Yandicoogina Junction Southeast Mine, Mining Lease 274SA

Hamersley Iron Pty Limited

Report and recommendations of the Environmental Protection Authority

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1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to a proposal by Hamersley Iron Pty Limited (Hamersley), the proponent, to mine a section of the Yandicoogina Channel Iron Deposit (CID). The proposal is known as the Yandicoogina Junction Southeast (JSE) Mine, and is located within mining lease 274SA, 90 kilometres northwest of Newman, in the Central Pilbara Region (Figure 1).

A previous Minister for the Environment issued approval in May 1996 for the first iron ore mining operation on ML 274SA, to mine the CID at a rate of 15 million tonnes per annum and construct associated infrastructure, including a railway (EPA, 1996). This mine is known as Yandicoogina Junction Central, and mining commenced in 1998. In 1999, the EPA assessed a modification to this proposal, which involved an extension to the mining area (EPA, 1999). The Yandicoogina JSE mine is a downstream extension of the existing CID being mined at Yandicoogina Junction Central (Figure 2).

The EPA was advised of the proposal in September 2004. Based on the information provided, the EPA considered that the proposal had the potential to have an effect on the environment, but could be managed to meet the EPA's environmental objectives. Consequently, it was notified in *The West Australian* newspaper on 11 October 2004 that, subject to the preparation of a suitable Environmental Protection Statement (EPS) document, the EPA intended to set the level of assessment at EPS.

The proponent has prepared the EPS document (Strategen, 2005), which accompanies this report. The EPA considers that the proposal can be managed in an acceptable manner subject to the conditions being legally binding.

The EPA has determined, under section 40(1) of the *Environmental Protection Act 1986,* that the level of assessment for the proposal is EPS, and this report provides the EPA's advice and recommendations in accordance with section 44(1).

BHP Billiton Iron Ore also mines the CID, approximately 12 kilometres west and upstream of Hamersley's lease. BHP Billiton Iron Ore has sought approval to mine the entire Yandicoogina CID orebody, within ML 270SA and 47/292 at a rate of 45 million tonnes per annum. Hamersley may also propose to mine other deposits that exist within ML 274SA, including Junction Southwest, Snooker, Meander and Billiards in the future.

2. The proposal

The proponent proposes to develop a new open cut iron ore mine in a CID, and construct associated infrastructure within ML 274SA. The CID is about 500 metres wide with a thickness of about 55 metres, under approximately 10 metres of overburden. The lower CID is the deeper, lower grade portion of the deposit. The proponent will operate dewatering bores to lower the water table of the pit by approximately 45 metres.

The proposal is described in detail in Section 3 of the proponent's *Yandicoogina Junction South East Project – Environmental Protection Statement* (Strategen, 2005). Table 1 shows the key proposal characteristics.

Table 1 - Key Proposal Characteristics

Characteristic	Quantities / Description
Mining	
Project life	Approximately 16 years
Length of deposit to be mined	Approximately 5.8 kilometres
Ore reserve to be mined	Approximately 280 million tonnes
Mining rate	Approximately 16 million tonnes per annum
Pit depth	Approximately 65 metres (45 metres below the present water table)
Overburden	Overburden will be stockpiled in a temporary storage area. Some of the material will be used for constructing drainage embankments. The remaining material will be used as backfill in the pit void
Total disturbance area - Infrastructure - Overburden waste dump - Pit - Post-closure backfill source	Approximately 669 hectares (within mining lease 274SA) - Approximately 79 hectares - Approximately 60 hectares - Approximately 370 hectares - Approximately 160 hectares
Closure and rehabilitation	The final pit void will be backfilled to at least 490 metres Relative Level. The total disturbance area will be rehabilitated with local native vegetation
Dewatering	
Initial dewatering	Approximately 27-30 megalitres per day
Maintenance	Approximately 15-20 megalitres per day
Sump dewatering	Approximately 1 megalitre per day
Dewatering well fields	Initially 2 clusters of wells and a sacrificial well. As mining progresses, 3 additional cluster wellfields, plus sumps
Processing and transport	
Crushing plant	Construction of a dry primary and secondary crushing plant
Conveyor	Construction of a 4.8 kilometre long overland conveyor to link the crushing plant to the existing overland conveyor at Yandicoogina Junction Central. Ore will be conveyed to the Yandicoogina Junction Central mine, where it will undergo additional processing
Transport	Ore will be transported along the Central Pilbara Railway to the ship-loading facilities at Dampier Port and Cape Lambert
Infrastructure	
Power	An 8-megawatt diesel-fired power station will be used for additional power during early stages of construction. Connected to grid with power supplied by Hamersley's gas-fired power stations at Dampier and Paraburdoo
Access roads	▪ Light vehicle access road from the transfer point on the current conveyor to the new crushing plant at Yandicoogina Junction Southeast. A crossing on Yandicoogina Creek will be required ▪ Heavy vehicle access road from Yandicoogina Junction Central to Junction Southeast. A crossing on Marillana Creek will be required ▪ Realignment of part of the public access road to Newman to allow bypass of heavy vehicle access road
Other facilities	Administration building, plant workshop and fuelling facility
Water	
Water management	Construction of flood protection levees and diversion drains
Water use	Approximately 3 megalitres per day of dewatered water for dust

