CONSULTATIVE ENVIRONMENTAL REVIEW
MINE AND WASTE DUMPS – FIMISTON

Kalgoorlie Consolidated Gold Mines Pty Ltd

August 1990

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ABBREVIATIONS

AGC	Australian Groundwater Consultants Pty Limited
AHD	Australian Height Datum
BCM	Bank Cubic Metre
^{o}C	Degrees Celsius
CALM	Department of Conservation and Land Management, Western Australia
CIP/CIL	Carbon–in–pulp/carbon–in–leach process
DOM	Department of Mines
EPA	Environmental Protection Authority
ECe	Electrical Conductivity of Saturated Extract of a Soil

GDAC	Goldfields Dust Abatement Committee
g/t	Grams per tonne
ha	Hectares
KALTAILS	Kalgoorlie Tailings Retreatment Project
kg	Kilogram
kL	Kilolitre
kL/d	Kilolitres per day
km	Kilometre
km/h	Kilometres per hour
kV	Kilovolts
m,m^3	Metre, cubic metre
mg/L	Milligrams per litre
m/s	Metres per second
MSm	Milli Siemens per metre
Mt, Mta	Million tonnes, million tonnes per annum
SECWA	State Energy Commission of Western Australia
t	Tonne
TDS	Total Dissolved Salts
t/ha	Tonne per hectare
WAWA	Water Authority of Western Australia

CONSULTATIVE ENVIRONMENTAL REVIEW

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KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD

AUGUST 1990

SUMMARY AND COMMITMENTS

Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM) is a co-operative management company owned by Homestake Gold of Australia Ltd (HGAL), Gold Mines of Kalgoorlie Ltd (GMK) and North Kalgurli Mines Ltd (NKML). KCGM proposes to develop and expand its open-cut gold mining activities within the Fimiston leases on the Golden Mile near Kalgoorlie, Western Australia.

The current proposal represents an opportunity to rationalise the various open-cut mining ventures on the Fimiston Leases into a single operation which incorporates the recommendations of the Golden Mile Mining Development Planning Committee. As well as bringing economic benefits, the proposal has provided the opportunity to initiate the development of an Environmental Management Programme for all of the operations of KCGM.

This document describes the open-cut mining and waste dumping activities to be carried out on the Fimiston Leases and provides the basis for the mining and rehabilitation programmes. Other issues, such as underground mining, ore treatment and tailings disposal, are dealt with in separate proposals.

The Golden Mile has been the site of gold mining since 1893, and numerous mining and processing operations are currently located in the Project Area. Some of these will be consolidated under this proposal. Some operations, such as the Mt Charlotte and Fimiston underground, will continue independently of this proposal. Others, such as the Oroya and Paringa roasters, will be closed, and their roles filled by the new Gidji roaster which has been in operation 20 km north of Kalgoorlie since 1989.

The proposal involves large-scale open-cut mining on the Fimiston Leases for at least 15 years. Total material movement over this period will be approximately 243 million bank cubic metres (Mbcm), for a total gold production of over 10 million ounces. As exploration identifies new resources within the existing leases, the life of the operation will probably be extended.

Mining will be carried out by heavy earthmoving equipment using drilling and blasting where necessary. Ore will be crushed at the Fimiston Plant. Oxidised ore will be refined by Carbon-In-Leach (CIL) technology at Fimiston. Sulphide ores will be crushed at Fimiston then trucked to Gidji for roasting and leaching. Final gold recovery will be performed at Fimiston.

Of major importance is the stability of the walls of the pit, in particular the west wall closest to Boulder townsite. To this end, geotechnical studies are continuing into determining the optimum slope angle and wall configuration to ensure the long-term stability of the pit.

Waste from the mining operation will be dumped on existing and new dump areas including the current North-east waste dump, a new South-east waste dump and a relocated Western Pits waste dump. Dumps will expand to the east, with the northern and western faces of the north dump becoming available for rehabilitation in the early phases of the operation. Sub-grade material will be dumped in the designated waste dump areas within an arc of one kilometre from the Fimiston plant. This will enable future processing if economic factors make this feasible.

Some infrastructure changes will be made necessary by the development of the project. These include degazetting of the abandoned Brownhill and Trafalgar townsites, Kamballie Road and other minor service roads (to be replaced by a new southern bypass road), and the relocation of some SECWA power lines and Water Authority mains. These changes will be subject to negotiation with, and approval from, the relevant authorities.

The environment in the Golden Mile area is typical of the Eastern Goldfields; high temperatures, low rainfall, sparse vegetation and low topography. Surface drainage is poorly-defined and ephemeral, and the groundwater is generally hypersaline and unsuitable for human or animal consumption. Groundwater is used by KCGM for processing and dust suppression in the Fimiston operations. The vegetation and fauna of the Golden Mile have been severely degraded by previous mining activities.

The significant environmental impacts associated with this project have been identified as the use of hypersaline water, sediment transport, dust, public nuisance noise and the development of waste dumps. These issues have been evaluated and strategies have been proposed for their management.

The following commitments have been developed to address these impacts.

COMMITMENTS

1. KCGM will prepare and implement, by December 1992, an Environmental Management Programme (EMP) for all of its operations in agreement with the Environmental Protection Authority and the Department of Mines.

2. KCGM undertakes to prepare annual reports of the Mining and Rehabilitation sub-programme of the broader EMP, as agreed with the EPA and the Department of Mines.

3. KCGM undertakes to continue an ongoing programme of geotechnical investigations for slope stability purposes and report the findings of these investigations to the Department of Mines.

4. KCGM will develop a surface drainage system incorporating sediment detention systems and a water quality monitoring programme. The results of the sampling will be included within the annual report and updated annually.

5. In association with the Goldfields Dust Abatement Committee and Kaltails, KCGM will install and support a Dust Monitoring Programme within the Kalgoorlie-Boulder area. The data obtained will be made available to the EPA via the Goldfields Dust Abatement Committee.

6. KCGM will undertake a review of all potential dust sources within its operation by August 1991. Where appropriate KCGM will quantify the significance of these sources in terms of their contribution to dust levels in Kalgoorlie-Boulder and where appropriate develop strategies to minimise that contribution. The results of the review will be provided in the annual report and updated annually.

7. KCGM will undertake a programme of noise monitoring to ensure continued compliance with occupational health and public nuisance noise requirements. If considered necessary an ongoing monitoring strategy will be devised.

8. KCGM will implement a progressive rehabilitation programme as outlined in section 4.3 as agreed with the EPA in consultation with the Department of Mines.

Refer to section 4.3 for details of commitments relating to rehabilitation. These commitments are extensive and as such are not repeated here.

CONSULTATIVE ENVIRONMENTAL REVIEW
MINE AND WASTE DUMPS - FIMISTON

1.0 INTRODUCTION

1.1 BACKGROUND

In 1987 North Kalgurli Mines Limited (NKML) submitted an overall Conceptual Plan (Dallhold, 1987) for the development of their Fimiston Leases. The main thrust of this conceptual plan was mining of the Fimiston Leases using large-scale open-cut methods, together with construction of additional treatment plant capacity.

Subsequent to this, appropriate approvals were granted for construction and operation of Phase I of the Fimiston Plant, with a processing capacity of 2Mtpa, Phases I and II of the Gidji Satellite Roaster, and concurrent open-cut mining and waste dumping on the Fimiston Leases.

During 1989 ownership and management of the Kalgoorlie mining companies changed significantly, with the formation of Kalgoorlie Consolidated Gold Mines Pty Ltd (KCGM).

The ownership change resulted from the takeover of NKML by Gold Mines of Kalgoorlie Limited (GMK) and the agreement by GMK and Homestake Gold of Australia Limited (HGAL) to merge their Kalgoorlie operations.

KCGM now operates, on behalf of the various owners, the Mt Percy, Mt Charlotte, Fimiston Open Cut and Fimiston Underground mines and associated plants as a single, consolidated operation. Further detail of the ownership of the operations is given in Section 1.4.

This consolidation of ownership is the final step in permitting the concepts proposed in the 1987 plan to be fully implemented, with the development of a single integrated open cut mine over the leases owned by the Fimiston/Paringa Joint Venture (formerly owned by NKML) and Kalgoorlie Mining Associates (KMA).

Thus the existing open-cut operation on Kalgoorlie's Golden Mile is planned to be further expanded and has therefore been referred to the Department of Mines (as the decision making authority) to determine the State's requirements in regard to environmental impact assessment of the project. The Department of Mines

advised the Environmental Protection Authority (EPA) of the referral, and the EPA determined that the appropriate level of assessment is a Consultative Environmental Review (CER), previously called a Notice of Intent (NOI). Guidelines for the CER were subsequently provided by the EPA, and are reproduced in Appendix A.

The joint venture arrangement between HGAL and GMK is intended to rationalise current operations into one gold mining project, the resource and scope of which are world class. The project does not involve new deposits, untested ore types, or remote area development, but is an existing operation which is to be significantly expanded.

A recoverable resource of over 10 million ounces of gold has been identified for the consolidated operations. This will be extracted at an average rate in excess of 500,000 ounces per year. It is expected that additional resources will be identified as considerable areas within existing lease boundaries have not yet been explored and, as a result, the project will probably continue beyond present resource limits.

Concurrent with the Fimiston open cut mining, operations will continue unchanged at the Mt Percy open cut and Mt Charlotte and Fimiston underground operations. These areas of operation are outside the scope of this CER. The CER applies only to the Fimiston open cut operation and associated waste dumps.

Further expansion of the Fimiston Mill is also contemplated to match the mining capacity proposed in this document, and such expansion is the subject of a separate proposal.

1.2 OBJECTIVES

A large mineable resource of 89Mt at 3 grams of gold per tonne (g/t) has been identified straddling the Kalgoorlie Mining Associates (KMA)–Fimiston/Paringa Joint Venture ((FPJV)) lease boundary. This resource is amenable to large–scale open pit mining. The proposed expansion of this open–cut mining area has been referred to as the "Super Pit". It is the mining of this open cut (now designated the "Fimiston Pit") which is the subject of this document.

This Fimiston Open Pit resource that has provided the impetus for the expansion and consolidation of activities which are now taking place and has resulted in a plan to utilise mining and processing resources to reduce effective

unit costs. The expansion of activities started with the commencement of large-scale open-cut mining on the Fimiston/Paringa Joint Venture leases and the construction and commissioning of the new 2Mtpa Fimiston mill, which lifted KCGM's existing total processing capacity to 6.3Mtpa. Expansion plans for further increases in processing capacity to match the mining capacity proposed in this document are the subject of a separate proposal.

1.3 LOCATION

The project area is located adjacent to the City of Kalgoorlie-Boulder, 600km east of Perth, in the "Golden Mile". Figure 1 shows the general locality plan of the operations and the proximity of the operations to Kalgoorlie-Boulder.

1.4 OWNERSHIP

There are two joint ventures and a partnership which are all owned by the GMK group and HGAL in equal shares. These co-operatives are described below. These entities are managed under a Co-operation Agreement by a new management company, KCGM, also owned on the above basis.

Mt Percy Joint Venture (MPJV)
This joint venture between North Kalgurli Mines Limited (NKML) (2.5%), HGAL (50%) and Windsor Resources NL (WNR) (47.5%) owns and operates the Mt Percy mining operations and the associated treatment plant, and represents the northernmost unit of the Kalgoorlie operations. WNR is a 96.2%-owned subsidiary of NKML. The Mt Percy operation is ongoing and is not part of this CER.

Fimiston/Paringa Joint Venture ((FPJV))
This is a joint venture between NKML (50%) and HGAL (50%) and holds the northern tenements of the Combined Pit and Fimiston underground operations. This Joint Venture also owns two existing treatment plants, Croesus and Paringa, and the new Fimiston plant.

Kalgoorlie Mining Associates (KMA)
KMA is a partnership between GMK (50%) and HGAL (50%) and owns the Mt Charlotte mine to the north, and southern part of the Combined Pit, the Western

Lodes Open Cut and the southern Fimiston underground operations. This partnership also owns the Oroya plant and will fund future expansion of the new Fimiston plant.

This corporate structure is illustrated in Figure 2.

A breakdown of the tenements and their ownership applying to the Fimiston area is presented in Table 1.1. Tenement boundaries are shown in Figure 3, and as an overlay to existing and planned surface features (Figure 11 A).

1.5 HISTORY OF THE PROPOSAL

The combined operations of KCGM have a history of gold mining dating back to the initial discovery on the Golden Mile in 1893. Since commencement of mining some 40.8 million ounces (1,273 tonnes) of gold have been recovered from the combined leases at an average recovered grade of 10 g/t.

The majority of the gold recovered has been from underground mining (98%) with most of that coming from the Golden Mile operations (92% of total). The Golden Mile has experienced several changes in prosperity over its life, associated with fluctuating gold prices and world crises. Since the early 1980's there has been an upsurge in surface mining gradually increasing to its present level.

Earlier studies carried out independently by NKML and KMA indicated a requirement for the delineation of the resource potential for the surface operations on the eastern lodes of the Golden Mile. During the past three years both organisations have undertaken extensive drilling and/or data-gathering exercises to this end. As a result a considerable reserve/resource available to KCGM and its owners has been identified. It is this resource which is the target of the proposed Fimiston Pit, representing an open cut gold mining development of significance by international standards.

As a result of the long history of mining activity, the landscape in the lease area is severely degraded by pits, tailings dumps, roads and general litter. A significant feature of the consolidated operation will be a coordinated strategy of rationalisation of these pits and waste dumps, and the introduction of an integrated rehabilitation plan.

TABLE 1.1

LIST OF TENEMENTS FORMING THE CONSOLIDATED OPERATIONS OF KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD

NORTH KALGURLI MINES LIMITED AND HOMESTAKE GOLD OF AUSTRALIA LIMITED TENEMENTS

Gold Mining Lease	26/6145E
Gold Mining Lease	26/6227E
Gold Mining Lease	26/6683E
Gold Mining Lease	26/6886
Gold Mining Lease	26/7039
Gold Mining Lease	26/7147
Gold Mining Lease	26/7151
Gold Mining Lease	26/7152
Gold Mining Lease	26/7153
Mining Lease	26/14
Mining Lease	26/62
Mining Lease	26/64
Mining Lease	26/65
Mining Lease	26/167
Mining Lease	26/200
Prospecting Licence	26/1206

GOLD RESOURCES PTY LTD AND HOMESTAKE GOLD OF AUSTRALIA LIMITED TENEMENTS

Mining Lease	26/46

MOUNT PERCY JOINT VENTURE TENEMENTS

Mining Lease	26/95

KALGOORLIE LAKE VIEW PTY LTD TENEMENTS (held on behalf of the KMA Partnership)

Gold Mining Lease	26/7458
Gold Mining Lease	26/7602
Mining Lease	26/54
Mining Lease	26/55
Mining Lease	26/106
Mining Lease	26/120
Mining Lease	26/155
Mining Lease	26/294
Prospecting Licence	M26/326

KALGOORLIE LAKE VIEW PTY LTD/CONSOLIDATED CAPITAL PTY LTD TENEMENTS

Mining Lease	26/83
Mining Lease	26/266 (Application)
Mining Lease	26/267 (Application)

A side effect of previous mining and treatment of gold ore in the Golden Mile has been the emission of sulphur dioxide (SO2) during the roasting of sulphide ores. As part of the consolidation programme, it is planned to relocate all existing roaster capacity from the Golden Mile area to the Gidji roaster, north of Kalgoorlie. The Gidji roaster will be upgraded to handle the increased quantities of material. The roasters which are to be closed are:

Paringa roaster (closed 10 October 1989)
Croesus roaster (closed 9 November 1989)
Oroya roaster (to be closed by the end of 1991).

The importance of this "Super Pit" development in terms of its impact on land use planning for the Kalgoorlie–Boulder area has been recognised by government. A committee with broad–based representation was established by Cabinet with the task of developing a concept plan for mining and related activities. This committee, the Golden Mile Mining Development Planning Committee, prepared a Golden Mile Environmental Strategy in January 1988, and later, a Conceptual Plan for Mining Developments on the Golden Mile (DOM 1988a & 1989). The Conceptual Plan recognises gold mining as being the primary land use in the Golden Mile and establishes guidelines for its future development and coexistence with other land uses. It provides a broad strategic framework for co–ordinated development of the Fimiston Pit and associated infrastructure.

An important aspect of these plans has been the recognition of the proximity of the mine to the City of Kalgoorlie–Boulder. In this respect the proposal is unique and presents a significant management challenge. This CER details the areas of existing and predicted environmental effects and the strategies that the company will implement to manage those impacts. The CER logically follows from the Conceptual Plan and provides the necessary further level of detail.

1.6 EXISTING FACILITIES

Existing KCGM operations consist of all of the old North Kalgurli Mines, Kalgoorlie Mining Associates and Mt Percy joint venture tenements, facilities and developments. These consist of open pit and underground mines, five processing plants and their associated infrastructure. The location of the existing facilities is shown in Figures 4 and 5.

1.6.1 Surface Mining

Fimiston

The proposed expanded open cut mining area (the subject of this CER), which lies within the (FPJV) and KMA tenements, is known as the "Fimiston Pit", and is divided on the basis of geological features into the Combined Pit Open Cut on the Eastern Lode structure and the Western Lodes Open Cut on the Western Lode structure.

In the area of the proposed Combined Pit Open Cut, a number of smaller open cuts exist: Paringa, Brown Hill, South, Oroya and Judd Pits. The proposed Western Lodes Open Cut currently contains the Drysdale, Morrison and Horseshoe pits.

Mt Percy

At the north-eastern edge of Kalgoorlie, the Mt Percy Open Cut operates. This open cut will continue to operate as a separate mine.

1.6.2 Underground Mining

Mt Charlotte Underground

Mt Charlotte is a mechanised underground mine incorporating the Cassidy and Reward shafts with associated ore crushing facilities. Mt Charlotte is the largest underground gold mine in Australia, and will continue to be a major source of ore for at least the next 15 years.

Fimiston Underground

The Fimiston underground operation comprises six shafts with associated infrastructures under the following ownership:

Fimiston/Paringa Joint Venture ((FPJV)) – Croesus, Paringa and Main Shafts
Kalgoorlie Mining Associates (KMA) – Perseverance, Lakeview and Chaffers Shaft

As the Combined Pit develops, some of the existing shafts, including Paringa, Perseverance and Lake View, will be closed as they fall within the area being mined. Access to associated underground workings will be maintained through the other shafts.

1.6.3 Metallurgical Treatment Plants

Five treatment plants currently operate on the Golden Mile, extracting gold from the ores produced at the existing workings. The Gidji roaster, 20km north of Kalgoorlie, is also operating.

Fimiston Plant

The Fimiston Plant has been in operation since August 1989 with a capacity of 2Mtpa. It ultimately may be upgraded to a capacity of 6Mtpa. Plant expansions will be the subject of separate proposals.

The plant will treat sulphide ores, primarily from the Combined Pit, using conventional Carbon-In-Leach (CIL) technology. It has facilities for crushing, grinding and flotation to yield a sulphide concentrate which is trucked to the Gidji Roaster for roasting and treatment in a CIL circuit. Tailings from the flotation circuit are treated in the CIL circuit at the Fimiston plant.

The gold absorbed onto carbon from the Gidji and Fimiston CIL circuits is recovered in the gold room located at the Fimiston plant.

Oroya Plant

The Oroya Plant currently treats up to 2.25Mtpa of ore from three sources:

- non-refractory (free-milling) ore from Mt Charlotte
- refractory sulphide ore from Fimiston leases
- oxidised ore from Fimiston leases

The plant incorporates crushing, grinding, flotation, roasting and gold recovery facilities.

By agreement with the EPA the Oroya plant will cease roasting operations by 31 December 1991. All concentrates requiring roasting will thereafter be treated at the Gidji roaster. As the Oroya plant lies within the final pit limits its eventual decommissioning and removal is planned as the Fimiston Pit develops.

Croesus Plant

The Croesus plant operates two separate circuits to treat oxidised and refractory sulphide ores using Carbon-In-Pulp treatment. Plant capacity is currently 900,000 tpa. The plant incorporates crushing, grinding, flotation, roasting and gold

recovery facilities. Since October 1989, flotation product has been transported to the Fimiston plant for treatment.

Mt Percy Plant

The Mt Percy plant treats 900,000 tpa of ore from the Mt Percy mine. The plant comprises crushing, milling, leaching and gold recovery facilities. No roasting is performed at the plant.

Paringa Plant

The Paringa Plant formerly treated 250,000 tpa of sulphide ore from underground operations by crushing, milling, flotation, roasting, leaching and gold recovery. Since October 1989 the milled ore has been transported to the Fimiston plant for treatment.

The Paringa plant will be decommissioned and dismantled during 1991 due to the development of the Fimiston Pit.

Gidji Roaster

Located 20 km north of Kalgoorlie, this facility has been designed and sited to comply with EPA requirements. The plant, Phase 1 of which has been in full production since August 1989, consists of a roaster and CIL circuit. Commissioning of Phase 2 commenced in July 1990. This will result in a doubling of the present plant capacity.

Concentrates are trucked to Gidji where they are re-pulped, roasted and leached. Gold-loaded carbon from the CIL circuit is returned to Fimiston for gold recovery.

1.6.4 Infrastructure

The operations currently have extensive facilities in terms of roads, electric power, compressed air, water, buildings and communications. As a result of the consolidation of the operations, rationalisation of these facilities will take place to optimise infrastructure facilities and support. Details of infrastructure are given in Section 3.0.

2.0 EXISTING ENVIRONMENT

2.1 GEOLOGY

2.1.1 Regional Geology

The Golden Mile gold deposit is located in the 800km long by 200km wide Norseman–Wiluna gold belt in the Eastern Goldfields Province of the Yilgarn Block. Partly metamorphosed igneous and sedimentary assemblages (popularly known as greenstone belts) underlie approximately 30% of the Kalgoorlie area and are of major economic importance to the Eastern Goldfields. Regional folding is upright, with steeply plunging axes and steeply dipping limbs.

The Kalgoorlie Anticline and Kalgoorlie Syncline are regional folds plunging gently to the south–east. The Golden Pike, Trafalgar and Adelaide Faults are north–north– east–trending oblique faults. Figures 5 and 6 show the geology in plan and section views, respectively.

Mineralisation of the Golden Mile is located within a complex shear system developed within the confines of the Golden Pike and Trafalgar–Adelaide faults and is divided into two parts.

The Eastern Lode Group formations are situated on the western flanks of the Kalgoorlie anticline and on the eastern side of the Golden Mile fault which has faulted and attenuated the Kalgoorlie syncline. The lode formations occur principally within the Golden Mile dolerite and underlying Paringa basalt. These host rocks form part of a steeply–dipping, isoclinally–folded succession characterised by major strike faults.

The Western Lode Group is located on the western side of the Golden Mile fault and is hosted entirely within the upper units of the Golden Mile dolerite. Lodes typically strike north–north–west and dip steeply west. Variations in strike and dip of lodes result in merging of lodes. These intersections have created areas of enhanced grade and mineralisation.

2.1.2 Mineralisation

The mineralising event on the Golden Mile has led to an overall geochemical enrichment in SiO_2, CO_2, S, K_2O, As, Te, Hg, Pb, V and B. This enrichment is

very largely confined to the main lode systems with decreased levels of enrichment in the surrounding host rocks. The dominant ore mineral is pyrite (FeS_2) occurring in the wall rock as 0.05 to 0.2mm subhedral grains. The majority of gold occurs as 0.5 to 5 micron inclusions within the pyrite lattice.

Gold is also present in a number of tellurides the most abundant of which is coloradoite (HgTe), followed by lesser calaverite ($AuTe_2$), krennerite ($(Au,Ag)Te_2$), petzite (Ag_3AuTe), hessite (Ag_2Te) and sylvanite $(AuAg)Te_2$.

Fluid activity before and during the mineralising event has led to complex alteration of the host Golden Mile Dolerite and Paringa Basalt. The dominant alteration assemblage consists of quartz–carbonate (mainly ankerite)–sericite–pyrite (5–15%)–leucoxene ± albite ± tourmaline ± magnetite ± hematite. This assemblage is immediately surrounded by either a CO_2 metasomatic or pervasive K–metasomatic assemblage. Typical whole rock compositions of altered Dolerite and Paringa basalt are given in Table 2.1.

During mining of the expanded Fimiston Open Pit operations the principal rock types within the pits will be Golden Mile Dolerite and Paringa Basalt. The relative proportions of basalt to dolerite will approximate 1:4.

Minor felsic porphyries are present but are volumetrically insignificant.

Analysis of over 1200 samples of basalt and dolerite from non–mineralised diamond drill core indicates that sulphur grades within proposed waste dumps will average approximately 0.38 wt% sulphur. During initial construction of these dumps sulphur grades will be slightly lower reflecting material transitional between the oxide and sulphide domains. The precise levels of enriched heavy metals such as Hg, Te and As within the waste dumps have not yet been fully determined, however, the sulphides and tellurides which contain these metals are uncommon outside of the major mineralised lodes.

2.1.3 Resources and Ore Reserves

An open cut recoverable resource containing some 8 million ounces of gold has been identified in the Fimiston Leases area of the KCGM operations. Open cut mining in these areas commenced in the 1980's and is expected to continue for in excess of 15 years.

TABLE 2.1

TYPICAL EXAMPLES OF WHOLE ROCK COMPOSITIONS OF ALTERED GOLDEN MILE DOLERITE AND PARINGA BASALT

Components	Altered Dolerite	Paringa Basalt
Si02	49.10	45.88
Ti02	1.36	1.11
A1203	15.05	13.76
FeO	14.76	Fe203 13.16
Mn0	0.22	0.27
Mg0	4.95	4.14
Ca0	9.47	7.48
Na20	3.29	2.58
K20	1.66	0.85
P205	0.14	0.09
Total	100.0	99.46
H20	2.11	2.80
C02	15.30	6.97
S	0.16	FeS2 0.37
Mineral Elements ppm level		
Ba	178	185
Co	31	35
Cr	67	–
Cu	43	85
Ga	19	–
Ha	7	12
Mo	0	–
Nb	2	3
Ni	33	–
Pb	1	4
Rb	65	27
Sc	49	52
Sn	1	–
Sr	144	100
Th	1	–
U	0	–
V	354	374
Y	27	–
Zn	97	170
Zr	77	70

Ore reserves and resource potential for the Fimiston Pit area as at 1 July 1989 are given in Table 2.2. Reserves at Mt Charlotte, Mt Percy and the Fimiston Underground are in addition to thcse shown in Table 2.2.

TABLE 2.2

ORE RESERVE/RESOURCE TABULATION

	Type	ORE RESERVE as at 30/6/89		RESOURCE POTENTIAL as at 30/6/89		TOTAL RESOURCE as at 30/6/89	
		Mt	g/t	Mt	g/t	Mt	g/t
Fimiston Pit							
Combined Pit							
Oxide	Proved	0.000	0.00				
	Probable	1.634	2.80	0.875	3.00	2.849	2.71
	Stockpile	0.340	1.49				
Western Lodes							
Oxide	Proved	1.725	3.15				
	Probable	0.005	3.40	0.500	3.50	2.230	3.23
Western Lodes							
Stope Fill	Proved	0.293	5.13				
	Probable	0.057	4.39			0.350	5.01
Combined Pit							
Sulphide	Proved	0.000	0.00				
	Probable	67.678	2.90	5.000	2.90	73.508	2.89
	Stockpile	0.830	1.73				
Western Lodes							
Sulphide	Proved	2.678	3.94				
	Probable	0.587	3.74			3.265	3.90

2.2 HYDROLOGY

2.2.1 Surface Drainage

The low relief and low annual rainfall (Section 2.3) have resulted in poorly-defined surface drainage within the site area. Drainage in the area to the east of the combined pit flows easterly and then to the south after joining an ephemeral creek (see surface contours and drainage, Fig. 9). This eastern creek line drains directly to Hannans Lake.

