

CONFIDENTIAL

CABINET DECISION

NO. 949

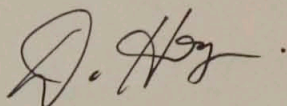
Submission No.: 817

Title: ASSESSMENT OF THE MCARTHUR RIVER PROJECT
FEASIBILITY AND ENVIRONMENTAL REPORTS.

Cabinet approved:

- a) expenditure of up to \$50,000 to engage a firm of consultants to provide an independent assessment of the metallurgical, financial and associated aspects of the McArthur River Project in order to determine an appropriate course of action for the development of a mine;
- b) a reply to Mount Isa Mines following the initial assessment of the report; and

Cabinet directed the working group to report back to Cabinet following the receipt of the consultants report recommending terms and conditions for a new agreement for development of a mine.



D. HOGAN,
(~~XXXXXXXXXXXX~~),

Actg. Secretary to Cabinet.

7 November, 1979.

CONFIDENTIAL

THE NORTHERN TERRITORY OF AUSTRALIA

CONFIDENTIAL

Copy No. /

FOR CABINET

SUBMISSION No.

Title:	ASSESSMENT OF THE McARTHUR RIVER PROJECT FEASIBILITY AND ENVIRONMENTAL REPORTS
Cabinet Member	I. L. TUXWORTH, MINISTER FOR MINES AND ENERGY
Purpose:	To approve the engagement of consultants to review the metallurgical, financial and associated aspects of the McArthur River Project Feasibility and Environmental Report submitted by Mount Isa Mines in order to determine an appropriate course of action for the development of a mine.
Relation to existing policy:	Consistent with the policy of self-government for the Territory.
Timing/ legislative priority:	Urgent
Announcement of decision, tabling, etc.:	Public announcement neither desirable or necessary.
Action required before announcement:	N/A
Staffing implications, numbers and costs, etc.:	N/A
Total cost:	\$50,000

CONFIDENTIAL

CONFIDENTIAL

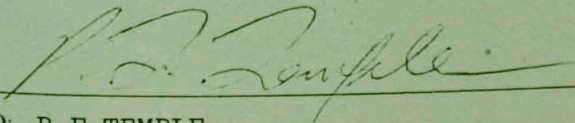
Department/Authority DEPARTMENT OF THE TREASURY

COMMENT ON CABINET SUBMISSION No.

TITLE: MT ISA MINES LIMITED -MCARTHUR RIVER PROJECT

COMMENTS:

Funding of \$50,000 for consultants fees is not provided for in the Mines and Energy budget, but would be available from Treasurer's Advance.



SIGNED: P F TEMPLE

DESIGNATION: A/UNDER-TREASURER

DATE: 30 OCTOBER 1979

CONFIDENTIAL

Department/Authority Law

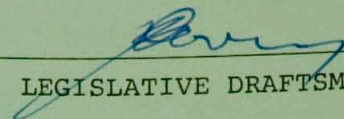
COMMENT ON CABINET SUBMISSION No.

TITLE: MOUNT ISA MINES LIMITED - McARTHUR RIVER PROJECT

COMMENTS:

There are no legal barriers to the proposal.

There appear to be no constitutional barriers to the proposal.



SIGNED: LEGISLATIVE DRAFTSMAN

DESIGNATION: for SOLICITOR GENERAL

DATE: 30 October 1979

1.

MOUNT ISA MINES LIMITED - MCARTHUR RIVER PROJECT

THE ISSUES

1. The issues requiring consideration by Cabinet are :
 - (a) A proposal by the McArthur River Working Group to engage a firm of consultants to review the McArthur River Project Feasibility and Environmental Report relating to Mount Isa Mines H.Y.C. zinc, lead and silver mineral deposit within Mining Reserve No. 581.
 - (b) The need for a reply to Mount Isa Mines following an initial assessment of their report.
 - (c) Procedures for the renegotiation of the contract, previously held between Mount Isa Mines and the Commonwealth.

BACKGROUND

2. Mount Isa Mines Ltd first became interested in the McArthur River region in 1948. By the early 1960's they had delineated a large zinc, lead and silver orebody. During ensuing years the company instigated research projects both in Australia and overseas for a solution to the metallurgical problems caused by the very fine grained nature of the ore but without success.

2.

3. In January 1977 the company entered into a contract with the Commonwealth for the further testing and evaluation of the deposit. However, with the advent of self government the company were advised that a new contract would need to be negotiated, this time with the Northern Territory Government.

4. Subsequently, by Cabinet Decision No.490 (20 November 1978), Cabinet :

- (a) Endorsed a suggestion that Mount Isa Mines Limited submit a feasibility study on the McArthur River project by 30 June 1979;
- (b) expressed its desire to see the project proceeding if it is feasible; and
- (c) endorsed in principle the present leaseholders having security of tenure but wish to enter into detailed arrangements with the company for the development of the project only after its feasibility study had been received and assessed.

5. In April 1979 a Working Group comprising representatives from the Department of Mines and Energy, Department of the Chief Minister and Department of the Treasury was established with responsibility for the full assessment of all aspects of the project in order to ensure that the timing and eventual development is in

3.

the best interests of the Territory.

6. On 31 July 1979 a very comprehensive Feasibility and Environmental report consisting of thirty volumes was submitted by the company (see summary volume at Attachment 'A'). The report amplifies a preliminary report which was made available in January 1979. A more detailed outline of events leading to the submission of the report is at Attachment 'B'.

CONSIDERATION OF THE ISSUES

7. There can be little doubt that the proposed McArthur River Mine creates genuine problems of development for Mount Isa Mines, mainly due to the metallurgically complex ore. In addition, uncertainty in the state of world markets for zinc and lead and the availability of more viable deposits at the company's other undertakings in Queensland, have almost certainly induced excessive caution in the company's approach to the development of McArthur River.

8. An initial assessment of the report has identified the following key factors :

- (a) the need to understand the nature of the metallurgical problem and to identify further research which might overcome it;

4.

- (b) the need to identify the likely course in market trends for zinc and lead concentrates and the processed metals;
- (c) the need to check the cost estimates and financial analysis; and
- (d) the need to investigate the financial capability of Mount Isa Mines to develop the mine.

9. In regard to these factors, the Northern Territory Government is to some degree handicapped by a paucity of industrial intelligence and a lack of expertise in certain areas of the project, in particular the metallurgical area. This makes it necessary to consider the employment of a reputable firm of consultants. Mount Isa Mines are aware of the possible use of consultants as this was intimated to them by Government officers at a meeting earlier this year. They agreed to provide consultants with any relevant material not included in the report but which is in their offices.

10. The employment of consultants is not however a straightforward matter as any discussions will need to be discreet so as not to unnecessarily jeopardise the prospects of further co-operation with Mount Isa Mines.

Account must also be taken of the fact that the company have themselves employed many of the firms who are generally accepted in Australia as being eminent in mining projects. Lists of the main McArthur research projects and sample distribution is at Attachment 'C'.

OPTIONS

11. There are three options available :

- (a) Do nothing, other than re-negotiate the agreement with Mount Isa Mines. This will allow continuation of the status quo and the probability that the orebody will not be developed in the foreseeable future.
- (b) Refuse to continue giving favoured status to Mount Isa Mines and make lease areas available to any company (including Mount Isa Mines) which can put forward acceptable proposals for earlier development of the orebody.
- (c) Undertake to continue protection of Mount Isa Mines' position on being satisfied that the company is genuinely working towards the development of the orebody as quickly as possible. This will require the imposition

of the most stringent conditions including requiring the company to undertake certain types of metallurgical research.

In order to decide on the appropriate course of action and before any negotiations can be commenced it will be necessary for the Government to make a proper assessment of the company's Feasibility and Environmental Report. This will necessitate employing a firm of consultants with terms of reference as at Attachment 'D'.

PUBLIC IMPACT OF THE RECOMMENDATIONS

12. The public will expect the Government to do whatever is necessary to facilitate the earliest possible development of this major mineral deposit. However, caution will be needed, if exercising option (b) that the Government is not seen as reneging on any moral commitment to Mount Isa Mines as this could not only damage relations with that company but might affect credibility with the business sector at large.

FINANCIAL CONSIDERATIONS

13. Mining of the H.Y.C. orebody, with associated infrastructure including the building of a deepwater port in the Sir Edward Pellew Group, will obviously be extremely beneficial in terms of the economic development of the Territory.

Early development could furthermore be a vital factor in the development of an industrial 'package' linked with exploitation of natural gas reserves. On the other hand, from the point of view of royalty yields it is important that the Government should not force premature development of the deposit. The present value of royalties is likely to be significantly higher when the deposit is 'ripe' for exploitation than when it is barely economic.

14. The cost of a consultant's services to undertake the work as contained in the terms of reference is estimated at \$50,000. Funds for the employment of consultants for the McArthur River project are not available from the budget of the Department of Mines and Energy. The Department of the Treasury has indicated that if Cabinet approves the study, funds can be made available from other sources. It will be necessary therefore for a special appropriation to be made if the work is to be undertaken this financial year.

EMPLOYMENT CONSIDERATIONS

15. No additional staff will be required.

COMMONWEALTH AND LOCAL GOVERNMENT RELATIONS

16. Will not be directly affected, other than Commonwealth involvement through export controls.

CO-ORDINATION AND CONSULTATION

17. The McArthur River Working Party involves officers from the Departments of the Chief Minister, Mines and Energy and Treasury, with wide consultation being undertaken as required, but these are the principal Departments concerned.

LEGISLATION

18. It is not envisaged that any additional legislation will be required.

PUBLICITY

19. It is considered that publicity is neither desirable or necessary in respect of the presently proposed exercise. In fact, the exercise is seen as one requiring considerable discretion.

TIMING

20. Mining Reserve No. 581 is being maintained intact without diminution until 31 December 1979 (see Attachment 'E'). In view of the time which will elapse for a firm of consultants to present their report, have it examined by the Department and the possible renegotiation of the Agreement, it would be expedient to extend the reservation, intact and without diminution until 30 June 1980.

A letter to Mount Isa Mines to this effect is at Attachment 'F'.

RECOMMENDATIONS

21. It is recommended that Cabinet :
- . approve expenditure of up to \$50,000 to engage a firm of consultants to provide an independent assessment of the metallurgical, financial and associated aspects of the McArthur River Project in order to determine an appropriate course of action for the development of a mine;
 - . approve the reply to Mount Isa Mines following the initial assessment of the report;
 - . direct the Working Group to report back to Cabinet following receipt of the consultant's report recommending terms and conditions for a new agreement for development of a mine.



November 1979

IAN TUXWORTH

MOUNT ISA MINES LIMITED

(A MEMBER OF THE M.I.M. HOLDINGS GROUP OF COMPANIES)



M.I.M. BUILDING, 160 ANN ST., BRISBANE 4000
 TELEPHONE 228 1122, G.P.O. BOX 1433, 4001
 TELEGRAMS: "MIMHOLD", BRISBANE
 TELEX: AA 40160

IN REPLY QUOTE

REF.:

DATE: July 31 1979

Hon. I.L. Tuxworth M.L.A.
 Minister for Mines and Energy
 Northern Territory Legislative Assembly
 P.O. Box 3721
 DARWIN N.T. 5794

Dear Mr. Tuxworth

Following recent discussions in Darwin with the Chief Minister, members of the Northern Territory Administration and yourself, we submit our McArthur River Project Feasibility and Environmental Report. This report amplifies the preliminary report, a copy of which we made available to your Government in January 1979.

