Hope Downs Iron Ore Mine, 75 km north-west of Newman, Pilbara Region

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Hope Downs Management Services Pty Ltd

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

Hope Downs Management Services Pty Ltd (HDMS) proposes to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

The EPA decided that the following environmental factors relevant to the proposal require detailed evaluation in the report:

(a) Weeli Wolli Spring;

(b) Subterranean fauna; and

(c) Rail connection.

A number of other factors which are very relevant to the proposal are evaluated within the context of the three factors set out above.

Conclusion

The EPA has considered the proposal by Hope Downs Management Services Pty Ltd to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway.

The main issues associated with this proposal relate to the impacts on Weeli Wolli Spring and subterranean fauna due to dewatering of the orebodies, and the selection of the railway connection route.

While the potential for impact on Weeli Wolli Spring is great, the proponent has thoroughly investigated this issue and convinced the EPA that appropriate management can avoid such impact. It is a measure of the seriousness of this aspect of the assessment that the adopted management strategy is expensive in terms of time and resources. It is predicted that management measures will continue until 20 years after the conclusion of mining and will cost approximately $200 million. The management strategy to prevent impacts on Weeli Wolli Spring will also prevent adverse impacts on the stygofauna of this area. Throughout the assessment it has been understood that there was potential for dewatering to have a major impact on Weeli Wolli Spring and that such impacts would be unacceptable because of the high conservation and heritage values of Weeli Wolli Spring. To address this concern the proponent has carried out a thorough investigation of the groundwater system, the proposal's impacts upon it, and ways to prevent significant impacts on Weeli Wolli Spring. The EPA acknowledges the thorough way in which the proponent has approached this problem.

The importance of the post-mining management strategy for preventing impacts on Weeli Wolli Spring cannot be overstated. Noting that implementation of this strategy is essential to preventing unacceptable impacts on Weeli Wolli Spring and noting that they come at a significant post-mining cost, it is the EPA's view that the Minister for the Environment and Heritage would need to be satisfied that a mechanism was in place within Government to

ensure that the proponent had adequate and tangible funds available to implement the strategy. The EPA therefore recommends that the Minister seek to have a clear and transparent mechanism for ensuring that maintenance of Weeli Wolli Spring is assured.

A number of options for the railway connection have been put forward, along with a mechanism for providing further review of the detailed alignment and design when a preferred option is chosen. Based on the information presented by the proponent, the EPA considers that an environmentally acceptable rail connection can be constructed, subject to review of the detailed alignment and design.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

Recommendations

The EPA submits the following recommendations to the Minister for Environment and Heritage:

1. That the Minister notes that the project being assessed is for the development of a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3;
3. That the Minister adopts the EPA advice that any detrimental impacts of the proposal in Weeli Wolli Spring, which is a special area near the project location, be accepted as a "fatal flaw" to the proposal, as discussed towards the end of Section 3.1;
4. That the Minister takes action to be satisfied that a transparent mechanism is in place within Government to ensure that the proponent will have adequate and tangible funds available to fulfil essential post-mining actions necessary for the long-term maintenance of Weeli Wolli Spring;
5. That the Minister notes that the EPA has concluded that subject to the Minister's consideration of recommendations 3 and 4 above it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 and summarised in Section 4, including the proponent's commitments; and
6. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Hope Downs Management Services Pty Ltd to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;

(b) that the proponent be required to prepare and implement a Subterranean Fauna Sampling Plan; and

(c) that standard conditions appropriate to mining operations of this scale and type be applied.

Contents

1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal by Hope Downs Management Services Pty Ltd to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway.

The Hope Downs Iron Ore Mine proposal was referred to the EPA in December 1999 and the level of assessment set at Public Environmental Review with a public review period of eight weeks. This level of assessment was based on the scale of mining, the need for an extensive dewatering programme, and the potential for impacts on Weeli Wolli Spring.

In parallel with the EPA's assessment the proposal is also undergoing environmental impact assessment by the Commonwealth. Commonwealth involvement was triggered under the *Environment Protection (Impact of Proposals) Act* 1974 by the need to gain approval from the Foreign Investment Review Board. A joint "Public Environmental Review / Public Environmental Report" document was prepared to meet State and Commonwealth requirements, and released for a concurrent public review period. At the conclusion of the State's assessment process, the Commonwealth will prepare it own assessment report.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the environmental factors relevant to the proposal. The Conditions and Commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 presents the EPA's conclusions and Section 6, the EPA's Recommendations.

Appendix 5 contains a summary of submissions and the proponent's response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process and that have been taken into account by the EPA, appear in the report itself.

2. The proposal

Hope Downs Management Services Pty Ltd (HDMS) proposes to develop an iron ore mine based on the Hope Downs 1 deposit, located approximately 75 km north-west of Newman (Figure 1).

The proposal has the following major components:

- open pit mining of both Hope North and Hope South ore bodies (Figure 2);
- ore processing, stockpiling and reclaiming facilities at the mine site (Figure 2); and
- a rail connection linking the Hope Downs deposits to one of the existing or proposed major rail networks of other iron ore producers with ore export via an existing port site (Figure 3).

Both ore bodies involve mining below the water table. Therefore a substantial dewatering operation will be required during mining.

Critical to the prevention of unacceptable impacts on Weeli Wolli Spring as a result of the dewatering operation are the following management strategies:

1. maintenance of spring flow by direct discharge of up to 18 000 kL/day to the spring during dewatering; and

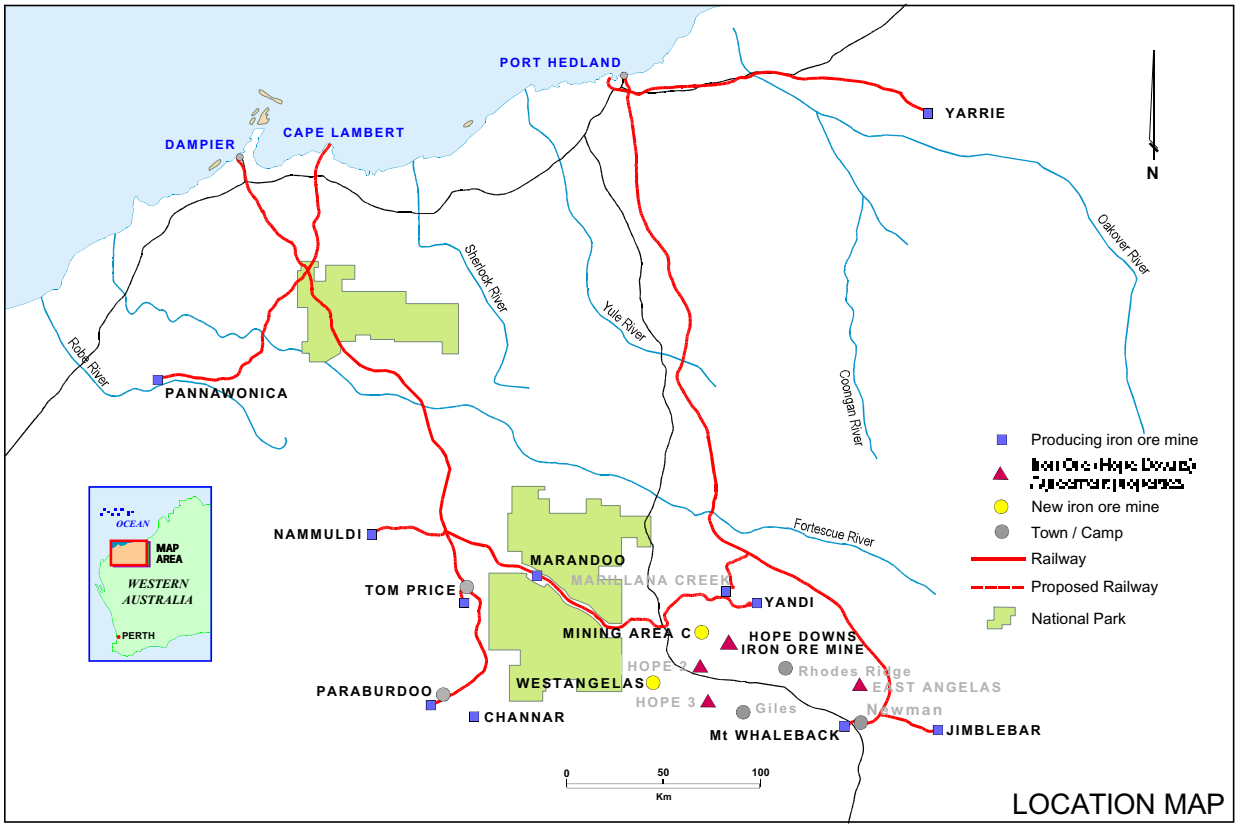

Figure 1. Location map.

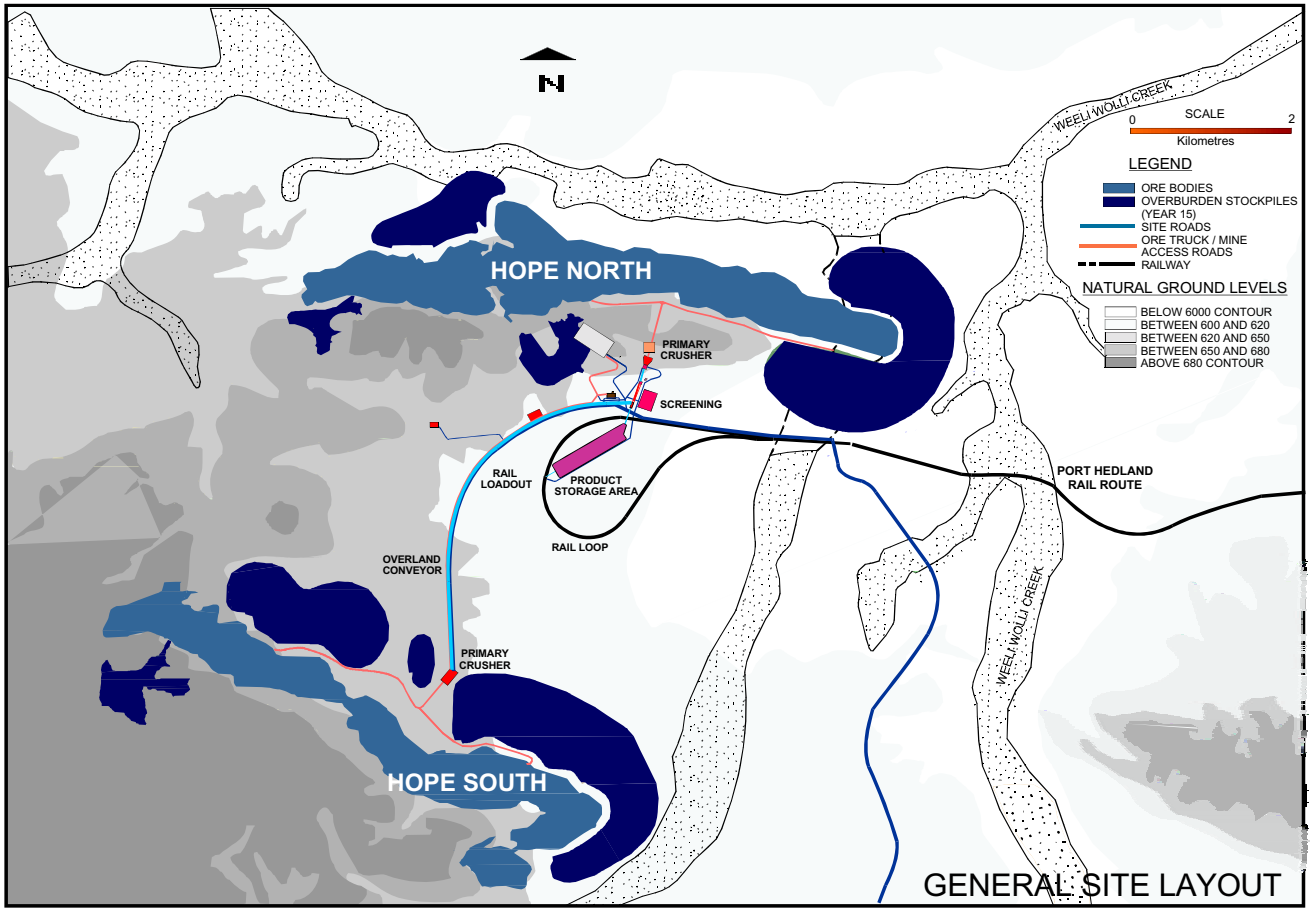

Figure 2. Site layout.

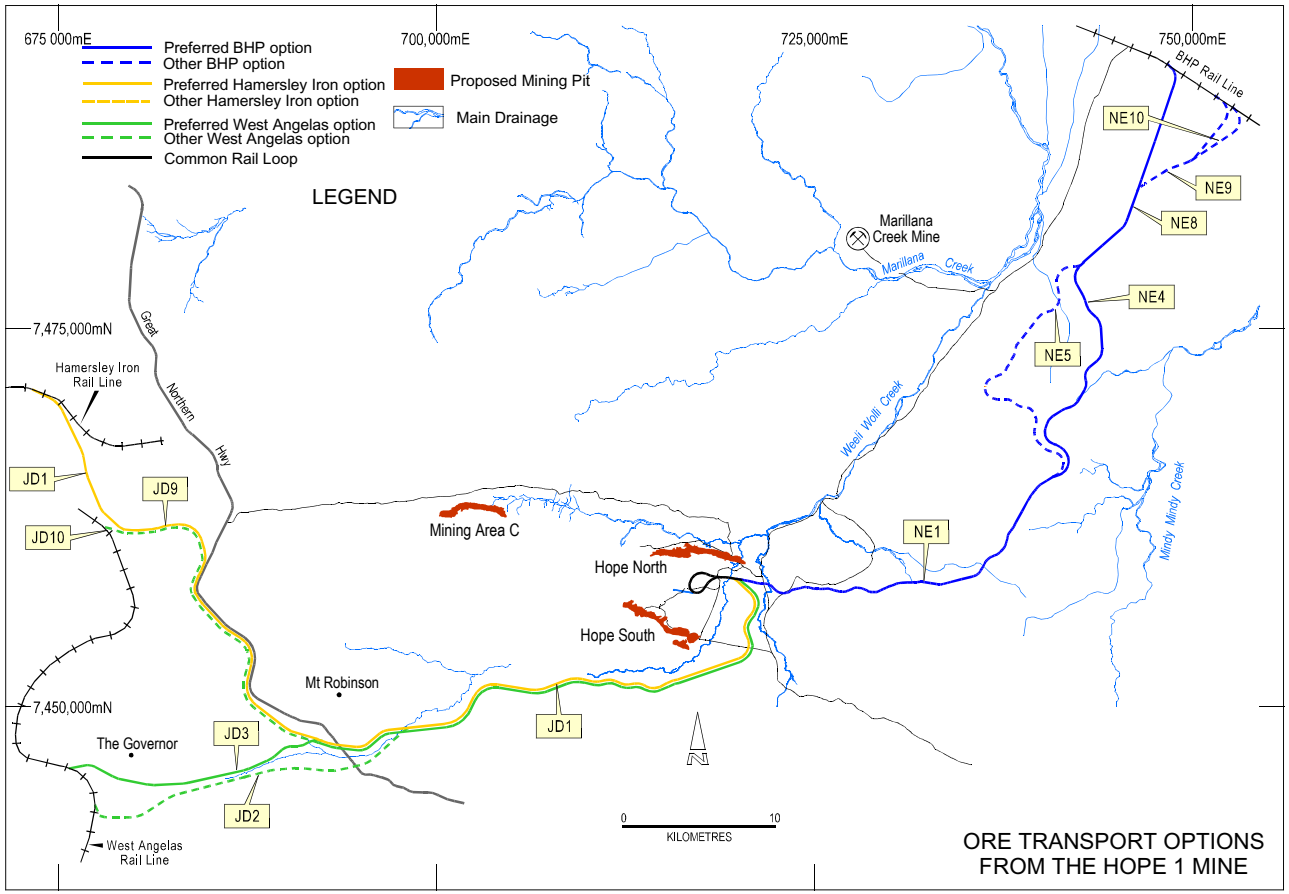

Fig 3. Rail connection options.

2. in the long-term:

   (a) backfilling of the mine pits to above the water table level; and

   (b) a 20 year post-mining phase where approximately 40 000 kL/day is pumped into the spring and the dewatered groundwater system, until the natural groundwater system has been re-established (this water must come from outside the catchment of the project area).

Also discussed within the proposal is the possibility of using an Aquifer Storage and Recovery (ASR) technique. In this technique excess water is recharged to a suitable aquifer during the mining phase, in the expectation that part of it can be recovered from the aquifer during the post-mining phase. The option of using this technique requires further investigation and is not critical to the implementation of the proposal.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Part Two of the PER (Hope Downs Management Services, 2000)

3 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors selected for detailed evaluation in this report is summarised in Appendix 3. The reader is referred to Appendix 3 for the evaluation of factors not discussed below. The reader will note from Appendix 3 that a number of the factors, such as 'Vegetation communities', which are very relevant to the proposal, are identified as being evaluated within the context of the three factors set out below. For the remaining factors, the information given in Appendix 3 provides sufficient evaluation.

It is the EPA's opinion that the following environmental factors relevant to the proposal require detailed evaluation in this report:

(a) Weeli Wolli Spring;

(b) Subterranean fauna; and

(c) Rail connection.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

Details on the relevant environmental factors and their assessment are contained in Sections 3.1 - 3.3. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

Table 1 – Summary of key proposal characteristics

Characteristics	Hope North and Hope South
Mine and Processing	
Construction period	Approximately 2 years
Project life	Approximately 20 years
Ore reserves	400 Mt
Ore mining rate	up to 25 Mtpa
Average pit depth	240 m (North), 130 m (South)
Mining below the water table	60% (North), minor pods (South)
Maximum overburden movement during life of mine	98 Mm_ (Hope North), 103 Mm_ (Hope South)
Maximum overburden at end of mining	49.5 Mm_ (Hope South)
Low grade stockpiles	7 Mt (maximum)
Average stripping ratio (average ratio of ore to overburden for north and south deposits)	1:1.42
Processing facilities/materials handling	Primary crusher Secondary dry screening and crushing Product stockpiles. Train load out facilities. Rail spur to existing railway (depending on option selected) Conveyors. Stackers and reclaimers.
Infrastructure	
Power	15 MW, diesel
Water	5.8 ML/day (2.1 GLpa)
Airstrip	Existing airstrip at Hope North
Roads	General traffic, ore truck, mine access, and rail and conveyor access.
Railway connection	Connection to existing iron ore railway (up to 75 km)
Buildings	Administration, maintenance workshops, storage and village.
Sewage	Sewage treatment plant (village), septics (other).
Dewatering	
Rate	30 to 110 ML/day
Disposal of excess	To Weeli Wolli Spring To sustain ecological requirements Aquifer storage with recovery post mining
Disturbance Areas	
Area of pits	349 ha (North), 296 ha (South)
Waste dumps	328 ha (North), 368 ha (South)
Other mine infrastructure	235 ha
Total area disturbed (mine)	1,600 ha
Area rehabilitated	1,340 ha
Average width of rail corridor	25 m
Length of rail corridor	Up to 75 km (depending on option selected)
Rail corridor disturbance	Up to 200 ha
Workforce	
Construction	500 peak
Permanent	Up to 300 fly in/fly out

Note: km kilometre; ha hectare; Mt million tonnes; Mtpa million tonnes per annum; ML/day million litres per day; GL/a gigalitres per annum; MW megawatts; Mm^3 million cubic metres

Since release of the PER, a number of modifications to the proposal have been made by the proponent. These include:

- deletion of a number of rail connection options, the remaining options are depicted in Figure 3.

3.1 Weeli Wolli Spring

Description

Weeli Wolli Spring is a permanent water body downstream of the proposed Hope Downs Iron Ore Mine. The spring arises from a "damming" of groundwater flow by the Brockman Iron Formation causing the groundwater to intersect the land surface as spring flow (Figure 4).

The spring is of high environmental significance due to its biological and conservation value, and because of its ethnographic significance to Aboriginal people. Weeli Wolli Spring has an ecosystem that is unusual in the region, since permanent surface water bodies are rare within the Pilbara. It also has a large diversity of vegetation and high floristic richness due to the varied geology and landscape of the local area. Associated with this is the presence of several rare, threatened, and/or endangered species. In addition, the area is relatively undisturbed and so is a good representative of Pilbara riparian habitat. Ethnographic research undertaken as part of the Hope Downs heritage surveys has revealed that the spring and its surrounds are of major mythological and ceremonial importance to the Aboriginal people.

Dewatering of the orebody has the potential to affect the spring both during mining and after mining. It was realised early on in the design of the proposal that, without mitigative measures, the dewatering operation for the mine would cause Weeli Wolli Spring to dry up and its ecosystem to collapse. This is because the water table being lowered by the dewatering operation is also the watertable that supports Weeli Wolli Springs (refer to Figure 5 for a schematic representation of this). In addition, if the mine pits were not backfilled, evaporative losses of groundwater at the conclusion of mining would also lower the long-term watertable.

Noting the potential for significant impact on Weeli Wolli Spring, the proponent has carried out a thorough investigation of the hydrological system supporting the spring and used this to predict impacts and formulate a management strategy. The proponent has had the technical aspects of this strategy independently reviewed by an experienced groundwater modeller. The proposed management strategy involves:

1. maintenance of spring flow by direct discharge of up to 18 000 kL/day to the spring during dewatering (Figure 5); and
2. in the long-term:
    (a) backfilling of the mine pits to above the water table level; and
    (b) a 20 year post-mining phase where approximately 40 000 kL/day is pumped into the spring and the dewatered groundwater system, until the natural groundwater system has been re-established (this water must come from outside the catchment of the project area).

While the dewatering discharge will be used to maintain the spring flow, it should be noted that the rate and water quality of discharge may differ from the natural flow and so have the potential for impact upon the spring ecosystem.

Figure 4. Conceptual groundwater system (Source: Hope Downs Management Services, 2000).

Figure 5. Spring augmentation (Source: Hope Downs Management Services, 2000).

Submissions

A number of government agencies, public groups, and members of the public made submissions related to various aspects of this factor. In summary the main points were.

(a) The ability of surface water discharge alone to adequately meet the water needs of vegetation.

The Water and Rivers Commission noted that there was some uncertainty regarding the long-term effects on Weeli Wolli Spring and downstream areas as a result of only supplementing the spring through surface water discharge. Currently water flows through the gorge both as surface flow and as sub-surface flow. It was not clear how dependant the vegetation within the gorge is on the sub-surface flow and therefore difficult to predict what the long-term (+ 20 years) effect may be of only having surface flow and some resultant shallow infiltration within the alluvial system along the gorge.

(b) The quality of discharge water (turbidity, salinity, contaminants, and quality control).

The Conservation Council was concerned that discharged water would have the ability to create surface flow over and through loose scree ore increasing its turbidity, and that additional evaporation would also increase salinity. In turn this could impact on the water quality of the Weeli Wolli Spring and or exposed water bodies in the Weeli Wolli pass.

The Water and Rivers Commission noted that predicted impacts were based on the assumption that the quality of the dewatering discharge and imported spring supplementation water would be the same as the current groundwater entering the spring system and would remain constant over the full 40 years.

The Department of Conservation and Land Management wished to know what monitoring would be done to ensure that the water discharged back into Weeli Wolli Spring is of an appropriate quality (e.g. was there a risk of pollutants cycling through the mine groundwater and then back to Weeli Wolli Spring by spring augmentation).

(c) Confidence in the predictions of spring hydrology modelling and proposed management.

The Pilbara Development Commission wanted to know what contingency plans the proponent had in case the strategies in Section 6.5 and 6.6 of the PER do not work.

The Department of Conservation and Land Management was particularly concerned with the environmental impacts of the water abstraction in relation to decommissioning and augmentation of Weeli Wolli Spring. It wanted to know what conditions were necessary to ensure the maintenance of Weeli Wolli Spring past the 20-year maintenance period.

(d) Doubts as to the ability of the Aquifer Storage and Recovery (ASR) option to supply the necessary volume of water post-mining.

The Waters and Rivers Commission, while pleased to see innovative options such as the ASR project considered, had some doubts as to the ability of this scheme to provide the necessary volume for the 20-year period. The only alternative source of available water appears to be the dewatering discharge from the BHP and HI mining operations at Yandi. The PER does not include any environmental impact assessment of such an option (i.e. pipeline route and area from which water would be removed).

The concept of artificially recharging any excess water was, however, supported as it would help to counter the dewatering cone of depression along the valleys in the upper catchment (e.g. the southern flank where under normal circumstances the modelling has shown a possible lowering of the water table of as much as 20 m). This could possibly allow the proponent to pump water from this area after mining ceases for recharge in the calcrete area (still within the same aquifer system, but closer to the centre of the cone of depression and the spring).