	suppression and potable use

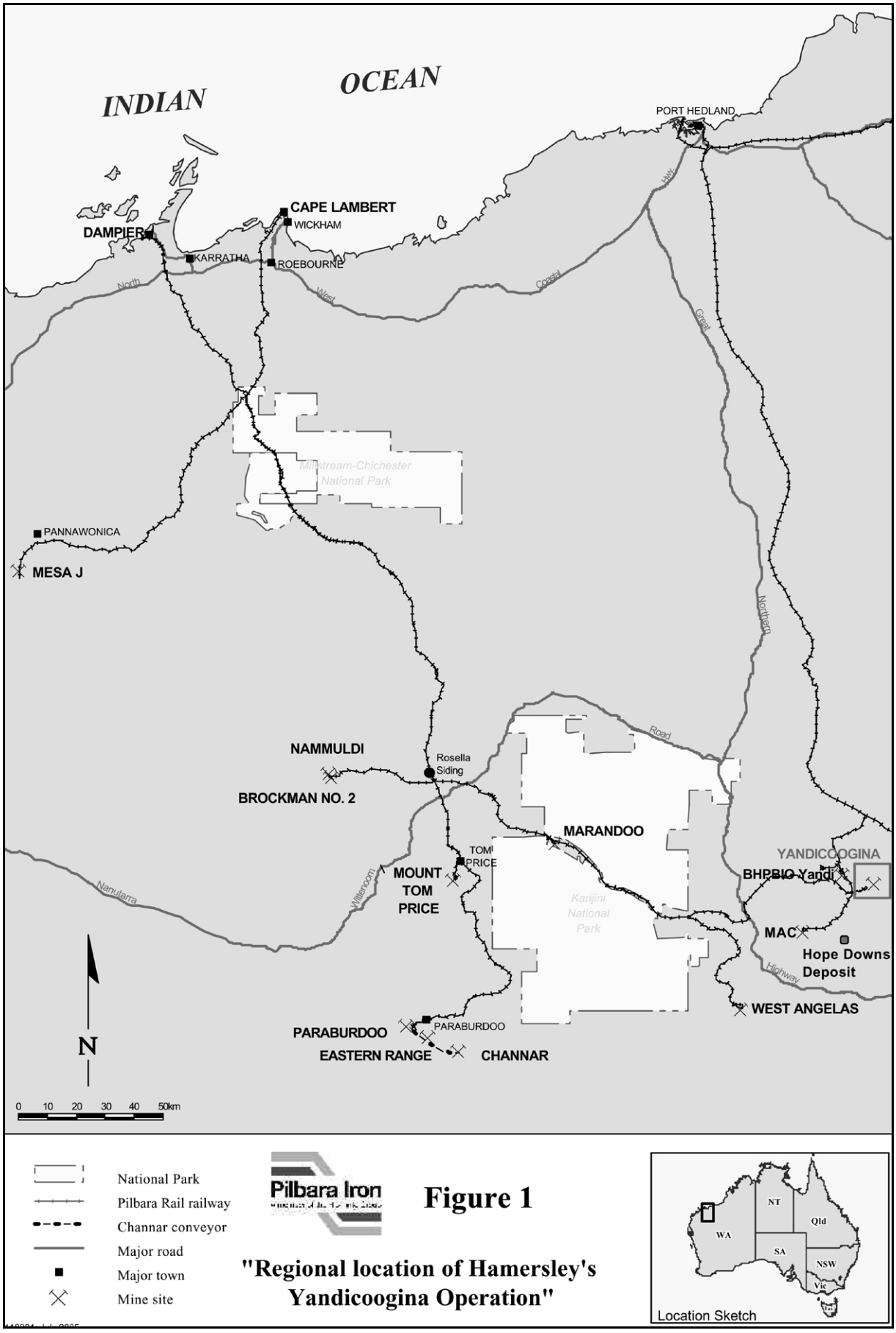

Figure 1: Site location

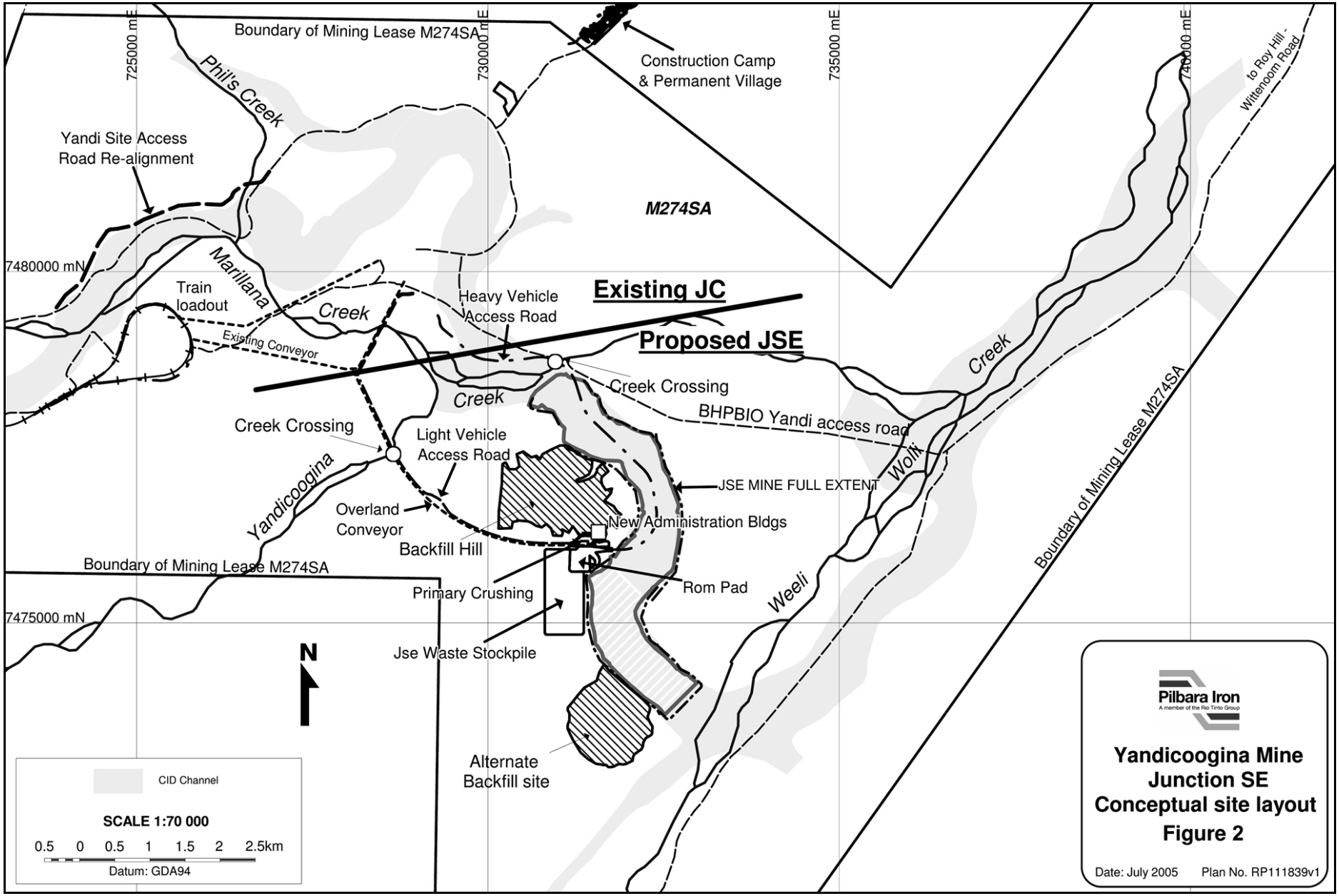

Figure 2: Site layout

The main components of Hamersley's Yandicoogina JSE proposal are:

- conventional open cut mining of overburden and ore from the CID;
- dewatering of the orebody, with a supply pipeline to Yandicoogina Junction Cental where the water will be discharged from a licensed location;
- placement of overburden in a temporary out-of-pit storage area for later use as fill material during partial backfill of the pit void;
- construction of the following infrastructure:
    - a light vehicle access road and a heavy vehicle access road, which include crossings of Yandicoogina and Marillana Creeks respectively;
    - realignment of part of the public access road to Newman;
    - dry primary and secondary crushing plant with run-of-mine (ROM) pad;
    - 4.8 kilometre long overland conveyor (with covers fitted over its length), to link the crushing plant with the existing conveyor system;
    - fuelling facility, to be connected to the Yandicoogina Junction Central fuel facility by an above ground pipeline; and
    - administration building and workshop
- tertiary crushing and screening of the ore at the existing Yandicoogina Junction Central processing plant;
- wet processing of the lower CID material with a high clay content, at the existing Yandicoogina Junction Central wet processing plant;
- loading and transportation of ore along the Central Pilbara Railway to the ship-loading facilities at Dampier Port and Cape Lambert;
- maintenance of a 200-metre separation distance between the proposed pit and Yandicoogina, Marillana and Weeli Wolli Creeks;
- possible re-injection of a component of the dewatering discharge into the Billiards CID aquifer, down gradient of the proposed pit, near Weeli Wolli Creek;
- permanent loss of at least part of a nearby hill to partially fill the pit void to at least 490 metres Relative Level (mRL); and
- progressive rehabilitation of all disturbed areas.

3. Consultations

The proponent has advised that consultation has occurred with the following government agencies and stakeholders during preparation of the EPS document:

- Department of Conservation and Land Management (CALM);
- Department of Industry and Resources;
- Department of Environment (DoE);
- Conservation Council of Western Australia;
- Wildflower Society;
- Gumala Aboriginal Corporation;
- BHP Billiton Iron Ore; and
- Hope Downs Management Services.

The main issues raised by the government agencies and stakeholders in meetings held with the proponent during preparation of the EPS were:

- closure management;
- hydrogeological impacts; and
- disturbance to vegetation.

The proponent has addressed these issues in the EPS document (Strategen, 2005).