The study is based on the proposed treatment of 10 000 tonnes of ore per day from an integrated mining and concentrating operation from which zinc and lead concentrates would be exported for processing at overseas smelting and refining plants. In addition, cases of 20 000 tonnes and 5000 tonnes per day have been studied to investigate the effect of treatment rate on financial return.

A study relating to the addition of a zinc refinery and lead smelter at the mine site has been included to indicate any improvement in the economics by treatment of the concentrates locally.

The studies of all the cases described within this Feasibility and Environmental Report indicate that development of the McArthur River Project as a production unit is not an economic reality under present conditions. The substantial supporting information accompanying the report will enable those reviewing the study to gain a complete understanding of the scope of the project and the extent of the problems that must be overcome.

You will appreciate that sections of the report have particular commercial value to our Company. Those sections have been clearly identified and we would appreciate your maintaining confidentiality of those sections to your own Government departments.

Our efforts to establish the feasibility of the project at McArthur River will continue, with particular emphasis on:

- geological exploration in an attempt to locate mineralisation with better metallurgical characteristics than the HYC ore,
- an MIM hydrometallurgical research program which will include consideration of McArthur HYC ore, and a complete review of potential metallurgical research activities which could be applicable to the McArthur ore,

July 31 1979

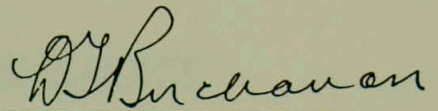
monitoring of changes in any factors which could vary the economics, particularly market conditions, metal prices, operating costs and metal recoveries.

We suggest that an appropriate time for updating the study would be 1984, unless significant changes in the factors which affect the economics warrant an earlier revision.

In preparing this report we have used the best expertise available which has involved Company personnel supplemented where necessary by reputable consultants. We believe that the bases for geological, mining, metallurgical, engineering, marketing and financial studies are sound, professional and realistic.

We look forward to receiving your comments on the report.

Yours faithfully
MOUNT ISA MINES LIMITED



D.T. Buchanan
Director



MOUNT ISA MINES LIMITED

McARTHUR RIVER PROJECT

***FEASIBILITY AND ENVIRONMENTAL
REPORT***

VOLUME 1

Report Prepared by
MIMETS DEVELOPMENT PTY LTD.

JULY 1979

McARTHUR RIVER PROJECT
FEASIBILITY AND ENVIRONMENTAL REPORT

Report Contents

VOLUME 1

Section	1	Introduction
	2	Summary
	3	Conclusions

VOLUME 2

Section	4	Geology
	5	Mine
	6	Metallurgy
	7	Concentrator

VOLUME 3

Section	8	Tailings Disposal
	9	Transportation
	10	Mine Site Development
	11	Port Area

VOLUME 4

Section	12	Water Supply
	13	Power Supply
	14	Communities
	15	Communications
	16	General Infrastructure & Support Facilities
	17	Capital and Operating Cost Estimates
	18	Marketing
	19	Financial Analysis
	20	Environment
	21	Aboriginal Affairs

Addendum	A	Treatment of Lead and Zinc Concentrates
----------	---	---

VOLUME 5

Part	A	Summary of Environmental Background Reports
Part	B	Environmental Impact Statement

VOLUMES 6-20

Appendices	4/1 - 4/15	Geological Report (Refer Section 4 for detailed list)
------------	------------	---

VOLUME 21		
Appendix	5/1	Preliminary Rock Mechanics Assessment Mine Dewatering Survey
Appendix	5/2	
VOLUME 22		
Appendix	6/1	McArthur River Pilot Plant Operations
VOLUME 23		
Appendix	9/1	Survey — Parts 1, 2 and 3
VOLUME 24		
Appendix	9/1	Survey — Parts 4 and 5
VOLUME 25		
Appendix	9/2	Geotechnical Investigation Access Route Borroloola — Centre Island Slurry Pipelines Study
Appendix	9/3	
VOLUME 26		
Appendix	10/1	Surface Hydrological Studies
Appendix	10/2	Geotechnical Investigation of Minesite Area — Civil Works
Appendix	10/3	River Diversion, Seismic Refraction Study
VOLUME 27		
Appendix	11/1	Port McArthur, Report on Investigation
Appendix	12/1	Water Supply Investigation
Appendix	14/1	Civil Services & Conceptual Town Layout
Appendix	17/1	List of Major Items of Equipment
Appendix	18/1	An Analysis of Base-Metal Smelter Terms
VOLUME 28		
Appendix	20/1	Environmental Background Reports, Dames & Moore Volume II
VOLUME 29		
Appendix	20/2	Environmental Background Reports, Dames & Moore Volume III
VOLUME 30		
Appendix	20/3	Environmental Background Reports, Dames & Moore Volume IV

VOLUME 1

INDEX

Section		Page
1.	INTRODUCTION	
	1.1 General	1
	1.2 History	1
	1.3 Scope of Feasibility Study	2
	1.4 Timing	3
2.	SUMMARY	
	2.1 Geology	4
	2.2 Mine	4
	2.3 Metallurgy	4
	2.4 Tailings Disposal	5
	2.5 Transportation	5
	2.6 Mine Site Development	7
	2.7 Port Area	7
	2.8 Water Supply	8
	2.9 Power Supply	9
	2.10 Communities	9
	2.11 Communications	10
	2.12 Cost Estimates	10
	2.13 Marketing	11
	2.14 Financial Analysis	12
	2.15 Treatment of Concentrates	15
	2.16 Environment	15
3.	CONCLUSIONS	
	3.1 Mine	16
	3.2 Metallurgy	16
	3.3 Transportation	16
	3.4 Infrastructure	17
	3.5 Marketing	17
	3.6 Financial Analysis	17
	3.7 Treatment of Concentrates	18
	3.8 Future Studies	18

DRAWINGS

SECTION 1
INDEX

	Page
1. INTRODUCTION	
1.1 General.....	1
1.2 History.....	1
1.3 Scope of Feasibility Study.....	2
1.4 Timing.....	3

1. INTRODUCTION

1.1 General

This report presents a developmental study of the HYC zinc/lead mineral deposit within Mining Reserve No. 581 at McArthur River in the Northern Territory of Australia. The mineral deposits are approximately seven hundred and twenty kilometres south-east of Darwin, and approximately one hundred kilometres inland from the Gulf of Carpentaria, as illustrated in Figures 1/1 and 1/2. The requirements of the total project have been considered and the engineering, economic, social and environmental aspects have been investigated.

The report is presented in five volumes. This Volume 1 summarises the report, Volumes 2, 3 and 4 cover the detailed engineering and economic considerations, and Volume 5 deals with the environmental aspects. Supplementary technical details are presented as appendices in twenty-five additional volumes.

1.2 History

Mount Isa Mines Limited first became interested in the area in 1948, and in 1955 the "Reward" lead/zinc deposit on the western side of the Carpentaria Highway was discovered. In the same year, the HYC outcrop was discovered. By the early 1960's an intensive drilling program had defined the orebody as one of considerable magnitude.

The ore is characteristically extremely fine-grained and the inherent metallurgical problems of separation of the constituent minerals were recognised early in the development of the project. Plans proceeded towards possible development in the 1966/67 period, and during that time the present camp facilities were constructed, and a shaft was sunk to provide bulk ore samples for metallurgical testing.

In early 1968 the extent of the metallurgical problem was confirmed and development plans were deferred until a viable treatment process could be developed. Research has continued at leading research centres around the world and at Mount Isa since that time.

In early 1974 a major review of the McArthur project was carried out. None of the many and varied treatment processes considered to that date had resulted in a viable operation being demonstrated. Of the unsuccessful tests, the best results were based on a conventional grinding/flotation process to produce a bulk lead/zinc concentrate. It was considered that more favourable economic results could be obtained by the production and marketing of separate lead and zinc concentrates.

In May 1974 a decision was made to construct a fifty tonne per day pilot plant on the mine site, and to develop a pilot mine and infrastructure facilities to support the development work. Details of the pilot plant are included in Section 6 of this report. The Company commissioned the plant in July 1977 and operated it until December 1978.

Since 1955 the expenditure by the Company on exploration, metallurgical research, site facilities, and feasibility studies has exceeded \$21 million.

1.3 Scope of Feasibility Study

1.3.1 The study covers the viability of the total project from mine to market. A preliminary design for a mining operation has been developed using the available geological data. The results of the pilot plant operation have been used to develop a conceptual process plant. Sufficient preliminary engineering on the infrastructure has been completed to allow reasonable estimates of cost and time to be established.

1.3.2 The total project covered by the study is illustrated in Figures 1/3 and 1/4 and includes:

- . diversion of the McArthur River
- . major earthworks at the mine site
- . open pit mine
- . ore handling system
- . concentrator
- . concentrate drying facilities
- . tailings dam
- . heavy-duty road from mine site to port site
- . road transport fleet
- . deep water wharf installation on Horn Islet
- . ship loading and unloading facilities
- . communities near mine site and port site
- . power supplies
- . water supplies
- . communications system
- . airfields near the mine site and port site
- . other infrastructure requirements to support the total operation.

1.3.3 The study has been carried out on the basis of an operation where 10 000 tonnes per day of ore would be treated to produce separate zinc and lead concentrates for sale to overseas custom smelters and refineries. Such an operation would produce 4.5% of the total 1978 world zinc production at which level marketing difficulties could be expected.

1.3.4 To investigate the sensitivity to treatment rates, brief supplementary studies were carried out as follows:

- . 5000 tonnes of ore per day — the project is less viable than for the base case
- . 20 000 tonnes of ore per day — although the rate of return is slightly higher than for the base case it is still unsatisfactory. Also the marketing problems would be accentuated.

1.3.5 A further supplementary study was carried out for the inclusion of a zinc refinery and a lead smelter at the base rate of 10 000 tonnes of ore per day. The rate of return is only slightly better than the base case, and financing such a high cost project would be difficult.

1.4 Timing

The results of the McArthur River Project Feasibility and Environmental Study indicate no early development of the project.

The study has shown the factors which have the most significant effect on the economics of the project, and those factors will be monitored. The Company will update the study in 1984 unless changes in the economic factors warrant an earlier revision.

If circumstances should change and the project is shown to be viable, the subsequent program is shown in Figure 1/5.