The Conservation Council felt that the proposal should not be assessed until a full evaluation of the water bodies in BHP's Area C and re-injection characteristics had been assessed. The council believed there was no evidence that re-injection back into the dolomite zones in this area of the Pilbara is possible.

(e) Potential conflict between the ASR option and other future mining developments in the area.

There was concern over the prospect that large volumes of water may be discharged into Weeli Wolli Creek as a consequence of operational limitations of alternative disposal mechanisms (the ASR option) or infrastructure breakdown. This may directly affect future mining activities downstream of the Hope Downs area and may invalidate water quality assumptions that are already incorporated into approved mine closure plans.

The Water and Rivers Commission believed that any ASR scheme would have to be restricted to the Southern Flank Valley, as the other areas shown in Figure 6.20 (of the PER) impact on other mining areas/companies. Raising of the water levels in these areas could have implications for future mining activity in these areas. There was also the possibility of increased peak surface flow during rainfall periods as a result of the groundwater system being "fully topped up" and therefore possibly less infiltration and more surface flow.

(f) Interaction with Mining Area C (an approved BHP Iron Ore mine) water requirements and impacts on Weeli Wolli Spring.

This point was raised by a number of submitters (CALM, WRC, and the Conservation Council). The major concern was about how the Hope Downs dewatering programme would affect the Mining Area C borefield and whether this would involve additional environmental impacts if an alternative supply was necessary. Another concern was whether the quantity of water available to augment Weeli Wolli Spring would be reduced in order to meet the needs of Mining Area C. The Conservation Council also wanted the cumulative impacts on the Weeli Wolli system, of all potential mines in the area, considered as part of this assessment.

(g) Clarification of the proponent's commitment to backfill.

A number of submitters were concerned about inconsistencies in the text of the PER on the commitment to backfill the Hope North void. It was felt that the commitment to backfill was based solely on maintaining flow at Weeli Wolli Spring, and that this was not sufficient, given there were other impacts to consider. It was felt that the default situation should be that backfilling is carried out.

(h) The proponent's ability to meet expensive and lengthy decommissioning requirements.

The Water and Rivers Commission considered that the proponent had correctly identified the environmental water requirements at Weeli Wolli Spring as a key issue and had gone to great lengths in modelling the system and proposing a management

strategy. However, no mining should be allowed until there is more assurance that the proponent has the ability to meet certain commitments which are going to come at significant cost. Of major concern to the Commission was the necessity for the proponent to continue artificially sustaining the spring system for some 20 years after mining has ceased. The Commission was reluctant to see proponents who do not have any other long-term mining operations in the Pilbara, with such lengthy environmental liabilities.

(i) The need for bonds or some other form of financial security to ensure decommissioning requirements are met.

The Conservation Council believed that a realistic bond should be established to ensure reparation of the water body during the proposed 15-year remediation process.

Assessment

The area considered for assessment of this factor is Weeli Wolli Spring and the ground and surface water on which it depends.

The EPA's environmental objectives for this factor are to:

(a) maintain the integrity, functions and environmental values of watercourses and sheetflow;

(b) maintain (sufficient) quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected; and

(c) maintain the quality of surface water and groundwater to ensure that existing and potential uses, including ecosystem maintenance, are protected.

In its response to public submissions the proponent provided the following advice.

(a) The ability of surface water discharge alone to adequately meet the water needs of vegetation.

Surface discharge will maintain both surface and subsurface flow at the spring and so meet vegetation needs. Modelling predicts that a maximum of about 80% of the discharged water will infiltrate into the aquifer to become part of the groundwater system. Thus a substantial sub-surface flow will also be maintained from the spring augmentation process.

(b) The quality of discharge water (turbidity, salinity, contaminants, and quality control).

The groundwater to be discharged and the spring water are virtually identical with respect to quality, turbidity, and salinity; contaminants are not expected to be significant given the design of the dewatering/discharge operation. The design and location of bores will ensure that turbid water, or water potentially polluted from mining operations, will not be discharged at the spring. Discharge water will be drawn form screened production wells outside of the pit and will intercept water before coming into contact with mining activities. In addition, the outfall structure will be designed with energy dissipaters to prevent potential turbidity effects.

(c) Confidence in the predictions of spring hydrology modelling and proposed management.

Groundwater modelling to date has determined that Weeli Wolli Spring can be maintained during mining and restored to a self-sustaining system approximately 20 years after the completion of mining. During mining there will be an excess of water

available to maintain the spring. Over this period groundwater models will be refined and contingency plans developed. It has also been demonstrated that there are sufficient water resources within the region for the decommissioning phase and that it will be feasible to use these sources.

(d) Doubts as to the ability of the ASR option to supply the necessary volume of water post-mining.

The ASR option is not critical to the proposal, and maintenance of Weeli Wooli Spring can still be achieved even with zero contribution from ASR. The ASR option was presented in the PER as one component of the preferred management scheme as it attempts to "re-use" dewatering discharge. Preliminary work has been undertaken to demonstrate it would be feasible to obtain the total volume of 40 000 kilolitres per day from the Marillana Creek catchment. In addition, further work suggests that it may be possible to source up to 20 000 kilolitres per day from within the Weeli Wolli Spring aquifer catchment rather than further afield (e.g. the southern flank area), but more work would be needed to support this approach.

There are several potential ASR sites and possible conflicts with other mining operations will be considered. If there is no viable site then ASR need not be implemented.

(e) Interaction with Mining Area C (an approved BHP Iron Ore mine) water requirements and impacts on Weeli Wolli Spring.

The only mining activities proposed to take place concurrently with Hope Downs are those associated with Mining Area C. The cumulative effect of these mining activities has been taken into account in the hydrogeological modelling.

(f) Potential conflict between the ASR option on other future mining developments in the area.

The Hope Downs dewatering operation will not affect BHP Iron Ore's approved plans for Mining Area C and will provide sufficient water for Weeli Wolli Spring. Groundwater modelling indicates that the Hope Downs mining activities would not impact on the planned Mining Area C borefield within the predicted life of that borefield (seven years). After this time, Hope Downs dewatering would have plenty of surplus water available (after providing for spring augmentation) to supply water to Mining Area C should it become necessary. HDMS would make this water available for BHP Iron Ore's water supply.

(g) Clarification of the proponent's commitment to backfill.

Commitment 10 has been modified to clarify the commitment to backfilling and that any alternative would require further approval.

(h) The proponent's ability to meet expensive and lengthy decommissioning requirements.

Closure costs have been calculated and in accordance with Australian accounting standards will be included in annual provisioning for future expenditures. HDMS has substantial financial backing and expects to have a continued presence within the region during the closure operations. HDMS intends to develop Hope 2 and Hope 3 deposits, which are within 20 kilometres and 30 kilometres of Hope 1 respectively, at the completion of operations at Hope 1. The costs of backfilling and maintenance of water to Weeli Wolli Spring are currently estimated to cost $190 million (total) and $0.5 million/year respectively.

The proponent has been advised by the Office of Major Projects that bonds are not normally required of companies subject to Agreement Acts, since these involve substantial companies and include mechanisms to protect the State should the company default on the cost of mine closure. Clause 16 of the *Iron Ore (Hope Downs) Agreement Act 1992* requires the company to periodically submit comprehensive reports detailing its environmental performance. This report can be extended to include the provision for updates to the mine closure plan on a regular basis and, if necessary, to advise the Government of the state of the contingent liability for environmental remediation in its annual report. Ultimately, if at any time the proponent defaults or fails in meeting its performance criteria in respect of the observance of any of the covenants or obligations under the Agreement Act, the Government has the right to determine (terminate) the Act and resume the tenements and take procession of all buildings, erections and other improvements without compensation.

Noting the submissions and the proponent's responses, the EPA takes, as its starting position, that any significant impact on the environment of Weeli Wolli Spring would be unacceptable. This is because the vegetation and flora of Weeli Wolli Spring has significant biological and conservation value, and the area is of high ethnographic importance.

The EPA's assessment of this factor is divided into two main phases, that is, the potential for impacts during mining, and the prevention of long-term impacts after mining is complete.

In relation to both of these, the EPA notes that the proponent has carried out extensive modelling and put forward management strategies that are the best that can be developed based on current information, and which have been independently reviewed. The Water and Rivers Commission has reviewed the plans and believe that it is sound and the best that can currently be achieved. Hence, it is technically possible that the impacts on Weeli Wolli Spring and its environs can be managed to an acceptable level based on the maintenance of spring flow by spring augmentation.

During mining

In this phase there will be an excess of water available from the dewatering operations to maintain Weeli Wolli Spring. As this water is taken from the same groundwater system that flows into the spring, the water quality of discharge to the spring will not change. In addition, the design will ensure that contaminants from mining operations do not enter the discharge.

Based on the information provided and the advice of the Water and Rivers Commission, the strategy presented in the PER of discharging to the spring to maintain spring flow is feasible, and would maintain both the spring and its ecosystem. The proponent has given commitments to refine this strategy (Commitment 5), monitor impacts on groundwater dependent vegetation (Commitment 6), and closely monitor the groundwater system (Commitment 4). An outline of a hydro-ecological monitoring programme for the Weeli Wolli Spring area has also been provided in the response to submissions.

While most of the emphasis has been on maintaining watertable levels at Weeli Wolli Spring, there are potential impacts from increased levels that may need to be considered in the final water management strategy. If the ASR proves to be impractical, then discharge of the full dewatering volume would be necessary to Weeli Wolli Creek. This is predicted to raise the stream height in the spring by 9 cm and would extend the stream several kilometres downstream. Noting that the vegetation and flora of the Weeli Wolli area is of high significance, the water management plan (Commitment 3) will need to address the potential for adverse impacts arising from a long-term increase in average water levels during mining, if this is to occur. This would require further work to detail the rate of increase of

groundwater levels, the duration above average levels, and identification of flora and vegetation communities that might be sensitive to these increases. In determining whether a water management plan would be acceptable, the EPA considers that the default case should be that there is no significant degradation of the flora and vegetation of Weeli Wolli Spring. Hence, it is necessary that any plan would need to demonstrate that excess discharge would not cause any significant reduction in the distribution of flora species and vegetation communities in the Weeli Wolli Spring area.

However, the EPA believes there is sufficient scope within the framework of water management strategies for this to be addressed. Either the proponent will be able to demonstrate no significant reduction in the distribution of vegetation or flora, or other plans could be developed. These include development of an ASR type scheme purely to dispose of excess water (for example, like that proposed by the Water and Rivers Commission on the southern flank), or discharge of excess water away from Weeli Wolli Spring (downstream of the spring, or increased use in the creek flooding programme that is to maintain vegetation in the south branch of Weeli Wolli Creek).

Post-mining

In order to prevent long-term impacts on Weeli Wolli Spring, a self-supporting spring/groundwater system must be re-established on closure of the mine. At this stage, the only feasible strategies to achieve this involve substantial post-mining obligations for the proponent, in terms of expense and time.

The current strategy to restore the natural source Weeli Wolli Spring and to maintain spring flow in the interim, involves three critical actions. These are:

1. backfilling of the Hope North and Hope South pits;
2. importation of water into the catchment for groundwater recovery; and
3. artificial maintenance of spring flow until a self-supporting system is restored.

Pits will be backfilled to prevent long term changes to the direction and rate of groundwater movement, and changes to groundwater quality. Without backfilling to above the current water table level (backfilling to RL 570), evaporation from the lakes formed in the pit would result in a loss of groundwater from the system. This loss would mean the groundwater levels would recover very slowly and remain depressed well below their current depth. In addition, evaporation would increase the salinity of groundwater.

Water will need to be imported into the system to replenish that which is removed during the mine life by dewatering. Modelling of the decommission phase has shown that recovery of natural spring flow will occur over a period of 20 years, if 40 000 kL/d of water is imported into the catchment for groundwater recovery and spring maintenance, and if surface flow from the South West Tributary is diverted into the pits. The proponent has demonstrated feasible water supplies are available outside of the catchment. It may also be possible, that some of this water for recovery and maintenance could come from inside the catchment, but this is an option requiring further work at this stage.

During the groundwater recovery phase, water will continue to be discharged to Weeli Wolli Spring to maintain spring flow, in a similar manner as during dewatering.

These three critical actions will be expensive. The backfilling referred to is that which occurs at the end of mining. It is estimated to cost $190 million and take three years. Groundwater injection and spring maintenance will require the construction of a pipeline in the last few

years of mining and then pumping operations at a cost of approximately $500 000 per annum for the predicted 20 year recovery period.

The EPA notes that the proponent wishes to explore the possibility of other management and closure strategies over the life of the mine. These relate to the need to backfill the pits and whether less water is required from outside the Weeli Wolli Spring catchment. However, at this time, these three critical actions are taken to be the default for which the impacts have been considered. Any alternatives would need to deliver equal, or better, environmental outcomes for Weeli Wolli Spring in order to be acceptable.

Noting that the three actions are essential to prevent unacceptable impacts on Weeli Wolli Spring and noting that they come at a significant post-mining cost, it is the EPA's view that the Minister for the Environment and Heritage would need to be satisfied that a mechanism was in place within Government to ensure that the proponent had adequate and tangible funds available to fulfil the essential actions required. The EPA would regard any detrimental impact on Weeli Wolli Spring as a "fatal flaw" to the proposal. Accordingly, in the event of the proponent failing to undertake the required work to maintain the values of the Spring, the responsibility would fall on the State Government.

The EPA recognises the development of the Hope Downs project would be under an Agreement Act. This may provide an avenue for the Minister to have confidence that a mechanism was available for the security of long-term funding. However, the matter is of such importance, the EPA recommends that the Minister seek to have a clear and transparent mechanism for ensuring that maintenance of Weeli Wolli Spring is assured (see Recommendation 4).

Summary

Having particular regard to the:

(a) high standard of the proponent's modelling of impacts and proposed management;

(b) Water and Rivers Commission's advice on the technical feasibility of the proposed management;

(c) proponent's commitments in relation to groundwater dependent ecosystems; and

(d) large liability associated with critical decommissioning actions,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objective provided that the proponent's commitments are made legally enforceable and that the State Government is satisfied a transparent mechanism is in place to ensure that the proponent has adequate and tangible funds available to fulfil the essential post-mining actions and management until natural groundwater levels are re-established (in the order of 20 years).

3.2 Subterranean fauna

Description

Subterranean fauna includes both troglobites (terrestrial subterranean fauna) and stygofauna (aquatic subterranean fauna). Both of these are important because of their species richness, evolutionary history and adaptations, and the evidence they can provide for continental drift. Hence they are significant in terms of Australian faunal biodiversity (EPA, 1997).

Dewatering operations have the potential to affect stygofauna within those areas affected by groundwater drawdown and dewatering discharge.

Two stygofauna habits are associated with these areas. A calcrete area between the mine and Weeli Wolli Spring is within the drawdown area, although sampling to date has not detected any stygofauna here. Stygofauna have been recorded in the interstitial gravel habitat of Weeli Wolli Spring where dewatering discharge will occur. The stygofauna composed Crustacea belonging to the groups Amphipoda, Copepoda, Bathynellacea, Ostracoda, and Isopoda. The Weeli Wolli Spring stygofauna are a significant stygofauna which is considered to be vulnerable to even slight drawdown effects (Eberhart and Humphreys 1999).

Submissions

The Western Australian Museum submitted that:

(a) it would be unsafe for the project to advance further until the nature and distribution of the stygofauna in the Weeli Wolli calcrete area has been established since a biodiversity "hotspot" occurs in a similar area nearby in the region;

(b) given that little is known about the functioning of these groundwater ecosystems, it would be unsafe to deal with this issue by monitoring impacts as the mine develops; instead, there needs to be substantial work conducted on the groundwater ecosystem(s) with sufficient lead time to do the detailed scientific work necessary for an informed decision;

(c) the proposal to reinject water or augment spring flow is based on no evidence that it would be effective for stygofauna or the remainder of the aquifer ecosystem;

(d) the survey work carried out within the calcrete area was insufficient due to a lack of access since it was unable to examine the distribution of stygofauna within the calcrete, which is important since experience elsewhere has shown that the distribution of species within a calcrete area can be clumped rather than uniform; and

(e) the distribution of the underlying karstic dolomite is not shown in the PER and it may provide open conduit flow in the groundwater.

The Department of Conservation and Land Management made the following comments.

(a) What impacts will water temperature, salinity, and turbidity have on calcrete area and invertebrates (stygofauna)?

(b) The failure to address the regional significance of stygofauna likely to be impacted by the project is an inadequacy of the PER document. It is very difficult to assess what impacts this project will have on the environment when there is no regional context for the project or information on the biota present in the project area and the representation of such biota in the conservation estate.

(c) Commitment 10 (in the PER) should include reference to ensuring that the data contributes to and is assessed in a regional context.

Assessment

The area considered for assessment of this factor is the potential subterranean habitat within the area of influence of the project, principally, the calcrete area between the mine and Weeli Wolli Spring, and the interstitial gravels of Weeli Wolli Spring.

The EPA's environmental objectives for this factor are to:

(a) maintain the abundance, diversity and geographical distribution of subterranean fauna; and

(b) improve our understanding of subterranean fauna through appropriate research including sampling, identification and documentation.

The proponent in its response to submissions provided the following information on actual and potential subterranean habitats.

(a) The calcrete area between the mine and Weeli Wolli Spring is unlikely to be a suitable habitat for stygofauna, as very little of it is below the water table. Drill logs show that only a small proportion of the calcretes are below the water table and that in some areas the calcrete is entirely above the water table. This general lack of suitable stygofauna habitat is supported by the fact that the sampling undertaken to date did not record any stygofauna from this area.

(b) Those areas of calcrete that are below the water table are within the range of natural water table fluctuations and so any stygofauna that may be present must be adapted to cycles of wetting and drying. Natural fluctuations in water table over the past few decades have been in the range of 2 – 4 metres, whereas in the upstream calcrete areas there is only around 1-2 m of saturated calcretes. This suggests that, even if stygofauna are actually present in this area, then they, like many other aquatic fauna of the Pilbara, may have some mechanism to accommodate major cycles of wetting and drying.

(c) With respect to stygofauna habitats in the interstitial gravel habitat of Weeli Wolli Spring, the dewatering discharge is expected to maintain the habitat; as aquifer levels and quality will be maintained. Dewatering discharge will maintain water levels at the spring and downstream of it. The water quality from the mine area is chemically very similar to that close to the spring. Total dissolved solids and pH are very similar across the catchment and the available data do not suggest that the reinjected dewatering water would result in significant changes to water quality in the vicinity of the spring. Temperature differences between spring augmentation and groundwater is only expected to be one degree Celsius at most, which is well within natural seasonal changes.

(d) Hydrogeological investigations indicate that there are likely to be equivalent, hydraulically connected, stygofauna habitats downstream of the dewatering impact area. Investigation of these habitats will form a focus for the sampling programme, as they may form contiguous saturated zones to provide refugia for stygofauna species associated with this part of the system during dewatering. Given the extremely dynamic nature of the alluvial systems of Pilbara creeks during cyclone and drought events, it is not unreasonable to expect stygofauna to persist in these areas and re-colonise contiguous habitats once the dewatered water table recovers.

The EPA notes that the submissions from the Western Australian Museum and the Department of Conservation and Land Management reflect the uncertainties associated with this particular factor due to a limited understanding of subterranean fauna in the Pilbara region and generally throughout the State. In previous assessments the EPA has commented on the lack of baseline information on the distribution of subterranean fauna, and the almost complete lack of monitoring data on the response of subterranean ecosystems to changes in this environment. Until this situation changes, the EPA must adopt a risk based assessment of this factor, that takes into account the distribution information presented at the project level and predicted impacts based on reasonable assumptions on how such ecosystems function.

Hence the EPA in its assessment of this proposal will weigh up the risks associated with this limited understanding against the benefits that may be gained by additional studies as a result of this proposal proceeding.

Based on the information currently available on the likely habitats and potential impacts on these habitats, the EPA considers that the risk of stygofauna species extinction as a result of this proposal is small. The interstitial gravel habitat of Weeli Wolli Spring has been found to contain stygofauna and may prove to be a significant area in terms of stygofauna diversity. But there should be little or no impact on this habitat, since maintenance of Weeli Wolli Spring will also maintain conditions in this habitat. Furthermore, the hydro-ecological monitoring programme for the Weeli Wolli Spring area will include stygofauna and so will add to knowledge of stygofauna in this area. Conversely, the calcrete area between the mine and Weeli Wolli Spring will be affected by dewatering operations, but is unlikely to contain stygofauna that is not already adapted to such changes. Most of the habitat is above the water table, and those areas below the water table are subject to dewatering from time to time due to natural fluctuations in the water table.

The proponent has also given an undertaking to extend current surveys by carrying out a comprehensive stygofauna sampling programme within the project area, commencing 3 years prior to the start of mining.

The EPA understands that subterranean fauna surveys of the Pilbara are intended as part of a wider biological survey of the Pilbara currently being proposed by the Department of Conservation and Land Management. The EPA supports this work as eventually providing the baseline information for establishing the regional significance of subterranean fauna communities and species. It is also noted that studies on the response of ecosystems to various pressures should be a priority of government and industry in the region.

Based on the above, the EPA considers that the risk of stygofauna species extinction as a result of this proposal is small. In addition, the collection of additional data during the life of the operation will add to basic knowledge of stygofauna within the Pilbara region. It is therefore the EPA's judgement that there is a reasonable balance between the risk that the EPA's objective will be compromised and the additions to fundamental taxonomic data that will accrue.

Summary

Having particular regard to the:

(a) results of survey work to date;

(b) proponent's commitment to undertake a comprehensive sampling programme; and

(c) limited predicted impacts on likely habitats,

it is the EPA's judgement that the balance of the risk that the EPA's objective is compromised against the benefits of improved basic knowledge of stygofauna is acceptable, provided a comprehensive study to improve knowledge is conducted and management practices are modified in response to this information (Condition 6, Appendix 5).

3.3 Rail connection

Description

This proposal includes a rail connection from the mine site to one of the existing railways used for the transport of iron ore to the coast for export. Since this aspect of the proposal is subject to continuing negotiations with the owners of the existing railways, no specific alignment for the rail connection has been given in the proposal. Instead, the proponent has set out a number of rail corridor options for the connection. In developing these options, the proponent evaluated many options and then eliminated a number on environmental, heritage, and engineering grounds. Those that remained were presented in the PER document, along with an examination of their potential environmental impacts. Subsequently, in response to submissions, the proponent has also withdrawn a number of these options. The remaining options are depicted in Figure 3.

The environmental impacts of the rail connections are primarily related to the clearing needed for the railway formation and the barrier that this formation represents, especially in regard to surface water movement. Construction of a rail connection will directly remove up to 200 ha of vegetation. Interruption of surface water flow may extend impacts for some distance away from the rail embankment unless managed appropriately. The physical barrier of the railway formation can also impede the movement of smaller fauna across the alignment.

Baseline surveys of the rail connection options have been carried out to identify environmental constraints for each option.

With regard to flora, over all the rail route survey areas there were:

- 3 Priority 1 species;
- 3 Priority 2 species;
- 8 Priority 3 species; and
- 19 “flora of interest”.

Given the indicative alignments the only species likely to be significantly impacted is *Calotis squamigera* (Priority 1). A population of this species is found along the JD1 route option. This population represents one of only two known populations of this species. Other species would either not be directly impacted, or only a small proportion of known populations would be affected.

Within the rail routes identified in the PER, the:

- gilgai at the northern end of the HI route;
- sandplain of the north eastern corridor;

are significant because they are likely habitat for specially protected fauna, and are either not well represented, or not well understood.

The PER puts forward a number of rail route options that have been designed taking into account impacts on significant vegetation communities. However, the remaining rail routes still cross some areas of vegetation with moderate to high conservation significance.

Preliminary ethnographic surveys have been conducted of the railway routes. Although the Aboriginal consultants identified no fatal flaws, they expressed a preference for routes away from Weeli Wolli Creek.

The PER also sets out a number of design considerations to ensure that impacts on surface water movement are reduced. Major creek crossings have been identified where bridges will be necessary and culverts will be used for minor creek crossings. Experience with other railways in the Pilbara has shown that changes to surface drainage can be reduced to an acceptable level by appropriate design measures.

Submissions

The Department of Conservation and Land Management made the following comments.

(a) Coondewanna Flats is an area of priority listed flora and will be impacted by some of the railway links. CALM has indicated its concerns to EPA on previous occasions regarding this site. Options JD 4,5 & 6 and parts of JD 2 are not supported by CALM. Options JD1 & JD9 do have CALM support. It is recommended that EPA make a clear statement that railways through Coondewanna flats are unacceptable.

(b) At this preliminary stage assessment of the rail option is difficult as only superficial data is provided. Once the preferred rail route has been identified, further environmental assessment would need to be performed on the proponent's preferred option (and its alternatives), in a manner similar to the review process undertaken for the Coondewanna West and Mt Robinson rail routes proposed for the West Angelas project.