The creek line has been recognised by the DOM (1989) as a natural constraint to the eastern extension of the Golden Mile waste dumps, and the planned waste dumps will not encroach upon this watercourse.

It is clear from historical accounts and theoretical flood evaluations (AGC 1988a 1988b), that (a) streamflow events occur only after intense rainfall events, and (b)

extreme flood levels are unlikely to impinge upon the planned waste dumps. Runoff coefficients are low for typical peak rainfall events, but very high for the longer average return intervals (0.18 for 2 years ARI versus 0.95 for 20 years ARI) (Pilgrim 1987, AGC 1988). Historical accounts indicate that flood levels did not exceeded the 330m contour during the highest recorded flood event (in 1942).

A further factor affecting the peak volume of water carried by the eastern creek is the Trans Australian Railway line. The major part of the catchment of the creek is located upstream of the railway line. Thus peak stream flows in the lower water course adjacent to the waste dumps will be largely restricted by the volume of water able to pass through the railway embankment culverts. The flood width of this creek downstream of the railway culverts is therefore restricted.

2.2.2 Groundwater

Groundwater in the region is mostly saline and not potable, but is suitable for process water supply and dust suppression. It is intended to draw saline water supply from the Gidji borefield, located approximately 20km north of Kalgoorlie–Boulder, and from Lakewood, 15km south and possibly Hannans Lake area. The quality of water from the Gidji borefield is approximately 170,000mg/l Total Dissolved Salts (TDS). The proponent is licensed to extract 3285Ml of water per year from the Gidji field, under Water Authority Licence No. 30449.

The water quality of the Lakewood borefield is approximately 130,000mg/l TDS. The proponent is licensed (Water Authority Licence No. 24023) to extract 1000Ml per year from this field.

The requirement for water is estimated at up to 2,000kl/day for the Fimiston Pit, primarily for dust suppression. Assessment indicates that the two borefields are able to supply dust suppression and process plant requirements indefinitely at projected drawdown rates. Where possible, process water will be recycled.

2.2.3 Potable Water

Potable water will be required for human consumption and the final stages of ore processing. Sufficient water supply exists for this purpose and will be drawn from the reticulated goldfields water supply scheme.

Two Water Authority of WA water mains cross the proposed mining areas and will require relocation. These are:

- Kamballie Road main
- Kalgoorlie–Boulder main

Provision has been made for the relocation or replacement of these mains, and negotiations regarding these relocations will take place between KCGM and the Water Authority when appropriate.

2.3 CLIMATE

The climate of the Kalgoorlie area is classified as semi–desert Mediterranean (Beard, 1978) and is characterised by cool winters and hot summers.

The mean annual daily maximum temperature is 25.2°C, with a range of 16.7°C in July to 33.7°C in January. Mean minimum temperatures range from 5.0°C in July to 18.3°C in January, with an annual mean of 11.6°C. Temperature variation during the year can be extreme with summer maxima as high as 50°C and winter minima as low as –5°C.

Average relative humidity ranges between 76% at 0900 hours in July to 22% at 1500 hours in December.

Rainfall occurs throughout the year with a slight predominance of winter falls. Mean annual rainfall for the area is 255mm (over 48 years of records). The mean monthly rainfall ranges from 32mm in June to 12mm in December (Bureau of Meteorology data). Winter rain is largely due to cold fronts moving in from the Southern Ocean while summer rain comes mainly from localised thunderstorm activity making it less regular and less predictable. This is borne out by the greater average number of raindays each month for winter (mean of 8 raindays for May to August). Summer falls are more sporadic but tend to be heavier (mean of 3.6 raindays for October to March).

Annual rainfall is highly variable with a recorded range of 125mm–475mm, and effective winter rainfall is not assured (Fletcher *et al*, 1989). Foley (1957, cited in Fletcher *et al*, 1989) estimated that a mean of 18–19 years out of every 40 years can be classified as drought affected.

The Bureau of Meteorology, the EPA and KCGM collect wind data for the Kalgoorlie region. Windroses indicate that the prevailing winds in autumn and summer are north–easterly to south–easterly, mainly in the 3.0m/s to 5.5m/s

range, with very few strong winds (Fig. 8). Spring winds are variable in both speed and direction. Winter winds are predominantly westerly to northerly at 3.0m/s to 8.0m/s.

2.4 VEGETATION AND FLORA

The proposed project area lies within the Coolgardie Botanical District's Coolgardie Vegetation System, in the South Western Interzone, the vegetation of which has been mapped at a scale of 1:250,000 (Beard, 1978).

An extensive history of mining activities in the project area has meant that only remnant vegetation remains, with large areas being severely disturbed (Fig. 10). The remnant vegetation is mostly in a degraded condition.

A specific search for gazetted rare flora has not been undertaken. The previous mining history of the area and its proximity to the City of Kalgoorlie–Boulder make it extremely unlikely that any flora which is rare or restricted would still exist there.

In recognition of the desirability of improving the condition of the vegetation of the area, the proponent intends to undertake a rehabilitation programme that includes degraded areas outside of the waste dump zones.

2.5 FAUNA

No faunal surveys have been undertaken. In view of the high levels of human activity and the degraded condition of the project area in its present form, there is likely to be at most a very limited value of the area for wildlife habitat.

In order to consider the opportunities for increasing the habitat value of areas undergoing rehabilitation, liaison will occur with the Department of Conservation and Land Management and independent groups and individuals with expertise and interest in the natural history of the local area.

3.0 PROJECT DESCRIPTION

The merging of HGAL and the GMK group interests in Kalgoorlie has enabled the previously separate operations at Kalgoorlie to be considered for development as one project.

3.1 Mining

3.1.1 Open Cut Mining

The proposal involves an expansion of existing open-cut mining activities. This expansion has already commenced with the construction and commissioning of the new 2Mtpa Fimiston mill, lifting the total existing processing capacity to 6.3Mtpa. The expansion plans involve an increase in open-cut ore mining capacity to 7Mtpa in 1993, which is considered the maximum rate at which ore can be mined to supply the processing facilities. The source of ore for this increased level of operations is the Fimiston Pit.

The main features of the plan of mining activity are:

- Large scale mining of the Combined Pit, with peak material movement of 23Mbcm pa and a peak ore production of 7Mtpa (Table 3.1). Total material movement over the 15-year-plus life of the Combined Pit is 228Mbcm for a total ore production of 84.5Mt.

- The Western Lodes area will function as a relatively flexible reserve. Mining will occur there periodically depending on variations in ore production requirements. Present reserve information indicates that 4.7Mt of ore is available for a total movement of 15Mbcm.

- Continued operation, followed by decommissioning due to impact of the Combined Pit, of the following major KCGM facilities:

  - Perseverance Shaft
  - Paringa Plant
  - Paringa Shaft
  - Main Shaft
  - Oroya Plant
  - Lakeview Shaft.

Extensive underground mining has taken place in the Combined Pit area for nearly 100 years, with underground workings within or adjacent to the pit limits and extending to 1200m below ground. These operations are expected to continue below the pit floor during and beyond the proposed life of the Fimiston Pit.

It is expected that open-cut mining will have a life in excess of 15 years. Current mining schedules for the Fimiston Pit are shown in Table 3.1. These schedules will be revised as knowledge of geological and mining conditions improves, with subsequent changes to key dates shown in this document, as appropriate. Table 3.2 provides an indication of the area of disturbance over the life of the mine.

Geotechnical Studies

Preliminary pit slope design criteria were formulated by Coffey & Partners Pty Ltd in March, 1989. This preliminary design is detailed in Coffey & Partners (1989), and is summarised in Table 3.3.

TABLE 3.1 MINING SCHEDULE (FIMISTON PIT AND WESTERN LODES)

YEAR	1 90/91	2 91/92	3 92/93	4 93/94	5 94/95	6 95/96	7 96/97	8 97/98
Ore Mining (t)	3500000	6000000	7000000	6700000	6000000	6000000	6000000	6000000
Ore Mining (BCM)	1346154	2307692	2692307	2294520	2054794	2054794	2054794	2054794
Oxide Waste (BCM)	1315789	4473684	3473684	1157895	1736842	1736842	1368421	263158
Subgrade (BCM)	2500000	4285714	5000000	4785714	4285714	4285714	4285714	4285714
Fresh Rk Waste (BCM)	4734211	6604888	11126316	14634962	12941730	12427444	12345865	13236842
Total Waste (BCM)	8550000	15364286	19600000	20578571	18964286	18450000	18000000	17785714
Total Mat. (BCM)	9800000	17507143	22100000	22971429	21107143	20592857	20142857	19928571

YEAR	9 98/99	10 99/00	11 00/01	12 01/02	13 02/03	14 03/04	15 04/05	Total 15 yrs
Ore Mining (t)	6000000	6000000	6000000	6000000	6000000	6000000	6000000	89200000
Ore Mining (BCM)	2054794	2054794	2054794	2054794	2054794	2054794	2054794	31243407
Oxide Waste (BCM)	526316	0	526316	263158	0	0	0	16842105
Subgrade (BCM)	4285714	4285714	4285714	4285714	4285714	4285714	4285714	63714286
Fresh Rk Waste (BCM)	9566541	9214286	7402256	5758271	6021429	2378572	2378572	130772181
Total Waste (BCM)	14378571	13500000	12214286	10307143	10307143	6664286	6664286	211328572
Total Mat. (BCM)	16521429	15642857	14357143	12450000	12450000	8807143	8807143	243185714

TABLE 3.2

MINING LEASE DISTURBANCE IN HA

Type of Disturbance	August 1990	1 Yr – Aug 1991		3 Yrs – Aug 1993		Life of Mine – 2005	
	(Existing) Change	Change	Total	Change	Total	Change	Total
Pits	123.0	6.3	129.3	22.6	151.8	175.3	327.1
Tailings Dams	341.5	0.0	341.5	-15.1	326.4	-182.4	144.0
Waste Dumps	163.7	32.5	196.2	39.1	235.3	828.7	1064.0
Roads/power	350.9	-36.8	314.1	-41.8	272.3	-52.4	219.9
Mills	38.3	0.0	38.3	-4.9	33.4	-13.4	20.0
U/G services	18.3	-2.0	16.3	0.0	16.3	-16.3	0.0
Other	12.0	0.0	12.0	0.1	12.0	-1.9	
Overall Area	1047.5	0.0	1047.5	0.0	1047.5	737.6	1785.1

TABLE 3.3
PRELIMINARY DESIGN FOR FINAL PIT SLOPES

BENCH	BENCH HEIGHT SLOPE	OVERALL (m)	SLOPE
WEST WALL	60° (O) * 75° (F)	20 20	46° to 60°
EAST WALL	60° (O) 75° (F)	20 20	46° to 49°
NORTH WALL	80°	20	56° to 60°
SOUTH WALL	80°	20	56° to 60°

* Note: (O) = oxide
(F) = fresh rock

A programme of geotechnical data collection is currently being carried out by KCGM. This involves the evaluation of pit exposures, underground exposures and diamond drill cores. These studies will enable optimal berm widths and inter-berm distances to be designed. Approval will be sought from the Department of Mines for any design which varies from prescribed standards provided in the Mines Regulations Act.

Detailed design of long-standing interramp and overall pit slopes have commenced. Completion of this work is scheduled for mid-1991. The requirements for additional investigations will be subject to annual review thereafter.

Mining Programme

The Combined Pit mining process will be divided into stages, as described below. The numbering of stages does not necessarily coincide with the sequence of

mining as operational decisions will determine the final schedule of mining. Figure 4 gives site locations.

Stage 1 First pass into the pit centre, mainly in Judd pit.

Stage 2 Cutback to the west and south of Stage 1, removing Perseverance Shaft.

Stage 3 Mining north through the Paringa slot and Brisbane Street pillar and deepening Paringa pit. Remove Paringa Plant.

Stage 4 Cutback to the west of Stage 3 out to ultimate pit; Remove Main Shaft.

Stage 5 Cutback to the south and west of Stages 1 and 2 out to ultimate limit.

Stage 6 Cutback to the east of Stage 1 out to ultimate pit; Remove Oroya Plant.

Stage 7 Deepening of the southern pit floor to optimum lower limit as stages are combined.

Stage 8 Deepening of the northern pit floor as stages are combined.

Stage 9 Extension to the north.

Stage 10 Extension to the south.

Mining will be carried out concurrently in the Western Lodes Open Cut.

Ultimately the main pit will be approximately 5km long by 1km wide at the widest point, to a proposed depth of 300m (Figs. 10,11, & 12).

Mining Methods

Mining is currently carried out on behalf of KCGM by contractors. Material will be loaded using $10m^3$ backhoe and shovel-configured, diesel-powered, hydraulic excavators and $10.3m^3$ front-end loaders, and hauled with 86 tonne and 130 tonne off-road dump trucks. Material varies from weathered oxide which can be dug without blasting to unweathered rock which requires full blasting.

Drilling is carried out using diesel powered hydraulic drill rigs with "down-the-hole" hammer sizes ranging from 76mm to 200mm diameter. Both 5.0m and 7.5m benches are mined and these may be dug off in 2.5m, 5.0m or 7.5m lifts, depending on the continuity of the ore body and its dip. In addition, in bulk waste areas which contain no ore or sub-grade material, benches of 10m or more may be fired, using holes of up to 200mm diameter.

As the production rates are increased, larger face shovels, loaders and trucks could replace presently used equipment. In addition, options such as in-pit crushing and trolley-assisted trucks will be assessed with a view to increasing efficiency and reducing costs.

Sub-grade material will be stockpiled directly adjacent to the waste material and forming part of the same dumps, but occupying those parts of the dumps closest to the Fimiston Mill. This placement will preserve the option of the treatment of sub-grade material at some future date.

Dust Control

Dust control measures will be employed during the mining process to minimise hazards to mine personnel and public nuisance. These measures are described in Section 4.2.4.

3.1.2 Underground Mining

Concurrent with the development of the Fimiston Pit, underground mining will continue at the Mt Charlotte and Fimiston Underground workings. A description of the present operations at these workings was presented in Section 1.6. They are not a subject of this CER.

3.1.3 Waste Dumping

Over the life of the mine, approximately 197 Mbcm of waste and sub-grade material will be extracted from the Combined Pit. This will be dumped to the east of the pit as follows:

A. Waste

(i) Dumping will continue on the presently used "Northern Dump", to the south east of Boorara Road (Figure 10). This dump is currently

constrained by Boorara Road, the Fimiston Mill Access road, Black Street and the pit haul roads and dumps.

Dump height is currently limited by Department of Aviation height restrictions from 419m AHD on the western side of this dump to 434m AHD on the east. Relocation of the airport in the future may remove this restriction. Otherwise, before reaching the height limit, the Boorara–Fimiston Access roads would be relocated to enable the dumps to be extended eastwards. This would be limited by the Trans Australia Railway Line and the eastern drainage line.

(ii) Dumping will commence on the new Southern Dump area, west of the Oroya Tailings Dam. This area is constrained by Black Street, the Oroya Tailings Dam and by services to the south west. Expansion will take place to the east and south as constraints are lifted (Fig 11).

The general configuration of the planned waste dumps in relation to other landscape features is presented in Figure 13. The view is from the north at an elevation of 30°.

B. Sub–Grade

(i) Dumping will continue on the present dump area to the south of the present Northern Dump (Fig 11).

(ii) Additional dump areas will be adopted adjacent to the new Southern Dump (Fig 11).

C. Western Pits

The Western Lodes pits will be worked on an opportunistic basis with the Combined Pit and may produce approximately 14 Mbcm of sub–grade and waste. Present plans are to relocate the Western Pits Waste Dump to the south of its current location (Fig. 10 and 11) to allow removal by Kaltails of the Tailings Dam underneath and to continue to use the present sub–grade dump.

A detailed description of the rehabilitation programme proposed for the waste dumps is given in Section 4.3.

3.2.1 General

With the development of the Fimiston Pit and expansion of the Fimiston Mill and Gidji Roaster certain infrastructure changes are required. These changes are outlined below.

3.2.2 Roads

A number of gazetted public roads exist in and around the proposed Combined and Western Lode open cut areas, and a significant amount of rationalisation of those to the north and north-east of the pits has taken place during the construction of the new Fimiston Plant. Additional closure, construction, relocation and/or upgrading is required of roads to the south-east, south and west of the pit areas to allow the pit to expand during its life and to permit access for waste dumping and other mine activities. These changes are illustrated in Figure 11 and on plans in Appendix C, and may generally be described as follows:

(a) Access from Kalgoorlie/Boulder to Lakewood, the Kaltails operation, Mount Monger, Karonie and all points on the Trans-Australia Railway Line east of Golden Ridge is currently via the Eastern Bypass Road, Boulder Block Road, Kamballie Road and Lakewood Road. Closure of Kamballie Road is required in two respects:-

- almost immediately for safety and efficiency reasons in respect of open pit blasting, mine haulage and mine security; and

- in the longer term (approximately 1993) to allow the Fimiston Pit to encroach on to the road reserve.

To provide alternative public access to the east and to enable Kamballie Road to close, a new southern access road has been constructed connecting the Eastern Bypass Road and Lakewood Road (Fig. 11). This new road is comprised of an upgrade of the existing Outram Street between Eastern Bypass Road and the Morrison/Horseshoe "bridge" and a new section of road to Lakewood Road. The new Southern Access Road has benefits over the old route in that it will be built to an 80 km/h standard

and have few intersections. A suitably-controlled haul road crossing (for Western Lodes waste) will be maintained on this road until completion of mining in the Western Lodes Open Cut.

(b) Minor service roads on the western side of the pit around the Hainault Mine/Old Fimiston Post Office region will be closed and subsequently de-gazetted following the finalisation of negotiations with existing land owners to allow mining to proceed in this area.

These arrangements have been approved by the Kalgoorlie/Boulder City Council subject to no road closures proceeding until the new Southern Access Road is constructed. The Southern Access Road is now complete and the matter will be put to Council formally as soon as practical.

3.2.3 Power

Electric power for the consolidated operations is generated by the State Energy Commission of WA (SECWA), and supplied to Kalgoorlie-Boulder via a grid system. Sufficient supply capacity exists to service the expanded open cut without the upgrading of this grid. Relocation of some 33kV and low voltage SECWA lines will be required, and will be the subject of future negotiations with SECWA. Power lines owned and operated by KCGM will also require relocation in some cases.

3.2.4 Water

3.2.4.1 Introduction

Potable water for the consolidated operations is supplied by the Water Authority of Western Australia. Sufficient capacity exists to service the expanded open cut without an upgrading of the system.

Dust suppression and process water is obtained from saline groundwater supplies 20km north of Kalgoorlie-Boulder near the Gidji Roaster, and from Lakewood, 15km south. Assessment of the source aquifers indicates an adequate supply of water for the life of the mine at the projected drawdown rates (AGC 1988,1990).

15 yrs.

Some changes to the local distribution network are required as noted in the following sections.

3.2.4.2 Potable Water

A number of Water Authority mains traverse the proposed mining areas and those requiring relocation will be the subject of negotiation between KCGM and the Water Authority.

3.2.4.3 Saline Water

Provision has been made for the relocation, adjacent to the public road, of the KCGM Lakewood to Croesus borefield line where it passes under the waste dump area to the north-east of the Fimiston Plant.

Adequate capacity exists in the water truck filling station recently constructed to the north of the Fimiston Plant to cater for the mining volumes and haul road watering requirements of both the Combined and Western Lode Pits.

3.3 WORKFORCE

The work-force is detailed by number and classification in Table 3.4. Mining is carried out by a contracting firm, Roche Bros Pty Ltd. The mining contractor provides manpower to operate all equipment on site and carries out the directly-related production functions. This includes supervision of operating personnel.

KCGM provides all planning, scheduling and technical input into the mining process.

KCGM staff hold all statutory positions and provide additional mine supervision as a check to ensure all relevant safety procedures are observed. This includes adherence to the provisions of the Mines Regulations Act and other statutory requirements.

In either a contract mining or owner operated configuration, KCGM will remain vigilant in its adherence to the Mines Regulations Act and other statutory regulations that apply to mining operations.

TABLE 3.4 WORKFORCE CATEGORIES

	JOB CLASSIFICATION	NO.
1.	**KCGM**	
	Supervisory/Planning	33
	Geological Sampling	10
	Sub Total	43
2.	**CONTRACT**	
	Supervisory	11
	Maintenance	17
	Production	72
	Sub Contractors	22
	Sub Total	122
	TOTAL	165

4.0 ENVIRONMENTAL IMPACTS AND MANAGEMENTS

4.1 Environmental Management Programme

With the formation of KCGM as the operating company for the Golden Mile, the need to develop a comprehensive environmental management programme (EMP) for the whole of the Golden Mile operations has been recognised.

KCGM is in the process of preparing such a programme. The formulation of the EMP will be the responsibility of the Environmental Department of KCGM and implementation will occur during 1991–2. In order to place the present document in the context of this larger plan, a brief overview of the scope of the EMP is warranted.

The development of the EMP will require:

(i) The development of a company environmental policy and a set of management objectives (completion goal – December 1990).

(ii) A review and audit of existing environmental licences and obligations and the identification of other (non-regulated) areas of potential environmental impact (completion goal - May 1991).

(iii) The development and implementation of a management programme to address the above (completion goal - December 1992).

The elements of the EMP will be based around the operational compartments of the organisation, e.g. exploration, open pit mining, underground mining, milling and roasting plants, and including their related components such as tailings dams, borefields and waste dumps.

The EMP will utilise the following mechanisms in its application to KCGM operations:

- A formal system of liaison, auditing and reporting linking environmental and operational areas.
- The use of detailed procedures and practices manuals to provide guidelines for operational personnel.
- A mining and rehabilitation sub-programme.
- A training and induction sub-programme.
- A monitoring and research sub-programme.
- A system of regular environmental reporting to relevant Government authorities which would consolidate the diverse reporting obligations and commitments presently applying to all areas of KCGM operations.

Sections 4.2 and 4.3 form the basis of the mining and rehabilitation sub-programme of the EMP.

4.2 POTENTIAL IMPACTS

4.2.1 Water

Groundwater

The primary potential impact of mining and associated activities on groundwater relates to its use in ore processing and dust suppression. The management of the groundwater supply system has been the subject of separate assessments (AGC 1988c, 1989 & 1990). These studies, which are regularly updated, have

confirmed the sustainability of groundwater aquifers at present and projected rates of exploitation.

Surface Run-off

The natural drainage pattern within the project area has already been modified by existing mining operations and infrastructure. It will be further modified by the development of the proposed pit expansions and waste dumps.

i) Pit Areas

Due to the natural topography (see surface contour and drainage overlay, Fig. 10), pit bunding and artificial drainage, the quantity of water entering the pits from outside the overall pit perimeters is minimal. However, the pits themselves and contained areas such as the Paringa Mill form a catchment of approximately 150 hectares and hence collect 1.5 megalitres of water per millimetre of rain.

During light rain, the majority of this water is retained in the pit but with heavier falls, which lead to appreciable run-off and ponding, excess water finds its way into underground workings through the many exposed stopes, rises and shafts. Although the points of ingress are numerous, because of their restricted size, water tends to build up underground slowly and over a large area rather than as a sudden rush into a single area. Therefore the risk of flooding the underground operation is considered to be small.

Water is removed from underground workings using the current dewatering equipment operating at Main Shaft, Paringa, Croesus, Perseverance, Lake View, Hainault and Chaffers shafts. As these shafts become decommissioned, pumping capacity at the remaining shafts will be upgraded to replace the lost capacity and to cope with the increased pit catchment area. The option of dewatering from presently disused shafts also will be investigated. Water pumped from underground is recycled and used in the milling process or is used to transport fill-back material as a slurry within the underground workings.

A water control management programme will be implemented to ensure that the amount of run off which enters the pit and underground workings is minimised. Experience has indicated that close attention to bench gradients and the condition in which berms are left is effective in controlling water ingress to underground workings. Procedures to control water that

enters the underground openings will be developed as required. These may include additional pumping capacity, drainage design, flood doors and evacuation procedures for the underground workforce.

ii) Waste Dump Areas

The waste dumps have been located to ensure that the natural eastern drainage channel is not blocked or modified. With the development of the waste dumps and associated infrastructure, an artificial drainage system will be required to ensure that run-off from major rainfall events will not cause flooding in and around the dump area. The design of the dumps and associated drainage system will aim to maximise water harvesting and *in situ* recharge.

Runoff from major storm events will be handled by a constructed drainage system. The system will incorporate sediment retention sumps with the aim of minimising the transport of sediment off-site.

Hypersaline Dust Suppression Water

The use of hypersaline water for dust suppression is recognised as contributing to increased salt load within the mining area. Approximately 2,000 kilolitres of water will be used daily, on average, for dust control in the open cut operations. This will be obtained from a truck filling station direct from the existing saline groundwater system. This water is expected to contain salt at concentrations within the hyper-saline range. The major constituents are chloride, sodium, sulphate and magnesium ions. A typical range of analysis for this water (Kyle, undated) is shown below.

TABLE 4.1
HYPERSALINE WATER ANALYSIS - RANGE OF VALUES

pH	3.5-8
TDS	90,000 - 170,000 mg/l
Na	30,000 - 40,000 "
Mg	35,000 - 50,000 "
Cl	50,000 - 60,000 "
SO_4	5,000 - 9,000 "

The water may also contain small amounts of calcium and bicarbonate ions (< 1 g/l).

A preliminary investigation on the effects of the use of salt water for dust suppression on salt contamination on surrounding soils was undertaken for the Goldfields Dust Abatement Committee (Kyle, undated).

That study was not exhaustive or conclusive in evaluating the extent of salt movement away from the mining area. However, it has highlighted that salt is transported mainly by run–off and wind dispersion, and that areas immediately adjacent to roads watered with hypersaline water will be most affected. Drainage lines also showed evidence of salt concentration, while soils away from haul roads and creeks were largely unaffected. The study concluded that salt concentration was confined to the immediate mining areas and to channels draining such areas.

The fate of any salt carried from this source in major run–off is into the drainage line east of the mining area and ultimately to Hannans Lake (Fig. 9). This eastern drainage line carries a 'broombush' shrubland (*Eremophila, Cassia, Acacia*) which grades into a succulent shrubland (*Frankenia, Atriplex, Maireana*) approximately halfway between where it crosses the Trans–Austalian Railway and where it ends at Hannans Lake. The area has been significantly disturbed by vehicle traffic, rubbish dumping, borefield development and livestock grazing, and there are a number of private residences with associated small paddocks and access tracks.

The surface soils of the eastern creek line can be described as moderately saline (EC >800 mS/m, Kyle, undated) in the section of broombush shrubland below the railway line. Salinity levels are 10–100 times higher than those of soils adjacent to the creek line (Kyle, undated). Salinity levels are presumed to further increase as the transition from broombush to succulent shrubland occurs. Hannans Lake itself is saline, and is highly disturbed, particularly around the northern margins where tailings material has eroded from nearby old tailings dams. These tailings dams now form part of the Kaltails tailings retreatment project.

In view of (i) the saline nature of the surface drainage system and (ii) the limited capacity for salt to be transported away from road watering areas (Kyle, undated), it is anticipated that salt transport and consequent effects on existing salt distribution will not be significant. Regular monitoring of water quality in sediment retention sumps will be carried out and the need for modifications to the mine drainage system will be reviewed as appropriate.

