

Goldsworthy Extension Project Phase 2 - Yarrie project area, East Pilbara

BHP Iron Ore (Goldsworthy) Limited

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 673
January 1993**

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of \$10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the \$10 fee) must reach the Minister's office no later than 5.00 pm on 29 January, 1993.

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Summary and recommendations

BHP Iron Ore (Goldsworthy) Limited proposes to develop an open-cut iron ore mine at Yarrie, located approximately 200 km east south-east of Port Hedland, Western Australia (see Figure 1). The proposal is an extension of the existing Goldsworthy iron ore operations which include mining deposits at Shay Gap, Nimingarra and Sunrise Hill. The high grade iron ore reserves at these current mines are nearly depleted.

The proposal to mine approximately 35 million tonnes of iron ore over a period of about 6 years includes an extension of the proponent's Goldsworthy railway line 25km to Yarrie. The railway line currently terminates at Shay Gap.

The proposal would involve removing overburden, open-cut mining of iron ore, primary crushing and loading of the ore into rail cars for transport to the secondary processing and export site at Finucane Island. Camps would be built to house the construction workforces and the operational workforce. Mining of the remnant Nimingarra and Sunrise Hill deposits would continue on a periodic basis in order to fulfil some existing sales contracts. The Shay Gap iron ore reserve is close to exhaustion and mining is scheduled to cease at this site by the end of 1993.

The mining operation at Yarrie would be carried out by a contractor and would most likely operate on a long distance commuting basis. The closest settlement is Shay Gap, a BHP company town. The town was established to provide a semi-permanent base for mining workforces for the Shay Gap, Nimingarra and Sunrise deposits. The proponent maintains that it would be uneconomic to refurbish Shay Gap town and thereby maintain it as a base for mine workers at the Yarrie mine.

The mining proposal was referred to the Environmental Protection Authority in September 1992. A Consultative Environmental Review (CER) level of assessment was set to evaluate particularly the dewatering associated with the mining operation and growing concerns about the potential for disused mining pits in the Pilbara to cause salinisation of fresh water aquifers.

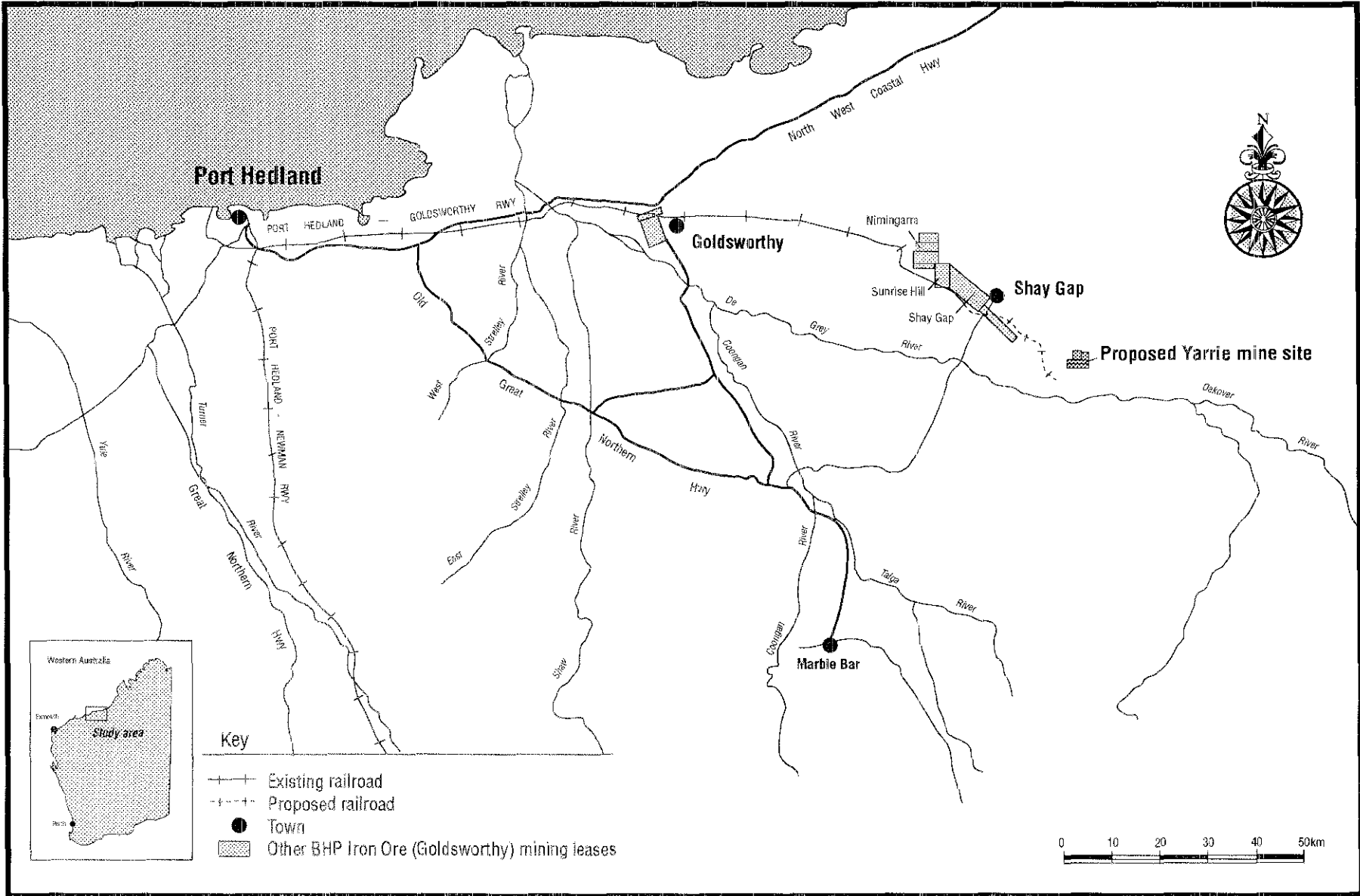
The CER was released for public review from 2 November to 30 November 1992. Eight submissions were received. There were three main issues (with a number of sub-issues) of significance identified in the submissions and by the Authority during the assessment of the proposal. They are:

- surface water (discharge quality and drainage impacts from "railway shadow");
- groundwater (dewatering impacts and potential for groundwater salinisation); and
- rehabilitation (landform, revegetation and infrastructure).

Conclusions and recommendations

Following consideration of the CER, submissions from government agencies and the proponent's response to them, the Authority considers that the environmental issues related to the proposal are manageable and has concluded that the proposal is environmentally acceptable.

Figure 1: Project location map.



Recommendation 1

The Environmental Protection Authority concludes that the proposal to develop an open-cut iron ore mine at Yarrie is environmentally acceptable, subject to the proponent's environmental management commitments and the recommendations in this report. In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- surface water (discharge quality and drainage impacts from “railway shadow”);
- groundwater (dewatering impacts and potential for groundwater salinisation); and
- rehabilitation (landform, revegetation and infrastructure).

The Environmental Protection Authority considers that these and other minor environmental issues can be adequately managed. If the proposal proceeds, the Environmental Protection Authority recommends that the proponent's environmental management commitments listed in Appendix 1 and the recommendations in this report be applied.

The CER did not provide sufficient analysis of the potential for salinisation of groundwater in the pit and subsequent movement of the salinised water. The proponent acknowledged the need for further investigation and modelling of this issue. Furthermore, as there has been little attention in the past to the environmental acceptability of potentially saline pits or their future rehabilitation, the proponent should monitor and manage water bodies exposed to long term evaporation with the objective of minimising the degree of salinisation of otherwise potable water and the potential effects of movement of this water on downstream ecosystems.

Recommendation 2

The Environmental Protection Authority recommends that:

- 2.1 The proponent should minimise the potential for salinisation in the Y2 pit and drawdown in order to minimise the potential groundwater impacts;
- 2.1 The proponent should ensure that surface water discharge impacts and drainage shadow effects from the railway line are minimised;
- 2.3 Prior to the commencement of productive mining, the proponent should design and implement a water management programme to the requirements of the Minister for the Environment on advice of the Water Authority of Western Australia and the Department of Minerals and Energy. This programme should be based on hydrogeological investigations and should include:
 - surface water monitoring and management procedures;
 - management of dewatering impacts; and
 - long term management of any water bodies which expose the water table to long term evaporation.

This programme should also be used to develop a plan for the long term management of any such water bodies at least six months prior to decommissioning.

