cover and overburden depth does vary over the land with an estimated 20% of the land being bare rock.

Part of the land, mainly Lot 5, was cleared of timber; evidence of a previous use for grazing however this is now covered with regrown bushland. Lot 6 is covered with natural bushland. In general the land has an adequate vegetation cover of grass and trees estimated to be about 80% covered, 20% bare rock. Trees on the land are mainly Narrow Leaved Ironbark (Eucalyptus crebra) and Slaty Redgum (Eucalyptus glaucina). Flora is also discussed in Appendix 7: the archaeological survey. Apart from rural fences there are no restrictions to the free passage of native fauna over the land. Rabbit scats were found on the land. Swamp wallabies were seen on the land.

2.9 Traffic

2.9.1 Road Network

The local traffic network consists simply of the Dungog Road, (MR.101) which connects with the New England Highway (National Route 15, State Highway 10) at Maitland. Dungog Road is the main traffic route for truck traffic to and from the quarry. Various minor roads cater for local traffic. Access to and from the quarry is via Station Street, Martins Creek.

The traffic route for trucks from the quarry to Dungog Road is via Station Street and Grace Avenue, Martins Creek. At Dungog Road truck turn right (north) for deliveries to, for example, Dungog or left (south) for deliveries to Paterson, Maitland and other locations in the Hunter Valley.

2.9.2 Traffic Movements.

The Roads & Traffic Authority maintains traffic counting stations on Dungog Road (MR 101): one at Paterson, two north of Paterson at the Singleton Road (MR.128) intersection and one at Wallarobba. The latest available data in AADT (5) for these stations are:

Station Number	Year 1978	1980	1982	1984	1986	1988	1990
05849 a	1410	1590	1710	1798	1991	2187	2362e
05349 b		1420		1410			
05350 c		760		980		1911e	1286e
05351 d		540		610		773	835e

a Paterson b south of MR.128 c east of MR.128
d Wallarobba e estimated values

2.9.3 Traffic Noise.

Access to and from the quarry is via Station Street, Martins Creek. The D.M.R., now the R.T.A. has published guidelines for the prediction and measurement of road traffic noise (6). These guidelines have been used in the Noise Impact Statement, Appendix 5, to calculate the noise traffic levels.

2.9.4 Road Damage.

Station Street and Grace Avenue are sealed all weather roads maintained by Council. Dungog Road is a sealed all weather "DMR" road maintained by the Roads & Traffic Authority. The New England Highway is a State highway maintained by the Roads & Traffic Authority and is designed as an all weather, all traffic roadway.

2.10 Economic Matters.

At present the land is unused although previously the land was cleared and used for grazing and a small quarry was developed in the northwestern corner from which some quarrying has occurred. The proposed development will provide income to the landowner and maintain employment to the proponent's employees and also indirect employment. The existing quarry provides direct employment for the present staff of 17 persons and indirect employment for some 34 or more persons mainly in the transport related industries.

The development will maintain the supply of rail balast and quarry products. Rail balast is supplied to the rail system north to Coffs Harbour, west to Muswellbrook and Ulan and south to Sydney. The quarry supplies quarry products locally and regionally to local councils, other state government bodies and private industry at competitive prices to the benefit of both producer and consumer.

2.11 Social & Cultural Matters.

The land has no particular social or cultural value. The land contains as improvements only rural fences, access tracks and a small quarry at its northwestern corner.

The Director of the Department of Planning advised that the prediction of noise and vibration effects to rural residences and St.James Anglican Church, Cook St., Martins Creek, were to be specifically addressed in the Statement.

St.James Anglican Church on the corner of Cook and Cory Streets is dated 1928. The church is a weatherboard and fibro timber frame building set on concrete stumps. The church is about 1300 metres from the existing quarry and about 1800 metres from the proposed quarry. The church is adjacent to Martins Creek public school which dates from 1892.

The closest residences to the proposed quarry are:

LOCATION	DISTANCE	DIRECTION	
Station St.	550 metres	S	lot 4, DP242210
Grace Ave.	600 metres	S	lot 2, DP242210
Dungog Rd.	600 metres	W	lot 1, DP242210
Dungog Rd.	1000 metres	NW	lot 8, DP242210
Merchants Rd.	1000 metres	NE	lot 4, DP250820

These distances are from the centre of the proposed quarry which is taken to be at grid reference 701976 (2).

2.12 Visual Impact

The land has an elevation of 90 metres AHD and is a uniform, rounded hill and overlooks some residences in the quadrant north to west. These are residences in Vacy and the residence on "Abberley" being lot 5, DP 249257 located on Horns Crossing Road.

The existing visual amenity of the land described as foreground, middleground and fargground (distant) views is as follows.

FOREGROUND VIEWS.

Foreground restricted by tree cover to immediate vicinity. No residences are located within this zone.

MIDDLEGROUND VIEWS.
From the high point of the land "Abberley" at about 1200 metres distance from the proposed quarry site is visible. The tree cover on the land restricts other middleground views.

FARGROUND VIEWS.
Some of the residences in Vacy, about 3.75 km west, are visible from the high point of the land. (The water tower at Vacy, grid reference 664982, Paterson map, is visible from the land with the aid of 8X binoculars.) Conversely from Vacy the proposed quarry site is visible but the view is restricted by the tree cover on the land. From Vacy the existing quarry is highly visible. The Vacy water tower is a convenient reference point from which to make visual assessments.

2.13 Archaeology
The land was first granted on 30 June 1823 and although under European influence for 167 years (see Appendix 1) there is no evidence of European land use. The National Parks & Wildlife Service advised (see Section 8) that an archaeological survey of the land was required. This survey was carried out and is included here as Appendix 7. The archaeological survey found only limited evidence of aboriginal archaeology, namely two isolated artifacts one of which is within the development area and three possible scarred trees, all outside the development area. The survey recommended that the trees be fenced off and that a "Consent to Destroy Permit" should be sought for the artifact within the development area.

2.14 Soil & Water Conservation Matters
The land is within the Paterson River catchment which in turn is within the Hunter River Basin, Water Resources Commission Basin No.210. The land contains two un-named creeks which flow to the west and join the Paterson River (at grid references 683974 and 687965 on the Paterson map (2)).

The land is generally gently sloping with a slope of 10 or less thus it is not protected land under the Soil Conservation Act 1938, hence approval under Section 21D of the Act is not required.

As stated above the land conforms to Class VIII of the Soil Conservation Service rural land capability classification being land not suitable for agricultural or pastoral production because of severe physical limitations to the land.

2.15 Bushfire Risk.
The land is within the Eastern Fire Zone being part of the Hunter Weather Forecast District. Martins Creek does not have a bushfire brigade as such but is serviced by the Paterson Bush Fire Brigade. The other bushfire brigades in the area are at Vacy and Gresford. No major fires have occurred in the area in the last 10 years (7).

The following bushfire hazard is based on Circular No.74 issued by the Department of Planning (8), topographical data is derived from the Paterson map (2).

VEGETATION TYPE: The vegetation of the land corresponds to Dry Sclerophyll Forest (Coastal) which has a Vegetation Hazard Index 2.8.

SLOPE: The land has an elevation of 90 metres AHD and is a uniform, rounded hill. The land has a fall of about 30 metres over 300 metres, thus a drop of 1 metre vertical per 10 metres horizontal equal to a grade of 10%. This slope has a Slope Index of 1.5

HAZARD SCORE: The Overall Hazard Score is equal to the Vegetation Hazard Index multiplied by the Slope Index, thus 2.8 x 1.5 = 4.2. This Overall Hazard Score is considered high according to Circular No.74.

Dungog Shire Fire Control Officer (7) considers that the railway line acts as a fire break to the west and that the wooded land to the north of the proposed quarry effectively ends at Shingle Splitters Creek which has the same alignment as Merchants Road. A further comment (7) was that quarrying as an development had a very low risk of causing bush fires. Quarrying consists of removing vegetation and fuel from the land and effectively forms it's own buffer zone.

3. PROPOSED DEVELOPMENT.

3.1 Introduction.

The development is to establish a replacement supply of quality rail ballast material as close as possible to the existing infrastructure at Martins Creek. Land adjacent to the existing quarry has been secured under a lease agreement with the landowner. A haul road will be constructed from the existing quarry to the proposed quarry site. The quarry will be developed on Lot 5. Material will be won by drilling and blasting to form broken rock. Face shovels will load this broken rock onto off-road haul trucks for transport to the existing processing plant. Plan 1 shows the existing topography and locations of the test bore holes (see Appendix 3). Plan 2 shows the location of the proposed quarry, haul road and details of the quarry faces and benches.

Other than a different source location for the rock the existing development will remain unchanged.

3.2 Extraction Sequence.

Extraction will commence from the end of the haul road and proceed in a south to southwesterly direction. Initial extraction will be in three strips each about 100 metres wide aligned north-south, in the sequence east strip, middle strip, west strip. For each strip the top soil will be removed and stored in a bund about the edge of the quarry. This material will be used in the rehabilitation of the quarry.

3.3 Winning & Processing.

Drill & Blast.

The blasting procedure used in the existing quarry and proposed to be used in the new quarry is Nonel firing of two blasts per month with burden x spacing = 3 x 3 metres and 15 metre faces. This procedure may need to be altered as the quarry proceeds in order to minimise the environmental effects of blasting.

The following details on drilling and blasting are derived from the ICI Handbook of Blasting Tables (9). With a nominal drill hole diameter of 89 mm and standard ANFO explosive with a bulk density of 0.8 g/cu.cm. a linear density of 5.0 kg/metre is obtained. For benches of 15 metres the drill holes details are:

stemming	2 metres
subgrade	1 metre
explosive column	14 metres
total length	16 metres
charge per hole	70 kg

Using double hole firing the Maximum Instantaneous Charge (MIC) is equal to twice the hole charge, thus 140 kg. The calculated environmental effects of ground vibration (peak particle velocity) and air overpressure for 70 kg and 140 kg at different distances are given below. These results indicate that at about 500 to 600 metres the environmental effects are within SPCC limits. At closer distances changes in blasting procedure will be necessary to ensure compliance with SPCC limits.

MIC kg	DISTANCE metres	GROUND VIBRATION mm/second	OVERPRESSURE dB(Linear)
140	200	17.1	126.2
	250	12.0	123.9
	400	5.7	119.0
	450	4.7	117.7
	500	4.0	116.6
	600	3.0	114.7
70	200	9.8	123.8
	250	6.9	121.4
	400	3.2	116.5
	450	2.7	115.3
	500	2.3	114.2
	600	1.7	112.3

MIC quantities are based on a "blue metal" type competent rock. A smaller charge is likely for a weaker rock or a heavily jointed rock. The overpressure values above relate to areas in front of the blast. At Martins Creek the residences will be behind the blast; a situation which significantly reduces the exposure to overpressure. The fragmentated (jointed) nature of the rock has the effect of reducing the calculated vibration values. Nevertheless the actual environmental effects of ground vibration and overpressure at different MICs and distances should be measured. As the quarry approaches the nearest residence to the west this practical data should be applied to ensure that the standard SPCC environmental limits for blasting, namely ground vibration of 5 mm/second peak particle velocity and air overpressure of 115 dB(Linear) are not exceeded.

Drilling Machine

A Gardner-Denver drilling Rig with a PR66 drifter, typical daily production:

drilling rate 170 linear metres/day
fuel consumption 220 litres/day

Excavator/face shovel

Two such units are used to load broken stone onto boot trucks.
A Hitachi UH171 machine with a 2.2 cu.m. bucket,
capacity 200 tonnes per hour
fuel consumption 17 litres/hour
The second machine is a Demag H36 with a 2.0 cu.m. bucket,
capacity 200 tonnes per hour
fuel consumption 18 litres/hour

Secondary Breaker

Typically an hydraulic excavator with a rock pick is used to break down over-sized material. Typically a Hitachi EX220 machine fitted with a Krupp 950 rock pick would be used to process about 3% of the production.
capacity 300 tonnes per hour fuel
consumption 80 litres/hour

Front-End Loader

One loader is required to load-out finished product onto trucks for removal by road. A Furakowa FL330 with a 3.5 cu.m. bucket is used at present.
capacity 250 tonnes per hour fuel
consumption 27 litres/hour

Boot Trucks
Three boot trucks will be used to haul raw material from the quarry face to the processing plant. These are two International PH95:
capacity 22 tonne load
fuel consumption 13 litres/hour
plus one International PH65:
capacity 18 tonne load
fuel consumption 12 litres/hour

Products
The main product from the existing and proposed quarry is rail ballast. Such ballast is produced according to S.R.A.specification, see Appendix 4, and is supplied to the rail system north to Coffs Harbour, west to Muswellbrook and Ulan and south to Sydney. Other products will be concrete aggregates, sealing aggregates and road base.

Product Delivery
Quarry products are shipped by rail and road. The distribution is 70% by rail and 30% by road vehicles. The road vehicles used consists of a fleet made-up as follows:

TYPE	DISTRIBUTION	LOAD
rigid 6 wheel trucks	15%	10 tonne
ditto + dog trailers	25%	27 tonne
semi trailers	60%	25 tonne
average load		23 tonne

3.4 Hours of Operation.
The normal hours of operation of the quarry are:
Mondays to Saturdays 7am to 5 pm
Sundays and public holidays no operations.
Operation outside these hours may occur from time to time depending on railway needs.

3.5 Employment.
The development will maintain the employment of 17 persons directly and at least a further 34 persons indirectly, the latter in the transport and associated industries.

3.6 Services.
The usual services of electricity, telephone, water and sewer are available at the existing quarry and are not required in the proposed development. Mobile plant is diesel powered. Such plant will be parked overnight within the existing quarry. The normal facilities for office, weighbridge, workshops, store rooms, lunchroom, change room, toilets, communications, etc. are also at the existing quarry.

3.7 Drainage & Erosion Control.
On land outside the active quarry diversion drains and/or top soil storage bunds will direct surface water away from the excavation so that the water passes over uncleared, naturally vegetated land.

Within the quarry drainage lines will terminate in detention structures. The overflow from these will pass to a retention structure (settling pond) which will act as a water supply for the development.

De-silting of the settling pond will be carried out prior to the pond capacity being reduced due to silt by 20%. This will be done when the water circuit is not operating and has settled-out overnight. For each pond the procedure will be:

1) the clear, supernatant water will be drawn off,
2) silt will be removed from the pond by hydraulic excavator,
3) silt should be formed into heaps to drain before being loaded into trucks for disposal,
4) silt disposal by mixing with top soil and overburden to assist in the rehabilitation of the land.

The drainage measures above will also act as erosion control measures. Appendix 6 deals with rainfall and drainage matters.

3.8 Pollution Control

3.8.1 Air

Within the land air pollution hazards are dust and engine exhausts. Control measures are:

1) watering of the haul roads during dry windy periods to reduce vehicle generated dust,
2) on site diesel plant to be correctly fitted and maintained.

3.8.2 Water

Water pollution control measures are:

1) mobile plant to be parked overnight at the existing quarry,
2) other than for immediate use petroleum products to be stored at the existing quarry,
3) surface water within the quarry to be directed into settling ponds,
4) the settling ponds to be de-silted prior to the pond capacity being reduced due to silt by 20%.

3.8.3 Noise

Notwithstanding the remote location and absence of close neighbours noise pollution control measures are:

1) normal operations within the following hours,
   Mondays to Saturdays 7am to 5pm,
   Sundays and Public Holidays no operations,
2) the on site haul roads to be graded and kept in good repair to minimise bouncing of trucks and subsequent noise,
3) diesel plant to be correctly fitted and maintained.

3.9 Traffic

Products from the quarry are removed and delivered by both rail (70%) and truck transport (30%). Road traffic from the development will pass along Station Street, Grace Avenue to Dungog Road and then to the north or south. The truck fleet which serves the quarry is made up of semi-trailers and 6 wheel rigid vehicles with and without trailers. These vehicles are normal road vehicles subject to the maximum gross loads and axel loads as specified in Ordinance 30C of the Local Government Act, 1919.

