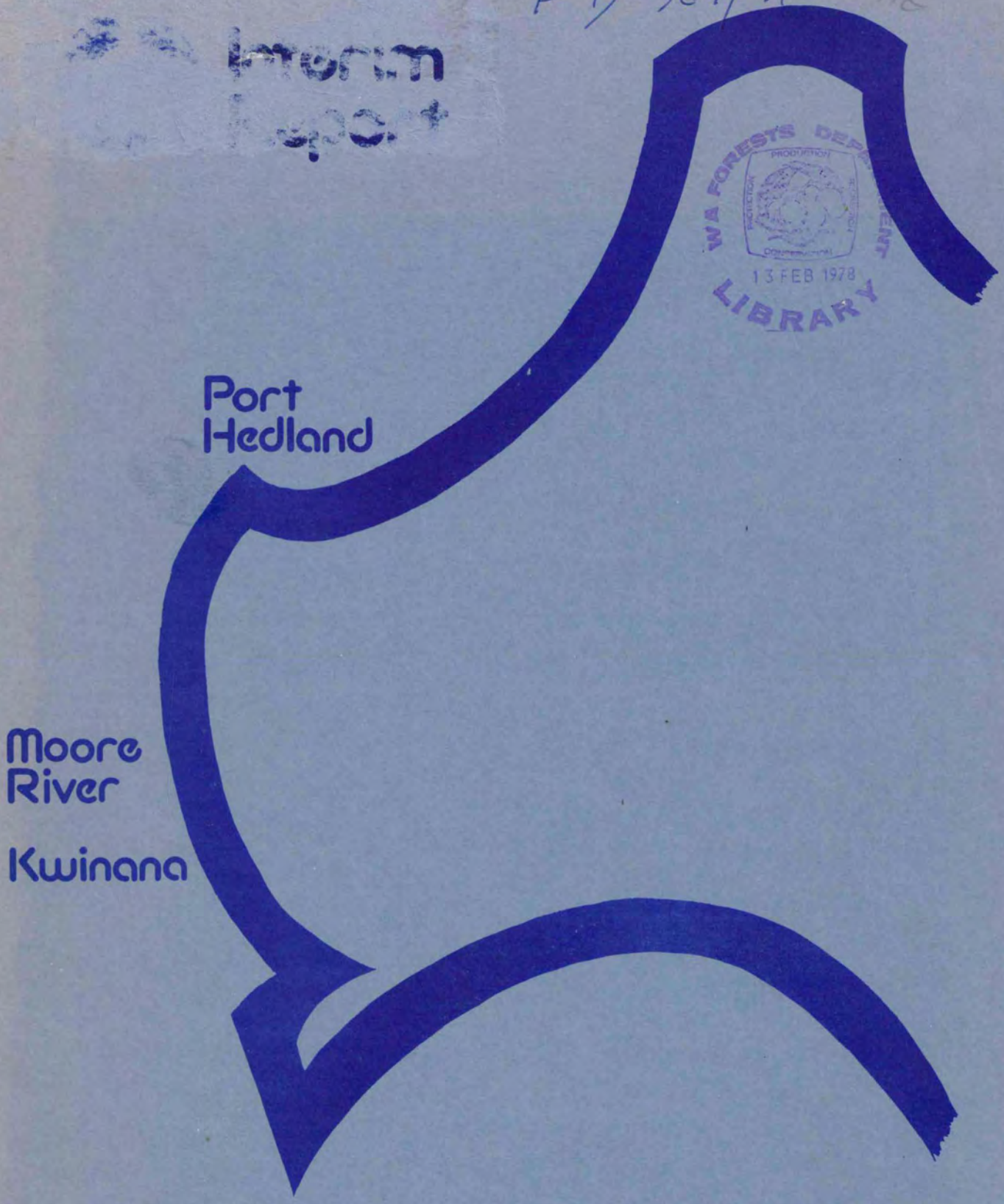

Environmental Aspects of Proposed Western Australian Jumbo Steel Plant.

April, 1975

BULLETIN No. 6.

ENVIRONMENTAL ASPECTS OF PROPOSED WESTERN AUSTRALIAN JUMBO STEEL PLANT

INTERIM REPORT

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TO DISTRIBUTION (APPENDIX 5)

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A Consortium has proposed the building of a major steel-works at one of three sites in Western Australia. The implementation of this proposal would present the challenge of assimilating a vast industry and an associated community with minimum detriment to the environment.

This document is a schedule of studies aimed at meeting the challenge and resolving the concomitant environmental issues.

Because there appears to be a relative dearth of basic information the initial need is to amass and interpret baseline environmental data. The ramifications of the Jumbo steel proposals are so extensive that this initial need can be met only by a co-operative effort by the relevant Government Departments and Authorities. At a meeting convened by this Department and held on 26 March 1975 the contents of this document were mutually agreed upon by the numerous Departments represented (see Appendices 5 and 6).

The preparation of this study scheme has therefore served the following purposes:

1. The document has been endorsed by the Environmental Protection Authority as a further step in the discharge of its statutory obligations imposed by the referral of the project to it by the Hon Minister for Development and Decentralisation under Section 57(1) of the Environmental Protection Act on 6 March 1973.

2. Departments and Authorities with vital and peripheral interests in the project have become more aware of the

.../2

proposals and have been alerted to the complexity of the interactions that will ensue when the proposals are implemented. Section 11, especially the first two paragraphs is relevant in this context.

3. The initial activity that has produced this study scheme will generate the forward planning necessary at Departmental level to activate these studies when the proposals are implemented. At that time it would be necessary to define the studies in more detail and to assign priorities. The rapidity with which this can be done is largely dependent on the resources that the Departments can now allocate to this aspect of coping with the environmental issues.

At this time it is appropriate to record my appreciation of the assistance given by other Departments and Authorities in achieving a consensus agreement on this document. The same degree of cooperation will ensure a successful prosecution of the studies should they become necessary.

Brian J. O'Brien
DIRECTOR

24 April 1975

1. INTRODUCTION

On behalf of an international Consortium a Study Team from Broken Hill Proprietary Ltd. is currently conducting a feasibility study to assess the economic viability of a major steelworks (10 million tonnes per year) in Western Australia. This project was referred to the Environmental Protection Authority under Section 57(1) of the Environmental Protection Act, 1971.

The objective of this Department is to ensure the assimilation of the works and the accommodation of the associated community with the minimum impact on the environment. One means of achieving this is seen as the coordination of the several Departmental activities related to the environmental management of the project.

The Study Team has concentrated its attention on three sites viz Kwinana, Moore River and Port Hedland. Although the Study Team's report may be concluded by 31 March 1975, the Consortium's decision and hence the preferred site may not be known for some time. However this Department is anxious to initiate action in advance of the Consortium's decision because the seasonal (and longer) cycles of environmental phenomena demand long lead times to accumulate and interpret data. Therefore to achieve preliminary definition of the problem a draft plan for an environmental study of the steelworks project has been drawn up. It contains a tentative allocation of Departmental areas of interest but it is anticipated that each Department will have its own view of its responsibilities in this matter and of the expertise it can contribute to the environmental studies. The draft will be revised to incorporate Departments' comments and will become the Plan for Environmental Study ready for implementation if the steelworks is viable.

2. PHASES OF PROPOSED STUDY

The environmental study would be expected to proceed through several phases. However in any phase the emphasis for the works site may differ from that for urban areas.

Phase 1

The current environment will need to be documented through a wide variety of field studies since at present there appears to be insufficient in-depth knowledge of the environment of any of the proposed sites.

Phase 2

Assessment of the effects of the design proposals on the existing environment. This will require the establishment of design criteria particularly in relation to discharges from the works (gaseous, liquid and solid wastes) and associated control equipment. Alternatives and options, including the option of not proceeding with the project, should be considered in this phase. The potential for environmental improvement by the project will not be neglected.

Phase 3

A draft Environmental Impact Statement (EIS) should be prepared. While the onus for the major portion of this may devolve on the Consortium it will be necessary for this Department to have on call sufficient expertise to check and assess the Statement. The EIS will include a summary evaluation of Phases 1 and 2 and an assessment of the effects, safeguards and alternatives shown by the investigations.

Phase 4

The draft EIS will be examined by appropriate Government Departments. Public comment will be invited perhaps by a public enquiry.

Phase 5

The draft EIS will be revised in the light of relevant comment.

In particular the Consortium will have to modify any of its initial proposals which would cause unacceptable environmental degradation.

Phase 6

The amended EIS will be presented to the appropriate Minister.

Phase 7

A continuous programme will be instituted to monitor plant operations and project development so that undesirable environmental consequences will be minimised.

3. ENVIRONMENTAL PROTECTION LEGISLATION

Under Section 57(1) of the Environmental Protection Act (1971) the matter of the proposed steelworks was referred to the Environmental Protection Authority (EPA) by the Minister for Development and Decentralisation. The Authority is bound to report to the Minister on the development.

