



# Report and recommendations of the Environmental Protection Authority



**Jack Hills Expansion Project**

**Crosslands Resources Ltd**

Report 1413

August 2011

## Public Environmental Review Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
22.6.09	Level of Assessment set	6
13.9.10	Environmental review document released for public review	47
22.10.10	Public review period for ERD closed	6
13.4.11	Final Proponent response to ERD issues raised	25
15.8.11	Publication of EPA report	18
29.8.11	Close of appeals period	2

Timelines for an assessment may vary according to the complexity of the project and are usually agreed with the proponent soon after the level of assessment is determined.

In this case, the Environmental Protection Authority did not meet the timeline objective in the completion of the assessment and provision of a report to the Minister



Dr Paul Vogel  
Chairman

12 August 2011

ISSN 1836-0483 (Print)  
ISSN 1836-0491 (Online)  
Assessment No. 1789

## Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for Environment on the proposal by Crosslands Resources Ltd to expand the Jack Hills Iron Mine.

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for Environment on the outcome of its assessment of a proposal. The report must set out:

- the key environmental factors identified in the course of the assessment; and
- the EPA's recommendations as to whether or not the proposal may be implemented, and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit. The EPA is also required to have regard for the principles set out in section 4A of the EP Act.

### **Key environmental factors and principles**

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

- (a) vegetation and flora;
- (b) terrestrial fauna (including short range endemics);
- (c) surface and groundwater; and
- (d) heritage values.

Several other factors were relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

These principles were considered by the EPA in relation to the proposal:

- (a) precautionary;
- (b) intergenerational equity;
- (c) the conservation of biological diversity and ecological integrity; and
- (d) the principle of waste minimisation.

### **Conclusion**

The EPA has considered the proposal by Crosslands Resources Ltd (CRL) to expand the Jack Hills iron mine.

Inclusive of the mine, infrastructure areas, and service corridors the project is expected to clear 9287 ha of vegetation. The expansion is located in banded

iron formation ranges (BIFs) with lower associated biodiversity values than those of some other BIFs in the Yilgarn region. The proposal will impact on the *Jack Hills Vegetation Complexes on Banded Ironstone*, a priority ecological community (PEC) of *Spinifex (Triodia melvillei)* hummock grassland, described as a complex of regional conservation significance. Regional surveys undertaken the impact is approximately 12% and the EPA is satisfied that the impacts on this community are not significant. The EPA has recommended a condition to ensure that the impacts on this PEC are minimised. The proposal will also impact on a number of priority flora species and the results of surveys for these species indicate that large numbers of the currently recorded populations are likely to be impacted by the proposal, but it is likely that these species are found within similar vegetation associations located within the broader region. The EPA therefore considers that there is a low risk that impacts on Priority flora species are significant. However, it is considered appropriate that additional targeted regional surveys are undertaken to confirm the likely distribution and extent of the populations at other locations. A condition has been recommended to achieve this outcome.

The proposal is not expected to impact fauna species or populations, however, the EPA has recommended a condition to ensure that trenching associated with the gas pipeline and mining areas does not cause significant fauna losses.

The proposed mine is adjacent to and in the floodplain of the Murchison River. A condition has been recommended to ensure that surface water flows are maintained.

The proposal also requires large amounts of water. Additional work undertaken by the proponent indicates that there is sufficient water available in the Byro Sub-basin borefield located 165 kilometres west of the minesite. It is proposed to abstract 37 GL/year from this aquifer. The EPA is satisfied that the Byro sub-basin can be developed with minimal impact on the environment. The impacts of abstraction can be monitored and managed according to the requirements of the *Rights in Water and Irrigation Act 1914* with a licence issued by the Department of Water (DoW). In particular, the DoW will require an operating strategy to manage the borefield to sustainable limits and monitoring of potential Groundwater Dependant Ecosystems (GDEs) will also be required to inform an adaptive groundwater operating strategy.

Abstraction is also proposed from the Murchison Paleochannel. The proponent has now reduced the amount of water proposed to be abstracted to 3 GL/year. The Murchison Paleochannel is likely to support groundwater dependant ecosystems. These include a series of pools along the Murchison River where the environmental values are not well researched or understood as well as groundwater dependant vegetation and stygofauna communities.

The EPA is advised by the DoW that it can require the monitoring of environmental values of GDEs through the licence and accompanying operating strategy. The operating strategy can also include reducing the amount of abstraction if required to ensure that there are no significant effects

on environmental values. The EPA therefore notes that the proposal includes abstraction of up to 3 GL/year from the Murchison Paleochannel aquifer and that this abstraction will be subject to the requirements of the *Rights in Water and Irrigation Act 1914* and DoW approvals processes. The EPA has advised CRL to develop a program of environmental investigations, modeling and monitoring in consultation with the DoW and the DEC to determine the environmental values of GDE before any significant increase is proposed in groundwater abstraction from the Murchison paleochannel system.

In relation to stygofauna associated with the Murchison Paleochannel Borefield the EPA has recommended a condition to ensure there are no significant adverse impacts on stygofauna communities.

The EPA notes that significant indigenous sites occur within the proposal footprint and discussions with the traditional owners are continuing.

CRL has advised the EPA that it has reached agreement with the traditional owners of Gudjeemia (Mt Hale) to protect the site by re-designing the pit.

The previously approved Jack Hills Stage 1 project contains a condition that does not allow mining of the rock overhang site. The EPA has recommended that this condition be retained for the current proposal. The EPA acknowledges, however, that a subsequent agreement may be reached with traditional owners, in which case this condition could subsequently be removed or amended through a Section 46 change to implementation conditions.

The EPA is satisfied that mine closure and rehabilitation can be managed by the Department of Mines and Petroleum (DMP) in accordance with the requirements of the *Mining Act 1978* and the EPA/DMP Guidelines for Preparing Mine Closure Plans 2010.

CRL has proposed a suite of possible mitigation strategies to address the residual environmental impacts of the proposal. These focus on biodiversity matters where there is incomplete knowledge of species and their distributions. The EPA has recommended a condition to address the residual environmental impacts of the proposal.

The EPA has also provided other advice in relation to asbestiform minerals, the Square Kilometre Array and residual impact management strategies proposed by the proponent.

The EPA has concluded that it is likely that the EPA's objectives would be achieved, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 and summarised in Section 4.

## **Recommendations**

That the Minister for Environment:

1. notes that the proposal being assessed is for the expansion of the Jack Hills iron mine;
2. considers the report on the key environmental factors and principles as set out in Section 3;
3. notes the EPA has concluded that it is likely that the EPA's objectives would be achieved, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 and summarised in Section 4;
4. imposes the conditions and procedures recommended in Appendix 4 of this report; and
5. notes the EPA's other advice presented in Section 5 regarding asbestiform minerals, the Square Kilometre Array and residual impact management strategies.

## **Conditions**

Having considered the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Crosslands Resources Ltd to expand the Jack Hills iron mine is approved for implementation. These conditions are presented in Appendix 4. Matters addressed in the conditions include:

- vegetation and flora (including weeds);
- terrestrial fauna;
- surface water and groundwater;
- stygofauna communities - Murchison Palaeochannel;
- indigenous heritage; and
- residual environmental impact management.

# Contents

	Page
<b>Summary and recommendations .....</b>	<b>i</b>
<b>1. Introduction and background.....</b>	<b>1</b>
<b>2. The proposal.....</b>	<b>4</b>
<b>3. Key environmental factors and principles .....</b>	<b>8</b>
3.1 Vegetation and flora .....	8
3.3 Surface water and groundwater.....	15
3.4 Heritage values.....	20
3.5 Rehabilitation and closure .....	22
3.6 Environmental principles .....	25
<b>4. Conditions.....</b>	<b>25</b>
4.1 Recommended conditions .....	25
4.2 Consultation .....	25
<b>5. Other advice.....</b>	<b>25</b>
<b>6. Recommendations .....</b>	<b>27</b>

## Tables

Table 1: Summary of key proposal characteristics.....	4
---	---

## Figures

Figure 1: Regional location

Figure 2: Project layout

## Appendices

1. List of submitters
2. References
3. Summary of identification of key environmental factors
4. Recommended environmental conditions and nominated Decision-Making Authorities
5. Summary of submissions and proponent's response to submissions

# 1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for Environment on the key environmental factors and principles for the proposal by Crosslands Resources Ltd (CRL) to expand the Jack Hills Iron Mine.

The original mine proposal was approved in September 2006 (EPA Bulletin 1220, Ministerial Statement 727). The mine expansion proposal is contiguous with the original development and sited approximately 400 kilometres (km) northeast of Geraldton in the Jack Hills Range (Figure 1).

For the original mine proposal the key issues were: protection and management of vegetation and areas of particular conservation significance (in Banded Iron Formations-BIFs); fauna management and decommissioning and closure.

The EPA is formally assessing the expansion proposal because:

- the mine would be large and requires the clearing of approximately 9287 hectares (ha) of native vegetation, a significant part with high floral and faunal conservation values and a greater degree of endemism than on the surrounding plains;
- large amounts of water would be needed and water extraction could impact ecological and cultural values of waterbodies and groundwater-dependent ecosystems (GDEs) and related habitats adjacent to borefields; and
- stygofauna in borefield aquifers could be adversely affected.

This assessment recognises the key principles described in the *Strategic Review of the Conservation and Resource Values of the Banded Iron Formation of the Yilgarn Craton* (Strategic Review) include:

- no development that would result in the increase of a IUCN threat category of any plant or animal taxon, or any ecological community; and
- 15-30% of the total number of BIF ranges should be preserved in their entirety where development has not significantly progressed.

An objective of mine planning should be to maximise the protected area of any floristic community that has been identified as restricted to the BIF, or is dependent on the BIF for its conservation (Strategic Review: 'Major Findings' section, page 9).

Although only a small fraction of BIFs in the Mid-West region is secured in conservation reserves, the Jack Hills area is considered in the Strategic Review to have "lower biodiversity value sites - although still providing refugial habitats with localised species and vegetation". There are six vegetation community types, at least one of which is endemic to the Range. It offers



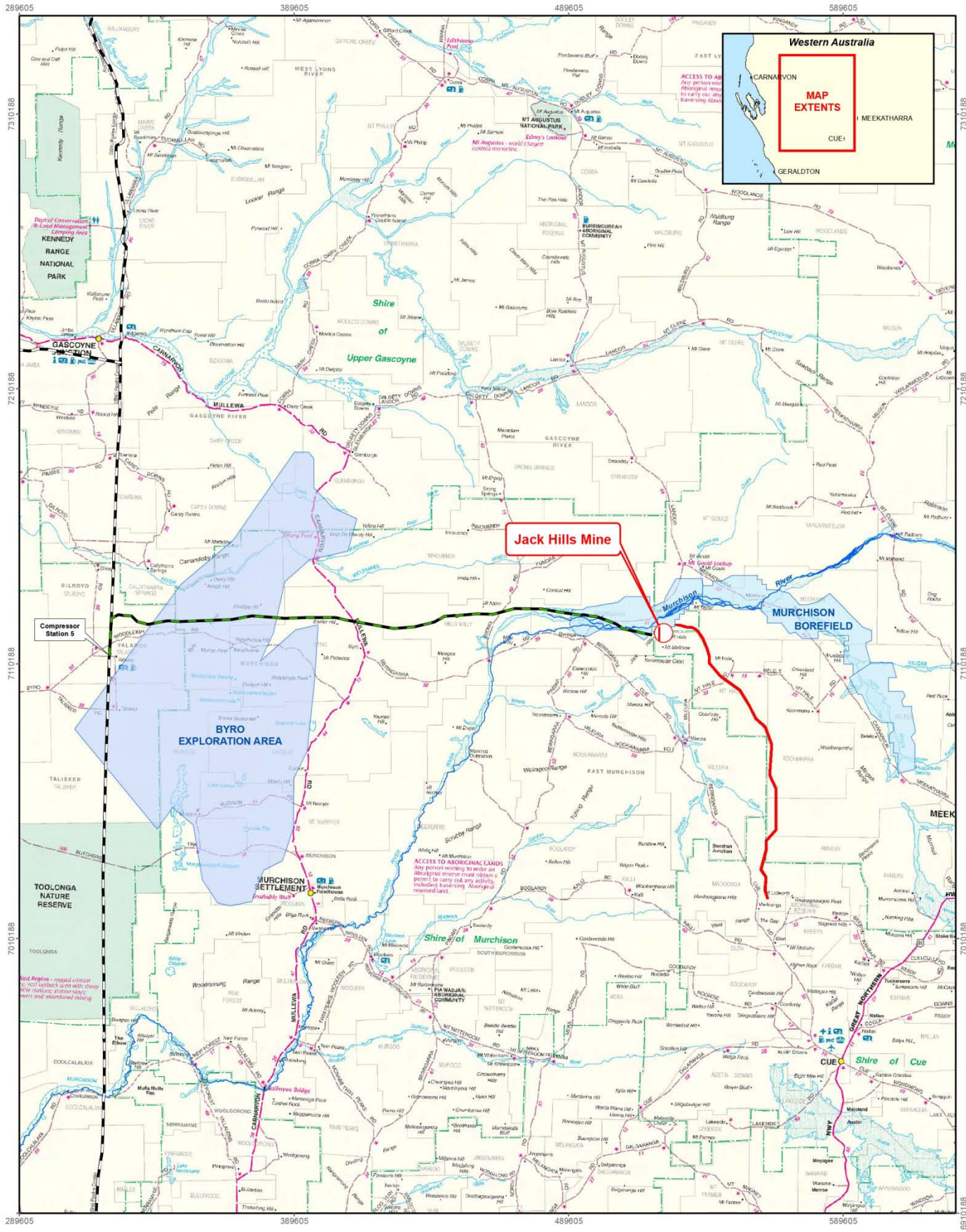
suitable habitat for, among other spiders, the Shieldback Trapdoor Spider, *Idiosoma nigrum*.