During the fauna survey evidence of two protected species was found in the project area. As the survey did not involve trapping it is difficult to clearly determine the range of species

occurring in the project area and hence to fully assess the likely impact of the proposal on fauna. The proponent has offered to undertake a more thorough survey of the Pebble-mound mouse in collaboration with the Department of Conservation and Land Management, however the fauna study should be expanded to include other significant species likely to occur in the region such as Rothschild's Rock-wallaby and the Long-tailed dunnart.

Recommendation 3

The Environmental Protection Authority recommends that:

- 3.1 The proponent should minimise impacts on protected fauna species and their habitats; and**
- 3.2 Prior to the commencement of any clearing or construction activity on the mine site, the proponent should prepare and implement a fauna survey and management programme to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.**

1. Introduction

BHP Iron Ore (Goldsworthy) Ltd proposes to develop an open-cut iron ore mine at Yarrie, located approximately 200 km east south-east of Port Hedland, Western Australia (see Figure 1). The proposal, an extension of the existing Goldsworthy iron ore operations in the northern Pilbara region of Western Australia, is subject to the *Iron-Ore (Goldsworthy-Nimingarra) Agreement Act 1972*. The Goldsworthy iron ore operations include mining deposits at Shay Gap, Nimingarra and Sunrise Hill. The high grade iron ore reserves at these current mines are nearly depleted.

The proposal was referred to the Environmental Protection Authority on 11 September 1992. A Consultative Environmental Review (CER) level of assessment was set due to a number of factors including the dewatering associated with the mining operation and growing concerns about the potential for disused mining pits in the Pilbara to cause salinisation of fresh water aquifers.

2. Project description

The major components of the proposed development include:

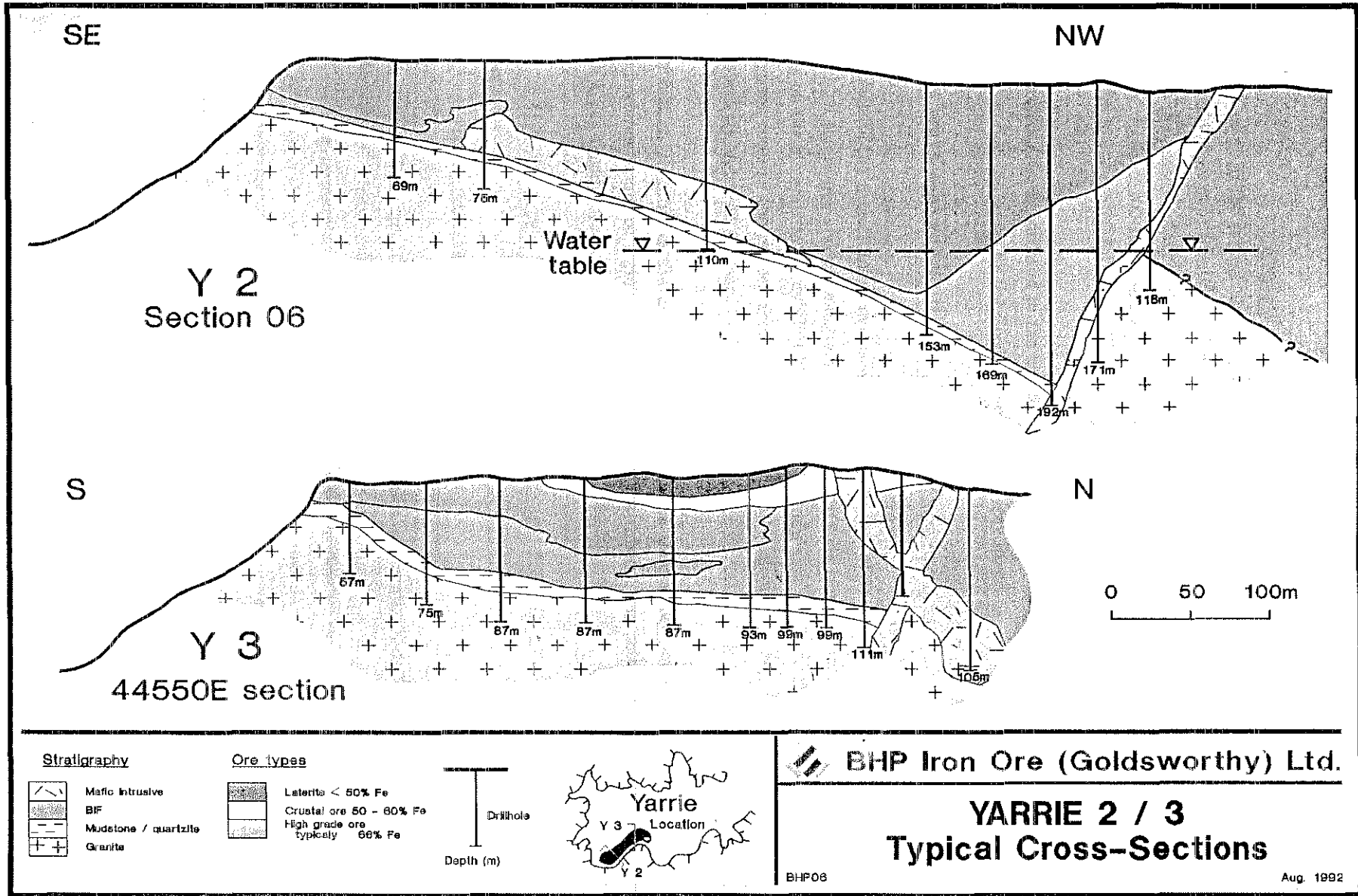
- site preparation which involves the removal of overburden;
- extension by approximately 25km of the existing Goldsworthy rail line which currently terminates at the Shay Gap crusher to Yarrie and construction of train loading facilities;
- construction and upgrading of roads and a powerline and other services to the mining area;
- construction of crushing plant, stockpiling and trainloading facilities and associated infrastructure to support the mining operation;
- development of facilities to enable dewatering of that portion of the ore body below the water table; and
- open-cut mining of the iron ore.

The total Yarrie deposit contains a known reserve of approximately 35 million tonnes and the proposed extraction rate of ore would be about 5 million tonnes per year. The ore body, although one continuous deposit, has a deep section (Y2) at the south-western end and a shallower section (Y3) to the north-east (Figure 2). Mining of ore in Y3 would begin following a development phase of about 6 months duration.

The mining method proposed for the Yarrie deposit would involve the selective removal of overburden and conventional open-cut mining. The overburden and ore would be excavated by means of drilling, blasting and loading by a large hydraulic excavator and front end loaders into off-highway dump trucks for transport to the crusher or overburden site as appropriate.

During the construction phase, the topsoil and vegetation on most areas to be cleared would be stripped and stored for later use in rehabilitation. During mining, overburden from the shallower section, Y3, would be placed in a crescent-shaped gully on the southern side of the Yarrie plateau. The reason for mining Y3 first is that this area has relatively little overburden to be removed thus enabling mining of the high grade ore to commence in the shortest possible time. Mining of the deeper section, Y2, would commence at a later stage but within the first year of operations. Once the Y3 pit was mined out overburden from Y2 would be backfilled into the Y3 pit. At the completion of mining the overburden would be shaped to blend with the

Figure 2: Diagram of ore body.



existing landform and rehabilitated. The total quantity of overburden proposed to be mined is about 100 million tonnes. The Y2 pit would not be backfilled.

Ore would be passed through the primary crusher on-site and then conveyed to a train loading facility for loading onto rail cars. The primary crushed ore would be transported by private railway from the mine to the existing secondary and tertiary crushing and ship loading facilities at Finucane Island.

Water supplies for the mining operation and the accommodation village would be from bores drilled into the Yarrie plateau on the periphery of the pit area. The lower parts of the Y2 pit would require dewatering once the base of the pit reaches below the water table level. By that time, substantial dewatering would be expected through the abstraction of water from the plateau for domestic and process water supply. Further dewatering would be achieved either with strategically located bores or by pumping from a sump in the base of the pit.

Dust and noise impacts are not regarded as significant issues. Dust would be suppressed by watering and noise control measures would be required to conform with regulations enforced under Part V of the *Environmental Protection Act 1986*.

Construction of the infrastructure and mine would employ approximately 200 workers, while the operation stage would employ approximately 100. The proponent intends to use contractors for construction work on the railway and the mine site. A temporary camp for the railway construction contractors would be built at the base of Shay Gap Ridge, close to Shay Gap town. This proposed camp would be built on an old construction camp site and would have a life of eight months. A second construction camp for the mine would be located on-site. Construction workers would fly in and out from other centres depending on the contractor's preference. The construction camps would be removed after construction including all of the existing structures present on the proposed railway construction camp site. The proponent altered the original proposal so that work on the railway line could commence before work on the mine site and the construction schedule could be maintained (see 8.1, Appendix B).

