BHP Billiton Iron Ore's

Strategic Proposal

Landscape and Visual Impact Risk Assessment (LVRA)

Prepared for:

BHP Billiton Iron Ore

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Executive Summary

BHP Billiton Iron Ore is pursuing a regional strategic environmental assessment for the Strategic Proposal, which includes proposed mines and associated infrastructure developments in the Central Pilbara region. The two key reasons to support a strategic assessment are to deliver:

- Environmental approval certainty; and
- Optimal environmental outcomes.

From an environmental approvals perspective, the Strategic Proposal requires primary approvals at the State and Federal levels, under the *Environmental Protection Act 1986* and the *Environment Protection and Biodiversity Conservation Act 1999*, respectively. At the State level, the impact assessment and approval will follow a Public Environmental Review Strategic Proposal (PERSP) process as set out in Schedule 3 of the *Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures* (Government of Western Australia 2012). The PERSP process is followed by subsequent verification steps for each component project (Derived Proposals).

As part of the assessment of the Strategic Proposal, a set of commitments relating to assessments on impact to visual amenity and landforms have been put forward in the approved Environmental Scoping Document (ESD). This Landscape and Visual Risk Assessment (LVRA) seeks to assess the potential risk of impacts to visual amenity and landscapes from the Strategic Proposal.

Potential Impact Scenarios

BHP Billiton Iron Ore's Strategic Proposal is expected to be progressively developed over 100 years. In order to adequately assess the potential risk of impacts to visual amenity and landscapes over the life of the Strategic Proposal, the LVRA considered two disturbance scenarios:

- A '30% Development Scenario' based on the production rate associated with approximately 30% of BHP Billiton Iron Ore's future identified projects being in concurrent operation; and
- A 'Full Development Scenario' based on the production rate associated with full development of BHP Billiton Iron Ores future identified projects being in concurrent operation.

In both these impact scenarios, consideration was also given to reasonably foreseeable third party iron ore developments, as well as existing third party and BHP Billiton Iron Ore operations, collectively contributing to baseline impact levels.

Assessment Methodology

The LVRA is comprised of three phases:

- Phase 1 – Desktop Assessment;
- Phase 2 – Field Assessment; and
- Phase 3 – Risk of Visual Impact Assessment.

The first desktop assessment phase was aimed at identifying key visual amenity and landscape values associated with the Strategic Proposal as well as identifying potential locations where they may be accessed. Based on public and internal data sources, Phase 1 identified approximately 300 valued locations with 82 being identified as potential viewpoints.

Phase 2 of the study involved a field survey over ten days in May 2013 during which a total of 92 viewpoints were visited by foot and by vehicle (a number of additional viewpoints were surveyed opportunistically). Characteristics of these sites that related to visual amenity were recorded and digital still photographs captured.

Data collected during the field survey was assessed to identify 'key' (highest value sites, with potential for high visual impacts) and 'representative' viewpoints (locations with high public interest or are representative of a broader range of landforms) for detailed analysis as part of the third phase - 'risk of impact assessment'.

The third phase utilised information collected during the survey in an impact risk assessment, aimed at assessing the levels of potential impacts to visual amenity and landscape values that may result from the Strategic Proposal and nearby third party developments.

Impacts to visual amenity were determined based on the results of viewshed and photomontage analyses conducted for each key and representative viewpoint. Potential impacts to landscapes were assessed by determining the percentage of landscape types (based on Land System mapping) that may be impacted due to land clearing as a result of the Full Development Scenario, in addition to existing and proposed (known) third party developments.

Summary of Results

The study identified two major landscape types, encompassing a number of Land Systems that were most commonly associated with the Strategic Proposal. Landscapes dominated by hills, ridges, plateaux and slopes were found to contain locations with high levels of visual amenity due to the diversity of visually appealing elements. Landscapes dominated by plains contained relatively fewer locations of high visual amenity value (these landscapes were also found to be relatively degraded due to pastoral land uses).

The impact risk assessment identified 17 key and 5 representative sites. It was found that these viewpoints were associated with several valued locations that may be considered as priority areas for future management. These areas were the Great Northern Highway (between Mt Robinson and Karijini Drive), Mt Meharry, Weeli Wolli Creek, Newman townsite and Ophthalmia Dam. Viewpoints located at these locations consistently showed high levels of potential impact based on the results of viewshed and photomontage analyses.

Viewpoints surveyed along the Great Northern Highway showed that on average 46% of the present viewshed may be affected while Mt Meharry may experience changes to approximately 44% of its viewshed based on the Full Development Scenario. Realistic levels of impact are likely to be considerably lower, considering the long timeframes over which the Mudlark and Tandanya mining operations will be progressively developed and closed. Direct impacts to the viewsheds of sites along Weeli Wolli Creek are unlikely due to vegetation screening; however the site is considered a priority for management due to the close proximity to the Jinidi and Mining Area C mining operations as well as the potential for direct (physical) impacts from third party operations (i.e., dewatering activities). The Newman townsite and Ophthalmia Dam may experience intensification of existing view experiences.

Impacts to landscapes at the regional level (as Landscape Character Types and dominant landform types) were found to be low. Impacts to local landscapes (as Land Systems) were found to be higher in some cases (potential impacts to the Newman, Wannamunna, Pindering, Fan, Turee and Urandy Sytems were found to be the highest; Table 9). It is worth noting that impacts to the Turee, Fan and Urandy Systems are largely due to third party developments. The dominant landforms associated with the Newman, Pindering and Wannamunna Land Systems are not unique and are found in a large number of other commonly found Land Systems (e.g. Boolgeeda, Spearhole and Egerton Systems). As such, it is unlikely that the variety and integrity of landscapes and landforms in the study area will be compromised.

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Definitions of Acronyms, Abbreviations and Terms

Term	Definition
Background	Five to ten kilometres from the viewer.
Foreground	From the viewer to one kilometre away.
Georeferenced	The attribution of a coordinate system to data which corresponds to real life.
Landform	Surface expressions of geology after being subjected to weathering processes, resulting in a defining morphology.
Landscape	A spatially heterogeneous area, scaled relative to the process of interest. Within landscapes it is usually possible to define a series of different ecosystems, landforms, habitats and natural or man-made features.
Landscape Character Type/ Unit	A geographic area sharing common characteristics such as landforms and geology.
Land System	A geographic area sharing common landforms, soils, geology and vegetation.
Midground	One to five kilometres away from the viewer.
Valued Location	A location within the landscape with valued visual amenity values.
View Experience	The view that a viewer experiences. Includes visual elements that contribute to the visual amenity of a site.
Viewpoint	A particular point in the landscape with high visual amenity values, where views of the surrounding landscapes are accessed. Multiple viewpoints may exist at one valued location.
Viewshed	The theoretical area of visibility from a given point.
Visual Amenity	The values and services that result from a view on a receptor, usually an individual or community.
Visual Elements	Elements that together make up a view. E.g. pool, gorge, outcrop, hills, trees
Visual Impact	The changes to visual amenity as a result of a development. Can be positive, for improvements to visual quality or negative for reductions in visual quality.
Visual Plane	The theoretical straight line of sight from a viewer to an object.
Visual Quality	A society based measure which contributes to the overall appeal of a region. Generally based on frequency and type of view experiences.
Visual Risk of Impact	The likelihood of positive and negative visual impact.
Acronym	**Definition**
AHD	Australian Height Datum (Relative to Sea Level)
CALM	Department of Conservation and Land Management (now the Department of Parks and Wildlife and the Department of Environment Regulation)
DEC	Department of Environment and Conservation, Western Australia
DMP	Department of Mines and Petroleum, Western Australia
DPI	Department of Planning and Infrastructure (now DoP), Western Australia
DoP	Department of Planning (previously DPI), Western Australia
DotE	Department of the Environment, Commonwealth of Australia
DPaW	Department of Parks and Wildlife, Western Australia
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities

	(now DotE)
EPA	Environmental Protection Authority
ESD	Environmental Scoping Document
ESRI	Earth Systems Research Institute
GDA	Geodetic Datum of Australia
GIS	Geographic Information Systems
GPS	Global Positioning Satellite System
LCT	Landscape Character Type
LVRA	Landscape and Visual Risk (of impact) Assessment
OSA	Overburden Storage Area
PERSP	Public Environmental Review Strategic Proposal
SEA	Strategic Environmental Assessment
WA	Western Australia
WAPC	Western Australian Planning Commission

ABBREVIATION	DEFINITION
Ck	Creek
ha	Hectare
Hwy	Highway
m	Metre
km	Kilometre
km^2	Square kilometre
Mt	Mount
Mtpa	Million tonnes per annum
Rd	Road

1 Introduction

1.1 Project Description

BHP Billiton Iron Ore is pursuing a regional strategic environmental assessment for the Strategic Proposal, which includes proposed mines and associated infrastructure developments in the Central Pilbara region. The two key reasons to support a strategic assessment are to deliver:

- Environmental approval certainty; and
- Optimal environmental outcomes.

The strategic environmental assessment (SEA) comprises the Strategic Proposal and Strategic Assessment, which are being undertaken under State and Commonwealth legislation, respectively. This LVRA has been prepared to support BHP Billiton Iron Ore's Public Environmental Review Strategic Proposal (PERSP). The purpose of the PERSP is to provide a regional scale assessment of potential impacts associated with the Strategic Proposal. This includes potential impacts from mining and associated infrastructure development activities within the Pilbara. The PERSP will establish the management framework within which Derived Proposals will operate.

The Strategic Proposal is defined as all of BHP Billiton Iron Ore's proposed mining and associated infrastructure development activities within defined boundaries in the Pilbara. Subject to express exclusions, the Strategic Proposal and Assessment includes all greenfields mine developments, involving resources in which BHP Billiton Iron Ore currently has an interest, or may acquire an interest in the future, and brownfields development of existing mining operations and supporting infrastructure. Figure 1 provides an indicative and non-exhaustive depiction of likely mining operation configuration in respect to currently known resources. The location of mines and mining operations may change in the future, for example in response to newly identified resources, as a result of technology advances or to avoid environmental impacts.

Detailed engineering has not yet been undertaken for all of the elements of the Strategic Proposal. Elements of the Strategic Proposal will include infrastructure typically used in Pilbara iron ore operations including crushers, conveyors, ore-handling and screening plants, stockpiles and train load-out facilities, rail loops, workshops, warehousing, concrete batching plants, administration facilities, refuelling facilities, laydown and storage areas, power and water distribution infrastructure, waste disposal, wastewater treatment, dangerous goods and hazardous materials storage facilities, water treatment facilities and surface water management infrastructure. Beneficiation facilities with associated tailings dams may also be proposed for some operations.

Road and rail networks to access these operations and allow the transportation of ore will also be required. A detailed description of the scope of the Strategic Proposal is provided in the PERSP.

The Strategic Proposal also includes supporting infrastructure related to these operations including, but not limited to rail spurs, conveyors, worker accommodation, water and gas pipelines, powerlines, access roads, telecommunications, airports or helipads and water bores.

The alignments of rail corridors at present are conceptual only, and may change in the future in response to resource knowledge, as designs progress, commercial agreements with other parties, and/or technological changes. A conceptual rail spur linking the proposed Rocklea operations to BHP Billiton Iron Ore's rail network (existing or proposed) has not been identified. Development of any future rail corridors will seek to avoid impacts on areas with high environmental or conservation values.

The Strategic Proposal also encompasses potential capacity upgrades of the Newman to Port Hedland rail line, from the Newman mining operation to the 26 km chainage mark near Port Hedland. This mark represents the boundary of the proposed BHP Billiton Iron Ore Outer Harbour development rail spur (the Western rail spur) connection to the Newman to Port Hedland mainline (approved in Ministerial Statement 890).

Collectively, these operations described above, and combined with the associated infrastructure, broadly define the scope of the Strategic Proposal being considered for the SEA.

No specific timeframe applies to the Strategic Proposal. However, it is anticipated that operations will be progressively developed over the next 100 years.

1.2 Legislative Context

When a proposal is assessed under the *Environmental Protection Act 1986* the Environmental Protection Authority (EPA) may consider the impacts of a proposal on landscapes and visual amenity under its guidance framework for environmental factors. These state the environmental factors and the objectives of the EPA for their protection:

- Landforms: "To maintain the variety, integrity, ecological functions and environmental values of landforms and soils";
- Air Quality: "To maintain air quality for the protection of the environment and human health and amenity"; and
- Amenity: "To ensure that impacts to amenity are reduced as low as reasonably practicable".

Landforms have numerous values including ecological, social and cultural values (EPA 2015; Landscape Institute 2002; Ludwig et al. 1996). Where the impact to socio-cultural values is deemed to be significant enough to warrant assessment, the EPA considers these values through the Amenity Factor. The EPA also considers the significance of landforms in terms of their variety, integrity, ecological importance, scientific importance and rarity (EPA 2015). This assessment does not encompass Air Quality and ecological or scientific importance as this is accounted for in other technical studies (details are provided in the PERSP).

The primary environmental approval at the State level will be via the PERSP and subsequent verification stages for each component project via Derived Proposals. The PERSP has been developed based on the approved Environmental Scoping Document (ESD) (BHP Billiton Iron Ore 2013) which includes requirements for the assessment of potential landscape and visual impacts.

There are also a number of State policies that highlight the need for visual impact assessment to be considered during the planning phase of developments. These include the Western Australian State Planning Framework and the Pilbara Planning and Infrastructure Framework.

The Western Australian Planning Commission's (WAPC) *State Planning Policy No. 2: Environment and Natural Resource Policy* for Western Australia (WAPC 2003) states that the objective for planning is to:

- "identify and protect landscapes with high natural resource values (such as ecological, aesthetic or geological)";
- "consider the capacity of the landscape to absorb new activities and incorporate building design and siting criteria to ensure that new developments are consistent and sensitive to the character and quality of the landscape"; and
- "consider the need for a landscape or visual impact assessment for development proposals that may impact upon sensitive landscapes".

The WAPC also encourages proponents to develop appropriate management and strategies that can contribute to the maintenance and enhancement of landscapes with high visual amenity values. The WAPC's Pilbara Planning and Infrastructure Framework (WAPC 2012) highlights the need to:

- "safeguard and enhance significant natural landscape assets and cultural heritage values"; and
- "protect and manage the region's cultural heritage, arts including indigenous significant places, and landscapes of significance".

1.3 Purpose and Objectives

The purpose of the LVRA is to identify and describe potential risk of impacts to visual amenity and landscapes from the Strategic Proposal.

The objectives of the study were to:

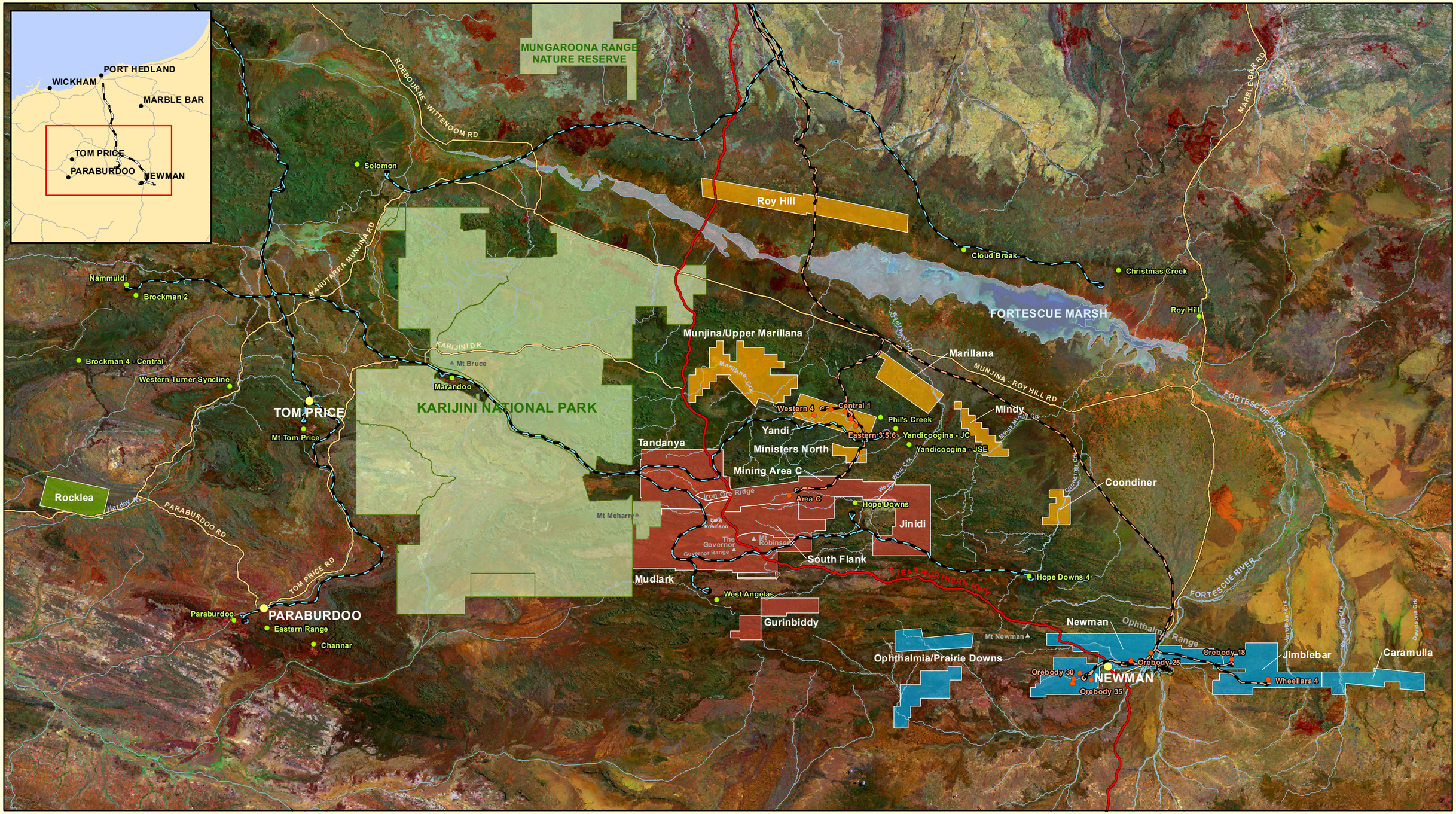
- Identify key landscape values within and surrounding the proposed Strategic Proposal development areas;
- Identify vantage points and corridors where these key values may be viewed/accessed/experienced;
- Evaluate the visual amenity associated with these landscape values;
- Assess potential risk of impacts on visual amenity resulting from the Strategic Proposal, including cumulative impacts from other existing and proposed projects; and
- Assess the significance of these impacts.

The ESD describes a set of objectives relevant to visual and amenity impacts (BHP Billiton Iron Ore 2013). These objectives are structured to fit into the Environmental Impact Assessment (EIA) process and so address the objectives of the EPA.

The required scopes of work and EPA objectives relating to this assessment are outlined in Table 1, adapted from the ESD (BHP Billiton Iron Ore 2013).

Table 1. Objectives and scopes related to visual amenity and landforms

EPA Objective (EPA 2013a)		BHP Billiton Iron Ore Proposed Study Scopes	Where Addressed
Terrestrial Environmental Quality and Landforms	**Assess Potential Impacts**	• Undertake Landscape and Visual Impact Assessment to assess potential impacts on Landforms.	This study
	Establish outcomes of management	• Establish outcome based management objective for terrestrial environmental quality and landforms.	PERSP
	Evaluate Existing Environment	• Describe the methodologies used and provide an overview of results of baseline studies on the visual landscape undertaken by BHP Billiton Iron Ore and others (where available); and, • Identify locally or regionally significant landforms within the region.	This study PERSP
Amenity	**Assess Potential Impacts**	• Assess against EPA Objective and policy context; • Assess potential impacts on visual amenity of the local area in accordance with Visual Landscape Planning in Western Australia (Department of Planning and Infrastructure 2007) or relevant standards at the time of proposal; and, • Assess cumulative impacts of the Strategic Proposal on regional landscape character.	This study
	Establish outcomes of management	• Establish outcome-based management objectives for noise and visual amenity.	PERSP



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STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)

Study Area

N

0 10 20 40 60
Kilometres
Datum: GDA 1994, Projection: GDA

Scale @ A3: 1:1,000,000	Prepared: J.N.Rao	Project No: RES048 Rev G
Date: 26/08/2015	Checked: F.Jones	Figure: 1
	Reviewed: M. Rhodes	

LEGEND

- Gazetted DPaW[1] Managed Areas
- Watercourses
- Localities

Existing Major Iron Ore Mines
- Third Party
- BHP Billiton Iron Ore
- BHP Billiton Iron Ore Existing Rail Lines
- Third Party Existing Rail Lines

Roads
- Great Northern Highway
- Other Roads

BHP Billiton Iron Ore Operational Zones
- Eastern Pilbara Operational Zone
- Northern Pilbara Operational Zone
- Central Pilbara Operational Zone
- Western Pilbara Operational Zone

Audience
This map has been compiled by BHP Billiton Iron Ore (BHPBIO) and is provided for planning purposes only and must not be distributed to third parties without the written permission of the Land Access function.

FOOTNOTE
1. DPaW (Department of Parks and Wildlife, Western Australia)

The content of this map is conceptual only, of a general nature and does not purport to contain all information relevant to future project development associated with the Project. This map has been prepared solely for the purposes of informing environmental impact assessment pursuant to the Environmental Protection Act 1986 (WA) and Environment Protection and Biodiversity Conservation Act 1999 (Cth) and is not intended for use for any other purpose. No representation or warranty is given that project development associated with any or all of the disturbance indicated on this map will actually proceed. As project development is dependent upon future events, the outcome of which is uncertain and cannot be assured, actual development may vary materially from this conceptual map.

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Mining Tenements
The tenement layer on this map consists of many tenements (both granted and pending applications) that overlap in time and space, with complex relati onships, but the depiction on the map is as if tenements form a simple 2D layer. Hence care should be taken in interpreting the colour-coded tenements and, where necessary, further details should be obtained from Department of Minerals and Petroleum's onli ne database - TENGRAPH.

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2 Background

2.1 Study Scope

The LVRA seeks to assess impacts to landscapes and visual amenity associated with the Strategic Proposal. The study scope therefore encompasses the spatial extent, typical activities and the timeframe covered by the Strategic Proposal.

The Strategic Proposal, as outlined in Section 1, relates to a series of future mining operations and associated infrastructure. The Strategic Proposal groups these proposed future developments around a series of 'mining operations', collectively termed 'operations'. This approach is designed to facilitate efficient processing and transportation of ore. These future and existing operations are identified in Figure 1. The area over which the Strategic Proposal will occur is defined as the Strategic Proposal area.

Some operations are not included in the Strategic Proposal due to the existence of current approvals. The Strategic Proposal excludes:

- Existing BHP Billiton Iron Ore operations and infrastructure;
- Future development of BHP Billiton Iron Ore northern Pilbara operations at Yarrie and Goldsworthy and associated infrastructure; and
- Development and operations at Port Hedland, including rail to the 26 km chainage mark from Port Hedland.

Specific details on individual future operations will not be available at the time of the PERSP due to the extended life of the Strategic Proposal and the early stage of mine planning for some future operations. Where specific details are not available for a future proposal, the impact assessment is based on 'typical' Pilbara iron ore mining projects (which may consist of mines, rail, and other infrastructure) as the basis for any consideration of impact. Whilst this definition will be generic, it is sufficiently detailed to enable valid high level assessment as it will be based on individual site profiles and the advanced understanding of the business from nearly 50 years of operation in the Pilbara.

The 'typical' mine components used in this assessment were:

- Conceptual layouts of key plant and infrastructure including crushers, stock-yards, ore handling plant (OHP), train load out (TLO) facilities, rail loops, and general infrastructure areas;

- Conceptual pit design and preliminary pit siting (largely based on various resource estimates); and
- Conceptual overburden storage area (OSA) design and preliminary siting (largely based on an 85% backfill scenario where realistic, and assuming no backfill where there is a low level of planning detail available).

These 'typical' layouts for the BHP Billiton Iron Ore's mining operations in the Strategic Proposal are shown in Figures 3a and 3b under two different impact scenarios – the '30% Development Scenario' and the 'Full Development Scenario' (these scenarios are further described in Section 2.3).

2.2 Strategic Environmental Assessment 'Operational Zones'

For the purposes of this study the Strategic Proposal area is divided into four 'operational zones' containing individual 'mining operations'; the Eastern, Central, Northern and Western Operational Zones (Figure 1; Figure 2). This was deemed appropriate due to the large number of mining operations and the similar landscape characteristics in these areas.

2.2.1 Eastern Pilbara Operational Zone

This cluster of operations consist of the Newman, Jimblebar, Caramulla and Ophthalmia/Prairie Downs mining operations. The Eastern Pilbara Operational Zone is an area in which mining is presently a key feature, being the site of BHP Billiton Iron Ore's Mt Whaleback, Orebody (OB) 25, OB18 (Shovellana), OB23, OB30, OB35 and Jimblebar (Wheelara) operations.

Accessibility in this area is relatively good for the region due to the proximity of Newman, although it is generally confined to publicly accessible roads such as the Great Northern Highway and the Marble Bar Road.

2.2.2 Central Pilbara Operational Zone

The Central Pilbara Operational Zone consists of the Mudlark, Gurinbiddy, South Flank, Mining Area C/Packsaddle and Jinidi mining operations. These operations are located adjacent to the Great Northern Highway within a region that is accessible to the general public. Mining activity in this area is relatively minimal at present, with BHP Billiton Iron Ore's Mining Area C, Robe River's West Angelas, and Hamersley Iron's Hope Downs 1 and Hope Downs 4 being the only major operations in the area. This operational zone is a key focus point of this study due to the accessibility and the density of proposed developments in this area.

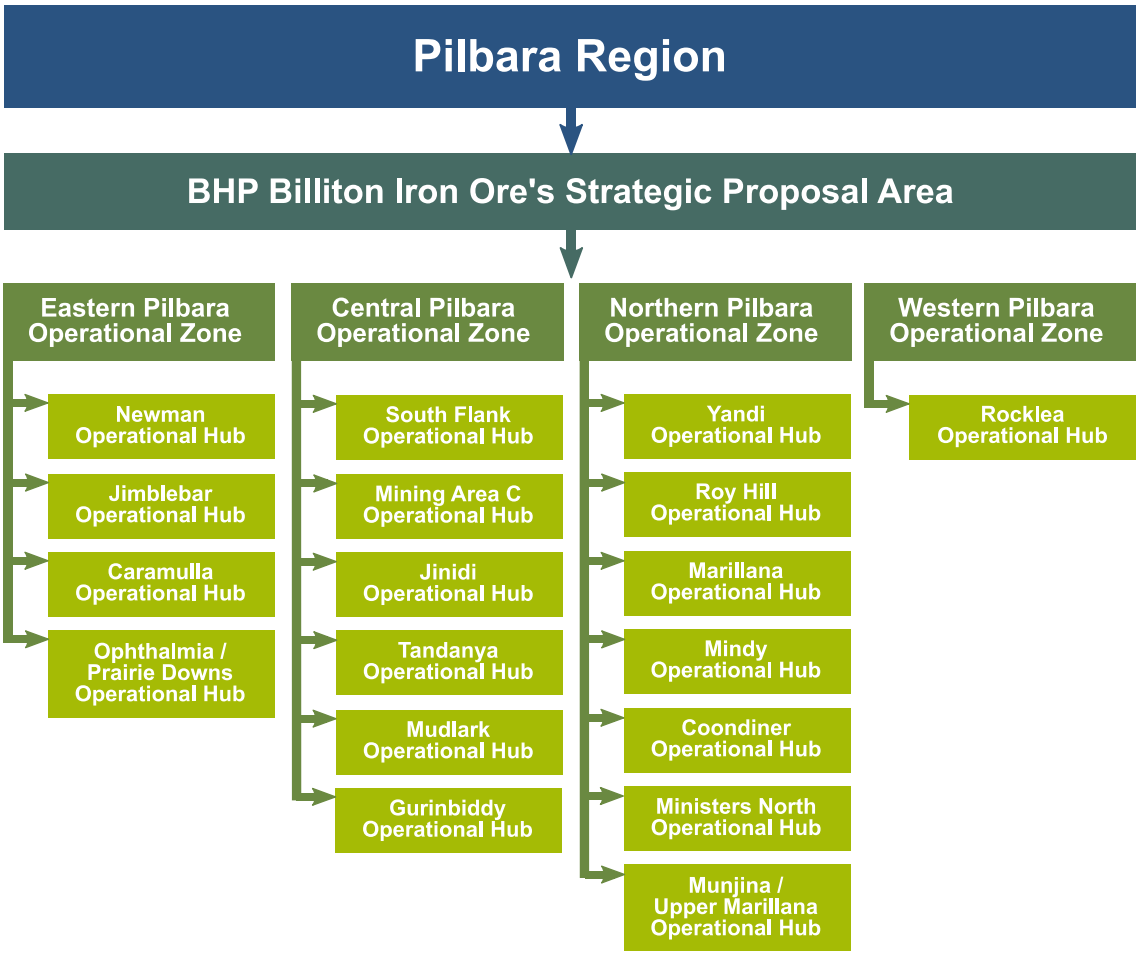


Figure 2. Scales used in this study

2.2.3 Northern Pilbara Operational Zone

The Northern Pilbara Operational Zone consists of the Yandi, Marillana, Mindi, Ministers North, Munijna/Upper Marillana, Roy Hill and Coondiner mining operations. Access to this region is relatively low, as the major transport route in the area is the rail access road for BHP Billiton Iron Ore's Newman to Port Hedland main rail line. This region of the Strategic Proposal will be subject to intensive mining activity in the future.

At present, Fortescue Metals Group (FMG) operates the Cloudbreak and Christmas Creek Mines north of the Fortescue Marsh, Rio Tinto operates the Yandicoogina mine while Roy Hill Pty Ltd operates its Roy Hill mine (Figure 3a). It is expected that a large number of third party iron ore operations may be active in the reasonably foreseeable future, including Rio Tinto's Koodaideri, Marillana Iron Ore, Junction and Oxbow operations, FMG's Mindy Mindy and Nyidingu operations in addition to BHP Billiton Iron Ore's future operations.

2.2.4 Western Pilbara Operational Zone

The Western Pilbara Operational Zone consists only of the Rocklea mining operation. The Rocklea mining operation is unique in that that it is situated in isolation of the other areas of development. At present, no indicative rail route has been proposed to link the Rocklea mining operation to the main BHP Billiton Iron Ore rail line. As such, visual impacts from rail for this mining operation have not been assessed as part of this study. There are no third party operations currently active within the operational zone; the closest being the Western Turner Syncline, Brockman 4 and Paraburdoo projects (operated by Rio Tinto Iron Ore). The area immediately surrounding the Rocklea mining operation is currently pastoral station with an area in the east proposed for the development of Australian Premium Iron's West Pilbara Iron Ore (Hardey) Project, which received environmental approval in late 2013 (EPA 2013b).

2.3 Impact Scenarios

The majority of operations considered within the Strategic Proposal are unlikely to be operational at the same time and as such, it is expected that the level of impact will vary over time in terms of intensity of impact, and location of impact. This study considers two scenarios or levels of impact which were adapted from BHP Billiton Iron Ore's (2014) Strategic Proposal cumulative impact assessment footprint dataset, as well as a conceptual scenario for future third party operations in the region.

It is generally acknowledged that a major impediment to the assessment of impacts from a cumulative perspective is accurate and reliable forecasting (Franks et al. 2010). The data used in this study reflected the best available information at the time of writing. Potential impacts from these two scenarios are assessed in relation to existing impacts (Figure 3a).

2.3.1 30% Development Scenario

The disturbance areas for the 30% Development Scenario are based on the production rate associated with approximately 30% of BHP Billiton Iron Ore's future identified projects being in concurrent operation (Figure 3b). As it is based on current information on demand and schedule, it may change over time, and as such, is an indicative scenario only. Conceptual infrastructure areas and, in some cases, rail spur alignments were placed based on best judgment taking into account topographical constraints and positioning in relation to surrounding mine layouts.

The 30% Development Scenario also includes areas of existing disturbance.

2.3.2 Full Development Scenario

The Full Development Scenario is based on the production rate associated with full development of BHP Billiton Iron Ores future identified projects being in concurrent operation (Figure 3c). The Full Development Scenario is useful for assessing impacts

collectively at a regional scale, however will present a distorted view of impacts when assessed from a particular point in time as it assumes concurrent operation.

It should be noted however, that the Full Development Scenario underestimates the impacts from third parties as public information is generally not as available for developments at this time scale. This study gives preference to the 30% Development Scenario over the Full Development Scenario when attempting to simulate realistic impacts to visual amenity as potential impact contribution from not only BHP Billiton Iron Ore, but also third party operations can be reliably estimated. The Full Development Scenario also includes disturbance areas from existing and 30% Development Scenario mining operations.

For the purposes of landscape and visual impacts, the 30% Development Scenario is better suited to assessing impacts to visual amenity as it is a reasonable assumption of maximum development at a given point in time. The Full Development Scenario is better suited at assessing impacts to landscapes as it considers total potential impact over time. This is due to the higher level of certainty with the relevant resource bodies, as opposed to the Full Development Scenario which represents the total area of disturbance at a high level over the life of the Strategic Proposal. As such, potential impact statistics are calculated for the Full Development Scenario, whereas photorealistic simulations of potential impacts to visual amenity gives preference to the 30% Development Scenario (See Sections 3.3.2 and 3.3.3).

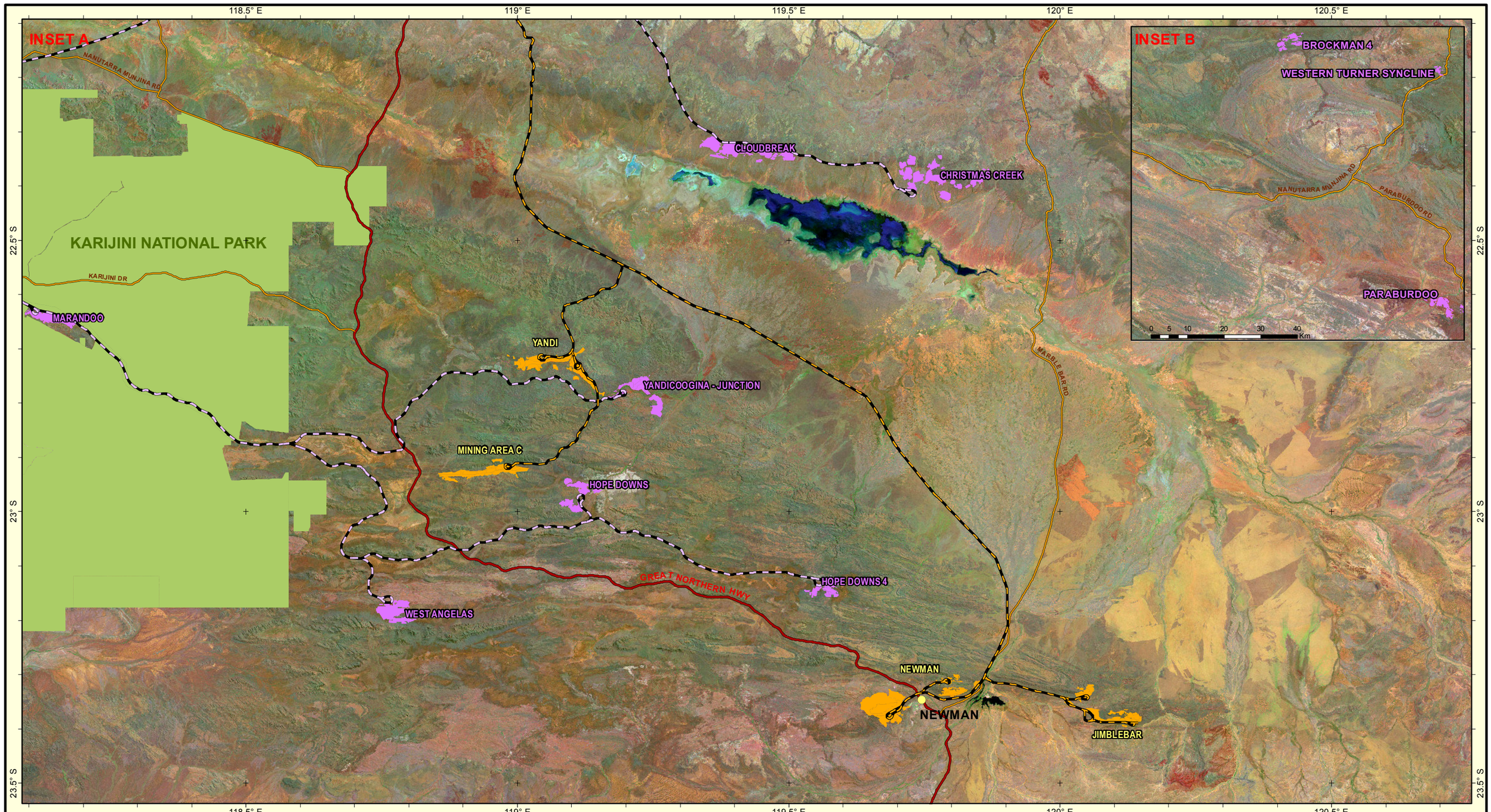
Disturbance data used in this assessment is structured to reflect these two impact scenarios and are presented in Figures 3a, 3b and 3c. Although disturbance footprints are based on a single generalised disturbance area, the assessment utilised conceptual information on OSA and infrastructure placement to account for potential impacts from these elements when considering simulated views such as those in the Photomontage Analysis (Section 3.3.3 and Section 4.3.1).

2.3.3 Third Party Impacts

To estimate cumulative impacts, proposed third party iron ore developments in the vicinity of the Strategic Proposal are considered in this LVRA. However, it should be noted that little information on third party proposals is publicly available and therefore only limited insight into the scale of such operations in the future is provided. The third party assessment was limited to iron ore proposals within a 50 km radius of the Strategic Proposal mining operations (Figure 3b and 3c).

Third party footprint data was sourced from a combination of environmental approvals documentation, supporting studies, mining proposals and aerial imagery. Footprints were limited to a generic disturbance area, as information on footprint type could not be reliably determined.

It was found that the larger iron ore projects undergoing the approvals process at present will largely be operational around the year 2030 (termed ‘reasonably foreseeable’ for purposes of the assessment); however the vast majority of existing operations will have been decommissioned. Where possible this assessment has taken these development timelines into consideration.



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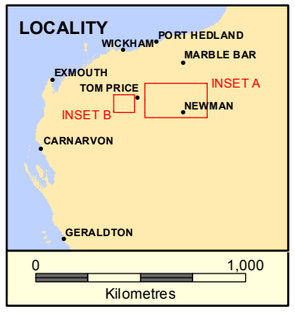
STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
BHP Billiton Iron Ore and Third Party Existing Disturbance

N

0 10 20 40 60
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:750,000	Prepared: J.N.Rao	
Date: 23/08/2015	Checked: L. Reilly	Figure: **3a**
	Reviewed: K. Hollins	



LEGEND

- Town
- Gazetted DPaW[1] Managed Areas

Roads
- Great Northern Highway
- Other Roads

BHP Billiton Iron Ore Existing Disturbance
- BHP Billiton Iron Ore Existing Disturbance
- BHP Billiton Iron Ore Existing Rail Corridor

BHP BILLITON IRON ORE MINING OPERATION

Third Party Existing Disturbance
- Third Party Existing Direct Disturbance [2]
- Third Party Existing Rail Corridor

THIRD PARTY IRON ORE MINING OPERATION

FOOTNOTES
1. DPaW (Department of Parks and Wildlife, Western Australia)
2. Third Party Existing Disturbance represents existing disturbance as verified by aerial imagery attributable to third party iron ore operations that have been referred to or approved by the Environmental Protection Authority prior to September 2013.