SECTION 2

INDEX

Page

2. SUMMARY

2.1	Geology.....	4
2.2	Mine.....	4
2.3	Metallurgy.....	4
2.4	Tailings Disposal.....	5
2.5	Transportation.....	5
2.6	Mine Site Development.....	7
2.7	Port Area.....	7
2.8	Water Supply.....	8
2.9	Power Supply.....	9
2.10	Communities.....	9
2.11	Communications.....	10
2.12	Cost Estimates.....	10
2.13	Marketing.....	11
2.14	Financial Analysis.....	12
2.14.1	Parameters.....	12
2.14.1.1	Production.....	12
2.14.1.2	Capital Costs.....	12
2.14.1.3	Operating Costs.....	12
2.14.1.4	Revenue.....	12
2.14.1.5	Taxation.....	13
2.14.2	Rate of Return.....	13
2.14.3	Required Metal Prices.....	13
2.14.4	Variation of Treatment Rate.....	14
2.14.5	Sensitivities.....	14
2.15	Treatment of Concentrates.....	15
2.16	Environment.....	15

2. SUMMARY

2.1 Geology

- 2.1.1 The HYC mineral deposit is about 1.5 kilometres long by 1.0 kilometres wide and 55 metres thick, and contains 227 000 000 tonnes of ore of average grade, 9.2% Zn, 4.1% Pb and 41 g/t Ag.
- 2.1.2 Considerable geological exploration has been carried out within Mining Reserve 581, but to date none of this work has indicated mineral resources of possible economic significance except for the HYC deposit.

2.2 Mine

- 2.2.1 For the pilot plant operation a small underground mine was developed by driving a decline tunnel to intersect the orebody 80 metres below the surface. This allowed the mining of ore which was fully representative of the total deposit and unaffected by weathering or oxidation.
- 2.2.2 For a large scale operation two methods of mining have been considered:

An open pit mine which would have dimensions approximately 2 kilometres from north to south, 1.5 kilometres from east to west and would extend in its final form 450 metres below the surface.

The open pit would require the removal of 1 106 000 000 tonnes of overburden to allow the extraction of 198 000 000 tonnes of ore. To mine the remainder of the ore reserves, underground methods would be required. The open pit would necessitate diversion of the McArthur River and the construction of a bund wall to prevent water run-off into the pit.

An underground mine employing an open stope method of mining with ore haulage by means of a conveyor system.

- 2.2.3 Preliminary studies of Rock Mechanics and Groundwater were carried out by specialist consultants. Considerably more investigations would be required before a final mine design could be undertaken, but the initial studies indicate that there should be no major problems with either of these two aspects of the mine design.

2.3 Metallurgy

- 2.3.1 Since 1959 many research institutions both in Australia and overseas have carried out investigations into the metallurgical problems associated with the McArthur HYC ore. Up to 1974 when a decision was made to build a pilot plant on site at McArthur River, the research work had not resulted in the development of products which were commercially marketable.

2.3.2 The pilot plant operation indicated that zinc and lead concentrates of marketable grades could be produced in a large scale plant. The following products could be expected:

- A zinc concentrate assaying 52% Zn and 110 – 120 g/t Ag in which 68% of the zinc and 30% of the silver content of the ore would be recovered
- A lead concentrate assaying 55% Pb and 230 g/t Ag in which 25% of the lead and 10% of the silver content of the ore would be recovered.

2.3.3 Because of the very fine grained nature of the ore, to achieve the results listed above, the ore must be ground to an average size of 95% passing 37 micrometres or 400 Tyler mesh. (Section 6 "Metallurgy" gives a comparison of the McArthur metallurgy with that of other mining properties.)

2.3.4 A conceptional large scale concentrator is described in the report. A flowsheet has been developed and equipment types and sizes are nominated.

2.4 Tailings Disposal

2.4.1 The topography of the McArthur area does not provide any deep valleys in which to store large quantities of tailings. The proposed tailings dam would be comparatively shallow and would extend for approximately 5 kilometres from south to north and 5 kilometres from east to west at its widest part.

2.4.2 A computer study has been employed to investigate the capacity required in the tailings dam and it has demonstrated that impoundment of the tailings without any possibility of overspilling the tailings dam walls could be achieved.

2.5 Transportation

2.5.1 Alternative transport arrangements from the mine site to the port site have been considered as follows:

- A high grade highway accommodating double-trailer road units for transporting concentrates.
- A railway.
- Transport of zinc and lead concentrates in slurry form through a high pressure pipeline.
- Transport of concentrates by a conveyor system or an aerial ropeway. (Economic and environmental considerations led to the early elimination of these alternatives).

2.5.2 Associated with the system for transport of concentrates is the selection of the site of a major power station. The alternatives are:

- . Power station at the mine site with coal transported from the port site backloaded on road units, by rail, or via a separate slurry pipeline; or
- . Power station at the port site with a high voltage transmission line from the port site to the mine site.

2.5.3 After complete development of the proposed mining operation, the following approximate tonnages would require to be transported between the mine site and the port site:

. Outwards

Zinc concentrate — 450 000 tonnes per annum

Lead concentrate — 70 000 tonnes per annum.

. Inwards

Coal — 143 000 tonnes per annum

Stores — 40 000 tonnes per annum

Liquid fuel — 21 000 tonnes per annum.

2.5.4 In addition to the transport requirements after the proposed mine was fully developed, the transport of construction equipment and materials during the construction phase would have to be catered for. During that phase a total of 300 000 tonnes of cargo would be handled during a four year period.

2.5.5 The transportation study includes the selection of a route between the mine and port which would be suitable for either a road or a railway. Construction of the access to the port would include three major bridges and 21 kilometres of formation over estuarine mud flats.

The proposed road would consist of an extra heavy duty asphaltic concrete surface designed to accommodate axle loads higher than the normal legal limit. The higher axle load would allow 100 tonne road-trains to be carried for the transport of concentrates. To transport the concentrates produced, 7 road-trains would be required to operate continuously on a three shift basis, that is, 21 road-trains per day on each of five days per week. While special arrangements would be required between the Company and the Northern Territory Department of Transport and Works to allow the over-legal weight trucks to be used, it is envisaged that the road would be an "open" highway to accommodate normal regional and tourist traffic.

2.6.1 The project would require major civil engineering works in construction of the access route, the port, and the following works at the mine site:

- . Diversion of the McArthur River
- . Diversion of streams in the vicinity of the mine site
- . Construction of the bund wall around the open pit
- . Construction of a platform to accommodate the process plant
- . Construction of a large tailings dam and minor dams
- . Diversion of a seven kilometre length of the Carpentaria Highway
- . Pre-production stripping of overburden for the open pit operation
- . Major and minor roadworks
- . Drainage works
- . General civil engineering services.

2.6.2 The study is based on the construction work being carried out by one or more major contractors. Equipment has been selected and performance assessed to establish estimates of cost and time.

The works would be limited by the wet seasons, and the contractors would be required to comply with a tightly controlled integrated construction program.

2.7 Port Area

2.7.1 While the transportation study included consideration of shipping the products of the treatment plant through Darwin or Townsville, the results show that a deep water port close to the mine site is essential for the viability of the project.

2.7.2 Investigations in early development of a port in the Sir Edward Pellew Group date back to beginning of the century. Since 1965 the Company has commissioned a marine consultant to study the port requirements and report on the selection of the most suitable site. The investigations have resulted in the selection of a port site on Horn Islet on the eastern side of Centre Island and only that location has been considered in the study.

2.7.3 The proposed port would accommodate bulk carriers for concentrates in the 60 000 to 65 000 tonne range, in addition to colliers and general cargo vessels in the 10 000 to 15 000 tonne range.

2.7.4 The port complex envisaged would include:

- . A wharf structure and approaches

- . Covered storage for concentrates
- . Shiploading facilities for concentrates
- . Ship unloading facilities for coal and general cargo
- . Coal stockpiles
- . General cargo storage facilities
- . A small community
- . A light aircraft airstrip
- . Power and water supplies and general services.

2.7.5 In order to produce realistic costs the study has been carried out on the basis of the total port requirements being part of the mining project. However the proposed design of the wharf and the low berth occupancy would allow substantial use of the installation by other commercial interests. It is envisaged that an open regional port and community would be developed and that other industries would become established in the region after the construction of the port.

2.8 Water Supply

- 2.8.1 A water supply of 25 megalitres per day would be required for the proposed concentrator operation, a township of 2000 persons, and a thermal power station at the mine site.
- 2.8.2 The study included the consideration of six dam sites on the McArthur, Kilgour and Glyde Rivers upstream of the mine site, and in addition a bore field to tap a source of underground water.
- 2.8.3 All the dam sites considered appear to offer practicable schemes, but considerably more investigation would be required before the final selection of a dam site.
- 2.8.4 For the most likely dam sites on the McArthur or Kilgour Rivers the scheme would include a small weir on the McArthur River immediately upstream of the mine site from which water would be pumped to storage reservoirs at the plant area and the town site.
- 2.8.5 For the port area the following alternative sources of water were considered:
- . A supply from a weir on Batten Creek on Bing Bong Station
 - . Underground water supplies, if such a source could be proved by further investigations
 - . A desalination plant.

The first alternative has been included in the cost estimates as this is the only alternative which would not require further investigation.

2.9 Power Supply

- 2.9.1 At the mine site the maximum power demand would be approximately 59 megawatts, and at the port site approximately 2 megawatts.
- 2.9.2 The major power station is proposed as a coal fired steam station, and for the purposes of this study it has been assumed that coal would originate in the Bowen Basin, Queensland. The station would comprise three 30 megawatt turbo generators, allowing two normally running and one standby.
- 2.9.3 Two alternative arrangements were considered:
- . The major power station at the mine site with a small diesel station to supply the port
 - . The major power station at the port site with a 132 kilovolt transmission line between the port site and the mine site.

2.10 Communities

- 2.10.1 The workforce at the mine would total approximately 920 people, and at the port approximately 20 people. The workforce is envisaged as 40% married and 60% single people so that accommodation would be required near the mine site for approximately 2000 Company personnel and families, and at the port site for approximately 40 people.
- 2.10.2 Various alternative locations for the town near the mine site were considered. Because of the continuous operation at the mine site the Company considered that locations more than 10 kilometres from the mine site would not be suitable. With that limitation and others imposed by flood levels, access, orientation and avoidance of dust and noise, the alternatives are few.
- 2.10.3 The town is envisaged as comprising air-conditioned homes for married personnel, air-conditioned barracks for single personnel, and a caravan park. The proposed plans include a shopping centre, hospital, ambulance station, and recreational facilities. Provision would also be made for various Government Departments and facilities including Education, Police, Australia Post and Telecom.
- 2.10.4 The port community would be comprised of air-conditioned houses and barracks with minimal service facilities.
- 2.10.5 Both communities are envisaged as being "open". For the purposes of estimating, the costs of all facilities have been included in the overall project cost, but it is envisaged that private investors other than the Company would be interested in establishing some of the facilities.

- 2.11.1 Communications to the area are totally inadequate at present.
- 2.11.2 The study has included discussions with Telecom and Australia Post regarding the most efficient means of communication to support a large scale operation.
- 2.11.3 The proposed communication system must cover:
- . External telephone communication
 - . Telex communication
 - . TV and radio broadcast
 - . Mail service
 - . Internal telephone/radio
 - . High speed data transmission.
- 2.11.4 The alternatives considered include:
- . Connection to the microwave system between Mount Isa and Darwin
 - . An ultra-high frequency radio system
 - . A tropospheric scatter system
 - . Use of satellite facilities if they were available by the time the project was developed.