The proponent intends to also contract out the mine operations. Workers would commute on a week-on/week-off basis from Perth and other centres. Workers would live on-site in a new, specially constructed village approximately 2km west from the Yarrie mine. The proponent maintains that it would be uneconomic to refurbish Shay Gap town and thereby maintain the town as a base for mine workers.

Mining of the remnant Nimingarra and Sunrise Hill deposits would continue on a periodic basis in order to fulfil some existing sales contracts. Mining of the Shay Gap deposit is scheduled to cease by December 1993.

3. Existing environment

The Yarrie project area is located in an area of low, rocky hills, plateaux and ridges interspersed with wide sandy plains and occasional small claypans. Numerous small ephemeral, sandy-bedded creeks dissect the area. The project area is bordered to the north and east by the broad sandplains of the Great Sandy Desert and to the south by the floodplain of the De Grey River.

The Yarrie iron ore deposit is located next to a steep cliff on a ridge about 120m above the level of the surrounding plain. The Yarrie Y3 deposit of high-grade iron ore is flat-lying and is covered by lateritic capping material up to 20 metres thick. The western Y2 deposit is downward sloping and covered by some 40-100 metres of overburden.

Surface water flow in the area is generally comprised of converging, small ephemeral stream lines. The largest creek is Eel Creek which joins the De Grey River, a major inland watercourse, about 8km south of the proposed mine site. Permanent pools which have traditionally been used by Aborigines occur on some of the ridges.

Groundwater in the region occurs mainly within two distinct hydrogeological units, fractured bedrock and alluvium. The groundwater is recharged by infiltration of summer rainfall,

particularly along major drainage lines. There are aquifers in the banded iron formation on the plateau and alluvial aquifers on the plain. Exploratory drilling has shown that the Yarrie plateau contains a perched aquifer confined by the granite and mudstone that underlie the ore body. The groundwater table in the plateau is considerably higher than the water table in the plains. The perched aquifer is considered to be recharged by rainfall with a very slow discharge into the regional water table.

The vegetation of the project area is typical of the northern Pilbara. No declared rare flora or priority flora were identified during the vegetation and flora surveys. However, several species are of local conservation significance and were recorded in only one or two locations in the project area.

During the fauna survey, evidence of two protected species was found in the project area. They were the Pebble-mound mouse and the Rabbit-eared bandicoot (bilby). Other protected species may possibly be present in the project area but were not detected during the four day survey. Feral donkeys were observed in the area.

Archaeological and ethnographic surveys were conducted in the Yarrie mining area and a number of Aboriginal sites were identified. There are no identified historic European structures or European heritage values associated with the project area. Four pastoral leases exist in the vicinity of the project area. The proposed mine site would impinge on three of the leases and the rail and access road routes would traverse two of them.

The closest settlement is Shay Gap, a BHP company town within the East Pilbara shire, with a population of approximately 800. The town was established to provide a semi-permanent base for mining workforces for the Shay Gap, Nimingarra and Sunrise deposits. Nearly half the total population is involved in mining with the remainder comprising of dependents and service providers. Shay Gap town is also a supply point for Aboriginal people from the "Nomads" group.

BHP has decided to close the town during the next two years as a result of decommissioning the existing mining operations and the resultant reduction in workforce. The high cost of maintenance of infrastructure and services which are reaching the end of their practical life was also a factor in the company's decision. Workers would be made redundant or relocated to other BHP operations if positions are available.

4. Public review

The CER was released for public review from 2 November to 30 November 1992. Eight submissions were received from conservation groups and government departments and none were received from private individuals. There were three main issues, with a number of sub-issues, of significance identified in the public submissions and by the Authority during the assessment of the proposal. They are:

- surface water (discharge quality and drainage impacts from "railway shadow");
- groundwater (dewatering impacts and potential for groundwater salinisation); and
- rehabilitation (landform, revegetation and infrastructure).

5. Environmental impacts and their management

5.1 General

Following consideration of the CER, submissions and the proponent's response to them, the Authority believes that the potential environmental impacts could be managed adequately.

The local impacts of the iron ore mine proposal at Yarrie would not be environmentally significant, however the cumulative impacts of iron ore mining in the Pilbara could be if they are not managed in a co-ordinated manner. The regional impacts needing consideration are the following:

- groundwater drawdown;
- habitat destruction;
- associated mine infrastructure impacts (e.g. construction camps, workforce village, power and transport corridors);
- waterbodies in mined-out pits (concentration of salts and modification of ecosystems); and

Recommendation 1

The Environmental Protection Authority concludes that the proposal to develop an open-cut iron ore mine at Yarrie is environmentally acceptable, subject to the proponent's environmental management commitments and the recommendations in this report. In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **surface water (discharge quality and drainage impacts from "railway shadow");**
- **groundwater (dewatering impacts and potential for groundwater salinisation); and**
- **rehabilitation (landform, revegetation and infrastructure).**

The Environmental Protection Authority considers that these and other minor environmental issues can be adequately managed. If the proposal proceeds, the Environmental Protection Authority recommends that the proponent's environmental management commitments listed in Appendix 1 and the recommendations in this report be applied.

5.2 Surface water impacts

5.2.1 Water discharge

Pit dewatering may be required during the latter years of the project when mining has reached the local water table. The water table level in the area of the mine pit would be gradually lowered due to abstraction of water for domestic and mine uses, however additional dewatering of the Y2 mine pit is expected to be required.

To help ensure that the volume or quality of water discharged from the mine pit does not result in unacceptable effects on the environment, the proponent would pump the minimum quantity of water necessary to achieve adequate dewatering. The required rate of dewatering would depend on the amount of pre-existing drawdown but is predicted to be less than a few hundred cubic metres per day. Most or all of this water would be used for dust suppression and other mine-related uses. Any excess would be discharged to a natural water course and allowed to find its way to Eel Creek. Depending on the dewatering method used (bores or an in-pit sump), this water may contain high loads of suspended solids and would be discharged via settling ponds if necessary to ensure that the water finally released is of acceptable quality.

The proponent has made a commitment to constantly monitor the dewatering rate and the degree of drawdown. Regular samples of any discharged water would also be collected and analysed for water quality parameters. All water discharges would be controlled under licences issued under Part V of the *Environmental Protection Act 1986*.

for water quality parameters. All water discharges would be controlled under licences issued under Part V of the *Environmental Protection Act 1986* .

5.2.2 Drainage

Where the railway line crosses drainage lines it has the potential to interrupt the natural surface flow of water. This could adversely affect vegetation downslope of the railway. The design of the railway would incorporate extensive culverting to ensure disruption and shadowing effects on surface drainage were kept to a minimum. To further minimise effects on drainage, where two channels occur very close to each other they would be trained together to pass through one culvert. This would occur on only a few occasions along the entire length of the railway extension. The proponent has made a commitment to establish and implement a programme to evaluate the health of vegetation downslope of the railway embankment. If any adverse impacts were revealed by the monitoring, BHP has made a commitment to take steps as necessary to mitigate these impacts.

Submissions indicated that large culverts would be needed at the two major creek crossings, Eel Creek and Cooneeina Creek and that spreader drains should be used for the short sections of railway crossing flat country. It was also noted that there was no commitment to dismantle the railway at the end of the project and the “shadowing effects” of the railway could continue. Under the Agreement Act BHP is required by the State to leave the railway in place.

Since the CER was released for public review the proponent has conducted further hydrogeological investigations to more precisely predict discharge water quality and rates. The findings from these on-going studies should be incorporated into the mining proposal and include a surface water management programme in order to ameliorate any unacceptable impacts from the proposed mine as recommended in Recommendation 2.

5.3 Groundwater impacts

5.3.1 Dewatering

The CER states that water for mining operations and domestic requirements would be primarily supplied from the orebody aquifer and would be supplemented by water from the Eel Creek aquifer as required. At the time the CER was released for public review the abstraction rate, quality and quantity of water supply were not defined. The proponent acknowledged that more predictive modelling was needed and has continued hydrogeological investigations.