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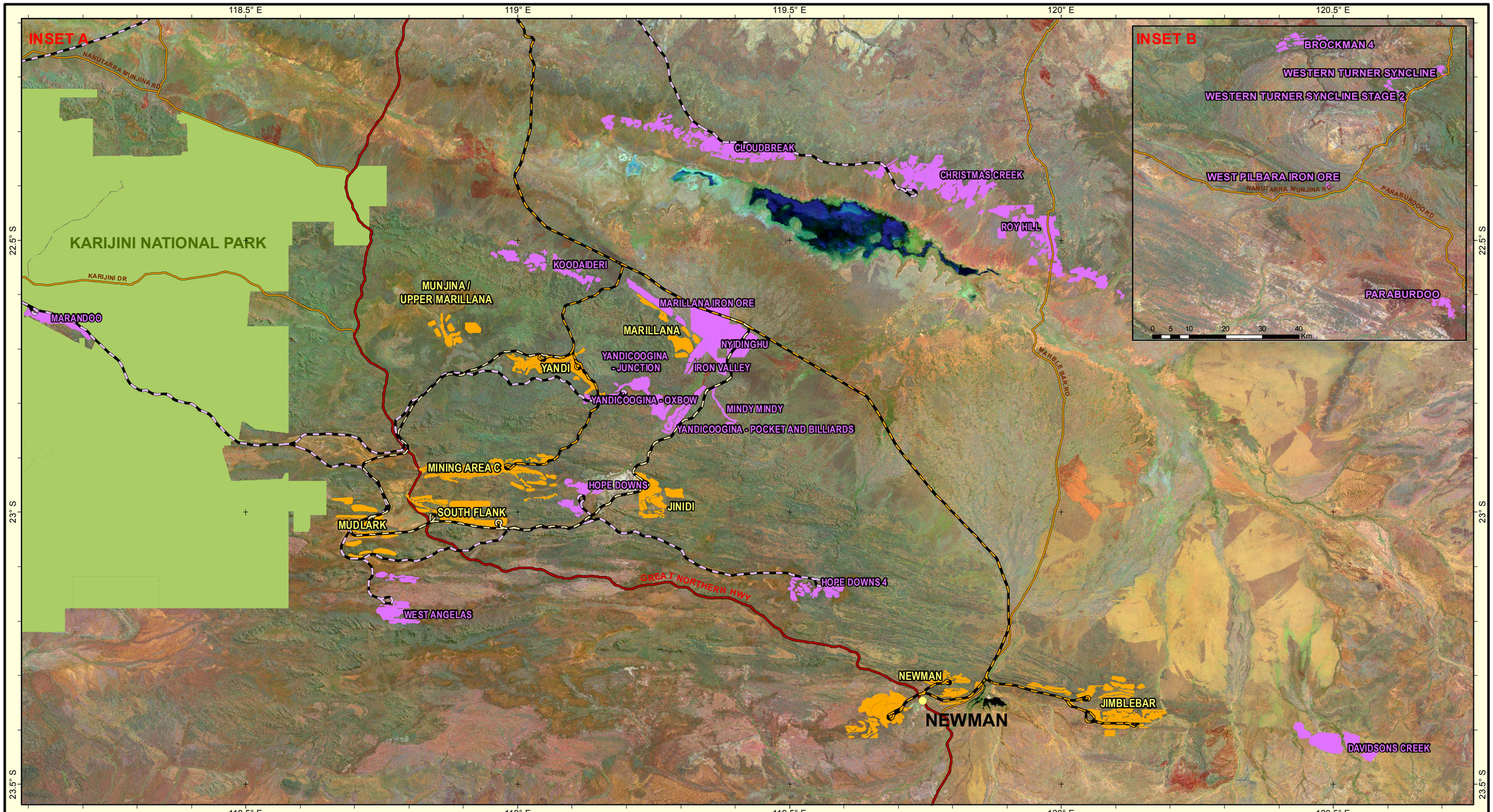
Data source:
DPaW Reserves (DPaW 2015)
Roads (MRWA 2012)
Aerial Image (Landsat 7)
Third Party Disturbance digitized from
Aerial imagery (Aug - Sept 2013)
& Approval Documentations
All other data supplied by BHP Billiton Iron Ore (2012)



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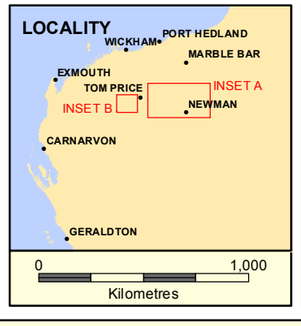
Health Safety and Environment
BHP BILLITON IRON ORE

STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
BHP Billiton Iron Ore 30% Development Scenario and
Third Party Reasonably Foreseeable Disturbance Areas

N

0 10 20 40 60
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:750,000	Prepared: J.N.Rao	
Date: 23/08/2015	Checked: L. Reilly	Figure: **3b**
	Reviewed: K. Hollins	



LEGEND

- Towns
- Gazetted DPaW[1] Managed Areas

Roads
- Great Northern Highway
- Other Roads

BHP Billiton Iron Ore 30% Development Scenario
- BHP Billiton Iron Ore Conceptual Direct Disturbance
- BHP Billiton Iron Ore Existing Rail Corridor
- BHP Billiton Iron Ore Conceptual Rail Corridor

BHP BILLITON IRON ORE MINING OPERATION

Third Party Reasonably Foreseeable Disturbance
- Third Party Reasonably Foreseeable Disturbance
- Third Party Existing Rail Corridor

THIRD PARTY IRON ORE MINING OPERATION

FOOTNOTE
1. DPaW (Department of Parks and Wildlife, Western Australia)

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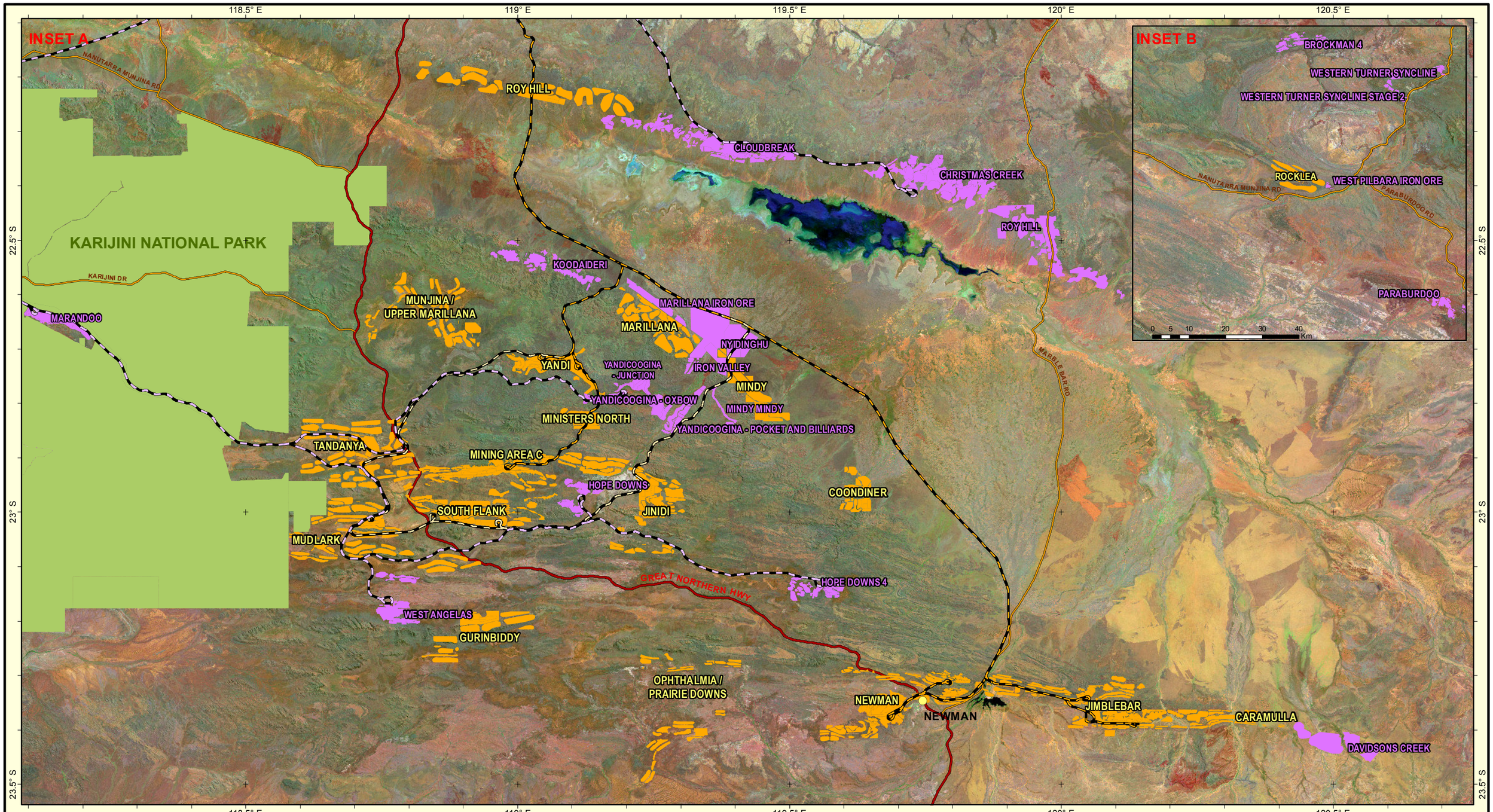
Roads (MRWA 2012)
Aerial Image (Landsat 7)
Third Party Disturbance digitized from Aerial imagery (Aug - Sept 2013)
& Approval Documentations
All other data supplied by BHP Billiton Iron Ore (2012)



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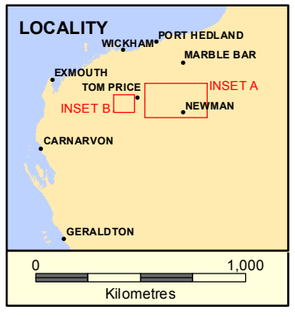
Health Safety and Environment
BHP BILLITON IRON ORE

STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
BHP Billiton Iron Ore Full Development Scenario and
Third Party Reasonably Foreseeable Disturbance Areas

N
0 10 20 40 60
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:750,000	Prepared: J.N.Rao	
Date: 23/04/2015	Checked: L. Reilly	Figure: **3c**
	Reviewed: K. Hollins	



LEGEND

- Towns
- Gazetted DPaW[1] Managed Areas

Roads
- Great Northern Highway
- Other Roads

BHP Billiton Iron Ore Full Development Scenario Disturbance
- BHP Billiton Iron Ore Conceptual Direct Disturbance[1]
- BHP Billiton Iron Ore Existing Rail Corridor
- BHP Billiton Iron Ore Conceptual Rail Corridor[1]
- BHP BILLITON IRON ORE MINING OPERATION

Third Party Reasonably Foreseeable Disturbance
- Third Party Reasonably Foreseeable Disturbance[2]
- Third Party Existing Rail Corridor
- THIRD PARTY IRON ORE MINING OPERATION

Data source:
DPaW Reserves (DPaW 2015)
Roads (MRWA 2012)
Aerial Image (Landsat 7)
Third Party Disturbance digitized from Aerial imagery (Aug - Sept 2013) & Approval Documentations
All other data supplied by BHP Billiton Iron Ore (2012)

FOOTNOTE
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2.4 Social Setting

2.4.1 Major Population Centres

The nearest regional centre to the Strategic Proposal area is the town of Newman, which provides accommodation and services for many current mining employees and contractors. Newman was established in the 1960's by the Mt. Newman Mining Company, around the discovery of rich iron deposits in the adjacent Mt Whaleback (Shire of East Pilbara 2014). Community infrastructure at Newman includes medical and hospital facilities, banks, an airport, post office, sporting facilities and schools.

Newman is a relatively isolated community. The nearest neighbouring towns include Nullagine (192 km by road), Tom Price (277 km by road), Marble Bar (303 km by road) and Meekatharra (422 km by road). Being developed around mining, a large portion of Newman's workforce is employed within the mining industry.

2.4.2 Visitor Demographics

The North West Region of Western Australia receives a relatively small amount of visitors in comparison to the rest of the state. It is estimated that the region receives 5% of the total visitors to and within Western Australia (the remoteness of the region however results in the region receiving approximately 11% of the total overnight visitors) (Tourism WA 2014).

Within the North West Region, the Strategic Proposal is expected to fall largely within the Shires of Ashburton and East Pilbara. In the 2011 to 2013 period these two local governments received an average of 20% and 18% of the total number of intrastate visitors to the North West Region (Tourism WA 2014). Intrastate visitors appear to dominate the market (likely due to employment opportunities in the region), accounting for approximately 65% of all visitors (Figure 4; Table 2).

According to Tourism WA, visitor numbers to the North West (not specifically the Pilbara Region) have largely declined in the 2013 period in relation to 2012. However a three year average still shows growth. Data specific to the Newman or Pilbara Region was not consistently available. Figure 4 shows the historical trend of visitor numbers to the North West since 2005.

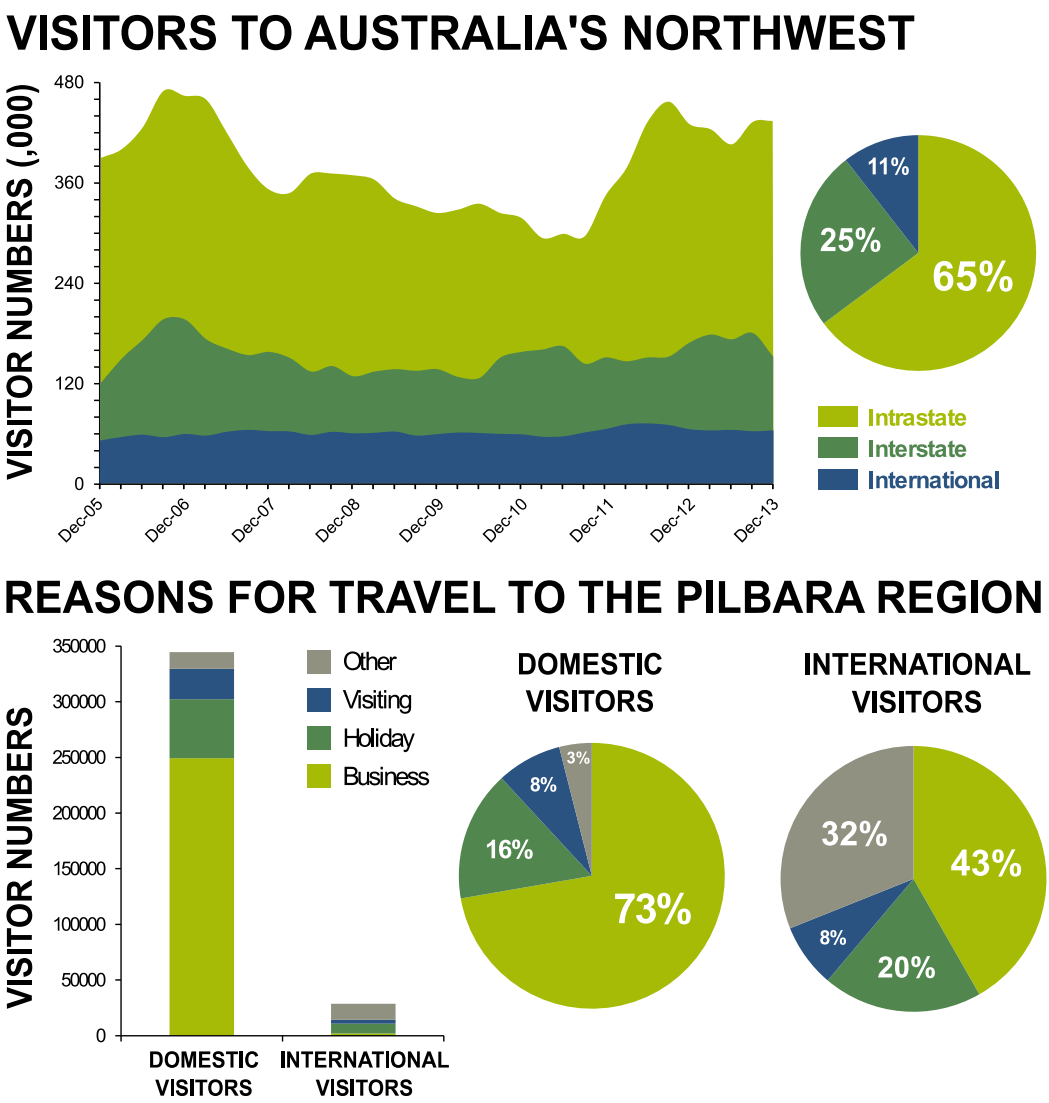
Table 2. Visitor origins and trends for the year ending June 2013 (Tourism WA 2014)

Visitor Origins for the North West Region	Year Ending (YE) December 2013	% Change YE December 2012 – YE December 2013	3 Year Average annual growth rate (2011 – 2013)
Domestic Total	589,000	˅2.3%	^8.6%
Intrastate	439,000	^0.9%	^12.0%

Visitor Origins for the North West Region	Year Ending (YE) December 2013	% Change YE December 2012 – YE December 2013	3 Year Average annual growth rate (2011 – 2013)
Interstate	150,000	**v10.7%**	**^0.3%**
International Total	65,600	**v1.8%**	**v1.1%**
Overall Total	654,600	**v2.3%**	**^7.5%**

The social and economic development of the Pilbara Region has been driven by pastoral enterprises, followed by the discovery of vast deposits of iron ore in the region. More recent discoveries of oil, gas and other mineral resources have further boosted the Pilbara economy and population growth.

The Australian Bureau of Statistics (ABS) 2011 Census data shows that the population of the Pilbara Region was 59,894 and the population in the Newman area was 9,087 (ABS 2011). The data indicates the Pilbara region had positive growth rates from 2006 to 2011 (i.e. 46%).



Sources:
Tourism WA's (2014a) Overnight visitor fact sheet for Australia's North West for year ending Dec 2013
Tourism WA's (2014b) Pilbara Development Commission Area Overnight visitor fact sheet - Years ending Dec 2011/12/13

Figure 4. Visitor counts and origins for the North West region, and purpose of visits to the Pilbara region (adapted: Tourism WA 2014)

Newman experienced positive growth in the five years from 2006 to 2011 (an average of approximately 7.6% per year), however is lower than the average for the whole of WA of 12.5% or the national average of 8.5% (ABS 2011).

Developments of major resource projects have initiated a large amount of socio-cultural development in recent decades, such as the establishment of the towns of Newman, Paraburdoo and more recently Tom Price.

A large proportion of visitors to the region also visit for business purposes rather than other recreation related activities. Tourism WA estimates that in 2013, 73% of all

domestic visitors and 43% of international visitors travelled to the northwest region for business purposes (Tourism WA 2014; Figure 4).

2.4.3 Native Title Groups and Aboriginal Communities

BHP Billiton Iron Ore has relationships with the native title groups and Aboriginal communities that are either directly or indirectly impacted by its operations across the Pilbara. Consultation regarding the Strategic Proposal will be undertaken with the various native title groups whose land is subject to the geographical scope of the Strategic Proposal. Consultation will continue to be undertaken with Aboriginal communities that are in relative proximity to the geographical scope of the Strategic Proposal.

2.4.4 Heritage

The Pilbara Region is rich in Aboriginal heritage. The area covered by the Strategic Proposal is primarily of importance to the Banjima and Nyiyaparli people. Impacts to heritage sites, in terms of physical disturbance, are outside the scope of this study, locations with heritage value are only assessed for potential impacts to visual amenity. Aboriginal heritage sites within the Strategic Proposal area are either ethnographic sites mainly associated with the Dreamtime and ceremonies, or archaeological sites which are the remains of material culture. A number of these sites hold considerable visual amenity value (e.g. rock art and creeks or waterholes at water source sites).

The EPA's objective for heritage is to ensure that historical and cultural associations are not adversely affected (EPA 2013a). This objective is supported by the EPA's Guidance Statement No. 41: Assessment of Aboriginal Heritage (EPA 2004).

BHP Billiton Iron Ore manages and protects Aboriginal heritage in compliance with the WA *Aboriginal Heritage Act 1972*. Potential impacts to heritage sites associated with the Strategic Proposal will continue to be managed through BHP Billiton Iron Ore's heritage management processes. These processes are based on the legislation and heritage protocols between BHP Billiton Iron Ore and the relevant Native Title groups. They include measures to identify significant heritage sites during planning phases to avoid or minimise potential heritage impacts. If any heritage site cannot practically be avoided, BHP Billiton Iron Ore will consult with the relevant Indigenous group and seek consent from the Minister under Section 18 of the *Aboriginal Heritage Act 1972*. As Aboriginal heritage implications will be considered under legislation and agreements outside the Federal and State environmental assessment process, it will not be specifically discussed as part of this report.

There are relatively fewer places of significance to European Heritage relevant to the Strategic Proposal. Sites in the Pilbara region are generally listed on the State Heritage Council database for their significance to the areas' mining or pastoral history (Heritage Council of WA 2014).

2.4.5 Current Land Use

All of BHP Billiton Iron Ore's proposed future operations within the Strategic Proposal are located on mining tenure for which BHP Billiton Iron Ore is the Manager and Agent. Some of these proposed future operations occur partly within the BHP Billiton Iron Ore-managed Marillana and Ethel Gorge pastoral leases. Infrastructure (e.g. rail, roads) outside existing mining tenure would be located on miscellaneous licenses.

The current use of lands surrounding the proposed mines and associated infrastructure is predominantly for mineral exploration, iron ore mining and dry land agriculture, specifically pastoralism. Pastoral activities are generally restricted to the Fortescue Valley and Bulloo Plains LCT, due to the flatter terrain, and (suitability for) prevalence of tussock grasses. Within the Hamersley Range LCT, pastoral activity is generally restricted to the Boolgeeda and Wannamunna Land Systems, due to terrain suitability.

Conservation lands amount to less than 10% of the total area of the Pilbara Bioregion, with the major reserves being Karijini and Millstream-Chichester National Parks. These Parks are supplemented by lesser conservation estates such as Cane River and Meentheena Conservation Parks. Wetlands of national significance include the permanent pools of Millstream and Karijini National Parks and the Fortescue Marsh.

2.5 Physical Setting

The Pilbara Craton is characterised in the north by Archaean granite-greenstone terranes, shales, siltstones and sandstones (Tille 2006). The northern Hamersley basin dominates the southern portion of the Craton, and is typified by Archaean basalts, shales, sandstones, conglomerates, tuffs and carbonates. Further south, the Hamersley Range comprises late Archaean to Proterozoic banded-iron formations, shales, dolerites, carbonates, cherts and rhyolites. The northeast and southeast regions of the Strategic Proposal comprise variously aged sandstones while the tertiary drainages, including the Fortescue Valley, consist of tertiary deposits of calcrete and ferruginous pisolites (Tille 2006). The interaction between geology, morphology and landforms is described in the PERSP.

The physiography of the Pilbara Bioregion is dominated by rugged hills, ridges and dissected plateau associated with the Hamersley and Chichester Ranges, which separate the lower plains and drainage valleys of the Fortescue and De Grey River catchments (Tille 2006). The ranges are bound by long stony foot slopes and plains, while the Chichester Plateau also supports stony gilgai plains. Coastal plains are bordered by extensive intertidal mudflats. Ranges, hills and stony plains are characterised by red loams and sands of varying depths. Cracking clays can be found on basaltic plateau and non-cracking-clays on the granitic plains. Alluvial and coastal plains are dominated by deep red loams and deep red sands respectively (Tille 2006).

2.5.1 Broad Landscape Characters

At the regional scale, landscapes are grouped into a number of Landscape Character Types (LCTs) which broadly correspond to similarities in landforms, vegetation and soils (Figure 5). These are described by Tille (2006) in *Soil Landscapes of Western Australia* as:

- **Nullagine Hills**: Located in the north-eastern Pilbara around Marble Bar and Nullagine. Hills and ranges (with some stony plains) on volcanic and sedimentary rocks of the Pilbara Craton (including the Hamersley Basin). Stony soils with red shallow loams and sands. Spinifex grasslands with kanji and snappy gum;
- **De Grey-Roebourne Lowlands**: Located in the northern Pilbara between Karratha and the De Grey River. Alluvial plains and sandplains (and some floodplains and stony plains) on alluvial and marine deposits over rocks of the northern Pilbara Craton. Red deep sandy duplexes with red loamy earths and some red/brown non-cracking clays, cracking clays, red sandy earths and red deep loamy duplexes. Spinifex grasslands with kanji and tussock grasslands;
- **Chichester Ranges**: Located in the northern Pilbara between Pannawonica and Nullagine. Hills and dissected plateau (and some floodplains and stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Stony soils with some red shallow loams and hard cracking clays. Spinifex grasslands with kanji and snappy gum (and some tussock grasslands);
- **Abydos Plains and Hills**: Located in the northern Pilbara between Yandeyarra Community, Bamboo Springs Station and Marble Bar. Stony plains (with some hills) on granitic rocks of the Pilbara Craton (East Pilbara Terrane). Red deep sandy duplexes and red shallow loams with stony soils, red sandy earths and red loamy earths. Spinifex grasslands with kanji (and some tussock grasslands). Located in the northern Pilbara with kanji (and some tussock grasslands);
- **Fortescue Valley**: Located in the Pilbara along the Fortescue River between Millstream National Park and Ethel Creek Station. Alluvial plains, hardpan wash plains and sandplains (with stony plains, floodplains and some salt lakes) on alluvial deposits over sedimentary rocks of the Hamersley Basin. Red deep sands, red loamy earths and red/brown non-cracking clays with some red shallow loams and hard cracking clays. Mulga shrublands and spinifex grasslands (with some tussock grasslands and halophytic shrublands);
- **Hamersley Plateau**: Located in the Pilbara between Pannawonica, Newman and Paraburdoo. Hills and dissected plateau (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin (Ophthalmia Fold Belt). Stony soils with red shallow loams and some red/brown

non-cracking clays and red loamy earths. Spinifex grasslands with snappy gum and kanji (and some mulga shrublands);

- **Jigalong Plains**: Located in the eastern Pilbara between Jigalong, Ethel Creek and Balfour Downs (easternmost areas of study area). Alluvial plains, sandplains, hills and ranges (with floodplains and hardpan wash plains) on sedimentary rocks of the Manganese Group (with some basalt and granite). Red deep sands with red/brown non-cracking clays, red loamy earths, red deep sandy and loamy duplexes, stony soils and red shallow loams. Mulga woodlands/shrublands with spinifex and tussock grasslands;
- **Bulloo Plains and Hills**: Located in the southeastern Pilbara between Newman, Jigalong and Three Rivers (Upper Gascoyne, southernmost sections of study area). Hardpan wash plains, stony plains, hills and ranges (with some sandplains) on sandstone and shale of parts of the Collier and Bresnahan Basins and granite of the Sylvania Inlier. Red shallow loams (often with hardpans), red loamy earths, stony soils and red deep sands with some red shallow sands. Mulga shrublands (with some spinifex grasslands); and
- **Ashburton Valley**: Located in the southern Pilbara along the Ashburton River between Nanutarra, Paraburdoo and Turee Creek Station. Hills and ranges (with some floodplains and stony plains) on sandstone, shale and conglomerate of the Ashburton Basin. Stony soils with red loamy earths and red shallow loams. Mulga snakewood shrublands with mixed scrub and spinifex grasslands (and some halophytic shrubs and tussock grasses).

The Strategic Proposal will affect four of these LCTs, namely the Chichester, Fortescue, Hamersley and Bulloo LCTs.

2.5.2 Local Landscapes

At a more localised scale, landscapes are more heavily influenced by a number of elements such as landforms (surface expressions of particular geological formations; e.g. Banded Iron Formations [BIFs]), soils and vegetation. These ‘Land Systems’ have been described by Van Vreeswyk et al. (2004) and can be used to inform amenity values associated with an area. Land Systems within the Strategic Proposal area and their descriptions are illustrated in Figure 6.

A large number of Land Systems fall within the Strategic Proposal area; however three are most commonly encountered within the BHP Billiton Iron Ore mining operation tenure (Newman, Boolgeeda and Wannamunna Systems). Detailed descriptions of these systems are given below (adapted from Van Vreeswyk et al. 2004).

- **Newman:** Rugged jaspilite plateau, ridges and mountains supporting hard spinifex grasslands. Usually mountain tracts, plateaux and strike ridges, relief up

to 400 m; level or rounded plateaux summits and mountain crests, ridges and indented escarpments with vertical upper cliff faces and moderately inclined to very steep upper scree slopes; surface mantles of abundant to very abundant pebbles, cobbles and stones of ironstone, jaspilite, chert and other rocks. Also outcrop of parent rock. Normally vegetated by hummock grasslands of *Triodia wiseana*, *T. brizoides, T. plurinervata* (hard spinifex), with very scattered to scattered shrubs and trees including *Acacia* and *Senna* spp. *Grevillea wickhamii, Eucalyptus leucophloia* and other eucalypts;

- **Boolgeeda:** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands. Primarily almost level plains downslope from the Newman System, surface mantles vary from few to very abundant ironstone and other pebbles; subject to sheet and channelised flow. Primarily vegetated by hummock grasslands of *T. wiseana*, *T. lanigera* (hard spinifex) or *T. pungens* (soft spinifex). Also scattered to moderately close tall shrublands of *A. aneura* and other acacias with hard and soft spinifex ground layer; and
- **Wannamunna:** Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands. Primarily consists of level plains up to 5-6 km in extent, subject to overland sheet flow; surface mantles of very few to few pebbles (occasional abundance) of ironstone. Usually vegetated with very scattered tall or low shrublands of *Acacia aneura, Eremophila* spp., *Ptilotus obovatus* (cotton bush), and *Maireana villosa*.

The transitions between LCTs are particularly noticeable when driving along major roads. For instance, the transition between the Hamersley Plateaux and Fortescue Valley LCTs is easily noticeable by the change from exposed rock faces, gorges, spinifex and gnarled eucalypts to a relatively flat terrain, dominated by cracking clays and dense groves of mulga. This broadscale characterisation of LCTs influences perceptions of a regional landscape; however amenity at a particular location is more likely to be determined by the local Land Systems.

Diversity in elements such as vegetation, landforms, geology and water features can result in different perceptions visual amenity. It is apparent that in natural landscapes, the Newman Land System holds a greater number of locations with high visual amenity value (e.g. Karijini National Park's gorges and waterholes). This is likely due to the large variety of vegetation (several species of spinifex, acacias, and eucalypts) and landforms (plateaux, ridges, mountains, gorges, outcrops, drainage tracts [results in diverse water features due to diverse landforms]) that are likely to be encountered at a given location.

In contrast, physical elements of the Wannamunna System (for example) are considerably less varied, with lower levels of vegetation diversity (usually Mulga and

tussock grasses, occasionally spinifex and occasionally eucalypts) and landforms (primarily level plains, drainage tracts) which may result in lower amenity values.

2.5.3 Dominant Landforms

Landforms are considered an abiotic component (i.e. independent of vegetation, unlike landscapes). The Land Systems within the study area can be grouped into 'dominant landform types', which identifies the most common landform within a given Land System. The study area is contains several different landform types, these are:

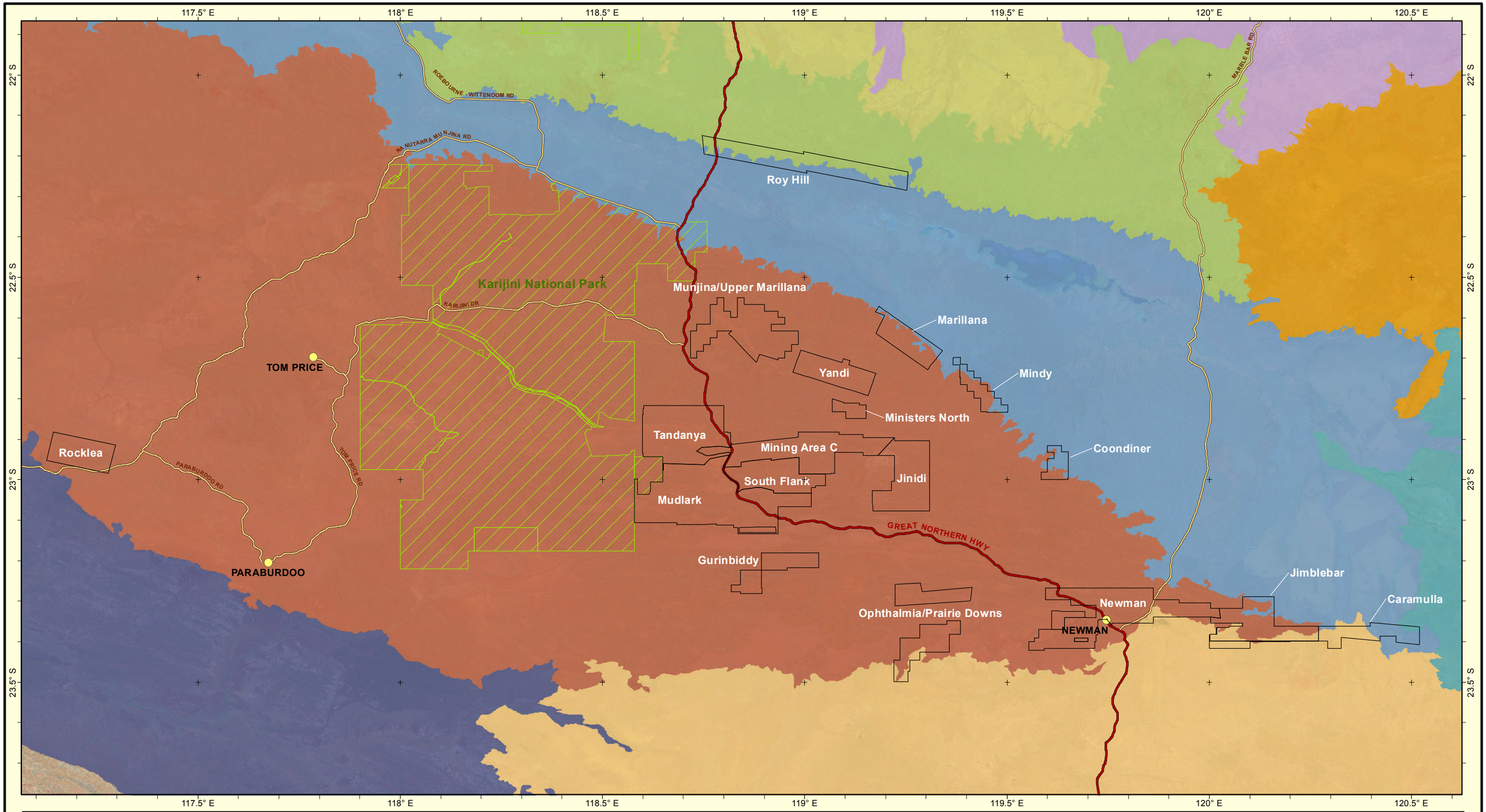
- Hills and ranges;
- Plateaux, mesas and breakaways;
- Stony Plains;
- Washplains;
- Sandplains;
- Alluvial plains;
- Dissected plains;
- River plains;
- Stony gilgai plains;
- Calcrete and Warri Systems; and
- Salt lakes and fringing alluvial plains.

The most commonly seen landforms within the study area are hills and ranges followed by stony plains and washplains. A typical view of the landforms associated with the Hamersley Ranges is shown in Plate 1, an oblique aerial image showing a landscape dominated by hills and ranges, with drainage tracts and stony plains.

Plate 1. Typical landforms associated with the Hamersley Ranges.

Plate 2 presents common landforms associated with the Fortescue Valley, which is largely dominated by washplains, river plains and alluvial plains. The Chichester Ranges are visible in the distance.

Plate 2. Typical landforms associated with the Fortescue Valley.



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STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
Landscape Character Types

N

0 10 20 40 60
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:1,000,000	Prepared: J.N.Rao	Project No: RES048
Date: 26/08/2015	Checked: F. Jones	Figure: 5
	Reviewed: S. Hashim	

LEGEND

Landscape Character Types (LCT)
- Nullagine Hills
- Chichester Ranges
- Abydos Plains and Hills
- Fortescue Valley
- Hamersley Plateaux
- Warrawagine Hills
- Jigalong Plains
- Bulloo Plains and Hills
- Ashburton Valley

- Gazetted DPaW[1] Managed Areas
- BHP Billiton Iron Ore Mining Operation Tenure
- Localities

Roads
- Great Northern Highway
- Other Roads

FOOTNOTE
1. DPaW (Department of Parks and Wildlife, Western Australia)

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Data source:
Elevation (Geoscience Australia 2008)
DEC Reserves (DEC 2012)
Roads (MRWA 2012)
Aerial Image (Landsat 7)
LCTs (DAFWA 2012)

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650,000 700,000 750,000 800,000 850,000

7,500,000

7,450,000

7,400,000

Munjina/Upper Marillana

Marillana

Yandi

Ministers North

Tandanya

Mining Area C

South Flank

Mudlark

Gurinbiddy

Mindy

Coondiner

Jinidi

Newman

Ophthalmia/Prairie Downs

Jimblebar

Caramulla

LAND SYSTEMS DESCRIPTION

UNIT	SYSTEM	SYSTEM DESCRIPTION
ADR	Adrian System	Stony plains and low silcrete hills supporting hard spinifex grasslands.
AUG	Augustus System	Rugged ranges, hills, ridges and plateaux with skeletal soils supporting mulga and other acacia shrublands in southern parts or hard spinifex grasslands in northern parts.
BLF	Balfour System	Shale, gravel and clay plains supporting eremophila-cassia shrublands, tussock grasslands, and halophytic shrublands.
BLG	Billygoat System	Dissected plains and gravelly slopes supporting hard spinifex grasslands.
BOO	Boolaloo System	Granite hills, domes, tor fields and sandy plains supporting spinifex grasslands with scattered shrubs.
BGD	Boolgeeda System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
BRO	Brockman System	Gilgai alluvial plains with cracking clay soils supporting tussock grasslands and low woodlands.
BUC	Buckshot System	Gravelly sandplains and occasional sand dunes supporting shrubby hard spinifex grasslands.
CAD	Cadgie System	Hardpan plains with thin sand cover and sandy banks supporting mulga shrublands with soft and hard spinifex.
CAL	Calcrete System	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.
CPN	Capricorn System	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.
CHA	Charley System	Dolerite or basalt hills and ridges and restricted plains supporting mulga and cassia shrublands or spinifex grasslands.
CEE	Cheela System	Alluvial plains with sparse shrublands and tussock grasslands.
CHR	Christmas System	Stony alluvial plains supporting snakewood and mulga shrublands with sparse tussock grasses.
COR	Collier System	Undulating stony uplands, low hills, ridges, stony plains and drainage floors supporting mulga shrublands and some spinifex.
COB	Coolibah System	Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey.
CWA	Cowra System	Plains fringing the Marsh land system and supporting snakewood and mulga shrublands with some halophytic undershrubs.
DIV	Divide System	Gently undulating sandplains with minor dunes, supporting hard spinifex hummock grasslands with numerous shrubs.
DOR	Dollar System	Stony plains supporting mulga and snakewood shrublands with somes chenpod low shrubs.
EGE	Egerton System	Highly dissected plains and slopes with sparse mulga shrublands or shrubby hard spinifex grasslands.
ELI	Elimunna System	Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.
FAN	Fan System	Washplains and gilgai plains supporting groved mulga tall shrublands and minor tussock grasslands.
FTC	Fortescue System	Alluvial plains and flood plains supporting patchy grassy eucalypt and acacia woodlands and shrublands and tussock grasslands.
GRC	Granitic System	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands.
JAM	Jamindie System	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.
JIG	Jigalong System	Alluvial plains and flood plains supporting grassy shrublands and woodlands and halophytic shrublands.
JUR	Jurrawarrina System	Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses.
KUM	Kumina System	Duricrust plains and plateau remnants supporting shrubby hard spinifex grasslands.
KUN	Kunderong System	Sandstone hills, outcrop plains and minor hardpan plains supporting dwarf acacia and cassias shrublands and sparse mulga tall shrublands.
LAT	Laterite System	Low lateritic plateaux, mesas, buttes and gravelly rises and plains supporting sparse mulga shrublands.
MAC	Macroy System	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.
MDO	Marandoo System	Basalt hills and restricted stony plains supporting grassy mulga shrublands.
MRA	Marillana System	Gravelly plains with large drainage foci and unchannelled drainage tracts supporting snakewood shrublands and grassy mulga shrublands.
MSH	Marsh System	Lakebeds and flood plains subject to regular inundation, supporting samphire shrublands, salt water couch grasslands and chenopod shrublands.
MCK	McKay System	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.
MOS	Mosquito System	Stony plains and prominent ridges of schist and other metamorphic rocks supporting shrubby hard spinifex grasslands.
NAB	Narbung System	Alluvial washplains with prominent internal drainage foci supporting snakewood and mulga shrublands with chenopod low shrubs.
NEW	Newman System	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
NIR	Nirran System	Undulating stony plains and hills on basalt and metabasalt, supporting hard spinifex grasslands and mulga shrublands with soft spinifex.
NON	Nooingnin System	Hardpan plains with very large groves and sandy banks supporting mulga shrublands and wanderrie grasses.
OAK	Oakover System	Breakaways, mesas, plateaux and stony plains of calcrete supporting hard spinifex shrubby grasslands.
PAR	Paraburdoo System	Basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.
PDG	Pindering System	Gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.
PLA	Platform System	Dissected slopes and raised plains supporting shrubby hard spinifex grasslands.
PRA	Prairie System	Gently undulating stony plains and granite hills supporting acacia-eremophila-cassia shrublands and minor soft spinifex grasslands.
RIV	River System	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.
ROB	Robe System	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.
RBT	Robertson System	Hills and ranges of sedimentary rocks supporting hard spinifex grasslands.
ROC	Rocklea System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.
SPH	Spearhole System	Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.
SYL	Sylvania System	Gritty surfaced plains and low rises on granite supporting acacia-eremophila-cassia shrublands.
TAB	Table System	Low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.
TLG	Talga System	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.
TUR	Turee System	Stony alluvial plains with gilgaied and non-gilgaied surfaces supporting tussock grasslands and grassy shrublands of mulga and snakewood.
URY	Urandy System	Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands.
WNM	Wannamunna System	Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.
WAI	Warri System	Low calcrete platforms and plains supporting mulga and cassia shrublands and minor chenopod low shrublands.
WSP	Washplain System	Hardpan plains supporting groved mulga shrublands.
WHS	White Springs System	Stony gilgai plains supporting Roebourne Plains grass grasslands and hard spinifex grasslands.
WON	Wona System	Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields.
ZEB	Zebra System	Hardpan plains with large linear gravelly sand banks supporting acacia tall shrublands with soft and hard spinifex.

Data source:
Elevation (Geoscience Australia 2008)
DEC Reserves (DEC 2012)
Roads (MRWA 2012)
Aerial Image (Landsat 7)
Land Systems (DAFWA 2012)
All other data: BHP Billiton Iron Ore 2012

INSET A

Rocklea

INSET B

Roy Hill

Audience
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STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT(LVRA)

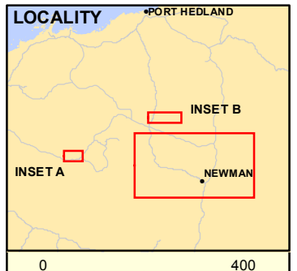
Land Systems

N

0 7.5 15 30 45
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:600,000	Prepared: J.N.Rao	Project No: RES048
Date: 29/08/2015	Checked: F. Jones	Figure: 6a
	Reviewed: S. Hashim	

LOCALITY



LEGEND

BHP Billiton Iron Ore Mining Operation Tenure

Roads
- Great Northern Highway
- Other Roads

Land Systems
Adrian System, Augustus System, Balfour System, Billygoat System, Boolaloo System, Boolgeeda System, Brockman System, Buckshot System, Cadgie System, Calcrete System, Capricorn System, Charley System, Cheela System, Christmas System, Collier System, Coolibah System, Cowra System, Divide System, Dollar System, Egerton System, Elimunna System, Fan System, Fortescue System, Granitic System, Jamindie System, Jigalong System, Jurrawarrina System, Kumina System, Kunderong System, Laterite System, Macroy System, Marandoo System, Marillana System, Marsh System, McKay System, Mosquito System, Narbung System, Newman System, Nirran System, Nooingnin System, Oakover System, Paraburdoo System, Pindering System, Platform System, Prairie System, River System, Robe System, Robertson System, Rocklea System, Spearhole System, Sylvania System, Table System, Talga System, Urandy System, Wannamunna System, Warri System, Washplain System, White Springs System, Wona System, Zebra System

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650,000 700,000 750,000 800,000 850,000

7,500,000

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Munjina/Upper Marillana
Marillana
Yandi
Ministers North
Tandanya
Mining Area C
South Flank
Mudlark
Jinidi
Mindy
Coondiner
Gurinbiddy
Ophthalmia/Prairie Downs
Newman
NEWMAN
Jimblebar
Caramulla

INSET B
Roy Hill

INSET A
Rocklea

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STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
Land Systems

N

0 7.5 15 30 45
Kilometres
Datum: GDA 1994, Projection: GDA94

Scale @ A3: 1:600,000	Prepared: J.N.Rao	Project No: RES048
Date: 29/08/2015	Checked: F. Jones	Figure: 6b
	Reviewed: S. Hashim	

LOCALITY
PORT HEDLAND
INSET B
INSET A
NEWMAN
0 400
Kilometres

LEGEND

- Localities
- BHP Billiton Iron Ore Mining Operation Tenure

Roads
- Great Northern Highway
- Other Roads

Dominant Landform Types
- Salt Lakes and Fringing Alluvial Plains
- Plateaux, Mesas and Breakaways
- Calcreted Drainage Plains
- Stony Gilgai Plains
- Hills and Ranges
- Dissected Plains
- Alluvial Plains
- Stony Plains
- River Plains
- Washplains
- Sandplains

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Data source:
Elevation (Geoscience Australia 2008)
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Landforms (DAFWA 2012)
All other data: BHP Billiton Iron Ore 2012

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3 Methodology

The methodology used to assess risk of impact to landscape and visual amenity is detailed below. The assessment methodology comprised three phases:

- Phase 1 - Desktop assessment;
- Phase 2 - Field assessment; and
- Phase 3 - Risk of visual impact assessment.

The desktop assessment aimed to identify important landscape values as well as points and corridors in which they may be accessed and experienced. To achieve this, a thorough review of internal and public datasets was conducted to identify areas with important amenity value. As a large number of locations exist in the Strategic Proposal area, and a risk of impact probability matrix was used to identify a number of 'viewpoints' that were most at risk of being impacted.

