SHIRE OF ROEBOURNE: MINING LEASES M47/306 AND M47/331 AND MINING LEASE APPLICATION M47/353: CONSULTATIVE ENVIRONMENTAL REVIEW FOR HARD-ROCK QUARRYING BURRUP PENINSULA

prepared by

W G MARTINICK AND ASSOCIATES PTY LTD

for

GUISEPPE, PAMELA MARGARET AND STEVEN ROCCA

NOVEMBER 1994

CONSULTATIVE ENVIRONMENTAL REVIEW - THE ASSESSMENT PROCESS

MINING LEASES M47/306 AND M47/331 AND MINING LEASE APPLICATION M47/353 PROPOSAL FOR A HARD-ROCK QUARRY; SHIRE OF ROEBOURNE BURRUP PENINSULA

The Environmental Protection Authority invites people to make a submission on this proposal.

This Consultative Environmental Review for a proposed hard-rock quarry on the southern part of Burrup Peninsula adjacent to an existing quarry has been prepared by W G Martinick and Associates Pty Ltd on behalf of Guiseppe Rocca, Pamela Margaret Rocca and Steven Joseph Rocca in accordance with the requirements of the Western Australian Government. The review will be available for public comment for four weeks, commencing on 19 November 1994 and finishing on 17 December 1994.

Copies of this document may be obtained for the sum of $5.00 (including postage) from:

Attn: Ms Julie Stearne
W G Martinick and Associates Pty Ltd
4/114 Churchill Avenue
SUBIACO WA 6008

Submissions will be treated as public documents unless specifically marked confidential and may be quoted in full or in part.

All submissions received by the Environmental Protection Authority will be acknowledged.

Following receipt of comments from Government agencies and the public, the Environmental Protection Authority will discuss these comments with the proponent and may ask for further information. The Environmental Protection Authority will then prepare an Assessment Report with recommendations to Government, taking into account issues raised in the public submissions.

WHY WRITE A SUBMISSION?

A submission is a way to provide information, express your opinion and put forward your suggested course of action including any alternative approach. It is helpful if you indicate any suggestions you have to improve the proposal.

DEVELOPING A SUBMISSION

You may agree or disagree, or comment on, the general issues discussed in the Consultative Environmental Review or with specific proposals. It helps if you give reasons for your conclusions, and substantiate this with relevant data.

You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

POINTS TO KEEP IN MIND

By keeping the following points in mind you will make it easier for your submission to be analysed.

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section, chapter or recommendations in the Consultative Environmental

Review. If you discuss different sections of the Consultative Environmental Review keep them distinct and separate, so there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Submissions will be treated as public documents unless confidentiality in full or in part is requested.

REMEMBER TO INCLUDE; YOUR NAME, ADDRESS, DATE.

THE CLOSING DATE FOR SUBMISSIONS IS 17 DECEMBER 1994.

SUBMISSIONS SHOULD BE ADDRESSED TO:

The Chairman
Environmental Protection Authority
8th Floor
Westralia Square
141 St Georges Terrace
PERTH WA 6000
Attn: Mr Jim Treloar

CONTENTS

CONSULTATIVE ENVIRONMENTAL REVIEW - THE ASSESSMENT PROCESS

1.0 SUMMARY AND COMMITMENTS

The overall objective of this Consultative Environmental Review is to secure approval to commence quarrying operations on two granted mining leases and a mining lease application, all of which are located on the southern side of the Pistol Range of the Burrup Peninsula in the Shire of Roebourne. A summary of the proposed operations, complete with the environmental issues considered in the design of the operations and their ongoing management is given below followed by a list of commitments.

1.1 Summary

The proponent selected Mining Leases M47/306 and M47/331 to commence hard-rock quarrying operations in the Karratha region to meet the demand of current and anticipated developments. The selection of these leases was discussed with the Department of Minerals and Energy, and their locations were selected on the basis of being in close proximity to potential clients and because they adjoin an existing quarry; quarrying is thus an established land use. The two mining leases and the mining lease application are located mainly in a proposed Conservation Zone and partly in a proposed Industrial Zone South as recommended in the Burrup Peninsula Draft Land Use and Management Plan of May 1994; the proposed quarrying operations are in the proposed conservation zone and the infrastructure area will be located in the proposed Industrial Zone South.

Market research was undertaken for alternative quarry sites elsewhere in the Karratha region, but were dismissed because they were 30-40km from potential markets, adding considerable transport costs and thus rendering them less economically viable. An important consideration with respect to consistent market supply is that a quarry on the Burrup Peninsula is likely to be less affected by cyclones because of the proximity to all-weather roads and main customer locations. The results of a previous tender indicate that some customers value this highly and are prepared to pay a premium for this convenience.

The potential visual impact of the proposed quarries was considered to be a major environmental concern, and consequently the pit locations and access routes to these pits were carefully considered in the planning of the proposed operations. This was based on a detailed Visual Assessment. To minimise the potential visual impact it was decided to locate the quarry pits on natural terraces to the rear, or northern end, of the two leases and to avoid damage to the base of the Pistol Range which consists of steep rockfaces, precipitous rock piles and Spinifex (*Triodia* sp.) covered slopes.

A substantial part of the granted mining leases will thus remain untouched. To compensate for this loss of useable land, Mining Lease Application M47/353 was lodged on 8 July 1994; this is adjacent to the proposed pit for Mining Lease M47/331, and will allow this pit to be extended along the same terrace.

Access to the proposed pits is from the coastal plain to the immediate south, or Karratha side, of the Project Area. This provides access to the proposed Industrial Zone South, minimises the visual impact of the access route, and is the shortest distance to customers in the Karratha region. Access from the northern, or Dampier side, was considered, but dismissed as it would have been very visible because it would cross the crest of the Pistol Range. To minimise disturbance to the base of the Pistol Range, entry through the base of the range to the respective pits was carefully selected. With respect to Mining Lease M47/306 the entry is via a natural gap and with respect to Mining Lease M47/331 the preferred route is via an existing valley and gully. These entry points are well hidden, and lead via bends in the road to the proposed pits, thereby avoiding long sight lines into the pits. Two alternative access options have also been selected for Mining Lease M47/331 and approval for these is also requested in the event that approval is not secured for the preferred route since this is subject to approval of Miscellaneous Licence Application M47/27 which is across Mining Leases owned by Readymix Group Australia Limited.

The environment of the Project Area and its surrounds is described and appraised in terms of its terrain, soils, vegetation, plants, habitats, animals and conservation values. It is concluded that the environmental characteristics of the Project Area are very common on the Burrup Peninsula and elsewhere in the Pilbara and that the Project Area does not support outstanding or unique environmental attributes or microhabitats.

The proposed operations are described in detail. Quarrying will be by blasting and conventional earthmoving, and it will require crushing and screening. It is anticipated that quarrying will be undertaken at a rate to produce 1000 tonnes of saleable product per week, with the rate of quarrying being determined by demand. The operations will commence immediately after the securing of approval and it will commence on Mining Lease M47/306 and soon afterwards on Mining Lease M47/331.

The access routes will be developed by quarrying at a rate which is also determined by the demand for product. Once the access routes have been established, the pits will be quarried concurrently depending on the demand for the range of products which the two quarries will produce.

Inspection from a distance of the existing quarrying operations in the area indicate that the quarry faces are not very visible because their red-brown colour is similar to that of the surrounding terrain, thus resulting in a low colour contrast. However, the operations are visible because of the large stockpiles which are grey in colour which contrasts with the pale yellow-brown background colours. In addition, waste rock has been dumped against the precipitous rock piles which form the base of the Pistol Range; this dump has a very noticeable horizontal surface which leads into the pit. Importantly, few, if any, efforts appear to have been made to hide or minimise the visual impact of the existing operations.

To minimise the visual impact of the proposed operations, the proposed pits and access to these pits has been selected very carefully. In addition, to hide the operations on the infrastructure areas, the following will be undertaken:

- the need for stockpiles will be kept to a minimum by operating at a flexible rate which is closely linked to demand for the products,

- stockpiles will initially be established on the plain of the southern part of Mining Lease M47/306, but once sufficient pit area has been developed, additional stockpiles will be located within the pit,

- the height of stockpiles will be kept to less than about 10m to ensure that they will not exceed the canopy of existing trees and trees which will be planted,

- fines, which are a by-product of crushing and screening, will not be allowed to accumulate into a large stockpile. Rather, they will be sold as building fill as a substitute for building sand which is very scarce in the region,

- the clearing of trees on the plain of Mining Lease M47/306 will be kept to an absolute minimum, and additional trees will be planted, especially along the southern boundary to provide additional screening,

- there will be no waste rock material because all of the quarried rock will be crushed and screened and all soil will be retained for rehabilitation purposes, and

- no material will be stockpiled against the base of the Pistol Ranges.

It is concluded that by careful design the potential visual impact of the proposed operations will be kept to a minimum. This can be assessed from illustrations of the proposed operations and colour plates which are included in this Consultative Environmental Review.

The proposed operations require very little clearing of native vegetation. For the pits this is confined to rocky terraces which support Spinifex (*Triodia pungens* and *Triodia wiseana*) grasses. About four Kurrajong (*Brachychiton acuminatus*) trees have to be destroyed. This is a Priority 4 listed species which is common on the Burrup Peninsula and other parts of the Pilbara. Approval to remove these trees has been obtained from the Department of Conservation and Land Management. The impact of the proposed operations on the vegetation and flora is thus relatively minimal. The same conclusion also applies with respect to its impact on animals and animal habitats. The Project Area is within the proposed

Conservation Zone of the Burrup Peninsula Draft Land Use and Management Plan. A major consideration in recommending this Conservation Zone was to ensure that it provided a south to north continuum for the entire Peninsula. The Project Area is located at the southern end of this Conservation Zone and it does not interrupt the desired south to north continuum.

No archaeological survey of the areas to be affected by the proposed quarrying has been undertaken, although searches by non-archaeologists of the access route and proposed pit areas suggest that they do not have rock engravings. The region has been extensively searched by archaeologists, and the register of the Department of Aboriginal Sites list 63 archaeological sites, all on open file, within about 1km of the Project Area; these records indicate that the Project Area does not contain any sites which are of cultural significance to Aboriginal People. Prior to the commencement of quarrying the proponent will commission a survey by an archaeologist of the areas to be affected by the proposed quarrying.

The arid environment of the region and the lack of topsoil almost precludes the establishment of vegetation as a component of proposed rehabilitation. Rehabilitation of the proposed operations will be undertaken progressively, but it is likely to be many years before quarrying has progressed sufficiently for rehabilitation to commence. When the final pit walls have been attained, the proposal is to reduce the angle at the top of the pit walls by blasting, to provide a more natural appearance. The upper pit walls, where they meet the surface of the surrounding terrace, will have their near vertical slope reduced to about 45°, and this will then be topsoiled to encourage the establishment of spinifex grasses and native shrubs. This slope will greatly reduce the visual impact when viewed from a distance because it will change the angle at which light will be reflected, and importantly, the surface will tend to absorb rather than reflect light which will ensure that it blends into the surrounds. The access routes into the pits will be blocked. On completion of all operations the infrastructure area will be cleared and all equipment, buildings and concrete foundations will be removed, and all compacted surfaces will be ripped to enhance the establishment of vegetation. If necessary, seeding will be undertaken. Rehabilitation is not likely to be completed before the year 2010, and it is likely that the rehabilitation methods may have to be reviewed in line with the then prevailing methods, conditions and expectations.

It is concluded that the proposed operations and their ongoing management have been designed with careful attention to visual, environmental and Aboriginal site issues, and that the operations will have a minimal impact on these issues.

1.2 Commitments

The proponent makes the following commitments with respect to the proposed operations:

a) General

i. To operate and manage the proposed operations as outlined in this Consultative Environmental Review.

ii. Permit no cats as domestic pets on the Project Area.

iii. Allow no firearms on the Project Area.

iv. Bund all fuel and oil storage areas to contain all fuel and oil during accidental spillages.

v. A site plan showing the locations of infrastructure facilities will be presented to the relevant Authorities such as the Shire Council, and the Department of Minerals and Energy, prior to the commencement of operations.

b) Aesthetics, vegetation and flora

i. The quarrying operations will be undertaken as outlined in Section 5 to ensure that the visual impacts are kept to a minimum, especially from sensitive view areas.

ii. The base of the Pistol Range will not be disturbed except for the two narrow entrances through the base into the proposed pits. No stockpiles will be placed against the base of the Pistol Range; an area of at least 10m in front of the rock face of the base of the Pistol Range will be regarded as out-of-bounds for any stockpiling.

iii. No trees on the plain in front of the base of the Pistol Range will be removed except in front of the proposed entry to the pits; here too the removal of trees will be kept to a minimum. The clearing of vegetation will be restricted to an absolute minimum, and it will be confined to the actual quarry pits and to the access into the two pits.

iv. Additional trees of *Brachychiton acuminatus* and *Eucalyptus dichromophloia* raised from locally collected seed will be planted on the boundaries of the infrastructure area facing the adjoining plains to further screen the stockpiles when viewed from these plains.

v. The height of the stockpiles on the plain in front of the Pistol Range will not exceed 10m so that they will not exceed the height of the trees on this plain.

vi. The size of the stockpiles will be kept to a minimum in order to store about two months production, or about 8000 tonnes or 3000m^3.

c) Aboriginal heritage

i. To abide by the Aboriginal Heritage Act (1972) and to inform the Department of Minerals and Energy and the Department of Aboriginal Sites immediately if any archaeological sites or sites of cultural significance to Aboriginal people are found on the Project Area during the course of operations.

ii. To undertake an archaeological survey of the Project Area before commencement of quarrying.

d) Pit wall stability

To ensure that the design of the pit walls is approved by the Department of Minerals and Energy.

e) Blasting and noise

Conditions for blasting and noise are expected to be set by the Department of Minerals and Energy. The following management commitments will be implemented:

i. The operations will comply with the noise requirements stipulated by the relevant Authorities.

ii. Procedures concerning air safety within the Karratha Airport circuit will be implemented. The airport will be advised during working hours and not less than 24 hours prior to any blast in order that a Notice to Airmen concerning the blast is issued by the Civil Aviation Authority.

iii. The road to the existing installations belonging to the Water Authority of Western Australia and Telecom on Katrins Hill to the immediate north of the proposed quarry pits will not be affected by the proposed operations. As the project progresses, the need to warn the public using this road of blasting will be reviewed regularly, at least annually, with the Shire of Roebourne and the Department of Minerals and Energy. When deemed appropriate, warning signs will be erected on the road to the installations on Katrins Hill warning the public of blasting. If necessary, the road will be closed temporarily during blasting. The method of protecting the public will always be undertaken in consultation with the Shire of Roebourne and the Department of Minerals and Energy.

iv. Provide workers with appropriate ear protection.

v. Efficient noise suppression devices will be maintained on all equipment and plant used at the site.

f) Topsoil

All topsoil will be saved for future rehabilitation.

g) Masts, drill rigs and cranes

The need for masts, drill rigs and cranes on the Project Area will be discussed with the Shire of Roebourne and the proponent will comply with the Shire's conditions.

h) Dust

The operations will comply with the conditions which are likely to be set by the relevant Authorities.

i) Water run-off

All rainwater run-off in the pit will be contained within the pit, and will not be drained out of the pit. When available, this water will be used for dust suppression; the balance will be lost by evaporation.

j) Waste disposal

i. All materials suitable for recycling will be recycled.

ii. All other wastes will be taken to the Karratha waste disposal site on a regular basis.

k) Rehabilitation

i. The rehabilitation of the pit will be undertaken progressively as outlined in Section 5 and to the satisfaction of the relevant Authorities.

ii. The rehabilitation progress will be monitored and procedures will be modified when and if necessary.

l) Safety

i. All relevant Acts and Regulations covering occupational health and safety, and the safety of the general public, will be complied with.

ii. The infrastructure area and access into the pits will be fenced and sign posted, and the gates will be locked when the quarry is unattended.

m) Decommissioning

i. On decommissioning the rehabilitation of the pit will be completed as outlined in Section 5.

ii. All of the equipment, buildings and machinery and all waste will be removed from the entire quarry site. The infrastructure area will be ripped and seeded as outlined in Section 5 and to the satisfaction of the relevant Authorities.

2.0 OBJECTIVES

The overall objectives of this Consultative Environmental Review are to design a hard-rock quarry complete with access, crushing and screening facilities, and stockpiles for each of two mining leases and an adjoining Mining Lease Application, and to secure the necessary approvals from the Department of

Minerals and Energy and the Environmental Protection Authority to proceed with these operations. Important considerations are to minimise or avoid visual, environmental and social impacts.

To achieve these objectives this Consultative Environmental Review:

- appraises the environment of the Project Area and the transport routes to be used during the life of the project; particular attention is being given to a visual assessment of the Project Area and the minimisation of visual impacts of the proposed operations,
- outlines the proposed quarrying, crushing, screening, stockpiling and transport operations,
- identifies and appraises the likely visual, environmental and social impacts of the project, and
- outlines a design and management programme which will minimise or avoid all potentially adverse visual, environmental and social impacts.

3.0 INTRODUCTION

3.1 Location

The Project Area is located in the Shire of Roebourne on the southern side of the Burrup Peninsula, and it commences about 850m to the east of the main road from Dampier to Karratha (Figure 1 and Plate 1). The nearest residential areas to the Project Area are Dampier and Karratha. In direct lines, the edges of the towns of Dampier and Karratha are about 2.5km and 9.0km, respectively, from the Project Area, and the direct distance to the Karratha Airport is about 5km. It is also important to note that the town of Dampier is separated from the Project Area by the Pistol Range of the Burrup Peninsula.