The information subsequently provided by the proponent's detailed flora and fauna survey results described in its PER has supplemented the knowledge base and informed this assessment. The Strategic Review adds "it will be important that mining approvals...are coupled with conservation outcomes for appropriate parts...as an outcome of the environmental process".

Other matters the EPA considered were: cultural heritage, rehabilitation, and mine closure. Radio quietness for the Square Kilometre Array is not intrinsically an environmental issue but was raised in submissions. However, it has the potential to impact on environmental considerations if, for example, it were found necessary to re-route the haul road and infrastructure services corridor, or the power station in order to ensure that radio transmissions would not affect the performance of the Square Kilometre Array.

Details of the proposal are presented in Section 2 of this report. Section 3 discusses the key environmental factors and principles for the proposal. The conditions to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides other advice by the EPA and Section 6 presents the EPA's recommendations.

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



**LEGEND**

- Proposed Gas Pipeline
- Dampier-Bunbury Natural Gas Pipeline (DBNGP)
- Byro Sub-Basin
- Murchison Borefield
- Murchison River
- Proposed Services Corridor



Scale 1:1,750,000 (at A4)



**JACK HILLS EXPANSION PROJECT**

**Figure 1: Regional setting**

## 2. The proposal

The mining expansion proposal comprises:

- two open pits;
- a crusher and processing plant (for the beneficiation feed ore-stream);
- an integrated tailings dam and waste rock landforms;
- haul road and services corridor from Weld Range to Jack Hills, with an ore stockpiling and loading facility at Weld Range;
- a gas spur line from the Dampier-Bunbury natural gas trunk line to Jack Hills to fuel a power station;
- borefields in the Murchison River Palaeochannel, and the Byro Sub-basin, plus associated linking pipeline corridors;
- workshops, village and airstrip.

Iron product would initially be trucked to Geraldton as it is now, but the intention, once production increases significantly, is to rail it to the proposed Oakajee Port. The railway and port are part of a separate proposal being developed by different proponents, and are not considered as part of this assessment.

The proposal characteristics are summarised in Table 1 below and outlined in Figure 2. Details are in Section 5 of the PER (Crosslands Resources Ltd, 2010).

**Table 1: Summary of key proposal characteristics**

Element	Description
<b>Resource</b> <ul style="list-style-type: none"> <li>• direct shipping ore:</li> <li>• beneficiation feed ore:</li> <li>• mining rate:</li> </ul>	110 million tonnes (Mt) 2900 Mt 150 Mtpa
<b>Plant</b> ore treatment plant output:	45 Mtpa (combined products)
<b>Pit area</b> <ul style="list-style-type: none"> <li>• Main pit:</li> <li>• Brindal pit:</li> </ul>	813 ha / 360 metres(m) deep 120 ha
<b>Tailings and waste rock storage</b> <ul style="list-style-type: none"> <li>• integrated tailings dam:</li> <li>• waste rock dump - extension of Stage 1:</li> <li>• waste rock dump - Brindal Pit:</li> <li>• topsoil storage:</li> </ul>	2 km x 4 km x 105 m high 2200 ha / 290 m high 69 ha 424 ha
<b>Infrastructure</b> <ul style="list-style-type: none"> <li>• haul road and services corridor (Jack Hills to Weld Range):</li> <li>• gas pipeline corridor (E-W line to Compressor Station 5):</li> </ul>	120 km x 50 m = 600 ha 220 km x 50 m = 1100 ha

<ul style="list-style-type: none"> <li>• airstrip:</li> <li>• accommodation village – construction – operation</li> <li>• sewage treatment and waste disposal</li> </ul>	2400 m x 400 m = 150 ha
<b>Water</b> <ul style="list-style-type: none"> <li>• Murchison Palaeochannel Borefield:</li> <li>• Byro Borefield:</li> </ul>	3 Gigalitres (GL)/ yr  37 GL/yr
<b>Power station</b> <ul style="list-style-type: none"> <li>• Gas-fired turbine (diesel backup)</li> <li>• borefield:</li> </ul>	350 Megawatt(MW) 8.5 MW
Infrastructure area:	3301 ha
<b>Total disturbance footprint:</b>	9287 ha

Table 1 incorporates modifications to the proposal made by the proponent following release of the PER. These include:

- an increase to the depth of the main pit from 260 m to 360 m;
- increases to the sizes of the integrated tailings dam and the waste rock dump from 1785 ha to 2200 ha and from 230 m to 290 m high;
- an increase in the footprint to 9287 ha also reflecting the updated areas of the proposed borefields;
- a change to the crossing point of the gas pipeline on the Murchison River to avoid an indigenous heritage site. As the new site has fewer large trees, it would also avoid disturbance to *Eucalyptus victrix* trees in the riparian zone;
- the PER indicated water demand at up to 37 GL per annum, to be taken from the Murchison Palaeochannel Aquifer. With the results of more recent surveys showing that salinities in the lower aquifer are very high, CRL indicated that it would prefer to draw from the upper, rather than the lower sequence. This may result in a more significant effect on groundwater-dependent ecosystems following the Murchison River;
- as studies to determine the potential impacts of water extraction have not been completed, CRL has agreed to draw a reduced maximum of 3 GL per annum from the Murchison Palaeochannel Borefield, for up to three years to cover the construction period, with any subsequent increase subject to the approval processes of the Department of Water in accordance with the requirements of the *Rights in Water and Irrigation Act 1914*; and
- there are fewer potential environmental consequences of developing the Byro Sub-basin and CRL now proposes to develop a borefield there during the construction phase. CRL will draw water needed for construction and mining purposes whilst it assesses the results of environmental studies to determine potential impacts of groundwater

abstraction on adjacent ecosystems in the Murchison Palaeochannel Borefield.

The potential impacts of the proposal predicted by the proponent, and their proposed management, are summarised in Table 1.2 of the PER document titled *Jack Hills Expansion Project Public Environmental Review*. Sept. 2010.



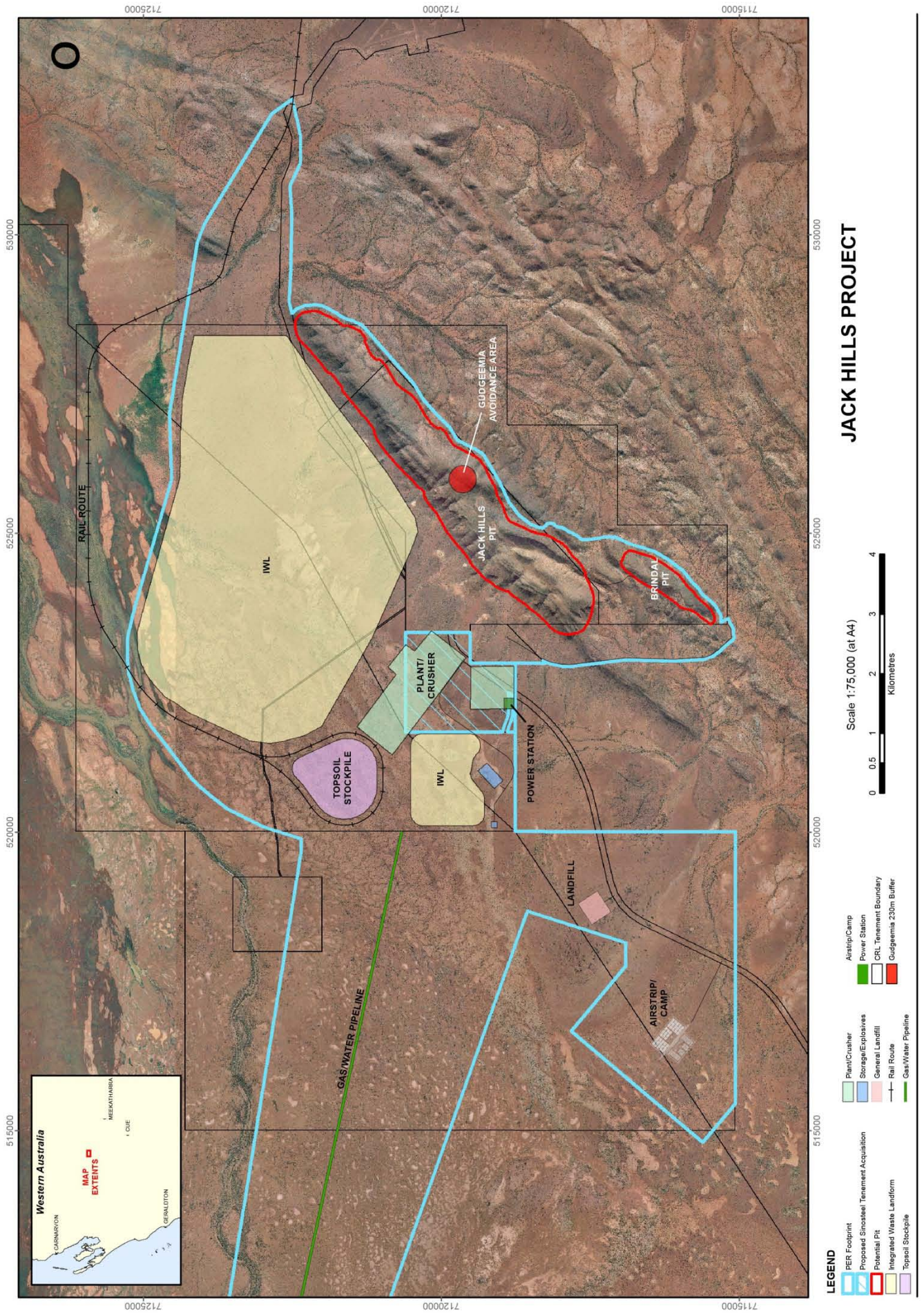


Figure 2: Jack Hills Expansion Project Footprint

### 3. Key environmental factors and principles

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

The identification process for the key factors selected for detailed evaluation in this report is summarised in Appendix 3. A number of factors not discussed below are relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

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

- (a) vegetation and flora;
- (b) terrestrial fauna (including short range endemics);
- (c) surface and groundwater; and
- (d) heritage values.

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

Details on the key environmental factors and their assessment are contained in Sections 3.1 - 3.5. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective(s) set for that factor.

The EPA considered the following principles in relation to the proposal:

- a) precautionary;
- b) intergenerational equity;
- c) the conservation of biological diversity and ecological integrity; and
- d) waste minimisation.

#### 3.1 Vegetation and flora

##### Description

Inclusive of the mine, infrastructure areas, and service corridors the project is expected to clear 9287 ha of vegetation.

The Jack Hills Range hosts a suite of rocks, collectively known as banded iron formation, which differs from those underlying the surrounding plains. It supports a complex of vegetation communities which are more ecologically diverse than those on the plain. One of the most important features is the



'Jack Hills Vegetation Complexes on Banded Ironstone', a priority ecological community (PEC) of Spinifex (*Triodia melvillei*) hummock grassland, described as a complex of regional conservation significance. Taken as a whole, the range vegetation can be described as combinations of Acacia woodlands and shrubland communities; and Spinifex grasslands. Tables 8.3 to 8.5 of the PER describe the vegetation communities within the mine and corridor footprints of the proposal.