Truck movements have been estimated on the basis that 30% of the annual production of 265,000 tonnes of all products is removed by road. Twenty three tonnes per load has been taken as an average load of the fleet vehicles. Operations at 5.5 days per week for 50 weeks per year gives 12 loads per day, thus 24 truck movements per day. The destination of these trucks will depend on regional demand. The majority of truck deliveries are to the south.

It should be noted that these are average movements. In practice quarry traffic tends to be mainly before noon and is less during wet weather. Truck movements may be expected to vary between nil and a peak of about 36 per day, ie a 50% increase. Truck movements also vary with sales which in turn depend on development activity in the area. For example a large roadworks or construction project could result increased in quarry sales and lead to the increased truck movements quoted above.

3.10 Reserves.

The calculated reserves according to the geological investigation of the resource, included here as Appendix 3, are:

7,360,000 tonnes of proven reserves, and
11,224,000 tonnes of probable reserves.

3.11 Rehabilitation.

Rehabilitation is designed to allow the land to achieve a near natural land form. Rehabilitation is also dependent on the final land use which at this stage has not been determined. The various dams and ponds on the land are to remain for use as water reservoirs. Wherever possible rehabilitation is to be progressive, that is as the extraction in an area has been completed it is to be rehabilitated. In this manner the scope of rehabilitation will be kept within reasonable operational and cost limits.

QUARRY AREA: The general procedure for quarry area is for all plant, machinery and rubbish to be removed. All disused or unwanted stockpiles removed or knocked down and spread out over the land. The quarry floor to be shaped to give an uneven, non-geometrical form. The quarry faces are to be partly blasted to give surfaces which range from vertical to angled with coarse broken rock.

HAUL ROAD: In general the haul road will provide access to the whole of the land and thus may remain. Since the road was used for off-road haul trucks it's construction is in excess of that normally required for rural access.

SET BACK AREAS: Top soil storage bunds are to be knocked down and spread out. This material should be sown with a suitable ground cover. As a means of reducing the visual impact the set back along the southern boundary of the quarry is to be planted with acacias native to the area (10).

4. ENVIRONMENTAL IMPACTS & PROTECTION MEASURES

4.1 Land Use.

The development has only a minor impact on land use. The quarry areas are poor quality land not suited for agriculture. Such land cannot be used for agriculture consequently the development will not impact on lands used for agricultural production.

4.2 Climate.

Hot, dry, windy conditions which favour the formation of dust may cause an impact on air quality. Such an impact can be minimised by the use of water carts on the haul roads. Although the location is remote temperature inversion enhanced noise propagation may be a problem, especially with blasting. This may be minimised by restriction blasting to the hours 9 am to 4 pm weekdays and preferably between the hours of noon to 3 pm.

4.3 Air Quality.

The major hazard to air quality is dust generated by vehicles passing over the land. Under hot dry conditions water carts to lay dust along the road should be used. The other air quality hazard is exhaust emissions from fixed and mobile diesel powered plant. This can be controlled by having such plant correctly fitted and maintained, with the manufacturers' and/or suppliers' requirements being the minimum standards.

Air pollution control measures from Section 3.8.1 above are:

1) watering of the haul roads during dry windy periods to reduce vehicle generated dust,
2) on site diesel plant to be correctly fitted and maintained.

4.4. Water Quality.

Possible impacts on water quality are from runoff from about the quarry areas and from petroleum products used in the fixed and mobile plant. Extraction will be of dry materials and will not be a water quality hazard. Petroleum product storage, including the diesel fuel supply, is to remain at the existing facilities at the present quarry. The drainage and water management methods detailed in Appendix 6 will control surface run-off water and will minimise water quality impacts.

The following measures will minimise and protect against water pollution:

1) mobile plant to be parked overnight at the existing quarry,
2) other than for immediate use petroleum products to be stored at the existing quarry,
3) surface water within the quarry to be directed into settling ponds,
4) the settling ponds to be de-silted prior to the pond capacity being reduced due to silt by 20%.

4.5 Noise.

The remote location and absence of nearby residences mean that noise from the development will not be an impact, see Figure 1 and also Appendix 5: the Noise Impact Statement. The conclusions of the Noise Impact Statement were:

1) Provided that the noise control measures are applied it is unlikely that the sound from the development will be offensive.

2) The nearest residence to the land is about 200 metres to the west and at such a distance the calculated worst case sound level from the development is below the daytime extreme limit for rural land recommended by the SPCC.

3) Peak particle velocity and overpressure from blasting will not affect the rural residences in Station Street or St.James Anglican Church.

4) Road traffic noise along Station Street and Grace Avenue is unlikely to be a problem because of the general speed limit of 60 km/hour and the level terrain.

Notwithstanding the lack of impact, protection measures to minimise noise pollution will be applied and are as follows:

1. normal operations within the times below,

Mondays to Saturdays	7am to 5pm
Sundays and Public Holidays	No operations

2. diesel powered plant to be correctly fitted and maintained with the manufacturers' standards being the minimum standards. Particular attention should be given to diesel engine exhaust systems and the care and maintenance of mufflers
3. on site haul roads to be graded to prevent bouncing and drumming of empty trucks.
4. blasting is to be carried out weekdays between the hours of 9 am to 4 pm and preferably between the hours of noon to 3 pm.

4.6 Flora & Fauna.

The land has a limited range of flora. The principal means of protecting the flora and minimising floristic impact is to revegetate with the existing tree species and with tree species native to the area and with grasses which will survive in the shallow soils.

The main impact on fauna is the alienation of habitat during the term of the development. The protection measure to minimise this impact is the provision of setbacks about the quarry to allow the free passage of fauna around the land.

4.7 Traffic.

Traffic impacts from the development will not change from the existing situation and are considered to be slight. The level of truck movements will remain at the existing level of about 24 movements per day. A speed limit of 60 km/hour applies to the roads within the township of Martins Creek. These roads are also formed and sealed. These factors together minimise the risk of vehicle generated dust. The local roads are also generally level which minimises the noise from trucks.

4.8 Economic Matters.

The economic impacts of the development are positive and consist of income to the landowner, direct and indirect employment and the provision of rail ballast to the rail system and quarry products to the local and regional market.

4.9 Social & Cultural Matters.

The Director of the Department of Planning advised that the prediction of noise and vibration effects to rural residences and St.James Anglican Church, Cook St., Martins Creek, were to be specifically addressed in the Statement.

St.James Anglican Church on the corner of Cook and Cory Streets is about 1300 metres from the existing quarry and about 1800 metres from the proposed quarry. The rural residences are mainly located in Station Street about 550 metres from the centre of the proposed quarry.

Calculations (9) of the environmental effects of blasting, namely ground vibration (peak particle velocity) and air overpressure for these distances with different MICs are below.

DISTANCE metres	MIC kg	GROUND VIBRATION mm/second	OVERPRESSURE dB(Linear)
500	50	1.7	113.1
	70	2.3	114.2
	140	4.0	116.6
1200	50	0.4	103.9
	70	0.6	105.1
	140	1.0	107.5
1800	50	0.2	99.7
	70	0.3	100.9
	140	0.5	103.3

For the rural residences in Station Street a Maximum Instantaneous Charges (MIC) of that proposed (140 kg) produces a calculated overpressure value slightly above the SPCC accepted limit. Actual overpressure values will be lower as the quarry faces are directed away from Station Street and the intervening topography and vegetation will shield Station Street. Nevertheless blasts should be monitored for ground vibration (peak particle velocity) and air overpressure and these data applied to complement the Handbook (9) values. Based on this monitoring blasting procedures may be altered as the quarry approaches its southern extent to ensure that the SPCC limits at the residencs in Station Street are not exceeded.

For St.James Anglican Church the environmental effects of a MIC of 140 kg are within the SPCC limits. [By way of example a 1000 kg MIC, greatly in excess of normal quarrying practice, at the Church location would result in ground vibration and air overpressure values below the SPCC limits of 5 mm/second and 115 dB(Linear).]

4.10 Visual Impact.

The visual impacts of the development and the means to minimise such impacts are as follows.

FOREGROUND VIEWS: Foreground restricted by tree cover to immediate vicinity. No residences are located within this zone and the visual impact is slight. Within the active quarry area during the course of quarrying the impact on foreground views will be severe and would be experienced by visitors. This impact can be minimised by restricting the size of the active quarry area and by progressive rehabilitation.

MIDDLEGROUND VIEWS: The high point of the land is close to the northeast corner of Lot 4, see Plan 1. From this location the property "Abberley" (lot 5, DP 249257, Horns Crossing Road) at about 1200 metres distance from the proposed quarry site is visible. At maximum exposure of 30 metres the field of view is about 1.5 vertically. The high point is within the set back from the property boundary and not subject to quarrying. The visual amenity can be enhanced by planting a tree screen along the edge of the quarry on and about the top soil bund. This screen should be of trees 2 to 5 metres in height and be of acacias native to the area (10).

FARGROUND VIEWS: From Vacy about 4 km west of the proposed development the quarry site is visible but the view is restricted by the tree cover on the land. The extent of the proposed quarry that would be visible is about 30 metres vertically and 150 metres horizontally. These dimensions are equal to fields of view of about 0.5 vertically and 2 horizontally. The visual impacts of these exposures are considered to be slight. The tree screen proposed above to minimise middleground views will also minimise farground views.

4.11 Soil & Water Conservation Matters.

Measures to minimise the impact on soil and water conservation are given in Appendix 6 and are repeated below.

1) Diversion drains to deflect water away from the site towards natural bushland.
2) Water on the quarry will be directed to a series of dams of aggregate capacity equal to the volume of a 1 in 10 year return period storm.
3) Water retained in these dams will be used as the water supply for the development.
4) The quarry floor will slope down to a dam to contain the initial flush of the quarry floor. Water in this dam will pass to a second dam before discharge.
5) Top soil is to be stripped and stored in bunds about the development to act as a seed source in rehabilitation. (It should be noted that the land has a shallow depth of soil overlying either rock or a layer of clay overburden.)
6) Friable overburden about the edge of excavations shall be battered at 3H:1V away from the excavation.
7) The faces of quarry excavations may be vertical, with a average maximum face height of 15 metres.
8) Haul roads on site to have a grade consistent with good quarry practice and, as appropriate to have crossfall drainage and cross bank runoff diversions.

4.12 Bushfire Risk.

Although the Overall Hazard Score is 4.2 which is a high score according to Circular No.74 the actual bushfire risk is considered to be low according to Dungog Shire Fire Control Officer (7). The factors which contribute to this conclusion are:

1) the railway line acts as a fire break to the west,
2) the wooded land to the north of the proposed quarry effectively ends at Shingle Splitters Creek/ Merchants Road, and
3) quarrying as a development has a low risk as it consists of removing vegetation and fuel from the land and effectively forms it's own buffer zone.

4.13 Energy Requirements.

The development will consume energy in the form of diesel fuel to power the mobile plant. The annual energy consumption to produce 265,000 tonnes of quarried raw material is below. A 5% idle allowance has been added to all plant fuel consumption.

1. Drilling.

At a density of 2.7 tonnes per cubic metre 265,000 tonnes equates to 98,000 cubic metres. With spacing and burden each of 3 metres every blast hole affects 9 square metres. The total length of hole to be drilled is 11,000 metres.

drilling rate	200	metres/day
total days	55	days
fuel consumption	200	litres/day
fuel used	11000	litres
fuel allowed	11550	litres

2. Secondary Breaking.

An allowance of 3% of total production will require secondary breaking, ie 8000 tonne.

capacity	300	tonnes per hour
time	26	hours
fuel consumption	80	litres/hour
fuel used	2080	litres
fuel allowed	2185	litres

3. Load into Boot trucks. Face shovel

capacity	200	tonnes per hour
time	1325	hours
fuel consumption	17	litres/hour
fuel used	22500	litres
fuel allowed	23600	litres

4. Boot Haulage; assume a round trip of 1.5 km at 25 km/hour plus loading and unloading to give a cycle time of 7 minutes or 8 loads per hour.

capacity	21	tonnes/load
loads	12600	loads
total time	1575	hours
fuel consumption	12	litres/hour
fuel used	18900	litres
fuel allowed	19800	litres

Total fuel allowance	57,135	litres
Fuel heating value	38.5	megajoules per litre
TOTAL ENERGY	2200	gigajoules

5. ALTERNATIVES

5.1 Development Alternatives.

As with most extractive industry developments there is little scope for viable alternatives. The geological investigation has identified the location of the resource. The most efficient method of extraction is to commence from the north and proceed south - southwest. This method gives the easiest means of extraction with the least environmental impact. The extraction method could be altered somewhat but without any gain in efficiency or reduction in environmental impact. Alternative resources are located in the locality and region. In the former case either transport of the raw material to the existing plant would be required or the plant relocated. An alternative resource in the region would require it's own plant and the abandonment of the existing plant. In all cases where an alternative plant is required the existing infrastructure and employment would be at risk.
A further alternative is to locate a balast quarry somewhere within the existing rail network. This alternative has the same effects as above namely the loss of the existing infrastructure and employment prospects plus the loss of the existing non-balast market.

5.2 "No Development" Alternative.

Should the development not proceed then reserves at the existing quarry would be quickly depleted, say within about 2 years. After this period the quarry would be forced to close with the loss of its economic benefits of which, locally, the most sensitive is employment.

The supply of rail balast is the main reason for the development. With the closure of the Martins Creek quarry this would be supplied by the other railway quarries at Bombo and Ardglen or alternatively by private quarries. In either case there would be an unnecessary increase in cost.

With the "No Development" Alternative the disbenefits of the development are not incurred. The main disbenefit is the impact on middleground visual amenity; with "No Development" this would not occur and the land would remain for rural purposes.

6. JUSTIFICATION, ASSESSMENT & CONCLUSIONS

The Martins Creek quarry has been operational since before 1915. The quarry is located on the North Coast Railway line and supplies rail ballast north to Coffs Harbour, west to Muswellbrook and Ulan and south to Sydney and other quarry products to the Hunter and surrounding districts.

The reserves of quality stone for rail ballast and other quarry products have almost been completely depleated and are expected to last for about another 2 years. Additional reserves are required for the quarry to continue. The proposed development will ensure that the existing quarrying operation at Martins Creek is retained. Retention of the Martins Creek quarry means that the existing infrastructure will not be lost and that the economic benefits will also remain. Of principal local concern is the retention of employment propects; the quarry currently employs 17 persons directly and at least another 34 persons indirectly.

The proposed development will not alter the existing situation save for the location of raw material. All other quarrying operations will remain as at present.

The environmental impacts of the development are minor and the proposed environmental protection methods simple and effective. The main environmental impact is on the visual amenity of middleground views. Although the field of view is small the provision of tree screens will ameliorate this impact.

The development of the quarry faces from north to south with blasting directed to the north and/or east will ensure that flyrock, should it occur will be into the quarry and away from residences. The proposed Maximum Instantaneous Charge (MIC) for blasting of about 140 kg is sufficient to fracture the rock without undue ground vibration. For St.James Anglican Church the environmental effects of the proposed blasting procedure are well below the SPCC accepted limits. For the rural residences in Station Street the proposed blasting procedure will result in overpressure values within the SPCC limit.

The surface water management methods proposed are sufficient to ensure that sedimentation from the development does not enter the catchment of the Paterson River.

Although the site is hidden with limited impact on the visual amenity rehabilitation of the quarry, as with most hardrock quarry sites, will be difficult and require adherence to the rehabilitation proposals. At present the only proposed final land use is for rural purposes. A higher land use would help to finance rehabilitation.

In summary the proposed development has positive benefits and only minor disbenefits.

7. REFERENCE

1. Hunter Regional Environmental Plan No.1, 1982.
2. CMA map Paterson 9232-4-N scale 1:25000.
3. Bureau of Meteorology, Met Note No.48, Canberra June 1981.
4. Bureau of Meteorology, "Climatic Survey: Sydney", AGPS 1979.
5. Newcastle and Districts: Traffic Volumes, 1988, R.T.A.
6. "Road Traffic Noise", D.M.R, 1987.
7. E.M.Murrell, Dungog Council Fire Control Officer, per.com.
8. "Planning in Fire Prone Areas", D.E.P. Circular No.74, 1984.
9. ICI Handbook of Blasting Tables, Jan.1989.
10. Trees for...the Upper Hunter, Publication X8, Forestry Commission.