2.12 Cost Estimates

CONFIDENTIAL

- 2.12.1 Preliminary designs for the project have been developed in sufficient detail to allow realistic capital cost estimates to be compiled. Appropriate contingencies have been assessed for each section of the works and have been included in the estimates. The total figure including contingencies should be considered to have an accuracy of the order of 20%.
- 2.12.2 Operating procedures have been analysed and performances calculated to allow reasonable operating costs to be established. The operating costs listed in the report should be considered to have an accuracy of the order of 15%.
- 2.12.3 All the items in the capital cost estimates are of sufficient capacity for the needs of the mining operation only. Any regional requirements would be in addition to the costing which is listed in the report.
- 2.12.4 The capital cost covering the mine, process plant, transportation system and complete infrastructure from mine to port, and including all indirect costs, working capital and contingencies is estimated at \$812 000 000 (1978 dollars).

2.12.5 The direct operating cost including mining, processing, transport, loading into ship and all overhead costs is estimated at \$56 000 000 per annum (1978 dollars).

2.13 Marketing *CONFIDENTIAL*

2.13.1 At a treatment rate of 10 000 tonnes of ore per day the operation would result in the production of approximately 4.5% of the total 1978 world zinc production.

2.13.2 The products to be marketed would consist of approximately 450 000 tonnes per annum of zinc concentrate, and 70 000 tonnes per annum of lead concentrate. The study has assumed that 50% of each of these products would be marketed in Japan and 50% in Europe.

2.13.3 The value of concentrates at the mine site would be a function of three components:

- . Metal prices
- . Treatment charges
- . Freight and handling costs from mine to final receiver.

2.13.4 The extremely small grain size of the concentrates, the comparatively high lead and silica contents of the zinc concentrate, and the iron, zinc and copper contents of the lead concentrate all present processing problems in further treatment. Discussions with overseas custom smelters and refineries have indicated that blending of the McArthur concentrates with a considerably higher tonnage of other concentrates could be necessary for successful processing.

2.13.5 Because of the preliminary stage of the project, no negotiations have been entered into with possible customers regarding financial terms. However, because of the technical problems mentioned above, negotiation of long term contracts with several smelting and refining plants to absorb the total production would be required.

2.13.6 As no negotiations with customers have been possible at this stage, forecasts of metal prices and treatment charges were considered inappropriate for the study. Instead, three cases have been considered using actual prices and treatment charges as follows:

- . the average prices for the last five years escalated to 1978 terms
- . the average prices for the last ten years escalated to 1978 terms
- . the prices current at May 1 1979.

The financial analyses using these prices are summarised in Section 2.14 and described in detail in Section 19 "Financial Analysis".

All costs and prices quoted in this report are in Australian dollars unless otherwise noted.

2.14.1 Parameters

The chief parameters used to assess the economics of the project are:

2.14.1.1 Production

- . Ore treatment rate 3.6×10^6 tonnes per annum
- . Production life for financial analysis 25 years
(Actual life of open pit would be 55 years.)
- . Average head grade (over the assumed 25 year financial life) 9% Zn, 4% Pb, 39 g/t Ag
- . Concentrator recoveries

68% Zn	to	zinc	concentrate
25% Pb	to	lead	concentrate
30% Ag	to	zinc	concentrate
10% Ag	to	lead	concentrate

2.14.1.2 Capital Costs (1978 dollars)

- . Pre-production capital \$787 528 000
- . Working capital \$24 225 000
- . Replacement capital \$86 449 000.
(Covers major equipment replacement during the production life.)

2.14.1.3 Operating Costs (1978 dollars)

- . Operating cost f.o.b. \$56 123 000 per annum.
(Covers mining, concentrating, transport and loading into ship.)
- . Sea freight \$17.50 per tonne concentrate.

2.14.1.4 Revenue (1978 dollars)

- . Metal prices

Zinc	\$760 per tonne
Lead	\$550 per tonne
Silver	\$4.76 per ounce (\$153 per kilogram)

The silver price is quoted on a "per ounce" basis on international bullion markets and that basis has been used throughout the report. The above prices represent the average for the period 1974-78 escalated to 1978 dollars.

- . Treatment charges

Zinc	39.7% of value of payable metal content
Lead	35.1% of value of payable metal content.
- . Total revenue f.o.b. \$91 500 000 per annum.

2.14.1.5 Taxation

· Tax rate	46%	
.. Royalty	1.25%	of nett value as determined by Section 20 of the Northern Territory Mining Act 1939-1979.

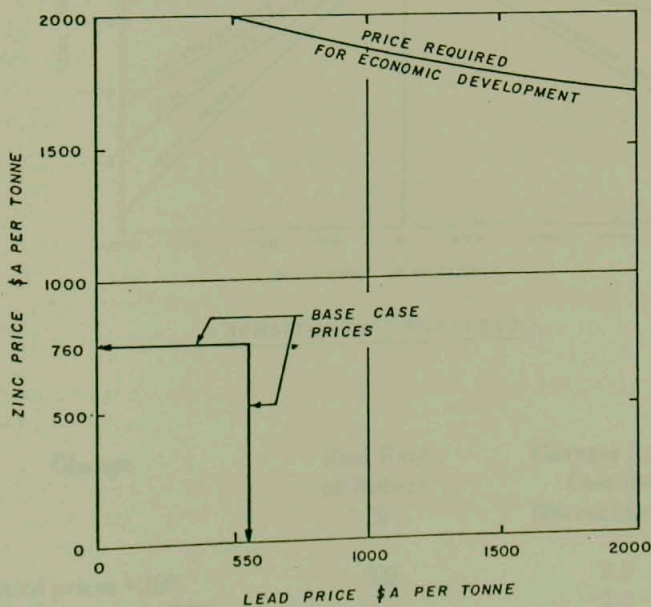
2.14.2 Rate of Return

Under the above assumptions (referred to in this report as the base case) real rate of return from the project would be minus 2.0%.

At May 1 1979 price levels (zinc \$724 per tonne, lead \$1071 per tonne, silver \$7.25 per ounce) real rate of return from the project would be minus 0.6%.

2.14.3 Required Metal Prices

On the basis of the technology adopted, the metal recoveries detailed in Section 2.3.2 and cost estimates listed in Section 2.12, a 135% increase in the prices of all three metals (above the average for the Period 1974 - 1978) is required for the project to be economic. This represents a price for zinc of \$1790 per tonne, for lead of \$1295 per tonne and for silver \$11.20 per ounce (all in 1978 Australian dollars). Refer graph below:



Zn & Pb PRICES REQUIRED
(ASSUMING Ag PRICE \$A 4.76 PER OUNCE)

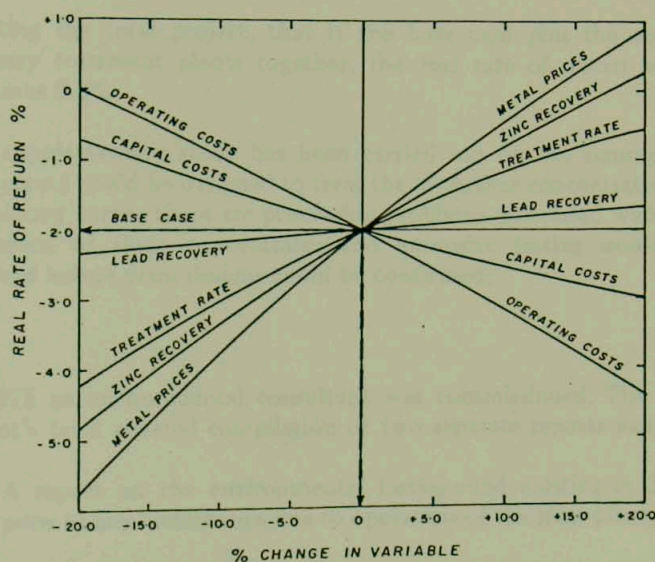
2.14.4 Variation of Treatment Rate

A case which assumes a treatment rate of 5000 tonnes per day was studied. This case indicates a real rate of return of minus 6.3%. The reduced production would alleviate the marketing problems. However, the required prices for an economic operation would be higher and even less likely to be achieved and maintained.

An additional case which assumes a treatment rate of 20 000 tonnes per day was also studied. This case indicates a real rate of return of 1.5%. However, the marketing problems of such an operation would be accentuated as discussed in Section 18 "Marketing".

2.14.5 Sensitivities

Project return is most sensitive to changes in metal prices, operating costs and zinc recovery. The effect of changes in these variables on base case return is illustrated in graphical and tabular form below:



SENSITIVITY ANALYSES

Change	Real Rate of Return %	Changes from Base Case Return (Percentage points)
Metal prices +20%	0.9	2.9
Operating costs -20%	0	2.0
Zinc recovery +20%	0.3	2.3
Treatment rate +100%	1.5	3.5

2.15.1 The main study has been carried out on the basis of sale of separate zinc and lead concentrates to overseas custom smelters. A brief study on the inclusion of a zinc refinery and a lead smelter for the further treatment of the concentrates has resulted in the following approximate main figures (1978 dollars):

- Capital cost of zinc refinery, lead smelter, and associated additional works \$561 000 000

Total capital cost then becomes \$1 373 000 000

- Operating cost f.o.b. in addition to the base case \$47 000 000 per annum

Total operating cost f.o.b. then becomes \$103 000 000 per annum

- Total revenue f.o.b. (based on average prices for the period 1974 - 1978 escalated to 1978 dollars) \$176 400 000 per annum.

Treating the total project, that is the base case plus the supplementary treatment plants together, the real rate of return would be minus 0.9%.

2.15.2 The supplementary study has been carried out on the assumption that plants could be designed to treat the McArthur concentrates. As mentioned earlier there are processing problems associated with the treatment of these concentrates and extensive testing would be required before plant designs could be confirmed.

2.16 Environment

2.16.1 In 1975 an environmental consultant was commissioned. The consultant's brief covered compilation of two separate reports namely:

- A report on the environmental background existing in 1975 prior to any disturbance due to operation of the pilot plant, and
- An assessment of the impact on the environment caused by development of a full scale operation.

2.16.2 Environmental aspects have been considered in all sections of the feasibility study.

2.16.3 The environmental report includes sections on archaeology and anthropology. Sites considered to be significant to Aboriginal groups are covered in the archaeological section.

2.16.4 The report makes mention of aboriginal land claims and the activities of the Australian Heritage Commission. However, the feasibility study has been carried out on the assumption that the land required for the mining operation, the port area, and the access corridor as shown on the Company's drawings would be available without any extra expense being incurred by the Company.

SECTION 3

INDEX

	Page
3. CONCLUSIONS	
3.1 Mine.....	16
3.2 Metallurgy.....	16
3.3 Transportation.....	16
3.4 Infrastructure.....	17
3.5 Marketing.....	17
3.6 Financial Analysis.....	17
3.7 Treatment of Concentrates.....	18
3.8 Future Studies.....	18

3. CONCLUSIONS

3.1 Mine

- 3.1.1 An open pit would provide the most economical method of mining the McArthur HYC deposit, and would allow extraction of 198 000 000 tonnes of ore.
- 3.1.2 An open pit would require diversion of the McArthur River.
- 3.1.3 Underground mining may be practicable, but would be more expensive than an open pit in both capital and operating costs.

