MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

ecoscape

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ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronym	Definition
AGL	Above Ground Level
AHD	Australian Height Datum
CALM	Western Australian Department of Conservation and Land Management (1985-2006, now DBCA)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DE	Development Envelope
DEM	Digital Elevation Model
EPA	Environmental Protection Authority
EP Act	Environmental Protection Act 1986
EPGH	East Pilbara Generation Hub
GDA 94	Geographic Datum of Australia 1994
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/hectares
km	kilometre/kilometres
LCT	Landscape Character Type
LCU	Landscape Character Unit
m	metre/metres
MDIOM	Mulga Downs Iron Ore Mine
MGA	Map Grid of Australia
ROM	Run of Mine
VIA	Visual Impact Assessment
VLE	Visual Landscape Evaluation
VMO	Visual Management Objective
VP	Viewpoint
WAPC	Western Australian Planning Commission
WRD	Waste Rock Dump

Table 2: Defined Terms

Term	Definition
Development Envelope	The area that HanRoy have determined to be potentially impacted by the proposed works
Development Footprint	The clearing footprint for the mine infrastructure
Gilgai Microrelief	Clay soils that shrink and swell during alternate drying and wetting cycles
Landscape Sensitivity	The ability of a landscape to absorb a visual change.
Magnitude Of Change	The extent of physical landscape change based on the proposed Proposal's respective design, within the context of the surrounding landscape.
Mesa	An isolated, flat-topped elevation, ridge or hill, which is bounded from all sides by steep escarpments and stands distinctly above a surrounding plain
Proposal	The Mulga Downs Iron Ore Mine (MDIOM) and borefield (mine)
Receptors	Areas where viewers may be impacted by the Proposal
Scree Slope	An accumulation of loose stones or rocky debris lying on a slope or at the base of a hill or cliff
Sense Of Place	An intangible viewer experience of a landscape
Viewpoints	Representative receptors as viewpoints to assess the anticipated visual impact from a particular location.
Viewshed	The area where views of the infrastructure elements are theoretically possible based on modelling

EXECUTIVE SUMMARY

BACKGROUND

HanRoy (part of Hancock Prospecting) are proposing to develop the Mulga Downs Iron Ore Mine (MDIOM) (the Proposal) located approximately 210 kilometres (km) south of Port Hedland and 180 km north west of Newman in the Pilbara Region of Western Australia.

In 2022 HPPL engaged JBS&G Australia Pty Ltd (JBS&G) to undertake a Visual Impact Assessment (VIA) to support the assessment of the Proposal in accordance with the requirements of the *Environmental Protection Act 1986* (EP Act). Since this assessment, the Development Envelope has reduced in area by about 58%, the Development footprint has reduced in area by about 53% and the location of mine infrastructure has also been amended. Subsequently, JBS&G have engaged Ecoscape to update the visual impact assessment undertaken in 2022 to reflect the updated Proposal.

The Proposal includes conventional open mining pits, haul roads and access tracks, processing equipment and associated infrastructure. The Proposal comprises a Development Envelope of approximately 39,207 hectares (ha) and a disturbance footprint of 4,484 ha.

The objectives of the VIA are to:

+ describe the existing environment in which the Proposal is set
+ identify the current surrounding environment and assess the magnitude of visual change resulting from the proposed activities
+ describe the impact on key sensitive receptors.

VISUAL LANDSCAPE EVALUATION

The VIA is based on an assessment of the landscape surrounding the Proposal and considers zoning and land use, landscape character type, land systems and sense of place which provides context for the Proposal, and the visual environment in which is located.

The Proposal assessed in the VIA is set in a landscape relatively untouched, and unmodified by pastoral use for cattle grazing. It includes a variety of landscape types with distinctive displays of diversity. The following features contribute to the landscape values of the area:

+ a high degree of perceived wilderness value, due to undisturbed sweeping views across the Fortescue Valley, weathered and rugged landscape elements
+ the presence of undulating topography characterised by the rugged high hills of the Hamersley Range to the south and lower hills of the Chichester Ranges to the north
+ sweeping panoramic views from vantage points and rugged ridgelines in Hamersley Ranges
+ displays of vegetation diversity such as low-lying soft spinifex, tussock grasses, colourful wildflowers, mid level acacias and tall eucalypts providing a range of textures, tones and heights
+ stark juxtaposition of flat plains with undulating hillsides/ridges with jagged rock outcrops
+ distinctive displays of colour diversity including deep red/orange surface intermittently broken up with various shades of green and brown.

VISUAL IMPACT ASSESSMENT

The Proposal's visual impact was assessed based on analysis of nine representative viewpoints and associated photomontages created through 3D modelling. The potential visual impact during operation was assessed as Negligible to Moderate as listed below:

Negligible:

+ VP 6 (Highway North)
+ VP 7 (Highway South)

Low:

+ VP 1 (Karijini)
+ VP 2 (Nanutarra Road East)
+ VP 3 (Nautarra Road West)
+ VP 4 (Fortescue River)
+ VP 8 (Youngaleena Community)
+ VP 9 (Wirrlimurra Community)

Moderate:

+ VP 5 (Mulga Downs Homestead).

One of the main contributing factors to the generally low level of impact associated with the Proposal is its location within a sparsely populated area and siting away (distance) from publicly accessible areas. This demonstrates the effectiveness of distance as a visual mitigation strategy.

The Moderate impact experienced at the Mulga Downs homestead (VP 5) is due to the close proximity to the Proposal. However, it should be noted that the main mine area is located 3.6 km to the south east and is not expected to be visible, as shown in the photo montage (refer to **Section 4.1.5**).

VISUAL MANAGEMENT OBJECTIVES

The Visual Management Objectives considered appropriate for the management of the visual landscape are:

+ Best Practice Siting and Design as the baseline objective for all landscapes; and
+ Protection and Maintenance of view experiences and landscape values that are integral to the 'Sense of Place' from all viewpoints.

Due to the distance of the Proposal from public accessible areas and residential communities, it is expected that the key view experiences and landscape values will be retained from these view locations.

1 INTRODUCTION

HanRoy (part of Hancock Prospecting) are proposing to develop the Mulga Downs Iron Ore Mine (MDIOM) (the Proposal) located approximately 210 kilometres (km) south of Port Hedland and 180 km north west of Newman in the Pilbara Region of Western Australia.

In 2022 HPPL engaged JBS&G Australia Pty Ltd (JBS&G) to undertake a Visual Impact Assessment (VIA) to support assessment of the Proposal in accordance with the requirements of the *Environmental Protection Act 1986* (EP Act). Since this assessment, the Development Envelope has reduced in area by about 58%, the Development Footprint has reduced in area by about 53% and the location of mine infrastructure has also been amended. Subsequently, JBS&G have engaged Ecoscape to update the visual impact assessment undertaken in 2022 to reflect the updated Proposal.

The Proposal includes conventional open mining pits, haul roads and access tracks, processing equipment and associated infrastructure. The Proposal comprises a Development Envelope of approximately 16,848 hectares (ha) and a disturbance footprint of 4,484 ha.

The objectives of the VIA are to:

+ describe the existing environment in which the Proposal is set
+ identify the current surrounding environment and assess the magnitude of visual change resulting from the proposed activities
+ describe the impact on key sensitive receptors.

1.1 PROPOSAL BACKGROUND

Three stand-alone projects at varying stages of planning, assessment and approval are currently being progressed in the Mulga Downs area of Western Australia. Although in fairly close physical proximity to one another, they are independent projects. Each will be constructed and operated independently of each other, as outlined in **Table 3**. With approval, each project can be implemented, regardless of whether the other projects ever receive approval. The three standalone projects have been called the Mulga Downs Iron Ore Project (MDIOP).

Table 3: Independent Mulga Downs Iron Ore Project

Project	Proponent
Mulga Downs Iron Ore Mine (MDIOM)	HPPL
Murray's Hill and Mulga West Borefield	HPPL
Mulga Downs Hub and Rail Spur	Roy Hill Infrastructure Ltd (RHIL)

This VIA report provides an assessment of the MDIOM only.

1.2 PROPOSAL LOCATION

The Proposal location is presented in **Map 1** and includes conventional open mining pit, processing equipment, associated infrastructure and ore transport infrastructure via private transport corridor. The cadastral and tenement boundaries that encompass all areas to be developed are referred to as the Development Envelope.

1.3 PROPOSAL DESCRIPTION

1.3.1 VISUALLY SIGNIFICANT PROPOSAL ELEMENTS

The Proposal will have several key elements that are considered visually significant. This VIA assesses the likely visual impact of key visual elements during the operation phase, and comment is made regarding the construction, operational and closure phase.

The Proposal comprises a Development Envelope of approximately 16,848 hectares (ha) and a disturbance footprint of 4,484 ha. The mine layout of the Proposal is shown in **Map 2**.

Due to the scale of the Proposal, only visually significant Proposal elements have been considered. Visually significant infrastructure are elements of sufficient scale to potentially alter the landscape character to an observer.

Visually significant elements have been grouped according to similar infrastructure types which have similar corresponding visual impacts. The visually significant elements of the Proposal are provided in **Table 4**.

Most landform elements listed below will be no higher than 35 m and are designed and situated within undulating topography to ensure they blend in with the surrounding topography.

Table 4: Visually significant Proposal elements

Proposal Element	Description
Open pits	Large, extensive landform features which will require vegetation clearance.
Above ground landforms (35 m maximum height)	
Waste rock dumps (WRDs) (35 m high)	Additional landform features, up to 35 m high that will require vegetation clearance.
Run of mine (ROM) pad	
Low Grade Stockpiles (5 m high)	
Topsoil Stockpiles (5 m high)	
Linear elements	
Conveyors for the transportation of ore	Roads and conveyors will introduce additional linear features and will require vegetation clearance
Haul and light vehicle roads	
Above ground plant infrastructure	
Mine services area	Isolated from other infrastructure on higher ground, will require clearance and infrastructure will stand at 10 to 25 m above surface level.
Processing plant including plant, magazine and plant services area	Industrial processing infrastructure that will require vegetation clearance. This infrastructure will be up to 30 m above surface level. The plant services area will comprise low lying buildings no higher than 10 m.

Proposal Element	Description
Power infrastructure including transmission line to existing line along Fortescue rail	Powerlines may be up to 28 m above surface level within an easement area and access road below. Roads and conveyors will introduce additional linear features and will require vegetation clearance.
Accommodation camp	Accommodation most likely to be single storey structures that will require vegetation clearance.
Airport	Airport infrastructure including apron, runway and hangar infrastructure that will require vegetation clearance.
Radio/communications mast	Approximately 80 m in height, located on area of high ground to the west of the RoM and processing plant.

1.3.2 PROPOSAL ELEMENTS NOT ASSESSED

Table 5 outlines the proposal elements that are not considered visually significant and have not been assessed for visual impacts.

Table 5: Proposal elements not visually significant

Proposal Element	Reason for exclusion from the VIA
Groundwater abstraction for water supply (for the mine and all associated infrastructure) and for the dewatering to facilitate the recovery of ore below water table in the mine pits located in Mulga West.	Post construction (drilling) the borefield and access roads will be obscured by vegetation. Limited vegetation clearance will be required, pump heads will be largely obscured by vegetation, and pipelines will be laid at ground level.
Surplus water management with discharge of excess water either via limited direct disposal to the environment (into existing creek lines) and injection via managed aquifer reinjection (MAR).	This Proposal element is understood to include minimal infrastructure including bores and pipe network which will not be visually significant and therefore are not assessed in this VIA.
Transport of the ore via the Great Northern Highway to Port Hedland for export. The Great Northern Highway transport option will enable commencement of the Mulga Downs Iron Ore Mine. Future transport options (e.g. rail) will be subject to a separate approvals and VIA assessment process.	A rail alignment is also proposed to service the mine which has been assessed in a separate VIA, as it does not form part of the MDIOM. The Great Northern Highway is an existing infrastructure element utilised by a range of other road users.
Ammonium nitrate and fuel oil (ANFO)	Relatively small area required to be cleared, infrastructure won't be visually significant compared to surrounding infrastructure as the height of this element won't exceed 15 m.

