Marillana Creek (Yandi) Life of Mine Proposal, Mining Leases 270SA and 47/292, 90 km north-west of Newman

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BHP Billiton Iron Ore Pty Ltd

Report and Recommendations
of the Environmental Protection Authority

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1. Introduction

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 BHP Billiton Iron Ore Pty Ltd (BHPBIO) to mine the Yandi orebody, within mining leases (ML) 270SA and 47/292. BHPBIO operates the Marillana Creek (Yandi) mine, which is located 90 kilometres northwest of Newman, in the Pilbara Region of Western Australia (Figure 1).

The EPA was advised of the proposal in January 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 (BHPBIO, 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).

2. The proposal

The proponent proposes to mine the entire Yandi orebody within ML 270SA and 47/292, and subsequently rehabilitate all the disturbed areas. The Yandi orebody occurs within an ancient channel iron deposit (CID), which is subdivided into a series of mine areas based on the natural mesa-shaped landscape of the area. These mine areas are known as the central mesa pits (C1 to C5), eastern mesa pits (E1 to E8), and the western mesa pits (W1 to W6). Figure 2 illustrates the layout of the mine areas. The CID is about 80 metres thick and the majority of mining is within the upper 60 metres. The lower CID is the deeper, lower grade portion of the deposit. The proponent operates dewatering bores that lower the water table in the vicinity of each pit by approximately 30 metres (BHPBIO, 2005).

The proposal involves concurrent mining from pits across the leases, and as individual pits are mined, the voids will be partially filled with overburden material from other pits. The same open cut mining techniques and ore processing methods will be used over the remaining life of the mine (BHPBIO, 2005). The proponent has submitted a separate proposal for additional infrastructure at the mine, which is currently being considered by the EPA.

A previous Minister for the Environment issued approval in May 1988 for the first iron ore mining operation on ML 270SA to mine E2 and C5 at a rate of 5 million tonnes per annum (EPA, 1988). Mining commenced in 1991. In 1992, 1994 and 1995, the EPA assessed modifications to the original proposal, which involved increased rates of production and mining of additional pits (EPA, 1992; EPA, 1994; and EPA, 1995). Mining is currently taking place in the E2, C1/C2 and C5 areas.

The proposal is described in detail in Appendix B (Section 2) of the proponent's 'Marillana Creek (Yandi) Life of Mine Proposal – Environmental Protection Statement' (BHPBIO, 2005). Table 1 shows the key proposal characteristics.

Hamersley Iron also holds a mining lease (274SA) over the CID, east of BHPBIO's lease and is currently mining up to 34 million tonnes per annum.

The main components of BHPBIO's proposal are:

- open cut mining of overburden and ore from the CID;
- dewatering of the orebody during mining operations;
- placement of overburden in mine voids and out-of-pit storage areas;
- processing, loading and transportation of ore;
- possible mining of the lower CID;
- supply and distribution of power and raw materials; and
- provision of existing service infrastructure (e.g. main access roads, workshops, administration areas, accommodation village and airstrip).

Significant features of the proposal are:

- progressive mining and rehabilitation of the site;
- permanent diversion of sections of Marillana Creek; and
- permanent changes to the final landforms, including hill-like features of the out-of-pit overburden storage areas and pit lakes created in the final voids.

3. Consultation

During preparation of the EPS document, the proponent consulted with:

- government agencies, including the Department of Conservation and Land Management (CALM) and the Department of Environment (DoE);
- community groups, including the Martu Idja Banyjima and Innawonga Bunjima Niapaili Aboriginal groups; and
- other stakeholders with a direct interest in the project, including Hamersley Iron.

Consultation commenced in 2003 and included the release of the project's revised Environmental Management Plan and Decommissioning and Final Rehabilitation Plan for a four-week public review period in January 2004. The comments received during the review period, and the proponent's responses are included in Appendix A of the EPS document (BHPBIO, 2005).

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

- potential impacts and management of the pit lakes;
- impacts to the ecology of Marillana Creek; and
- mine closure and rehabilitation.