There exist along the gas pipeline corridor and the Jack Hills to Weld Range services corridor several communities of Acacia (Mulga) woodland and shrubland, with occasional sparse stands of *Eucalyptus victrix* trees.

Twelve species of priority flora on Jack Hills range have been mapped; four species along the pipeline route and eight species in the services corridor (PER Table 8-8). No Declared Rare flora (DRF) or Threatened Environmental Communities were recorded during surveys undertaken for the project.

The proposed Murchison Palaeochannel Borefield, adjacent to the Murchison River, lies close to communities dominated by Acacia shrublands and woodlands, with groundwater-dependent Eucalyptus trees (*E. victrix* and *E. camaldulensis*), and sedges marking the braided river channels (see section 8.4.2.5 of the PER). The potential impacts on vegetation from groundwater abstraction of the Murchison paleochannel and Byro sub basin are discussed under the factor on Surface and Groundwater.

Several weed species also grow in the project area (PER Table 8.9) but none is a 'declared plant' within this region.

The project could directly and/or indirectly affect native vegetation by clearing; changes to surface and groundwater distribution patterns and levels, the spread of weeds; and by changed patterns of fire.

## **Submissions**

Noting that several priority flora species in the footprint of the proposal would be cleared, the Department of Environment and Conservation (DEC) recommended that CRL should change the proposal design where practicable, to reduce impacts on the regional conservation status of flora of significance. Several suggestions were made with regard to appropriate mitigation strategies for the expected loss of significant flora. The DEC has recommended that special consideration via commitments or conditions be given to populations of conservation-significant species close to the mine footprint.

Apart from any direct impacts to vegetation from clearing, there are likely to be other effects if current surface water drainage patterns are disrupted near surface-water feeders, such as Mulga groves, which have been found along the infrastructure corridor.



## Assessment

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

- maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; and
- ensure that native flora are conserved consistent with the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999*.

The conservation values of the 'Jack Hills Vegetation Complexes on Banded Ironstone' community were recognised in the assessment of the original Jack Hills Mine proposal (EPA Bulletin 1220). The combined original and current mine expansion footprint is expected to clear about 76% of the *Triodia melvillei* community on Jack Hills. The total mapped extent of the community at Jack Hills is 359 ha. Approval for the Stage 1 project included a Ministerial condition requiring the definition of the extent of plant communities on Jack Hills Range, as well as regionally. As required by Ministerial condition 8-10 of Ministerial Statement 727, CRL surveyed *Triodia* communities on other hill ranges within 250 km of the minesite (see PER Table 8.7), concluding that less than 12% of this type of community would be lost as a result of the project. The approximate regional extent of similar vegetation communities, as visited by CRL, amounts to 2286 ha. Of those visited, the *Triodia* community at Kennedy Range (a conservation reserve) shows the greatest similarities to the Jack Hills community.

The impact on the known extent of this vegetation community is considered acceptable, however, the EPA has recommended a condition be included to ensure that the impacts from the development of the mine, in particular infrastructure and the waste dumps, on this community are minimised.

The gas pipeline corridor (which would also carry the pipeline from the Byro Borefield) does not intersect the *Triodia melvillei* community. The infrastructure services corridor does not support the vegetation types defined by the PEC (PER page 84). Both corridors would be aligned to avoid all priority flora recorded during the baseline surveys. The condition of vegetation along the route varies from 'very good' along creek lines in the Weld Range corridor, to 'completely degraded'. Rocky plateaux, the preferred habitats of goats and kangaroos, have suffered from heavy overgrazing.

The minesite and surrounding facilities would directly affect nine of the twelve recorded priority species of flora in the area. The extent of those impacts is as follows (from Table 9.1 of the PER).

### Priority 1 flora

- *Ptilotus tetrandrus* is very uncommon, with only five plants documented state-wide. Two of these are within the project infrastructure footprint. The species has recently also been recorded from the Weld Range;

- *Stenanthemum mediale* would be heavily affected as 51 out of 77 (66%) documented plants would be taken. Regionally 120 plants have been recorded, bringing the affected proportion down to 42.5%;
- *Acacia* sp. Jack Hills is known only from the Jack Hills Range, where it is widespread and common, especially at mid-to-upper altitudes. Of the estimated 3.5 million plants in the broader Jack Hills Range 403,000, or 11.5%, lie within the project footprint.

### Priority 3 flora

- *Prostanthera petrophila* would be heavily impacted. 713 individual plants out of 820 locally (87%) would be cleared. The regional count indicated the occurrence of 1077 plants, reducing the regional impact to 66.6%;
- *Homalocalyx echinulatus* is recorded by the WA Herbarium as having an isolated to sparse occurrence. Surveying has recorded 16,367 plants within the project area, where they are found on the lower slopes of the Jack Hills. 19,761 plants were recorded more regionally, bringing the proportion affected to 82.4%;
- *Prostanthera ferricola* species would be significantly affected locally. From a total of 511 at Jack Hills 62.4% (319) plants would be taken. More regionally the total number of plants recorded to date is 1394, reducing the percentage impacted to 23%;
- *Indigofera gilesii* subsp. *gilesii* ms has been recorded only 16 times in the Jack Hills, but regionally 68 plants have been found. Of the total, four (6%) would be cleared from the project footprint;
- *Calytrix verruculosa* plants would be slightly impacted; three individual plants out of a total of 549 recorded in the project area would be taken; and
- *Verticordia jamiesonii* is reasonably common-a regional population of 3017 plants and a project footprint population of 2453 plants were mapped, of which three individuals are likely to be affected.

At face value these impacts appear significant, however the EPA considers that they are more likely to be a result of unfocussed survey effort. If regional survey effort had been applied to the other known locations of these priority species it is likely that the total number of plants recorded for each species at the other locations would have increased. This would have the effect of reducing the significance of overall potential impacts to these species.

In view of the above, the EPA is satisfied that there is a low risk that impacts on Priority flora species are significant. However, it is considered appropriate that additional targeted regional surveys are undertaken to confirm the likely distribution and extent of the populations at other locations. A condition has been recommended to achieve this outcome surveying for the following priority species:

- *Stenanthemum mediale* (P1);
- *Ptilotus tetrandrus* (P1);
- *Prostanthera ferricola* (P3); and
- *Homalocalyx echinulatus* (P3)

Other species listed in Table 9-1 of the PER which were encountered by surveys along the infrastructure corridors would be avoided during construction of the services (PER p113).

A system to monitor the effects of dust on vegetation is in place at the current minesite and would be expanded to encompass the expansion area. Dust deposition gauges are read monthly, whilst vegetation in permanent quadrats is monitored annually. The EPA notes that CRL states that to date no impacts have been found.

The EPA has recommended a condition to ensure that the number of species of weeds, the intensity of weed infestation and the extent of weed distribution does not increase as a result of implementing the proposal.

### **Summary**

The EPA considers the key environmental factor of vegetation and flora around the minesite and infrastructure corridors has been adequately addressed. To achieve the EPA's objectives for this factor, the EPA has recommended conditions requiring the proponent to:

- submit to the EPA prior to ground-disturbing activities a report detailing how the project design has reduced potential impacts on the *Triodia melvillei* priority ecological community and priority flora within the stated project footprint;
- extend flora surveys to determine the regional extent of heavily impacted priority flora species; and
- prevent the introduction and spread of weeds.

## **3.2 Fauna**

### **Description**

Four terrestrial fauna surveys of the Jack Hills project area have been carried out between 2005 and 2009 (Table 8.10 of the PER). The mine area contains three 'regional' habitats - ridges, plains and drainage lines. A total of 15 native mammal species, 82 bird species and 23 reptiles were recorded.

The pipeline routes cross several habitats: Acacia shrublands, rocky breakaways, and drainage lines with dense vegetation. Fauna recorded include one native mammal along with feral goats, cats and donkeys. Ten bird and two reptile species were also seen. Along the infrastructure corridor seven habitats were recognised, but only five native vertebrate species (three birds, a kangaroo species and the Ring-tailed Dragon) were recorded, possibly due to the cold, wet conditions during the field survey.

The Long-tailed Dunnart, Peregrine Falcon, Bush Stone-curlew and the Rainbow Bee-eater are listed as conservation-significant terrestrial fauna recorded from the mine area. The gas pipeline and infrastructure corridors were stated to be unlikely to support any priority species, except for the Rainbow Bee-eater; which was recorded (PER Table 8.11). The former prefers the rugged rocky areas in open woodlands or shrublands over a

grassy understorey, as typically found on the Jack Hills. The Bee-eater normally breeds in sandy areas, so it prefers habitats other than the ranges. Sections 9.3.3.1 to 9.3.3.3 of the PER list other species recorded around the proposal footprint.

CRL has recently discovered a Priority 2 fish in a pool 300m downstream of Kalamunda Pool on the Murchison River. The Golden Gudgeon (*Hypseleotris aurea*) has a limited distribution in the Mid-west Region, but is stated to be common in the Gascoyne and Murchison Rivers, including in Kalbarri National Park, the only protected habitat of the known distribution of the species. As a bottom-dweller it prefers to inhabit places where aquatic vegetation and woody debris collect in rocky pools and is thought to not tolerate high salinity (Morgan and Gill, 2004).

Surveys around the minesite footprint for short-range endemic fauna (PER sections 8.5.3 and 9.4.3) identified three species of trapdoor spider: *Idiosoma nigrum*, *Cethegus sp.* and *Eucryptops sp.* Whilst Jack Hills has the most north-easterly known population of *I. nigrum* it is also recorded from other ranges in the Murchison district (including Weld and Karara Ranges) and in the Wheatbelt. *Cethegus* appears to be widespread and abundant in the hills and on adjacent floodplains; *Eucryptops* has also been found in the Carnarvon Basin. Neither *Cethegus sp.* nor *Eucryptops sp.* is considered to be at significant risk from the proposal.

*I. nigrum* was closely surveyed because the proposal would directly affect about 3899 burrows, which is 18.57% of the local population of approximately 21,000 of the recently active burrows identified to date at Jack Hills. Most of the burrows found are on south-facing slopes, in drainage lines (where moisture levels are higher) and under acacia vegetation. Potential threats to the species include changes to surface hydrology, moisture levels, nutrient and microclimates from clearing; grazing by feral animals; vibration; dust; fire; and the establishment or spread of weeds.

## **Submissions**

The DEC submitted that the pit should be backfilled to above water level. Otherwise an extra supply of water would be accessible for feral animals and stock after mine closure. Water in the pit would be expected to become more salty over time. In the event that a permanent water-filled void is approved the DEC recommended monitoring of void water quality, together with fencing to restrict access by fauna, and monitoring and control of fauna attracted to the water.

Noting the proposal to trench the gas supply pipeline, the proponent was asked to provide information on the strategies that would be used to minimise trauma to fauna that may become trapped in the trench during construction. Trenching management strategies should be developed and formalised in consultation with the DEC, to be consistent with those already used for construction of the Dampier – Bunbury gas pipeline Stage 5, fauna management protocols.

Clarification was sought on the distribution of troglofauna and of the specific identity and conservation status of short-range endemic species found to date.

The potential impacts of groundwater abstraction from the borefields on stygofauna is discussed under the factor of Groundwater.

### **Assessment**

The EPA's environmental objectives for fauna are to:

- maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; and
- protect threatened fauna and priority fauna species and their habitats, consistent with the provisions of the *Wildlife Conservation Act 1950*.

The clearing of 9287 ha of habitat, changes to surface drainage patterns and the potential for fauna to become trapped in the open (construction phase) gas pipeline trench are all high risks for fauna.

Regionally, in relation to conservation significant fauna, the Long-tailed Dunnart has a large, but scattered, distribution. Its preferred habitat is rugged, rocky areas with open woodland over a grassy understorey. The EPA notes that CRL has calculated that locally about 10% of the Dunnart's range habitat would be affected by the proposal and concludes that the marsupial's population within the Jack Hills is unlikely to be significantly affected.

The Rainbow Bee-eater visits the area seasonally. It is very mobile and is likely to move outside disturbed areas. Regionally the species is widely distributed across most of Australia and also considered unlikely to be significantly affected.

Several other bird species which have previously been recorded (or could potentially occur) in the area are discussed in the PER (section 9.3.3). None are likely to be significantly affected by the proposal, although locally they could be expected to be displaced.