The legislation also imposes the following duties on the EPA:

a) to enhance the quality of the environment; and

b) to control and wherever practicable to prevent any act or omission which causes, or is capable of causing, pollution.

The Act confers very broad powers on the EPA to enable it to perform its duties and these powers encompass the specification of environmental standards and criteria where necessary.

Clearly an important role of the EPA in this connection is the coordination of existing work and plans of Government Departments and other bodies. Some of these may be already charged with statutory responsibilities on individual environmental matters under other legislation affecting the project. Most, if not all, of such Departments are also involved by representation at a very senior level on the Environmental Protection Council. This is a statutory body under the Environmental Protection Act (1971) and among other duties is charged with the responsibility of advising the EPA and the Minister for Environmental Protection "in respect of environmental protection and enhancement generally".

The legislation also created the Department of Environmental Protection as the executive arm of the EPA. In this role it is seeking to integrate the broad ramifications of the environmental consequences of the steelworks into a coherent whole. The Department's report will be to the EPA but the

nexus between the EPA, the Council and the Department is such that the Council will review the report.

Hence, those Departments concerned with the major environmental impact of the steelworks will be involved at two tiers of responsibility. One will be the working-group level at which specific Departmental matters will be the main issue. The second will be the higher level of the Environmental Protection Council which will discuss the overall implications of the whole project and advise the EPA accordingly. There will be a continuous cycle of data input, evaluation and feedback over a prolonged period of assessment to seek a rational solution to environmental problems and environmental planning.

The final evaluation of the environmental aspects of the proposal is the responsibility of the EPA and this will involve supervision of any Environmental Impact Statement which will certainly be required.

4. THE PROPOSAL

The scheme has been outlined in broad terms only and the current relevant information is attached as Appendix 1. The final form of the proposal may vary considerably in some areas. The most pertinent parameters are summarised here.

The works will produce about 10 million tonnes per year of semi-finished steel by the conventional blast furnace - basic oxygen furnace technology. The annual requirement of the major raw materials is listed below.

TABLE 1

Major Raw Material Requirements at Maximum Output

17.5 million tonnes of (Pilbara) iron ore
7.5 million tonnes of (Queensland) coal
4.5 million tonnes of (Japanese) limestone
1 million tonnes of ferro-alloys, refractories etc.
32340 megalitres of potable water
461000 megalitres of sea water

The estimate of coastal land required varies from 800 to 2400 hectares (2000 to 6000 acres) and this includes provision for a port.

Site construction labour would rise to an average level of about 4000 from 1977 to 1980 and would commence reducing from 1985. Operating and maintenance labour would rise from 4000 in 1981 to some 8000 to 10000 by 1986 at maximum production. The associated community will probably exceed 60000 people.

These brief details of themselves may not lead to a true understanding of the magnitude of the project. The proposed steel output would exceed the current total Australian production of iron and steel from Newcastle, Wollongong, Whyalla and Kwinana and would be similar to the production at some modern major steelworks in Japan. The capital investment involved is about $A1600-$A2000 million.

The dimensions of the project indicated in the above summary (Table 1) can be partly clarified by considering the steelmaking process as discussed below.

4.1 The steelmaking process.

Iron ore, coal and limestone will be brought to the site through a port which will be integral with the works. Port facilities will be capable of handling ships up to 135000 DWT (and possibly up to 165000DWT in the long term) so that adequate access channels (through reefs) and turning areas must be provided. The annual throughput of 30 million tonnes of raw materials will require a continuous average unloading and material transfer rate in excess of 3400 tonne per hour.

Stockpiles will be developed to hold about one month's reserve of raw materials ie

1) 1.5 million tonnes of iron ore
2) 0.7 million tonnes of coal
3) 0.4 million tonnes of limestone

There will be continual transfer of material into and out of these and subsidiary stockpiles.

Iron ore will be crushed and screened because lump ore (+6mm) is used in the blast furnace while fine ore (-6mm) is fed to the sinter plant. Coal will be carbonised in batteries of coke ovens with by-product recovery. The continuous average rate of feed to the coke oven batteries will exceed 900 tonnes per hour. The discharged coke will be quenched, crushed and screened. Coarse coke is required for the blast furnace and the coke breeze is utilised in the sinter plant.

Some of the limestone will be calcined for steelmaking but most of it will be used as limestone in the blast furnace.

Blast furnace feed will comprise iron ore, sinter, coke and limestone and the products will be molten iron and slag. About 4 million tonnes of slag will be produced annually.

The molten iron will be converted to steel in basic oxygen furnaces using oxygen lancing and lime injection. The steel will be cast into ingots or continuously cast into billets, blooms or slabs mainly for export as members of the Consortium are sharing the output in proportion to their investment.

4.2 Potential sources of pollution

These various operations are potential sources of air, water, land, thermal and noise pollution. The extent to which effective control can be exercised is critically affected by

1) site considerations
2) efficient in-plant control measures
3) isolating the works behind green belts and buffer zones
4) planned development of associated urban areas for the workforce of the major and spin-off activities.

The whole proposal can be resolved into two major areas:

1) The siting, construction and operation of a vast industry in a coastal situation involving major port facilities, vast materials handling operations and manufacturing processes. These are all potential sources of pollution but are all amenable to control to varying degrees of perfection.
2) The siting and establishment (or absorption) of more than 60000 people into communities with all the social, cultural and recreational facilities of similar Australian communities.

The broad objective of the Department of Environmental Protection is to develop a plan for the environmental management of the whole proposal, with the assistance of and in consultation with associated authorities.

5. ADDITIONAL CONSIDERATIONS

The Study Team for the Consortium is aware of the industry's problems with pollution but it believes that a plant which incorporates the best available technology will be environmentally acceptable at any of the proposed sites. There has been as of 26 March, 1975, no indication of the anticipated quantity and nature of effluents and discharges nor of the type and projected cost of control measures. However, the modern Japanese Steelworks at Oita is cited as representative of the works considered in this proposal.

5.1 Status of present study.

The Study Team's current involvement is at State Government level and preparation of an Environmental Impact Statement for the Federal Government is not yet being undertaken. However, an environmental appraisal of the project has been conducted for Broken Hill Pty. Ltd. by Mr. M. W. Hunt who is that organisation's Manager, Environmental Engineering. In the course of several visits to Western Australia Mr. Hunt has approached relevant Departments and authorities for detailed information. His report to the Study Team will embrace the works and residential areas and is expected about the end of March 1975. It will be made available to this Department.

The following schedule of operations is forecast on the assumption of a "go" decision and negotiation of a suitable Agreement in 1975:

1976 - 1977	Detailed planning and design
1978	Construction begins
1981	Output of steel 4 million tonnes per year
1983	Output of steel 7 million tonnes per year
1985 - 1986	Output of steel 10 million tonnes per year

Environmental management of the project will also require detailed planning and design. Therefore there is an urgent need to define the relevant parameters and amass and interpret data in sufficient time to influence the design

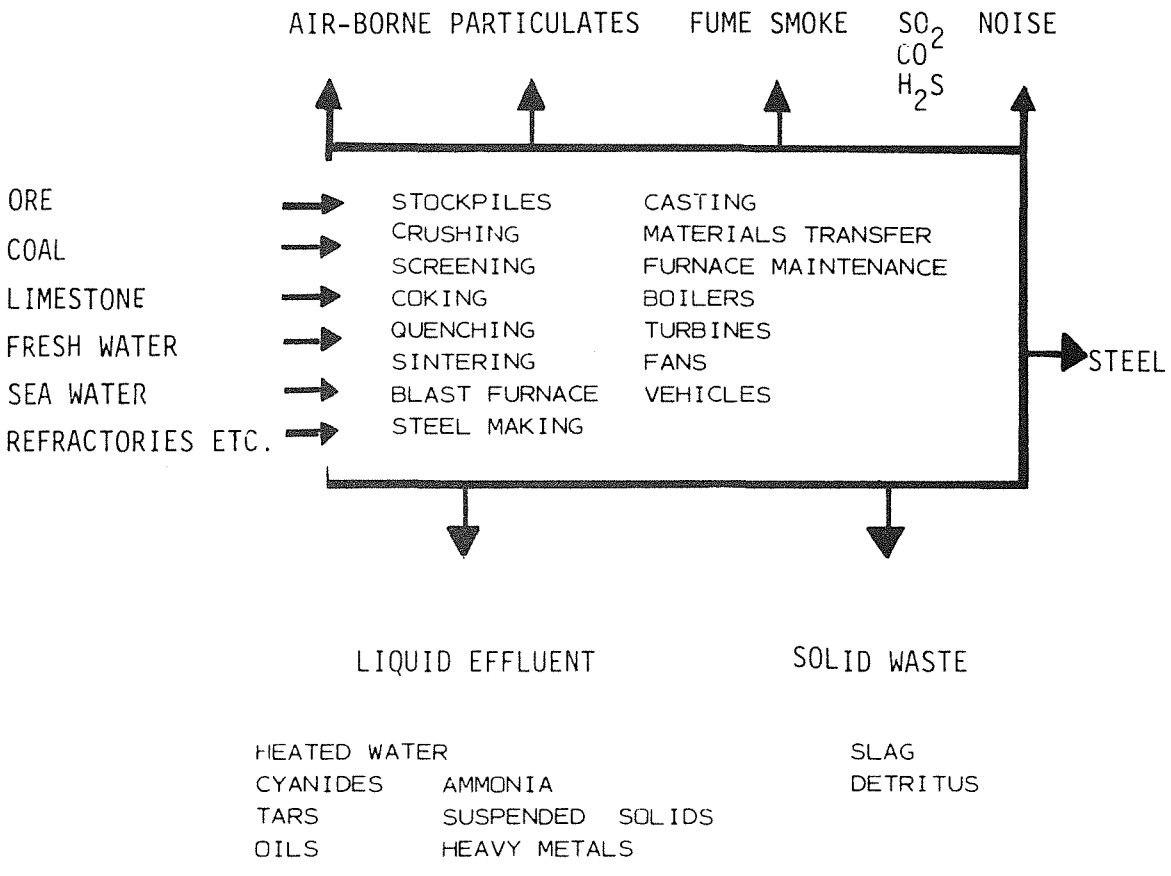
of the project where necessary. The alternative may be to attempt corrective measures at the operating stage and this is clearly less desirable and frequently less effective, but more costly in the long term.