The field assessment in Phase 2 sought to evaluate amenity values associated with the potentially impacted viewpoints identified in Phase 1. These viewpoints were visited and characteristics indicative of their visual amenity values (e.g. view experience, notable features and landscape descriptions) noted. The probability of impact identified in Phase 1 was verified on site, using viewpoint characteristics such as the screening potential of existing vegetation, the relative frequency of access and the visibility level of nearby mining operations.

The final risk of impact assessment phase (3) aimed to assess potential impacts to visual amenity and landscape values which involved modelling the Strategic Proposal Project as two development scenarios (30% Development and a Full Development Scenario). A number of analyses were conducted on these models, including a number of viewshed and photomontage analyses for viewpoints with high visual amenity and landscape values as well as a pre-post development comparison of landscapes. In all these analyses, available information on current and proposed Third Party developments was incorporated with the overall aim of considering cumulative impacts to visual amenity and landscapes.

A summary of the methodology used in the study and its relation to the study objectives is illustrated in Figure 7.

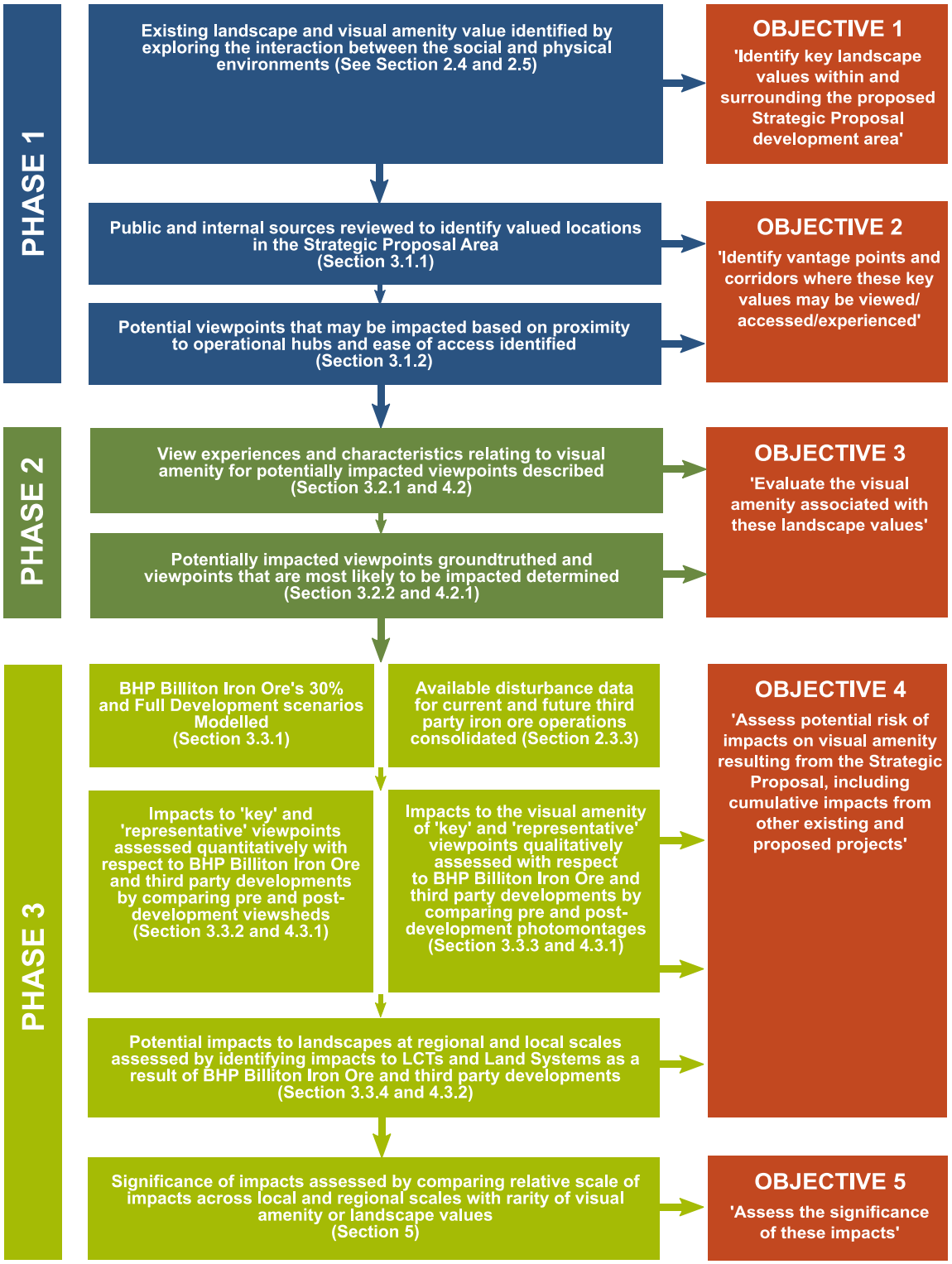


Figure 7. Summary of methods

3.1 Phase 1 – Desktop Assessment

The aim of the desktop assessment was to identify locations that may hold high visual amenity and landscape values which may be impacted by the implementation of future operations developed as part of the Strategic Proposal.

3.1.1 Identifying Valued Locations

The interaction between social and physical environments can often influence perceptions towards visual amenity and landscape values present at particular locations. Known information on the social and physical settings (Sections 2.5 and 2.6) were used to inform the selection of potentially valued locations.

Locations of value within the Strategic Proposal area were identified from several data sources. Due to the sensitivity and early phase of the Strategic Proposal, direct interaction with the public in identifying valued locations was limited. Where possible, locations with public interest were captured based on publically available sources and were placed at a higher priority for surveying. Information sources that were used to identify potentially valued locations include:

- BHP Billiton Iron Ore's internal datasets – contains a list of regionally significant features such as pools, hills, towns, streams, rock-holes and gorges, as well as culturally significant locations;
- Tourist maps – contain locations of recreational and regional interest likely to be accessed by tourists, generally with good levels of accessibility;
- Four wheel drive forum and clubs – contains locations commonly accessed by the local four wheel driving communities with varying levels of accessibility;
- Newman Visitors Centre – several locally valued locations were identified through this source as well as advice on accessibility and popularity; and
- Other sources – these included public websites and social network sites which contain geo-tagged place marks of locations within the Strategic Proposal area. These locations were recorded by various members of the public, including tourists and local residents and have varying levels of accessibility.

BHP Billiton Iron Ore datasets contain a large register of notable locations within the Strategic Proposal area. These were reviewed to identify areas that may hold high visual amenity value. The following sections detail the types of locations targeted as well as their inherent visual amenity values.

3.1.1.1 Water Features

A large number of water features in the form of creeks, rivers, pools and gorges exist in the Pilbara region. In a primarily semi-arid environment, these are an important

attraction for visitors (for example, the gorges, waterholes and creeks in the Karijini National Park area). As these are often located within gorges and areas of the landscape that are relatively recessed and sheltered, it is unlikely that their visual amenity will be directly impacted by the development. However, in many cases, access to these locations requires travel over elevated areas or flat floodplains which may be visually impacted. As the access route will likely be accessed by a larger number of viewers, these were also included as potential target sites. Water sites, in some cases are sites of indigenous cultural significance (Department of Aboriginal Affairs 2013), and as such were given a higher survey priority.

3.1.1.2 Hills and Mountains

Accessible elevated positions within the landscape often have views over large areas of the landscape. Many of these hills and mountains are significant tourist attractions, often with lookouts boasting panoramic views at the summits (e.g. Mt Meharry, Mt Bruce, Mt Robinson and Mt Wildflower). These elevated areas were included as potential target viewpoints.

3.1.1.3 Towns and Homesteads

As towns represent centres of population with high numbers of potential viewers, locations within these were also included as potential target viewpoints.

3.1.1.4 Lookouts

There are several lookouts within the region most often adjacent to major transportation corridors. As these locations are often in elevated positions overlooking visually appealing views, they often experience high visitor traffic and were therefore included as valued locations. Many lookouts are often demarcated with brown tourist signs, which may increase the likelihood of access by visitors.

3.1.1.5 Public Roads

As public roads are the most significant transportation corridor in the region, these locations are likely to receive a large amount of viewer traffic. Valued road locations included layovers, roadhouses and stop overs as well as bridges. Several regionally and nationally significant roads exist within the Strategic Proposal area. Of largest significance (in terms of use) is the Great Northern Highway.

3.1.1.6 Heritage Sites

Common heritage locations within the study area include Aboriginal sites, as well as abandoned mine sites which are often significant tourist destinations, and were therefore included as potential target sites. As Aboriginal heritage sites may involve restrictions on photography or entry, these sites are only discussed in terms of potential impacts and therefore, photographic plates are not included.

3.1.2 Viewpoint Selection

The size of the Strategic Proposal area may result in a large number of valued locations being identified. To filter out locations which are very unlikely to be impacted, it was necessary to consider and evaluate the risk of impact to any given viewpoint at a high level. To do this, the following risk formula was used.

Risk = (consequence or severity of impact) x (likelihood or probability of impact)

This formula can be adapted for use in the context of a visual impact assessment, where the probability of impact can be substituted by the likelihood of a viewpoint being accessed (accessibility).

Risk of Visual Impact = (Potential severity of visual impact) x (Accessibility)

As the potential severity of an impact to visual amenity can be predicted from distance, and accessibility of a viewpoint can be determined based on access routes and proximity to major roads or population centres, viewpoints can be ordered by potential risk. This formed the basis of the viewpoint selection method for the field survey, as presented in Table 3.

Table 3. Risk to viewpoints with high visual amenity value: potential impact versus accessibility

		Increasing likelihood of viewers (accessibility) →		
		Low	Moderate	High
Increasing severity of potential impact ↓	Low	Very Low Significance	Low Significance	Moderate Significance
	Moderate	Low Significance	Moderate Significance	Moderate Significance
	High	Moderate Significance	Moderate Significance	High Significance

Accessibility for a viewpoint was determined based on a combination of the proximity of the site to centres of population, and the ease of access (using distance from a transportation route as a proxy). Potential impact was determined as the distance between the viewpoint and the proposed mining operations. Risk areas are shown in Figure 11.

This method is similar to the Department of Planning and Infrastructure's (DPI; now the Department of Planning [DoP]) criteria for a locations' significance as described in *Visual Landscape Planning in Western Australia* (2007):

- Rarity of a view based on natural beauty and/or cultural significance;

- The background of viewers i.e. tourists or local residents;
- The degree of use i.e. the amount of traffic a view location receives;
- The relative significance of a viewpoint to the area, for instance a viewpoint on a major highway as opposed to a viewpoint located on a remote observation platform; and
- The duration and clarity of a view, for instance a sudden glimpse of the operation area through dense vegetation while travelling along a highway from close proximity, as opposed to a sustained view of the operation area from further away.

Ease of access was determined based on the type of road access available. A viewpoint was given a higher ease of access if it was located within five kilometres of a sealed road, and a lower ease of access if it was in proximity to an unsealed road or track.

3.1.2.1 Proximity to Population Centres

A viewpoint's proximity to population centres (Newman, Paraburdoo and Tom Price) increases the number of potential viewers, making it more likely that a given site may be accessed.

3.1.2.2 Distance from Operations (Potential Severity of Impact)

The potential for impact was determined based on categorisation of the distance of a site from operation areas. Based on the results of the South Flank Landscape and Visual Impact Assessment (GHD/360 Environmental 2013), it was found that viewpoints within five kilometres of the mining operations generally showed high visual impacts, while viewpoints between five and ten kilometres showed moderate impacts. Viewpoints further than 10 km generally constituted low visual impacts. Viewpoints identified for field assessment were therefore scored according to the following criteria:

- High potential impact: Viewpoint < 5 km from mining operations;
- Moderate potential impact: Viewpoint 5 to 10 km from mining operations; and
- Low potential impact: Viewpoint > 10 km from mining operations.

3.1.3 Limitations and Assumptions of the Desktop Analysis

The viewpoint selection process does not consider topography in assisting with determining potential impact. In theory, a cumulative pre-field survey viewshed analysis using all the target sites would identify sites that would not have views of mining operations. However, this method runs the risk of prematurely discounting sites prior to field verification based on a relatively coarse Digital Elevation Model (DEM).

As the viewshed analyses used in this assessment is based on a 30 by 30 m DEM, rapid changes in terrain smaller than this scale (e.g. some gorges) will likely be smoothed over. For instance, a site may be located within a small gorge, with one end of the gorge open and overlooking a mining operation. Whereas a viewshed analysis may indicate that this site will not have views of an operation area as the elevation model used would not capture the topography of the site accurately. Situations like these are usually addressed during the field assessment phase.

The post-field survey viewshed analysis is not subject to these same limitations, as the results of that viewshed analysis are compared with photographs of the actual site in order to ground truth and verify the analysis results.

3.2 Phase 2 – Field Assessment

The field assessment aimed to evaluate visual amenity and landscape values at each viewpoint identified in Phase 1. The assessment consisted of a field survey, in which viewpoints were visited and characterised according to their visual amenity values, their potential for impact as well as their visual absorption capacity (ability to absorb visual impact and remain relatively un-impacted). The results of the survey were also used to identify 'key' or 'representative' viewpoints for further assessment in Phase 3.

3.2.1 Viewpoint Survey Methodology

Characteristics relating to view experience and the visual absorbance capacity of a viewpoint was recorded in tabular format while in the field. Typical definitions for these are listed in Table 4.

Typically, digital photographs taken at a height of approximately 1.65 m were combined to produce a panoramic image with a focal length equivalent to approximately 50 mm (in 35 mm film format) which is acknowledged to be a 'normal' focal length (is similar to what human eyes perceive) (Landscape Institute 2002). This is considerably wider than what the DoP recommends (90 mm) in *Visual Landscape Planning in Western Australia* (WAPC 2007). A wider focal length was intentionally used to adequately capture the wide open space of the region, often considered to be a defining characteristic of the Pilbara. Furthermore the scale and relative proximity of mining operations to each other suggests that a wider field of view was most appropriate.

Table 4. Characteristics Relating to Visual Amenity Recorded on Site

Field Terms	Definition	Notes
Location	Precise coordinates of viewpoint (GDA 1994)	Coordinates obtained during Phase 1 may not be accurate enough to conduct detailed analysis
View Direction	Direction of view (N, S, E, W,	For some locations it may be

Field Terms	Definition	Notes
	NE, SE, NW or SW)	necessary to consider several view directions
Land System	Land Systems associated with the view experience	This was done to identify Landscapes that contributed to visual amenity
Description of View	Description of foreground, midground and background	Notable elements present in the view that contribute to visual amenity may be noted
Vegetation Screening Capability	The capability of vegetation at the viewpoint to screen views of the mining operations	This characteristic relates to the visual absorbance capacity of the view
Site Significance	The values of a site that may affect its visual amenity (e.g. use for recreation or tourism)	This corresponds to the land use of a viewpoint. Some land uses (such as tourism may place additional value of visual amenity)
Visitor Traffic	The level of use a viewpoint experiences	This is usually determined by recording the number of users present during the study as well as evidence of previous use (e.g. well-worn tracks, footprints or other signs of use)
Accessibility	The ease of accessing the site	Indicators of accessibility include well marked road signs, well maintained access routes and proximity to nearby major roads
Overall Impact	The predicted level of impact to the viewpoint from surrounding mining operations (high if substantial areas of surrounding mining operations were visible, moderate if partially visible and low if not very visible)	A site may have high accessibility and use, but a low overall impact if it contains dense screening vegetation or is sheltered from visual impact by landforms

Understanding view experience is an integral part of the development of strategies to manage visual landscape character. In this context, a ‘view experience’ can be termed as how a view or landscape is valued by an individual. This is usually the result of a combination of elements such as landforms (natural and man-made), geology, water features, vegetation and topography producing a relatively positive, neutral or negative view (as presented in Plate 3). View experience was qualitatively assessed at each viewpoint during the site visit, with notes taken on the combination of landforms. Greater variety in landforms, topography and vegetation result in a more interesting view which is more likely to hold the viewers’ attention for longer periods of time. The inclusion of features that are considered ‘rare’ (in this case water bodies, gorges, rock

art or even mountaintop views, due to their limited accessibility) can also increase the value of a view (Landscape Institute 2002).

Plate 3. View experiences from different landform combinations

Different combinations of vegetation, landforms, water features, soils, topography and geology may interact to form different view experiences. The left most view demonstrates a high variety in natural features, including a cliff in the foreground, hills in the background, a water body, different vegetation types as well as soils. Although the middle view does show some variety in vegetation types the terrain is relatively uniform, with stony plains in the foreground and midground, and hills in the background. The rightmost experience on the other hand demonstrates little variation in vegetation type, topography or geology. The leftmost view is of Wanna Munna Pool, a popular tourist destination. The middle view is of a typical stony Pilbara plain, while the rightmost view is of relatively disturbed environment. It is therefore safe to assume that landscapes with varied elements results in higher levels of visual amenity. This was an important consideration during the field survey and to the study as a whole.

3.2.2 Identifying Key and Representative Viewpoints

Key viewpoints are those which have been determined to be most at risk of potential impact based on real world observations during the field survey. These viewpoints are typically high in visual amenity values, but also have good levels of accessibility, receive higher numbers of visitor traffic and may have a high level of overall impact (as determined from the field survey).

The scale of this study warranted that additional sites that have a high level of public or cultural interest (iconic tourist destinations or heritage sites) should also be considered at a high level. To this end, viewpoints were chosen to ‘represent’ locations of high visual amenity values as well as the large variety in landforms. Further assessment of these ‘representative’ sites was aimed at informing the potential for, and the pattern of, typical visual impacts at a high level.

3.3 Phase 3 – Risk of Visual Impact Assessment

Phase 3 of the study aimed to assess the potential risk of impacts on the visual amenity and landscape values of the key and representative viewpoints identified at the end of Phase 2.

This required the 30% Development and Full Development Scenarios to be modelled in three dimensions (3D). The product of the modelling exercise was used in viewshed and photomontage analyses with the aim of determining levels of potential impacts quantitatively and qualitatively respectively.

3.3.1 Three-Dimensional (3D) Mine Layout Modelling

As only two-dimensional generalised footprints for disturbance were available at the time of analysis for this study, some assumptions have been made in order to model these in 3D with a reasonable level of accuracy. The allocation of footprint type (pit, OSA or infrastructure areas) was largely based on the disturbance areas of typical mining operations in the Pilbara, BHP Billiton Iron Ore general mine design assumptions, and the general topography of the landscape. These allocations are purely conceptual in nature and were only undertaken to provide strategic level statistics of potential impact.

For the purposes of assessment, BHP Billiton Iron Ore's standard design specifications were used as a guide for the design of conceptual OSAs (20 m lift height and 17 m berm with a slope angle of 15 degrees after re-profiling; BHP Billiton Iron Ore 2012). Re-profiled geometries were used as this gives an indication of end-of-life condition. Using this geometry also adheres to the worst-case-scenario principle of visual impact assessments, as re-profiling does not typically alter the height and usually results in a wider footprint, useful when estimating potential impacts to landform types and their distributions.

3D mine layouts were not completed for all mining operations. Only operations located in proximity to key viewpoints were modelled. As planning details for some of these operations were not available at the time of the study, a generic mine layout for infrastructure was used and placed within the conceptual infrastructure footprints.

An example of the mine layouts produced is shown in Figure 8 (the westernmost sections of the Munjina-Upper Marillana mining operationsis pictured).

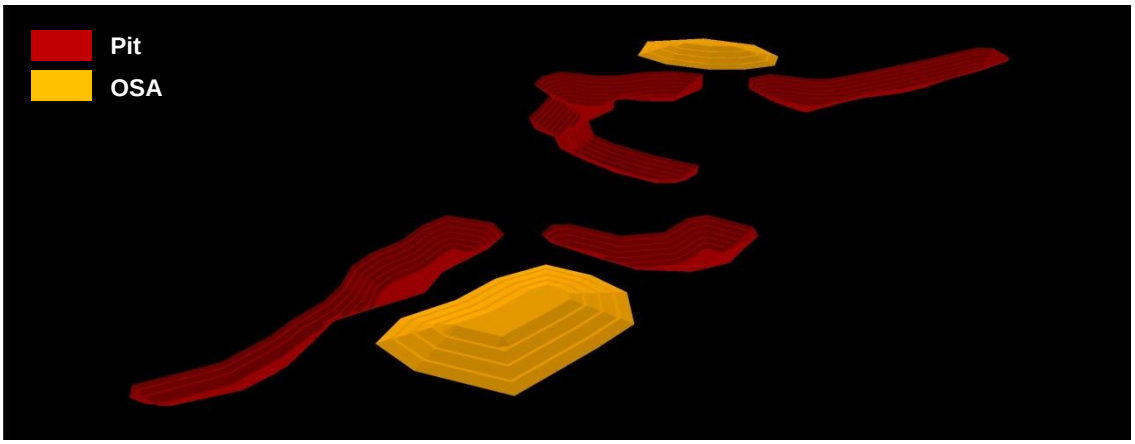


Figure 8. An example of a generalised conceptual 3D site model

The assumptions made (such as OSA position) for conceptual mine footprints when using quantitative assessment methods such as viewshed analyses could reduce the accuracy of the modelled results. In typical scenarios where viewshed analyses are applied, siting and design options are usually well defined. The purpose of this assessment was to visually show the potential 'worst case' impact that the development could have and the relative levels of impact between different receptors. The results from this assessment may be used to guide siting decisions as mining operations are further developed.

3.3.2 Impacts to Amenity - Viewshed Analysis

The key and representative viewpoints identified in Phase 2 were subject to a viewshed analysis, which was done for several important reasons:

- To identify areas of the landscape that will be lost as a result of the development;
- To identify areas of the landscape that will be exposed as a result of the development;
- To identify areas of the development that will be exposed; and
- To quantitatively determine the relative levels of these potential impacts.

The analysis combines pre- and post-development topographies to quantitatively identify changes in the landscape and its potential implication on amenity. To achieve this, two sets of topographies were created, one representing a pre-development setting and the other representing a post-development setting. Only the Full Development Scenario was used in this section, with the aim of understanding the total levels of potential impact over the life of the Strategic Proposal.

The pre-development topography was created from a 30 m by 30 m Digital Elevation Model (DEM) within a 25 km radius of a viewpoint (radius increased to 50 km for the case of elevated viewpoints). The post-development topography was created by

integrating the 3D mine models created at the start of Phase 3 into the pre-development elevation model.

The large size and sprawl of the mine footprints to be modelled limited the accuracy of the post-development topography in several aspects. In particular was the alteration to ridgelines. Limitations in the large scale mine footprint modelling used in the study resulted in some OSAs directly affecting ridgelines.

An example of pre- and post-development topographies are shown in Figure 9 with brown areas representing highest elevation and dark blue the lowest (the westernmost sections of the Munjina/Upper Marillana mining operationis pictured).

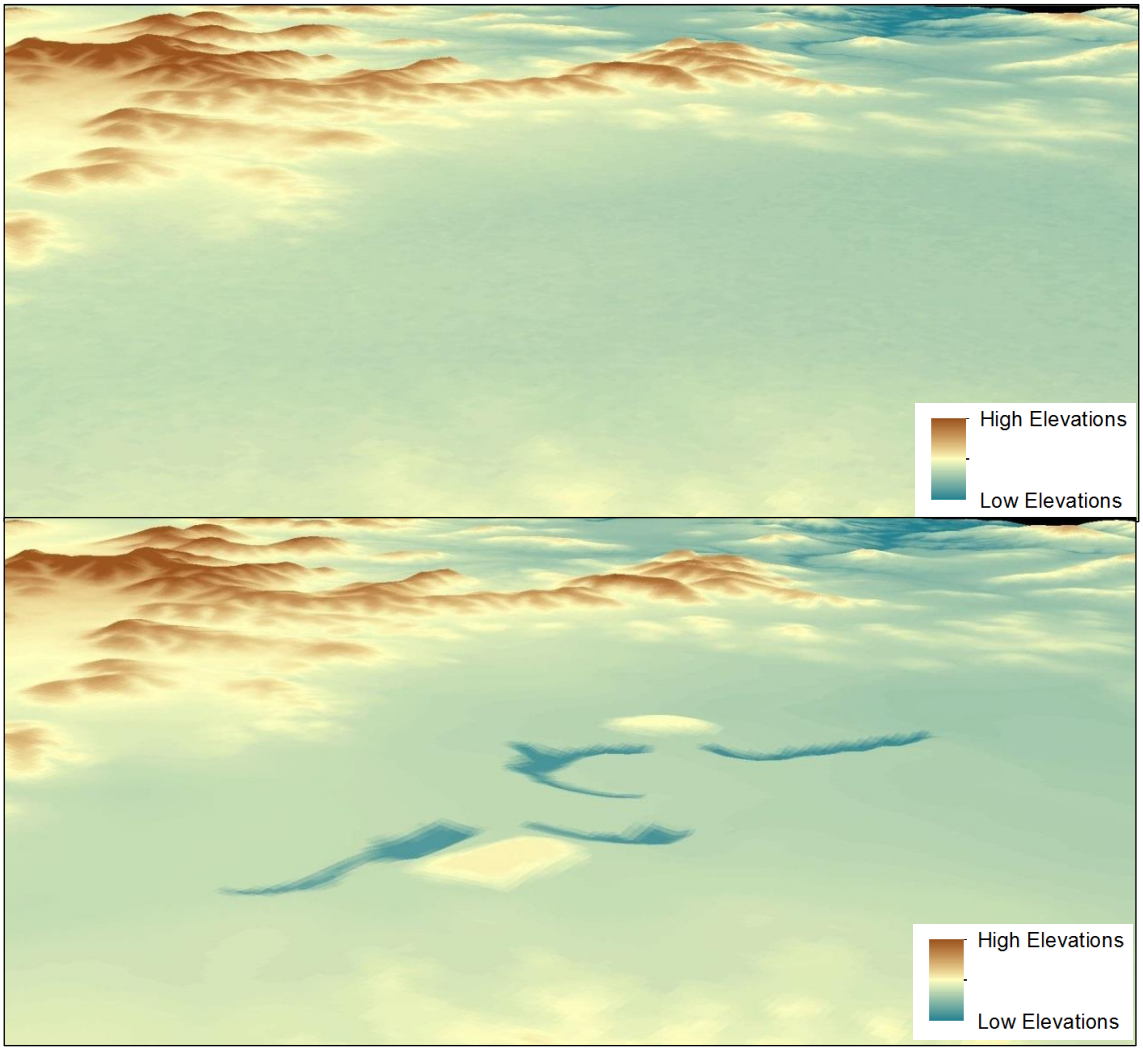


Figure 9. An example of a pre-development and post-development topography

Determining the changes in a viewshed based on the difference between a pre-development and post-development topography enables the quantitative identification of areas of the landscape which will be blocked, exposed or altered.

Several categories were used to describe changes seen in the pre- and post-development viewsheds. These were:

- **Always Visible**: areas of the landscape that are unchanged directly from development and still either represent natural landscapes or an existing man made landform;
- **Always Not Visible**: areas of the landscape that are unchanged directly from development and remain outside the viewshed; and
- **Altered Views**: Areas of the landscape that may experience an altered view. These include:
    - Views of natural landscape blocked out by a development;
    - Views of potential pit areas;
    - Views of potential OSA areas; and
    - Views of natural landscape that may be exposed by a development.

Percentages of the viewshed that make up the Altered View category are presented as a conceptual statistic.

Figure 10 illustrates this using an example (western Munjina/Upper Marillana) from an oblique view. Here, a hypothetical viewpoint is used to better illustrate the potential changes to a viewshed.

As seen in Figure 10, areas of the landscape located on the leeward side of an OSA will be identified as being blocked, whereas areas on the forward side as a created OSA view. Created pit views are relatively rare and only occur when the viewpoint is located on a lower elevation (such as within a valley) or on a higher elevation (on a ridgeline). The grainy nature of the viewshed is reflective of the resolution and nature of the topography used.

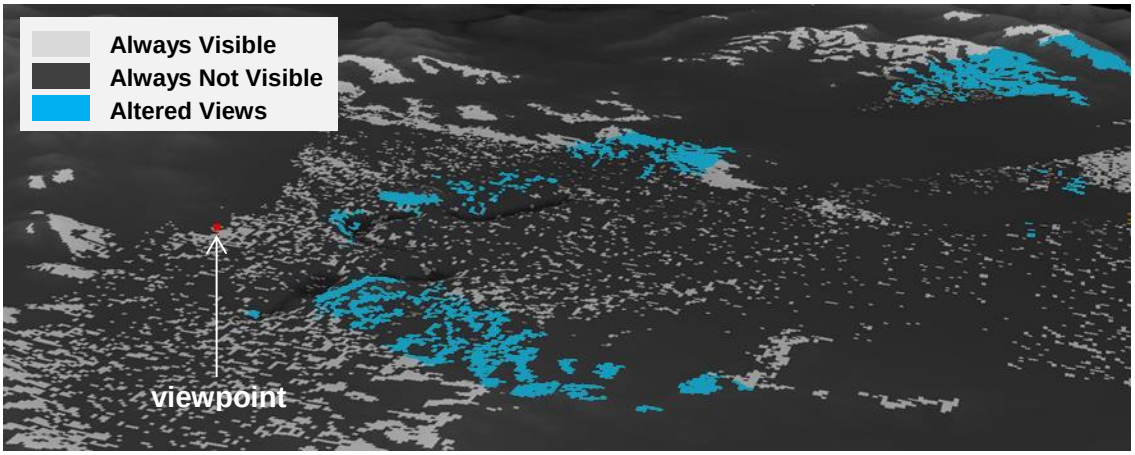


Figure 10. An example of the resultant viewshed created from pre and post development scenarios

3.3.3 Impacts to Amenity - Photomontage Analysis

Photomontage analyses were also completed for all key and representative viewpoints, with the aim of understanding impacts to amenity associated with these viewpoints. Although the assessment of overall impact conducted in the field is based on the relative area of a mining operation that is visible, the photomontage analysis attempts to simulate the levels of potential impact on visual amenity by using a 3D mine layout.

The developed 3D mine layouts were positioned within a virtual software environment (ESRI's ArcScene) to emulate the aspect and view of the key viewpoint photographs obtained at the site. Once an accurate representation of the terrain and development is obtained, a 2D snapshot of the model is then blended into the digital photograph and rendered.

This process accounts for vegetation screening as well as potential coloration and texture of site elements. The potential effects of dust have not been simulated in the photomontages as it is the subject of a separate assessment (Pacific Environment Limited 2014).

Two photomontage scenarios were completed for each key viewpoint, these were:

- Schematic (exaggerated colours) scenario; and
- Realistic (post-development) scenario.

The schematic montage identifies areas that will be developed in the 30% and in the Full Development scenarios. The realist photomontage however, only renders either the 30% or the Full Development Scenario. This was undertaken on the basis that as a photomontage represents a visual depiction of impacts to visual amenity at one point of time; it is unrealistic to depict both a 30% Development and Full Development operation simultaneously. Where a view will be altered by both the 30% Development and Full Development Scenarios, the realistic montage depicts the 30% Development Scenario, as this is considered to be a more true to life approximation of potential impact. Where a view is only altered by a Full Development Scenario, the realistic photomontage then depicts the Full Development Scenario.

This is illustrated in the two photomontages shown in Plate 4.

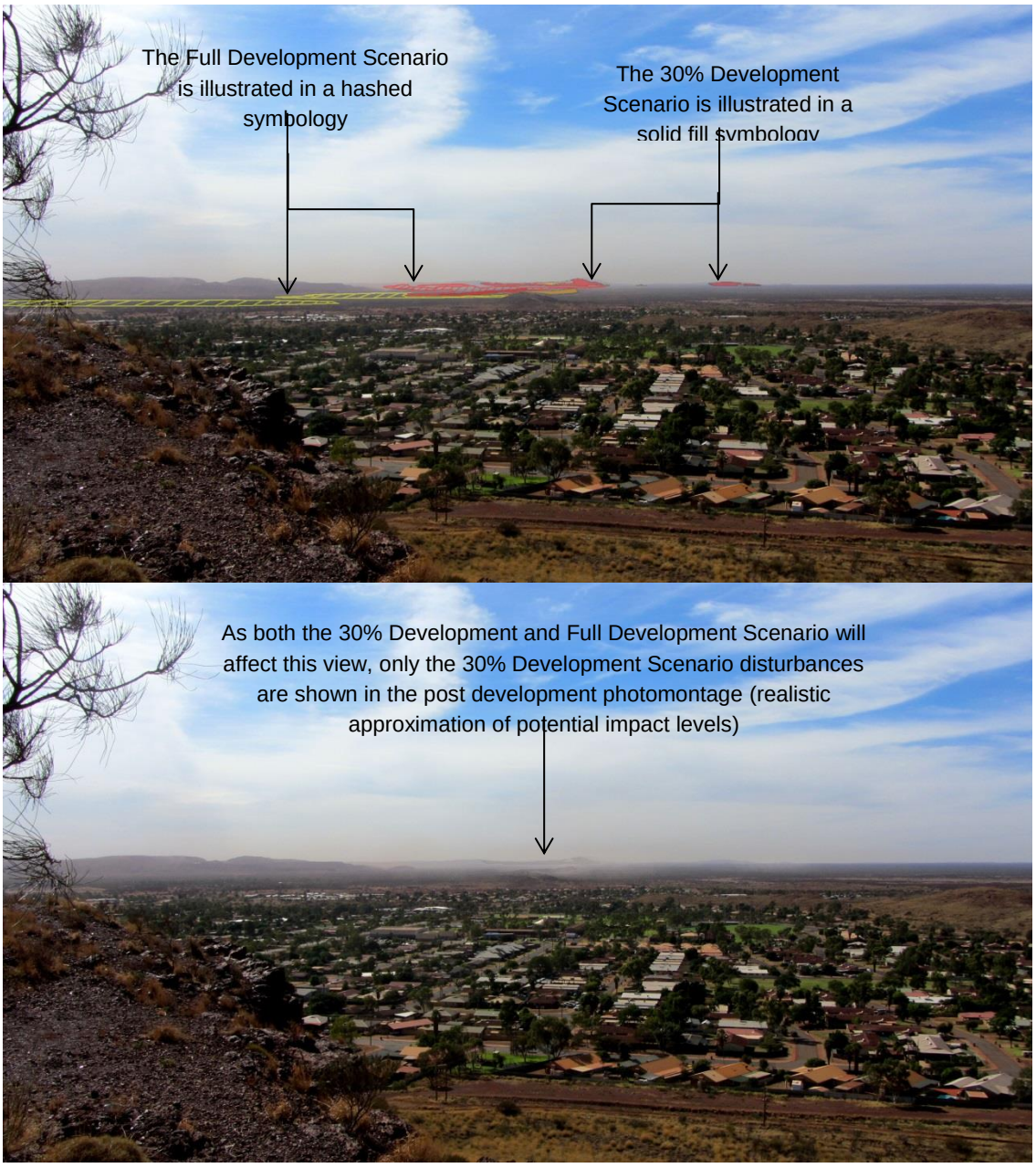


Plate 4. Schematic and post development photomontages

3.3.4 Landscape Impacts

Impacts to landscapes were assessed by combining the development extents of BHP Billiton Iron Ore's Strategic Proposal along with that of (known) current and proposed third party developments. As physical elements of a landscape and their corresponding levels of visual amenity are related, it is possible to infer potential impacts to amenity at a later stage.

To provide a quantitative estimate of potential impact, the percentage of a landscapes/landform's pre-European extent that may be impacted was determined and compared to the existing extents. Existing extents were determined by combining existing disturbance data from BHP Billiton Iron Ore, third parties and the Department of Agriculture and Food's Native Vegetation extents data. To cover the various levels of landscape mapping available, the assessment was carried out at two scales. A regional scale based on LCT mapping and a local scale, based on Land System mapping was used.

3.3.4.1 Regional Scale

The primary approach to assessing cumulative landscape impacts at a regional scale was to assess impacts to LCTs. This was done to define the potential levels of impact on various broad landscape types that fall within the Strategic Proposal area. LCT mapping is considered to be complete, and as such the individual contribution of BHP Billiton Iron Ore and third party developments can precisely be determined (subject to the limitations and assumptions of the disturbance data and scenarios used).

3.3.4.2 Local Scale

Impacts at local scales were assessed in relation to Land Systems. As Land Systems are a physical representation of landscapes, this was done to gain not only an understanding of the spatial impacts but also the potential impacts on amenity (due to the relationship between visual elements associated with particular Land Systems and their relative levels of visual amenity).

An important limitation to this method is the availability of Land System mapping. The data that was used is interpolated from the work of Van Vreeswyk et al. (2004), and is therefore restricted to the survey area covered in the study. The survey area of the study is large however and does cover all BHP Billiton Iron Ore and third party developments that are being considered, and was therefore used as an indicator of landscapes.

4 Results

4.1 Phase 1 – Desktop Assessment

A total of approximately 300 valued locations were originally identified within the Strategic Proposal area. This number was narrowed down to 82 potentially significant viewpoints.

4.2 Phase 2 – Field Assessment

The field survey was conducted between 7 and 17 May 2013. GPS waypoints, field notes and digital photographs were taken at each viewpoint. The digital photographs were later used in the photomontage analysis.

In total, 78 of the 82 viewpoints identified in the desktop assessment were visited and surveyed during the field assessment. Four could not be reached in the field, largely due to dangerous track conditions or the site not being successfully located. One site, the Punda rock art and spring site (identified in the desktop study) was excluded from the detailed analysis by request of the Traditional Owners, however is included in broad descriptions of potential impacts.

Fourteen additional sites were surveyed opportunistically, largely identified from discussion with tourist information centres in Newman and Tom Price, as well as BHP Billiton Iron Ore staff. These opportunistic sites were usually sites that were popular with the local community but not necessarily well known to the greater public.

Locations, photographs and characteristics of the 92 sites visited during the field survey are presented in Figure 11 and Appendix B.

4.2.1 Key and Representative Viewpoints

A total of 17 key sites were found to constitute a high risk of visual impact based on the field assessment findings (Table 5). As expected, based on the significance criteria set out in Section 3.1.2 as well as the findings during the field assessment, eight high risk sites (sites with high accessibility and potential impact) were located along the Great Northern Highway in the Central Pilbara Operational Zone.

Table 5. Further analysis selection criteria site summary

		Potential Severity of Impact		
		Low	Moderate	High
Accessibility	Low	4 Sites	3 Sites	16 Sites
	Moderate	4 Sites	4 Sites	13 Sites
	High	16 Sites	14 Sites	17 Sites

As the 17 'key' sites typically account for a limited range of landforms and locations, five additional 'representative' sites were chosen for the detailed analysis. 'Key' sites are denoted by the prefix 'K' in Table 6. The majority of the 'representative' sites are moderately significant, but were included as they are considered to have high levels of public interest. These sites are listed in Table 6, in addition to the key sites, and have been given the prefix 'R'.

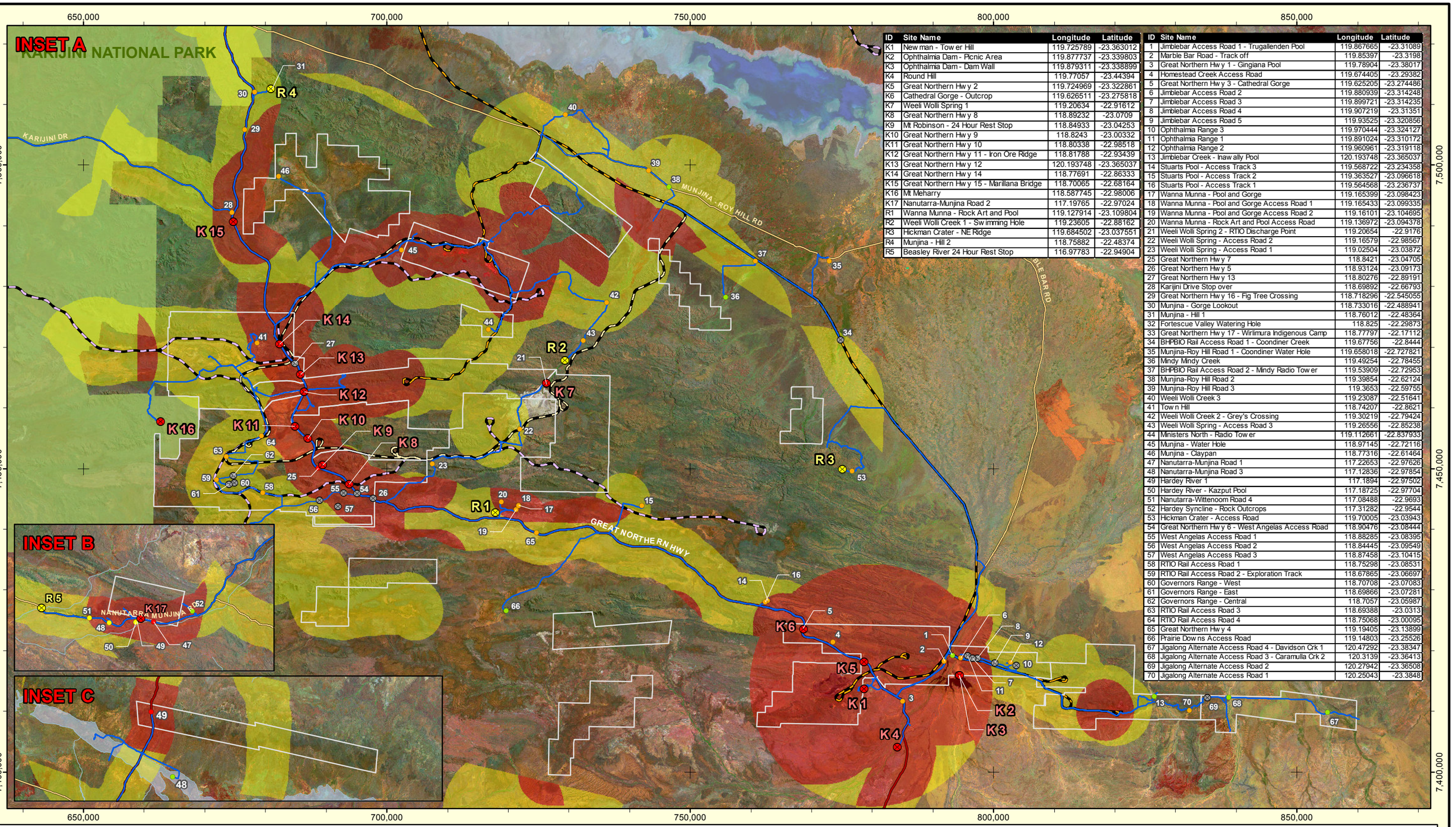
Table 6. Key and representative viewpoint sites identified

No	Site Name	Site Type	Relevant Mining operations	Operational Zone
K1	Tower Hill, Newman	Lookout	Newman	Eastern
K2	Ophthalmia Dam Picnic Area	Recreation Area	Newman/Jimblebar	Eastern
K3	Ophthalmia Dam Wall	Lookout/Recreation	Newman/Jimblebar	Eastern
K4	Round Hill, Newman	Recreation/Heritage	Newman/Jimblebar	Eastern
K5	Great Northern Hwy 2	Transport	Newman	Eastern
K6	Cathedral Gorge Rock Outcrop	Transport	Newman	Eastern
K7	Weeli Wolli Spring	Recreation/Heritage	Jinidi/MAC	Central
K8	Great Northern Hwy 7 – Rail Line Crossing	Transport	Gurinbiddy, Mudlark, South Flank	Central
K9	Mt Robinson 24 Hr Rest Stop	Recreation/Transport	Gurinbiddy, Mudlark, South Flank	Central
K10	Great Northern Hwy 9	Transport	South Flank, Mudlark	Central
K11	Great Northern Hwy 10	Transport	South Flank, Mudlark	Central
K12	Great Northern Hwy 11	Transport	South Flank, MAC, Mudlark	Central
K13	Great Northern Hwy 12	Transport	MAC, Tandanya	Central
K14	Great Northern Hwy 14	Transport	Tandanya	Central
K15	Great Northern Hwy 15	Transport/Lookout	Upper Marillana/Munjina	Northern
K16	Mt Meharry	Recreation	Mudlark, Tandanya, MAC, South Flank	Central

No	Site Name	Site Type	Relevant Mining operations	Operational Zone
K17	Nanutarra-Munjina Road 2	Transport	Rocklea	Western
R1	Wanna Munna Pool	Heritage	Jinidi	Central
R2	Weeli Wolli Creek Swimming Hole	Recreation	MAC/Jinidi	Northern
R3	Hickman Crater	Recreation	Coondiner	Northern
R4	Munjina Hill	Recreation	Upper Marillana/Munjina	Northern
R5	Beasley River 24 Hour Rest Stop	Recreation/Transport	Rocklea	Western

Descriptions of these sites are provided in Appendix A.