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

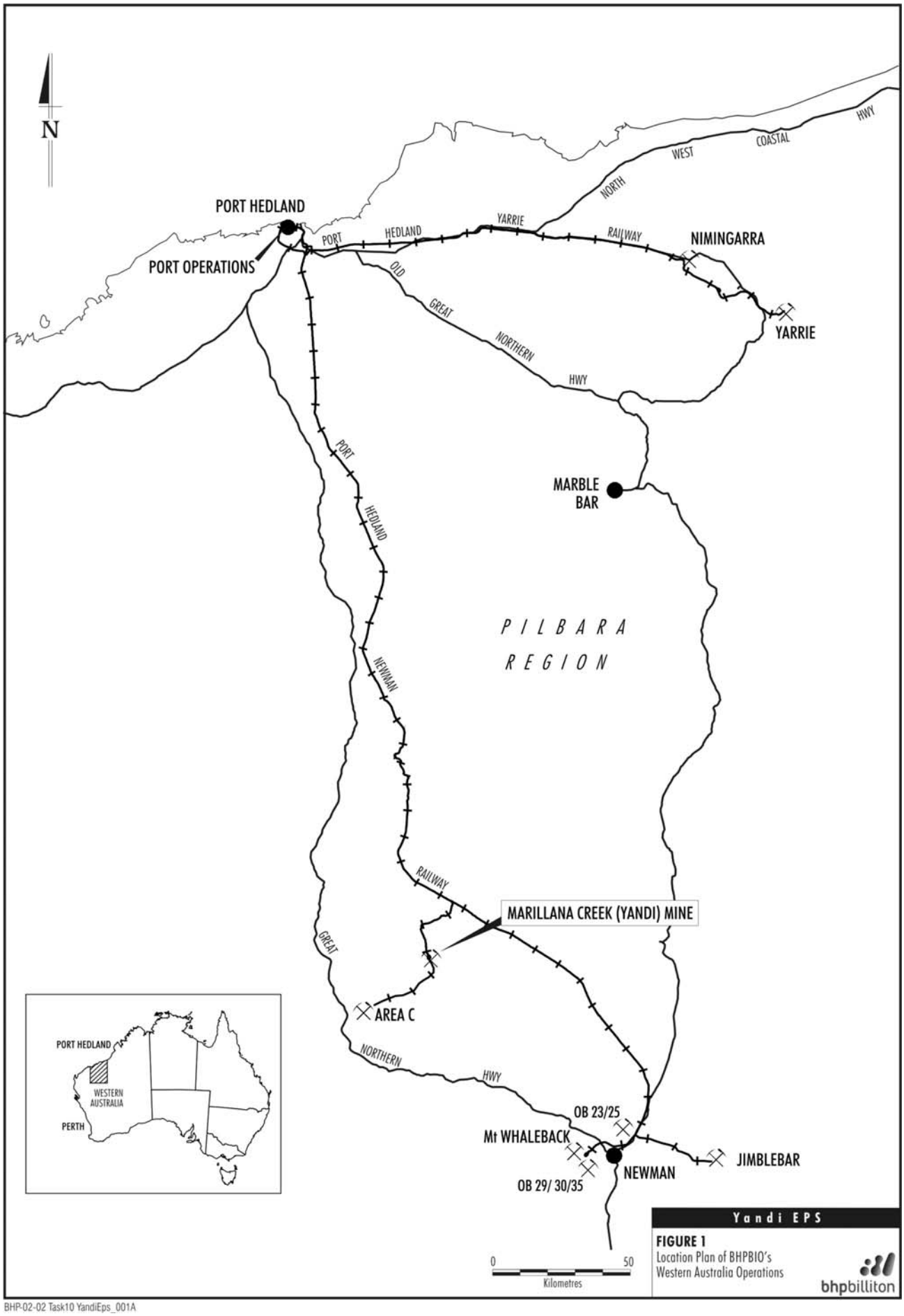

Figure 1: Site location

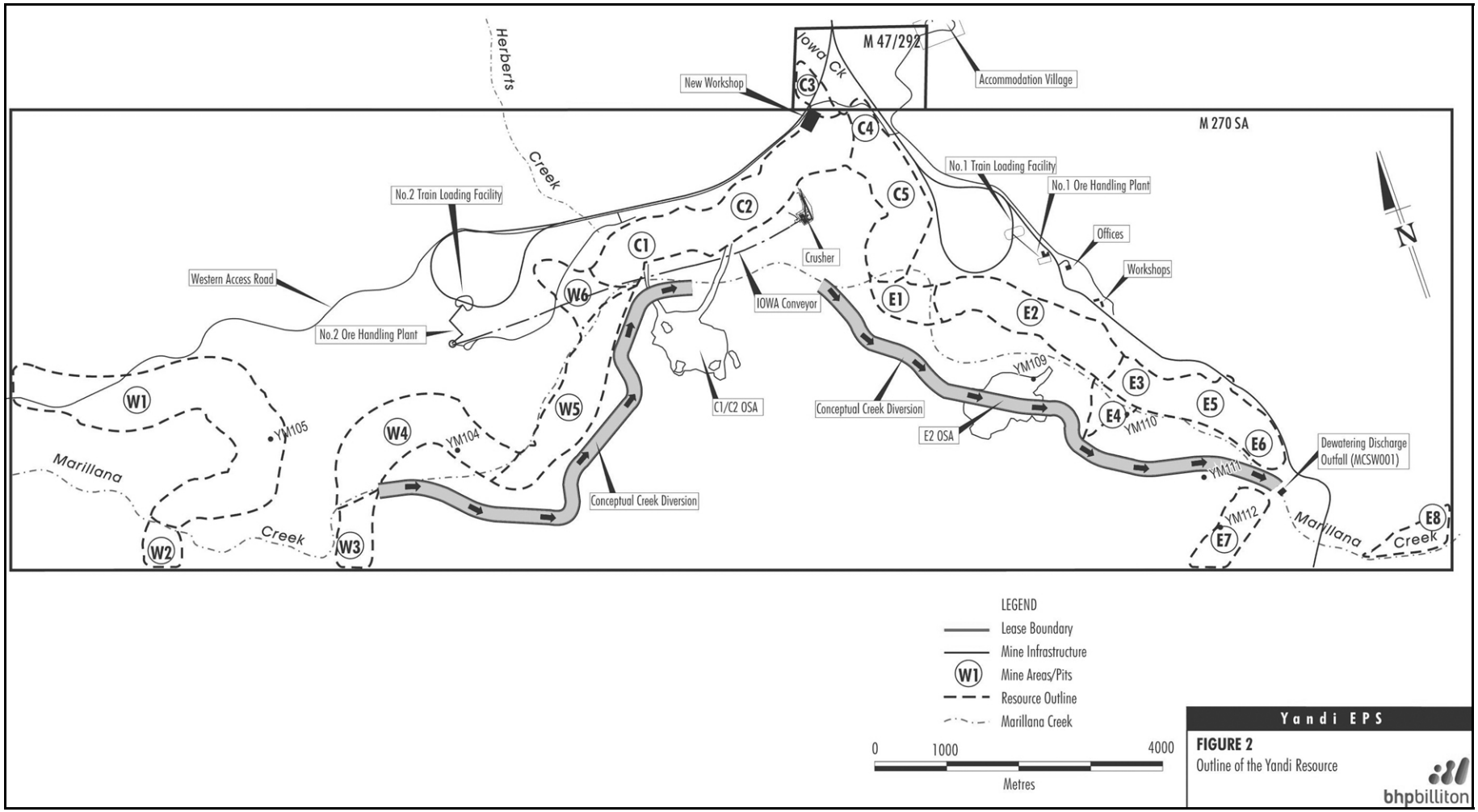

Figure 2: Site layout

Backfilling of the mine voids with overburden will be optimised to ensure there is through-flow of groundwater in the pit lakes and to prevent the build up of salinity. The edges of the pit lakes will be revegetated with local riparian species as part of the rehabilitation programme. Groundwater modelling has indicated that the water quality in the pit lakes will support the proposed beneficial use of stock watering. In the event that any adverse impacts are detected, the proponent will develop contingency plans to manage these impacts.

There will be some loss of riparian vegetation associated with the proposed diversions of Marillana Creek. The actual location and design of the diversions will be provided in the Marillana Creek Diversion Management Plan, which will be prepared prior to diversion construction. Alternative diversion designs will be evaluated to minimise or avoid impacts to species of conservation significance or habitat suitable for fauna species of conservation significance associated with the riparian vegetation. Section 2.2 of the EPS document (BHPBIO, 2005) describes the potential impacts to the ecological values of Marillana Creek, and management measures to ensure that the diverted sections replicate the existing system.

Table 1- Key proposal characteristics

Characteristic	Quantities / Description
Project life	Approximately 30 yrs
Total resources	Approximately 1,420 million wet tonnes
Overall ore production rate	Approximately 45 Mtpa
Mining method	Conventional open cut methods (hydraulic shovels, loaders and haul trucks)
Marillana Creek diversion	Diversion of sections of Marillana Creek, to access iron ore in the W5 mine area and the E1 to E6 mine area, will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan
Overburden	Approximately 820 Mt
Overburden stripping ratio	0.35 : 1
Pit depth	Typically 60 m (ranges from 55 to 80 m)
Mining disturbance area	
- Previously approved pits	Approximately 1,580 ha
- Proposed additional pits	Approximately 1,020 ha
Infrastructure disturbance area to date	Approximately 270 ha
Proposed additional disturbance area associated with diverting Marillana Creek	Approximately 230 ha
Total disturbance area	Approximately 3,100 ha (within ML 270SA & 47/292)
Water use	Up to 400 m^3/day of groundwater for dust suppression, ore processing and potable use
Ore processing	Crushing and screening
Ore transportation from site	Ore loaded in one of two rail loading stockpiles/loops and railed from site to Port Hedland for shipping
Power supply	On site diesel generators (Future power demand expected to be met by the Newman gas-fired station via connecting overhead transmission line)
Workforce	Approximately 350

The proponent has developed guiding closure principles for the proposal in consultation with key stakeholders in the Decommissioning and Final Rehabilitation Plan, which need to be met prior to lease relinquishment. The proponent will also prepare and implement a Progressive Rehabilitation Implementation, Monitoring and Management Programme, which will include the development of rehabilitation completion criteria.