8. CONSULTATIONS

Consultations have been had with the following bodies either formally in writing or informally by personal visit or phone. Where an existing file or reference is available this is given.

	reference/file
Dungog Shire Council	
Dept. of Planning	N90/0233
N.P.& W.S.(Muswellbrook office)	SLE:LH:F261 CRO/200
State Rail Authority	

The Director of the Department of Planning advised that the following matters be specifically addressed in the Statement. The location(s) in the Statement where the matters are raised is/are given.

MATTER	LOCATION
1. measures to contain sedimentation into Paterson River catchment,	2.6, 2.14, 3.8.2 4.4, Appendix 6
2. dust control measures to be employed,	2.5, 3.8.1, 4.3
3. prediction of noise and vibration effects to rural residences and St.James Anglican Church, Cook St., Martins Creek,	2.11, 4.5, 4.9 Appendix 5.
4. statement of controls to limit vibration effects and mitigate flyrock,	3.3, 4.5 Appendix 5.
5. bushfire risk at site,	2.15, 4.12
6. rehabilitation strategy for the site.	3.11

New South Wales Government

Department of Planning

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
D.X. 15 Sydney

Telephone: (02) 266 7111 Ext.
Fax No: (02) 266 7599

7235

Contact: V THOMSON

Our reference: N90/0233

Your reference:

D P James & Co
PO Box 170
KOGARAH 2217 210

Dear Sir,

PROPOSED QUARRY AT MARTINS CREEK
LOTS 5, 6 DP 242210, PARISH BARFORD

Thank you for your letter of 8 May 1990 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. As development consent is required for the proposal and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, as amended, an EIS must accompany the development application to the Dungog Shire Council. The EIS shall be prepared in accordance with clause 34 of the Regulation and shall bear a certificate required by clause 26(1)(b) of the Regulation (see Attachment No. 1).

3. In addition, pursuant to clause 35 of the Regulation, the *Director requires that the following matters be specifically* addressed in the EIS:

- measures to contain sedimentation into Paterson River catchment;
- dust control measures to be employed;
- prediction of noise and vibration effect to rural residences and St. James Anglican Church, Cook Street, Martins Creek;
- statement of controls to limit vibration effects and mitigate flyrock;
- investigation of visual impact and mitigation measures;
- bushfire risk at site;
- rehabilitation strategy for the site.

4. Attachment No. 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

5. In preparing your EIS you should approach the Dungog Shire Council and take into account any comments Council considers may apply to its determination of the proposal.

6. Should you require any further information regarding this matter please do not hesitate to contact us again.

Yours faithfully,

Barbara Adams
Manager, Assessments Branch
As Delegate for the Director.

New South Wales Government

National Parks and Wildlife Service

HUNTER DISTRICT

Sturgeon Street
P.O. Box 270
Raymond Terrace, N.S.W. 2324

Our reference:

Your reference:

Telephone: STD 049
87 3108

D P James & Company

P.O. Box 170

KOGARAH NSW 2217

ATTENTION: Patrick James

SLE:LH:F261
CRO/200

5 July, 1990

Dear Sir,

Aboriginal Sites: Hardrock Quarry
Martins Creek

I refer to your letter of 3rd July 1990 requesting information on Aboriginal site location and the need for an archaeological survey.

I have checked your proposal against the Aboriginal Site Register. The following types of Aboriginal sites exist in the vicinity of the proposal:

- scarred tree, Grid ref. 369300 639800
  1:25,000 Paterson

As no systematic archaeological survey has been undertaken within the area of the project it is very likely that unrecorded sites are present. Therefore, I consider that a systematic survey for sites is necessary.

The archaeologist you contract for the survey should ensure that the creek banks in the study area are checked for open-campsites and be prepared to undertake test-pitting of any areas where exposures of lithic material are located.

Please do not hesitate to contact Ms S Evans, Cultural Resource Officer, on (065) 433533 if you have any difficulties or queries. I look forward to receiving a copy of your archaeologist's report.

Yours faithfully

S-L Evans for

I Nowacki
SUPERINTENDENT
for Director

Copy to: Paul Packard
Consultant Archaeologist

APPENDIX 1. The Land

Title Description
All those pieces or parcels of land being the whole of the lands contained within Folio Identifiers 5/242210 and 6/242210 being lots 5 and 6 in DP 242210 in the parish of Barford in the county of Durham in the shire of Dungog containing by admeasurement 27.13 ha. and 25.26 ha. respectively.

Previous Title details.
Previously lot 5 in DP 242210 was contained in Certificate of Title Vol.11918 Folio 155 and lot 6 in DP 242210 was contained in Certificate of Title Vol.11918 Folio 156. Prior to these titles the land was contained in Certificate of Title Vol.10734 Folio 181 being shown in plan FP 79921 being known as "Martins Creek No.1 Estate".

Originally the land formed part of portion 131 in the parish of Barford granted on 30 June 1823 and shown on plan H 40R. The land was part of "Gostwick" owned by Edward Gostwick Cory (the Gostwick Estate), vide DP 249257. The Gostwick Estate was bound to the north by Shingle Splitters Creek.

Folio Ident.	DP 242210	Area	Previous Title 1. Vol./Folio	Previous Title 2. Vol./Folio
5/242210	lot 5	27.13 ha	11918/155	10734/181
6/242210	lot 6	25.26 ha	11918/156	10734/181
	total	52.39 ha		

Physical description
The land is freehold land with an elevation of 90 metres AHD and is a uniform, rounded hill. The top soil covering of the land is thin and incomplete and in many places the rock substrate is exposed. Vegetation cover is estimated to be 80% covered and 20% bare rock.

Location
The land can be located on the CMA map Paterson (2327-4-N) scale 1:25000 about grid reference: 701975.

Access
Access to the land is from the adjoining existing quarry.

Aerial Photography.
The land is covered by the following aerial photograph:
Australian Aerial Mapping: Frame 1419c, Run 6 dated 8 March 1980.
Aerial photo scale 1:1900 based on dimensions of the Grace Avenue sub-station of 29.65 m x 41.75 m .

APPENDIX 2 Extract: Department of Mines.

The extract below is from the 1915 Annual Report of the Department of Mines and indicates that the quarry was operational in 1915.

REPORT ON METAL QUARRY, MARTIN'S CREEK.

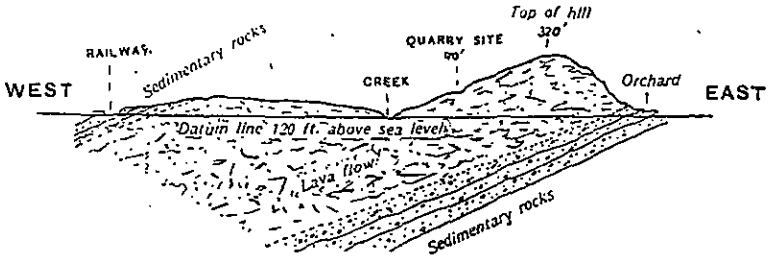
(*L. F. Harper*).

With reference to the attached paper, I beg to report having visited Martin's Creek quarry as arranged with Mr. McKern, Manager of State Metal Quarries.

The quarry site in question adjoins the North Coast Railway about 3 miles north of Paterson, and consists of a hill rising to an altitude of approximately 200 feet above the line. The hill trends north and south, falls steeply to the east, and more gradually to the west, the latter angle of slope being about 1 in 2½.

The rock being quarried is a quartz felsite or porphyry which occurs as a contemporaneous lava flow of Carboniferous age. In the railway cutting south-west from the quarry pebbly arkose sandstones are exposed, dipping south-westerly at an angle of 20 degrees, and these beds overlie the lava in the low ground west of the hill. The base of the flow apparently crops out at the foot of the eastern side of the hill, but lack of exposures do not permit of its boundary being defined.

The available information indicates that a transverse geological section through the hill from east to west would be as follows :—



Section through "Blue Metal" Deposit, Martin's Ck.

The porphyry is of a very homogeneous character, and should be admirably adapted for road metal, whilst the nature of the occurrence points to a uniform grade throughout the hill. Two sets of jointing occur—one almost vertical, and the other dipping at an angle of about 20 degrees from the horizon whilst the amount of soil overburden is negligible, and the rock surface free from decomposition.

In the absence of a contour survey of the hill, it is impossible to form an exact estimate of the quantity of metal available, but in my opinion there are not less than 20,000,000 tons within the area indicated by blue edging on the accompanying tracing.

The range extends north through portions 8 and 31, and is composed of the same rock, so that if desirable a much larger area for quarrying could be secured.

APPENDIX 3 Geological Investigation.

Geological Investigation of a Quarry site at Martins Creek, near Paterson.

Contents

Prepared by

C.L.Adamson,
Consulting Geologist,
43 Holt Avenue,
CREMORNE, 2090.

December 1979.

1. Introduction.

This report presents the results of of a diamond drilling programme of five holes at a site at Martins Creek. The property investigated is Lot 5 Dp 242210 consisting of 27 ha. It is located adjacent to the Martins Creek railway quarry, but separated from it by the road along the eastern boundary of Lot 5.

2. Geology.

The rock occupying most of the area of Lot 5 is andesite (Martins Creek andesite) similar to that exploited in the railway quarry. On the east facing slope leading down to the creek no andesite is present as clayey, silty and sandy rocks underlying the andesite crop out in this area. The andesite consists of a bed up to 45 m thick sloping in a westerly direction from the crest of the hill near Peg A down to the North Coast railway line.

Section A-B demonstrates the sequence of sedimentary beds overlain by the volcanic andesite. On the plan, the eastern limit of the andesite is shown in the area between the contoured and uncontoured parts of the property. Owing to the lack of survey points in this area and doubts about the exact location of the contact between the andesite and the sedimentary rocks, the boundary of the plan is approximate. Elsewhere andesite extends over the boundaries of the area enclosed by Pegs A,B,and C and line peg 3.

The andesite is hard durable rock which crops out strongly in the main westerly flowing creek and in the old quarry near Peg C. Numerous pavements of rock are present on the more gentle slopes in the central part of the outcrop area.

At the quarry about 10 -12 m of rock is exposed in the face. The most obvious feature of the rock in the quarry is its jointing which is well developed and blocky. Low angle joints dipping to the west are probable parallel to the base of the andesite flow. Also prominent are steeply dipping joints in several directions, but those parallel to the strike and at right angles to the dip are common.

Joint spacing varies from about 50mm to over 1 m and at least two closely jointed zones of up to 1 m wide were observed. Rock in the closely jointed zones and adjacent to the more major joints suffers from alteration and/or weathering but most joints are very tight with very little weathering.

The drill cores showed common steep and low angle joints similar to those in the quarry. The more prominent joints frequently are filled with cream or pink calcite and/or zeolite mineralisation a few millimetres thick.

3. Results of the Drilling

The drilling programme was designed to penetrate the full thickness of the andesite flow. Bore No.5 was terminated in solid andesite due to lack of time for completion. Owing to the hardness of the rock the drilling occupied a much longer period than anticipated. Nine metres per shift was a common result.

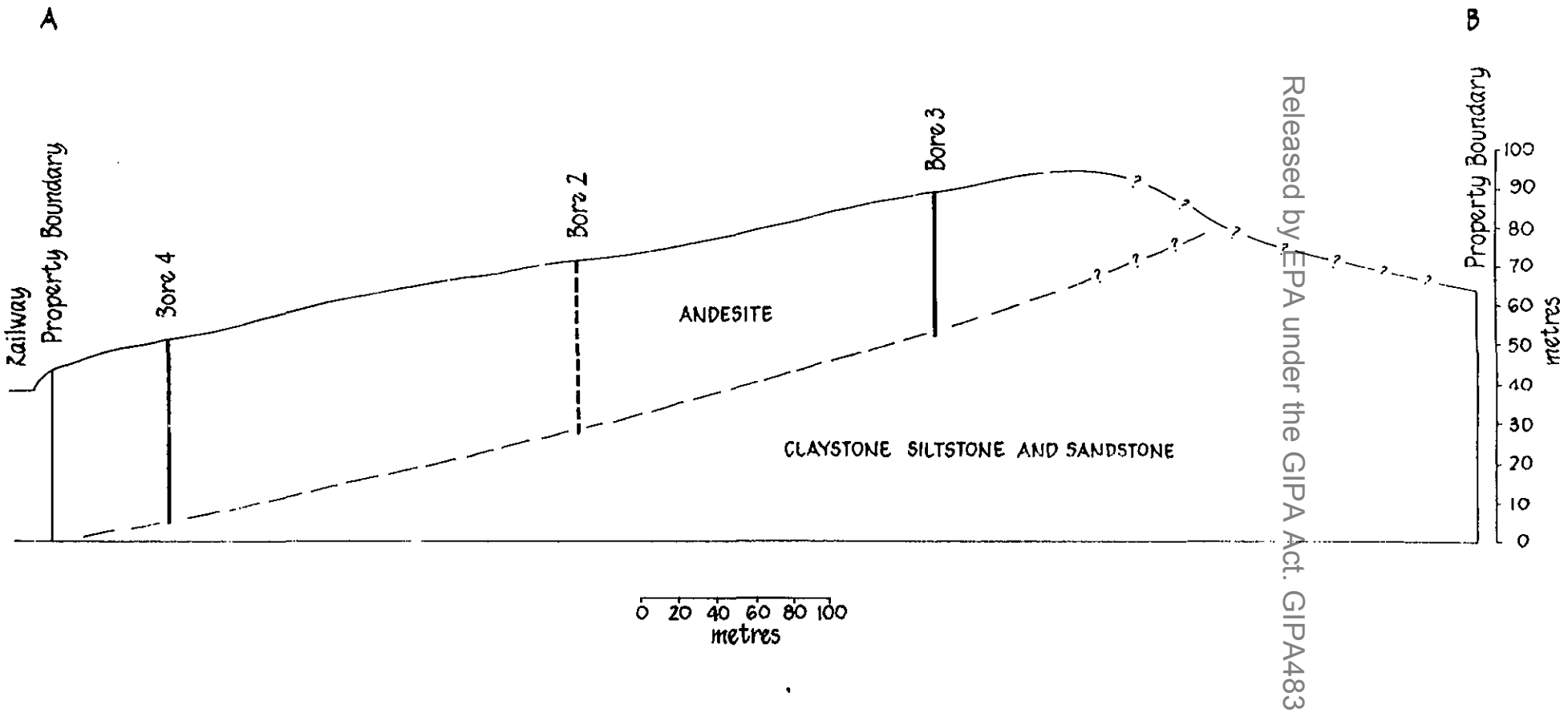


Figure 2
CROSS SECTION A-B
of Lot 5 D.P. 242210
TO ACCOMPANY REPORT BY
C.L. ADAMSON DEC. 1979

In each hole the andesite at the base changed from grey to pink and at the junction it is altered and soft. The underlying sediments are sandy, silty and clayey and apparently tuffaceous. Some of the clayey beds are quite plastic. Similar conditions have been reported in the railway quarry.

Rock in the bore cores varies somewhat in quality, but most variations in quality are due to steeply dipping joints with soft mineral filling and rock wall alteration. In these cases a narrow zone, steeply dipping, can produce a considerable length of inferior core which increases the percentage of inferior rock.

Overburden varies from zero where there are rock pavements to 2.4 m in Bore No.5 with an average thickness of 1.57 m.

The four bores which penetrated to the base of the flow indicate that the base appears to be planar, dipping westerly with a slight increase in dip near the outcrop. This feature is shown in Section A-B.