Some existing developments were observed in the field to be causing visual impacts. Where significant, annotations are presented in Figures 13 to 34.



ID	Site Name	Longitude	Latitude
K1	New man - Tow er Hill	119.725789	-23.363012
K2	Ophthalmia Dam - Picnic Area	119.877737	-23.339803
K3	Ophthalmia Dam - Dam Wall	119.879311	-23.338899
K4	Round Hill	119.77057	-23.44394
K5	Great Northern Hw y 2	119.724969	-23.322861
K6	Cathedral Gorge - Outcrop	119.626511	-23.275818
K7	Weeli Wolli Spring 1	119.20634	-22.91612
K8	Great Northern Hw y 8	118.89232	-23.0709
K9	Mt Robinson - 24 Hour Rest Stop	118.84933	-23.04253
K10	Great Northern Hw y 9	118.8243	-23.00332
K11	Great Northern Hw y 10	118.80338	-22.98518
K12	Great Northern Hw y 11 - Iron Ore Ridge	118.81788	-22.93439
K13	Great Northern Hw y 12	120.193748	-23.365037
K14	Great Northern Hw y 14	118.77691	-22.86333
K15	Great Northern Hw y 15 - Marillana Bridge	118.70065	-22.68164
K16	Mt Meharry	118.587745	-22.98006
K17	Nanutarra-Munjina Road 2	117.19765	-22.97024
R1	Wanna Munna - Rock Art and Pool	119.127914	-23.109804
R2	Weeli Wolli Creek 1 - Sw imming Hole	119.23605	-22.88162
R3	Hickman Crater - NE Ridge	119.684502	-23.037551
R4	Munjina - Hill 2	118.75882	-22.48374
R5	Beasley River 24 Hour Rest Stop	116.97783	-22.94904

ID	Site Name	Longitude	Latitude
1	Jimblebar Access Road 1 - Trugallenden Pool	119.867665	-23.31089
2	Marble Bar Road - Track off	119.85397	-23.3198
3	Great Northern Hw y 1 - Gingiana Pool	119.78904	-23.38017
4	Homestead Creek Access Road	119.674405	-23.29382
5	Great Northern Hw y 3 - Cathedral Gorge	119.625205	-23.274486
6	Jimblebar Access Road 2	119.880939	-23.314248
7	Jimblebar Access Road 3	119.899721	-23.314235
8	Jimblebar Access Road 4	119.907219	-23.31351
9	Jimblebar Access Road 5	119.93525	-23.320856
10	Ophthalmia Range 3	119.970444	-23.324127
11	Ophthalmia Range 1	119.891024	-23.310172
12	Ophthalmia Range 2	119.960961	-23.319118
13	Jimblebar Creek - Inaw ally Pool	120.193748	-23.365037
14	Stuarts Pool - Access Track 3	119.568722	-23.234358
15	Stuarts Pool - Access Track 2	119.363527	-23.096618
16	Stuarts Pool - Access Track 1	119.564568	-23.236737
17	Wanna Munna - Pool and Gorge	119.165399	-23.098423
18	Wanna Munna - Pool and Gorge Access Road 1	119.165433	-23.099335
19	Wanna Munna - Pool and Gorge Access Road 2	119.16101	-23.104695
20	Wanna Munna - Rock Art and Pool Access Road	119.136972	-23.094378
21	Weeli Wolli Spring 2 - RTIO Discharge Point	119.20654	-22.9176
22	Weeli Wolli Spring - Access Road 2	119.16579	-22.98567
23	Weeli Wolli Spring - Access Road 1	119.02504	-23.03872
25	Great Northern Hw y 7	118.8421	-23.04705
26	Great Northern Hw y 5	118.93124	-23.09173
27	Great Northern Hw y 13	118.80276	-22.89191
28	Karijini Drive Stop over	118.69892	-22.66793
29	Great Northern Hw y 16 - Fig Tree Crossing	118.718296	-22.545055
30	Munjina - Gorge Lookout	118.733016	-22.488941
31	Munjina - Hill 1	118.76012	-22.48364
32	Fortescue Valley Watering Hole	118.825	-22.29873
33	Great Northern Hw y 17 - Wirlimura Indigenous Camp	118.77797	-22.17112
34	BHPBIO Rail Access Road 1 - Coondiner Creek	119.67756	-22.8444
35	Munjina-Roy Hill Road 1 - Coondiner Water Hole	119.658018	-22.727821
36	Mindy Mindy Creek	119.49254	-22.78455
37	BHPBIO Rail Access Road 2 - Mindy Radio Tow er	119.53909	-22.72953
38	Munjina-Roy Hill Road 2	119.39854	-22.62124
39	Munjina-Roy Hill Road 3	119.3653	-22.59755
40	Weeli Wolli Creek 3	119.23087	-22.51641
41	Tow n Hill	118.74207	-22.8621
42	Weeli Wolli Creek 2 - Grey's Crossing	119.30219	-22.79424
43	Weeli Wolli Spring - Access Road 3	119.26556	-22.85238
44	Ministers North - Radio Tow er	119.112661	-22.837933
45	Munjina - Water Hole	118.97145	-22.72116
46	Munjina - Claypan	118.77316	-22.61464
47	Nanutarra-Munjina Road 1	117.22653	-22.97626
48	Nanutarra-Munjina Road 3	117.12836	-22.97854
49	Hardey River 1	117.1894	-22.97502
50	Hardey River - Kazput Pool	117.18725	-22.97704
51	Nanutarra-Wittenoom Road 4	117.08488	-22.9693
52	Hardey Syncline - Rock Outcrops	117.31282	-22.9544
53	Hickman Crater - Access Road	119.70005	-23.03943
54	Great Northern Hw y 6 - West Angelas Access Road	118.90476	-23.08444
55	West Angelas Access Road 1	118.88285	-23.08395
56	West Angelas Access Road 2	118.84445	-23.09549
57	West Angelas Access Road 3	118.87458	-23.10415
58	RTIO Rail Access Road 1	118.75298	-23.08531
59	RTIO Rail Access Road 2 - Exploration Track	118.67865	-23.06697
60	Governors Range - West	118.70708	-23.07083
61	Governors Range - East	118.69866	-23.07281
62	Governors Range - Central	118.7057	-23.05987
63	RTIO Rail Access Road 3	118.69388	-23.0313
64	RTIO Rail Access Road 4	118.75068	-23.00095
65	Great Northern Hw y 4	119.19405	-23.13899
66	Prairie Dow ns Access Road	119.14803	-23.25526
67	Jigalong Alternate Access Road 4 - Davidson Crk 1	120.47292	-23.38347
68	Jigalong Alternate Access Road 3 - Caramulla Crk 2	120.3139	-23.36413
69	Jigalong Alternate Access Road 2	120.27942	-23.36508
70	Jigalong Alternate Access Road 1	120.25043	-23.3848

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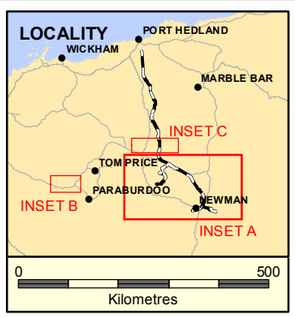
STRATEGIC PROPOSAL
LANDSCAPE AND VISUAL IMPACT RISK ASSESSMENT (LVRA)
Survey Effort

N
0 5 10 20 30 40
Kilometres
Datum: GDA 1994, Projection: GDA

Scale @ A3: 1:600,000	Prepared: J.N.Rao	Project No: RES048 Rev D
Date: 16/08/2015	Checked: F. Jones	Figure: 11
	Reviewed: S. Hashim	



LEGEND

- BHP Billiton Iron Ore Mining Operation Tenure
- Survey Route
- Third Party Existing Rail Corridor
- BHP Billiton Iron Ore Existing Rail Corridor
- BHP Billiton Iron Ore Conceptual Rail Corridor

Roads
- Great Northern Highway
- Other Roads

- 'Lost' Sites

Key and Representative Sites
- Key
- Representative

Surveyed Sites (92)
- High Potential Impact
- Moderate Potential Impact
- Low Potential Impact

Risk Areas (potential impact x accessibility)
- High - Moderate
- Low

DISCLAIMER
The content of this map is conceptual only, of a general nature and does not purport to contain all information relevant to future project development associated with the Project. This map has been prepared solely for the purposes of informing environmental impact assessment pursuant to the *Environmental Protection Act 1986* (WA) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and is not intended for use for any other purpose. No representation or warranty is given that project development associated with any or all of the disturbance indicated on this map will actually proceed. As project development is dependent upon future events, the outcome of which is uncertain and cannot be assured, actual development may vary materially from this conceptual map.

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For greater certainty regarding the currency, location or status of any heritage information depicted on this map or before making any decision that may impact a heritage site, Land Access should be consulted.

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Mining Tenements
The tenement layer on this map consists of many tenements (both granted and pending applications) that overlap in time and space, with complex relati onships, but the depiction on the map is as if tenements form a simple 2D layer. Hence care should be taken in interpreting the colour-coded tenements and, where necessary, further details should be obtained from Department of Minerals and Petroleum's onli ne database - TENGRAPH.

K:\Projects\4.0 RES\RES048\\Figures\SP VIA\Report Figures\August 2015

4.3 Phase 3 – Risk of Visual Impact Assessment

4.3.1 Viewshed & Photomontage Analysis

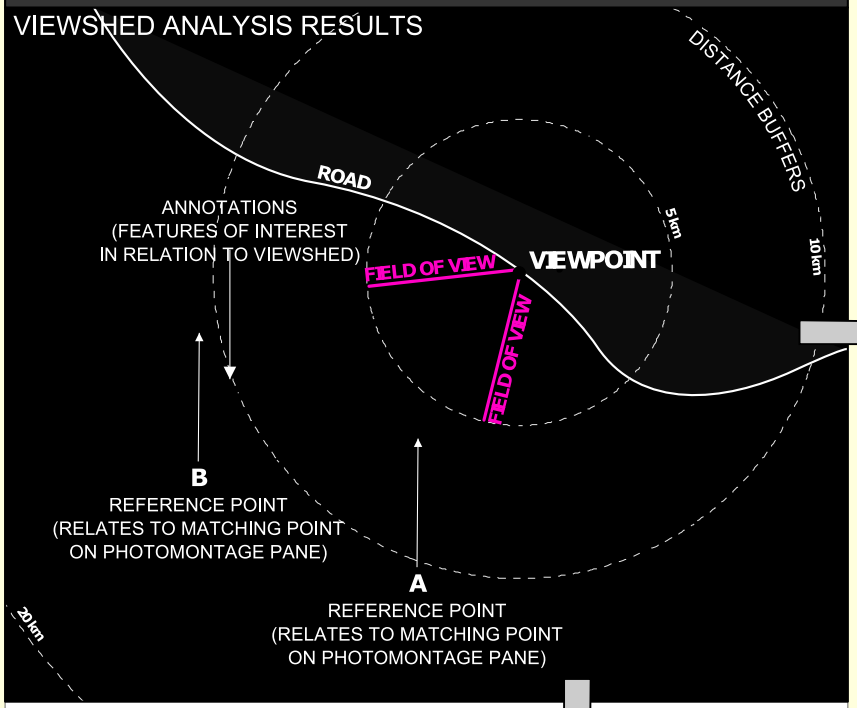
The main outputs of the LVRA are presented in Figures 13 to 34. A guide to interpreting the analysis results is illustrated in Figure 12. The main outputs of the LVRA were generated from a combination of three dimensional mine and terrain modelling coupled with a viewshed and photomontage analysis.

A plate for each key and representative site has been created to illustrate and consolidate essential information with respect to potential visual impacts. Information such as site characteristics and statistics on potential direct impacts based on the viewshed statistics are shown along with annotated plates depicting schematic and photorealistic (post-development) montages.

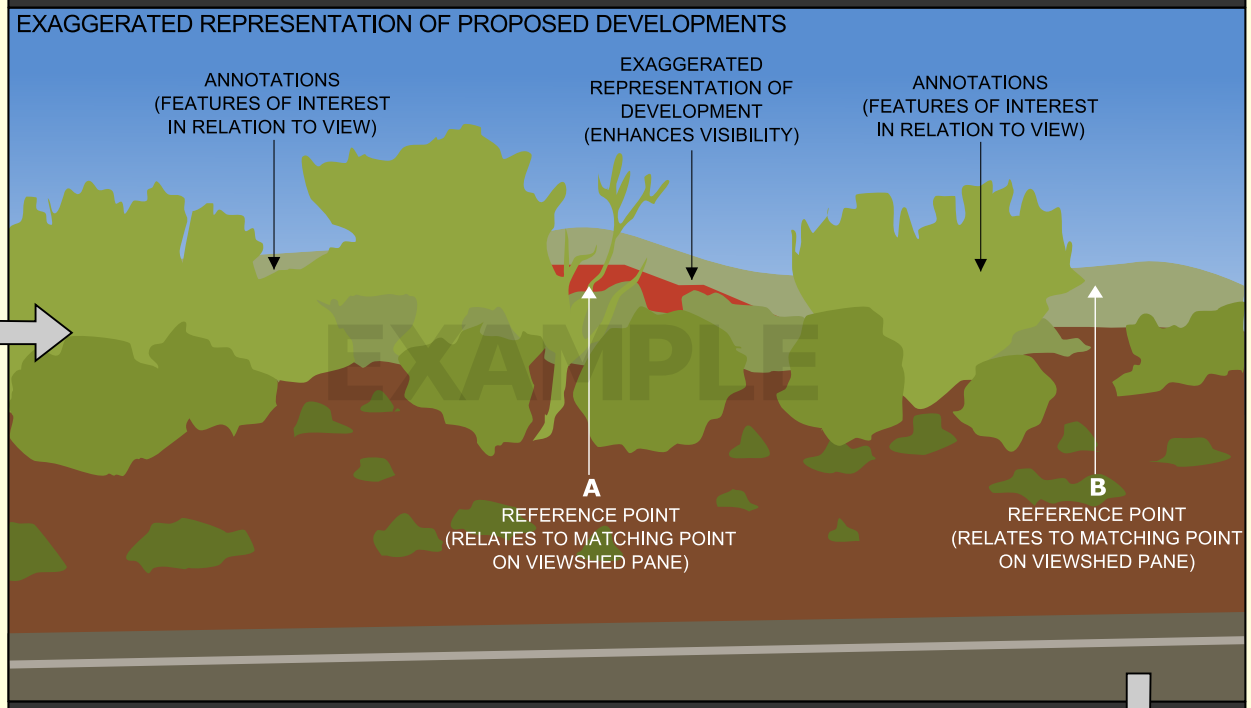
In order to provide photomontages that are most accurate, developments that are proposed at the 30% Development scenario are photo realistically rendered. These are also presented in the schematic montages in the form of a solid fill (red, orange or blue). Disturbance areas in the Full Development Scenario are shown with a hashed symbology on the schematic montages, but not in the realistic (unless potential disturbance from the 30% Development Scenario is proposed at a site).

Conceptual viewshed statistics on the level of direct impact derived from the viewshed analysis based on the viewshed analysis are summarised in Table 7 for all key and representative sites. These statistics were developed based on the Full Development Scenario (see Section 3.3.2).

VIEWSHED



SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

VIEWSHED ANALYSIS LEGEND

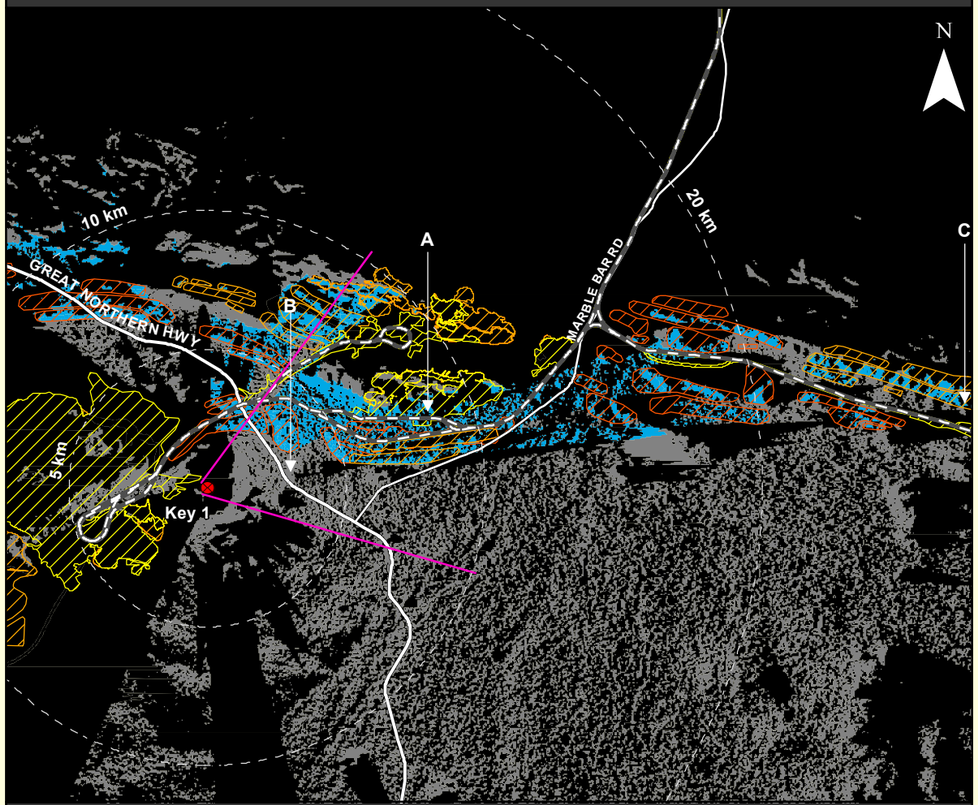
LEGEND

VIEWPOINT CHARACTERISTICS	
Site No & Name	**Viewpoint name and ID.**
Location (GDA94)	Site coordinates.
View Direction	General direction of view.
Land System	Major land systems visible in view. Generally in order of foreground to background.
Description of View	Description of view, inlcluding noteable features, relationship of the view to the proposed development and general notes on view experiences.
Vegetation Screening Capability	The ability of existing vegetation to effectively screen the proposed development. Categorised into high, moderate, low or negligible.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	Change in post-development viewshed based on its difference to pre-development viewsheds. Detailed explanation of categories are listed in Section 3.3.2.	Site Significance	Importance to various sectors (e.g. tourism).
% Pit views created		Visitor Traffic	High, moderate or low.
% OSA views created		Accessibility	High, moderate or low.
% Natural Landscape views created		Overal Impact	High, moderate, low or negligible

Figure 12 - Guide to Interpreting Analysis Results

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K1 Tower Hill, Newman**
Location (GDA94)	119.725789, -23.363012
View Direction	NE
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
Description of View	Panoramic views of the surroundings, including the Orebody 25 operation (A) and the distant Ophthalmia Range, the site of various mining operations in the future.
Vegetation Screening Capability	Low - Negligible: the viewpoint is located on a hill, placing it above most stands of vegetation.

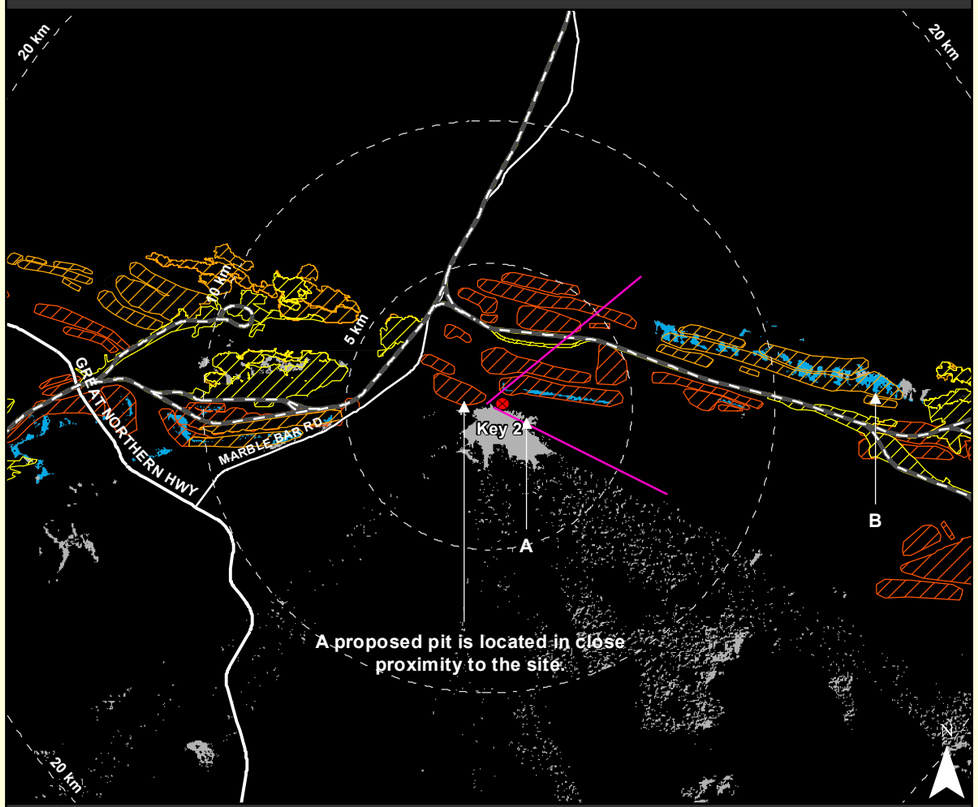
CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	6.38%	**Site Significance**	Recreation
% Pit views created	1.92%	**Visitor Traffic**	High
% OSA views created	1.63%	**Accessibility**	High
% Natural Landscape views created	0.21%	**Overal Impact**	**High**

SCHEMATIC PHOTOMONTAGE

POST-DEVELOPMENT PHOTOMONTAGE

Figure 13 - K1 Tower Hill, Newman

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always not Visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K2 Ophthalmia Dam Picnic Area**
Location (GDA94)	119.877737, -23.339803
View Direction	E
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **McKay** - Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.
Description of View	The site is located along the northwestern banks of Ophthalmia Dam and is used as a picnic area. The site features, toilet and picnic facilities.
Vegetation Screening Capability	Moderate; vegetation in certain areas are capable of acting as effective screens.

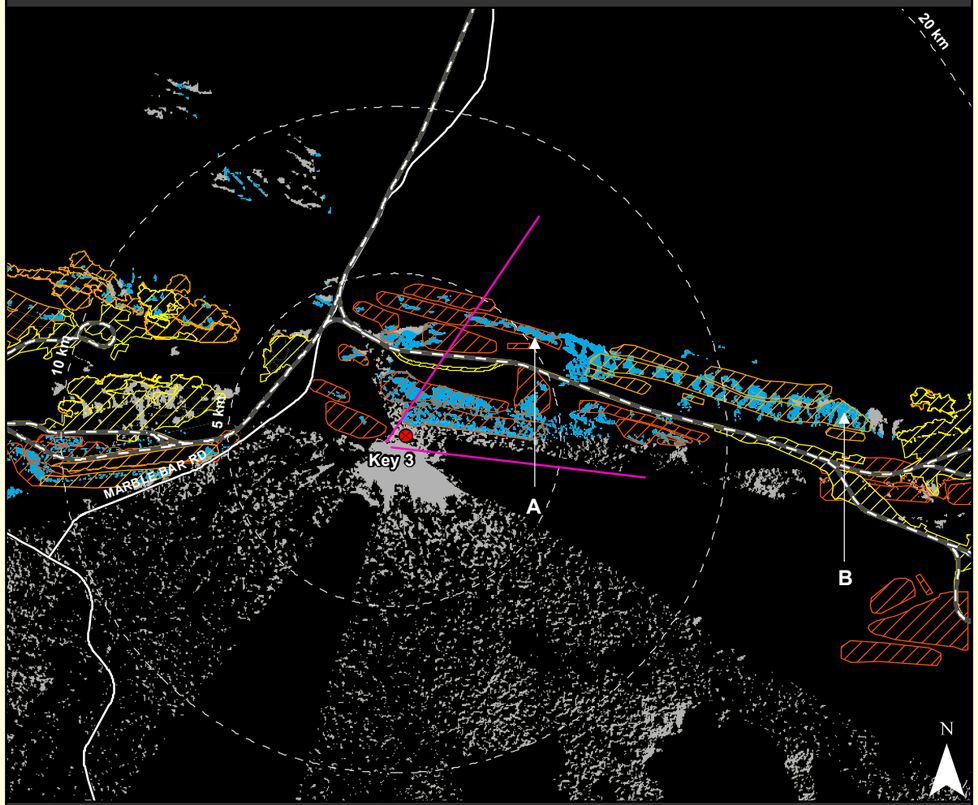
CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	9.79%	**Site Significance**	Recreation
% Pit views created	0.47%	**Visitor Traffic**	High
% OSA views created	5.22%	**Accessibility**	High
% Natural Landscape views created	0.13%	**Overal Impact**	**High**

SCHEMATIC PHOTOMONTAGE

POST-DEVELOPMENT PHOTOMONTAGE

Figure 14 - K2 Ophthalmia Dam Picnic Area

VIEWSHED



LEGEND

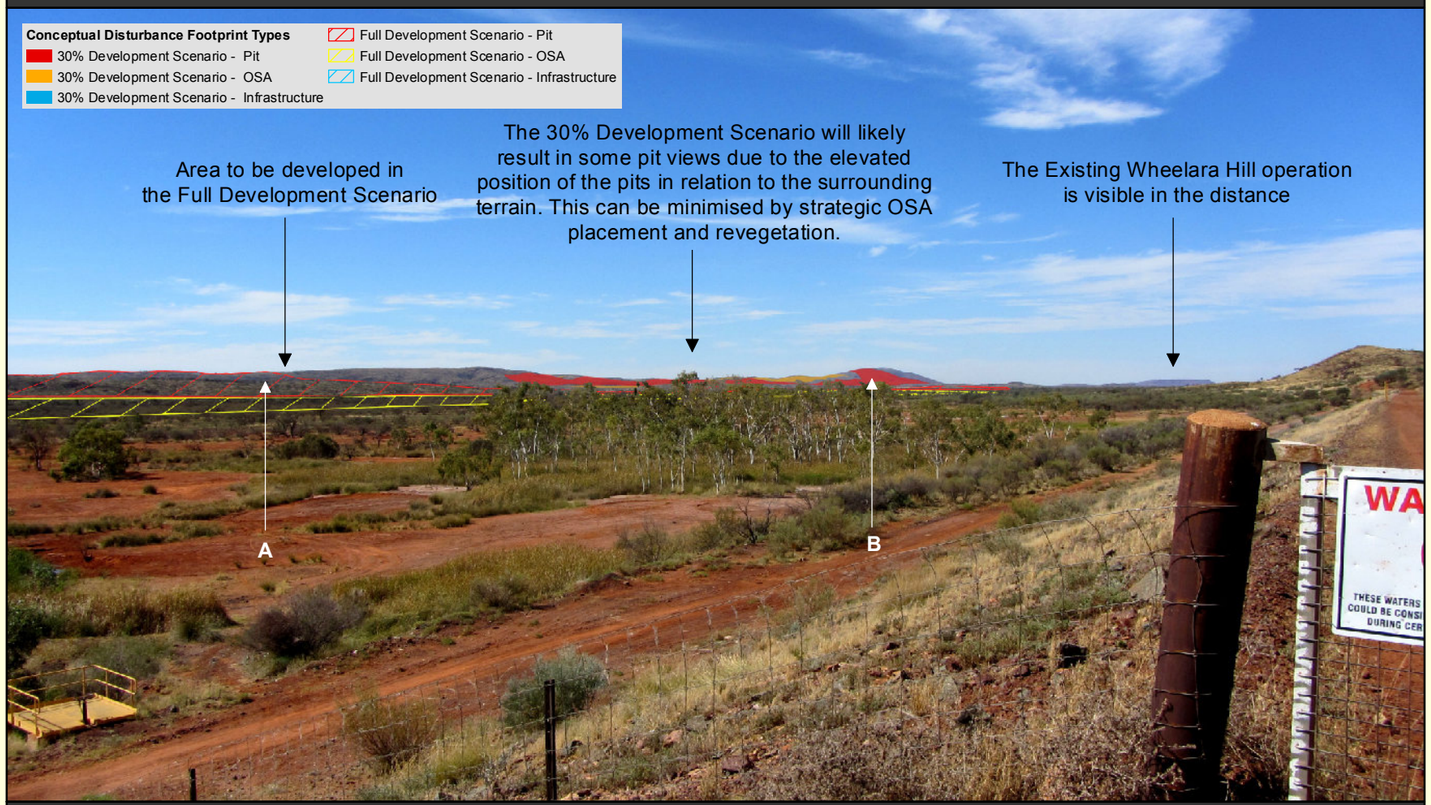
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K3 Ophthalmia Dam Wall**
Location (GDA94)	119.879066, -23.339684
View Direction	NE
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **McKay -** Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.
Description of View	A lookout point close to the popular picnic spot at Ophthalmia Dam. Panoramic views over the Fortescue valley floodplain and the Ophthalmia Ranges are characteristic of this site.
Vegetation Screening Capability	Moderate - Low: Being a floodplain, large stands of tall eucalypts exist however as the site is raised itself, vegetation screening ability is minimal.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	15.00%	**Site Significance**	Major Transport Route
% Pit views created	2.20%	**Visitor Traffic**	High
% OSA views created	6.34%	**Accessibility**	High
% Natural Landscape views created	1.47%	**Overal Impact**	**Moderate**

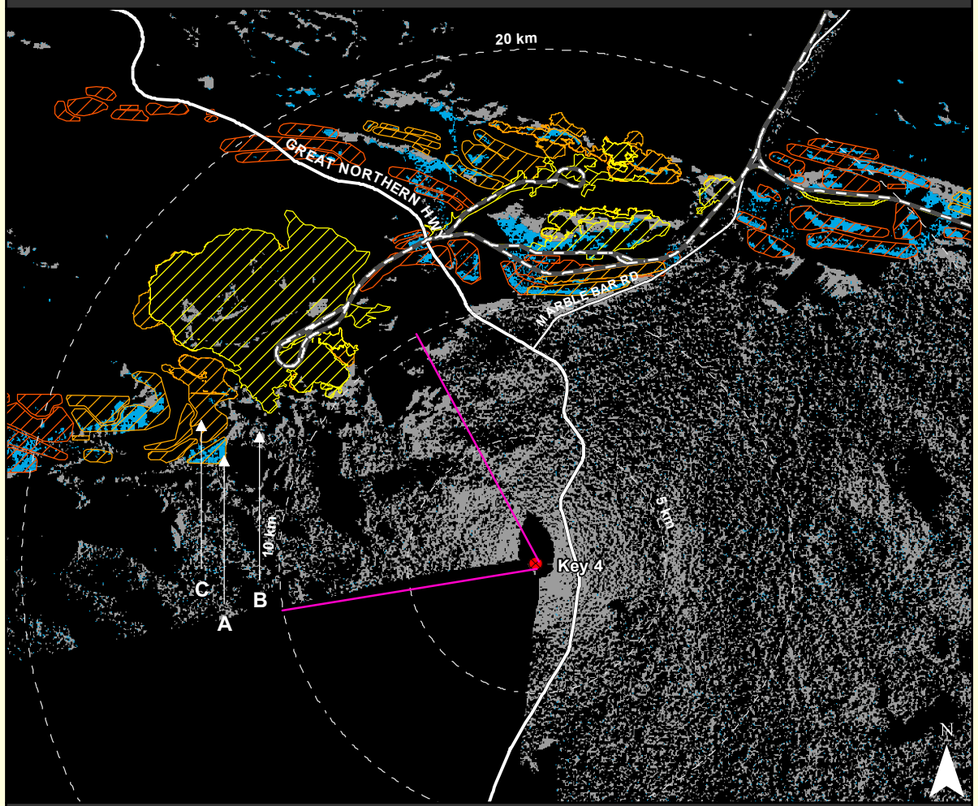
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 15 - K3 Ophthalmia Dam Wall

VIEWSHED



LEGEND

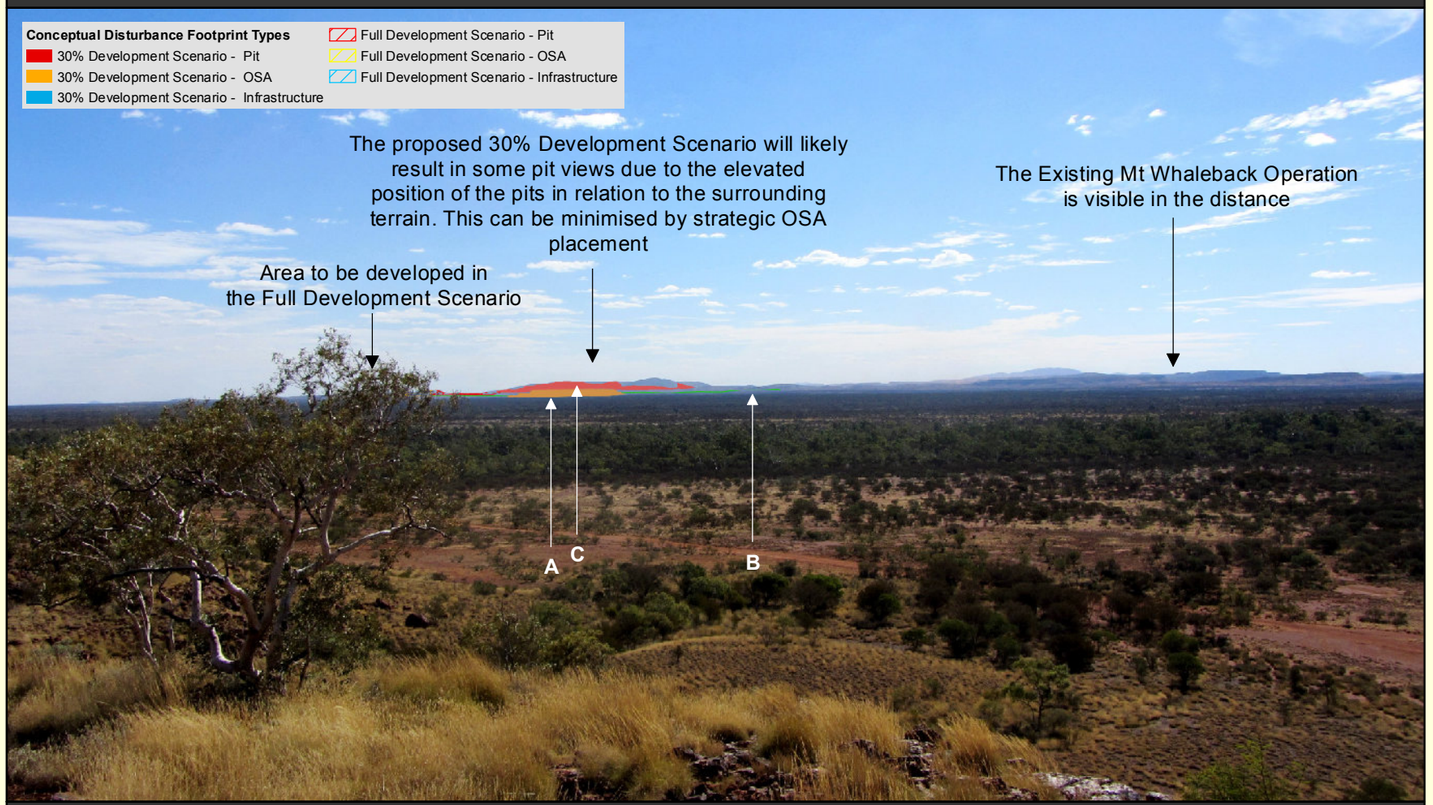
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K4 Round Hill, Newman**
Location (GDA94)	119.77057, -23.44394
View Direction	WNW
Land System	**Spearhole** - Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.
Description of View	A small hill located in the middle of the Fortescue River flood plain. Unique in that it is the only elevated point within the floodplain in the region. Panoramic views of the landscape can be seen from the top. Popular as a recreation spot (camping/hiking). Also significant for its Aboriginal heritage value.
Vegetation Screening Capability	Low: Being a raised rocky hill within a floodplain, there is limited vegetation screening capacity.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	8.57%	**Site Significance**	Socio-cultural, Recreation, Heritage
% Pit views created	0.78%	**Visitor Traffic**	Moderate
% OSA views created	2.67%	**Accessibility**	High
% Natural Landscape views created	3.45%	**Overal Impact**	**Moderate**

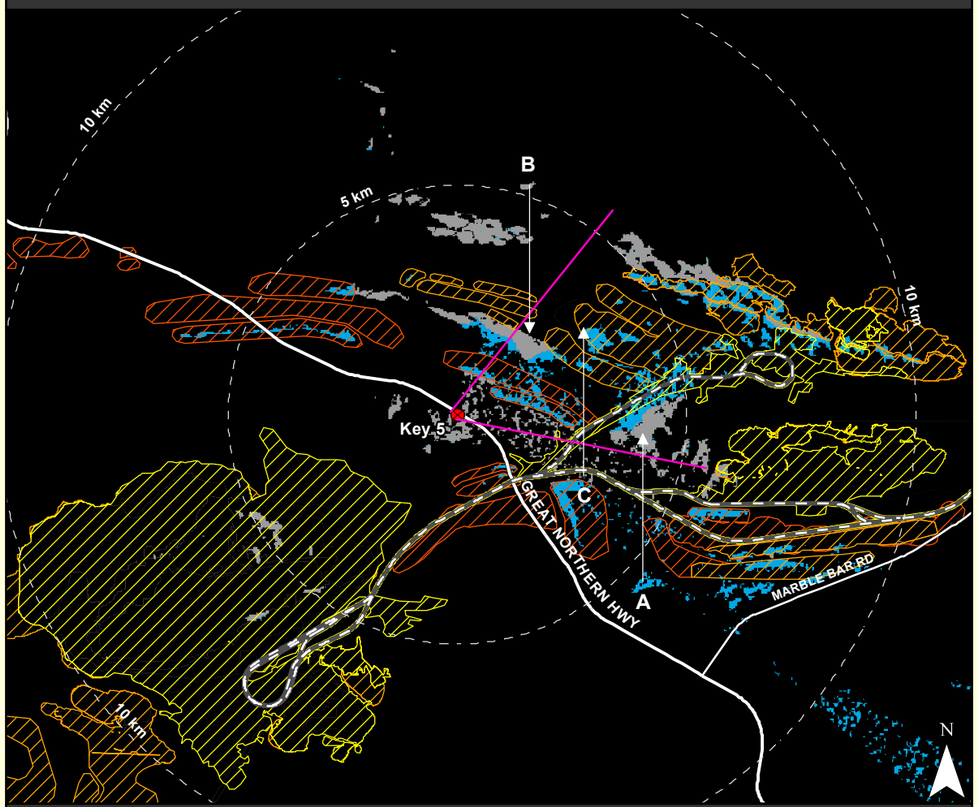
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 16 - K4 Round Hill, Newman

VIEWSHED



LEGEND

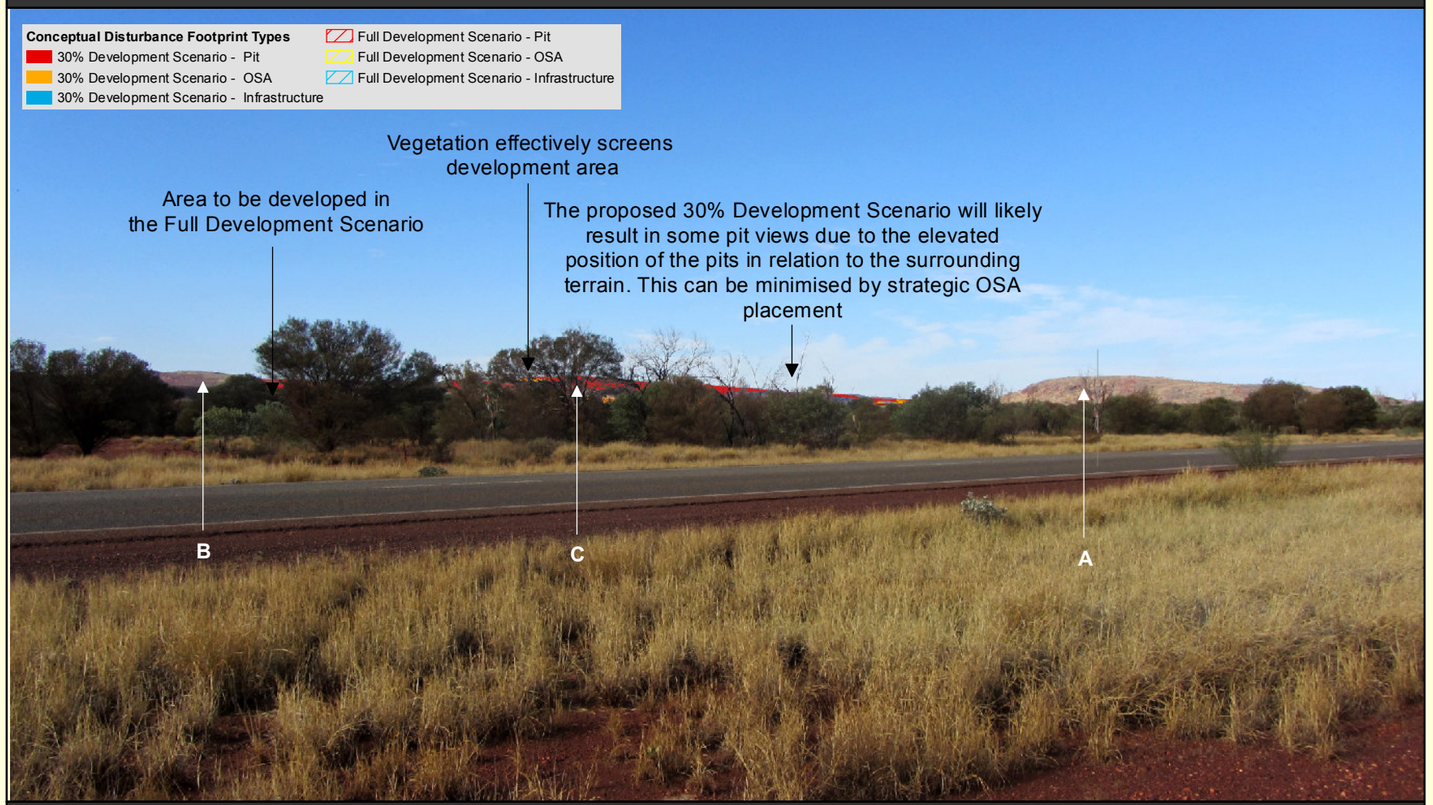
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K5 Great Northern Highway 2**
Location (GDA94)	119.724969, -23.322861
View Direction	ENE
Land System	**Elimunna** - Stony plains on basalt supporting sparse acacia and cassia shrublands and patchy tussock grasslands.
Description of View	A stop over site along the Great Northern Highway. The route is the primarly means of transportation to the northern sections of the state and is therefore used very frequently. The road sides are vegetated with tall acacia shrubs.
Vegetation Screening Capability	High; Dense stands of mulga, and other *Acacia sp.* provide a significant screening. Areas of the development at higher elevations are still visible however.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	74.71%	**Site Significance**	Transport
% Pit views created	1.58%	**Visitor Traffic**	High
% OSA views created	3.38%	**Accessibility**	High
% Natural Landscape views created	0.98%	**Overal Impact**	**Moderate**