To help ensure that groundwater abstraction and pit dewatering do not result in unacceptable drawdown effects on vegetation and nearby springs, the proponent has made a commitment to abstract the minimum quantity necessary to supply project water and meet pit dewatering requirements and to abstract water from the Eel Creek aquifer only if supplies from the plateau are insufficient. BHP has made commitments to monitor the rate of abstraction and adjust it to the lowest possible level and monitor the water quality and take action to ameliorate any impacts. BHP has also committed to monitoring the nearby springs and undertaking remedial work to provide a water resource to replace inflow to the natural springs if necessary. Based upon results from the on-going hydrogeological studies, the proponent should detail the monitoring and management methods that would be used as is recommended in Recommendation 2.

5.3.2 Potential for groundwater salinisation

After the cessation of mining, the mined-out Y2 pit is expected to gradually fill with water from incident rainfall and groundwater inflows to a level between the regional groundwater level and the perched groundwater level of the plateau. The final water level in the pit is unclear and would be expected to take many years to be attained. A permanent water body in the pit would

eventually form and consequently the salinity level could increase due to evaporation of water and the subsequent concentration of salt. The rate of salinisation is site-specific and undetermined at this stage but, according to the proponent, it is predicted that a brine of 200,000 mg/L would form in approximately 1,000 years time.

Groundwater would eventually migrate from the mined-out pit after it has reached equilibrium with the surrounding groundwater system. The rate of movement at the Y2 pit cannot be predicted now, however hydrogeological studies indicate the ore body is structurally isolated from the surrounding area and consequently the movement of groundwater through the surrounding rocks is expected to be slow.

Submissions indicated that it would be preferable to backfill the Y2 pit to the original water table as part of rehabilitation. This would eliminate the perched water table being exposed to the atmosphere, thereby reducing evapoconcentration and removing the possibility of increased salinity of the water body. In order to fill the Y2 pit, 25 million tonnes of overburden would be needed and backfilling could not begin until the pit was mined out. If the pit was required to be backfilled the proponent stated that the project would be uneconomic as it would be very expensive to double-handle this quantity of overburden.

To minimise the build-up of salinity in the decommissioned Y2 pit and the potential effects of such an increase on the water quality of the regional aquifer, the proponent stated the need and options for future management of salinity in the Y2 pit would be determined based upon monitoring results of the Mt Goldsworthy pit and results from ongoing hydrogeological studies. There needs to be a strategy or contingency plan in place prior to finalising the pit layout. This plan could then be upgraded as further monitoring data are collected and a decommissioning plan prepared soon after the cessation of mining.

The CER did not provide sufficient analysis of the potential for salinisation of groundwater in the pit and saline water movement. The proponent acknowledged the need for further investigation and modelling of this issue and has undertaken further hydrogeological studies. The report is expected to be completed shortly. Due to the need for more data and consideration of contingency plans for surface and groundwater management, a water management programme should be developed prior to commencement of mining and updated as data becomes available and finalised at decommissioning.

Recommendation 2

The Environmental Protection Authority recommends that:

- 2.1 The proponent should minimise the potential for salinisation in the Y2 pit and drawdown in order to minimise the potential groundwater impacts;**
- 2.1 The proponent should ensure that surface water discharge impacts and drainage shadow effects from the railway line are minimised;**
- 2.3 Prior to the commencement of productive mining, the proponent should design and implement a water management programme to the requirements of the Minister for the Environment on advice of the Water Authority of Western Australia and the Department of Minerals and Energy. This programme should be based on hydrogeological investigations and should include:**
 - surface water monitoring and management procedures;**
 - management of dewatering impacts; and**
 - long term management of any water bodies which expose the water table to long term evaporation.**

This programme should also be used to develop a plan for the long term management of any such water bodies at least six months prior to decommissioning.

5.4 Flora and fauna

The potential impacts on flora and fauna resulting from the construction and operation of the project are:

- loss of vegetation and fauna habitat;
- changes to drainage, altering vegetation patterns;
- disturbance due to noise; and
- partitioning of faunal territories.

To ensure that weed species are not introduced or spread by the mining operation, no soil or fill material would be imported from outside the project area. The proponent has made a commitment to regularly inspect the vegetation alongside the railway line, access roads and other trafficked areas to detect weed invasion and to take appropriate weed control measures if necessary. These inspections would be timed to occur after significant rainfall events to maximise the potential for identifying any infestation.

Submissions identified that a large water body such as the proposed Y2 pit would create a significant localised modification to the ecosystems of the arid region. Not only were there concerns about the eventual effect of the Y2 pit on the level of future salinity in the area and its effect on flora and fauna but the more immediate impacts on current fauna also require consideration. In arid areas large water bodies have the positive benefit of providing for water fowl but also provide an accessible and constant water source to feral animals. These animals then compete with the native species for limited food resources and are often predators on smaller marsupials.

The proponent has made a commitment to manage and monitor railway line and road kills of fauna. To minimise the overall impact of the project on fauna, pet dogs and cats, firearms and indiscriminate use of off-road vehicles would be prohibited in the project area.

To avoid potential interference by the project to any populations of the Pebble-mound mouse and to collect data to assist in its proper management, the proponent has made a commitment to avoid disturbing areas containing Pebble-mound mouse mounds as a matter of priority. The known area containing mounds is generally outside the area to be disturbed by the operation. The proponent would liaise with the Department of Conservation and Land Management and other wildlife researchers over the design and implementation of an appropriate programme of data collection.

Submissions called for a more complete fauna survey. During the fauna survey evidence of two protected species was found in the project area. As the survey was undertaken over four days and did not involve trapping it is difficult to clearly determine the range of species occurring in the project area and hence to fully assess the likely impact of the proposal on fauna. The proponent has offered to undertake a more thorough survey of the Pebble-mound mouse in collaboration with Department of Conservation and Land Management, however the fauna study should be expanded to include other significant species likely to occur in the region such as Rothschild's Rock-wallaby and the Long-tailed dunnart.

Recommendation 3

The Environmental Protection Authority recommends that:

- 3.1 The proponent should minimise impacts on protected fauna species and their habitats; and**
- 3.2 Prior to the commencement of any clearing or construction activity on the mine site, the proponent should prepare and implement a fauna survey and management programme to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.**

5.5 Rehabilitation

5.5.1 Landform and visual amenity

Changes to the topography of the project area would result from earthworks required to prepare the principle development sites including the mine pit, overburden storage site, village, railway line, access roads, airstrip and mine buildings. Construction earthworks would affect approximately 354 ha.

The proponent has made commitments that minimum areas for construction would be disturbed, borrow pits would be suitably managed and wind and water erosion control measures would be implemented. Mining of the ore from the Yarrie ore body would result in the formation of a large mine pit. Most overburden from the mining operation would be deposited in a crescent-shaped gully to the south of the mine pit. In time, this gully would be filled in and would eventually resemble an extension of the plateau. Some of the overburden would be backfilled into the Y3 pit. In the long term the Y2 mine pit would remain visible at short to medium range while the overburden would be visible from close range as a slightly more regularly-shaped part of the plateau. At longer range its shape would blend into the outline of the plateau. All other visible signs of the project would be removed at decommissioning. The project area is not presently accessible to the general public and is therefore not visited for tourism or sightseeing purposes.

5.5.2 Revegetation

The proponent has stated that it has developed rehabilitation procedures through its experience in the Pilbara region and would apply this experience to rehabilitation at Yarrie. The overall objective of the rehabilitation programme would be to ensure that at the end of the project, disturbed surfaces, with the exception of the mine pit, are returned to a stable condition with a flora and fauna that approach the natural condition of the site.

The proponent would progressively rehabilitate the project area throughout the life of the mine. During the construction phase, topsoil and vegetation on most areas to be cleared would be stripped and stored for later use in rehabilitation. Using previously developed rehabilitation procedures the overburden dump would be sloped, shaped and seeded using a mixture of local species. This technique has been used successfully for a number of years by the proponent at other similar mine sites. Submissions indicated that only local seed should be used for rehabilitation and that there should be a commitment for weed control as weeds are not dominant yet in the area and railways and roads are important conduits for weeds.

5.5.3 Infrastructure

Following the completion of the Yarrie project the village, workshops and other buildings, most local roads and other structures would be removed. The railway line would not be dismantled. There is insufficient information to determine future mining scenarios and the implications for the proposed end use of the rail line. The current plan as agreed to in the State Agreement Act is to retain the line for possible future use. Rehabilitation of overburden, remaining borrow pits and all unwanted bare or compacted areas would be completed. The proponent has made a commitment to monitor the rehabilitated areas to gauge the success of the rehabilitation.