(c) Coondewanna Flats is an area of priority listed flora and so railways through this area are unacceptable;

- options JD4, JD5, JD6, and parts of JD 2 are not supported;
- options JD1 and JD9 are supported;
- JD3 and JD2 are possibly acceptable;
- options to the north-east (BHP line) are probably acceptable, although the terrain is difficult and the cost of constructing these railway links will be high.

The Department of Minerals and Energy considered that the rail option to be adopted and the subsequent access route should be finalised before major construction activities commence on the site.

The Conservation Council of Western Australia believed that the PER process should not proceed until a total plan including a rail option/agreement was presented to the EPA. Given the difficulties in negotiating shared use of infrastructure the Council considered that it must be assumed that the proponent will have to construct a separate rail and port facility to ensure continuity of supply to their customers.

Assessment

The area considered for assessment of this factor is the Fortescue Botanical District (Pilbara region) as defined by Beard (Beard 1975).

The EPA's environmental objectives for this factor are to:

(a) maintain the abundance and diversity of species, and geographic distribution and productivity of vegetation communities;

(b) protect Declared Rare and Priority Flora, consistent with the provisions of the Wildlife Conservation Act 1950;

(c) protect other flora species of conservation significance; and

(d) ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.

The EPA believes that a sufficiently well-defined proposal has been put forward for it to carry out its assessment, even although there remain a number of alternatives for the export of the iron ore product from the mine.

The proposal put forward seeks to use existing rail infrastructure wherever possible. In previous assessments (EPA, 1999) the EPA has been made aware of the additional environmental impacts where railway infrastructure has to be duplicated by different iron ore producers. Hence the proponent's starting point of seeking to share infrastructure rather than build it own is a preferred starting position. However, it is acknowledged that the end result of negotiations between the proponent and existing railway owners may not allow shared use, and that the proponent may have to develop it own railway and port infrastructure. In this case, a separate proposal will be put forward and its environmental impacts considered separately. In such a case, the consideration of the new infrastructure would not derive any impetus from this proposal, since no major construction of this proposal would occur until the rail access is finalized (refer to the response to Submission 25).

A number of rail connection options have been put forward by the proponent and evaluated through the course of the EPAs' assessment. The PER presented sufficient baseline information on the various options for the major environmental constraints associated with each route to be identified. In its response to submissions, the proponent has withdrawn all options which were not supported by the Department of Conservation and Land Management. Those that remain are depicted in Figure 3. Given the known constraints, the EPA believes that there is sufficient scope within the remaining route options for a rail connection to either the east (connection to BHP railway) or the west (Hamersley Iron or West Angelas railway) to be constructed without unacceptable impacts on the environment. However, before any particular route is implemented more detailed information on the selected option will need to be submitted to demonstrate that the identified environmental constraints (such as priority flora, significant habitats, and archaeological or ethnographic sites) have been properly taken into account in the detailed design and alignment of the route. This additional detailed information will be submitted to the Department of Conservation and Land Management, the Water and Rivers Commission, and appropriate Aboriginal Elders for review (Commitment 15).

Summary

Having particular regard to the:

(a) advice from CALM on various route options; and

(b) proponent's commitment to a process that will provide more detailed information and involve CALM, the WRC, and Aboriginal people,

it is the EPA's opinion the proposal is capable of being managed to meet the EPA's objectives for this factor provided the proponent's commitments are made legally enforceable.

4. Conditions and Commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal and, following discussion with the proponent, the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject, if it is to be implemented.

4.1 Proponent's commitments

The proponent's commitments as set in the PER and subsequently modified, as shown in Appendix 4, should be made enforceable.

4.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Hope Downs Management Services Pty Ltd to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 4;

(b) that the proponent be required to prepare and implement a Subterranean Fauna Sampling Plan; and

(c) that standard conditions appropriate to mining operations of this scale and type be applied.

It should be noted that other regulatory mechanisms relevant to the proposal are:

- requirements under the *Iron Ore (Hope Downs) Agreement Act 1992*;
- requirements of the Department of Minerals and Energy for the proponent to comply with the provisions of the *Mines Safety and Inspection Act 1995* with respect to public safety and the management of mining voids, waste dumps, mine planning, decommissioning of plant infrastructure and final rehabilitation;

- requirements of CALM for the proponent to comply with the provisions of the *Wildlife Conservation Act 1950* with respect to disturbance of Priority flora species and Threatened fauna;
- requirements of the Department of Environmental Protection to comply with the provisions of the Part V of the *Environmental Protection Act 1986* with respect to the discharge of groundwater and the construction and operation of prescribed premises, including tailings storage facilities; and
- requirements of the Aboriginal Affairs Department for the proponent to comply with the provisions of the *Aboriginal Heritage Act 1972*.

5. Conclusions

The EPA has considered the proposal by Hope Downs Management Services Pty Ltd to develop a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway.

The main issues associated with this proposal relate to the impacts on Weeli Wolli Spring and subterranean fauna due to dewatering of the orebodies, and the selection of the railway connection route.

While the potential for impact on Weeli Wolli Spring is great, the proponent has thoroughly investigated this issue and convinced the EPA that appropriate management can avoid such impact. It is a measure of the seriousness of this aspect of the assessment that the adopted management strategy is expensive in terms of time and resources. It is predicted that management measures will continue until 20 years after the conclusion of mining and will cost approximately $200 million. The management strategy to prevent impacts on Weeli Wolli Spring will also prevent adverse impacts on the stygofauna of this area. Throughout the assessment it has been understood that there was potential for dewatering to have a major impact on Weeli Wolli Spring and that such impacts would be unacceptable because of the high conservation and heritage values of Weeli Wolli Spring. To address this concern the proponent has carried out a thorough investigation of the groundwater system, the proposal's impacts upon it, and ways to prevent significant impacts on Weeli Wolli Spring. The EPA acknowledges the thorough way in which the proponent has approached this problem.

The importance of the post-mining management strategy for preventing impacts on Weeli Wolli Spring cannot be overstated. Noting that implementation of this strategy is essential to preventing unacceptable impacts on Weeli Wolli Spring and noting that they come at a significant post-mining cost, it is the EPA's view that the Minister for the Environment and Heritage would need to be satisfied that a mechanism was in place within Government to ensure that the proponent had adequate and tangible funds available to implement the strategy. The EPA therefore recommends that the Minister seek to have a clear and transparent mechanism for ensuring that maintenance of Weeli Wolli Spring is assured.

A number of options for the railway connection have been put forward, along with a mechanism for providing further review of the detailed alignment and design when a preferred option is chosen. Based on the information presented by the proponent, the EPA considers that an environmentally acceptable rail connection can be constructed, subject to review of the detailed alignment and design.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be

compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

6. Recommendations

The EPA submits the following recommendations to the Minister for Environment and Heritage:

1. That the Minister notes that the project being assessed is for the development of a new iron ore mine in the East Pilbara and a connection to an existing iron ore railway;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3;
3. That the Minister adopts the EPA advice that any detrimental impacts of the proposal in Weeli Wolli Spring, which is a special area near the project location, be accepted as a "fatal flaw" to the proposal, as discussed towards the end of Section 3.1;
4. That the Minister takes action to be satisfied that a transparent mechanism is in place within Government to ensure that the proponent will have adequate and tangible funds available to fulfil essential post-mining actions necessary for the long-term maintenance of Weeli Wolli Spring;
5. That the Minister notes that the EPA has concluded that subject to the Minister's consideration of recommendations 3 and 4 above it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 and summarised in Section 4, including the proponent's commitments; and
6. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Appendix 1

List of submitters

Organisations:

Pilbara Development Commission
Water and Rivers Commission
Department of Conservation and Land Management
Department of Resources Development
Western Australian Museum
Department of Minerals and Energy
Shire of Roebourne
Hamersley Iron Pty. Limited
Hamersley Resources Limited
Conservation Council of Western Australia Inc.

Appendix 2

References

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Appendix 3

Summary of identification of relevant environmental factors

Appendix 3: Summary of Identification of Relevant Environmental Factors

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Terrestrial Flora — vegetation communities	The project involves clearing of up to 1 800 ha of native vegetation, of which 1300 ha will ultimately be rehabilitated. Impacts on vegetation are associated with: • clearing for the mining operation; • dewatering operations; and • construction of the rail connection. 1 600 ha of vegetation will be clearing in the mining area. Vegetation communities in the mining area are well represented outside of this area and so are only of low to moderate conservation significance. Dewatering operations would, in the absence of additional management, affect riverine vegetation in the vicinity of the mine and at Weeli Wolli Spring. The vegetation and flora of Weeli Wolli Spring has significant biological and conservation value. *E. camaldulensis / E. victrix* woodlands are associated with the	**CALM** At this preliminary stage assessment of the rail option is difficult as only superficial data is provided. Once the preferred rail route has been identified, another environmental assessment would need to be performed on the proponent's preferred option (and its alternatives), in a manner similar to the review process undertaken for the Coondewanna West and Mt Robinson rail routes proposed for the West Angelas project. • Coondewanna Flats is an area of priority listed flora and so railways through this area are unacceptable; • options JD4, JD5, JD6, and parts of JD 2 are not supported; • options JD1 and JD9 are supported; • possibly JD3 and JD2 are acceptable; • options to the north-east (BHP line) are probably acceptable, although the terrain is difficult and the cost of constructing these railway links will be high Section 4.10 – "Infrastructure": the investigation into the new service road into Hope Downs should have been completed prior to this document's release. Will CALM have an option to comment on the road proposal before it is implemented? **DME** The rail option to be adopted and the subsequent access route should be finalised before major construction activities commence on the site.	Vegetation clearing associated with the mine itself is not considered to be significant at a regional level. Furthermore, in time successful rehabilitation will reduce this impact. In the draft EMP the proponent has set out measures to reduce the impacts of clearing (clearing control and weed management) and optimise the successfulness of rehabilitation (progressive rehabilitation and topsoil management). The draft EMP will be finalized before operations commence and will be continually reviewed (Commitment 2) While there may be some decline in riverine vegetation in parts of Weeli Wolli Creek (excluding Weeli Wolli Spring), periodic flooding of the south main branch of the creek should maintain most of the riverine vegetation. The proponent has committed to monitoring this vegetation and providing this extra water if necessary (Commitment 7). In its response to submissions the proponent has provided a map of the service road alignment to CALM, and stated that while it would continue to consult with pastoralists, it would act

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	south main branch of Weeli Wolli creek. Such riverine vegetation is important in the Pilbara due to its relative scarcity and habitat values. It is proposed to periodically flood these areas to maintain most of this vegetation, if necessary. Construction of a rail connection will directly remove up to 200 ha of vegetation. Interruption of surface water flow may extend impacts for some distance away from the rail embankment. The PER puts forward a number of rail route options that have been designed taking into account impacts on significant vegetation communities. However, the remaining rail routes still cross some areas of vegetation with moderate to high conservation significance.	**Pilbara Development Commission** The proponent should also consult with the local pastoralists about measures to reduce impacts on vegetation and soils as a result of earthworks. Pastoralists may have local knowledge that would be of assistance to the proponent. **WRC** The Commission notes that there is some uncertainty regarding the long-term effects on Weeli Wolli Spring and downstream areas as a result of only supplementing the spring through surface water discharge. Currently water flows through the gorge (Weeli Wolli Spring to Tarina gauging station) both as surface flow and as sub-surface flow. It is not clear how dependant the vegetation within the gorge is on the sub-surface flow. It is therefore difficult to predict what the long-term (+ 20 years) effect may be of only having surface flow and some resultant shallow infiltration within the alluvial system along the gorge.	primarily on CALM's advice with regard to management of soils and vegetation. Potential impacts on the vegetation of Weeli Wolli Spring require further evaluation. CALM's concerns regarding some of the rail route options, and the process for making a final choice, requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factors of "Weeli Wolli Spring" and "Railway connection".**
Terrestrial Flora — Declared rare and priority flora; flora of conservation significance	One priority 3 species (*Eremophila magnifica*) and nine "flora of interest" have been recorded at the mine site. Three of five local populations of *Eremophila magnifica* will be removed or affected by mining. This species has been recorded in a number of locations elsewhere in the region. The "flora of interest" within the mine site are generally of interest due to being poorly	**CALM** Coondewanna Flats is an area of priority listed flora and will be impacted by some of the railway links. CALM has indicated its concerns to EPA on previous occasions regarding this site. Options JD 4,5 & 6 and parts of JD 2 are not supported by CALM. Options JD1 & JD9 do have CALM support. It is recommended that EPA make a clear statement that railways through Coondewanna flats are unacceptable.	There will be no impacts on Declared Rare Flora and impacts on Priority listed species within the mining area can be managed to acceptable levels. The draft EMP recognises the need to avoid significant vegetation wherever possible. For those populations that cannot be avoided, the EPA expects that these species will be given special consideration in the rehabilitation plans and completion criteria.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	collected. However, two of these are potentially new species. These two species will not be affected by mining. Over all the rail route survey areas there are: • 3 Priority 1 species; • 3 Priority 2 species; • 8 Priority 3 species; and • 19 "flora of interest". Given the indicative alignments the only species likely to be significantly impacted is *Calotis squamigera* (Priority 1).		CALM's concerns regarding some of the rail route options, and the process for making a final choice, requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor "Railway connection".**
Fauna	The primary impact on fauna of the mine site will be due to loss of habitat associated with clearing. Surveys of the mine area have recorded: • 24 mammal; • 88 bird; • 45 reptile; and • 1 amphibian species. Outwash plains and drainage line habitats recorded the highest species richness. Impacts on fauna along the rail connection will also be due to loss of habitat. Fauna surveys have been conducted of habitats within the various rail options. Most	**WRC** It is not apparent whether a detailed study on the aquatic fauna has been undertaken. The PER has made mention (Page 6.34) that three fish species have been observed opportunistically. Further investigation is required to define the species richness and abundance of aquatic fauna especially within the permanent pools of Weeli Wolli springs.	There is not expected to be any regionally significant loss of fauna habitat, based on the predicted impacts on vegetation communities. In addition, the draft EMP sets out the usual measures to reduce impacts on fauna, such as: • minimising clearing; • covering holes that may trap fauna; • progressive rehabilitation; • workforce induction; and • periodic monitoring of rehabilitated areas. Due to the limited potential for impacts, if water flows to Weeli Wolli Spring are maintained as proposed, no systematic survey of the aquatic fauna of Weeli Wolli

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	habitats are well represented in the region. Those that are not are related to Priority fauna species.		springs was undertaken as part of the current assessment. However, the species currently known to occur in the system are widespread and common within the major drainages of the Pilbara. **Factor does not require further EPA evaluation.**
Terrestrial Fauna — Specially Protected (Threatened) Fauna	A number of specially protected fauna have been found, or are expected to occur, on the mine site or rail routes. These are: • Mulgara (Schedule 1); • Pilbara Olive Python (Schedule 1); • Golden Horseshoe-bat (Schedule 1); • Peregrine Falcon (Schedule 4); • Major Michell's Cockatoo (Schedule 4); • Long-tailed Dunnart (Priority 4); • Ghost Bat (Priority 3); • Grey Flacon (Priority 4); • Square-tailed Kite (Priority 4); • Grey Honeyeater (Priority 4); and • Bush Stonecurlew (Priority 4) • Western Pebble-mound Mouse (Priority 4); • Lakeland Downs Mouse (Priority 4)	No comments received.	Impacts on specially protected fauna in the mining area will not be significant since habitats within the mining area are well represented elsewhere. However, this is not true of all the rail route options and so further evaluation is required of the rail route options and the process for making a final choice. **Considered to be a relevant environmental factor and is discussed under the factor "Railway connection".**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Once again, most impacts are expected to result from loss of habitat. Within the rail routes identified in the PER, the: • gilgai at the northern end of the HI route; • sandplain of the north eastern corridor; are significant because they are likely habitat for specially protected fauna, and are either not well represented, or not well understood.		
Subterranean Fauna	Dewatering operations have the potential to affect stygofauna within those areas affected by groundwater drawdown and dewatering discharge. Two stygofauna habits are associated with these areas. A calcrete area between the mine and Weeli Wolli Spring is within the drawdown area, although sampling to date has not detected any stygofauna here. Stygofauna has been recorded in the interstitial gravel habitat of Weeli Wolli Spring where dewatering discharge will occur.	**WA Museum** The project will directly impact on the Weeli Wolli calcrete area (that occurs below the water table: 6.5.1) as a result of drawdown of water from mine dewatering. It would be unsafe for the project to advance further until the nature and distribution of the stygofauna in the Weeli Wolli calcrete area has been established. A biodiversity "hotspot" occurs in a similar area nearby in the region. Endemic stygofauna are known to be associated with the Weeli Wolli calcrete area. It would be unsafe to deal with this issue by monitoring impacts as the mine develops; there needs to be substantial work conducted on the groundwater ecosystem(s) with sufficient lead time to do the detailed scientific work necessary for an informed decision. Little is known about the functioning of these groundwater ecosystems and the proposal to reinject water or augment spring flow is based on no evidence that it would be effective for stygofauna or the reminder of the aquifer ecosystem. There is evidence to suggest that groundwater flow and direction can have a considerable impact on stygal communities. Re-injection or augmentation is also likely to affect the	**Considered to be a relevant environmental factor**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		hydrogeochemistry. The work cited in the PER as the authority for the distribution of stygofauna in the region (Eberhard and Humphreys 1999) effectively did not examine the distribution of stygofauna within the calcrete owing to the lack of access, and so is inadequate. Sampling carried out elsewhere in the Pilbara has demonstrated that, despite stygal communities being endemic to given calcrete area, they are not uniformly distributed within them, indeed the distribution of species appears clumped. The distribution of the underlying karstic dolomite (6.5.1) is not shown: it may provide open conduit flow in the groundwater, which is not concordant with surface drainage catchments. **CALM** What impacts will water temperature, TDS and turbidity have on limestone caves (calcrete), invertebrates (stygofauna), and other fauna and plants? The failure to address the regional significance of stygofauna likely to be impacted by the project is an inadequacy of the PER document. It is very difficult to assess what impacts this project will have on the environment when there is no regional context for the project or information on the biota present in the project area and the representation of such biota on the conservation estate. Commitment 10 should include reference to ensuring that the data contributes and is assessed in a regional context.	
Watercourses	The Hope Downs mining area is closely associated with Weeli Wolli Creek and its tributaries. Mining of Hope North will require the diversion of the South West	**Pilbara Development Commission** While sections 6.5 and 6.6 of the PER outline a fairly comprehensive strategy to prevent changes to groundwater and surface waters, the Commission would like to be informed of what contingency plans the	The mining areas will affect a small proportion of the catchments of the West Tributary and South West Tributary of the Weeli Wolli Creek. Although there will be localised effects through interruption of

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Tributary. Dewatering of the mine pits has significant potential to affect Weeli Wolli Spring, a permanent water body fed by groundwater. Dewatering operations will disturb the groundwater system supporting the spring. Excess water from dewatering will be discharged to the spring. The rail connection will cross a number of creeks, tributaries, and flood plains. The rail embankment will disturb drainage flow and could cause upstream flooding, downstream drainage effects, and scour.	proponent has in case these strategies do not work. **WRC** The proponent does not address the issue of possible increased peak surface flow during rainfall periods as a result of the groundwater system being "fully topped up" and therefore possibly less infiltration and more surface flow. **CALM** A predicted outcome of the rail design through "appropriate sizing of bridges and culverts" is "Maintenance of surface water flow" (no drainage shadow effect). This is impossible to achieve. The best that can be done is to reduce these impacts through good design, including maximum opportunity for water to pass across the rail alignment. **Public** There is concern at the prospect of large volumes of water may be discharged into Weeli Wolli Creek in the event that discharge down the creek becomes necessary as a consequence of operational limitations alternative disposal mechanisms (the ASR option) or infrastructure breakdown. This may directly affect future mining activities downstream of the Hope Downs area and may invalidate water quality assumptions that are already incorporated into approved mine closure plans.	minor drainage lines there will be little permanent loss of surface water to the creek system. A short section of the South West Tributary (from the Hope North Pit to the main creek) will be cut off as a result of mining. In the long-term, water that would have flowed through this section will be diverted to the South Tributary or it may be allowed to discharge into the Hope North pit, depending on further consideration of the effects on the groundwater system. The impacts of any increased flow at the spring due to dewatering discharge would not be significant. The maximum discharge rate would case an increase in stream height of 9 centimetres and extend surface water flow downstream for several kilometres. A similar situation exists at the Marillana and Yandi operations of BHP and Hamersley Iron. Impacts on surface water flow due to the railway can be reduced to acceptable levels by appropriate route choice and drainage structures. The PER sets out design standards for drainage structures (culverts and bridges) that will not substantially impede surface water flow. Avoidance of areas of sheet flow (which are difficult to provide adequate drainage structure for) is one of the factors to be taken into account when selecting the rail route.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			The potential for the proposal to affect Weeli Wolli Spring due to changes in the groundwater system requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor of "Weeli Wolli Spring".**
Groundwater quantity	Mining of ore below the water table will require a large dewatering operation over the life of the mine. This will lower groundwater levels for several kilometres around the mine. This change to the groundwater system will disrupt the normal supply of water to Weeli Wolli Spring, which would cease to exist if not artificially maintained. In order to maintain surface water flow at Weeli Wolli Spring, the proposal includes a discharge (and possible groundwater storage) operation during mining and for 20 years after mining. Post mining, backfilling of the mine pit and importing of water into the groundwater system is proposed to restore the groundwater system to its pre-mining state.	**WRC** While the Commission is pleased to see innovative options such as the ASR project considered, it has some doubts as to the ability of this scheme to provide the necessary volume of the 20-year period. The only alternative source of available water appears to be the dewatering discharge from the BHP and HI mining operations at Yandi. The PER does not include any environmental impact assessment of such an option (i.e. pipeline route and area from which water would be removed). Further comments on ASR from WRC (letter dated 30 November 2000): The concept of artificially recharging any excess water is however supported as it will help to counter the dewatering cone of depression along the valleys in the upper catchment (eg the southern flank where under normal circumstances the modelling has shown a possible lowering of the water table of as much as 20 m). This could possibly allow the proponent to pump water from this area after mining ceases for recharge in the calcrete area (still within the same aquifer system, but closer to the centre of the cone of depression and the spring)." Any ASR scheme would also have to be restricted to the Southern Flank Valley as the other areas shown in Figure 6.20 impact on other	The potential for the proposal to affect Weeli Wolli Spring due to changes in the groundwater system requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor of "Weeli Wolli Spring".**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		mining areas/companies. Raising of the water levels in these areas could have implications for future mining activity in these areas. The Hope Downs mining activity will definitely impact on the planned Area C borefield which was to supply the BHP operations with process water for at least the first 7 years of operations. This water requirement will therefore have to be made good by Hope Downs from their dewatering discharge. (Water and Rivers Commission) **CALM** The impact of water supply (after year 7) to mining in Area C has not been considered. If this occurs then less water will be available to augment Weeli Wolli (see pages 6.9 "Cumulative Impacts" & 6.1). How much water would Area C require? The 'Do Nothing' option with respect to mine dewatering (pg. 6.10) would not be acceptable. (Department of Conservation and Land Management) **Conservation Council** The PER should not be assessed until a full evaluation of the water bodies in BHP's Area C and re-injection characteristics have been assessed. There is no evidence that re-injection back into the dolomite zones in this area of the Pilbara is possible. No supporting information has been made available showing that the porosity of the dolomite in the region will accept the proposed re-injection from the Hope Downs proposal. Dewatering activities that take place at the Hope Downs mines must factor in the cumulative effect of the proposed mining and associated dewatering on the 12 listed mines of ML 244 SA. All of these are within, and would impact upon, the Weeli Wolli catchment and	