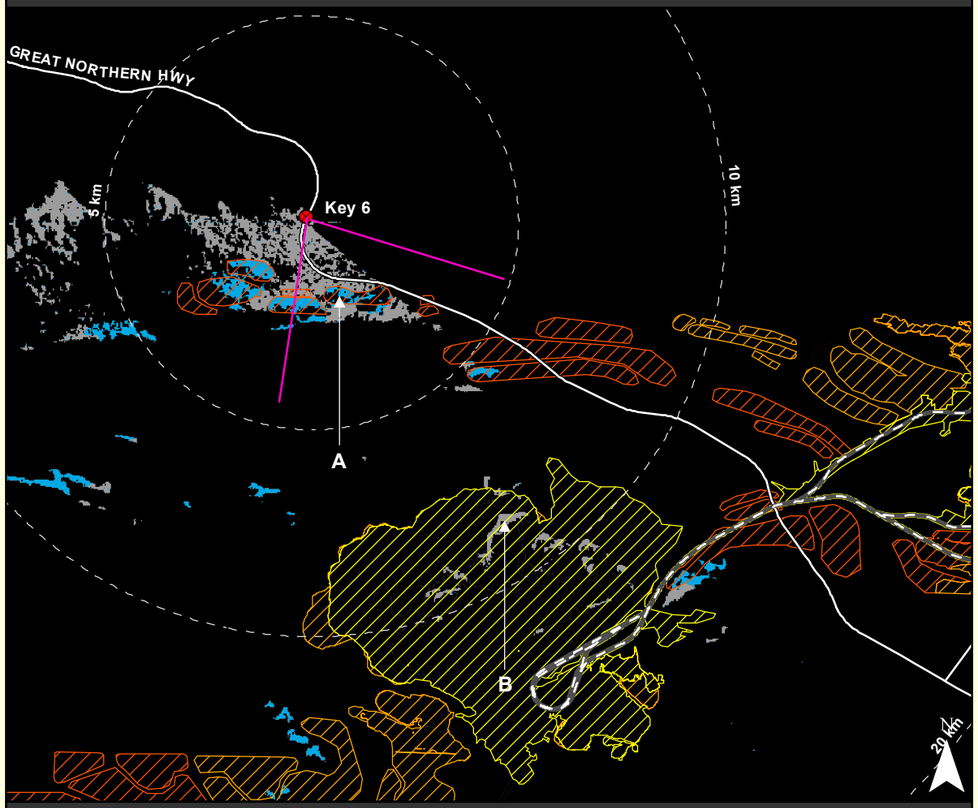
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 17 - K5 Great Northern Hwy 2

VIEWSHED



LEGEND

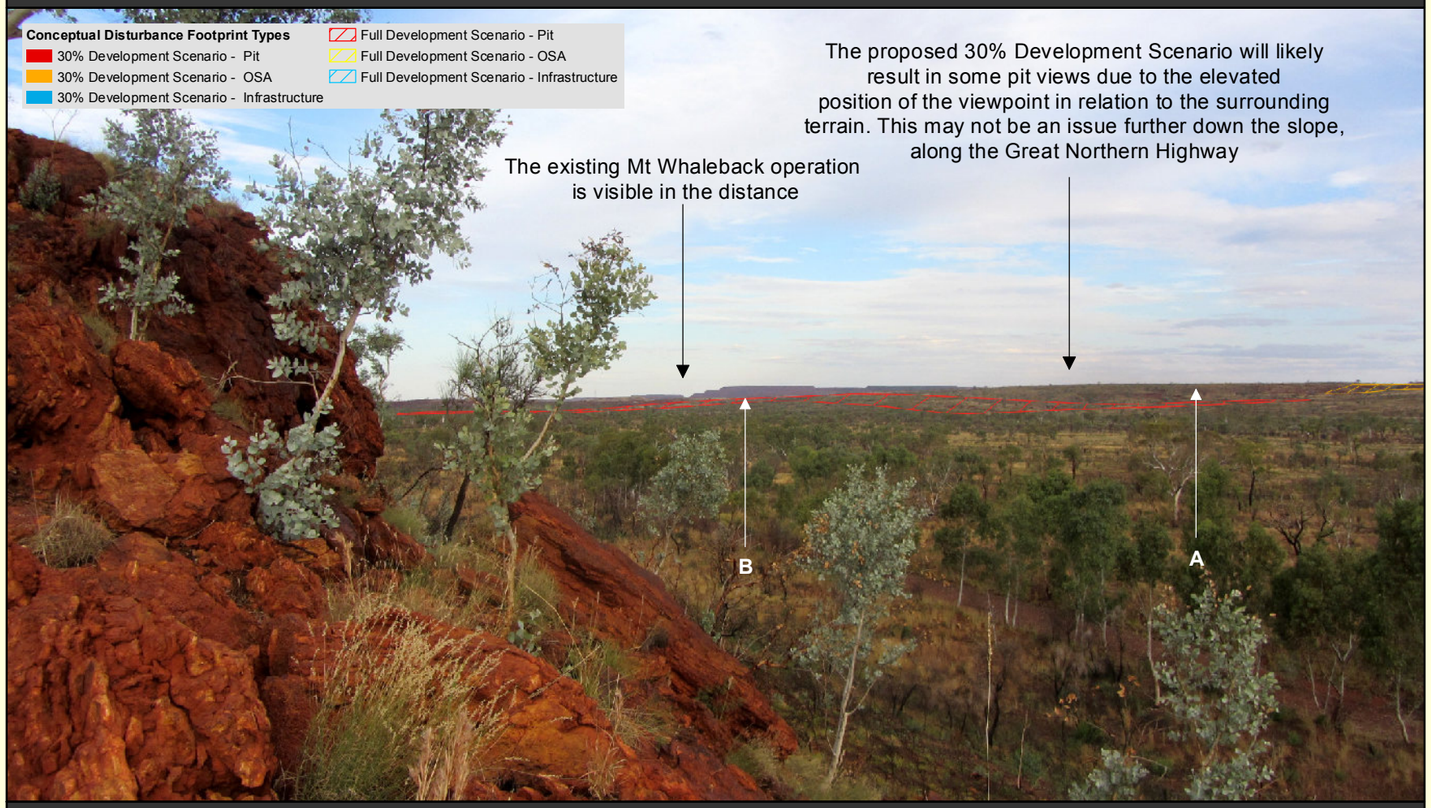
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K6 Cathedral Gorge Rock Outcrop**
Location (GDA94)	119.626511, -23.275818
View Direction	SE
Land System	**Boolgeeda** - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	The site is located adjacent to the Great Northern Highway along Cathedral Gorge. The track beside the highway leads up to a natural platform that acts as a lookout over the surrounding landscape. This view is similar to that from the highway lower down, with the exception of vegetation screening.
Vegetation Screening Capability	Low; Elevated position of the site limits the ability of vegetation to act as a screen. Views from the highway lower down however will be screened by vegetation.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	28.13%	**Site Significance**	Transport
% Pit views created	0.25%	**Visitor Traffic**	High
% OSA views created	4.37%	**Accessibility**	High
% Natural Landscape views created	1.31%	**Overal Impact**	**Moderate**

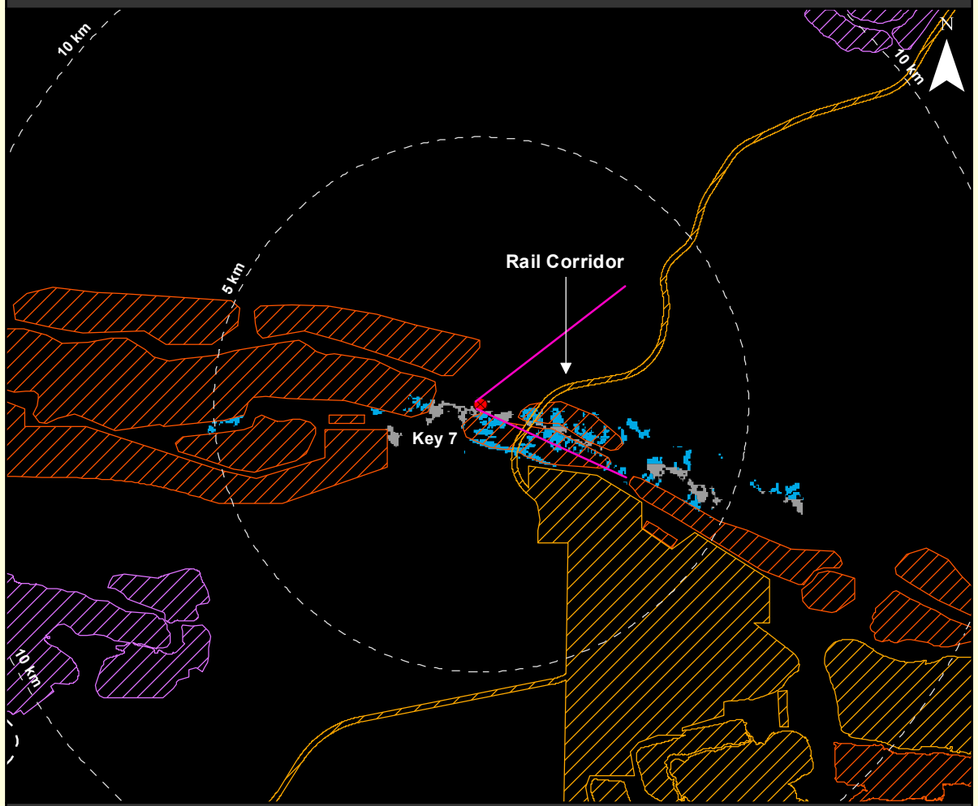
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 18 - K6 Cathedral Gorge Rock Outcrop

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K7 - Weeli Wolli Spring**
Location (GDA94)	119.20634, -22.91612
View Direction	E
Land System	**River** - Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.
Description of View	The viewpoint is located within the centre of Weeli Wolli Creek, a short distance from the spring. The site has high ecological, tourism, recreational, heritage and socio-cutural value.
Vegetation Screening Capability	High; Creekside vegetation provides screening for mine infrastructure and landforms, but not for dust.

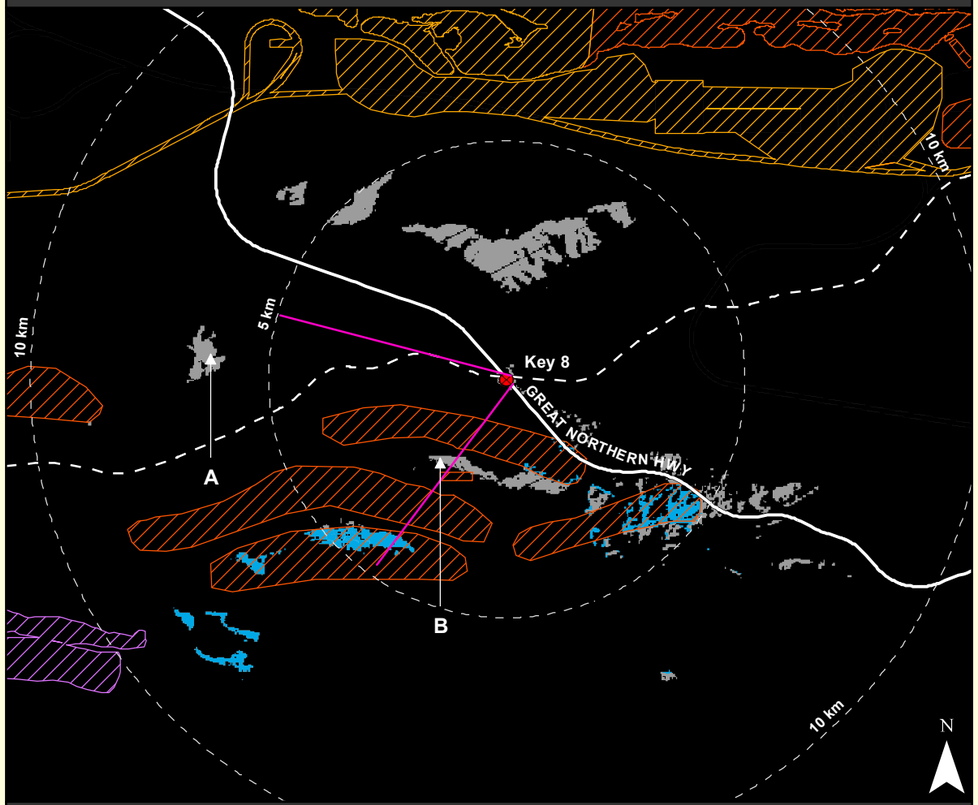
CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	36.10%	**Site Significance**	Socio-cultural, ecological, recreational
% Pit views created	9.22%	**Visitor Traffic**	Moderate
% OSA views created	8.40%	**Accessibility**	Moderate
% Natural Landscape views created	12.62%	**Overal Impact**	**High**

SCHEMATIC PHOTOMONTAGE

POST-DEVELOPMENT PHOTOMONTAGE

Figure 19 - K7 Weeli Wolli Spring

VIEWSHED



LEGEND

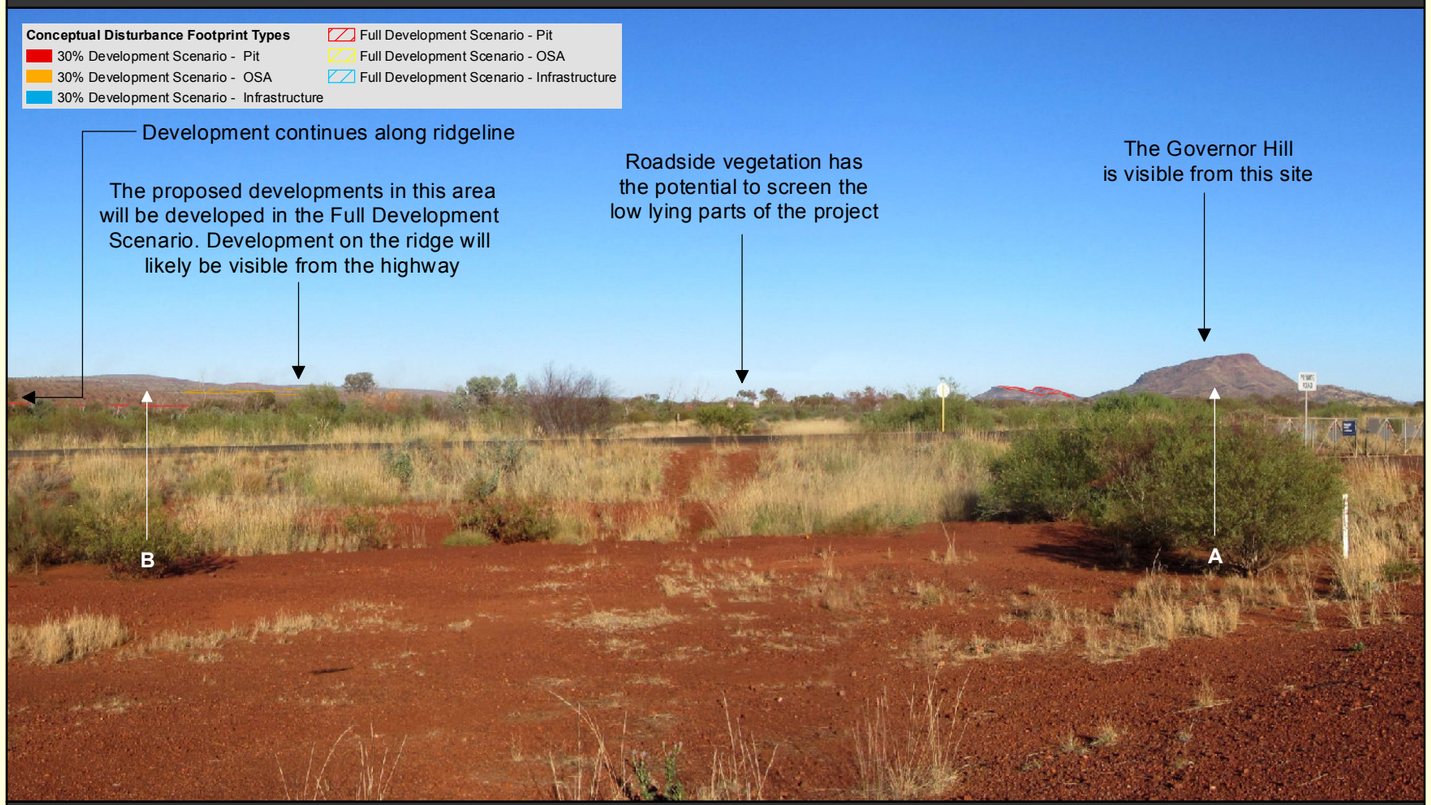
- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K8 Great Northern Hwy 8 - Rail Line Crossing**
Location (GDA94)	118.89232, -23.0709
View Direction	WSW
Land System	**Newman** - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **Boolgeeda** - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	This site is located alongside the rail crossing for Rio Tinto's Hope Downs rail line. There are numerous stopovers as well as a rest stop at this site. Tourists to the Pilbara region often stop at this site to observe the passing ore trains.
Vegetation Screening Capability	Moderate; roadside vegetation at this site has the capability to screen low lying areas of developments. There is limited screening ability for pits and waste dumps located on or alongside ridges.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	15.08%	Site Significance	Transport, Tourism
% Pit views created	0.87%	Visitor Traffic	High
% OSA views created	9.84%	Accessibility	High
% Natural Landscape views created	1.73%	Overal Impact	**Moderate**

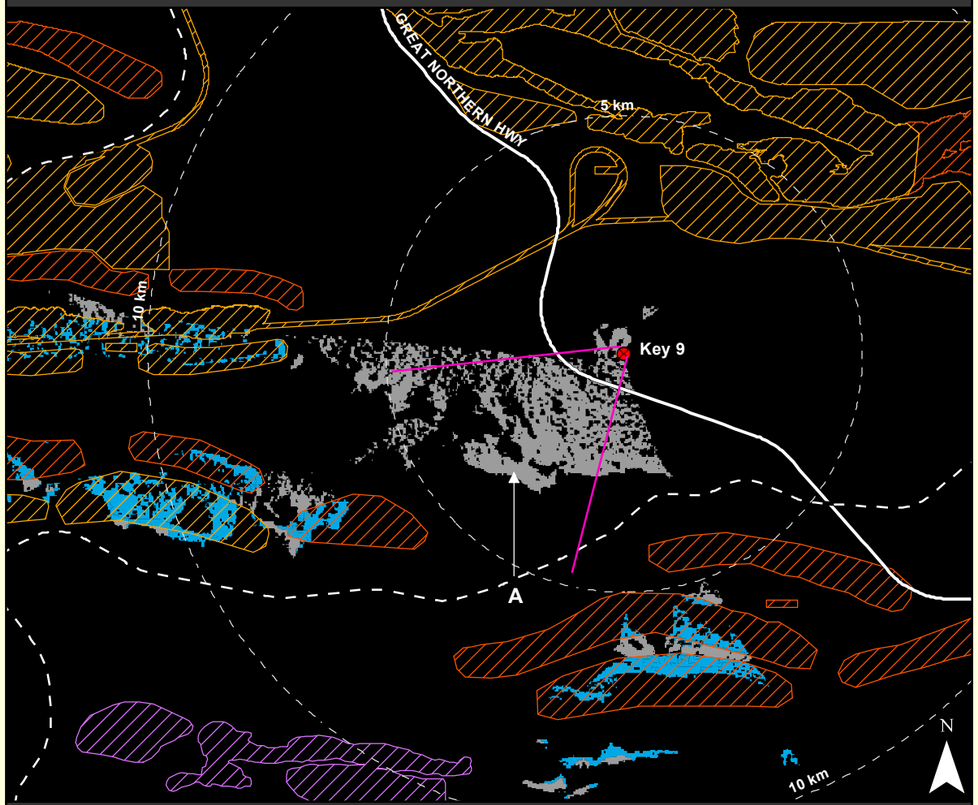
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 20 - K8 Great Northern Hwy 8 - Rail Line Crossing

VIEWSHED



LEGEND

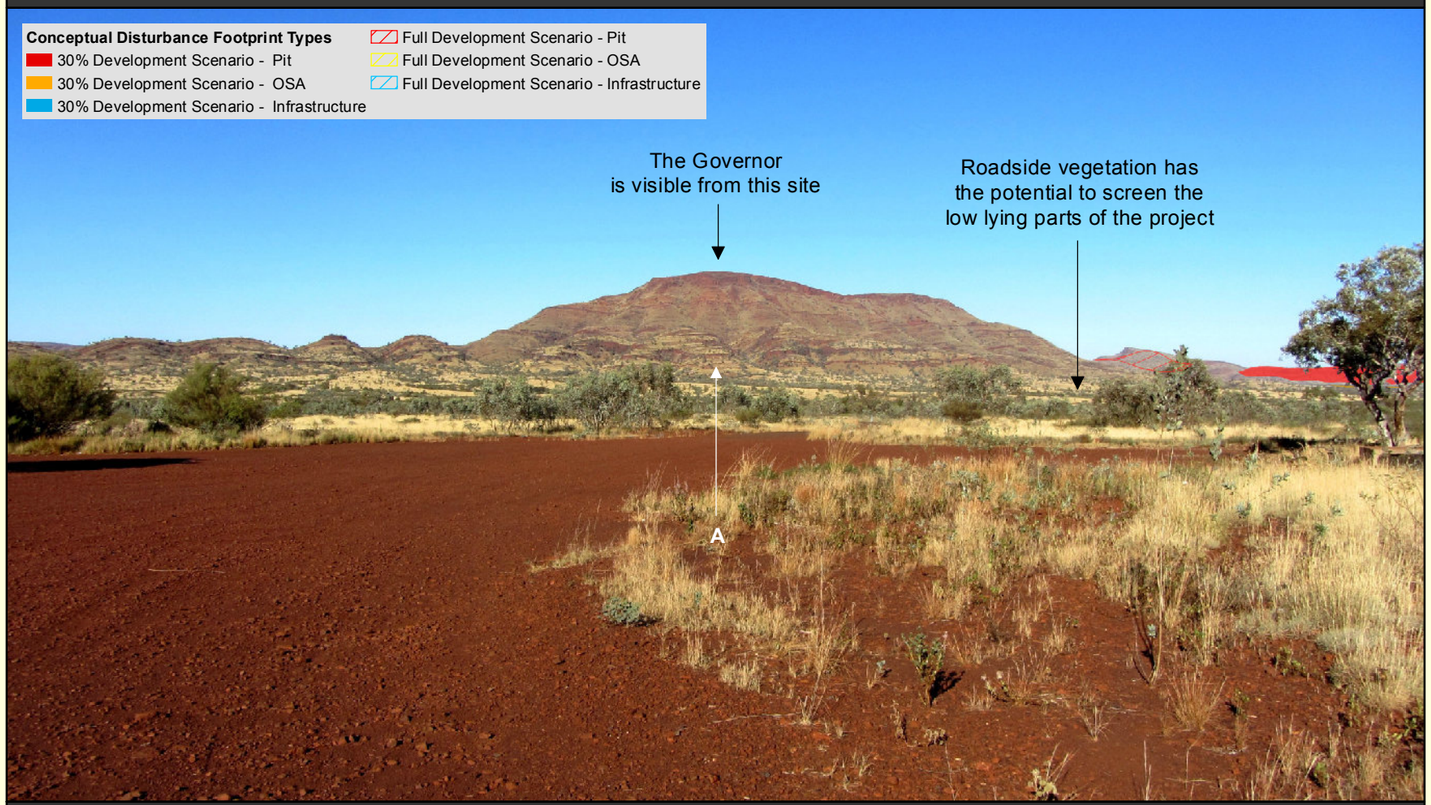
- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K9 Mt Robinson 24 Hour Rest Stop**
Location (GDA94)	118.84933, -23.04253
View Direction	SW
Land System	**Newman** - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **Boolgeeda** - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	This site is located alongside the Great Northern Highway and features camping and toilet facilities. It is also the starting point for the Mt Robinson summit trail. Views of the Governor are a prominent feature.
Vegetation Screening Capability	Moderate; roadside vegetation at this site has the capability to screen low lying areas of developments. There is limited screening ability for pits and waste dumps located on or alongside ridges.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	32.90%	Site Significance	Recreation, Transport
% Pit views created	5.31%	Visitor Traffic	High
% OSA views created	9.02%	Accessibility	High
% Natural Landscape views created	2.57%	Overal Impact	**High**

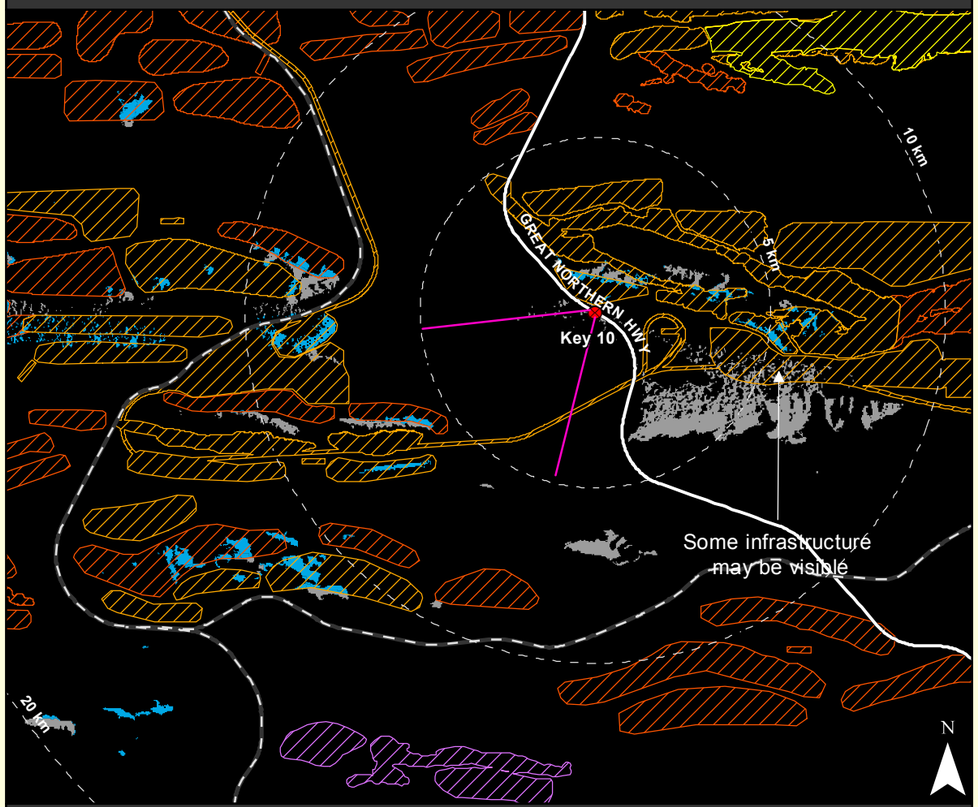
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 21 - K9 Mt Robinson 24 Hour Rest Stop

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K10 Great Northern Highway 9 (Lake Robinson)**
Location (GDA94)	118.8243, -23.00332
View Direction	SW
Land System	**Wannamunna** - Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.
Description of View	This site is located alongside the Great Northern Highway and is considered significant as it is nested between two mining operations, South Flank and Mudlark. The site also holds some significant ecological value as a Priority Ecological Community.
Vegetation Screening Capability	High; the vegetation in this area is dense and tall, and provides good visual screening. Vegetation health may be related to Lake Robinson, and therefore, impacts to this community should be minimised.

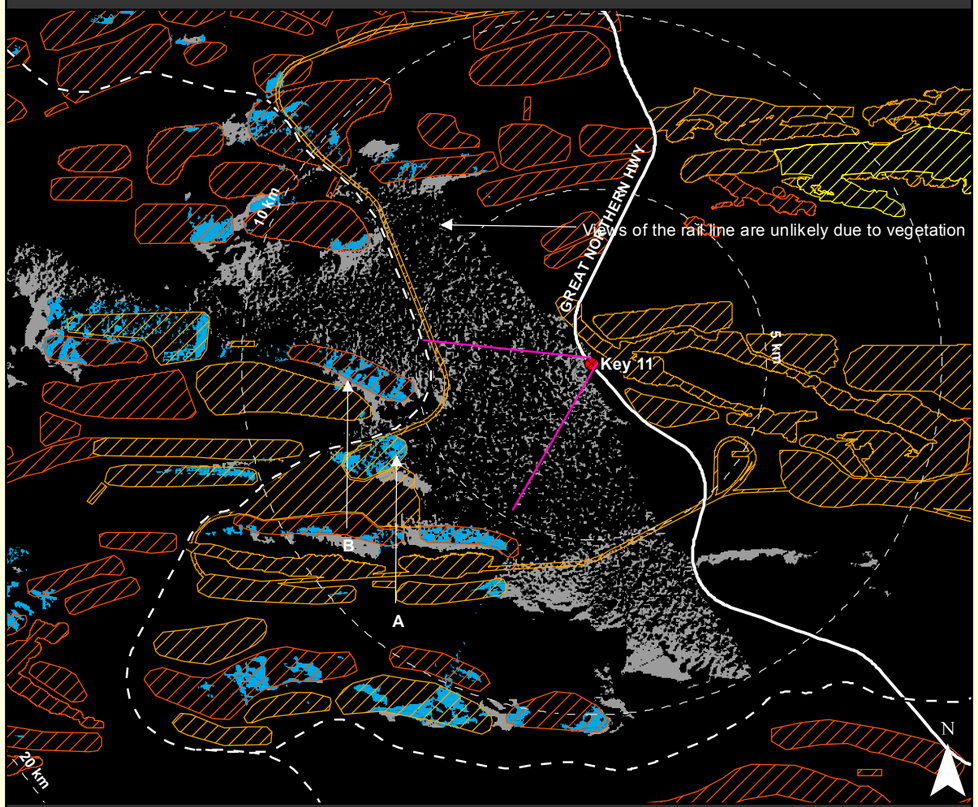
CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	20.07%	**Site Significance**	Recreation, Transport
% Pit views created	3.71%	**Visitor Traffic**	High
% OSA views created	8.93%	**Accessibility**	High
% Natural Landscape views created	4.39%	**Overal Impact**	**Moderate**

SCHEMATIC PHOTOMONTAGE

POST-DEVELOPMENT PHOTOMONTAGE

Figure 22 - K10 Great Northern Highway 9

VIEWSHED



LEGEND

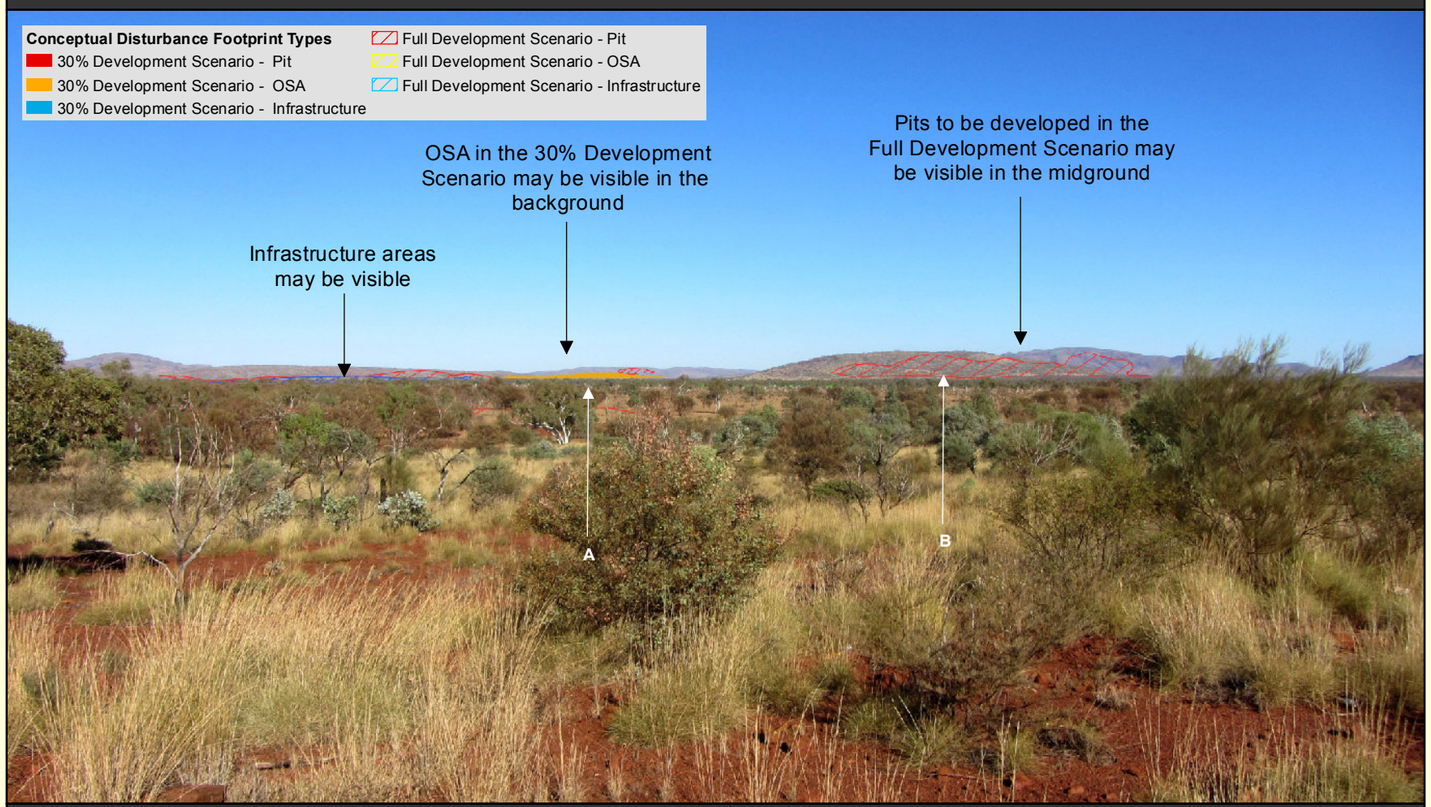
- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K11 Great Northern Highway 10**
Location (GDA94)	118.8243, -23.00332
View Direction	SW
Land System	**Wannamunna** - Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.
Description of View	This site is located alongside the Great Northern Highway and is considered significant as it is nested between two mining operations, South Flank and Mudlark. The site is considered significant due to its proximity to the developments. The South Flank mining operation is directly behind this site and is scheduled for development in the 30% Development Scenario.
Vegetation Screening Capability	High; the vegetation in this area is dense and provides good visual screening for lowlying areas of the project. In the Full Development scenario, the foreground will be developed and as a result, vegetation will likely be cleared.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	23.13%	**Site Significance**	Recreation, Transport
% Pit views created	3.76%	**Visitor Traffic**	High
% OSA views created	7.11%	**Accessibility**	High
% Natural Landscape views created	0.55%	**Overal Impact**	**High**

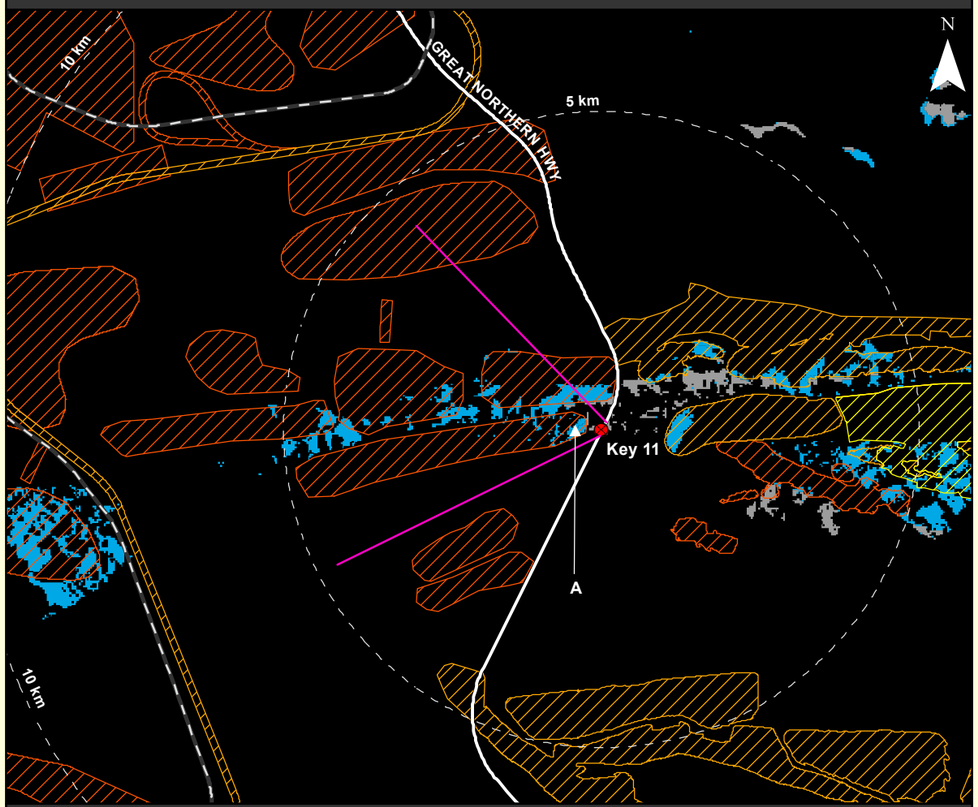
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 23 - K11 Great Northern Highway 10

VIEWSHED



LEGEND

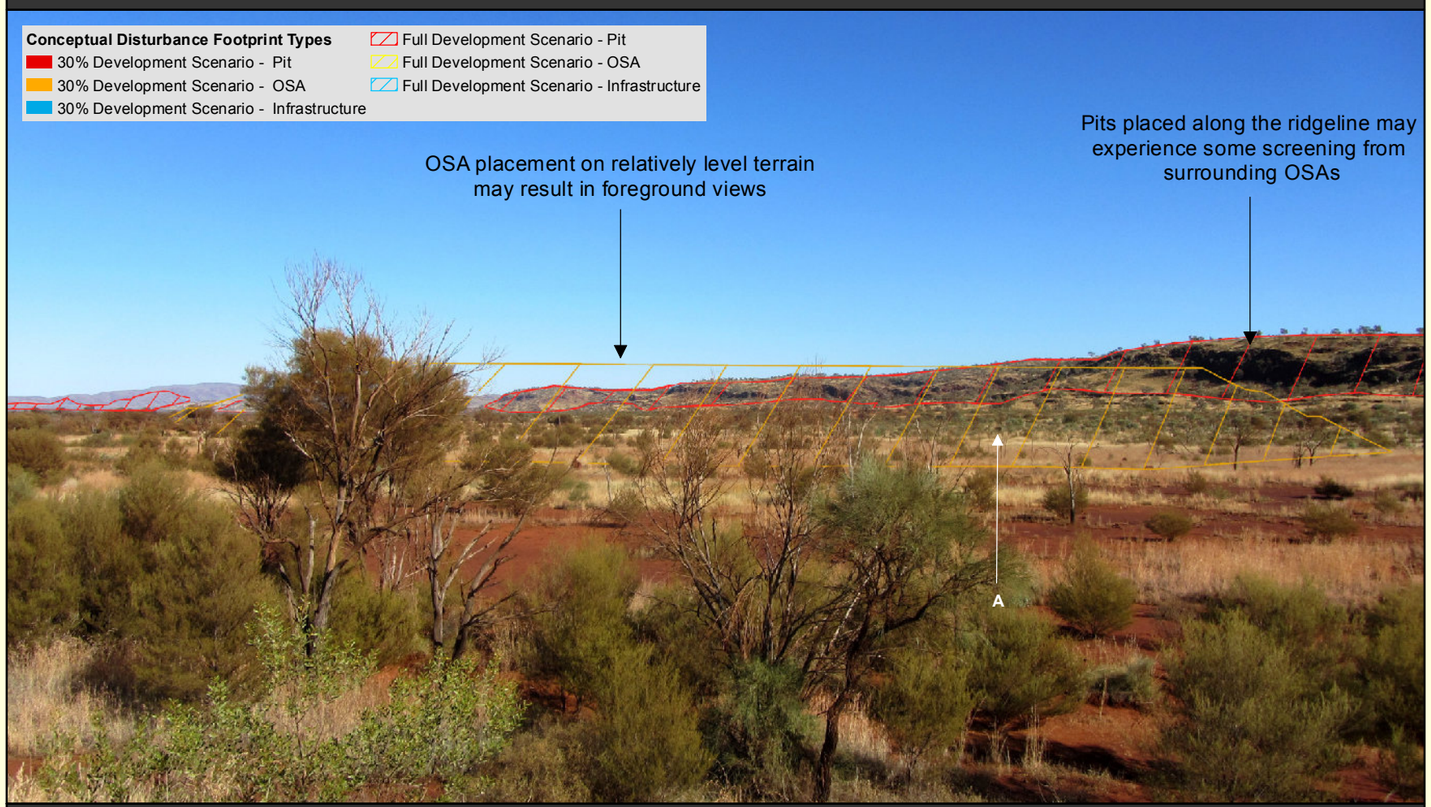
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K12 Great Northern Highway 11 (Iron Ore Ridge)**
Location (GDA94)	118.81788, -22.93439
View Direction	W
Land System	**Wannamunna -** Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands. **Boolgeeda -** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	This site is located alongside the Great Northern Highway and is considered significant as it runs in close proximity to two mining operations. Directly to the east is the eastern section of the Mining Area C mining operation which is to be developed in the 30% Development Scenario. The majority of the view shown in the plate will be altered in the Full Development Scenario.
Vegetation Screening Capability	Moderate-Low; as the majority of the pits in this area will be located on ridges, the screening potential of vegetation is limited.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	68.24%	**Site Significance**	Transport
% Pit views created	1.64%	**Visitor Traffic**	High
% OSA views created	11.76%	**Accessibility**	High
% Natural Landscape views created	3.59%	**Overal Impact**	**High**