In the following section the environmental problems arising from steelworks operations are briefly considered. This is a pragmatic approach which ignores for the time being the wider environmental issues of a steelworks and its location.

6. POLLUTION FROM STEELWORKS

In the absence of data from the Study Team it is not possible to quantify or characterise the various effluents and discharges which may occur. However it is possible to comment on the usual nature of such discharges and it is convenient to consider them under the headings Air, Water (including Thermal), Land and Noise Pollution. Figure 1 below shows in outline the various inputs and processes that create the pollution potential of a steelworks.

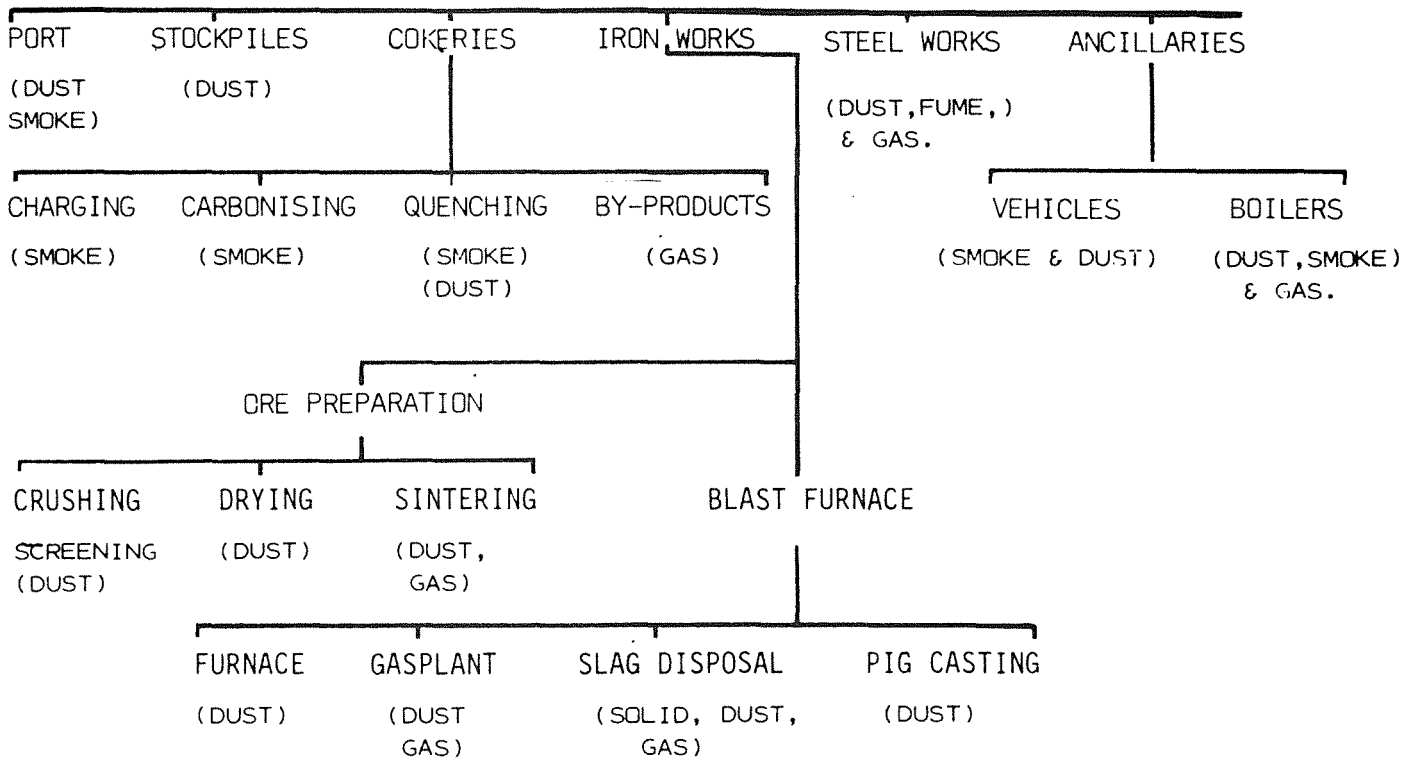
Figure I



6.1 Air Pollution

The sources and nature of air pollution are indicated in the diagram below:

Figure II
SOURCES AND NATURE OF AIR POLLUTION



Technology provides a number of means of reducing emissions from these sources to levels which are acceptable in terms of the industry's ability to meet emission standards. Such standards vary from country to country and even within a country. In Western Australia the Clean Air Act is administered by the Public Health Department through the Air Pollution Control Council. The legislation provides comprehensively for control of air pollution by requiring a company to obtain formal approval of the detailed design of a project and by licensing the operational premises. The licence may be conditional on certain standards being met or on any other necessary conditions. The matter of emission standards which might apply to the steelworks has already been referred to the Air Pollution Control Council.

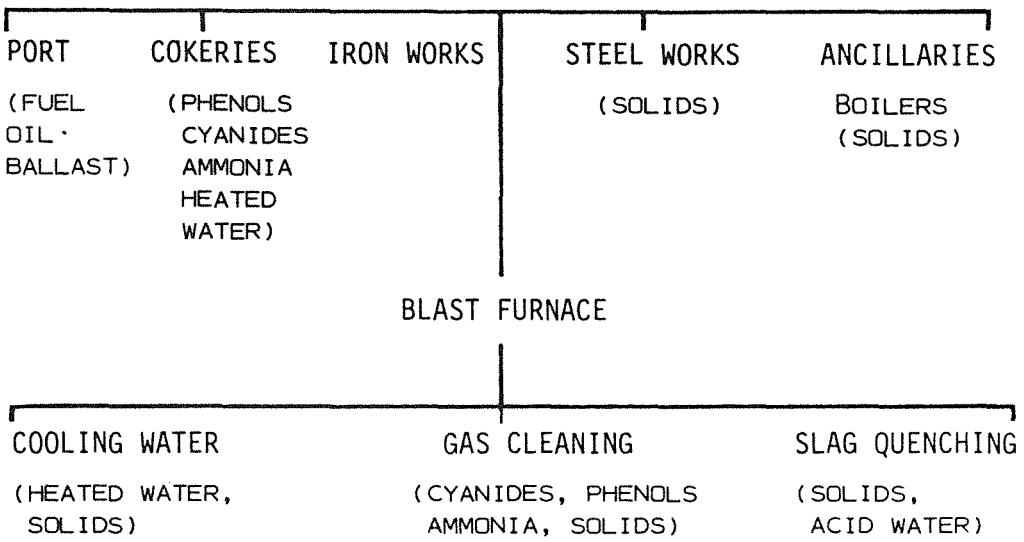
The difficulty of predicting air dispersion patterns in coastal regimes was highlighted by investigations in the Kwinana area reported in the Coogee Air Pollution Study. The collection and interpretation of meteorological and climatological data are integral parts of such studies.

6.2 Water Pollution (including thermal pollution)

The origin and general nature of water pollutants are shown diagramatically below:

Figure III

ORIGIN AND NATURE OF WATER POLLUTANTS



The fresh water requirement of 32 340 megalitres per year is make-up intake after applying maximum measures for cooling, clarification and recirculation within the plant.

The salt water requirement of 461 000 megalitres per year is mostly used for condenser application as a once through use.