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		aquifer. **Pilbara Development Commission** Given the potential for dewatering to affect the pastoral industry, the Commission believes that HDMS should consult closely with Marillana Station. The Commission understands that some concerns have been expressed over potential conflict between possible areas for the Aquifer Storage and Recovery Strategy and potential ore bodies in the area.	
Landform	The proposal will cause permanent changes to the landscape due to the construction of open pits, waste dumps, and the railway formation. Pits will cover an area of 645 ha and be backfilled to a level so that there is no standing water. This will result in pits with an average depth of 60 m (Hope North) and 45 m (Hope South). Remaining waste dumps will cover an area substantially less than 700 ha (as much will be backfilled into pits) and will be battered to 20° or less. Construction of the railway will create a continuous railway embankment over most of its length, with some areas of cut or	**CALM** Rehabilitation Criteria indicates that the rail formation will be retained at the end of mining. CALM's preference is that the rail formation be removed and the land put back to its original profile.	Permanent changes to the landscape will not result in landforms greatly different to those in the surrounding areas. Waste dumps will be contoured to resemble nearby hills and the pits will have accessible internal benches and revegetated floors. The mining area is not visible from any populated areas or major public roads. Parts of the railway connection will be visible from public roads. Due to terrain in these areas, the railway formation is not expected to affect the visual amenity of any landscape features. **Factor does not require further EPA evaluation**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	fill. The railway embankment will generally be left in place on decommissioning, except in areas where the natural pre-construction surface hydrology needs to be reinstated.		
POLLUTION			
Particulates / Dust	Dust will be generated through mining, ore handling, ore processing, and from unsealed roads. Although it has not been found in the orebody to date, it is possible that material containing asbestos fibres may occur within the mine pit and be exposed or disturbed.	No comments received.	Standard dust suppression measures will be applied to the mine site and processing facility. Dust is a health hazard and can smother vegetation. On the mine site dust is managed to health and mine safety requirements. This is expected to be adequate protection for vegetation as well in this case. Area where asbestos may be present will be identified. Protective health measures will be taken and exposed areas will be covered at the end of disturbance. **Factor does not require further EPA evaluation.**
Greenhouse gases	Carbon dioxide (CO_2) will be the only significant greenhouse gas emission from the proposal. CO_2 will be produced by: • fuel used in the mining and transport of ore; • decomposition of cleared vegetation;	**DME** While two options are presented for power generation, the use of power from a gas-fired power station is the preferred option. (Department of Minerals and Energy)	At the predicted emission levels this project will be a moderate contributor to State greenhouse gas emissions. The issue of "Greenhouse gas emissions" will be included in the EMP (refer to Commitment 2). The EPA expects the EMP to include reporting and continuing

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	• use of explosives; and • fuel used offsite to produce electricity for the ship loading, at rate of up to 350 000 tonnes per year.		investigations of options to reduce greenhouse emissions throughout the life of the project. **Factor does not require further EPA evaluation.**
Surface water quality	Surface run-off from project areas may pick up pollutants or high sediment levels. Dewatering discharge at Weeli Wolli Spring will reflect groundwater quality in the aquifers being dewatered.	**Conservation Council** Discharged water would have the ability to create surface flow over and through loose scree ore increasing its turbidity. This is turn could impact on the water quality of the Weeli Wolli Spring and or exposed water bodies in the Weeli Wolli pass. **WRC** The Water Management Plan will have to address the issue of dewatering discharge water quality control. The assumption is that the quality of the dewatering discharge and imported spring supplementation water will be the same as the current groundwater entering the spring system and will remain constant over the full 40 years. **Conservation Council** Any water extracted from the aquifer and allowed to dissipate over the surface will suffer extreme evaporation, reducing its net volume and value, as well as suffering an increase in its salinity levels. **CALM** What monitoring will be done to ensure that the water discharged back into Weeli Wolli Spring is of an appropriate quality (there is a risk of pollutants cycling through the mine groundwater and then back to Weeli Wolli Spring by re-injection)?	Water released from the site will be discharged through appropriate sediment reduction controls. Hydrocarbons and oily waste will be managed through appropriate storage and handling procedures, clean-up procedures for spills, and environmentally acceptable recycling or disposal of waste. Any off-site discharge of water will be subject to licence conditions under Part V of the *Environmental Protection Act 1986*. These conditions will specify appropriate limits for pollutants likely to be generated on-site. Dewatering discharge water quality requires further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor "Weeli Wolli Spring".**
Groundwater quality	Depending on the closure options	No comments received.	Backfilling of the pits to prevent standing

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	the final mine voids has the potential to expose groundwater to evaporation and thereby increase salinity. Hydrocarbon spills can enter the groundwater.		water will prevent the major potential impact on groundwater quality, that of increased salinity due to increased rates of evaporation in the final pit void. Proper management of hydrocarbons on the mine-site is included in the draft EMP. **Factor does not require further EPA evaluation.**
Noise	Mining and rail transport operations will increase the ambient noise levels in nearby areas. Mining plant and equipment, blasting activities, and train movements will generate noise. The nearest residence will be the Hope 1 Camp. which is remote (> 2 km) from mining activities.	No comments received.	Remoteness of the project will ensure that it will readily comply with the *Environmental Protection (Noise) Regulations 1997*. **Factor does not require further EPA evaluation.**
Solid waste	About 50 Mm^3 of waste rock will be remain out of the pit at the end of mining. Due to the geology of the orebody, this material has little potential to generate acid mine drainage. Miscellaneous non-hazardous wastes (scrap metal, tyres, wood, paper, and domestic solid waste) not suitable for recycling will be disposed of in a properly constructed and licensed landfill. The accommodation village will	No comments received.	The following waste management practices will be employed: • the accommodation village will have a sewerage treatment plant; • recyclable waste will be periodically removed by a contractor; and • domestic and industrial solid waste will be buried in a landfill site to be constructed to DEP code of practice standards. **Factor does not require further EPA evaluation.**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	have a sewerage treatment plant.		
SOCIAL SURROUNDINGS			
Culture and Heritage — Aboriginal culture and heritage	Aboriginal heritage surveys have been conducted over the mine site areas and a number of sites recorded. One of the archaeological sites (known as the Malea rockshelter) is of high cultural and archaeological significance. Material found at this site provides the first evidence of human presence in the Pilbara between 18 000 and 10 000 years BP (before present). This site is within the planned Hope North Pit. Two ethnographic sites (two distinctive trees and a possible burial site) occur within the mine site but will not be disturbed by mining. Weeli Wolli Spring and its surrounds are of major mythological and ceremonial importance. Preliminary ethnological surveys have been conducted of the railway routes. Although the	No comments received.	The EPA notes that significant archaeological sites would be affected by mining and that this will require Approval under the *Aboriginal Heritage Act* 1972. The proponent has indicated it will undertake archaeological work to salvage archaeological material and increase knowledge of the past history of the region. In developing these plans for submission to the Aboriginal Cultural Materials Committee, the proponent has committed to consult with the Banyjima, Nyiyaparli and Innawonga Elders (Commitment 14) The cultural importance of Weeli Wolli Spring is noted and is one of the attributes that establish the spring as highly significant area that must be protected from detrimental impacts. Provided environmental impacts on the spring can be prevented (this is evaluated under the relevant factor "Weeli Wolli Springs)", then impacts on Aboriginal heritage and culture will relate to ability to access the site. The proponent has indicated that special access provisions will be made with the traditional owners as part of the Heritage Management Plans developed under

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Aboriginal consultants identified no fatal flaws, they expressed a preference for routes away from Weeli Wolli Creek.		Commitment 13. Aboriginal Heritage and Culture is an import factor to be addressed when considering the rail route options and the process for making a final choice. Therefore further evaluation is required. **Considered to be a relevant environmental factor and is discussed under the factor "Railway connection".**
OTHER			
Decommissioning and rehabilitation	In addition to the usual progressive rehabilitation plans consistent with best practice environmental management in mining, this proposal has identified a number of mine closure requirements necessary to maintain the environment of Weeli Wolli Spring. These requirements are: • that both mine pits must be backfilled so that there is no generation of standing water; • flood waters from the south west tributary be diverted into the back filled pit for at least 20 years to enhance groundwater recovery;	**WRC** The Water and Rivers Commission considers that the proponent has correctly identified the environmental water requirements at Weeli Wolli Spring as a key issue and has gone to great length in modelling the system and proposing a management strategy. However, no mining should be allowed until there is more assurance that the proponent has the ability to meet certain commitments which are going to come at significant cost. Of major concern to the Commission is the necessity for the proponent to continue artificially sustaining the spring system for some 20 years after mining has ceased. The Commission is not particularly keen to see proponents who do not have any other long-term mining operations in the Pilbara, with such lengthy environmental liabilities. It is also strongly recommended that the State be very closely involved with the environmental monitoring programme, should mining take place. The Commission notes that in the PER the commitment is made to backfill the Hope North void, yet in several sections (eg	CALM's comments on topsoil management and railway rehabilitation are adequately addressed in the proponent's response to submissions. The issues will be dealt with further through revisions of the EMP and development of a Mine Closure Plan (Commitments 2 and 11) for which CALM is an advising agency. The Conservation Council's comments on the proponent's past environmental performance have been investigated and responded to by the proponent in detail. The proponent has investigated the history of each instance and has evaluated the current need for any remedial work. Its conclusion is that while past practices were in some cases substandard, the areas are now adequately rehabilitated and no additional work is required at this time, nor would it improve the outcome.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	and • importing up to 40 ML/day of water into the catchment until the groundwater system has returned to its pre-mining state (approximately 20 years); • maintaining direct discharge to Weeli Wolli Spring over the recovery period.	decommissioning strategy on Page 6.17) the suggestion is made that, if at all possible, the void will not be backfilled. This is not a negotiable issue, as the void must be backfilled to above the original groundwater level to prevent salinisation of the groundwater and in turn the spring. **CALM** What conditions will ensure the maintenance of Weeli Wolli Spring past the 20-year maintenance period? The environmental impacts of the water abstraction are not fully addressed, particularly with respect to decommissioning and augmentation of Weeli Wolli Spring. Potential impacts and their management – paragraph 2: indicates that if topsoil is not available then areas will be left to be colonised by wind borne seed or by hydro mulching seeding. CALM will be looking to have the maximum use made of topsoil and if there is no topsoil, then the area must be seeded with seed collected from the surrounding flora (i.e. seed must have been collected from an area within 50 kilometres of the mine). Materials Management and Rehabilitation. This section indicates that all vegetation and topsoil will be removed on the preferred rail alignment. There are potentially large volumes of material that will be produced by this commitment, and few areas for this material to be directly utilised in the short term. No indication is given on the areas that may need to be disturbed to store these materials. Also the time frames for storing this material during the life of the railway may be 20+ years. There should be a commitment to minimise the need for borrow pits. This can be achieved by using overburden from the mine areas where practical and balancing cut and fill in other areas. Backfill of the Hope North pit will not be done if it can be	The additional requirements necessary to prevent long-term impacts on Weeli Wolli Spring and mechanisms to ensure these requirements are implemented require further evaluation. **Considered to be a relevant environmental factor and is discussed under the factor "Weeli Wolli Spring".**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		demonstrated that the Weeli Wolli spring flow can be maintained by an alternative means. The backfilling of this pit should be done irrespective of the outcome of flows at Weeli Wolli springs. A commitment should be established for the backfilling of any pits to cover exposed water tables. **Conservation Council** A realistic bond should be established to ensure reparation of the water body during the proposed 15-year, remediation process. Prior to approval for this or any project by Hancock Prospecting Pty Limited (the ultimate holding company for Hope Downs Pty Ltd) a commitment to environmental management be established by a commitment to the clean up of the environmental harm created in the Pilbara by this group of companies. The Council is aware of a number of instances where the company has caused environmental damage without seeking appropriate approvals and where no rehabilitation has subsequently been carried out. **DME** The Department recommends that rehabilitation of disturbed areas should be undertaken on a progressive basis wherever possible. As part of this progressive rehabilitation a mine closure plan should be developed and continually updated over the life of the project as part of the Environmental Management System process.	

Appendix 4

Recommended Environmental Conditions and

Proponent's Consolidated Commitments

Statement No.

RECOMMENDED ENVIRONMENTAL CONDITIONS

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)

Assessment Title: HOPE DOWNS IRON ORE MINE, 75 KM NORTH-WEST OF NEWMAN, PILBARA REGION

Proposal: To establish an iron ore mine in the Hope Downs area, including facilities for limited processing of the ore, and a rail connection from the mine to an rail network for the transport of iron ore product to the coast, as documented in Schedule 1 of this statement.

Proponent: Hope Downs Management Services Pty Ltd

Proponent Address: Level 1, 34 Colin Street
WEST PERTH WA 6005

Assessment Number: 1308

Report of the Environmental Protection Authority: Bulletin 1024

The proposal referred to above may be implemented subject to the following conditions and procedures:

1 Implementation and changes

1-1 The proponent shall implement the proposal as documented in schedule 1 of this statement subject to the conditions of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment and Heritage determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment and Heritage determines, on advice of the Environmental Protection Authority, is not substantial, the proponent may implement those changes upon receipt of written advice.

2 Proponent commitments

2-1 The proponent shall implement the environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments that the proponent makes as part of the fulfilment of the conditions in this statement.

3 Proponent nomination and contact details

3-1 The proponent for the time being nominated by the Minister for the Environment and Heritage under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment and Heritage has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.

3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.

3-3 The nominated proponent shall notify the Department of Environment, Water and Catchment Protection of any change of contact name and address within 60 days of such change.

4 Commencement and time limit of approval

4-1 The proponent shall provide evidence to the Minister for the Environment and Heritage within 5 years of the date of this statement that the proposal has been substantially commenced or the approval granted in this statement shall lapse and be void.

Note: The Minister for the Environment and Heritage will determine any dispute as to whether the proposal has been substantially commenced.

4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond 5 years from the date of this statement to the Minister for the Environment and Heritage prior to the expiration of the 5 year period referred to in condition 4-1.

4-3 The proponent shall demonstrate in the application required by condition

4-2 that:

- environmental factors of the proposal have not changed significantly,
- new, significant, environmental issues have not arisen, and
- all relevant government authorities have been consulted,

to the requirements of the Minister for the Environment and Heritage, on advice of the Environmental Protection Authority.

Note: The Minister may consider the grant of an extension of the time limit of approval not exceeding 5 years for the substantial commencement of the proposal.

Environmental conditions

5 Compliance Audit and Performance Review

5-1 The proponent shall prepare an audit program in consultation with and submit compliance reports to the Department of Environment, Water and Catchment Protection that address:

- the implementation of the proposal as defined in schedule 1 of this statement;
- evidence of compliance with the conditions and commitments; and
- the performance of the environmental management plans and programs.

Note: Under sections 48(1) and 47(2) of the Environmental Protection Act 1986, the Director General of the Department of Environment, Water and Catchment Protection is empowered to audit the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement. Usually, the Department of Environment, Water and Catchment Protection prepares an audit table that can be utilised by the proponent, if required, to prepare an audit program to ensure the proposal is implemented as required. The Director General is responsible for the preparation of written advice to the proponent, which is signed off either by the Minister or, under an endorsed condition clearance process, a delegate within the Environmental Protection Authority or the Department of Environment, Water and Catchment Protection that the requirements have been met.

5-2 The proponent shall submit a performance review report every five years after the start of the operations/development phase to the Minister for the Environment and Heritage on advice of the Environmental Protection Authority, which addresses:

- the major environmental issues with the project, the objectives for those issues, the methodologies used to achieve these, and the key indicators of environmental performance measured against those objectives;
- the level of progress in the achievement of sound environmental performance, including industry benchmarking and use of best available technology where practicable;

- significant improvements gained in environmental management, including the use of external peer reviews;
- the proposed environmental objectives over the next six years, including improvements in technology and management processes; and
- stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed.

Environmental Conditions

6 Subterranean Fauna Sampling Plan

6-1 Prior to commencing dewatering operations, the proponent shall develop a Subterranean Fauna Sampling Plan for the respective area to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Conservation and Land Management, and the Western Australian Museum.

The objective of this Plan is:

- to increase scientific knowledge about subterranean fauna to assist in the conservation of this element of the environment.

This Plan shall address:

1 subterranean fauna surveys of the areas to be affected by dewatering operations to assist in establishing the conservation significance of any species within the affected areas;

2 characterisation of subterranean fauna habitats to be affected by dewatering and identification of similar subterranean fauna habitats outside the affected areas;

3 subterranean fauna surveys of similar habitats outside the areas to be affected by dewatering operations to assist in establishing the conservation significance of fauna within the areas to be affected; and

4 specific measures to record and preserve biological information on any species collected in the project area.

6-2 The proponent shall implement the Subterranean Fauna Sampling Plan required by condition 6-1.

6-3 The proponent shall make the Subterranean Fauna Sampling Plan required by condition 6-1 publicly available, to the requirements of the Environmental Protection Authority.

6-4 The proponent shall submit the results from the Subterranean Fauna Sampling Plan to the Environmental Protection Authority, the Department of Conservation and Land Management, and the Western Australian Museum.

6-5 In the event that the Environmental Protection Authority consider, based on the results of the Subterranean Fauna Sampling Plan, that its objective would be compromised, then the proponent shall develop an action plan to the requirements and timing of the Environmental Protection Authority.

Note

1 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

Schedule 1

The Proposal

The proposal is to establish a new iron ore mine in the Hope Downs area (Area A of the *Iron Ore (Hope Downs) Agreement Act* 1992) and a rail connection from the mine to a rail network for the transport of iron ore product to the coast (Figure 1 shows the mine site on a regional map).

The project has the following main components:

- conventional open pit mining of both the Hope North and Hope South orebodies (Figure 2);
- ore processing, stockpiling, and reclaiming facilities at the mine site; and
- a rail connection to either the BHP main line, the Hamersley main line or the proposed West Angelas line (Figure 3).

Both deposits involve mining below the water table and therefore a substantial dewatering operation will be required during mining.

Critical to the prevention of unacceptable impacts on Weeli Wolli Spring as a result of the dewatering operation are the following management strategies:

1. maintenance of spring flow by direct discharge of up to 18 000 kilolitres per day to the spring during dewatering; and
2. in the long-term:
    (a) backfilling of the mine pits to above the water table level; and
    (b) a 20 year post-mining phase where approximately 40 000 kilolitres per day is pumped into the spring and the dewatered groundwater system, until the natural groundwater system has been re-established (this water will come from outside the catchment of the project area).

Key Characteristics Table

Characteristics	Hope North and Hope South
Mine and Processing	
Construction period	Approximately 2 years
Project life	Approximately 20 years
Ore reserves	400 Mt
Ore mining rate	up to 25 Mtpa
Average pit depth	240 m (North), 130 m (South)
Mining below the water table	60% (North), minor pods (South)
Maximum overburden movement during life of mine	98 Mm_ (Hope North), 103 Mm_ (Hope South)
Maximum overburden at end of mining	49.5 Mm_ (Hope South)
Low grade stockpiles	7 Mt (maximum)
Average stripping ratio (average ratio of ore to overburden for north and south deposits)	1:1.42
Processing facilities/materials handling	Primary crusher Secondary dry screening and crushing Product stockpiles. Train load out facilities. Rail spur to existing railway (depending on option selected) Conveyors. Stackers and reclaimers.
Infrastructure	
Power	15 MW, diesel
Water	5.8 ML/day (2.1 GLpa)
Airstrip	Existing airstrip at Hope North
Roads	General traffic, ore truck, mine access, and rail and conveyor access.
Railway connection	Connection to existing iron ore railway (up to 75 km)
Buildings	Administration, maintenance workshops, storage and village.
Sewage	Sewage treatment plant (village), septics (other).
Dewatering	
Rate	30 to 110 ML/day
Disposal of excess	To Weeli Wolli Spring To sustain ecological requirements Aquifer storage with recovery post mining
Disturbance Areas	
Area of pits	349 ha (North), 296 ha (South)
Waste dumps	328 ha (North), 368 ha (South)
Other mine infrastructure	235 ha
Total area disturbed (mine)	1,600 ha
Area rehabilitated	1,340 ha
Average width of rail corridor	25 m
Length of rail corridor	Up to 75 km (depending on option selected)
Rail corridor disturbance	Up to 200 ha
Workforce	
Construction	500 peak
Permanent	Up to 300 fly in/fly out

Note: km kilometre; ha hectare; Mt million tonnes; Mtpa million tonnes per annum; ML/day million litres per day; GL/a gigalitres per annum; MW megawatts; Mm^3 million cubic metres

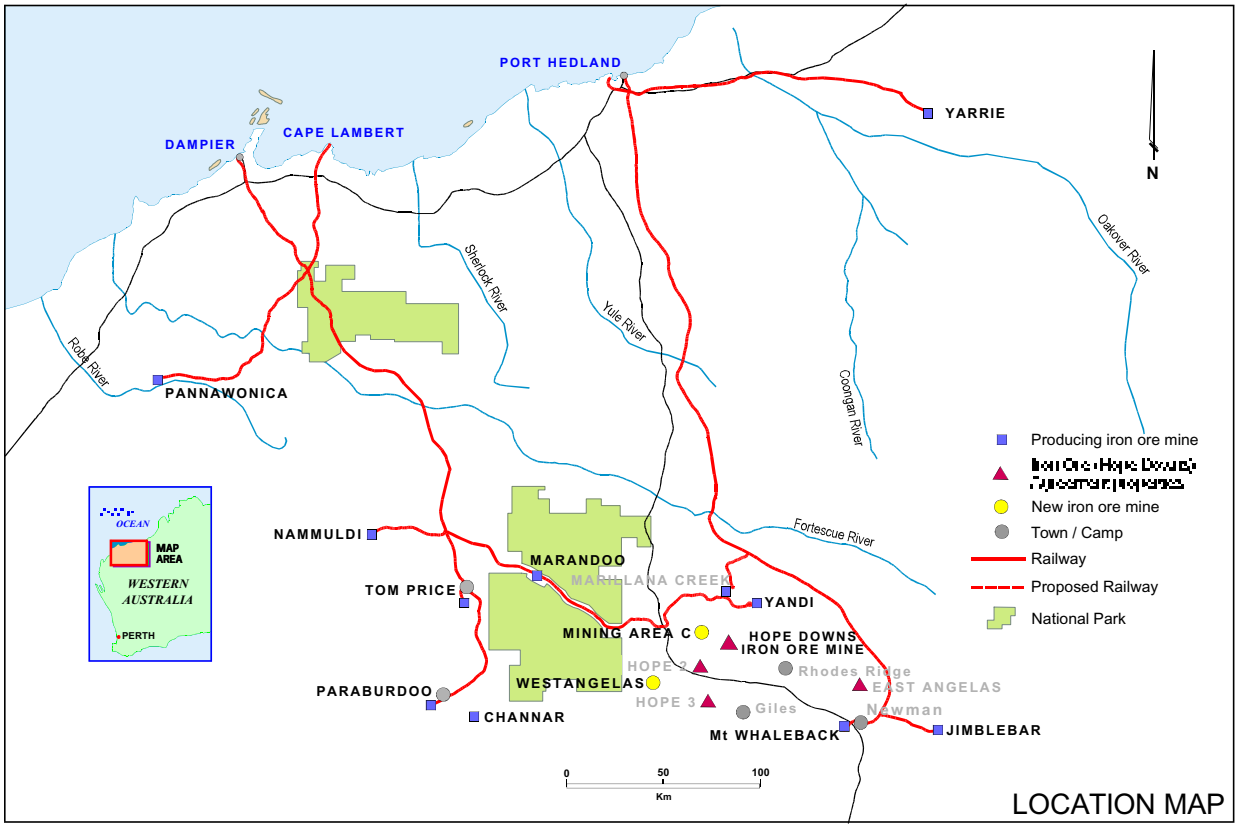

Figure 1: Location map.

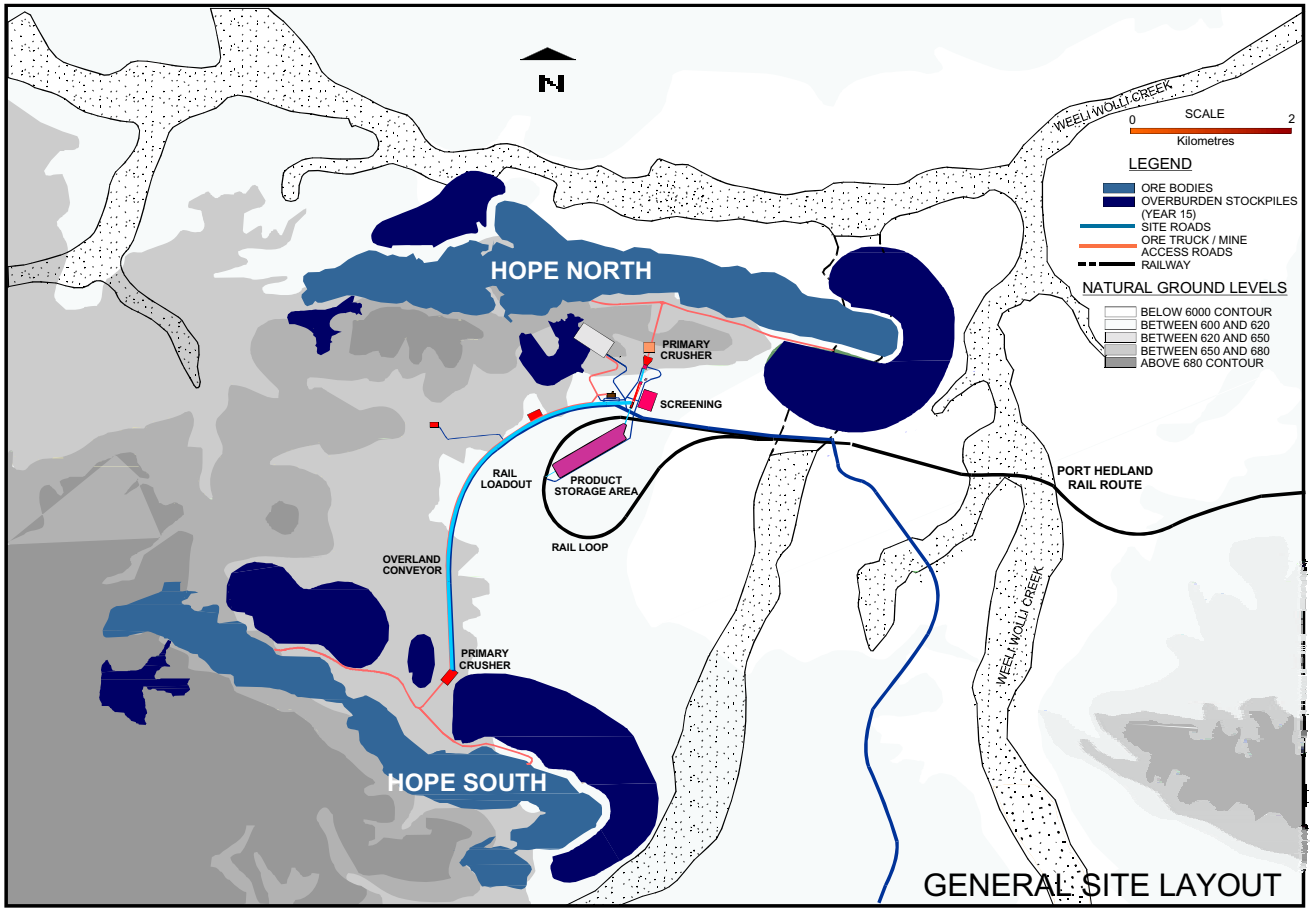

Figure 2. Site layout.