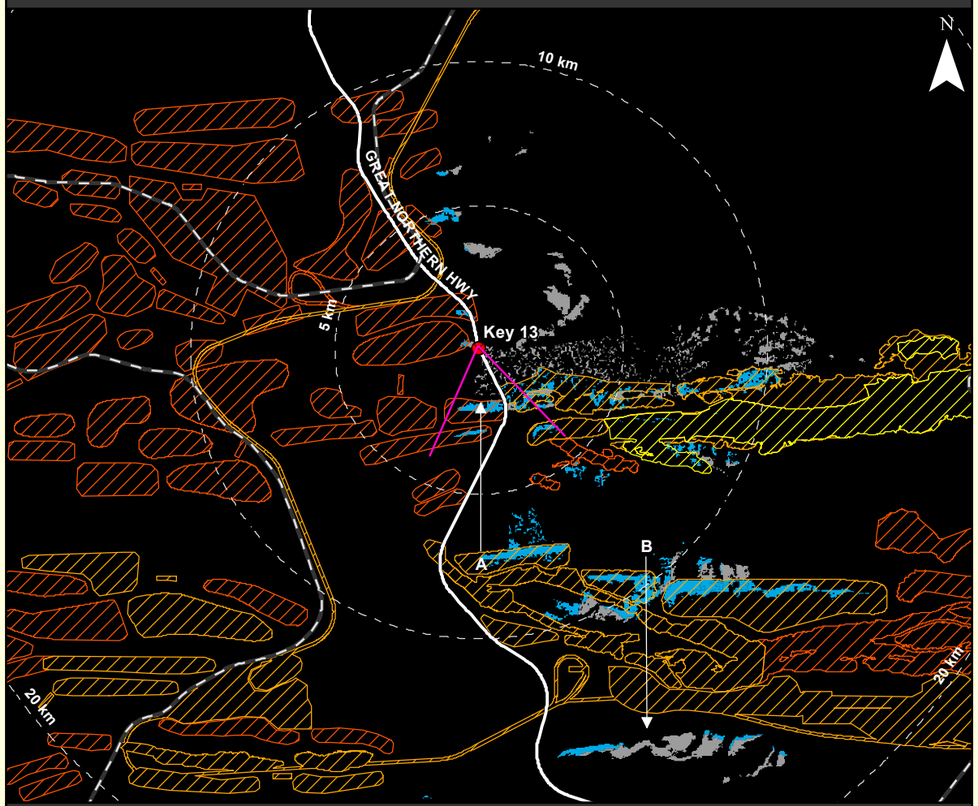
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 24 - K12 Great Northern Highway 11

VIEWSHED



LEGEND

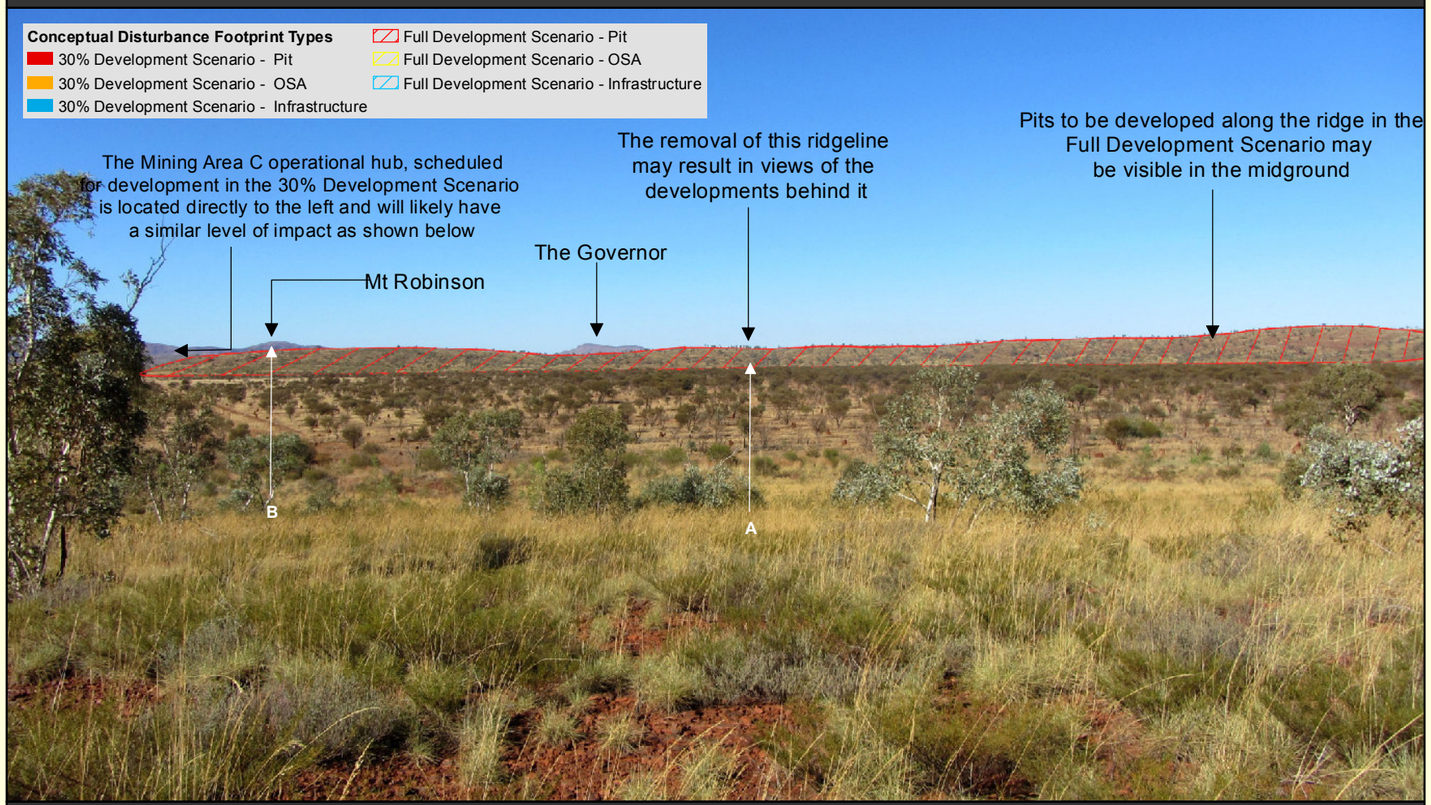
- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K13 Great Northern Highway 12**
Location (GDA94)	118.811035, -22.908385
View Direction	S
Land System	**Wannamunna -** Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands. **Boolgeeda -** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	This site is located alongside the Great Northern Highway and is considered significant as it runs in close proximity to two mining operations (Tandanya and Mining Area C).The majority of the developments seen on the plate will be developed in the Full Development Scenario.
Vegetation Screening Capability	Moderate-Low; as the majority of the pits in this area will be located on ridges, the screening potential of vegetation is limited.

CONMCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	18.32%	**Site Significance**	Transport
% Pit views created	2.10%	**Visitor Traffic**	High
% OSA views created	20.86%	**Accessibility**	High
% Natural Landscape views created	10.68%	**Overal Impact**	**High**

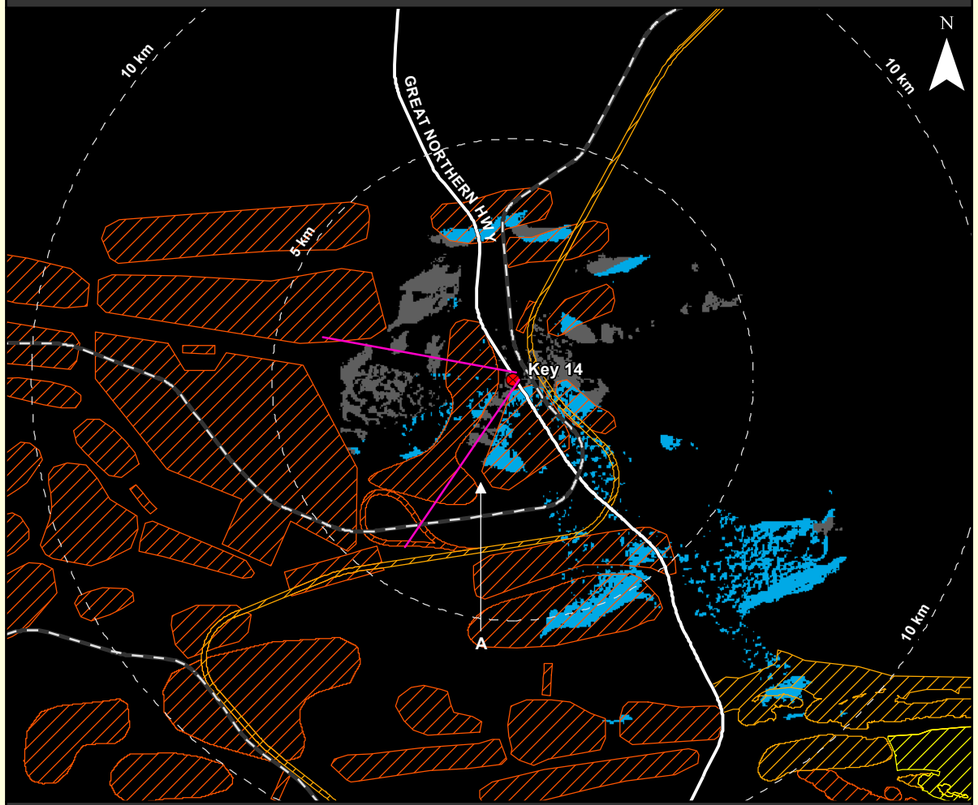
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 25 - K13 Great Northern Highway 12

VIEWSHED



LEGEND

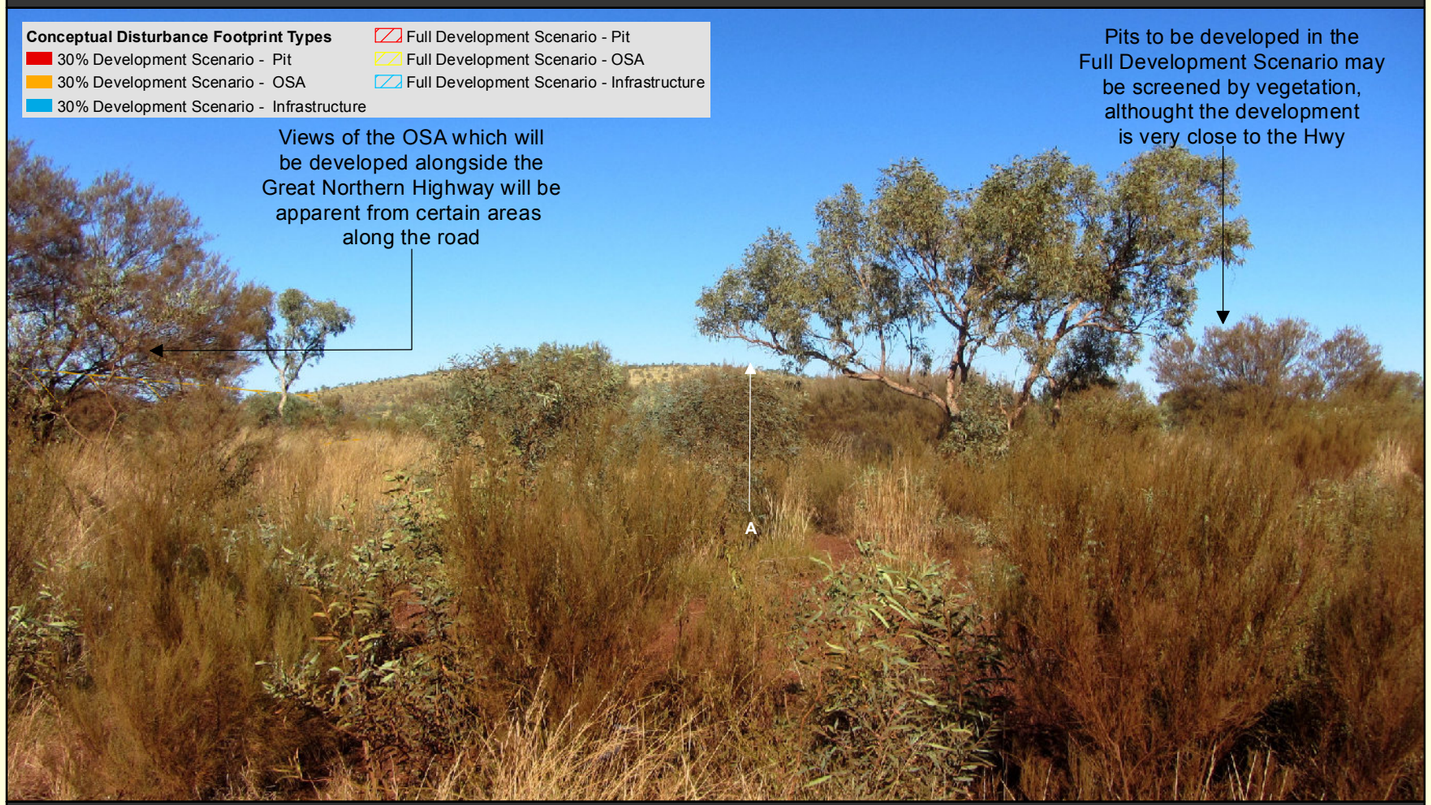
- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K14 Great Northern Highway 14**
Location (GDA94)	118.77691, -22.86333
View Direction	E
Land System	**Wannamunna -** Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands. **Boolgeeda -** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	This site is located alongside the Great Northern Highway and is considered significant as it runs in close proximity to two developments. The site is used as a rest stop for travellers along the Great Northern Highway. The site is in close proximity to the proposed Tandanya mining operation.
Vegetation Screening Capability	High; as a large portion of the developments in Tandanya are located on low lying areas, tall vegetation has a high capability to act as screens.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	59.95%	Site Significance	Transport
% Pit views created	0.59%	Visitor Traffic	High
% OSA views created	4.32%	Accessibility	High
% Natural Landscape views created	12.15%	Overal Impact	**High**

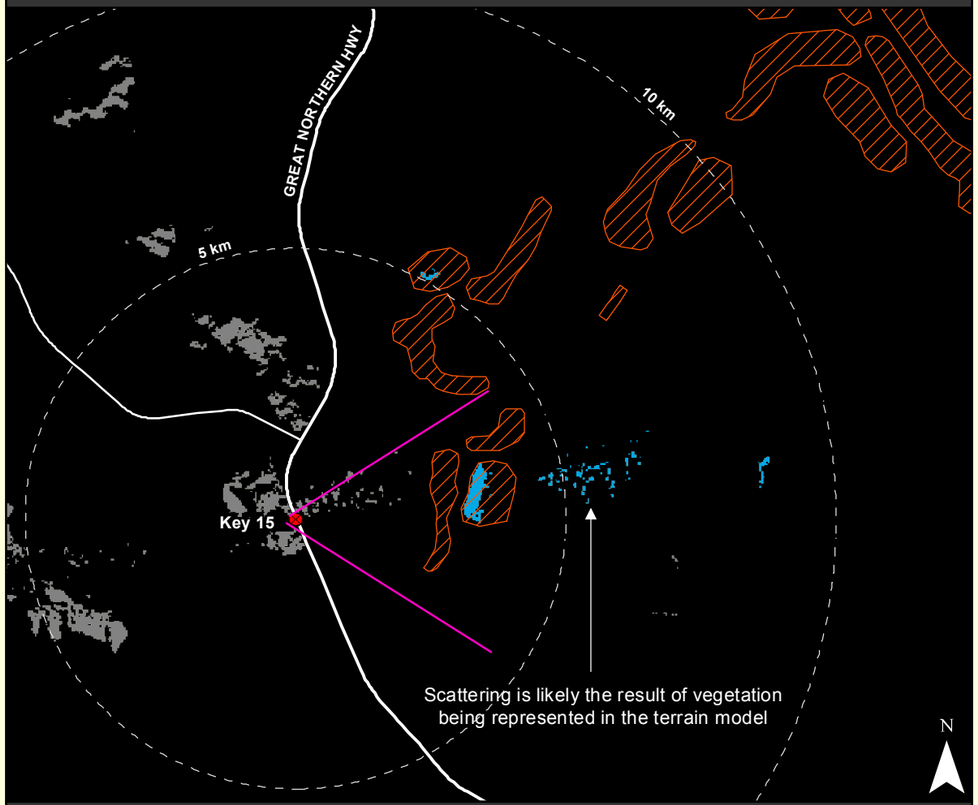
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 26 - K14 Great Northern Highway 14

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K15 Great Northern Highway 15 (Marillana Bridge)**
Location (GDA94)	118.70065, -22.68164
View Direction	E
Land System	**Pindering** - Gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.
Description of View	A lookout point overlooking Marillana Creek from the Great Northern Highway. The viewpoint is likely to be accessed after rains, while the creek is still flowing. Impacts to the Great Northern Highway in this section are likely to be moderate. This is partly due to the site being recessed in the landscape.
Vegetation Screening Capability	High; Proximity to the creek has resulted in an open eucalypt woodland with considerable screening potential.

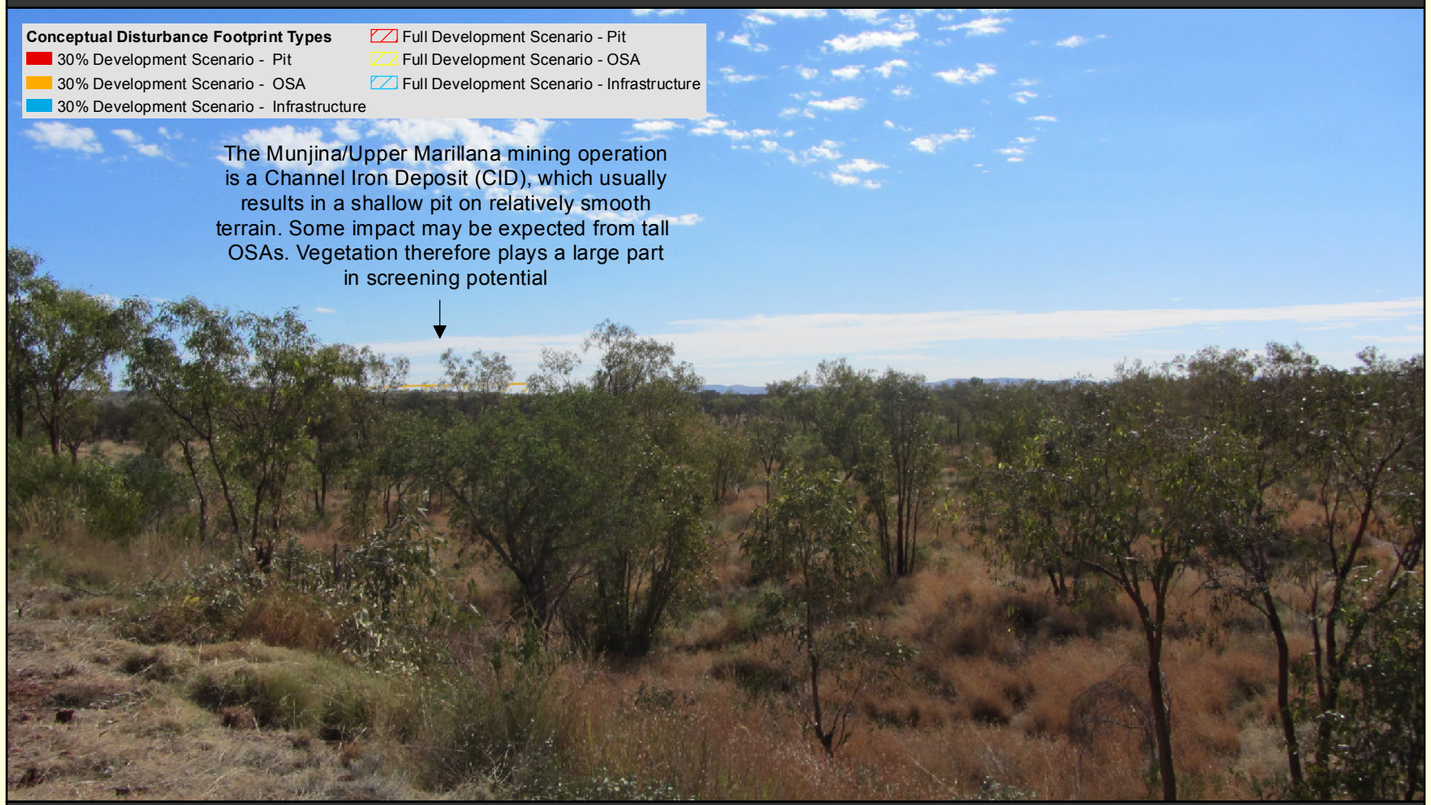
CONCEPTUAL VIEWSHED STATISTICS

% Viewshed blocked out by Development	7.50%
% Pit views created	0.34%
% OSA views created	1.16%
% Natural Landscape views created	0.00%

SITE VISUAL IMPACT

Site Significance	Major Transport Route
Visitor Traffic	High
Accessibility	High
Overal Impact	**Moderate**

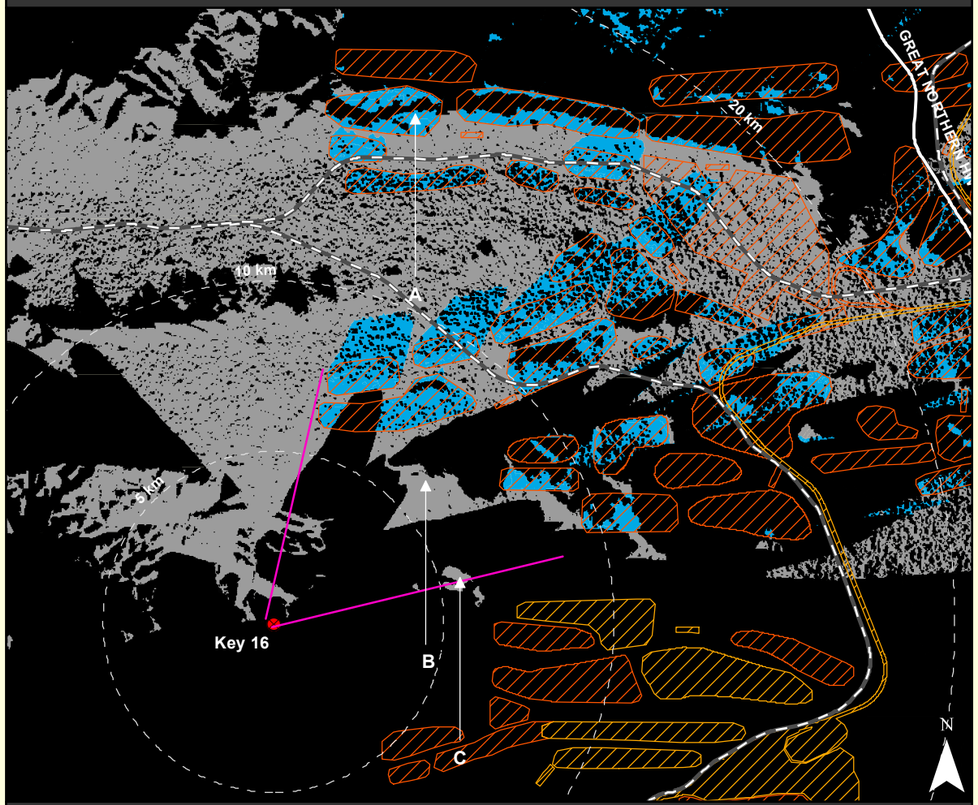
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 27 - K15 Great Northern Highway 15

VIEWSHED



LEGEND

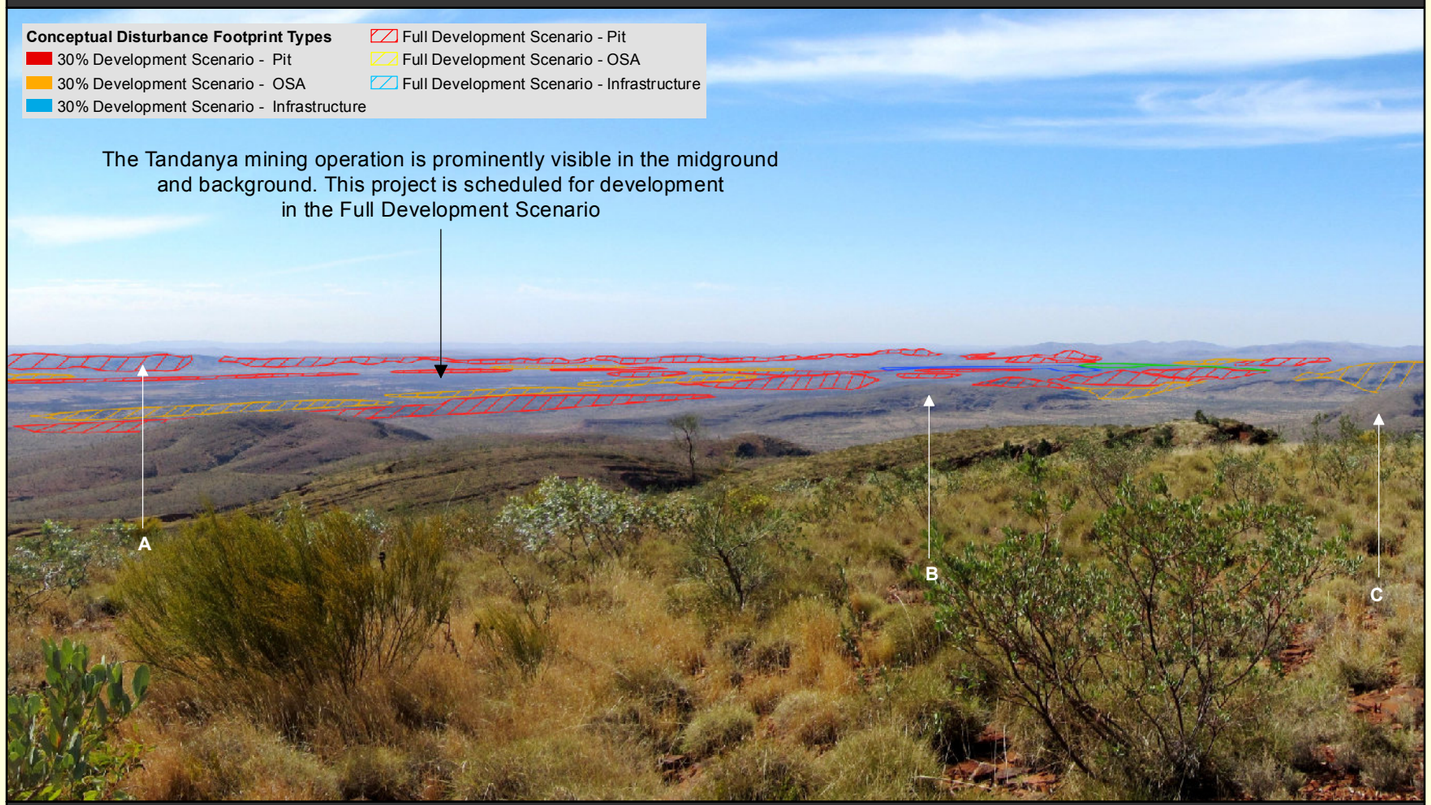
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K16 Mt Meharry (Northeast View)**
Location (GDA94)	118.587745, -22.98006
View Direction	NE
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **Boolgeeda -** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	The northeastern view from the summit of Mt Meharry, Western Australia's highest peak, which offers 360 degreee views of the surrounding landscape. It is estimated that close to 50% of the view from this site will be impacted by the development. Views to the west should largely be unaffected.
Vegetation Screening Capability	Low - negligible; the summit is relatively barren, with low shrubs.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	42.79%	**Site Significance**	Tourism, Socio-cultural
% Pit views created	4.69%	**Visitor Traffic**	Moderate
% OSA views created	11.32%	**Accessibility**	Moderate
% Natural Landscape views created	6.52%	**Overal Impact**	**High**

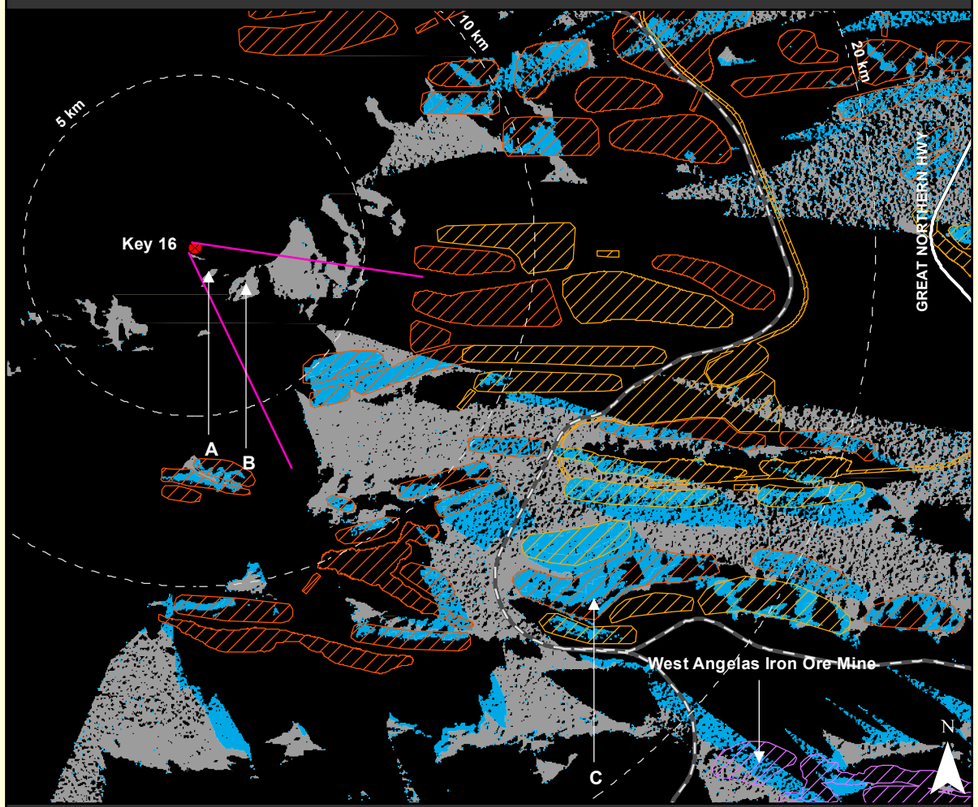
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 28a - K16 Mt Meharry (Northeast View)

VIEWSHED



LEGEND

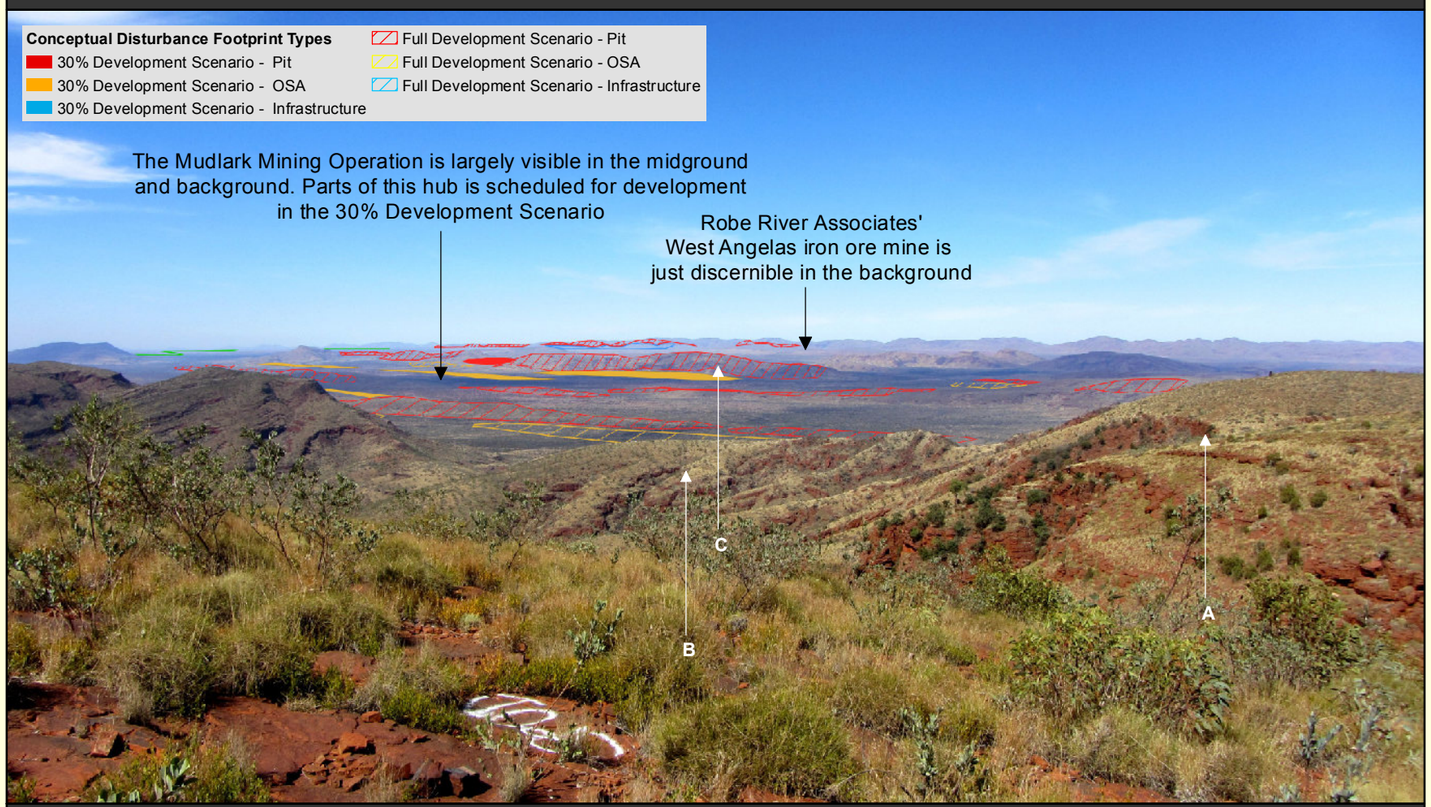
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K16 Mt Meharry (Southeast View)**
Location (GDA94)	118.587745, -22.98006
View Direction	SE
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. **Boolgeeda -** Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.
Description of View	The southeastern view from the summit of Mt Meharry, Western Australia's highest peak, which offers 360 degreee views of the surrounding landscape. It is estimated that close to 50% of the view from this site will be impacted by the development. Views to the east should largely be unaffected.
Vegetation Screening Capability	Low - negligible; the summit is relatively barren, with low shrubs.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	19.25%	**Site Significance**	Tourism, Socio-cultural
% Pit views created	2.13%	**Visitor Traffic**	Moderate
% OSA views created	7.16%	**Accessibility**	Moderate
% Natural Landscape views created	4.86%	**Overal Impact**	**High**

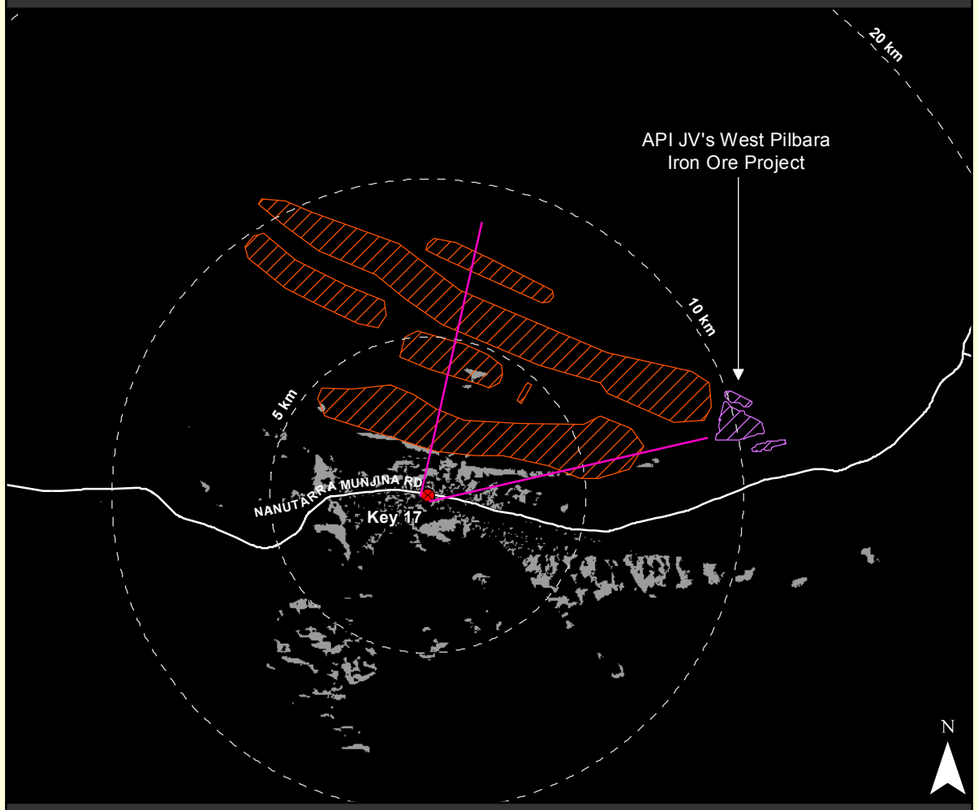
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 28b - K16 Mt Meharry (Southeast View)

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**K17 Nanutarra-Munjina Road 2**
Location (GDA94)	119.77057, -23.44394
View Direction	NE
Land System	**Spearhole** - Gently undulating gravelly hardpan plains and dissected slopes supporting groved mulga shrublands and hard spinifex.
Description of View	A stopover location along the Nanutarra-Munjina Road, the primary transport route from Tom Price and Paraburdoo to the north west (also the only significant site found in the Western Pilbara Operational Zone). The Rocklea mining operation is located behind the ridge in the foreground.
Vegetation Screening Capability	Moderate; As the site itself is not visible, vegetation screening is irrelevant. Emphasis should be placed on retaining the ridgeline in the foreground and appropriate dust control measures.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	0.00%	**Site Significance**	Transport
% Pit views created	0.00%	**Visitor Traffic**	Moderate
% OSA views created	0.00%	**Accessibility**	High
% Natural Landscape views created	0.00%	**Overal Impact**	**Low**

SCHEMATIC PHOTOMONTAGE

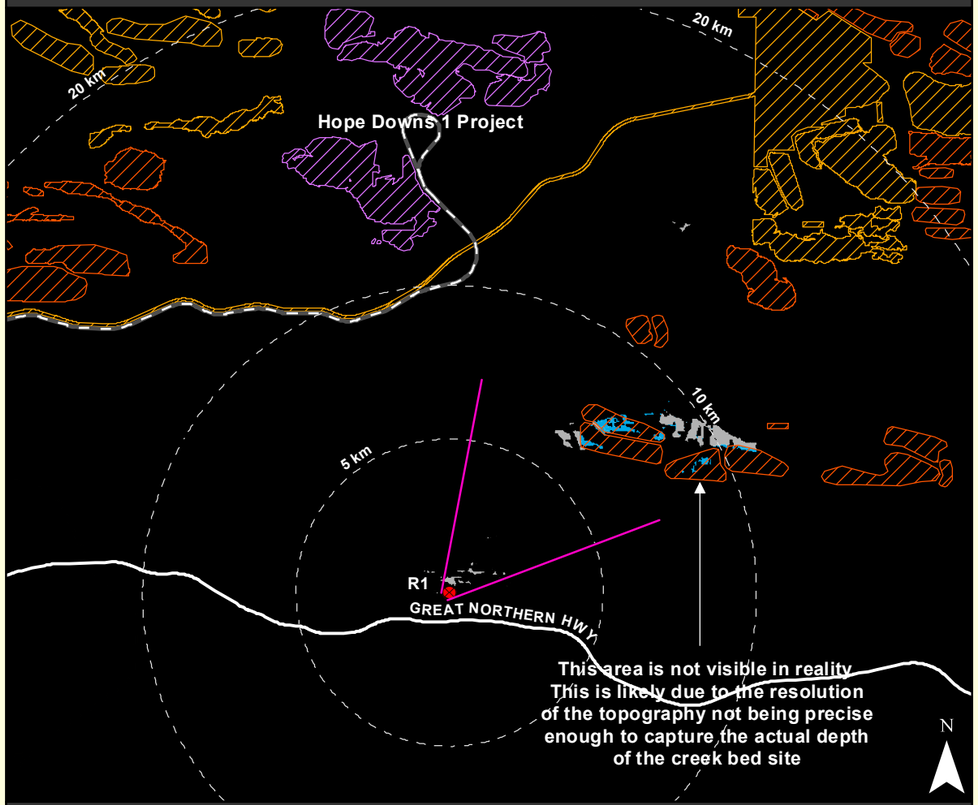
Conceptual Disturbance Footprint Types

- 30% Development Scenario - Pit
- 30% Development Scenario - OSA
- 30% Development Scenario - Infrastructure
- Full Development Scenario - Pit
- Full Development Scenario - OSA
- Full Development Scenario - Infrastructure

POST-DEVELOPMENT PHOTOMONTAGE

Figure 29 - K17 Nanutarra-Munjina Road 2

VIEWSHED



LEGEND

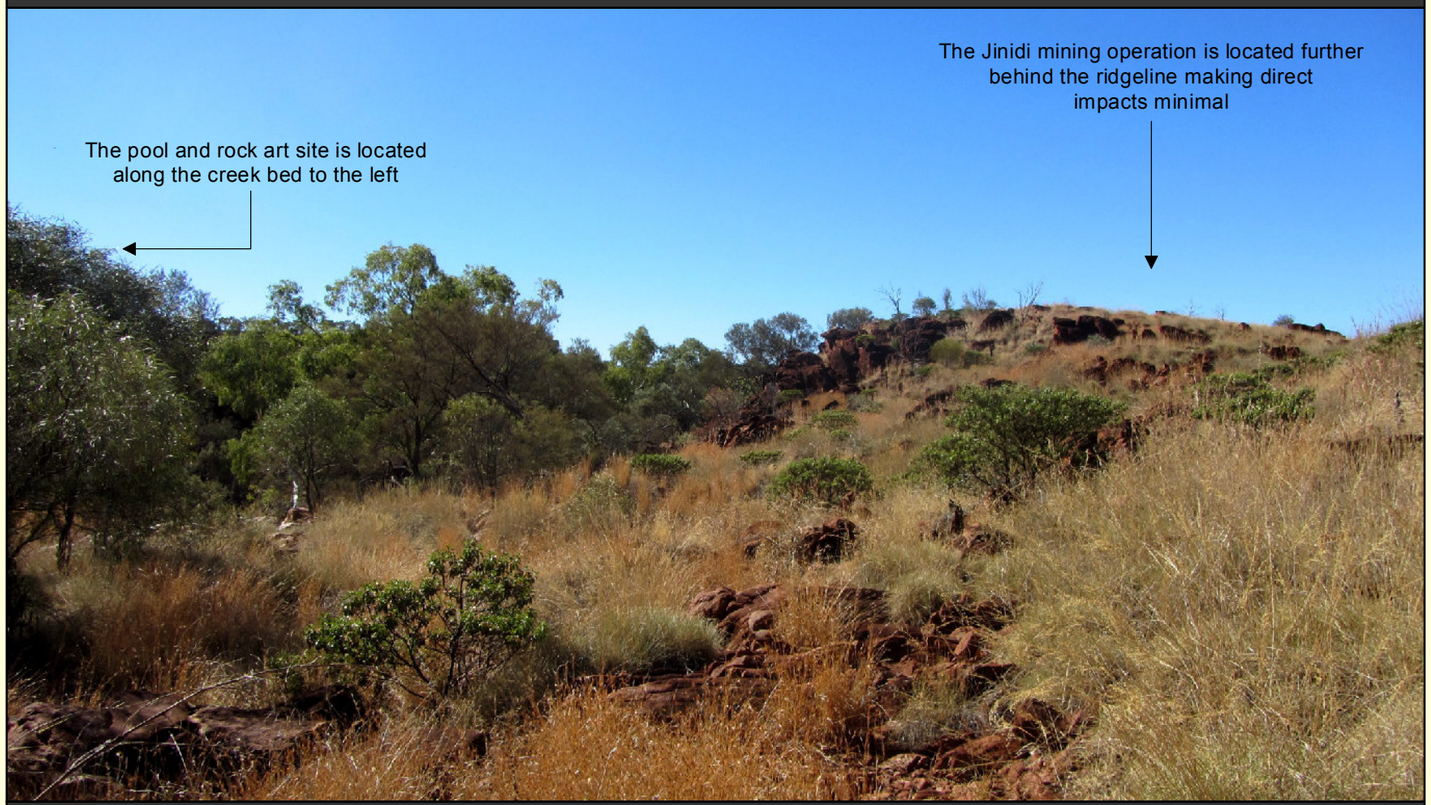
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**R1 Wanna Munna Pool**
Location (GDA94)	119.127914, -23.109804
View Direction	NE
Land System	**Rocklea -** Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.
Description of View	The site is one of the most important and accessible heritage sites with Aboriginal rock art. The actual pool and art faces the west, in the opposite direction of impacts. The view shown here is to the northeast in the direction of the Jinidi mining operation. The site is surrounded by ridges on all sides, greatly minimising any potential impacts.
Vegetation Screening Capability	High; as the site is located along a creekline, vegetation is relatively dense.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	16.52%	**Site Significance**	Tourism, Heritage
% Pit views created	2.16%	**Visitor Traffic**	Moderate
% OSA views created	16.95%	**Accessibility**	Moderate
% Natural Landscape views created	1.36%	**Overal Impact**	**Low**

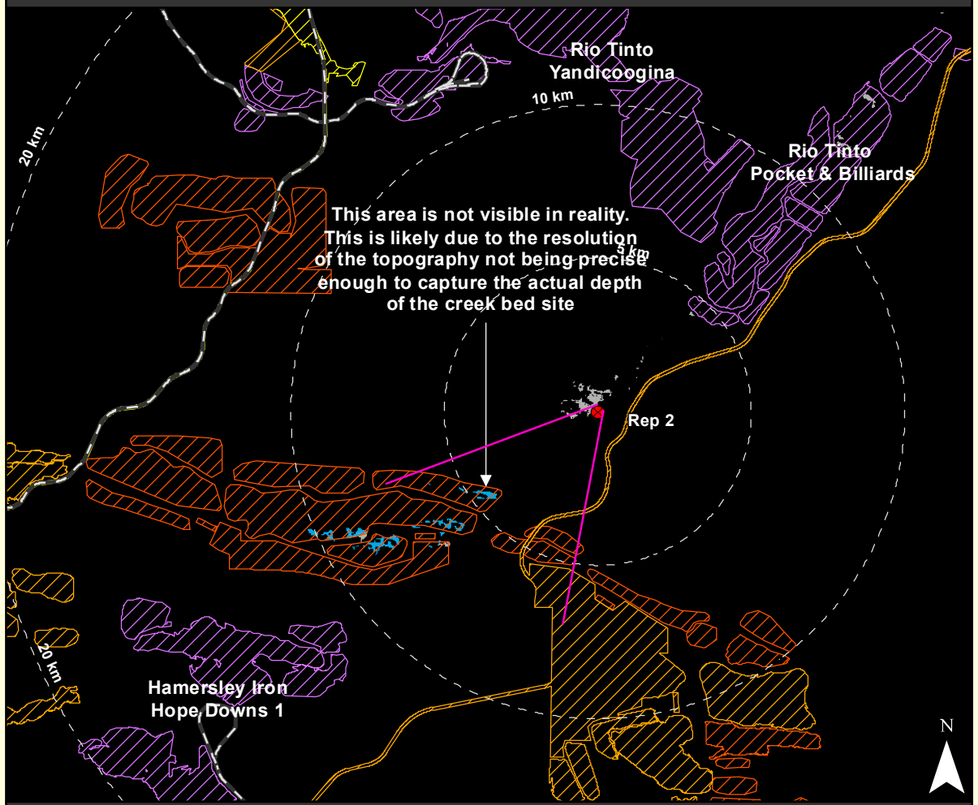
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 30 - R1 Wanna Munna Pool

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridor
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**R2 Weeli Wolli Creek Swimming Hole**
Location (GDA94)	119.23605, -22.88162
View Direction	SW
Land System	**River -** Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.
Description of View	The site is a popular recreational site as it is features wide, shallow and slow moving water. At the time of the field study, evidence of recent use for camping and angling was found. Due to the low lying elevation and resultant small viewshed, direct impacts are likely to be minimal.
Vegetation Screening Capability	High; as the site is located along a creekline, vegetation is relatively dense.