1.3.3 MINE STAGES

This VIA assesses the visual impacts during operation of the Proposal at the peak of the operation phase when all Proposal elements are fully developed and operational.

Visual aspects for the construction and closure development phases are outlined below.

1.3.3.1 Site establishment

Site establishment will include the following key activities:

+ clearing of native vegetation
+ construction of Proposal infrastructure including vehicles movements.

1.3.3.2 Closure – Rehabilitated State

The Proposal has an estimated mine life of 18 years. Where practicable, progressive rehabilitation will be undertaken over the life of the mine.

Rehabilitated landforms will be designed in accordance with the Mine Closure Plan that ensures it will be safe and non-polluting and will be constructed so the final shape, size, stability, are comparable with the natural landforms in the area, as far as practicable.

The closure phase would primarily consist of the following activities and resulting visual elements:

+ removal of equipment and infrastructure
+ backfilling of some of the pits to above the water table after settlement
+ grading and revegetation on the WRDs and other landform elements to remain insitu and emulate the surrounding topographical setting
+ planting of native vegetation.

1.4 SCOPE OF WORKS

1.4.1 2022 ASSESSMENT

The scope of works for the 2022 assessment included the following:

+ a desktop assessment of key environmental, topographic and social features, and Proposal elements
+ a site assessment to capture images and assess the character of the surrounding landscape
+ identify elements within the Proposal and surrounding viewshed
+ assess the Proposal within the context of local government strategic plans, planning schemes, and land use
+ identify major views, existing viewing outlooks, ridgelines and other features contributing to the visual amenity of the area
+ capture representative views from various locations around and within the site
+ identify focal points, landmarks (built form or topography), gateways in the surrounding areas, waterways and other features contributing to the visual quality of the area
+ describe the character of the local and surrounding areas including character of built form (scale, form, materials and colours) and vegetation (natural and cultural vegetation)
+ where relevant, discuss the value of existing vegetation as a visual screen, and removal of vegetation as part of the Proposal
+ identify the visual impact, particularly in terms of the extent and significance of the changed skyline, as viewed from places of residence, work and recreation, from road, cycle and walkways and other known vantage points
+ identify visual impact mitigation measures.

1.4.2 2024 ASSESSMENT

This assessment updates the 2022 visual impact assessment conducted by JBS&G. The following tasks have been undertaken to update the 2022 report:

+ review and incorporate the results of the 2022 assessment into the updated report
+ undertake a viewshed analysis from the large proposal elements (WRDs and stockpiles).
+ Update photo montages to reflect the updated development footprint.
+ Create new photo montages using a 3D generated images at the Aboriginal Communities of Youngaleena (VP 8) and Wirrlimurra (VP9).

+ identify and describe the potential visual impacts from each of the view locations (9 in total).

1.5 VISUAL PLANNING CONTEXT

The following documents provide guidance on visual landscape planning in Western Australia.

1.5.1 FEDERAL GOVERNMENT – LEGISLATIVE CONTEXT

There is no Federal legislation that provides specific regulation regarding visual amenity however impacts to visual amenity can be considered an 'environmental' impact under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Under Section 528 of the EPBC Act, the term 'Environment' is defined as:

(a) ecosystems and their constituent parts, including people and communities, and

(b) natural and physical resources, and

(c) the qualities and characteristics of locations, places and areas, and

(d) Heritage values of places, and

(e) the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), or (c).

Therefore, under this definition, impacts to visual amenity can be considered an 'environmental' impact, as it falls under the definition in (c).

1.5.2 STATE PLANNING POLICY AND GUIDELINES

1.5.2.1 Environmental Protection Act 1986

The Western Australian EP Act was established to provide for:

+ the prevention, control and abatement of pollution and environmental harm
+ the conservation, preservation, protection, enhancement, and management of the environment
+ matters incidental to or connected with the above.

The Environmental Protection Authority (EPA) is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

The EP Act includes **Social Surroundings** in the definition of what constitutes 'Environment'. Further guidance on social surroundings is provided in the EPA's *Environmental Factor Guideline – Social Surroundings* (2023).

1.5.2.2 Planning and Development Act 2005

The *Planning and Development Act 2005* (PD Act) provides for development and subdivision within the state. The act aims to facilitate an efficient and effective land use planning system, promoting sustainable use and development.

Development planning in Western Australia is guided by a number of key documents that include an overarching State Planning Strategy (2050), state planning policies, and local planning strategies. Of greater relevance to the VIA is the local planning strategy as it provides strategic land use and development rationale at the local level.

Relevant to visual impact, State Planning Policy No.2 seeks to:

+ protect significant natural, indigenous and cultural features, including sites and features significant as habitats and for their floral, cultural, built, archaeological, ethnographic, geological, geomorphological, visual or wilderness values
+ support conservation, protection and management of native remnant vegetation where possible, to enhance soil and land quality, water quality, biodiversity, fauna habitat, landscape, amenity values and ecosystem function

+ identify and safeguard landscapes with high geological, geomorphological or ecological values, as well as those of aesthetic, cultural or historical value to the community, and encourage the restoration of those that are degraded
+ in areas identified in above, consider the level or capacity of the landscape to absorb new activities and incorporate appropriate planning and building design and siting criteria to ensure that new development is consistent and sensitive to the character and quality of the landscape
+ consider the need for a landscape, cultural or visual impact assessment for land use or development proposals that may have a significant impact on sensitive landscapes.

Further, the policy highlights the importance of identification and protection of natural landscapes, specifically those that have competing demands, such as primary production.

1.5.2.3 State Planning Policy No 2 Environment and Natural Resources

The *Environment and Natural Resources Policy* (WAPC, 2003) defines the principles and considerations that represent good and responsible planning in terms of environment and natural resource issues within the framework of the State Planning Strategy.

The objectives of the policy are to:
+ integrate environment and natural resource management with broader land use planning and decision-making
+ protect, conserve and enhance the natural environment
+ promote and assist in the wise and sustainable use and management of natural resources.

This policy also identifies the importance of protecting and enhancing landscapes and states the need:
+ to identify and protect landscapes with high natural resource value
+ for careful planning, siting and design of development proposals in a way that is sensitive to the landscape character
+ for landscape or visual impact assessment for proposals that may impact on sensitive landscapes.

1.5.2.4 Environmental Factor Guideline: Social Surroundings (EPA, 2023)

The EPA's objective for the social surroundings environmental factor is, *"To protect social surroundings from significant harm"*

For social surroundings to be considered in Environmental Impact Assessment (EIA) there must be there must be a clear direct link between a proposal or scheme's impact on the physical or biological surroundings and the subsequent effect on a person's aesthetic, cultural, economic or other social surroundings.

Furthermore, *for the EPA to consider social surroundings as a factor in EIA, a proposal's or scheme's impacts on the physical or biological environment, must directly and significantly affect or be affected by those social surroundings*.

The EPA is also required to consider potential impacts to Aboriginal Cultural Heritage (ACH) values which includes *significant visual impacts to ACH cultural landscapes*.

The guideline recognises that *natural landscapes and views often contribute to visual amenity, such as areas of high heritage, cultural or social significance due to their natural features or scenic quality*. Although, *amenity values can be highly subjective.*

The EPA recognises that development activities may impact aesthetic values such as:
+ *large scale quarry or mining activities on landscapes of significant aesthetic value*
+ *major tourism or other developments in or adjacent to natural areas with significant aesthetic values*

The EPA may require information from the proponent where there is the potential to significantly impact the social surroundings, in the case of visual amenity a landscape and visual impact assessment may be required.

1.5.2.5 Environmental Factor Guideline: Landforms (EPA, 2018)

The EPA's environmental objective for the factor Landforms is: *"To maintain the variety and integrity of significant physical landforms so that environmental values are protected."*

This objective recognises that the geology and morphology of a landform can have value in their own right, as well as the important role significant landforms often have in supporting environmental values.

Landforms can also embody social and cultural values, such as strong historical and cultural associations and also provide enjoyment through aesthetics or active use (e.g. tourism, climbing, hiking, etc.).

Consistent with this objective, the EPA will firstly determine whether the landform to be impacted is a significant landform. If the EPA determines that the landform is significant, further assessment regarding the impacts of the proposal or scheme may be required to demonstrate whether the environmental objective for Landforms can be met.

To determine whether a landform is significant, the EPA may consider criteria such as *variety, integrity, ecological and scientific importance, rarity and social importance*. Concerning the latter, *the landform would support significant amenity, cultural or heritage values.*

1.5.2.6 Technical Guidance: EIA of Social Surroundings – Aboriginal Cultural Heritage (EPA, 2023)

The EPA acknowledges the repealed Aboriginal Cultural Heritage Act 2021 and has adjusted its Environmental Factor Guideline (EFG) - Social Surroundings and related Technical Guidance to reflect the role of the amended and restored Aboriginal Heritage Act 1972.

The Technical Guidance provides additional information on procedures and the EPA's environmental impact assessment process for Social Surroundings under the Environmental Protection Act 1986. This has been updated to support the latest changes made to the EFG and to ensure alignment with the restored AH Act 1972.

Under the EP Act, the EPA is required to consider social surroundings to the extent to which they directly affect or are affected by physical or biological surroundings. This may include significant visual impacts to ACH cultural landscapes.

The Aboriginal Heritage Places which are in the vicinity of the Proposal are shown on **Map 3**. The MDIOM development envelope also occurs within the Banjima People Native Title claim area.

Youngaleena and Wirrlimurra Aboriginal communities are within the vicinity of the Proposal. Photo simulations at each of these locations have been undertaken to identify potential visual impacts to these communities which is presented in **Section 4.1**.

1.5.3 LOCAL GOVERNMENT POLICY

The Shire of Ashburton's local planning strategy provides the strategic basis for decision making and land use planning by the Shire. Local Planning Scheme (LPS) No. 7 2018 makes provision for certain uses within applicable zones. The applicable uses to the Proposal are outlined within **Table 6**.

Table 6: Summary of planning requirements relevant to the VIA

Proposal Element / Area	Zone	Purpose relevant to the VIA
Broad Proposal Site	Rural	The zone provides for extractive industries. The proposed use as an iron ore mine, and associated works, is therefore compatible with the current zoning.
Aerodrome	Rural	The use is not permitted unless the Local Government has exercised its discretion and has granted planning approval after giving special notice in accordance with Clause 5.7.
Resource Processing	Rural	The use is not permitted unless the Local Government has exercised its discretion and has granted planning approval after giving special notice in accordance with Clause 5.7.
Extractive	Rural	The use is not permitted unless the Local Government has exercised its discretion by granting planning approval.

1.5.4 GUIDELINES FOR VISUAL IMPACT ASSESSMENT IN WESTERN AUSTRALIA

1.5.4.1 Visual Landscape Planning in Western Australia 2007

This comprehensive manual has been developed by the WAPC (2007) to help public and private sector planners address visual landscape in the planning process. The manual explains the fundamental planning tools of visual landscape evaluation and visual impact assessment. It provides guidelines for siting and design in relation to a range of landscape types and land uses. It has been developed through extensive research, workshops and also draws on previous visual methodologies. The manual has been developed specifically for Western Australian landscapes and presents a systematic method for undertaking visual assessments in Western Australia. The process of assessing the visual landscape set out in this manual is generally consistent with other methodologies, however it provides added detail on landscape preferences and specific land uses.

It is recognised by the EPA (2023) that amenity values may be highly subjective, therefore, Ecoscape has adopted the WAPC (2007) methodology to provide a clear and systematic approach to assessing the visual landscape.