4.2.2 Waste Products

Mine Waste

Waste rock from the mining operations will be dumped to the east of the mining area. Management of waste dumping is discussed in the Section 4.3.

Disposal of tailings resulting from the mining activities, and management of tailings dams, are the subject of separate proposals and are not discussed here.

Domestic and Industrial Wastes

Solid wastes will be disposed of in a number of ways. Normal domestic waste, e.g. paper and plastics, from offices and plants will be disposed of at the municipal rubbish tip or recycled if recycling facilities become available. Contaminated or potentially toxic industrial materials, e.g. empty cyanide drums, diesel filters etc., will be buried at depth within waste rock dumps. Cyanide boxes will be burnt as per Mines Department recommended procedures. Bulky non–toxic industrial/milling wastes, e.g. timber and metal rejected from the milling circuit, will be removed by waste disposal contractors or buried in waste dumps.

Sewage

Sewage from toilets and washroom facilities on site will be disposed of by means of septic tanks.

4.2.3 Toxic Materials

Blasting Materials

Blasting materials currently used in the operations comprise Jubilee 200 bulk–dispensed liquid emulsion in ore bodies and a 50/50 mix of HEF (High Energy Fuel) and ANFO (Ammonium Nitrate/Fuel Oil) in waste areas. These materials may be varied in future as mining needs or technological improvements dictate.

The transport, storage and use of these materials is strictly in accordance with the Mines Regulations Act and the provisions of the Explosives and Dangerous Goods Act (1961).

Fuels, Oils and Solvents

Storage, use and disposal of these materials will be in accordance with Mines Department Regulations.

Storage will be in above–ground tanks within bunded pits to minimise the chance of spills contaminating groundwater or watercourses. The tanks and pits will comply with relevant standards and statutory requirements.

Used oils and solvents will be recycled where possible or disposed of in an approved liquid waste disposal site.

4.2.4 Dust

Dust arising from mining operations is recognised as having the potential to contribute to the condition of air quality within the Kalgoorlie–Boulder area. Dust may be generated from mining activities such as drilling, blasting, loading, dumping, transporting, and crushing. In addition, dust may be generated from waste dumps and disturbed areas. The close proximity of the project to the residential areas of Kalgoorlie–Boulder increases the importance of managing this impact. KCGM acknowledges its responsibility to manage and monitor dust levels within the residential area and is actively involved in the community–based Goldfields Dust Abatement Committee.

The significance of dust generated from the mining operation and its contribution to the total dust load within the Kalgoorlie–Boulder area is not well understood. The occurrence of long periods of drought are known to be a major environmental factor influencing the level of dust experienced within the Kalgoorlie–Boulder region (Richmond et al, 1973; Kinhill Engineering, 1988).

As well as the mining operation, other sources of dust are:

- Unsealed, non–vegetated areas, including road verges, service lanes and vacant crown land within the town.
- Degraded range lands adjacent to the town.
- Old mine tailings dumps east and south east of Boulder.
- Land disturbed during the construction phase in new residential and industrial sites.

- Recreational disturbance of bushland adjacent to town.

(Kinhill Engineers, 1988)

The Goldfields Dust Abatement Committee is progressively addressing these sources through implementation of their strategic plan.

The Goldfields Dust Abatement Committee in association with KCGM (and Kaltails) are also implementing a new dust monitoring programme. This programme involves the installation of a network of five stationary high volume samplers within the boundary of the city of Kalgoorlie–Boulder, one station 17 km from town to provide a "control" and possibly one mobile unit to be used for short term, specific sampling.

This network will provide quantitative data on total suspended particulates and is based on procedures described in Australian Standard 2724.3 – 1984, Ambient Air – Particulate Matter, Part 3. The programme is under the management of the Goldfields Dust Abatement Committee.

In addition to providing three of the high volume samplers involved in the programme KCGM will evaluate methods of determining the relative contributions of mining and other dust sources to the overall dust load. KCGM also has purchased an additional high volume sampler that will be used as a mobile unit to assess specific locations within the mine and adjacent areas.

In recognition of the potential contribution of the mining operation to the total dust load, KCGM will instigate management strategies aimed at reducing the potential sources of dust. This will involve reviewing the existing dust suppression procedures and an evaluation of dust propagation sources. If feasible, the quantification and ranking of the significance of the major dust sources will be undertaken. Engineering solutions and dust suppression strategies will be then be researched and modified as appropriate.

4.2.5 Noise

Public Nuisance

The principal sources of noise from open–cut mining activity in the Golden Mile are mobile mining and haulage equipment and blasting. The proximity of the

operation to residential areas means that noise generated from the mining operation has the potential to create public nuisance.

In response to noise complaints received by North Kalgurli Mines in 1988 from the Shire of Boulder, late night and early morning noise surveys were conducted when mining operations were being performed in areas of the mine close to the residential area. These surveys were conducted by an approved Noise Officer using an approved and calibrated Integrating Sound Level Meter.

These surveys indicated that noise levels were below the assigned outdoor neighbourhood noise levels for Category B localities (residential, educational, hospital or the like) as specified in the Noise Abatement (Neighbourhood Annoyance) Regulations 1979.

Since that time no noise complaints have been registered by the City of Kalgoorlie–Boulder from mining sources involved with the open pit operation.

In recognition of the potential impact of blasting noise, vibration and airblast over pressure problems, KCGM have modified blasting techniques and procedures. Blasting schedules are modified where atmospheric conditions are conducive to reflection of blast noise, and simultaneous detonation of the blast pattern is avoided by the use of timing delays.

These blasting designs and procedures have been developed in association with airblast over pressure monitoring and in consultation with the Mining Engineering Division of the Department of Mines (Airblast Technology 1988a, 1988b & 1989).

In general, noise levels associated with the operation will be relatively low in view of the fact that the excavation of the upper levels will require far less drilling and blasting. At lower levels within the pit, confinement will help limit the dispersal of noise. The proposed decommissioning of the Paringa mill, which lies within the limits of the Fimiston Pit, will reduce noise levels for residents in the vicinity. The timing of this shut down is dependent upon the mining schedules, but is likely to occur within the first 3 years of operation.

Occupational Noise

Maximum permissible occupational noise levels in open cut mining in Western Australia are specified by Australian standards A.S.A.2012, 2436 and 2240. These Standards require that "Engineering noise reduction shall be carried out on

any work process or machine with a peak noise level in excess of 140 dB (DIN) so that the damage risk criterion is not exceeded". KCGM intends to ensure that all machinery, processes and vehicles comply with occupational noise limits set by these Australian Standards.

Monitoring

KCGM intend to undertake a comprehensive review of noise sources during a study programme planned to be undertaken in 1990. The purpose of this study will be to ensure that occupational noise levels are being adhered to. During this programme the earth moving fleet will be reviewed to ensure compliance with Noise Abatement Regulations. Monitoring will also be carried out within the residential areas in close proximity to the mining operation.

4.3 REHABILITATION

4.3.1. Introduction

This section of the report provides a description of the proposed rehabilitation programme for the waste dumps and surrounding areas associated with the Fimiston Pit.

Reviews of the programme will be required to ensure that changing circumstances and knowledge are integrated into the programme. This review process will be undertaken annually, concurrent with annual internal and external (EPA and DOM) reporting requirements. It will involve redefining the specific goals and the time-related objectives on an annual basis. Periodically through the 15-year mining programme, reviews of the conceptual plan will be undertaken. Towards the end of the mining programme greater emphasis will be placed on planning for mine closure. The following discussion will define priorities of the early phase of the programme and detail the programme of year one.

4.3.2 Rehabilitation Objectives

Clearly defined rehabilitation objectives are the essential platform for the development of any useful rehabilitation programme. In preparing the objectives for this project two important points have been recognised. Firstly, that the "land forming process" provided by the mining operation has the potential to develop landforms capable of being utilised in the long term by the community of Kalgoorlie-Boulder. Secondly, that the mining process and the final landform will influence the broader environment surrounding the project.

Based on these considerations the following objectives have been established:

1. Within the limit of practical landform constraints evaluate possible end land use options.

2. Minimise off-site environmental impacts.

3. Establish a soil profile which is appropriate for the proposed end land use.

4. Establish a stable landform which as far as possible is sympathetic to the regional landscape.

5. Consider incorporating micro-topographical modifications within the waste dumps design to aid in increasing the diversity and complexity of the vegetation and improving the potential for providing a greater range of habitats.

6. Design and establish a favourable on-site and off-site hydrology.

7. Ensure that an appropriate access system is maintained following the mining period.

These objectives will guide the implementation of the programme. Like all components of the strategy, the objectives will be periodically reviewed.

4.3.3 Conceptual Plan

The DOM (1988 & 1989) has identified three land use zones associated with the project. These are the waste zone, the mining zone and the buffer zone. Figure 14 illustrates the zones.

4.3.3.1 The Waste Zone

Within the waste zone, located to the east of the mining area, the primary function is waste rock disposal, sub-grade ore stockpiling and tailings disposal.

This zone is restricted to the area between the pit and the Trans-Australian railway line and the natural drainage channel east of the mining area. These

constraints, and the considerations of economic haul distances, restrict the waste zone area to within approximately a two kilometre arc east of the Fimiston plant.

The footprint of the waste rock dumps are indicated in Figures 10 & 11.

A maximum height restriction for the dumps has been imposed by aviation safety requirements associated with the existing airport. These restrictions limit the height of western side of the dumps to 419M AHD and the eastern side of the dump to 434M AHD. With the proposed relocation of the airport, these limits may be modified. For the purposes of the present plan the existing restrictions are adopted.

These constraints restrict the final landform options to the development of large "mesa" or "table top" structures (Figs 12 and 14). Ultimately this feature will dominate the eastern skyline of the Kalgoorlie–Boulder area. Therefore the final landform of the waste dump, being a high point in the terrain, offers opportunities as a lookout, communication tower, or water reservoir site. Access will be maintained so that such end land use options are maintained.

Across the major proportion of the dumps the initial goal will be revegetation, with the primary purpose of surface stabilisation. As far as practically possible, micro–topographic modification will be incorporated into the final design. This will add to the possibility of diversifying the range of species and habitat types capable of developing.

Within the waste dump footprints, provision for dumping of sub–grade ore within 1000 metres of the Fimiston Plant has been made. Beyond that distance waste will be progressively dumped and the outer surfaces rehabilitated. If sub–grade material is treated by heap leaching techniques, this will occur within the sub–grade zone of the waste dump area.

The existing tailings structure within the area will provide adequate volume for three years of operation before alternative sites previously identified by DOM (1988) east of the Trans–Australian railway line are utilised. The design and management of tailings dams has been addressed by AGC (1988b). Tailings dam extensions will require new proposals.

4.3.3.2 The Mining Zone

The Mining Zone represents the active mining area and related infrastructure of haul roads and plant sites as described in Section 3.

The proposed final pit will have dimensions of some five kilometres long and approximately one kilometre at the widest point. It is not considered feasible to incorporate back-filling the mine within the programme because of the prohibitive economics and the presence of underground workings with the potential to develop a decline at depth from the pit.

A major consideration in pit design and long term safety is pit wall stability. This will be addressed through ongoing geotechnical studies by KCGM and reviews by the Department of Mines. Ultimately the most important consideration for the Mining Zone is ensuring that the pit area is made safe with adequate slope stability and perimeter bunding.

During and at the end of the mine life the pit has the potential to be of significant tourist interest. Provision can be made for a suitable tourist vantage point. The most likely place for this will be via an access to the Croesus Waste Dump (Fig. 14). An evaluation of this concept can be reviewed by the Golden Mile Mining Planning Development Committee prior to implementation.

4.3.3.3 The Buffer Zone

The primary function of the Buffer Zone is to provide a spatial separation between the mining zone and the residential areas of town. The further development of dust abatement revegetation within this area will be encouraged. Other possible uses which may be compatible with this primary function include bicycle and horse trails and passive recreational activities.

As outlined by the DOM (1988) the process of defining the Buffer Zone and the evaluation of land use options will be co-ordinated by the Golden Mile Mining Development Planning Committee. Establishment of dust abatement zones and subsequent revegetation will be co-ordinated by the Goldfields Dust Abatement Committee with assistance from KCGM.

4.3.4 Waste Dump Management and Rehabilitation

The primary requirement in waste dump management is to provide an end product which is stable, erosion free, aesthetically pleasing and has minimal site environmental impact. This process involves the integration of a number of parameters such as the chemical and physical characteristics of the waste material, dump shape and form, a consideration of local landforms, rainfall, hydrological characteristics, slopes and final vegetation cover.

4.3.4.1. Waste Volume and Waste Characteristics

The type, the relative volume and the physical and chemical characteristics of the waste material is an important consideration in waste dump management and rehabilitation. An evaluation of these factors will identify the need for preferential waste dumping, stockpiling and soil profile construction.

Section 2.1 has described the geology of the area and indicated that the ore body is hosted within the unweathered Golden Mile Dolerite and the underlying Paringa Basalt. These fresh rock materials represent the largest component of the waste rock generated by the operation. However, during progressive cut backs of the upper levels to create the ultimate pit limits, waste from the upper, oxidised zone will be generated. The existing waste dumps associated with the current operation consist primarily of oxidised waste.

Table 4.1 below provides a breakdown of the material types, approximate volumes and percentage of ore, sub-grade and waste. This illustrates the relative magnitude of the fresh rock component of the waste material.

TABLE 4.2 VOLUME OF MATERIAL TYPES (APPROXIMATE)

Material	Volume Mbcm	% Break down Ore	Subgrade	Waste
Oxide	18	5	5	90
Paringa Basalt	45	20	20	60
Golden Mile Dolerite	170	20	20	60
Total	243 Mbcm			

The physical and chemical characteristics of the oxide waste material have been evaluated as part of the MERIWA Research Project No 66 (Fletcher *et al* 1989) and previously described by Peterson (1987). This work has concluded that this material is highly variable, moderate to severely saline, severely sodic, infertile, can be acidic or alkaline and is structureless. Thus, in rehabilitation terms, this material is a difficult medium to revegetate. Research has established, however, that with appropriate site preparation, a range of salt resistant and salt tolerate vegetation can be established directly on it. Although these problems are recognised, the oxide material is considered to be an important resource for rehabilitation (See Section 4.3.4.4).

To date no attempts have been made to revegetate the unweathered fresh rock waste consisting of Golden Mile Dolerite and Paringa Basalt. Physically this material is different to the oxidised material. Run of mine waste from this source is typically of "blue stone" appearance, competent in nature and in size fractions ranging from boulders of up to one metre diameter down to crushed aggregate size. The size faction is dependent upon the nature of the original rock and the blasting techniques used.

The chemical properties of the hard rock as a growth medium have not been fully investigated. It is recognised that there may be a risk of generating run-off and drainage waters of low pH and high salinity containing potentially toxic elements (e.g. heavy metals). Problems of this type are a function of the geochemical characteristics of the rocks and the oxidisation process that goes on within the waste dump. The risk of problems of this type is considered to be low as the fresh rock waste has a low sulphur content in contrast to the ore body which is sulphidic (Section 2.1).

Average levels of sulphur in the waste are 0.38% by weight, with a range from 0.01% to 1.2%. By comparison the sulphur levels in the ore are typically around 3.5% by weight. The sulphur content of the waste increases with proximity to the mineralised zone. The sulphur content of the waste will therefore be unevenly distributed, with the majority of waste rock exhibiting very low levels. Any pockets of waste with higher than normal levels of sulphur are likely to be well mixed and hence diluted by the more abundant lower sulphur waste during relocation to waste dumps. Thus there should be no "pools" of high sulphur-containing rock within the waste dump for which acid formation could result.

The semi-arid nature of the climate also limits the potential for problems of this type to occur. Typically acid mine drainage and contaminated run-off is experienced only in high rainfall areas (J. Clarke, pers. comm).

Due to the relatively low rainfall experienced in Kalgoorlie, it is highly unlikely that a permanent water table will develop in the dump. Any water that does infiltrate will be restricted in its downward movement by the aquitards created by earthmoving equipment compacting the surface at each layer of the dump.

Although the risk of these problems is considered to be low, KCGM will undertake an investigation of the geochemical characteristics of the waste. The factors to be investigated will include the total sulphur content and the form of sulphur present, the capacity of the fresh waste to neutralise acid, the solubility of the constituents in the waste under a range of pH conditions and the total elemental composition (Miller *et al* 1987, Caruccio *et al* 1988).

If these preliminary investigations indicate potential problems, the physical and hydrological characteristics of the waste dump, particularly its infiltration characteristics, will be examined in more detail. If problems are predicted from the investigations, KCGM will incorporate containment measures within the waste dump design, appropriate to ensure the integrity of the surrounding environment.

4.3.4.2 Slope

Stabilisation of the outer slopes of the waste dump is an important component of the rehabilitation strategy. To ensure that waste dumps are left in a stable condition, the Department of Mines requires that waste dump slopes do not exceed 20° from horizontal, on the interberm face. The MERIWA research (Fletcher *et al*, 1989) has recommended shallower slopes of 14° (or less), to ensure adequate vegetative stabilisation of the slopes.

At present the design concepts for the waste dumps have been based on 20° interberm slopes to ensure that the total volume of waste can be accommodated. A number of factors may allow slope angles to be reduced. These include changes to height restrictions associated with the present airport configuration and more detailed evaluation of volumes of waste and the availability of unmineralised ground suitable for the development of waste dumps. These factors will be progressively resolved, as KCGM has assumed a long term commitment to reduce slopes below 20° wherever practicable.

4.3.4.3 Hydrological Design

The need to establish an adequate drainage system to handle run–off from the dumps in the event of major storms is recognised.

Studies such as Cull and East (1987) have shown that stabilisation and the reduction of sediment yields from rehabilitated slopes should be based on consideration of a wider range of features including:

- Slope geometry (slope angle and length) and slope shape.
- Material selection and placement including the nature of the surface layer (i.e. rock lag or rock mulch).
- Surface drainage design.
- Revegetation strategies.

Due to the previously described space limitation the early phases of the rehabilitation programme will utilise the engineered drainage design system commonly used in the goldfields of surveyed benches and graded drains, with rock–filled drop structures (see Section 4.3.5).

It is recognised that this initial engineering solution may not remain the approach preferred as the project progresses. Design techniques will be continually evaluated during the project and incorporated as appropriate.

4.3.4.4 Dump Surface Preparation

The establishment of an appropriate soil profile/growing medium is a high priority of the rehabilitation strategy. A programme of investigation will be implemented to identify the most practical and effective use of the materials available. This will involve an evaluation of topsoil availability, material handling/earthmoving sequences and methods and soil profile construction techniques utilising waste materials.

Topsoil will be routinely stripped, used immediately as a cover on prepared slopes or stockpiled for future use. Because of the disturbed nature of the site, however,

topsoil is in limited supply. 300 hectares of the site is available for topsoil recovery, out of a life-of-mine disturbance area of approximately 1200 hectares.

In parts of the eastern area of the leases that are to be covered by the waste dumps, relatively deep loamy soils are present. However, the quality of the subsoil material has not been fully established. It is known from previous soil testing investigations of this area that at least the upper 20cm of this material is non-saline (ECe<400 mSm^{-1}). Mildly saline material (ECe<800 mSm^{-1}) occurs with increasing depth. Under normal circumstances subsoil material with higher salinity levels would be considered to be of low value. However, because of the topsoil deficit and the extremely saline nature of the overburden, this material will be recovered for use as a growth medium. Material of up to one metre in depth appears likely to be suitable as topsoil for waste dumps. This would provide up to 30cm of topsoil material for rehabilitation purposes.

To quantify the availability and quality of the material, a topsoil and subsoil evaluation will be undertaken during the first six months. This will assist the development of a topsoil stripping and stockpiling programme. Dependent upon the adequacy of topsoil material from areas currently available for stripping, the opportunities for supplementing topsoil reserves from other sources will be investigated. Surplus topsoil from the Kaltails project is one such option.

The development of a subsoil profile utilising an appropriate blend of oxidised and fresh rock is also considered to be an important consideration. The aim of investigations in this area will be to evaluate the optimum mixture and placement of overburden material.

At present it is considered that the oxidised waste, although known to be highly saline and sodic in nature, will be an important resource in the development of the growth medium. Based on present calculations of the volume of oxidised material that will be generated from expansion of the Fimiston Pit, a layer up to one metre of this material is available for covering the hard rock waste. Oxidised waste will be stockpiled separately to ensure supplies of this material can be used in progressive rehabilitation. The existing waste dumps consist largely of oxidised material and offer an additional source of this material, if required.

Other important considerations in developing the optimum soil profile will include: evaluating the weathering properties of the waste; overcoming the tendency of the saline and sodic oxidised waste from clogging and restricting infiltration; and evaluating optimum depth of materials and mixing techniques.

Investigations of soil preparation techniques will be an important part of the early rehabilitation programme (see Rehabilitation 1990–1992, below).

4.3.4.5 Revegetation

The MERIWA research (Fletcher *et al* 1989) has shown that when adequate site preparation has been undertaken, even on highly saline and sodic material, a range of salt resistant and salt tolerant species of *Atriplex* and *Maireana* can be established. These species are seen as providing an initial colonising community, but are known to be vulnerable to environmental variables such as drought. Therefore, the aim of the revegetation programme will be to introduce a wider range of species to assist in the development of a more diverse and resilient vegetation community.

The success of this aim is dependent upon the outcome of surface preparation evaluations previously discussed. As the surface preparation practices improve, vegetation monitoring will be used as a tool to evaluate and update the revegetation prescriptions.

The species which will be used in the early phase of the revegetation prescriptions will include species identified by Fletcher *et al* (1989), plus the species which are known to freely colonise in the field. (Section 4.3.5 provides an initial species list.)

The opportunity to introduce diversity into the revegetation programme is also dependent upon micro-topographic variability. It is anticipated that variation in slope morphology, surface roughness, drainage etc. will be used in the construction of waste dumps to encourage variation among the developing plant communities. The seeding programme will be selective and introduce species in accordance with natural plant affinities, e.g. *Melaleucas* on water-holding sites.

4.3.5 Implementation of the Programme

The initial phases of the rehabilitation programme will focus on three specific areas:

- Revegetation of existing disturbed areas within the mining zone and buffer zone. To be undertaken on an opportunistic basis.

- Landscaping around the Fimiston Plant (to improve aesthetic appearance and to mitigate dust). This will involve the planting of a tree belt around the plant site.

- Progressive waste dump rehabilitation. The guidelines for the initial phase of the rehabilitation programme follows.

The programme has been guided by DOM (1988b), Fletcher *et al* (1987), SAM (1987), AMIC (undated) and field observations of existing rehabilitation programmes in the Kalgoorlie area.

Progressive rehabilitation will be achieved by establishing outer slopes of the waste dumps in advance of infill dumping. In the early phases of the mining programme the western and northern faces of the northern dump will be developed for revegetation.

4.3.5.1 Rehabilitation Methods And Waste Dump Design Guidelines

4.3.5.1.1 Preparations Prior to Dumping

1. Delineate boundary of dumping area and define boundary with pegs.

2. Clear vegetation. Large timber should be removed first. If appropriate, any useful timber should be recovered for fence posts or firewood. Light scrub and branches of trees to be stockpiled for future respreading or directly applied to rehabilitation sites.

3. Strip topsoil and subsoil, relocate directly to rehabilitation site or stockpile. Topsoil and subsoil to be stripped as two distinct materials. The top 20cm should be stripped and classified as topsoil having low salinity levels and high seed store values. Subsoil will be obtained from below 20cm to a maximum depth defined by soil investigations.

4.3.5.1.2 Waste Dumping and Drainage

1. Prior to dumping, design details relating to micro-topographic modification should be established. Items to consider include: Variation in drainage design; final shape configuration; increasing the number of water-gaining sites and aesthetic considerations.

2. Define the ultimate toe of the slope.

3. Batter to designed angle and develop berms at 10 metre vertical intervals for 20° slopes (Fig 15). The berms provide access and act as contour drains (Fig 16). Berm width should be four to five metres wide, sufficient to accommodate earthmoving equipment during topsoil spreading. To minimise water velocities all berms will have surveyed slope of 0.5 per cent along their length and lead to vertical rock lined drains. Figure 16 shows a schematic cross section of berms.

4. Vertical waterways should be constructed using competent rock capable of resisting erosion. The spacing of the vertical waterways should be such that catchment areas do not exceed two hectares.

   The distance between vertical drains should not normally exceed 300 metres apart. At the base of the vertical waterways, rockfilled, energy absorbing sediment traps of approximately 10 metre diameter should be constructed. The sediment trap will flow out into a toe drain taking the water off-site in major storm events. Figure 17 provides design details of these structures.

4.3.5.1.3 Site Preparation and Revegetation

1. After battering of the slopes, approximately 50 cm of oxide waste material should be spread over the fresh rock.

2. Topsoil material should then be spread to a depth of 20 cm.

3. If available, light vegetation stripped prior to topsoil removal, bush litter, and road sweepings from Kalgoorlie-Boulder could be incorporated into the topsoil spreading programme.

4. Fertiliser – 400 kg/ha of Agras Cu-Mo-Zn, broadcast before deep ripping.

5. Deep ripping to a minimum of 0.75m should be carried out on the contour. The ripping should be carried out at intervals of <2m. Ripping should aim to key the top soil, oxide waste and rock materials together. The final surface should have a rough texture and incorporate stony material. The development of a rough surface texture will assist in water penetration and the creation of niches.

6. Seeding – 8 to 10 kg/ha of seed should be spread after the ripping programme. Seeding should be carried out before April each year. If fresh topsoil is available the rate of seed application could be reduced to 5–8 kg/ha.

Species Mix:

Atriplex bunburyana
A. stipitata
A. nummularia
A. vesicaria
A. amnicola ("Pintharuka" if available)
Maireana brevifolia
M. pyramidata
Acacia acuminata
A. sclerosperma
Eucaluptus brockwayi
E. lesoueffi
E. sargentii

Additional Species (Experimental)

Acacia victoriae
Eremophila scoparia
E. maculata
Frankenia spp.
Sclerolaena spp.
Ptilotus spp.

4.3.5.2 Existing Waste Dumps

The existing waste dumps will ultimately require rehabilitation treatment to ensure that a stable landform is established.

With the development of the ultimate pit boundaries some of this material is required to be relocated. One existing waste dump, from the Morrison Pit, is presently overlying tailings material which is part of the Kaltails project. This material is scheduled to be relocated during 1990/91. Figure 10 shows the ultimate location of this material.

The rehabilitation strategy for the existing waste dumps has not yet been finalised. The available options will be evaluated following an assessment of the total requirements for oxide material for the sheeting of fresh rock dumps.

The options include :

- The use of relocated material from the existing dumps for soil profile reconstruction on the main waste dumps.

- Establishing shallower slope angles by dumping fresh waste around the perimeter of the existing dumps.

- Establishing shallower angles by battering down the slopes of the existing dump profiles and creating stable landforms via incorporating benches and berms.

4.3.5.3. Rehabilitation 1990 - 1992

A major limiting factor during the first years of the programme will be the availability of outside slopes for rehabilitation. As a minimum, a 3 ha area will be established in 1991. This will act primarily as a trial for the purpose of determining the optimum topsoil and oxide depths for revegetation and stabilisation of waste dump surfaces. This trial will be established on the western face of the north dump.