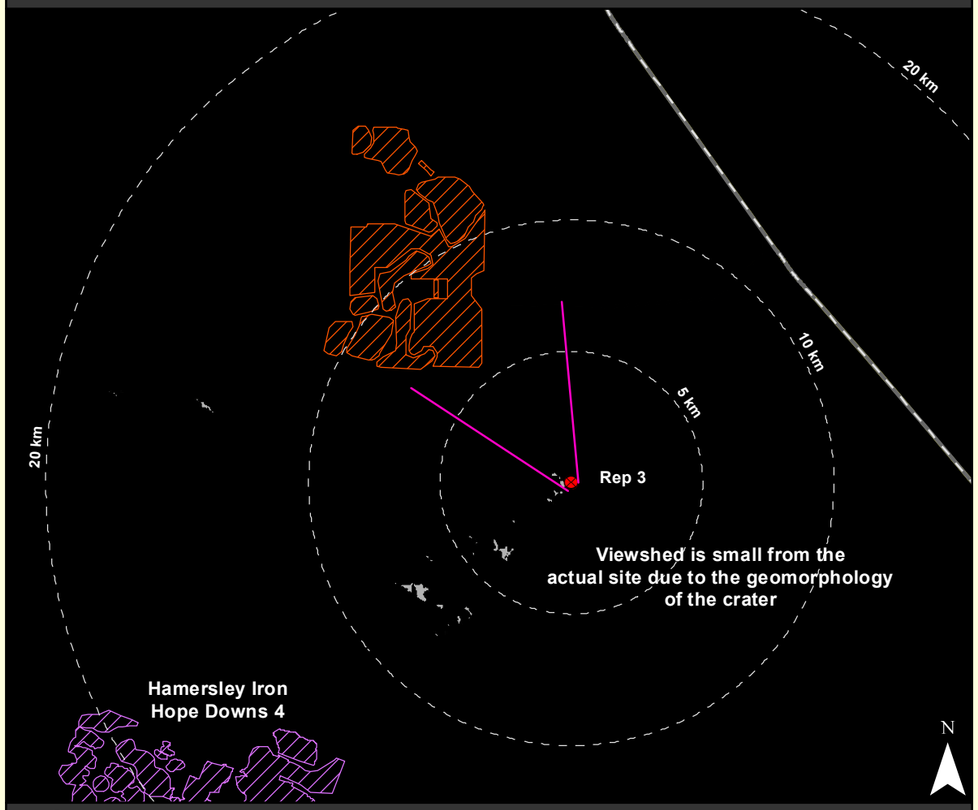
CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	27.80%	Site Significance	Tourism, Recreation
% Pit views created	2.29%	Visitor Traffic	Moderate
% OSA views created	6.98%	Accessibility	Moderate
% Natural Landscape views created	1.17%	Overal Impact	**Low**

SCHEMATIC PHOTOMONTAGE

POST-DEVELOPMENT PHOTOMONTAGE

Figure 31 - R2 Weeli Wolli Creek Swimming Hole

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**R3 Hickman Crater**
Location (GDA94)	119.684502, -23.037551
View Direction	NW
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
Description of View	The site is a very well preserved meteorite impact crater approximately 5.5 kilometers from the Coondiner mining operation. Located on the north eastern ridge of the site, it is one of two viewpoints at the site, the other being within the crater itself. During the time of the survey, two buses of tourists were noted at the site. Impacts to the site itself is unlikely to the restricted viewshed.
Vegetation Screening Capability	High; as the site is located along a creekline, vegetation is relatively dense.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	0.00%	**Site Significance**	Tourism, Recreation
% Pit views created	0.00%	**Visitor Traffic**	High
% OSA views created	0.00%	**Accessibility**	Moderate
% Natural Landscape views created	0.00%	**Overal Impact**	**Low**

SCHEMATIC PHOTOMONTAGE

Conceptual Disturbance Footprint Types

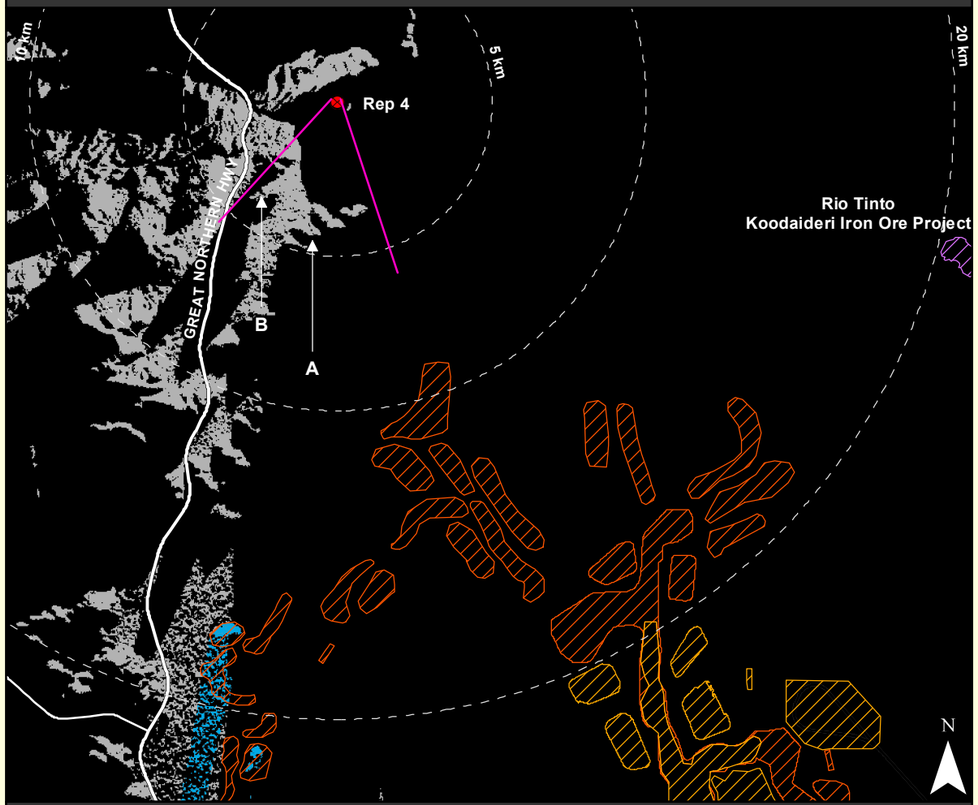
- 30% Development Scenario - Pit
- 30% Development Scenario - OSA
- 30% Development Scenario - Infrastructure
- Full Development Scenario - Pit
- Full Development Scenario - OSA
- Full Development Scenario - Infrastructure

The Coondiner mining operation is located 5.5km away but is shielded by the crater walls and ridges. The project is located close to the floodplain and dust is therefore unlikely to be be significant

POST-DEVELOPMENT PHOTOMONTAGE

Figure 32 - R3 Hickman Crater

VIEWSHED



LEGEND

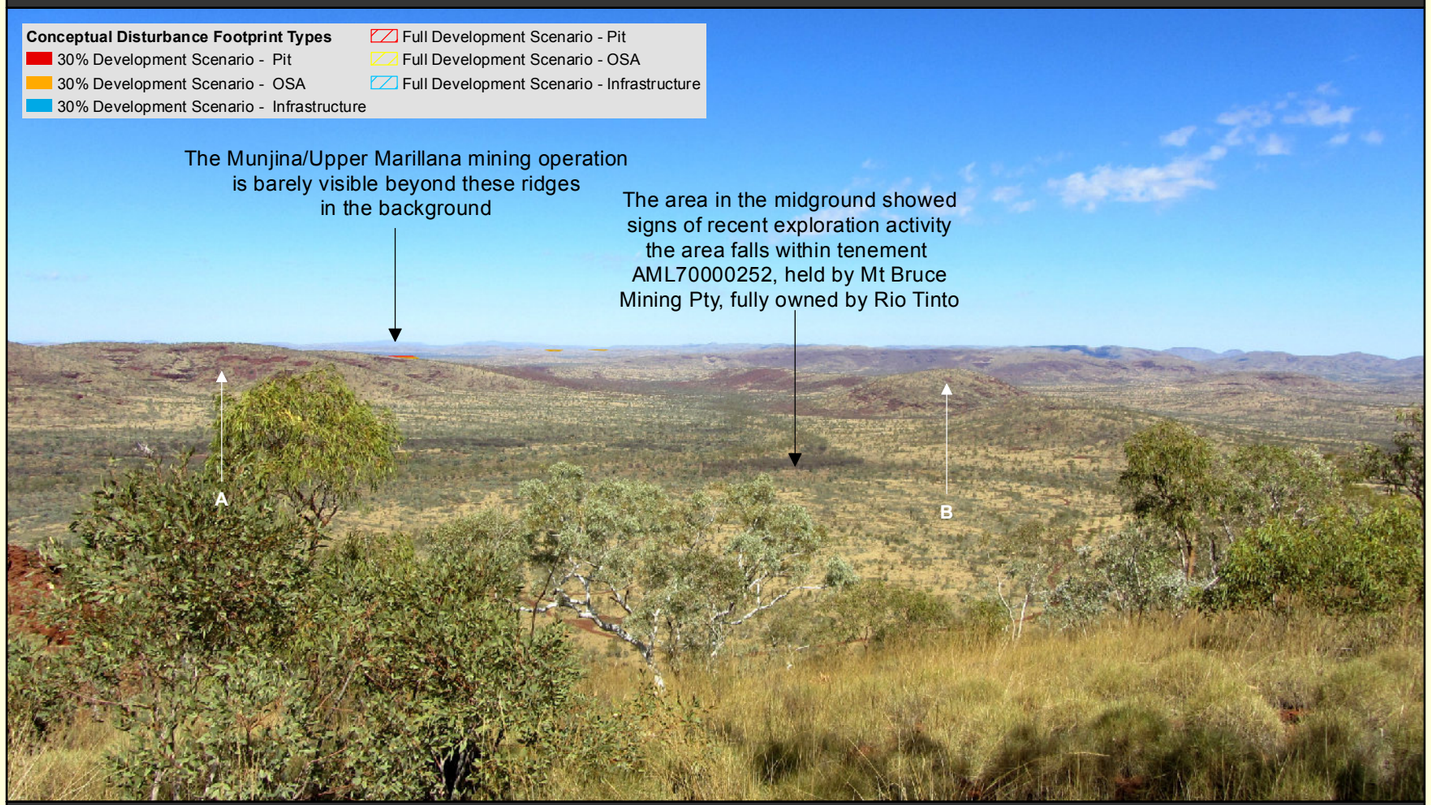
- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

VIEWPOINT CHARACTERISTICS

Site No & Name	**R4 Munjina Hill**
Location (GDA94)	118.75882, -22.48374
View Direction	S
Land System	**Newman -** Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands **Platform** - Dissected slopes and raised plains supporting shrubby hard spinifex grasslands.
Description of View	The site is located on a high point on a mountain ridge to the east of the popular Munjina East Gorge Lookout. The site is easily accessible via a four wheel drive track off the central lookout carpark. At the time of the survey, evidence of recreational activities (camping) was found at various spots.
Vegetation Screening Capability	High; as the site is located along a creekline, vegetation is relatively dense.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	2.85%	**Site Significance**	Recreation
% Pit views created	0.00%	**Visitor Traffic**	Low
% OSA views created	0.48%	**Accessibility**	Moderate
% Natural Landscape views created	0.00%	**Overal Impact**	**Low**

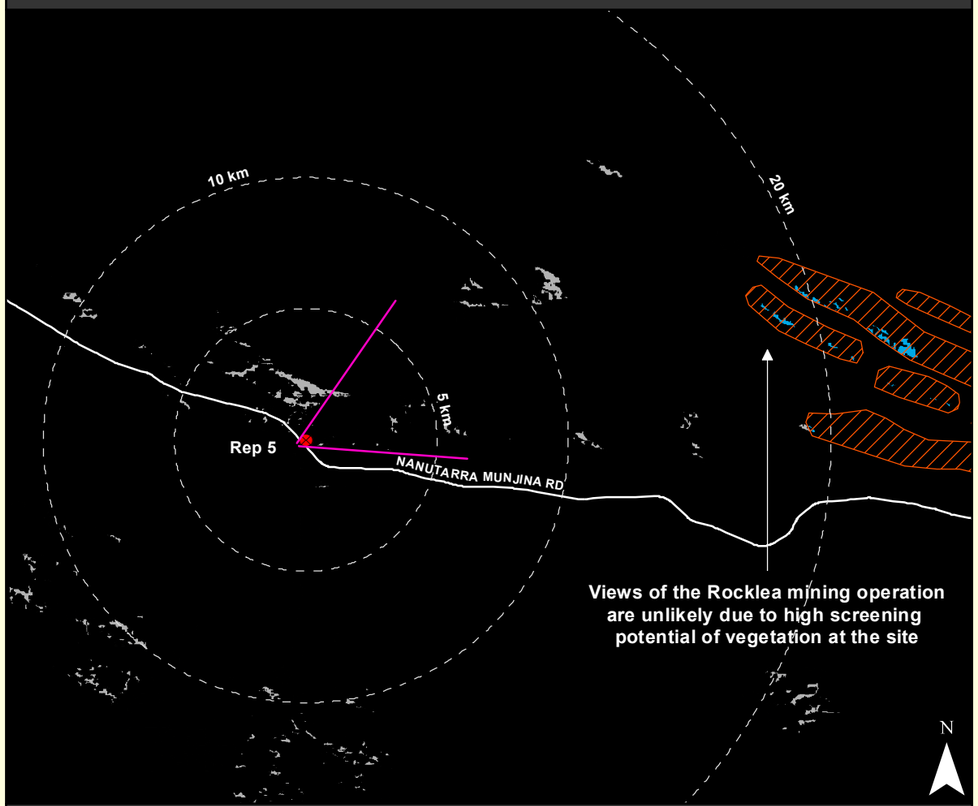
SCHEMATIC PHOTOMONTAGE



POST-DEVELOPMENT PHOTOMONTAGE

Figure 33 - R4 Munjina Hill

VIEWSHED



LEGEND

- Viewpoint
- View Aspect
- Existing Rail Corridors
- Existing Disturbance
- 30% Development Scenario
- Full Development Scenario
- Third Party Reasonably Foreseeable Disturbance
- Altered Views
- Always Visible
- Always Not visible

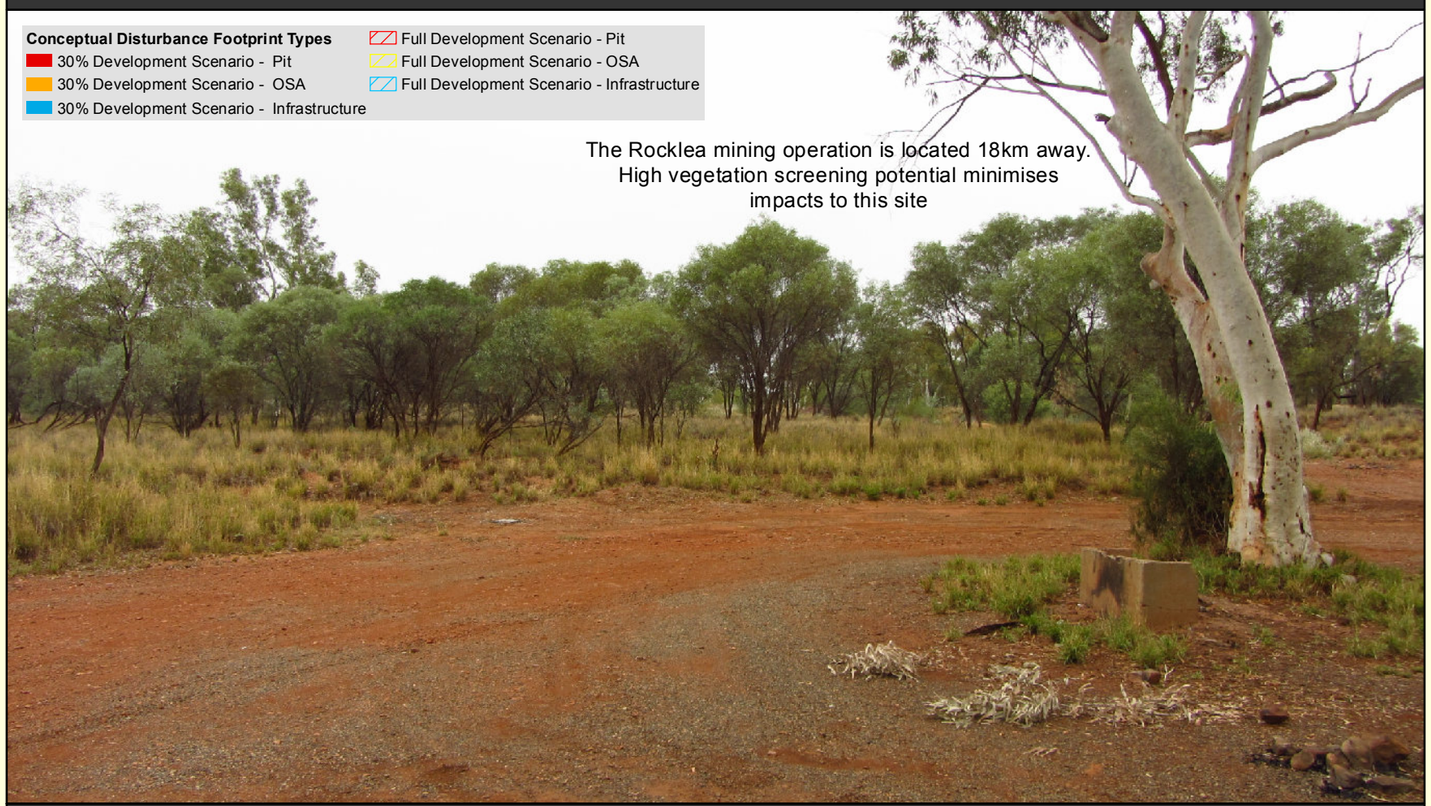
VIEWPOINT CHARACTERISTICS

Site No & Name	**R5 Beasley River 24 Hour Rest Stop**
Location (GDA94)	119.684502, -23.037551
View Direction	ENE
Land System	**River-** Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.
Description of View	The site is the only major rest stop along the Nanutarra-Munjina Road in the Western Pilbara operation zone. It features picnic and camping facilities.The site is primarily used as a rest stop for drivers and a small number of tourists.
Vegetation Screening Capability	High; as the site is located along a creekline, vegetation is relatively dense.

CONCEPTUAL VIEWSHED STATISTICS		SITE VISUAL IMPACT	
% Viewshed blocked out by Development	9.21%	Site Significance	Transport, Recreation
% Pit views created	0.26%	Visitor Traffic	Moderate
% OSA views created	3.70%	Accessibility	High
% Natural Landscape views created	0.00%	Overal Impact	**Low**

SCHEMATIC PHOTOMONTAGE

Conceptual Disturbance Footprint Types
- 30% Development Scenario - Pit
- 30% Development Scenario - OSA
- 30% Development Scenario - Infrastructure
- Full Development Scenario - Pit
- Full Development Scenario - OSA
- Full Development Scenario - Infrastructure



POST-DEVELOPMENT PHOTOMONTAGE

Figure 34 - R5 Beasley River 24 Hour Rest Stop

Table 7. Potential impacts to key and representative site viewsheds

Site	Name	% Viewshed Blocked	% Pit View Created	% OSA View Created	Total Impact %
K1	Tower Hill, Newman	6.38	1.92	1.63	**9.93**
K2	Ophthalmia Dam Picnic Area	9.79	0.47	5.22	**15.48**
K3	Ophthalmia Dam Wall	15.00	2.20	6.34	**23.54**
K4	Round Hill, Newman	8.75	0.78	2.67	**12.2**
K5	Great Northern Hwy 2	74.71	1.58	3.38	**79.66***
K6	Cathedral Gorge Rock Outcrop	28.13	0.25	4.37	**32.75**
K7	Weeli Wolli Spring	36.10	9.22	8.4	**53.72**
K8	Great Northern Hwy 8 – Rail Line Crossing	15.08	0.87	9.84	**25.79**
K9	Mt Robinson 24 Hr Rest Stop	32.90	5.31	9.02	**47.23**
K10	Great Northern Hwy 9	20.07	3.71	8.93	**32.71**
K11	Great Northern Hwy 10	23.13	3.76	7.11	**34**
K12	Great Northern Hwy 11	68.24	1.64	11.76	**81.64**
K13	Great Northern Hwy 12	18.32	2.10	20.86	**41.28†**
K14	Great Northern Hwy 14	59.95	0.59	4.32	**64.86***
K15	Great Northern Hwy 15	7.50	0.34	1.16	**9**
K16	Mt Meharry (combined viewshed)	31.02	3.41	9.24	**43.67**
K17	Nanutarra-Munjina Road 2	0	0	0	**0**
R1	Wanna Munna Pool	16.52	2.16	16.95	**35.63‡**
R2	Weeli Wolli Creek Swimming Hole	27.80	2.29	6.98	**37.07*‡**
R3	Hickman Crater	0	0	0	**0**
R4	Munjina Hill	2.85	0	0.48	**3.33**
R5	Beasley River 24 Hour Rest Stop	9.21	0.26	3.70	**13.17***

* Viewshed statistics may be subject to errors due to vegetation screening in real life resulting in a much smaller viewshed than what is shown in the theoretical analysis. Percentage Impact will likely be similar however.

†Analysis assumes that ridgelines are removed (a limitation of the analysis and conceptual disturbance areas), exposing other areas of the development.

‡Resolution of the terrain used is too coarse to capture details of the site accurately.

4.3.2 Cumulative Impacts

Table 8 details the cumulative impacts on LCTs from existing and proposed BHP Billiton Iron Ore and third party projects within the Strategic Proposal area. It is not an indication of the total impact caused by all operations in a particular LCT, as only developments located inside the Strategic Proposal area were considered. The assessment considered the direct impacts from both BHP Billiton Iron Ore and third party projects in comparison to the existing extents of each LCT's in relation to its statewide pre-European Extents.

Table 8. Cumulative impacts to landscape character affected by the Strategic Proposal

Landscape Character Types (LCT)	Current Extents (% pre-European) undisturbed, including existing impacts from BHP Billiton Iron Ore and 3rd Parties	% pre-European Extent Impacted (additional to existing impacts)		Predicted combined impact (% pre-European extent)	Predicted combined % pre-European extent undisturbed post-impact
		% BHP Billiton Iron Ore Impacts*	% Third Party Impacts		
Hamersley Plateaux	99.10	1.815	0.296	2.112	96.98
Fortescue Valley	99.57	1.132	1.872	3.004	96.56
Bulloo Plains and Hills	99.94	0.121	0.038	0.159	99.78
Chichester Ranges	99.84	0.274	0.201	0.475	99.36
Jigalong Plains	100	-	0.133	0.133	99.86
Warrawagine Hills	99.73	-	0.001	0.001	99.73

* BHP Billiton Iron Ore Impacts are based on the Full Development Scenario, excluding existing impacts

† Third Party impacts at a comparable timeframe to the Full Development Scenario could not be reliably determined.

Table 9 summarises the impacts to Land Systems based on the area proposed to be developed. Only Land Systems affected by the Strategic Proposal are detailed. Additional Land Systems which are only affected by third party developments do exist. The assessment considered the direct impacts from both BHP Billiton Iron Ore and third party projects in comparison to the existing extents of each LCT's in relation to its statewide pre-European Extents.

Table 9. Cumulative impacts to Land Systems affected by the Strategic Proposal

Land Systems	Current Extents (% pre-European) undisturbed, including existing Impacts from BHP Billiton Iron Ore and 3rd Parties	% pre-European Extent Impacted (additional to existing impacts)		Predicted combined impact (% pre-European extent)	Predicted combined % pre-European extent undisturbed post-impact
		% BHP Billiton Iron Ore Impacts	% Third Party Impacts		
Boolgeeda System	98.99	2.219	0.447	2.667	96.33
Brockman System	99.99	0.785	-	0.785	99.21
Cadgie System	100	0.117	-	0.117	99.88
Calcrete System	99.87	0.711	0.061	0.772	99.10
Christmas System	99.58	0.804	0.01	0.814	98.76
Divide System	99.81	0.137	0.294	0.430	99.38
Egerton System	100	0.180	-	0.180	99.82
Elimunna System	97.64	1.194	-	1.194	96.45
Fan System	99.55	0.249	3.146	3.395	96.15
Jamindie System	99.62	0.361	0.980	1.341	98.28
McKay System	99.24	0.428	0.127	0.556	98.68
Newman System	99.16	2.662	0.569	3.232	95.93
Nooingnin System	100	0.066	-	0.066	99.93
Oakover System	99.94	0.246	0.004	0.250	99.69

Land Systems	Current Extents (% pre-European) undisturbed, including existing Impacts from BHP Billiton Iron Ore and 3rd Parties	% pre-European Extent Impacted (additional to existing impacts)		Predicted combined impact (% pre-European extent)	Predicted combined % pre-European extent undisturbed post-impact
		% BHP Billiton Iron Ore Impacts	% Third Party Impacts		
Pindering System	99.05	4.834	0.059	4.894	94.15
Platform System	98.87	1.954	0.302	2.256	96.62
River System	99.19	0.237	0.148	0.385	98.80
Robe System	96.31	0.529	0.174	0.703	95.61
Rocklea System	99.90	0.042	0.006	0.047	99.85
Spearhole System	99.75	0.721	0.539	1.260	98.49
Sylvania System	99.96	0.199	0.862	1.061	98.90
Table System	99.97	0.005	0.030	0.036	99.94
Turee System	99.40	0.046	3.322	3.368	96.04
Urandy System	99.78	0.444	3.037	3.481	96.30
Wannamunna System	99.80	9.847	0.565	**10.413**	**89.39**
Washplain System	99.85	0.580	0.097	0.677	99.18
Zebra System	100	1.757	-	1.757	98.24

Note: these Land Systems are those affected by BHP Billiton Iron Ore projects. Third party developments may affect other Land Systems to a greater or lesser extent, but are not presented here.

Additional impacts at a regional scale were found to peak at 2.1% for the Hamersley Plateaux. Impacts to other LCTs were considerably lower, with the exception of the Fortescue Valley (3%; a considerable portion is attributed to third parties).

At a local scale however, the impact on Land Systems is more apparent. Impacts to the Wannamunna, Pindering, Urandy, Fan, Turee and Newman Systems exceeded 3%. It should be noted that potential impacts to the Urandy, Fan and Turee Systems were largely due to third party developments (Table 9). The distributions of these landforms are shown in Figure 6b.

Impacts to dominant landforms for Land Systems affected by the Strategic Proposal and known third party developments are listed in Table 10. The assessment considered the direct impacts from both BHP Billiton Iron Ore and third party projects in comparison to the existing extents of each dominant landform in relation to its statewide pre-European Extents.

Table 10. Cumulative Impacts to dominant landforms for Land Systems affected by the Strategic Proposal

Dominant Landforms	Current Extents (% pre-European) undisturbed, including existing impacts from BHP Billiton Iron Ore and 3rd Parties	% pre-European Extent Impacted (additional to existing impacts)		Predicted combined impact (% pre-European extent)	Predicted combined % pre-European extent undisturbed post-impact
		% BHP Billiton Iron Ore Impacts*	% Third Party Impacts		
Hills and Ranges	99.71	0.519	0.112	0.631	99.08
Plateaux, mesas and breakaways	99.63	0.147	0.039	0.186	99.14
Dissected plains	99.74	0.626	0.084	0.710	98.98
Stony plains	99.84	0.625	0.146	0.771	98.86
Sandplains	99.69	0.025	0.055	0.080	99.76
Washplains	99.39	0.593	0.682	1.275	98.46
Alluvial plains	99.33	0.106	0.550	0.656	99.25
River plains	99.87	0.174	0.142	0.316	99.07
Calcreted drainage plains	99.93	0.307	0.026	0.334	99.60

The distributions of these landforms are shown in Figure 6b.

4.3.3 Lost Sites

A number of surveyed sites were found to be located within proposed disturbance footprints. These 'lost' sites are listed in Table 11 and correspond to locations on Figure 11.

Site significance was determined using the same assessment of potential severity of impact as well as accessibility as was used in the desktop and field analysis (Section 3.1.2).

Table 11. Sites surveyed that will be lost based on current BHP Billiton Iron Ore development footprints

No	Site Name	Latitude	Longitude	Site Importance*	Scenario during which loss occurs
1	Governor's Range - Central	-23.05987	118.7057	Low	30% Development
2	Jimblebar Access Road 5	-23.320856	119.93525	Moderate	30% Development
3	Ophthalmia Range 3	-23.324127	119.970444	Low	30% Development
4	Governors Range – East	-23.07281	118.69866	Moderate	Full Development
5	Governors Range – West	-23.07083	118.70708	Moderate	Full Development
6	Great Northern Hwy 5	-23.09173	118.93124	High	Full Development
7	Great Northern Hwy 6 – West Angelas Access Road	-23.08444	118.90476	Moderate	Full Development

No	Site Name	Latitude	Longitude	Site Importance*	Scenario during which loss occurs
8	Great Northern Hwy 13	-22.89191	118.80276	High	Full Development
9	Jigalong Alternate Access Road	-23.36508	120.27942	Low	Full Development
10	Jimblebar Access Road 3	-23.314235	119.899721	Moderate	Full Development
11	Jimblebar Access Road 5	-23.320856	119.93525	Moderate	Full Development
12	Ophthalmia Range 1	-23.310172	119.891024	Low	Full Development
13	West Angelas Access Road 1	-23.08395	118.88285	Moderate	Full Development
14	West Angelas Access Road 2	-23.09549	118.84445	Moderate	Full Development
15	West Angelas Access Road 3	-23.10415	118.87458	Moderate	Full Development

* Based on a combination of public access and distance to mining operations.

With the exception of the Great Northern Highway, the vast majority of sites listed in Table 11 do not hold high visual amenity values, most notably due to low accessibility and the lack of unique landscape or visual amenity features.

5 Discussion

5.1 Potential Impacts on Visual Amenity

The impacts resulting from BHP Billiton Iron Ore's Strategic Proposal on visual amenity are discussed below.

5.1.1 Eastern Pilbara Operational Zone

The Eastern Pilbara Operation Zone is a landscape where mining is already a key land use. It is likely that impacts seen will not be new, rather an intensification of existing, observable impacts in publically accessible areas. As the vast majority of current and likely future operations have limited public accessibility and direct visibility, it is considered that visual impacts in this area may be adequately managed through BHP Billiton Iron Ore's standard management practices.

5.1.1.1 Newman Townsite

Sites located within the Newman townsite will not likely experience substantial changes in view experiences; however an intensification of mining within existing view experiences may be expected. Dust models suggest that the Full Development Scenario under the absence of, or with standard dust control measures may result in high to moderate risks of reduced visibility. The 30% Development Scenario however was not found to cause deteriorating visibility levels providing that standard dust control measures are implemented (Pacific Environment Limited 2014).

5.1.1.2 Ophthalmia Dam

Ophthalmia Dam is considered an important location as it is the only large, open and accessible fresh water body in the Central Pilbara and is used for recreation such as boating, picnicking and for various water sports as well as offering a unique view experience in the region. The dam itself however, is man-made, and has been used to manage aquifer recharge. The potential development of pits in close proximity to the dam may impact visual amenity by altering vegetation and surface water features. Other impacts may include reduced public accessibility.

5.1.2 Central Pilbara Operational Zone

The assessment found that sensitive receptors in this operational zone with the highest levels of potential impact were the Great Northern Highway, Weeli Wolli Creek and Mt Meharry.

5.1.2.1 Great Northern Highway

Sites located along the Great Northern Highway, from K8 to K14 will likely experience altered viewsheds (an average of 46% change in pre to post-development extents [Figures 20 to 26; Table 7]) due to their close proximity to several of the proposed mining operations (Mudlark Well, Tandanya, South Flank and Mining Area C).

Indirect impacts to these sites are likely to be caused by intensification of ambient dust levels. Dust modelling conducted on this stretch of highway predicted that there is 'generally a medium to low risk for visibility reduction' with no dust control measures (Pacific Environment Limited 2014).

In most areas, direct interference to the Great Northern Highway from disturbance footprints is minimal. The study has demonstrated that visual amenity values associated with this section of highway are not necessarily unique.

5.1.2.2 Mt Meharry

It is expected the visual impacts from Mt Meharry will also be relatively high due to its relative elevation, the size of its viewshed and the number of developments surrounding it. The viewshed analysis suggested that up to 44% of easterly views from the summit will be directly affected by future operations (Figure 28a; Table 7).

Consideration should be given to potential access routes to Mt Meharry. At present, two access roads exist, however both start at the Juna Downs Road. This area will be subject to the developments associated with the Tandanya mining operation which may result in impaired access. Management of alternate access routes may be a key consideration.

Mt Robinson is an elevated point where visual amenity may be impacted. It is anticipated that views to the north will be altered (due to the South Flank mining operation) as well as views to the west and south (the Gurinbiddy and Mudlark mining operation). A visual impact assessment carried out for the South Flank mining operation assessed impacts to this site in a limited fashion, as with this study, the site was inaccessible at the time of the survey. The geomorphology of Mt Robinson's summit may play a key role in the minimisation of impacts to this site. As the summit is considerably flatter, wider and forms more of a plateau than that of Mt Meharry, impacts to the actual summit may be lower than views from the edges of the summit plateau.

5.1.2.3 Weeli Wolli Creek

The analysis shows that sites along the creek are unlikely to be directly impacted by BHP Billiton Iron Ore mining operations (no views of mining operations are expected) however impacts from third party operations may be possible. Loss of access to areas of the creek may result in a decrease in accessible visual amenity values at various

locations along the creek. Indirect impacts that may cause changes in visual amenity (changing water and vegetation patterns) have not been assessed.

5.1.3 Northern Pilbara Operations

There were limited sites identified within the Northern Pilbara Operational Zone that represented key viewpoints. The region is largely undeveloped and primarily used for pastoral purposes, mining and some transport (via the rail access road being used as an alternate route to the Great Northern Highway).

Several viewpoints in the operational zone warrant mention. The Hickman Crater, seven kilometres southeast of the Coondiner mining operation was analysed as a representative viewpoint however both viewshed and photomontage analysis suggested that the site will not be directly affected.

The Punda Spring site is a valued Aboriginal site that was not assessed as a key viewpoint in this study due to cultural sensitivity of the site. The spring is located approximately 900 m from the Coondiner mining operation; however it is nestled within a valley. Impacts to this site are likely to be low.

The Wirlimura Indigenous Camp is a site located within the Roy Hill mining operation tenure, directly westward of Viewpoint 33 (Figure 11; Appendix B). The proposed development in this area will be developed approximately 4.4 km to the east, behind a series of ridges (Figure 3b). No direct impact on the visual amenity of the site is expected.

5.1.4 Western Pilbara Operational Zone

Impacts to the Western Pilbara Operational Zone (Rocklea) are expected to be relatively minimal in comparison with other operational zones. The mining operation is located behind a natural ‘wall’ formed by a ridgeline between it and the Nanutarra-Munjina Road. It is likely that sites with high visual amenity values along the Nanutarra-Munjina Road will be largely unaffected.

5.1.5 Cumulative Impacts to Visual Amenity

The vast majority of key viewpoints identified in this study are located at a distance at which cumulative impacts from third party developments will be minimal. The exception to this is Mt Meharry and Weeli Wolli Creek.

On a clear day, the current view from Mt Meharry extends to Robe River Mining’s West Angelas Iron Ore Mine, approximately 20 kilometres southeast. The large distance means that only low dust plumes are visible. The West Angelas Project is expected to have a life of mine extending to 2034 (EPA 2009a). Surrounding BHP Billiton Iron Ore mining operations that are active during this period may contribute to cumulative dust impacts. Dust models predict that ambient dust concentrations may be higher at this site under both the 30% Development Scenario and the Full Development Scenarios

by a small margin, with leading dust control measures (Pacific Environment Limited 2014). As West Angelas moves into closure and rehabilitation in future, more BHP Billiton Iron Ore operations will be developed closer to Mt Meharry therefore potentially contributing directly and indirectly to increased impacts at the site.

The Weeli Wolli Creek area may also experience some cumulative impacts, due to a number of third party developments (the proposed Yandicoogina expansion projects) in the immediate surrounds. Cumulative impacts to amenity at sites in the Weeli Wolli Creek area may eventuate from alterations to the creek's surface water flow patterns (resulting in a reduction of riparian vegetation in some areas and/or the growth of vegetation in others) or from direct interference from mining activities. No direct impacts are expected to sites with high visual amenity values from BHP Billiton Iron Ore's Strategic Proposal.

The North Pilbara Operational Zone, despite its lack of key sites is likely to be the area with the largest cumulative impacts to landscape (impacts to visual amenity are restricted by the limited number of sites with high visual amenity values in the area). It is expected that by 30% Development, a large number of iron ore projects will be in operation on either side of the Fortescue Marsh. These include BHP Billiton Iron Ore's Marillana Project, Rio Tinto's Koodaideri and Marillana Iron Ore Projects, Roy Hill's Roy Hill Iron Ore Project, Fortescue Metals Group's Nyidinghu Project as well as the likely expansions of the Cloudbreak and Christmas Creek mines (Rio Tinto Iron Ore 2012; EPA 2009b; FMG 2012).