The characteristics of the postulated sites suggest that liquid effluents will be discharged into the adjacent waters viz. into Cockburn Sound for Kwinana, into the ocean for Moore River and into the tidal creek system for Port Hedland. No single authority controls off-shore discharges

in these three areas. Such discharges cause concern because of the danger to marine ecosystems arising from various causes eg heavy metal contaminants, abnormal temperatures, increased turbidity, depleted oxygen etc. The massive quantity of the discharge is another factor in that even at low concentration the mass discharge of a particular component may be unacceptably high.

If the discharge is to be onto ground surface or into a bore then the possibility of contamination of ground water or aquifers would require the strictest control over the characteristics of the effluent. Although no standards for effluents have been set for this project recent standards from elsewhere may be taken as guidelines. These apply to discharges to controlled waters under the New South Wales Clean Waters Act and to navigable waters in the United States. The limits are tabulated below with some additions as noted (Table III).

The American regulations also limit temperatures of all discharges to less than 100°F (about 38°C) but in most cases the temperature of large volumes of waste is limited to some suitable figure depending on the temperature of the receiving water. In the case of the Pilbara Study the discharge temperature of cooling water was limited to 40°C to protect the mangroves. However there is considerable scope for research in this matter.

6.3 Land Pollution

In this context no cognisance is taken here of the actual allocation of land for a steelworks because the aspect is considered elsewhere. The pollution referred to is that occasioned by disposal of:

1) the solid material residual from steelworks operations; and
2) the normal detritus of a vast industry employing about 10000 workers.

TABLE III

Guidelines for liquid effluent standards

Component	New South Wales	United States	
		Average	maximum
PH	6.5 to 8.5	6.5 to 9.0	6.5 to 9.0
	milligrams per litre		
Cadmium	0.01	0.02	0.03
Iron (a)	0.3	-	-
Cyanide	0.05	0.1	0.2
Phosphate (a)	50 (b)	-	-
Lead	0.05	0.1	0.2
Chromium (hexavalent)	0.05	-	-
Chromium (total)	-	0.005	0.01
Arsenic	0.05	0.01	0.02
Mercury	0.001	0.001	0.002
Copper	1.0	0.2	0.3
Zinc	5.0	0.3	0.5
Manganese	0.05	-	-
Fluorine	-	-	1.0
Oil, Vegetable oils	none visible	10	15
Phenol	0.001	0.5	1.0
BOD, maximum and daily	20	20	30
COD, Maximum and daily (a)	50 to 70	-	-
Solids, maximum and daily	30	15	40
Nitrogen	-	30	40 (c)
Chlorinated hydrocarbons	-	0.002	0.004

a) Suggested figure only

b) Possibly too high for an area such as Cockburn Sound

c) suitable for ocean discharge

The slag alone is expected to amount to about 4 million tonnes per year and if disposed of as landfill this quantity would fill 100 hectares per year to a depth of 3 metres. Off-shore dumping on reefs to reduce wave energy has been suggested for the Moore River site and at Kwinana the possibility of using slag in reclamation of Cockburn Sound has been mooted. Blast furnace slag has commercial potential for various uses but this method of disposal is unlikely to absorb the whole quantity in Western Australia. The problem is unresolved at this stage and is seen as a major environmental problem. The normal detritus of industrial operations and the workforce will be a problem in its own right but a smaller one. On-site incineration and sanitary landfill under the control of the local authority may suffice but will need to be planned.

6.4 Noise Pollution

This term refers to the nuisance arising from the operation of modern high speed, high power machinery (fans, turbines etc.) and sometimes from gaseous flares. The phenomenon is recognised by industry and technology has been devised to mitigate the problem. Legislation to protect on-site workers and to prevent undue effect on adjacent areas has been enacted in Western Australia (Noise Abatement Act, 1972) and is administered by the Public Health Department.

6.5 General

The several sources of pollution indicated above add up to potential environmental effects of some magnitude and cause for concern. The adequacy of technology to mitigate these effects is acknowledged. However there is considerable scope for improvement in control measures in many areas particularly in coke ovens, sinter plants and stockpiles as indicated in a recent report by Mr. R. Powell of the Clean Air Section of the Public Health Department (Appendix 4, Ref. 9). For this reason at least the siting of the plant remote from residential areas and its isolation behind green belts and buffer zones are regarded as particularly crucial requirements for environmental management of such a project.

7. ENVIRONMENTAL CONSIDERATIONS FOR ASSOCIATED COMMUNITIES

At this point of time this multi-facetted problem is considered in the broadest terms only. The nature of the problem is critically dependent on the siting of the works and is affected by the mobility of the workforce in Western Australia. This latter phenomenon was documented by the Demographic and Environmental Resources Committee in the course of their early study of the Kwinana workforce. Distances to work in excess of 50 kilometres and travelling times up to 45 minutes (each way) were recorded. This is a factor to be evaluated in assessing the distribution of the workforce.

Establishment of the works at Kwinana or Moore River would allow the workforce to be absorbed into the Perth Metropolitan Region with particular emphasis on southern and northern extensions respectively. This would create additional pressure (beyond natural increase) to enlarge and extend existing facilities thus continuing the urban sprawl of the Perth Metropolitan Region. The preferable alternative is to plan the development of new communities in which environmental consequences can be designed and managed. Establishment of the works at Port Hedland would pose the severe problems of community development and provision of an adequate workforce in an arid, inhospitable climate.

This Department is concerned with the total environment for the community embracing the provision of social, cultural, recreational and support facilities. Many aspects of this are part of the normal pattern of community development e.g. housing, schools, hospitals, sewerage etc. and are not the prerogative of this Department. However they do form part of the environmental fabric of a community and as such need to be woven into the design. A prime consideration of course will be the location of residential areas with the emphasis on environmentally desirable development rather than totally on logistical convenience. Elementary considerations are that the works should not be visible from residential areas and that residences should not be in the pollution "shadow" of the works, for example.

8. SITE DEFINITION AND CHARACTERISTICS

The actual sites at Kwinana and Port Hedland can be described but no specific site has been nominated in the Moore River area. In general "Moore River" means an area a few kilometres south of the mouth of the Moore River. The Study Team believes that a modern steelworks incorporating the latest technology would be environmentally acceptable at any of these sites. This view ignores wider environmental issues eg alternative uses for the site selected and problems arising from the associated urban development.

8.1 Kwinana

The proposed site in the Kwinana environs is specifically the present Australian Iron and Steel works in the industrial area of Kwinana. The existing installation is a small (0.7 million tonne per year) blast furnace with appropriate wharves, stockpiles and ancillary facilities. This small works would be demolished and the site expanded by filling in the shoreline of Cockburn Sound and resumption of red mud ponds east of the works. Even with this expansion the available land is less than 600 hectares and thus offers the probability of a cramped layout for the proposed works.

Development on this site would pose the problems of:

1) a severe potential threat of air pollution for the surrounding urban and adjacent metropolitan areas arising from the massive (30 million tonnes per year) materials handling operations and about 200 per cent increase in emissions of sulphur dioxide;

2) potential degradation of Cockburn Sound by extensive port development, thermal pollution and effluent discharge;

3) a potential slag disposal problem;

4) severe road, transport and logistic problems;

5) encroachment on existing buffer zones and green belts;

6) a peak addition to the natural growth rate of the metropolitan area with an accompanying stress on the environment.

The Town Planning Department has suggested that Kwinana may not be a suitable location for the proposed works and an officer of the Department of Fisheries and Wildlife has expressed concern about the effects of such a development on Cockburn Sound.

8.2 Moore River

The nomination of this area as a potential site may be related to the Salvado City concept which would have created a city north of Perth with an industrial area and port in the area now being considered for the steelworks. The land is generally consolidated sand dunes and limestone ridges of the Spearwood system leading to mobile coastal dunes and sand beaches protected to some extent by off-shore reefs. The vegetation is mainly coastal heath and banksia with some larger trees and cultivated pine forest and supports some species of native fauna. The land is zoned for rural purposes and is mainly used as cattle grazing and fattening paddocks. This area may offer the opportunity of allocating sufficient land for isolation of the works behind green belts and buffer zones. The establishment of urban communities for the workforce would fit in well with the development of the northern corridor in accord with the planning of the metropolitan region. However the cutting of access channels through reefs, port development and a general increase in human activities could threaten marine and terrestrial ecosystems. In this connection an officer of the Department of Fisheries and Wildlife has drawn attention to a possible conflict of interest with the rock lobster industry. The creation of marine reserves may be an ameliorating factor and this concept may be a necessary area of study.

8.3 Port Hedland

The actual possible site is Anderson Point opposite the Mt. Newman Mining Company's loading point on land presently under the control of the Port Authority and intended for industrial use. The area available is relatively small at 476 hectares but it may be able to be increased to 680 hectares which would be much more amenable to any necessary alterations. Probably the annual throughput of about 40 million tonnes of material in the works would pose an additional air pollution threat to areas already affected by stockpiles in the port area. However the newer and future residential areas would be sufficiently remote to minimise such risk. The proposed site lies across the path of drainage from South Hedland and provision would be required to avoid interfering with such run-off.