Agency comments on the draft EPS and the proponent's responses are provided in Appendix A of the EPS document (BHPBIO, 2005). The proponent will continue to liaise with the stakeholders and government agencies during implementation of the proposal. The EPA considers that the proponent has been proactive in consulting with the relevant stakeholders and that the consultation process has been appropriate.

4. Relevant environmental factors

A summary of all the environmental factors and their management is outlined in Table S1 of the EPS document (BHPBIO, 2005). In the EPA's opinion the following are the key environmental factors relevant to the proposal:

1. surface water;
2. groundwater; and
3. riparian vegetation and conservation significant flora and fauna.

4.1 Surface water

Description

Marillana Creek is a wide, gravel-bed stream, which typically only flows during the wet season following significant rainfall. Periodically it is subject to major flooding as a result of cyclones sweeping inland from the coast. Marillana Creek drains eastward, where it joins Weeli Wolli Creek, which in turn flows to the north and discharges into the Fortescue River Valley (BHPBIO, 2005). The Marillana Creek system is an important source of surface runoff to Weeli Wolli Creek, as well as a source of recharge to the Marillana Creek CID groundwater aquifer (WRC, 2003).

Assessment

The EPA's environmental objectives for this factor are to ensure that alterations to surface water flows and quality do not adversely impact on beneficial or environmental uses of the water, and while recognising that sections of Marillana Creek may be diverted, that the integrity, functions and environmental values of watercourses are maintained.

The proposed diversions of sections of Marillana Creek have the potential to impact the surface water flow of the creek if construction and maintenance of the diversions are not managed in an environmentally acceptable manner. To enable mining of the iron ore beneath and immediately adjacent to the existing Marillana Creek alignment, sections of the creek may be permanently diverted (Figure 2).

The EPA notes that Gilbert & Associates Pty Ltd carried out a hydrological and hydraulic investigation for the worst-case scenario on the post-closure effect of the project on stream flows in Marillana Creek. This report is provided in Appendix C of the EPS (BHPBIO, 2005).
The investigation included hydrological and hydraulic modelling of the proposed diversion for specific flow conditions and an assessment of the existing and post-closure surface water

regimes within and downstream of the project site. The results of this conceptual investigation found that the guiding closure principles relating to surface water, identified in the Decommissioning and Final Rehabilitation Plan (condition 5), can be achieved, and there will be no discernable reduction in the number of days with some stream flow and no significant change in the range of daily flows. To ensure the long-term integrity and sustainability of the diversions, several high flow spill out structures will be constructed upstream of the diversion such that extreme flow events would drain into the mine depression and away from the diversion (BHPBIO, 2005). The actual location and design of the diversions will be provided in the Marillana Creek Diversion Management Plan (condition 7). Further detailed surface water modelling will be carried out in accordance with this plan prior to any creek diversion.

The EPA considers that the contribution of surface water from Marillana Creek to the Fortescue River Valley and recharge to the Marillana Creek CID groundwater aquifer will not be significantly altered by the proposal.

The EPA recommends the proponent be required to continue to use best practice surface water modelling, and ensure that surface water monitoring (condition 8) is consistent with best practice (where practicable to site conditions). The EPA also recommends the proponent be required to design the diverted sections of Marillana Creek consistent with best practice and construct the creek in accordance with best practicable measures available (condition 7). The proponent is required to undertake independent peer reviews of the above to ensure that there is continuous improvement, based on adaptive management and benchmarking against similar projects in Australia and internationally. Best practicable measures is defined as "the incorporation of technology and environmental management procedures which are practicable, having regard to local conditions and circumstances, including costs, and to the current state of technical knowledge, including the availability of reliable, proven technology. Best practice involves the prevention of environmental impact, or, if this is not practicable, minimising the environmental impact, through the incorporation of best practicable measures. No significant residual impact should accrue as a result of a proposal" (EPA, 2003).

The EPA notes that the proponent intends to integrate the surface water monitoring programme with the wider monitoring initiatives in the Marillana Creek catchment to identify cumulative impacts. This may include establishing additional flow gauging stations on Marillana Creek and its tributaries within, upstream and downstream of ML 270SA and 47/292.

Summary

Having particular regard to the:

(a) high standard of the proponent's hydrological and hydraulic modelling of impacts and proposed management;
(b) advice by the DoE on the technical feasibility of the proposed management; and
(c) recommended conditions;

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

4.2 Groundwater

Description

The CID forms the main groundwater aquifer for the Marillana/Yandicoogina Creek systems, with a through-flow of 2.5 to 3 megalitres/day. Downstream of the mine site the Marillana Creek CID joins the Weeli Wolli Creek CID, where it then moves northeast to the Fortescue River Valley. The water within the CID aquifer is fresh, about 500 milligrams/litre (mg/L) Total Dissolved Solids (TDS). The groundwater of the deep aquifer of the Fortescue River Valley is saline to hypersaline (Woodward-Clyde, 1995). The through-flow contribution of the Marillana Creek CID aquifer to the Weeli Wolli Creek CID aquifer is relatively small (WRC, 2003). The Marillana Creek system is also an important source of recharge to the Marillana Creek CID groundwater aquifer (WRC, 2003).

Pit lakes are considered here because they are a surface expression of the groundwater.

Assessment

The EPA's environmental objectives for this factor are to ensure that alterations to groundwater flows and quality do not adversely impact on beneficial or environmental uses of the water, and while recognising that sections of Marillana Creek may be diverted, that the integrity, functions and environmental values of watercourses are maintained.

Mining on the site will alter the groundwater through-flow and quality from mining below the water table and from the creation of partially in-filled mine voids with pit lakes.

The EPA notes that due to the low overburden to ore strip ratio for the orebody, there is insufficient overburden to fill some of the mine voids to above the water table. Consequently, surface water bodies or pit lakes will develop post-closure, as the groundwater level recovers (BHPBIO, 2005). The majority (at least 90%) of the overburden material removed during the remaining life of the mine will be used to partially fill the mine voids. The EPA notes comments made by the proponent that it may not be practicable to backfill all of the material.

The EPA notes that the proponent has modelled and monitored groundwater at Yandi since mining commenced in 1991. Aquaterra Consulting Pty Ltd carried out modelling of the hydrogeological impacts and outcomes for the worst-case scenario for the current proposal. This report is provided in Appendix C of the EPS (BHPBIO, 2005). The modelling results indicated that the guiding closure principles relating to groundwater, identified in the Decommissioning and Final Rehabilitation Plan (condition 5), can be achieved provided that the infill configuration in the mine voids finds an appropriate balance between groundwater inflow, recharge, groundwater outflow and evaporation (BHPBIO, 2005).