The route taken for both the railway extension and the power line extension would be the shortest possible for each, taking into account the topography in the area. A minor adjustment has been made to the railway alignment from Eel Creek to the terminating loop. This change would place the rail, road and power lines in the same corridor for 5km thereby minimising the area disturbed.

5.6 Social impacts

5.6.1 Aboriginal social and cultural concerns

At least one Aboriginal site would need to be cleared to make way for the operations camp and runway. Traditional Aboriginal land owners have had a series of consultations with the proponent. According to recent social research carried out for the WA Museum Aboriginal Sites Department, these consultations resulted in an agreement with the Nyamal senior law man that traditional sites required for the development may be used by the proponent. BHP has also agreed to avoid other local sites of cultural significance.

The Sites Department research indicates that the traditional owners have been willing to accommodate BHP's requirements without compensation. Social change has brought considerable pressure on the survival of the cultural practises of the local people. Few opportunities exist for local social development through training and employment.

Despite having a "good neighbour policy" with local communities, the proponent has made no indication in the CER of how the traditional owners might benefit from mining development on their country. With the intention to use contract construction and operations workforces on a long distance commuting basis, the opportunity for local aboriginal people to enter into training and employment on mining at Yarrie would appear to be considerably diminished. It is suggested that BHP should consider establishing, within the Yarrie project a programme of training and employment generation for the traditional owners as a means of returning social benefits to these people, such as was instituted by BHP at its Cadjebut mine in the Kimberley. Any such programme should be developed in consultation with the traditional Aboriginal owners of the Yarrie mine site area.

The CER notes in its research that in the general vicinity of the Yarrie project there are a number of areas of particular ongoing cultural and social sensitivity for aboriginal people. While BHP has made commitments to avoid sensitive "no-go" areas, active protection would be required, especially given the presence of up to 200 construction workers, and 100 semi-permanent mine workers resident in the area. BHP could consider developing in collaboration with the traditional owners a cultural heritage induction programme for employees and contractors on the Yarrie project to assist in such protection and to ensure good relations with the traditional owners.

5.6.2 Impacts on local communities

The use of long distance commuting raises concerns about the loss of employment opportunities in the North Pilbara, particularly for local Aboriginal people and young people. The loss of long term employment is exacerbated by contractors using long distance commuting where there are no opportunities for training local people for employment in the mining industry in the future. The government's recently released discussion paper on long distant commuting recommends against fly-in/fly-out from Perth, preferring companies and contractors to employ locally or from the region.

In response to submission questions on this issue the company said it would encourage construction and operations contractors to employ local, appropriately qualified workers. However, the company does not explain how it would do so, whether it would attach incentives to encourage local employment and/or training, nor how it would monitor the source of the workforce.

6 Conclusion

The Authority concludes that the proposal could be environmentally acceptable provided the proponent's commitments and the recommendations of this report were implemented. This

includes the preparation of a comprehensive water management programme and a fauna management programme prior to operations commencing. The Authority has established an implementation and auditing system which requires the proponent to advise the Authority on how it would meet the requirements of the environmental conditions and commitments of the project. The proponent would be required to develop a Progress and Compliance report for this project as a section of the recommended programmes. According to the conditions of the *Iron-Ore (Goldsworthy-Nimingarra) Agreement Act 1972*, BHP is also required to submit annual reports under the Agreement Act. The reporting requirements for the programmes may be included as a section of these annual Agreement Act reports to avoid duplication.

The Authority's experience is that it is common for details of the proposal to alter through the detailed design and construction phase. In many cases alterations are not environmentally significant or have positive effects on the environmental performance of the project. The Authority believes that such non-substantial changes and especially those which improve environmental performance and protection should be provided for.

The Authority believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time further consideration of the proposal should occur only following a new referral to the Authority.

7 Reference

BHP Iron Ore (Goldsworthy) Ltd (1992). Goldsworthy Extension Project Phase II - Yarrie project area, East Pilbara - Consultative Environmental Review.

Appendix 1

Proponent's commitments

BHP Iron Ore (Goldsworthy) Pty Limited makes the following commitments to management of environmental and social impacts with respect to the Yarrie project.

7.1 CLEARING OF VEGETATION

Only the minimum area required for construction and operation of the project will be disturbed. Where practicable, topsoil to a depth of about 15cm will be stripped and stockpiled prior to any earthmoving and, once construction is completed, all disturbed areas no longer required for the operation of the facility will be contoured (where necessary), topsoiled (where available), ripped and seeded where necessary.

7.2 DEVELOPMENT POLICY

BHP will pursue a "minimum impact" development policy which will include minimum clearing and ground disturbance, minimum groundwater abstraction, minimum water discharge, careful monitoring and effective rehabilitation. Adherence to this policy will be a requirement written into the mining contracts.

7.3 RAILWAY CREEK CROSSINGS

Care will be exercised at all stages of construction to minimise damage to drainage channels. Culverts will be utilised along the rail route to avoid interference with the natural surface drainage. Large culverts will be utilised to cross Eel Creek.

7.4 SHADOWING EFFECTS OF RAILWAY LINE

BHP will establish a programme to monitor and evaluate the health of vegetation downslope of the railway embankment. If any adverse impacts are revealed by this monitoring, BHP will take steps as necessary to mitigate those impacts.

7.5 BORROW PITS

Borrow pits for all construction materials will be selected and operated to minimise erosion and land disturbance. Where possible, pits will be located where they are not visible from the village or access roads. The BHP-Newman Guidelines and Objectives for Borrow Pit Development and Rehabilitation (Appendix D) will be applied.

7.6 WATER SUPPLIES

Water supplies will be preferentially obtained from bores drilled into the Yarrie plateau adjacent to the mine pit. Water will be abstracted from the Eel Creek aquifer only if supplies from the plateau are insufficient to meet project requirements.

7.7 MONITORING OF DRAWDOWNS AND WATER QUALITY

If water is abstracted from the Eel Creek aquifer, BHP will monitor the groundwater levels and water quality in the aquifer to detect excessive drawdown or water quality changes. If significant effects are observed, the health of vegetation in the creekbed will be monitored and steps taken to mitigate adverse impacts.

7.8 SURFACE WATER DISCHARGES

Water produced from dewatering will be used, as much as possible, for domestic and mine uses. The minimum possible amount will be discharged to the natural surface drainage. BHP will monitor the quality of all water discharged to the environment from pit dewatering or other sources. Water discharged to natural drainage will comply Works Approvals and Licences issued under Part V of the *Environmental Protection Act 1986*.

7.9 HYDROGEOLOGICAL INVESTIGATIONS

Hydrogeological investigations will continue with the aims of better defining the aquifers of the Yarrie area, identifying sources of project water supply, predicting drawdown effects and modelling the effect of salinity buildup in the mined-out Y2 pit. The results of these investigations will be used to optimise the water abstraction and dewatering programmes and the long-term management of the mined-out pit.

7.10 EROSION CONTROL

Erosion around roads and building areas will be controlled by minimisation of clearing, rehabilitation, proper drainage and bunding where necessary. Erosion at creek crossings and culverts will be minimised by the use of rock armouring and careful design. Regular inspections will be carried out to detect and repair any erosion damage which does occur.

7.11 OVERBURDEN

The overburden storage site will be designed to be stable and to resist erosion. At the completion of mining, the surface of the overburden will be rehabilitated.

7.12 HAZARDOUS MATERIALS STORAGE

The handling, use and disposal of hazardous materials will comply with all local and State regulations. Bulk fuel will be stored in above-ground tanks held in impermeable, banded enclosures, in accordance with Department of Minerals and Energy (DOME) requirements. Explosives will be stored in a magazine remote from accommodation facilities, workshops, the mine site and any areas susceptible to flooding.

7.13 OILY WASTES

Used oils will be stored securely in drums or tanks and will be periodically removed by a licensed waste disposal contractor for recycling or disposal at a Shire Council-approved site.

Runoff and wastewater from areas subject to hydrocarbon contamination, such as workshops and washdown bays, will be drained to evaporation ponds where sunlight and bacteria will decompose the hydrocarbons. Water contaminated with hydrocarbons will not be released to the environment.

7.14 LANDFILLS

Landfills for the disposal of non-toxic (including domestic) wastes will be managed in accordance with relevant local health authority requirements.

7.15 FIRE PREVENTION

BHP will maintain firefighting equipment at the mine site in case of accidental fires. The induction briefing given to all site personnel will include the prevention of accidental fires.