Liquid Earth (2005) carried out hydrogeological studies for the proposal. The studies assessed the influence of dewatering on surrounding groundwater systems, the optimum methods of water discharge and the actions required at mine closure to produce acceptable long-term outcomes. Overburden removed during the life of the mine will be used to partially fill the pit void. However, there is insufficient overburden to fill the pit void to above the post-closure water table. Groundwater modelling indicated that the post-closure backfill level should be at least 490mRL to ensure that there is through-flow of groundwater and hence no build up salinity. Therefore, the proponent has proposed to source at least part of a nearby hill to backfill the pit void to 490mRL. This would reduce the extent of a surface water body, or pit lake, developing post-closure, as the groundwater table recovers. The preferred hill to be sourced is called Backfill Hill, which is located approximately two kilometres west of the proposed pit. Backfill Hill will only be mined if baseline surveys show that no significant environmental values will be lost. An alternative hill, which does not appear to have any significant environmental values, may be used if Backfill Hill is found to be inappropriate.

Mine dewatering will result in a cone of depression in and around the pit during the mine life. This is expected to have only a limited and localised effect on the adjacent Billiards CID aquifer due to a hydraulic barrier at the junction of the two aquifers. The Weeli Wolli Creek alluvial aquifer is not likely to be affected by dewatering due to the distinct hydraulic separation from the underlying Billiards CID aquifer. However, ongoing groundwater monitoring of Weeli Wolli Creek will confirm any impacts.

The discharge of surplus water is not expected to have a significant impact on the regional hydrology. The proponent is investigating the feasibility of re-injecting part of the surplus water into the Billiards CID aquifer, and if this proceeds, the water levels in the Billiards CID aquifer may rise locally but will not affect the overlying perched Weeli Wolli Creek aquifer.

The vegetation and flora survey carried out by Biota Environmental Sciences (2004a) found that the vegetation in the project area was generally well represented in the region. However, riparian vegetation along sections of Yandicoogina Creek and Marillana Creek were identified as being significant. The proponent will minimise impacts to riparian vegetation by maintaining a 200-metre separation distance between the proposed pit and the major creeks, and preparing and implementing a Riparian Vegetation Management Plan.

The proponent will review and revise the existing Yandicoogina Decommissioning and Rehabilitation Plan to include closure of the Yandicoogina JSE mine. This Plan will include the development of completion criteria for the rehabilitation of all disturbed areas.

Stakeholder and government agency comments on the proposal, and the proponent's responses are provided in Table 2 of the EPS document (Strategen, 2005). The proponent will continue to liaise with the stakeholders and government agencies during implementation of the proposal.

4. Relevant environmental factors

A summary of all the environmental factors, potential impacts and their management is outlined in Table S3 of the EPS document (Strategen, 2005). In the EPA's opinion the following are the key environmental factors relevant to the proposal:

1. groundwater;
2. riparian vegetation; and
3. flora and fauna.

4.1 Groundwater

Description

The three main aquifer systems identified in the area are the Yandicoogina JSE CID aquifer, the Billiards CID aquifer and the Weeli Wolli Creek alluvial aquifer (which is perched above the Billiards CID aquifer).

The CID forms the main groundwater aquifer for the Marillana-Yandicoogina-Weeli Wolli Creek system. Current groundwater levels in the Yandicoogina JSE CID are between 495 and 498mRL (Strategen, 2005). Downstream of the mine site the Yandicoogina JSE CID aquifer joins the Weeli Wolli Creek CID aquifer, where it then moves northeast to the Fortescue River Valley (WRC, 2003). The water within the CID aquifer is fresh, about 500 milligrams per litre Total Dissolved Solids (WRC, 2003). The groundwater of the deep aquifer of the Fortescue River Valley is saline to hypersaline.

Assessment

The EPA's environmental objective for this factor is to maintain the quality and quantity of groundwater so that existing and potential environmental values, including ecosystem maintenance are protected.

The proposal involves mining of a pit approximately 65 metres below the existing ground level, and approximately 45 metres below the present water table. The proposal has the potential to alter the groundwater through-flow and quality of the local aquifers, from dewatering of the pit.

The proponent proposes to dewater the pit in a similar manner to other CID mining operations in the area, where groundwater is managed by a series of sacrificial 'cluster' borefields along the channel. Mine dewatering will draw the water table down, resulting in a cone of depression in and around the pit during the life of the mine. The DoE has advised that existing hydrogeological data indicates that the Yandicoogina JSE CID aquifer has limited hydraulic connection to the Billiards CID aquifer, due to a groundwater mound and low permeability zone between the two aquifers. Therefore, dewatering of the Yandicoogina JSE CID aquifer is likely to have only a localised effect on the adjacent Billiards CID aquifer due to the hydraulic barrier at the junction of the two aquifers. Although some groundwater through-flow between the two aquifers still exists. Dewatering is not expected to influence the Weeli Wolli Creek alluvial aquifer because it is perched with very limited hydraulic connection to the underlying Billiards CID aquifer (Strategen, 2005). The proponent is undertaking additional investigative drilling and boretesting to further understand the relationship between the aquifers in the area.

The EPA notes that the proponent has modelled and monitored groundwater at Yandicoogina since mining commenced at the Junction Central mine in 1998. Liquid Earth (2005) carried out modelling of the hydrogeological impacts and outcomes for the current proposal. The modelling results indicated that the pit void should be backfilled to a minimum level of 490mRL, so that an adequate gradient will exist to allow groundwater to flow from the Yandicoogina JSE CID aquifer to the Billiards CID aquifer. The infill configuration in the pit void will need to find an appropriate balance between groundwater inflow, recharge, groundwater outflow and evaporation. This will ensure that the groundwater system continues to conduct water and there is no build up of salinity.

Due to the low overburden to ore strip ratio for the orebody, there is insufficient overburden to fill the pit void to above the water table. Post-mining, the CID would have been dewatered to 450mRL. Backfilling the pit with the available overburden will only raise part of the pit floor to 490mRL. To minimise the development of a surface water body or pit lake post-closure, and potential evaporative salinity problems as the groundwater level recovers, the proponent proposes to source material from a nearby hill to backfill the pit void to near the post-closure groundwater level, at 490mRL. No significant environmental values will be lost as a result of mining the proposed hill to be sourced as backfill (condition 6). This is consistent with the EPA's preferred closure procedure, to backfill pit voids to the post-closure groundwater level.

Groundwater can be exposed in pit voids, causing evaporation and saline water forming within the pit. This water can then migrate into surrounding groundwater and surface water systems (EPA, 1999). The EPA notes that modelling predicted a maximum long-term groundwater salinity concentration of 2,000 mg/L TDS, which is suitable for stockwatering. The DoE advised that the salinity is not expected to create an expanding salinised area, since the shallow groundwater system will be subject to flushing by wet season rainfall and runoff.

The EPA considers that further detailed groundwater modelling is required, as part of the Groundwater Management Plan (condition 7) and Decommissioning and Rehabilitation Plan (condition 5) during the course of mining operations, to refine predictions of the short-term and long-term hydrogeological impacts. The EPA recommends that in revisions of the Groundwater Management Plan, the proponent should adopt current best practice, while having regard for continuous improvement in groundwater management, based on adaptive management (condition 7).

Water abstraction and impacts to the groundwater resource as a result of the adjacent BHP Billiton Iron Ore and Hope Downs operations have been taken into account in the proponent's groundwater model and dewatering licence. In addition, groundwater monitoring will provide a mechanism for monitoring cumulative impacts.