CRL has listed management and monitoring strategies to minimise or mitigate impacts to vertebrates (PER section 9.3.4) and invertebrates (section 9.4.4). The proponent has also prepared a Construction Environmental Management plan and an Operations Environmental Management Plan. The EPA considers that these management strategies, both around the minesite and along the infrastructure and pipeline corridors, are adequate. The EPA has recommended a condition to ensure the project is implemented according to the requirements outlined in these plans.

Potential impacts on trapdoor spiders include habitat clearing, changes in surface drainage, grazing by feral animals, weed growth, fire, dust and vibration. A change to surface drainage patterns caused by CRL diverting a watercourse around a mine component may increase water volumes in other

drainage line and thus the flood height of water. As the spiders build their burrows immediately above common flood heights, an increase in the volume of water could result in their inundation, or erosion of the banks on which they are situated.

CRL commissioned a study on the effects of vibrations from exploration drilling on *I. nigrum*. As a result of favourable findings (PER section 9.12.3) the DEC reduced the 200 m exclusion zone around spider burrows to 100 m and subsequently, following a second survey, reduced the buffer around drilling to 25 m. CRL intends to maintain the 25 m exclusion zone around any spider burrows that are not within the proposal's footprint. A five year monitoring program, to establish if there are any long term effects on *I. nigrum*, would be developed in consultation with the DEC.

### **Summary**

The EPA considers fauna can be managed and the EPA's objectives for this factor can be achieved, provided that conditions are imposed requiring the proponent to:

- implement the proposal in accordance with the appropriate construction and operational management plans;
- manage trenching activities to prevent impacts on fauna.

## **3.3 Surface water and groundwater**

### **Description**

The Murchison River, one of the main drainage systems in the proposal footprint, lies a few kilometres to the north and east of the proposed mine. It contains several pools along its course, including Colyeda, Kalamunda, Yalgar and Berrin Pools. They are important ecologically, culturally and to the pastoralist as a water source.

Significant rain events flood the plain where the airstrip, topsoil stockpiles and waste rock landform are proposed to be sited. Surface water flows would have to be diverted around the pit and the waste rock landforms (PER Fig 5.3).

The water table on the plain north of the minesite is stated to vary between 4 m and 40 m below ground surface. Groundwater inflow from surrounding rock formations would make dewatering necessary after about eight years of mining. The expected dimensions of the drawdown cone are up to 7 km along strike (of the Jack Hills Range) by up to 3 km across. The profile of the drawdown cone is described as steep, with "minimal" drawdown on the plain towards the Murchison Palaeochannel.

At the time the PER was written, the degree of hydrologic connectivity between the mine rock sequence (comprising Jack Hills) and the Murchison palaeochannel aquifer to the north was uncertain. Subsequent CRL studies indicate that the pit host rocks have demonstrably low transmissivity.<sup>1</sup> As

---

<sup>1</sup> see CRL 'Response to Submissions' under Pit dewatering

well, no significant cross-faults that could transport water from the Murchison Palaeochannel Aquifer to the mine have been found. Contrary to the description in the PER, pit dewatering is now not expected to be needed.

The water needed to run the mine and ore processing plant would be taken from two separate sources: the palaeochannels of the Murchison River (near and upstream from the mine), and aquifers in the Byro sub-section of the Carnarvon Basin, approximately 165 km west.

The Murchison Palaeochannel Borefield lies within the floodplain of the adjacent Murchison River. The aquifer system is adjacent to the Murchison River and consists of an upper and a lower sequence, separated by low permeability clays. Rainfall and river flows directly recharge the upper sequence. From recent drilling it is apparent that connectivity between the upper and lower sequences is limited, because, while water in the upper system is relatively fresh, that of the lower system is much saltier, even hypersaline in places. The fresher water of the upper aquifer would be preferentially used. Unlike on the Jack Hills Range itself, where the condition of the vegetation is described as 'fair to healthy,' stock grazing pressures are high on the floodplain and large areas are degraded. However, there are stands of groundwater-dependent *Eucalyptus victrix* and *E. camaldulensis* trees along the watercourses. Groundwater dependant ecosystems (GDEs), in particular, groundwater dependant vegetation and the pools, have the potential to be impacted by groundwater abstraction proposed at the Murchison Paleochannel Borefield.

Surveying of the Murchison Palaeochannel Borefield has recorded stygofauna from depths between 6 m and 78 m. This work is incomplete, with second phase follow-up surveys due later in 2011. A new stygofauna species of chiltoniid amphipod was recorded in several bores and two new copepods have been found. Also found was a new species of dytiscid diving beetle. CRL intends to complete surveys for stygofauna in the Murchison Palaeochannel Borefield.

The Byro Sub-basin, Borefield is approximately 165 km west of the mine site, in the Carnarvon Basin. In the PER, vegetation at this location is described as minimal and highly degraded. Subsequent survey work has outlined drainage systems associated with the Wooramel River and its tributaries contain environmentally significant pools in this vicinity. Riparian vegetation accompanies these drainage systems. CRL has recently mapped the extent of *Eucalyptus victrix* and *E. camaldulensis* trees along the watercourses.

### **Submissions**

The issue of where water for this proposal would be obtained had not been conclusively determined at the time the PER was made available for public review. Submissions doubted that such large amounts of water could be sourced sustainably from inland. The issue of water supply is fundamental to the proposal and comprehensive additional information was sought from the proponent.

The DoW advised that water in the Carnarvon Basin, while not over-allocated presently, is highly requested and several applications for water are currently being assessed. The DoW sought data on the maximum volume of water required for the proposal and requested a water balance and description of the water quality required. In addition, the DoW highlighted the possibility of leakage from the Murchison palaeochannel aquifers to the pit if a watertight hydrogeological boundary does not exist between the aquifer and the mine rock sequence.

The Department of Mines and Petroleum (DMP) stated that provisions for site drainage and surface water movements are not adequately explained in the PER and it is not known if they would be of a permanent nature. The DMP sought proposed specifications for protection to the toe of the waste rock landform.

### **Assessment**

The EPA's environmental objectives for these factors are to:

- maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected; and
- maintain the integrity, functions and environmental values of rivers.

Potential impacts from the proposal include changed surface runoff patterns (which could affect Mulga groves along the Weld Range Infrastructure Corridor) erosion and subsequent deposition of sediments, increased turbidity, possible contamination of runoff. Dewatering of the mine pit has potential to impact local aquifers and subterranean fauna. The proposed borefields have the potential to effect Groundwater Dependant Ecosystems including vegetation, pools and subterranean fauna.

Flooding from severe rainfall events is possible around the waste rock landform, as well as on the proposed airstrip. To ensure there would be no significant impacts to surface water flows, the waste rock landform would be sited at least 1 km from the Murchison River. The toe of the dump, the airstrip, topsoil stockpiles and the process plant would be armoured to prevent erosion from floodwaters. So that erosion and siltation are minimised, CRL proposes engineering and management measures to ensure control of surface water at times of heavy rain.

CRL has stated that work done since the release of the PER indicates that the strata surrounding the proposed pit have very low transmissivity and hence it is expected that connectivity between the two systems is likely to be very limited. No cross-fault systems that could act as a preferred conduit for water from the aquifer to the pit have been found, hence development of the mine pit is not expected to impact on adjacent aquifers. Examining diamond drill cores from the areas to be mined has revealed extensive areas of subterranean voids at varying depths that are inhabited by various species of troglofauna. Geological mapping shows continuous and uninterrupted rock



units within the Main and Brindal pits, without extensive cross-faulting, and the PER implies that these habitats potentially extend beyond the pits in both directions. Surveys carried out on adjacent tenements suggest that many of the troglofauna have regional distributions, but the inherent low abundance and capture rates of these fauna make it difficult to adequately demonstrate the full distribution of some taxa. Surveys at Noonie Hills and Stewart Bore (60 km to the southwest and 20 km east, respectively) have discovered species previously found only in the proposed Main and Brindal Pits. The EPA considers that adequate survey work has been carried out on troglofauna and is satisfied that habitat remains outside of the project area and it is likely that species likely to be impacted by the proposal are also found outside of the project area.

Clearing for the proposed services and gas pipeline corridors would add to silt burdens, for at least the short term. If surface water-flow patterns in the Mulga groves along the service corridor to Weld Range are altered, some trees may receive less water. CRL proposes to install culverts along access roads where necessary to facilitate natural surface water cross-flow to sensitive areas, at intervals varied according to assessment of expected flow velocities.

The gas pipeline would be buried under the Murchison River, requiring temporary disturbance to both banks in an area subject to periodic inundation. However, the water pipeline would be built over the river. The range of mitigatory measures (PER section 9.5.4) listed by the proponent indicates that, if carried out appropriately, disruption to surface water flows should be minimised.

In view of the above the EPA has recommended a condition to ensure that surface water flows are maintained so that there are no significant effects on vegetation, fauna and water values throughout the proposed footprint including the infrastructure corridors.

The proponent has been investigating two potential groundwater supplies, being the Byro Sub-basin and the Murchison Paleo Channel closer to the mining operations.

In the Byro Sub-basin, water is expected to be abstracted from below 40 m where a band of up to 200 m of water bearing sands has been located. It is currently estimated that the annual abstraction rate represents <1% of available water. While there may be some groundwater dependant vegetation present at the recharge points for this system, they are a considerable distance (>50 km) and therefore, given the expected small rates of drawdown, they are not expected to be significantly impacted.

Stygo fauna in this aquifer are unlikely to be affected by water abstraction because water levels in this confined system are predicted to not drop more than 5 m over the life of the mine.

Given that proposed abstraction represents a small volume of available water, it is expected that the impacts of abstraction can be monitored and managed according to the requirements of the *Rights in Water and Irrigation Act 1914* with a licence issued by the Department of Water (DoW). In particular, the DoW will require an operating strategy to manage the borefield to sustainable limits and monitoring of potential GDEs will also be required to inform an adaptive groundwater operating strategy.

The EPA is satisfied that the Byro Sub-basin has sufficient water available and can be developed with minimal impact on the environment provided.

Initially CRL proposed to draw water from the Murchison lower palaeochannel system, which was expected to result in limited drawdown of the upper aquifer because of limited leakage from the upper to the lower sequence. With the results of more recent surveys showing that salinities in the lower aquifer are typically much higher than those in the upper aquifer, CRL indicated that it seeks to restrict withdrawals to the upper sequence. If this were to occur, groundwater dependant vegetation might be affected due to less water being available to root systems. CRL has carried out a literature search of the available (limited) studies in the Pilbara, the results of which indicate that groundwater-dependent trees such as *Eucalyptus victrix* and *E camaldulensis* are able to adapt to groundwater drawdown of as much as 3.5 m a year. *E victrix* trees appear to be able to access groundwater to depths of around 10 m and *E camaldulensis* to around 20 m below ground surface. Notwithstanding the above, there is currently limited confidence in the expected drawdown rates if this aquifer is targeted for substantial abstraction, and the risk to groundwater dependant vegetation remains.

The Murchison paleo channel also contains a series of pools where the environmental values are not well researched or understood. It has been estimated that drawdown near Kalamunda Pool (a semi-permanent waterhole on the Murchison River, with significant conservation and amenity values) would be of the order of about 0.8 m. This may be enough to affect the pool's environmental values. There are several other pools upstream and downstream of Kalamunda Pool. Little is also yet known about the environmental or cultural significance of these pools and CRL has still to establish what the effects of groundwater drawdown might be on them. In view of the above, the EPA indicated it was unlikely to support significant abstraction from the Murchison paleochannel aquifer.

CRL has subsequently advised that it will source the majority of its water from the Byro Sub-basin (37 GL/year). CRL now proposes to only take up to 3 GL/year from the Murchison paleochannel aquifer under license from the Department of Water. The EPA is advised by the DoW that it can require the monitoring of environmental values of groundwater dependant ecosystems through the licence and accompanying operating strategy. The operating strategy can include reducing the amount of abstraction if required to ensure that there are no significant effects on environmental values. The EPA therefore notes that the proposal includes abstraction of up to 3 GL/year from the Murchison Paleochannel aquifer and that this abstraction will be subject to

the requirements of the *Rights in Water and Irrigation Act 1914* and DoW approvals processes.

The EPA advises CRL to develop a program of environmental investigations, modeling and monitoring in consultation with the DoW and the DEC to determine the environmental values of GDE before any significant increase is proposed in groundwater abstraction from the Murchison paleochannel system.