3.2 Mining leases

The Project Area consists of Mining Leases M47/306 and M47/331 which are 12.4ha and 7.9ha in area, respectively, and which were granted in May 1993, and Mining Lease Application M47/353 which was lodged on 8 July 1994. The latter adjoins the north east side of Mining Lease M47/331 and is required for an extension of the proposed quarry pit for Mining Lease M47/331.

The two mining leases are separated from each other by Mining Lease M47/309 which belongs to Readymix Group Australia Limited, and to the immediate west of Mining Lease M47/306 are Mining Leases M47/255 and M47/26 which are being quarried by Readymix Group Australia Limited.

The location of all of these mining leases is shown in Figure 2a, and the approximate location of the Project Area is relation to the terrain of the region is shown in Figure 2b which shows the contours of the region at 10m intervals.

3.3 Proponent

The proponent and operators of the project are Guiseppe Rocca, Pamela Margaret Rocca and Steven Joseph Rocca of PO Box 237, Karratha, WA 6714.

The mining tenements are owned as follows:

- Mining Leases M47/306 and M47/331: Guiseppe Rocca (50 shares) and Pamela Margaret Rocca (50 shares) of PO Box 237, Karratha WA 6714.
- Mining Lease Application M47/353: Guiseppe Rocca (34 shares), Pamela Margaret Rocca (33 shares) and Steven Joseph Rocca (33 shares) of 103 Caporn Street, Wanneroo WA 6065.

The proponent includes earth moving contractors who have operated a number of quarries, and they currently operate a quartz sand quarry inland of the town of Karratha, in the Shire of Roebourne.

3.4 Scheduled commencement of the project

The proposal is to commence quarrying shortly after the granting of approval for the operations as outlined in this Consultative Environmental Review. Quarrying is scheduled to commence on M47/306 and shortly afterwards on M47/331, and from there into Mining Lease Application M47/353, to produce the range of different products. The two leases will then be quarried concurrently, with the location of the quarrying activities being determined by the demand for particular products. It is anticipated that the resources are sufficient to meet the demand for well beyond the year 2010.

4.0 THE EXISTING ENVIRONMENT

A comprehensive environmental description and assessment of the entire Burrup Peninsula was published in May 1994 by O'Brien Planning Consultants in the Burrup Peninsula Draft Land Use and Management Plan and accompanying Technical Appendices. These documents provide a regional environmental appraisal of the Project Area, and they are a valuable source of environmental baseline information for the planning and impact assessment of the proposed quarrying operations. The documents were extensively referred to in the preparation of this Consultative Environmental Review.

4.1 Existing and proposed landuse

Mining Leases M47/306 and M47/331 are located on Vacant Crown Land in Temporary Reserve 5461H which is vested with the Department of Land Administration. The leases straddle part of a proposed Conservation Zone and a proposed Industrial Zone South as recommended in the Burrup Peninsula Draft Land Use and Management Plan. Prior to the development of the towns of Dampier and Karratha, the Project Area was part of the Karratha Station Pastoral Lease, but because of the rugged terrain of the Project Area and the absence of grazing potential it was rarely grazed. Quarrying of hard-rock is an established land-use on the adjoining land, where Readymix Group Australia Limited is operating a hard-rock quarry which is presumed to have been commissioned in the late 1960's to produce aggregate for the construction of infrastructure facilities associated with Hamersley Iron Pty Ltd's operations at Dampier. For most of the area to the north and east of the Project Area, conservation is the recommended long-term land use whilst the recommended land use to the immediate south of the leases is industrial. The southern boundary of Mining Lease M47/331 initially overlapped slightly with the rifle range of Pistol Range Reserve 40174 which is used by the Nickol Bay Branch SSAA; however, Endorsement 1 on the Conditions of Mining Lease 47/331 states "The land the subject of this lease does not include land the subject of Pistol Range Reserve 40174."

4.2 Climate

The following climatic information has been taken from the Burrup Peninsula Draft Land Use and Management Plan.

"The Burrup Peninsula is located approximately at latitude 21° south and is situated within the arid, summer rainfall tropical zone. The summers are very hot, the winters are moderate and rainfall is low, occurring almost entirely in the first half of the year. Records for nearby Roebourne date from 1887, and in the period until December 1992, an average 310mm of rainfall was received each year, two thirds of which occurred in the period January to March. The daily maximum temperature averaged 39.2°C in December (25.0°C minimum) and 26.6°C in July (13.6°C minimum). Being a coastal location, these extremes will be moderated somewhat on the Peninsula itself, but no long-term records are available for the Burrup.

Winds blow predominantly from the eastern sector, with a strong south-easterly component in the mornings and a north-easterly component in the afternoons, in the period April to August, and from the

west and north-west during October to February. The intervening months have an approximately equal incidence of winds from both easterly and westerly sectors.

Tropical cyclones are a common occurrence, averaging approximately two crossings of the adjacent coastline per year. These sometimes bring heavy rain and may be accompanied by a tidal surge. The most recent cyclone to cross the coast within 50km of the Peninsula was cyclone Orson in 1989 which resulted in a 3.1m surge. It is estimated that a similar strength cyclone (905 HPa) occurring at the high tide and crossing the coast at West Intercourse Island would result in a tidal surge level of 9.6m AHD.

From a planning point of view, tropical cyclones need to be considered when making land use decisions. Land below the 10m contour is vulnerable to storm surge".

4.3 Terrain and soil

The terrain of the Project Area and its surrounds can be assessed from the contour map shown in Figure 2b and Plate 11 which shows a five fold enlargement of the colour aerial photograph shown in Plate 1. The Project Area is located partly on **low coastal terrain** and mainly on **scree slope terrain** of the Pistol Range of the Burrup Peninsula. The **scree slope terrain** is composed largely of high linear rock piles which are the result of the physical disintegration of the granophyre and gabbro rock material, and to the immediate north and north-west of the Project Area they form a peak which is known as Katrins Hill. Adjacent ridges are of similar elevation being separated by valleys which may be 50m to 80m lower than the ridges. The ridges are sometimes terraced, with isolated pockets of soil on ledges which allow vegetation to flourish. The **scree slope terrain** has been subdivided in the Burrup Peninsula Draft Land Use and Management Plan into the following six sub-units:

i. high precipitous rock piles with little or no vegetation,
ii. plateaux,
iii. wide valleys between rock piles,
iv. narrow gorges, generally rock-bottomed which pond after rain,
v. soil covered terraces, and
vi. rocky coastal cliffs.

The Project Area contains the **high precipitous rock piles, plateau, valley between rock piles** and **soil covered terraces**.

A small area of **low coastal terrain** (Plate 2) was included in Mining Lease M47/306 as an infrastructure area for Mining Leases M47/306 and M47/331, and Mining Lease Application M47/353.

The various landform subunits of the **scree slope terrain** within the Project Area can be readily seen and they are described in the following. The south side of the Pistol Range (Mining Leases M47/306 and M47/331) consists of **high precipitous rock piles** (Plates 3a and 3b) which lead to a number of narrow **soil covered terraces** which are orientated approximately from west to east, and parallel to each other, separated by lines of rock piles, which are also orientated approximately from west to east. The northern parts of these leases extend to the **plateau** of the Pistol Range, consisting of more extensive and wider **soil covered terraces**, which in the case of Mining Lease M47/306 are very rocky (Plate 4) whilst in the case of Mining Lease M47/331 they are less rocky (Plate 5). Mining Lease M47/306 includes part of the crest of the Pistol Range whilst Mining Lease M47/331 is entirely to the south of the crest, with a ridge of rock piles occurring to the north of this lease. Mining Lease Application M47/353 is an extension of the more extensive **soil covered terrace** of Mining Lease M47/331 as shown in Plate 5(b). Mining Lease M47/331 has a substantial drainage line of about 50m width which forms a valley (Plate 6) leading from approximately west to east to the plateau of the range. A gully (Plate 7) of about 20m width leads approximately at right angle from this valley to the upper **soil covered terrace** of Mining Lease M47/331 and Mining Lease Application M47/353.

Soils are generally absent or very sparse in the rocky terrain. A shallow red-brown clayey loam is present on the terraces and in the valley of Mining Lease M47/331. The **low coastal terrain** of the southern

portion of Mining Lease M45/306 has red-brown sandy loam of about 20cm depth over dark brown clayey loam.

4.4 Vegetation and flora

The vegetation of the Burrup Peninsula was described in detail in 1979 for an Environmental Review and Management Programme for the North-West Shelf Development, and it was reviewed in the Burrup Peninsula Draft Land Use and Management Plan. The vegetation and flora of the Burrup Peninsula is very varied and noted for its species diversity and richness. According to the Burrup Peninsula Draft Land Use and Management Plan the "complexity of vegetation communities and richness of flora assemblages on the Burrup are, within the limits of current knowledge, unequalled elsewhere in the Pilbara", and "the diversity of vegetation suites can be related both to the unique topography and therefore edaphic conditions, and to the micro-climate of the study area". Many of the landforms and vegetation communities of the Burrup Peninsula are common and widespread elsewhere in the Pilbara, but on the Burrup Peninsula they are considered to be present in "unique combinations of inland and coastal features", resulting "in a diversity of micro-habitats which in turn produce a rich and varied spread of vegetation consisting of both inland and coastal species".

No declared rare flora have been reported for the Burrup Peninsula despite relatively detailed vegetation studies. Two priority 4 listed tree species, Kurrajong (*Brachychiton acuminatus*) and *Terminalia supranitifolia*, are widespread on the Burrup Peninsula. Both generally occur on rock piles and in rock pockets which occur as part of extensive boulder hills. The Kurrajong is widespread on the Burrup Peninsula and over extensive parts of the Pilbara, whereas *Terminalia supranitifolia* is common on the Burrup Peninsula but it has only been reported for one other location in the Pilbara.

The Project Area was traversed extensively for the purpose of this environmental appraisal. A description of the vegetation and flora follows.

Immediately adjacent to the Pistol Range, the **low coastal terrain** of Mining Lease M47/306 supports a *Eucalyptus dichromophloia* over *Triodia pungens* Tree Steppe. Further south this changes to a *Triodia pungens* grassland. The *Eucalyptus dichromophloia* trees are typically 8m to 12m in height and the spinifex grass, *Triodia pungens*, has been extensively invaded by Buffel (*Cenchrus ciliaris*) and Birdwood (*Cenchrus setigerus*) grasses and Kapok bush (*Aerva javanica*).

The vegetation of the rocky areas of the Project Area is very sparse and consists of isolated trees of *Brachychiton acuminatus*, a single *Ficus platypoda*, occasional *Grevillea pyramidalis*, *Hakea suberea* and *Terminalia canescens* and a single *Terminalia supranitifolia* tree. Shrubs are very sparse and they include *Acacia pyrifolia*, *Acacia victoriae*, *Corchorus walcottii*, *Dichrostachys spicata*, *Gossypium australe*, *Ipomoea costata*, *Pittosporum phylliraeoides*, *Senna artemisiodes*, *Senna glutinosa*, *Senna notabilis*, *Senna pruinosa*, *Senna sturtii* and *Solanum phlomoides*. Grasses are also generally sparse, and they include *Chrysopogon fallax*, *Triodia angusta*, *Triodia pungens* and *Triodia wiseana*. The introduced Buffel and Birdwood grasses and the Kapok bush are also present.

On Mining Lease M47/331 *Eucalyptus coolabah* var. *rhodoclada* over the hummock grasses *Triodia pungens* and *Triodia wiseana* is common in the valley (Plate 6) which leads approximately from west to east to the plateau. The gully which leads from this valley to the upper terrace has a scattered stand of *Terminalia canescens* trees over a very sparse grass cover of *Chrysopogon fallax* and *Triodia wiseana* (Plate 7). A number of creepers were observed in the rocky areas, including *Cynanchum floribundum*, *Ipomoea muelleri* and *Trichosanthes cucumerina*; the groundcover species *Ptilotus auriculifolius*, *Trachymene oleracea* and *Trianthema turgidlifolia* were also present.

4.5 Conservation value of the vegetation

The vegetation communities of the Project Area are common on the Burrup Peninsula and widespread in the Pilbara. They do not contain unique or unusual botanical features, and they will be conserved extensively in the proposed Conservation Zone of the Burrup Peninsula which is 53.3km² in area and

represents 60.5% of the Burrup Peninsula.

The Mining Leases M47/306 and M47/331 are 20.3 hectares in area, and Mining Lease Application M47/353 is 4 hectares, bringing the total to 24.3 hectares. Of this it is estimated that about 21 hectares are located in the proposed conservation zone, or about 0.4% of the proposed Conservation Zone. The remaining 3.3 hectares are located in the proposed Industrial Zone.

The Burrup Peninsula Draft Land Use and Management Plan identified five dominant vegetation communities which are regarded as being particularly significant to the Burrup Peninsula in that they are not widespread and under threat from disturbance. None of these communities, which are listed below, are found in the Project Area or its immediate vicinity.

- mangals, coastal marine community,
- tall Dense stands of vegetation, found along water courses and in low lying areas,
- coastal grasslands, found in coastal sands,
- samphire communities, occurring in salt flats, and
- rarely occurring communities:
  - *Acacia bivenosa/Paspalidium* aff. *tabulatum* (five locations).
  - *Chrysopogon fallax/Eucalyptus* aff. *dichromophloia* (one location).
  - *Sesuvium portulacastrum* community (two locations).

The Project Area also does not include any unusual microhabitats.

4.6 Fauna

The Burrup Peninsula Draft Land Use and Management Plan reviewed the fauna of the Burrup Peninsula, and in the following this information is reviewed in relation to the Project Area.

4.6.1 Mammals

Fifteen native terrestrial mammal species have been recorded for the Burrup Peninsula and evidence of another species, the Pebble Mound Mouse (*Pseudomys chapmani*), has been reported. No detailed fauna information is available for the Project Area in the Pistol Range of the Burrup Peninsula. The known habitats for six of these species is given in the Burrup Draft Land Use and Management Plan, and based on a habitat assessment, the Pistol Ranges as a whole are likely to provide a habitat for the following species:

Dasykaluta rosamondae
Eptesicus finlaysoni
Macropus rufus
Planigale maculata
Tachyglossus aculeatus
Zyzomys argurus
Dasyurus hallucatus
Macropus robustus
Petrogale lateralis
Pteropus scapulatus
Taphozous georgianus

Of the above, the Euro (*Macropus robustus*) is very common in the Project Area.

The following introduced mammal species have been reported for the region and are likely to frequent the Project Area and its surrounds: cats (*Felis catus*), dogs (*Canis familaris*), fox (*Vulpes vulpes*), house mouse (*Mus musculus*) and rats (*Rattus rattus*).

4.6.2 Birds

A total of 121 bird species have been recorded for the Burrup Peninsula. None of these species are endemic to the Burrup Peninsula and the Project Area does not provide a significant habitat for any of these species.

4.6.3 Reptiles and frogs

A total of 47 reptile and two frog species are listed for the Burrup Peninsula. The specific habitats of most of these species are not well understood and many of these species could possibly be found in the Project Area; these are listed below:

SPECIES NAME	COMMON NAME
GECKOES	
Crenodactylus ocellatus hornii	Clawless Gecko
Diplodactylus conspicillatus	Spine-tailed Gecko
Diplodactylus savagei	Tree Dtella
Diplodactylus stenodactylus	Fat-tailed Gecko
Gehyra punctata	Bynoes Gecko
Gehyra variegata	Spotted Dtella
Heteronotia binoei	Velvet Gecko
Oedura marmorata	-
LEGLESS LIZARDS	
Diplodactylus nasuta	-
Diplodactylus pax	-
Lialis burtonis	Burtons Legless Lizard
DRAGON LIZARDS	
Ctenophorus caudicinctus	Ring-tailed Dragon
Ctenophorus isolepis	Military Dragon
Pogona minor	Western Bearded Dragon
GOANNAS	
Varanus acanthurus	Ridge-tailed Goanna
Varanus eremius	Desert Goanna
Varanus giganteus	Perentie
Varanus gouldii	Bungarra
Varanus tristis	Racehorse Goanna
SKINKS	
Carlia munda	-
Cryptoblephatus plagiocephalus	-
Ctenotus pantherinus	-
Ctenotus saxatilis	-
Cyclodmorphus malanops	-
Lerista bipes	-
Lerista muelleri	-
Menetia greyii	-
Menetia surda	-
Morethia ruficauda exquisita	Firetailed Skink
Notoscincus ornatus	-
Sphenomorphus isolepis	-
SNAKES	
Acanthophis pyrrhus	Desert Death Adder
Demansia rufescens	Rufus Whipsnake
Furina ornata	Moon Snake
Morelia olivaceous	Olive Python
Morelia perthensis	Pygmy Python
Morelia stimsoni	Stimsons Python

Pseudonaja australis	Mulga Snake
Pseudonaja nuchalis	Gwardar
Ramphotyphlops australis	Worm Snake
Ramphotyphlops diversus	Worm Snake
Ramphotyphlops grypus	Worm Snake

FROGS

Cyclorana maini	Burrowing Frog
Litoria rubella	Desert Tree Frog

The two frog species of the Burrup Peninsula are unlikely to be found in the Project Area because no permanent water or water gathering sites are found within the Project Area and its immediate vicinity.