Summary

Having particular regard to the:

(a) high standard of the proponent's hydrogeological modelling of impacts and proposed management;
(b) advice by the DoE on the technical feasibility of the proposed management;
(c) water licensing requirements of the DoE; and
(d) recommended conditions;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.2 Riparian vegetation

Description

Biota Environmental Sciences (2004a) prepared a vegetation and flora survey report for the project area. The report identified that the vegetation of Yandicoogina Creek was in excellent condition and the vegetation of Marillana Creek was in moderately good condition, with several weed species present (including Buffel Grass) but at low density. Yandicoogina Creek is a tributary of Marillana Creek.

Riparian vegetation grows within a creek bed and along the banks of a water body, and is directly dependent on the proximity of the water body. The creek systems in the project area support combinations of *Melaleuca argentea*, *Eucalyptus camaldulensis* and *Eucalyptus victrix* over dense mixed shrubs. The riparian vegetation within the project area is considered to be of conservation significance because it has high relative species richness and supports numerous flora and fauna species that are reliant on such habitat, and it is also considered to be particularly susceptible to weed invasion (Strategen, 2005). The conservation significance of the vegetation was assessed against CALM's Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (2001).

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographical distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

The proposal has the potential to impact on the riparian vegetation from direct clearing, changes in the water availability through pit dewatering and discharge, and weed invasion.

Up to four hectares of riparian vegetation will be cleared. Clearing will be for the construction of creek crossings on Yandicoogina and Marillana Creeks associated with the proposed light vehicle access road and heavy vehicle access road. The creek crossings will be removed post-closure. Clearing of riparian vegetation will also be required for mining, where minor creeks intersect the proposed location of the pit. This clearing is not considered to impact on the regional conservation of the vegetation communities, because the area to be cleared represents 0.09% of the riverine land system mapped within the Pilbara area (Biota, 2004a).

The EPA notes, on advice from the DoE, that the riparian vegetation communities are widespread, and there will be no regional loss of these communities as a result of the proposal.

The proponent will be required to apply for a permit to interfere with bed and banks under the *Rights in Water and Irrigation Act 1914*. The application would need to include information on how the potential impacts to the creeks and the surrounding environment, from the construction and operation of the crossings, will be minimised and managed.

Dewatering will draw the water table down resulting in a cone of depression around the pit. Dewatering is not expected to influence water tables and associated dependant vegetation in

Weeli Wolli Creek as the alluvial aquifer in this area is perched with very limited hydraulic connection to the underlying CID aquifer. A 200-metre separation distance will be maintained between the pit and the edge of Marillana, Yandicoogina and Weeli Wolli Creeks. The EPA notes that the proponent has collaborated with the University of Western Australia and others to research the impacts of dewatering on tree health and provide a trigger for management responses. The findings of the research to date identified the need for adaptive management, whereby monitoring of tree health should include the collection and interpretation of remote sensing data (to map large scale changes in tree distribution and possible health), analysis of groundwater depth and quality, establishment of tree health monitoring sites (including reference sites), establishment of visual inspection zones and analysis of tree water use and root growth where significant impacts from dewatering and discharge is likely (Strategen, 2005).

The EPA recommends that the proponent should maintain the flow paths, quantity and quality of Marillana, Yandicoogina and Weeli Wolli Creeks and the underlying aquifers to protect surface water and groundwater dependent ecological systems, monitor the effects of the proposal on the riparian vegetation and undertake remedial action if impacts are detected in accordance with a Riparian Vegetation Management Plan (condition 8).

Similar to other iron ore mining operations in the area, the majority of the groundwater pumped from the dewatering bores will be discharged at a licensed location. At other mining operations including Hamersley's Yandicoogina Junction Central mine and BHP Billiton Iron Ore's Yandi mine, enhanced vegetation growth and seedling establishment in the vicinity of the discharge point is evident. However, when discharge stops, the vegetation that has become dependant on surface water may find it difficult to survive. To reduce this impact to the riparian vegetation, the proponent is investigating the potential to re-inject a component of the dewatering discharge into the Billiards CID aquifer, down gradient of the proposed mine, near Weeli Wooli Creek. The proponent intends to use the re-injection as a water banking system, so the stored water can be accessed later, if required.

CALM has advised that the preferred option to disposing of dewatering discharge to minimise impacts to the environment, is to re-inject the surplus water into the underlying Billiards CID aquifer. Therefore the EPA recommends that the proponent be required to re-inject surplus water from dewatering into the Billiards CID aquifer, if investigation studies indicate it is feasible (condition 7).

The vegetation and flora report (Biota, 2004a) identified creek line vegetation as being particularly susceptible to weed invasion. Appropriate wash down of equipment should be undertaken prior to any activities near the creek lines. Strict weed hygiene measures should be implemented during construction of the access roads that require creek crossings. The EPA recommends that the proponent be required to implement measures to avoid disturbance and weed introduction to vegetation in creek lines, particularly vegetation that is currently in good or excellent condition (condition 8).

Summary

Having particular regard to the:

(a) proponent's research into alternative dewatering discharge methodologies and locations;

(b) creek interference permitting requirements by the DoE;

(c) advice by CALM on the acceptability of the proposed management of riparian vegetation; and

(d) recommended conditions;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.3 Flora and fauna

Description

Previous surveys by Hamersley identified a Declared Rare Flora (DRF) species, *Lepidium catapycnon* to the west of the junction of the proposed overland conveyor and the existing Yandicoogina Junction Central conveyor. Biota Environmental Sciences prepared flora and fauna survey reports for the project area. The flora report (Biota, 2004a) identified five Priority flora species within the project area. *Olearia fluvialis* is restricted to riparian habitats and was recorded in Marillana Creek. The low shrub *Sida sp.* Barlee Range was recorded on the bank of Marillana Creek. *Abutilon trudgenii* ms. is a low shrub stimulated by fire and was recorded at five locations, mostly on alluvial clay flats. The tussock grass, *Themeda sp.* Hamersley Station, was recorded on a floodplain north of Marillana Creek. The small herb *Goodenia stellata* was recorded in a tributary of Weeli Wolli Creek.

Thirteen species of weeds were recorded in the project area (Biota, 2004a). The species that are most widespread are, Mexican Poppy, Buffel Grass, Spiked Malvastrum and Whorled Pigeon Grass. Many of these species, as well as Ruby Dock, occur in creek lines, which are particularly susceptible to weed invasion.

The Pilbara Olive Python is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*, and is likely to occur within the project area, particularly in rock pools along Marillana Creek and in adjacent rocky areas (Biota, 2004b). The Western Pebble-mound Mouse, Australian Bustard, Bush Stonecurlew and Peregrine Falcon are also likely to occur in the project area, and are considered to have conservation significance (Biota, 2004b). The genus *Synsphyronus* (pseudoscorpion) was identified in the fauna report (Biota, 2004b) as containing short-range endemic taxa.

Six fauna habitat types based on topography and vegetation were identified; low stony hills, Mulga on stony hills, exposed ridges and breakaways, valley floors, major creeks, and secondary creeks (Biota, 2004b).

The stygofauna report (Biota, 2005) recognised that the abundance and diversity of stygofauna collected from Yandicoogina was considerable. The ostracod, *Gomphodella* sp. was recorded as occurring in the impact area, and the identification for the water mite, *Recifella* was incomplete (Biota, 2005). Recent sampling has identified that *Gomphodella* sp is also located outside the project area (Strategen, 2005).

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

The proposal has the potential to impact on conservation significant flora and fauna through clearing of native vegetation for mining. Pit dewatering may lower the water table in some areas in which stygofauna species live. Land clearing and vehicle movement have the potential to introduce weeds and spread existing populations of weeds within the project area, if these activities are not managed appropriately.

The total area of disturbance (approximately 669 hectares) will be progressively rehabilitated in accordance with the Decommissioning and Rehabilitation Plan (condition 5). The rehabilitation of the pit void will evolve as the proponent continually adapts its program in response to results of previous rehabilitation.