In relation to stygofauna associated with the Murchison Paleochannel, recent work (GHD Feb. 2011) states that, as drawdown from the Murchison Borefield will be a maximum of 3.5 m immediately surrounding proposed bores, and the general level of drawdown throughout the field will be from 1-2 m, water extraction should have no significant impacts on stygofauna in an aquifer which is up to 40 m thick.

This work however, presumes that the aquifer is habitable by the stygofauna at depths other than where they were found. Little is known about the homogeneity, or otherwise, of the Murchison Palaeochannel aquifer. It may only be habitable in small portions of the whole system, which has been described as having limited connectivity. CRL therefore needs to demonstrate that abstraction from the Murchison Paleochannel will not lead to the loss of stygofauna species. The EPA has recommended a condition to ensure there are no significant adverse impacts on stygofauna associated with the abstraction of groundwater.

### **Summary**

The EPA considers that surface and groundwater can be managed and the EPA's objectives for this factor can be achieved, provided that conditions are imposed requiring the proponent to:

- ensure that surface water flows are maintained so that there are no significant effects on vegetation, fauna and water values throughout the proposed footprint including the infrastructure corridors; and
- monitor and manage the potential impacts of groundwater abstraction from the Murchison Paleochannel on stygofauna.

## **3.4 Heritage values**

### **Description**

Indigenous heritage surveys have covered several areas of significance to the Wajarri Yamatji People which are already listed in the sites register. The PER describes some places as being highly sensitive and connected to watercourses or places of spiritual significance. The proposal would directly affect two registered heritage sites in the vicinity of the proposed minesite. Ministerial Statement 727, in giving conditional approval for the original mine proposal, recognised the archaeological values associated with a rock overhang and required the installation and maintenance of a fence to exclude human entry to the area. At the second location an exclusion zone currently

of 230 m radius on Mt Hale contains relocated artifacts and a mythological site.

Further consultation is anticipated with two native title parties for potential sites along the pipeline route and the service corridor.

CRL has a mining agreement with the Wajarri Yamatji Native Title Party. A cultural heritage management plan has been prepared in partnership with the Wajarri Yamatji People who, together with the Malgana/Shark Bay People, have also agreed a heritage agreement with CRL for water exploration drilling. CRL has committed to protecting any pools with ethnographic and archaeological significance to the traditional owners that may be affected by groundwater drawdown from water extraction. CRL has advised that all such pools would be identified and recognised.

### **Submissions**

The Department of Indigenous Affairs (DIA) requested that a map be provided to show surveyed areas versus those that remain to be investigated, and also a list of the groups consulted and the dates on which the consultations occurred. CRL should form an agreement with the Malgana Shark Bay People.

The Yamatji Warlpa Aboriginal Corporation was concerned that there was inadequate discussion of the importance of the Gudjeemia site on Mt Hale.

One submission noted that adequate supplies of gas are unlikely to be available and questioned the use of natural gas as a reliable source of energy for the power station.

### **Assessment**

The EPA's environmental objectives for these factors are to:

- ensure that changes to the biophysical environment do not adversely affect historical and cultural associations with the area;
- comply with relevant heritage legislation; and

The EPA notes that significant indigenous sites occur within the proposal footprint and discussions with the traditional owners are continuing.

CRL has advised the EPA that it has reached agreement with the traditional owners of Gudjeemia (Mt Hale) to protect the site by re-designing the pit to exclude it.

The previously approved Jack Hills Stage 1 project contains a condition that does not allow mining of the rock overhang site. The EPA has recommended that this condition be retained for the current proposal. The EPA acknowledges, however, that a subsequent agreement may be reached with traditional owners, in which case this condition could subsequently be removed or amended through a Section 46 change to implementation conditions.

## **Summary**

The EPA considers the issue of heritage values has been adequately addressed and the proposal can meet the EPA's objectives for this factor with the inclusion of a recommended condition to ensure that the rock overhang site is not mined.

## **3.5 Rehabilitation and closure**

### **Description**

The mining proposal would convert much of a 300 m high ridge to a saline pit lake, bordered to the north by the expanded integrated waste rock and tailings landform, ultimately to rise 290 m above the floodplain. The final water level in the pit would reflect the balance between inflows from groundwater and rain, and losses from evaporation. At this stage the resultant water level is not stated because the volume of inflows from the country rock has not been estimated.

CRL has also commissioned a preliminary study of the acid-generating potential of the waste dump and tailings. Some areas of potentially acid-forming (PAF) material were identified, but the vast majority of waste ores were considered to be at very low risk.

Total sulphur concentrations are very low and therefore mine acidity and metalliferous mine drainage from the exposure of sulphide mineralisation to air are unlikely. Recent static and kinetic testing of a representative suite of samples from the ore and waste rocks has shown that about 3% of the Jack Hills resource is expected to generate acid. These samples occur in clusters near the northeast and southwestern ends of the orebody (see SGS Figure 15). The remaining 97% of non-acid forming waste has some acid neutralisation potential, although lower than originally expected. The potentially acid-forming waste material will therefore require mitigation strategies to be developed. Final results of the kinetic testing of the oxide and fresh rock tailings fractions are expected late in 2011.

CRL has prepared a Decommissioning and Closure Management Plan which includes post-closure monitoring, with the aim being to confirm that rehabilitation has been effective and the closure criteria satisfied.

### **Submissions**

The proponent was asked to discuss 'learnings' from operating the original project that would be usefully applied to the current proposal. Final land uses need to be identified at this planning stage, based on this stakeholder consultation. The final landform and vegetation should be addressed and characterisation of all the materials going to the waste dump and incorporation into the mine plan should be done before mining begins.

The reliability of Potentially Acid Forming (PAF) waste studies, in particular, how representative of the whole orebody are the collected test samples, was queried. If the PAF wastes are to be specifically identified and isolated, the methods to be used to track it would be critical to the effectiveness of the study.

## **Assessment**

The EPA's environmental objectives for these factors are to ensure that:

- as far as practicable, rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values;
- mine closure planning and rehabilitation are carried out in a coordinated, ecologically sustainable, progressive manner and are treated as an integral part of mine development, consistent with the ANZMEC/MCA Strategic Framework for Mine Closure and the EPA/DMP Guidelines for Preparing Mine Closure Plans, without causing unacceptable State liability;
- the visual amenity of the area and adjacent surrounds are not unduly affected by the proposal; and
- regionally significant landforms and geo-conservation values are protected.

CRL has advised that it understands that the overall success of its rehabilitation strategy depends on the interrelation of several factors, including water and tailings management, landform design, weed and feral animal control, and revegetation success. Steps proposed to minimise impacts from erosion and to encourage successful rehabilitation are listed in sections 9.1.4 and 9.2.4 of the PER.

CRL's existing *Land Clearing and Topsoil Stockpiling Work Instruction* and *Rehabilitation and Monitoring Work Instruction* would be adopted for the expansion. Key points from those documents are listed in section 9.1.4.3 of the PER. *Triodia melvillei* seeds and those of other impacted priority flora species would be collected and used for rehabilitation where possible. Monitoring of rehabilitated sites would assess the species diversity, plant density and community structure against agreed completion criteria.

Propagation and restoration trials initiated for the Stage 1 minesite for the dominant species of floristic communities in the PEC would continue. Research and propagation areas would be developed and key performance indicators and completion criteria prepared for Stage 1 would be modified as required to suit this current phase with monitoring undertaken annually until the relevant completion criteria are achieved.

CRL has advised that it does not propose to backfill the pit because drilling has not closed off the mineralisation at depth. Closure and rehabilitation

therefore needs to address the potential problems associated with a pit lake, which include:

- worsening water quality over time (either from salinity and/or potentially acid and metalliferous mine drainage);
- harm to wildlife, birds or stock that may come in contact with pit lake water; or
- available water giving rise to more animals, leading to over-grazing of surrounding vegetation or attracting increased numbers of predators which may impact native wildlife in the area.

A Decommissioning and Closure Management Plan has been developed for the proposal and included in the PER. The EPA notes that it has been prepared to be consistent with mining industry best practice as set out in the *Australia and New Zealand Minerals and Energy Council / Minerals Council of Australia, 2000, Strategic Framework for Mine Closure*, as well as with *EPA Guidance Statement #6 (Rehabilitation of Terrestrial Ecosystems)*. The closure plan was prepared before the release of the *EPA/DMP Guidelines for Preparing Mine Closure Plans* released in 2011. Subsequent reviews of the plan will bring it in line with these guidelines.

Recent amendment to the *Mining Act 1978* now require the preparation of mine closure plans at the early stages of mine planning. In view of the statutory requirements of the *Mining Act 1978*, the EPA is satisfied that rehabilitation and, mine closure and decommissioning can be managed by the DMP consistent with the *DMP/EPA Guidelines for Preparing Mine Closure Plans*. Key matters to be considered by the DMP in approving the plan include

- designing waste dumps and tailings storage so that they are non-polluting, stable and able to support native vegetation comparable with natural analogue landforms;
- progressive rehabilitation of disturbed areas with local provenance vegetation and with percentage cover and species diversity comparable to undisturbed natural analogue sites;
- development of trigger levels, monitoring of pit lake water chemistry and undertake approved remediation to ensure that the formation of a pit lake does not adversely affect fauna or regional groundwater; and
- confirmation of rehabilitation completion criteria to apply to disturbed areas

### **Summary**

The EPA considers the issues of rehabilitation and closure have been adequately addressed. Noting the proposal is also subject to the requirements of the *Mining Act 1978* which has statutory requirements relating to mine closure and rehabilitation, the proposal meets the EPA's objectives.

### **3.6 Environmental principles**

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the EP Act. Appendix 3 contains a summary of the EPA's consideration of the principles.

## **4. Conditions**

Section 44 of the EP Act requires the EPA to report to the Minister for Environment on the key 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.

### **4.1 Recommended conditions**

Having considered the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Crosslands Resources Ltd to expand the Jack Hills Iron Mine with the Stage 2 development is approved for implementation.

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

- vegetation and flora (including weeds);
- terrestrial fauna;
- surface water and groundwater;
- stygofauna communities-Murchison Palaeochannel; and
- indigenous heritage.

Other regulatory mechanisms relevant to the proposal relate to the need to obtain an operating licence under Part V of the *Environmental Protection Act 1986* for the processing plant and the power station and a groundwater licence under the provisions of the *Rights in Water and Irrigation Act 1914* to be issued by the DoW.

### **4.2 Consultation**

In developing these conditions, the EPA consulted with the proponent, the DEC, DMP and DoW in respect of matters of fact and matters of technical or implementation significance.

## **5. Other advice**

### ***Asbestiform minerals***

The EPA considers it important for the proponent to recognise and isolate areas of asbestiform materials during mining, and ensure they are handled separately from other run-of-mine material. The asbestiform minerals should be securely buried in the integrated waste dump. The EPA notes, however, there need to be effective controls on fibrous dust released from blasting. Otherwise, these fibrous minerals could remain a health hazard after mine



closure if the public have access to the area. The DMP has overall responsibility for the control of asbestiform emissions and indicated that appropriate management strategies would be imposed under its legislation.

### ***Square Kilometre Array***

The Jack Hills site lies just beyond the 70 km buffer for the proposed Square Kilometre Array (SKA), otherwise known as the Murchison Radio-astronomy Observatory (MRO). The minesite, radio communications from vehicles and proposed infrastructure corridors, would be sources of electromagnetic transmissions. The location of this facility has been chosen to be as far as practically possible from undue interferences from radio transmissions.

Submitters raised the issue of mine-related radio emissions and the potential impacts this could have on the SKA. As this is not strictly an environmental matter it was not discussed in the PER. Submissions stated that SKA users should be recognised as stakeholders and that the PER should discuss fully the issue of the potential for interference with the SKA, including emissions from aircraft flying to and from the minesite. The CSIRO wishes to be fully consulted about the planning and operational phases of the mine expansion, and requested CRL to outline measures that would be adopted to ensure that the mine proposal would comply with radio-quiet regulations and requirements. The EPA expects that CRL will consult the CSIRO during the development of its project.

### ***Mitigation strategies***

CRL has proposed a suite of possible mitigation strategies to address the residual environmental impacts of the proposal in its April 2011 Draft Environmental Offsets Plan. These focus on biodiversity matters where there is incomplete knowledge of species and their distributions. Programs may include:

- the inclusion of suitable land into the conservation estate, following consultation with DEC and DMP;
- regional surveys for *Triodia melvillei* communities to determine the degree of similarity with other communities;
- taxonomic studies on *Acacia* sp Jack Hills;
- taxonomic, translocation and ecological studies on *I. nigrum*;
- research on priority ecological communities in the region;
- restoration and rehabilitation of degraded areas outside of the project area;
- weed management; feral goat control initiatives;
- investigation of the economic uses of native species;
- promotion of a TAFE course on environmental management for local contractors;
- scholarships for indigenous people.