The EPA notes that modelling predicted post-mining equilibrium groundwater levels close to the downstream lease boundary (i.e. at E7) to be three metres less than those measured prior to mine development. The modelling also indicated that groundwater through-flow in the CID aquifer will vary along its full extent, depending on the permeability of the backfill material and proximity to Marillana Creek (which acts as a significant source of recharge). The EPA considers that further detailed groundwater modelling is required during the course of mining operations to refine predictions of the short-term and long-term impacts.

The EPA considers there may be potential for the water in the pit lakes to become saline, due to the low annual rainfall and high evaporation experienced in the region. The proponent has addressed this in the hydrogeological modelling, by ensuring that the final configuration of the void backfill would be designed to ensure that there is groundwater through-flow and no build up of salinity within the pit lake. The EPA notes that the groundwater salinity in most of the pit lakes is predicted to increase to a maximum long-term steady value of around 2,000

mg/L TDS. However, there was one pit lake where salinity was predicted to increase to around 6,500 mg/L TDS (at W5). The EPA considers that in order to protect the future beneficial uses of the pit lakes, the proponent needs to take all necessary measures to ensure that these levels are not exceeded. As a contingency, the EPA considers that in the event that groundwater monitoring indicates that salinity in the pit lakes exceeds the "target" level of 6,500 mg/L TDS, on one or more occasion in each of three consecutive years, the proponent should either backfill the pit lake to above the water table, divert surface water flow into the pit lake or undertake any other appropriate remedial measures to reduce salinity to below the "target" level (condition 9). The EPA considers that salinity in the pit lakes should not exceed 8,000 mg/L because this is considered unacceptable stock water quality for cattle.

The EPA notes that the proportion of waste that will be returned as backfill has increased from that stated in the Consultative Environmental Review for the C1 and C2 pits (Woodward-Clyde, 1995), from 75% to 90%. Furthermore, the salinity in the pit lakes has significantly improved from the initial predictions of 45,000 mg/L (Woodward-Clyde, 1995).

The EPA considers there is potential for saline plumes to move out of the void and affect the down gradient groundwater resource. The natural flooding of the mine voids from intense rainfall events and diversion of surface water runoff from the northern tributaries (such as Iowa Creek and Herberts Creek) will replenish the aquifer levels and maintain adequate through-flow in the CID aquifer, thereby minimising the build up of salinity. Hydrogeological modelling indicated that the groundwater salinity at the lease boundary would reach a steady state of around 1,100 mg/L TDS after 2,000 years (BHPBIO, 2005). This level is slightly above that acceptable for potable use, but suitable for the proposed future beneficial use of stockwatering. The EPA considers that the predicted salinity increase in the Marillana Creek groundwater system post-closure would not impact on the quality of the saline groundwater aquifer of the Fortescue River Valley.

The EPA recommends the proponent be required to continue to use best practice hydrogeological modelling and ensure that groundwater monitoring (condition 8) is consistent with best practice (where practicable to site conditions), and that both be subject to independent peer review every five years to ensure there is continuous improvement in groundwater management, based on adaptive management and benchmarking against similar projects in Australia and internationally.

Water abstraction and impacts to the groundwater resource as a result of the adjacent Hamersley Iron operation have been taken into account in the proponent's Regional Groundwater Model and dewatering licence. In addition, surface water and groundwater monitoring will provide a mechanism for monitoring cumulative impacts (BHPBIO, 2005).

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; and
(c) recommended conditions;

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

4.3 Riparian vegetation and conservation significant flora and fauna

Description

A flora and fauna report for the proposal was prepared by Maunsell (2003) and is provided in Appendix C of the EPS document (BHPBIO, 2005).

The riparian vegetation consists of a community dominated by *Malaleuca argentea* (Cadjeput) and *Eucalyptus camaldulensis* (River Gum) over dense mixed shrubs. No Declared Rare Flora species were recorded in the project area, but six Priority flora species have been recorded (BHPBIO, 2005). *Goodenia nuda* was recorded along Marillana Creek, near the E2 pit. *Olearia fluvialis* was recorded in Marillana Creek and near the proposed E3 and W4 pits. *Goodenia stellata* has been recorded at twelve locations within the Yandi lease and *Eriachne tenuiculmis* at one location along Marillana Creek, near the proposed E6 pit. *Rostellularia adscendens* and *Themda* sp. Mt Barricade have also been recorded within the project area. Figure 4 of the Maunsell (2003) report shows the locations of recorded populations of threatened flora species within the project area.

The Pilbara Olive Python, Peregrine Falcon, Australian Bustard, and Pebble-mound Mouse have been identified as conservation significant fauna species (BHPBIO, 2005). The Maunsell (2003) report identified the following fauna habitat areas of significance:

- river pools and riparian woodlands associated with Marillana Creek, and areas adjacent to the creek; and
- gravel rises across the project area.

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 riparian vegetation from pit dewatering and the diversion of sections of Marillana Creek. The proposal has the potential to impact on conservation significant flora and fauna through clearing of native vegetation for mining. The total area of disturbance (3,100 hectares) will be progressively rehabilitated.

To enable mining of the iron ore beneath and immediately adjacent to the existing Marillana Creek alignment, sections of the creek may be permanently diverted (Figure 2). The proposed diversions in Figure 2, based on conceptual designs, are about 14 kilometres in length. The total length of Marillana Creek where the CID interacts with the creek system is 70 kilometres. There may be some decline in the riparian vegetation and adjoining communities within the sections of Marillana Creek that will be diverted (BHPBIO, 2005). The EPA notes, on advice from the DoE and CALM, that the riparian vegetation communities are widespread, and there will be no regional loss of these communities as a result of the proposal. Also, successful revegetation, in accordance with the Progressive Rehabilitation Implementation, Monitoring and Management Programme (condition 6) will reduce this impact.

Prior to the diversion of any section of Marillana Creek, the EPA recommends that the proponent be required to prepare a Marillana Creek Diversion Management Plan (condition 7). This plan will provide further detailed information on the actual location and extent of the

diversion, including quantification of the actual impacts on flora, vegetation and fauna (including habitat).

The EPA recommends that the proponent be required to monitor the effects of the proposal on the riparian vegetation and undertake remedial action if impacts are detected (condition 8). Periodic flows in Marillana Creek should maintain most of the riparian vegetation.

The majority of the groundwater pumped from the dewatering bores is being discharged to Marillana Creek near the proposed E6 pit. Enhanced vegetation growth and seedling establishment in the vicinity of the discharge point is evident. However, when discharge at this point stops (when mining commences in the E6 pit), the vegetation that has become dependant on surface water may find it difficult to survive. Therefore the EPA recommends that the proponent be required to implement management measures to minimise potential impacts to riparian vegetation associated with dewatering across the mine and at the discharge point and evaluate alternative discharge locations and methodologies as part of the Surface Water and Groundwater Management Programme (condition 8).

To minimise potential impacts on flora and fauna species and habitat areas for species of conservation significance, it is recommended that the proponent prepare and implement a Significant Species Management Programme (condition 11). The programme requires the proponent to avoid impacts on identified flora and fauna species and habitat areas for species of conservation significance where possible. Where mining or creek diversion activities are likely to impact on known locations of significant flora and fauna species and/or habitat areas of conservation significance, the proponent is to prepare and implement species-specific management plans.