The climate of the area poses an undefined problem as to its effect on those people engaged in some of the more heat-intensive processes in the works. The effect of the general environment on community establishment and development is another uncertainty in relation to this area, although experience gained from existing small townsites in the region is likely to be valuable.

To some extent Port Hedland is representative of coastal sites elsewhere in the Pilbara e.g. Dixon Island. However Consortium interests are such that Port Hedland is the centre of attraction in this general area.

8.4 General Considerations

In Appendix 2 some relevant site factors are listed. In particular Item 12 represents the Study Team's brief and superficial assessment of environmental considerations but it must be remembered that Mr. M. Hunt is investigating this aspect in detail separately for the Study Team. In the following section the factors affecting site evaluation are summarised.

9. ENVIRONMENTAL REVIEW OF PREFERRED SITE

In early negotiations between Study Team representatives and this Department some guidelines for an environmental review of the project were passed on to Mr. M. Hunt. These are attached as Appendix 3 and Sections 5 and 6 are particularly relevant at this point. The following list of environmental factors to be considered in assessing the steelworks' site incorporates those Sections with additional factors:

1. Availability of sufficient area

Many steelworks throughout the world show the undesirable environmental effects that arise when works and residential areas are in close proximity. The problem is not always apparent when the respective areas are established but occurs when expansion causes both areas to encroach on pre-existing buffer zones.

The remedy would seem to lie in

1) Initial allocation of a sufficiently large works area to cater for expansion and any necessary additional control measures (up to 2000 hectares ie 5000 acres).

2) Reservation of land around the works for green belts and buffer zones incorporating development of compatible industries and uses (up to 10000 ha ie 25000 acres).

3) Prohibition of residential and dormitory use in such land.

4) Planned development of urban areas sufficiently remote from the works.

If this is the remedy it pre-supposes the availability of sufficient land for these various purposes.

2. Accessibility to port facilities

In Western Australia this necessarily infers a coastal location and the following comments apply:

1) The port development will alienate a section of coastline and off-shore area so that existing and alternative future uses of these should be assessed. (This can be assisted by referral to the Conservation Through Reserves Report to hand).

2) The harbour will be an intrusion into a marine ecosystem and the environmental consequences of this must be assessed.

3) The hydrological consequences of the harbour and its effect on littoral drift require evaluation perhaps by model studies by PWD and/or by contract.

4) there is the possibility of conflict with the commercial fishing industry. This should be referred to the Department of Fisheries and Wildlife.

3. Land Use

Land with an existing or proposed use will be required for the works site and residential areas. The alienation of such land for the steelworks project should be evaluated against other uses including preservation of the land in its natural state eg as a national park or wildlife sanctuary. In this connection the morphology and geology of the preferred area will need to be evaluated. Again the existing Conservation Through Reserves Committee Report to the EPA will help clarify the situation.

4. Effluents and residues

The characteristics and qualities of effluents and residues will have to be known and evaluated so that the effect of their disposal on the environment can be

assessed. Some aspects that require consideration are:

1) The acceptability of off-shore dumping of slag;
2) The acceptable composition and temperature of water discharged to the ocean:
3) The possible contamination of ground water;
4) The effect of air-borne pollutants on surrounding areas.

5. Marine and terrestrial biota

Documentation of the existing assemblages of fauna and flora is the first stage of defining the problem of their conservation. Protective measures might involve the creation of reserves, preservation of access corridors and provision of barriers against intrusion.

Hydrological studies should be aimed at measuring the capacity of the off-shore waters to absorb and disperse liquid effluents. The effect of the works is one agent of degradation of the environment but it can be controlled to a large extent. Increased human activity in the area is another agent against which there is frequently less well defined means of control. The necessary studies will be aimed at preserving the ecosystems as far as possible and particularly any rare or unique species.

6. Climatology

There are two particularly important aspects of this. The first is the definition of the meteorological parameters relating to dispersion of air-borne pollutants. The second is the effect of the climate on living and working conditions and this refers particularly to Port Hedland.

7. Human environment

A community in excess of 60000 people will have to be established or absorbed with an acceptable level of all those facilities which make up the normal urban Australian environment. These comprise the usual provisions for health, education, welfare, roads, transport, water, sewerage etc. with a considerable emphasis on recreational and cultural amenities. The environmental design should permit enjoyment of the surroundings without an accompanying destruction of the amenity. The need for recreational facilities offered by natural parks and reserves (including beaches) cannot be stressed too much.

10. DEPARTMENTAL INVOLVEMENT IN ENVIRONMENTAL MATTERS

The environmental responsibilities of this Department could be met only by drawing on the resources of other Departments and Authorities. The involvement of these was agreed upon at a specially convened meeting on 26 March 1975. The ready co-operation of these Departments and Authorities was apparent from the rapidity with which agreement was reached and their assistance is hereby acknowledged.

The Departmental representative(s) who attended the meeting are listed in Appendix 6 for ease of future reference.

Department	Area of Interest
Agriculture	1. Soil and vegetation surveys.
	2. Land use-current and potential.
	3. Flora assemblage and its susceptibility to damage by pollution (incl. heavy metals) salinity etc.
Education	1. Primary, secondary and technical education services for the community, (including pre-primary education).
Environmental Protection	1. Overall environmental aspects of the project.
	2. Supervision of the development o any Environmental Impact Statements.
	3. Evaluation of environmental facets by its expert groups eg Demographic and Environmental Resources Committee.

Fisheries and Wildlife	1. Marine ecosystems.
	2. Terrestrial ecosystems.
	3. Effect of Works establishment, operations and waste disposal on 1 and 2.
	4. Effect of community establishment and activity on 1 and 2.
	5. Effect of works and community on commercial fishing.
Forests	1. Effect of project on Forest's programme
	2. Effect of emissions on forests.
	3. Green belts.
Fremantle Port Authority	1. Responsibility for Cockburn Sound.
	2. General advice in relation to other ports.
Industrial Development	1. Co-ordination of the entire project.
	2. Buffer zones for other industries.
Lands and Surveys	1. Land utilisation and ownership.
	2. Topographical data

Main Roads and Director-General of Transport, Western Australian Government Railways	1. Traffic forecasts. 2. Transport system including road, rail and public transport. 3. Road induced pollution
Mines	1. Geological aspects of sites. 2. Groundwater resources and protection. 3. Port-channel cutting. 4. Natural building materials-assessment and protection.
Public Health	1. Clean air aspects. 2. Noise pollution. 3. Solid waste disposal. 4. Community health services. 5. Sanitation. 6. "Buffer" zones.
Public Works	1. Harbour development. 2. Off-shore discharges. 3. Surface and groundwater development, management and protection. 4. Country water supplies.
Tertiary Education Commission	1. Tertiary education facilities including teacher-training.

Town Planning	1. Effect of the project on regional development including the Corridor Plan for Perth.
	2. Location and design of residential areas.
	3. Community support and welfare facilities.
	4. Land use planning including transportation.
	5. Local authority statutory responsibilities.
Water Supply, Sewerage and Drainage	1. Emission standards for liquid effluents.
	2. Fresh water supply for works and community.
	3. Process water supply for works.
	4. Groundwater development and protection.
	5. Sewerage systems.
	6. Alternative methods of supplying process water eg recycling sewerage effluent.

11. SUGGESTED STUDIES

In the following section proposals are made for studies which bear on environmental issues. Until the site is specified the topics can be stated only in general terms and for the same reason the list is not necessarily exhaustive. At this point of time the list has been endorsed by the Departments involved. At the proper time it will be essential to decide a priority of studies and to phase them in on a schedule that will allow the most efficient use of Departments' resources. Clearly there will be some complex interaction between Departments.

Included for each study are details of some factors considered important and Departments have been nominated to contribute expert assistance. The extent of this assistance has not been defined but in relation to environmental aspects of the proposal, Departments might be called on for:

1) expert advice to the Department of Environmental Protection;

2) setting terms of reference for environmental studies;

3) assessing relevant portions of any Environmental Impact Statements;

4) carrying out environmental studies.

A short list of some sources of information available in this Department are listed in the Bibliography attached as Appendix 4.

11.1 Steelworks - site and operations

1) Physiography, Pedology and Geology

Preparation of a landform map of the area and detailed morphological and geological maps of the site to assist

a) landscaped design of plant

b) assessment of soil erosion and deposition

c) reservation of green belts and buffer zones

Mines Department, Lands and Surveys Department, Agriculture Department, Town Planning Department.

2) Hydrology (surface and underground water)

Assessment of the effects of site development (including storage and treatment lagoons and possible spillages) on the surface and underground waters and on the drainage pattern.

Mines Department, Public Works Department, Metropolitan Water Supply.