The trial will be set up as a two-way factorial experiment, with topsoil depth and oxide subsoil depth being the factors under investigation. All combinations of three depths of oxide (20cm, 50cm and 100cm) and two depths of topsoil (10cm and 30cm) will be included, i.e. 6 treatments. Four 30m X 30m replicates of each treatment will be installed. All sites will be deep ripped to a minimum of 0.75m at a minimum spacing of 2m. Seeding prescriptions will be based on the guidelines above (section 4.3.5.1.3.), dependent upon the availability of species.

Monitoring and amendment will be carried out between 1992 to 1995 with results reported annually. Monitoring will consist of an evaluation of species density, species richness, survival and an index of vigour, using $1m^2$ quadrats.

Erosion evaluation will be based on semi-quantative assessments of the same quadrats. Broader-scale photographic monitoring also will be used.

4.3.6 Research and Monitoring

In the early phase of the rehabilitation programme research will concentrate on the resolution of the information gaps identified in section 4.3.4.

The priorities will be :

1. Topsoil availability, storage and handling, including an assessment of the option of utilising topsoil from the Kaltails project.

2. Geochemical evaluation of fresh rock to evaluate the potential for weathering and the formation of leachate having toxicity to plants.

3. Evaluation of waste volume and space requirements with the aim of reducing the slope angle of waste dumps.

4. Dump surface preparation trials to develop the most practical soil profile technique.

5. Evaluation of hydrological design options and drainage requirements.

6. Species selection trials when soil reconstruction techniques are better defined.

As the rehabilitation programme develops, monitoring will become an important part of the programme. Vegetation monitoring will aim to evaluate species density, species richness, survival and vigour. The primary aim of the monitoring will be to evaluate the seed prescription and to monitor the success of micro-topographic modifications incorporated into the programme. Sampling will be based on $1m^2$ quadrants at 10m intervals along randomly-sited 100m transects.

Runoff, erosion and sediment transport monitoring will be based on analysis of the water quality of runoff captured in sediment traps. The aim of this monitoring will be to establish whether the methods applied are effective in reducing sediment load over time.

Photographic monitoring will be undertaken from fixed stations to establish a record of the appearance of the developing vegetative cover. Photography will be taken twice a year, providing a record of summer drought condition and winter growth appearance.

The monitoring programme will be reported annually and provide the basis for modifications to the programme. Modifications will be foreshadowed in the annual report.

5.0 SOCIAL IMPACTS

5.1 ABORIGINAL SITES

Surveys carried out by the Western Australian Museum, and more recently by R. O'Connor and G. Quartermaine, have identified several sites of significance to Aborigines to the north of the Fimiston pit area. These are:

- Nanny Goat Hill (Mt Gleddon/Marilana Hill) (on lease no. M26/53)
- Muruntjarta (on lease no. M26/54)
- Mount Charlotte (on lease no. M26/48)
- Microwave Tower Hill (on lease no. M26/63)
- Kalgoorlie Aboriginal Reserve
- Ninga Mia
- Rockhole (unnamed)
- Kalgurlanya Rockhole

All of these sites have been inspected and found to be severely degraded, being littered with disused mining machinery and rubbish. They are, however, still considered significant by the local Aborigines.

The Muruntjarta site is close to the Fimiston pit. However, this part of the lease area is not intended to be part of the currently proposed open cut mine or waste dumps, and precautions will be taken to ensure that it is not damaged or degraded by the mining or associated operations.

None of the other sites are within the area covered by this CER. Any future northerly extension of the Fimiston pit will have the potential to affect these sites. Their protection will be discussed in a CER or similar document if and when the need arises.

If any artefact scatters or archaeological sites should become apparent during the life of the project, the Proponent will immediately notify the Department of Aboriginal Sites. The Proponent will comply with the Aboriginal Heritage Act (1972–1980).

The full report of an archaeological and ethnographic survey conducted by O'Connor and Quartermaine (1989) is presented in Appendix B.

5.2 EUROPEAN HERITAGE

A search has been made of both the National Trust's Register and the National Estate Register for historic sites. In both cases no registered, interim listed or nominated places are present in the vicinity of the project area.

5.3 LAND USE

5.3.1 Land Tenure

The land tenure in the vicinity of the Fimiston pit and associated infrastructure is detailed in Appendix C. The plans also indicate those public roads that are to be degazetted.

5.3.2 Townsites

The uninhabited Brown Hill and Trafalgar townsites will be almost completely covered by waste dumps. The City of Kalgoorlie–Boulder has approved the cancellation of these townsites. To this end, all of the available freehold and leasehold land has been purchased and subsequently transferred or surrendered to the Crown. Other freehold land, apparently abandoned and for which the owners could not be located, is being revested by the City of Kalgoorlie–Boulder for non–payment of rates. The most recent dealing on any of this land was in 1921.

The City of Kalgoorlie–Boulder has also initiated degazettal of all of the roads within the townsites, other than those currently in use (Appendix C).

5.3.3 Reserves

All Reserves within the townsites have now been cancelled in association with the cancellation of the townsites. The only Reserve not within a townsite and affected by the operation is Parklands Reserve 35662. Consent to dump waste on that Reserve has been granted by the Minister for Mines subject to certain additional conditions imposed upon the relevant mining tenements.

5.3.4 Tourist Railway

A portion of the Golden Mile Loopline Railway Reserve is leased by the Kalgoorlie–Boulder Tourist Bureau Inc. from Westrail for a period of 21 years expiring on 31 August 2003. The tourist railway being operated on the Reserve will be able to continue for some years, but its position within the boundary of the planned pit will necessitate its eventual partial relocation. Discussions are proposed with Westrail and the current leaseholders with the aim of arranging a suitable site for relocation.

5.3.5 Other Mining Operations

Potential areas of conflict between KCGM and the Kaltails tailings retreatment programme are provided for in an agreement between the parties.

Balgold Nominees Pty Ltd are managing a mining operation immediately to the east of the existing Oroya tailings dam on Mining Lease 26/86. In addition, Balgold are treating tailings within the Project Area under licence from Kalgoorlie Lakeview Pty Ltd. An agreement is being negotiated between the parties which will, interalia, provide for the acquisition of Mining Lease 26/86 by KCGM at the completion of the Balgold operation.

5.3.6 Hainault Tourist Mine

This tourist attraction lies on the western side of the southern portion of the project area, and will be affected by the current proposal. The mine is owned by North Kalgurli Mines Ltd, and discussions with the current managers are in progress concerning resumption of the area and the relocation of the tourist mine to a suitable alternative site.

5.3.7 Other Landowners

Discussions are continuing with a small number of other owner–occupiers directly affected by the mining with a view to acquiring their properties.

5.3.8 Buffer Zone

DOM (1989) proposed the development of a Buffer Zone in the "Conceptual Plan for Mining Developments on the Golden Mile". The establishment of a buffer zone

would ensure that a spatial separation between the mining activity and the residential areas of Kalgoorlie–Boulder is maintained.

The concept of the Buffer Zone has been discussed in Section 4.3.3. Establishment of the zone will be co–ordinated by the Golden Mile Mining Development Planning Committee.

5.4 SOCIAL ENVIRONMENT

In 1988 the Department of Land Administration prepared a Structure Plan for the City of Kalgoorlie–Boulder, directing future urban expansion to the west of existing urbanised zones and away from the Golden Mile. This plan takes into account increased gold mining activity and encompasses an area sufficiently large to accommodate future population growth.

However, the City of Kalgoorlie–Boulder has traditionally developed in very close proximity to the Golden Mile (Figure 1) and some of the most important potential impacts of the proposed project are social.

5.4.1 Benefits of the Project

KCGM's plan to consolidate operations and thus more efficiently utilise its resource will bring considerable local, state and national benefits.

5.4.1.1 Economic Benefits

In terms of national and state benefits the project will contribute to the Gross National Product in terms of increased gold production and sustained employment. The proposed expansion of open–cut mining will make KCGM the largest gold producer in Australia, contributing approximately 13% of Australia's total estimated gold production of 200tpa.

Closure of some surface–based facilities such as the Paringa plant will result in changes to the composition of the KCGM workforce, but as the open cut expands the proponent anticipates that the existing workforce will be largely sufficient for the planned operations. Details of anticipated workforce requirements are given in Section 3.3.

The existing workforce is drawn from the adjacent City of Kalgoorlie–Boulder and is relatively stable. It is expected that the operation will remain a large employer in the region.

As a result of the expansion of open–cut mining, the benefits to employment are expected to include:

- continuation of relatively stable project employment conditions
- continuation of indirect and induced employment benefits in the region
- enhancement of long–term employment prospects.

5.4.1.2 Air Quality Benefits

On a local level, air quality has been a fundamental issue of health in the City. There have been three roasters operating in the vicinity of the Fimiston Pit (Croesus, Paringa, Oroya).

In its continuing commitment to improve the air quality in Kalgoorlie–Boulder, the proponent will complete the relocation of all roasting capacity from the locations adjacent to the urban zone, to the Gidji roaster site, by the end of 1991. This relocation is resulting in a substantial improvement in air quality in and around Kalgoorlie–Boulder.

KCGM will maintain its programme whereby SO2 levels are monitored at various points in and around Kalgoorlie.

5.4.2 Potential Adverse Impacts

The impacts of dust, noise and ground vibration on local residents have been discussed in Sections 4.2 and 4.3 and strategies for their amelioration and management are outlined there.

In summary, the proponent considers that these impacts can be managed so as not to become a public nuisance. The proponent is committed to keeping dust, noise and ground vibration impacts to a minimum.

While there may be an initial loss of visual amenity from those areas close to the Golden Mile, the already considerable degradation of the site and, above all, the proponent's commitment to rehabilitation will minimise, and ultimately reverse, this impact.

ACKNOWLEDGEMENTS

This document has been prepared by Kalgoorlie Consolidated Gold Mines with the assistance of Whelans – Planning and Environmental Division. An earlier draft was prepared with the assistance of Dames and Moore.

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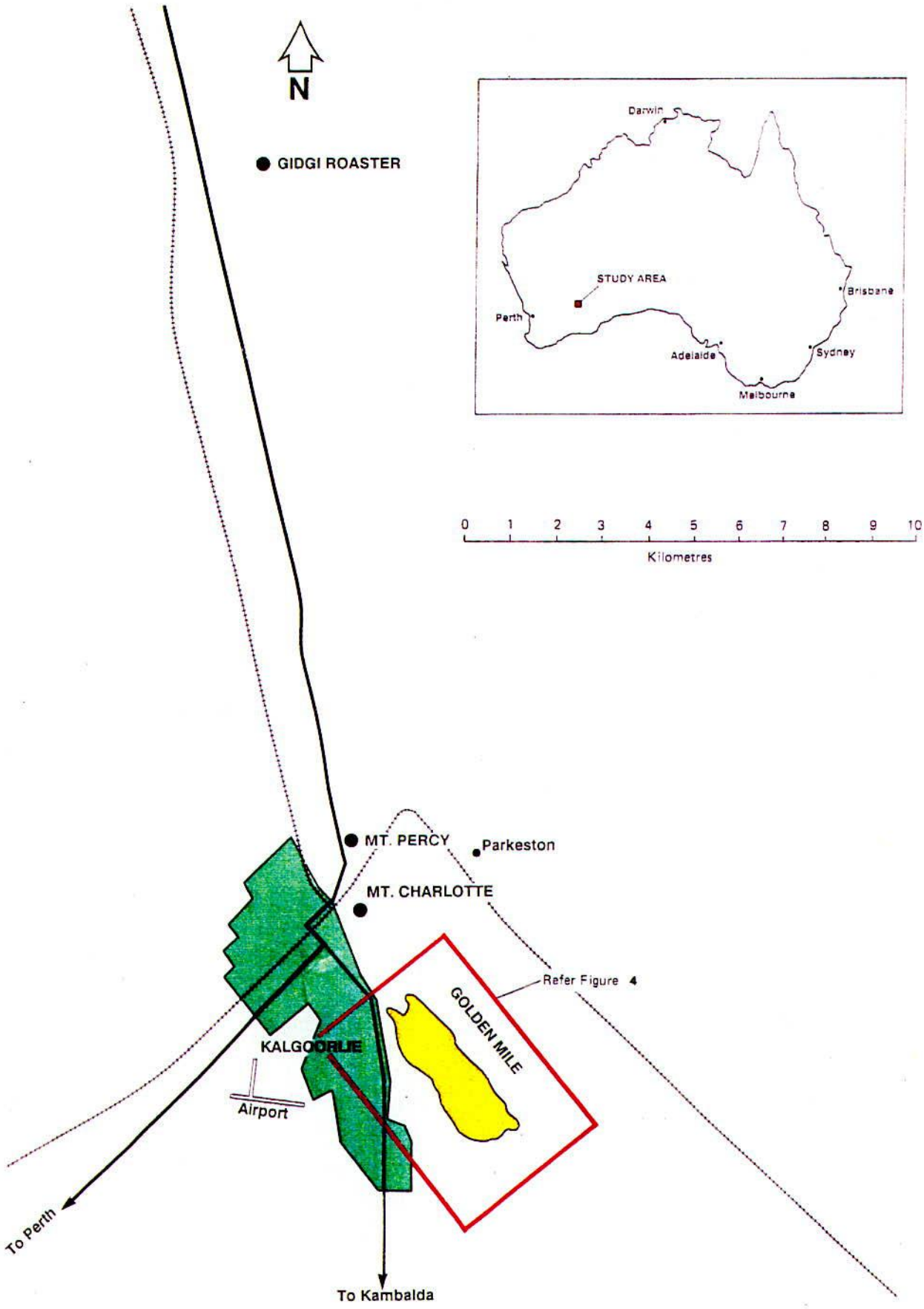
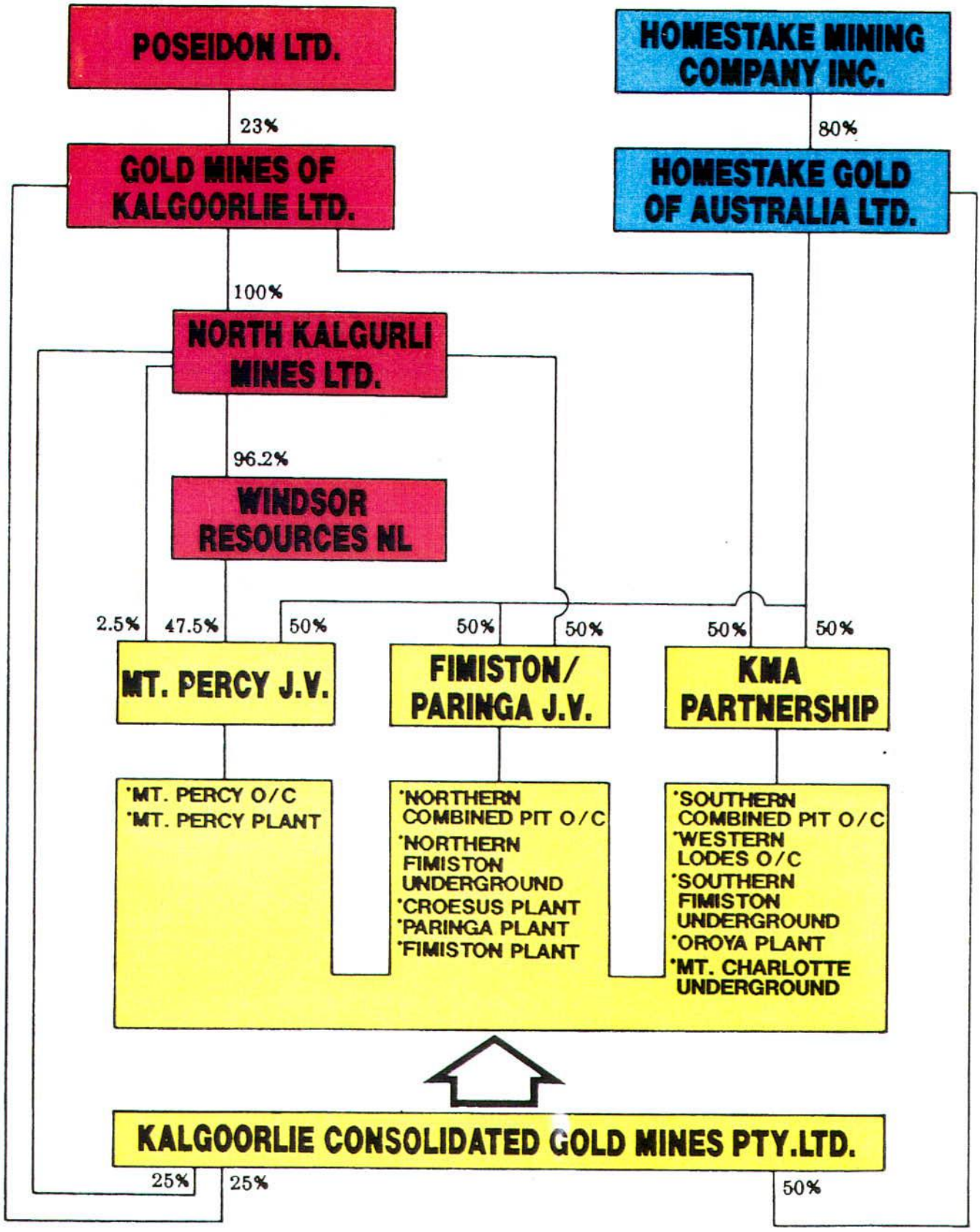


LOCALITY PLAN

FIGURE 1

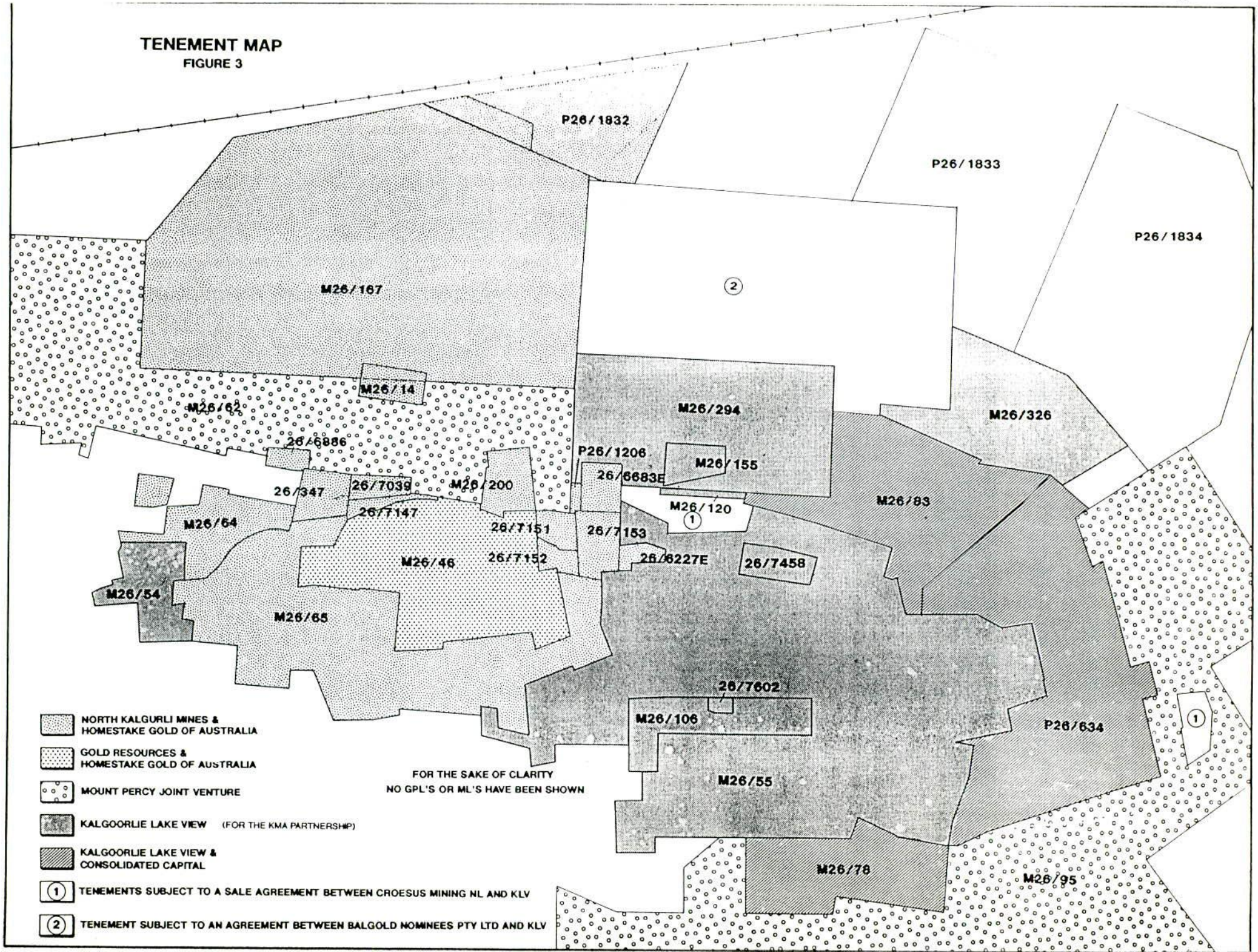


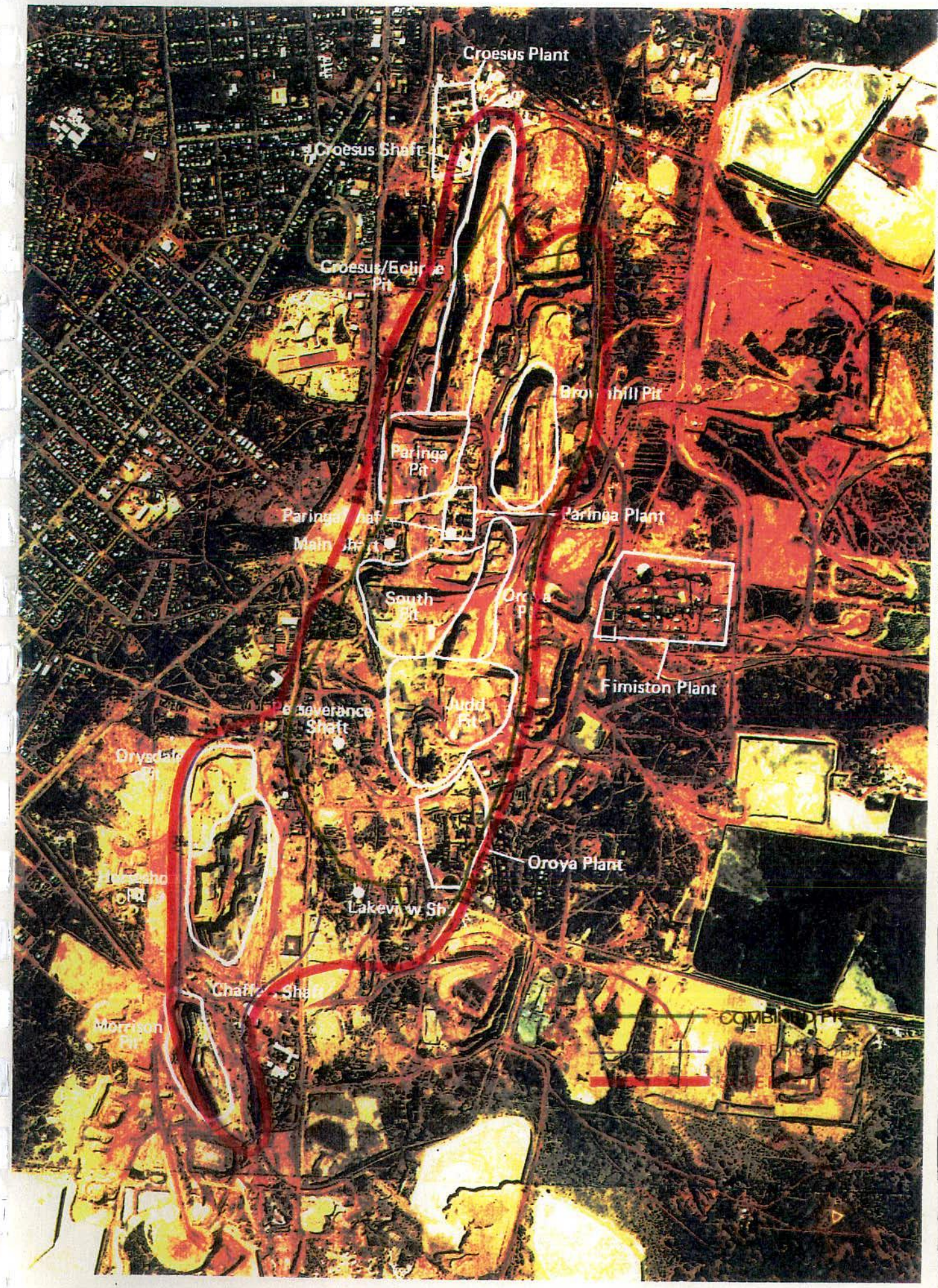
OWNERSHIP AND MANAGEMENT STRUCTURE

FIGURE 2

TENEMENT MAP

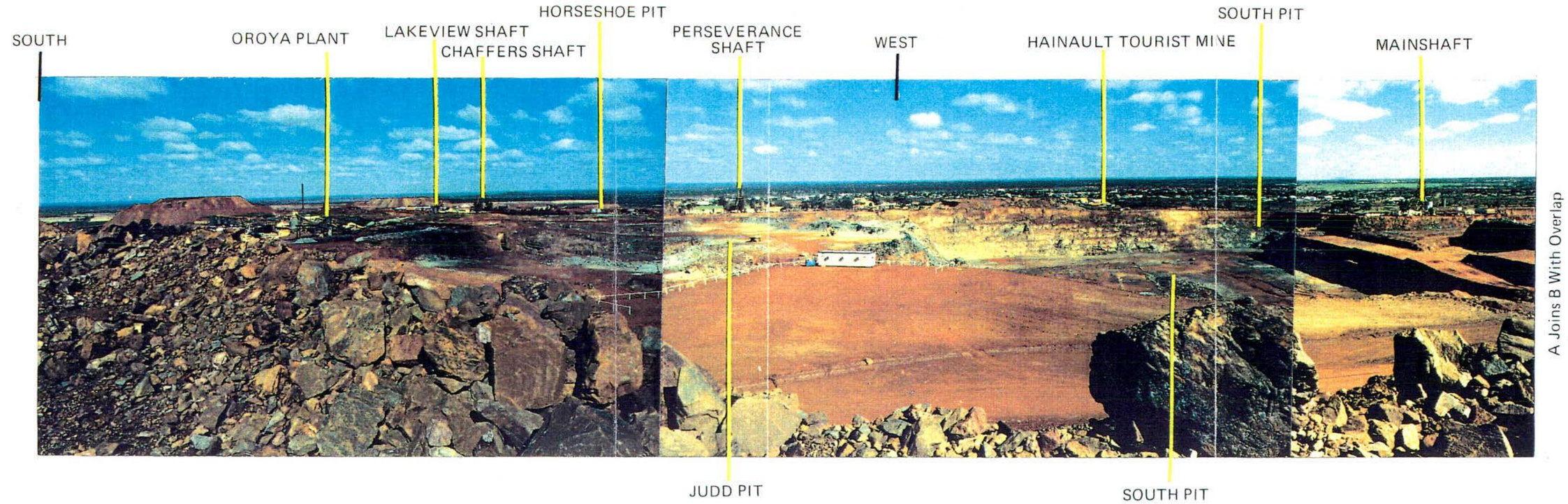
FIGURE 3





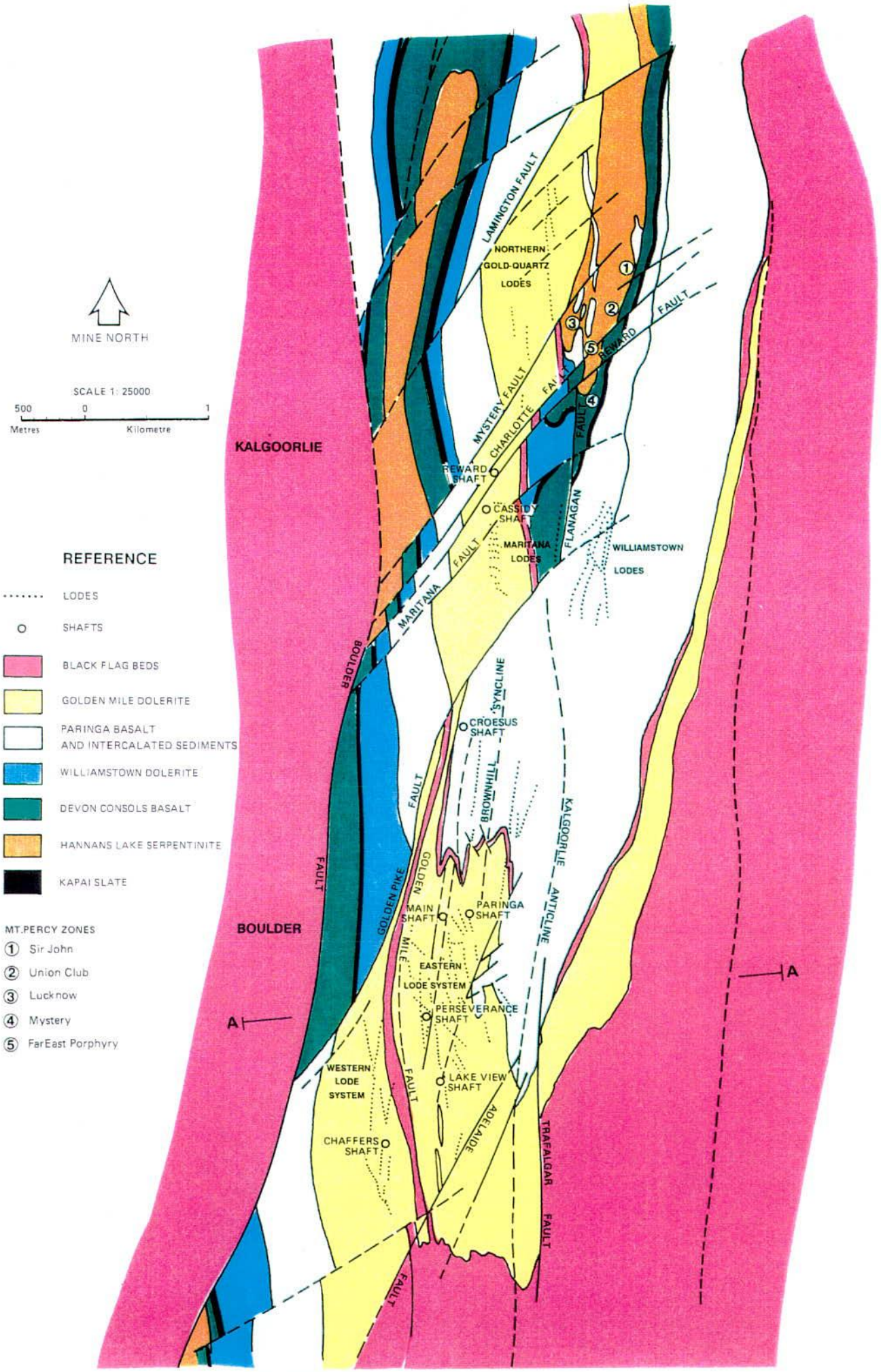
GOLDEN MILE DISTRICT
EXISTING PITS, PLANTS & SHAFTS