The EPA notes that the pit lakes may attract animals and hence impact the ecology of the area. The proponent will revegetate the edges of the pit lakes to support fringing vegetation that would be comparable to the existing local riparian species found in the area, in accordance with the Progressive Rehabilitation Implementation, Monitoring and Management Programme (condition 6). In the event that any adverse impacts are detected, such as an increase in the population of grazing or feral animals, the proponent will carry out management measures, as part of the Decommissioning and Final Rehabilitation Plan (condition 5).

Summary

Having particular regard to the:

(a) riparian vegetation not being of regional significance;
(b) advice by CALM on the acceptability of the proposed management of conservation significant flora and fauna; and
(c) recommended conditions;

it is the EPA's opinion that the proposal can be managed to meet the EPA's 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 has taken a performance and peer review approach to evaluating the proposal and considering related environmental management requirements, while incorporating best practice and best practicable measures, continuous improvement and adaptive management in the conditions, where appropriate.

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

- ensuring that alterations to surface and ground water flows and quality do not adversely impact on beneficial or environmental uses of the water, and while recognising that sections of Marillana Creek may be diverted, maintaining the integrity, functions and environmental values of watercourses; 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 (BHPBIO, 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 Marillana Creek (Yandi) Life of Mine Proposal, 90 kilometres north west 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

BHP Billiton Iron Ore 2005, *Marillana Creek (Yandi) Life of Mine Proposal – Environmental Protection Statement*, March 2005.

EPA 1988, *Yandicoogina (Marillana) iron ore project*, Report and Recommendations of the Environmental Protection Authority, Bulletin 323, Environmental Protection Authority, Perth, Western Australia.

EPA 1992, *Yandicoogina (Marillana) iron ore project – change of ministerial condition due to increase in rate of production*, Report and Recommendations of the Environmental Protection Authority, Bulletin 622, Environmental Protection Authority, Perth, Western Australia.

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EPA 1995, *Duplication of iron ore mining operation, Yandi mine ML 270SA, Hamersley Range, 90 km north west of Newman*, Report and Recommendations of the Environmental Protection Authority, Bulletin 802, Environmental Protection Authority, Perth, Western Australia.

EPA 2003, *Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process*, Guidance for the Assessment of Environmental Factors, Environmental Protection Authority, Perth, Western Australia.

Woodward-Clyde 1995, *Yandi Mine Expansion Central Mesa 1 and 2 – Consultative Environmental Review*, August 1995.

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

Appendix 2

Recommended environmental conditions

Statement No.

RECOMMENDED CONDITIONS AND PROCEDURES

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

MARILLANA CREEK (YANDI) LIFE OF MINE PROPOSAL, MINING LEASES 270SA AND 47/292, 90 KM NORTH-WEST OF NEWMAN

Proposal: Life of mine proposal to mine iron ore within mining leases 270SA and 47/292 at a rate of approximately 45 million tonnes per annum, and subsequent rehabilitation and decommissioning of the site, as documented in schedule 1 of this statement.

Proponent: BHP Billiton Iron Ore Pty Ltd

Proponent Address: 225 St George's Terrace PERTH WA 6000

Assessment Number: 1555

Report of the Environmental Protection Authority: Bulletin 1166

The conditions of this statement supersede those of statements 029, 259, 357 and 405.

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 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 annual 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 address:

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 auditor approved by the Department of Environment under the "Compliance Auditor Accreditation Scheme" 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 Final Rehabilitation

5-1 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 Decommissioning and Final Rehabilitation Plan 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 objective of this plan is to ensure that rehabilitation achieves a stable and functioning landform, which is consistent with the surrounding landscape, other environmental values and, as far as practicable, the pre-mining environmental conditions.

This plan shall include:

1. A description of the key components of the mine (i.e. mining method, mine dewatering, overburden management, ore processing, ore loading and transportation, water and power supply and service infrastructure).

2. Development of 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.

3. A description of how the project will be closed and disturbance areas rehabilitated, with consideration of the potential impacts of climate change, to fulfil the following guiding closure principles:

Surface Water Resources

- Maintain the overall Marillana Creek surface water flow regime (i.e. hydraulic conditions) upstream and downstream of the diverted sections of Marillana Creek, within mining lease 270SA.
- Maintain the integrity of the Marillana Creek surface water resource during operations and post-closure by construction of permanent diversions and training bunds.
- Minimise the diversion of Marillana Creek and utilise other natural drainage lines where practicable.
- Design diverted sections of Marillana Creek to function as a fluvial system in a similar manner to the existing creek system (i.e. similar hydrology and hydraulics).
- Discharge of Iowa Creek, Herberts Creek and other northern tributaries of Marillana Creek to the mine voids following closure to ensure direct recharge of the palaeochannel aquifer with surface water flows from these creeks and tributaries.
- Discharge of the majority of the southern tributaries of Marillana Creek to the original Marillana Creek channel or to the new diversions.

Groundwater Resources

- Maintain the through-flow of groundwater along the mine path through areas of overburden infill and pit lakes.
- Maintain groundwater through-flow at the eastern boundary of mining lease 270SA.
- Maintain the suitability of groundwater quality in the pit lakes and within the in-filled mine path for beneficial use.

Surface and Groundwater Interaction

- Construct permanent overflow structures from Marillana Creek to the mine path, upstream of the Creek diversions, in order to allow surface water flow events of 1:100 year or greater to discharge to the mine voids.
- Retain the existing groundwater recharge interaction between Marillana Creek and the palaeochannel at crossover points.

Landforms, Revegetation and Land Use

- Minimise the number and size of out-of-pit overburden storage areas and diversions of Marillana Creek.

- Retain the residual mine voids as run-of-mine where geotechnically stable, and profile so as to achieve long-term closure objectives.
- Use at least 90% of the overburden/waste material to partially fill the mine voids and profile so as to maintain groundwater through-flow conditions and minimise salinity build up.
- Within the constraints imposed by the physical nature of the materials, design the final landform to be similar to the existing regional landforms.
- Design diverted sections of Marillana Creek to function as a fluvial system in a similar manner to the existing creek system (i.e. similar geomorphology and ecological processes).
- Revegetate the mine landforms to establish local native vegetation suitable to the characteristics of the area.
- Use Ecological Function Analysis or an equivalent long-term systems-based monitoring approach to track the course of the rehabilitated areas towards self-sustaining status.
- Determine the end land use for the project area in consultation with stakeholders, and agreed with the administering government authority.

4. Management strategies and/or contingency measures in the event that operational experience and/or monitoring indicate that a guiding closure principle is unlikely to be achieved or any other significant environmental impact arises.