3.2 Metallurgy

- 3.2.1 Extensive metallurgical research up to 1974 had not resulted in the development of products which would be commercially marketable.
- 3.2.2 The results of the pilot plant operation during 1977-78 indicate that a large scale concentrator could be designed to produce the following:
 - . A zinc concentrate assaying 52% Zn and 110 - 120 g/t Ag in which 68% of the zinc and 30% of the silver content of the ore would be recovered
 - . A lead concentrate assaying 55% Pb and 230 g/t Ag in which 25% of the lead and 10% of the silver content of the ore would be recovered.
- 3.2.3 The plant referred to above would result in approximately 35% by weight of the zinc plus lead metal content of the ore being discharged to tailings. Table 6-4 in Section 6 shows that zinc recovery at 68% is lower than that of any of the other major properties in the world which range from 72% to 92% and lead recovery at 25% is very much lower than the others which range from 54% to 97%.
- 3.2.4 Capital costs for the proposed concentrator would be much higher than for a plant treating the more usual coarser grained ores, because of the much greater grinding and flotation capacities required with the McArthur HYC ore. Operating costs would also be much higher principally due to higher costs for grinding power, grinding media, and reagents.

3.3 Transportation

- 3.3.1 Zinc and lead concentrates produced in a large scale plant would be exported to overseas countries particularly Japan and Europe. A deep water port for large bulk carriers would be required and a suitable port could be developed on Horn Islet on the eastern side of Centre Island in the Sir Edward Pellew Group.
- 3.3.2 For transport between the mine site and the port site an access corridor would be required. The most economical transport system between the mine and port would be a high grade road suitable for

axle loads higher than the normal legal limits. Multi-trailer road-trains would be used for the transport of concentrates outwards and coal and plant stores inwards. Perishables and liquid fuel would be transported on standard semi-trailer units.

3.4 Infrastructure

- 3.4.1 A large coal-fired power station would be required and the most economical and suitable location would be at the mine site, with coal delivered by ship to the port and transported by road-train to the power station.
- 3.4.2 Suitable dam sites are available on the McArthur, Kilgour or Glyde Rivers for water supply.
- 3.4.3 Infrastructure requirements such as communities, communications, and other service facilities, while being expensive, present no major technical problems.
- 3.4.4 The project would involve major engineering works, and a tightly controlled integrated program for the construction works would be required for development within the cost estimates included in the report.
- 3.4.5 The cost estimates in the report cover the infrastructure requirements of the mining operation only. Any additional regional requirements would be the subject of negotiations between the Company and the Government.

3.5 Marketing

- 3.5.1 The McArthur HYC concentrates would be marketable but the physical and chemical characteristics of the concentrates may limit the quantities which any particular customer could accept. The Company's experience indicates that such limits may result in unfavourable commercial terms.
- 3.5.2 A mining operation treating 10 000 tonnes of ore per day would result in the production of 4.5% of the total 1978 world zinc production. Timing of the development would be critical to ensure that the market could absorb that additional production.
- 3.5.3 An operation treating 20 000 tonnes per day would result in accentuated marketing problems.

3.6 Financial Analysis *CONFIDENTIAL*

- 3.6.1 Based on average metal price levels of the last five years (in 1978 dollar terms) the McArthur River project would result in a real rate of return of minus 2.0% and is not economic. At current metal prices (May 1, 1979) the rate of return from the project is only marginally improved to minus 0.6%.
- 3.6.2 Under current technology the metal prices required to ensure an economic operation of the project are substantially higher than both recent and current price levels.

3.6.3 The study indicates that there will be no early development of the project.

3.6.4 Factors which would have the most beneficial effect on project economics are in the areas of metal recovery, operating costs, and metal prices.

3.7 Treatment of Concentrates *CONFIDENTIAL*

The supplementary case for the addition of a zinc refinery and a lead smelter to the base case does not result in significant improvements to the economics of the project. The additional level of finance for these operations is a major consideration.

3.8 Future Studies *CONFIDENTIAL*

3.8.1 Geological exploration will be continued in an attempt to locate mineralisation with better metallurgical characteristics than the HYC ore.

3.8.2 An MIM hydrometallurgical research program which will include consideration of McArthur HYC ore has been commenced, and a complete review of potential metallurgical research activities which could be applicable to the McArthur HYC ore will be carried out.

3.8.3 Changes in any factors which could vary the economics, particularly market conditions, metal prices, operating costs and metal recoveries will be monitored and the study updated if warranted.

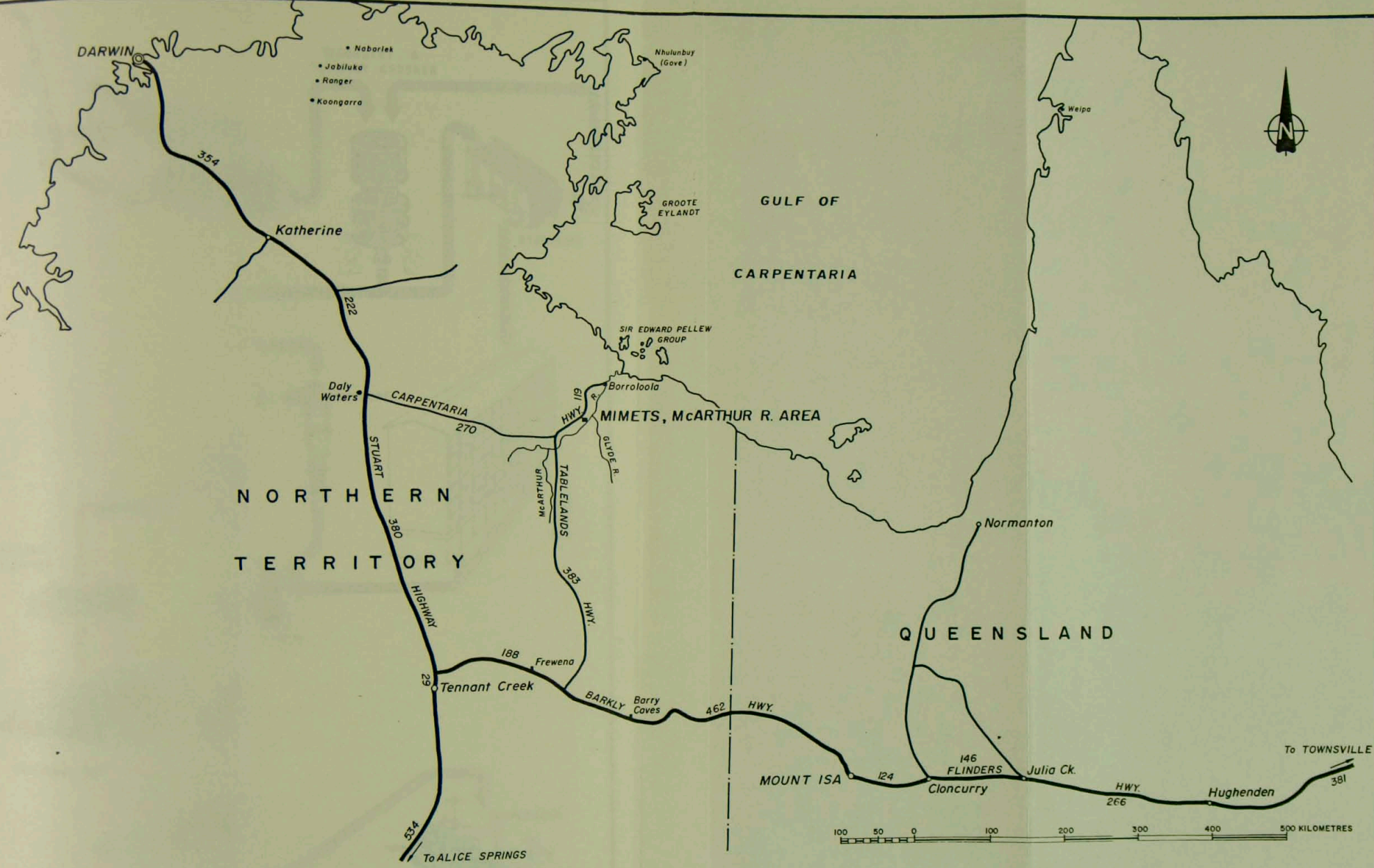
DRAWINGS

INDEX

- Figure 1/1 Map of Australia Showing McArthur
 River Area in the Northern Territory
- Figure 1/2 Locality Map
- Figure 1/3 Scope of Project
 Artist's Impression During Operations
- Figure 1/4 Operations
 Simplified Flow Diagram
- Figure 1/5 Construction Program