FIGURE 4



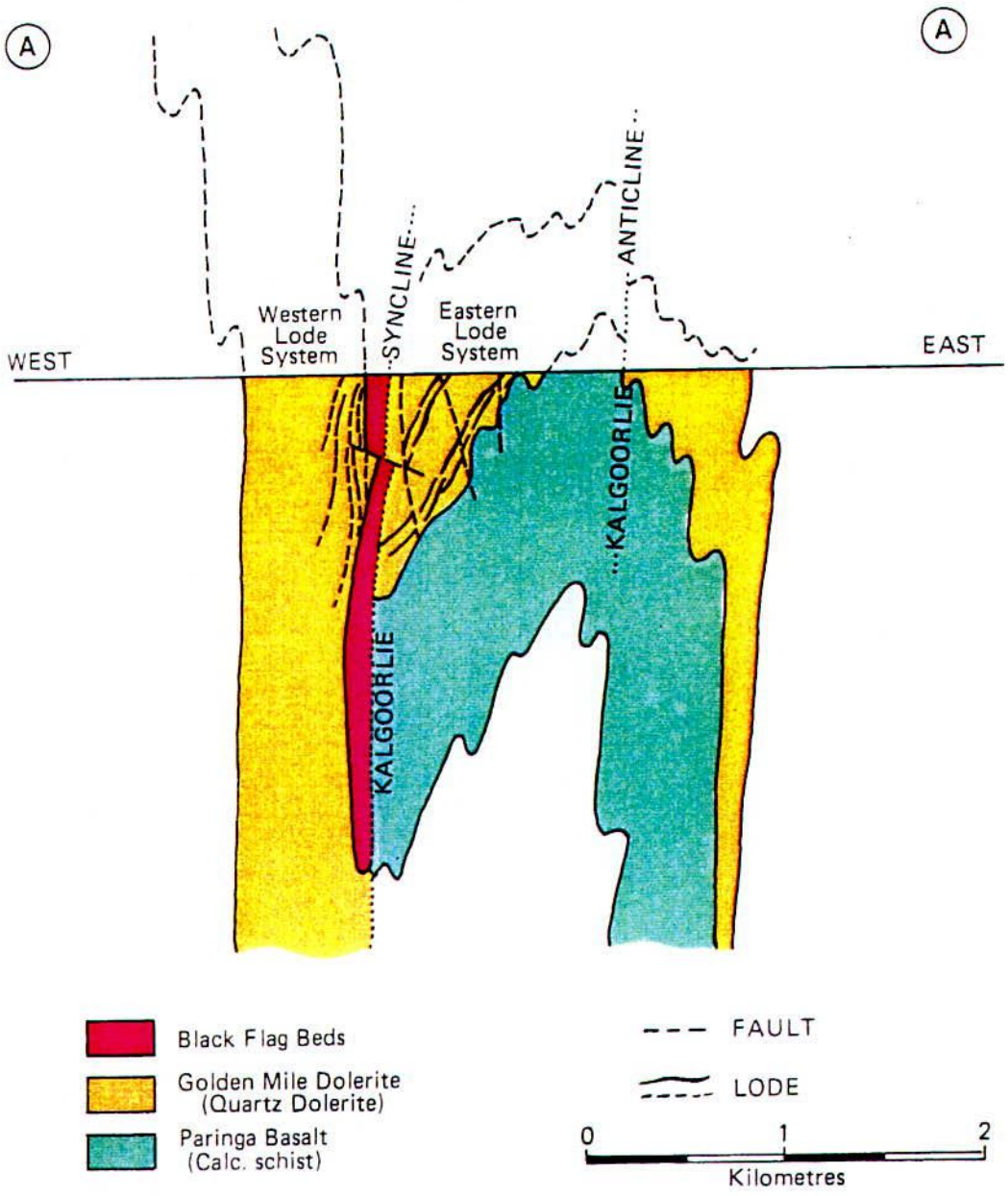
PANORAMA OF GOLDEN MILE DISTRICT

FIGURE 5



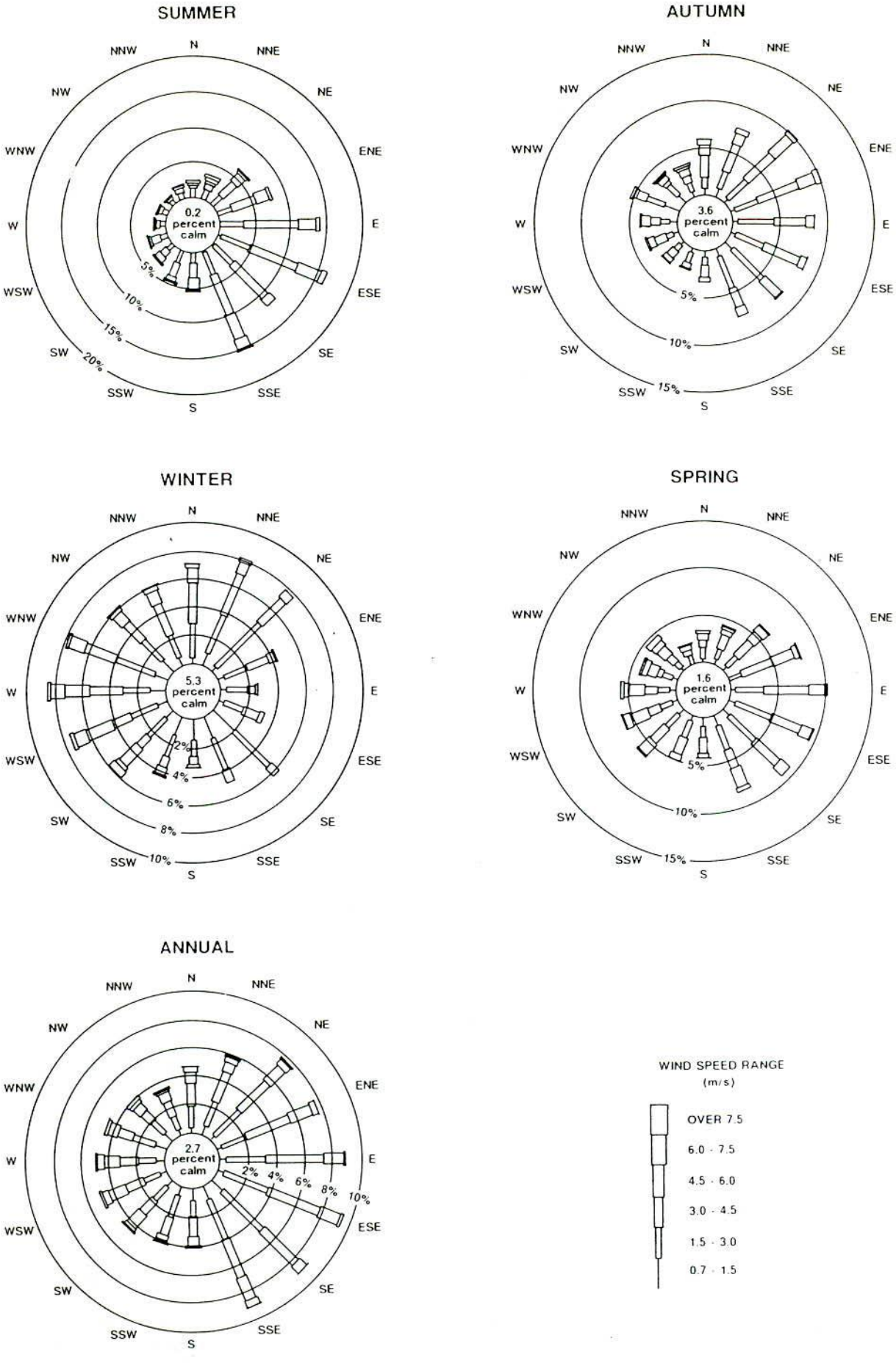
KALGOORLIE GEOLOGICAL PLAN

FIGURE 6



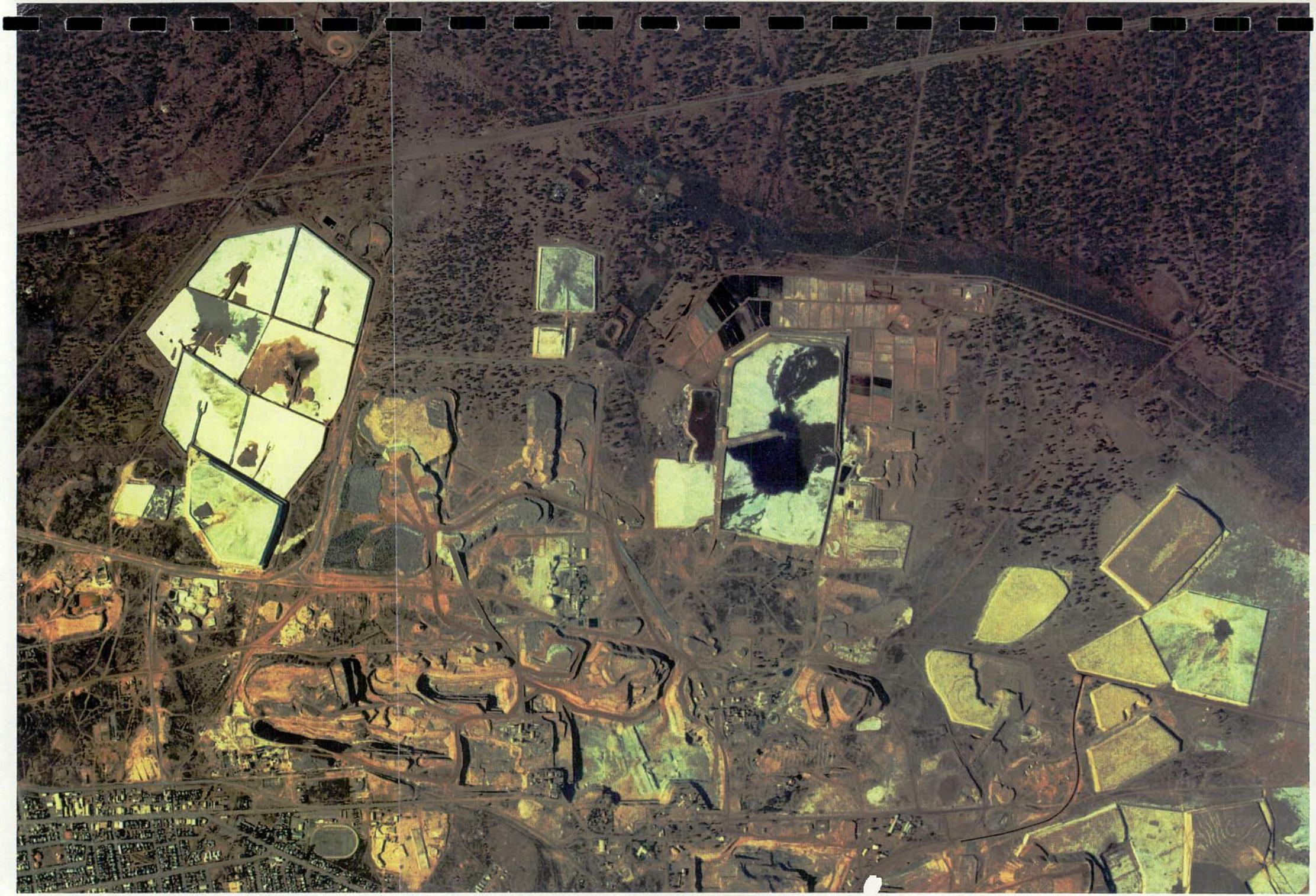
STYLISED CROSS SECTION AA - GOLDEN MILE

FIGURE 7



SEASONAL & ANNUAL WINDROSES FROM EPA DATA FOR 1984

FIGURE 8



EXISTING IMPACT MAY 1990

FIGURE 9

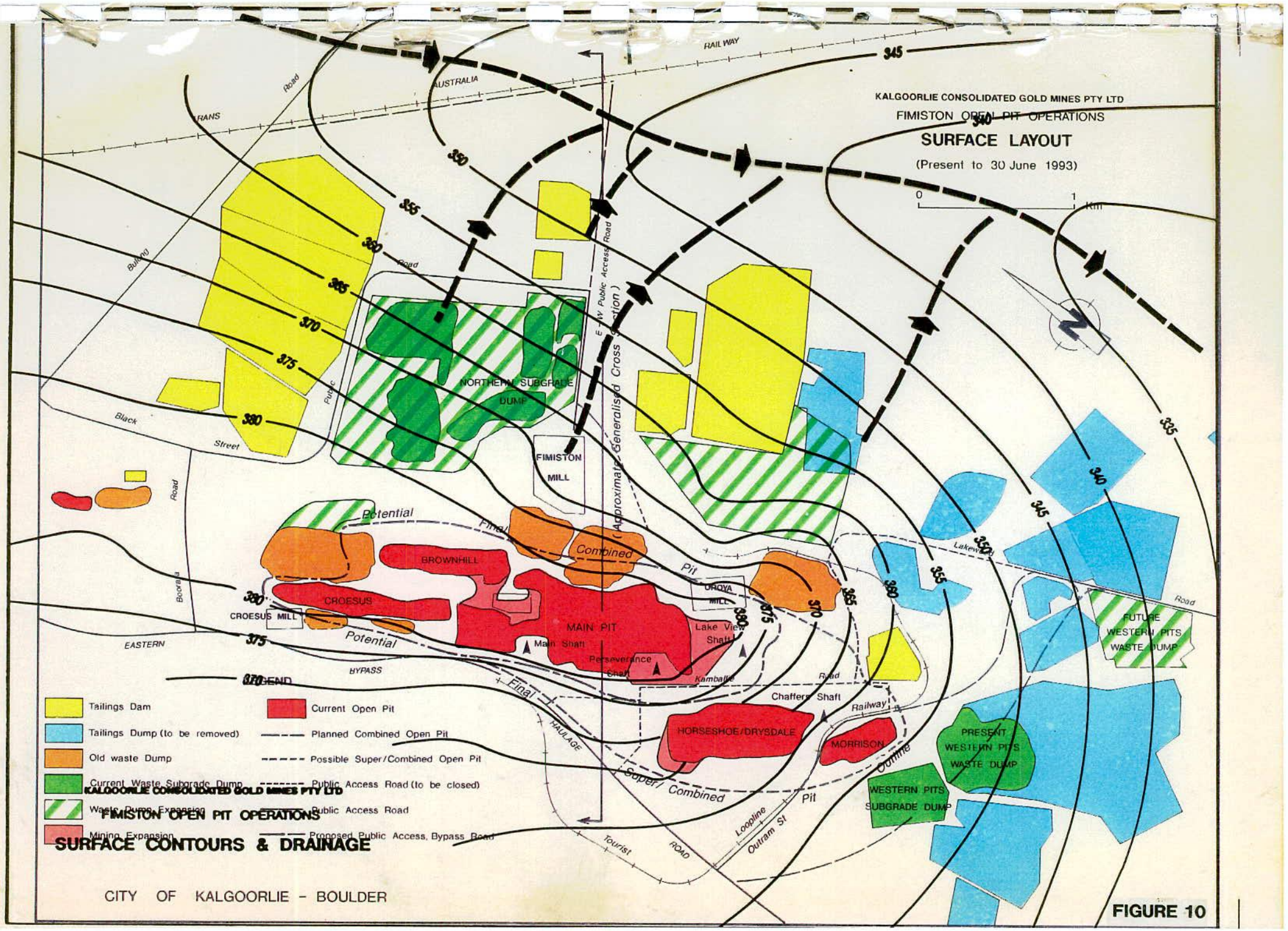
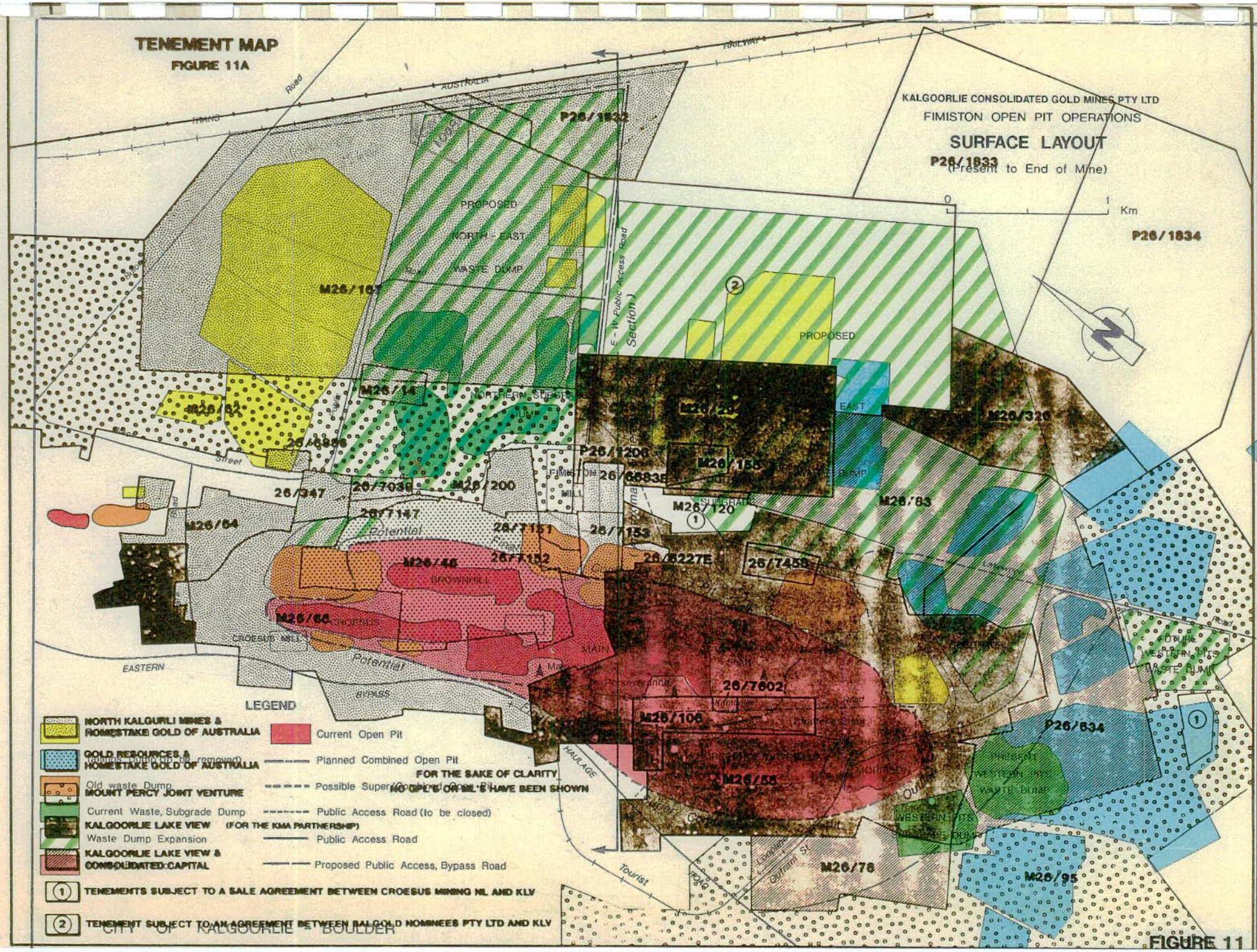
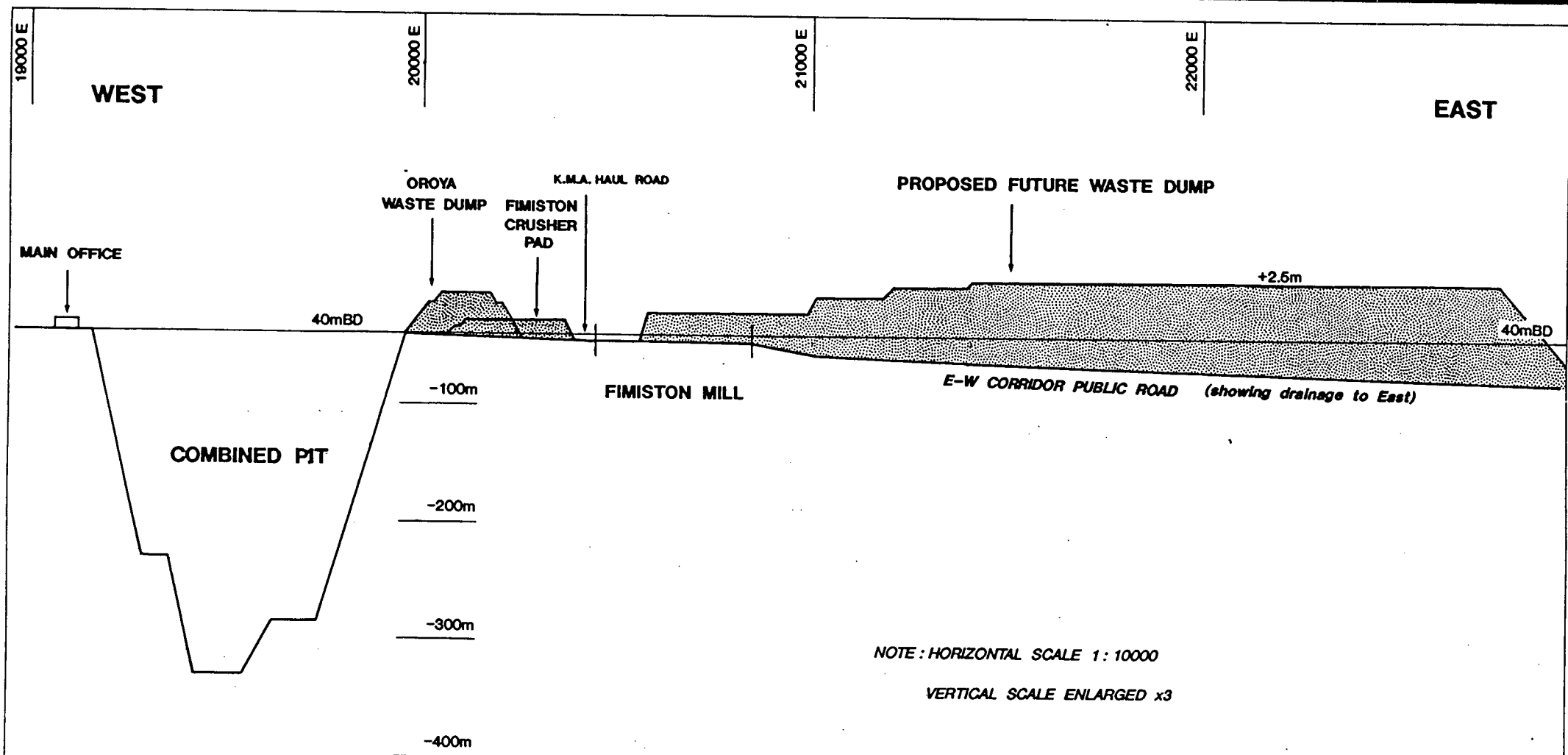

KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD
FIMISTON OPEN PIT OPERATIONS
SURFACE LAYOUT
(Present to 30 June 1993)
0
1
km
RAILWAY
AUSTRALIA
TRANS
Road
Bulong
Road
Black
Street
Public
E-W Public Access Road
(Approximate Generalised Cross Section)
NORTHERN SUBGRADE DUMP
FIMISTON MILL
Potential
Final
Combined
Pit
BROWNHILL
CROESUS
CROESUS MILL
OROYA MILL
MAIN PIT
Main Shaft
Perseverance Shaft
Lake View Shaft
Potential
Final
EASTERN
BYPASS
Kambalda
Road
Chaffers Shaft
Railway
HORSESHOE/DRYSDALE
MORRISON
HAULAGE
Super/Combined
Pit
Outline
Loopline
Outram St
Tourist
ROAD
Lakeway
Road
FUTURE WESTERN PITS WASTE DUMP
PRESENT WESTERN PITS WASTE DUMP
WESTERN PITS SUBGRADE DUMP
Boorara
Road
345
340
335
330
325
320
315
310
305
300
295
290
285
280
275
270
LEGEND
Tailings Dam
Tailings Dump (to be removed)
Old waste Dump
Current Waste Subgrade Dump
Waste Dump Expansion
Mining Expansion
Current Open Pit
Planned Combined Open Pit
Possible Super/Combined Open Pit
Public Access Road (to be closed)
Public Access Road
Proposed Public Access, Bypass Road
KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD
FIMISTON OPEN PIT OPERATIONS
SURFACE CONTOURS & DRAINAGE
CITY OF KALGOORLIE - BOULDER