The DRF species, *Lepidium catapycnon*, is outside the proposed construction area of the overland conveyor and access road. The plants should not be disturbed if construction is managed carefully, so that an exclusion zone exists around the plants. If subsequent surveys identify any DRF species that cannot be avoided by adjusting the clearing boundaries, the proponent would be required to prepare and submit an application to take DRF pursuant to the *Wildlife Conservation Act 1950*.

To minimise potential impacts on flora and fauna species and habitat areas for species of conservation significance, the EPA recommends that the proponent be required to prepare and implement a Significant Species Management Plan (condition 9). Conservation significant species are those that are un-described, poorly sampled, listed as rare, threatened or endangered under the *Wildlife Conservation Act 1950* or listed as Priority by CALM. Potential impacts to conservation significant flora and fauna species and significant fauna habitat need to be identified and recorded on mine plans so that they can be managed appropriately. Where necessary, the proponent would undertake additional pre-clearance survey work to identify or improve knowledge of the distribution of the species of conservation significance and where possible, adjust clearing boundaries to avoid disturbance. CALM would be consulted to develop management strategies where significant flora or fauna, vegetation associations or habitat areas cannot practically be avoided.

The EPA notes, on advice from CALM, that strict weed hygiene measures should be implemented during all phases of the project to prevent the introduction of new weeds and minimise the spread of existing weeds. The EPA recommends that a Weed Management Plan should be prepared and implemented by the proponent (condition 10).

Biota Environmental Sciences (2005) conducted stygofauna sampling within the project area and outside the project area to determine the conservation significance of the identified stygofauna species. The sampling results and current knowledge of the biology and distribution of stygofauna in the Pilbara suggest that it unlikely that there are any stygofauna restricted to the project area. However, to maintain the long-term persistence of stygofauna species and communities within the project area, the EPA recommends, on advice from CALM, that the proponent prepare and implement a Stygofauna Management Plan (condition 11). The EPA notes that the proponent is involved in a stygofauna research program with the University of Western Australia (in collaboration with BHP Billiton Iron Ore and Hope Downs). The EPA commends the proponent on this initiative, which aims to improve the knowledge of the taxonomy, distribution and ecology of stygofauna within the Pilbara region.

The proponent has assisted the Pilbara Region Biological Survey conducted by CALM and the WA Museum by providing relevant data. The results of the survey provide for the

appraisal of the region's conservation reserve system and verification of the distributional information for threatened species and ecological communities (Strategen, 2005).

Summary

Having particular regard to the:

(a) advice by CALM on the acceptability of the proposed management of conservation significant flora and fauna, stygofauna and weeds; and

(b) recommended conditions;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

5. Conclusions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment 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.

The EPA concludes that provided the conditions are applied to the proposal, the factors of groundwater, riparian vegetation and flora and fauna can be managed to meet the EPA's objectives of:

- maintaining the quality and quantity of groundwater so that existing and potential environmental values, including ecosystem maintenance are protected;
- maintaining the abundance, diversity, geographic distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge; and
- maintaining the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

6. Recommendations

The EPA considers that the proponent has demonstrated, in the EPS document (Strategen, 2005), that the proposal can be managed in an environmentally acceptable manner and provides the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for the Yandicoogina Junction Southeast Mine, 90 kilometres northwest of Newman.
2. That the Minister considers the report on the relevant environmental factors as set out in section 4.
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised provided there is satisfactory implementation by the proponent of the recommended conditions as set out in Appendix 2.
4. That the Minister imposes the conditions and procedures recommended in Appendix 2 of this report.

Appendix 1

References

Biota 2004a, *Yandi Expansion Vegetation and Flora Survey*, December 2004.

Biota 2004b, *Yandi Expansion Desktop Fauna Assessment and Targeted Invertebrate Survey*, December 2004.

Biota 2005, *Yandi Junction Southeast Expansion Baseline Stygofauna Assessment*, March 2005.

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Liquid Earth 2005, *Hamersley Iron Yandi 48Mt Pre Feasibility Study – Hydrogeological Investigations Junction South East Deposit*, March 2005.

Strategen 2005, *Yandicoogina Junction South East Project – Environmental Protection Statement*, August 2005.

WRC 2003, *Mine Void Water Resource Issues in Western Australia*, Water and Rivers Commission, Perth, Western Australia.

Appendix 2

Recommended environmental conditions

RECOMMENDED CONDITIONS AND PROCEDURES

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

YANDICOOGINA JUNCTION SOUTHEAST MINE, MINING LEASE 274SA

Proposal: To mine iron ore within mining lease 274SA at a rate of approximately 16 million tonnes per annum, and subsequent rehabilitation and decommissioning of the site, as documented in schedule 1 of this statement.

Proponent: Hamersley Iron Pty Limited

Proponent Address: Level 22, 152-158 St George's Terrace PERTH WA 6000

Assessment Number: 1590

Report of the Environmental Protection Authority: Bulletin 1195

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

1 Implementation

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

2 Proponent Nomination and Contact Details

2-1 The proponent for the time being nominated by the Minister for the Environment 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 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.

2-2 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.

2-3 The nominated proponent shall notify the Department of Environment of any change of contact name and address within 60 days of such change.

3 Commencement and Time Limit of Approval

3-1 The proponent shall substantially commence the proposal within five years of the date of this statement or the approval granted in this statement shall lapse and be void.

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

3-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement to the Minister for the Environment, prior to the expiration of the five-year period referred to in condition 3-1.

The application shall demonstrate that:

1. the environmental factors of the proposal have not changed significantly;

2. new, significant environmental issues have not arisen; and

3. all relevant government authorities have been consulted.

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

4 Compliance Audit and Performance Review

4-1 The proponent shall prepare an audit program and submit compliance reports to the Department of Environment which address:

1. the status of implementation of the proposal as defined in schedule 1 of this statement;

2. evidence of compliance with the conditions; and

3. the performance of the environmental management plans and programmes.

Note: Under sections 48(1) and 47(2) of the *Environmental Protection Act 1986*, the Chief Executive Officer of the Department of Environment is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions and procedures contained in this statement.

4-2 The proponent shall submit a performance review report every five years following the formal authority issued to the decision-making authorities under section 45(7) of the *Environmental Protection Act 1986*, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority, which addresses:

1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;

2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best practicable measures available;

3. significant improvements gained in environmental management, including the use of external peer reviews;

4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and

5. the proposed environmental objectives over the next five years, including improvements in technology and management processes.

4-3 The proponent may submit a report prepared by an independent auditor to the Chief Executive Officer of the Department of Environment on each condition of this statement which requires the preparation of a management plan, programme, strategy or system, stating whether the requirements of each condition have been fulfilled within the timeframe stated within each condition.

5 Decommissioning and Rehabilitation

5-1 Within 12 months of commissioning, the proponent shall review and revise the existing Yandicoogina Decommissioning and Rehabilitation Plan to include the Yandicoogina Junction Southeast Mine. The Plan shall be prepared to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority, the Department of Conservation and Land Management and the Department of Industry and Resources.

The objectives of this Plan are to:

- achieve construction of landforms that are stable, non-polluting and aesthetically compatible with the surrounding landscape;
- establish sustainable endemic vegetation communities, consistent with the reconstructed landscape and surrounding vegetation; and
- ensure that closure planning and rehabilitation are carried out in a coordinated, progressive manner and are integrated with development planning, consistent with current best practice, and the agreed land uses.