3) Climatology

Information on wind patterns, inversion conditions and mixing depths is required as part of the evaluation of the dispersion of air-borne pollutants and associated calculations of chimney heights. The same information may decide the relative locations of works and residential areas and associated urban design. General climatology data may be relevant to working conditions eg need for air conditioning and other facilities. These studies should include an assessment of background pollution levels.

Public Health Department (Bureau of Meteorology)
Town Planning Department

4) Fauna and Flora

Detail the present environmental profile and predict the effects of works establishment and operations on floral assemblage and fauna population. Suggest means of preserving representative areas of the environment and particularly any rare or unique species by creation of reserves, access corridors or barriers.

Departments of Fisheries and Wildlife, Agriculture, Lands and Surveys.

5) Land use

Assess alternative and potential uses of the works site and the impact of the project on land utilisation in adjacent areas. Land used for green belts and buffer zones should be included in these studies.

Departments of Lands and Surveys, Agriculture, Town Planning, Industrial Development, Forests.

6) Industrial waste disposal

At maximum output of steel, the mass of slag produced each year will be about 4 million tonnes. The disposal of this material will be a major environmental issue because its utilisation is subject to economic constraints. In other areas some blast furnace slag is used in insulating materials, in the cement industry, as railway ballast and as a replacement for agregate particularly in road making. Slag from steel making can be used as filling material. If all the slag has to be disposed of as filling material the yearly output (4 million tonnes) would fill an area of 100 hectares (250 acres) to a depth of 3 metres (10 feet).

The by-product uses for slag will be limited by the comparatively small markets available in Western Australia and by the high cost of transporting slag over a distance. In particular it is anticipated that penetration of the road aggregate market will be difficult. Traditionally a considerable amount of slag is used in reclamation to accommodate expansion of the works. The slag is generally regarded as inert and non-toxic in marine and terrestrial environments. However this feature would have to be established beyond doubt.

Additional to the slag there will be other solid wastes generated by the works and the work-force which will contribute to the problem. On-site incinerators for organic wastes may be used but such units will have to be approved by the Air Pollution Control Council.

In the case of this proposal the alternatives for solid waste disposal will be different at each of the potential sites. The problem might not become acute in the short term as long as off-shore dumping is practicable. In the long term the problem is potentially difficult at all sites but seems most intractable at Kwinana.

The proposed study scheme should examine

1) the chemical and physical characteristics of the types of slag and other solid wastes anticipated
2) effects of off-shore dumping
3) availability of disposal sites
4) possible markets
5) long term disposal

Departments of Public Health, Public Works, Metropolitan Water Supply, Mines, Lands and Surveys, Environmental Protection, Fremantle Port Authority, Fisheries and Wildlife.

11.2 Coastal Waters

The emphasis in these studies will shift in sympathy with the actual site chosen. However the topics listed are sufficiently general to have some validity at each site.

Studies in Cockburn Sound (see Appendix 4) and elsewhere have shown marine environments that are delicately balanced and largely dependent on the stability of sea grass communities. Therefore it is essential that the impact of the project and any effluents from it should be assessed against these factors. Consideration in these studies should be given to any spillages from the port, works and townships which may enter the waters.

1) Waste Water Disposal

The mixing, turbulence and natural interchange of the waters should be studied in sufficient detail to assess the dispersion of effluents discharged into the waters. As well the chemical characteristics and seasonal turbidity of the waters should be measured.

Department of Fisheries and Wildlife, Public Works Department, Public Health Department Metropolitan Water Supply

2) Seagrasses and Benthic Communities

The distribution and density of the seagrass communities and epibenthic organisms in the area should be investigated. Indicator organisms such as faunal and algal epiphytes should be identified so that a continuing study will provide the feedback information required to minimise damage from works' operations.

Department of Fisheries and Wildlife.

3) Heavy Metal Concentrations

Current levels of any heavy metals which could be increased by discharges from the works should be determined in typical indicator organisms. As above a continuing study will provide the feedback required to monitor and control the effect of works effluent.

Department of Fisheries and Wildlife, Mines Department (Government Chemical Laboratories), Public Health Department

4) Toxicity tests

Artificial effluents could be synthesised and tested for toxic effects on marine fauna and flora. The slag could also be tested in this manner to assess the effect of off-shore dumping.

Department of Fisheries and Wildlife, Mines Department (Government (Chemical Laboratories), Public Health Department.

5) Commercial fishing

A description should be made of the present resources of the area for commercial fishing and scientific research. The effect of the works on these should be predicted as accurately as possible. The survey should be extended to include the non-commercial fish resources since these may have importance in the fish chain.

Department of Fisheries and Wildlife

6) Littoral growth

The possibility of damage to littoral growth eg mangroves should be assessed, and "minimum effect" solutions promulgated.

Departments of Agriculture, Public Works

7) Liquid discharge (cooling water)

Since a large volume of sea water (461000 megalitres per annum) will be used for cooling purposes there will need to be an evaluation of a suitable temperature of discharge and speed of dispersal.

Departments of Fisheries and Wildlife, Public Works

8) Sediments

The nature of the off-shore sediments should be examined for stability.

Mines Department, Public Works Department

9) Industrial waste disposal

Relevant comment was made in Section 11.1 (6) and will not be repeated here.

Departments of Fisheries and Wildlife, Public Health, Harbours and Lights, Fremantle Port Authority, Metropolitan Water Supply, Public Works

11.3 Harbour development

The mass of material moving through the port and the size of carrier involved imply a large harbour with a corresponding potential impact. The positive and negative effects of the construction should be considered eg any negation of commercial fishing may be compensated by harbour facilities which shorten travel times to fishing grounds.

1) Harbour works (including off-shore dumping of slag)

Hydrological and model studies may be required to assess the effect of the port construction on;

a) water movement, littoral drift and erosion-deposition patterns;
b) marine flora and fauna;
c) commercial fishing.

2) Channel cutting

The effect of dredging and blasting on the stability of the sea bed and on fish population should be assessed.

Public Works Department, Department of Fisheries and Wildlife, Mines Department.

11.4 The Associated Residential Areas

The complexity of this problem and the conceivable scope for environmental conservation will vary with the site selected. As mentioned before most of the matters listed here are part of the normal pattern of community development and are included in the approved town planning schemes. They are listed here to indicate that they are components of the total environment. Development companies, local authorities and relevant Government Departments are the agents for integration of their separate responsibilities into the establishing of a community that is compatible with the environment.

1) Urban impact

Areas selected for urban purposes should complement the environmental design of the region. Attention should be paid to the conservation of natural resources especially by avoiding sterilisation of resources.

Lands and Surveys Department, Town Planning Department, Mines Department (Geological Survey)

2) Housing

Assessment of the requirements of the construction force and the permanent population. Some consideration should be given to the probable transient nature of the construction force and to minimise transient nature of the works population.

Town Planning Department, Planning and Co-ordinating Authority, State Housing Commission, Lands and Surveys.

3) Education

A study of present facilities, of projected demand and the ability to cater for it is required. Planning for this will obviously depend on decisions in other areas and hence is not in the front-line of the decision making parameters.

Department of Education, Tertiary Education Commission

4) Health

Similar to (3) above.

Department of Public Health, Medical Department.

5) Utility services

Similar to (3) above except that the initial construction force will require services in advance of permanent installations eg sewerage, water, waste disposal etc.

Department of Public Health, Public Works Department, Metropolitan Water Supply, State Electricity Commission, Main Roads Department.

6) Recreation and cultural facilities

These facilities will be in demand with the influx of construction workers and the demand for quantity and variety will increase as the permanent population grows. The effect of the increased population on the surrounding areas and adjacent waters is part of the assessment required.

Town Planning Department, Department of Environmental Protection (Conservation Through Reserves Committee), Lands and Surveys Department.

7) Local Government

The sudden expansion in a particular area and the consequent demand for services will strain the resources of the relevant local authority. Some study of this facet will be required to ensure logical growth without undue social stress or economic inefficiency.

Local Government Department, State Housing Commission.

CONCLUSION

The preceding pages pose the environmental problems and suggest a scheme for a rational approach to their solution. The call is for a co-ordinated total approach based on collection of data, their interpretation and application to a design which will cater for the total environment.

APPENDIX 1

STATEMENT OF INFORMATION RELEVANT TO WESTERN AUSTRALIAN STEEL PLANT FEASIBILITY STUDY

1. Participating companies or corporations in the Study total 13:

Australian	2
British	2
European	1
American	3
Japanese	5

2. BHP has accepted the prime task of carrying out the Feasibility Study with some participating companies undertaking planning of specific sections of plant where their expertise is of particular value.

3. Overall policy matters are subject to determination by a Steering Committee comprised of senior representatives of participating companies with Mr. J. Anderton of BHP as Chairman.