## 6. Recommendations

The EPA submits the following recommendations to the Minister for Environment.

That the Minister:

1. notes that the proposal being assessed is for the expansion of the Jack Hills iron mine;
2. considers the report on the key environmental factors and principles as set out in Section 3;
3. notes the EPA has concluded that it is likely that the EPA's objectives would be achieved, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 and summarised in Section 4;
4. imposes the conditions and procedures recommended in Appendix 4 of this report; and
5. notes the EPA's other advice presented in Section 5 regarding asbestiform minerals, the Square Kilometre Array and residual impact management strategies.

# **Appendix 1**

## **List of submitters**

## **Organisations**

CSIRO Astronomy and Space Science  
Department of Environment and Conservation  
Department of Indigenous Affairs  
Department of Mines and Petroleum  
Department of Water  
Wildflower Society of Western Australia  
Yamatji Marlpa Aboriginal Corporation

## **Individuals**

C Rose Holdaway  
Greg Burrows  
Heike Hess-Hirschhausen  
Tanya Causer

# Appendix 2

## References

*Crosslands Resources Ltd (2010) Jack Hills Expansion Project. Public Environmental Review. September 2010.*

*Report for Jack Hills Expansion Project. Groundwater Dependent Ecosystems. GHD. February 2011.*

*Jack Hills Expansion Project. Byro Basin Groundwater Dependent Ecosystems. GHD. March 2011.*

*Jack Hills Expansion Project. Murchison Borefield Groundwater Dependent Ecosystems. GHD. March 2011.*

*Report for Jack Hills Expansion Project. Murchison Borefield Stygofauna Survey-Phase 2. GHD February 2011.*

*Byro Sub-basin Borefield. Level 1 Flora and Vegetation Assessment. GHD April 2011.*

*Report for Jack Hills Expansion Project. Byro Sub-basin Borefield Stygofauna Survey Phase 1. GHD February 2011.*

*Jack Hills Expansion Project Acid and Metalliferous Drainage Study. SGS Lakefield Oretest Pty Ltd. March 2011.*

*Crosslands Resources Ltd. Jack Hills Expansion Project. Carbon Emission Reduction Assessment. Cardno (WA) Pty Ltd. December 2009.*

*Fish fauna in inland waters of the Pilbara (Indian Ocean) Drainage Division of Western Australia-evidence for three subprovinces. Zootaxa 636: 1-43. 2004.*

## **Appendix 3**

**Summary of identification of key environmental factors and principles**

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
Vegetation and flora	Loss of significant vegetation communities and priority flora from extensive clearing and creation of new landforms: pit lake and integrated waste rock dump.	Nine priority species affected. DEC prefers that offsets include targeted surveys to clarify the size and conservation status of other populations in the region. Offsets should compensate for the losses of <i>Triodia melvillei</i> community and <i>Idiosoma nigrum</i> . Need to be discussed with DEC.	Considered to be a relevant environmental factor.
Terrestrial and subterranean fauna	<p>Loss of habitat and flora from clearing; new landforms to replace the original hill range: a water-filled open pit, becoming more saline with time.</p> <p>Loss of habitat for SRE spider populations from mine and infrastructure corridor clearing.</p> <p>Potential to affect flora and fauna with competition for groundwater usage. Potential to affect troglofauna and stygofauna.</p>	<p>Potential to affect short range endemic species. The specific identity and conservation status of several SRE invertebrate species remains uncertain and needs more work. DEC expects discussion regarding appropriate action to be taken to protect them, and also of offsets.</p> <p>Water-filled pit would present an ongoing risk to fauna. Need strategies to minimise trauma to fauna that may become trapped in open trenches.</p> <p>What impacts to nesting hollows for Major Mitchell Cockatoos and to bats?</p> <p>Questions on the methodology of surveys for stygofauna-Yilgarn region shows distinctive fauna in each aquifer, unlike Pilbara species distributions.</p> <p>Stygofauna surveys for the Byro Sub-basin are needed.</p> <p>Troglofauna species recorded from the mine pit areas only would need a risk assessment to determine if restricted to only those areas. Need to establish trigger levels for groundwater drawdown.</p>	Considered to be a relevant environmental factor.



Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
Surface water and groundwater	<p>Need for water supply to run the minesite and ore processing plant.</p> <p>Potential for water in the Murchison Palaeochannel to leak into the mine sequence and thence the pit. Significant implications for ecosystems dependent on this water supply.</p> <p>Potential for changes to the pattern of surface water flow where ground surface is disturbed.</p> <p>Floodwaters around the base of the waste dump could cause undue erosion of the structure.</p>	<p>Need a comprehensive survey for water resources. Significant doubt that enough groundwater would be found. The assessment should be suspended until the data are available for assessment.</p> <p>What are the likely impacts of water use from the Murchison Palaeochannel Aquifer? How much would phreatophytic vegetation be affected?</p> <p>What is the relationship between the calcrete aquifer above and the Murchison Palaeochannel Aquifer -ie how connected are they? Need a contingency plan and stated trigger levels for action in case pit dewatering affects the aquifer.</p> <p>What would be the effects of modeled drawdown on the conservation values of Kalamunda Pool?</p> <p>Mulga groves rely on surface water movements. The infrastructure corridor crosses Mulga country and could affect those trees if surface drainage patterns are altered. Areas which need to have sheetflow patterns maintained should be monitored and reported.</p> <p>The toe of the waste dump juts into the flood plain of the Murchison River. Specifications for rock armouring should be provided. More information is needed on minesite drainage provisions. Structures should be fully explained.</p>	Considered to be a relevant environmental factor.



<b>Preliminary Environmental Factors</b>	<b>Proposal Characteristics</b>	<b>Government Agency and Public Comments</b>	<b>Identification of Key Environmental Factors</b>
Greenhouse gas emissions	<p>asbestiform minerals as dust particles arising from operational practices related to the mining, processing and transport of ore. Residual health risks after mine closure unless all asbestiform material has been safely buried.</p> <p>Power station, ore processing facilities and heavy moving machinery and support equipment, plus village facilities.</p>	<p>zones in the mineralised zone. Standard dust management practices will be used to protect mine workers. However, dust levels at the current mine are already high and with the expansion are expected to increase. They currently exceed the DEC-recommended guidelines. Asbestiform minerals could also be a problem after mine closure.</p> <p>Natural gas is to be used to generate power. Gas supplies for this project could be tight. Large amounts of diesel fuel would also be required to run haul trucks and support equipment.</p>	<p>The nearest residence is Mileura Station, 35km south of the site. This is considered to be too distant to be affected by noise, vibration or dust from the minesite.</p> <p>CRL to use natural gas to run its power station as it produces less carbon dioxide and other pollutants than coal or diesel fuel.</p>
<b>SOCIAL SURROUNDINGS</b>			
Heritage values	Sites on Mt Hale and others along the infrastructure corridors.	<p>Need a map showing which areas have been properly surveyed and which remain to be.</p> <p>Is the rock overhang site specifically mentioned for protection in the Stage 1 proposal still to be protected?</p> <p>The data on aboriginal sites in the PER are inadequate for a proper assessment of the indigenous heritage values. More</p>	Considered to be a relevant environmental factor.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
Age of rocks	Said to contain the world's oldest rocks.	discussion with relevant indigenous groups needs to take place, and the outcomes documented. This includes for the Byro Sub-basin Borefield.  Expected this aspect to be discussed regarding potential impacts and appropriate protection.	Not a relevant environmental factor. The site containing the oldest known rocks is Eranondoo Hill, some 35km to the south west of the minesite.
Radio noise	Radio communications on site, along the infrastructure corridors and from aircraft servicing the site.	Radio-frequency emissions could conflict with the quiet zone necessary for the proposed Square Kilometre Array. CSIRO needs CRL to liaise closely to discuss potential issues. The Beringarra-Pindar Road should not be used for normal operations as it passes too close to the SKA and would interfere with the radio-quietness of the array. CRL should document the steps to be taken to minimise radio frequency interference.	Not a relevant <u>environmental</u> factor. However it is an important issue that needs to be resolved between CRL and the proponents of the SKA.
Visual amenity	Minesite and waste dump visible from public road to the north of the site.	Concerns that the waste dump will not blend in visually with the main range because of its contrasting colours.	Not a relevant environmental factor.



Principle	Relevant?	If yes, Consideration
<p>1. The precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In applying this principle, decisions should be guided by: careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and assessing the risk-weighted consequences of options.</p>	YES	<p>In considering this principle, the EPA notes the following: -investigations of the biological and physical environments, including the regional context, provided background information to assess risks and identify measures to avoid or minimise impacts; -the assessment of the adequacy of these impacts and management is provided in Section 3 of this report. -conditions have been recommended where necessary.</p>
<p>2. The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</p>	YES	<p>The proposal would result in the permanent reduction of some natural resources. The EPA has recommended conditions to mitigate impacts.</p>
<p>3. The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.</p>	YES	<p>In considering this principle, the EPA notes the following: -scientific studies have contributed to the understanding and management of impacts of mining operations on biodiversity and ecological integrity of the area. -the above impacts have been assessed and provided in Section 3 of this report.</p>
<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p>	NO	
<p>5. The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge to the environment.</p>	YES	<p>In considering this principle, the EPA notes the following: -the proposal would generate residue and waste rock. -potentially acid-forming waste and asbestiform minerals would be encapsulated in the waste disposal facilities. -other waste products would be created as a result of implementation of the proposal, and would be disposed of according to relevant regulations and legislation.</p>

# **Appendix 4**

## **Identified Decision-making Authorities and Recommended Environmental Conditions**

## Identified Decision-making Authorities

Section 45(1) requires the Minister for Environment to consult with decision-making authorities, and if possible, agree on whether or not the proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified for this consultation:

<b>Decision making authority</b>	<b>Approval</b>
Minister for Water	Water extraction licence
Department of Environment and Conservation	Works Approval and Licence <i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i>
Shires of Meekatharra, Murchison, Cue and Shark Bay	Planning Approval- <i>Local Government Act 1995</i>
Minister for Indigenous Affairs	<i>Aboriginal Heritage Act 1972</i> – s18 approval for disturbance to recognised sites
Minister for Mines and Petroleum	<i>Mining Act 1978</i>
Director General, Department of Mines and Petroleum	Mines Safety regulations-explosives and asbestiform minerals
Minister for Lands	<i>Land Administration Act 1997</i>

Section 44(2) of the EP Act specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA's recommended conditions and procedures.



RECOMMENDED ENVIRONMENTAL CONDITIONS

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

JACK HILLS EXPANSION PROJECT  
SHIRES OF MEEKATHARRA, MURCHISON, CUE AND SHARK BAY

**Proposal:** To expand the Jack Hills Iron Mine, 120 kilometres northwest of Meekatharra and approximately 400 kilometres northeast of Geraldton.

The proposal consists of a designated mining area containing two open pits, integrated waste and tailings landform, ore beneficiating plant and workshops, a combined gas pipeline spur and water pipe corridor, a services (possible water, gas, power transmission) corridor to Weld Range, the Byro Sub-basin Borefield and the Murchison Palaeochannel Borefield, a power station, airstrip, village and ancillaries. The Jack Hills Expansion Project is contiguous with the Stage 1 mine.

The proposal is further documented in schedule 1 of this statement.

**Proponent:** Crosslands Resources Ltd

**Proponent Address:** Level 2, 18 Richardson Street,  
WEST PERTH WA 6005

**Previous Ministerial Statement:** 727

**Assessment Number:** 1789

**Report of the Environmental Protection Authority:** Report 1413

The conditions of this Statement supersede the conditions of Statement 727 in accordance with section 45B of the *Environmental Protection Act 1986*. The Jack Hills Iron Ore Project, Murchison region, as expanded and revised by the Jack Hills Expansion Project (together "the Proposal") to which the above reports of the Environmental Protection Authority relate may be implemented subject to the following conditions and schedules.

The proposal referred to in the above report of the Environmental Protection Authority may be implemented. The implementation of that proposal is subject to the following conditions and procedures:

## **1 Proposal Implementation**

- 1-1 The proponent shall implement the proposal as documented and described 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 Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.
- 2-2 The proponent shall notify the Chief Executive Officer of the Office of the Environmental Protection Authority of any change of the name and address of the proponent for the serving of notices or other correspondence within 30 days of such change.