The Plan shall set out procedures to:

1. manage long-term hydrogeological impacts of mining the channel iron deposit;

2. model the long-term hydrogeological impacts, particularly the water levels and quality in the pit void;

3. manage over the long-term the surface water systems affected by the open pit;

4. progressively rehabilitate all disturbed areas to a standard suitable for the agreed end land use(s), with consideration and incorporation of:
    - the characteristics of the pre-mining ecosystems within the project area (through research and baseline surveys);
    - the performance of previously rehabilitated areas within the mining lease;

- the performance of rehabilitation areas at the proponent's other operations in the Pilbara; and
- best practice rehabilitation techniques used elsewhere in the mining industry;

5. develop and identify completion criteria;

6. monitor rehabilitation to assess the performance of all rehabilitated areas against the completion criteria;

7. report on the rehabilitation and monitoring results;

8. remove all infrastructure;

9. develop management strategies and/or contingency measures in the event that operational experience and/or monitoring identify any significant environmental impact as a result of the proposal; and

10. develop a 'walk away' solution for the decommissioned mine site.

Note: A 'walk away' solution means that the site shall either no longer require management at the time the proponent ceases mining operations, or if further management is deemed necessary, the proponent shall make adequate provisions so that the required management is undertaken with no liability to the State.

5-2 The proponent shall implement the Decommissioning and Rehabilitation Plan required by condition 5-1.

5-3 The proponent shall review and revise the Decommissioning and Rehabilitation Plan required by condition 5-1 at intervals not exceeding five years, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority, the Department of Conservation and Land Management and the Department of Industry and Resources.

5-4 The proponent shall make revisions of the Decommissioning and Rehabilitation Plan required by condition 5-1 publicly available.

6 Post-closure Backfill Source

6-1 At least 12 months prior to decommissioning, the proponent shall commence Aboriginal ethnographic and archaeological surveys and vegetation, flora and fauna surveys for the preferred backfill source "Backfill Hill", located approximately two kilometres west of the proposed pit.

6-2 Prior to sourcing "Backfill Hill" for the purpose of backfilling of the pit void, the proponent shall prepare a Backfill Hill Management Plan to the requirements of the Minister for the Environment, on advice from the Environmental Protection Authority, the Department of Conservation and Land Management and the Department of Indigenous Affairs.

The objective of the Plan is to minimise impacts on vegetation, flora, fauna, surface drainage patterns and Aboriginal sites from the use of a nearby hill for backfill.

The Plan shall include:

1. the results of the biological and heritage surveys required by condition 6-1; and

2. measures to minimise and manage impacts on vegetation, flora, fauna, Aboriginal sites and surface water flows associated with sourcing material from the hill.

6-3 The proponent shall only implement the Backfill Hill Management Plan if the following criteria are met:

1. no loss of Declared Rare Flora, Threatened Ecological Communities or significant impact on other flora species and vegetation communities considered of conservation significance;

2. no impact on Threatened Fauna or significant impact on other fauna species of conservation significance; and

3. Archaeological and ethnographic sites to be managed in accordance with the *Aboriginal Heritage Act 1972*.

6-4 The proponent shall make the Backfill Hill Management Plan required by condition 6-1 publicly available.

7 Groundwater

7-1 Prior to the commencement of dewatering, the proponent shall prepare a Groundwater Management Plan, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The objectives of this Plan are to:

- monitor the impacts of the proposal on key water parameters; and
- maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

The Plan shall set our procedures to:

1. model the short-term hydrogeological impacts;

2. establish baseline data on groundwater levels, quality and through-flow at the downstream boundary of mining lease 274SA, and at appropriate locations along the channel iron deposit aquifer;

3. monitor the groundwater levels, quality and through-flow at appropriate locations along the channel iron deposit aquifer and along Weeli Wolli Creek during all phases of mining;

4. monitor the dewatering and discharge rates (both cumulative and direct);

5. re-inject surplus water from dewatering into the Billiards channel iron deposit aquifer if investigation studies indicate it is feasible;

6. manage and minimise impacts to groundwater; and

7. report on the management actions and monitoring results.

7-2 The proponent shall review and revise the Groundwater Management Plan required by condition 7-1 at intervals not exceeding five years.

Note: In revising the Groundwater Management Plan, the proponent should adopt current best practice, while having regard for continuous improvement in groundwater management, based on adaptive management.

7-3 The proponent shall implement the Groundwater Management Plan required by condition 7-1.

7-4 The proponent shall make the Groundwater Management Plan required by condition 7-1 publicly available.

8 Riparian Vegetation

8-1 Prior to the commencement of dewatering, the proponent shall prepare a Riparian Vegetation Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

The objectives of this Plan are to:

- minimise impact on riparian vegetation from dewatering and discharge; and
- maintain the abundance, diversity, geographical distribution and productivity of vegetation communities through the avoidance or management of adverse impacts and improvement in knowledge.

The Plan shall set out procedures to:

1. maintain the flow paths, quantity and quality of water within Marillana, Yandicoogina and Weeli Wolli Creeks and the underlying aquifers to protect surface water and groundwater dependent ecological systems;

2. monitor the effects of dewatering on riparian vegetation communities in areas where the water table is predicted to be lowered by at least two metres (during and after mining), and to implement remedial measures if impacts are detected;

3. manage and minimise potential impacts on riparian vegetation associated with dewatering and at the discharge point;

4. evaluate alternative discharge locations and methodologies, including the re-injection of surplus water from dewatering into the Billiards channel iron deposit aquifer; and

5. avoid disturbance and weed introduction to vegetation in creek lines, particularly vegetation that is currently in good or excellent condition.

8-2 The proponent shall review and revise the Riparian Vegetation Management Plan required by condition 8-1 at intervals not exceeding five years.

8-3 The proponent shall implement the Riparian Vegetation Management Plan required by condition 8-1.

8-4 The proponent shall make the Riparian Vegetation Management Plan required by condition 8-1 publicly available.

9 Conservation of Significant Flora and Fauna

9-1 Prior to any ground-disturbing activities, the proponent shall commence staged pre-clearance surveys of the areas to be disturbed by the Project for conservation significant flora and fauna species. The summary report of the results of the staged per-clearance surveys will be provided to the Environmental Protection Authority and the Department of Conservation and Land Management within two weeks of it becoming available.

9-2 Prior to any ground-disturbing activities in a particular staged area to be cleared, the proponent shall prepare a Significant Species Management Plan for any conservation significant flora or fauna species recorded during the staged pre-clearance surveys required by condition 9-1. This Plan will be prepared to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

The objective of this Plan is to maintain the abundance, diversity, geographic distribution, conservation status and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

The Plan shall describe the significant, identified species of flora and fauna, and describe significant vegetation associations and habitat areas, and shall set out procedures to:

1. demarcate identified populations and/or individuals of conservation significant, identified species of flora and fauna, vegetation associations and habitat areas;

2. modify land clearing plans and evaluate alternative mine plans, to minimise or avoid impacts on the conservation significant, identified species of flora and fauna, vegetation associations and habitat areas;

3. minimise impacts where proposed mining activities are likely to impact on conservation significant, identified species of flora and fauna, vegetation associations and habitat areas;

4. monitor and record impacts on conservation significant, identified species of flora and fauna, vegetation associations and habitat areas; and

5. implement appropriate contingency measures where impacts on conservation significant, identified species of flora and fauna, vegetation associations and habitat areas are identified.

9-3 The proponent shall review and revise the Significant Species Management Plan required by condition 9-2 at intervals not exceeding five years.

9-4 The proponent shall implement the Significant Species Management Plan required by condition 9-2.

9-5 The proponent shall make the Significant Species Management Plan required by condition 9-2 publicly available.