4. The detailed progress of the study is undertaken by a Technical Committee on which most companies are represented and such committee advises and assists the appointed Study Director, Mr. D. Chaffey of BHP. Other BHP officers directly involved in the Study Group are Mr. E.R. Kennett (Engineering), G.R. Johnson (Finance), D. Box (Planning).

5. The Technical Committee is working to a target of completion of a report by the end of March 1975

6. The study is directed towards determining the economic viability of a steel plant development which would achieve levels of output of semi-finished product (slabs, blooms, billets) of approximately 4.0 million tonne in 1981, 7.0 million tonne in 1983 and 10.0 million tonne in 1986. If Kwinana was acceptable as the preferred site, consideration would be directed to achieving an earlier commencement of steelmaking from iron available from the existing blast furnace.

7. The three sites of Kwinana, Moore River and Pt. Hedland remain the prime sites for evaluation there having been no fourth site proposed to the Committee as being one which would rank with the above three under currently known economic conditions.

Site inspections have been made, site data is now being correlated and it would be expected that a determination of the economically preferred site made at the next meeting of the Technical Committee scheduled for 28th October 1974.

8. The timing of such a steel development project is considered to be determined primarily by the time required for negotiation of the necessary agreements, the first major stage detailed engineering design, the ability to obtain the volume of site labour required and the rate of supply of equipment and materials both local and imported.

9. Site Construction Labour is forecast to rise to an average level of approximately 4,000 from 1977 to 1980, and commence reducing from 1985. The degree of fluctuation above and below the average cannot be assessed until a detailed site construction programme is established.

10. Operating and maintenance labour is likely to amount to some 8,000 to 10,000 employees by the final stage in 1986, and recruitment of a significant number would need to be underway in 1980, to have available in 1981 a work force of the order of ',000. Again these figures are subject to more detailed appraisal.

11. For a plant based on conventional blast furnace practice with its own coke ovens capacity and processing of steel not proceeding beyond the semi-finished product state, such a plant would be close to balanced in energy requirements with the exception of a substantial intake of oil in blast furnace injection if this practice is followed rather than a gaseous hydrocarbon injection. Oil injection appears to be still commonly applied in overseas practice in spite of highly escalated oil costs. By product fuels appear to be adequate for plant power generation to the levels

required of 200 to 240 MW. The BHP Manager Electrical Engineering would be available to discuss matters of electrical energy with Commission Officers.

12. Water consumption for the steelplant stated in terms of Megalitres Per Annum for the three stages have been estimated at:

	4.0 MTPA	7.0 MTPA	10.0 MTPA
Fresh Water	12,470	21,710	32,340
Salt or Brackish Water	158,800	309,600	461,000

Fresh water is make-up intake after applying maximum measures for cooling, clarification and recirculation within the plant.

Salt water is mostly used for condenser application as a once through use.

The above fresh water requirement corresponds closely with previously advised estimates of 20/21 m.g.p.t. for plant use and we would assume that the appropriate requirements for a township would remain in the order of 10/12 m.g.p.t. but naturally dependant on the ratio of total population to work force which could vary widely according to location.

13. Raw material supply would approximate to the following:

Iron Ore	7 M. tonne	12 m. tonne	17.5 M. tonne
Coal (Dry Basis)	3 M. tonne	5 M. tonne	7.5 M. tonne
Add 10% for moisture for freight purposes			
Limestone	1.8 M tonne	3 M. tonne	4.5 M. tonne

Suitable local limesands if located could substitute for some limestone to extent of:

0.2 M. tonne 0.35 M. tonne 0.5 M. tonne

Other materials, ferro alloys, refractories, manganese ore, etc., to approximately 1.0 M. tonne.

14. Vessel Sizes - While 165,000 DWT is considered for ore and coal in longer term, 135,000 DWT has been used as possibly optimum size in short term - other materials including export product in vessel size ranges 25,000/60,000 DWT.

15. Environmental Studies are being developed by BHP Manager Combustion Engineering with DEP with liaison maintained with Mr. N. Barker.

16. Waste disposal has not been considered in detail. The Works will incorporate the best available technology so that liquid and gaseous wastes will be treated so that effluents and emissions conform to accepted standards. Some slag may be used in local markets eg as railway ballast and in road-making. However it is expected that most of it will be used for off-shore construction or for reclamation of off-shore areas. Other solid wastes may be incinerated or used as land-fill.

APPENDIX 2

SUMMARY OF SITE FACTORS

	KWINANA	MOORE RIVER	PORT HEDLAND
1. Location	42 km south of Perth.	68 km north of Perth.	1300 km north of Perth.
2. Site dimensions	525 hectares (1300 acres) including reclaimed area and red mud ponds.	Nominally shown as 800 hectares (200 acres) with provision for extension to 1200 ha.	Nominally shown as 476 hectares (1200 acres) with provision for extension to 680 ha (1700 ac).
3. Site description	Flat industrial site - formerly coastal sand dunes; involves some reclamation of Cockburn Sound and utilisation of former red mud ponds.	Coastal sand dunes currently zoned rural and used for grazing. Filling and levelling would be required.	Port Authority land consisting of mud flats, mangroves and creeks. Extensive filling would be required.
4. Potential for Expansion	Very limited.	Could be provided.	Somewhat limited.
5. Potential for Buffer Zones	Very limited.	Could be provided.	Could be provided.
6. Tidal Conditions	Normal 1m, maximum 2m.	Expected to be similar to Kwinana.	Normal 6.4m, maximum 7m.
7. Meteorology	Coastal regime but otherwise essentially similar to Perth.	As for Kwinana except the rainfall is slightly lower than Perth.	Coastal tropic regime; arid area subject to cyclones.
8. Harbour facilities	FPA area with existing harbour sheltered by Garden Island; involves reclamation by dumping in Cockburn Sound.	Harbour facilities would need to be developed with consequent blasting, dredging and construction involving off-shore dumping.	Dredging and construction required additive to existing harbour.
9. Water resources	Metropolitan resources.	Metropolitan resources.	Probably available from aquifers.
10. Transport	Adds to congestion and road pollution south of Perth.	Could take advantage of road system developing north of Perth.	No logistical problems.
11. Housing and infrastructure	Based on metropolitan area.	Would add impetus to development of north-west corridor.	Expansion of South Hedland and adjacent areas.

	KWINANA	MOORE RIVER	PORT HEDLAND
12. Environment (BHP comments)	A plant established at Kwinana would be required to observe strictly limitations on air, water and noise pollution. Some tolerance can be expected from local residents but environmental and conservationist groups are expected to resist establishment in this area. The waters of Cockburn Sound are attracting much attention at present. Government officals have indicated that reclaiming land in Cockburn Sound and dumping of works refuse on the foreshore is unlikely to be permitted.	Adherence to general world standards with modern plant is expected to be acceptable in this area. There are no immediate neighbours to the site and controlled development will apply. Ample provisions can be made for green belts.	The existing township and proposed new township will need to have special consideration. General world standards with modern plant are expected to be acceptable. Some tolerance can be expected from local residents.
13. Site restriction	Restrained to 10 mtpa by presence of existing industry.	No restriction on future expansion.	Water-front area will be limited to some degree. Expansion may require re-location of Goldsworthy railway.
14. Waste disposal	Disposal of works refuse and slag would be a problem. Dumping of slag in Cockburn Sound may be possible but reaction could lead to prohibition.	It is expected that off-shore disposal will be allowed in this area.	The need to fill low-lying areas and creeks will provide adequate area for slag disposal.
15. Land alienation	Minimal because Kwinana is already industrial and Cockburn Sound is FPA area.	Rural areas would become industrial and coastline would become harbour. Further areas of coastline and adjacent rural land would be needed for housing. A large buffer zone (light industry, recreation and green belt) would be required.	This is Port Authority land reserved for industry and harbour expansion.

APPENDIX 3

BHP JUMBO STEEL PLANT

ENVIRONMENTAL REVIEW

The Review is not to be simply a list of characteristics of the existing environment and effects which the proposal will have but rather should guide the reader through the process by which the decision was made to proceed with the particular proposal at the particular site. In addition to proposed safeguards to protect the environment the Review should show an awareness of the need for on-going research which will be necessary to ensure the proper management and control of environmental matters associated with the proposal.

The Review should take into account all environmental factors including those associated with social and demographic matters and include sufficient data on costs and economics of various alternatives to allow assessment of these in the light of environmental factors. Where data is lacking this should be clearly stated and any assumptions made on inadequate data should also be clearly acknowledged.

The following notes give guidance for the preparation of the Environmental Review:

1. Summary - this section of the Review should form a self-contained document of perhaps 10 pages summarising the proposal and the conclusions of the Review. It should answer, in summary form, the questions: why is the proposal desired?; what environmental advantages and disadvantages will the project have?; what safeguards will be instituted to minimise the disadvantages?; what irreversible effects cannot be safeguarded?.

1.1 Report Structure - outline the report structure as a guide to the reader to indicate the flow of the decision-making process through the Review.