FIGURE 10


TENEMENT MAP
FIGURE 11A
KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD
FIMISTON OPEN PIT OPERATIONS
SURFACE LAYOUT
P26/1833
(Present to End of Mine)
0
1
Km
P26/1834
PROPOSED
NORTH - EAST
WASTE DUMP
PROPOSED
EAST
NORTHERN SUPER PIT
FIMISTON MILL
SUBGRADE
Potential
Potential
BROWNHILL
CROESUS MILL
EASTERN
bypass
MAIN
Perseverance
HAULAGE
Tourist
Loopline
Eastern Pit
WESTERN PITS WASTE DUMP
LEGEND
NORTH KALGURLI MINES & HOMESTAKE GOLD OF AUSTRALIA
GOLD RESOURCES & HOMESTAKE GOLD OF AUSTRALIA
Old waste Dump
MOUNT PERCY JOINT VENTURE
Current Waste, Subgrade Dump
KALGOORLIE LAKE VIEW
Waste Dump Expansion
KALGOORLIE LAKE VIEW & CONSOLIDATED CAPITAL
Current Open Pit
Planned Combined Open Pit
Possible Super/Combined Open Pit
Public Access Road (to be closed)
(FOR THE KMA PARTNERSHIP)
Public Access Road
Proposed Public Access, Bypass Road
FOR THE SAKE OF CLARITY
NO DUMPS OR PITS HAVE BEEN SHOWN
1 TENEMENTS SUBJECT TO A SALE AGREEMENT BETWEEN CROESUS MINING NL AND KLV
2 TENEMENT SUBJECT TO AN AGREEMENT BETWEEN BALGOLD NOMINEES PTY LTD AND KLV
CITY OF KALGOORLIE - BOULDER
FIGURE 11

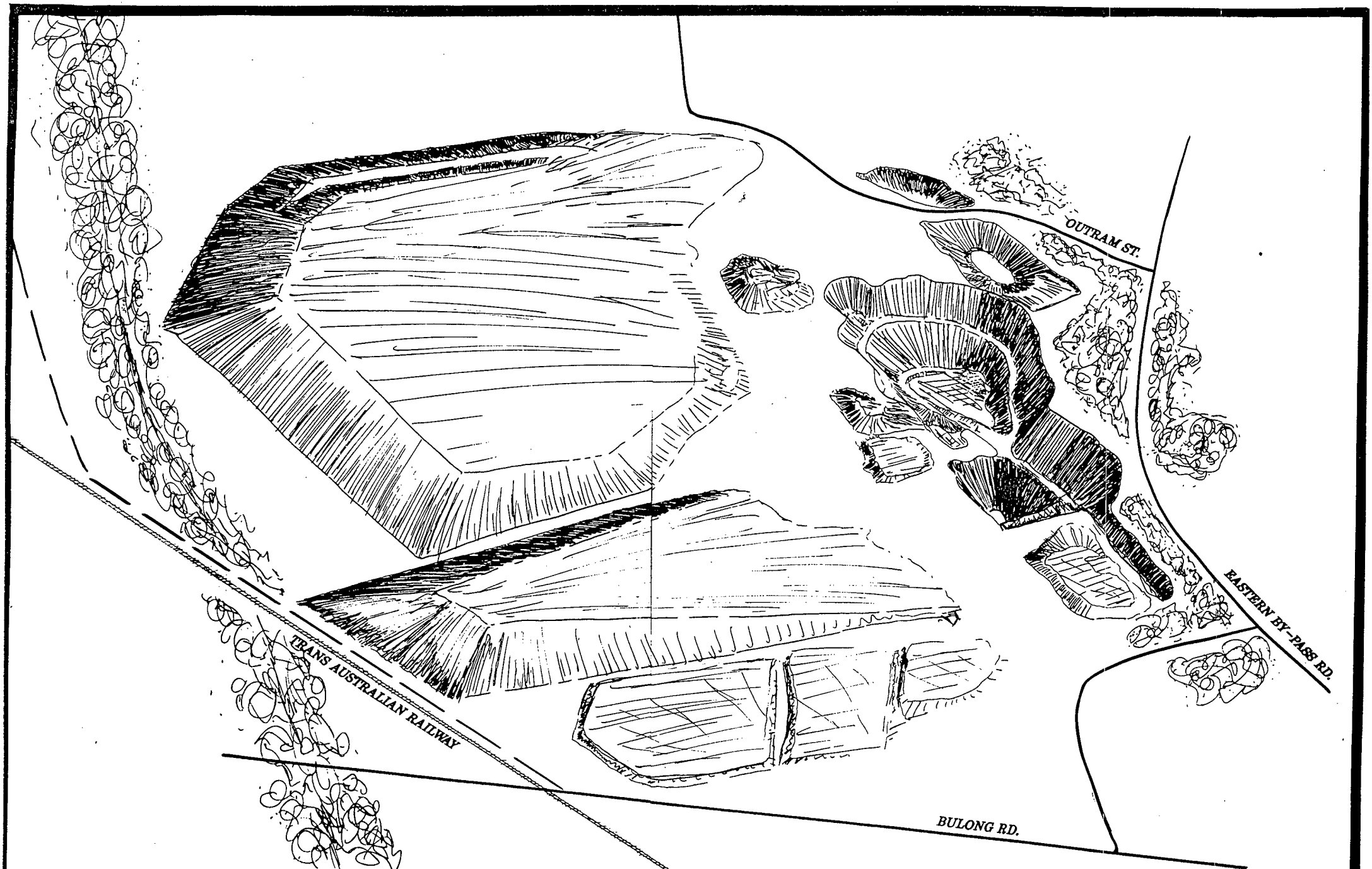


KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD

FIMISTON LEASES

GENERALISED CROSS SECTION THROUGH COMBINED PIT

SCALE: 1 : 10000	DATE: July 1990	FIGURE 12



ELEVATED VIEW OF WASTE DUMPS AND OPEN PIT FIGURE 13

(INTENDED AS A PRELIMINARY REPRESENTATION ONLY – TO BE REPLACED BY A MODIFIED PHOTOGRAPHIC IMAGE WHEN AVAILABLE)

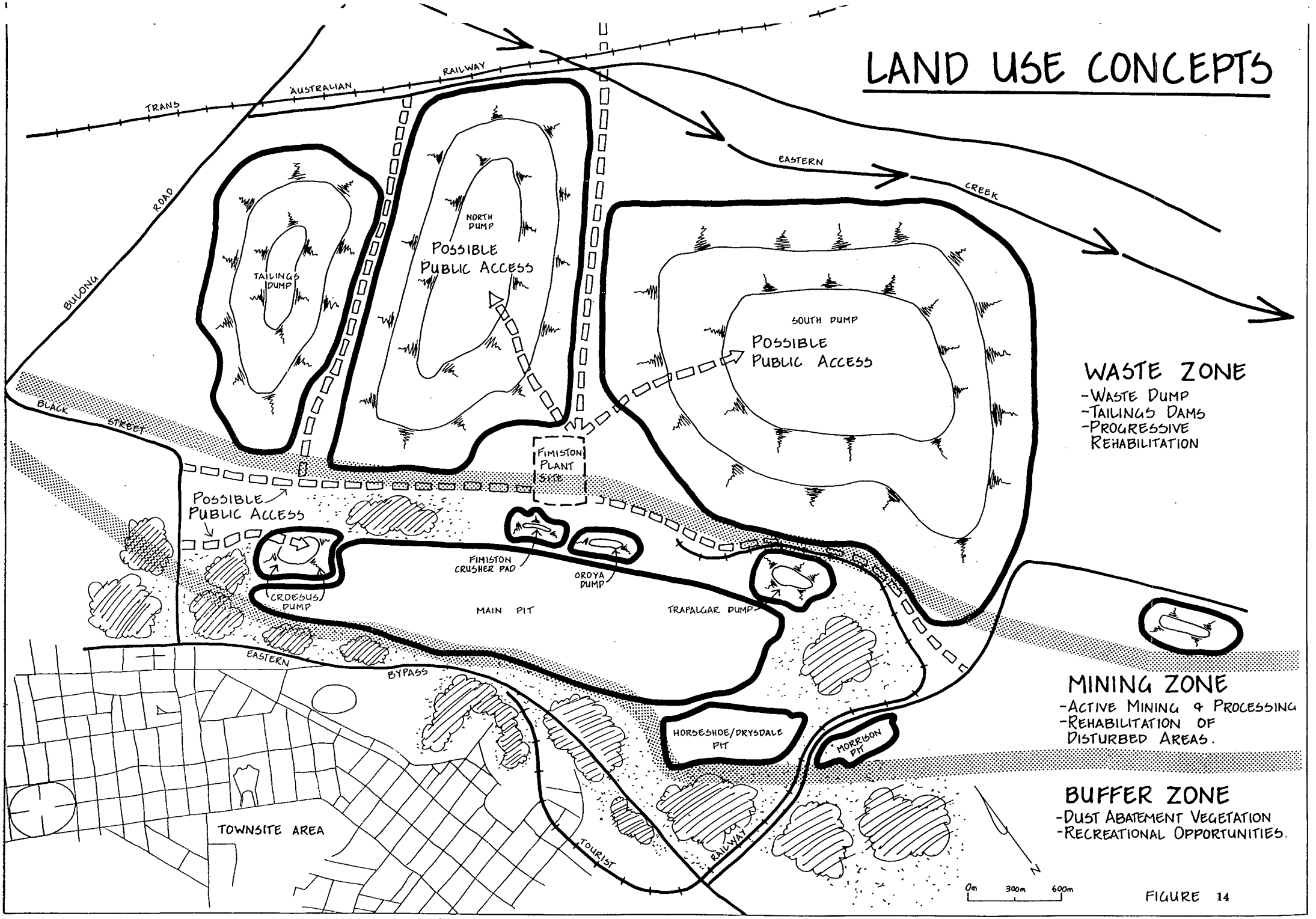

LAND USE CONCEPTS
TRANS AUSTRALIAN RAILWAY
EASTERN CREEK
BULONG ROAD
TAILINGS DUMP
NORTH DUMP
POSSIBLE PUBLIC ACCESS
SOUTH DUMP
POSSIBLE PUBLIC ACCESS
BLACK STREET
FIMISTON PLANT SITE
POSSIBLE PUBLIC ACCESS
FIMISTON CRUSHER PAD
OROYA DUMP
CROESUS DUMP
MAIN PIT
TRAFALGAR DUMP
EASTERN BYPASS
HORSESHOE/DRYSDALE PIT
MORRISON PIT
TOWNSITE AREA
TOURIST
RAILWAY
WASTE ZONE
-WASTE DUMP
-TAILINGS DAMS
-PROGRESSIVE REHABILITATION
MINING ZONE
-ACTIVE MINING & PROCESSING
-REHABILITATION OF DISTURBED AREAS.
BUFFER ZONE
-DUST ABATEMENT VEGETATION
-RECREATIONAL OPPORTUNITIES.
N
0m 300m 600m

FIGURE 14

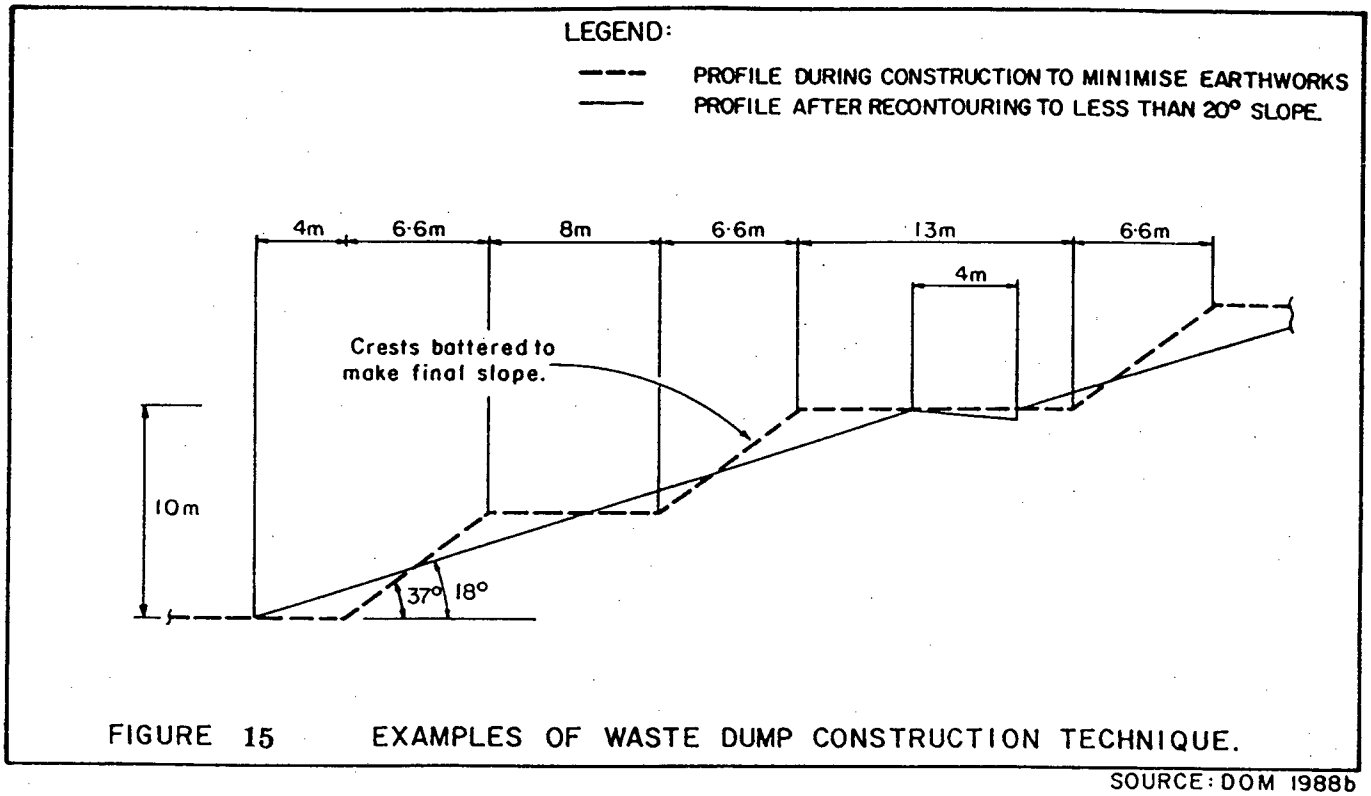


FIGURE 15 EXAMPLES OF WASTE DUMP CONSTRUCTION TECHNIQUE.

SOURCE: DOM 1988b

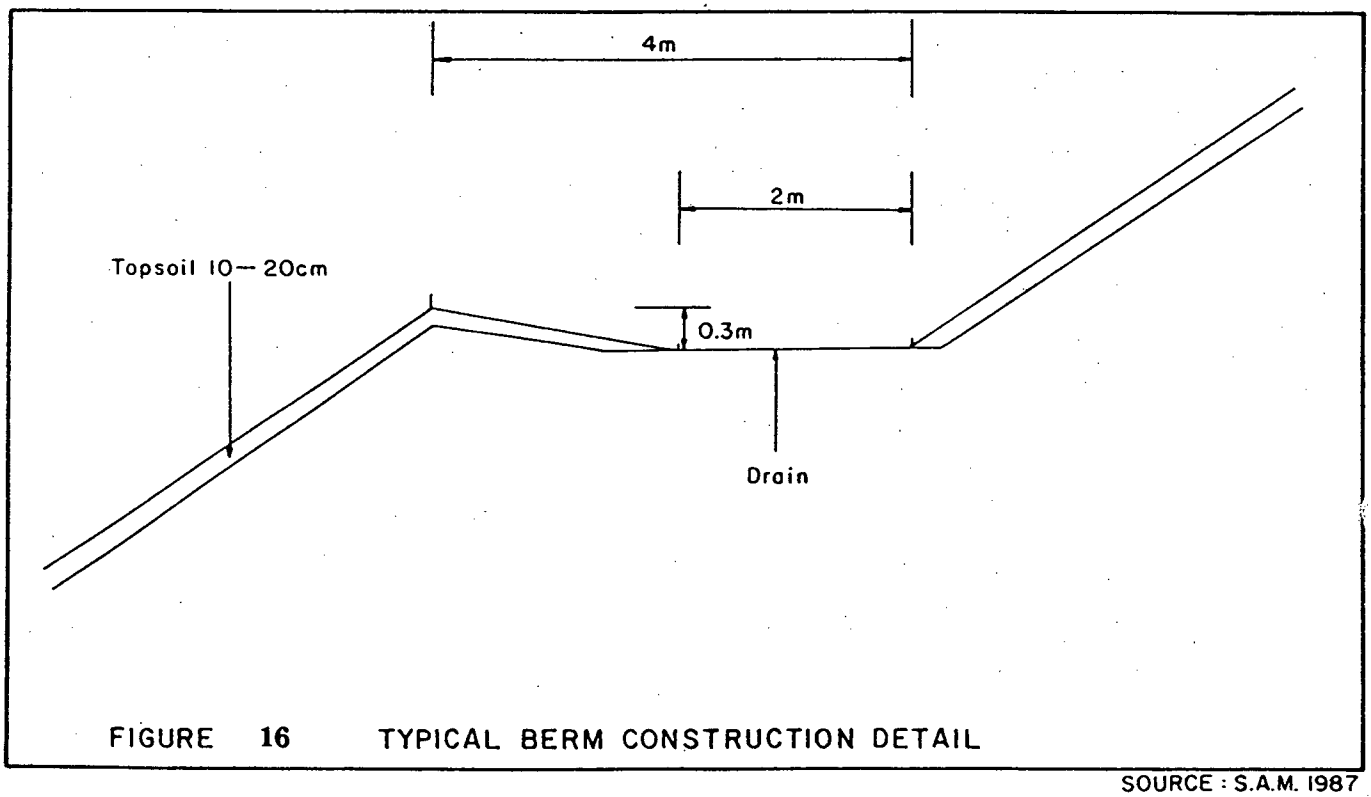
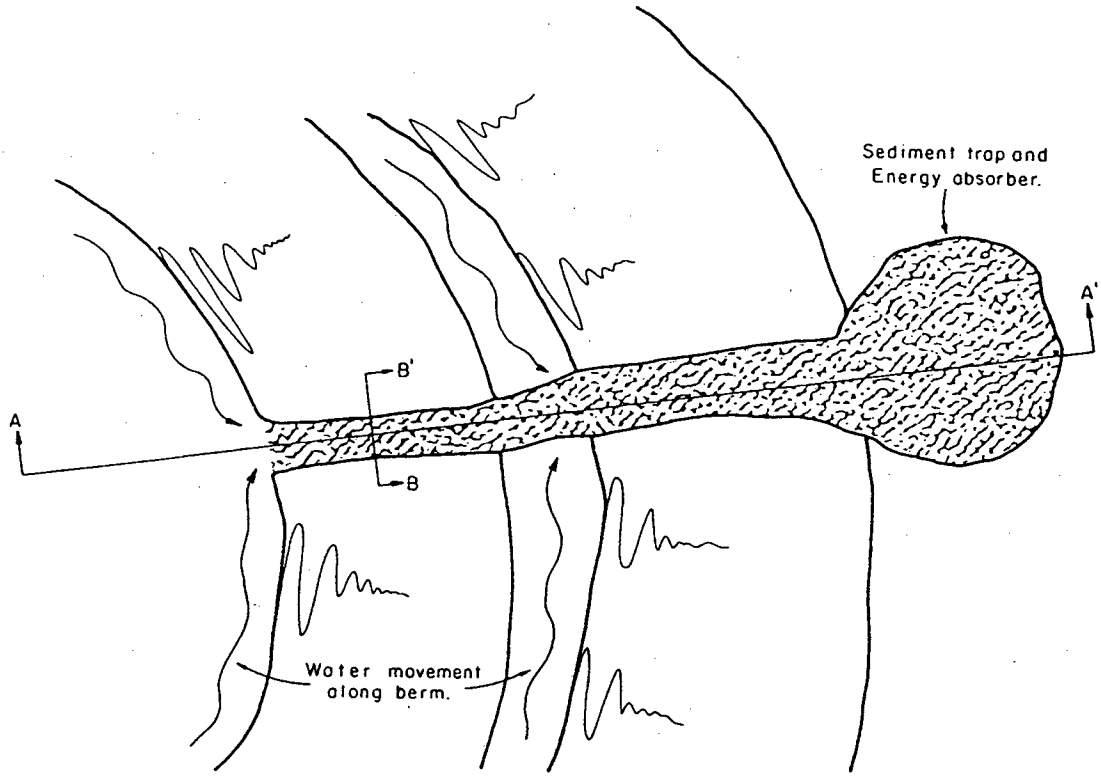


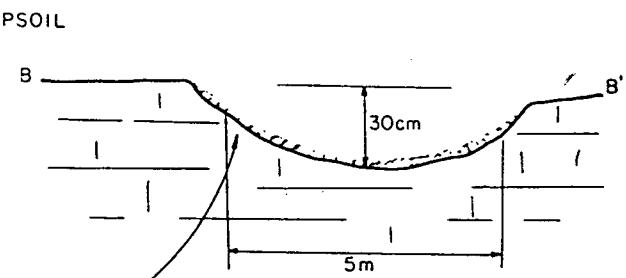
FIGURE 16 TYPICAL BERM CONSTRUCTION DETAIL

SOURCE : S.A.M. 1987

SCHEMATIC DIAGRAM OF VERTICAL DRAINAGE
PLAN VIEW



SECTION B-B'



SECTION A-A'

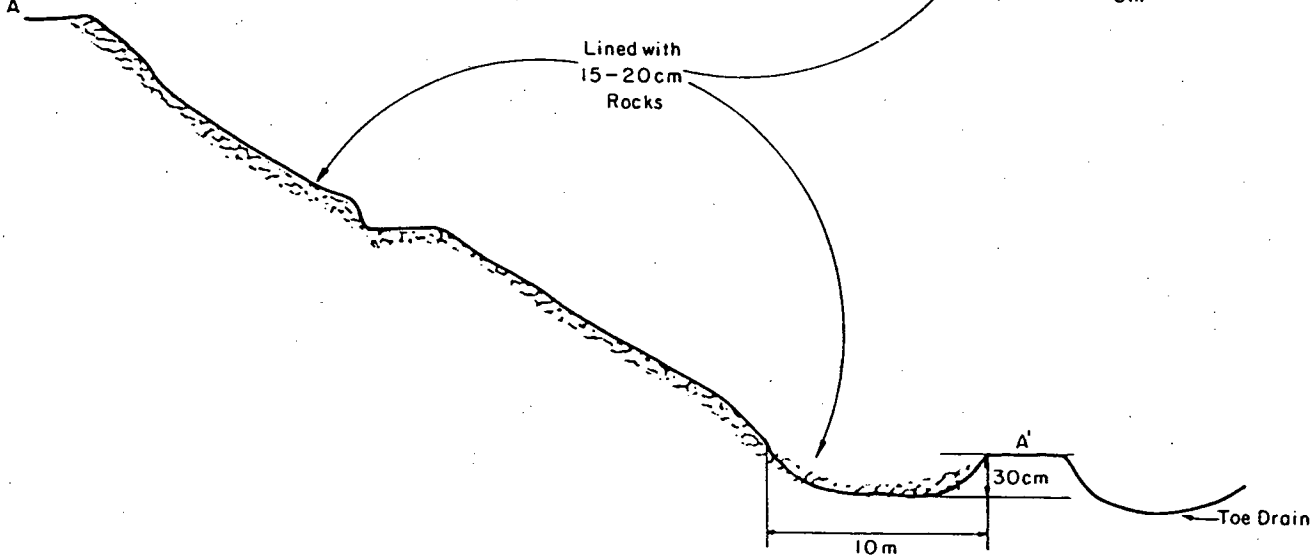


FIGURE 17.

APPENDIX A

GUIDELINES FOR PREPARATION OF CONSULTATIVE ENVIRONMENTAL REVIEW (CER) FOR MINE AND WASTE DUMPS - FIMISTON

1.0 INTRODUCTION

1.2 SUMMARY

A brief summary of proposal covering major features should be given.

1.3 OBJECTIVES

Brief summary of the scale and type of operation planned eg. to develop an open-cut gold mine and associated waste dumps, consolidation of existing operations in the area, etc.

1.4 LOCATION

A plan to be provided showing tenements, location of various facilities, and an aerial photograph should be provided.

1.5 OWNERSHIP

Lessees of all tenements covered by proposed operation, status on any joint ventures and name of managing/operating company.

1.6 HISTORY

Extent of previous mining activity in the area, amount of ground disturbance, exploration activities, etc. Outline of project rationalisation, highlight removal of roasters from town, Golden Mile Environmental Strategy with opportunity for public input, GMMDPC and the Conceptual Plan.

1.7 EXISTING FACILITIES

Brief description of existing facilities at operating site, and planned use of any nearby facilities, including the use of public roads and other infrastructure.

2.0 EXISTING ENVIRONMENT

2.1 GEOLOGY

Brief description of geology specific to the area of interest including a basic description of the mineralisation and ore reserves.

2.2 HYDROLOGY

Brief summary of surface and subsurface water flows and quality as they relate to the project and facilities. Details of the project water requirements including the source, quantities required and quality as well as details of existing water use, water reserves and catchment areas must be included. Any requirement for dewatering, proposed discharge point, quantity and quality. The development and extraction of groundwater usually requires Water Authority of Western Australia's approval and a licence as does any dewatering discharge.

2.3 CLIMATOLOGY

Regional weather patterns, average rainfall, average evaporation, prevailing winds, etc. Minimum drainage design should be based on the 20 year return rainfall event or longer if the design life exceeds 20 years. The section is mainly intended to be of use in assessing potential use impact in the residential areas.

2.4 FLORA AND FAUNA

Brief description of flora and fauna in area and reference to any previously published studies.

3.0 PROJECT DESCRIPTION

3.1 MINING

Outline of proposed method of operation,k pit design, waste dump design and location. Both a long term concept plan as well as detailed plans for the first few years of operation should be provided. Any alternative methods of operations, such as conveyor

transport instead of truck haulage, considered should be outlined. The progressive rehabilitation of the waste dumps should be discussed. Dust control strategies and blasting practices to minimise neighbourhood impact should be described.

Rock mechanic studies to be carried out should be indicated, particularly those affecting the west wall, together with the overall stability strategy.

3.2 SUPPORT FACILITIES

Location of on-site offices, workshops, power supply, accommodation policy, etc.

3.3 WORKFORCE

Number and classification of workers. Provisions of the Mines Regulation Act and Regulations in relation to certification and working conditions should be acknowledged.

3.4 TRANSPORTATION CORRIDORS

Location of main access, power and water supply lines. The use, maintenance of local roads to be agreed with Local Government, and relocation.

4.0 ENVIRONMENTAL IMPACT AND MANAGEMENT

The aim of this section is to identify environmental impacts and make commitments to minimise disturbance and manage adverse impacts. Specific guidelines for environmental planning are available from the Mines Department.