4.7 Visual assessment

The Pistol Range of the Burrup Peninsula is very visible from Dampier (Plate 8) and Karratha (Plate 9). Most of the Project Area is visible from the Karratha side, but only the north eastern corner of Mining Lease M47/306 is visible from Dampier because this part of the lease extends onto the crest of the range and rises towards the north-east (see Figure 2b). Mining Lease M47/331 and Mining Lease Application M47/353 are located entirely on the Karratha side, below the crest of the Pistol Range and they are not visible from Dampier. Prominent terrain features of the Project Area are the **high precipitous rock piles** at the base of the Pistol Range, whereas the terraces and plateau of this range are less visible when viewed from the surrounding plain such as from the Karratha Airport or from the town of Karratha. Katrins Hill forms a peak in the Pistol Range, immediately to the north and north-east of the Project Area. To the immediate west of the Project Area the terrain of the Pistol Range is interrupted by the existing quarry, stockpiles and ongoing quarrying operations.

A Visual Assessment, adapting the method outlined in the Environmental Protection Authority, Bulletin 677, of the Pistol Range was undertaken to:

- determine the Scenic Quality of the Project Area,
- identify the Seen Area from which the Project Area and its immediate surrounds are visible,
- identify the Sensitivity Level of viewing locations from fore, mid and background zones,
- study the visual impacts of the existing quarrying operations to determine the contributions of the various components of these operations to the visual impact, and
- develop design objectives and a management policy to avoid or minimise all potential visual impacts.

A Seen Area Assessment has two components, namely:

- sensitivity levels from viewing locations, and
- the distance of the viewshed from the Project Area.

For visual assessments the viewshed is usually divided into Distance Zones, and for the proposed quarry it was divided into the following three Distance Zones.

- Foreground zone: up to 500m.
- Midground zone: 0.5 to 6.5km.
- Background zone: greater than 6.5km.

The sensitivity levels of the travel routes, public use areas and residences with potential views of the Project Area are determined on the basis of criteria such as the number of users, the importance of the

viewshed location and the scale of potential visual intrusion. For the proposed project the sensitivity levels of its components are given descriptively for ease of understanding, rather than rating them on a nominated scale. This was considered appropriate in view of the relatively simple viewshed and readily identifiable sensitive viewing locations and potential visual impacts.

The proposed operations can be divided into the following three components on the basis of their visual impacts, namely:

- two quarry pits and access through the Pistol Range into the pits,
- an infrastructure area (Plate 11) on the plain of Mining Lease M47/306 at the base of the Pistol Range, and
- an access road on the plain to the Project Area.

A Visual Assessment of each of these components was undertaken.

No detailed Visual Assessment was previously undertaken of the Pistol Range and no Landscape Management Zones had been established for the greater project region. Consequently, it was not possible to relate the Visual Assessment to previously determined landscape standards for the greater project region. A Landscape Management Zone being an area of similar scenic quality and landscape values as seen from viewing locations which are graded as to their use, importance and sensitivity.

The results of the Visual Assessment are described in the following:

a) Viewshed

The north-east corner of Mining Lease M47/306 is the only part of the Project Area which is visible from the Dampier side; an estimated 4m of the quarry face over a horizontal distance of about 50m will potentially be visible from Dampier which is about 2km away from the Project Area. This visual impact will be avoided by not quarrying this north-east corner.

The Seen Area is to the south and it includes the town of Karratha, Karratha Airport, Hamersley Iron Pty Limited's Seven Mile Railway facility, and a large section of Dampier Salt Ltd's solar evaporation ponds. Of these, the most sensitive area is the town of Karratha and to a lesser extent Karratha Airport. This is shown in Figure 3, together with Distance Zones of 0 to 0.5km, 0.5 to 6.5km, and greater than 6.5km, respectively.

b) Scenic quality

The Pistol Range is considered by the Consultant to have a high Scenic Quality based on landform and natural landscapes, and this would appear to be in agreement with the Burrup Peninsula Draft Land Use and Management Plan. This high Scenic Quality is impaired by the existing quarrying operations to the immediate west of the Project Area. However, it is possible that in the future a major part of the visual impacts of the existing operations will be removed by appropriate rehabilitation, especially the removal of the stockpiles and material which has been dumped against the base of the Pistol Ranges.

In contrast, the plain in front of the Pistol Range is considered to have a low Scenic Quality because these plains are very common in the greater project region and because of their proposed Industrial Zoning.

c) Sensitivity levels

i. Access road to Project Area

The access road from the existing gravel road on the plain in front of the Pistol Range to the Project Area is rated as having a low sensitivity level. This is because it is located in a proposed Industrial Zone

which already supports a number of roads, a speedway, a rifle range, infrastructure areas for a substantial quarry, and, most importantly, because it supports no residences and the proposed access road will not be visible from the nearest residences of Karratha. Similarly, this access road will not be visible from the Karratha to Dampier road, and from the Karratha Airport.

ii. Proposed pits and access into the pits

The sensitivity level of the proposed pits is considered to be moderate because:

- with appropriate design the pits will only be visible from within the 0 to 0.5km Distance Zone, and this zone is completely within the proposed Industrial Zone which does not currently support any residences,

- the pits will only be marginally visible from within the 0.5 to 6.5km Distance Zone, but most of this is from within the proposed Industrial Zone, the solar ponds of Dampier Salt Ltd, and the Karratha Airport. It does not include any residences,

- the pits are unlikely to be visible, or only very marginally visible, from within the greater than 6.5km Distance Zone which includes the town of Karratha, and

- the pits will only be marginally visible from isolated locations along the Karratha to Dampier road.

iii. Infrastructure area

A visual assessment of the existing quarrying operations adjacent to the Project Area revealed that they are particularly visible, as can be seen from Plate 10, because of the:

- presence of substantial stockpiles and the grey colour of the stockpiled material which results in a major colour contrast relative to the surrounding terrain,

- dumping of what appears to be waste rock immediately against the **high precipitous rock piles** which are a prominent and natural base to the Pistol Range,

- horizontal floor which has been established from waste rock in front of the quarry and which then enters the quarry,

- entry into the quarry being very wide and prominent, and

- **high precipitous rock piles** of the Pistol Range that have been quarried rather than being retained as a visual barrier.

Importantly, the quarry faces are not very noticeable. This is because they blend into the background as their colour is similar to that of the red-brownish surface rock.

The existing operations have a high sensitivity level because their infrastructure activities are very visible from the Karratha to Dampier road, from the Karratha Airport (0.5km to 6.5km Distance Zone) and to a lesser extent from the town of Karratha (greater than 6.5km Distance Zone).

An important conclusion of this Visual Assessment is that the existing quarrying operations have a major impact on the Scenic Quality of the Pistol Ranges and they have a high sensitivity level which is attributable almost exclusively to the design and management of the infrastructure activities. The quarry pit itself is not readily visible despite having been designed with what would appear to be minimal attention to aesthetics and impact on Scenic Quality.

d) Conclusions

The infrastructure area of the proposed quarrying operations has the potential to substantially affect the Scenic Quality of the Pistol Ranges. However, this can be avoided by careful design and management such as limiting the size and especially the height of the stockpiles; avoiding the destruction of the base of the Pistol Ranges; avoiding the formation of a substantial base in front of the Pistol Range which would protrude onto the plain like a large embankment; and avoiding the clearing of trees.

The quarry pits also have the potential to have a major impact on the Scenic Quality of the Pistol Range. This can be managed by careful design and avoiding any damage to the base of the Pistol Range.

4.8 Hydrology

4.8.1 Surface water

No surface water is found in the Project Area, and all rainwater drains from the area and does not pool.

4.8.2 Groundwater

No information is available on the groundwater of the Project Area, but if groundwater is available, then it is likely to occur at a depth of below that of the surface of the surrounding **low coastal terrain**.

4.9 Archaeological sites and sites of importance to Aboriginal people

The region in which the Project Area is located has been searched extensively in the past for Aboriginal sites. A search of the records of the Department of Aboriginal Sites indicates that there are 63 listed Aboriginal sites within 1km of the Project Area and none of these appear to be within the Project Area. All of these sites have an **open** access code, and they are listed in Appendix 1. Most of these sites were recorded as part of the **Dampier Archaeological Project** for Woodside Offshore Petroleum Pty Ltd, and some of them were cleared or partially cleared during the construction of the Withnell Bay Access Road and gas pipeline. The extensive surveys undertaken to date and the records of the Department of Aboriginal Sites indicate that the Project Area does not have any sites which are of cultural significance to Aboriginal people. Preliminary site specific searches by non archaeologists of the proposed access routes and pits of the Project Area revealed no stone engravings or other artefact material, but a detailed survey of the Project Areas, especially of the areas which will be affected by the quarrying and associated operations will be undertaken by an archaeologist before the commencement of operations.

4.10 Infrastructure

The Project Area is in close proximity to gravel roads leading from the main road from Dampier to Karratha. This can be seen in Plate 1. There are no reticulated sewerage, water, electricity or communication services to the Project Area.

4.11 National Parks and Nature Reserves

No National Park or Nature Reserve is located within close proximity of the Project Area, but the Project Area is within the proposed Conservation Zone of the Burrup Peninsula.

4.12 The need for another quarry

Recent developments in Western Australia with respect to the pricing of natural gas, proposals by Hamersley Iron Pty Ltd to undertake downstream processing of iron ore in the Pilbara, expansions by Woodside Petroleum, and proposals for other industrial developments suggest that the Dampier-Karratha and Burrup Peninsula regions are poised for substantial further developments. This view is supported by the Pilbara Development Commission (Nigel Grazia, Pilbara Development Commission, pers comm, 1994). The likely outcome of these foreseen developments is a substantial increase in the demand for

basic building materials, including building aggregate. Other important considerations are that another quarry would result in desirable commercial competition (Nigel Grazia, pers comm, 1994), especially as other quarries are a considerable distance (30-40km) from the Burrup Peninsula.

4.13 Alternative quarry sites

Possible alternative quarry sites were considered by the proponent on the Burrup Peninsula, especially in the northern and central sections, and some 30km to 40km from the town of Karratha. The central and northern areas of the Burrup Peninsula were not considered to be suitable alternatives because they contain, or are close to significant rock engravings; they form important components of the proposed Conservation Zone; are not adjacent to a proposed Industrial Zone South; and are not in a region where quarrying is already an established land use. Alternative sites inland of the Burrup Peninsula are 30km to 40km from Karratha. These were dismissed on the basis of high infrastructure costs, especially high transport costs to customer locations, and in particular because purchasers of aggregate for use on the Burrup Peninsula and in Karratha have in the past demonstrated a willingness to pay a premium for aggregate quarried on the Burrup Peninsula because this is considered to be a more secure supply of aggregate following cyclones when access from more distant quarries to the Burrup Peninsula may not be possible for some time. Relevant confidential correspondence to this effect is available.

5.0 PROPOSED QUARRYING OPERATIONS

The proposed location of the two quarry pits and access to them was selected following careful visual, terrain and environmental assessment to minimise the potential visual impacts when viewed from the surrounding coastal plain and to minimise potentially adverse environmental impacts. A major objective was to "hide" the two quarry pits and their proposed access within the Pistol Range and to minimise the visual impacts of the stockpiles, general road access and the crushing and screening operations.

5.1 Selection of pit locations

The approximate outline of the quarry pits, access routes, and alternative access routes, is shown in Plate 11.

Following a detailed inspection of the terrain (by means of contour maps, aerial photographs and field traverses), a comprehensive visual assessment and considerations of other environmental constraints, it was decided to locate the pits in the northern parts of Mining Leases M47/306 and M47/331 so that they will be on relatively level terraces and hidden behind the **high precipitous rock piles** and **narrow terraces** leading to the **plateau** of the **scree slope terrain** of the Pistol Range.

Mining Lease M47/306 will be quarried to the north-west boundary of the lease but the north-east corner of the lease will not be quarried above approximately the 80m contour line (see Figure 2b) to avoid the quarry becoming visible from the Dampier side. This will avoid the interruption of the skyline of the Pistol Range when viewed from the surrounding coastal plain and from Dampier. Importantly, no materials will be stockpiled on the surface of the Pistol Range adjacent to the pits as they would be visible from the surrounding plain and from Dampier. Mining Lease M47/331 will also be quarried up to the northern boundary, which in this area is below the crest of the Pistol Range; immediately north of the northern boundary is an embankment of rock piles and further terraces. The pit from Mining Lease M47/331 will then lead into the pit proposed for Mining Lease Application M47/353.

The approximate outline of the proposed pits as viewed from the plain the south of the Pistol Range is shown in Plate 15.

5.2 Selection of access routes into proposed pits

The approximate location of the preferred access route and two alternative options is shown in Plate 11.

Access to the pits was selected equally carefully to minimise destruction of the base of the Pistol Range and their **high precipitous rock piles**, take advantage of natural terrain features and minimise visual impacts.

The entry from the **low coastal terrain** to the proposed pit of Mining Lease M47/306 is via a natural gap shown in Plate 12, and the approximate location of the proposed access route is shown in Plate 11. As can be seen from Plate 11, the entry through the **high precipitous rock piles** is at an angle towards the west and then swings in a north-easterly direction into the pit. By this means a direct sight line into the pit along the access route is avoided. In addition, the entry through the **high precipitous rock piles** is oriented so that it can not be seen from the Dampier to Karratha main road, and the entry is too small to be readily visible from the airport and, in particular, from Karratha. No alternative entry into the Pistol Range was considered for Mining Lease M47/306 because the proposed entry is such a natural choice.

The preferred entry into the pit of Mining Lease M47/331 is also shown in Plate 11. From this it can be seen that the entry is via the main valley which runs approximately from west to east, and then swings north-westerly into the gully from where it will enter the south-west of the proposed pit. This route will be hidden behind the southern most ridge of Mining Lease M47/331, and this ensures that it is almost totally hidden and that it will not interfere with the activities on the adjoining rifle range. The natural entry of the proposed access route is shown in Plate 13, whilst the route up the valley is shown in Plate 6 and through the gully is shown in Plate 7. The entry point from the plain to the preferred access route of Mining Lease M47/331 is via the south eastern corner of Mining Lease M47/309 which is owned by Readymix Group Australia Limited. An application for a Miscellaneous Licence across Mining Lease M47/27 which belongs to Readymix Group Australia Limited has been submitted to the Department of Minerals and Energy for approval for this entry. The access into the Pistol Range of Mining Lease M47/331 will be restricted to a gravel road along the base of the range to the **low coastal terrain** of the southern part of Mining Lease M47/306; this road will follow along an established track. All of the infrastructure requirements for both pits will be located on the plain of this coastal terrain, and Miscellaneous Licence Application M47/27 has been lodged for approval of the preferred route which is located on Mining Leases owned by Readymix Group Australia Limited.

Two alternative entry options, Option A and Option B, were considered for Mining Lease M47/331, and they are shown in Plate 11. Approval for these options is also requested in this Consultative Environmental Review so that either of them can be used in the event that the preferred access route is unavailable because of objections from Readymix Group Australia Limited. Both options will use the gully to the terrace. Option A will require an access road on a natural bench on the southern side of the ridge to the south of the valley (Plate 14) and then to cross the valley opposite the gully. Option A will not be visible to the general public, but it will be noticeable to users of the Rifle Range, and it will require earthworks to cross the valley. Option B crosses the southern ridge from the south-east, approximately opposite the gully, and then crosses the valley and enters the gully. Option B will also not be visible to the general public, but it will be visible to users of the Rifle Range; it will also require considerable earthworks.

The exact route from Option B to the infrastructure area on Mining Lease M47/306 will be finalised in consultation with the Shire of Roebourne and the Department of Minerals and Energy, but it is likely to be as indicated on Plate 11. Approval for this route and the necessary flexibility in finalising this route is herewith requested.

Access to the Project Area was also considered from the northern or Dampier side via the existing road to the installations on Katrins Hill, but it was dismissed because:

- access would be visible as it would traverse the skyline,
- access would cross the proposed Conservation Zone,
- the quarries would be separated by part of the proposed Conservation Zone from the proposed Industrial Zone South, and

- the transport distance to likely consumers would be increased.

An artistic impression of the proposed access through the **high precipitous rock piles** is shown in Figure 4a for Mining Lease M47/306; for Mining Lease M45/331 the entry into the valley is shown in Figure 4b and the entry into the gully is shown in Figure 4c. An overall impression of the access routes, quarry pits, infrastructure area, and access to the Project Area is shown in Figure 5 as viewed obliquely from the air and in Figure 6 as viewed from the coastal plain to the south of the Project Area.

5.3 Quarrying method

The hard-rock will be quarried by blasting and subsequent excavation with excavators and front-end-loaders. The rate of quarrying will be determined by the weekly demand for product, and it will be approximately equal to this demand. It is anticipated that the average weekly production is about 1000 tonnes of marketable product. Blasting is likely to be on a weekly basis, and will be relatively minor to produce, on average, 1000 tonnes of crushed and screened product per week.

The access routes to both pits will be quarried progressively until the proposed pit is reached. Quarrying of the pit will then commence, probably in benches of up to 20m height and 10m to 20m width. The final design of the pit walls will be undertaken in consultation with the District Mining Engineer of the Department of Minerals and Energy to ensure that it meets the necessary slope stability. The initial entry of about 50m into the Pistol Range will be slightly uphill and then downhill into the pits. All rainwater and run-off into the pit will thus be retained in the pit. The final level of the pit floors is likely to be equal to that of the surrounding coastal plain, giving a maximum quarry wall height of about 75m.