MAP OF AUSTRALIA
SHOWING McARTHUR RIVER AREA
IN THE NORTHERN TERRITORY



LOCALITY MAP

FIGURE 1/2

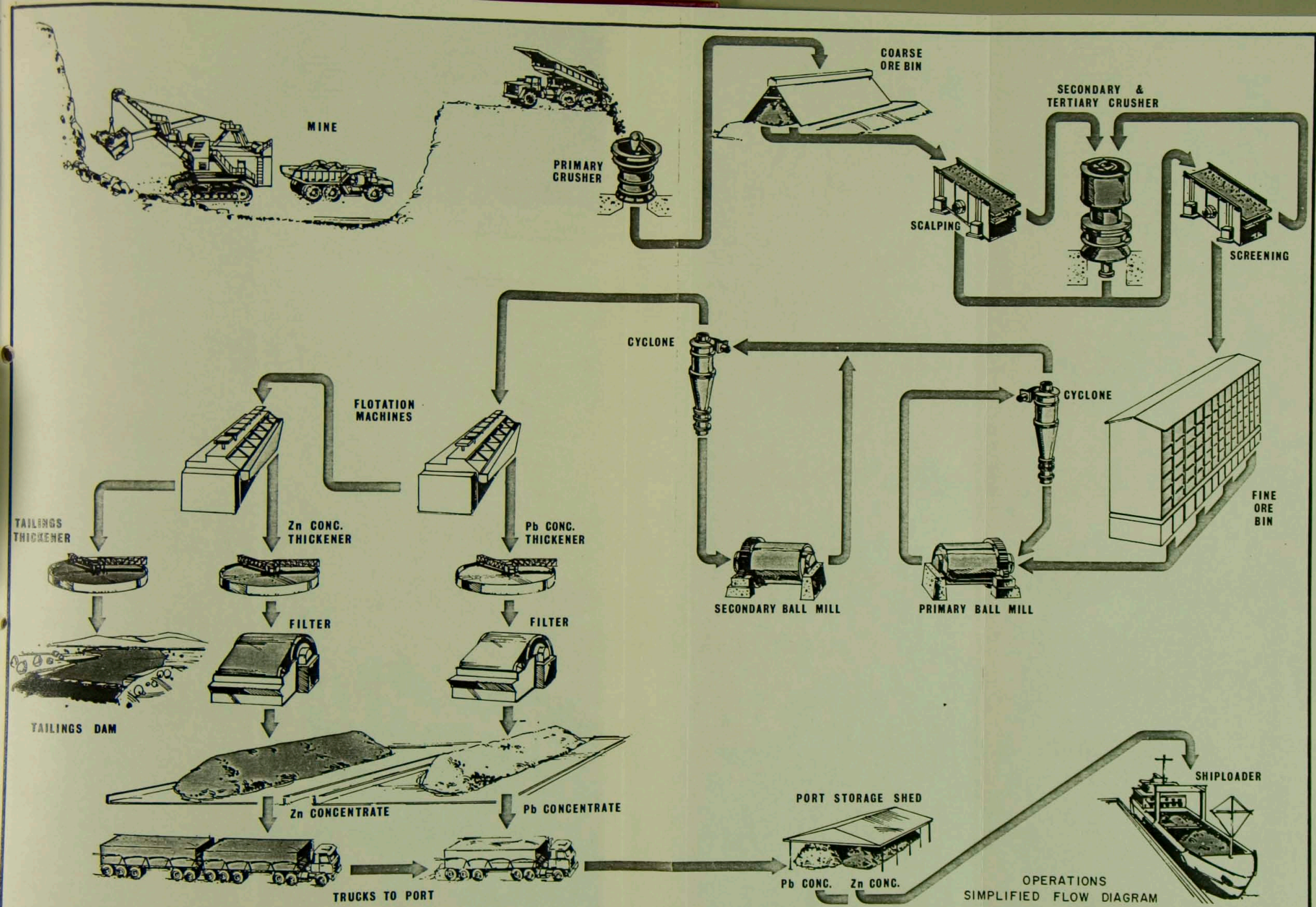
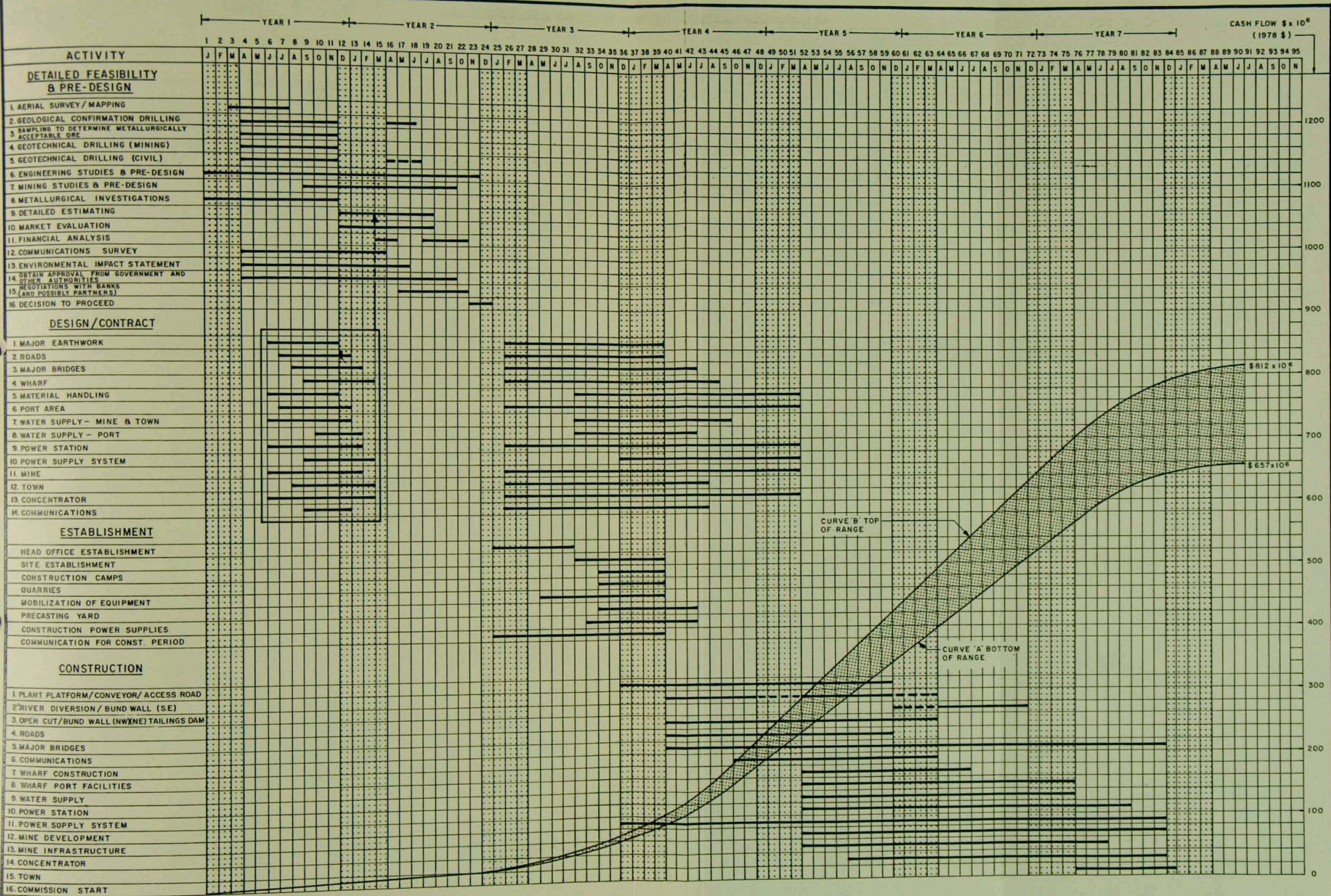


FIGURE 1/4



SCOPE OF PROJECT
ARTIST'S IMPRESSION DURING OPERATIONS



NOTE
 SHADED PERIODS INDICATE WET SEASONS

CONSTRUCTION PROGRAM

EVENTS LEADING TO THE SUBMISSION OF THE
McARTHUR RIVER PROJECT FEASIBILITY AND
ENVIRONMENTAL REPORT ON 31 JULY 1979

1. On 5 January 1977 a contract for the further testing and evaluation of the McArthur River zinc, lead and silver deposit was entered into by Mount Isa Mines and the Commonwealth. The contract provided for the company to submit a preliminary feasibility study in January 1979 and a final study in May 1980.

2. Following transfer of responsibilities for mineral development from the Commonwealth to the Northern Territory on 1 July 1978 the company was advised that the contract would need to be renegotiated between it and the Northern Territory Government.

3. By Cabinet Decision No.490 (20 November 1978)
Cabinet:
 - (a) endorsed the suggestion that Mount Isa Mines Limited submit a feasibility study on the McArthur River project by 30 June 1979;

 - (b) expressed its desire to see the project proceeding if it is feasible; and

(c) endorsed in principle the present leaseholders having security of tenure but wish to enter into detailed arrangements with the company for the development of the project only after its feasibility study had been received and assessed.

4. In January 1979, the company lodged a preliminary report which showed that :

- (a) the HYC orebody contained some 227 million tonnes of ore averaging 9.2% zinc, 4.1% lead and 41 grams per tonne silver;
- (b) to exploit the orebody would require the development of a major open cut mine, the diversion of the McArthur River, the establishment of a town, treatment plant, deepwater port, road or pipeline links between the mine and port and ancillary services including power and water supply;
- (c) the results of 18 months operation at the company's pilot plant have shown that normal flotation processes are capable of recovering 68% of the zinc content and 25% of the lead content of the ore in the form of saleable concentrates;

(d) on the basis of the above figures and in conjunction with projections on metal prices and estimates of operational and infrastructure costs, it is the Company's conclusion that the project would not operate profitably at this time.

5. In April 1979 a Working Group comprising representatives from the Department of Mines and Energy, Department of the Chief Minister and Department of the Treasury was established with terms of reference to :

- (a) Consider and report on the implications of -
- (i) the preliminary feasibility report dated January 1979 and the final feasibility report due on 30 June 1979;
 - (ii) the agreement between Mount Isa Mines Limited and the Commonwealth Government, for development of the proposed McArthur River Mine.
- (b) Consider and advise on the possible need to engage a consultant or consultants to provide independent assessment of metallurgical, financial or other aspects of the McArthur River Mine.
- (c) Review and make recommendations concerning ways and means of ensuring that the timing

and terms and conditions of eventual development and operation of the proposed McArthur River Mine are in the best interests of the Northern Territory.

6. A memorandum of 21 May 1979 from the Chief Minister indicated his desire to see that Mount Isa Mines were kept up to the mark and their reports evaluated. In addition, he stated that appropriate officers of the Department of Mines and Energy and the Treasury should visit Mount Isa Mines in Brisbane to examine their records on the project as soon as possible.
7. Consequent to this memorandum, two senior officers from the Department of Mines and Energy, together with a senior officer from the Department of the Chief Minister visited Mount Isa Mines office in Brisbane on 4 and 5 June, 1979. The Treasury were unable to send a representative due to pressure of other commitments.
8. An examination was made of the company's proposed 'Feasibility and Environmental Report' which was to be submitted at a revised date of 31 July 1979, and the associated records. In addition, discussions were held on future development proposals, particularly in relation to the renegotiation of the contract. The officers' report is at Appendix 1.

9. On 31 July 1979 Mount Isa Mines Limited submitted their McArthur River Project Feasibility and Environmental Report. The report was presented in five volumes. Volume 1 summarised the report, volumes 2, 3 and 4 covered the detailed engineering and economic considerations and volume 5 dealt with the environmental aspects. Supplementary technical details were presented as appendices in twenty-five additional volumes.

BACKGROUND

The Secretary of this Department wrote to Mount Isa Mines on 15 March 1979 indicating particular areas in which the Department of Mines and Energy needed substantial additional information before it could advise the Northern Territory Government on the project. These areas were the metallurgical process for treatment of the ore and the financial analysis of the project as a whole. It was hoped that the Company would provide the further information in advance of the major study report.

2. A reply from Mr. Buchanan of Mount Isa Mines dated 23 March, 1979 and a subsequent visit by him and other M.I.M. personnel to Darwin on 21 and 22 May 1979 for discussions with the Chief Minister, effectively precluded any advance information being sent but left open the possibility of officers visiting Brisbane.
3. Following a memorandum of 21 May, 1979 from the Chief Minister to Mr. Tuxworth, two officers of the Department of Mines and Energy, Mr. Gary Higgins and Mr. John Fenton together with Mr. Gordon James of the Chief Minister's Department visited M.I.M. Holding Limited in Brisbane on 4 and 5 June, 1979. The Treasury were unable to send a representative due to pressure of other commitments.
4. The purpose of the visit was to make an examination of the Company's proposed 'Feasibility and Environmental Report' due to be submitted at the end of July 1979, and to examine associated records. In addition, discussions were to be held on future development proposals, particularly in relation to the possibility of the renegotiation of the agreements with the Company previously held with the Commonwealth.
5. Discussions were held under the chairmanship of Mr. K.W. Miller, Project Manager, and in an amicable atmosphere. Unfortunately, Mr. Higgins, due to a previous engagement could only stay one day. The final report, although not finally edited was available for examination. Unfortunately time did not permit a detailed study of a massive volume of paper, and it soon became apparent that nothing new was being offered and that the final report would only be an enlargement of the preliminary one submitted late December 1978.
6. The statements made in the preliminary report, namely:

"2.7.5." 'Preliminary profit estimates indicate that the project would operate at a loss, even under the relatively favorable conditions adopted in the study' and

"2.7.6." 'Unless there is considerable change in the above costs it is unlikely that the project would be developed for many years' were reinforced in the final report.