1.2 Parties Responsible - list the members of the consortium together with brief details of their structure and expertise.

1.3 Authorities Consulted - list the authorities consulted in preparing the Review.

1.4 The Proposal - a short description of the proposal including ancilliary items such as transport, services and housing.

1.5 Environmental Effects - a summary of the environmental effects, both positive and negative, of the proposal and proposed methods of amelioration.

1.6 Management - a summary of the further research and investigation required to ensure adequate environmental management of the project.

2. Project Description - a sufficiently detailed description of the project to give an understanding of possible interactions between it and the physical and human environment. The description should include ancillary developments such as transport, services, housing, etc, and give specific details of wastes and waste disposal to air, water and land.

3. Project Justification - under the following headings the reasons for proceeding with the project should be discussed in terms of the Company, the region, the State and the Nation in decreasing detail. The detail should be such as to show appreciation for the broad National issues as well as the particular Company objectives. This section is not seen as a benefit/cost analysis, but rather a brief outline of economic and other considerations and constraints leading to the choice of the project at this time and place and should indicate that the broader implications are appreciated.

3.1 Objectives - discuss the objectives sought by the proposal; both the major objectives and "spin-off" objectives employment, decentralisation, transport, etc) should be discussed.

3.2 Rationale - discuss the question: why proceed at this time, in this way, at this place?; include here demand/supply considerations.

3.3 Implications - discuss the implications of proceeding and not proceeding.

4. Alternatives - discuss the alternatives available to the Company in terms of sites and processes (including the alternative of doing nothing); discuss reasons for rejection of those rejected with a view to identifying a "short list" of possibilities for further analysis and discussion. This section should include a review of sites other than Port Hedland, Kwinana and Moore River such as Esperance, Albany, Bunbury, Geraldton or any other areas of the State.

5. Existing Environment - for each of the areas identified in the "short list" describe and discuss the existing environment under the following headings. The depth and detail of these discussions should be only such as is adequate to give an understanding of the likely effects of the development upon the environment. More detailed data, where available, should be attached in the Appendices.

5.1 Physical Environment

5.1.1 Land form - (see 5.1.3).

5.1.2 Geology - (see 5.1.3).

5.1.3 Water - discuss those features of the areas with particular reference to works requirements and effluent disposal, water requirements, pipelines, power lines, road and rail links, etc.

5.1.4 Marine - discuss the existing marine environment particularly in relation to proposed port structures, cooling water, etc.

5.1.5 Meteorology - discuss the meteorology of the areas with particular reference to air pollution factors such as humidity, temperature inversions.

5.1.6 Flora - discuss the vegetation of the area with special reference to rare species;

5.1.7 Fauna - discuss the fauna of the area.

5.1.8 Ecosystem - discuss any interrelations of the physical environment not already covered.

5.2 Human Environment

5.2.1 Land Utilisation - discuss the present land use situation including industry, primary production (farming, forests, bee-keeping, etc), water catchment, recreation (active and passive), etc.

5.2.2 Population Distribution and Structure - discuss the present population structure in the areas and areas to be affected by the proposed development and its ancillary requirements; include factors such as employment opportunities, recreational facilities, etc.

5.2.3 Transport - discuss the present transport system and usage.

6. Environmental Modification - discuss the positive and negative effects which the "short list" options and associated developments will have on the existing environment and, where applicable, the constraints imposed on the operation by the environment.

6.1 Physical Environment

6.1.1 Land Form - discuss modifications which will be made to the land form, eg site levelling, rail cuttings, valley fill, etc.

6.1.2 Geology - discuss the geology of alternative sites with particular reference to waste disposal areas.

6.1.3 Water - discuss effects of the options in terms of surface and underground water supply.

6.1.4 Marine - discuss effects on the existing marine environment with reference to hydrography, fisheries, port construction and operation, cooling water and effluent etc.

6.1.5 Meteorology - discuss the effects of meteorological conditions on air pollution aspects of the options.

6.1.6 Flora - discuss effects in terms of the vegetation of the areas.

6.1.7 Fauna - discuss effects in terms of the fauna of the areas.

6.1.8 Ecosystem - discuss effects in terms of environmental interactions.

6.2 Human Environment

6.2.1 Land Utilisation - discuss the effect of the options and ancillary developments in terms of the present land uses.

6.2.2 Population Distribution and Structure - discuss the effect of the added workforce on the social structure of the population, eg shift work, male/female ratios, age distribution, effect on external populations, employment opportunities, etc.

6.2.3 Transport - discuss the effects of various transport needs on existing transport facilities; public use of company roads and vice versa; commuter transport facilities, etc.

6.2.4 Health - discuss the health aspects of effluent disposal to air, water and land including odours, noise, aesthetics of the proposal.

6.3 Resource Commitment - discuss the effects which the steel works and its associated developments will have in terms of constraints on future use of the resources of the area.

6.3.1 Land - what land areas are committed by the development and what future alternative uses are available for land?

6.3.2 Natural Resources - what irreversible use is made of vegetation, animal, mineral and water resources and what alternative uses of these are then available?

6.3.3 Human Use and Appreciation - what irreversible use is made of areas of human use and appreciation such as tourism, standing water, forest scenery, bushwalking trails, fishing, sailing, camping, etc and what alternative uses then remain?

7. Choice of Steelworks Option - in view of the fore-going discussions and analyses of the various options defined in the "short list", specify the preferred options in terms of:

7.1 Benefits and Adverse Effects - review the benefits and adverse effects of each of the "short list" options and, taking also into account non-environmental benefits and disbenefits, specify the perferred option or options.

7.2 Safeguards and Research - discuss the safeguards and on-going research which will be implemented with regard to the specified option, including details of further data collection and analysis required to properly manage environmental aspects of the proposal.

8. References - a detailed list of all references should be attached and the text should include references wherever applicable.

9. Appendices - attach here any detailed specifications and data such as lists of flora and fauna, detailed geological, hydrological or other studies, costs, flow charts, maps, etc.

APPENDIX 4

BIBLIOGRAPHY

1. Coogee Air Pollution Study (May 1974) published by Environmental Protection Authority, Perth

2. Sense Of Place by G. Seddon published by University of Western Australia Press

3. Problems Of Air And Water Pollution Arising In The Iron And Steel Industry, United Nations Publication ST/ECE/STEEL 32

4. Demographic And Environmental Resources Study Of Kwinana

5. Redcliff Petrochemical Development - Plan For Environmental Study published by the South Australian Department Of Environmental Conservation

6. Progress Report On Existing Baseline Environmental Data And Sources Of Information On The Salvado Strip A report from WAIT-AID for the Department of Environmental Protection.

7. Perth North-West Corridor-Development Study by Maunsell and Partners Pty. Ltd. for the Cities Commission (formerly National Urban And Regional Development Authority).

8. The Cockburn Sound Ecosystem Spring 1972. A report to the Fremantle Port Authority.

9. Report On Six Month World Health Organisation Overseas Travelling Fellowship. R.A. Powell, Public Health Department, Perth.

APPENDIX 5

DISTRIBUTION LIST

Minister for Conservation and Environment
Director, Department of Agriculture
Director, Department of Fisheries and Wildlife
Conservator, Forests Department
General Manager, Fremantle Port Authority
Coordinator, Department of Industrial Development
Under Secretary, Department of Lands and Surveys
Commissioner, Department of Main Roads
Under Secretary, Mines Department
Commissioner, Department of Public Health
Under Secretary, Department of Public Works
Director Of Engineering, Public Works Department
Commissioner, Department of Town Planning
General Manager, Water Supply, Sewerage and Drainage Department
Director General, Department of Education
Under Secretary, Premiers Department
General Manager, State Housing Commission
Environmental Protection Authority
Environmental Protection Council
Tertiary Education Commission
Director General of Transport
Western Australian Government Railways
State Electricity Commission

APPENDIX 6

REPRESENTATION AT MEETING 26 MARCH 1975

Dr. B.J. O'Brien	-	Department of Environmental Protection
Mr. L. Brennan	-	Department of Environmental Protection
Mr. N. Barker	-	Department of Industrial Development
Mr. B. Bowen	-	Department of Fisheries and Wildlife
Mr. J. Butcher	-	Public Works Department
Dr. D. Carr	-	Town Planning Department
Mr. M. Caldwell	-	Metropolitan Water Board
Mr. D. Collett	-	Public Works Department
Miss M. Cooper	-	Education Department
Mr. G. Dunham	-	Education Department
Mr. G. Hackett	-	Main Roads Department
Mr. R. Hampson	-	Premier's Department
Dr. E. Hopkins	-	Forests Department
Mr. L. Jones	-	Department of Agriculture
Mr. J. Lord	-	Mines Department
Dr. J. McNulty	-	Public Health Department
Mr. J. Morgan	-	Lands and Surveys Department
Capt. F. Adams	-	Fremantle Port Authority
Mr. J. Rothwell	-	State Housing Commission