7.16 WEEDS

Regular inspections of the vegetation adjacent to the railway line, roads and rehabilitated areas to ensure that weed infestation is not occurring. Any infestations discovered in the area will be dealt with by appropriate physical or chemical means.

7.17 PEBBLE-MOUND MOUSE NESTS

Disturbance of areas where Pebble-mound Mouse nests are located will be avoided wherever possible. BHP will undertake detailed surveys of Pebble-mound Mouse populations in the project area as described in Section 5.0 to provide data for their proper management.

7.18 GENERAL FLORA AND FAUNA PROTECTION

Pets (dogs and cats), firearms and indiscriminate use of off-road vehicles will be prohibited in the project area.

7.19 NOISE

Blasting will be carried out at specified times during daylight hours to minimise noise impacts at the village. Occupational noise levels will be monitored and managed as required under Works Approvals and Licences issued under Part V of the *Environmental Protection Act 1986*.

7.20 DUST CONTROL

Normal means of dust suppression, including watering of roads, will be employed to minimise dust generation. Occupational dust levels will be monitored and managed as required under Works Approvals and Licences issued under Part V of the *Environmental Protection Act 1986*.

7.21 EMPLOYMENT

The mining contractor will be encouraged to source the operational workforce from the Pilbara, including Karratha and Wickham as well as Port Hedland and Newman. Former BHP employees accepting redundancy from Shay Gap will, if they indicate interest, be made known to the contractor and, if suitable, the contractor will be encouraged to employ them.

7.22 COMMUNITY LIAISON

BHP will continue to consult with Aboriginal custodians of the project area and the owners of the neighbouring pastoral leases. BHP will respect the "no-go" areas agreed to with the Aboriginal elders.

7.23 REHABILITATION

Procedures developed by BHP in the Pilbara will be applied to rehabilitation at Yarrie. The object of the rehabilitation will be to ensure that, at the end of the project, all disturbed surfaces (with the exception of the mine pits) are returned to a stable condition with a flora and fauna which approaches the natural condition of the site.

7.24 DECOMMISSIONING

Following the completion of the project, buildings and other structures will be removed. Concrete slabs will be broken up and buried. The rehabilitation of the overburden will be completed. Remaining borrow pits will be rehabilitated. All unwanted bare or compacted areas will be contoured (where necessary), ripped and seeded. Monitoring of the rehabilitated areas will be undertaken to gauge success. This monitoring will continue until the vegetation is seen to be progressing towards a condition similar to that which existed before mining.

7.25 YARRIE PIT LONG-TERM SALINITY

BHP will continue to monitor the salinity of water in the Goldsworthy pit for several years to determine the future likelihood of saline water seeping from the pit into the De Grey River aquifer. The results of this monitoring will be used to formulate management strategies for the Yarrie pit if necessary.

7.26 PROJECT MANAGEMENT

The Yarrie project will be overseen by BHP environmental officers to ensure that the environmental management programme is adhered to. The commitments made to environmental protection in this CER will be written into the contracts for construction and mining. Regular internal audits will be carried out to ensure that the environmental management programme is being fulfilled and that no unacceptable environmental impacts are occurring.

Appendix 2

Summary of submissions and the proponent's response

BHP IRON ORE (Goldsworthy) LIMITED

RESPONSES TO PUBLIC SUBMISSIONS TO THE GOLDSWORTHY EXTENSION PROJECT PHASE II

1. GROUNDWATER

1.1 Dewatering

The potential yield and water quality of the groundwater sources intended for use should be identified as well as any potential dewatering impacts. What are the dewatering methods, timing and volumes? What are the predicted dewatering rates, drawdown effect and discharge rates?

There is a possibility the groundwater in the vicinity of the pit discharges through a set of springs (Chinamans Springs) 3 km east of the pit. If this is correct, what impacts would groundwater abstraction have on the springs, the surrounding vegetation and the dependent wildlife?

What monitoring and remedial methods are proposed for dealing with any adverse effects from dewatering?

1.2 Discharge Water Quality

What would be the dewatering discharge water quality (ie salinity and nutrient levels). What would be the impacts of this discharge on vegetation and surface water flow?

GROUNDWATER

Water Supply

For this discussion please refer to figure 3.3 and 3.4 of the CER.

The project has a water requirement of approximately 1,000 kL/d which will be sourced from the Eel Creek area and the Yarrie orebody as appropriate. The potable quality component is 200 kL/d to supply the accommodation village.

Test pumping of two bores in the orebody indicate that bores at optimum locations will yield from about 100 to 500 kL/d. The water quality is in the range 500 to 1,500 mg/L TDS.

The Eel Creek area has been investigated by the test pumping of five drillholes. Aquifers have been located in a fracture zone associated with Elephant Rock and a quartz dyke, located to the east, sub-parallel to Elephant Rock. Bore yields ranged from 175 to 790 kL/d during testing.

The Elephant Rock aquifer is a narrow fracture-controlled system which will limit the long-term abstractions due to the limited groundwater storage. The results from two tests (215 and 175 kL/d) show a strip aquifer response with an increasing rate of drawdown with time, thus, the long-term pumping would be considerably less than the tested rates. However, the aquifer is well situated to receive recharge during the periodic streamflow events in Eel Creek. The salinity estimated from electrical conductivity ranged from 1,300 to 4,800 mg/L TDS. This aquifer may best be utilized to provide the water necessary during construction and thereafter be a standby source of water.

The quartz dyke aquifer occurs along the contact between granitic rocks and highly sheared mafic rocks. The two tests (590 and 790 kL/d) in this unit show strip aquifer response at one location and an unconfined response without barrier boundaries in the second. This second location appears to derive water from both the quartz-intruded contact and the sheared mafic rocks. Bore yields from this and similar locations are expected to be in the range 200 to 500 kL/d. The water quality, as estimated from electrical conductivity, ranges from 1,300 to 1,800 mg/L TDS. This aquifer could provide a portion, or all, of the water supply. The potable component would require some form of desalination.

The proposed abstractions may result in a lowering of the water table in the vegetated Eel Creek where there are phreatophytic trees. This lowering, if significant, could adversely affect these trees. At this stage, the possible lowering of the water table has not been quantified but will be assessed as part of a groundwater investigation report to be issued by the end of January 1993. If impacts to the vegetation are as predicted, measures to mitigate them will be evaluated and agreed upon with the relevant authorities.

MINE DEWATERING

The dewatering strategy is currently being examined and two recently completed pumping tests are being analyzed in order to determine the likely rates of dewatering necessary to achieve mining to 46 m AHD. The preliminary analysis of the results show a low transmissivity of 10 to 20 m²/d. One of the bores intersects the thickest section of the orebody in the central area of the proposed pit while the second intersects a moderate thickness to the west. The results of the two tests are similar.

The existing water table within the orebody is approximately 170 m AHD. Mining to 46 m AHD will require the water table to be lowered in the area of the pit to approximately 40 m AHD. The total volume of ore plus waste to be mined below the water table is 10.1 x 10⁶ m³. Assuming an average specific yield of 5% (a high estimate), the volume of groundwater to be removed from this rock mass is 5.1 x 10⁵ kL and would take approximately 250 days pumping at 2,000 kL/d. The total dewatering volume requiring pumping is expected to be greater than calculated above because of the contributions of groundwater from the host rocks. The rate of dewatering however is expected to be low, occurring for only a few years, and the quality of the water is good. During the dewatering phase, the use of this water for mining activities will be maximized. As a result of this strategy, no impacts are anticipated from the dewatering discharge.

EFFECT ON CHINAMAN SPRINGS

The Y2 orebody dewatering will primarily remove groundwater from within the orebody itself. The orebody is structurally isolated from the surrounding area by a series of faults and fault-intruded dolerite dykes. There are at least five such faults between the Y2 and Chinaman Springs, located approximately 3 km east. The springs are a series of groundwater soaks occurring along the flank of the Yarrie Massif at elevations between about 135 and 145 mAHD. No permanent water flows emerge from the springs, although the immediate area is believed to be permanently wet.

The water table elevation in the Y2 orebody is at approximately 170 m AHD and is relatively uniform within the orebody with no defined hydraulic gradient. The interpreted structural geology indicates that the Y2 orebody is compartmentalized by faults, dykes, stratigraphy and underlying mudstone on granite basement. This is supported by the absence of a defined hydraulic gradient within the orebody. This suggests that the groundwater system is effectively a closed "tank aquifer" under natural conditions with very little movement of groundwater through the host rocks. Groundwater levels outside of the orebody to the east are some 20 m higher, showing that groundwater is not currently moving directly from the orebody towards Chinaman Springs.