1.5.4.2 Other visual assessment guidelines

The following documents provide guidance on a suitable framework for assessing visual impact:

+ *Guidance Note for Landscape and Visual Assessment, Australian Institute of Landscape Architects, 2018* provides guidance aimed at landscape architects which sets out minimum requirements and an accepted set of assessment methods;
+ *Guidelines for Landscape and Visual Impact Assessment (GLVIA), Third Edition (2013)* prepared by the Landscape Institute and Institute of Environmental Management and Assessment. These guidelines provides detailed advice on the process of assessing the landscape and visual effects of developments and their significance, as well as cumulative effects.

2 METHODOLOGY

The methodology used to assess the impacts to visual amenity included the following steps:

+ characterising the existing visual landscape surrounding the site
+ a viewshed analysis from visually significant proposal elements (WRDs and stockpiles) to determine the areas in the landscape that may be able to see the Proposal
+ capturing photographs from representative viewpoints within the public domain and creation of photomontages to show views of Proposal in the existing landscape.
+ quantifying potential visual impacts using the visual impact criteria and rankings established for this assessment.

2.1 VIEWSHED MODELLING

The objective of the viewshed analysis was to determine the areas in the landscape that may be able to see the significant elements of the Proposal. Seen area or viewshed analysis is a tool performed using a Geographic Information Systems (GIS) computer program, in this case ArcGIS Pro. It is a conceptual desktop method best complemented by a site visit to confirm the results of the analysis as it does not account for features such as vegetation. A viewshed analysis calculates the areas that are visible from an observation point using a set of user defined parameters such as height of observer and target height. The analysis used a 30 m resolution smoothed digital elevation model (DEM-S) derived from the Shuttle Radar Topography Mission (SRTM) 1 second digital elevation model (Geoscience Australia, 2010).

Viewsheds were generated each of the WRDs at a maximum height of 35 m AHD and each of the stockpiles at a maximum height of 5 m AHD. The viewshed results were used in conjunction with the photo montages to assess visibility of the proposed development.

2.2 PHOTO MONTAGES

Photomontages at nine viewpoint locations were developed through creating a digital representation of the existing landscape, topography, vegetation and urban form.

Photomontages were developed to compare existing landforms and landforms during mining at nine viewpoint locations. Viewpoints 1, 2, 3, 6 and 7 were updated using Photoshop to adjust the infrastructure locations based on the 2024 mine infrastructure footprint, as these viewpoints were expected to have low to negligible visual impacts. For viewpoints expected to have moderate visual impact, Sentient Computing created photo montages for the culturally sensitive viewpoints (4, 5, 8 and 9) by processing the terrain and infrastructure data through GIS software, 3D modelling software and real-time gaming engines, to give geolocated, accurate but indicative, visual representations of project designs. The final renders for VIA are taken from a height of 1.7m to give a view from an average human perspective.

The images produced are manually enhanced through the painting of custom textures over the aerial imagery and decorating of the landscape with vegetation and props. JBS&G provided photo examples near the viewpoints which were used as a reference, creating an indicative visualisation of the landscape from ground level.

2.3 IMPACT ASSESSMENT CRITERIA

The VIA was undertaken in broad accordance with applicable Federal and State guidance, council planning schemes and other guidelines presented in Section 2.

The VIA consists of two main components:

+ a quantitative desktop assessment to determine the theoretical visual impact of the Proposal at the operational stage
+ a qualitative photomontage assessment to verify and support the quantitative assessment and to show how the Proposal is anticipated to appear from selected viewpoints.

The visual impact assessment process is summarised graphically below in **Figure 1**.

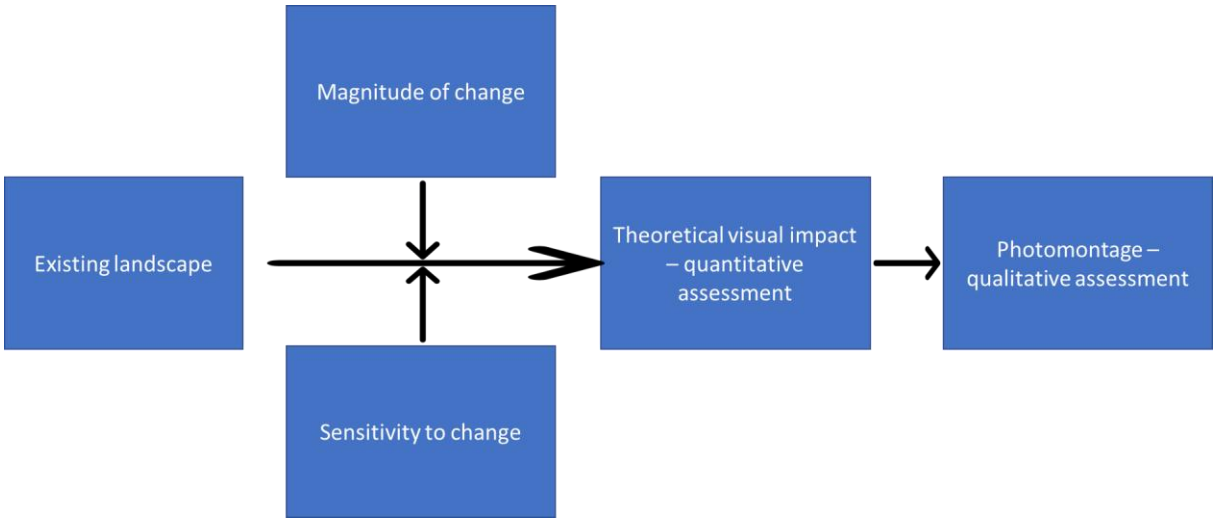

Figure 1: VIA Process

The quantitative desktop assessment of this VIA comprised an assessment of the following components based on representative viewpoints in accordance with a matrix score which produce the theoretical visual impact for the assessed viewpoints as summarised in **Table 7**.

The assessment described below has been developed in consideration and in accordance with the VIA guidance set out in **Section 1.5.4**.

Table 7: Components of the Quantitative Assessment

Components	Inputs	Outputs
Magnitude of Change	+ Distance from the Proposal (closest visually significant Proposal element) + Visual Dominance of Proposal Infrastructure in Photomontages.	Theoretical Visual Impact Photo montages
Landscape Sensitivity to Change	+ Scenic Quality + Vegetation Height + Viewer Sensitivity	

2.3.1 MAGNITUDE OF CHANGE

The Magnitude of Change refers to the proposed Proposal's respective design, within the context of the surrounding landscape. It determines the overall visual effect and the visibility of the Proposal. This is primarily driven by:

+ distance of the receptor from the Proposal infrastructure
+ visual dominance of Proposal infrastructure in photomontages.

2.3.1.1 Distance from the Proposal

Distance is a key determining factor in visual impact attenuation, as both apparent size and visual contrast decrease exponentially with distance (Hecht, 2017). The non-linear horizontal scale for increasing distance from the visual receptor has been selected as this represents the exponential effect of visual degradation over distance. The highest level of visual impact from the visual source will be within the foreground of the observer (0 - 500 m), with the visual impact decreasing as one moves away from the visual impact source.

The distance from the visually significant Proposal elements has been divided into four categories which are similar to the distance zones identified in WAPC (2007), being 0-500 m (Foreground), 0.5-6.5 km (mid-ground) and greater than 6.5 km (background). In **Table 8** below, the addition of a 'near mid-ground' zone (0.5 – 3 km) has been included to better reflect the difference in visibility in the mid-ground zone.

Table 8: Distance Categories (a)

Visibility	Distance from the Proposal	Description	Ranking for Matrix
High	0 – 500 m	Infrastructure (landform/structure) dominates the visual field and dramatically alters the viewpoint location landscape.	**16**
Moderate	500 – 3,000 m	Moderate visibility of infrastructure (landform/structure) – easy to see and alters the viewpoint location landscape to a degree.	**8**
Low	3,000 – 6,500 m	Low visibility of infrastructure (landform/structure) – harder to see and not obvious in the viewpoint location landscape.	**4**
Negligible	> 6,500 m	Limited/ no visual effect of the infrastructure (landform/structure). Visible as a minor feature in the viewpoint location landscape.	**2**

2.3.1.1 Visual Dominance of Proposal in Photo Montages

Visual dominance was characterised as how much of the development area or infrastructure is visible from a given viewpoint and how this alters the landscape. This can vary considerably based on the viewpoint as described in **Table 9**.

Table 9: Visibility Categories (b)

Visibility	Description	Ranking for Matrix
High	Infrastructure dominates the visual field and dramatically alters the landscape from the viewpoint location	**8**
Moderate	Infrastructure easy to see and alters the landscape from the viewpoint location to a degree	**4**
Low	Infrastructure is harder to see and not obvious in the landscape from the viewpoint location	**2**
Negligible	Infrastructure only visible as a minor feature or not visible at all in the landscape from the viewpoint location	**1**

2.3.2 LANDSCAPE SENSITIVITY TO CHANGE

Landscape sensitivity is the ability of a landscape to absorb a visual change. This considers the visual setting in which the Proposal occurs, as well as the setting of the viewer, or receptor, from various locations looking towards the Proposal.

The following elements have been used to inform the landscape sensitivity assessment:

+ scenic quality
+ vegetation height
+ viewer sensitivity.

2.3.2.1 Scenic Quality

As described in **Section 3.3**, there are a range of different land systems in the landscape where the Proposal is located and these represent a variety of scenic landscapes of different levels of scenic quality.

The scenic quality of an area is highly subjective. For this assessment, it is related to areas of high natural value, which correlates to the degree of transformation (via anthropogenic impacts) on the landscape. More specifically this refers to the degree of infrastructure present, the state of transformation of the natural vegetation, the diversity of the landscape and its overall aesthetic value.

Factors contributing to high scenic quality include topography, sense of place, diversity of habitat, water features, variety of colours, vegetation condition and presence of contrasting foreground and background elements. The WAPC (1997) have also identified preferred landscape indicators that can be used as a basis for classifying the landscape into two preference categories; 'most' preferred and 'least' preferred landscapes. These are presented in **Appendix 1** for natural landscapes.

Sensitivity to change based on scenic quality is broken into four categories of visual impact, as detailed in **Table 10**.

Table 10: Scenic Quality Categories (c)

Sensitivity to Change	Description	Ranking for Matrix
High	No to negligible existing built infrastructure present. Natural vegetation is not altered and is in excellent condition and the landscape exhibits a range of colours, textures and heights. The view contains features such as undulating topography, water features and has a spectacular sense of place. The landscape is unique and has outstanding, diverse features with numerous or significant focal areas.	**8**
Moderate	Very little existing built infrastructure present. Natural vegetation is slightly altered and is in moderate condition and the landscape exhibits less range of colours, textures and heights. The view contains features such as some undulating topography and has a less established sense of place. The landscape has some scenic diversity and some focal areas.	**4**
Low	Some existing built infrastructure present. Natural vegetation is in a degraded condition with little diversity. The view contains features such as generally flat topography with no focal areas. The landscape has little scenic diversity and few focal areas.	**2**
Negligible	Existing built infrastructure is obvious in the field of view. Natural vegetation in a degraded condition with no diversity. The view contains features such as flat topography and no sense of place. The landscape has no scenic diversity and no focal points.	**1**

2.3.2.2 Vegetation Height

The presence of vegetation assists in mitigating the visual impact by providing a physical visual barrier between the receptor and the Proposal and drawing the focus of the viewer to a different area than that of the proposed development. Sensitivity to change based on vegetation height is broken into four categories of visual impact, as detailed in **Table 11**.