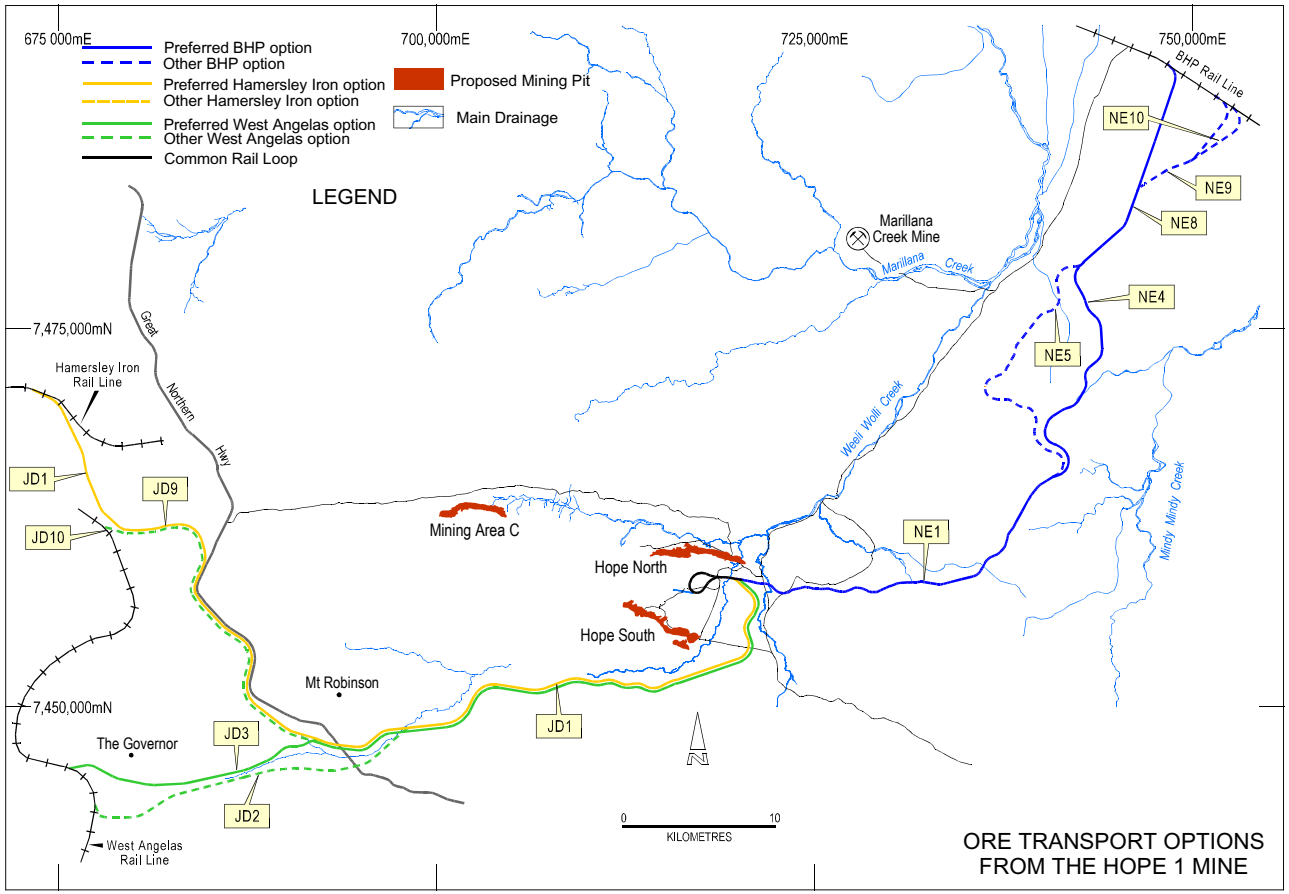

Figure 3. Rail connection options.

Schedule 2

Proponent's Environmental Management Commitments

30 July 2001

Hope Downs Iron Ore Mine, 75 km north-west of Newman, Pilbara Region (1308)

Hope Downs Management Services Pty Ltd

Proponent Commitments

No.	Commitment	Objective	Action	Timing	Whose advice	Measurement/ compliance criteria
1	Prepare and implement an Environmental Management System (EMS) for the project	To manage the relevant environmental factors and to fulfill the requirements of the Conditions and procedures in the Ministerial Statement.	The EMS will include: • an environmental policy and corporate commitment to the EMS • planning to meet environmental requirements • specification and implementation of actions to meet environmental requirements • measurement and evaluation of environmental performance • review and improvement of environmental outcomes The Management Plans identified below will form part of the EMS.	A Construction Phase EMS will be completed prior to construction commencing. An Operations Phase EMS will be substantially completed prior to operations commencing.	Accredited assurance service.	Evidence of 1st party audits annually and 3rd party audits after certification to ISO14001 or equivalent where the scope covers the EPA's environmental factors.
2	Prepare, implement and regularly revise a Life of Project Environmental Management Plan. (EMP)	To manage the potential impacts of the construction and operations phases of the project.	The EMP will contain plans, guidelines and procedures to manage environmental issues associated with construction and operation of the project including: • surrounding environment. • vegetation clearing and management • overburden storage • surface water quality and quantity • groundwater quality and quantity • flora and fauna particularly introduced species • Aboriginal heritage • Greenhouse gases • dust and noise • fire • waste and hazardous materials • decommissioning and rehabilitation • contracting • continuous improvement	A Construction Phase EMP will be prepared prior to construction commencing. An Operations Phase EMP will be prepared prior to commissioning.	DME, DRD, CALM, WRC and MRD (depending on the project component).	EMP implemented and regularly revised. Results provided in annual and triennial reports.
3	Prepare and implement a Water Management Plan.	To manage the potential effects of operations on the surface and groundwater regimes and any dependent ecological systems	The Water Management Plan will contain plans, guidelines and procedures to manage environmental issues relating to the potential effects of operations on the surface and groundwater regimes and any dependent ecological systems. The Water Management Plan will incorporate the strategies outlined in Commitments 5 to 9.	Prior to the commencement of mining.	WRC and CALM.	No project induced, major long-term adverse effects on the surface and groundwater regimes and any dependent ecological systems. Results provided in annual and triennial reports.
4	Prepare and implement a Groundwater Monitoring Programme.	To confirm the extent and magnitude of groundwater drawdown.	To manage the effects of the operations on regional groundwater, particularly in areas potentially affected by drawdown, including Weeli Wolli Spring.	Prior to the commence-ment of mining.	WRC and CALM.	Results provided in annual and triennial reports.

No.	Commitment	Objective	Action	Timing	Whose advice	Measurement/ compliance criteria
5	Prepare alternative water management strategies and implement and refine as required.	To ensure that spring flow at Weeli Wolli Spring is not significantly affected by mining.	Alternative water management strategies will be prepared. The strategies will be implemented should monitoring identify a project-induced, statistically significant long-term decrease in water level or mean monthly flow at Weeli Wolli Spring. Reinstatement and ongoing monitoring of Wee1i Wolli Spring low flow gauging station (GS 08016).	Prepared prior to the commencement of mining. Implemented and refined as required.	WRC and CALM.	No project induced major long-term impact on spring flow. Results provided in annual and triennial reports.
6	Prepare a Vegetation Monitoring Programme.	To monitor phreatophytic vegetation in Weeli Wolli Creek.	A Vegetation Monitoring Programme will be prepared and implemented to quantify any project-induced effects on phreatophytic vegetation within the project area.	Prepared and implemented prior to the commencement of mining. Monitoring to continue through to decommissioning.	WRC and CALM.	Results provided in annual and triennial reports.
7	Provide water supplementation to phreatophytic vegetation in the main Weeli Wolli Creek system, should vegetation monitoring indicate the need.	To maintain phreatophytic vegetation in Weeli Wolli Creek.	Strategies will be prepared to provide water supplementation to phreatophytic vegetation in areas along Weeli Wolli Creek. Should monitoring indicate that vegetation is being affected by dewatering drawdown these strategies will be implemented.	Prior to the commencement of mining. Water supplementation as required.	WRC and CALM.	No project-induced, major long-term adverse effect on phreatophytic vegetation at the Spring and within the main South branch of the Weeli Wolli Creek. Results provided in annual and triennial reports.
8	Design and implement flood diversion works.	To ensure that the project does not adversely impact on the surface water resources of the area.	Flood diversion works will be designed to maintain existing catchment flow volumes and quality. Existing flow paths will be maintained where possible. Decommissioning strategies may involve enhancing aquifer recovery through artificial recharge of flood flows in some sub-catchments.	Progressive development in relation to the stage of project development.	WRC and CALM.	No major project-induced impact on surface water resources. Results provided in annual and triennial reports.
9	Enhance the recovery of the groundwater system following mine closure.	To sustain phreatophytic vegetation and restore a self-sustaining spring flow at Weeli Wolli Spring within a reasonable period following mine closure (decommissioning period).	The Proponent will prepare and implement strategies to enhance the recovery of regional groundwater levels. This will include an investigation of the practicality of Aquifer Storage and Recovery. Should this prove practicable, any sites considered for ASR will be discussed and agreed with relevant Government agencies and other mining companies, if they are likely to be impacted by such activities.	Prepared prior to the commencement of mining Refined during mining operations (with the addition of monitoring data and further analysis).	WRC and CALM.	Monitoring of recovering groundwater levels and spring flows. Groundwater recovery to support a self-sustaining spring and phreatophytic vegetation. Results provided in annual and triennial reports during decommissioning period.
10	Undertake a comprehensive stygofauna sampling programme within the project area.	To establish the distribution and status of stygofauna species in a local and regional context.	Implement a Stygofauna sampling strategy, including taxonomic identifications and genetic studies as required. Confirmation by specialists of the status of the species involved.	Commencing at least 3 years prior to the start of mining.	CALM.	Understanding of the distribution of stygofauna species and their regional significance.

No.	Commitment	Objective	Action	Timing	Whose advice	Measurement/ compliance criteria
11	Backfill the Hope North and Hope South pits such that there is no generation of standing water unless a closure strategy can be developed and approved by Government approval that demonstrates that Weeli Wolli Spring flow can be maintained by an alternative means.	To ensure that Weeli Wolli Spring flow is self-sustaining following mine closure and there is no unacceptable deterioration in groundwater quality.	Backfilling of the Hope North pit will ensure that Weeli Wolli Spring flow is self-sustaining in the long term following mine closure. Investigate alternative strategies that will achieve the same objective and may not require 100% backfill to the pre-existing water table. Any alternative strategy will require acceptance and approval by government before being implemented.	Investigations will continue as necessary during the life of the mine. Prior to closure the final strategy will be developed and submitted to the relevant authorities for approval.	WRC. and CALM	Weeli Wolli Spring flow is self-sustaining in the long term.
12	Prepare and implement a Mine Closure Plan.	To ensure that a self-sustaining walk-away solution is implemented as soon as practicable following the completion of mining.	Prepare and implement a Mine Closure Plan to cover: • the removal of redundant infrastructure • rehabilitation • management of the final void • groundwater recovery and • post mining monitoring The plan will include an assessment of the need to import water following the cessation of mining to increase the rate of groundwater recovery.	Pre-construction identification of post-mining land uses. Progressive development in relation to the stage of project development.	WRC, CALM and DME.	Mine Closure Plan meets or exceeds regulatory requirements.
13	Consult with Banyjima, Nyiyaparli and Innawonga Elders in respect of additional Aboriginal site surveys in areas not already surveyed.	To identify any heritage sites.	Undertake additional surveys in areas not already surveyed within the Mining Lease area or Miscellaneous Licence areas that are likely to be disturbed or otherwise affected by mining operations or the construction of associated mining or transportation infrastructure.	Prior to the final design of mine or rail infrastructure or construction.	Banyjima, Nyiyaparli and Innawonga Elders.	Consultation with Elders on location of heritage sites and this information taken into account in route selection.
14	Prepare and implement an Aboriginal Heritage Management Programme.	To ensure that changes to the biological and physical environment do not adversely affect cultural associations with the area, to increase the cultural understanding of the area by implementing an ongoing programme of investigation and cultural management and to manage access to the important sites for purposes of their ongoing preservation.	Discuss and agree on an Aboriginal Heritage Management Programme with the Banyjima, Nyiyaparli and Innawonga people that protects cultural associations with the local area.	Prior to commencement of construction.	Banyjima, Nyiyaparli and Innawonga Elders.	Aboriginal Heritage Management Programme meets the requirements of the regulatory authorities and local people.

No.	Commitment	Objective	Action	Timing	Whose advice	Measurement/ compliance criteria
15	Consult with appropriate Aboriginal people in respect of heritage sites in the project area before any Section 18 (*Aboriginal Heritage Act* 1972) application is developed.	Consult with the appropriate Aboriginal groups regarding the necessary disturbance of sites.	Conduct consultations.	Prior to construction.	Banyjima, Nyiyaparli and Innawonga Elders as required.	Consultation conducted.
16	Submit the preferred rail option for review including the detailed design of the railway and associated infrastructure.	To ensure that all environmental and heritage issues are identified and addressed.	Undertake additional biological, physical and heritage studies on the preferred rail option. Overburden material will be used for embankment construction where this is practical in the vicinity of the mine area. Elsewhere, in line with normal engineering practice, where practicable cut and fill will be balanced to minimise the need for borrow pits.	Prior to construction.	CALM, WRC and appropriate Aboriginal Elders.	Final rail route selection and design review satisfies regulatory authorities and local people and is to Pilbara best practice.
17	Support and promote the free exchange of scientific information	To assist in a better understanding of biodiversity and regional impact	Provision of scientific data relating to flora and fauna baseline studies, hydrogeology and other studies undertaken as part of environmental reporting in a form that is compatible with and in line with best practice to enable the integration of this information into regional databases.	Contributions have already commenced and will be reviewed regularly	CALM, WRC, DEP	By agreement with CALM, WRC, DEP
18	The Proponent will undertake to assist where possible in the implementation of and supervision of compliance with management guidelines for Section 16 (*Conservation and Land Management Act 1984*) Agreements in respect of areas falling within the boundaries of its mining leases.	To improve management of conservation, recreation, heritage and research for the above areas.	Seek agreement with CALM and pastoral station owners on management guidelines and responsibilities for:- water resources, fencing, stock control, flora, fauna, fire management, rehabilitation, access and infrastructure, including roads, signage, management plans for areas of special significance (such as Weeli Wolli Spring) and future activities.	As soon as required.	CALM and pastoral station owners.	Compliance with management plans and guidelines.

Note: ASR Aquifer Storage and Recovery
CALM Department of Conservation and Land Management
DEP Department of Environmental Protection
DME Department of Minerals and Energy
DRD Department of Resources Development
WRC Water and Rivers Commission
MRD Main Roads Department

Appendix 5

Summary of Submissions and

Proponent's Response to Submissions

SUMMARY OF SUBMISSIONS AND RESPONSES ON HOPE DOWNS IRON ORE MINE, 75 KM NORTH-WEST OF NEWMAN, PILBARA REGION (8 WEEK PUBLIC REVIEW) (1308)

Weeli Wolli Spring

1 *The Water and Rivers Commission considers that the proponent has correctly identified the environmental water requirements at Weeli Wolli Spring as a key issue and has gone to great length in modelling the system and proposing a management strategy. However, much of this strategy is conceptual and requires further investigation once operations start. Although this approach is acceptable elsewhere, it may not be quite as acceptable at this locality, because of the environmental values of the Weeli Wolli Spring system. No mining should be allowed until there is more assurance that the proponent has the ability to meet certain commitments which are going to come at significant cost. Of major concern to the Commission is the necessity for the proponent to continue artificially sustaining the spring system for some 20 years after mining has ceased. The Commission is not particularly keen to see proponents who do not have any other long-term mining operations in the Pilbara, with such lengthy environmental liabilities.*

It is also strongly recommended that the State be very closely involved with the environmental monitoring programme, should mining take place. (Water and Rivers Commission)

(In subsequent correspondence the Commission further endorsed the work done in modelling the system advising in a letter to the DEP dated 30 November 2000 that the "groundwater modelling done to date is sound and the best that can be done with the existing data, current level of hydrogeological knowledge and currently available technology". The Commission goes on to say that further field work will allow the model to be further refined).

HDMS understands the concerns of the Commission and others regarding the need to ensure that, at the completion of operations at Hope 1, all necessary mine closure conditions are met to ensure that there are no long term environmental impacts at the Spring.

This matter has been discussed at length with the Department of Resources Development and the following positions established:

- Environmental bonds or financial guarantees are not usually sought from companies developing projects under an Agreement Act.

- Agreement Acts by their very nature are only granted to substantial companies that the Government believes are able to meet the development conditions required by the Act.

HDMS believes that both Iscor and Hancock have demonstrated, to the satisfaction of DRD, that they are companies with substantial financial backing. It should be noted that HDMS will be 80% owned by Iscor post the decision to proceed with the Project.

It should also be noted that, in September 2000, HDMS was granted Major Project Facilitation status through Invest Australia. Such status is only conferred by the Minister for Industry, Science and Resources on companies which have satisfied Federal Government requirements, including that of substance, that they qualify for such status.

Since the release of the PER, HDMS has undertaken substantial additional work on the mine closure plan with particular regard to the planning and scheduling of backfilling operations. These investigations have shown a considerable reduction in total backfilling requirements and, at the completion of operations at Hope North, it will only take just over three years to complete the backfilling of 190 million tonnes of waste into the North and South pits, assuming that the average material movement for the last five years of mining operations is maintained.

In this respect, it should be noted that the last five years of mining operations require uphill haulage from the deepest point in the pit to waste dumps or to the crusher. Backfilling operations by comparison are downhill and will involve dumping of material at RL 570, which is the level of the pre mining water table. This should be both faster and less expensive in unit rate terms. The overall cost of these operations is currently estimated to be $190 million.

After completion of operations at Hope 1, the agreement between Iscor and Hancock allows for development of the Hope 2 and Hope 3 deposits, which are within 20 kilometres and 30 kilometres of Hope 1 respectively, and can share much of the same infrastructure.

Reserves at Hope 2 and 3 are estimated to be in the vicinity of 170 million tonnes, which would sustain mining operations at the then current rate for over ten years.

The backfilling will clearly be achieved well within this time frame.

The other major elements of the mine closure plan are the construction of a pipeline, most probably from Marillana, to supplement recharge of the aquifer and the operation and maintenance of pumping operations for twenty years post mining.

The pipeline will in fact be constructed in the last two years of mining operations at Hope 1 and, thus, will already exist at the completion of mining operations.

Pumping is the only issue which may not be complete at the finalisation of operations at Hope 2 and 3, although there is potential for additional reserves to be found or for the participants to agree to develop one of the other deposits in the area in which Hancock Prospecting has an interest. In this case, mining operations by the joint venture may continue well beyond the currently projected 30-year period.

The cost of pumping operations averages approximately $500 000 per annum over the twenty year period.

Given the potential profits from the Project, at the completion of mining of Hope 1 when virtually all of the capital will have been amortised, it is unlikely that the participants would not proceed with the development of Hope 2 and 3.

If there is a concern that the companies would default on the cost of mine closure, which seems remote given the substance and reputation of the participants, there are several mechanisms in place which protect the State under such circumstances.

Hancock Prospecting Pty Ltd has already given DRD performance guarantees in respect of its subsidiary, Hope Downs Iron Ore Pty Ltd, in respect of its liabilities under the Iron Ore (Hope Downs) Agreement Act (the Act).

At the completion of the feasibility study, assuming that a decision is made to proceed with the Project, Iscor will seek a sub leasing of rights under the Act, from HDIO to an investment arm of Iscor, as a participant in the joint venture. This assignment of rights will require Ministerial approval.

At this stage, the Government would seek a parental guarantee from Iscor in respect of its subsidiary's performance under the Act.

The Government is further protected under Clause 16 of the Act by the requirement on the part of the company to periodically submit comprehensive reports detailing its environmental performance. Thus, DRD has both the means and responsibility to monitor HDMS' environmental performance and take remedial steps if necessary.

This report can be extended to include the provision for updates to the mine closure plan on a regular basis and, if necessary, to advise the Government of the state of the contingent liability for environmental remediation in its annual report.

In the final event, if at any time HDMS defaults or fails in meeting its performance criteria in respect of the observance of any of the covenants or obligations of the Company under the Act, the Government, after a due period of notice (180 days), has the right to determine the Act.

The result of such action would be for the Government to resume the tenements and under clause 38 (2) of the Act, all buildings, erections and other improvements would without compensation become the property of the State.

Finally, HDMS will adopt the current Australian accounting standards of the day, providing for the annual provisioning for future expenditures in respect of mine closure, based on the contingent liability for the environmental rehabilitation referred to above.

We believe that the above provides substantial evidence that the risk of default in respect of mine closure obligations is minimal and that, in any event, the Government has ample protection under the Act to either force the parties to meet their obligations or, if necessary, recoup costs for mine closure by the determination of the Act and seizure of assets.

2 *The Commission notes that there is some uncertainty regarding the long-term effects on Weeli Wolli Spring and downstream areas as a result of only supplementing the spring through surface water discharge. Currently water flows through the gorge (Weeli Wolli Spring to Tarina gauging station) both as surface flow and as sub-surface flow. It is not clear how dependant the vegetation within the gorge is on the sub-surface flow. It is therefore difficult to predict what the long-term (+ 20 years) effect may be of only having surface flow and some resultant shallow infiltration within the alluvial system along the gorge. (Water and Rivers Commission)*

From recent groundwater modelling (additional to the PER work) it is predicted that it will be necessary to discharge a maximum of 18 000 kilolitres per day into the Weeli Wolli Creek to maintain the pre-mining spring flow of approximately 4000 kilolitres per day. The model predicts that a maximum of about 80% of the discharged water infiltrates into the aquifer to become part of the groundwater system. Thus a substantial sub-surface flow (greater than the accepted estimate of natural groundwater throughflow under the spring) is also maintained from the spring augmentation process. Given this, it is expected that both superficial and subsurface soil strata will remain fully saturated as an outcome of the planned management. There will, therefore, be no expected decrease in the amount of water available to phreatophytic vegetation in superficial and subsurface strata within the creek system.

If necessary, this discharge can be increased to permit a greater quantity of water from dewatering to be discharged down the creek.

Tree monitoring test work has shown that the total quantity of water required for evapotranspiration by phreatophytic vegetation is less than 5% of the total available from dewatering even at the lowest planned dewatering rates. The quantity of water available for augmentation of the spring and maintenance of vegetation is therefore not seen to be in question. HDMS acknowledges that additional study is necessary to optimise techniques of water distribution for vegetation maintenance.

Details of the proposed Hydro-ecological Monitoring Programme, which will be part of the Water Management Plan, are included as **Attachment A** to this Response document.