5-2 The proponent shall implement the Decommissioning and Final Rehabilitation Plan required by condition 5-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

5-3 The proponent shall review and revise the Decommissioning and Final Rehabilitation Plan at intervals not exceeding five years, or when significant changes occur at the mine, taking into account the rehabilitation monitoring and management required by condition 6, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

5-4 The proponent shall make the Decommissioning and Final Rehabilitation Plan required by condition 5-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

6 Progressive Rehabilitation

6-1 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 Progressive Rehabilitation Implementation, Monitoring and Management Programme 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 programme are to establish rehabilitation completion criteria, to carry out rehabilitation works and to establish a monitoring programme to demonstrate whether the criteria are being achieved.

This programme shall include:

1. Progressive rehabilitation works (i.e. new areas) and rehabilitation management activities (i.e. maintenance of existing areas).

2. A description of how the planned works and activities have been developed with consideration and incorporation (where practicable to site conditions) of:
   - the characteristics of the pre-mining ecosystems within the mining leases (through research and/or 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.

3. A description of the process and timing for developing rehabilitation performance objectives, parameters and completion criteria.

4. Rehabilitation performance objectives, parameters and completion criteria once they have been developed.

5. Rehabilitation monitoring (i.e. Ecosystem Function Analysis or an equivalent long-term systems-based monitoring programme) that will be used to assess the performance of all rehabilitated areas against the rehabilitation completion criteria.

6. Reporting of rehabilitation activities and monitoring results.

6-2 The proponent shall implement the Progressive Rehabilitation Implementation, Monitoring and Management Programme required by condition 6-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

6-3 The proponent shall review and revise the Progressive Rehabilitation Implementation, Monitoring and Management Programme at intervals not exceeding five years, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

6-4 The proponent shall make the Progressive Rehabilitation Implementation, Monitoring and Management Programme required by condition 6-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

7 Marillana Creek Diversion

7-1 At least 12 months prior to diversion construction of any section of Marillana Creek, the proponent shall prepare a Marillana Creek Diversion 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 ensure that diverted sections of Marillana Creek are designed to function as a fluvial system in a similar manner to the existing creek system.

This plan shall include:

1. design details and specifications of the planned diversion and associated diversion cut-off levee, high flow by-pass spill-out channel(s);

2. design details for creating appropriate transitional gradients to minimise the potential for scouring at the confluence of tributaries and the creek diversion;

3. the construction programme for the creek diversion, including how the work is to be staged and progressively integrated with the mining operations and mine void overburden infill programme;

4. baseline information on water flow, water quality, geomorphology, fauna, vegetation and flora on the section of Marillana Creek to be diverted;

5. revegetation for the diversion channel using suitable riparian species and alluvial sediment sourced from the diverted section of Marillana Creek;

6. management of Aboriginal heritage matters within the planned disturbance area and immediate vicinity of the planned diversion;

7. weed management within the planned disturbance area and immediate vicinity of the planned diversion;

8. performance criteria for water flow, water quality, vegetation, flora, fauna, ecology and geomorphology for the creek diversion;

9. monitoring of water flow, water quality, vegetation, flora, fauna and ecological and geomorphologic integrity of the creek diversion and downstream of the creek diversion during operations and post-closure;

10. inspection and maintenance of the creek diversion and revegetation works during operations and until the objective is met;

11. findings of hydrological and hydraulic modelling and assessment, groundwater modelling, research programmes, and monitoring results to show whether the planned diversion satisfy the relevant guiding closure principles of the Decommissioning and Final Rehabilitation Plan (see condition 5);

12. water quality management of Marillana Creek that is consistent with the State Water Quality Management Strategy; and

13. reporting procedures and schedule.

7-2 The proponent shall design the diverted section of Marillana Creek to be consistent with current best practice and shall construct the diverted section of the creek to be consistent with current best practicable measures.

The design and construction of the diverted section of Marillana Creek shall be subject to independent peer review to ensure that at each diversion there is continuous improvement, based on adaptive management and benchmarking against similar projects in Australia and internationally.

7-3 The proponent shall implement the Marillana Creek Diversion Management Plan required by condition 7-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

7-4 The proponent shall make the Marillana Creek Diversion Management Plan required by condition 7-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

8 Surface Water and Groundwater

8-1 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 Surface Water and Groundwater Management Programme, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The objectives of this programme are to monitor the impact on key water parameters and to maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

This programme shall include:

1. baseline data on groundwater levels and quality within the channel iron deposit aquifer;

2. baseline data on surface water quality and flow for Marillana Creek;

3. groundwater impact assessment criteria;

4. monitoring of the rate of through-flow and quality of groundwater at the downstream boundary of mining lease 270SA, at appropriate locations along the channel iron deposit aquifer and in the pit lakes within the project area;

5. monitoring of the effects of drawdown/dewatering on phreatophytic vegetation communities within the project area, and implementation of remedial measures if impacts are detected;

6. management measures to minimise potential impacts to riparian vegetation associated with dewatering and at the discharge point;

7. evaluation of alternative discharge locations and methodologies;

8. management measures to minimise impacts to surface water and groundwater;

9. water quality management that is consistent with the State Water Quality Management Strategy; and

10. reporting of management actions and monitoring results.

8-2 The proponent shall prepare the Surface Water and Groundwater Management Programme required by condition 8-1 to be consistent with current best practice (where practicable to site conditions) and be subject to independent peer review every five years, or unless otherwise agreed with the administering authority, to ensure that there is continuous improvement, based on adaptive management and benchmarking against similar projects in Australia and internationally.

8-3 The proponent shall review and revise the Surface Water and Groundwater Management Programme required by condition 8-1 at intervals not exceeding five years, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

8-4 The proponent shall implement the Surface Water and Groundwater Management Programme required by condition 8-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

8-5 The proponent shall make the Surface Water and Groundwater Management Programme required by condition 8-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

9 Pit Lake Salinity

9-1 At all times up to lease relinquishment, the proponent shall not cause or allow the Total Dissolved Solids concentration in any pit lake to exceed the "critical" level of 8,000 milligrams/litre (mg/L) on one or more occasion in each of three consecutive years.

9-2 In the event that groundwater monitoring shows the concentration of Total Dissolved Solids to be in excess of the "target" level of 6,500 mg/L on one or more occasion in each of three consecutive years, the proponent shall undertake management measures to reduce the Total Dissolved Solids concentration in the pit lake to below the "target" level and to maintain this reduced level for at least three years thereafter.

The abovementioned management measures shall be one or more of the following:

1. backfill the pit lake to above the water table;

2. divert surface water flow into the pit lake; or

3. any other appropriate remedial measures,

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

The proponent shall immediately submit a report to the Department of Environment outlining the action to be taken to achieve levels below the "target", including the time to be taken.

9-3 In the event that the proponent implements option 2 of condition 9-2, and surface waters are diverted into a pit lake and hypersaline water is allowed to flow out of the pit lake into adjoining water courses, the proponent shall address potential impacts on Marillana Creek, and shall prepare a plan to monitor, manage and report on the impacts, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

10 Stygofauna

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 Stygofauna Investigation Programme 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 programme 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 improvements in knowledge.

This programme shall include:

1. Subterranean fauna surveys in areas affected by mining operations to assist in establishing the conservation significance of any species within the affected areas.