Table 11: Vegetation Height Categories (d)

Sensitivity to Change	Average Vegetation Height	Description	Ranking for Matrix
High	< 1 m	Foreground vegetation is on average lower than 1m, it provides limited/no visual mitigation. The associated visual impact is high.	**8**
Moderate	1 – 2 m	Foreground vegetation is between 1 and 2 metres high, it is starting to provide a visual screen, and will partially hide infrastructure when close to a viewer. The associated visual impact is moderate.	**4**
Low	3 – 10 m	Foreground vegetation at this height will create a visual shield at greater distances and, when present over a large area, begins to dominate the visual field. The associated visual impact is low.	**2**
Negligible	> 10 m	Foreground vegetation over 10m dominates the landscape and provides a visual screen for great distances. The associated visual impact is very low.	**1**

2.3.2.3 Viewer Sensitivity

The type of viewer sensitivity is an important factor in the associated visual impact the Proposal may have. This is predominately based on the duration of view and the context within which the viewer experiences a change of view. For example, a nearby resident who will experience a prolonged change of view will have a higher sensitivity to change compared to a motorist experiencing fleeting views of the Proposal from a nearby road or highway. Sensitivity to change based on viewer sensitivity is broken into four categories of visual impact, as detailed in **Table 12**.

Table 12: Viewer Sensitivity Categories (e)

Sensitivity to Change	Description	Ranking for Matrix
High	Viewers such as residents of local communities and/or viewers within culturally significant sites that previously viewed an unmodified landscape and would be subject to long term viewing duration. The duration of view at these locations is also longer than transient observers such as motorists.	**8**
Moderate	Viewers such as hikers and eco tourism visitors in recreational areas who have travelled to the area to experience the untouched sense of place described in **Section 3.4** and will experience short term views from undisturbed vantage point as they move through the area.	**4**
Low	Viewers such as road users that may experience views of the Proposal however duration of view may be fleeting and coupled with simultaneous road infrastructure views.	**2**
Negligible	Viewers such as train drivers and onsite workers that would not be sensitive to changes in the viewshed for a purpose associated with the construction, operation or closure of the mine or other mines.	**1**

2.3.3 THEORETICAL VISUAL IMPACT RATING

Following the assessment and categorisation of visual impact for each component, the theoretical (quantitative) visual impact of the Proposal infrastructure can be calculated for any chosen location in the surrounding landscape. These findings are then supported by the photomontages at selected viewpoint locations to illustrate the Proposal infrastructure in situ (as it would appear on the landscape to a receptor).

The visual impact rating is calculated using the following formula:

+ a+b+c+d+e = quantitative visual impact model score

Where:

+ a = distance to Proposal
+ b = visual dominance (visibility)
+ c = scenic quality
+ d = vegetation height
+ e = viewer sensitivity.

A description of the visual impact rating model scores and the corresponding degree of visual impact is presented below in **Table 13**.

Table 13: Visual Impact Rating

Sensitivity to Change	Description	Ranking for Matrix
High	Proposal element is very obvious in the visual field and dominates the landscape	**37-84**
Moderate	Proposal element is obvious, but does not dominate the landscape	**25-36**
Low	Proposal element can be seen in the visual field and alters the landscape to a small degree	**13-24**
Negligible	Limited/ no visual effect on the landscape. Proposal element is visible as a minor feature in some locations.	**0-12**

3 VISUAL LANDSCAPE EVALUATION

The VIA is based on an assessment of the landscape surrounding the Proposal and considers zoning and land use, landscape character type, land systems and sense of place which provides context for the Proposal, and the visual environment in which is located. The following maps have been prepared to support the landscape assessment:

+ **Map 4**: Local Planning Scheme Zones and surrounding iron ore mine developments
+ **Map 5**: Surface elevation
+ **Map 6**: Land Systems
+ **Map 7**: Viewshed from the Waste Rock Dumps (35 m AHD)
+ **Map 8**: Viewshed from the Stockpiles (5 m AHD).

3.1 LAND USE

As outlined within **Table 6**, LPS No. 7 (Shire of Ashburton) describes the area surrounding the Proposal as providing for extractive industries. The zone is therefore broadly compatible with the Proposal (**Map 4).**

The Pilbara Planning and Infrastructure Framework designates the Proposal area as an Iron Resource Province. As shown on **Map 4**, there are a number of proposed and undeveloped iron ore deposits in the area.

The Development Envelope is used for cattle grazing as it is within the Mulga Downs Station pastoral lease. The Old Mulga Downs Station homestead (now unused) is located immediately to the north, but outside the Development Envelope.

There are two conservation areas, elevated above the Fortescue River Valley forming a natural visual barrier to views from within the valley; being Karijini National Park in the Hamersley Range and Millstream Chichester National Park.

Karijini National Park is located 7.6 km to the south of the Development Envelope and covers almost 630,000 ha of the Hamersley Range which forms a dominant landscape feature rising above the valley floor. This conservation area is an important tourism asset with accommodation, hiking trails and other ecotourism facilities. Karijini Eco Retreat is located in the northern part of the Karijini National Park, approximately 25 km south west of the Development Envelope.

Millstream Chichester National Park is approximately 25 km north west of the Development Envelope the and the Mungaroona Range Nature Reserve is approximately 13 km north of the Development Envelope and extends over an area of 430,000 ha.

The Development Envelope has been subject to localised clearing associated with access as part of the exploration drilling activities.

Transport infrastructure, notably, the Great North Highway is located 8 km east of the eastern portion of the Development Envelope, and the Wittenoom-Mujina Road is located 7 km south of the southern boundary, while the Roebourne-Wittenoom Road is located approximately 2 km west of the Mulga West Development Envelope. There are several existing rail alignments, the Fortescue Solomon Rail traverses 8 km north of the Development Envelope before crossing just before the Great Northern Highway.

3.2 LANDSCAPE CHARACTER TYPES

Reading the Remote: Landscape Characters of Western Australia (CALM 1994) provides descriptive inventories of the varied and unique landscapes in Western Australia, and frames of reference to assist in describing the landscape. The landscapes are classified into distinctive ‘Landscape Character Types (LCT)’, which are geographic areas sharing common characteristics such as landform, vegetation, water form and cultural land use patterns relevant to human interaction and experience.

The purpose of classifying the landscapes of Western Australia in Reading the Remote (CALM 1994) is to 'study their representation and significance and to ultimately develop appropriate planning and design policies, guidelines and specifications to protect and enhance them'. The value of landscapes is also set out as an 'important resource because it acts as an indicator of environmental health, contributes to our quality of life, and provides people with a sense of place'.

Most of the Development Envelope and viewpoints are located within the Fortescue Valley LCT. The north eastern section of the Proposal occurs in the Chichester Ranges LCT (CALM 1994) as shown on **Map 5 - Map 6**.

The Fortescue Valley LCT is described as a long, broad "u"-shaped valley with wide open sandy alluvial plains surrounding the intermittent Fortescue River. The vegetation is varied and comprises thick hummock grasses overlain by tall Eucalyptus and Acacia. The valley is bound to the south by the Hamersley Range which are 200 m above the alluvial plains of the Fortescue Valley (referred to as 'high hills' in this VIA). To the north are the Chichester Ranges with low hills extending up to approximately 30 m above the surrounding ground level. These are referred to as the 'low hills'. The elevation of the region is shown on **Map 5**.

Plate 1 depicts a view of the Fortescue Valley with the Hamersley Ranges visible on the horizon line looking south from the low hills of the Boolgeeda Land System.

Plate 1: Fortescue Valley

The Chichester Ranges LCT is a gently undulating plain forming a plateau. It is a relatively narrow unit and extends in a north west to south east direction for about 320 kilometres from the Millstream Chichester National Park in the north west to the Marble Bar Road in the south east. The vegetation consists of spinifex grasses on rocky slopes with shrubs and scattered trees such as the white barked snappy gums, although there are many areas with sparse vegetation cover (CALM, 1994).

Due to the topographical screening of the Chichester Range to the north and the Hamersley Range to the south, views of the Proposal further south or north of these ranges are expected to be restricted as demonstrated by the viewshed analysis shown on **Map 7** and **Map 8**.

3.3 LAND SYSTEMS (LANDSCAPE CHARACTER)

The visual landscape within the vicinity of the Proposal can be described within the context of land systems which reflect a set of major environmental, geographical and biophysical influences which shape the landscape and can be used to describe the landscape character of the area.

The Western Australian department of Primary Industries and Regional Development (DPIRD) published a document; *An inventory and condition survey of the Pilbara region, Western Australia* (DPIRD 2004). The purpose of the survey was to provide a comprehensive description and maps of the biophysical resources of the region, together with an evaluation of the condition of the soils and vegetation throughout. The survey is based on field work undertaken during 1995, 1996, 1997 and 1999 and covers approximately 181,723 km2 of the Pilbara region. A total of 102 land systems are described in the survey characterised by their geomorphology, soils, vegetation, site type ecology and resource condition.

For the purposes of this VIA, the land systems have been used to characterise the varied landscapes within and surrounding the Development Envelope to understand the associated visual sensitivity to change and the scenic quality of the land systems and corresponding impact the Proposal may have.

There are 10 land systems that intersect the development envelope, these are listed along with a brief description in **Table 14**. The location of the land systems in relation to the Proposal are shown on **Map 6**.

Table 14: Land System Descriptions

Land System	Description
Bonney System	Low rounded hills and undulating stony plains supporting soft spinifex grasslands.
Boolgeeda System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrubla7nds.
Brockman System	Gilgai alluvial plains with cracking clay soils supporting tussock grasslands and low woodlands.
Coolibah System	Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey. *Does not intersect the Development Envelope but is a large unit occurring near the southern boundary.*
Hooley System	Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands.
Jamindie System	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.
Jurrawarrina System	Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses.
McKay System	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.
Newman System	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
Rocklea System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs
Wona System	Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields.

3.3.1 BONNEY SYSTEM

This land system intersects a small area in the northern area of Development Envelope and forms the northern foothills of the more dominant hills of the McKay system to the south, with the plains of the Wona system further north.

3.3.1.1 Visual summary

+ Gently undulating low hills;
+ Low-lying vegetation;
+ Screening topography; and
+ Generally high scenic quality.

3.3.1.2 Geomorphology

This land system is underlain by Lower Proterozoic basalt, tuff, lava and sedimentary rocks. This land system contains predominately erosional surfaces with gently undulating low hills and stony plains with relief of up to 30 m and widely spaced tributaries.

3.3.1.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 65%;
+ Good condition: 30%;
+ Fair condition: 4%
+ Poor condition: 0%; and
+ Very poor condition: 1%.

3.3.1.4 Landform, soil and vegetation

The landform predominately comprises stony plains which are characterised by gently undulating stony plains downslope if rounded hills and low rises. This landform contains calcareous loamy soils and red loamy soils with plains with basalt and occasionally calcrete pebbles. The vegetation in the stony lower plains comprises hummock grasslands and isolated acacia shrublands.

The hills and low rises upslope of the stony plains support larger vegetation such as occasionally eucalyptus.

3.3.2 BOOLGEEDA SYSTEM

This land system occurs in the northern and southern areas of the Development Envelope and forms the foothills of the more dominant hills of the McKay system to the north, and the Newman system to the south.

3.3.2.1 Visual summary

+ Gently undulating low hills;
+ Mostly Low-lying vegetation;
+ Screening topography; and
+ Generally high scenic quality.

3.3.2.2 Geomorphology

This land system is underlain by quaternary colluvium. This land system contains predominately depositional surfaces with very gently inclined stony slopes and plains with relief of around 20 m with closely spaced dendritic drainage lines.

3.3.2.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 82%;
+ Good condition: 13%;
+ Fair condition: 4%; and
+ Poor condition: 1%.

3.3.2.4 Landform, soil and vegetation

The landform predominately comprises stony lower plains which are characterised by red loamy soils with plains with ironstone and other pebbles. The vegetation in the stony lower plains comprises hummock grasslands and scattered acacia shrublands with occasional eucalypt trees with a spinifex ground layer.

The stony plains also occasionally contain groves of trees and narrow drainage channels that host moderately close woodlands or tall shrublands with sparse low shrubs and tussock or hummock grasses.