3 *Discharged water would have the ability to create surface flow over and through loose scree ore increasing its turbidity. This is turn could impact on the water quality of the Weeli Wolli Spring and or exposed water bodies in the Weeli Wolli pass. (Conservation Council of Western Australia Inc.)*

The water from pit dewatering will not have the opportunity to flow over/through loose scree. The water that is intended for spring augmentation will be abstracted via gravel-packed bores and discharged into Weeli Wolli Creek. An appropriate outfall structure will be designed, with energy dissipaters, to further reduce potential turbidity effects. From this point the water will have the same surface and sub-surface flow path as natural surface run-off after a rainfall event. The water which may be re-injected into an ASR area would be injected through bores and would not undergo any surface flow. Quality issues are addressed in more detail in Response 4 below.

4 What monitoring will be done to ensure that the water discharged back into Weeli Wolli Spring is of an appropriate quality (there is a risk of pollutants cycling through the mine groundwater and then back to Weeli Wolli Spring by re-injection)? (Department of Conservation and Land Management)

Dewatering abstraction will be drawn mainly from screened production wells around the perimeter of the pit (ie intercepting groundwater prior to contact with mining activities). Some in-pit sump pumping may be required, but this water will be managed by reticulation systems (including primary treatment) which are kept separate from the dewatering bore system. The sump water will be used in the mining process and for dust suppression.

To comply with the conditions of abstraction and discharge licences, HDMS is continuing to undertake a monitoring programme, and will seek its approval by the Water and Rivers Commission during the groundwater licensing process. The Water Management Plan will specify an appropriate monitoring programme (see Response 1 above) for both flow and water quality at Weeli Wolli Spring, which is designed to identify any potential pollutants in the reticulation from the dewatering system.

The water throughout the catchment (both groundwater and spring water discharge) has been demonstrated to be almost identical in quality (with respect to major ions and TDS). Based on the data available at present, it is therefore believed that there are no issues in terms of water quality in relation to abstraction and re-injection and/or discharge of water across the catchment. Further details of environmental management methods to be applied to reduce the potential for contamination are outlined in the Life of Project Environmental Management Plan incorporated into the PER. In addition, the natural course of groundwater is to flow from the pit area towards Weeli Wolli Spring, and leave the catchment either as surface flow (spring flow) or sub-surface flow (groundwater). Therefore the discharge of groundwater from the dewatering bore system to the spring has no additional risk associated with pollutants from mining contaminating the spring.

In respect of temperature variations between groundwater and surface water at outfall the following is of relevance.

Data obtained from hydrogeological investigations in the area over the past three years show that seasonal variations in groundwater temperature range from a minimum of about 25° Celsius in July to a maximum of around 30° Celsius in January and February. The data indicates that groundwater temperatures are very consistent from different bore locations across catchments, and are also consistent regionally between catchments (eg Marillana Creek, Nammuldi, etc). Long term Weeli Wolli Spring surface flows result from groundwater discharge (during non-flood periods), and would have water temperatures consistent with groundwater temperatures.

Heat gain calculations have been completed for the pipeline from Hope North to Weeli Wolli Spring, which could convey up to 100 000 kilolitres per day (maximum predicted discharge) through a buried polyethylene pipe. Engineering calculations indicate that earth cover of 600 millimetres is sufficient to result in negligible heat gain from solar radiation, and ground temperatures at this depth are consistent with groundwater temperatures from deeper levels.

Even when assumptions are made of a 5° Celsius temperature differential between the shallow ground surrounding the pipeline and the water inside the pipeline, engineering calculations indicate a maximum potential heat gain of 0.4° Celsius over the route from Hope North to the spring. This is much less than seasonal range in average temperatures.

Based on the above, we do not believe that increase in temperature during pumping transportation or discharge is likely to be an issue.

5 *Has the time taken for the aquifer to totally recharge been considered? What conditions will ensure the maintenance of Weeli Wolli Spring past the 20-year maintenance period? The environmental impacts of the water abstraction are not fully addressed, particularly with respect to decommissioning and augmentation of Weeli Wolli Spring. (Department of Conservation and Land Management)*

The groundwater model has predicted that the natural (ie unsupported) spring flow will return to within 10% of the pre-mining flow within 20 years of mining. This corresponds to water levels at the spring being within 4 millimetres of pre-mining levels, which is well within the natural variation observed for the long-term low spring flow regime. Relevant additional comments are also made in Response 8.

6 *The impact of water supply (after year 7) to mining in Area C has not been considered. If this occurs then less water will be available to augment Weeli Wolli (see pages 6.9 "Cumulative Impacts" & 6.1). How much water would Area C require? (Department of Conservation and Land Management)*

The impact of the Mining Area C water supply has not been considered beyond Year 7 as BHP has committed to obtaining water from outside the catchment after this time. This is due to BHP modelling predicting an independent impact on Weeli Wolli Spring after Year 7.

As indicated in Section 6.5.2 of the PER, HDMS would have plenty of surplus water available (even after spring augmentation) to supply water to Mining Area C, should it become necessary, without additional impacts on the Spring.

It should be noted that a recent decision by BHP not to beneficiate ore at Mining Area C is likely to halve process water requirements for that project.

7 *The Pilbara Development Commission advises that the Weeli Wolli Creek acts as a campsite for a number of people (particularly from the region) who are on holiday. This is due to the pristine state of the Creek's natural environment. The proposed Weeli Wolli management strategy must be vigorously pursued to maintain this environment and not detract from its attractiveness to visitors.*

HDMS notes the concerns of the Pilbara Development Commission (PDC) regarding the spring amenity. HDMS also notes that the spring and surrounding areas contain important environmental and ethnographic sites. For these reasons, camping overnight is prohibited at the spring.

Special access provisions will be made with the traditional owners as part of the Heritage Management Plans.

HDMS will do nothing to compromise in any way the attractiveness of the spring to visitors. In HDMS' view, there is more cause for concern over the current lack of proper management of visitors, and implementation of a management strategy for the spring and surrounding region is long overdue.

HDMS is prepared to assist in the implementation of such a strategy as part of its community programme and as an environmental offset.

At the present time, cyclonic activity has caused severe deterioration to roads accessing the spring and there are few visitors. This will change when access to the area improves with the construction of BHP's Mining Area C and the Hope Downs Project.

HDMS has added Commitment 18 to Section 8 of the PER to cover its responsibilities in respect of management of land in the vicinity of its operations (including Weeli Wolli Springs) lying either within its leases or accessed by roads that will be constructed by HDMS to facilitate access to its mining or rail operations.

Groundwater

8 *While sections 6.5 and 6.6 of the PER outline a fairly comprehensive strategy to prevent changes to groundwater and surface waters, the Commission would like to be informed of what contingency plans the proponent has in case these strategies do not work. (Pilbara Development Commission)*

When the Project goes ahead, contingency plans would be outlined in the Water Management Programme. At this stage, however, it is predicted that there will be an excess of water available for injection and/or augmentation during dewatering. Thus, should the spring flow require increased augmentation, additional water is readily available. Once decommissioning commences there will be approximately 20 years of data for re-calibrating the model and there should be a much better understanding of the groundwater-surface water interaction. The 20 years of operation will therefore allow future predictions to be more reliable, and contingency plans to be refined on an ongoing basis.

9 *While the Commission is pleased to see innovative options such as the ASR project considered, it has some doubts as to the ability of this scheme to provide the necessary volume of the 20-year period. It appears most unlikely, on the evidence provided to date, that the ASR option will be able to deliver any where near the 40 ML/day required for spring supplementation over a period of 20 years. Water will have to be sourced from outside of the catchment and at this stage the required volume should be considered as 40 ML/day until further work is done to adequately prove up the ASR option. The only source of available water appears to be the dewatering discharge from the BHP and HI mining operations at Yandi. The PER does not include any environmental impact assessment of such an option (ie pipeline route and area from which water would be removed). (Water and Rivers Commission)*

Further comments on ASR from WRC (letter dated 30 November 2000):

"We advise that, for this assessment, the entire volume of water [40 ML/day] should be considered as having to be imported from outside the "Weeli Wolli Creek" alluvial aquifer catchment.
The ASR concept mentioned in the PER should not be factored in to the 40 ML/day, as although it may be possible to artificially recharge the excess dewatering discharge in the upper parts of the catchment/aquifer, this will not be available in twenty years time for subsequent abstraction. The concept of artificially recharging any excess water is however supported as it will help to counter the dewatering cone of depression along the valleys in the upper catchment (eg the southern flank where under normal circumstances the modelling has shown a possible lowering of the water table of as much as 20 m). This could possibly allow the proponent to pump water from this area after mining ceases for recharge in the calcrete area (still within the same aquifer system, but closer to the centre of the cone of depression and the spring)."

There appears to have been a considerable misunderstanding in respect to reliance on ASR as the source of water for recharge. The ASR option was presented in the PER as one component of the preferred management scheme as it attempts to "re-use" dewatering discharge.

The PER acknowledges that insufficient information is available to rely on ASR for recharge and, in fact, Figure 6.17 demonstrates that importing 20 000 kilolitres per day from outside the Weeli Wolli Spring catchment is necessary to recover 90% of spring flow.

In addition, recent modelling (post PER submission) has indicated that it may be possible to abstract 20 000 kilolitres per day from the South Flank Valley (during decommissioning) without previously injecting water during dewatering and without affecting the spring. Thus, only 20 000 kilolitres per day or thereabouts is required from outside the catchment.

This volume of water has been shown in recent studies by the Waters and Rivers Commission to be available from mining operations to be undertaken for many years at Marillana Creek. With further investigation, it may be possible to source the total volume of 40 000 kilolitres per day from the Marillana Creek catchment (although not solely from the mining operations), and/or the Weeli Wolli Creek CID aquifer in the area of the Marillana Creek confluence (ie downstream of the Weeli Wolli Spring catchment).

A preliminary pipeline design and route option has been undertaken for the supply pipeline for a volume up to 40 000 kilolitres per day from Marillana Creek, representing a feasible environmental recovery situation.

HDMS is, at this stage, willing, and has undertaken some planning, to source the 40 000 kilolitres per day from outside the Weeli Wolli Spring catchment, with the understanding that if, at a later date, the feasible abstraction of water from within the catchment is demonstrated, this will also be acceptable.

It should also be noted that if ASR proves for whatever reason not to be a viable or practical option, discharge of the full dewatering volume (less requirements by HDMS and third parties) would be necessary to Weeli Wolli Creek.

If this is the case, the main impact to the spring will be to increase the stream stage (ie stream height) by 0.09 metres (9 centimetres). Correspondingly, there will be an extension of surface water flow downstream for several kilometres due to the increased water volumes. A similar situation exists at the Marillana and Yandi operations of BHP and Hamersley Iron.

The extent of this surface water flow cannot be accurately predicted. It will, however, rapidly infiltrate into the fairly porous alluvial gravels which form the stream bed and ultimately disappear completely as groundwater. It is estimated that the extension of surface flow will increase evaporation by 2% and salinity by a similar percentage. In absolute terms, salinity in the groundwater will be 510 ml/litre. This increase is barely measurable and unlikely to be considered significant.

The net effect of this extension to surface water flow is likely to be an extension of vegetation downstream of the spring. To what extent this will occur is again unknown, as sub surface stream flow volumes already exceed that required to support existing phreatophytic vegetation and there is considerable evidence to support the contention that vegetation establishment and, in particular, the occurrence and longevity of the Cadjeput (*Melaleuca Argenta)* is controlled by major flood events. Some increase in opportunistic vegetation and fauna is likely to occur, and it must be expected that this will probably at least partially collapse and die when dewatering ceases and stream flow is reduced to that required to support the level of vegetation in the pre mining situation.

10 *The PER should not be assessed until a full evaluation of the water bodies in BHP's Area C and re-injection characteristics have been assessed. There is no evidence that re-injection back into the dolomite zones in this area of the Pilbara is possible. No supporting information has been made available showing that the porosity of the dolomite in the region will accept the proposed re-injection from the Hope Downs proposal. (Conservation Council of Western Australia Inc.)*

There are no significant water bodies in Mining Area C, as BHP intends to backfill its pits. Should ASR be shown to be a practical and economic option and become part of the proposed management strategy, a full hydrogeological investigation (inclusive of further groundwater modelling) will be conducted. We feel, however, that at this stage of the project (PER), the data presented is sufficient.

There are two existing production bores which intercept the dolomite at the proposed ASR location on the south-west tributary of Weeli Wolli Creek. Testing of these bores has proved the karstic and transmissive nature of the dolomite, suitable for accepting injection to the aquifer.

It should be noted that this type of aquifer is commonly used for ASR purposes across Australia and worldwide. There are at least three examples in the Pilbara: Ethel Creek (artificial recharge from Opthalmia Dam), Nammuldi iron ore project, and Telfer. A paper was presented at the International Hydrology and Water Resources

Symposium in Perth in November 2000, titled "Aquifer Storage and Recovery (ASR) as an Option in Minesite Water Management", by Brown, Pepper, Smith and Clark. The paper presents case study information relating to Nammuldi and Telfer and concludes that, while site-specific investigations are required prior to design and implementation, the preferred type of target formation is one which has open fractures or void features (such as karstic dolomite).

11 *Dewatering activities that take place at the Hope Downs mines must factor in the cumulative effect of the proposed mining and associated dewatering on the 12 listed mines of ML 244 SA. All of these are within, and would impact upon, the Weeli Wolli catchment and aquifer. (Conservation Council of Western Australia Inc.)*

The only mining activities proposed to take place concurrently with Hope Downs are those associated with Mining Area C. The cumulative effect of these mining activities has been taken into account in the hydrogeological modelling.

12 *The discussion of what management strategies may be used, as opposed to what will be used, is confusing. There are several anomalies in the text (eg values quoted in 6.5.3.1 & 6.5.3.2).*

The 'Do Nothing' option with respect to mine dewatering (pg. 6.10) would not be acceptable. (Department of Conservation and Land Management)

The anomalies in the text could not be found.

The "do nothing" option was included in the PER to demonstrate the unacceptable consequences to phreatophytic vegetation and spring flow if no action was taken to maintain spring flow.

HDMS clearly considers the "do nothing" option to be unacceptable and has totally discounted this option.

13 *Given the potential for dewatering to affect the pastoral industry, the Commission believes that HDMS should consult closely with Marillana Station. (Pilbara Development Commission)*

Discussions have been held already between HDMS and BHP Iron Ore Pty Ltd (BHPIO) (owner of Marillana Station) regarding its requirements and possible impacts of HDMS mining and rail operations.

HDMS is currently in the process of agreeing a Memorandum of Understanding with BHPIO to allow agreements to be reached in respect of mining, infrastructure and other developments which affect tenement areas or leases held by the other party.

Should any local pastoralists be adversely affected by the proposed water management strategies, steps will be taken to compensate their water supplies. As mentioned above, there is adequate water available to assist third parties. We are also advised that there are negotiations underway between the owner of Marillana Station and CALM regarding land management, and HDMS is willing to provide input and become party to the agreement as appropriate. A commitment to this effect has been included as Commitment 18 in Section 8 of the PER. HDMS is also interested in

providing assistance to upgrade the Weeli Wolli Spring management plan originally developed by BHP for CALM, and to assist with its implementation. See new Commitment 18.

Surface water

14 *The proponent does not address the issue of possible increased peak surface flow during rainfall periods as a result of the groundwater system being "fully topped up" and therefore possibly less infiltration and more surface flow. (Water and Rivers Commission)*

It is believed that such a situation (ie less infiltration and more surface flow when the aquifer is "fully topped up") will only occur in certain specific circumstances. In the Weeli Wolli catchment, these circumstances are believed only to occur at the spring (where there is a shallow water table) and possibly under the creeks in the ASR area (where high water levels may occur). As these areas are very small with respect to the catchment area, the potential flow volumes are insignificant.

At both these locations, groundwater levels will be monitored and appropriate management action taken. For example, should the water table in the ASR area rise significantly to result potentially in less infiltration and more surface flow, then injection/discharge rates can be adjusted to prevent further rising of the water table, and less potential impact on surface flooding. It should also be noted that, at the possible ASR area on the south-west tributary, the aquifer formations are actually confined. Therefore, while the piezometric surface in the confined unit may rise to the elevation of the natural surface, this would not necessarily reduce the infiltration capacity of the unconfined alluvial formations underlying the creeks, as the unconfined water table would not be expected to rise to the same level.

15 *The Water Management Plan will have to address the issue of dewatering discharge water quality control. The assumption is that the quality of the dewatering discharge and imported spring supplementation water will be the same as the current groundwater entering the spring system and will remain constant over the full 40 years. (Water and Rivers Commission)*

As mentioned in Response 5 (above) the monitoring and management of water quality will be addressed in the Water Management Plan. Recent hydrochemistry work (post-PER) has indicated that the groundwater and surface water quality across the catchment are virtually identical in terms of the balance of major ions. These are shown on an expanded Durov diagram as **Attachment B**. More work will be undertaken on this issue as part of the ongoing monitoring programme.

16 *Any water extracted for the aquifer and allowed to dissipate over the surface will suffer extreme evaporation, reducing its net volume and value, as well as suffering an increase in its salinity levels. (Conservation Council of Western Australia Inc.)*

The water discharged to Weeli Wolli Creek for spring augmentation will be discharged at a location very close to the spring itself. The distance travelled by the water over the surface will therefore be consistent with existing conditions and, consequently, there would be no additional evaporation. Indeed, the TDS

concentrations recorded at the emergence and disappearance of the present day spring (see Appendix 2 of the PER) demonstrate that evaporation over the short spring flow distance does not affect the water salinity.

Also see Response 9.

Fauna

17 It is not apparent whether a detailed study on the aquatic fauna has been undertaken. The PER has made mention (Page 6.34) that three fish species have been observed opportunistically. Further investigation is required to define the species richness and abundance of aquatic fauna especially within the permanent pools of Weeli Wolli springs. (Water and Rivers Commission)

No systematic survey of the fish fauna of Weeli Wolli springs was undertaken as part of the current assessment. However, the species currently known to occur in the system are widespread and common within the major drainages of the Pilbara.

The proposed management measures for the sections of Weeli Wolli Creek which contain permanent water will ensure that water levels are maintained to at least their current levels, suggesting no significant impacts on resident fish populations. Upstream sections of the creek contain top-filled ephemeral pools which are established as a result of surface flows rather than sustained by groundwater. These are therefore not reliant on groundwater and not expected to be susceptible to impacts from mine dewatering. In addition, the release of dewatering water into the system may actually serve to increase the extent of potential fish habitat in the locality.

Subterranean fauna

18 The project will directly impact on the Weeli Wolli calcrete area (that occurs below the water table: 6.5.1) as a result of drawdown of water from mine dewatering. It would be unsafe for the project to advance further until the nature and distribution of the stygofauna in the Weeli Wolli calcrete area has been established. A biodiversity "hotspot" occurs in a similar area nearby in the region. Endemic stygofauna are known to be associated with the Weeli Wolli calcrete area.

It would be unsafe to deal with this issue by monitoring impacts as the mine develops; there needs to be substantial work conducted on the groundwater ecosystem(s) with sufficient lead time to do the detailed scientific work necessary for an informed decision. Little is known about the functioning of these groundwater ecosystems and the proposal to reinject water or augment spring flow is based on no evidence that it would be effective for stygofauna or the reminder of the aquifer ecosystem. There is evidence to suggest that groundwater flow and direction can have a considerable impact on stygal communities. Reinjection or augmentation is also likely to affect the hydrogeochemistry. (Western Australian Museum)

Given the current state of knowledge of stygofauna, the PER presented a habitat-based risk assessment of potential impacts on stygofauna (see page 6.36). Evidence available to date suggests that the interstitial gravels and calcrete habitats associated with the alluvial systems of Weeli Wolli Creek are likely to provide the core

stygofauna habitat in the locality (Eberhard and Humphreys, 1999). This principally concerns two areas – the calcretes upstream of the spring proper and the calcretes and associated alluvials at, and downstream of, the spring. The calcretes upstream are under normal conditions primarily above the water table (see page 6.36 and Figure 6.10 of the PER), making them largely unsuitable for stygofauna. In fact, in some sections of this area such as BH10, drill logs indicate that the calcretes are entirely above the water table (23 metre depth of calcrete, water table at 30 metre depth from surface).
This general lack of suitable stygofauna habitat is supported by the fact that the sampling undertaken to date did not record any stygofauna from these upstream areas (Eberhard and Humphreys, 1999).

In addition, if one considers natural seasonal fluctuations in water level over the past few decades, there has been a maximum of 2 – 4 metres of water table change. Given that there are generally only around 1 – 2 metres of currently saturated calcretes in the calcrete areas upstream of the spring, it seems a reasonable likelihood that the water level may have naturally dropped below the calcrete in this area in the past. This suggests that, even if stygofauna are actually present in this area, then they, like many other aquatic fauna of the Pilbara, may have some mechanism to accommodate major cycles of wetting and drying. This may mean that stygofauna are capable of movement vertically or laterally into other connected, saturated geological types, which would suggest that they are not restricted to calcretes under these circumstances.

Alternatively, drying of cemented calcrete formations may not be total during periods when the water table is lower. It is possible that pools of water may be trapped within pockets and cemented formations within the system – providing humid and saturated refugia similar to permanent pools in surface systems in the Pilbara.

During the dewatering planned for this proposal, such an environment within the more eastern calcretes would also be continually 'topped up' by some level of leakage back towards the drawdown area into the calcretes upstream of the spring augmentation. Ordinary rainfall and flood recharge events would also serve to periodically top-fill these calcrete areas.

It has been suggested that stygofauna of Weeli Wolli calcretes may be endemic. The above discussion suggests that, if this is true for the upstream calcretes, then the stygofauna present must have either previously migrated to other saturated areas or tolerated historical periods of drying.

Given the relatively young geological age of calcrete formations (hundreds of thousands of years), it is not possible that many of the fauna known have evolved or been restricted to these formations. Many of the fauna are of ancient lineages of Gondwanan affinities which are in the order of millions of years (Humphreys, 2000). This suggests that some mechanism similar to those hypothesised above must exist for this fauna to have survived in the hydrologically dynamic systems of the Pilbara over such extended timeframes. In addition, analogies with the Orebody 23 situation have been suggested when in fact the nature of the geology, hydrogeology and proposed groundwater management strategies are quite different.

With respect to the fauna habitats at the spring itself and downstream, the springflow augmentation programme will ensure that water levels are maintained at, and downstream of, the spring. Available data also indicate that the water quality from the mine area is chemically very similar to that close to the spring (see Appendix 2 of the PER). Total dissolved solids and pH are very similar across the catchment and the available data do not suggest that the reinjected dewatering water would result in significant changes to water quality in the vicinity of the spring. Temperature differences between spring augmentation and groundwater is only expected to be one degree Celsius at most.
This is well within natural seasonal changes in groundwater temperatures and presumably, therefore, within stygofauna tolerance limits (see Response 4). Water quality sampling in relation to these key parameters will form a part of the stygofauna sampling programme to be developed in accordance with Commitment 10.

In addition, hydrogeological investigations indicate that there are likely to be equivalent, hydraulically connected, stygofauna habitats downstream of the dewatering impact area. Investigation of these habitats will form a focus for the sampling programme, as they may form contiguous saturated zones to provide refugia for stygofauna species associated with this part of the system, including possible endemics, during dewatering. Given the extremely dynamic nature of the alluvial systems of Pilbara creeks during cyclone and drought events, it is not unreasonable to expect stygofauna to persist in these areas and re-colonise contiguous habitats once the dewatered water table recovers.

HDMS appreciates the potential significance of the stygofauna associated with the Weeli Wolli Creek system. A commitment has been made by HDMS to undertake stygofauna sampling in the vicinity of Weeli Wolli Creek to improve the state of knowledge of this fauna. HDMS is in the process of developing a stygofauna sampling strategy which will be discussed and agreed with the WA Museum, CALM, UWA and the DEP prior to implementation. This work will serve to more clearly define both the biodiversity significance of the area and the spatial distribution of the fauna in the context of areas to be affected by drawdown. This study will also include allozyme electrophoresis analysis** of specimens collected to provide additional clarification of the validity of any species diagnosed on the basis of morphological taxonomy. The data arising from this work will be considered in a regional context at two levels. Results will be assessed as part of a joint initiative being undertaken by Hamersley Iron, BHP and HDMS in examining species distributions and allozymic variation at sites from Homestead Creek, Ethel Gorge and Weeli Wolli Springs. Specimens will also be lodged with the WA Museum and placed into context against broader regional work being conducted and planned by CALM and the WA Museum.

The determination of species status, endemism and distribution would be better considered on the basis of the more substantial dataset to be compiled as part of the pre-mining sampling programme and other wider regional initiatives. This work would be undertaken several years in advance of commencement of mining.

In addition, the hydroecological monitoring programme to be undertaken during dewatering is to include stygofauna species richness and occurrence and a range of parameters thought to be relevant to stygofauna community health (see **Attachment A**).