Where available, all topsoil will be saved for rehabilitation purposes, but the amount of available topsoil will be minimal. Topsoil from the terraces will, wherever possible, be pushed into windrows on the outside perimeter of the pits.

5.4 Location of crushing and screening operations

The crushing and screening operations will initially be undertaken on the plain at the base of the Pistol Range of Mining Lease M47/306; a detailed site plan showing the outline of the various facilities on the infrastructure area will be presented to the Authorities prior to the commencement of operations. Once the access routes have been quarried and quarrying of the pits has commenced, the crushing and screening will, as much as is practical, be undertaken within the pits. These operations will then not be visible from the surrounding plain. *Eucalyptus dichromophloia* trees will be planted on the plain of Mining Lease M47/306 to interrupt sight lines from the surrounding coastal plain to the operations at the base of the Pistol Range. This will provide a screen for these operations.

The proposed crushing operations will be undertaken with modern equipment complete with dust emission controls; this will comply with the conditions which are likely to be stipulated by the Authorities with respect to dust emissions. Dust is not considered to be a problem with respect to crushing and screening.

5.5 Location and design of stockpiles

The two quarries will produce a range of products which will vary in rock type and in particle size. Consequently there will be the need for a number of stockpiles. The need for stockpiles will be kept to a minimum as a major objective is to quarry at a rate which approximates the weekly demand. For these reasons it is unlikely that the stockpiles will store more than up to two months of production, or a total of about 8000 tonnes which is approximately equivalent to 3000m^3.

Fines are a major by-product of crushing and screening, and in many quarry operations they are considered to be a waste product because they can not be sold readily. However, in the Karratha region a market is developing for this product because of a shortage of building sand for fill required for building sites. These fines are increasingly being recognised as an alternative to sand as a fill-material, and it is envisaged that all of the fines will be sold. This will avoid the establishment over time of a large

stockpile of fines.

The stockpiles have the potential to adversely affect the visual qualities of the Pistol Range, and for these reasons the need for stockpiles will also be kept to a minimum. The stockpiles will be established on the plain at the base of the Pistol Range on Mining Lease M47/306. To ensure that they are not readily visible all of the existing trees on this plain will be retained and more will be established along the perimeter of the lease facing the plain, to provide a further natural screen. The trees to be planted will consist of *Eucalyptus dichromophloia* and occasional *Brachychiton acuminatus*, and they will be grown from locally collected seed. These trees are likely to range in height from 8m to 12m, and this will determine the height of the stockpiles, which will be kept below the height of the tree canopy. A stockpile of 3000m³, stacked to a height of 10m will occupy a surface area of about 30m by 10m. However, most of the stockpiles will seldom exceed a height of 5m, and for a volume of 3000m³ this would occupy a surface area of about 30m by 20m. From this it can be seen that the likely maximum area which will be occupied by a stockpile of screened aggregate will range up to 30m x 20m or its equivalent.

Once the pits have reached a sufficient size, part of the pit floor will be used as a bulk stockpile area, with the area on the plain being kept for smaller stockpiles from which product will be sold. The stockpiles on the plain will then be replenished on a needs basis from the bulk stockpiles within the pit area. The bulk stockpiles will be located in positions within the borrow pit so that access to them is not a major problem following high rainfall events.

5.6 Location and design of waste dumps

It is envisaged that there will be very little need for a waste dump. All soil will be saved for rehabilitation purposes and it will not be part of the waste. Efforts will be made to crush all excavated rock, with all undersized material being sold as fill or fines. A temporary stockpile will be required, and this will be located on the nominated stockpile area, and its height will not exceed that of the surrounding trees.

5.7 High precipitous rock face and piles at base of Pistol Range

No waste material will be stockpiled or stored against the rockface of the base of the Pistol Range. An area of at least 10m in front of the rockface will be regarded as out-of-bounds for any stockpiling. The removal of trees and disturbances in this area will be kept to a minimum, and the use of this area will be restricted to vehicle parking, office and ablution facilities, and storage shed(s).

5.8 Blasting

There will be a need for regular blasting, probably on a weekly basis, although there is a need for flexibility with respect to the frequency of blasting. On average, it is anticipated that blasting will be undertaken weekly to produce about 1000 tonnes of crushed and screened product.

All blasting will be undertaken by a licensed shot-firer and it will be undertaken in accordance with the safety requirements stipulated by the Department of Minerals and Energy.

If necessary, blasting will be restricted to small blasts, and all blasts will be fitted with millisecond delays to produce sequential firing. Liaison will also be established with the adjoining quarry to avoid the unlikely event of simultaneous blasting. The timing of blasting will also be discussed with the Department of Minerals and Energy, and it will be undertaken at nominated or recommended times.

Procedures with respect to air safety within the Karratha Airport circuit will be implemented. The airport at Karratha will be advised during working hours and not less than 24 hours prior to any blasts in order that a Notice to Airmen concerning the blast is issued by the Civil Aviation Authority.

Blasting will also be discussed with the Shire of Roebourne with regard to general public safety. The

need to warn the public travelling along the road to the installations belonging to the Water Authority of Western Australia and Telecom on Katrins Hill will be discussed and the required safety precautions nominated by the Shire and/or the Department of Minerals and Energy will be followed strictly.

5.9 Dust control

The blasting, crushing and screening operations have the potential to generate dust. The operators will comply with all of the dust control measures which are likely to be required by the Department of Minerals and Energy. Dust generated from blasting is difficult to control and dust generation will be unavoidable. The crushing and screening will be undertaken by a modern plant fitted with modern dust emission controls which will comply with the dust emission controls which are likely to be requested by the Authorities. At this stage a number of crushing plants are being evaluated, and they include dry and wet plants, all of which are efficient in removing dust from crushing plants. The necessary water for dust control will be transported to site in tankers, and it will be recycled as much as possible, although substantial losses will occur due to evaporation and water being taken up by the product material.

All rainwater within the pits will be collected and stored for dust control, but it will be several years before there is a sufficiently large pit floor for on-site water collection to supply some of the requirements.

Once the quarry pits have become sufficiently large, efforts will be made to locate the crushing and screening operations within the pits, thereby confining the dust and noise generated from these operations to within the "hidden" pits.

5.10 Rehabilitation and decommissioning

The objectives of rehabilitation are to render the affected areas safe and to return them to their long-term land use. With regards to the infrastructure area, the proposal is to return these to their proposed land use of Industrial Zone South. For the quarry pit and the access routes the long-term land use is a proposed Conservation Zone; the proposed rehabilitation will achieve this by making the affected area safe. It is conceivable that following rehabilitation the pit floor may be considered a valuable extension of the proposed Industrial Zone; this may need to be considered in the future, but the proposed rehabilitation will provide this flexibility with respect to future land use.

On decommissioning the edges of the quarry walls will be blasted and re-shaped as illustrated in Figure 7, and topsoil stored in adjacent windrows will be spread over the upper edge of the reshaped pit walls to facilitate the establishment of some vegetation in this area. The entry into the quarry will be blocked with the rocks; this will also require blasting. The proposed rehabilitation is likely to be subject to review closer to the time of decommissioning and in line with the then prevailing rehabilitation expectations, methods and requirements. Consequently, it is proposed to retain flexibility with respect to the proposed rehabilitation.

The arid climatic conditions of the region and the lack of sufficient soil make it almost impossible to contemplate the establishment of vegetation within the pits and on the access route into the pits. However, topsoil will be spread over the upper most slope of the pushed-in pit walls. This will provide conditions suitable for the colonisation of this surface by *Triodia* species. However, the most important impact of this rehabilitation is that it will alter the angle of the wall, and thus the angle of light reflection, and the respread soil and loose rock will ensure that most of the light is absorbed and that the colour of the surface will blend into the surrounding surface colours. This will further minimise the visual impact of this part of the quarry which would otherwise be visible from the coastal plain to the south. The remainder of the rehabilitated pit and access route will consist of a rock scree slope.

The rehabilitation of the quarry pits will, wherever possible, be undertaken progressively behind the operating front. It is envisaged that it will be many years, probably well in excess of 10 years, before such rehabilitation can be commenced.

The infrastructure area will be cleared of all buildings, rubbish, old machinery and other materials, and all tracks and other completed surfaces will be ripped to trap seed and to provide a root medium suitable for seedling establishment. If necessary, seeding of locally collected seed of *Triodia* species and local native shrubs will be undertaken.

5.11 Transport and traffic

All product from the two quarry pits will be sold from the stockpiles proposed for Mining Lease M47/306. It is envisaged that trucking will be undertaken by the clients but if necessary it will be arranged by the proponent, who may use their own trucks to deliver product or may use sub-contractors; it is likely to be a combination of these options.

Access to the proposed quarrying operations is via the infrastructure area on the plain of Mining Lease M47/306, and it will be from the existing gravel road from the Dampier to Karratha main road to the race track and to the rifle range. This road is shown in Figure 1. A gravel road of about 300m length will be constructed to provide access to the infrastructure site of the proposed quarries. This road will enter the infrastructure area from the east, behind the screen of trees to minimise visual impact.

On the basis that approximately 1000 tonnes of product are sold per week and that most of this will be removed in parcels of about 30 tonnes, the weekly trucking will be about 35 return truck journeys. In addition, there will be car movements, probably about 20 per day. This traffic requirement will be discussed with the Shire of Roebourne who have been informed of this project.

5.12 Water supply

No reticulated water is available at the Project Area. All water will be carted to site by tankers and it will be stored in the infrastructure area and in the pit depending on the location of its use.

5.13 Electricity

No reticulated electricity is available at the Project Area, and it is proposed that all electricity will be generated on site by portable generators.

5.14 Communications

Mobile telephone facilities will be used on site until a telephone line has been installed.

5.15 Waste disposal

All wastes other than quarrying and sewerage wastes will be removed from the site and disposed of at the Karratha Town waste disposal site. This will be rigorously controlled to avoid native and feral animals having access to domestic wastes.

5.16 Buildings and ablution facilities

Portable offices and basic mess facilities will be erected on the Project Area. There will be an on site septic tank system.

5.17 Workforce

It is anticipated that a workforce of about 4 people will be employed by the proposed operations. The workforce will commute to the site, although limited on-site accommodation may be provided for security purposes.

5.18 Public access to the site

The proposed operational areas will be fenced off from the public and a locked gate will prevent access when no workforce is on site.

6.0 ENVIRONMENTAL AND SOCIAL IMPACTS AND PROPOSED DESIGN AND MANAGEMENT CRITERIA TO ADDRESS THESE POTENTIAL IMPACTS

6.1 Visual impact

The potential visual impact of the proposed operations was a major consideration in the design of the proposed quarrying operations and their proposed management. The result is that the visual impact of the operations will be very minimal as can be seen in Plate 15 which shows the operational areas which are likely to be visible from the Karratha side of the coastal plain. This is also demonstrated in Figures 6a, 6b and 7 which give artistic impressions of the proposed operations as seen obliquely from the air and from the coastal plain. The proposed operations will not be visible from the Dampier side of the Project Area.

The factors which were considered to minimise the visual impact of the proposed operations were described in Sections 5.1 and 5.2, and based on a Visual Assessment (Section 4.7), and they are summarised below.

- the pits of the two Mining Leases and the Mining Lease Application will be confined entirely to the terraces of the Pistol Range, thereby "hiding" them inside the range; they will be marginally visible when viewed from the coastal plain to the south, and they will not be visible from the north,

- disturbance to the **high precipitous rocky piles** at the base of the Pistol Range will at all times be kept to an absolute minimum. In the case of Mining Lease M47/306 the entry through the base to the pit will be via a natural gap, and in the case of Mining Lease M47/331 it will be via an existing valley and gully. Visual disturbance, especially of Mining Lease M47/331, will be minimal and the operations will not be visible from a distance of greater than about 500m,

- access into the pits will be curved and hidden, thus avoiding long views into the respective pits,

- the need for stockpiles will be kept to a minimum, with ultimately some of the stockpiles being located within the pits,

- wherever possible the trees of the infrastructure area will be retained and trees will be planted along the southern boundary of Mining Lease M47/306 to provide a natural screen,

- the height of the stockpiles will be kept to below about 10m so that they will be below the height of the tree canopy which will be established on the southern boundary of Mining Lease M47/306,

- road access from the entry to the valley on Mining Lease M47/331 to the infrastructure area on the plain of Mining Lease M47/306 will be close to the existing tree line at the base of the Pistol Range, along an already well developed track. This will minimise the visual impact, and this will be further minimised by planting additional trees to the immediate south of this road. The use of this area for this road is subject to securing a necessary Miscellaneous Lease for this area. Otherwise, this road will be located further to the south,

- no product or waste material will be stockpiled against the base of the Pistol Range. The **high precipitous rocky piles** of this area will be retained and will continue to form a natural and undisturbed background to the operations. This will be further enhanced by a policy of minimal disturbance of trees in this area, and by restricting the use of this area entirely to office, ablution

and storage requirements (other than stockpiles), and

- access to the Project Area will be via a gravel road from the main gravel road leading from the Dampier to Karratha main road to the race track and the rifle range. The final entry into the Project Area will be via a turn to the west so that it will be entered from the eastern side, behind the screen of proposed trees.

6.2 Groundwater

The quarrying operations will have no impact on local groundwater resources.

6.3 Surface water and sediment

The two pits and the proposed access to the pit of Mining Lease M47/306 will not interfere with existing surface drainage systems. The access route via the valley into the proposed pit of Mining Lease M47/331 has the potential to interfere with the creekline within this valley. Damage to this creekline will be minimised by locating, wherever possible, the proposed access road adjacent to the defined creekline rather than in it. However, it is likely that some sediment from the proposed road will be washed into the creekline. This sediment is not considered to be a major problem since the drainage water from the creek is naturally dispersed across the plain after it has reached this plain rather than being directed into a well defined drainage line or creek. For these reasons it is recommended that there is no need for a sediment trap at the base of this valley. It is likely that the environmental impact of a sediment trap is more substantial than the sediment load of the run-off water. However, it is proposed that this is reassessed following the construction of the road along this valley, and at that time it may be decided to construct a sediment trap.

All run-off within the pit will be retained in the pit and, if possible, it will be used for dust suppression. Similarly, the access road into the pit of Mining Lease M47/306 will slope into the pit once it has entered about 50m into the Pistol Range, and the access road into the pit of Mining Lease M47/331 will drain into the pit from approximately where the gully meets the existing valley. Most of the run off from these access routes will thus be directed into the respective pits.

6.4 Terrain

The impact on the terrain of the Pistol Range will be confined mainly to the upper terraces. These terraces are common and widespread in the Burrup Peninsula and the Pilbara, and the main impact is a visual one which has been kept to a minimum as outlined in Section 6.1.

6.5 Vegetation

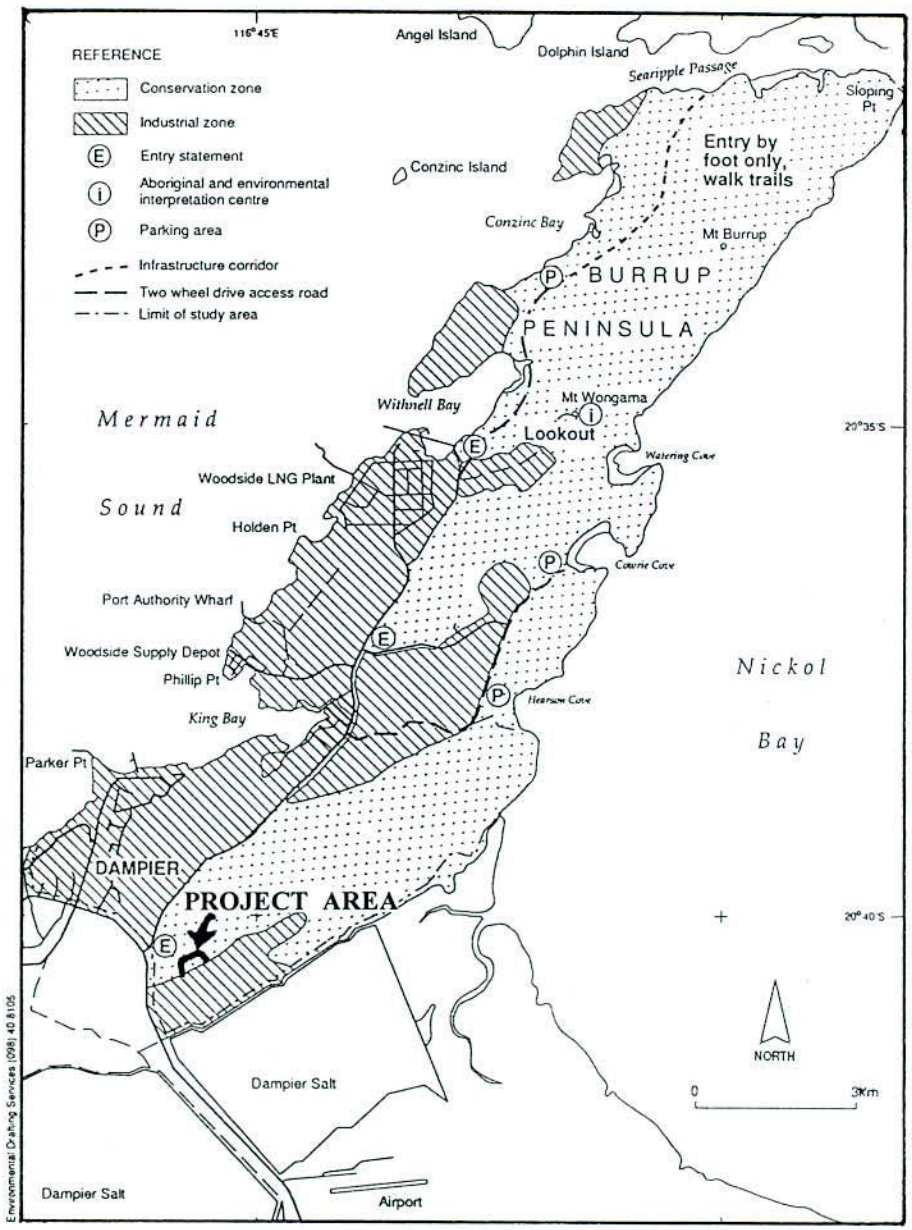
The impact of the proposed operations is confined mainly to 14 hectares of the sparse hummock grassland of the **soil covered terraces**. These grasslands are extensively represented on the Burrup Peninsula and the Pilbara. The access route to the proposed pit of Mining Lease M47/331 will require the removal of about 25 *Eucalyptus coolabah* var. *rhodoclada* trees, and all of the *Terminalia canescens* trees in the gully. The need for the removal of these trees is unavoidable and it has been kept to a minimum. However, all of these trees are common and widespread on the Burrup Peninsula and in the Pilbara. No *Terminalia supranitifolia* and possibly up to four *Brachychiton acuminatus* trees (both are Priority 4 listed flora species) will be removed during the course of quarrying.