TABLE 1. SUMMARY OF DRILLING

BORE No.	TOTAL DEPTH	DEPTH TO BOTTOM OF ANDESITE	DEPTH TO BOTTOM SOUND ANDESITE	OVERBURDEN	THICKNESS OF SOUND ANDESITE (1)
	metres	metres	metres	metres	metres
1	50.08	48.70	45.60	1.35	44.25
2	42.00	39.60	38.70	0.54	38.16
3	36.50	35.15	33.50	0.80	32.70
4.	45.55	44.30	43.30	1.20	42.10
5.	32.26	32.26 (2)	32.26 (2)	2.40	29.86 (2)

notes
1. Sound andesite includes minor zones of inferior rock within the sound andesite mass in some bores.
2. Bore 5 did not penetrate to the bottom of the andesite but finished in sound very hard rock.

4. Rock Quality.

Apart from minor altered zones, the bulk of the rock from visual inspection is of excellent quality. It is hard, medium grained with a fine groundmass. No directional structures which would produce long or flattened aggregate fragments are obvious in the hand specimens, although its hardness may produce flaky particles during primary crushing. Rock from the adjacent railway quarry is said to pass aggregate tests, but before any commitment to quarry development is made, samples from the cores and the old quarry should be tested with regard to Australian Standard 1465-1974.

5. Reserves.

Two classes of reserves have been calculated. These are Proved Reserves which are calculated from actual bore positions and thicknesses of sound rock and locations of outcrops in the main gully along the northern boundary. The area for this calculation extends slightly beyond the bore locations as is shown on the plan.

The other class of reserves is Probable Reserves which are based on extension of the data proved by drilling and surface observation to an extent which is probably correct considering the geological conditions of the area.

In both cases the quantities do not include overburden or inferior rock at the base of the flow.

It is certain that patches of inferior rock within the main rock mass will be encountered during quarrying. Estimation of quantities of this type of inferior rock are difficult to estimate due to the wide spacing of the drill holes and the only available data is the percentage of inferior rock encountered in the drilling.

Of the total length of core produced from the mass of andesite (neglecting overburden and the inferior rock at the base) it is estimated that 8% was in patches of unsound stone.

If most of the unsound rock is located in narrow vertical or steep zones associated with jointing, the percentage of unsound rock could be less than 8%. Bore 2 appeared to be located in such a position which resulted in a high percentage of unsound rock. However if unsound rock occurs in masses with random shapes the figure of 8% could be realistic.

In the adjacent Lot 4 the extra amount available would be of the order of 1,000,000 tonnes. This amount should be classified as Probable Reserves.

TABLE 2

RESERVE CLASSIFICATION	WEIGHT OF ROCK MASS, TONNES	WEIGHT LESS 8% FOR UNSOUND ROCK, TONNES
Proved Reserves	8,000,000	7,360,000
Probable Reserves	12,200,000	11,224,000

6. Conclusions.

Diamond drilling on the property has confirmed the original concept of the geological form of the andesite mass and has demonstrated that the quarry in the north west corner of the property represents a fair sample of the stone.

The stone quality appears to be very good but owing to its hardness when fresh, it may lose some favour for road surfacing due to possibility of polishing. It has the appearance of performing as a high grade concrete aggregate, but as andesite are sometimes suspect in regard to aggregate - cement reaction, this aspect should be tested prior to quarry establishment. In fact the usual tests required by AS 1465-1974 should be carried out before any commitment to further expenditure is made.

Appendix A: Calculation of Reserves.

1. Structure of the Andesite

Within the area under study the andesite has been assumed to have the form of a tabular body with an almost planar base dipping in a westerly direction. From the data supplied by bores 1, 2, 3 and 4 structure contours were drawn for the base of the andesite. These data suggest a slight increase in angle of dip as the outcrop of the contact between th andesite and the underlying rock is approached.

2. Proved Reserves.

For this calculation the following concepts have been used.

(a) The complete thickness of andesite as exposed in bores 1, 2, 3 and 4 and the partial thickness as exposed in bore 5 have been accepted.

(b) Thus the base of the block used for the volume calculation slopes upwards from the true andesite base in bores 1 and 4 and to the bottom of the proved andesite in bore 5. Likewise, the base of the block of proved reserves slopes upwards from the true andesite base in bores 2, 3 and 4 to the creek bed on the northern side of these bores.

The area used in the calculation is shown on the plan by the line with short dashes.

3. Probable Reserves.

In this case the structure contours on the base of the andesite as plotted from bores 1, 2, 3 and 4 have been continued to the limits of the area bounded by the line with long dashes. This surface was used as the base of the block for calculation of the volume.

4. Calculation Details.

In each calculation the volumes are the sums of the volumes of 5 m thicknesses obtained from the thickness isopachs. They do not include inferior andesite at the bottom of the flow or overburden.

Appendix B: Bore Logs.

Drilling commenced on 23 rd October and was completed on 21 st November 1979. A split inner tube NMLC barrel was used for rock drilling and core recovery was complete except where a roller bit was used to penetrate broken surface material.

The main drilling problem was slow penetration due to the hardness of the rock. Generally a full core barrel was achieved, and only occasionally was a short run recorded due to wedging of broken core.

The estimation of quality was done visually and rock was designated as sound even though a small percentage was altered along joint planes, provided that the rock mass generally was not altered.

BORE No.1

Depths,m	Quality*	Rock Type	Description
0 - 0.68	us	weath. andesite	no core, soil and rubble
0.68-1.25	us	"	highly weathered, brown, soft, crumbly
1.25-1.35	us	"	moderately weathered, brown, hard
1.35-3.72	s	andesite	fresh, light grey with brown, mod.weath. to 50 mm along one joint, minor weath. to 10 mm along some flat joints. max. core length 170 mm.
3.72-4.72	s	"	fresh, light grey, iron stained joints to 5 mm wide, joints vert. to flat, max.core 150 mm.
4.72- 15.10	s	"	fresh, light grey, occasional joints at 60 or flat with some iron staining & spacing to 1 m.
15.10-17.60	s	"	fresh, light grey, joints spaced commonly 100 mm with soft mineral filling to 5 mm. max core 200 mm.
17.60-18.72	us	"	altered with some brecciated material, light brown to light pink, some highly altered and closely jointed.
18.72-20.40	75%s	"	fresh, grey with brown altered zones along joints
20.40-45.60	s	"	fresh, light grey, a few flat and 45 joints, prominent very steep joints 30.50-34.40 iron stained wall alteration to 50mm. Very sound rock. max core 2.7m in bottom 1.5-2.0m common thin veins (to 3mm) of red soft minerals from a very small percentage of the rock.
45.60-48.70	us	tuff?	red to grey tuff with bedded structures and variable dips 5-60 . Variable composition from hard black siltstone to grain size to 2mm
48.70-50.08	us	sed.rock	dark grey to brown and red-brown, generally hard sandy and silty beds with some soft grey sandy clay
50.08			bottom

* quality: visual estimate s = sound
75%s = 75% sound
95%s = 95% sound
us = unsound

BORE No.2

Depths,m	Quality	Rock Type	Description
0 - 0.54	us	weath. andesite	no core, soil and rubble
0.54-2.10	75%s	andesite	fresh, light grey, mod. weathered along joints
2.10-4.85	25%s	"	fresh, light grey, broken by numerous joints, mostly horizontal, spaced 10-75mm weathering along joints to 35mm wide
4.85-21.70	90%s	"	fresh, light grey, flat and steep joints common with hard brown mod. weathering up to 50mm along joint planes, occasional red or white mineral joint filling to 5mm
21.70-23.15	25%s	"	mod.weathered, hard, associated with very steep soft mineral filled joints
23.15-25.30	90%s	"	fresh, light grey, one very steep soft mineral vein up to 5mm wide and at 24.90 a jointed zone 50mm wide dipping at 45 with brown alteration
25.30-28.70	us	"	altered andesite, zone of very steep joints in brown altered rock with soft mineral vein filling
28.70-38.70	s	"	fresh, light grey, occasional thin mineral filled steep veins and flat joints, joint spacing 100-1000mm
38.70-39.60	us	andesite & tuff	med. grained, mixed beds to 300mm, generally grey with some light brown. Generally hard when freshly drilled, but may not be sound rock
39.60-40.30	us	sed.rock	med.grained, brown to grey with mixed hard and very soft beds
40.30-42.00	us	"	fine grained silty, brown to grey with thin veins of pink and white minerals
42.00			bottom

BORE No.3

Depths,m	Quality	Rock Type	Description
0-0.80	us	overburden	no core, soil and rubble
0.80-18.90	s	andesite	fresh, med.to light grey occasional flat and steep joints with some soft mineral filling to 5mm and brown alteration up to 10mm wide each side of joints
18.90-23.60	s	"	fresh,med.grey,very steep to vert.joints along centre of core with iron stained min.filling to 10mm wide and up to 25mm of brown alteration on each side. Fresh rock outside joint zone for full depth
23.60-27.90	s	"	fresh,med.grey, rare flat dipping joints with minor staining
27.90-29.85	s	"	fresh, med.grey, two very steep joints with 1mm soft mineral filling and 10mm brown altered zones each side
29.85-30.27	s	"	fresh,med.grey,four flat and low angle joints with iron staining to max.of 1mm wide
30.27-30.36	us	"	altered,brown,with iron stained joints
30.36-32.40	s	"	fresh,med.grained,several flat or low angle joints with iron staining and alteration to 5mm
32.40-33.15	s	"	fresh,med.grey,prominent vert. to very steep joints with iron staining and wall alteration to brown andesite to a width of 15mm
33.15-33.50	s	"	fresh,med.grey with pink tinge
33.50-35.15	us	andesite & tuff	pinkish grey at top grading down to pink at bottom
35.15-36.50	us	sed.rock	siltstone,mudstone with sandy beds,some very weak and plastic when wet
36.50			bottom

BORE No.4

depths,m	Quality	Rock Type	Description
0-0.90	us		no core,soil and rubble
0.90-1.20	us	andesite	brown,moderately weathered
1.20-3.45	90%s	"	fresh,light to med.grey, several steep joints 65-80 with weathered zones to 40mm wide
3.45-4.25	us	"	brown,highly weathered,three very steep joints 25mm apart
4.25-6.35	90%s	"	fresh,med.grey,frequent horizontal or low angle joints with iron staining and weathering to 10mm wide,joint spacing av.50mm
6.35-8.00	us	"	mod.weathered,brown,zone of very steep joints inducing weathering
8.00-9.65	s	"	fresh, med.grey,common low angle or horiz.joints spaced 10-150mm with iron staining to max.of 1mm
9.65-32.50	s	"	fresh,med.grey,iron stained, tight joints spaced 40-150mm common to 12.30m then ocas. very steep joints with thin (max.5mm) mineral filling and low angle tight iron stained joints spaced at 50-200mm
32.50-35.20	us	"	altered,breciated and highly veined with soft pinkish minerals
35.20-37.50	90%s	"	fresh,light grey, numerous pink veins to 10mm spaced 25-150mm rock sound apart from mineral veins
37.50-43.30	s	"	fresh,grading downwards from light grey to med. and then darker grey, some mineral veins to 5 mm but most less than 1mm
43.30-44.30	us	andesite and tuff	fresh,pink and light brown,fine to med.grain,with traces of bedding
44.30-45.55	us	sed.rock	brown to pinkish brown,fine grained. highly plastic zone in top 400mm
5.55			bottom

BORE No.5

Depths,m	Quality	Rock Type	Description
0-0.45	us		no core,soil and rubble
0.45-2.40	us	andesite	mod.weathered,brown
2.40-3.50	s	"	fresh,light grey
3.50-3.75	us	"	highly weathered, brown
3.75-32.26	s	"	fresh,light to medium grey, occasional joints,low angle and steep, generally tight with thin (1mm) iron staining or pink mineral
32.26			bottom, due to lack of time the bore was terminated before penetrating the base of the andesite.

APPENDIX 4 SRA Ballast Specification

State Rail Authority of New South Wales
Way and Works Branch

Technical Standard T.S.3402, amended 28 September 1983.

SPECIFICATION FOR SUPPLY OF AGGREGATE FOR BALLAST

1. General Requirements

Ballast shall consist of crushed rock or crushed gravel. It shall be composed of hard durable particle, free of injurious amounts of deleterious substances and shall conform to the requirements of this Specification. At all times, acceptance of ballast material shall be subject to approval by the Superintendent.
The material shall be tested in accordance with Australian Standard Specification AS 1141-1974, and American Society for Testing and Materials Specification ASTM C142, as required by this Specification.

2. Sampling

Samples of ballast for laboratory testing shall be taken and handled fully in accordance with AS 1141, Sec.3.
The Authority reserves the right to carry out sampling and testing of samples at its own laboratories to ensure the material complies with the Specification.

3. Ballast Quality

Deleterious substances shall not be present in the ballast in excess of the following amounts (Table 1). The test methods to determine compliance with these limits shall be as indicated.

TABLE 1

	Limit	Test Method AS 1141-1974
Soft and friable pieces	5% max.	Section 32
Material finer than 75um	1% max.	Section 12
Clay lumps	0.5% max.	ASTM C142

Igneous or other rock, displaying minerals considered to be deleterious to the overall performance of the ballast (durability, free drainage, etc.), may be rejected following petrographic analysis or durability testing, notwithstanding the rock's compliance with other sections of the Specification.

4. Physical Properties

4.1 Grading

TABLE 2

AS sieve aperture size	% passing by weight GRADE 1	GRADE 2	GRADE 3
63.0 mm	100	-------	
53.0 mm	85 -100	100	
37.5 mm	20 - 65	70 -100	see
26.5 mm	0 - 20	-------	note
19.0 mm	0 - 5	40 - 60	three
9.5 mm		20 - 30	below
4.75 mm		10 - 20	
1.18 mm		5 - 10	
0.75 mm		0 - 5	

Note 1. Deleted 22 Dec.1977
Note 2. Material crushed from rounded river gravel and otherwise complying with the above grading may be suitable for use on Class 4 and Class 5 lines, or on Class 3 sidings. The decision in each case will be based on specific additional standard of the Commission.
Note 3. Grade 3 material shall be non-plastic, rock fines, generally 10.0 mm to dust.

4.2 Particle Shape

The proportion of misshapen particles in the fraction of the ballast retained on the 9.5 mm test sieve shall not exceed 10% using a ratio of 3:1 when tested as described in AS 1141, Section 14.

4.3 Strength/Abrasion Resistance

Ballast material shall have an aggregate crushing value (ACV) not greater than 25%, when tested in accordance with AS 1141, Section 21, for material passing the 26.5 mm sieve but retained on 19.0 mm sieve. Material having an ACV of greater than 25% may be accepted at the discretion of the Superintendent provided:

1) The resistance to abrasion for the fraction passing 37.5 mm test sieve and retained on the 10.0 mm test sieve (Los Angeles Test AS 1141, Section 23) results in a Los Angeles value of 30% max.
and
2) The wet strength (AS 1141, Section 22) for the fraction passing the 26.5 mm test sieve but retained on 19.0 mm test sieve exceeds 150 kN and the wet/dry strength variation does not exceed 25%.

4.4 Bulk Density

The ballast material shall have a minimum compacted bulk density of 2.300 tonnes/cubic metre when tested in accordance with AS 1141, Section 4.

5 Handling

Prepared ballast shall be handled at the producing plant in such a manner that it is kept clean and free from segregation. Vehicles used for transporting shall be in good order, tight enough to prevent leakage and waste of materials, and be clean and free from rubbish and substances which may foul or damage the ballast.

6 Inspection

If the material placed, or being placed, does not conform to this Specification, the Superintendent shall notify the Contractor to stop further placement of material until the fault has been corrected and dispose of, and replace all defective material without cost to the Principal.

7. Alternative Materials

Slag. Slag materials from various industrial processes conforming to the requirements of this Specification may also be supplied with prior approval of the Concrete and Soils Engineer.
Additional tests for other properties may be specified as required by the Concrete and Soils Engineer. These tests may include chemical reactions, electrical conduction and others.

R.A.Schwarzer
Chief Civil Engineer.

APPENDIX 5: NOISE IMPACT STATEMENT.

CONTENTS.