Officers were repeatedly reminded that the project, at this period of time was not viable and that Mr. Buchanan's statements at various times, that the studies do not indicate early development, were still correct.

7. Throughout the two days, M.I.M. staff concerned with the project (Appendix 1) outlined their positions and the work that had been undertaken. No questions were evaded and all help was given to explain the scope and ramifications of the proposed operations. Unfortunately officers of the Northern Territory Government were not allowed to copy excerpts from the report. They asked for time to study the report privately and whereas this was not denied, only a brief period was given before staff returned to hover in the background and look over their shoulders. This created an impression that the Company is anxious about its present standing with the Northern Territory Government.
8. Were the project to go ahead, officers were told that it would require seven years for development. The first two years would be for further detailed field work, especially in relation to soil and rock mechanics for the open cut and the river diversion; also for marketing and the negotiation of contracts and finance arrangements. The remaining five years would be for design and construction.

Points arising from the preliminary examination of the report:

1. Geology:

The work undertaken within Mining Reserve No. 581 at McArthur River in delineating the HYC zinc/lead mineral deposit was described fully. Other work in the Reserve in connection with the search for additional orebodies with more favourable metallurgical properties than the HYC was also described. To date, no additional orebodies with resources sufficient to perhaps allow the project to commence whilst a solution to the problem of the HYC orebody is found, have been located.

The Company made known its desire for time to complete its exploration in the area and outlined a proposed work programme.

2. Mining:

A major river diversion and an open cut mine had been decided upon with consideration having been given to an underground mine. No costs for an underground operation were given in the report so it would not have been possible to compare the two; however, costs were available as supplementary information and these will now be included in the main report. It was admitted that little or no work had been done on soil or rock mechanics in connection with the design of the open cut. Golder Associates had been used as consultants but had only exploration drill core to work on. No tests had been done on the vital areas adjacent to the proposed river diversion.

3. Metallurgy:

This was the main stumbling block to the viability of the operation. Lengthy discussions were held on all phases of work on this subject and it became apparent that despite the pilot plant operation, no break through in the metallurgical impasse had been achieved.

Despite the sending of samples of ore to numerous research institutions in Australia and overseas during the last eighteen years, no satisfactory results had been achieved. The majority of the research had been associated with conventional flotation with no follow up work on newer or more exotic treatment proposals which had been undertaken by only a few firms. Appendix 2 shows the types of research which have been undertaken over the years. Only the conventional grinding/flotation process has been researched at depth. It is the metallurgical area of the study which will require close attention and where, from the Government's point of view, it will be important to seek expert advice from consultants on how a break through might be achieved. Strong pressure on the Company will need to be applied to ensure they keep up their work to obtain this break through.

It was suggested to M.I.M. that it was in the newer areas of metallurgy such as hydrometallurgy that they should be paying particular attention. Officers were then told that a special study group was being set up to study hydrometallurgical treatment of Mt. Isa, Hilton and McArthur River ores. The study leader is yet to be recruited.

4. Infrastructure:

The town, road and port development was discussed, albeit briefly. Alternatives to the port site were outlined including the possibility of shipping through Darwin. A port in the location as proposed appeared the most feasible. The Company made it obvious that they would prefer not to have to build the road and port on their own.

5. Marketing and finance:

This will need much closer examination. The feeling was of a rather negative approach with no initiatives having been taken to sound out new markets. It was rather a case of, solve the metallurgy problem to give an acceptable metal recovery at a realistic cost and then the marketing will take care of itself. Officers were continually told that if metal prices increased, especially the price of zinc, then many of the problems would be solved. (This was played down by stating that whereas it would help, it might be offset because other potential producers or existing producers would also be helped.)

The Company's general capability in this area of the project should not however be underestimated. Their position is substantiated by a thorough cost benefit analysis. This is a particular area where it would be advisable to obtain an outside opinion from consultants.

THE COMPANY'S OUTLOOK

There can be little doubt that the proposed McArthur River Mine creates genuine problems of development for Mt. Isa Mines. Viewed in historical perspective, the Company has compounded the problems of the fine grained nature of the ore body by concentrating all its efforts in one avenue of research to solve the metallurgical problems. This, combined with the present uncertainty in the state of world markets for zinc and lead and the availability of more viable deposits at the Company's other undertakings in Queensland, have almost certainly induced excessive caution in the Company's approach to the development of McArthur River.

Proposed Course of Action

Deciding whether or not the Company is justified in its present outlook will require careful judgment, particularly in relation to the practicability or otherwise of offering the mining leases to possible competitors.

In assessing the final feasibility report, therefore, the following can be identified as the key factors:-

- (a) the need to understand the nature of the metallurgical problem and to identify further research which might overcome it;
- (b) a clear identification of the likely course in market trends for zinc and lead concentrates and the processed metals;
- (c) a clear understanding of the ramifications of the engineering concepts involved;

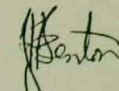
- (d) a thorough intelligence research on companies operating in this field, particularly Amoco who are known to be exploring on the edges of the McArthur River leases.

In regard to these factors, the Northern Territory Government is to some degree handicapped by a paucity of industrial intelligence and a lack of expertise in many areas of the project. It is necessary, therefore, to consider the employment of consultants to assist in the assessment of the feasibility study when it is received. This in itself is not a straight forward matter. Discussions with outside bodies will need to be discrete so as not to unnecessarily jeopardise the prospects of further co-operation with Mt. Isa Mines. The evidence available in Brisbane suggested that Mt. Isa Mines had in any case themselves employed many of the firms who are generally accepted in Australia as being eminent in mining projects.

As the next steps, therefore, this Department recommends:-

- (a) that in conjunction with the Office of Policy and Planning, the Department of Mines and Energy should proceed immediately with examining the best means of providing consultants for handling the projects when the feasibility study is finally received from the Company. This would entail amongst other things, discrete overtures in the industrial and academic fields in Australia;
- (b) that the McArthur River Working Party should be formally constituted into a Project Team comprising Mr. G. Higgins (Project Responsibility) Dept. Mines and Energy.
Mr. J.H. Fenton (Dept. Mines and Energy)
Mr. G. James Office of Policy & Planning, Chief Minister Dept.
Treasury (Representative to be nominated)

This Project Team would be responsible for wider Departmental consultations as required. The Department of Mines and Energy would provide the Secretariat.



(J.H. FENTON)

M.I.M. HOLDINGS LIMITED

STAFF ON McARTHUR RIVER PROJECT

Ian Alfredson, (I.D.)	- Chief Legal Officer
Tim Bennett, (E.M.)	- Manager - Carpentaria Exploration Company
Bob Challen, (R.H.)	- Manager - Environmental Affairs
David Cleary, (D.)	- Senior Investment Analyst
Rance Darlington, (R.E.)	- Administration Manager - (C.E.C.)
Ian Duncan, (I.D.)	- Design Engineer (Metallurgist)
Viv Forbes, (V.R.)	- Business Analyst
Boyd Harlen, (B.G.)	- Senior Mining Engineer
Carl Hoffman (C.W.)	- Financial Analysis Manager
George Lyon, (G.C.)	- Consultant Metallurgical Engineer
Keith Miller, (K.W.)	- Project Manager
Norm Thompson, (N.H.)	- Senior Civil Engineer
Derek White, (D.D.)	- Manager - Concentrate Sales

METALLURGICAL RESEARCH

1. Conventional Concentrate Production:

- (i) Grinding
- (ii) Flotation practice
- (iii) Reagents

2. Ore Treatment:

- (i) Re crystallisation
- (ii) Thermal
- (iii) Direct smelting
- (iv) Magnetic and electrostatic separation
- (v) Gravity separation
- (vi) Ore sorting
- (vii) Heavy media
- (viii) Chloride leaching
- (ix) Direct electrolysis

3. Concentrate Treatment:

- (i) Imperial Smelting Process (I.S.P.)
- (ii) Microbiological leaching
- (iii) Chloride metallurgy
- (iv) Salt roasting
- (v) Chlorination with gaseous chlorine
- (vi) Electrolysis of lead and zinc chlorides
- (vii) Sulphate metallurgy
- (viii) Iron reduction of concentrates
- (ix) Roasting tests

4. Hydrometallurgy

TABLE 6-5

LIST OF MAIN McARTHUR RESEARCH PROJECTS - TO 1976

Mineralogy

1966	Mineralogical investigation	Mount Isa Mines Limited
1966	Mineralogical investigation	Metallgesellschaft (Germany)
1970	Mineralogical, stratigraphic and geochemical examination	Mount Isa Mines Limited

Mineral Dressing

1959-70	Flotation investigation	Mount Isa Mines Limited
1961	Flotation investigation	Amdel
1962	Flotation investigation	Amdel
1964-66	Flotation investigation	ASARCO
1964	45 kg/h pilot plant test	Amdel
1966	45 kg/h pilot plant test	Mount Isa Mines Limited
1967	110 kg/h pilot plant test	Mount Isa Mines Limited
1968	68 kg/h pilot plant test	Mount Isa Mines Limited
1968	68 kg/h pilot plant test	Mount Isa Mines Limited
1968	450 kg/h pebble milling test	Kilborn Engineering (Canada)
1965	Pebble milling	Kilborn Engineering (Canada)
1966	Autogenous grinding	Lakefield Research (Canada)
1965	Tabling tests	Amdel
1965	Jigging tests	Amdel
1966	Heavy media	Amdel
1965	Ore sorting	Ore Sorters (Aust) Pty Ltd
1965	Magnetic separation	Amdel
1965	Electrostatic separation	Amdel
1965	Heavy media cyclones	Amdel
1966	Rotary furnace treatment	Amdel
1966	Flotation investigation	The Anconada Co
1967	Flotation investigation	D.S.I.R. (UK)
1967	Flotation investigation	Galigher Corp. (USA)
1967	Flotation investigation	Mitsui (Japan)
1967	Flotation investigation	Union Carbide Aust Ltd
1967	Flotation investigation	Cyanimid (USA)
1967	Flotation investigation	CSIRO (Mineral Dressing)
1967	Flotation investigation	Mitsubishi (Japan)
1967	Flotation investigation	D.S.I.R. (UK)
1969	Flotation investigation	Sala Maskinfabriks A.B.
1969	Flotation investigation	Sweden
		Royal Inst. of Tech. (Sweden)
		Dowa Mining Co (Japan)
1970-71	Flotation investigation	
1970-71	Flotation investigation	
1973-75	"Pangglomeration", syn. selective agglomeration	Arcanum (USA)
		CSR Limited (Aust)
1975	Flotation investigation	Sumitomo (Japan)
1975	Flotation investigation	