It is suggested that the removal of these trees is of minimal environmental consequence because *Brachychiton acuminatus* is widespread on the Burrup Peninsula and in parts of the Pilbara, and because the proponent will plant at least 12 *Brachychiton acuminatus* trees, grown from local seed, within the infrastructure area. Approval for the removal of the *Brachychiton acuminatus* trees has been obtained from the Department of Conservation and Land Management (see Appendix 2).

6.6 Fauna

The proposed operations will result in the destruction of 14 hectares of terraces which are sparsely vegetated with the hummock grasses of mainly *Triodia pungens* and some *Triodia wiseana*; a substantial portion of these terraces are very rocky and support very few plants. It is suggested that locally and regionally this loss of habitat will not have any significant impact on the fauna of the region.

6.7 Conservation



LOCATION OF PROJECT AREA AND PROPOSED LANDUSES FOR BURRUP PENINSULA AS PRESENTED IN THE BURRUP PENINSULA LAND USE AND MANAGEMENT PLAN

The Project Area is located at the southern edge of the proposed Conservation Zone of the Burrup Peninsula Draft Land Use and Management Plan as can be seen in the sketch below. An important

consideration in establishing this Conservation Zone was to provide a continuous north-south conservation corridor along the length of the Burrup Peninsula "to cater for fauna and flora continuity". The Project Area is located at the extreme southern end of the proposed Conservation Zone and thus it does not interfere with the concept of creating a continuous north-south conservation corridor. The Project Area also includes part of the proposed Industrial Zone South. Consequently, the location of the Project Area is not in conflict with the concepts of the Burrup Peninsula Draft Land Use and Management Plan, and its impact on the Conservation Zone is kept to a minimum because it is confined to the southern end of this zone, adjacent to an existing quarry and a proposed Industrial Zone. It is suggested, that the proposed quarry will have no effect on the high conservation values located elsewhere on the Burrup Peninsula, especially in the north of the Conservation Zone, and it does not interfere with the conservation objective of the Burrup Peninsula Draft Land Use and Management Plan to establish a continuous north-south conservation corridor.

6.8 Noise

The proposed quarrying, crushing and screening operations will result in increased noise levels. However, because the operations are separated from Dampier by the Pistol Range, the noise level is expected to meet the Noise Abatement (Neighbourhood Annoyance) Regulation 1979 for the residents of Dampier. Similarly, it is concluded that the noise levels will meet the regulations for the residents of Karratha because of the long distance involved (minimum of 8.75km); note that the existing quarrying operations could not be heard in Karratha by the consultant when visiting the town to undertake this study. Importantly, it is considered that the noise which will emanate from the proposed quarrying operations will be substantially less than those of the existing operations since the proposed operations will be contained within the Pistol Range and will be separated from the plain facing the town of Karratha by the base of the Pistol Range which will form a substantial noise barrier between the town of Karratha and the quarrying operations. This is unlike the existing quarrying operations which did not retain such a barrier.

The operations will be confined to hours of daylight so that no noise will be produced at night time when noise is typically more of a problem.

It is expected that conditions with respect to noise control will be set by the relevant Authorities. Noise levels will be monitored to ensure that the conditions are adhered to.

Apart from the actual quarrying operations, the crushing and screening operations and front-end-loaders are potentially important contributors to the noise which will be emanating from the total operation. In the long-term this will be minimised by locating the crushing and screening operations within the quarry pit, thereby also ensuring that a noise barrier will exist between these operations and the adjoining coastal plain and the more distant town of Karratha.

All employees will be required to wear noise protection equipment when exposed to excessive noise levels, and all of the proposed operations will be undertaken in compliance with normal noise standards nominated by the relevant Authorities for similar operations in remote locations.

6.9 Dust

A modern crushing screening plant will be used and this will result in dust emissions complying with the dust emission standards which are likely to be nominated by the relevant Authorities. Dust from the crushing and screening operations should therefore not be a problem to employees working on the site. Dust from the internal roads will be controlled on a needs basis by applications of water.

The proponent will comply with all of the conditions which the Authorities are likely to nominate with respect to dust control.

The selection of modern crushing and screening equipment and other dust control measures will ensure that the operations will not result in unacceptable dust levels.

6.10 Fuel

All fuel to be used in the Project Area will be stored in bunded areas which will prevent the spread of accidental spillages from the storage area. In the event of an accidental spillage. All fuel or oil soaked soil will be removed for burial at a recognised disposal dump; this will be undertaken in consultation with the Department of Minerals and Energy.

6.11 Pets

The workforce will not be permitted to bring cats to the Project Area. Domestic dogs will be permitted in the infrastructure area which will be part of the proposed Industrial Zone South; they will not be permitted to roam freely in the Pistol Range.

6.12 Firearms

The workforce will not be permitted to bring firearms to the Project Area.

6.13 Aboriginal heritage

A survey of the areas which will be affected by the proposed quarrying operations will be undertaken by an archaeologist to determine the presence of archaeological sites. This survey will be undertaken prior to the commencement of operations.

In the event that an archaeological site or a site of cultural importance to Aboriginal people is located in the Project Area, the Aboriginal Heritage Act will be observed, and the proponent will immediately inform the Department of Minerals and Energy and the Department of Aboriginal Sites.

6.14 Social impact

The proposed quarrying operations will provide work for four people, and during times of increased regional construction activities it is anticipated that this will increase substantially. A further beneficial effect is that the proposed operations will increase the competition with respect to the supply of quarried product, and because of its favourable location it will keep transport costs to a minimum; this will be of benefit to a great number of consumers in the region.

The proposed project was discussed with representatives of the Department of Resources Development and the Pilbara Development Commission, and received support from both (Nigel Grazia, Pilbara Development Commission, and John Prior, Department of Resources Development, pers comm, July 1994). Similarly, a copy of a detailed Notice of Intent prepared in July 1994 for this project was viewed favourably by the Shire of Roebourne; and all of their concerns have been addressed in this Consultative Environmental Review.

6.15 Land rehabilitation

The rehabilitation of affected land is considered to be an important component of the proposed quarrying operations. Rehabilitation will be undertaken as outlined in Section 5.

7.0 REFERENCES

Department of Conservation and Land Management (1990). Dampier Archipelago Nature Reserves - Management Plan 1990-2000.

Department of Conservation and Land Management (1990). Dampier Archipelago Nature Reserves, Management Plan 1990-2000, Management Plan No 18.

Dampier Archaeological Project (1984a). Survey and salvage of Aboriginal sites on portion of the Burrup Peninsula, for Woodside Petroleum Pty Ltd. Catchment Areas, Geomorphic Zones and Tabulations. Western Australian Museum, Perth.

Dampier Archaeological Project (1984b). Survey and salvage of Aboriginal sites on portion of the Burrup Peninsula, for Woodside Off-Shore Petroleum Pty Ltd. Map Folio. Western Australian Museum, Perth.

Environmental Protection Authority, Western Australia, December (1992). Quarry, Lot 344 South Western Highway, Mundijong. Report and recommendations of the Environmental Protection Authority. Bulletin 662.

Environmental Protection Authority, Western Australia, April (1993). Supplementary report on the visual impacts of quarry, Lot 344 South Western Highway, Mundijong. Bulletin 677.

O'Brien Planning Consultants, May (1994). Burrup Peninsula Draft Land Use and Management Plan (and Technical Appendices), prepared for the Burrup Peninsula Management Advisory Board.

Pilbara Development Commission (1993). Pilbara Tourism Development Implementation Plan; Prepared by the Pilbara Tourism Development Committee.

Shire of Roebourne (1992-1993). Information Directory, Karratha and Districts Chamber of Commerce.

Department of State Development (1992). Pilbara 21 - Final Strategy Report.

Woodside Offshore Petroleum Pty Ltd (1979). Environmental Impact Statement and Environmental Review and Management Programme for the North-West Shelf Development Project.

8.0 ACKNOWLEDGMENTS

The assistance of the Northern Sub Regional Office (Port Hedland) of the Department of Aboriginal Sites, especially Mr Louis Warren and Ms Diana MacCallum, is greatly appreciated. Similarly, assistance obtained from the Department of Conservation and Land Management, especially Dr Ken Atkins, is also acknowledged.

9.0 STUDY TEAM

This Consultative Environmental Review was prepared by the following study team:

- Dr Wolf Martinick: Project Leader.
- Dr Robert Holmes: Ecologist.
- Mr Ray Cranfield: Botanist.
- Ms Glenda Martinick: Editing.
- Ms Julie Stearne: Editing and drafting.
- Mr Christian Luther: Landscape Architect.
- Ms Christine Mellersh: Wordprocessing.

PLATE 1: Aerial view of Project Area, the town of Dampier and the main road from Karratha to Dampier

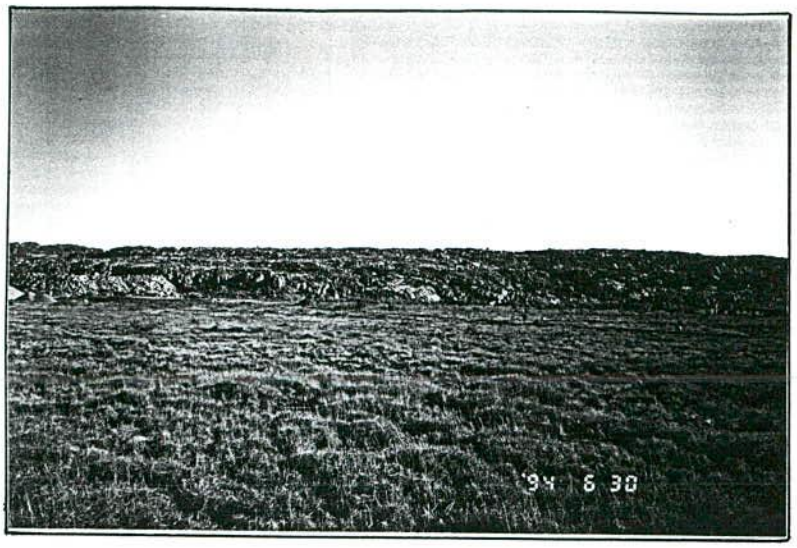


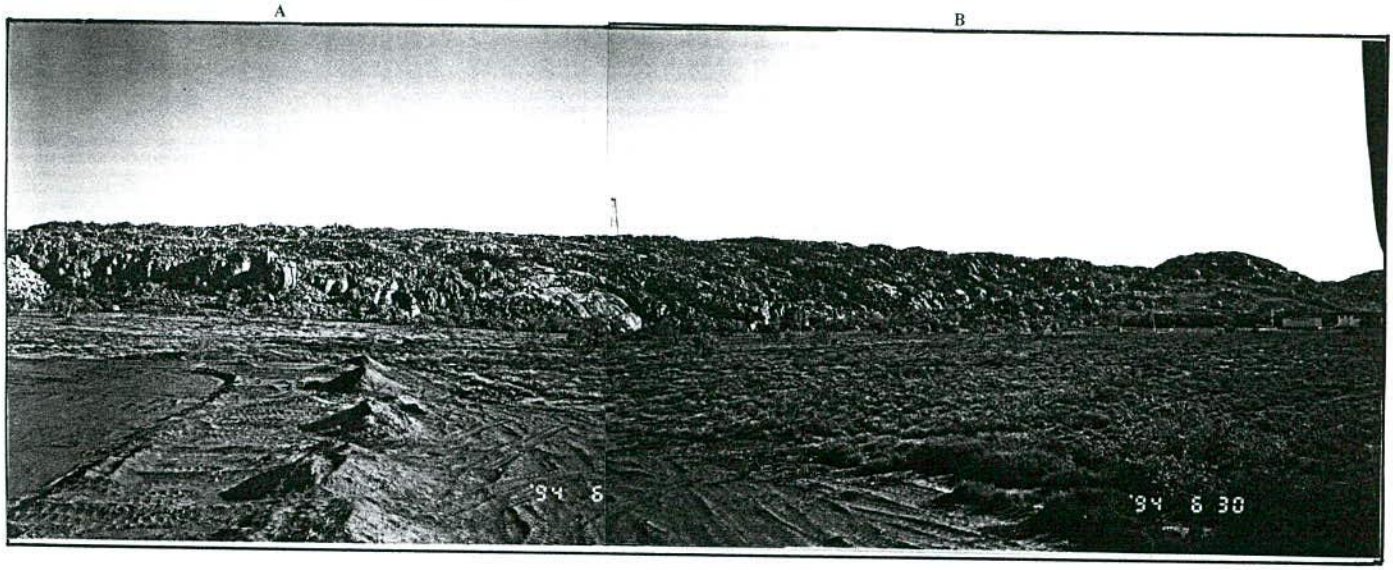
PLATE 2: View of the plain of the **low coastal terrain** of the southern part of Mining Lease M47/306

PLATE 3a: High precipitous rock piles at base of Pistol Range of Mining Lease M47/306

PLATE 3b: High precipitous rock piles and **scree slopes** at base of Pistol Range of Mining Lease M47/331

A

B



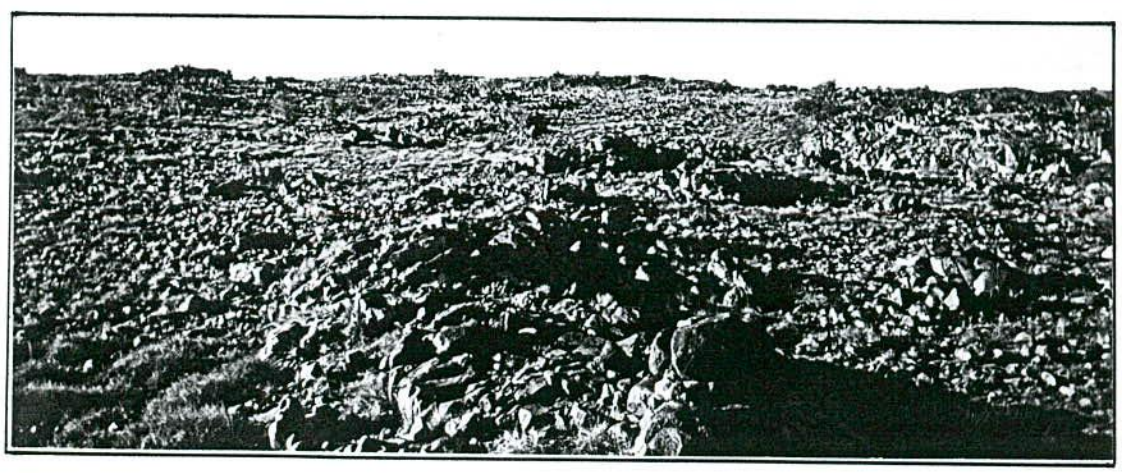


PLATE 4: Wide **soil covered terrace**, but very rocky, on upper slope of Pistol Range of Mining Lease M47/306

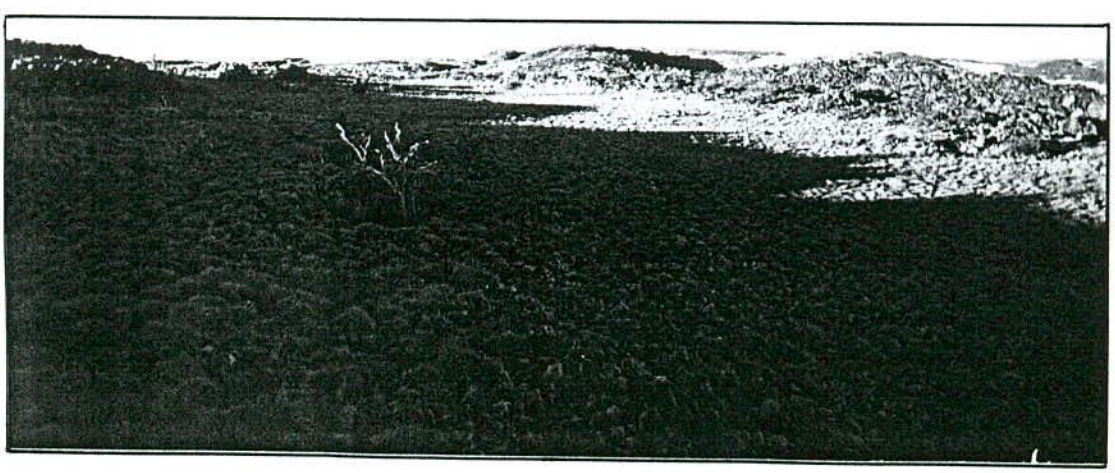


PLATE 5: Wide **soil covered terrace** on upper slope of Pistol Range of Mining Lease M47/306 and Mining Lease Application M47/353