Plate 2 below depicts hummock grasslands and scattered acacia shrublands with occasional eucalypt trees of the Boolgeeda System with low lying mesa and low hills of the Newman system beyond. **Plate 3** below depicts red loamy soils, shrubland, scattered eucalypts with low hills beyond.

Plate 2: Boolgeeda System

Plate 3: Boolgeeda System

3.3.3 BROCKMAN SYSTEM

This land system intersects a small area in the western portion of Development Envelope and forms the periphery of the floodplains of the flood plains of the Coolibah System in the centre of the Development Envelope surrounding the Fortescue River.

3.3.3.1 Visual summary

+ Flat;
+ Degraded low lying vegetation;
+ Screening from occasional tall trees; and
+ Generally low scenic quality.

3.3.3.2 Geomorphology

This land system is underlain by quaternary colluvium. This land system contains depositional surfaces comprised of level, non-saline alluvial plains with clay soils that shrink and swell during alternate drying and wetting cycles (gilgai microrelief). The tussock grasslands of this land system have been severely degraded through livestock overgrazing and soil erosion has occurred where vegetation cover has been depleted.

3.3.3.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 19%;

+ Good condition: 26%;
+ Fair condition: 21%
+ Poor condition: 17%; and
+ Very poor condition: 17%.

3.3.3.4 Landform, soil and vegetation

The landform predominately comprises gilgai plains which are characterised by level plains with ironstone and pebbles and self-mulching cracking clays and some red/brown non-cracking clay. The vegetation in the gilgai plains comprises tussock grasslands.

The gilgai plains also occasionally contain swamps and groves with deep red/brown non-cracking clays with scattered tall eucalyptus and acacia woodland with a patch understory of shrubs and tussock grasses.

Plate 4 below depict the landscape character of the Brockman System which is characterised by Acacia shrublands over a sparse ground cover.

Plate 4: Brockman System

3.3.4 COOLIBAH SYSTEM

This land system occurs to the south of the Development Envelope and forms the floodplains surrounding the Fortescue River.

3.3.4.1 Visual summary

+ Flat;
+ Degraded low lying vegetation;
+ Screening from acacia woodlands and tall eucalypts; and
+ High scenic diversity and moderate scenic quality.

3.3.4.2 Geomorphology

This land system is underlain quaternary colluvium and minor calcrete. This land system contains depositional surfaces comprised of active flood plains and alluvial plains with shallow meandering channels of the Fortescue River. Alluvial plains are highly susceptible to erosion and large areas of this land system are mapped as severely degraded and eroded.

3.3.4.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 9%;
+ Good condition: 14%;
+ Fair condition: 17%;
+ Poor condition: 34%; and
+ Very poor condition: 26%.

3.3.4.4 Landform, soil and vegetation

The landform predominately flood plains characterised by level plains up to 5 km wide with deep red/brown noncracking clay soil. The vegetation comprises moderately close woodlands of eucalyptus and acacia with tussock grasses.

The floodplains of this land system also comprise small areas of gilgai back plains that are subject to less regular flooding and host tussock grasslands..

Plate 5 - Plate 6 below depict the landscape character of the Coolibah System.

Plate 5: Coolibah System – sparse flood plain with scattered Eucalypts

Plate 6: Coolibah System – shrublands and woodlands of the flood plains and alluvial plains of the Coolibah system

3.3.5 HOOLEY SYSTEM

This land system occurs in the western portion of the Development Envelope and forms the alluvial clay plains on the foothills of the low hills of the Newman system. The proposed airfield occurs within this system.

3.3.5.1 Visual summary

+ Flat;
+ Degraded low lying vegetation;
+ Screening from occasional tall trees; and
+ Generally low scenic quality.

3.3.5.2 Geomorphology

This land system is underlain by Quaternary alluvium. This land system contains depositional surfaces comprised of level plains with mosaic surfaces of clayey and stony alluvium with gilgai microrelief.

3.3.5.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 20%;
+ Good condition: 20%;
+ Fair condition: 26%;

+ Poor condition: 21%; and
+ Very poor condition: 12%.

3.3.5.4 Landform, soil and vegetation

The landform predominately comprises gilgai plains characterised by level plains with areas of gilgai microrelief occurring in patches and ironstone pebbles. This landform contains self-mulching cracking clays soils that host tussock grasslands.

Plate 7- Plate 8 below depict the landscape character of the Hooley System.

Plate 7: Hooley System –cattle grazing on open plain surrounded by Eucalypt woodland

Plate 8: Hooley System – Tussock grasslands, scattered acacia trees and pastoral fence lines

3.3.6 JAMINDIE SYSTEM

This land system occurs in the central area of the Development Envelope and forms the shrubland plains between the floodplain area of the Coolibah System to the south and the low hills of the Newman System to the north. Most of the development footprint occurs within this system.

3.3.6.1 Visual summary

+ Generally flat with some vantage points along the northern portion of the system at the base of the low hills;
+ Screening from trees and dense vegetation;
+ Varied vegetation height, texture and colour profile with wildflowers; and
+ Moderate to high scenic quality.

3.3.6.2 Geomorphology

This land system is underlain by partly cemented Quaternary colluvium, alluvium and laterite with minor occurrences of sedimentary rocks of Proterozoic age. This land system contains depositional surfaces comprised of non-saline plains with hardpan at shallow depth and groved vegetation, stony upper and low

rises on hardpan or rock with relief of up to 30 m. This land system also comprises very widely spaced tributary drainage channels.

3.3.6.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 22%;
+ Good condition: 26%;
+ Fair condition: 25%;
+ Poor condition: 15%; and
+ Very poor condition: 12%.

3.3.6.4 Landform, soil and vegetation

The landform predominately comprises hardpan plains characterised by almost level vast plains up to 8 km in long by 4-5 km wide between shallow drainage tracts. The plains contain abundant ironstone pebbles and are subject to sheet overland flow. This landform contains red-brown hardpan shallow loam soils that host very scattered tall shrublands of acacia and a ground layer of soft spinifex.

The Jamindie land system also comprises stony upper plains and low rises that comprise shrubby hummock grasslands.

Large portions of this land system have been degraded within the Development Envelope as exhibited by a very visible scar from aerial imagery as a result of exploration activities. This appears as linear areas void of vegetation running north-east – southwest (shown in **Plate 9**) and spans over an area approximately 17 km long and 4 km wide in the Jamindie land system area.

Plate 10- Plate 11 below depict the landscape character of the Jamindie System.

Plate 9: Exploration drill lines as seen from aerial imagery within the Jamindie land system

Plate 10: Jamindie System - Eucalyptus trees over scattered spinifex grasses

Plate 11: Jamindie System – dense shrublands

3.3.7 JURRAWARRINA SYSTEM

This land system occurs in a small portion of the northwest area of the Development Envelope and forms plains immediately north and south of the floodplain area of the Coolibah System surrounding the Fortescue River. The Jurrawarrina System occurs in similar conditions to the Brockman system.

3.3.7.1 Visual summary

+ Flat;
+ Degraded low lying vegetation;
+ Screening from occasional tall trees; and
+ Generally low scenic quality.

3.3.7.2 Geomorphology

This land system is underlain by Quaternary alluvium and colluvium. This land system contains depositional surfaces comprised of plains receiving overland sheet flow with prominent drainage groves.

3.3.7.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 14%;
+ Good condition: 18%;
+ Fair condition: 19%;
+ Poor condition: 24%; and
+ Very poor condition: 25%.

3.3.7.4 Landform, soil and vegetation

The landform predominately comprises hardpan plains described in Jamindie land system section. This land system also comprises stony plains, drainage tracts and drainage grove landforms. The drainage tracts comprise level alluvial plains with clayey soil up to 750 m wide and host scattered to close tall woodlands and shrublands. The groves comprise small bands arranged with long axis at right angles to the direction of sheet flow on stony and hardpan plains with close woodlands.

Plate 12 - Plate 13 below depict the landscape character of the Jurrawarrina System.

Plate 12: Jurrawarrina System – Mulga shrubland with sparse ground cover

Plate 13: Jurrawarrina System – visible development – powerlines

3.3.8 MCKAY SYSTEM

This land system occurs in the eastern portion of the Development Envelope and forms the range of the low hills north of the Newman System in the Mungaroona Range.

3.3.8.1 Visual summary

+ Highly undulating;
+ Generally low lying vegetation;
+ Screening from topography and scattered tall trees; and
+ High scenic diversity, vantage points and high scenic quality.

3.3.8.2 Geomorphology

This land system is underlain by lower Proterozoic shale, chert, mudstone, sandstone and dolomite. This land system contains erosional surfaces comprised of hill tracts, ridges, plateaux remnants and breakaways with steep upper slopes and more gently inclined lower footslopes and restricted stony plains with relief up to 100 m. There are also moderately spaced tributary drainage patterns incised in narrow valleys in upper parts that become broader and more widely spaced downstream. This land system is mostly inaccessible due to the rugged terrain.

3.3.8.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 88%;
+ Good condition: 8%;
+ Fair condition: 3%; and
+ Poor condition: 1%;

3.3.8.4 Landform, soil and vegetation

The landform predominately comprises hills, ridges and plateaux remnants characterised by rounded hill and ridge crests, level to gently inclined plateaux surfaces and moderately inclined to very steep upper slopes. This landform has abundant surface pebbles, stones and cobbles of chert, ironstone and shale as well as rock outcrops. This landform contains stony soils that host hummock grasslands with isolated acais shrubs and eucalyptus trees.

This land system also contains breakaway landforms characterised by hardened mesa caps (an isolated, flat-topped elevation, ridge or hill, which is bounded from all sides by steep escarpments and stands distinctly above a surrounding plain) of ironstone or laterite with vertical breakaway faces up to 15 m high over weathered parent rock and with short, moderately inclined to steep slopes below. Breakaway landforms have stony soils with scattered acacia shrublands and spinifex understory and some hummock grasslands.

Plate 14- Plate 17 below depict the landscape character of the McKay System.

Plate 14: McKay System – mesa caps with vertical breakaway faces

Plate 15: Low hills of the McKay System in foreground, rugged terrain of the Newman System in the background

Plate 16: McKay System – shrublands on gently rolling terrain

Plate 17: McKay System – low rolling hills covered in hummock grassland and scattered Eucalypts

3.3.9 NEWMAN SYSTEM

This land system occurs in the central area of the Development Envelope and forms the initial low hills directly abutting the Fortescue valley. This land system also occurs in the dominant high hills of the Hamersley Range to the south and due to rugged topography and low accessibility, photos provided below only depict the low hills in the north of the Development Envelope and view towards the high hills and not within.

3.3.9.1 Visual summary

+ Highly undulating;
+ Generally low-lying vegetation;
+ Screening from topography and scattered tall trees; and
+ High scenic diversity, vantage points and high scenic quality.

3.3.9.2 Geomorphology

This land system is underlain by lower Proterozoic jaspilite, chert, siltstone, shale, dolomite and minor acid volcanics. This land system contains erosional surfaces comprised of plateaus and mountains with relief of around 450 m and dendritic (tree like) tributary drainage patterns in narrow valleys and gorges with narrow drainage floor and channels. This land system is mostly inaccessible due to the rugged terrain and contains iron ore deposits that are currently being mined. Spinifex is the dominant vegetation and the system is burnt fairly frequently.

3.3.9.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 91%;
+ Good condition: 7%;
+ Fair condition: 1%; and
+ Poor condition: 1%

3.3.9.4 Landform, soil and vegetation

The landform predominately comprises plateaus, ridges, mountains and hills characterised by 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 (an accumulation of loose stones or rocky debris lying on a slope or at the base of a hill or cliff). There are also outcrops of parent rock as well as pebbles and stones of ironstone, jaspilite, chert and other rocks. This landform contains stony soils, red shallow loams and sands that host hummock grasslands and very scattered acacia and eucalyptus trees and shrubs.

Plate 18 - **Plate 20** below depict the landscape character of the Newman System.