## **3 Time Limit of Authorisation**

- 3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.
- 3-2 The proponent shall provide the Chief Executive Officer of the Office of the Environmental Protection Authority with written evidence which demonstrates that the proposal has substantially commenced on or before the expiry of five years from the date of this statement.

## **4 Compliance Reporting**

- 4-1 The proponent shall prepare and maintain a compliance assessment plan to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.
- 4-2 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority the compliance assessment plan required by condition 4-1 at least six months prior to the first compliance report required by condition 4-6, or prior to implementation, whichever is sooner.

The compliance assessment plan shall indicate:

- 1 the frequency of compliance reporting;
- 2 the approach and timing of compliance assessments;
- 3 the retention of compliance assessments;

- 4 the method of reporting of potential non-compliances and corrective actions taken;
  - 5 the table of contents of compliance assessment reports; and
  - 6 public availability of compliance assessment reports.
- 4-3 The proponent shall assess compliance with conditions in accordance with the compliance assessment plan required by condition 4-1.
- 4-4 The proponent shall retain reports of all compliance assessments described in the compliance assessment plan required by condition 4-1 and shall make those reports available when requested by the Chief Executive Officer of the Office of the Environmental Protection Authority.
- 4-5 The proponent shall advise the Chief Executive Officer of the Office of the Environmental Protection Authority of any potential non-compliance within seven days of that non-compliance being known.
- 4-6 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority the first compliance assessment report fifteen months from the date of issue of this Statement addressing the twelve month period from the date of issue of this Statement and then annually from the date of submission of the first compliance assessment report.

The compliance assessment report shall:

- 1 be endorsed by the proponent's Managing Director or a person delegated to sign on the Managing Director's behalf;
- 2 include a statement as to whether the proponent has complied with the conditions;
- 3 identify all potential non-compliances and describe corrective and preventative actions taken;
- 4 be made publicly available in accordance with the approved compliance assessment plan; and
- 5 indicate any proposed changes to the compliance assessment plan required by condition 4-1.

## **5 Public Availability of Data**

- 5-1 Subject to condition 5-2, within a reasonable time period approved by the Chief Executive Officer of the Office of the Environmental

Protection Authority of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (such as reports and maps)) relevant to the assessment of this proposal and implementation of this Statement.

5-2 If any data referred to in condition 5-1 contains particulars of:

- i. a secret formula or process; or
- ii. confidential commercially sensitive information

The proponent may submit a request for approval from the Chief Executive Officer of the Office of the Environmental Protection Authority to not make this data publically available. In making such a request the proponent shall provide the Chief Executive Officer of the Office of the Environmental Protection Authority with an explanation and reasons why the data should not be made publically available.

## **6 Vegetation and Flora**

6-1 The proponent shall implement the proposal in accordance with the “*Jack Hills Expansion Project Construction Environmental Management Plan*”, Crosslands Resources Ltd, June 2010”, and “*Jack Hills Expansion Project Operations Environmental Management Plan*”, Crosslands Resources Ltd, June 2010” or subsequent revisions approved by the Chief Executive Officer of the Office of the Environmental Protection Authority on the advice of the Department of Environment and Conservation.

6-2 Prior to ground-disturbing activities of each specific infrastructure activity, and prior to the preparation of the report required under condition 6-2, the proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority a report detailing how the design of the infrastructure facilities has minimised impacts within the 9287 hectares of allowed clearing on the following conservation values:

- the *Triodia melvillei* Priority Ecological Community; and
- priority flora in the proposal footprint.

This report shall incorporate the advice of the Department of Environment and Conservation with regard to the final alignment and design of the infrastructure to minimise impacts to the abovementioned local conservation-significant flora and vegetation communities.

6-3 Within 12 months of this statement release the proponent shall undertake regional flora surveying to determine the presence and abundance of the following priority flora species:

- *Stenanthemum mediale* (P1);
- *Ptilotus tetrandrus* (P1);
- *Prostanthera ferricola* (P3); and
- *Homalcalyx echinulatus* (P3)

and submit the results of the survey to the Chief Executive Officer of the Office of the Environmental Protection Authority.

6-4 The survey shall be conducted in accordance with Environmental Protection Authority Guidance Statement 51 'Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia' (June 2004) or its revisions.

6-5 During construction the proponent shall ensure that there is a system to delineate the area of works in order to meet the outcome of minimising the disturbance to, or loss of, the *Triodia melvillei* Priority Ecological Community in accordance with condition 6-2.

6-6 During operations, the proponent shall conduct mining and mining-related activities in order to keep clearing of native vegetation to a minimum and manage and control adverse impacts from mining and mining-related activities.

6-7 At all times the proponent shall ensure that threatening processes such as fire, disease and feral animals arising from its operations are managed and controlled.

6-8 The proponent shall develop and implement procedures and measures to restrict access to areas under its control that support the *Triodia melvillei* Priority Ecological Community to authorised personnel only.

6-9 The proponent shall monitor impacts due to dust deposition, saline water application for dust control; fire; and feral species, on the *Triodia melvillei* Priority Ecological Community referred to in condition 6-5. This monitoring is to be carried out to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation.

6-10 In the event that the outcomes of conditions 6-5 and 6-6 are not being met or are unlikely to be met, the proponent shall immediately provide proposed management measures for approval of the Chief Executive Officer of the Office of the Environmental Protection Authority and shall implement these measures according to a schedule approved by the Chief Executive Officer.

6-11 The proponent shall ensure that no Priority or Declared Rare Flora along the gas/water pipeline route or the Weld Range infrastructure corridor are removed in implementing this proposal, unless otherwise agreed by the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation.

## **7 Weeds**

7-1 The proponent shall ensure that:

1. no new species of declared weeds and environmental weeds are introduced into the proposal area and that the abundance and distribution of existing weeds is not increased as a direct or indirect result of implementation of the proposal;
2. prior to ground disturbing activities the proponent shall undertake a baseline weed survey to determine the species and extent of declared weeds and environmental weeds present at weed monitoring sites and at least three reference sites on nearby undisturbed land beyond 200 metres from the disturbance footprint in consultation with Department of Environment and Conservation;
3. baseline and reference weed monitoring sites surveyed as required by condition 7-1 2 are to be monitored annually for two years following ground disturbance activities, and every two years for the life of the proposal, to determine whether changes in weed cover and type have occurred and are likely to have resulted from implementation of the proposal or broader regional changes;
4. if the results of monitoring under condition 7-1 3 indicate that adverse changes in weed cover and type are proposal-attributable, the proponent shall report the monitoring findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within three months of completion of the monitoring and shall undertake a programme of weed control and rehabilitation in the affected areas, where proposal-attributable weed cover has adversely changed, using native flora species of local provenance, to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority; and
5. the proponent shall continue to implement the remedial measures required by condition 7-1 4 until approval is given by the Chief Executive Officer of the Office of the Environmental Protection Authority to stop.

## 8 Terrestrial Fauna

8-1 The proponent shall implement the proposal in accordance with:

- “*Jack Hills Expansion Project Construction Environmental Management Plan*. Crosslands Resources Ltd, June 2011”;
- “*Jack Hills Expansion Project Operations Environmental Management Plan*. Crosslands Resources Ltd, June 2011”; and /or
- subsequent revisions approved by the Chief Executive Officer of the Office of the Environmental Protection Authority on the advice of the Department of Environment and Conservation; and
- project-related disturbance to *Idiosoma nigrum* shall be confined to the specified disturbance footprint of the project.

The objectives of these plans are to protect significant habitats, minimise impacts to individual fauna and minimise the impact of feral animals on native fauna.

8-2 In the event that a change to the infrastructure corridor is proposed, the proponent shall submit for approval a site-specific plan to manage fauna. This revised report shall be prepared with advice of the Department of Environment and Conservation in regard to appropriate management measures.

8-3 The proponent shall ensure that open trenches are cleared of trapped fauna by fauna-rescue personnel at least twice daily. Details of all fauna recovered shall be recorded, consistent with condition 8-7. The first daily clearing shall take place no later than three hours after sunrise and shall be repeated between the hours of 3:00pm and 6:00pm.

The open trenches shall also be cleared, and fauna details recorded by fauna-rescue personnel, no more than one hour prior to backfilling of trenches.

Note: “fauna-rescue personnel” means employees of the proponent whose responsibility it is to walk the open trench to recover and record fauna found within the trench.

8-4 The fauna-rescue personnel shall obtain the appropriate licences as required for fauna rescue under the *Wildlife Conservation Act 1950* and be trained in the following:

1. fauna identification, capture and handling (including specially protected fauna and venomous snakes likely to occur in the area);
2. identification of tracks, scats, burrows and nests of conservation-significant species;

3. fauna vouchering (of deceased animals);
  4. assessing injured fauna for suitability for release, rehabilitation or euthanasia;
  5. performing euthanasia; and
  6. familiarity with the ecology of the species which may be encountered in order to be able to appropriately translocate fauna encountered.
- 8-5 Open trench lengths shall not exceed a length capable of being inspected and cleared by the fauna-rescue personnel within the required times as set out in condition 8-3.
- 8-6 Ramps providing egress points and/or fauna refuges providing suitable shelter from the sun and predators of trapped fauna are to be placed in the trench at intervals not exceeding 50 metres.
- 8-7 The proponent shall produce a report on fauna management within the pipeline trench at the completion of pipeline construction. The report shall include the following:
1. details of all fauna inspections;
  2. the number and type of fauna cleared from trenches;
  3. fauna mortalities; and
  4. all actions taken.

The report shall be provided to the Chief Executive Officer of the Office of the Environmental Protection Authority and the Department of Environment and Conservation no later than 21 days after the completion of pipeline installation.

## **9 Surface Water and Groundwater**

- 9-1 The proponent shall ensure that run-off and/or seepage from the tailings storage facility and waste material landforms does not lead to the quality of surface water or groundwater within or adjacent to the proposal area exceeding the trigger values for a slightly to moderately disturbed ecosystem provided for in Table 3.4.2 of Chapter 3 of the *“Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand 2000, Australian Water Quality Guidelines for Fresh and Marine Waters”* and its updates, taking into consideration natural background water quality of the receiving environment.



- 9-2 The proponent shall ensure that surface water distribution patterns are maintained so that significant effects on vegetation, fauna, or water values throughout the proposed development footprint, including the infrastructure corridors are avoided.
- 9-3 To meet the requirements of condition 9-1 the proponent shall:
1. identify all sites and parameters to be monitored and the monitoring methodologies, to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of the Environment and Conservation and the Department of Water; and
  2. monitor the quality of surface and groundwater upstream and downstream of the integrated waste and tailings storage facility in accordance with methods of "*Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand 2000, Australian Guidelines for Water Quality Monitoring and Reporting*" (and its updates).
- 9-4 The proponent shall commence the water quality monitoring required by condition 9-3 prior to ground-disturbing activities.
- 9-5 In the event that monitoring required by condition 9-3 indicates that the requirements of condition 9-1 are not being met, the proponent shall:
1. report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within 7 days of the decline in water quality being identified;
  2. provide evidence which describes the decline of water quality and allows determination of the cause of the decline; and
  3. if the decline in water quality is determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall submit the actions to be taken to remediate the decline within 21 days of the determination being made to the Chief Executive Officer of the Office of the Environmental Protection Authority.
- 9-6 The proponent shall implement the actions identified in condition 9-5 3 upon approval to implement those actions from the Chief Executive Officer of the Office of the Environmental Protection Authority until such a time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

9-7 The proponent shall submit annually the results of monitoring required by conditions 9-3 to 9-4 to the Chief Executive Officer of the Office of the Environmental Protection Authority as part of the compliance assessment report required by condition 4-6.

## **10 Stygofauna Communities-Murchison Palaeochannel**

10-1 From the commencement of water extraction from the Murchison Palaeochannel Borefield the proponent shall monitor potentially affected aquifer stygofauna communities until at least twelve months after the cessation of borefield operations, unless otherwise agreed by the Chief Executive Officer of the Office of the Environmental Protection Authority. This monitoring program shall be designed and carried out to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation and the Department of Water and include:

1. monitoring of groundwater levels and chemistry at impact locations and reference sites
2. monitoring of stygofauna species richness; and
3. interpretation of the results in relation to influences on stygofauna and their habitat.

10-2 The proponent shall develop trigger levels for ground water level and groundwater chemistry for the approval of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation and the Department of Water.