1. Introduction

This Statement forms part of an Environmental Impact Statement for a hardrock quarry to extract andesite at Martins Creek. The land is vacant rural land located about 1 km north of Martins Creek township. The land is described in Appendix 1 of the Statement and can be located on the CMA map, Paterson (2327-4-N) scale 1:25000 about grid reference 701976, see Figure 1 and Plan 1 of the Statement. The existing noise environment consists of the present SRA quarry, rail traffic on the North Coast Railway line and local and regional road traffic. The land may be effected by aircraft noise; the land is within the Williamstown Military controlled air zone and additionally a air corridor along the railway line is designated as a general aviation route through the Williamstown airspace.

2. Sound Level Measurements.

Sound level measurements were determined using a B & K instrument model 2219 with microphone type 4130 and set at fast response.

MEASUREMENT 1.

The background sound level was determined as follows:

Ambient	:	0940 hours EST, 4 July 1990, 14 C. bright and sunny, no cloud, slight wind: Beaufort scale 2, no rain
Location	:	Lot 5 in DP 242210
Sound Level 1:		39 to 40 dB(A)
Note 1	:	0950 hours, no machinery audible in background
Sound Level 2:		48 to 49 dB(A)
Note 2	:	0940 hours, noise of train in distance
Sound Level 3:		58 dB(A)
Note 3	:	0944 hours, train passing close to the land
Comments	:	passing trains considerably alter the background noise levels of the locality. Without train traffic the background level is below the daytime limit for rural land of 45dB(A) (Acceptable) recommended by the SPCC (1).

MEASUREMENT 2.

Ambient	:	0857 hours EST, 31 May 1990, 17.5 C. overcast, seven eights cloud, no wind, no rain
Location	:	Horns Crossings Road, 45 metres west from the centre of railway bridge.
Sound Level	:	78 dB(A)
Comments	:	goods train, main noise source was the locomotive. The cutting at the bridge acts as a noise control structure and reduces the noise propagation horizontally.

MEASUREMENT 3.

Ambient	:	0905 hours EST, 31 May 1990, 17.5 C. overcast, seven eights cloud, no wind, no rain
Location	:	Horns Crossings Road, 45 metres west from the centre of railway bridge.
Sound Level	:	38 dB(A)
Comments	:	background sound level measurement without rail or road traffic.

3. Machinery.

The sound levels of machinery proposed to be used are as below. Unless stated to the contrary the sound levels are for "bystanders at 7 metres according to AS 2012" and were obtained from the machinery suppliers and/or manufacturers.

Drilling Machine

A Gardner-Denver drilling Rig with a PR66 drifter,
Sound levels are not available for this machinery combination.

Secondary Breaker

Hitachi EX220 excavator	73 dB(A)
plus Krupp 950 rock pick	94 dB(A)

Excavators/face shovels

Hitachi UH171	87 dB(A)
Demag H36	86 dB(A)

Front-End Loader

Furakowa FL330	83 dB(A) at 11 metres

Boot Trucks

International PH95: sound levels are not available for these
International PH65: trucks, a level of 85 dB(A) is estimated.

4. Nearest Residence.

The nearest residence to the land is sited on Dungog Road on lot 1, DP242210. This residence is located about 200 metres to the west and is separated from the land by the North Coast Railway.

The closest residence plus other residences close to the proposed quarry are:

LOCATION	DISTANCE*	DIRECTION	
Station St.	550 metres	S	lot 4, DP242210
Grace Ave.	600 metres	S	lot 2, DP242210
Dungog Rd.	600 metres	W	lot 1, DP242210
Dungog Rd.	1000 metres	NW	lot 8, DP242210
Merchants Rd.	1000 metres	NE	lot 4, DP250820

* These distances are from the centre of the proposed quarry which is taken to be at grid reference 701976 (2).

5. Winning.

Material will be won by drilling and blasting. Drilling machines are usually pneumatically actuated "air track" types comprising of a track mounted drill plus an air compressor fitted with both dust and noise suppression equipment. The Gardner-Denver drilling Rig with PR66 drifter in service at the existing quarry will be used in the proposed quarry.

The closest residence to the proposed quarry is on the western boundary. Notwithstanding the noise generated by railway traffic silencing of the drill rig should be applied when drilling on the natural surface at this location. Methods to do so are either muffling of the machine and/or by shielding of the machine by movable wooden screens.

Secondary breaking of oversized rock is done by either an hydraulic rock pick or by pop blasting. Of these two methods the former is preferred for safety considerations and ease of production. In either case the breaking is carried out close to the quarry face which acts as a noise control structure.

6. Blasting.

The blasting procedure used in the existing quarry and proposed to be used in the new quarry is Nonel firing of two blasts per month with burden x spacing = 3 x 3 metres and 15 metre faces. This procedure may need to be altered as the quarry proceeds in order to minimise the environmental effects of blasting.

The following details on drilling and blasting are derived from the ICI Handbook of Blasting Tables (3). With a nominal drill hole diameter of 89 mm and standard ANFO explosive with a bulk density of 0.8 g/cu.cm. a linear density of 5.0 kg/metre is obtained. For benches of 15 metres the drill holes details are:

stemming	2 metres
subgrade	1 metre
explosive column	14 metres
total length	16 metres
charge per hole	70 kg

Using double hole firing the Maximum Instantaneous Charge (MIC) is equal to twice the hole charge, thus 140 kg. The calculated environmental effects of ground vibration (peak particle velocity) and air overpressure for 70 kg and 140 kg at different distances are given below. These results indicate that at about 500 to 600 metres the environmental effects are within SPCC limits. At closer distances changes in blasting procedure may be necessary to ensure compliance with SPCC limits.

MIC kg	DISTANCE metres	GROUND VIBRATION mm/second	OVERPRESSURE dB(Linear)
140	200	17.1	126.2
	250	12.0	123.9
	400	5.7	119.0
	450	4.7	117.7
	500	4.0	116.6
	600	3.0	114.7
70	200	9.8	123.8
	250	6.9	121.4
	400	3.2	116.5
	450	2.7	115.3
	500	2.3	114.2
	600	1.7	112.3

MIC quantities are based on a "blue metal" type competent rock. A smaller charge is likely for a weaker rock or a heavily jointed rock. The actual environmental effects of ground vibration and overpressure at different MICs and distances should be measured. As the quarry approaches the nearest residence to the west this practical data should be applied to ensure that the standard SPCC environmental limits for blasting, namely ground vibration of 5 mm/second peak particle velocity and air overpressure of 115 dB(Linear) are not exceeded.

7. Blasting Effects.

The Director of the Department of Planning advised that the prediction of noise and vibration effects to rural residences and St.James Anglican Church, Cook St., Martins Creek, were to be specifically addressed in the Statement. St.James Anglican Church on the corner of Cook and Cory Streets is about 1300 metres from the existing quarry and about 1800 metres from the proposed quarry. The rural residences are mainly located in Station Street about 550 metres from the centre of the proposed quarry.

Calculations (3) of ground vibration (peak particle velocity) and air overpressure for the above distances with different MICs are below.

DISTANCE metres	MIC kg	GROUND VIBRATION mm/second	OVERPRESSURE dB(Linear)
500	50	1.7	113.1
	70	2.3	114.2
	140	4.0	116.6
1200	50	0.4	103.9
	70	0.6	105.1
	140	1.0	107.5
1800	50	0.2	99.7
	70	0.3	100.9
	140	0.5	103.3

For St.James Anglican Church the environmental effects of a MIC of 140 kg are within the SPCC limits. [By way of example a 1000 kg MIC, greatly in excess of normal quarrying practice, at the Church location would result in ground vibration and air overpressure values below the SPCC limits of 5 mm/second and 115 dB(Linear).]

For the rural residences in Station Street a Maximum Instantaneous Charges (MIC) of that proposed (140 kg) produces a calculated overpressure value slightly above the SPCC accepted limit. Actual overpressure values will be lower as the quarry faces are directed away from Station Street and the intervening topography and vegetation will shield Station Street. Nevertheless blasts should be monitored for ground vibration (peak particle velocity) and air overpressure and these data applied to complement the Handbook (3) values. Based on this monitoring, blasting procedures may be altered as the quarry approaches its southern extent to ensure that the SPCC limits at the residencs in Station Street are not exceeded.

The development of the quarry faces from north to south with blasting directed to the north and/or east will ensure that flyrock, should it occur will be into the quarry and away from residences.

8. Traffic Noise.

The route from the proposed quarry to the processing plant in the existing quarry will be along internal haul roads. To ensure that such haulage does not become a source of noise the following control measures should be applied:

1. haul roads on site to have a grade consistent with good quarry practice,
2. haul roads to be formed and graded to prevent bouncing and drumming of empty trucks.

9. Estimates of Sound Levels.

Rail traffic on the North Coast Railway line is 36 trains per 24 hours made up of 6 passenger trains and 30 goods trains. These trains effect the background noise level of the locality. The background level at the proposed quarry site is raised from 39 dB(A) to about 58 dB(A) when a train passes.

In the development phase of the quarry, the quarry face will start at the north and proceed to the south. Most noise producing operations will be on the quarry floor below the natural surface of the land. The principal exception is the drilling rig which is located on the top of the advancing face. Monitoring of this machine will be necessary to ensure that it does not become a source of offensive noise.

To estimate the effect of the development on the noise environment at the nearest neighbour some 200 metres to the west the worst case is considered to be when a face shovel and dump truck are operating concurrently at the toe of the quarry face of 15 metres. The combined noise level of these machines is 89 dB(A). This level attenuates (4) to 58 dB(A) over a distance of 250 metres (200 metres plus 50 metres set back). The quarry face is considered to be a long, thick barrier and a reduction of at least 10 dB(A) to about 48 dB(A) can be expected. Under this worst case condition the sound level at the nearest neighbour is below the daytime extreme limit for rural land of 50 dB(A) recommended by the SPCC (1).

10. Noise Control Measures.

Measures to control the generation of noise are:

1. normal operations within the times below,
   Mondays to Saturdays 7am to 5pm
   Sundays and Public Holidays No operations
2. property boundary set backs of approximately 50 metres,
3. diesel powered plant to be correctly fitted and maintained with the manufacturers' standards being the minimum standards. Particular attention should be given to diesel engine exhaust systems and the care and maintenance of mufflers,
4. overburden bunds and stockpiles should be formed and positioned so as to act as noise control barriers,
5. haul roads to be formed and graded to prevent bouncing and drumming of empty trucks,
6. when drilling along the western boundary silencing of the drill rig should be applied,
7. blasting to be carried out between the 9 am and 3 pm Mondays to Fridays,
8. overpressure from blasting not to exceed 115 dB(Linear) at the nearest affected residence,
9. ground vibration from blasting not to exceed 5 mm/second at the nearest affected residence.

11. Discussion.

The development is located adjacent to the existing SRA quarry at Martins Creek which has been in operation for at least 75 years. The development will simply be a source of raw material to supply the existing quarry. The infrastructure at the existing quarry will remain as it is at present, thus changes will not be made to processing, stockpiling, loading and delivery of products.

The quarrying operations which at present are carried out in the existing quarry will be transferred to the proposed quarry site. These operations are drilling & blasting, secondary breaking, loading of raw material and boot haulage. Noise from these operations will be, for the main, contained within the quarry site the faces of which will act as a noise control structure. The

quarry will commence in the northeast and progress to the southwest with the active faces open to the east and north. Once the initial quarry faces have been established noise from the quarry is expected to be equal to or less than the existing quarry operation. The orientation of the quarry faces will direct blasting effects away from the residences in the south and west and the township of Martins Creek and for these locations a reduction in the sound level from the existing situation can be expected.

Based on normal blasting practice (3) operation within the SPCC environmental limits can be achieved for most locations in the proposed quarry with a maximum instantaneous charge (MIC) of 140 kg in holes 89 mm dia. by 14 metres long. As the quarry approaches the western boundary and hence the closest residence the MIC will need to be reduced. Measurements should be made during normal production blasting to build up a data bank of ground vibration, overpressure and MIC information in order to determine optimum blasting parameters.

12. Conclusions.

1) Provided that the noise control measures are applied it is unlikely that the sound from the development will be offensive.

2) The nearest residence to the land is about 200 metres to the west and at such a distance the calculated worst case sound level from the development is below the daytime extreme limit for rural land recommended by the SPCC.

3) Peak particle velocity and overpressure from blasting will not affect the rural residences in Station Street or St.James Anglican Church.

4) Road traffic noise along Station Street and Grace Avenue is unlikely to be a problem because of the general speed limit of 60 km/hour and the level terrain.

13. References.

1. SPCC, Environmental Noise Control Manual, 1985, Chapter 21-1
2. CMA map Paterson 9232-4-N scale 1:25000.
3. ICI Handbook of Blasting Tables, Jan. 1989.
4. Handbook of Noise Control, ed: C.M.Harris, 2nd ed.1979

14. Declaration.

This Statement was prepared by the undersigned to accompany the Environmental Impact Statement for the extraction of andesite by the State Rail Authority of New South Wales at Martins Creek in the Shire of Dungog. Dated: 26 July 1990

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APPENDIX 6 SOIL AND WATER MANAGEMENT

Contents.

1. Introduction.

The management of soil and water is necessary to, inter alia, prevent erosion, retain soil for rehabilitation, prevent siltation and sedimentation of water courses and conserve water resources. Site location is shown in Figure 1 and site topography is shown in Plan 1.

The area of the development totals about 10 ha. made up of about 5 ha. for the quarry and another 5 ha. for the haul road. Mean annual rainfall for the area is 950 mm spread over 110 rain days. Details of rehabilitation are given within the body of the Statement.

2. Rainfall and Runoff

For the locality rainfall intensity - frequency - duration values have been determined by means of Australian Rainfall and Runoff (1987) data and are attached to this Appendix. As the quarry developes corresponding increases will occur in the quarry floor area, catchment, time of concentration and catchment dam requirement. Water volumes for rainfall within the quarry, for quarry floor areas of 1 ha and 5 ha, for both mean annual rainfall and storm events are below:

quarry floor area	1 ha	5 ha
water flow length	140 metres	350 metres
time of concentration	6 minutes	17 minutes
intensity		
1 in 10 year storm	131.8 mm/hour	83.7 mm/hour
1 in 100 year storm	205.5 mm/hour	129.6 mm/hour
rain volume		
1 in 10 year storm	132 cu.m.	1,185 cu.m.
1 in 100 year storm	205 cu.m.	1,835 cu.m.
annual rain volume	9,500 cu.m.	47,500 cu.m.

3. Water Management Requirements.

The requirements of the Department of Water Resources are for runoff from process tailings and stockpile areas to be contained in a dam to contain runoff from a 1 in 10 year storm. SPCC requirements are for total impoundment of a 1 in 10 year storm of duration equal to the time of concentration of the catchment.

4. Design Storm Event.

The design storm event is a 1 in 10 year storm. The duration will vary between 6 minutes and 17 minutes depending on the area of the quarry. The water volume will correspondingly vary between 132 cubic metres and 1,185 cubic metres. A dam or series of dams is required to contain this volume.

5. Water Demand.

Water will be required in the development for the watering of haul roads to lay dust and in the rehabilitation of the land. The annual water requirement is about 400 cubic metres and consists of 300 cubic metres for dust control on haul roads, and 100 cubic metres for rehabilitation. The water will be obtained from that impounded and retained on the land.

6. Water Management.

Water management will consist of diversion drains within the set back areas to deflect water away from the site towards natural bushland. The quarry floor will slope down at a gradient of 1 in 100 to a dam or series of dams to detain and retain the initial flush (i.e. the water volume equal to the time of concentration). The aggregate storage capacity will be equal to the volume of a 1 in 10 year return period storm. The water retained will be used as the water supply for the development. Detention of the water will allow entrained sediment to settle-out before discharge. This will minimise sedimentation contamination of the Paterson River catchment.

Culverts are to be provided as necessary under haul roads and tracks to allow the passage of water. Without such culverts the water would become muddied by vehicles passing through the water and the tracks and roads would deteriorate.

7. Soil & Water Control Measures.

To assist in rehabilitation, to prevent soil erosion, and in general to minimise the impact on soil and water conservation the following general measures are to be applied.