Dewatering of the orebody will eventually lower the water table to approximately 40 m AHD. The lowered water table within the orebody will create steep hydraulic gradients towards the pit. It is possible that, under these conditions, the faults may not prevent movement of groundwater towards the pit from areas that under natural conditions are hydraulically isolated. It is therefore possible that the Y2 dewatering will eventually reduce the amount of groundwater available to Chinaman Springs but this cannot be determined with certainty in advance of mining.

Any reduction in groundwater available to support the springs would reduce the size of the soak area and therefore less water would be available to support the existing vegetation and wildlife. The impacts would be greatest on the springs at the highest elevations on the flanks of the Massif.

MONITORING AND MITIGATION

The dewatering will be monitored in adjacent drillholes that will be established as permanent groundwater observation bores. Several of these observation bores will be located between the mine and Chinaman Springs in order to determine the degree of hydraulic connection across and along the fault, if any. If this programme of groundwater monitoring shows that drawdowns will impact Chinaman Springs, the springs will be artificially supported by piping a portion of the dewatering discharge to the Springs.

2. SURFACE WATER

2.1 Surface Water Flow

The railroad design should provide adequate drainage channels to avoid impacts on soil erosion and surface drainage. For example, the culverts should be dedicated to small creek crossings not trained together. How would the railway design cater for surface water flows?

Surface Water Flow

The new railway line extension will cross numerous minor drainage lines. The catchment area that feeds into these drainage lines is quite small due to the positioning of the railway line close to the base of Cundaline Ridge. There are two creek crossings; one at either end of the extension, these being Coongina Creek and Eel Creek.

Although there is a large number of drainage lines, a small culvert will be placed under the railway embankment for each one. It is only when two channels occur very close together, that these will be trained together to pass through the one culvert. From a detailed survey of the area, this will only occur on a couple of occasions along the entire length of the extension. The effect of the railway embankment on surface flow will therefore be almost negligible.

3. SALINITY OF EXCAVATED PIT

3.1 Salinisation rate

In the CER, there are very general predictions given for the salinisation of the Eel Creek aquifer and the De Grey River aquifer. The rate of through-flow of groundwater through the lake in the mined out pit would be a primary factor in determining the rate of salinisation.

It is possible to carry out pump tests to determine the transmissivity of the aquifer in the region of the pit and make predictions about the rate of salinisation.

The rates of salinisation may well be quite different between the Goldsworthy and Yarrie pits. How and when will such data be collected?

SALINISATION RATE

The mined-out pit would gradually fill with water from incident rainfall and groundwater inflows. Eventually, the surface area of water within the pit will become sufficiently large for the average discharge by evaporation to equal the average rate of inflow, and it will equilibrate at about that level.

Groundwater exposed in the mined out pit will be expected to increase in salinity with time. The final salinity level may not be reached for many years and will depend upon the hydrogeological setting and the water balance of the mined-out pit, that is, the outcome is entirely site-specific. For example, if the rocks surrounding the pit were impermeable, the salinity would eventually increase to the point where salt was precipitated from a brine. If the rocks were highly permeable, so that groundwater could flow through the pit, or incident rainfall drain readily, the amount of salinity increase would be small. At this stage there is insufficient information for the Yarrie Deposit to know where, within this possible range of outcomes, is the correct interpretation.

The current investigations will provide additional data concerning the hydrogeology of the orebody and its host rocks, together with water quality data. This will assist in the preliminary assessment of the potential for salinisation but a more definite interpretation will not be practicable until the groundwater system has been stressed more than is achievable with low rate test-pumping. This requires that the mine dewatering be monitored carefully with detailed interpretation of the results.

The Goldsworthy Pit is in a similar geological setting to the Yarrie Deposit. Work there (AGC Woodward-Clyde 1992) suggests that the salinity is increasing by some 200 mg/L/year. The Goldsworthy pit is still receiving groundwater inflow, without any discharge other than by evaporation, nine years after the cessation of mining. The pit water salinity is currently about 4,500 mg/L, similar to the only visible groundwater inflow, which has been sampled. In this case, a brine of 200,000 mg/L would form in some 1,000 years time. The existing model of the Yarrie Pit suggests a similar scenario as that shown for the Goldsworthy Pit.

3.2 Leaching of Saline Water from the Pit (Y2)

There is increasing concern about the potential for disused mine pits in the Pilbara to cause salinisation of the fresh aquifer. The proponent's analysis of pit salinisation and plume movement (Section 4.3) is inadequate and the proponent acknowledged the need for further modelling and investigation. What are the results of modelling and investigation on pit salinisation and plume movement conducted since the CER was published? How would the direction of flow change with the post-mining densities? What monitoring methods and remedial action would be implemented if necessary? What additional data will be collected and how will it be used to manage any potential problems?

Leaching of Saline Water from the Pit

Groundwater will eventually migrate from the mined-out pit after it has reached equilibrium with the surrounding groundwater system. This could happen in a relatively short time, ie. years to decades if there is an active groundwater flow system flowing through the pit, in which case salinity increase would be expected to be relatively small. Alternatively, the rate of outflow may be low, controlled by low permeability host rocks, in which the salinity level would be high.

The rate of movement of water from the pit is site specific and cannot be predicted at this time. The work at Goldsworthy has suggested that the rate of movement there would be extremely low, about 1 m per year and therefore a brine plume exiting in the pit would travel 1 km in 1,000 years. The best data available today is the monitoring work presently being carried out at the Goldsworthy Pit and this work will be used to develop strategies to mitigate any expected ground water impacts.

4. REHABILITATION

4.1 Backfilling of Pit

It is preferable that the Y2 pit is backfilled to the original water table as part of rehabilitation. This would eliminate the perched water table being exposed to the atmosphere, reducing evaporation and removing the possibility of increased salinity in the water body. Based on information in the CER, it appears that by careful design of the mining plan, the cost of this rehabilitation could be minimised and the environmental impacts reduced. What is the justification for leaving the pit excavated below the water table? If backfilling to the water table doesn't occur, how will salinisation be managed?

Backfilling of Pit

The main areas of mineralisation has been divided into two sections. Y3 in the eastern section where the ore occurs near the surface. Y2, the western section, the ore is deep and has a high cover of overburden. It is only on the Y2 section that mining takes place below the watertable which is nominally indicated at 170 m R.L. Mining commences on the Y3 section because the amount of overburden to be removed to uncover ore is minimised. It requires several years of overburden removal to uncover sustainable quantities of ore in Y2. Once this occurs, Y3 is completely mined out.

Back filling of the Y3 pit can then occur to the extent of availability of overburden.

Mining activity occurs in the Y2 pit until the end of the project and because of the narrow deep nature of the deposit, does not lend itself to backfilling until all mining activity within the pit has ceased.

The quantity of overburden material to be rehandled after the extraction of ore to backfill up to the level of the original watertable at 170 m R.L. is 25 million tonnes. This is calculated from the total volume to 170 m R.L. at 10.1×10^6 cubic metres, an overburden bulk density of 3.2 and a swell factor of 30%.

The cost of rehandling this quantity of overburden, which would occur at the end of the project when the income has ceased, would render the entire project uneconomic.

Additional to the cost of backfilling is the negative impact of the area disturbed by the temporary stockpile.

5. FLORA AND FAUNA

5.1 Fauna Survey and Management

A more thorough fauna survey of the proposed area should be undertaken and a management plan put in place accordingly. Would this occur and when?

5.2 Flora Management

In order to control weeds, vegetation alongside the railroad and other trafficked areas should be inspected regularly and within a week or two of significant rainfall events. Would this occur?

Fauna Survey

Discussions have been held with members of CALM regarding the nature of future fauna surveys. It was agreed that the major species likely to be impacted by the project is the Pebble Mound Mouse, which appears to have a high mound density near the project area. In consultation with members of CALM, a programme to expand the knowledge of this species of mouse will be undertaken so that management techniques can be developed. This work is scheduled to commence in January 1993 and will continue for several years.

Flora Management

Commitment 7.16 of the CER states :

"Regular inspections of the vegetation adjacent to the railway line, roads and rehabilitated areas will be carried out to ensure that weed infestation is not occurring. Any infestations discovered in the area will be dealt with by appropriate physical or chemical means".

These inspections will be timed to occur after significant rainfall events to maximise potential for identifying infestation.

6. INFRASTRUCTURE

6.1 Rail, Road and Power Corridors

The CER proposed three separate rail, road and power corridors. The infrastructure design could combine these corridors into one road and one corridor with net environmental and financial savings. Has this proposal been considered?