2. Subterranean fauna surveys in areas with similar habitats outside the areas to be affected by mining operations to assist in establishing the conservation significance of fauna within the areas to be affected.

3. Recording and preserving of biological information on any species collected in the project area.

4. A Stygofauna Management Plan where surveys indicate that species and/or communities of conservation significance exist within the impact areas.

   This plan will include a monitoring programme for species and/or communities of conservation significance and details of management measures that will be implemented to ensure persistence of those species and/or communities.

5. Reporting procedures and schedule.

10-2 The proponent shall implement the Stygofauna Investigation Programme required by condition 10-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

10-3 The proponent shall make the Stygofauna Investigation Programme required by condition 10-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

11 Conservation Significant Flora and Fauna

11-1 Prior to any ground disturbing activity 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 Significant Species Management Programme 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 programme 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.

This programme shall include:

1. surveys, prior to ground disturbing activities, where baseline surveys have identified the likelihood of significant impact (see note) to flora and fauna species, vegetation associations and habitat areas for species of conservation significance;

2. a description of the identified flora and fauna species, vegetation associations and habitat areas for species of conservation significance;

3. modification of land clearing plans and evaluation of alternative mine plans or creek diversion designs, where practicable, to minimise or avoid impacts on identified flora and fauna species, vegetation associations and habitat areas for species of conservation significance;

4. appropriate demarcation of identified populations and/or individuals of species of conservation significance or habitat areas suitable for fauna species of conservation significance in the vicinity of the disturbance areas;

5. species-specific management plans where mining or creek diversion activities are likely to impact on known locations of significant flora and fauna species, vegetation associations and habitat areas of conservation significance;

6. records of impacted flora and fauna species, vegetation associations and habitat areas of conservation significance and consultation with regulators where potential impacts on conservation significant species are identified;

7. allowance for the staging of mining operations; and

8. reporting procedures and schedule.

Note: ‘Significant impact’ will be determined by the Minister for the Environment acting on advice of the Environmental Protection Authority and the Department of Conservation and Land Management.

11-2 The proponent shall review and revise the Significant Species Management Programme required by condition 11-1 at intervals not exceeding five years, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

11-3 The proponent shall implement the Significant Species Management Programme required by condition 11-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

11-4 The proponent shall make the Significant Species Management Programme required by condition 11-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

12 Weeds

12-1 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 objective of this plan is to minimise the spread of weed species.

This plan shall include:

1. the location, approximate number and type of each weed species that has been recorded during previous vegetation surveys;

2. weed control and eradication measures and monitoring activities to manage weed species that have been recorded;

3. weed species that have not been recorded within the project area, but have the potential to occur;

4. weed control measures and/or monitoring activities to be used to minimise the potential for weed species that have not been previously recorded in the project area from entering; and

5. reporting procedures and schedule.

12-2 The proponent shall review and revise the Weed Management Plan required by condition 12-1 at intervals not exceeding five years, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

12-3 The proponent shall implement the Weed Management Plan required by condition 12-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

12-4 The proponent shall make the Weed Management Programme required by condition 12-1 publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

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 (Marillana Creek) Agreement Act 1991*.

Schedule 1

The Proposal (Assessment No 1555)

The project is located approximately 90 kilometres northwest of Newman, in the Hamersley Ranges of the Pilbara Region of Western Australia (Figure 1).

The proposal is to mine the entire Yandi orebody within mining leases 270SA and 47/292, and subsequently rehabilitate all the disturbed areas. The Yandi orebody occurs within an ancient channel iron deposit, which is subdivided into a series of mine areas known as the central mesa pits (C1 to C5), eastern mesa pits (E1 to E8) and the western mesa pits (W1 to W6). As individual pits are mined, the voids will be partially in-filled with overburden materials from other pits within the leases.

Previous environmental approvals for the mining operation on mining leases 270SA and 47/292 were granted to mine E2, C1/C2, C4, C5 and W4 at a rate of 45 million tonnes per annum.

The project comprises:

- open cut mining of overburden and ore from the channel iron deposit;
- dewatering of the orebody during mining operations;
- placement of overburden in mine voids and out-of-pit storage areas;
- processing, loading and transportation of ore;
- possible mining of the lower channel iron deposit;
- supply and distribution of power and raw materials; and
- provision of existing service infrastructure (e.g. main access roads, workshops, administration areas, accommodation village and airstrip).

Significant features of the proposal are:

- progressive mining and rehabilitation of the site;
- permanent diversion of sections of Marillana Creek; and
- permanent changes to the final landforms, including hill-like features of the out-of-pit overburden storage areas and pit lakes created in the final voids.

The key proposal characteristics are shown in Table 1.

Figure 2 shows the site layout, illustrating the outline of the iron ore resource; the location of planned mine areas; the location of mine infrastructure; and the conceptual location of the planned Marillana Creek diversions. The final location of the creek diversions will be developed and documented in the Marillana Creek Diversion Management Plan.

Table 1 – Key proposal characteristics

Characteristic	Quantities / Description
Project life	Approximately 30 yrs
Total resources	Approximately 1,420 million wet tonnes
Overall ore production rate	Approximately 45 Mtpa
Mining method	Conventional open cut methods (hydraulic shovels, loaders and haul trucks)
Marillana Creek diversion	Diversion of sections of Marillana Creek in order to maximise resource use in the W5 mine area and the E1 to E6 mine area will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan
Overburden	Approximately 820 Mt
Overburden stripping ratio	0.35 : 1
Pit depth	Typically 60 m (ranges from 55 to 80 m)
Mining disturbance area - Previously approved pits - Proposed additional pits Infrastructure disturbance area to date Proposed additional disturbance associated with diverting Marillana Creek Total area disturbed	 Approximately 1,580 ha Approximately 1,020 ha Approximately 270 ha Approximately 230 ha Approximately 3,100 ha (within mining leases 270SA & 47/292)
Water use	Up to 400 m³/day of groundwater for dust suppression, ore processing and potable purposes
Ore processing	Crushing and screening
Ore transportation from site	Ore loaded in one of two rail loading stockpiles/loops and railed from site to Port Hedland for shipping
Power supply	On site diesel generators (Future power demand expected to be met by the Newman gas-fired station via connecting overhead transmission line)
Workforce	Approximately 350

Figures (attached)