Bulk Concentrate Treatment

1964	Thermal treatment to obtain PbS	Amdel
1965	Study of alternative methods of pressure leaching	Colorado School of Mines Research Foundation
1966	Roasting, leaching, electro-winning	ASARCO
1967	Treatment with hot aqueous HCl	University of Melbourne
1968-70	Fused salt electrolysis of lead and zinc chlorides	University of New South Wales
1968	Fundamental study of reaction with Cl and HCl	University of Melbourne
1969-70	Fused salt electrolysis of lead sulphate	University of New South Wales
1969	Vacuum iron reduction	Amdel
1969	Chlorination with hot gaseous HCl	Amdel
1969	Microbiological leaching	British Columbia Research Council, Canada
1969	Sulphite metallurgy	CSIRO (Chemical Eng.)
1969	Fluid bed roasting of concentrates	Mount Isa Mines Limited
1968-70	Salt roasting	University of Tasmania
1969	Lead sulphate reduction	Mount Isa Mines Limited
1970	Iron reduction in concentrate melts	Amdel
1970	Salt roasting	Amdel
1970	Chlorination of concentrates	University of Melbourne
1970	Leaching of roasted calcine	EZ Co
1969-70	Hydrometallurgical process	CSIRO - EZ - MIM

Metal Extraction from Ore

1976	Ferric chloride leach	Duval Corp. (USA)
1976	Electrolysis of ore slurry	B.H.P. Limited

General

1966	Survey of methods of chemical treatment	Amdel
1965-68	Recrystallisation	CSIRO (Applied Mineralogy)
1968	Roast reactions in bulk concentrate	CSIRO (Applied Mineralogy)

TABLE 6-6

SAMPLE DISTRIBUTION

Date	Organisation	Sample Dispatched		Process
		Ore	Concentrate	
1961/63	Amdel — various drill core samples			Flotation
1962	University of Sydney, Hargraves	45 kg		Flotation
1963	ASARCO — El Paso	45 kg		Flotation
1963	Amdel	410 kg		Flotation
1964	I.S.P. Ltd — U.K.		1.5 kg	Smelting
"	S.G.M., Brussels		1.5 kg	Smelting
"	R.T.Z., U.K.		1.5 kg	Smelting
"	Metallgesellschaft AG, Germany	1 kg	1.5 kg	General
"	Sullivan Concentrator, Canada	1 kg		Flotation
"	ASARCO (Plainfield)	5 kg	2 kg	General
"	ASARCO, Taylor	5 kg	2 kg	General
"	Kilborn Engineering, Canada	450 kg		Pebble Milling
"	Amdel	30 t		Flotation
1965	Lakefield Research, Canada	80 t		Autogenous grinding
"	The Anaconda Co., U.S.A.	90 kg		Flotation
"	K. Ueda, Japan	320 kg	23 kg	Flotation
"	ASARCO — El Paso	90 kg		Flotation
"	ASARCO — El Paso	136 kg		Flotation
"	Sullivan Concentrator, Canada	45 kg		Flotation
"	D.S.I.R.	23 kg		Flotation
"	D.S.I.R.	3 t		Flotation
"	CSIRO, Mineral Dressing	45 kg		General
"	CSIRO, Mineral Chemistry		36 kg	Pressure Leaching
"	University of N.S.W., Burdon	18 kg		General
"	University of Melbourne, Dunkin	153 kg		Flotation
"	Anglo American, S.A.	2 kg		General
"	E.Z. Co., Risdon	9 kg	45 kg	Pressure Leaching
"	Ore Sorters Aust. Pty Ltd	3 t		Ore sorting
1966	Galigher Corp. U.S.A.	225 kg		Flotation
"	D.S.I.R., (U.K.)	500 kg		Flotation
"	K. Ueda, Japan	225 kg		Flotation
"	Cyanimid, U.S.A.	225 kg		Flotation
"	The Anaconda Co., U.S.A.	90 kg		Flotation
"	ASARCO, El Paso, U.S.A.	136 kg		Flotation
"	Sullivan Concentrator, Canada	12 t		Flotation
"	Amdel	12 t		General
"	University of Qld, Plowman	2 kg		General
"	University of Sydney, Green	2 kg		General
"	Amdel	5 kg		Roast, Leach,
"	ASARCO, U.S.A.		23 kg	Electrolysis
"	University of N.S.W., (School of Mining)	18 kg		Flotation

Date	Organisation	Sample Dispatched		Process
		Ore	Concentrate	
1966	CSIRO, Ore Dressing Lab.	136 kg		Flotation
"	Sheritt Gordon Mines, Canada		45 kg	Pressure
"	CSIRO, Mineral Chemistry		90 kg	Leaching
"	CSIRO, Applied Mineralogy	90 kg		Pressure
"	Amdel		1.2 t	Leaching
"	CSIRO, Applied Mineralogy		23 kg	Recrystallisation
"	I.C.I.A.N.Z.	90 kg	7 kg	General
1967	Anglo American, S.A.	50 kg		General
"	K. Ueda, Japan	45 kg		Flotation
"	Union Carbide (Aust)	45 kg		Flotation
"	University of Qld, Prince	90 kg		General
"	Mitsui Min. & Smelt. Co., Japan		5 kg	Flotation
"	Union Carbide (Aust)	45 kg		Flotation
"	Mitsui Min. & Smelt. Co., Japan		90 kg	Flotation
"	CSIRO, Chem. Engineering	18 kg		Sulphite & Metallurgy
"	CSIRO, Mineral Chemistry		11 kg	Pressure
"	I.S.P. Ltd. U.K.		29 kg	Leaching
"	ASARCO, El Paso, U.S.A.	9 kg		Sintering
"	D.S.I.R., (U.K.)	1 t		Flotation
"	Australian Hoechst Ltd	270 kg		Flotation
1967	University of Sydney, Hargraves	23 kg		Flotation
"	CSIRO, Blaskett	50 kg		Flotation
"	British Columbia Research Council, Canada	2 kg	14 kg	Microbiological
				Leaching
1968	CSIRO, Applied Mineralogy		2 kg	Roasting
"	I.S.P. Ltd, U.K.		33 kg	Sintering and Smelting
"	I.S.P. Ltd, U.K.		318 kg	Sintering and Smelting
"	Amdel			Chlorination
"	E.Z. Co., Risdon	11 kg		Pressure
"	CSIRO, Chemical Engineering	11 kg	4 kg	Leaching
"	CSIRO, Chemical Engineering	100 kg		Sulphite Metallurgy
"	E.Z. Co., Risdon		90 kg	Sulphite Metallurgy
"	R.M.I.T., Melbourne	68 kg		Pressure
"	CSIRO, Chemical Engineering		3 kg	Leaching
"	Erzgesellschaft M.B.H., Germany		18 kg	Flotation
"	Sala Maskinfabriks, Sweden	27 kg	20 t	General
"	CSIRO, Mineral Chemistry			Hydro-metallurgy
"	I.C.I.A.N.Z.		5 kg	General
"	University of Tasmania, Bloom		5 kg	Salt Roasting

Date	Organisation	Sample Dispatched		Process
		Ore	Concentrate	
1969	The Hanna Mining Co., U.S.A.	320 kg		General
"	Dow Chemical, U.S.A.	3 kg	3 kg	General
"	Metallgesellschaft AG, Germany	90 kg		General
"	Swiss Aluminium	136 kg		General
"	Prof. Kihlstedt, R.I.T. Stockholm, Sweden	2 t		Flotation
"	Dowa Mining Co., Japan	390 kg		Flotation
"	University of Melb., Byrne		45 kg	Chlorination
"	I.C.I.A.N.Z.		45 kg	General
1970	Anglo American, S.A.	5 kg		General
"	Dowa Mining Co., Japan	450 kg		Flotation
1971	Dowa Mining Co., Japan	1.1 t		Flotation
"	Prof. Kihlstedt, R.I.T. Stockholm, Sweden	45 kg		Flotation
"	Anglo American, S.A.	45 kg		General
1973	Arcanum Corporation, U.S.A.	8 kg		Agglomeration
1975	Arcanum Corporation, U.S.A.	15 kg		Agglomeration
"	CSR Ltd., Australia	5 kg		Flotation
"	Sumitomo Metal Mining Co., Japan	57 kg		Flotation
"	Chlorine Technology, Australia	15 kg		Chlorination
"	Dowa Mining Co., Japan	100 kg		Flotation
"	Tokyo Menka Kaisha Ltd., Japan	10 kg		Flotation
1976	Duval Corporation, U.S.A.	20 kg		Chlorine leaching
"	B.H.P. Ltd., Australia	120 kg		Electrolysis

CONSULTANTSTERMS OF REFERENCE

To review the McArthur River Project Feasibility and Environmental Report submitted by Mount Isa Mines and determine whether the project could be developed into a viable operating mine in the near future, and in particular :

- (i) assess the metallurgical work identifying further research which might be necessary to make the project viable;
- (ii) identify the likely course in market trends for zinc and lead concentrates and the processed metals;
- (iii) in close co-operation with appropriate Northern Territory Departments check the cost estimates and financial analysis contained in the report; and
- (iv) investigate the financial capability of Mount Isa Mines to develop the mine.

30-5-1979

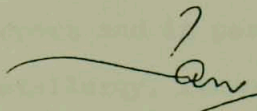
Mr D. T. Buchanan,
Director,
M.I.M. Holdings Limited,
G.P.O. Box 1433,
BRISBANE. QLD. 4001

Dear Mr Buchanan,

I refer to our conference in Darwin on 21 May 1979 and confirm that the Mining Reservation No. 581 at McArthur River will be maintained intact, without diminution, until 31 December 1979.

Your application for an eighteen months exemption from the labour covenants in the fifty-six mineral leases is noted and I confirm that the application is being processed by my Department.

Yours sincerely,



IAN TUXWORTH

Mr D. T. Buchanan,
Director,
M.I.M. Holdings Limited,
G.P.O. Box 1433,
BRISBANE. QLD. 4001

Dear Mr Buchanan,

McARTHUR RIVER PROJECT

I should like to take this opportunity of thanking you formally for the very comprehensive report which Mount Isa Mines has submitted on the McArthur River Project.

Following initial assessment by my Department and other Government Departments, the Northern Territory Government has approved the use of consultants to review aspects of the report and in particular those sections dealing with metallurgy, finance and marketing.

An appropriate course of action will then be determined consistent with the desire of the Government to see the project proceed and that the timing and terms and conditions of eventual development are in the best interests of the Northern Territory.

In order to preserve the interests of Mount Isa Mines during the intervening period, the Mining Reserve No.581 at McArthur River will be maintained intact, without diminution until 30 June 1980. Applications for exemption from labour covenants on the mineral leases should be made when necessary.

It is noted and agreed that the Company will continue its efforts to establish the feasibility of the project with particular emphasis on :

- . geological exploration in an attempt to locate mineralisation with better metallurgical characteristics than the HYC ore;
- . a hydrometallurgical research programme, and a review of potential metallurgical research which could be applicable to the McArthur ore;
- . monitoring changes in any factors which could vary the economics, particularly market conditions, metal prices, operating costs and metal recoveries.

Yours sincerely,

IAN TUXWORTH