Plate 18: Newman System – rolling hills and mesas

Plate 19: Newman System – exposed rock outcrops and scree slopes with scattered Eucalypts

Plate 20: Newman System –hummock grasslands with scattered Acacias and Eucalypts

3.3.10 WONA SYSTEM

This land system occurs in the north eastern portion of the Development Envelope and forms the basaltic gilgai plains within a sub valley area north of the elevated low hills range. Based on the general land system overview (both are gilgai plains within the centre of valleys), refer to the photos for the Brockman system within Section 5.3.3 as an indication of the views of the Wona system.

3.3.10.1 Visual summary

+ Flat;
+ Low lying vegetation with low vegetation diversity;
+ Low screening capacity due to low vegetation height; and

+ Generally low scenic quality.

3.3.10.2 Geomorphology

This land system is underlain by Lower Proterozoic basalt. This land system contains mainly erosional surfaces comprised of gently sloping stony gilgai plains and minor basalt hills with relief up to 30 m. There are sparse incised drainage channels within narrow valleys.

3.3.10.3 Vegetation condition

The condition of the vegetation in this land system was assessed by DPIRD (2004) as:

+ Very good condition: 30%;
+ Good condition: 20%;
+ Fair condition: 20%;
+ Poor condition: 22%; and
+ Very poor condition: 8%.

3.3.10.4 Landform, soil and vegetation

The landform predominately comprises stony gilgai upland plains that have self-mulching cracking clay soils and some deep red/brown noncracking clay soils that support tussock grasslands.

Plate 21 - Error! Reference source not found. below depict the landscape character of the Wona System.

Plate 21: Wona System – grassland plain with the low hills of the McKay System and high hills of the Newman System in the background

Plate 22: Wona System – red/brown non-cracking clay soils, shrublands of the Rocklea System visible in the foreground.

3.4 SENSE OF PLACE

Sense of place refers to an intangible viewer experience of a landscape. One of the most striking elements in the landscape surrounding the Proposal, is the relatively untouched, unmodified, natural sense of place. This sense of place is characterised by the long-distance views, the variety of landscape types contributing to scenic

diversity and generally high visual landscape quality. The following features contribute to the landscape values of the area:

+ a high degree of perceived wilderness value, due to undisturbed sweeping views across the Fortescue Valley, weathered and rugged landscape elements
+ the presence of undulating topography characterised by the rugged high hills of the Hamersley Range to the south and lower hills of the Chichester Ranges to the north
+ sweeping panoramic views from vantage points and rugged ridgelines in Hamersley Ranges
+ displays of vegetation diversity such as low-lying soft spinifex, tussock grasses, colourful wildflowers, mid level acacias and tall eucalypts providing a range of textures, tones and heights
+ stark juxtaposition of flat plains with undulating hillsides/ridges with jagged rock outcrops
+ distinctive displays of colour diversity including deep red/orange surface intermittently broken up with various shades of green and brown.

3.5 VISUAL MANAGEMENT OBJECTIVES

The aim of Visual Management Objectives (VMOs) is to provide clear and concise objectives to manage landscape character, view experiences and landscape values that are integral to the 'sense of place'.

The VMOs adopted by WAPC (2007) to manage the visual landscape that are applicable to this assessment are described below.

3.5.1 BEST PRACTICE SITING AND DESIGN

This VMO should be the baseline objective for all landscapes. To meet this VMO, it is expected that the proposed development blends in with the surrounding landscape, where development may be evident but generally not prominent in that it borrows from the existing landscape setting. Strategies to meet this objective may include:

+ the application of practical and sensitive siting and design techniques
+ retaining dominant landscape features and characteristics
+ enhancing or restoring landscape features.

3.5.2 PROTECTION AND MAINTENANCE

Protection and maintenance is the maximum retention of existing visual character which is likely to apply to the highly valued visual landscapes that describe Sense of Place (**Section 3.4**) and visual receptors that are considered highly sensitive to change. For this assessment those receptors are residential communities and culturally significant locations. Therefore, future development should be planned and designed to have minimal visual impact view experiences and landscape values that are intrinsic to the Sense of Place of for the region. Any alterations to the visual landscape assigned this objective should be planned and designed to have minimal visual impact, in which development would either be not evident (i.e. development may be hidden, screened or not visible, from specified viewing locations) or blending (i.e. development may be evident, but generally not prominent in that it borrows from the existing landscape setting) (WAPC, 2007).

3.6 VIEWPOINT SELECTION

A desktop assessment was undertaken to determine the type and location of potential receptors (areas where viewers may be impacted by the Proposal) within the vicinity of the Proposal. The first stage was a detailed desktop assessment of the landscape surrounding the Proposal to map any visible dwellings, infrastructure and access roads. This was supported by a review of relevant databases to identify mapped tourist attractions, culturally significant sites, mapped localities any other surrounding destinations. As a result of this assessment, key receptor locations were mapped as shown on the viewshed maps (**Map 7** - **Map 8**).

The receptor types were categorised as:

+ Culturally significant: including Aboriginal meeting places and burial grounds
+ Residential: including communities and camps

+ Tourism: including tourist facilities, attraction, hiking trails and accessible vantage points
+ Transient: including roads and railways.

Desktop review of the identified receptors was undertaken to select representative receptors that would be assessed for visual impacts. Photos were captured from these viewpoints for the purpose of photo montage creation and the assessment of impacts. Viewpoints selected for visual impact analysis based on the following considerations:

+ viewshed modelling
+ accessibility
+ distance to the Proposal infrastructure
+ direction of view
+ receptor type.

Nine representative viewpoints were selected and are shown on all maps and listed in **Table 15** below.

Table 15: Viewpoint Location Description

View-point	Label	Type	Description	Within mine viewsheds?	Distance from Significant Proposal Infrastructure
1	Karijini	Tourism	Auski Tourist Village at Karijini	Yes	23 km
2	Nanutarra Road East	Transient	Nanutarra Road 7 km northwest of Wittenoom	Yes	16 km
3	Nanutarra Road West	Transient	Nanutarra Road 17 km northwest of Wittenoom	No	26 km
4	Fortescue River	Culturally Significant	Culturally sensitive area –- 14 km north of Youngaleena Banjima.	Yes	4 km
5	Mulga Downs Homestead	Culturally Significant	Mulga Downs homestead/ Aboriginal burial grounds	Yes	0.3 km
6	Highway North	Transient	Great Northern Highway 13 km north of Tucker Camp	No	13 km
7	Highway South	Transient	Great Northern Highway 10 km south of Tucker Camp	Yes	14 km
8	Youngaleena Community	Culturally Significant	Aboriginal Community 20 km west of Auski Tourist Village (VP 1).	Yes	16 km
9	Wirrlimurra Community	Culturally Significant	Aboriginal Community 22 km north of Auski Tourist Village (VP 1).	Yes	16 km

4 VISUAL IMPACT ASSESSMENT

4.1 VIEWPOINT ANALYSIS

The following section presents the photo montage analysis for the nine viewpoints. The highest degree of impact from the Proposal will occur within the operation phase and specifically towards the end of mine life where above ground mound elements are established. This VIA has assessed the operational phase of the Proposal which is likely to be the 'worst case scenario' as not all Proposal elements are likely to all be visually significant at the same time.

Images from each viewpoint were captured looking towards the Development Envelope. The representative images were then assessed according to the criteria set out in **Section 2.3**.

The photomontages created for each viewpoint are also provided with the existing view from each viewpoint to support the quantitative analysis and provide a basis for qualitative photomontage assessment. For the following viewpoints, photo montages were undertaken by Sentient Computing which show 3D created images of both the existing view and proposed view:

+ VP 4: Fortescue River
+ VP 5: Mulga Downs Homestead
+ VP 8: Youngaleena Community
+ VP 9: Wirrlimurra Community

The photo montage methodology is provided in **Section 2.2**.

4.1.1 VIEWPOINT 1: KARIJINI

Plate 23: Viewpoint 1 - existing north view

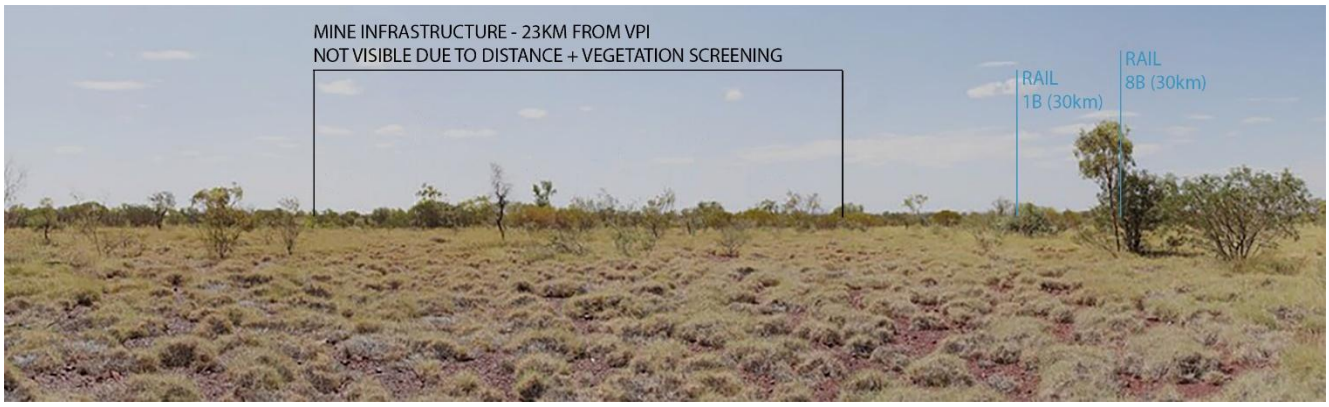

Plate 24: Viewpoint 1 - proposed north view

Table 16: Viewpoint 1 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Tourism	-
Viewshed direction	North	-
Distance from the Proposal (km) (a)	23.3 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Negligible	1
Scenic Quality (c)	Moderate	4
Vegetation Height (d)	1 – 2 m – moderate	4
Viewer Sensitivity (e)	Tourists - moderate	4
Visual Impact Score (a+b+c+d+e)	15	
Visual Impact	**Low**	

4.1.2 VIEWPOINT 2: NANUTARRA ROAD EAST

Plate 25: Viewpoint 2 - existing north east view

Plate 26: Viewpoint 2 - proposed north east view

Table 17: Viewpoint 2 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Transient	-
Viewshed direction	North East	-
Distance from the Proposal (km) (a)	16 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Low	2
Scenic Quality (c)	Low	2
Vegetation Height (d)	<1 m – high	8
Viewer Sensitivity (e)	Road users - low	2
Visual Impact Score (a+b+c+d+e)	16	
Visual Impact	**Low**	

4.1.3 VIEWPOINT 3: NANUTARRA ROAD WEST

Plate 27: Viewpoint 3 - existing east view

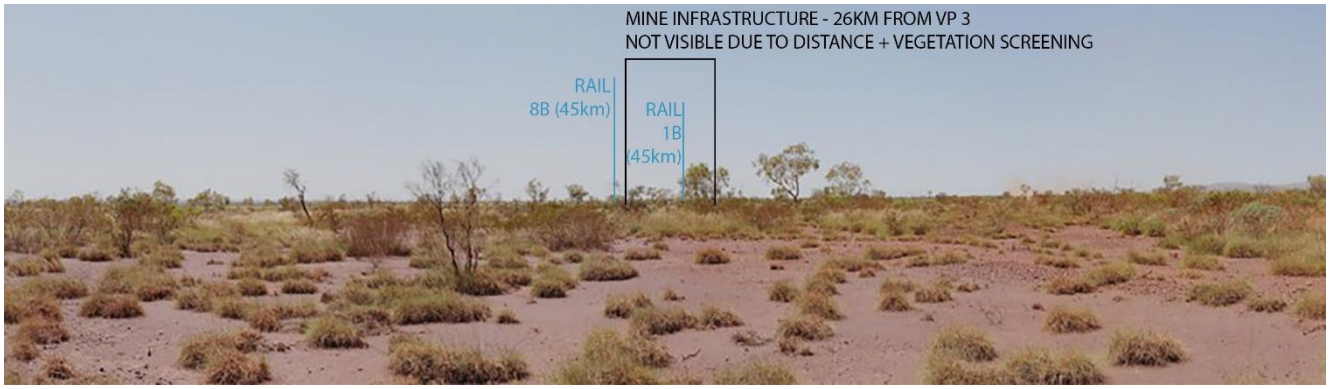

Plate 28: Viewpoint 3 – proposed east view

Table 18: Viewpoint 3 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Transient	-
Viewshed direction	North east	-
Distance from the Proposal (km) (a)	26 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	negligible	1
Scenic Quality (c)	Low	2
Vegetation Height (d)	<1 m – high	8
Viewer Sensitivity (e)	Road users - low	2
Visual Impact Score (a+b+c+d+e)	15	
Visual Impact	**Low**	