Rail, Road and Power Corridors

The route taken for both the railway extension and the power line extension are the shortest possible for each, taking into account the topography in the area. The current railway line terminates on the southern side of the Shay Gap Ridge. The closest take-off point to Yarrie from the existing power line is the Shay Gap township. To place these two structures in the same corridor would require traversing across a longer distance which would not only add an additional cost to the project, but also disturb a larger area.

A minor adjustment has been made to the railway alignment from Eel Creek to the terminating loop. This change now places the rail, road and power line in the same corridor for 5 kilometres.

The existing sealed road terminates at Shay Gap township. To align the road along the power line corridor for the first half of its length, would require disturbing more area than the proposed alignment. A larger number of surface drainage lines are crossed and borrow pits would be required to build-up the road in low areas susceptible to flooding.

For the second half of the alignment, the road and powerline occupy the same corridor.

7. SOCIAL

7.1 Fly-in/fly-out Workforces

Submissions and comments received have raised the potential impact of the decision to use fly in/fly out workforces for the construction and operation of the Yarrie mine. The social, including economic, impacts on the Pilbara of the decision to use fly in/fly out are central to the concerns expressed, particularly with reference to Port Hedland and South Hedland.

What would be the social, including economic, impact on Port Hedland of flying in construction and operations workers from home bases outside the region compared with locating them in the region?

What impact would fly in/fly out have on regional businesses supplying services to the Shay Gap area at present? How would the proposal impact on the maintenance of public services and infrastructure for the remaining population of the northern Pilbara?

Fly-in/Fly-out

The social, including economic, impact on Port Hedland of flying in construction and operations workers from home bases outside the region compared with locating them in the region involves several elements. These are :

- BHP Iron Ore will not dictate to its employees or its contractors' employees, where they or their families should live. For example, construction workers required to live in South Hedland to be employed at Yarrie would need to relocate their families to South Hedland for a relatively short period, during which they would spend most of the time living at Yarrie with their families living alone, without normal support networks and without the "breadwinner" in town.

- While there may be small economic benefits through local grocery purchases, it is likely that the temporary surge in demand for social amenities such as schools and support services, would create short-term difficulties for service providers rather than result in permanent benefits to those aspects of Port/South Hedland social environment.
- Where appropriately qualified workers are locally domiciled, the construction and operations contractors will be encouraged to consider them for employment.
- The time taken to transport workers from Port Hedland to the site at Yarrie (4 hours return) would reduce the time available for work. Contract operators depend on completion of contracts within strict time constraints so that payment can be made for the work and they can move to the next project.
- Port Hedland suppliers would be given the same opportunities to tender for goods and services for the Yarrie project and its workforce wherever that workforce is recruited.
- BHP Iron Ore has demonstrated its commitment to the use of local suppliers where they can offer competitive prices and services. The development of new projects such as Yarrie, offers these suppliers further opportunities to bid for new work. Examples of BHP Iron Ore's commitment include :

- \$35 million spent in Port Hedland annually from Nelson Point and Finucane Island.

- \$3.9 million spent in Port Hedland to date in the Nelson Point Development Project and this is expected to increase by \$10 million in the next year.

- Sponsorship of and participation in the "Meet the Buyers" seminar in Port Hedland.

- Addresses to the Port Hedland Chamber of Commerce on local content opportunities for local suppliers.

- The Yarrrie construction and operational workforce will be located at site and will have no impact on public services and infrastructure provided for the remaining population of the northern Pilbara, other than use of the airport and some possible use of overnight hotel accommodation if individuals choose to spend a short period of leave in Port Hedland.

7.2 Workforces Recruitment (construction and mine site)

How would the company encourage the contractor to recruit locally? How would it ensure that the mining contractor would source as many of the workers as possible from the Pilbara? What monitoring of recruitment would be carried out?

Would the company commit to providing the same encouragement with regard to the construction workforce and the use of Pilbara based construction contractors, and what form would this encouragement take?

Workforce Recruitment

BHP Iron Ore will include advice to its contractors that they should seek to recruit locally where appropriately qualified workers are available.

The local CES office will be used as a source of their workforces.

Local construction contractors are being used extensively on BHP Iron Ore's current Nelson Point Development project, and will be given similar opportunities to tender for work on the Yarrie project.

Construction contractors will similarly be advised that they should seek to recruit locally where appropriately qualified workers are available.

7.3 Alternative Accommodation

It was noted that the mine would have a life of about 6 years, to be followed by the opening up of other mines nearby. It was argued that given the possibility of sustained mining, the scaling down and refurbishment of Shay Gap may be a cost effective alternative to fly-in/fly-out in the longer term.

What are the relative social costs of using Shay Gap, in a scaled down form, for workforce accommodation compared with the costs of establishing and running new facilities at Yarrie and possibly elsewhere at a later date?

Accommodation

The costs involved in refurbishment of Shay Gap to a standard which would be suitable for the life of the Yarrie mine, would contribute substantially to forcing the project's returns to an uneconomic level.

Identified areas of low grade mineralisation occurring in the Yarrie area are presently uneconomic. Given the long-term flat outlook for iron ore demand and prices the utilization of these low grade resources is very unlikely. These areas of mineralisation have been misconstrued as potential future ore sources and could not support sustained mining, or a town.

The current costs of maintaining social services for Shay Gap are disproportionately high compared with the costs of provision of these services in other centres such as Port Hedland, Karratha or Perth.

7.4 Community Consultation

Submissions also note that the company has briefed some local authorities on its intentions regarding Yarrie, but expressed concern over the lack of consultation between the company and employee representatives, local government and the community (Shay Gap and Port Hedland), particularly over the issue of workforce options and their impacts.

What consultations or discussions have occurred with the various interested groups and organisations to overcome the company's perceived constraints on employing locally based labour? What consultation is planned? What ongoing liaison or consultation is the company planning which may involve the relevant local authorities and organisations of the Pilbara?

Community Consultation

BHP Iron Ore has briefed the Shay Gap unions, the Port Hedland Town Council and the East Pilbara Shire Council on all of the issues associated with the project. Consultation with these and other interested groups is ongoing as a normal part of BHP Iron Ore's business, including Yarrie and existing projects.

In addition, each Shay Gap employee has received a personal letter explaining the decision and has been interviewed individually to answer questions and to determine their preferences for future employment with other BHP Iron Ore operations, the contractor or voluntary redundancy.

Employees at Shay Gap will continue to receive regular updates on the plans for the town's closure.

A meeting with the Port Hedland Chamber of Commerce has been arranged to discuss local supply opportunities.

There are no constraints on recruiting suitably qualified local workers or on local suppliers providing competitive goods and services.

8.0 CHANGE TO ORIGINAL PROPOSAL

8.1 Temporary Construction Camp

All the activities associated with the development of Yarrie are geared around two main contracts. These two contracts are :

1. Construction of the railway line extension, and
2. Relocation of the Shay Gap plant and all mining activities.

The CER proposed that one construction camp would be established for both contracts and this would be the responsibility of the mining contract. The timing of events highlighted by the construction schedule dictates that work on the railway line commences before the mining activities. A problem therefore exists for accommodation of the railway construction personnel.

To overcome the problem, BHP proposes that the railway contractor establish his own construction camp on a different site. This would eliminate the problem of having the mining contractor establish a camp site for a second party, months before they themselves have a presence on site. It would also eliminate the extra burden placed on resources if two separate camps were established on the one site, and the difficulty which could arise between contractors with possibly different standards of facilities in close proximity to one another.

The most suitable location to establish the railway construction camp is the site originally used for the construction camp when building the Shay Gap township and the Goldsworthy to Shay Gap railway line. This site is situated at the base of the Shay Gap Ridge to the south east - within 'Shay Gap'. It is positioned on the Shay Gap mining lease - ML249SA. It is anticipated that the life of the temporary camp will be eight months.

An assortment of infrastructure is present on the site, which includes concrete footings and pathways, power poles, piping, disused electrical cable and general rubbish.

The railway contractor, in establishing his camp, would make use of existing infrastructure where possible. An existing water bore is 1 km to the east, which would be re-established for a potable water supply. The buildings including mess, offices, recreation and bunkhouses would be serviced by a semi-mobile sewage treatment plant and a portable power generator.

At the completion of the railway construction, all buildings will be removed and the site cleaned up (including all of the existing structures) and refuse will be buried in an old worked out pit. Deep ripping of this area will then take place to promote re-vegetation.