1) Diversion drains to deflect water away from the site towards natural bushland.
2) Water on the quarry will be directed to a series of dams of aggregate capacity equal to the volume of a 1 in 10 year return period storm.
3) Water retained in these dams will be used as the water supply for the development.
4) The quarry floor will slope down to a dam to contain the initial flush of the quarry floor. Water in this dam will be pass to a second dam before discharge.
5) Top soil is to be stripped and stored in bunds about the development to act as a seed source in rehabilitation. (It should be noted that the land has a shallow depth of soil overlying either rock or a layer of clay overburden.)
6) Friable overburden about the edge of excavations shall be battered at 3H:1V away from the excavation.
7) The faces of quarry excavations may be vertical, with an average maximum face height of 15 metres.
8) Haul roads and on site tracks to have a grade consistent with good quarry practice and, as appropriate to have crossfall drainage and cross bank runoff diversions.

9. References

Advice in the preparation of this Appendix has been received from the Department of Water Resources, the Soil Conservation Service of New South Wales and the State Pollution Control Commission. The following documents and sources have been referred to:

1. General Requirements for Environmental Impact Statements Dept.of Water Resources, 1990.
2. Guidelines for the planning, construction and maintenance of trails. Soil Conservation Service of New South Wales, 1985.
3. Guidelines to meet Soil Conservation Service requirements for Environmental Impact Statements - Mining (provisional issue), Soil Conservation Service of New South Wales.

MARTINS CREEK

2 year, 1 hour intensity: 28.50 mm/hr
2 year, 12 hour intensity: 7.00 mm/hr
2 year, 72 hour intensity: 2.20 mm/hr
50 year, 1 hour intensity: 56.50 mm/hr
50 year, 12 hour intensity: 14.50 mm/hr
50 year, 72 hour intensity: 5.00 mm/hr
Skewness: .07
Geographical factor for 6 minute, 2 yr storm: 4.32
Geographical factor for 6 minute, 50 yr storm: 16.00
Latitude : 32.5570 Longitude: 151.6200

MARTINS CREEK: RAINFALL INTENSITY (mm/h)

Duration	Average Storm Recurrence Interval (years)						
	1	2	5	10	20	50	100
5m	72.00	93.64	123.81	140.97	164.37	195.67	219.97
6	67.42	87.65	115.81	131.81	153.64	182.82	205.48
7	63.60	82.67	109.15	124.19	144.71	172.14	193.43
8	60.34	78.41	103.47	117.69	137.10	163.04	183.17
9	57.51	74.72	98.55	112.05	130.50	155.16	174.28
10	55.02	71.47	94.22	107.10	124.71	148.23	166.47
11	52.80	68.58	90.36	102.70	119.56	142.07	159.53
12	50.82	65.99	86.91	98.75	114.94	136.56	153.31
13	49.02	63.64	83.79	95.18	110.76	131.57	147.70
14	47.38	61.51	80.94	91.93	106.97	127.03	142.59
15	45.88	59.55	78.34	88.96	103.49	122.89	137.91
16	44.50	57.76	75.95	86.23	100.30	119.07	133.62
17	43.23	56.09	73.74	83.70	97.35	115.55	129.65
18	42.04	54.55	71.69	81.36	94.61	112.29	125.98
20	39.91	51.77	68.00	77.15	89.69	106.42	119.37
25	35.62	46.19	60.58	68.69	79.81	94.63	106.10
30	32.35	41.93	54.94	62.26	72.30	85.68	96.03
35	29.76	38.55	50.47	57.16	66.36	78.60	88.06
40	27.64	35.80	46.82	53.01	61.51	72.83	81.58
45	25.87	33.49	43.78	49.54	57.47	68.02	76.17
50	24.36	31.54	41.19	46.60	54.04	63.93	71.58
55	23.06	29.85	38.96	44.06	51.08	60.41	67.62
60	21.92	28.37	37.01	41.84	48.50	57.34	64.18
75	19.39	25.11	32.81	37.12	43.06	50.96	57.06
90	17.52	22.70	29.69	33.62	39.02	46.20	51.76
2.0h	14.89	19.31	25.32	28.69	33.33	39.51	44.29
3.0	11.82	15.34	20.17	22.90	26.63	31.61	35.48
4.0	10.02	13.01	17.15	19.49	22.69	26.97	30.28
5.0	8.82	11.46	15.12	17.20	20.04	23.84	26.79
6.0	7.94	10.33	13.65	15.54	18.11	21.56	24.24
8.0	6.74	8.77	11.61	13.24	15.44	18.40	20.70
10.0	5.93	7.73	10.25	11.69	13.65	16.28	18.32
12.0	5.35	6.97	9.25	10.56	12.34	14.73	16.58
14.0	4.86	6.35	8.46	9.67	11.31	13.52	15.24
16.0	4.48	5.85	7.82	8.95	10.49	12.55	14.16
18.0	4.17	5.45	7.29	8.36	9.81	11.75	13.27
20.0	3.90	5.11	6.85	7.87	9.23	11.07	12.51
22.0	3.68	4.82	6.48	7.44	8.74	10.49	11.87
24.0	3.48	4.56	6.15	7.07	8.31	9.99	11.30
36.0	2.69	3.53	4.80	5.54	6.54	7.89	8.95
48.0	2.22	2.92	3.99	4.62	5.47	6.63	7.53
60.0	1.89	2.50	3.43	3.99	4.73	5.75	6.55
72.0	1.66	2.19	3.02	3.52	4.18	5.09	5.80

APPENDIX 7

ARCHAEOLOGICAL SURVEY

OF PROPOSED HARDROCK QUARRY

AT MARTIN'S CREEK, NSW

Report prepared for D.P. James & Co. and N.S.W. State Rail Authority.

By Gary Dunnett and Paul Packard

June 1990.

Table of contents

1 Introduction

This report describes an archaeological survey of the site of a new hardrock quarry to replace the existing Martin's Creek Quarry. The general location of the proposed developement is shown in Figure **1.1**. The positioning of the zone of maximum impact, resulting from the quarry and associated haulage road, are shown in Figure **1.2**. The area covered by the archaeological survey is shown in Figure **1.3**.

During the survey three possible Aboriginally scarred trees and an isolated flaked stone artefact were located within the general proposed development area. The possible scarred trees are all located outside of the actual proposed quarry impact zone but within the land portions covering the quarry development. An additional isolated flaked stone artefact was also found in exposed ground outside the development area.

On-site consultations with members of the Mindarriba Local Aboriginal Land Council indicated that the isolated stone artefact held no particular Aboriginal significance. There was concern however that the possible scarred trees should be protected from disturbance.

This report recommends that a buffer zone be established around the scarred trees. It also recommended that no further archaeological work be required before the development is allowed to proceed. The developer must apply for a Consent to Destroy permit from the National Parks and Wildlife Service in respect of the isolated artefact.

2 Background

2.1 Environmental Background

The proposed development area lies in the Hunter Valley Central Lowlands zone as defined in the National Parks and Wildlife Service Hunter Valley Region Archaeological Project (Hughes 1984).

The northern half of the development area (see Figure **1.1**) is a lightly timbered west facing slope. The southern half consists of a similarly lightly timbered central knoll and western slope and a more densely timbered east facing slope. There is a north-south running creek on the eastern margin of the development area, and

three east-west running creeks, one of which bisects the proposed development area.

The proposed development is a hardrock quarry. The bedrocks are volcanics of the Nerong Group (Newcastle 1:250000 Geological Series Sheet S1 56-2). This group includes the marginally flakeable material ignimbrite.

The western slopes are degrading surfaces with shallow soils. The steeper valley to the east, which includes the eastern slope of the area, has deeper, more developed soils. In both cases the landsurface is well stabilised. The only washouts or exposed sections which occur are around vehicular tracks and along the banks of the north-south flowing creek. There is therefore limited opportunity to inspect vertical sections for cultural material. Instead, site visibility is largely restricted to exposed ground surfaces.

The basic vegetation structure is open forest on the slopes and central knoll with slightly denser stands in the creeks.

On the eastern slope and around the east-west flowing creeks the dominant species is Ironbark, *Eucalyptus fibrosa,* with some *Angophera sp.* and *Acacia sp.* The western slopes are dominated by Spotted Gum, *E. maculata*, with a few Paperbark, *Melaleuca sp.* The lower part of the western slope, towards the western boundary of the area, also has some *E. fibrosa* and Stringybark, *E. eugenioides* mixed in with the *E. maculata* (see Plates 1 and 2 for an example of this landscape). There are extensive clear areas on the knoll and the western slopes with thick grass cover. There is also an infestation of Lantana on the western side, particularly around the creeks.

The timbered areas were notable for the absence of mature trees. No individual trees with a diameter of greater than about 35cms were observed on the main knoll. The only larger trees were on the lower margin of the western slopes, along the creeks and on the eastern slope.

There is a different vegetation pattern associated with the north-south flowing creek which supports a dense stand of Lilypillys, *Acmena sp.* The exposure and aspect of the surrounding slopes suggests that these are probably an isolated pocket of rainforest species rather than the relic of a more extensive patch.

The soils in the area vary from brown silty clays on the western slopes to compact red clay-rich units on the eastern slopes, overlain by brown silty clays (see Plate **4** for an example of red clay-rich soils). These soils on the eastern slopes follow a catenary progression and are more developed towards the valley floor.

2.2 Archaeological Background

There were five sites previously recorded for the 1:250000 sheet grid square (Newcastle S1-56-2 :368000-378000,639000-640000) surrounding the present survey (see Table **1**). Three of these were open sites consisting of scatters of flaked stone artefacts. Raw materials recorded on these sites were silcrete, quartzite, mudstone and hornblend-andesite. One of the sites was a scarred tree, interpreted as a possible canoe scar. The remaining two sites were stone arrangements, both destroyed at some stage in the 1920's or 1930's.

An overview of the considerable quantity of research conducted in the Hunter Valley to 1984 was prepared by Hughes (1984). This study lists the site types represented in the region; rock shelters with occupation and/or art; rock engravings; axe grinding grooves; open artefact scatters; scarred and carved trees; stone arrangements; Bora grounds; natural mythological sites; shell middens; and burials. Artefact scatters account for 60% of the total sites. Half of all the sites found in the Hunter Valley were recorded in the Central Lowlands zone, although this is probably partly the result of the concentration of surveys in this zone.

Hughes suggests that in the Central Lowlands region, of which the area around Martins' Creek Quarry is part, there are strong regularities in the patterning of site locations. Sites tend to be concentrated around the middle reaches of major rivers or creeks flowing into the Hunter River, with the frequency of artefacts decreasing up the smaller tributaries. Sites are generally located on level ground (Hughes 1984:9).

Recent research in the Central Lowlands region by Koettig has focused upon the detection of subsurface sites from minimal surface indications. Test pitting over areas where small quantities

of artefacts were visible on the surface has resulted in the discovery of intact sites, including knapping floors and what has been interpreted as a heat treatment area.

Reports relating to the Martin's Creek region are listed in Appendix 1.

2.3 Ethnohistory

Brayshaw (1984) has conducted an exhaustive review of the ethnohistoric data available for the Hunter region. The following is derived from her description of the primary sources.

The ethnohistory does not lend itself to detailed reconstruction of settlement patterns, movements or population densities. At the broadest level, it is probable that the Martin's Creek area was part of the territory of the Worimi tribe, which seems to have been centred around the Port Stephens area (Brayshaw 1984:3.11). This would suggest that the Martin's Creek area was part of the hinterland of a predominantly coastal group. It has been suggested from a number of analyses of the N.S.W. coast that a common residence pattern was for groups to spend the summer on the coast and to move into their inland territories during the colder months (eg Poiner 1976; Brayshaw 1984). One problem with this interpretation is the preponderance in the ethnohistory of observations of coastal groups. It is possible, though less likely, that the Martin's Creek area was more central to the territory of an unrecognised group.

The ethnohistory contains considerable information about material culture and diet. One important feature of the material culture of the region was the prominence of bark as a construction material. "Bark appears to have been one of the most widely used commodities, presumably because it was adaptable to so many purposes" (Brayshaw 1984:4.1).

These purposes included the manufacture of canoes, huts, string, baskets, nets, dishes and shields. In the light of this it is not surprising that scarred trees figure so prominently in the archaeological landscape of the region. Other items were made from wood: clubs, "swords", spearthrowers, hatchet handles, shields and fishing, hunting and fighting spears; from shell:

woodworking scrapers; from bone: awls; and from kangaroo and possum skins: clothing.

Plant foods recorded from the Hunter region included yams, fern roots, Gymea lily, kurrajong, native cherry and Macrozamia. Animals included kangaroos, wallaby, bandicoot, possum, echidna and flying foxes. Fish and shellfish seem to have been particularly important, with capture techniques ranging from nets and weirs to spears and hook and line (Brayshaw 1984:5.5). Muttonbirds and waterfowl were taken in season. It should be noted that the concentration of observations in the coastal regions probably means that many "inland" foods were not recorded.

European occupation of the nearby Paterson Plains commenced as early as 1813 and had extended as far northwest as Singleton by 1821 (Brayshaw 1984). The proposed development area was first granted as part of the property "Gostwick" in 1823.

3 Survey Strategy

3.1 The Sample Area

The sample area was surveyed on foot by G. Dunnett accompanied by Steve Talbot and two other representatives of the Mindaribba Land Council. The area which was surveyed is shown in Figure **1.2**

3.1.1 Sample Selection

The development consists of a new hardrock quarry to replace the current Martin's Creek Quarry. The new quarry would utilize the existing crushing mill and other fixed plants. A haulage road with setbacks would be required to link this complex to the new quarry. The location of the quarry and haulage roads, as indicated by the development consultant and by the acting quarry manager in the field, are shown in Figure **1.2**. The developer estimates that the quarry would cover 5 hectares, with a further 5 hectares required for the haulage road.

The development would effectively destroy the present landsurface over this 10 hectare area. An additional zone of impact can be anticipated in the downstream portion of the east-west flowing stream which passes through the area to be quarried. The development area can be divided into 5 units:

1.central knoll
2.westward facing slopes
3.eastward facing slopes
4 east-west running creeks
5.north-south running creek

Ground exposure in the surveyed area varies between around 5% to 10%. There does not seem to be any noticeable bias in terms of the availability of exposures in the different landscape units. The exposures include both "naturally" bare surfaces, especially on the thin soils of the western slopes, and ones produced along the vehicular tracks which cross much of the area. Most exposures were easily visible and were inspected for sites. Trees with a diameter of greater than 30 cms were inspected for scars, however such trees were rare.

3.1.2 Sample Representativeness

The sample chosen fulfills two functions. Firstly, it provides as complete as possible a coverage of the area where the current landsurface will be removed. Secondly, it includes samples of the five units recognised in the area.

3.1.3 Sample Dimensions

The area surveyed is illustrasted in Figure **1.3**. The total area involved in the development proposal is approximately 0.5 of a square kilometre. The area of maximum impact, the quarry and haulage roads, together cover 0.1 square kilometres. The sampled area acounts for some 0.2 of a square kilometre, representing about 40% of the total development area.

3.2 Sample Effectiveness

Since the degree of ground exposure was around 5% to 10%, the effective ground surface coverage of the archaeological survey over the area was between 1% and 4%. With the exception of the area around the banks of the north-south flowing creek, exposures were restricted to sediment surfaces, rather than revealing vertical sections. However, given that the soils are generally shallow, it is reasonable to presume that the exposed, and in some cases deflated, surfaces which were observed should give a reasonable indication of the presence of artefactual material. This cannot be assumed with as much confidence in the case of the valley on the eastern margin of the development area, where the soils are somewhat deeper.

In the case of scarred trees the survey results can be interpreted with some confidence, as all the trees which were potentially of suitable age were examined.

At present the survey area has little evidence of landscape destabilisation. The presence of open grassy areas and the absence of mature trees suggests that at some stage the area has been cleared, however any effect of this on the local landsurface is not apparent. There are differences in sediments across the area. The western slopes have a thin cover of soil with frequent exposures of bare rock. The east-west running creek which passes through the centre of the area has a rocky base with little or no sediment accumulation around its banks. In contrast, the north-south flowing creek to the east of the area incises through up to 50 cms of sediment. The adjoining eastern slopes seem to have deeper soils than those in the west.