4.1.4 VIEWPOINT 4: FORTESCUE RIVER

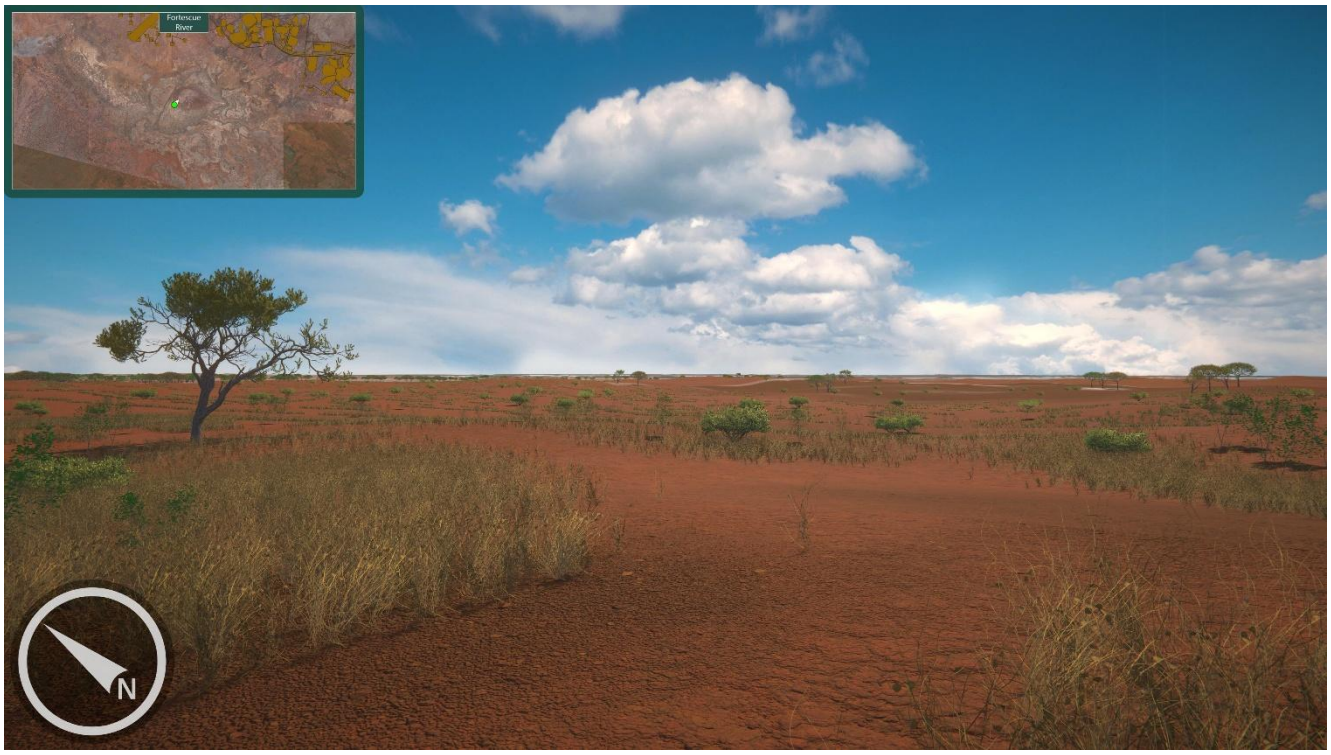

Plate 29: Viewpoint 4 photo simulation of existing north east view

Plate 30: Viewpoint 4 photo simulation of proposed north east view

Table 19: Viewpoint 4 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Culturally significant	-
Viewshed direction	North	-
Distance from the Proposal (km) (a)	4 – Low	4
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Low	2
Scenic Quality (c)	Low*	2
Vegetation Height (d)	1-2 m – Moderate	4
Viewer Sensitivity (e)	Culturally significant - high	8
Visual Impact Score (a+b+c+d+e)	20	
Visual Impact	**Low**	

*Assessment of scenic quality and vegetation height is based on the reference photo (**Plate 31**) for this viewpoint.

Plate 31: Viewpoint 4 reference photo

4.1.5 VIEWPOINT 5: MULGA DOWNS HOMESTEAD

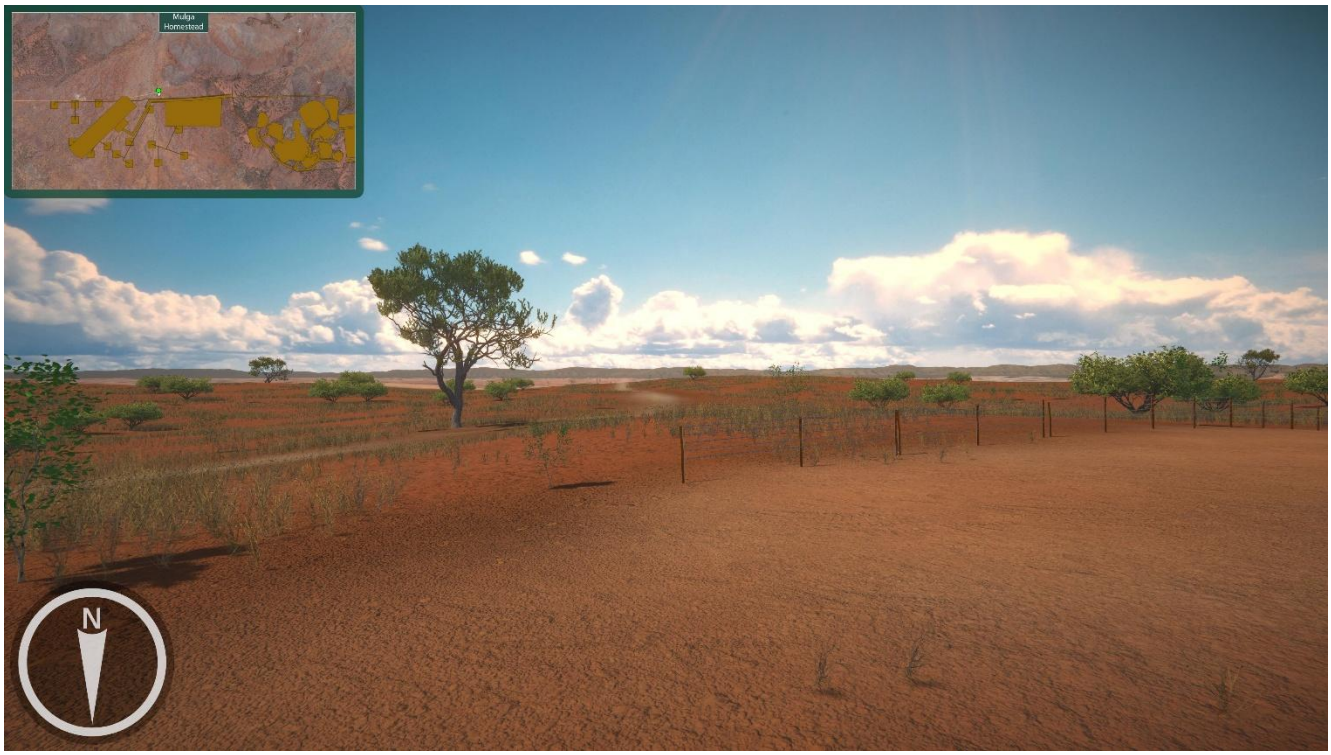

Plate 32: Viewpoint 5 photo simulation of existing south view

Plate 33: Viewpoint 5 photo simulation of proposed south view

Plate 34: Viewpoint 5 photo simulation of proposed south west view

Table 20: Viewpoint 5 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Culturally significant	-
Viewshed direction	South	-
Distance from the Proposal (km) (a)	0.3 – high	16
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Low	2
Scenic Quality (c)	Low*	2
Vegetation Height (d)	<1 m – high	8
Viewer Sensitivity (e)	Culturally significant - high	8
Visual Impact Score (a+b+c+d+e)	36	
Visual Impact	**Moderate**	

*Assessment of scenic quality and vegetation height is based on the reference photo (**Plate 35** and **Plate 36**) for this viewpoint

Plate 35: Viewpoint 5 reference photo

Plate 36: Viewpoint 5 reference photo

4.1.6 VIEWPOINT 6: HIGHWAY NORTH

Plate 37: Viewpoint 6 - existing south west view

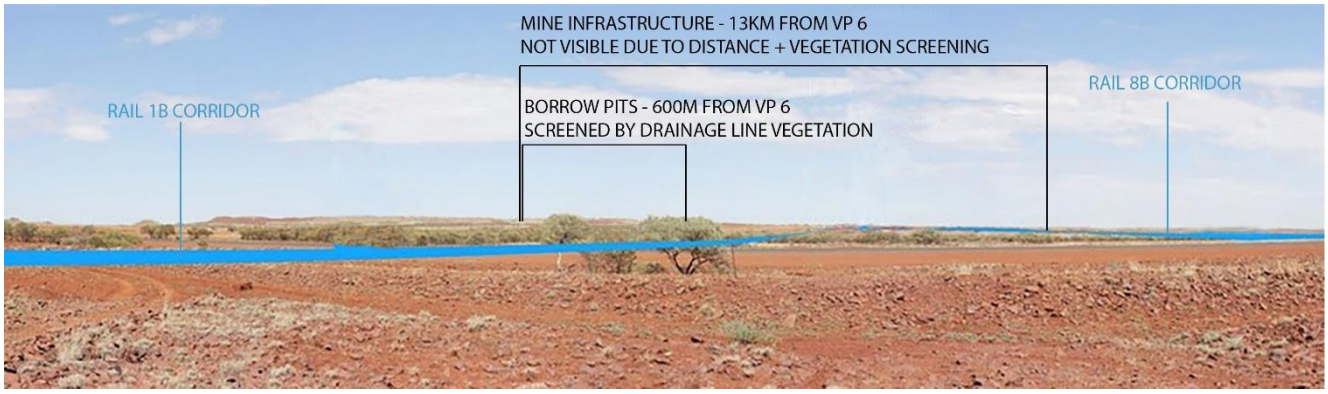

Plate 38: Viewpoint 6 - proposed south west view

Table 21: Viewpoint 6 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Transient	-
Viewshed direction	South west	-
Distance from the Proposal (km) (a)	13 – negligible*	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Negligible	1
Scenic Quality (c)	Low	2
Vegetation Height (d)	1 - 2 m west of highway – moderate	4
Viewer Sensitivity (e)	Road users - low	2
Visual Impact Score (a+b+c+d+e)	11	
Visual Impact	**Negligible**	

* The main mine area is 13 km from the viewpoint, however borrow pits are located about 620 m west of the viewpoint but will be screened by drainage line vegetation. The visual impact score does not consider the rail corridor development shown in blue on **Plate 38**.