PLATE 6: Valley leading approx from west to east at southern end of Mining Lease M47/331 from the surrounding coastal plain to the plateau

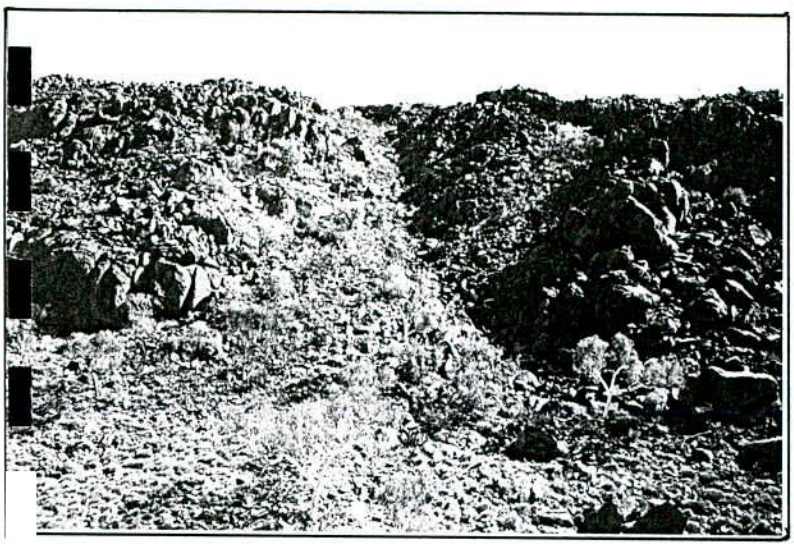


PLATE 7: Gully leading approx from east to west from the valley shown in Plate 6 to the upper soil covered terraces

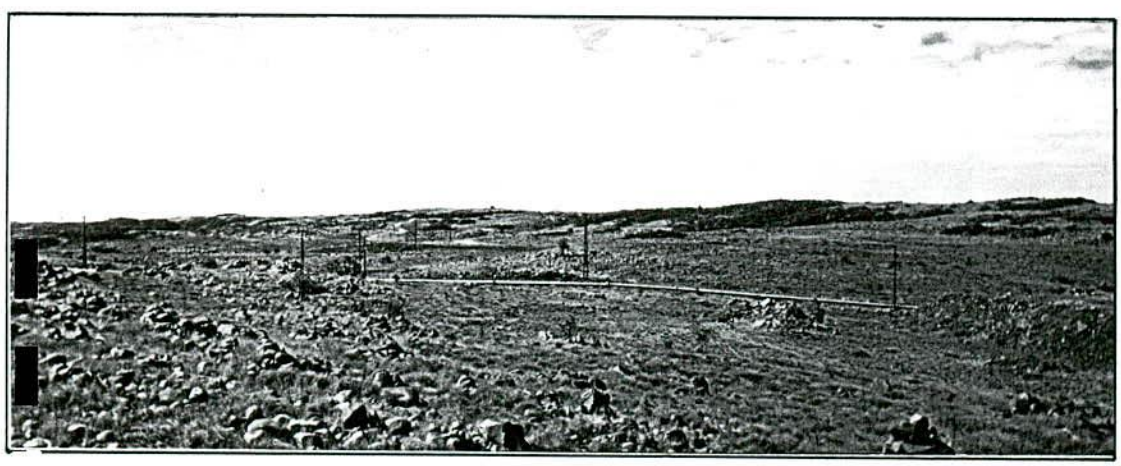


PLATE 8: View of the Pistol Range from the Dampier side of the Project Area towards the Project Area; the approx locations of Mining Leases M47/306 and M47/331 are indicated

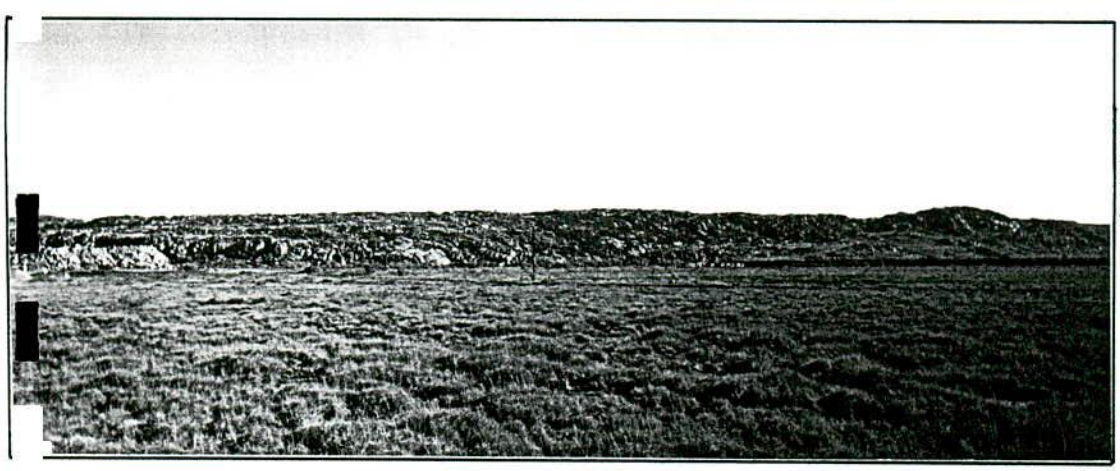


PLATE 9: View of the Pistol Range from the Karratha side towards the Project Area; the approx locations of Mining Leases M47/306 and M47/331 are indicated

PLATE 10: View from the Karratha side towards the existing quarry to the immediate west of the Project Area

PLATE 12: Natural gap which will become the entry through the **high precipitous rock piles** of the proposed access route to the pit proposed for Mining Lease M47/306

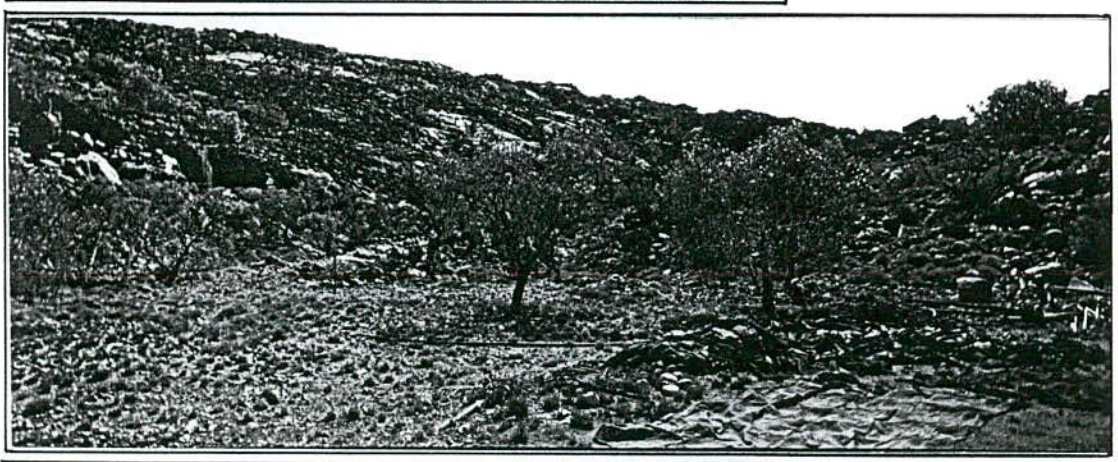


PLATE 13: Natural entry along the valley into the Pistol Range of the proposed access route to the pit proposed for Mining Lease M47/331

PLATE 14: Location of an alternative access route to the gully leading to the pit proposed for Mining Lease M47/336

MLA M47/353

M47/331

M47/309

M47/306

PREFERRED ROUTE

A

B

INFRASTRUCTURE AREA

PLATE 11: Approx outline of the proposed quarry pits and access routes (and alternative access routes) shown on the coloured aerial photograph of Plate 1(b)

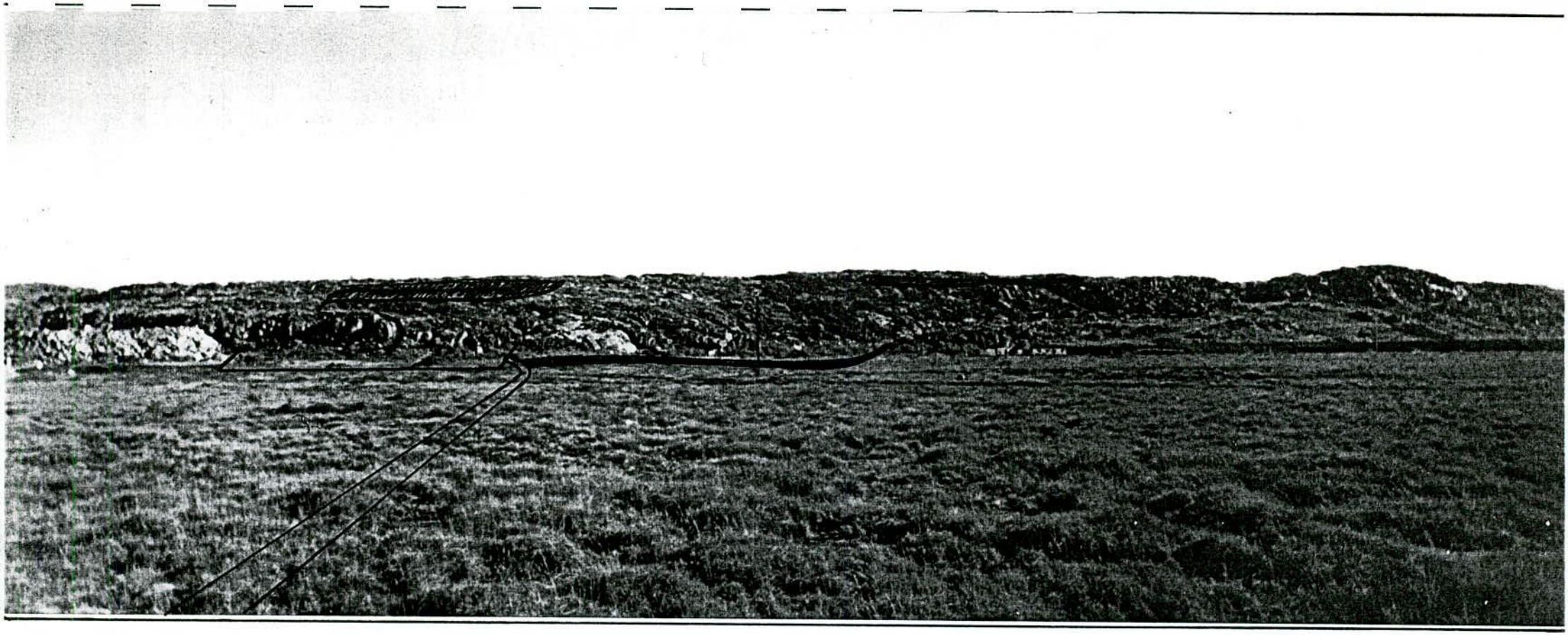


PLATE 15: The Project Area viewed from the coastal plain to the south (Plate 9) with approx locations of pit walls proposed for Mining Leases M47/306 and M47/331, and Mining Lease Application M47/353

FIGURE 1: Location of the Project Area (from Burrup Peninsula Land Use and Management Plan; O'Brien Planning Consultants, 1994)

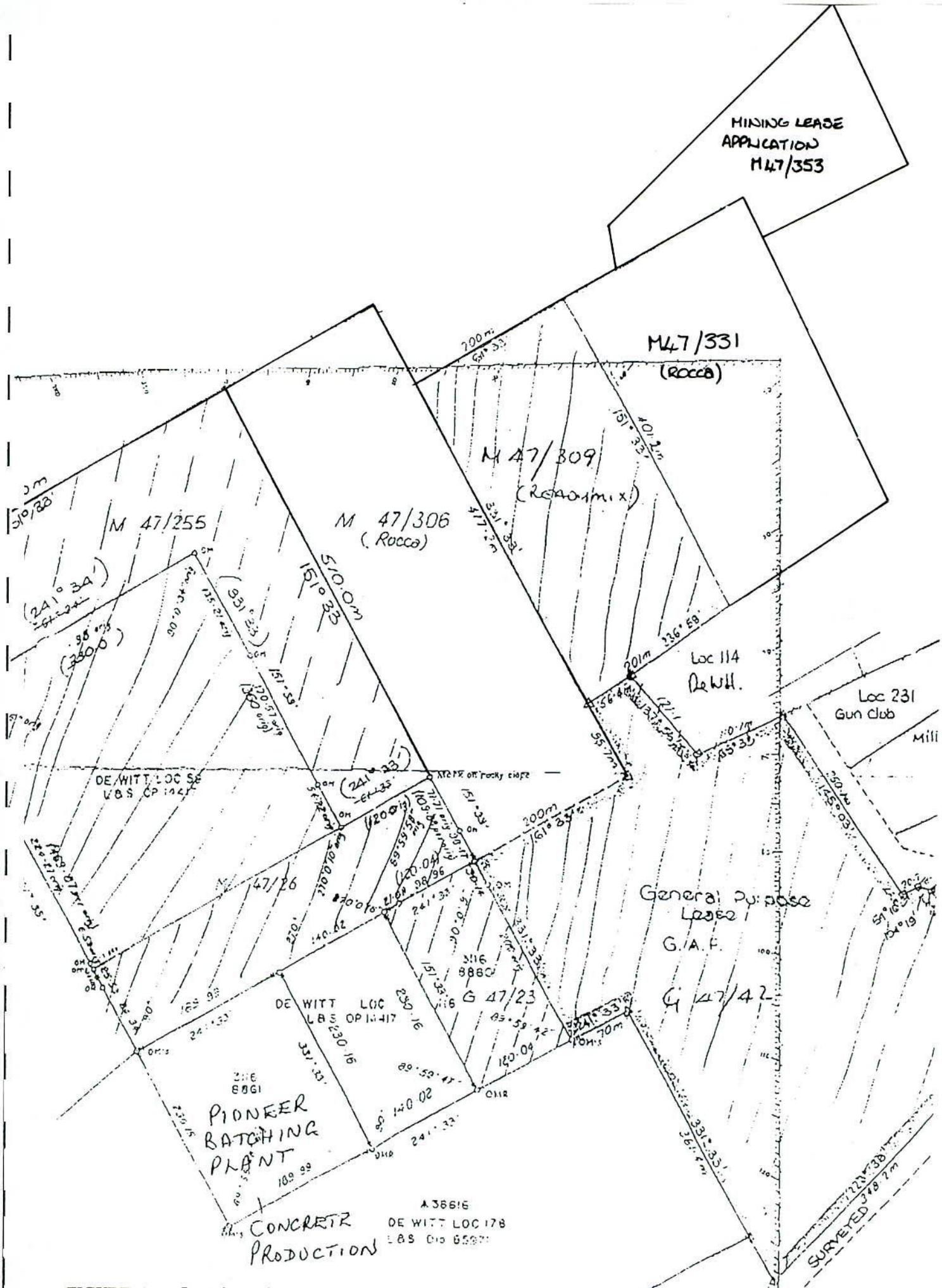


FIGURE 2a: Location of various Mining Leases and Mining Lease Applications of the greater Project Area