In addition to this, BHP Billiton Iron Ore's Roy Hill, Mindi and Coondiner mining operations are expected to be developed alongside a number of other presently undeveloped third party projects. Cumulative visual impacts to the Fortescue Marsh should be considered as developments in the region will essentially occur along both sides of the marsh. However, this study did not identify any accessible sites with significant visual amenity values within the marsh and therefore impacts to visual amenity associated with it are likely to be minimal.

The Rocklea mining operation, the only one known to be reasonably foreseeable in the Western Pilbara operation area, is located alongside Australian Premium Iron's West Pilbara Iron Ore (Hardey) Project. However as the Hardey Project has an expected life of mine of 10-15 years, it is likely that the project will be moving into the rehabilitation and closure phases at the time when Rocklea is proposed to be developed (API 2013).

5.2 Potential Impacts to Landscapes

As was shown in Tables 8, 9 and 10, impacts to any given LCT, Land System and Landform are relatively minimal based on the estimated area of land impacted by BHP Billiton Iron Ore and third party operations in comparison with their pre-European extents. At a regional scale, landscape values associated with the Strategic Proposal

is unlikely to be significantly impacted. Table 9 however shows that several Land Systems, in particular the Wannamunna, Pindering and Newman Land Systems will potentially be affected, primarily due to the Strategic Proposal.

The Wannamunna System is characterised by 'hardpan plain and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands' (Van Vreeswyk et al. 2004). This system is relatively small and is largely located within the Mudlark, Tandanya and Munjina/Upper Marillana mining operations (Van Vreeswyk et al. 2004).

The Pindering System on the other hand, described as 'gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex' is considerably smaller which accounts for the large percentage of impact (Van Vreeswyk et al. 2004). This Land System is restricted to the South Flank and Munjina/Upper Marillana mining operation areas. Access to the majority of the system is relatively restricted, and few locations with high visual amenity value were found. One key site was located within this system (K15; Figure 27) however is associated with the Great Northern Highway. Impacts to this area were deemed low based on the findings of the viewshed and photomontage analysis.

The Newman System, described as 'rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands', is relatively well distributed throughout the Hamersley Ranges (Van Vreeswyk et al. 2004). Impacts on this system are relatively high due to the high concentration of iron bearing formations (predominantly the Brockman Iron Formation), and as such are commonly targeted in a number of BHP Billiton Iron Ore and third party projects. It is expected that following the Full Development Scenario and reasonably foreseeable third party developments, approximately 95.9% of the Newman System's pre-European extents may be remaining. Cumulative impacts on the Turee and Urandy and Fan Systems are also notably high; however the vast majority of impact is from third party projects.

It is worth noting that the impact estimates in Tables 8, 9 and 10 consider BHP Billiton Iron Ore's Full Development Scenario and third party developments in the near future. Should inclusion of future third party developments be used, estimates of potential impact are likely to increase. It is likely that cumulative impacts to the Newman System in particular may increase over time, as more third party developments are proposed. This increase would be associated with a decrease in BHP Billiton Iron Ore's percentage contribution towards potential impact. At present impacts from proposed mining operations are low and are unlikely to compromise the integrity and variety of these landscapes or landforms, when considering their representation and extents across the Pilbara. It is expected that the certainty in estimates of cumulative impacts will increase over time.

6 Conclusion

This LVRA presents a review of the key landscape values of areas surrounding the Strategic Proposal area. The study also presents a review of public and internal datasets and has identified a number of locations within the Strategic Proposal Area with high values to visual amenity. The amenity values associated with these locations were documented while potential impacts were assessed with consideration given to current and reasonably foreseeable third party developments. The results of this assessment have in turn identified a number of areas which can be considered as priority areas for management.

6.1 Summary of Potential Impacts to Visual Amenity

The assessment found that implementation of mining operations within the Central Pilbara operational zone is most at risk from impact resulting from the Strategic Proposal as it introduces mining as a relatively new land use (in areas that have highest levels of public accessibility). View experiences in many publicly accessible viewpoints with high visual amenity values (Great Northern Highway, Mt Meharry and Weeli Wolli Creek) may also be altered by the removal of elements contributing to visual amenity or by the restrictions in access. The Eastern Pilbara Operational Zone may experience intensification in mining, an existing prevalent land use. The Northern Pilbara operational zone will likely generate a relatively lower level of impact due to the lower density of operations and the fewer number of publicly accessible sites. The Western Pilbara Operational Zone was found to have negligible levels of direct impact to surrounding sensitive receptors.

The assessment also identified a number of priority areas within each operational zone. Impacts to visual amenity at each priority area is summarised in Sections 6.1.1 to 6.1.4.

6.1.1 Eastern Pilbara Operational Zone

The Eastern Pilbara operations surround the townsite of Newman, which hosts the largest density of sensitive receptors. It is anticipated that impacts are likely to centre on areas in and around the townsite. The assessment showed that priority areas for management within this operational zone are the Newman townsite, and Ophthalmia Dam.

6.1.1.1 Newman Townsite Area

As mining is a present land use, intensification in visible mining operations may be expected. Priority should be placed on management measures that minimise adverse

impacts to visual amenity (e.g. those associated with Radio Tower, Round Hill and other public areas). Impacts to the townsite can therefore be summarised as:

- Intensification of mining as an existing land use, however this does not alter existing view experiences; and
- Potential increases in ambient dust concentrations if poor dust control measures are implemented (Pacific Environment Limited 2014).

6.1.1.2 Ophthalmia Dam

Ophthalmia Dam is considered a location with high visual amenity primarily value due to its uniqueness. Priority should be placed on minimising potential impacts to visual amenity values wherever possible. Potential impacts to the visual amenity of this site include:

- Potential for nearby mining operations to indirectly impact visual amenity values of the dam;
- Access to the site may become limited; and
- Potential loss in a relatively rare view experience (vast body of fresh water).

6.1.2 Central Pilbara Operational Zone

As mining is currently not a widespread land use, impacts to the Central Pilbara Operational Zone are estimated to affect high value receptors sites in the area, such as the Great Northern Highway, Mt Meharry and Weeli Wolli Creek. These can be considered priority areas for visual impact management.

6.1.2.1 Great Northern Highway

The Great Northern Highway is considered to be a priority for management in this operational zone due to its high level of use and its role as an access route to other high value locations. Potential impacts are expected to be:

- Direct alteration of visual amenity associated with a major national transport route; and
- Access to surrounding high value sites may be impaired.

6.1.2.2 Mt Meharry

Mt Meharry's location in between two mining operations as well as its significance to the State (highest peak in WA) warrants it to be considered as a priority area. Potential impacts to Mt Meharry can be summarised as stemming from:

- Direct replacement of existing view experience from natural landscapes to mining operations;

- Potential impacts to accessibility; and
- Potential indirect impacts to the iconic values in some areas of Karijini National Park associated with potential changes to views and viewing experience.

6.1.2.3 Weeli Wolli Creek

Weeli Wolli Creek can be considered a priority area for management due to it being a hotspot for biodiversity and presents unique visual amenity values (due to running water all year round). Potential impacts resulting from the Strategic Proposal on the Creek sites are:

- Potential changes in the nature of the creek (flow patterns and vegetation) which directly influences visual amenity; and
- Potential cumulative impacts from nearby third party operations.

6.1.3 Northern Pilbara Operational Zone

The Northern Pilbara Operational Zone was found to impact considerably fewer sensitive receptors than the Eastern or Central Pilbara Operational Zones. No areas of significant risk of visual amenity impacts were found and as such, no priority areas have been identified.

6.1.4 Western Pilbara Operational Zones

The Nanutarra-Munjina Road contains the closest receptors to the Rocklea mining operation; however the LVRA showed there were no direct impacts to visual amenity at viewpoints located along the road.

At present all information on third party developments suggests that only one other project (API's West Pilbara Iron Ore [Hardey Project]) will be active in this operational zone, and is expected to be closed at the time when the Rocklea Project is to be developed (based on current projections). As the ridgeline adjacent to the Nanutarra-Munjina Road shields it from direct views of the site, direct impacts to visual amenity along the road is unlikely.

It is unlikely that accessibility to high value sites via the Nanutarra-Munjina Road will be altered as interaction from the Rocklea mining operation is limited.

6.2 Summary of Potential Impacts to Landscapes

The Strategic Proposal area was found to encompass a large variety of landscapes, however two general landscape types were found to be most commonly found immediately surrounding the proposed mining operations, namely landscapes dominated by hills, ridges, plateaux and elevated areas, and landscapes dominated by lower slopes and plains.

Landscapes dominated by hills, ranges and plateaux (corresponding to the Newman Land System) typically contain the largest diversity of locations with high visual amenity values (panoramic viewpoints, lookouts, gorges, rock pools and heritage sites). This is mainly due to the large diversity of elements found at typical locations in the Newman Land System. The values often found at locations within this Land System also tended to be synonymous with the visual character of the Pilbara (ancient, weathered, wide open spaces and contrasts between the soils, rocks, vegetation and sky).

Landscapes dominated by lower slopes and plains generally showed lower densities of locations with high visual amenity, but were found to be a very common landscape within the Strategic Proposal Project Area (related to the Boolgeeda and Wannamunna Land Systems).

The study has shown that impacts to regional landscape types are low, with maximum impact predicted to be approximately 2.11% for the Hamersley Plateaux LCT and 3% for the Fortescue Valley LCT (primarily third party). Impacts at local scales on individual Land Systems however may be considerably higher, peaking at 10.4% for the Wannamunna System (dominated by hardpan plains landscapes). Other Land Systems which were found to have high levels of cumulative impact (in order of decreasing potential impact levels) were the Pindering (mulga dominated gravelly plains), Urandy (stony alluvial plains), Fan (washplains and gilgai plains), Turee (stony alluvial plains) and Newman Systems (hills, ridges and elevated areas). It should be noted that none of these Land Systems present a unique view experience when other local landscapes within the Strategic Proposal are considered. Impact levels to the Urandy, Fan and Turee Sytems were also found to stem primarily from third party developments.

Priorities for further work and management may be extended to the Wannamunna and Pindering Systems, as these were found to be geographically restricted, with a higher level of potential impact attributable to the Strategic Proposal.

6.2.1 Wannamunna System

The Wannamunna Land System was found within the Mudlark, Tandanya and Munjina/Upper Marillana mining operation. The assessment considers that visual amenity values associated with this system are low due to the lower number of high value locations found. From a broad landscape perspective, being dominated by rocky plains, the Wannamunna System does not hold any unique landscape values.

Due to its limited geographic extent and the high contribution of potential impacts from BHP Billiton Iron Ore developments, it is advised that further work be undertaken on this system in the future, at a time when more certainty around the development extent and the design characteristics are available.

6.2.2 Pindering System

This system was found to be primarily located within the South Flank and Munjina/Upper Marillana mining operations. The system also consists primarily of plains landscapes. Visual amenity in this system is limited and it does not hold any unique landscape values.

It is advised that further work be undertaken on this system in the future, at a time when more certainty around the development extent and the design characteristics are available.

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8 Disclaimer

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Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary. All information on site layouts and infrastructure is based on proposed designs and may not reflect significant future changes.

APPENDIX A

Key and Representative Viewpoints

8.1.1 Key Viewpoint 1 - Tower Hill, Newman

Tower Hill (also known as Radio Tower Hill) Lookout provides panoramic views of the town of Newman, the Mt Whaleback Operation and the surrounding landscape. The lookout is situated behind the Newman Visitor Centre and is easy to access by road and walking tracks (DriveWA, 2013).

8.1.2 Key Viewpoint 2 - Ophthalmia Dam Picnic Area

Ophthalmia Dam is a popular swimming and recreation spot (fishing and sailing) 16 km north east of Newman (About Australia 2014). The site features picnic facilities.

8.1.3 Key Viewpoint 3 - Ophthalmia Dam Wall

Ophthalmia Dam is valued by residents and tourists for its views of sunsets and landscape surrounding the town of Newman (About Australia 2014). The dam wall is used as a lookout point, offering panoramic views over the Fortescue River valley.

8.1.4 Key Viewpoint 4 - Round Hill, Newman

Round Hill is a locally significant recreation spot used primarily for camping and hiking. It offers 360^{o} panoramic views of the Fortescue River Valley as well as of Ophthalmia Ridge (pictured). Part of the site is also regionally significant as an Aboriginal heritage site.

8.1.5 Key Viewpoint 5 - Great Northern Hwy 2

The view from a stopover along the Great Northern Highway, the primary transport route from Perth to Port Hedland.

8.1.6 Key Viewpoint 6 - Cathedral Gorge Rock Outcrop

This view is typical of the view highway users experience when passing through the Ophthalmia Ranges through Cathedral Gorge.

8.1.7 Key Viewpoint 7 - Weeli Wolli Spring

Weeli Wolli Spring is a permanent spring located approximately 100 km from the town of Newman. The spring has considerable cultural and spiritual significance to the traditional owners of the Hamersley Range (DEC 2009). The spring supports a unique community of plants and animals some of which are endemic to the spring (DEC 2009). The permanence of the spring is thought to be due to the ongoing discharge of abstracted groundwater from Rio Tinto's Hope Downs Mine's.

8.1.8 Key Viewpoint 8 - Great Northern Hwy 8

This site is a rest stop located alongside Rio Tinto's Hope Downs rail crossing. The site is one of the most easily accessible points to view passing ore trains which are considered an attraction. The site features a number of stop overs and observation points.

8.1.9 Key Viewpoint 9 - Mt Robinson 24 Hour Rest Stop

The Mount Robinson Rest Area is a free overnight rest area 107 km northwest of Newman off the Great Northern Highway. The rest area provides scenic views of a low mountain ranges and The Governor (pictured). The site is used as an access point to Mt Robinson's summit trail. Historically, the summit has been accessible via four wheel drive vehicle however due to poor track conditions in recent years, access is only currently possible by foot.

8.1.10 Key Viewpoint 10 - Great Northern Hwy 9

The view from along the Great Northern Highway, the primary transport route from Perth to Port Hedland. There is no stopover at this site. Lake Robinson is located within the grove of mulga. The lake is devoid of surface water during the drier months.

8.1.11 Key Viewpoint 11 - Great Northern Hwy 10

The view from the Great Northern Highway, the primary transport route from Perth to Port Hedland. There is no stopover at this site.

8.1.12 Key Viewpoint 12 - Great Northern Hwy 11

View from along the Great Northern Highway, the primary transport route from Perth to Port Hedland. There is no stopover at this site. Iron Ore ridge is seen in the midground. The aptly named ridge continues to the east and forms the primary deposit mined at the Area C minesite.

8.1.13 Key Viewpoint 13 - Great Northern Hwy 12

View from along the Great Northern Highway, the primary transport route from Perth to Port Hedland. There is no stopover at this site. Iron Ore ridge is seen in the background. The Area C mine site is located to the east, towards the left side of the frame.

8.1.14 Key Viewpoint 14 - Great Northern Hwy 14

The western view from a rest stop along the Great Northern Hwy.

8.1.15 Key Viewpoint 15 - Great Northern Hwy15

The Marillana Bridge lookout located alongside the Great Northern Highway. A rest stop is located directly after the bridge and is therefore a site where visitors may observe the landscape.

8.1.16 Key Viewpoint 16 - Mt Meharry (northeastern view)

Mount Meharry is Western Australia's highest peak, at an elevation of 1,249 m Australian Height Datum (AHD). It is located in the Hamersley Range within the southeastern border of Karijini National Park. Under good weather conditions, the summit can be accessed via four wheel drive vehicle and is a popular spot with tourists, as it offers 360^{o} panoramic views of the Hamersley Ranges.

Key Viewpoint 16 - Mt Meharry (southeastern view)

Mt Robinson and the Governor are visible to the very left of the frame.

8.1.17 Key Viewpoint 17 -Nanutarra-Munjina Road 2

Nanutarra-Munjina (previously Nanutarra-Wittenoom) Road is located alongside the Hamersley Range. It is the primary transportation route from Tom Price and Paraburdoo to Nanutarra and is primarily used by heavy transport vehicles.

8.1.18 Representative Viewpoint 1 –Wanna Munna Pool

Wanna Munna Pool and rock art site is located between Karijini National Park and Newman. The site contains a waterhole with a large number of petroglyphs contained on the rocks surrounding the waterhole, making it a regionally significant site in terms of its Aboriginal heritage value.

8.1.19 Representative Viewpoint 2 –Weeli Wolli Creek Swimming Hole

This is one of the more popular swimming holes located along Weeli Wolli Creek, directly downstream of the Hope Downs groundwater outfall. This site is primarily used for recreation, including swimming, camping and freshwater angling. The site is accessible via two major routes and by four wheel drive vehicle.

8.1.20 Representative Viewpoint 3 - Hickman Crater

The Hickman Crater is a meteorite impact crater approximately 36 kilometres north east of Newman, (accidentally) discovered by Dr Arthur Hickman from the Geological Survey of WA while browsing aerial imagery (DMP 2013). Tour operators in Newman run regular tours to the site.

8.1.21 Representative Viewpoint 4 –Munjina Hill

This site is accessible via a track and a four wheel drive vehicle from the Munjina Gorge Lookout, a regionally significant lookout site. Its proximity and access from a high value site makes it a likely candidate for regular use (evidence of camping at this site was noted during the field survey).

8.1.22 Representative Viewpoint 5 - Beasley River 24 Hour Rest Stop

The Beasley River rest area provides free camping and amenities for travellers along the Nanutara-Munjina Road. Due to its regular use and location, it was considered a high value site in the Western Pilbara operational zone.

APPENDIX B

Surveyed Viewpoints

Site ID	K1	**Site Name**	Tower Hill, Newman	**Location**	119.725789	-23.363012
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	High	
Setting	Lookout site within the town of Newman			**Land Use**	Tourism	

Site ID	K2	**Site Name**	Ophthalmia Dam Picnic Area	**Location**	119.877737	-23.339803
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	High	
Setting	Picnic and water-sport site on the north western banks of Ophthalmia Dam			**Land Use**	Recreation	

Site ID	K3	**Site Name**	Ophthalmia Dam Wall	**Location**	119.879311	-23.338899
Impact Level	High	**Mining Ops.**	Newman, Jimblebar	**Site Usage**	Moderate	
Setting	The view over the Fortescue valley floodplain from a lookout point on the Dam's north wall			**Land Use**	Recreation	

Site ID	K4	**Site Name**	Round Hill, Newman	**Location**	119.77057	-23.44394
Impact Level	Moderate	**Mining Ops.**	Newman, Jimblebar	**Site Usage**	High	
Setting	On the top of Round Hill, overlooking the Fortescue Valley floodplain.			**Land Use**	Tourism, Recreation	

Site ID	K5	**Site Name**	Great Northern Hwy 2	**Location**	119.724969	-23.322861
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	High	
Setting	Stopover location alongside the GNH			**Land Use**	Transport	

Site ID	K6	**Site Name**	Cathedral Gorge Rock Outcrop	**Location**	119.626511	-23.275818
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Moderate	
Setting	Rock outcrop beside Cathedral Gorge			**Land Use**	Tourism, Transport	

Site ID	K7	**Site Name**	Weeli Wolli Spring	**Location**	119.20634	-22.91612
Impact Level	Moderate	**Mining Ops.**	Jinidi, MAC	**Site Usage**	High	
Setting	Within the creek bed directly down-stream from the Spring site.			**Land Use**	Tourism, Recreation	

Site ID	K8	**Site Name**	Great Northern Hwy 8	**Location**	118.89232	-23.0709
Impact Level	High	**Operations**	Mudlark	**Site Usage**	High	
Setting	Stopover site adjacent next to the Rio Tinto Iron Ore rail line. Used to view passing trains.			**Land Use**	Transport, Tourism	

Site ID	K9	**Site Name**	Mt Robinson 24 Hour Rest Stop	**Location**	118.84933	-23.04253
Impact Level	Moderate	**Operations**	Mudlark, Gurinbiddy	**Site Usage**	High	
Setting	View from the 24 hour rest stop at Mt Robinson. Access to the summit starts here.			**Land Use**	Tourism, Recreation	

Site ID	K10	**Site Name**	Great Northern Hwy 9	**Location**	118.8243	-23.00332
Impact Level	High	**Operations**	Mudlark	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway			**Land Use**	Transport	

Site ID	K11	**Site Name**	Great Northern Hwy 10	**Location**	118.80338	-22.98518
Impact Level	High	**Operations**	Gurinbiddy, Mudlark	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway.			**Land Use**	Transport	

Site ID	K12	**Site Name**	Great Northern Hwy 11	**Location**	118.81788	-22.93439
Impact Level	High	**Operations**	Mudlark, Tandanya	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway			**Land Use**	Transport	

Site ID	K13	**Site Name**	Great Northern Hwy 12	**Location**	120.193748	23.365037
Impact Level	High	**Operations**	MAC, Tandanya	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway			**Land Use**	Transport	

Site ID	K14	**Site Name**	Great Northern Hwy 14	**Location**	118.77691	-22.86333
Impact Level	High	**Operations**	Tandanya	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway			**Land Use**	Transport	

Site ID	K15	**Site Name**	Great Northern Hwy 15	**Location**	118.70065	-22.68164
Impact Level	Moderate	**Operations**	Munjina/Upper Marillana	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway at the Marillana Bridge lookout			**Land Use**	Transport	

Site ID	K16	**Site Name**	Mt Meharry (northeast view)	**Location**	118.587745	-22.98006
Impact Level	High	**Operations**	Mudlark, Tandanya, South Flank, MAC	**Site Usage**	Moderate	
Setting	The view from the summit of Mt Meharry, WA's highest peak			**Land Use**	Tourism	

Site ID	K16	**Site Name**	Mt Meharry (southeast view)	**Location**	118.587745	-22.98006
Impact Level	High	**Operations**	Mudlark, Tandanya, South Flank, MAC	**Site Usage**	Moderate	
Setting	The view from the summit of Mt Meharry, WA's highest peak			**Land Use**	Tourism	

Site ID	K17	**Site Name**	Nanutarra-Munjina Road 2	**Location**	117.19765	-22.97024
Impact Level	Moderate	**Operations**	Rocklea	**Site Usage**	Moderate	
Setting	Stop over site along the Nanutarra-Munjina Road			**Land Use**	Transport	

Site ID	R1	**Site Name**	Wanna Munna Pool	**Location**	119.127914	-23.109804
Impact Level	Low	**Operations**	Jinidi	**Site Usage**	High	
Setting	Adjacent to the rock art and pool site. One of the most important heritage sites in the area.			**Land Use**	Tourism, Recreation	

Site ID	R2	**Site Name**	Weeli Wolli Creek Swimming Hole	**Location**	119.23605	-22.88162
Impact Level	Moderate	**Operations**	Jinidi, MAC, Ministers North, Marillana	**Site Usage**	Moderate	
Setting	A campsite and swim hole site along Weeli Wolli Creek.			**Land Use**	Recreation	

Site ID	R3	**Site Name**	Hickman Crater - NE Ridge	**Location**	119.684502	-23.037551
Impact Level	Low	**Operations**	Coondiner	**Site Usage**	High	
Setting	On the ridge of Hickman Crater, a small, well preserved meteorite impact crater.			**Land Use**	Tourism	

Site ID	R4	**Site Name**	Munjina Hill	**Location**	118.75882	-22.48374
Impact Level	Moderate	**Operations**	Munjina/Upper Marillana	**Site Usage**	Moderate	
Setting	The view from a site on a hill adjacent to a site on Munjina Gorge, accessible via 4WD track			**Land Use**	Tourism, Recreation	

Site ID	R5	**Site Name**	Beasley River 24 Hour Rest Stop	**Location**	116.97783	-22.94904
Impact Level	Low	**Operations**	Rocklea	**Site Usage**	Moderate	
Setting	The view from the Beasley River 24 hour rest stop			**Land Use**	Transport, Tourism	

Site ID	1	**Site Name**	Jimblebar Access Road 1 - Trugallenden Pool	**Location**	119.867665	-23.31089
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Within the Fortescue River plain close to Trugallenden Pool			**Land Use**	Recreation	

Site ID	2	**Site Name**	Marble Bar Road - Track off	**Location**	119.85397	-23.3198
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	The view of the OB23 project from a 4WD track located alongside the Marble Bar Rd			**Land Use**	Recreation, Mining	

Site ID	3	**Site Name**	Great Northern Hwy 1 - Gingiana Pool (approx)	**Location**	119.78904	-23.38017
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Within the Fortescue River creek bed close to Gingiana Pool			**Land Use**	Recreation	

Site ID	4	**Site Name**	Homestead Creek Access Road	**Location**	119.674405	-23.29382
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Access road to Homestead Creek. Access restricted at time of the survey			**Land Use**	Transport, Exploration	

Site ID	5	**Site Name**	Great Northern Hwy 3 - Cathedral Gorge	**Location**	119.625205	-23.274486
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	High	
Setting	View from the exit of the Great Northern Hwy at Cathedral Gorge			**Land Use**	Transport, Tourism	

Site ID	6	**Site Name**	Jimblebar Access Road 2	**Location**	119.880939	-23.314248
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Track along the Jimblebar Access road at the foot of Ophthalmia Ridge			**Land Use**	Exploration, Transport	

Site ID	7	**Site Name**	Jimblebar Access Road 3	**Location**	119.899721	-23.314235
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Track along the Jimblebar Access road at the foot of Ophthalmia Ridge			**Land Use**	Exploration, Transport	

Site ID	8	**Site Name**	Jimblebar Access Road 4	**Location**	119.907219	-23.31351
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Track along the Jimblebar Access road at the foot of Ophthalmia Ridge			**Land Use**	Exploration, Transport	

Site ID	9	**Site Name**	Jimblebar Access Road 5	**Location**	119.93525	-23.320856
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	Track along the Jimblebar Access road at the foot of Ophthalmia Ridge			**Land Use**	Mining (Exploration, Access)	

Site ID	10	**Site Name**	Ophthalmia Range 3	**Location**	119.970444	-23.324127
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	View from the top of Ophthalmia Ridge			**Land Use**	Mining (Exploration)	

Site ID	11	**Site Name**	Ophthalmia Range 1	**Location**	119.891024	-23.310172
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	View from the top of Ophthalmia Ridge			**Land Use**	Mining (Exploration)	

Site ID	12	**Site Name**	Ophthalmia Range 2	**Location**	119.960961	-23.319118
Impact Level	High	**Mining Ops.**	Newman	**Site Usage**	Low	
Setting	View from the top of Ophthalmia Ridge			**Land Use**	Exploration	

Site ID	13	**Site Name**	Jimblebar Creek - Inawally Pool	**Location**	120.193748	-23.365037
Impact Level	Moderate	**Mining Ops.**	Jimblebar	**Site Usage**	Low	
Setting	A pool located along Jimblebar Creek. Various birds, cattle and dingoes were noted.			**Land Use**	Exploration	

Site ID	14	**Site Name**	Stuarts Pool - Access Track 3	**Location**	119.568722	-23.234358
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	Moderate	
Setting	Access track to Stuarts Pool (inaccessible at time of survey)			**Land Use**	Tourism, Recreation	

Site ID	15	**Site Name**	Stuarts Pool - Access Track 2	**Location**	119.363527	-23.096618
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	Moderate	
Setting	Access track to Stuarts Pool (inaccessible at time of survey)			**Land Use**	Tourism, Recreation	

Site ID	16	**Site Name**	Stuarts Pool - Access Track 1	**Location**	119.564568	-23.236737
Impact Level	Moderate	**Mining Ops.**	Newman	**Site Usage**	Moderate	
Setting	Access track to Stuarts Pool (inaccessible at time of survey). Mt Newman is visible.			**Land Use**	Tourism, Recreation	

Site ID	17	**Site Name**	Wanna Munna - Pool and Gorge	**Location**	119.165399	-23.098423
Impact Level	Low	**Mining Ops.**	Jinidi	**Site Usage**	Low	
Setting	At the top of a gorge and rock pool site close to Wanna Munna, with potential heritage value.			**Land Use**	Recreation, Heritage	

Site ID	18	**Site Name**	Wanna Munna - Pool and Gorge Access Road 1	**Location**	119.165433	-23.099335
Impact Level	Low	**Mining Ops.**	Jinidi	**Site Usage**	Low	
Setting	At the top of a gorge and rock pool site close to Wanna Munna, with potential heritage value.			**Land Use**	Recreation, Heritage	

Site ID	19	**Site Name**	Wanna Munna - Pool and Gorge Access Road 2	**Location**	119.16101	-23.104695
Impact Level	Moderate	**Mining Ops.**	Jinidi	**Site Usage**	Moderate	
Setting	The access road to the Wanna Munna pool and art site			**Land Use**	Recreation, Transport	

Site ID	20	**Site Name**	Wanna Munna - Rock Art and Pool Access Road	**Location**	119.136972	-23.094378
Impact Level	Low	**Mining Ops.**	Jinidi	**Site Usage**	Low	
Setting	At the top of a gorge and rock pool site close to Wanna Munna, with potential heritage value.			**Land Use**	Recreation, Heritage	

Site ID	21	**Site Name**	Weeli Wolli Spring 2 - RTIO Discharge Point	**Location**	119.20654	-22.9176
Impact Level	High	**Mining Ops.**	Jinidi, MAC	**Site Usage**	High	
Setting	The information center located at the RTIO groundwater discharge outlet			**Land Use**	Tourism, Recreation	

Site ID	22	**Site Name**	Weeli Wolli Spring - Access Road 2	**Location**	119.16579	-22.98567
Impact Level	Moderate	**Mining Ops.**	Jinidi, South Flank, MAC	**Site Usage**	High	
Setting	Access road to the Weeli Wolli Creek spring and discharge sites.			**Land Use**	Recreation, Transport	

Site ID	23	**Site Name**	Weeli Wolli Spring - Access Road 1	**Location**	119.02504	-23.03872
Impact Level	Moderate	**Mining Ops.**	Jinidi, South Flank, MAC	**Site Usage**	High	
Setting	Access road to the Weeli Wolli Creek spring and discharge sites.			**Land Use**	Recreation, Transport	

Site ID	25	**Site Name**	Great Northern Hwy 7	**Location**	118.8421	-23.04705
Impact Level	High	**Mining Ops.**	Jinidi	**Site Usage**	High	
Setting	Stopover site along the Great Northern Highway			**Land Use**	Transport	

Site ID	26 (Lost LOA)	**Site Name**	Great Northern Hwy 5	**Location**	118.93124	-23.09173
Impact Level	High	**Mining Ops.**	Mudlark, Gurinbiddy	**Site Usage**	High	
Setting	View alongside the Great Northern Highway			**Land Use**	Transport	

Site ID	27 (Lost LOA)	**Site Name**	Great Northern Hwy 13	**Location**	118.80276	-22.89191
Impact Level	High	**Mining Ops.**	Tandanya	**Site Usage**	High	
Setting	View from the side of the Great Northern Highway			**Land Use**	Transport	

Site ID	28	**Site Name**	Karijini Drive Stop over	**Location**	118.69892	-22.66793
Impact Level	Moderate	**Mining Ops.**	Munjina/Upper Marillana	**Site Usage**	Moderate	
Setting	View from the stopover adjacent to the Karijini Drive and Great Northern Hwy			**Land Use**	Transport	

Site ID	29	**Site Name**	Great Northern Hwy 16 - Fig Tree Crossing	**Location**	118.718296	-22.545055
Impact Level	Low	**Mining Ops.**	Munjina/Upper Marillana	**Site Usage**	High	
Setting	From the lookout site at Fig Tree Crossing			**Land Use**	Transport, Tourism	

Site ID	30	**Site Name**	Munjina - Gorge Lookout	**Location**	118.733016	-22.488941
Impact Level	Low	**Mining Ops.**	Munjina/Upper Marillana	**Site Usage**	High	
Setting	From the lookout site at Munjina Gorge			**Land Use**	Transport, Tourism	

Site ID	31	**Site Name**	Munjina - Hill 1	**Location**	118.76012	-22.48364
Impact Level	Moderate	**Mining Ops.**	Munjina/Upper Marillana	**Site Usage**	Moderate	
Setting	The view from a site on a hill adjacent to a site on Munjina Gorge, accessible via 4WD track			**Land Use**	Tourism, Recreation	

Site ID	32	**Site Name**	Fortescue Valley Watering Hole	**Location**	118.825	-22.29873
Impact Level	Moderate	**Mining Ops.**	Roy Hill	**Site Usage**	Low	
Setting	A water hole on a pastoral station			**Land Use**	Pastoral	

Site ID	33	**Site Name**	Great Northern Hwy 17	**Location**	118.77797	-22.17112
Impact Level	Moderate	**Mining Ops.**	Roy Hill	**Site Usage**	High	
Setting	View from the road side of the Great Northern Highway			**Land Use**	Transport	

Site ID	34	**Site Name**	BHP Billiton Iron Ore Rail Access Road 1 - Coondiner Ck	**Location**	119.67756	-22.8444
Impact Level	Low	**Mining Ops.**	Coondiner	**Site Usage**	Moderate	
Setting	View from alongside the BHP Rail Access Road			**Land Use**	Mining (Rail), Transport	

Site ID	35	**Site Name**	Munjina-Roy Hill Road 1 - Coondiner Water Hole	**Location**	119.658018	-22.727821
Impact Level	Low	**Mining Ops.**	Mindi	**Site Usage**	Moderate	
Setting	Waterhole located alongside the Munjina-Roy Hill Road			**Land Use**	Transport, Pastoral	

Site ID	36	**Site Name**	Mindy Mindy Creek	**Location**	119.49254	-22.78455
Impact Level	Low	**Mining Ops.**	Mindi	**Site Usage**	Low	
Setting	Within the creek bed of Mindy Mindy creek			**Land Use**	Pastoral	

Site ID	37	**Site Name**	BHP Billiton Iron Ore Rail Access Road 2 - Mindy Radio Tower	**Location**	119.53909	-22.72953
Impact Level	Moderate	**Mining Ops.**	Mindy	**Site Usage**	Low	
Setting	View from a stopover site along the rail access road beside the Mindy Radio Tower			**Land Use**	Transport, Communication	

Site ID	38	**Site Name**	Munjina-Roy Hill Road 2	**Location**	119.39854	-22.62124
Impact Level	Low	**Mining Ops.**	Marillana	**Site Usage**	Low	
Setting	The junction to Munjina-Roy Hill Road from Marillana Station			**Land Use**	Transport	

Site ID	39	**Site Name**	Munjina-Roy Hill Road 3	**Location**	119.3653	-22.59755
Impact Level	Moderate	**Mining Ops.**	Marillana	**Site Usage**	Low	
Setting	View from the side of Munjina-Roy Hill Road			**Land Use**	Transport	

Site ID	40	**Site Name**	Weeli Wolli Creek 3	**Location**	119.23087	-22.51641
Impact Level	Low	**Mining Ops.**	Marillana	**Site Usage**	Low	
Setting	View from the creek bed of Weeli Wolli Creek, before it joins the Fortescue River			**Land Use**	Pastoral	

Site ID	41	**Site Name**	Town Hill	**Location**	118.74207	-22.8621
Impact Level	High	**Mining Ops.**	Tandanya	**Site Usage**	Low	
Setting	View from the Summit of Town Hill, accessible by 4WD from the Juna Downs Road			**Land Use**	Exploration (Mining)	

Site ID	42	**Site Name**	Weeli Wolli Creek 2 - Grey's Crossing	**Location**	119.30219	-22.79424
Impact Level	Moderate	**Mining Ops.**	Jinidi, MAC, Ministers North, Marillana	**Site Usage**	Moderate	
Setting	The view from Greys Crossing, a water crossing, an access route to RTIO's Yandi minesite			**Land Use**	Transport	

Site ID	43	**Site Name**	Weeli Wolli Spring - Access Road 3	**Location**	119.26556	-22.85238
Impact Level	Moderate	**Mining Ops.**	Jinidi, MAC	**Site Usage**	Moderate	
Setting	On a small hill alongside the access road to a Weeli Wolli Creek swimming hole (Site 60)			**Land Use**	Transport, Recreation	

Site ID	44 (Lost LOA)	**Site Name**	Ministers North - Radio Tower	**Location**	119.112661	-22.837933
Impact Level	High	**Mining Ops.**	Minsters North	**Site Usage**	Low	
Setting	View from the a high point in the Ministers North tenement			**Land Use**	Exploration, Communication	

Site ID	45	**Site Name**	Munjina - Water Hole	**Location**	118.97145	-22.72116
Impact Level	Moderate	**Mining Ops.**	Yandi	**Site Usage**	Moderate	
Setting	Within the creek bed of Marillana Creek			**Land Use**	Mining	

Site ID	46	**Site Name**	Munjina - Claypan	**Location**	118.77316	-22.61464
Impact Level	High	**Mining Ops.**	Munjina/Upper Marillana	**Site Usage**	Low	
Setting	Claypan site within the centre of Munjina Claypan			**Land Use**	Pastoral	

Site ID	47	**Site Name**	Nanutarra-Munjina Road 1	**Location**	117.22653	-22.97626
Impact Level	Moderate	**Mining Ops.**	Rocklea	**Site Usage**	Moderate	
Setting	Stop over site along the Nanutarra-Munjina Road			**Land Use**	Transport	

Site ID	48	**Site Name**	Nanutarra-Munjina Road 3	**Location**	117.12836	-22.97854
Impact Level	Moderate	**Mining Ops.**	Rocklea	**Site Usage**	Moderate	
Setting	Stop over site along the Nanutarra-Munjina Road			**Land Use**	Transport	

Site ID	49	**Site Name**	Hardey River 1	**Location**	117.1894	-22.97502
Impact Level	Moderate	**Mining Ops.**	Rocklea	**Site Usage**	Low	
Setting	Camp site along the Hardey River			**Land Use**	Recreation	

Site ID	50	**Site Name**	Hardey River - Kazput Pool	**Location**	117.18725	-22.97704
Impact Level	Moderate	**Mining Ops.**	Rocklea	**Site Usage**	Low	
Setting	Pool along the Hardey River. Accessible via the Nanutarra-Munjina Road			**Land Use**	Pastoral	

Site ID	51	**Site Name**	Nanutarra-Munjina Road 4	**Location**	117.08488	-22.9693
Impact Level	Moderate	**Mining Ops.**	Rocklea	**Site Usage**	Moderate	
Setting	Stop over site along the Nanutarra-Munjina Road			**Land Use**	Transport	

Site ID	52	**Site Name**	Hardey Syncline - Rock Outcrops	**Location**	117.31282	-22.9544
Impact Level	High	**Mining Ops.**	Rocklea	**Site Usage**	Low	
Setting	Exploration track along the Hardey syncline			**Land Use**	Exploration (mining)	

Site ID	53	**Site Name**	Hickman Crater - Access Road	**Location**	119.70005	-23.03943
Impact Level	Low	**Mining Ops.**	Coondiner	**Site Usage**	High	
Setting	One of two access tracks to the Hickman Crater			**Land Use**	Tourism	

Site ID	54 (Lost LOA)	**Site Name**	Great Northern Hwy 6 - West Angelas Access Road	**Location**	118.90476	-23.08444
Impact Level	High	**Mining Ops.**	Gurinbiddy, Mudlark	**Site Usage**	Moderate	
Setting	Stop over at the turnoff from the Great Northern Hwy to the West Angelas Access Road			**Land Use**	Mining (Access), Transport	

Site ID	55 (Lost LOA)	**Site Name**	West Angelas Access Road 1	**Location**	118.88285	-23.08395
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Moderate	
Setting	View from the side of the West Angelas mine access road			**Land Use**	Mining, Transport	

Site ID	56 (Lost LOA)	**Site Name**	West Angelas Access Road 2	**Location**	118.84445	-23.09549
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Moderate	
Setting	View from the side of the West Angelas mine access road			**Land Use**	Mining (Access), Transport	

Site ID	57 (Lost LOA)	**Site Name**	West Angelas Access Road 3	**Location**	118.87458	-23.10415
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Moderate	
Setting	View from the side of the West Angelas mine access road			**Land Use**	Mining (Access), Transport	

Site ID	58	**Site Name**	RTIO Rail Access Road 1	**Location**	118.75298	-23.08531
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from along the RTIO Rail Access Road			**Land Use**	Mining (Rail), Transport	

Site ID	59	**Site Name**	RTIO Rail Access Road 2 - Exploration Track	**Location**	118.67865	-23.06697
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from an exploration track at the foothills of the Governor Range			**Land Use**	Mining (Exploration)	

Site ID	60	**Site Name**	Governors Range - West	**Location**	118.70708	-23.07083
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from an exploration track at the top of the Governor Range			**Land Use**	Mining (Exploration)	

Site ID	61	**Site Name**	Governors Range - East	**Location**	118.69866	-23.07281
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from an exploration track at the top of the Governor Range			**Land Use**	Mining (Exploration)	

Site ID	62	**Site Name**	Governors Range - Central	**Location**	118.7057	-23.05987
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from an exploration track at the top of the Governor Range			**Land Use**	Mining (Exploration)	

Site ID	63	**Site Name**	RTIO Rail Access Road 3	**Location**	118.69388	-23.0313
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from along the RTIO Rail Access Road			**Land Use**	Mining (Rail), Transport	

Site ID	64	**Site Name**	RTIO Rail Access Road 4	**Location**	118.75068	-23.00095
Impact Level	High	**Mining Ops.**	Mudlark	**Site Usage**	Low	
Setting	View from along the RTIO Rail Access Road			**Land Use**	Mining (Rail), Transport	

Site ID	65	**Site Name**	Great Northern Hwy 4	**Location**	119.19405	-23.13899
Impact Level	Low	**Mining Ops.**	Jinidi	**Site Usage**	High	
Setting	View from a stop over site along the Great Northern Hwy			**Land Use**	Transport	

Site ID	66	**Site Name**	Prairie Downs Access Road	**Location**	119.14803	-23.25526
Impact Level	Low	**Mining Ops.**	Ophthalmia/Prairie Downs	**Site Usage**	Low	
Setting	View from an access road towards the Prairie Downs airstrip			**Land Use**	Mining (Exploration)	

Site ID	67	**Site Name**	Jigalong Alternate Access Road 4 - Davidson Crk 1	**Location**	120.47292	-23.38347
Impact Level	Moderate	**Mining Ops.**	Caramulla	**Site Usage**	Low	
Setting	View from the less used Jigalong alternate access road			**Land Use**	Mining (Exploration), Trans.	

Site ID	68	**Site Name**	Jigalong Alternate Access Road 3 - Caramulla Crk 2	**Location**	120.3139	-23.36413
Impact Level	Moderate	**Mining Ops.**	Caramulla	**Site Usage**	Low	
Setting	View from the less used Jigalong alternate access road, along Caramulla Crk			**Land Use**	Mining (Exploration), Trans.	

Site ID	69 (Lost LOA)	**Site Name**	Jigalong Alternate Access Road 2	**Location**	120.27942	-23.36508
Impact Level	High	**Mining Ops.**	Jimblebar, Caramulla	**Site Usage**	Low	
Setting	View from the less used Jigalong alternate access road, along Caramulla Crk			**Land Use**	Mining (Exploration), Trans.	

Site ID	70	**Site Name**	Jigalong Alternate Access Road 1	**Location**	120.25043	-23.3848
Impact Level	High	**Mining Ops.**	Jimblebar	**Site Usage**	Low	
Setting	View from the less used Jigalong alternate access road, along Caramulla Crk			**Land Use**	Mining (Exploration), Trans.	