** [Protein electrophoresis is a well established technique of investigating genetic variation within and between populations of organisms. Different species and different individuals within species produce different variations of the same protein, known as allozymes. If populations of fauna are sufficiently different to be reproductively isolated (i.e. different species), then many of these allozymes will also differ. Electrophoresis basically consists of extraction of a protein rich sample from the subject fauna (or whole animals in the case of stygofauna). This sample is then inserted into one end of a starch gel and a weak electric field applied to it. Due to their differing size and structure, different proteins will migrate at varying speeds through the gel and suitable stains will then reveal a banding pattern of different allozymes for each animal sampled. Testing of a range of protein loci enables a 'genetic distance' to be calculated based on the number of shared allozymes. These data, combined with a review of the morphological variation enable decisions to be made as to whether morphological variation present is supported by species level allozyme differences]

19 *The work cited in the PER as the authority for the distribution of stygofauna in the region (Eberhard and Humphreys 1999) effectively did not examine the distribution of stygofauna within the calcrete owing to the lack of access, and so is inadequate. Sampling carried out elsewhere in the Pilbara has demonstrated that, despite stygal communities being endemic to given calcrete area, they are not uniformly distributed within them, indeed, the distribution of species appears clumped. (Western Australian Museum)*

The issue of potential endemic stygofauna in calcrete areas is addressed in detail in Response 18.

20 *The distribution of the underlying karstic dolomite (6.5.1) is not shown: it may provide open conduit flow in the groundwater, which is not concordant with surface drainage catchments.*

The distribution of the karstic dolomite referred to in item 6.5.1 of the PER is shown in a supporting document to the PER (Figure 4.1 of the report to HDMS titled "Groundwater Modelling for Dewatering and Mine Closure" (Aquaterra, June 2000)). A copy of that figure, "Distribution of Model Parameters, Fig 4.1" is appended as **Attachment C** to this Response document.

Whereas the Paraburdoo Member of the Wittenoom Formation is nominally described as "karstic", this formation is not known to exhibit "open conduit flow" characteristics on a regional scale. Rather, it would be more accurately described as a highly transmissive aquifer due to the highly weathered and/or fractured zone at the contact between it and the West Angela Shale (the lower-most member of the Wittenoom Formation). There may be areas on a local scale where karst-type (open conduit-type) flow could occur (eg up to a few kilometres).

It should be noted that the ancient and present river valleys have eroded down into the Paraburdoo Member and the associated transmissive aquifer is aligned with the surface drainage system. Available data indicate that groundwater flow patterns are also consistent with surface drainage patterns. That is, the groundwater divides in the

transmissive aquifer within the Paraburdoo Member are concordant with the surface water divides.

21 *What impacts will water temperature, TDS and turbidity have on limestone caves (calcrete), invertebrates (stygofauna), and other fauna and plants? (Department of Conservation and Land Management)*

See Response 18.

22 *The failure to address the regional significance of stygofauna likely to be impacted by the project is an inadequacy of the PER document. It is very difficult to assess what impacts this project will have on the environment when there is no regional context for the project or information on the biota present in the project area and the representation of such biota on the conservation estate. (Department of Conservation and Land Management)*

The data collected as part of the Commitment 10 stygofauna sampling will form part of a regional database being developed as an initiative by several major Pilbara iron ore industry parties and Government agencies (see also Response 18).

This will be further put into context with other information which will be collected as part of regional stygofauna initiatives planned by both CALM and the WA Museum, in addition to records of species distributions already held by the Museum and other industry parties.

Also see Response 18.

23 *Commitment 10 should include reference to ensuring that the data contributes and is assessed in a regional context. (Department of Conservation and Land Management)*

This has now been included in Commitment 10.

Rail link options

24 *With regard to the railway links the Department of Conservation and Land Management (CALM) provides the following comments.*

(a) *While it is acknowledged that at this stage in the project's development a preferred rail option has not been identified it makes the task of assessment difficult as only superficial data is provided on all the possible alternatives. Once the preferred rail route has been identified, another environmental assessment would need to be performed on the proponent's preferred option (and its alternatives), in a manner similar to the review process undertaken for the Coondawanna West and Mt Robinson rail routes proposed for the West Angelas project. (Department of Conservation and Land Management)*

The requirement to carry out this type of additional work was discussed and agreed with CALM personnel after the preparation of the Draft PER. It appears that these, and several other comments in the CALM submission, were not updated from the Department's preliminary comments on the Draft PER. Detailed environmental assessment on the final rail route will be carried out to the satisfaction of CALM as

committed to in the PER. The requirement to carry out comprehensive design reviews and modifications to CALM's satisfaction will be discussed with CALM dependent on the sensitivities of the areas through which the final rail alignment passes.

Also see Commitment 16.

(b) *Coondawanna Flats is an area of priority listed flora and will be impacted by some of the railway links. CALM has indicated its concerns to EPA on previous occasions regarding this site. Options JD 4,5 & 6 and parts of JD 2 are not supported by CALM. The Department is aware that Hamersley Iron is in discussion regarding JD1 & JD9 as alternatives for West Angelas instead of the Coondawanna West route. Options JD1 & JD9 do have CALM support. It is recommended that EPA make a clear statement that railways through Coondawanna flats are unacceptable.*

HDMS notes CALM's position on the matter of the route options through the Coondawanna Flats area. It was after consideration of CALM's preliminary comments on the Draft PER (which are repeated above), that HDMS relinquished option JD5 in recognition that it was environmentally unacceptable. Based on the CALM submission, HDMS believes that route options JD1, 3, 9 and parts of 2 are all potentially acceptable from CALM's perspective and that JD 4, 5, 6 and the western part of JD2 are not. HDMS is prepared, for the purposes of this assessment, to relinquish its intention to further consider these routes thus complying with CALM's wishes. HDMS believes that route options JD1, 3, 9 and the eastern part of JD2 provide adequate, although not necessarily optimum, scope for the project to develop a rail connection to the west, should this prove to be the ultimate rail corridor adopted.

Also see Commitment 16 where HDMS commits to discuss all aspects of rail design with CALM before taking a final decision.

(c) *Possibly JD3 & JD2 are acceptable. To be decided once greater design detail is available.*

Refer to Response 24(b).

(d) *Proposals to the north-east (BHP line) probably are acceptable, although the terrain is difficult and the cost of constructing these railway links will be high.*

HDMS notes the CALM view of the railway options to the northeast. The financial and design viability of these options will be considered as part of normal engineering evaluation to be carried out by HDMS.

(e) *The Department would like to see a commitment to minimise the need for borrow pits. This can be achieved by using overburden from the mine where practical and balancing cut and fill in other areas. Borrow pits are to be self-draining.*

The number of borrow pits will be minimised as far as practicable during the construction of the railway by maximising where practicable the use of cut and fill construction principles which, in any event, is in line with construction best practice. Overburden material will also be used in the construction of the rail embankment where this is practicable in proximity to the mine area and where such material is suitable for this purpose. HDMS will apply a policy of minimisation of ground

disturbance on the whole project and this will also apply to earthworks design and borrow pit number and location. Where possible, borrow pits will be situated and excavated such that they are self-draining. However, it is worth noting that the greatest requirement for borrow pits is in long stretches of flat country. In these areas, it is frequently impossible to practically achieve self-draining borrow pits without extensive additional ground disturbance from collateral drains and the like.

Also see Commitment 16.

(f) *Weeds are to be reported, but there is no indication on action to be taken. CALM would like to see a commitment to control weeds.*

Again, this comment appears to have been retained from comments on the Draft PER. Weed management plans will be implemented for the railway lines as noted in Section 1.2, on page 9.31 of the PER.

(g) *Rehabilitation Criteria indicates that the rail formation will be retained at the end of mining. CALM's preference is that the rail formation be removed and the land put back to its original profile.*

Portions of the rail formation will be utilised by HDMS for subsequent projects. In those areas where this is not the case, HDMS' rehabilitation strategy for the formation is as follows. All rail and sleepers will be removed and areas where the formation has diverted drainages will be breached to re-establish natural drainage patterns. The remainder of the formation will then be ripped and sown with provenance collected native seed.

(h) *A predicted outcome of the rail design through "appropriate sizing of bridges and culverts" is "Maintenance of surface water flow" (no drainage shadow effect). This is impossible to achieve. The best that can be done is to reduce these impacts through good design, including maximum opportunity for water to pass across the rail alignment.*

The final PER summary table does contain 'negligible regional impact on surface flows' as the outcome in recognition of this earlier CALM comment. However, HDMS still considers that its objective is to achieve 'maintenance of surface water flow (no drainage shadow effect)' wherever possible.

(i) *Proposed management states "Discussions with CALM and WRC". There is no commitment to implement anything arising out of these discussions, nor any commitment to "best practice". This type of "commitment" appears in a number of places throughout the document.*

These comments also appear to be based on the Draft PER, as the final Commitments do commit to best practice levels, and the relevant sections of the final PER talk in terms of 'compliance' with CALM and DEP requirements.

25 The rail option to be adopted and the subsequent access route should be finalised before major construction activities commence on the site. (Department of Minerals and Energy)

This will be done as a matter of course as part of normal mine design and planning processes.

Vegetation and flora

26 *The PER document fails to provide appendices listing the flora and fauna species recorded in the project areas (mine and rail routes). This publication is the primary document available on this project and its environmental setting and as such will provide the foundation on which assessments are based. Therefore the document should contain such fundamental information as species and vegetation association lists. A similar inadequacy exists with respect to the provision of the vegetation community maps for the mine area and rail routes. The maps provided (half an A4 page) are inadequate representations that need to be re-scaled to a suitable size to facilitate informed assessment. It is acknowledged that in the case of the rail routes a more detailed vegetation map may be forthcoming in a subsequent document when the final route is settled upon. (Department of Conservation and Land Management)*

Again, this comment appears to have been inadvertently carried over from comments made by CALM on an earlier pre-release Draft of the PER. This comment on the draft was addressed in finalisation of the document prior to public release. Appendix 5 of the final PER contains the fundamental information requested by CALM.

The vegetation maps were also enlarged from the Draft PER and provided at far larger scale in the Biological Survey report on the rail corridors, which was also provided to CALM.

27 *The Pilbara Development Commission recommends that the proponent also consult with the local pastoralists measures to reduce impacts on vegetation and soils as a result of earthworks. Pastoralists may have local knowledge that would be of assistance to the proponent.*

Pastoralists will be informed and consulted as normal for a project of this nature. However, the advice of CALM will be used as the primary guide to acceptable methods of reducing impacts on soils and vegetation arising from project earthworks.

Rehabilitation

28 *Why is the area for rehabilitation stated as 860 ha? The area should be 328 ha North + 368 ha South + 235 ha for other mine infrastructure. The figure of 860 ha means some mine infrastructure will not be rehabilitated. What areas will not be rehabilitated?*

Table 6.1 - indicates that major site roads and rail loop will not be rehabilitated. Why? (Department of Conservation and Land Management)

In Table 6.1 of the PER the total area of expected rehabilitation is stated as 1 345.5 hectares. Those areas that are not expected to be able to be practically rehabilitated include the horizontal expression of the pit slopes, the major roads

(which will ultimately remain as part of the Shire road network in the area), some parts of the rail loop and the airstrip.

29 *Potential impacts and their management – paragraph 2: indicates that if topsoil is not available then areas will be left to be colonised by wind borne seed or by hydro mulching seeding. CALM will be looking to have the maximum use made of topsoil and if there is no topsoil, then the area must be seeded with seed collected from the surrounding flora (ie seed must have been collected from an area within 50 kilometres of the mine). Topsoil storage should reduce the loss of seed stored in the soil by storing the soil less than 2 metres in depth. Also topsoil can be sieved, or shandied to enable more ground to be covered. (Department of Conservation and Land Management)*

The sorts of measures identified in this submission to maximise the use of topsoil will be refined as part of the development of the rehabilitation and topsoil management plan for the project. Provenance seed collecting will be carried out as part of this exercise. Seed material for this purpose will be collected from within the 50 kilometre radius recommended by CALM and the CALM Pilbara office will be consulted as part of the development of rehabilitation strategies.

30 *Any seed used on this project must be from native species within a radius of 50kilometres of the site it will be used at. Seeds from outside this area will not be acceptable to CALM due to the possibility of introducing species and seed sources that are not appropriate to the area. (Department of Conservation and Land Management)*

See Response 29.

31 *Materials Management and Rehabilitation. This section indicates that all vegetation and topsoil will be removed on the preferred rail alignment. There are potentially large volumes of material that will be produced by this commitment, and few areas for this material to be directly utilised in the short term. No indication is given on the areas that may need to be disturbed to store these materials. Also the time frames for storing this material during the life of the railway may be 20+ years. (Department of Conservation and Land Management)*

The best use and viability management of this topsoil material is an issue for the Project, given the time periods identified above. At the very least, the material will still provide a growth medium requiring direct seeding even after extended periods. Other options may also be investigated for this material as part of the topsoil management plan. Typically, there is a shortfall of topsoil material in the Pilbara and in development projects in general and other options may be identified for its use. HDMS will address this as part of the topsoil management plan to be prepared for the Project to the satisfaction of CALM.

32 *There should be a commitment to minimise the need for borrow pits. This can be achieved by using overburden from the mine areas where practical and balancing cut and fill in other areas. If borrow pits are required then the issue of drainage also needs consideration in rehabilitation in addition to the three points indicated in this*

section. Wherever possible after rehabilitation borrow pits should be self draining. (Department of Conservation and Land Management)

This comment essentially repeats Submission 24(e).

Decommissioning and closure

33 Backfill of the Hope North pit will not be done if it can be demonstrated that the Weeli Wolli spring flow can be maintained by an alternative means. The backfilling of this pit should be done irrespective of the outcome of flows at Weeli Wolli springs. A commitment should be established for the backfilling of any pits to cover exposed water tables. (Conservation Council of Western Australia Inc. and the Department of Conservation and Land Management)

There appears to be a misunderstanding in relation to the question of backfilling the open pit voids. HDMS has committed to fill these voids to at least the level of the pre-mining water table, and the necessary sum ($190 million) is included in the feasibility study cost estimate. Most of the Hope South Pit, and the entire western end of the Hope North Pit will be backfilled as part of the normal mining operations (ie through direct infill of waste rock). For the part of the Hope North Pit known as the East Pit, part of the backfill will be achieved as part of normal operations. However, the remainder will have to be backfilled with adjacent overburden stockpiles.

The present extent of knowledge of the hydrogeological system at Weeli Wolli indicates that 100% backfill (over the excavation area, to at least the level of the pre-mining water table) will be necessary to achieve natural recovery of the spring and to avoid future salinity problems.

Backfilling is, however, extremely expensive and if, in the course of the next 20 years, it can be demonstrated that spring recovery and salinity issues or other environmental impacts can be overcome without the need to fully backfill, HDMS would seek leave to do so. We would expect that any proposal to leave a pit area open would be subject to further approval by the relevant agencies.

Once this was explained to the WRC (recently), they stated, "We are, however, quite happy for a clause to be inserted that if, during mining, HDMS is able to develop a closure strategy which does not involve 100% backfill, it can submit this strategy for Government assessment." (30 November 2000). Commitment 11 has now been modified to reflect this statement.

34 The Commission notes that in the PER the commitment is made to backfill the Hope North void, yet in several sections (eg decommissioning strategy on Page 6.17) the suggestion is made that, if at all possible, the void will not be backfilled. This is not a negotiable issue, as the void must be backfilled to above the original groundwater level. The north side of the pit will be in direct hydraulic connection with the regional groundwater system and any pit lake developing in the void would with time become saline and have a detrimental impact on the surrounding groundwater that is fresh (260 – 540 mg/L TDS). This in turn would impact on the spring water quality. (Water and Rivers Commission)

See item 33 above.

35 *A realistic bond should be established to ensure reparation of the water body during the proposed 15-year, remediation process. (Conservation Council of Western Australia Inc.)*

See Response 1.

36 *The Department recommends that rehabilitation of disturbed areas should be undertaken on a progressive basis wherever possible. As part of this progressive rehabilitation a mine closure plan should be developed and continually updated over the life of the project as part of the Environmental Management System process. (Department of Minerals and Energy)*

Agreed. This is covered in Section 9 of the PER, which covers the EMP.

The mine closure plan will be developed once a decision is made to proceed with the Project. This plan will be reviewed at a maximum on a five-yearly basis or more frequently if changes to the mine plan or substantial variations to the hydrogeological regime or the predictions of the hydrogeological model occur.

Social

37 *The Pilbara Development Commission is generally supportive of the project, but has some concerns relating to the management of the project's workforce being managed on a fly-in/fly-out basis. The Commission is opposed to further extension of fly-in/fly-out operations in the Pilbara because it acts against the development of communities in the region and provides little ongoing economic benefit to local areas.*

HDMS intends to further investigate fly-in/fly-out operations compared with the only likely alternative of basing all personnel in Newman. Unfortunately prevailing working conditions in the iron ore industry require operations to be based on 12-hour shifts in order to maintain competitiveness.

The driving distance from Newman to Hope Downs is about 110 kilometres, which implies a door-to-door time of one and one quarter hours. This has serious safety implications before and after a long shift. If buses are used, safety is much improved but the workforce is unlikely to accept the inevitable increase in time in arranging a bus-load of people to be collected and dropped off.

Impacts on other mining operations

38 *The Commission understands that some concerns have been expressed over potential conflict between possible areas for the Aquifer Storage and Recovery Strategy and potential ore bodies in the area. (Pilbara Development Commission)*

There are several potential Aquifer Storage and Recovery (ASR) sites both within the Hope Downs tenements and nearby. HDMS will assess all potential sites and discuss possible conflicts with other companies should ASR be shown to be a viable technique of water management.

It should be noted that alternative recovery scenarios have been developed in the event that no suitable ASR site can be found. See Response 9.

39 *There is concern at the prospect of large volumes of water may be discharged into Weeli Wolli Creek in the event that discharge down the creek becomes necessary as a consequence of operational limitations alternative disposal mechanisms (the ASR option) or infrastructure breakdown. This may directly affect future mining activities downstream of the Hope Downs area and may invalidate water quality assumptions that are already incorporated into approved mine closure plans.*

Based on creek level versus flow data recorded at Weeli Wolli Spring, an increase in discharge of 100 000 kilolitres per day (the large volume referred to) would result in an increase in surface water level of 0.09 metres (9 centimetres) at the spring gauging station. The increased discharge may also result in a temporarily longer reach of surface flow at Weeli Wolli Spring (perhaps several kilometres in length).

As discussed in Response 4 screened production wells will be used in conjunction with energy dissipaters to minimise turbidity to levels similar to that occurring naturally.

Also see Response 15.

In respect of impact on third parties HDMS is not aware of any potential mining operations in Weeli Wolli Creek downstream of Weeli Wolli Spring.

40 *Any ASR scheme would also have to be restricted to the Southern Flank Valley as the other areas shown in Figure 6.20 impact on other mining areas/companies. Raising of the water levels in these areas could have implications for future mining activity in these areas. (Water and Rivers Commission)*

Should the alternative ASR areas be considered, their impact on other mining activities will also be assessed.

Commitment 18 has been added to include a commitment to consult in detail both in respect of location and design of such facilities with regulatory agencies such as CALM, WRC and the DME and third parties who might be impacted by such a proposal.

41 *The Hope Downs mining activity will definitely impact on the planned Area C borefield which was to supply the BHP operations with process water for at least the first 7 years of operations. This water requirement will therefore have to be made good by Hope Downs from their dewatering discharge. (Water and Rivers Commission)*

The groundwater modelling indicates that the Hope Downs mining activities do not impact on the planned Mining Area C bore field within the first seven years of operation. As mentioned in Response 7 and as indicated in Section 6.5.2 of the PER, HDMS would have plenty of surplus water available (even after spring augmentation) to supply water to Mining Area C should it become necessary. HDMS would make this water available for BHP's water supply.

General

42 *The council does not believe that this PER process should proceed until a total plan including a rail option/agreement is presented to the EPA. No rail options have been taken into account in the PER document. HDMS in its PER has indicated that it supports the view that rail infrastructure should be shared and has based it development on that premise. However, other major producers in the region have indicated that they do not anticipate sharing rail facilities with any third party. It must therefore be assumed that HDMS will have to construct a rail and port facility to ensure continuity of supply to their customers. (Conservation Council of Western Australia Inc.)*

This environmental approval is premised on reaching agreement with an existing infrastructure owner. When such an agreement is reached all other route options would be forfeited. Environmental approval for a "mine only" scenario may facilitate such negotiations. HDMS clearly however could not give up its consideration of independent rail and port facilities until such an agreement was reached.

In the executive summary of the PER, HDMS acknowledges that access to existing infrastructure might not be achieved and indicates separate environmental approval would be sought under such circumstances. In either event the necessary additional environmental assessments would be sought.

43 *Prior to approval for this or any project by Hancock Prospecting Pty Limited (the ultimate holding company for Hope Downs Pty Ltd) a commitment to environmental management be established by a commitment to the clean up of the environmental harm created in the Pilbara by this group of companies. The Council is aware of a number of instances where the company has caused environmental damage without seeking appropriate approvals and where no rehabilitation has subsequently been carried out. (Conservation Council of Western Australia Inc.)*

HDMS has discussed the concerns raised by the Conservation Council of Western Australia Inc with Hancock Prospecting Pty Ltd and engaged Biota Environmental Sciences to provide an independent opinion on the current state of the environment at the locations raised in the Conservation Council's submission. Based on this report and recorded correspondence at the time when the various works were undertaken, HDMS addresses the Conservation Council's concerns as follows:

<u>East Island Causeway</u>

Whilst it is acknowledged that the correct procedures may not have been followed in respect of this work, it should be remembered that, particularly in respect of work undertaken in the 1970s, a different ethos existed than is in place today. At that time, hundreds of kilometres of access roads were constructed through station properties throughout the Pilbara. It was necessary to seek the approval of the station owner before work commenced, and this was the case in respect of the access to Ronsard Island constructed on land that was part of Mundabullangana Station (more normally known as Munda Station).

The approval of the station owner is documented in a progress report written in 1975 by the consultant engaged to supervise this work, and the comment made that the

station owner subsequently cordially confirmed his agreement to the work on a subsequent visit to the site. It should be noted that the progress report also states the objectives of the exercise being to gain access to Ronsard Island to enable proper investigation of the area as a potential new port site, and in doing so, "to undertake the work with a minimum of disturbance to the natural environment and be fully conscious of obligations in this respect".

The Conservation Council's main concerns appear to be destruction of mangroves associated with construction of the causeway and that no rehabilitation of the causeway has been undertaken.

The site was inspected in February 2001 by representatives of HPPL, HDMS and Biota. Access difficulties required that a helicopter be used for this purpose.
This inspection revealed that probably less than 1% of an estimated 800 hectares of mangal community on East Island had been lost as a result of the construction of the causeway in the first instance. The East Island area, over which the causeway passes, now supports a dense mangrove community which is generally in excellent condition.

Based on the site visit, it appears that there are minimal ongoing indirect impacts on the causeway due to the presence of the causeway which, as a consequence of tidal action and cyclones, has substantially eroded away. With one exception, the formation of the causeway has been breached at every point where it crosses tidal creeks. It is likely that this occurred some considerable time ago, as there is no discernable impact on mangroves associated with tidal creeks potentially impacted by the causeway.

In the one location where the causeway is intact, which is well inland of the coast, the formation is at the convergence of two tidal creeks, both of which are flushed independently. Mangroves immediately associated with these creeks were in good condition and sediments on either side of the causeway were wet from the previous tide cycle.

One very small area of dead mangroves was apparently associated with one of these creek systems but sufficiently removed from the causeway as to make it likely that natural mortality was the likely cause. Subsequent aerial inspection revealed other areas of dead mangroves at East Island well removed from the formation and, again, most probably due to natural causes which form part of the natural cycle of mangrove communities.

The Conservation Council's concerns, that migratory material from the eroding causeway was causing suffocation of large quantities of mangroves, was not evident.

It should be noted that the causeway appears to be so eroded as to make access by vehicular traffic impossible, and there was no evidence of any access in the form of vehicle tracks from the old Roebourne to Port Hedland road crossing of the Peawah River to the coast.

No Name Gorge Access Road

This road, which was an extension of an existing track from the access road to Wittenoom Gorge, was constructed by a contractor, International Mining and Technical Consultants (IMTC) in 1992. Part of this track is outside TR5616H, which was the focus of the Wittenoom Scree Project at the time.

There is no question that this road was constructed without the necessary approval and, in all probability, to a standard which would not have been approved, had the necessary permission been sought. Unfortunately, all personnel associated with the project, including the principal of the contracting firm concerned, are now deceased.

Inspection of the area was made by a site visit to undertake a ground inspection of the area in February 2001. The consultants' report concludes that:

- In general terms the alignment has undergone substantial regrowth since abandonment.
- The formation is only partially visible primarily where rock cuttings occur.
- Elsewhere, many sections of the alignment are so well re-grown that they are virtually indistinguishable from the surrounding natural vegetation.
- In areas where the formation crosses gullies, rainfall and flood events have largely removed the formation entirely.
- In its current state, the formation presents a minimal barrier to the natural surface hydrology and no decline in downstream vegetation condition was observed in the valley floor.