10 Weeds

10-1 Within 12 months following the formal authority issued to the decision-making

authorities under section 45(7) of the *Environmental Protection Act 1986*, the proponent shall prepare a Weed Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

The objectives of this Plan are to:

- minimise the spread of weed species;
- prevent the introduction of new weeds; and
- control and/or eradicate both noxious and environmental weeds in the project area.

The Plan shall set out the procedures to:

1. identify target weeds having regard for weed species outside the project area;

2. control and eradicate target weeds;

3. monitor the success of weed control; and

4. report on the weed management actions and monitoring results.

10-2 The proponent shall review and revise the Weed Management Plan required by condition 10-1 at intervals not exceeding five years.

10-3 The proponent shall implement the Weed Management Plan required by condition 10-1.

10-4 The proponent shall make the Weed Management Plan required by condition 10-1 publicly available.

11 Subterranean Fauna

11-1 Prior to commissioning, the proponent shall prepare a Subterranean Fauna Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

The objective of this Plan is to maintain the abundance, diversity, geographic distribution and productivity of stygofauna at species and ecosystem levels through the avoidance or management of adverse impacts and through improvements in knowledge.

The Plan shall set out the procedures to:

1. avoid and/or manage impacts on subterranean fauna species, communities and their habitats where the long-term survival of those species and communities may be at risk as a result of project operations;

2. establish additional data on the distribution of existing stygofauna species and communities, particularly the ostracod *Gomphodella* sp. and water mite *Recifella* sp., to demonstrate there is no threat to these species;

3. take timely remedial action in the event that additional data indicates that project operations may compromise the long-term survival of subterranean fauna species and/or communities; and

4. report on the survey results and management actions.

11-2 The proponent shall implement the Subterranean Fauna Management Plan required by condition 11-1.

11-3 The proponent shall make the Subterranean Fauna Management Plan required by condition 11-1 publicly available.

12 Liaison with Adjacent Leaseholders

12-1 During mining and decommissioning phases, the proponent shall liaise with adjacent mining leaseholders in order to develop and evaluate options for viable and compatible long-term management strategies and to minimise cumulative environmental impacts. In particular, the impacts of mining and decommissioning on the Marillana-Yandicoogina-Weeli Wolli Creek systems and the channel iron deposit shall be evaluated jointly with BHP Billiton Iron Ore for the purposes of understanding the hydrological system.

Procedures

1. Where a condition states "to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority", the Environmental Protection Authority will provide that advice to the Department of Environment for the preparation of written notice to the proponent.

2. The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment.

3. Where a condition lists advisory bodies, it is expected that the proponent will obtain the advice of those listed as part of its compliance reporting to the Department of Environment.

Notes

1. The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment over the fulfilment of the requirements of the conditions.

2. The proponent is required to apply for a Works Approval, Licence and Registration for this project under the provisions of Part V of the *Environmental Protection Act 1986.*

3. Compliance and performance reporting will endeavour to be in accord with the timing requirements of the *Iron Ore (Yandicoogina) Agreement Act 1996.*

Schedule 1

The Proposal (Assessment No. 1590)

The proposal is to mine a section of the Yandicoogina channel iron deposit, known as the Yandicoogina Junction Southeast Mine, and subsequently rehabilitate all the disturbed areas. The proposal is located within mining lease 274SA, approximately 90 kilometres northwest of Newman, in the Central Pilbara Region (Figure 1). The Yandicoogina Junction Southeast Mine is a downstream extension of the existing channel iron deposit being mined at Yandicoogina Junction Central.

The Yandicoogina Junction Southeast proposal comprises:

- conventional open cut mining of overburden and ore from the channel iron deposit;
- dewatering of the orebody, with a supply pipeline to Yandicoogina Junction Central where the water will be discharged at a licensed location;
- placement of overburden in a temporary out-of-pit storage area for later use as fill material during partial backfill of the pit void;
- construction of the following infrastructure:
    - a light vehicle access road and a heavy vehicle access road, which include crossings of Yandicoogina and Marillana Creeks respectively;
    - realignment of part of the public access road to Newman;
    - dry primary and secondary crushing plant with run-of-mine (ROM) pad;
    - 4.8 kilometre long overland conveyor (with covers fitted over its length), to link the crushing plant with the existing conveyor system;
    - fuelling facility, connected to the Yandicoogina Junction Central fuel facility by an above ground pipeline; and
    - administration building and workshop
- tertiary crushing and screening of the ore at the existing Yandicoogina Junction Central processing plant;
- wet processing of the lower channel iron deposit with a high clay content, at the existing Yandicoogina Junction Central wet processing plant;
- loading and transportation of ore along the Central Pilbara Railway to the ship-loading facilities at Dampier Port and Cape Lambert;
- maintenance of a 200-metre separation distance between the proposed pit and Yandicoogina, Marillana and Weeli Wolli Creeks;
- possible re-injection of a component of the dewatering discharge into the Billiards channel iron deposit aquifer, down gradient of the proposed pit, near Weeli Wolli Creek;
- permanent loss of at least part of a nearby hill to partially fill the pit void to at least 490 metres Relative Level; and
- progressive rehabilitation of all disturbed areas.

Figures

Figure 1 – Site location
Figure 2 – Site layout

Table 1 - Key Proposal Characteristics

Characteristic	Quantities / Description
Mining	
Project life	Approximately 16 years
Length of deposit to be mined	Approximately 5.8 kilometres
Ore reserve to be mined	Approximately 280 million tonnes
Mining rate	Approximately 16 million tonnes per annum
Pit depth	Approximately 65 metres (45 metres below the present water table)
Overburden	Overburden will be stockpiled in a temporary storage area. Some of the material will be used for constructing drainage embankments. The remaining material will be used as backfill in the pit void
Total disturbance area - Infrastructure - Overburden waste dump - Pit - Post-closure backfill source	Approximately 669 hectares (within mining lease 274SA) - Approximately 79 hectares - Approximately 60 hectares - Approximately 370 hectares - Approximately 160 hectares
Closure and rehabilitation	The final pit void will be backfilled to at least 490 metres Relative Level. The total disturbance area will be rehabilitated with local native vegetation
Dewatering	
Initial dewatering	Approximately 27-30 megalitres per day
Maintenance	Approximately 15-20 megalitres per day
Sump dewatering	Approximately 1 megalitre per day
Dewatering well fields	Initially 2 clusters of wells and a sacrificial well. As mining progresses, 3 additional cluster wellfields, plus sumps
Processing and transport	
Crushing plant	Construction of a dry primary and secondary crushing plant
Conveyor	Construction of a 4.8 kilometre long overland conveyor to link the crushing plant to the existing overland conveyor at Yandicoogina Junction Central. Ore will be conveyed to the Yandicoogina Junction Central mine, where it will undergo additional processing
Transport	Ore will be transported along the Central Pilbara Railway to the ship-loading facilities at Dampier Port and Cape Lambert
Infrastructure	
Power	An 8-megawatt diesel-fired power station will be used for additional power during early stages of construction. Connected to grid with power supplied by Hamersley's gas-fired power stations at Dampier and Paraburdoo
Access roads	▪ Light vehicle access road from the transfer point on the current conveyor to the new crushing plant at Yandicoogina Junction Southeast. A crossing on Yandicoogina Creek will be required ▪ Heavy vehicle access road from Yandicoogina Junction Central to Junction Southeast. A crossing on Marillana Creek will be required ▪ Realignment of part of the public access road to Newman to allow bypass of heavy vehicle access road
Other facilities	Administration building, plant workshop and fuelling facility
Water	
Water management	Construction of flood protection levees and diversion drains
Water use	Approximately 3 megalitres per day of dewatered water for dust suppression and potable use