The survey area was chosen as a quarry site because of the presence of hard Nerong Group Volcanics. The same rock is used as road fill on tracks around the area. It also fractures off natural outcrops during the construction of tracks. Consequently, the identification of flakes of this material in these areas would be difficult. No suspected artefacts or manuports of these rocks were noted.

4 Aboriginal Consultation

The Mindaribba Local Aboriginal Land Council, based in Maitland, is responsible for the Martin's Creek area. The Land Council was contacted through their spokesperson, Ms Evelyn Barker. Ms Barker organised for the Land Council to be represented during the survey by Mr Steve Talbot. Two other representatives of the Land Council also assisted with the survey.

During on-site discussions with the people from the Land Council concern was expressed about the preservation of the scarred trees. The representatives who took part in the survey did not consider the isolated artefact to have high Aboriginal signifigance.

A copy of this report has been forwarded to the Mindaribba Land council for comment. Their response will be appended to the report once it has been received.

5 Archaeological Results

Five archaeological finds were recorded during the survey, four within the general development area and one on an exposure outside the development area to the east. Two of the finds were single isolated artefacts. The other three were possible scarred trees. The locations of the five finds are shown in Figure **1.3**.

5.1 The finds:

5.1.1 Scarred Trees

The western slope on which the three possible scarred trees are located supports a mixed assemblage of *E. Fibrosa*, *E. maculata*, *E. euginioides*, *Melaleuca sp.* and Lantana. They are all within 200 metres of a creek, although the creek does seem to hold permanent water.

1. Possible scarred tree (See Plate **5.1**). Location: Paterson 1:25000 Sheet 6990 9765. The scar is on the western face of an Ironbark, *E. fibrosa*. The tree is approximately 65cms in diameter.

The scar begins 4 metres above the ground and extends upwards for 1.6 metres. It is approximately 20cms wide. The underlying wood is exposed along the scar, and the remaining bark has grown a thick lip around the scar. The scar has a regular, lenticular shape.

The height above the ground of this scar lends some ambiguity to its status as a scarred tree. The scar is extremely regular and it is difficult to envisage how a natural trauma, such as a broken branch, could have produced this effect. It is possible that this particular point on the tree was chosen by Aborigines for some attribute which is not now recognisable.

2. Possible scarred tree. Location: Paterson 1:25000 sheet 6984 9759. This tree is another Ironbark. It's diameter is about 75 cms. The scar is on the northern face of the tree. In this case the scar begins at ground level and extends upwards for 1 metre. It varies between 5 and 10 cms in width, being wider at the base and tapering to a point at the top. The underlying exposed wood has been burnt. Given that none of the surrounding trees (diameters of around 30cms) show any evidence of burning this presumably indicates that the scar is of some age.

3. Possible scarred tree (see Plate **2**). Location: Paterson 1:25000 sheet 6988 9749. This tree is a Stringybark, *E. euginioides*. The scar is on the east face of the tree, which is around 70 cms in diameter. The tree is dead, probably sometime in the last 10 years. The scar is less regular than those on the other two trees. In this case the scar begins about 5cms above ground level, and finishes at 2.3 metres. It is approximately 50cms wide. The irregularity in the shape of this scar could possibly be accounted for by two adjacent lenticular strips being removed.

5.1.2. Isolated artefacts

Both of the isolated artefacts occur in the valley on the eastern margin of the development area. The area supports a mixture of *E. fibrosa, Angophera sp.* and *Acacia sp.* on its higher slopes, open grassed areas in the middle sections where the two

finds were located, and a dense stand of Lilypillys around the creek.

The north-south flowing creek is quite deeply incised with steep banks. These expose up to 40 cms of deposit in sections. No artefacts were noted in any of the sections. The soils further upslope where the isolated artefacts were located were much shallower, seeming to consist of a thin layer of brownish silts some 5-10cms thick overlying a red clay unit. This upper unit does not seem to be actively depositing.

4. Isolated artefact (see Plate **3**). Location: Paterson 1:25000 sheet 7040 9730. The artefact is an orange silcrete flake. It is 2.5cms long, 1.5cms wide and 1.3cms thick. The artefact shows no cortex and is unretouched. There is some edge damage which probably results from the artefact being driven over.

The flake lies on an exposure created by an unformed track. Vehicular movements and slopeward erosion have removed the loose upper layer of brown, humic-rich sediment and revealed a surface of red, clay rich deposits. The flake sits on the surface of these, although it probably derives from the overlying layer. The exposure stretches for 20 metres, and is around 2 metres wide. No other artefactual material was noted.

The site is 120 metres upslope from the creek, and the slope at this point has a gradiant of roughly 1 in 10. The vegetation in the immediate vicinity consists of thick grasses. Further upslope Ironbark, Angophera and Acacia species occur.

5. Isolated artefact. Location: Paterson 1:25000 sheet 7040 9730. The artefact is a red silcrete flake. It is 2.5cms long, 2.5cms wide and 0.7cms thick. It appeared to have some unifacial retouch along one edge of its bulbar surface.

This find is on the opposite side of the north-south running creek to site 4. It was decided to inspect this exposure even though it was not within the development area because it was one of the few opportunities to observe comparible deposits to those on the lower slopes of the eastern slope of the survey area.

The flake was located on a steep section of vehicular track, approximately 20 metres after the track crosses the creek (see Plate **4** for a view of the exposure and an example of this soil unit). The surface on which the flake lay was again the red clay

rich deposits which underlie the looser brown sediments. The exposure created by the road continues upslope. It was inspected for a further 300 metres without result.

5.2 Discussion

5.2.1 Scarred Trees

None of the trees can be unambiguosly catergorised as scarred trees. Nonetheless, the emphasis on bark as a construction material in the region requires that the possibility be carefully considered.

The scars are not sufficently large enough to result from canoe building. Considering the nearest waterway, the Paterson River, is nearly 3 kilometres distant, this is not surprising. As discussed in section **2.3**, many other smaller items of material culture were constructed from bark. Although canoe scars are generally of the classic lenticular form, it does not necessarily follow that the same should apply when bark is removed for other tasks. No axe or wedge marks were identified on any of these trees; this absence makes a firm identification of these as scarred trees difficult.

There are of course natural means by which scars can be created and there are trees in the area with scars that are clearly natural. Apart fom the irregularity of the scars one noticeable difference was that the surface of the underlying dead wood tended to be rougher than in the three examples recorded as possible scarred trees.

The representatives of the Mindaribba Land Council were confident that these trees were Aboriginally scarred trees. Taking into account all the above the most prudent option is to operate on the assumption that these three trees are sites.

5.2.2 Isolated Artefacts

Both artefacts seem to derive from the thin, 5 to 10 cm thick layer of brown sediment which overlies the denser clay unit.

This sedimentary succession seems to be constant on the slopes around the north-south flowing creek.

The eastern valley in which the two isolated artefacts are located offers the best potential of any area within the development area for producing intact sites. The issue which needs to be addressed is what sort of sites might be anticipated.

The two artefacts which were discovered both occurred on reasonably large exposures. In both cases inspection of these exposures failed to produce any further artefacts. On this basis it is most likely that they represent isolated finds rather than being part of either knapping floors or coherent campsites. There is of course a possibility that such sites do exist in the larger portion of this land unit where the ground surface was not visible. Nonetheless, since this surface, in common with the rest of the survey area, is not a depositional environment, there is little potential for the formation of well stratified sites.

The presence of the two isolated artefacts indicates that at some stage Aboriginal people have used this part of the survey area. In addition to the suite of resources associated with the open eucalypt forests of the surrounding slopes, the creekbed would provide some particularly attractive foods in the form of the Lilypilly, *Acmena sp.* stand that occurs there. The fruits of these trees were often available in large quantities. There are records from other rainforest areas in N.S.W. and Victoria of these fruits being eaten (Byrne 1987).

It is clear that there are attractive resources available, and that the valley has been utilized in the past. The question is what sorts of sites would result from such occupation. The area is not consistent with the localities that Hughes (1984) identifies as having the most potential for sites. There are few flat areas where campsites might be located. Those that do occur are down near the creekbed where site preservation is unlikely. The creek is a relatively minor tributary of the Paterson River, whereas Hughes argues that most of the larger sites occur on the larger tributaries. In addition, the creek does not hold permanent running water, and during dry periods, probably no water at all.

The above is not intended to suggest that no further sites would be present in this valley. Instead, it implies that the sites

which might exist are likely to be further isolated artefacts, reflecting a low-key exploitation of the valley's resources, possibly from camps located on the nearby Martin's Creek or Paterson River.

6 Site Signifigance

6.1 Scarred Trees

As discussed in the previous section, the most prudent option is to manage the three sites recorded as possible scarred trees on the assumption that they are genuine sites. Nonetheless, the ambiguity of their status does temper their strictly scientific signifigance. Accepting these problems, the emphasis on bark objects in the ethnohistory implies that these trees are potentially part of an important component of the archaeological landscape of the region.

The representatives of the Mindaribba Local Aboriginal Land Council who took part in the survey were confident that the sites were scarred trees.

The educational signifigance of these sites is limited. Access to the area is through an active quarry and their ambiguous status renders them unsuitable for interpretation. There are other examples in the region (eg NPWS site no 38-4-69) which would be better options from an educational perspective.

6.2 Isolated Artefact

One of the isolated finds lies outside the proposed development area. The other (Find No. 4) is not only within the development area, but also in the area of maximum impact. Construction of the haulage road would disturb or destroy the isolated flake. The haulage road would also remove a strip approximately 100 metres wide of the eastern slope, part of an area where more isolated artefacts might be located.

The archaeological signifigance of these finds and the potential signifigance of the landsurface can be approached from two perspectives. Firstly, at the local level, the presence of the site

indicates that this valley has been exploited during the past. That exploitation may be indicative of the value of small pockets of rainforest species, such as are found here. However, it is considered unlikely that the eastern slopes of the survey area contain any substantial archaeological materials which could allow more detailed analysis of the prehistoric exploitation of the valley.

Again at the local level, it is worth noting that the sedimentary unit in which both the isolated artefacts were located, continues upstream of the development area. The proposed quarry will not impact on this area.

The second context in which archaeological signifigance should be assessed is regional. Open artefact scatters are the most common site type in the Hunter Valley Central Lowlands Region, with over 700 such sites recorded by 1984 (Hughes 1984:13). The significance of this isolated find is that it extends the regional pattern into a very minor tributary. Studies which further extend our knowledge of the archaeological landscape of the region would require a more robust data base than appears to be available on this slope.

7 Recommendations

The possible scarred trees on the western slope of the development area should be protected. These trees are outside the area which will be directly impacted, provided the development does not extend further west than currently intended. One appropriate means of ensuring the protection of trees would be to turn the area for two hundred metres east of the North Coast Railway (effectively the western boundary of the development area) into a buffer zone. This area should be marked or fenced to prevent any incursions into the area by machinery during quarring. Any extension of activity beyond this point should only take place in consultation with the N.S.W. National Parks and Wildlife Service.

It is not considered that the area which will be affected by the haulage road, that is the eastern slopes of the development area, has potential to produce substantial archaeological sites. It is

recommended that no further archaeological work be required and that a Consent to Destroy Permit should be sought from the N.S.W. National Parks and Wildlife Service.for the isolated artefact located in this area.

The developer's attention is drawn to the fact that all Aboriginal relics are protected under the *National Parks and Wildlife Service Act 1974* and that should any relics be discovered during quarrying operations the developer must notify the Director of NPWS.

8. Bibliography

Brayshaw, H; 1984. **The Hunter Valley and its Aboriginal inhabitants: an ethnohistoric study.** Anutech, Canberra.

Bryne, D; 1987. **The Aboriginal and archaeological signifigance of the New South Wales rainforests.** Forestry Commision of N.S.W.,Sydney.

Hughes, P; 1984. **An overview of the archaeology of the Hunter Valley, its environmental setting and the impact of Developement.** Anutech, Canberra.

Poiner, G; 1976. "The process of the year among the aborigunes of the central and south coasts of N.S.W." **Archaeology and Physical Anthropology on Oceania** 11: 186 - 206

Appendix 1

There are more than a hundred reports in the NPWS central register for the lower Hunter Region. The following are included either because they are in the immediate vicinity of Martin's Creek or because they covered similar landscapes.

1. Djekic, A 1978. **An Archaeological Survey of the route of the Paterson-Martin's Creek Water Supply Pipeline.**

Results: no sites, one "ambigous" scarred tree.

2. Lance, A and Hughes, P. 1983. **An Archaeological Survey of the Vacy Rural subdivision, Hunter Region, N.S.W.**

Results: Three sites, all artefact scatters.

3. Brayshaw, H. 1983. **Archaeological Investigation of a proposed Quarry site at Mt Seaham, N.S.W.**

Results: no sites, some "possible" scarred trees.

4. Greer, S and Brayshaw, H. 1983. **An Archaeological Survey of a proposed gravel extraction site near Seaham, N.S.W.**

Results: no sites.

5. Brayshaw,H. 1982. **Archaeological Survey of gravel and sand extraction site north of Maitland**

Results: no sites

Table 1

Sites recorded on the N.P.W.S central site register for the Newcastle 1:250000 Sheet S1 56-2 for grid coordinates between Eastings 368000 -378000 and Northings 6390000 - 6400000.

N.P.W.S. Site No. 38 - 4 - 14
Stone arrangement, destroyed post 1930's.

N.P.W.S. Site No. 38 - 4 - 69
Scarred Tree, possibly canoe scar.

N.P.W.S. Site No. 38 - 4 -103
Open site, 2 artefacts.

N.P.W.S. Site No. 38 - 4 - 104
Open site, 3 artefacts.

N.P.W.S. Site No. 38 - 4 - 105
Open site, 5 artefacts.

N.P.W.S. Site No. 38 - 4 - 156
Stone arrangement.Site destroyed in the 1920's.