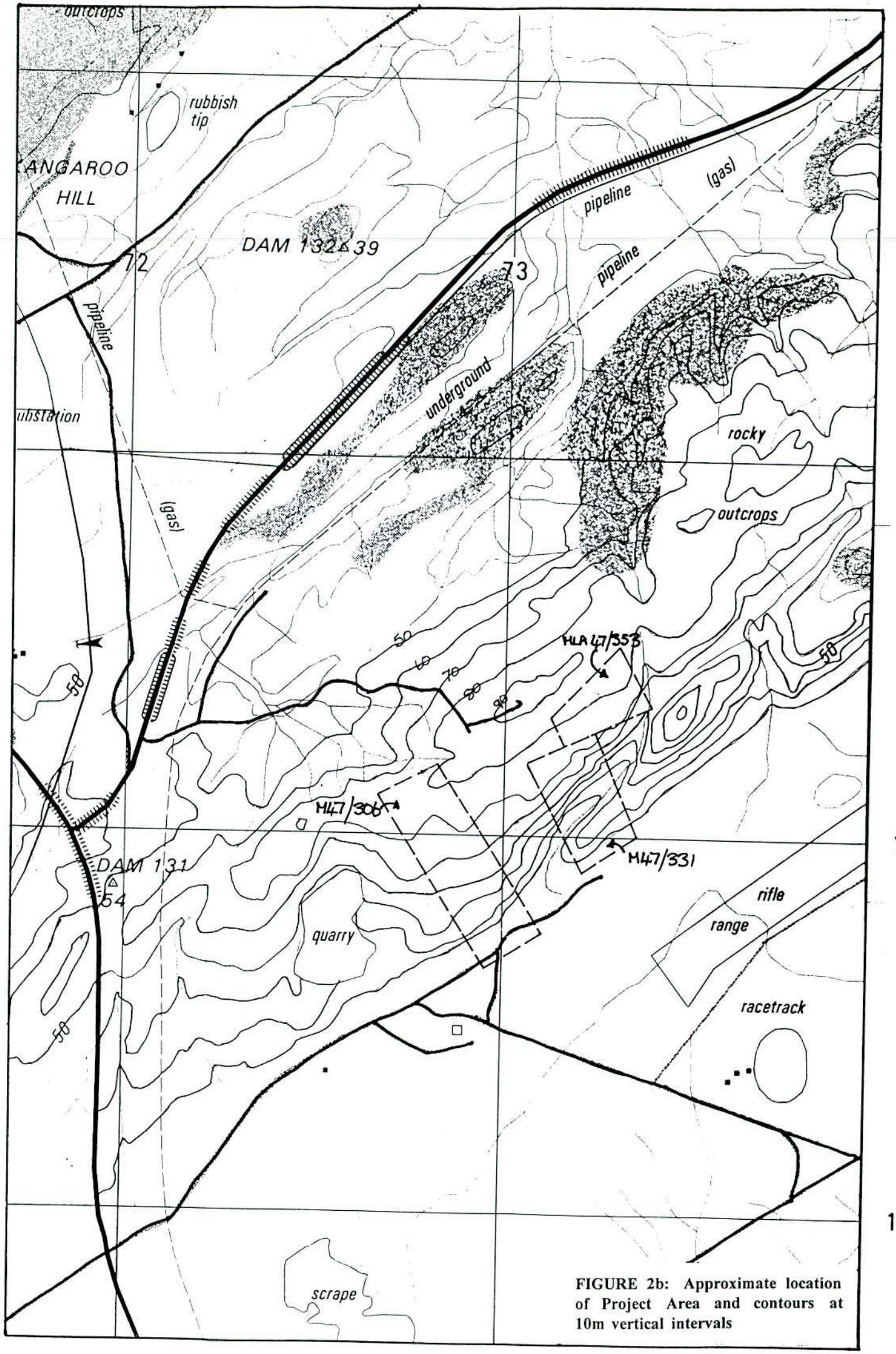


FIGURE 2b: Approximate location of Project Area and contours at 10m vertical intervals

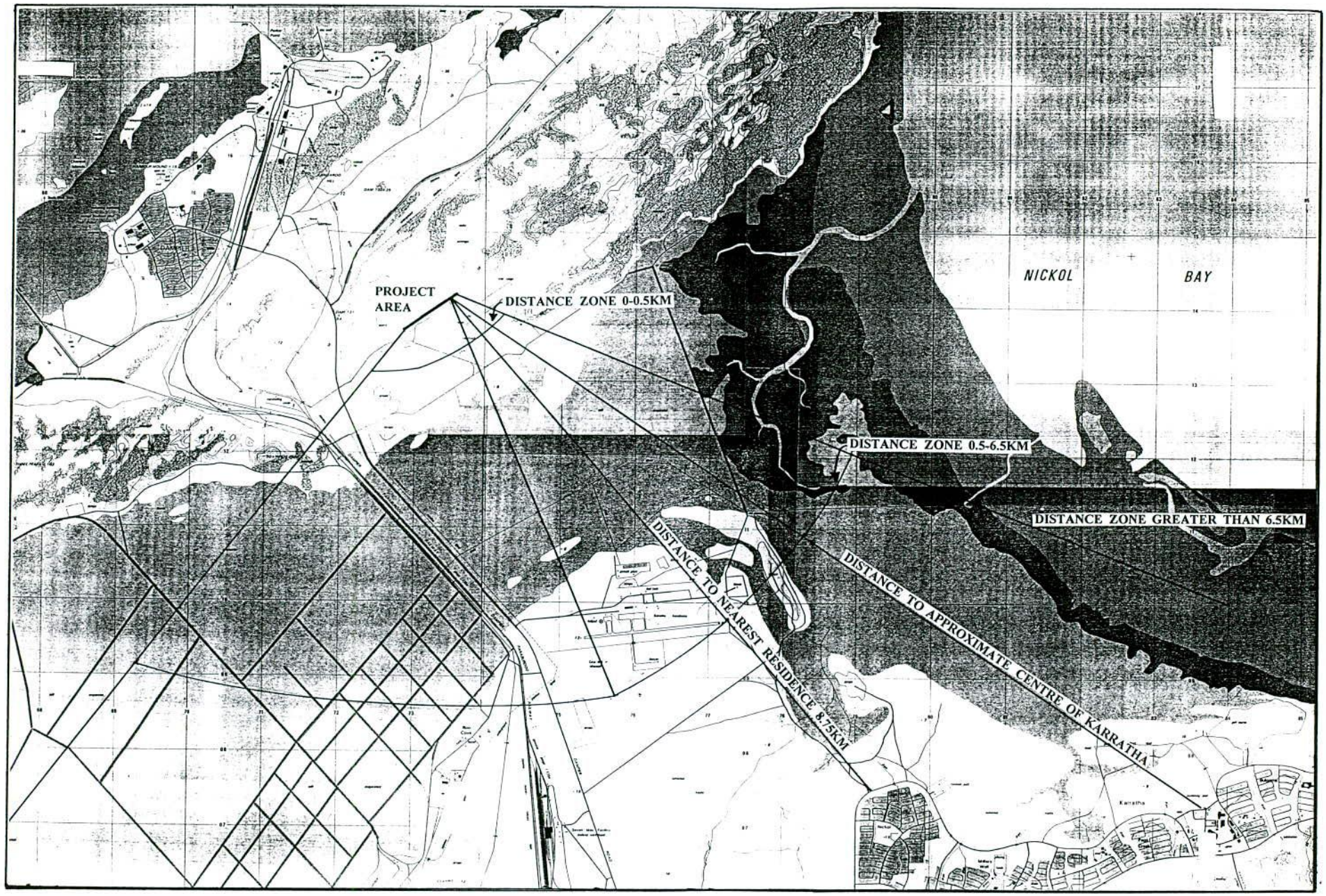


FIGURE 3: LOCATION OF THE PROJECT AREA AND SURROUNDS, WITH THE APPROXIMATE LOCATIONS OF MINING LEASES M47/306 AND M47/331, AND MINING LEASE APPLICATION M47/353; ALSO SEEN AREAS AND DISTANCE ZONES OF THE PROJECT AREA

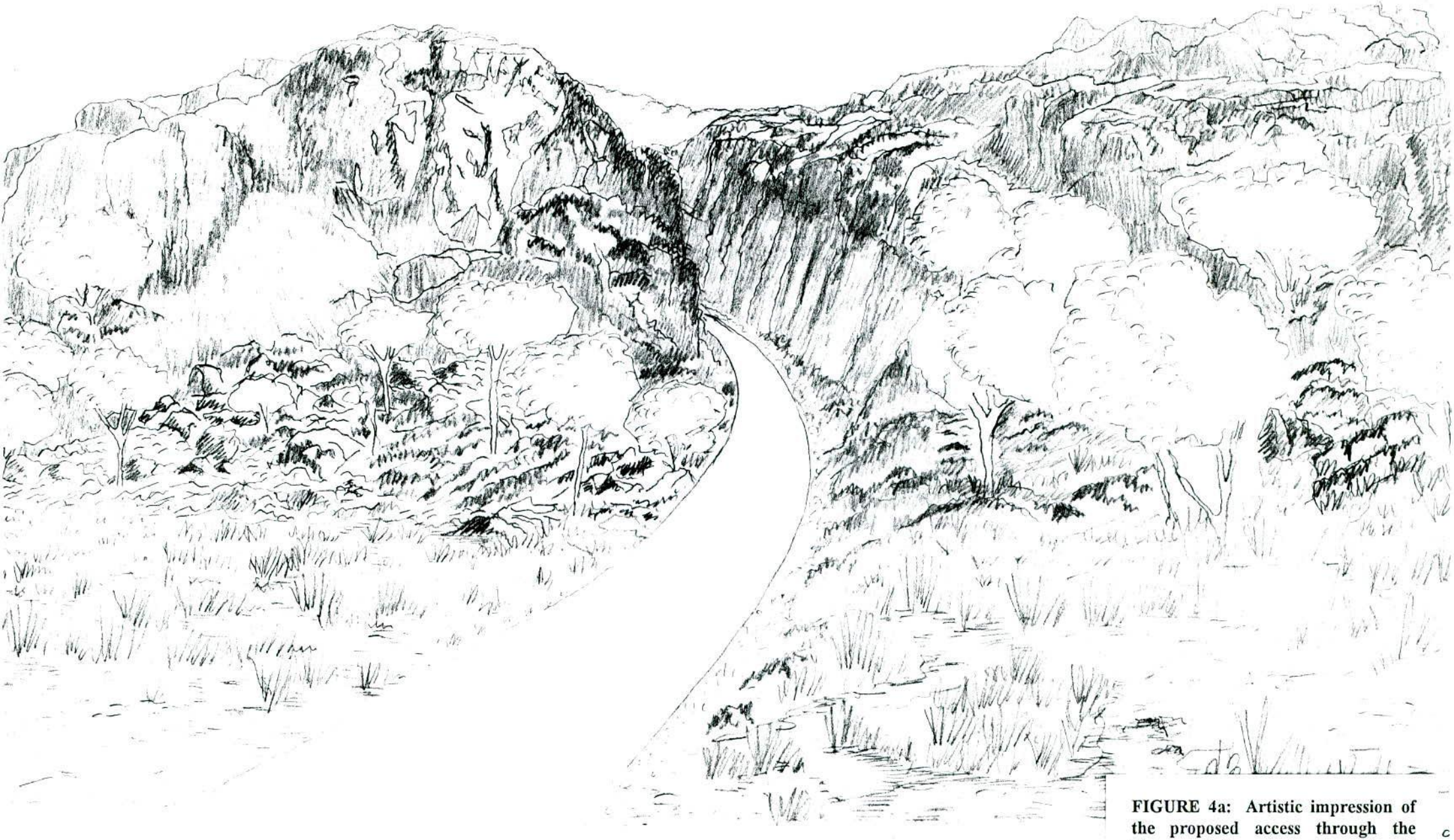


FIGURE 4a: Artistic impression of the proposed access through the high precipitous rock piles to the pit proposed for Mining Lease M47/306

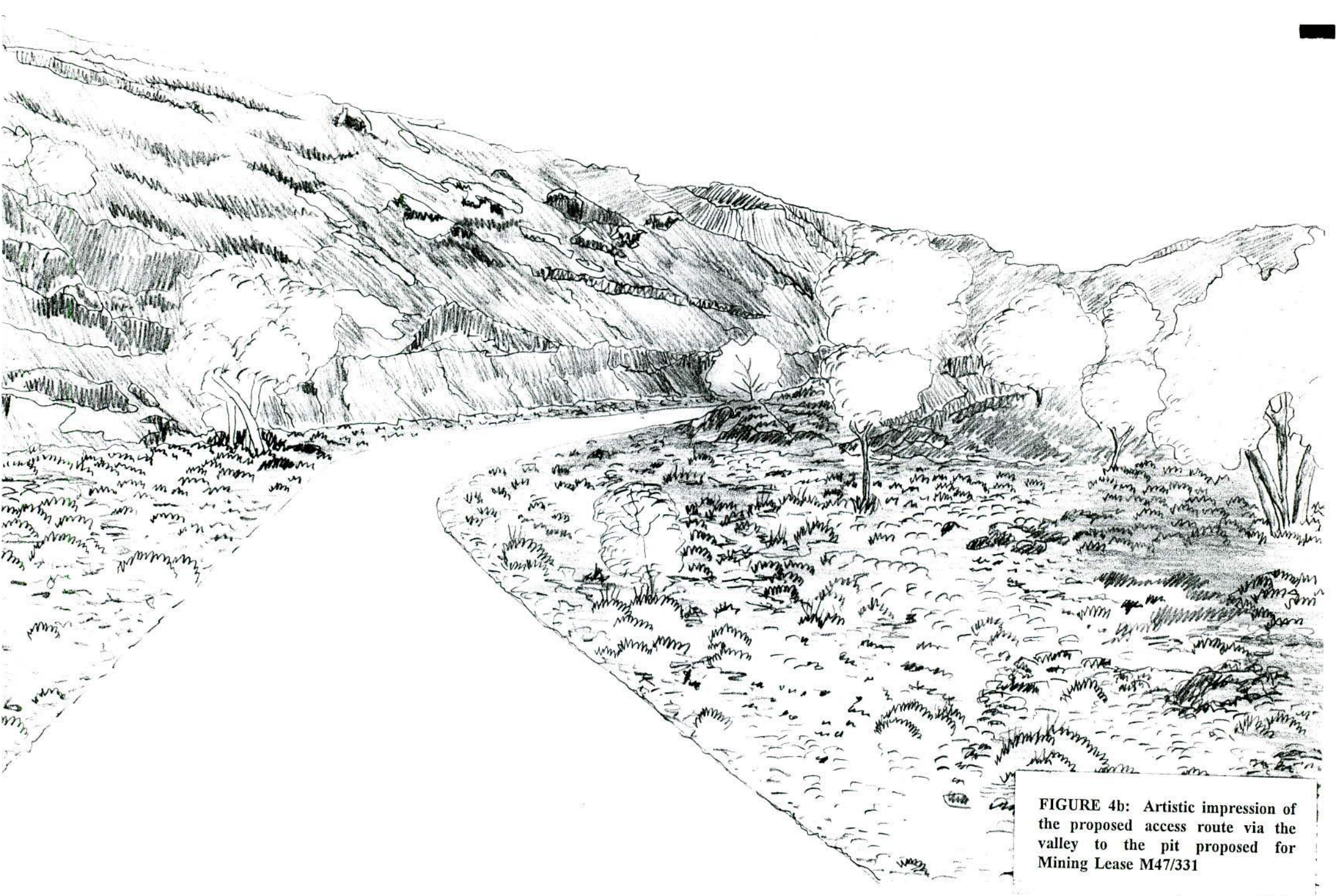


FIGURE 4b: Artistic impression of the proposed access route via the valley to the pit proposed for Mining Lease M47/331

FIGURE 4c: Artistic impression of the proposed access route from the valley into the gully leading to the pit proposed for Mining Lease M47/331

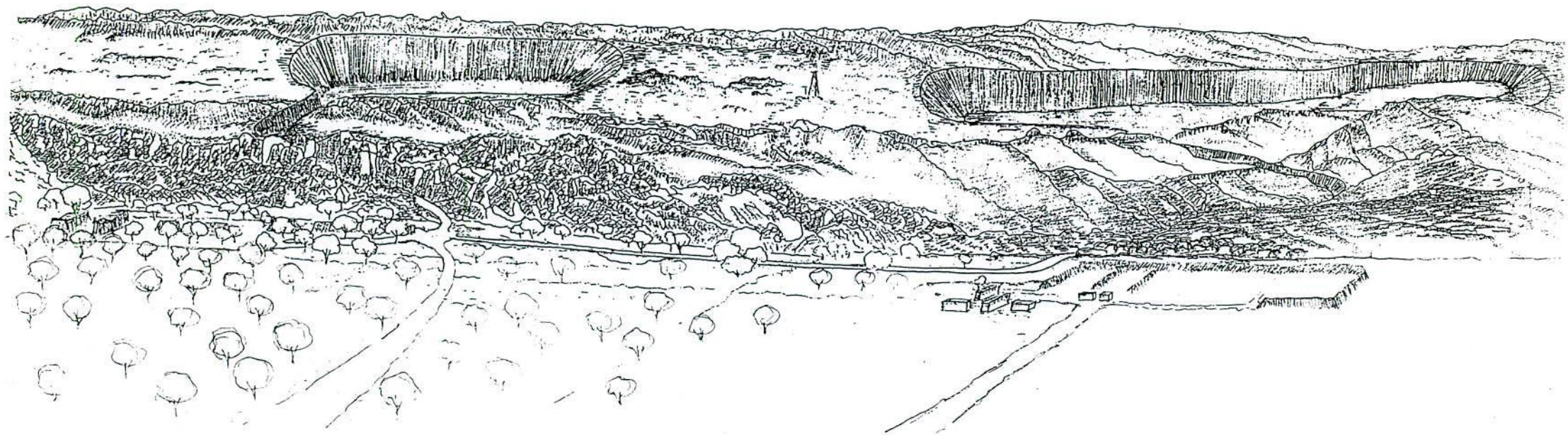


FIGURE 5: Artistic impression of the access routes, quarry pits, infrastructure areas, and access to the Project Area, as viewed obliquely from the air from a south-southwesterly direction

FIGURE 6a: Mining Lease M47/306: Artistic impression of the proposed access route, quarry pit, infrastructure area, and access to the Project Area as viewed from the coastal plain to the south of the Project Area