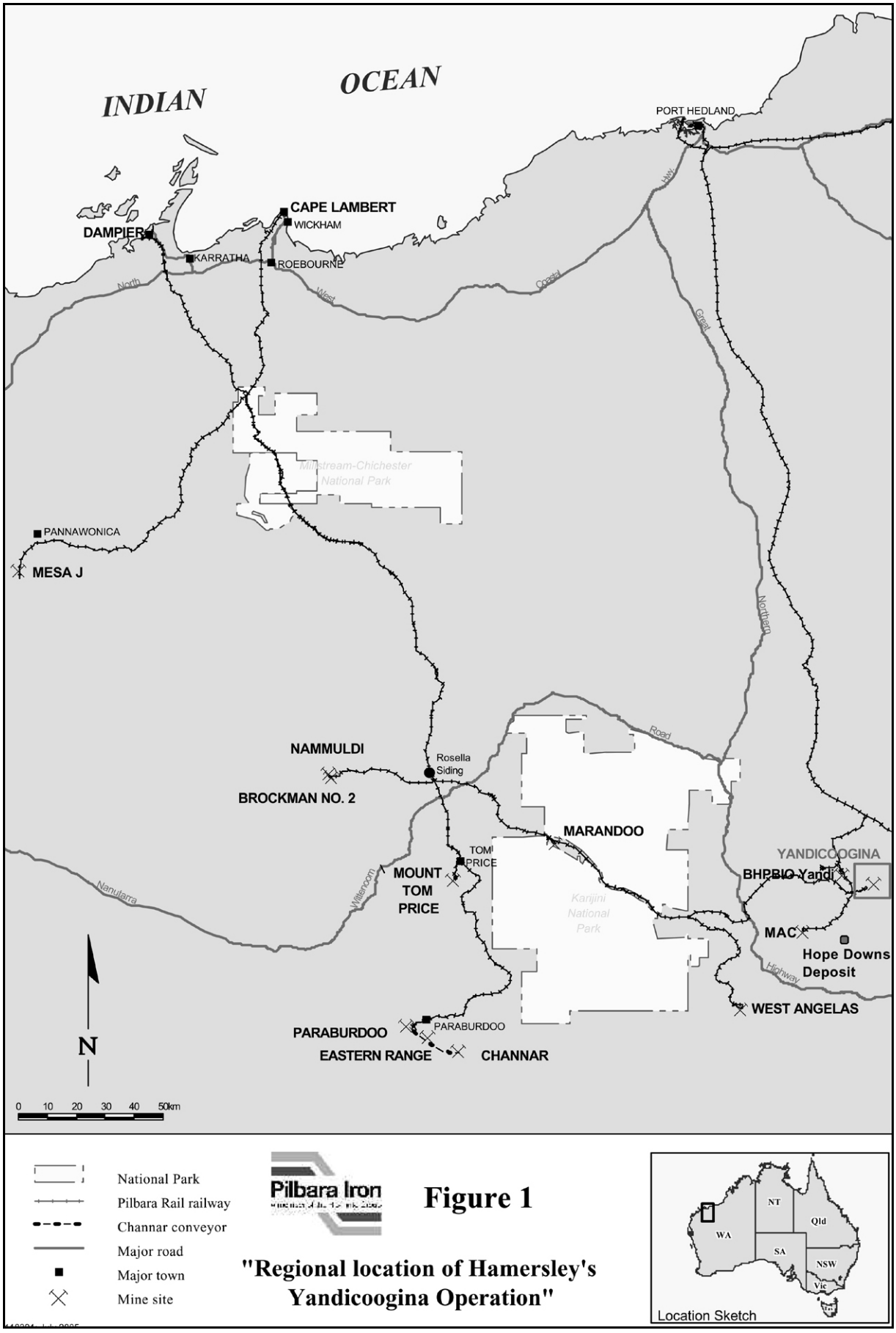

Figure 1: Site location

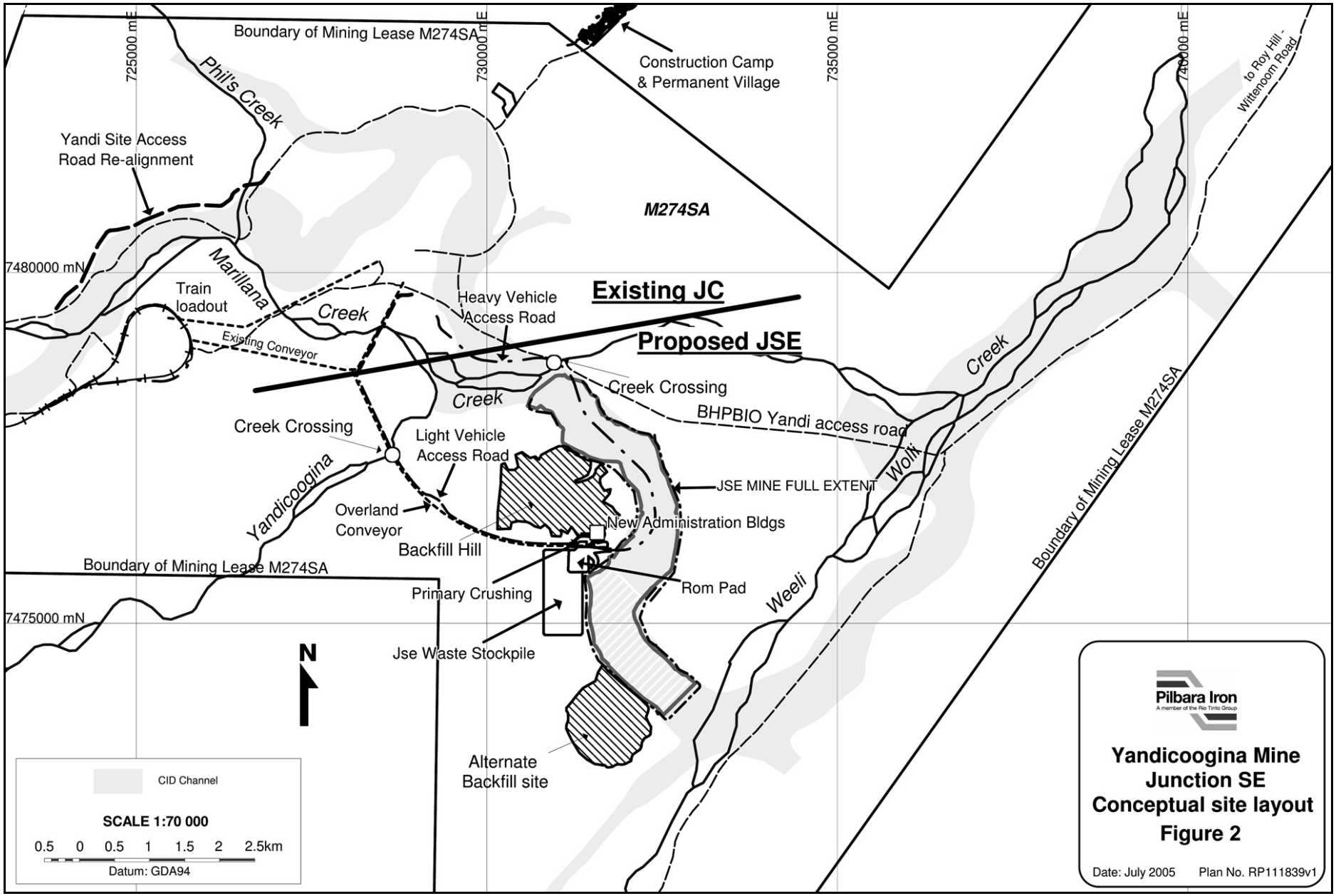

Figure 2: Site layout