4.1 WATER

Impact on local water resource and other users.
Water requirements for dust control and domestic use.
Dewatering requirements, drainage control and impact on regional drainage.
Water Authority of Western Authority approvals sought and those already obtained.

4.2 WASTE PRODUCTS

Method of management of wastes including domestic waste and sewerage Commitment to waste dump and tailings dam management.

4.3 TOXIC MATERIALS

Transport, storage and handling of all blasting materials.

Note: The transport and storage of certain materials requires the approval of the Explosives and Dangerous Goods Division of the Department.

4.4 DUST

Dust control methods for all phases of the operation, including rehabilitation. Both occupational health and environmental aspects must be addressed.

4.5 NOISE

Noise control procedures for both blasting and normal operations may be advantageous to report existing residential noise levels associated with present activities. Occupational noise levels and anticipated community or environmental levels should be covered.

4.6 REHABILITATION

Commitment to undertake progressive and final rehabilitation and site clean up. Details of proposed rehabilitation and environmental management which will lessen impact of project during operations and following decommissioning. Annual rehabilitation reporting will probably be required. The cleaning up of the present debilitated landscape should be highlighted. Use of results of recently completed MERIWA Project No. 66 as appropriate.

5.0 SOCIAL IMPACTS

5.1 ABORIGINAL SITES

A commitment to abide by the provisions of the Aboriginal Heritage Act, extent of ethnographic and archaeological surveys carried out (if any), commitment to inform the WA Museum of any sites of Aboriginal Heritage significance discovered in the course of the development.

5.2 HERITAGE

Items of European heritage value should be defined and a commitment to record, relocate or preserve such items as appropriate should be given.

5.3 LAND USE

Impact on other land users in the vicinity. Reserve land and town sites should receive particular attention. Any agreements reached should be acknowledged, including the GMMDPC initiatives.

5.4 SOCIAL ENVIRONMENT

Positive and negative social impact of project for the region and State/Local Government opportunities should be highlighted.

6.0 SPECIFIC COMMITMENTS

A summarised list of the proponents specific commitments for the protection of the environment is to be provided.

7.0 CONCLUSIONS

Outline conclusions including likely overall environmental acceptability of the project.

APPENDIX 1 GUIDELINES

Include a copy of these guidelines as an appendix to the document.

APPENDIX B

ABORIGINAL SITE SURVEY

REPORT ON A SURVEY FOR ABORIGINAL SITES AT THE KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD MINING LEASES, KALGOORLIE

Prepared for
Kalgoorlie Consolidated Gold Mines Pty Ltd
By Rory O'Connor and Gary Quartermaine
December 1989

PART ONE

ETHNOGRAPHY

PART ONE

ETHNOGRAPHIC COMPONENT

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

This report, which is based on a period of field research carried out in November, 1989, was commissioned by Kalgoorlie Consolidated Gold Mines Pty Ltd ("the Company"). The aim of the research was to identify and delineate any areas of Aboriginal significance within a designated section of the Company's Kalgoorlie gold mining tenements (see Figure One for location of the research area). To this end, Aboriginal people from Coolgardie, Kalgoorlie and Coonana who have long term association with the region were consulted by the author, and the research area was visited in the company of elders who have detailed knowledge of the region's totemic geography. At the same time. and in recognition of the project area, an archaeological survey was conducted by Gary Quartermaine.

1.2 Acknowledgements

The author gratefully acknowledges the assistance and advice of Mr R. Brooks, Mr P. Felton, Mr B. Wesley, Mr P. Donegan, Mr R. Underwood, Mr M. Anderson, Mr S. Hogan and Mr P Donaldson.

1.3 Format of Report

The conduct of the field survey and the format of this report are based upon:

(i) Guidelines for Developers and Consultants previously issued by the Department of Aboriginal Sites, Western Australian Museum;
(ii) discussions with senior officers of that Department;
(iii) the requirements of the W.A. *Aboriginal Heritage Act*;
(iv) procedures standardised by the author in a large number of similar exercises which have been acceptable to that Department in the past.

2.0 ANTHROPOLOGICAL BACKGROUND MATERIAL

2.1 Linguistic Groups

The original Aboriginal inhabitants of the survey area were part of the "Western Desert social and cultural bloc" (Bernt, 1959:104). which stretches in a broad sweep from Oodnadatta in South Australia, through the Great Victoria and Gibson Deserts to the Southern Kimberley. A high degree of cultural homogeneity exists throughout this region. Linguistic homogeneity also exists. although dialectal variation occurs (Douglas, 1964; Wurm, 1972). These dialectal differences are commonly used as a basis for differentiating between groups and assigning group names, and these names are sometimes taken incorrectly by non-Aborigines as signifying "tribal divisions".

In the survey region, following one hundred years of contact with the mining industry, large scale Aboriginal migrations, the anti - cultural influence of missions, and intermarriage both between Aborigines and non-Aborigines and between Aboriginal groups, the traditional social divisions have broken down and no longer function as recognisable entities. There is thus extreme difficulty in establishing the original distribution of the linguistic groups (see Figure 2 for a reconstruction attempted by Tindale in 1974).

2.2 Regional Mythology

Aboriginal traditional religion is based on the land; its shrines, hymns and religious objects refer to topographic and other natural features. In such a religion, a degree of permanence and stability exists, which would not be the case were the religion based in man-made structures. In the Kalgoorlie region, the hymns and stories which are the link that binds the human to the natural (viewed, from an emic perspective, as supernatural) have been retained by a pivotal generation of elderly Aborigines. In the current climate of nationwide Aboriginal neo-traditional renaissance, it is likely that this knowledge will be sought after and absorbed by younger persons and cherished as a symbol of their resurgent identity. Therefore, it is important that developers should be aware of the existence and location of Aboriginal sites.

Such sites, in the Coolgardie/Kalgoorlie/Menzies region are related mainly to four mythological sagas, which are commemorated in song and story, namely;

(i) The Yina Kutjara, two mythic human ancestors who brought law and religion to the region, and travelled from the Coolgardie region through Kalgoorlie, Ora Banda, Broad Arrow and Menzies towards Lake Carey;
(ii) The Tjilkarmarta or echidna ancestor, a topography creating being who travelled through Kalgoorlie and Goongarrie to a final resting place at Niagara falls;
(iii) The Nganamarra or mallee fowl ancestor, another topography creating being who appears to have circled the region;
(iv) The Kurangara or Pleiades, who created sacred areas of specific significance to women (one of these is close to Broad Arrow).

3.0 THE SURVEY

3.1 Methodology

Four separate phases were involved in the survey;

(i) examination of the existing ethnographic data base;
(ii) consultation and discussions with Aboriginal elders;
(iii) visit to the project area with Aboriginal elders;
(iv) report preparation.

3.2 Previously Recorded Sites

On January 1st, 1989, only one site of significance to Aboriginal people had been recorded in the Kalgoorlie region, namely Mt Charlotte, which was allotted the W.A. Museum Site number of W0120R, and listed at 1:250,000 grid reference 41-.19- (on mapsheet SH51-9). Since then, further information has been passed to the company from the W.A. Museum as follows:

(i) By letter of 20 July to Central Kalgoorlie Gold Mines, listing Nanny Goat Hill and "a rockhole/soak of reported Aboriginal significance adjacent to Williamstown road."
(ii) By letter of 25 July to Kalgoorlie Lakeview, listing Nanny Goat Hill and Mt. Charlotte.
(iii) By letter of 26 July to Macapa/Dallhold/Nth. Kalgoorlie Mines, listing the Microwave Tower Hill.
(iv) By letter of 20 September to Kalgoorlie Lakeview, listing Nanny Goat Hill (as W.A. Museum site number W.1662) and Muruntjarta.

This information can be tabulated as follows.

TABLE ONE : PREVIOUSLY RECORDED SITES OF SIGNIFICANCE

Site Name	Site No.	F.S. No.	Location (1:250,000 Grid Ref.)
Mt Charlotte	W0120	5	41-.19-
Nanny Goat Hill	W1662	2	UF54 97
Rockhole	W1661	3	UF54 98
Microwave Tower	W1663	6	UF53 91
Muruntjarta	-	1	UF55 96

3.3 Secrecy

Many Aboriginal stories, and by extension, the sites associated with these are secret, in the sense that details regarding them are restricted to specific Aboriginal persons or groups. This is true of the Yina Kutjara story which passes through the Company's holdings. The story details an encounter between the Yina Kutjara and a mythological woman, and their exploits in the course of this meeting. The author is not permitted to recount herein the story or the secret names of the persons involved. The large rockhole near Williamstown Road is the central focus of the story (i.e. Site no.4); it has not been shown and explained to previous researchers because of its extremely secret nature, and the Company is here requested to respect this secrecy.

3.4 Newly Recorded Sites

A rockhole, Ninga Mia Hill and part of the Kalgoorlie Aboriginal Reserve were newly recorded as sites of significance as a result of this survey. Details are tabulated below.

TABLE TWO : NEWLY RECORDED SITES OF SIGNIFICANCE

Site Name	F.S. No.	Location (1:250,000 Grid Ref)
Kalgurlanya	4	UF 54 98
Ninga Mia Hill	7	UF 55 98
Aboriginal Reserve	8	UF 55 99

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4.0 RECOMMENDATIONS

4.1 Human interference with Aboriginal sites in Western Australia is an offence under the *Aboriginal Heritage Act*, unless authorised as outlined in Section 17 of that Act.

4.2 It is therefore recommended that applications under Section 18 of that Act be made by the Company before impacting any land whose Aboriginal site status is reported in this document. Such application is best preceded by consultation. The avenue for this consultative process has been established in the course of the survey on which this report is based.

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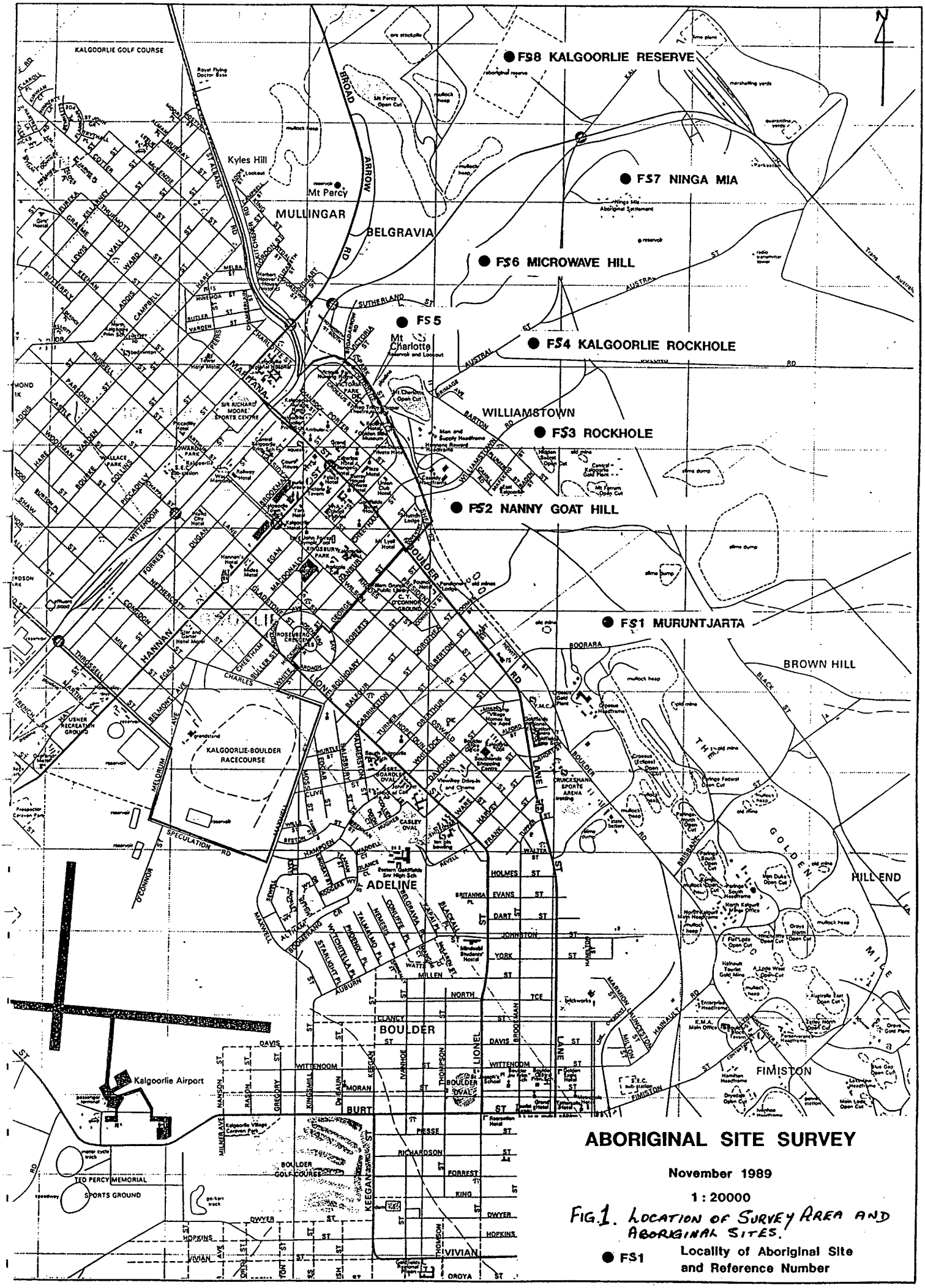


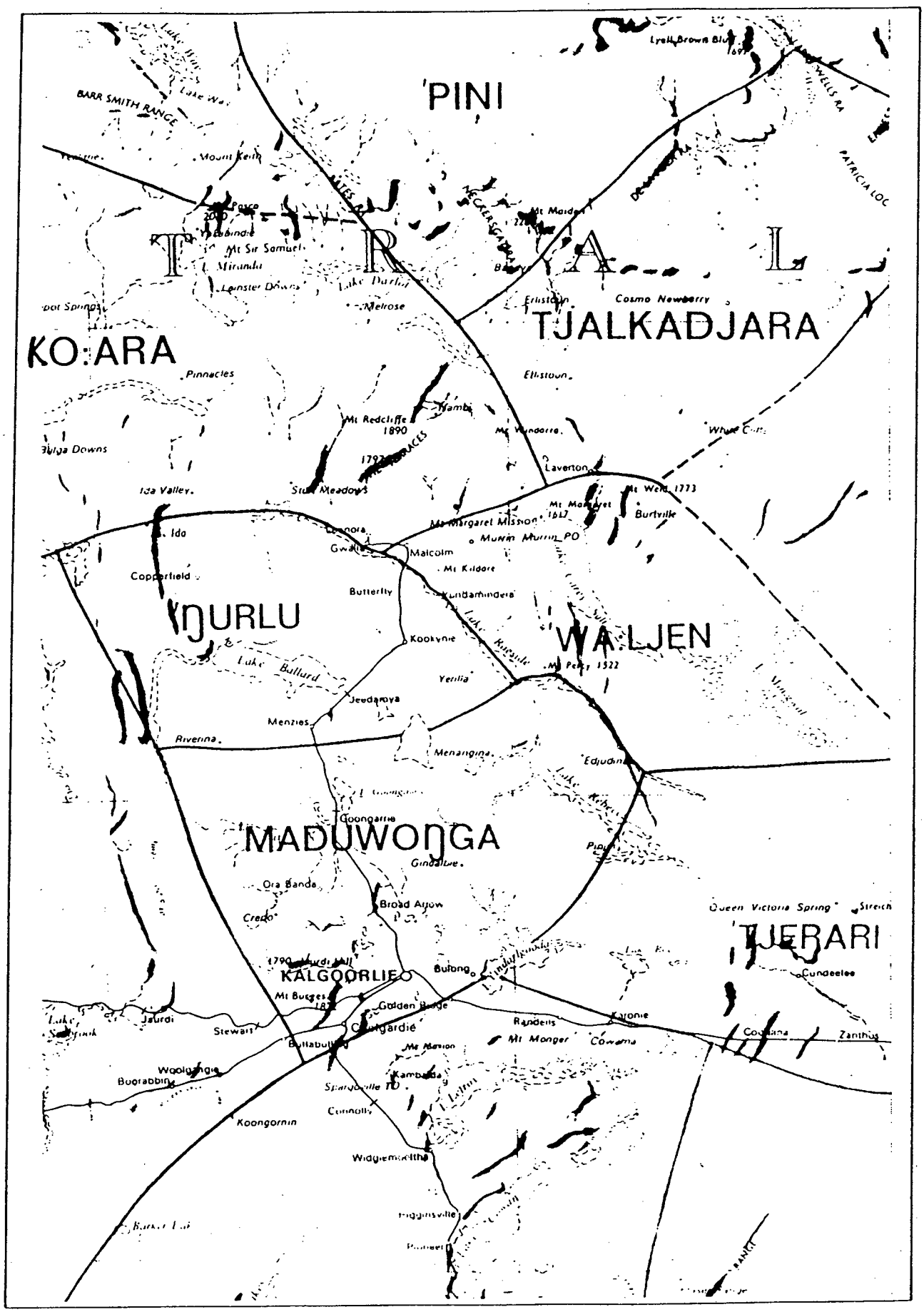
ABORIGINAL SITE SURVEY

November 1989

1 : 20000

FIG. 1. LOCATION OF SURVEY AREA AND ABORIGINAL SITES.

● FS1 Locality of Aboriginal Site and Reference Number



TRIBAL BOUNDARIES

Figure 2

(SOURCE: TINDALE, 1974)

PART TWO

ARCHAEOLOGY

PART TWO

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background to Survey

An Aboriginal site survey of gold mining leases in the east part of Kalgoorlie was commissioned by Kalgoorlie Consolidated Gold Mines Pty Ltd and the fieldwork was executed in November, 1989.

Gary Quartermaine conducted the archaeological component of the survey, with Emma Quartermaine as field assistant and Caroline Heine as research assistant, in conjunction with Rory O'Connor, who undertook the ethnographic investigation.

The objectives of the archaeological survey were as follows:

1. The assembly of data from previous work in the region, including information from W.A. Museum Aboriginal site files, previous survey reports, maps and environmental information.

2. A sample survey of the project area.

3. The location and recording of archaeological sites within the designated survey area.

1.2 Location

The survey area involves gold mining leases in the east part of Kalgoorlie (see Figure 1). This encompasses an area of 2.6 kilometres NS by 1.3 kilometres EW (maximum dimensions) south of the railway line and 1.4 kilometres NS by 0.4 kilometres EW north of the railway line. Four proposed pit areas and five Aboriginal site areas were designated as priority survey areas within the leases.

1.3 Environment

The climate of the project area is classified as semi-desert Mediterranean, characterised by warm winters and hot summers. Mean annual rainfall is 255mm, with a slight predominance of winter falls (Bureau of Meteorology data).

The project area is part of the Eastern Goldfields Province of the Yilgarn Block, which consists of belts of Metamorphic rocks. known as greenstones. These are folded into a gneissic complex and are widely mineralised (Williams, 1975:330).

The project area lies in the Coolgardie Plateau Physiographic Unit. Drainage is in a north - easterly direction, with streams terminating in dry lakes. The soils of the project area are transitional between the loams of the hills and the saline soils of the dry lakes.

The project area is classified within the Coolgardie Botanical District of the Coolgardie Vegetation System. The vegetation at the site is principally woodland dominated by salmon gum (Eucalyptus salmonophloia) with an understorey dominated by bluebrush (Maireana sedifolia) (Beard, 1972).

The survey area was very disturbed from previous mining activity and it is unlikely that any part of the ground surface has not been disturbed in some way by the roads and tracks, mines and tailings dumps, and buildings.

1.4 Previous Archaeological Research

Five Aboriginal sites have been previously recorded in the area of the proposed development (see Table 1). These are all mythological sites and no archaeological sites have been recorded in the survey area.

The earliest occupation dates for inland Western Australia are in the order of 20,000 years ago and these were obtained from rockshelter deposits near Newman (Maynard, 1980; and Troilett. 1982). A 10,000 year old occupation of a rockshelter site, Puntutjarpa, near Warburton, has been described by Gould (1977), with continuous occupation into the present.

Prehistoric stone tool industries in the South-West have been classified into earlier and later phases (Dortch, 1977). The early phase industries have only been documented from a few well-dated sites. They include small thick flake scrapers, bipolar cores, notched-denticulated pieces, flakes from discoidal cores, and single and multi-platform cores. These artefacts have been manufactures from a range of lithic materials,

Later phase stone industries, generally found in archaeological contexts dating from 4,000 years ago, include the addition of geometric microliths, backed blades, and a variety of adze flakes, which are part of the Australian "small tool tradition" (Dortch, 1977; Mulvaney, 1975).

The paucity of recorded archaeological sites in this area is probably as much the result of limited investigation and the great amount of disturbance from previous mining activities as any other factors.

TABLE 1 : Aboriginal Sites in the Vicinity of the Project Area

SH 51-9/10 1:250,000 Mapsheet

WA Museum Site No.	Grid Ref.	Site type	Site name
W0120	44-.19-	Mythological	Mt Charlotte
W1661	450.194	Mythological	Kalgoorlie Rockhole
W1662	450.194	Mythological	Nanny Goat Hill
W1663	450.195	Mythological	Microwave Tower Hill
-	450.194	Mythological	Muruntjarta

2.0 METHODS

2.1 Obligations under the Act

The Western Australian *Aboriginal Heritage Act*, 1972-1980, makes provision for the recording and preservation of places and objects customarily used by, or traditional to, the original settlers of Australia. The Act defines the obligations of the community relating to sites (Sections 15-18).

The archaeological survey should identify the effects of the proposed disturbance of the physical environment on any Aboriginal archaeological sites. In recognition of the possible significance of this area to living Aboriginal people. consultations with Aboriginal people identified as having an interest in the area were conducted by Rory O'Connor, in conjunction with the archaeological survey.

The consultants are obliged to submit site documentation for any newly recorded sites on appropriate forms for registration with the W.A. Museum.

2.2 Survey Design

The survey design involved the following stages of operation.

i) Background research - this involved familiarisation with W.A. Museum site files, survey reports, plus maps and environmental information for the area to be surveyed. Previously recorded Aboriginal sites, registered with the W.A. Museum, are listed in Table 1.

ii) Survey strategy - this consisted of a systematic sample survey of the mining leases.

The survey was completed using a 1:10,000 orthophotomap of the area plus 1:250,000 topographic maps.

There has been considerable disturbance to the environment of the leases with virtually no areas of undisturbed ground surface remaining.

There were no definite drainage areas in the flat terrain of the leases which included some low hill areas. Surface visibility was good on the lateritic ground which had a sparse to medium vegetation cover. Access was possible to all parts of the survey area by use of a 4 wheel drive vehicle and on foot.

The field survey was completed on foot in a series of E/W transects from baseline tracks running N/S through the leases. These transects were spaced at 25m intervals using the extent grid system and tracks and a compass which provided an adequate degree of accuracy for the purpose of this survey. Most of the survey area was covered by this means excepting those areas developed for housing, industry and mining.

2.3 Site Definitions

For the purpose of this survey, a site is defined as any material evidence of prehistoric Aboriginal activity. This is manifested in a number of different site components which may occur singularly or with one or more of the others to form an archaeological site. The most common of these are surface artefact scatters, quarries, art sites, stone arrangements, rockshelters with evidence of occupation, grinding patches, burials, and marked trees. An artefact scatter will be recorded as a site if it contains three or more artefacts in association. Solitary artefacts will be recorded as Isolated Finds but will not be registered as sites.

As samples will not be collected in the field, it is important to standardise a recording format that will be of use for analysis and have relevance for other researchers. Categories under which site data will be recorded are as follows:

i) Site dimensions - extent and type:

ii) Artefact assemblage - number, type, lithic material, and dimensions of artefact;

iii) Environmental setting - vegetation, soil, drainage and proximity to water, surface visibility and disturbance.

iv) Stratigraphy - assessment of potential.

3.0 RESULTS

No archaeological sites were recorded as a result of the field survey. Three Isolated Finds were recorded in the leases. These were :

I.F.1 Quartz flake side scraper, 24 x 33 mm, straight edge with step retouch. Quartz flake, 16 x 17 mm. Located 150 metres east of the Austral Street / Bulong Road Junction and 10 metres north of Bulong Road. This is near the Kalgoorlie Rockhole Aboriginal site.
I.F.2 Chalcedony flake, 36 x 30 mm, Muruntjarta area.
I.F.3 Chrysoprase flake, Muruntjarta area.

No archaeological sites are likely to be present in the survey area based on the sample survey and background research and the extensive disturbance caused by previous mining activity.

4.0 CONCLUSIONS

4.1 Discussion

The proposed development involves mining leases in the east part of Kalgoorlie within which four proposed pit areas and five Aboriginal sites are located. These encompass areas of approx 2.5 sq km south of the railway line and 0.5 sq km north of the railway line.

The archaeological field survey involved a systematic sample survey of the designated survey area. The terrain of the mining leases site is reasonably flat with some low hill areas on a lateritic soil. There were no watercourses or potential water - sources within the area, although there are indications that drainage was to the north - east.

Surface visibility was good because of the absence of ground cover vegetation. However, there was considerable disturbance at the site due to previous mining activity.

No archaeological sites were located in the designated survey area, however three Isolated Finds were recorded as a result of the field survey. The paucity of archaeological material is considered to be attributed to the small size of the survey area and the apparent lack of water on it, as well as the disturbance from mining activity dating back to the turn of the century.

4.2 Recommendations

The recommendations which follow are based on field observations and investigations of previously recorded sites in area. They relate to the archaeological component of this survey only. Recommendations relating to ethnographic sites are detailed in Part One of this report.

1. No archaeological sites were located on or near the proposed development and none are predicted based on the sample survey results. It is therefore recommended that development may proceed.

2. It is pointed out that human interference to Aboriginal sites is an offence, unless authorised under the Act, as outlined in Section 17 of the W.A. Aboriginal Heritage Act, 1972 - 1980. Therefore, it is recommended that the Developers take adequate measures to inform any project personnel of this requirement.

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APPENDICES

APPENDIX 1

OBLIGATIONS RELATING TO SITES UNDER THE *ABORIGINAL HERITAGE ACT*, 1972-1980

Report of Findings

"15. Any person who has knowledge of the existance of anything in the nature of Aboriginal burial grounds, symbols or objects of sacred, ritual of ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any other place or thing to which this Act applies or to which this Act might reasonably be suspected to apply shall report its existance to the Trustees, or to a police officer, unless he has reasonable cause to believe the existance of the thing or place in question to be already known to the Trustees."

Excavation of Aboriginal Sites

"16. (1) Subject to Section 18, the right to excavate or to remove any thing from an Aboriginal site is reserved to the Trustees.

(2) The Trustees may authorise the entry upon and excavating of an Aboriginal site and the and the examination or removal of any thing on or under the site in such manner and subject to such conditions as they may direct."

Offences Relating to Aboriginal Sites

"17. A person who-

(a) Excavates, destroys, damages, conceals or in any way alters any Aboriginal site; or

(b) In any way alters, damages, removes, destroys, conceals, or who deals with in a manner not sanctioned by relevant custom, or assumes the possession, custody or control of, any object on or under an Aboriginal site, commits an offence unless he is acting with the authorisation of the Trustees under Section 16 or the consent of the Minister under Section 18."

Consent to Certain Uses

"18. (1) For the purposes of this section, the expression "the owner of any land" includes a lessee from the Crown, and the holder of any mining tenement or mining privilege, or of any right or privilege under the *Petroleum Act*, 1967, in relation to the land.