It is evident that the track has substantially rehabilitated itself and that this rehabilitation is both in keeping with the pre existing environment and can be expected to continue to occur.

Exploration Work South of TR5616H

Examination of company records shows that an extension of an existing track and mining of a small costean occurred in an area to the south of TR5616H in 1991. HPPL had applied for an Exploration Licence (EL) over the area in question in May 1991 and this was granted in March 1992. The work in question, however, was undertaken prior to the application for the EL being approved. As with the previous matter, all personnel associated with the activity are deceased.

This matter was the subject of an investigation by the Department of Mines in late 1991 and the outcome of the investigation was that, providing that the area concerned was rehabilitated and the costean refilled, the Government would not proceed with prosecution under the Mining Act.

This decision was accepted by the contractor, IMTC, which undertook the necessary rehabilitation.

The area in question was inspected by representatives of Biota and HPPL in February 2001. The results of this investigation appear to confirm that the rehabilitation did occur:

- No evidence of costeaning was found.
- The unauthorised section of track south of TR5616H was found to have re-grown to the point that only two partially concealed wheel ruts are evident.

In all three cases bought to our attention by the Conservation Council, it is the considered opinion of both our consultants, Biota Environmental Sciences, and ourselves that, notwithstanding the incorrect approach adopted by the company in undertaking these constructions in the past, the areas concerned have, as we would have expected based on our experiences elsewhere, substantially rehabilitated themselves naturally. Further efforts to assist the natural process at this stage is both unnecessary and would, due to the requirement to bring in heavy machinery, cause considerable damage to natural vegetation and impede rather than assist the recovery process.

Finally, it should be pointed out that the current management of HPPL had no involvement with the events described above and have from the outset adopted high environmental and procedural standards in respect of all exploration activities at Hope Downs and other tenements.

44 *Table 1.1 "Average Stripping Ratio" — should this be 1:0.5 instead of 1:1.42 as the amount of ore is 400 and the overburden is 200. (Department of Conservation and Land Management)*

In Table 1.1 Key Characteristics of the Project ore reserves are quoted in tonnes whilst overburden is quoted in Mm^3. The stated stripping ratio of 1:1.42 is correct.

45 *Section 4.10 – "Infrastructure": the investigation into the new service road into Hope Downs should have been completed prior to this document's release. Will CALM have an option to comment on the road proposal before it is implemented? (Department of Conservation and Land Management)*

Engineering studies undertaken subsequent to the issue of the PER have identified a preferred road alignment that will be discussed with CALM before the matter is taken further. A map detailing this road alignment is appended as **Attachment D** to this Response document.

46 *Storage of Hazardous Materials – Explosives: a final location for this has not been determined. Why? (Department of Conservation and Land Management)*

Further engineering studies have now identified the proposed location of this facility, which is highlighted on the drawing appended as **Attachment E** to this Response document.

47 *While two options are presented for power generation, the use of power from a gas-fired power station is the preferred option. (Department of Minerals and Energy)*

HDMS acknowledges the preference for a gas-fired option, which will be given close consideration if a power line from Newman to Yandi and Area C is constructed.

48 Environmental Offsets

As part of HDMS' commitment to improving knowledge of environmental issues and environmental management in the Pilbara, the company has in the past encouraged and participated in the exchange and provision of information to improve regional knowledge, both in respect of geological, hydrogeological and knowledge of biodiversity of flora and fauna.

HDMS is prepared to continue this practice by participating in further studies at the Hope Downs site, specifically with respect to stygofauna studies within the Weeli Wolli aquifer and downstream of the Spring and to improve knowledge of aquatic fauna in the vicinity of Weeli Wolli Spring.

It would be HDMS' intention to continue to share information gathered in the course of its environmental studies and to participate in other studies to improve knowledge of regional biodiversity as opportunities permit.

HDMS would also intend supporting, where appropriate, the operation and maintenance of flow monitoring stations.

HDMS would further intend to assist in both heritage and environmental management by monitoring and, where appropriate, managing access to sites of environmental and ethnographic significance, and contributing to management programmes for sites such as Weeli Wolli Spring.

The environmental offsets referred to in Response 48 have now been incorporated into Commitments 17 and 18 in Section 8 of the PER.

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Attachments:

A Proposed hydro-ecological monitoring programme
B Water management: expanded Durov diagram
C Groundwater modelling for dewatering and mine closure: distribution of model parameters (PER Figure 4.1)
D Proposed road alignment
E Storage of hazardous materials: proposed location
F Amended Proponent Commitments

References:

Eberhard, S. M. and W. F. Humphreys (1999). *Stygofauna survey – orebody 23 (Newman) and Mine Area C*. Unpublished report for BHP Iron Ore Pty Ltd, Perth.

Humphreys, W. F. (2000). *The Pilbara Stygofauna: a synopsis*. Unpublished report for the Water and Rivers Commission, Perth.

ATTACHMENT A

HOPE DOWNS
HYDRO-ECOLOGICAL MONITORING PROGRAMME
FOR WEELI WOLLI SPRING AREA

A key environmental issue relating to the Hope Downs Project is the potential impacts of the development on the ecological and hydrological systems at Weeli Wolli Spring in terms of:

1. Surface water (spring) flow
2. Shallow sub-surface (groundwater) flow
3. Tree health
4. Stygofauna

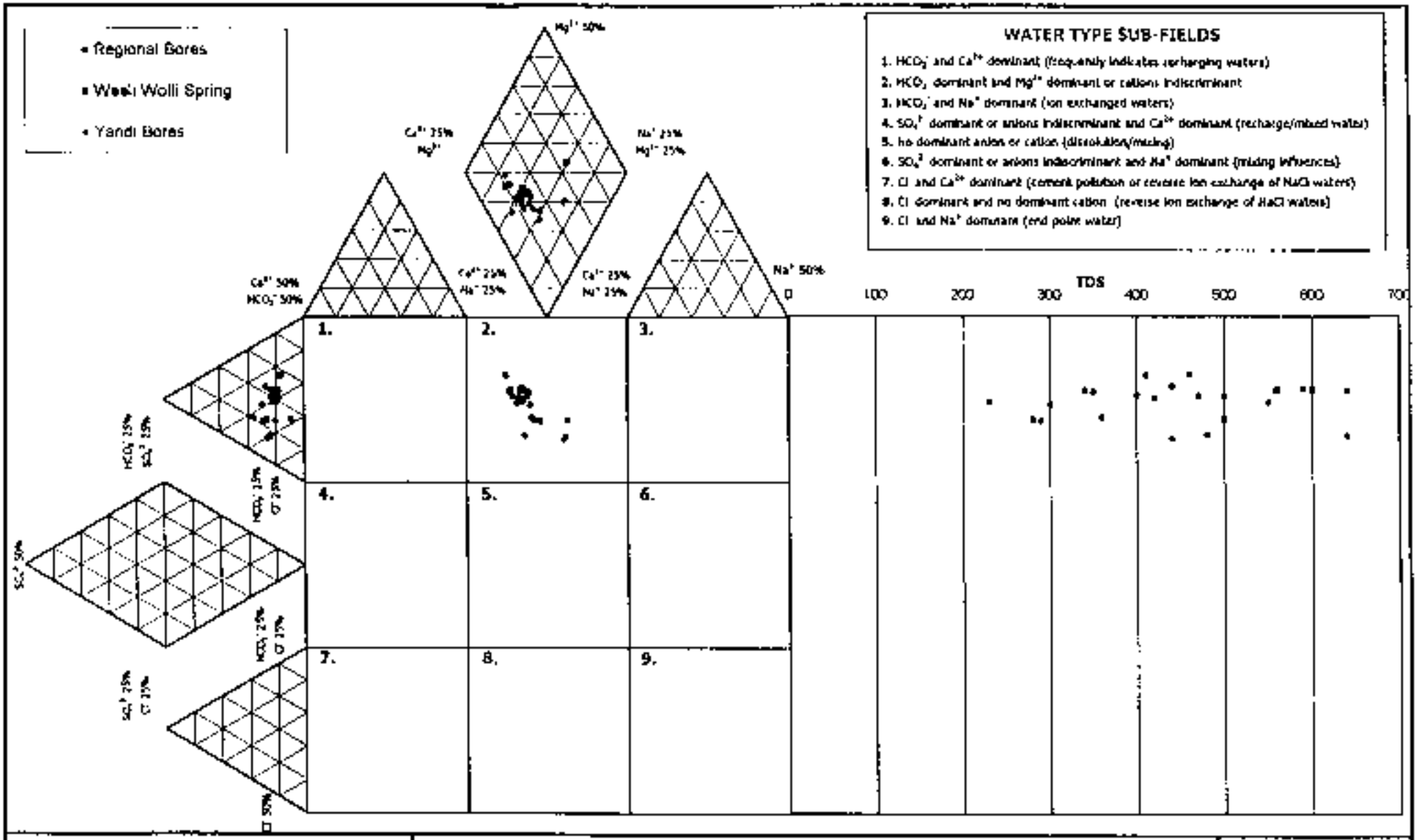
Accordingly, it is proposed that a specific programme of monitoring, assessment and reporting of hydrological and water-related ecological conditions be conducted in the spring area for the duration of applicable environmental licences. The programme will be 'incorporated in the Hope Downs Water Management Plan and will set out the procedures to enable HDMS to comply with the following licences for the Hope Downs Project:

- Pollution Prevention Licence (PPL) issued by the Department of Environmental Protection (DEP), which should include conditions related to dewatering discharge; and,
- Groundwater Well Licence (GWL) issued by the Water and Rivers Commission (WRC), which relates to. groundwater abstraction and use.

HDMS shall submit an annual monitoring report (Hydro-Ecological Report for the Weeli Wolli Spring area), which will be a supporting document for the catchment-wide PPL and GWL reports. It is intended that the Hydro-Ecological Report will include the following data and assessments:

1) Daily volumes of spring augmentation (ie mine dewatering discharge) and spring flow;
2) Monthly groundwater levels in the vicinity of the spring at observation bores BH17 and BH32.
3) Monthly tree monitoring (ie general health and tree water use rates) for the area of the spring between BH17 and BH32;
4) Monthly concentrations of TDS (total dissolved solids) and pH for both the surface water (near the flow gauging station and the augmentation discharge site) and groundwater (at BH17 and BH32);
5) Stygofauna sampling will be periodically undertaken in selected boreholes both in areas influenced by drawdown and in control sites within the same system. This will be based on a BACI design, with data on normal population fluctuations collected for several phases prior to the commencement of dewatering.
6) Annual sampling and hydrochemical analyses of the full suite of analytes for both groundwater and surface water at the sites listed in item 4;
7) An annual assessment will be made of the data collected and the following should be considered:
    i) Any variation in water quality (surface water or groundwater) from pre-mining conditions;
    ii) Any departure from the groundwater levels predicted by the Hope Downs regional groundwater model in the vicinity of the spring (as stated in the PER**);**
    iii**)** Any variation in tree water use and tree health from pre-mining conditions; and
    iv) Any significant changes in Stygofauna species richness, abundance or community structure.
8) Based on the above, an annual assessment of the need for adjustment to the model to refine predictions of the impact of dewatering and decommissioning on the spring and surrounding area.

It is intended that the spring flow will be maintained to at least pre-mining rates (ie approximately 4400 kL/day) during mining (and decommissioning). It is also intended that, by re-calibrating the model to recorded impacts, the reliability of the predictions for decommissioning will be greatly increased.



aquaterra

Expanded Durov Diagram

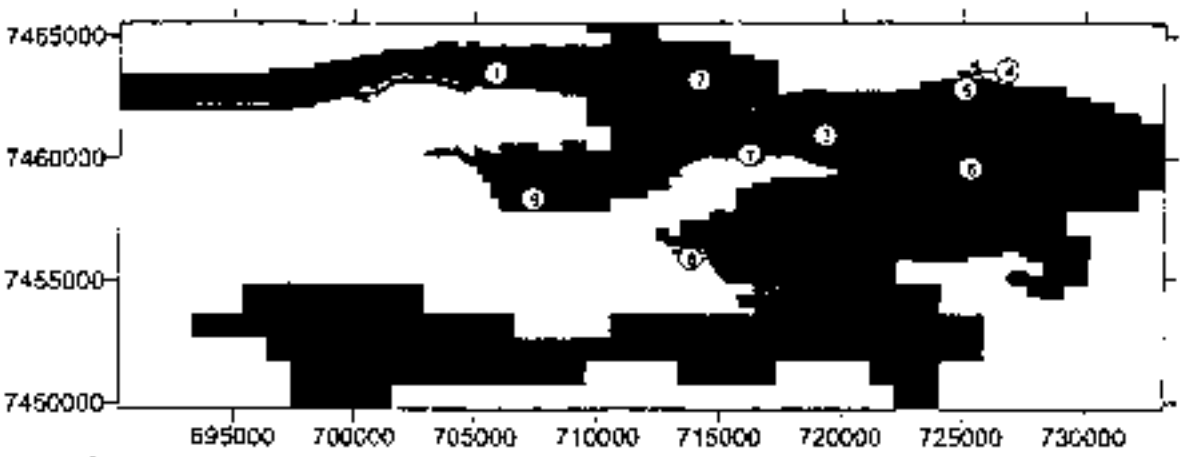
Figure 4

Date: 03/01/01

Project: Hope Downs Iron Ore Project
Project No: 14
Description: Water Management
Client: Hope Downs Management Services Pty Ltd

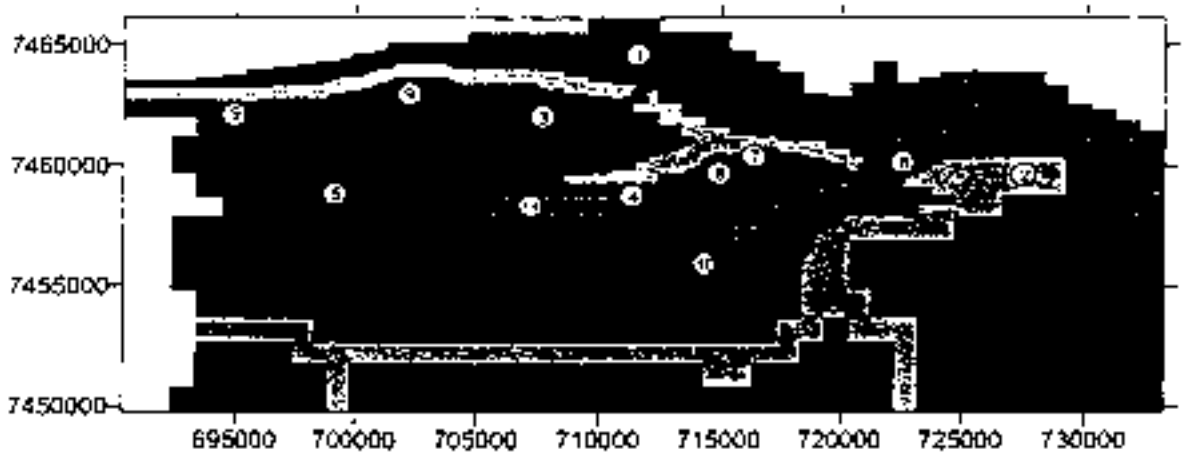
HydroCHEM 2.0

ATTACHMENT B



Layer 1

Zone No	Unit	Horizontal Hydraulic Conductivity (m/d)	Vertical Hydraulic Conductivity (m/d)	Unconfined Specific Yield	Confined Storage Coefficient
1	Alluvials (west)	0.2	0.02	0.07	-
2	Alluvials (east)	5	0.5	0.07	-
3	CID	30	3	0.03	-
4	Calcrete	10	10	0.05	-
5	Calcrete	20	20	0.1	-
6	Calcrete	50	50	0.1	-
7	Ore (Hope North)	6	2	0.1	-
8	Ore Hope South & MAC)	3	0.3	0.1	-
9	Ore (R & B Deposits)	0.3	0.03	0.1	-

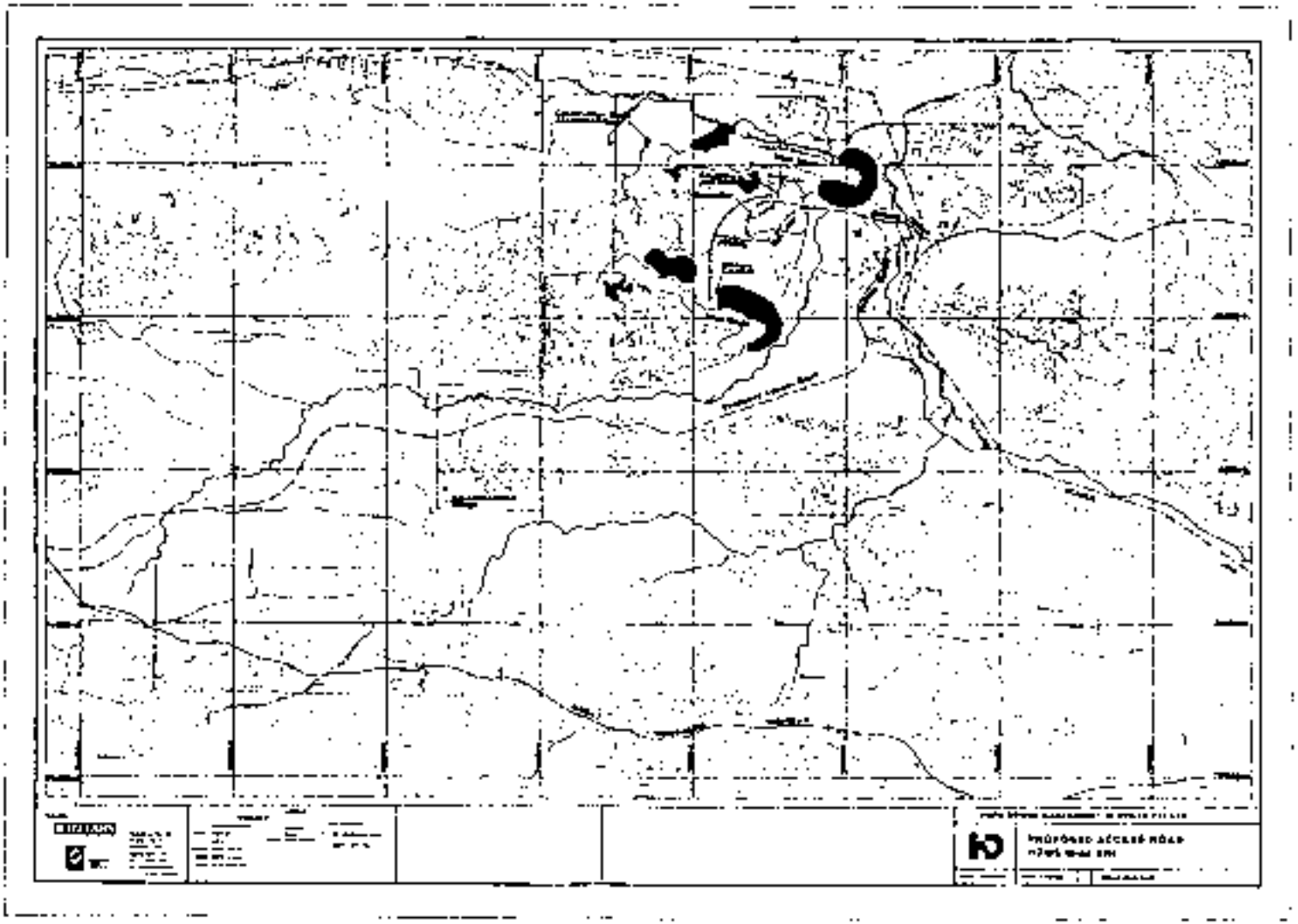


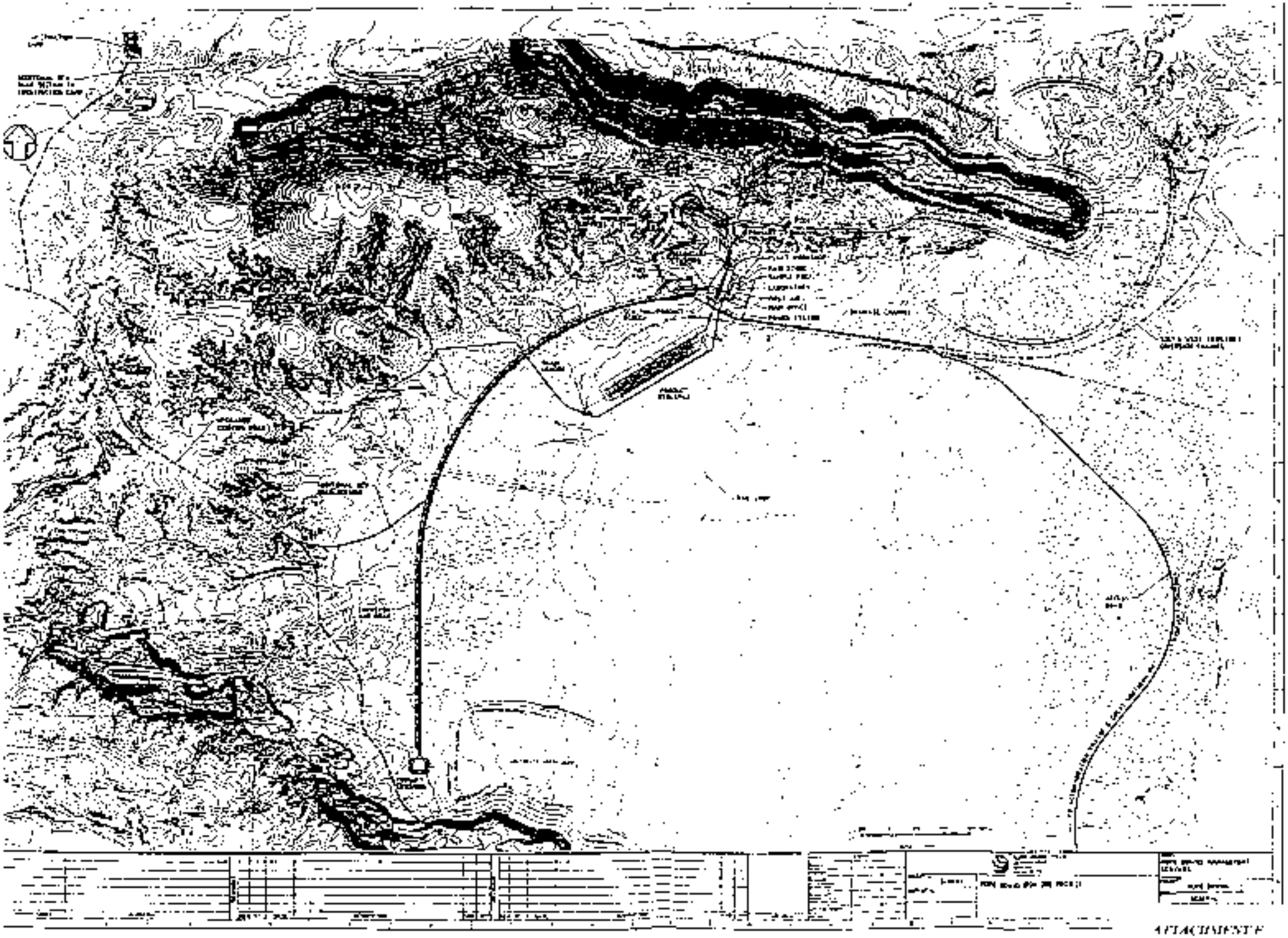
Layer 2

Zone No	Unit	Horizontal Hydraulic Conductivity (m/d)	Vertical Hydraulic Conductivity (m/d)	Unconfined Specific Yield	Confined Storage Coefficient
1	Mt Sylvia Shale & Bee Gorge Dolomite	0.1	0.01	0.0011	1.8×10^{-4}
2	Paraburdoo Dolomite *	6	6	0.005	3.1×10^{-4}
3	Low Permeability in Dolomite	0.7	0.07	0.06	3.1×10^{-4}
4	West Angela Shale	0.01	0.001	0.0011	1.8×10^{-4}
5	BIF	0.0001	0.00001	0.001	1.0×10^{-4}
6	High Permeability Zone in BIF	11	11	0.0011	3.0×10^{-4}
7	Ore (Hope North)	6	2	0.1	2.7×10^{-4}
8	Sub-grade Ore (Hope North)	0.001	0.3	0.001	1.0×10^{-4}
9	Orebody (MAC)	3	0.3	0.1	2.7×10^{-4}
10	Orebody (Hope South)	0.0001	0.00001	0.001	1.0×10^{-4}
11	Orebody (R & B Deposits)	0.3	0.03	0.1	2.7×10^{-4}

* includes permeable West Angela Shale near Hope North Deposit.

Distribution of Model Parameters
Figure 4.1





ATTACHMENT F