Figure 1.1 Proposed Martin's Creek Quarry

General Location
Paterson 1: 25 000 Sheet 9232 - 4 - N

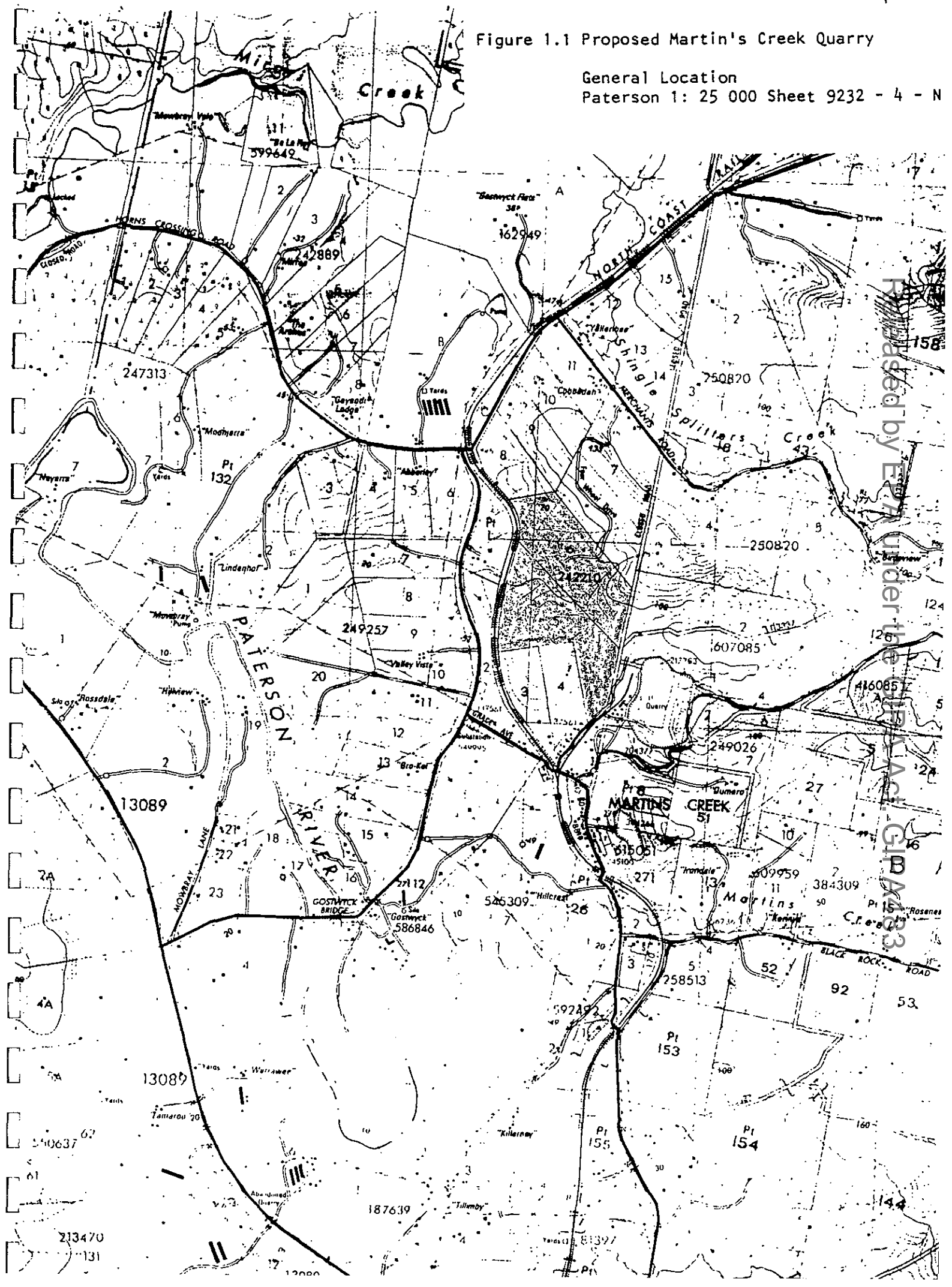

Figure 1.2 Proposed Martin's Creek Quarry

Quarry and Haulage Road Location

Key:Orange = Developement Area
Red = Quarry and Haulage Road

0 500 metres

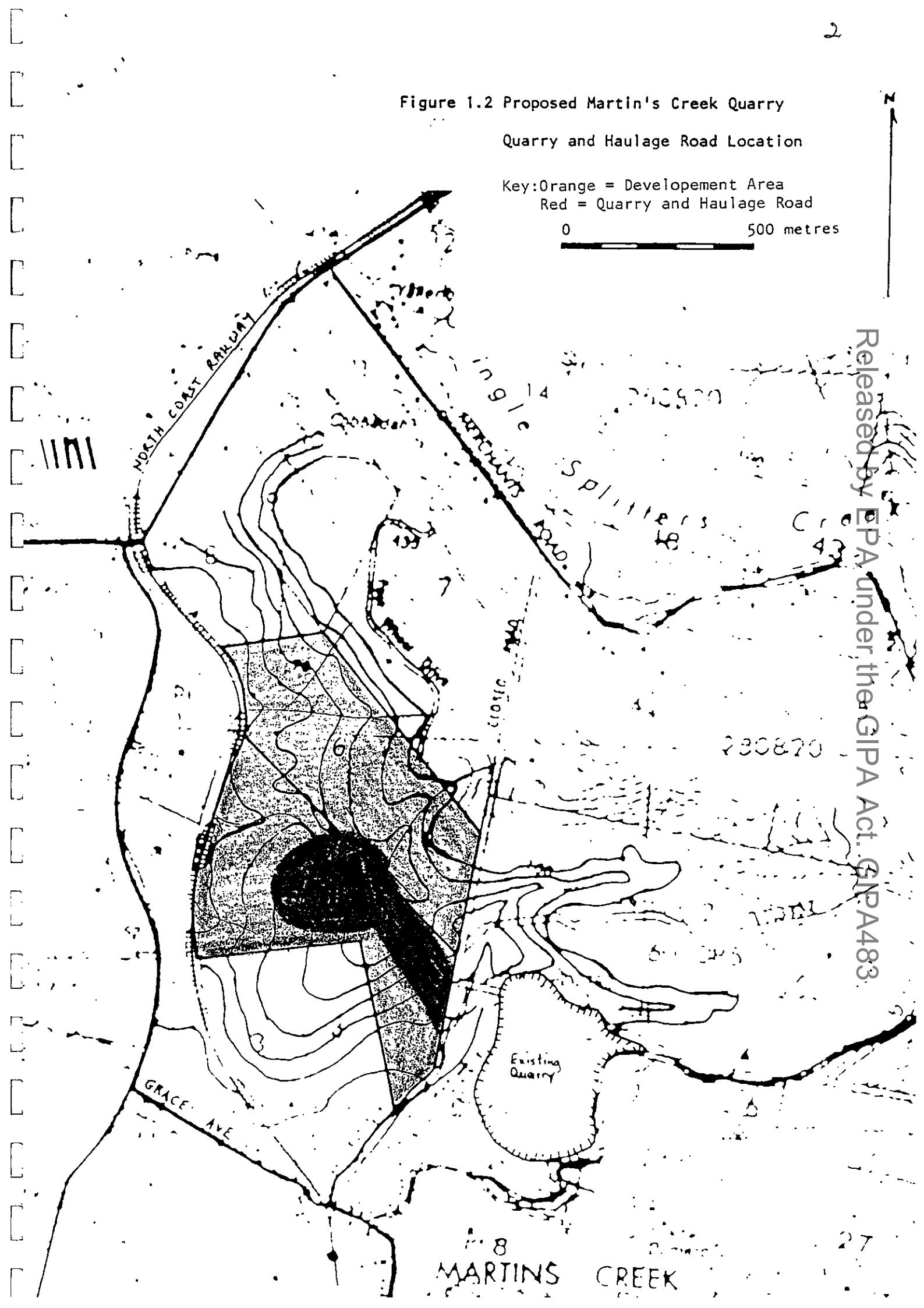

Figure 1.3 Proposed Martin's Creek Quarry

Archaeological Survey Area and Finds Locations

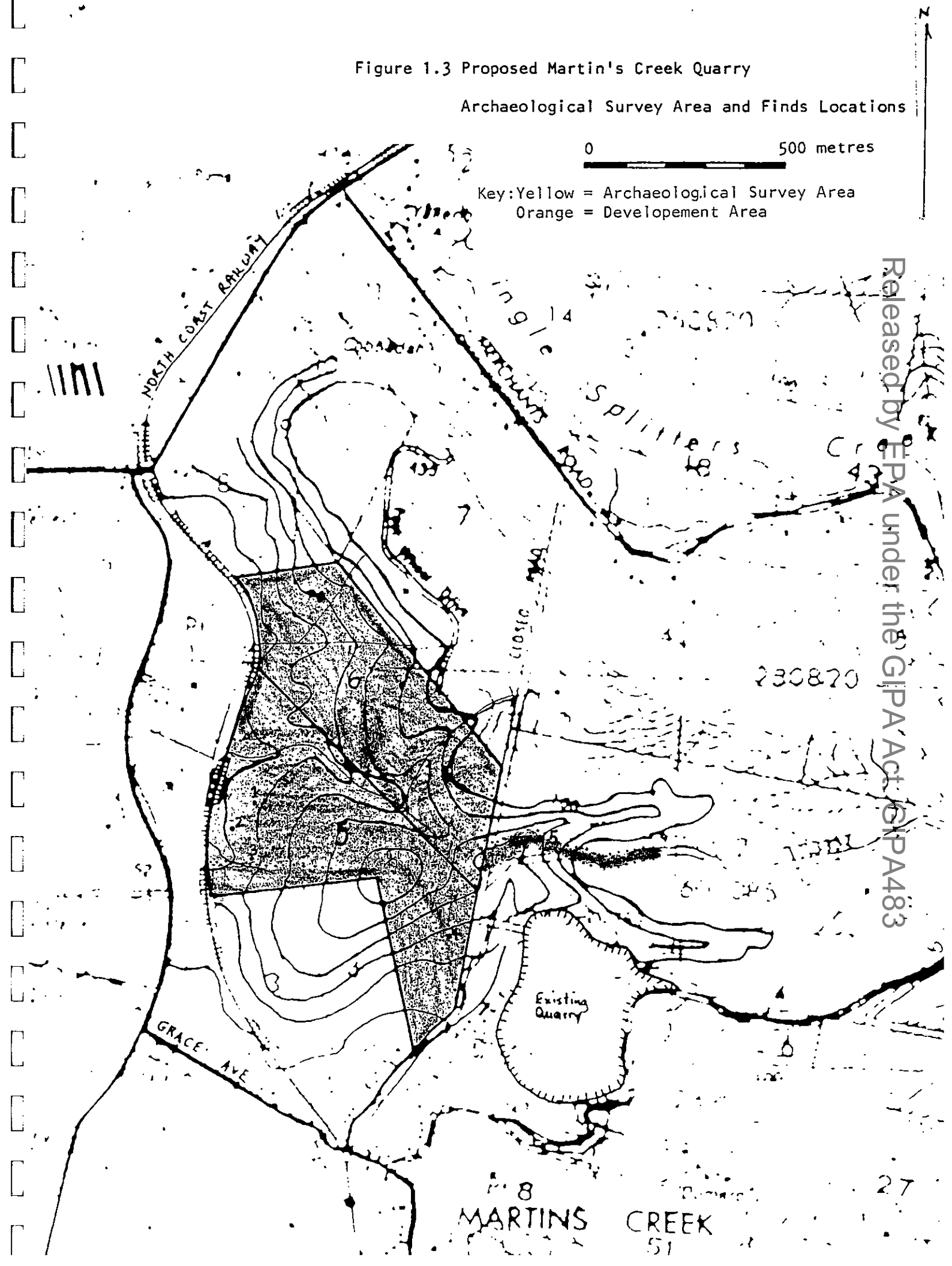

Plate Number 1

Possible Scarred Tree - Find No.1
Shows western slope vegetation

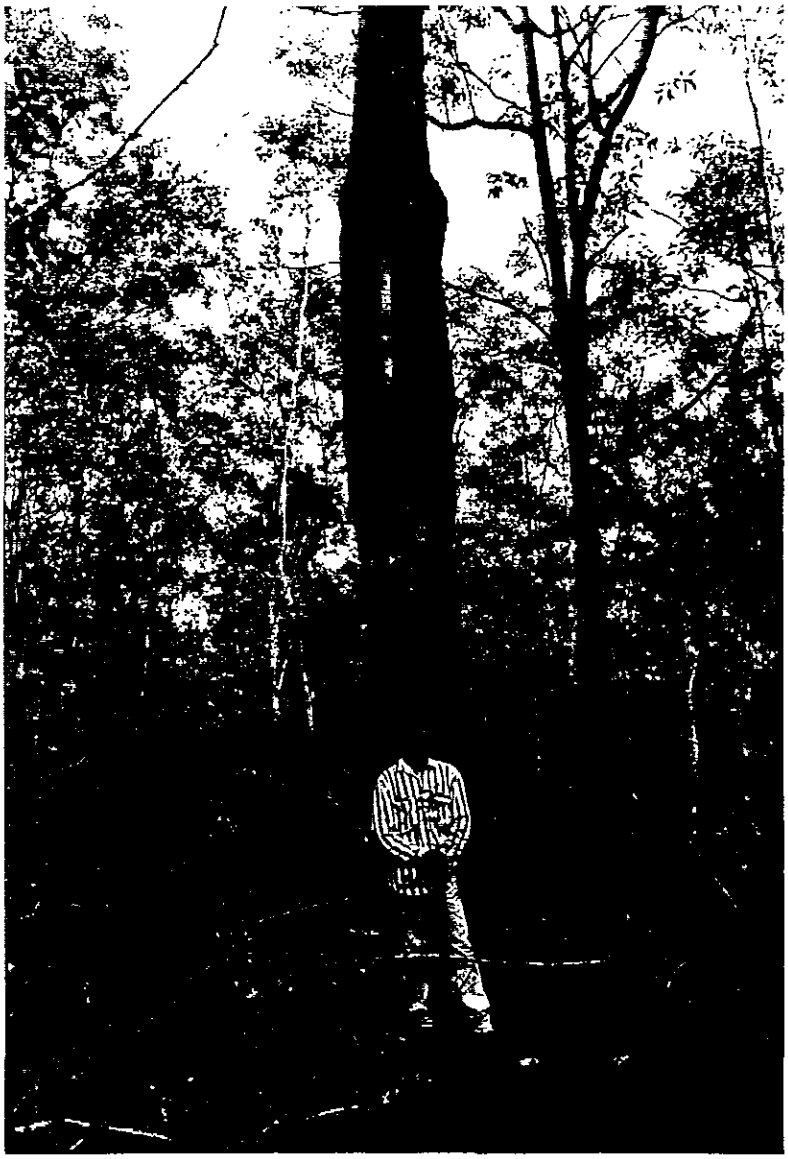

Plate Number 2

Possible Scarred Tree - Find No. 3
Shows western slope vegetation

Plate Number 3

Isolated Artefact - Find No.4

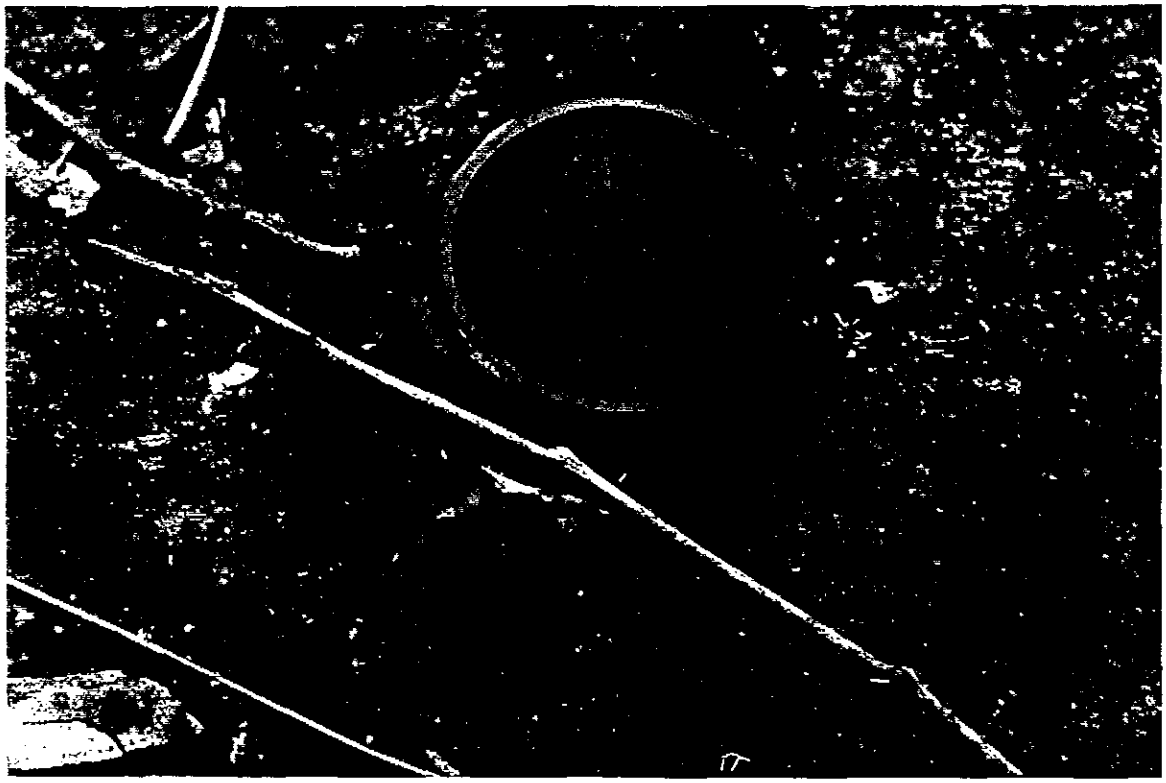

Plate Number 4

Location of Isolated Artefact - Find No.5
Shows track and surface exposure of red clayey soils