Figure 1 – Site location
Figure 2 – Site layout

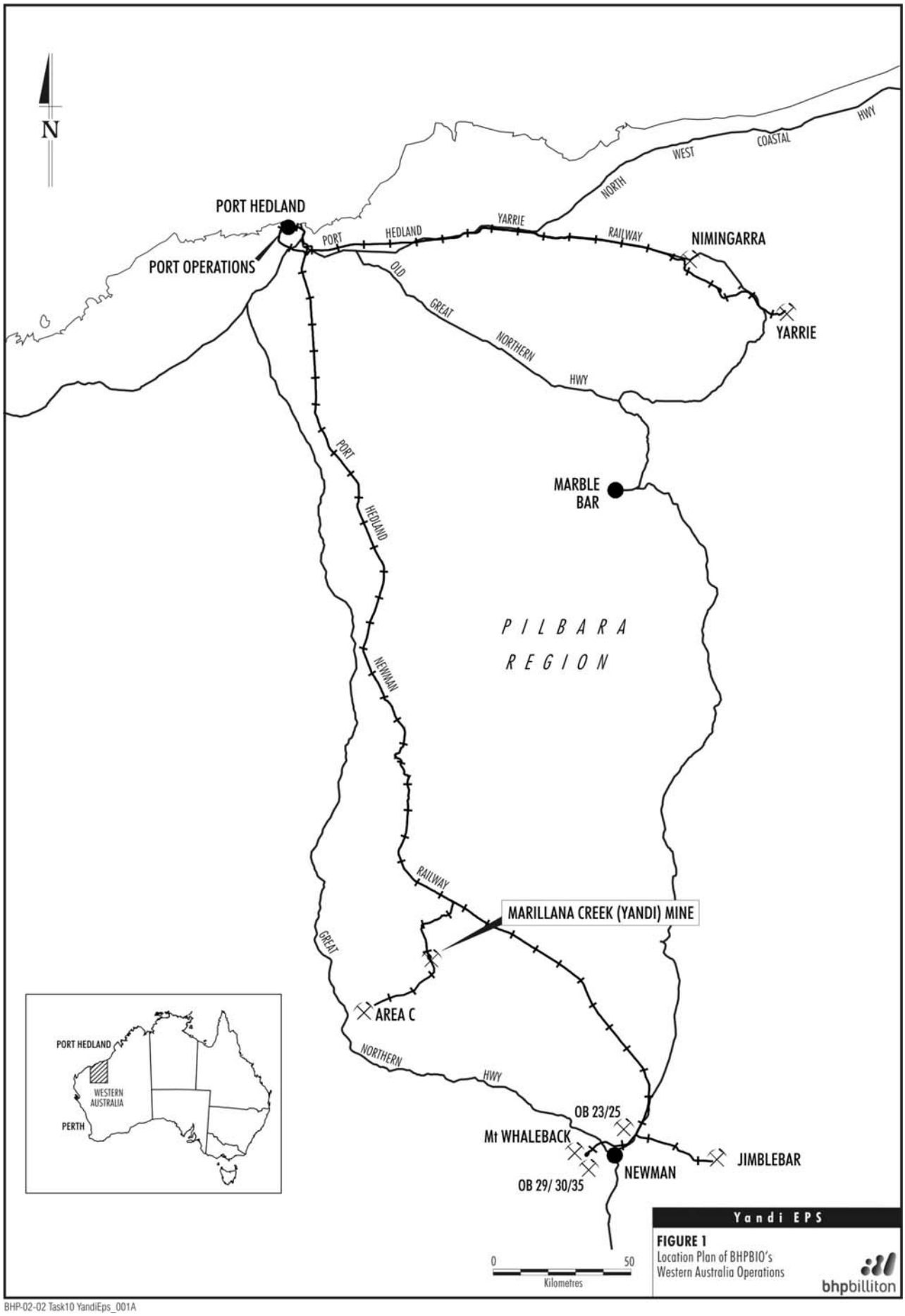

Figure 1: Site location

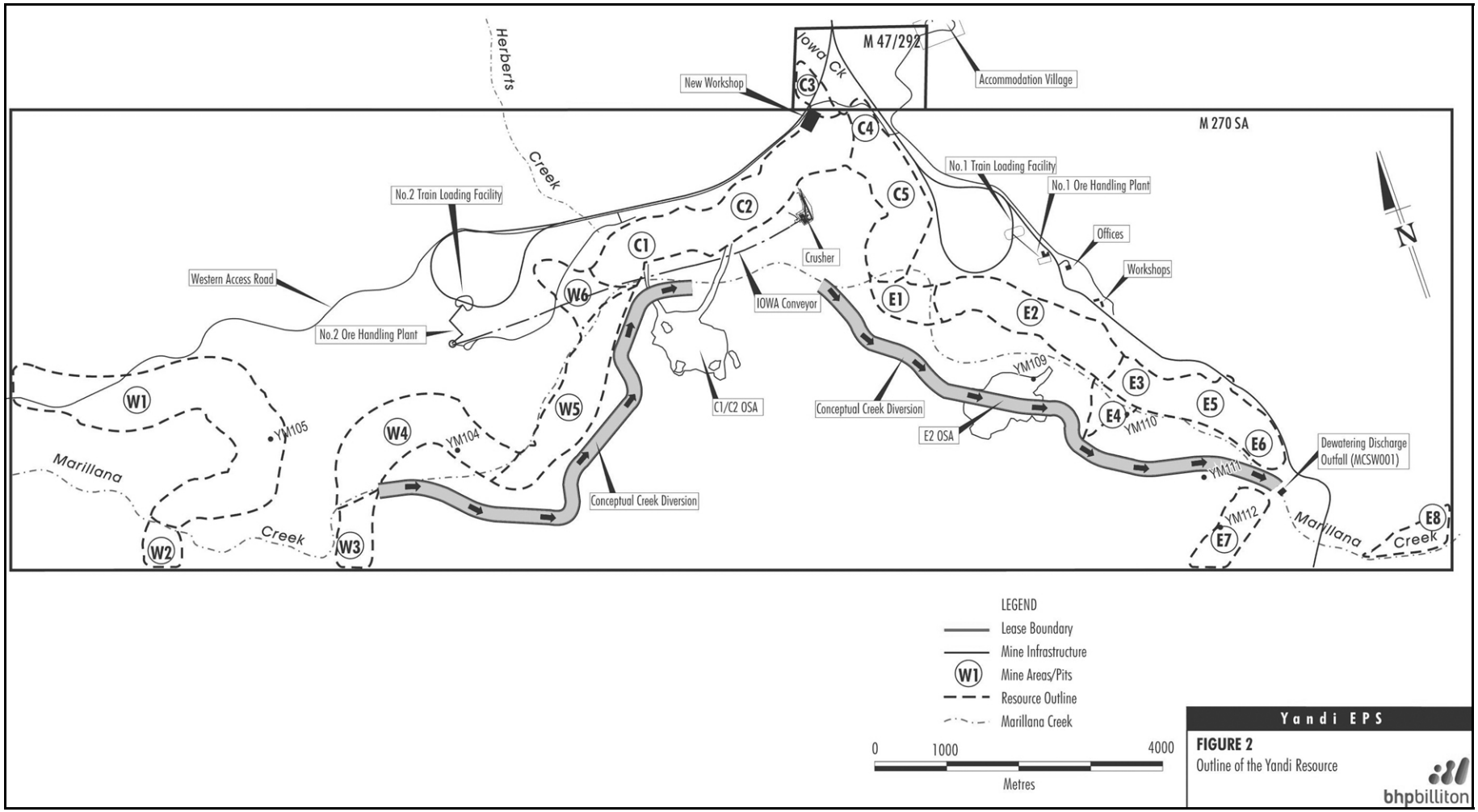

Figure 2: Site layout