(2) Where the owner of any land gives to the Trustees notice in writing that he requires to use the land for a purpose which, unless the Minister gives his consent in this Section, would be likely to result in a breach of Section 17 in respect of any Aboriginal site that might be on the land, the Trustees shall, as soon as they are reasonably able, form an opinion as to whether there is any Aboriginal site on the land, evaluate the importance and significance of any such site, and submit the notice to the Minister together with their recommendations in writing as to whether or not the Minister should consent to the use of the land for that purpose, and, where applicable, the extent to which and the conditions upon which his consent should be given.

(3) When the Trustees submit a notice to the Minister under subsection (2) of this section he shall consider their recommendation and having regard to the general interest of the community shall either -

(a) Consent to the use of the land the subject of the notice, or a specified part of the land, for the purpose required, subject to such conditions, if any, as he may specify;

or

(b) Wholly decline to consent to the use of the land the subject of the notice for the purpose required,

and shall forthwith inform the owner in writing of his decision.

(4) Where the owner of any land has given to the Trustees notice pursuant to the subsection (2) of this section and the Trustees have not submitted it with their recommendation to the Minister in accordance with that subsection the Minister may require the Trustees to do so within a specified time, or may require the Trustees to take such other action as the Minister considers necessary in order to expedite the matter, and the Trustees shall comply with any such requirement.

(5) Where the owner of any land is aggrieved by a decision of the Minister made under subsection (3) of this section he may, within the time and in the manner prescribed by the rules of court, appeal from the decision of the Minister to the Supreme Court which may hear and determine an appeal.

(6) In determining an appeal under subsection (5) of this section the Judge hearing the appeal may confirm or vary the decision of the Minister against which the appeal has been made or quash the decision of the Minister, and may make such order as to the costs of the appeal as he sees fit.

(7) Where the owner of the any land gives notice to the Trustees under subsection (2) of this section, the Trustees may if they are satisfied that it is practicable to do so, direct the removal of any object to which this Act applies from the land to a place of safe custody.

(8) Where consent has been given under this section to a person to use any land for a particular purpose nothing done by or on behalf of that person pursuant to, and in accordance with any conditions attached to, the consent constitute an offence against the Act."

APPENDIX 2

Notes on the Recognition of Aboriginal Sites

There are various types of Aboriginal Sites, and these notes have been prepared as a guide to the recognition of those types likely to be located in the survey area.

An Aboriginal Site is defined in the *Aboriginal Heritage Act*, 1972-1980, in Section 5 as:

"(a) Any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made for or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;

(b) Any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;

(c) Any place which, in the opinion of the Trustees is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the state;

(d) Any place where objects to this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed."

Habitation Sites

These are commonly found throughout Western Australia and usually contain evidence of tool-making, seed grinding and other food processing, cooking, painting, engraving or numerous other activities. The archaeological evidence for some of these activities is discussed in details under the appropriate heading below.

Habitation sites are usually found near an existing or former water source such as a gnamma hole, rock pool, spring or soak. They are generally in the open, but they sometimes occur in shallow rock shelters or caves. It is particularly important that none of these sites be disturbed as the stratified deposits which may be found at such sites can yield valuable information about the inhabitants when excavated by archaeologists.

Seed Grinding

Polished or smoothed areas are sometimes noticed on/near horizontal rock surfaces. The smooth areas are usually 25cm wide and 40 or 50cm long. They are the result of seed grinding by the Aboriginal women and indicate aspects of past economy.

Habitation Structures

Aboriginal people sheltered in simple ephemeral structures. generally made of branches and sometimes of grass. These sites are rarely preserved for more than one occupation period. Occasionally rocks were pushed aside or used to stabilise other building materials. When these rocks patterns are located they provide evidence for former habitation sites.

Middens

When a localised source of shellfish and other foods has been exploited from a favoured camping place, the accumulated ashes, hearth stones, shells, bones and other refuse can form mounds at times several metres high and many metres in diameter. Occasionally these refuse mounds or middens contain stone, shell or bone tools. These are most common near the coast, but examples on inland lake and river banks are not unknown.

Stone Artefact Factory Sites

Pieces of rock from which artefacts could be made were often carried to camp sites or other places for final production. Such sites are usually easily recognisable because the manufacturing process produces quantities of flakes and waste material which are clearly out of context when compared with the surrounding rocks. All rocks found on the sandy coastal plain , for example. must have been transported by human agencies. These sites are widely distributed throughout the State.

Quarries

When outcrops of rock suitable for the manufacture of stone tools were quarried by the Aborigines, evidence of the flaking and chipping of the source material can usually be seen in situ and nearby. Ochre and other mineral pigments used in painting rock surfaces, artefacts and in body decoration are mined from naturally occurring seams, bands and other deposits. This activity can sometimes be recognised by the presence of wooden digging sticks or the marks made by these implements.

Marked Trees

Occasionally trees are located that have designs in the bark which have been incised by Aborigines. Toeholds, to assist the climber, were sometimes cut into the bark and sapwood of trees in the hollow limbs of which possums and other arboreal animals sheltered. Some tree trunks bear scars where section of bark or wood have been removed and which would have been used to make dishes, shield, spearthrowers and other wooden artefacts. In some parts of the state wooden platforms were built in trees to accommodate a corpse during complex rituals following death.

Burials

In the north of the state it was formerly the custom to place the bones of the dead on a ledge in a cave after certain rituals were completed. The bones were wrapped in sheets of bark and the skull placed beside this. In other parts of Western Australia the dead were buried, the burial position varying according to the customs of the particular area and time. Natural erosion, or mechanical earthmoving equipment occasionally exposes these burial sites.

Stone Structures

If one or more stone are found partly buried or wedged into a position which is not likely to be the result of natural forces, then it is probable that the place is an Aboriginal site and that possibly there are other important sites nearby. There are several different types of stone arrangements ranging simple cairns or piles of stones to more elaborate designs. Low weirs which detain fish when tides fall are found in coastal ares. Some rivers contain similar structures that trap fish against the current. It seems likely that low stone slab structures in the south west jarrah forests were built to provide suitable environments in which to trap some small animals. Low walls or pits were sometimes made to provide a hide or shelter for a hunter.

Elongated rock fragments are occasionally erected as a sign or warning that a special area is being approached. Heaps or alignments of stones may be naturalistic or symbolic representations of animals, people or mythological figures.

Paintings

These usually occur in rock shelters, caves or other sheltered situations which offer a certain degree of protection from the weather. The best known examples in Western Australia occur in the Kimberley region but paintings are also found through most of the states. One of several coloured ochres as well as other coloured pigments may have been used at a site. Stencilling was a common painting technique used throughout the state. The negative image of an object was created by spraying pigment over the object which was held against the wall.

Engravings

This term described designs which have been carved, pecked or pounded into a rock surface. They form the predominant art form of the Pilbara region but are known to occur in the Kimberleys in the north to about Toodyay in the south. Most engravings occur in the open, but some are situated in rock shelters.

Caches

It was the custom to hide ceremonial objects in niches and other secluded places. The removal of objects from these places, or photography of the places or objects or any other interference with these places is not permitted.

Ceremonial Grounds

At some sites the ground has been modified in some way by the removal of surface pebbles, or the modeling of the soil, or the digging of pits and trenches. In other places there is not noticeable alteration of the ground surface and Aborigines familiar with the site must be consulted concerning its location.

Mythological Sites

Most sites already described have a place in Aboriginal mythology. In addition there are many Aboriginal sites with no man-made features which enable them to be recognised. They are often natural features in the landscape linked to the Aboriginal Account of the formation of the world during the creative "Dreaming" period in the distant past. Many such sites are located at focal points in the creative journeys of mythological spirit beings of the Dreaming. Such sites can only be identified by the Aboriginal people who are familiar with the associated traditions.

APPENDIX C

City of Kalgoorlie-Boulder

DAVIDSON STREET, KALGOORLIE, W.A. 6430
TELEPHONE (STD. 090) 21 2544, 21 1300 FAX (090) 21 6113
ALL CORRESPONDENCE TO BE ADDRESSED TO THE TOWN CLERK,
P.O. BOX 2042, BOULDER, W.A. 6432

YOUR REF:

OUR REF: T8/7 HFK:MMW

ENQUIRIES Mr. H.F. Kerspien

2nd August, 1990

Mr. M. Cutifani,
Open Pit Manager,
Kalgoorlie Central Gold Mines,
P.M.B. 27,
KALGOORLIE W.A. 6430

Dear Sir,

RE: Roads Within the Mining Area

I refer to your letter of the 27th July, 1990, regarding the above and attach copies of Council's minutes on the matter of rationalising roads within the mining area.

Yours faithfully,

L.P. STRUGNELL
TOWN CLERK

Enc.

3. MATTERS REFERRED FROM PREVIOUS MEETINGS

3:1 Hannan Street/Eastern By-Pass Intersection (T8/5) (HFK)

(Item 9:1, page 499, Works and Facilities Committee minutes of the 15th May, 1989)

A preliminary design for the connection of Park Street and Outridge Terrace to Hannan Street, near the latter's connection to the Eastern By-Pass, was tabled at the meeting.

The main concerns are:-

1. Access from Outridge Terrace into Hannan Street.

2. Access from Hannan Street to the Golden Mile Museum in Outridge Terrace.

Both movements are prevented by the continuous median in Hannan Street at its approach to the Eastern By-Pass.

IT WAS RECOMMENDED ON THE MOTION OF CR. ROBUSTELLINI, SECONDED CR. DOUGLAS, THAT THE PROPOSED LAYOUT BE REFERRED TO THE MAIN ROADS DEPARTMENT TOGETHER WITH A REQUEST FOR MAINTAINING ACCESS TO OUTRIDGE TERRACE, NORTH AND SOUTH OF HANNAN STREET.

CARRIED

3:2 Tourist Coach Parking (T6/1) (HFK)

(Item 11:2, page 682, Full Council minutes of the 18th December, 1989)

The plan, as attached to the Agenda, shows the present parking area layout and the effect on bays if provisions for parking of tourist coaches is made within this area.

At present, this parking area has provisions for 72 bays of which 16 would be lost to tourist coaches if this proposal was adopted.

IT WAS RECOMMENDED ON THE MOTION OF CR. ROBUSTELLINI, SECONDED CR. DOUGLAS, THAT COUNCIL ADOPT THE PLAN AS PRESENTED.

CARRIED

3:3 Roads within the Mining Area (T8/7) (HFK)

(Item 2, page 431, Special Works and Facilities Committee minutes of the 16th October, 1989)

Mr. W. Morris, Kalgoorlie Consolidated Gold Mines Pty. Ltd., advised that design for the road from the Eastern By-Pass to Mt. Monger Road, via Outram Street, had been completed and awaited Council's approval for construction to commence.

At the Special Works and Facilities Committee Meeting held on the 16th October, 1989:-

"It was recommended on the motion of Cr. Douglas, seconded Cr. Jones, that Council endorse the proposal and arrange for the funding to proceed."

Funding for Stage I - compaction and sealing of Black Street and Boorara Road was arranged and the work completed.

The Company is now seeking Council's approval for Stage II to proceed. This work will be carried out at no cost to Council.

IT WAS RECOMMENDED ON THE MOTION OF CR. ROBUSTELLINI, SECONDED CR. DOUGLAS, THAT COUNCIL GRANT APPROVAL FOR KALGOORLIE CONSOLIDATED GOLD MINES PTY. LTD. TO PROCEED WITH CONSTRUCTION OF THE ROAD LINKING THE EASTERN BY-PASS WITH MT. MONGER ROAD, VIA OUTRAM STREET.

CARRIED

3:4 Illuminated Street Name Sign System (S5/2.1) (JLL)
(Item 5:2, page 709, Full Council minutes of the 15th January, 1990)

The Divisional Engineer, Main Roads Department, writes in response to Council's request for advice on illuminated street signs, and advises the following:-

"In reference to your letter of January 4 1990 requesting a written explanation as to why the Department will not allow illuminated street name signs (ISNS) to be erected on roads under its control, Council is advised that the installation of ISNS on declared Highways and Main Roads is prohibited by Sub-Regulation 7 (1) (b) of the Main Roads (Control of Signs) Regulations 1983.

The Department has partial control over the use of ISNS on or adjacent to a Local Government road under the provisions of Regulation 301 of the Road Traffic Code 1975. Since the Commissioner of Main Roads is the sole traffic sign erecting authority for the State, it follows that his permission must be obtained prior to the erection of an ISNS on a Local Government road if the sign contains any word, phrase or direction that can be construed as giving directional guidance or an instruction to drivers. The Commissioner can also take action under Section 87 of the Road Traffic Act, 1974 against any ISNS where he considers its illumination to be distracting or confusing to motorists.

The Minister for Transport has been approached by Claude Neon Limited in an attempt to have the relevant regulations of the Main Roads (Control of Signs) Regulations 1983 changed.

At the request of the Minister, the Department is preparing guidelines for the erections of ISNS and following the Minister's concurrence all Local Authorities will be advised of these guidelines."

RECEIVED

It was recommended on the motion of Cr. Jones, seconded Cr. Douglas, that Council approve the Rotary Club of Kalgoorlie's request for closure of Hannan Street between Cassidy and Maritana Streets and the use of St. Barbara's Square for the purpose of conducting a Christmas Street Carnival on the 15th December, 1989.

CARRIED

3:2 Kaltails Mining Services Pty. Ltd. (T8/7) (HK)
(Item 10:3, page 392, Works and Facilities Committee meeting of the 4th October, 1989)

Road Condition as at the 25th October, 1989

From Kamballi Road to the Fintails turn-off (4.45 km) the road is generally 9 metres wide, of which the central 3.5 metres are sealed.

This section is maintained in a very good condition by private contractors using a grader and a water truck. A narrow culvert near the Loopline Railway Crossing was recently widened by 2.4 metres.

From the Fintails turn-off to the Kaltails turn-off (1.75 km) the road varies in width from 3.5 metres (1.0 km) to 8.0 metres (0.75 km). The narrow sections are wheel rutted and will need attention in the future. The 8.0 metre wide sections are of recent construction and in good condition. Some shoulder wear exists over this section and will require periodic maintenance grading.

A detailed pick up of road conditions is shown in Appendix 1.

It was recommended on the motion of Cr. Robustellini, seconded Cr. Douglas, that periodic shoulder grading be carried out as and when required.

CARRIED

3:3 Roads within the Mining Area (S5) (HK)
(Item 4:3, pages 382 to 383, Works and Facilities Committee meeting of the 4th October, 1989, and Item 2, pages 431 to 432, Special Works & Facilities Committee meeting of the 16th October, 1989)

The estimated $38,000.00 from Council's resources for upgrading Black Street and Boorara Road to the sealed stage are not provided for in the 1989/90 Budget but could be provided from funds allocated for road maintenance.

The allocation of $479,165.00 for road maintenance provides for:-

$391,935.00 - routine maintenance
$ 13,670.00 - stock grid maintenance
$ 73,560.00 - rehabilitation of depressed trenches across streets.

The required $38,000.00 could be made available from the $73,560.00 intended for rehabilitation of depressed trenches, thereby reducing this amount to $35,560.00

It was recommended on the motion of Cr. Jones, seconded Cr. Robustellini, that the matter be referred to Full Council for a Budget amendment by reducing the amount provided for road maintenance from $479,165.00 to $441,165.00 and creating a new item of $38,000.00 for compaction and sealing Black Street and Boorara Road.

CARRIED

4. CONFIRMATION OF THE MINUTES OF THE JOINT RECREATION FACILITIES ADVISORY COMMITTEE MEETING HELD ON THE 10th OCTOBER, 1989 (pages 433 to 435)

4:1 Motion to Confirm

The minutes were confirmed on the motion of Cr. Jones, seconded Cr. Robustellini.

CARRIED

4:2 Business Arising

Nil

5. CONFIRMATION OF THE CRUICKSHANK SPORTS ARENA ADVISORY COMMITTEE MEETING HELD ON THE 3rd OCTOBER, 1989 (page 353)

5:1 Motion to Confirm

The minutes were confirmed on the motion of Cr. Robustellini, seconded Cr. Jones.

CARRIED

5:2 Business Arising

Nil

6. REPORTS

6:1 Work Completed During Last Period (W1) (HP)

ROADWORKS:

Vivian Street:	Reconstruction and sealing of pavement failures plus some resealing.
Charles St./Meldrum Ave.:	Reconstructed gravelled and water bound.
Concrete footpaths:	Backfill and levelling of verges after laying of concrete is being carried out.

MINUTES OF THE SPECIAL MEETING OF THE WORKS AND FACILITIES COMMITTEE HELD IN THE COUNCIL CHAMBERS, DAVIDSON STREET, KALGOORLIE, TO DISCUSS THE ROAD SYSTEMS ALONG THE SECTION OF THE GOLDEN MILE, ON MONDAY 16th OCTOBER, 1989, AT 9.00 a.m.

PRESENT — Councillor O.A. Swiderski, Chairman;
Councillors J.D. Douglas and M.P. Jones

In Attendance

Mayor M.R. Finlayson	- City of Kalgoorlie-Boulder
Mr. I. Berston	- Kalgoorlie Consolidated Gold Mines Pty. Ltd.
Mr. A. Woskett	- Kalgoorlie Consolidated Gold Mines Pty. Ltd.
Mr. L.P. Strugnell	- City of Kalgoorlie-Boulder
Mr. H. Kerspien	- City of Kalgoorlie-Boulder
Mr. B. Harris	- City of Kalgoorlie-Boulder

1. APOLOGIES

Apologies were received from Councillors O.J. Robustellini and G.J. Smith.

2. REPORT - KALGOORLIE CONSOLIDATED GOLD MINES PTY. LTD.

Councillor Swiderski opened the proceedings and requested Mr. Berston to breifly outline the contents of Kalgoorlie Consolidated Gold Mines report, titled:-

"Strategy for Development of Roads within Kalgoorlie Consolidated Gold Mines Pty. Ltd. Mining Area".

Mr. Berston advised that the proposal was to provide a road system which would improve safe access to the mining areas, separate, to a large degree, public and mining traffic and provide public access and a service corridor to the eastern side of the mining operations.

for W&F 8/11/89

This could be achieved with minor financial input by the Council.

Mr. Woskett gave a run-down on the technical aspects of the proposed works and stated the continued cost of maintenance on a gravel road indicated that a sealed surface would be more economical.

The meeting adjourned at 9.20 a.m. for an on-site inspection.

The party inspected the proposed roads and the mining sites involved.

The meeting resumed at 10.05 a.m. in the Council Chambers.

Chairman Swiderski thanked Mr. Berston for the address and the site visit, and congratulated Mr. Berston and Mr. Woskett on the contents of the written report.

It was recommended on the motion of Cr. Douglas, seconded Cr. Jones, that Council endorse the proposal and arrange the funding to proceed.

CARRIED

3. CLOSURE

There being no further business, the Chairman, Councillor Swiderski, declared the meeting closed at 10.25 a.m.

Adopted: 16/10/1989

4:3 Roads Within the Mining Area (S:

(Item 6:1.2, page 269, Works and Facilities Committee minutes of the 6th September, 1989)

The Chief Executive, Kalgoorlie Consolidated Gold Mines, has submitted a Strategy for Development of Roads with Kalgoorlie Consolidated Gold Mines Mining Area.

The proposal is generally based on the expansion of open pit mining and conflict between public and mine traffic. The intention is to exclude public traffic from the mining areas in the interest of improved road services, safer access and separation of public and mining activities and improved productivity costs to mining.

Costs for these improvements are estimated at $1,900,000.00, Kalgoorlie Consolidated Gold Mines and $38,000.00, City of Kalgoorlie/Boulder.

The proposal is in two stages which can be carried out simultaneously.

Stage 1 - Upgrade Black Street and Boorara Road to sealed stage to minimise dust and maintenance and consequently improve safety and comfort.

This stage would require input of $38,000.00 from Council.

Kalgoorlie Consolidated Gold Mines suggest that the joint operation should be configured as follows:-

* The City Council shall manage and carry out the work on behalf of both parties.

* The City Council shall carry out formation maintenance at Kalgoorlie Consolidated Gold Mines cost by charging plant hire only at Council internal charge out rates.

* The City Council shall engage its bitumen application contractor to apply bitumen at the Council's contracted rate. Kalgoorlie Consolidated Gold Mines shall reimburse Council for this expenditure.

* The City Council shall purchase, cart and spread metal for the remaining road section up to the Fimiston Plant. Kalgoorlie Consolidated Gold Mines shall reimburse Council for purchase cost of metal over this section.

* Sealing work will comprise a two coat application of 14 mm and 10 mm aggregate.

* Kalgoorlie Consolidated Gold Mines shall carry out line marking at its cost.

Acceptance of this proposal should permit the works to proceed at the earliest possible opportunity and before the existing road surface suffers increased deterioration.

Comment - There are no provisions for funding in the 1989/90 Budget.

Stage 2 - Construction of Outram Street from the By-Pass to Mt. Monger Road via new alignment and closure of roads within the mining area.

Company to carry full cost.

It was recommended on the motion of Cr. Douglas, seconded Cr. Jones, that:-

1. A meeting be arranged between Mr. I. Burston and Members of the Works and Facilities Committee for detailed discussions of Kalgoorlie Consolidated Gold Mines' proposal.

2. The meeting be arranged on a Tuesday to allow maximum participation by members of the Works and Facilities Committee.

CARRIED

5. CONFIRMATION OF THE MINUTES OF THE WORKS AND FACILITIES COMMITTEE MEETING HELD ON THE 6th SEPTEMBER, 1989 (pages 264 to 275)

5:1 Motion to Confirm

The minutes were confirmed on the motion of Cr. Jones, seconded Cr. Borromei.

CARRIED

5:2 Business Arising

Item 3:1 - Cattle Grids (S5/9.1)
(Item 3:5, page 194, Works and Facilities Committee Minutes of the 21st August, 1989)

"Cleaning of grids is in progress using Council's workforce.

A contract has been made with the Eastern Goldfields Aboriginal Corporation Resource Agency and Ms. C. Kirkpatrick is examining means of using her agency to carry out the work.

In the long term, sealing of grid approaches for some 25 metres on each side could resolve the continuous maintenance problem.

The cost per grid will be in the order of $3,000.00.

It was recommended on the motion of Cr. Douglas, seconded Cr. Jones, that the item lay upon the table and that a Delegate from the Pastoralists and Graziers Association be invited to the next meeting to discuss the associated problem of cattle grids.

CARRIED

Grading: Maintenance grading, using Council's equipment, carried out on Yarri Road and various urban unsealed roads.

Work Planned During Next Period: Primer Sealing of Dugan Street, Mt. Monger Road and Lionel Street.

On completion of the above work, Council's programmed works, under the Statutory Grant Scheme, will have been completed.

RECEIVED

6:1.2 Roads Within the Mining Area

Discussions have been held with Kalgoorlie Consolidated Gold Mines Pty. Ltd., concerning rationalisation of roads within the mining belt.

A formal approach to Council will be made by the Company, however, a plan showing the Company's intentions will be presented at the Meeting.

The Company is also interested in sealing Black Street and Boorara Road to reduce the dust problems to road users and will be approaching Council with respect to Council's workforce carrying out the work and possibly some financial contribution in purchasing aggregate and supplying the labour component.

Estimated Aggregate Costs: $20,000
Estimated Labour Costs: $15,000

RECEIVED

6:1.3 Maintenance & Repairs - Council Mechanical Equipment

Please see attached.

RECEIVED

7. INWARD CORRESPONDENCE

7:1 Application for Prospecting Licences (M6/3)

The Director General of Mines has received applications for Prospecting Licences covering Parkland Reserve 8603 and Government Requirement (Gravel) Reserve 31713 in the Somerville Suburban area.

In view of Council being the vested authority, Council's concurrence must be obtained before the applications are given to the Minister for Mines for consideration.

City of Kalgoorlie-Boulder

DAVIDSON STREET, KALGOORLIE, W.A. 6430
TELEPHONE (STD. 090) 21 2544, 21 1300 FAX (090) 21 6113
ALL CORRESPONDENCE TO BE ADDRESSED TO THE TOWN CLERK,
P.O. BOX 2042, BOULDER, W.A. 6432

YOUR REF:

OUR REF: T8/7 HFK:MMW

ENQUIRIES: Mr. H.F. Kerspien

26th February, 1990

The Manager,
Project Office,
Kalgoorlie Consolidated Gold Mine,
P.O. Box 2408,
BOULDER W.A. 6432

ATTENTION: Mr. W. Morris

Dear Sir,

RE: Roads within the Mining Area
Stage 2 : Eastern By-Pass - Mt. Monger Road Deviation

I refer to the above and your enquiry regarding Council's approval to construct a new road from the Eastern By-Pass to connect with Mt. Monger Road, as presented to the Special Works and Facilities Committee Meeting held on the 16th October, 1989.

I advise that Council, at its meeting held on the 19th February, 1990, resolved to approve the proposed alignment.

Yours faithfully,

L.P. STRUGNELL
TOWN CLERK

SUPPLEMENT TO FIMISTON MINE AND WASTE DUMPS CER

PLAN FOR THE MANAGEMENT OF IMPACTS ON LEASEHOLD PROPERTIES LOCATED CLOSE TO THE EASTERN AND SOUTHERN BOUNDARIES OF PLANNED WASTE DUMPS

Proximity of waste dumps to private leases

Residences which will be located closest to the planned waste dumps are Hampton Lots 154, 158 and 159. Lot 163 is a garden/grazing lease only (refer to Appendix C, plans 7.7 and 7.8).

The configuration of waste dumps has been altered as per the attached plans. The resulting distance between the foot of waste dumps and the nearest private lease boundaries is 200m.
The relative position of Recreation Reserve 142 is also shown on the accompanying plans. This reserve is vested in the City and currently is used by the model aeroplane club.

Access to properties

Access will be maintained as indicated on the CER road plans (Appendix C). Long term plans are for an expansion of the southern waste dump over the access route passing through the old Trafalgar townsite (marked in brown on road plan 7.7). An alternative route will be provided before this occurs in consultation with affected leaseholders and the City of Kalgoorlie–Boulder .

Maintenance of water, telephone and power services

KCGM undertakes to re–route these services prior to encroachment of the southern waste dump.

Local impact on surface water flow

As described in the CER, an artificial drainage system will be designed and constructed around the dumps. The initial intention is to direct major surface flows away from residences. Preliminary discussions with landholders have indicated, however, that some enhancement of inflows to existing dams on leased properties may be desirable. A detailed drainage plan and construction schedule will be undertaken in 1991, and will involve liaison with leaseholders.

Local impact on dust

The generation of dust during waste dump construction will be controlled principally by means of:

(a) Regular watering of dump truck travel surfaces.

(b) The use of competent fresh rock material on dump faces which are left exposed prior to rehabilitation. The surface sheeting of dumps with material that is more likely to generate dust, e.g. oxide wastes, will be scheduled so as to be closely followed by topsoiling and revegetation.

(c) The scheduling of outer slope contouring and revegetation to occur as early as possible. Normally this will occur during the January–April period immediately following the completion of dumping at the waste dump faces.

Rehabilitation

Rehabilitation will proceed in sequence with perimeter waste dumping. Speedy rehabilitation, in combination with the use of fresh topsoil, is viewed as the most effective means of combating any detrimental impacts on local residences.

Where topsoil occurs on ground earmarked for waste dumping, topsoil stripping will occur in advance of dumping, and this material will be transferred directly to waste dump surfaces. Given that topsoil reserves in this area are limited, priority areas for direct topsoil transfer will be established based on proximity to residences.