10-3 Should the results of monitoring show that trigger levels identified in condition 10-2 have been reached for the ground water level or chemistry the proponent shall provide a report to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of the decline or change being identified which:

1. describes the decline or change;
2. provides information which allows determination of the likely root cause of the decline or change; and
3. if considered likely to be the result of activities undertaken in implementing the proposal, proposes the actions and associated timelines to remediate the decline or change to the requirement of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation and the Department of Water.

10-4 The proponent shall, on approval by the Chief Executive Officer of the Office of the Environmental Protection Authority, implement the actions identified in condition 10-3 3 until the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

## **11 Indigenous Heritage**

11-1 The proponent shall protect the rock overhang located at 523,895E 7,119,178N by installing and maintaining fencing at an appropriate setback to exclude human access.

## **12. Residual Impacts and Risk Management Measures**

12-1 There are residual impacts and risks of the Project to the Priority 1 *Triodia melvillei* Ecological Community, nine priority flora species and short range endemics (including *Idiosoma nigrum* and subterranean fauna). The proponent shall undertake measures during the implementation of the proposal, consistent with the Crosslands Resources Limited, Draft *Jack Hills Expansion Project Environmental Offsets Plan*, April 2011, as approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

### **Notes**

1. The Office of the Environmental Protection Authority may seek advice from other agencies or organisations, as required.
2. The Minister for Environment will determine any dispute between the proponent and the Office of the Environmental Protection Authority over the fulfilment of the requirements of the conditions.
3. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

## The Proposal (Assessment No. 1789)

The proposal is to expand the Jack Hills iron mine via the Jack Hills Expansion Project. Its main components are:

- an open pit mine and associated workshops;
- ore treatment plant (for direct-shipping ore and beneficiation feed ore);
- integrated tailings dam and waste rock landform;
- haul road and services corridor from Weld Range to Jack Hills with an ore stockpiling and loading facility at Weld Range;
- a gas spur line from the Dampier-Bunbury natural gas trunk line to Jack Hills for a gas-fuelled power station;
- water supply borefields near the Murchison River and in the Byro Sub-basin;
- accommodation village; and
- an airstrip.

The location of the various project components is shown in Figures 1 and 2.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in section 5 of the project referral document, *Jack Hills Expansion Project. Public Environmental Review*. (Sept. 2010), prepared by Crosslands Resources Ltd.

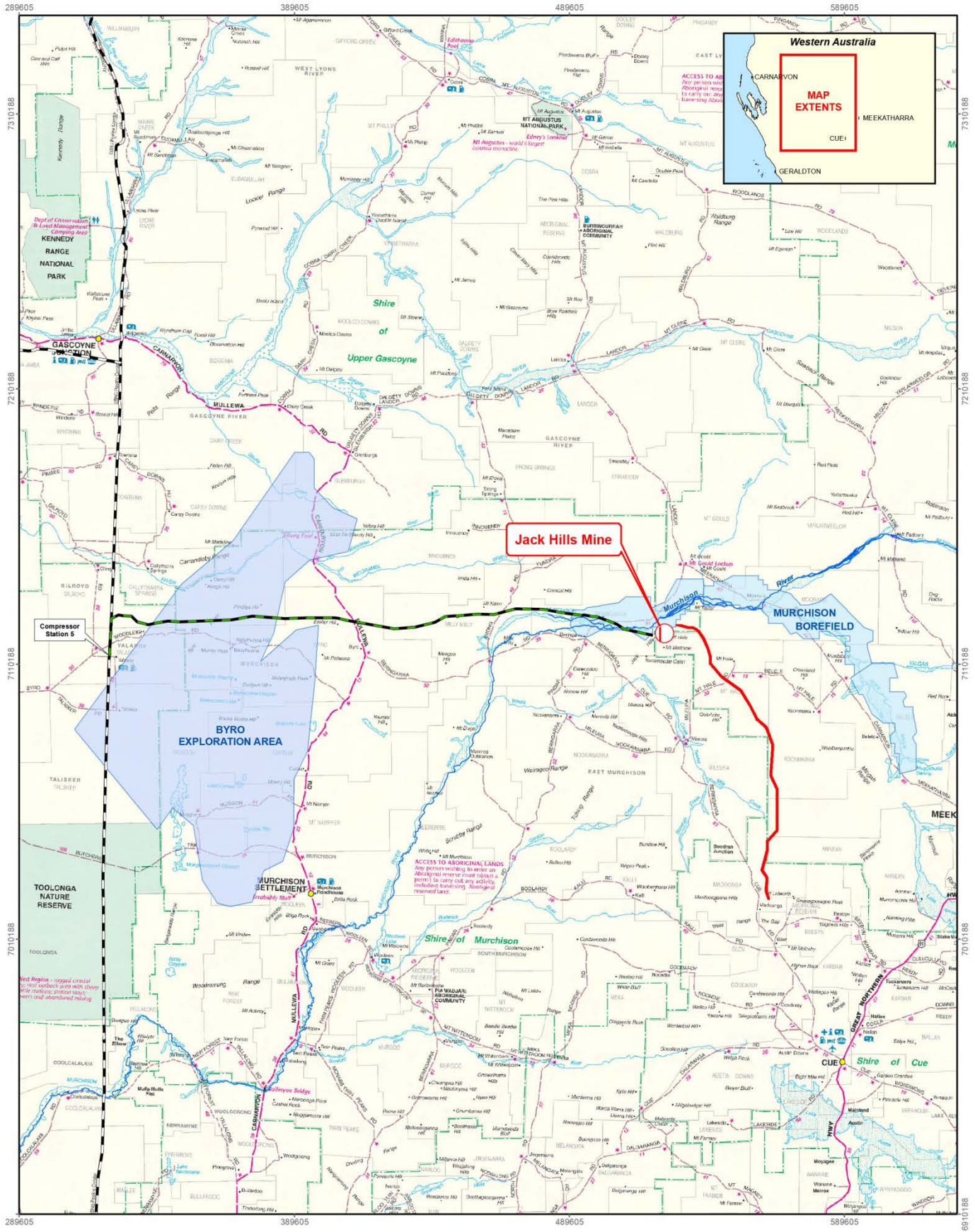
**Table 1: Summary of Key Proposal Characteristics**

Element	Description
<b>Resource</b> <ul style="list-style-type: none"><li>• direct shipping ore:</li><li>• beneficiation feed ore:</li><li>• mining rate:</li></ul>	110Mt 2900Mt 150Mtpa
<b>Plant</b> <ul style="list-style-type: none"><li>• ore treatment plant output:</li></ul>	45Mtpa (combined products)
<b>Pit area</b> <ul style="list-style-type: none"><li>• Main pit:</li><li>• Brindal pit:</li></ul>	813ha / 360m deep 120ha
<b>Tailings and waste rock storage</b> <ul style="list-style-type: none"><li>• integrated tailings dam:</li><li>• waste rock dump - extension of Stage 1:</li><li>• waste rock dump - Brindal Pit:</li><li>• topsoil storage:</li></ul>	2km x 4km x 105m high 2200ha / 290m high 69ha 424ha

<b>Infrastructure</b> <ul style="list-style-type: none"> <li>haul road and services corridor (Jack Hills to Weld Range):</li> <li>gas pipeline corridor (E-W line to Compressor Station 56):</li> <li>airstrip:</li> <li>accommodation village - sewage treatment and waste disposal</li> </ul>	120km x 50m = 600ha 220km x 50m = 1100ha 2400m x 400m = 150ha
<b>Water</b> <ul style="list-style-type: none"> <li>Murchison Palaeochannel Borefield:</li> <li>Byro Borefield:</li> </ul>	3GL/ yr 37GL/yr
<b>Power station</b> <ul style="list-style-type: none"> <li>Gas-fired turbine (diesel backup)</li> <li>borefield:</li> </ul>	350MW 8.5MW
<b>Infrastructure area:</b>	3301ha
<b>Total disturbance footprint:</b>	9287ha
<b>Life of project:</b>	approximately 35 years

Any proposal for an increase to the amount of water to be extracted, and / or a change to the location of the borefield shall be submitted for the approval of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of the Environment and Conservation and the Department of Water.

Figure 1: Regional location  
Figure 2: Project layout



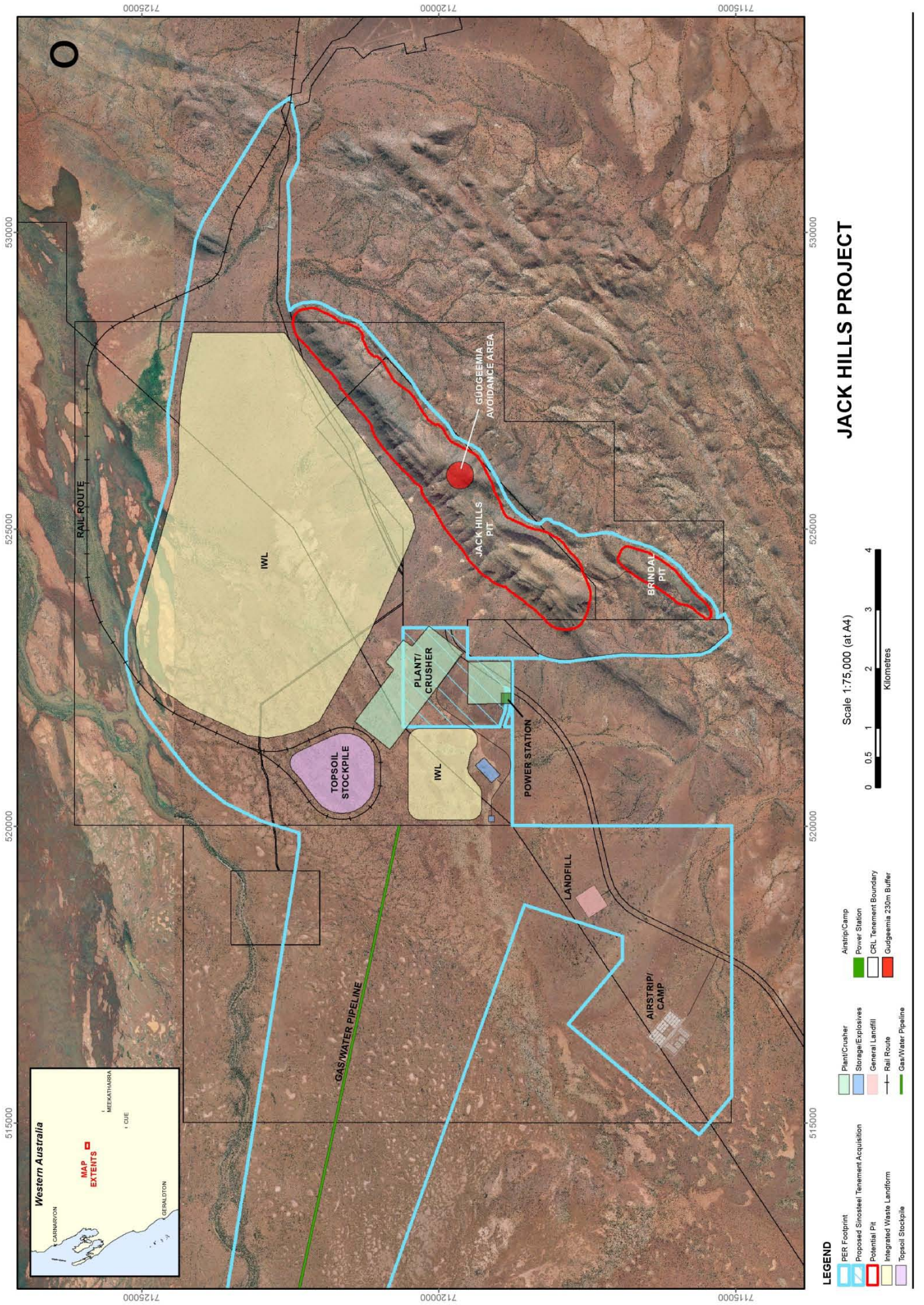
- LEGEND**
- Proposed Gas Pipeline
  - Dampier-Bunbury Natural Gas Pipeline (DBNGP)
  - Byro Sub-Basin
  - Murchison Borefield
  - Murchison River
  - Proposed Services Corridor

O  
 Scale 1:1,750,000 (at A4)  
 0    25    50    75  
 Kilometres

## JACK HILLS EXPANSION PROJECT

**Figure 1: Regional setting**





**Figure 2: Jack Hills Expansion Project Footprint**



# **Appendix 5**

## **Summary of Submissions and Proponent's Response to Submissions**