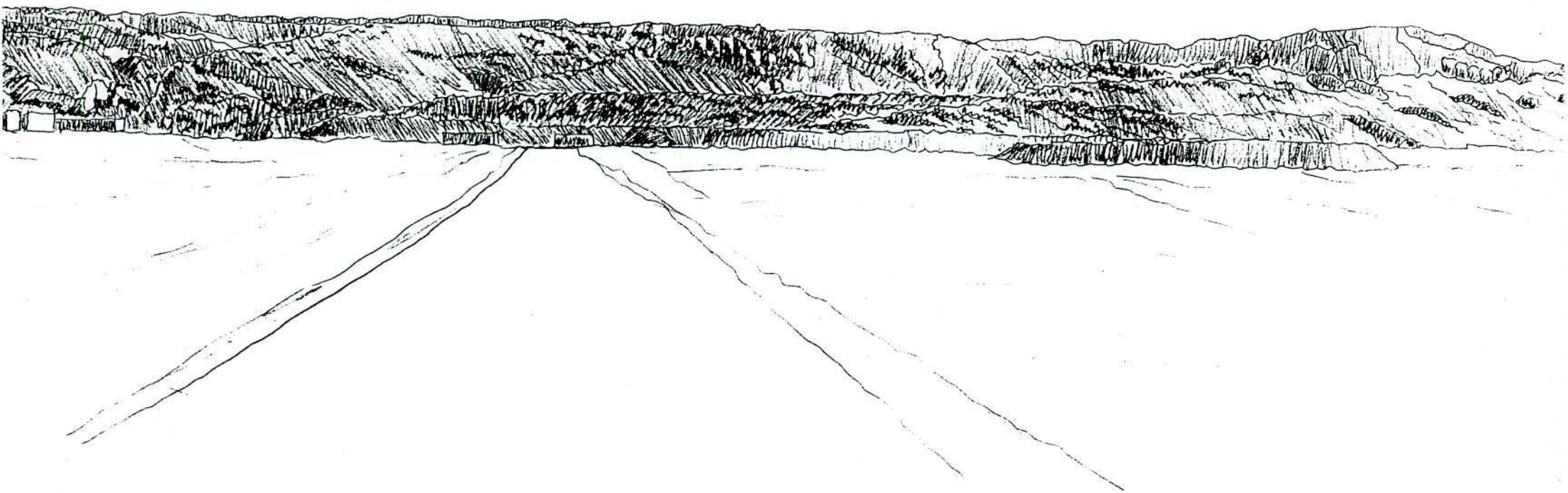


FIGURE 6b: Mining Lease M47/331 and Mining Lease Application M47/353: Artistic impression of the proposed access route, quarry pit and access road to the infrastructure area of Mining Lease M47/306

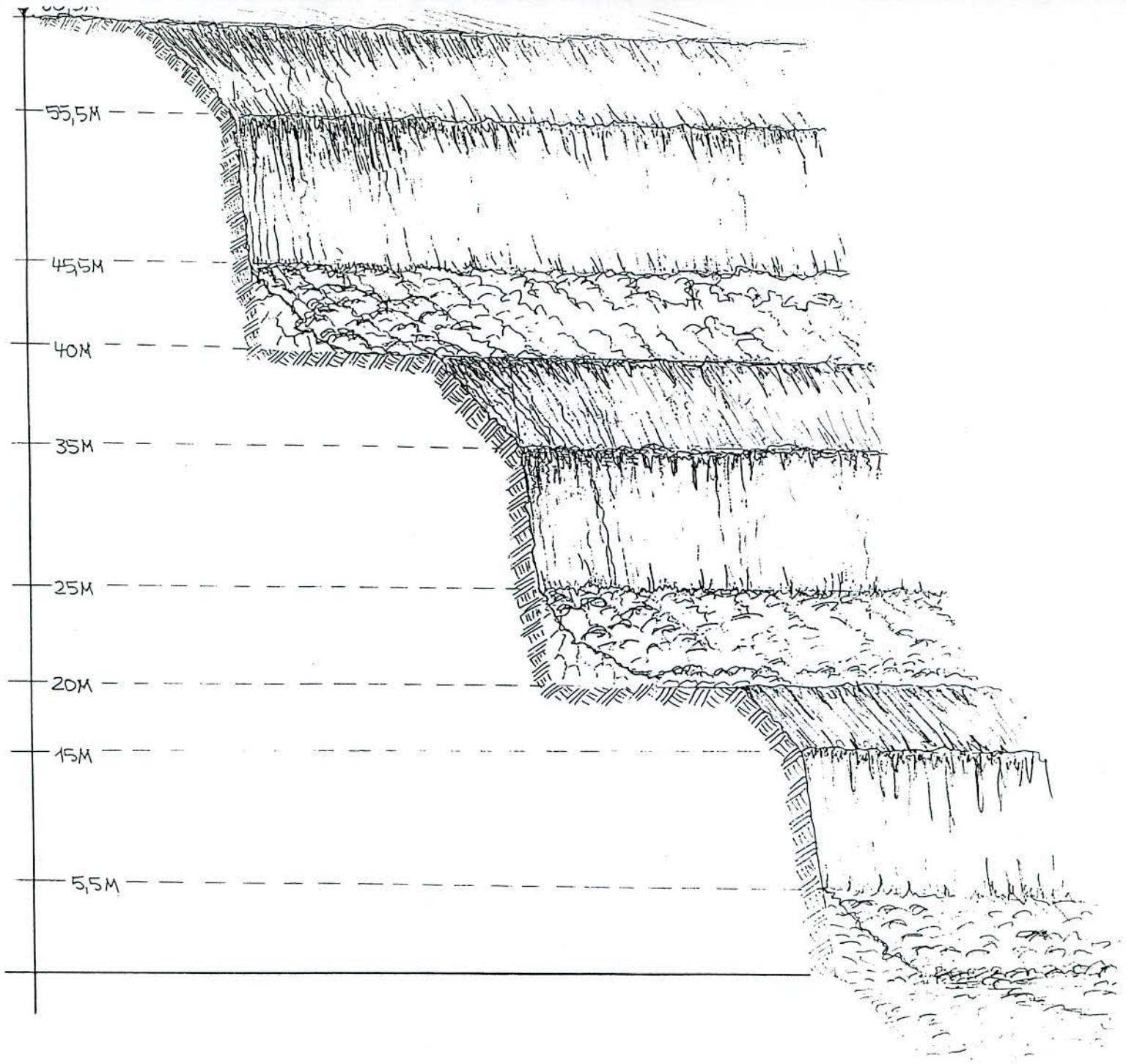


FIGURE 7: Artistic impression of the pit walls following decommissioning

APPENDIX 1

COPY OF RESULTS OF REGISTER SEARCH OF BURRUP PENINSULA FROM THE DEPARTMENT OF ABORIGINAL SITES

RESULTS OF REGISTER SEARCH:
BURRUP PENINSULA
19 July 1994

The Aboriginal Sites tabled below do not necessarily represent a complete record of all of the sites in your area of interest. The information should be used solely for the purpose of planning the development or activity identified.

All Aboriginal sites in our Register System have been designated into either the OPEN ("O") Access Code or the NOT OPEN ("R", "X", "D", "S", and "U") Access Codes. These access codes signify the degree of openness or confidentiality of the information relating to each site.

More detailed information on sites with an OPEN access code can be sought by contacting the Cataloguer at the West Perth office for an appointment to view the relevant site files.

For sites with NOT OPEN access codes, approval from the relevant Aboriginal communities, original informants (or their descendants) or the custodians of the site is required before viewing more detailed information. The Cataloguer can provide you with the relevant contact names on request Should none of the above contacts be available for consultation, access is at the discretion of the Registrar of Aboriginal Sites.

TABLE 1:
SITES WITH OPEN ACCESS CODE (An index to abbreviations used follows.)

site no	R	Mapsheet	MetGrid	C	Pos	CAT	Site Type	Site Name	Description
P01624	O	SF5002	472 714	-	r	- ---	ARC --E - - -	GAS PIPELINE 22	
P01946	O	SF5002	473 715	-	r	- ---	ARC S-E -A- -	DAMPIER	
P01947	O	SF5002	473 715	-	r	- ---	ARC S-E -A -	DAMPIER	
P01951	O	SF5002	473 715	-	r	- ---	ARC-S-- E -- --	DAMPIER	
P01952	O	SF5002	473 715	-	r	- ---	ARC ---E ----	DAMPIER	
P02129	O	SF5002	473 715	-	r	- ---	ARC S-- E ---	DAMPIER	
P02130	O	SF5002	473 715	-	r	- ---	ARC --E G -A	DAMPIER	
P02566	O	SF5002	474 714	-	r	- ---	ARC ------A -	BORROW PIT 1	
P02567	O	SF5002	474 714	-	r	- ---	ARC ---E --- --	THE RETURN	
P02697	O	SF5002	473 714	-	a	- ---	ARC ----A M--	DRD AREA D-01	
P02698	O	SF5002	474 713	-	a	- ---	ARC ----A M--	DRD AREA D-02	
P02699	O	SF5002	474 714	-	a	- ---	ARC ---A M--	DRD AREA D-03	
P02700	O	SF5002	474 714	-	a	- ---	ARC -- -E --A M--	DRD AREA D-04	
P02717	O	SF5002	472 714	-	a	- ---	ARC -- --E -----	INCISED KNOLL	
P02718	O	SF5002	472 714	-	a	- ---	ARC ---E ------	STRAY SITE	
P02719	O	SF5002	472 714	-	a	- ---	ARC ---E ------	LINEAR RIDGE	
P02720	O	SF5002	472 714	-	a	- ---	ARC -S-E -----	PIPELINE TERRACES	
P02721	O	SF5002	472 714	-	a	- ---	ARC -S-E ------	SMALL RIDGE SITE	
P02722	O	SF5002	472 714	-	a	- ---	ARC----E ------	GRANOPHYRE OUTCROP	
P02723	O	SF5002	472 714	-	a	- ---	ARC----E ------	HIDDEN HIDE	
P02724	O	SF5002	472 714	-	a	- ---	ARC----E ------	MEDIAN STRIP	

INDEX TO ABBREVIATIONS USED IN SITE FILE INFORMATION BY THE DEPARTMENT OF ABORIGINAL SITES

SITENo: Department of Aboriginal Sites' Number

R (ACCESS CODE): O = OPEN Access
R = RESTRICTED Access
X = Refer to Aboriginal community for details
D = DANGEROUS to enter
S = SIGNIFICANT
U = UNCERTAIN Insufficient information currently held to allocate code.

MAP: Number of 1:250,000 scale Map Sheet

IMPGRID: Imperial Grid Reference (either 4 - or 6 -figures)
A 6-figure grid ref. = site located within 1 $mile^2$ *
A 4-figure grid ref. = site located within 10 $mile^2$*

METGRID Metric Grid Reference (either 4- or 6 figures)
A 6-figure grid ref. = site located within $1km^2$*
A 4-figure grid ref = site located within $10km^2$*

C (CONVERSION): The IMPGRID has been electronically converted to METGRID, so this may be less reliable than the IMPGRID.

POS (POSITION RELIABILITY): r = reliable (within 1 mile or $1km^2$)
a = approximate (probably within 1 mile or $1km^2$, but maybe just outside)
d = doubtful (possibly within 10 miles or 10 km^2 area)
u = unknown
e = extensive area (site itself covers more than 1 mile or lkm^2), and the grid reference supplied is at the centre of the site.

CATEGORY: ETH = Ethnographic (information has been obtained from Aboriginal people)
ARC = Archaeological (physical archaeological features)

SITE TYPE: C = Ceremonial
M = Mythological
R = Repository/ Cache
B = Skeletal material/Burial
S = Man-made structure
F = Fish trap
T = Modified tree
P = Painting
E = Engraving
G = Grinding Grooves/Patches
Q = Quarry
A = Artefacts
M = Midden
O = Other (eg. Camp, Water Source, Named Place, Rockshelter, etc.

*** But also see Position Reliability**

P02725 O SF5002 472 714 - a - --- ARC - S-- E - - N BROKEN WALL
P02726 O SF5002 472 714 - a - --- ARC --E ------ MYSTIC EYES
P02727 O SF5002 472 714 - a - --- ARC ---E ------ FIG TREE KNOLLS
P02728 O SF5002 472 714 - a - --- ARC----E ------ SPINIFEX KNOLL
P02729 O SF5002 472 714 - a - --- ARC----E --A --- CORE SITE
P02730 O SF5002 472 714 - a - --- ARC---E ------ ROUGH SKETCH
P02731 O SF5002 472 714 - a - --- ARC----E ------ PIPE DREAM LOOKOUT
P02732 O SF5002 472 714 - a - --- ARC----E ------ FAINT LINE
P02734 O SF5002 472 714 - a - --- ARC-- S- E ------ MANDARIN KNOLL
P02735 O SF5002 472 714 - a - --- ARC ---E ------ OLD MAN SITE
P02736 O SF5002 472 714 - a - --- ARC-- S- E ------ ROCKY OUTLOOK
P02737 O SF5002 472 714 - r - --- ARC ---E ------ THOUGHTFUL MAN SITE
P02738 O SF5002 472 714 - r - --- ARC----E ------ LOW OUTCROP SITE
P02741 O SF5002 473 715 - r - --- ARC----E --A --- HIGHWAY 91
P02743 O SF5002 473 715 - r - --- ARC-S--E ------ LOST FELLOWS
P02744 O SF5002 473 715 - r - --- ARC ---E ------ DESERT PATHWAY
P02745 O SF5002 473 715 - r - --- ARC----E ------ HEROS HILL
P02746 O SF5002 473 715 - r - --- ARC ---E --A --- CLARKES FOLLY
P02750 O SF5002 473 715 - r - --- ARC----E ------ HEAT STRIKE HILL
P02751 O SF5002 473 715 - r - --- ARC ---E ------ FAT MAN KNOLL
P02762 O SF5002 473 715 - r - --- ARC-- T --- ----- RIVER GUM SITE
P02780 O SF5002 472 714 - r - --- ARC-- S- E ------ JOEYS KNOLL
P02782 O SF5002 472 714 - r - --- ARC-- S- E ------ STAIRWAY TO HEAVEN
P03044 O SF5002 473 715 - r - --- ARC ---E - A M - BORROW PIT 3A
P03045 O SF5002 473 715 - a - --- AR- ---E --A M -- BORROW PIT 3 (b)
P03050 O SF5002 473 715 - r - --- ARC ------A --- BORROW PIT 3G
P03445 O SF5002 473 714 - r - --- ARC-------A --- LONELY CORE
P03446 O SF5002 473 714 - r - --- ARC ------A --- CREEK SCATTER
P03447 O SF5002 473 714 - r - --- ARC-------A --- GRANITE REST
P03448 O SF5002 473 714 - r - --- ARC-------A --- LIGHT ROCKS
P03449 O SF5002 473 714 - r - --- ARC-------A --- TWIN FLAKES
P03450 O SF5002 473 714 - r - --- ARC-------A --- SPOTTED CORE
P03451 O SF5002 473 714 - r - --- ARC-------A --- CLUMP SCATTER
P03452 O SF5002 473 714 - r - --- ARC-------A --- FLAKE SCATTER
P03453 O SF5002 473 714 - a - --- ARC----E ------ KANGAROO ROCKS
P03545 O SF5002 473 713 - r - --- ARC-------A M -- KARRATHA RIDING SCHOOL 1
P03612 O SF5002 472 713 - r - --- ARC-------A --- NATGAS 158
P03613 O SF5002 473 714 - r - --- ARC-S- E ------ NATGAS 159
P03614 O SF5002 473 714 - r - --- ARC----E ------ NATGAS 160
P03615 O SF5002 473 714 - r - --- ARC----E ------ NATGAS 161
P03616 O SF5002 473 715 - r - --- ARC-------A --- NATGAS 162
P03618 O SF5002 472 713 - r - --- ARC-------A --- NATGAS 164

APPENDIX 2

COPY OF LETTER FROM THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT GIVING APPROVAL TO REMOVE *BRACHYCHITON ACUMINATUS* TREES AS OUTLINED IN THIS CONSULTATIVE ENVIRONMENTAL REVIEW

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

HEAD OFFICE
HACKETT DRIVE CRAWLEY
WESTERN AUSTRALIA
Phone (09) 386 8811
Telex AA94585
Facsimile (09) 386 1578

STATE OPERATIONS HEADQUARTERS
50 HAYMAN ROAD COMO
WESTERN AUSTRALIA
Phone (09) 334 0333
Facsimile (09) 334 0466

Please address all correspondence to Executive Director, P.O. Box 104, COMO W.A. 6152

Your Ref:
Our Ref:
Enquiries: Dr K Atkins
Phone: 334 0425

Dr Wolf Martinick
Chairman
W.G. Martinick & Associates Pty Ltd
4/114 Churchill Avenue
SUBIACO WA 6008

Dear Dr Martinick

Brachychiton acuminatus on Burrup Peninsula

Thank you for your letter dated 25 July 1994, regarding the above issue.

The destruction of the four *Brachychiton* trees under the circumstances described in your letter is not opposed by this Department.

This advice is, however, in reference to the plants alone, and does not take into account issues relating to land tenure, or other land management considerations. Comment on these issues will need to await the detail as provided in the Notice of Intent document that you are preparing.

The proposed amelioration of the impact through the planting of *Brachychiton* is noted, however, to retain the genetic integrity of the *Brachychiton* population on the Burrup Peninsular. I would request that the stock used for this purpose is sourced from local seed.

Should your clients require any advice about this issue, please direct them to the CALM Regional office at Karratha (phone 091 868 288).

Yours sincerely

.....
for Syd Shea
EXECUTIVE DIRECTOR

28 July, 1994

Copy to: CALM Regional Manager, Karratha

KA:CT 1KA042