4.1.7 VIEWPOINT 7: HIGHWAY SOUTH

Plate 39: Viewpoint 7 - existing north east view

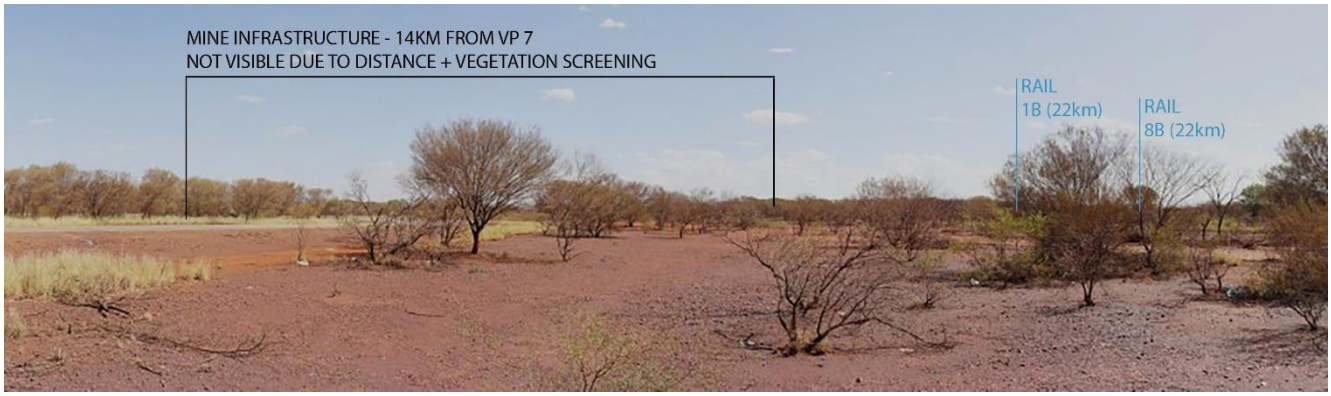

Plate 40: Viewpoint 7 - proposed north east view

Table 22: Viewpoint 7 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Transient	-
Viewshed direction	North west	-
Distance from the Proposal (km) (a)	14.4 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Negligible	1
Scenic Quality (c)	Low	2
Vegetation Height (d)	3 – 10 m - low	2
Viewer Sensitivity (e)	Road users - low	2
Visual Impact Score (a+b+c+d+e)	9	
Visual Impact	**Negligible**	

4.1.8 VIEWPOINT 8: YOUNGALEENA COMMUNITY

Plate 41: Viewpoint 8 photo simulation of existing north east view

Plate 42: Viewpoint 5 photo simulation of proposed north east view

Table 23: Viewpoint 8 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Culturally Significant	-
Viewshed direction	North	-
Distance from the Proposal (km) (a)	16 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Negligible	1
Scenic Quality (c)	Moderate*	4
Vegetation Height (d)	<1 m – High*	8
Viewer Sensitivity (e)	Culturally significant - high	8
Visual Impact Score (a+b+c+d+e)	23	
Visual Impact	**Low**	

*Assessment of scenic quality and vegetation height is based on the reference photo (**Plate 43**) for this viewpoint

Plate 43: Viewpoint 8 reference photo

4.1.9 VIEWPOINT 9: WIRRLIMURRA COMMUNITY

Plate 44: Viewpoint 9 photo simulation of existing north west view

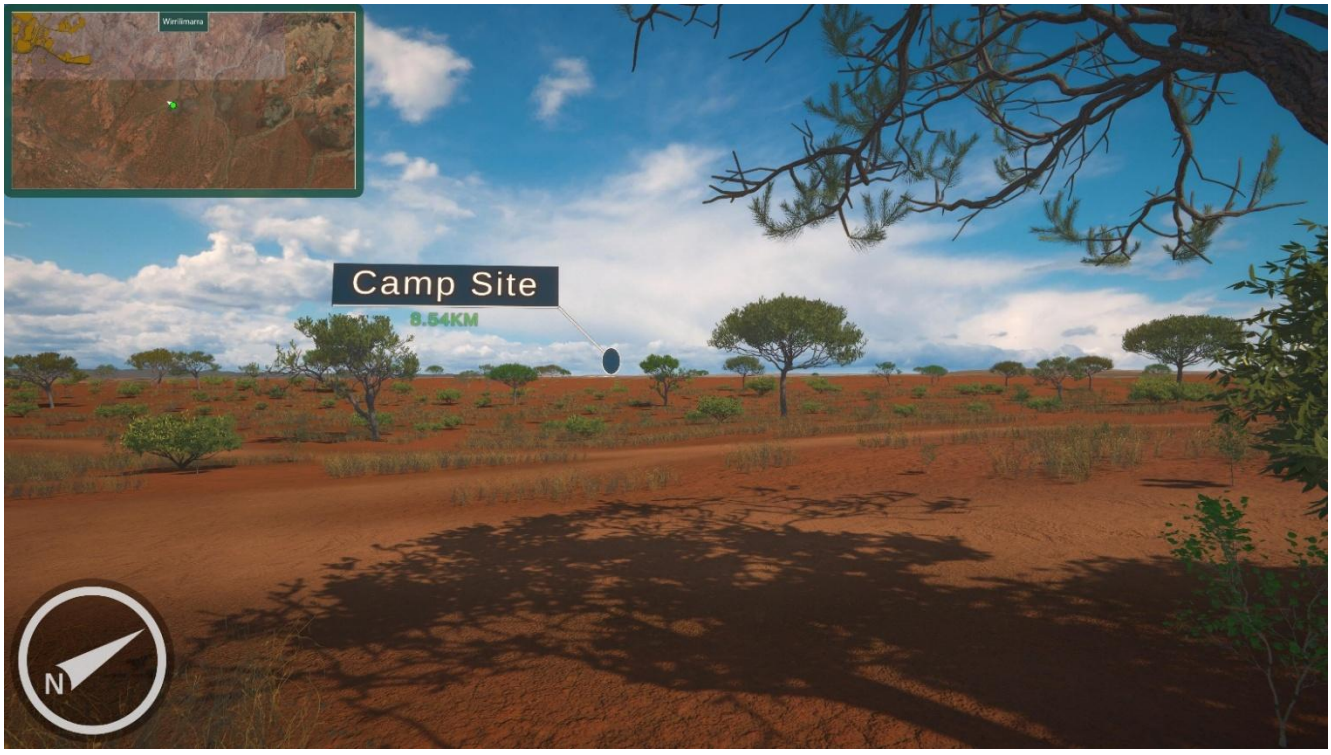

Plate 45: Viewpoint 9 photo simulation of proposed north west view

Table 24: Viewpoint 9 visual analysis

Parameter	Description	Ranking for Matrix
Viewpoint type	Culturally Significant	-
Viewshed direction	North west	-
Distance from the Proposal (km) (a)	16 – negligible	2
Visual Dominance of Proposal Infrastructure in Photomontages (b)	Low	2
Scenic Quality (c)	Moderate	4
Vegetation Height (d)	1 – 2 m moderate	4
Viewer Sensitivity (e)	Culturally significant - high	8
Visual Impact Score (a+b+c+d+e)	20	
Visual Impact	**Low**	

*The assessment of scenic quality and vegetation height are based on the photo simulation as there are no reference photos available due to access restrictions to the culturally sensitive site.

Table 25: Visual impact assessment summary table

Parameter	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9
Viewpoint label	Karijini	Nanutarra Rd East	Nanutarra Rd West	Fortescue River	Mulga Downs Homestead	Highway North	Highway South	Youngaleena	Wirrlimurra
Viewpoint type	Tourism	Transient	Transient	Culturally significant	Culturally significant	Transient	Transient	Culturally significant	Culturally significant
Viewshed direction	North	North east	North east	North east	South	South west	North west	North	North west
Distance from the Proposal	23 km Negligible	16 km Negligible	26 km Negligible	4 km Low	0.3 km High	13 km Negligible	14 km Negligible	16 km Negligible	6.4 km Low
Distance score (a)	2	2	2	4	16	2	2	2	4
Visual Dominance of Proposal Infrastructure in Photomontages	Negligible	Low	Negligible	Low	Low	Negligible	Negligible	Negligible	Low
Visual Dominance score (b)	1	2	1	2	2	1	1	1	2
Scenic Quality	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate
Scenic Quality score (c)	4	2	2	2	2	2	2	4	4
Vegetation Height	1 – 2 m Moderate	<1 m High	<1 m High	1 – 2 m Moderate	<1 m High	1 – 2 m Moderate	3 – 10 m Low	<1 m High	1 – 2 m Moderate
Vegetation Height score (d)	4	8	8	4	8	4	2	8	4
Viewer Sensitivity	Moderate	Low	Low	High	High	Low	Low	High	High
Viewer Sensitivity score (e)	4	2	2	8	8	2	2	8	8
Visual Impact Score (a+b+c+d+e)	15	16	15	20	36	11	9	23	22
Visual Impact	Low	Low	Low	Low	Moderate	Negligible	Negligible	Low	Low

4.2 CONSTRUCTION

Other project components that are potentially significant are the temporary construction camps, laydown areas, stockpiles, borrow pits and access tracks. These elements are not considered to result in a significantly negative visual effect on any receptors due to the short-term presence and low elevation (height) of these components. The construction camps will only be present during the construction phase of the project and will generally be located close to the centre of the Development Envelope and away from visual receptors. Construction impacts will be short term and localised, and therefore have not been modelled. It is anticipated that construction and maintenance activities will be significantly less than the modelled operational impacts.

4.3 CLOSURE-REHABILITATED STATE

The estimated life of the Proposal is 18 years. Decommissioning/closure will most likely require removal and rehabilitation of the land in accordance with the Mine Closure Plan associated with post-mine closure environmental standards and legislative requirements.

5 VISUAL IMPACT SUMMARY

5.1 VIEW LOCATIONS

The visual criteria values established in **Section 2.3** were assessed to determine the overall visual impact of the Proposal. **Table 25** provides a summary of the visual impact assessment of the significant Proposal infrastructure based on viewpoint analysis.

As shown in **Table 25**, the level of visual impact is anticipated to be mostly Low with the exception of VP5 at Mulga Downs Homestead which was assessed as Moderate. This is mainly a result of the close proximity to the visually significant proposal elements and the high sensitivity of the area due to cultural significance. From this viewpoint the powerlines are 600 m to the south which will be 28 m above ground level, however the mining area (pits and waste rock dumps) is located 3.6 km to the south east and the impact from these landforms is expected to be negligible as shown in the photo montage.

The other viewpoints were assessed as Negligible to Low levels of visual impact. This is mainly due to the large distance between the viewpoint and Proposal infrastructure. This demonstrates the effectiveness of distance as a visual mitigation strategy, as impacts are minimal from public accessible areas such as the Great Northern Highway and Munjina/Nanutarra Road.

In the assessment undertaken in 2022, access was not granted to the two surrounding Aboriginal communities (Youngaleena and Wirrlimurra). Subsequently photo montages have been produced for this assessment using computer generated imagery and 3D modelling software to accurately place the mine infrastructure in the landscape. While there are limitations in assessing visual impacts using simulated images, such as the assessment of scenic quality, the visibility of the proposal can be determined based on the modelling. In this case, the visual impact was assessed as Low from both viewpoints which is mostly due to the distance from the Proposal. This impact score is based on the quantitative visual impact assessment the criteria set out in **Section 2.3** and does not take into account the visual impact of the Proposal on Aboriginal story lines and dreamtime as this is assumed to be assessed as part of the cultural heritage assessment.

5.2 VISUAL MANAGEMENT OBJECTIVES

The Visual Management Objectives considered appropriate for the management of the visual landscape are:

- Best Practice Siting and Design as the baseline objective for all landscapes; and
- Protection and Maintenance of view experiences and landscape values that are integral to the ‘Sense of Place’ from all viewpoints, these are:
  - a high degree of perceived wilderness value, due to undisturbed sweeping views across the Fortescue Valley, weathered and rugged landscape elements
  - the presence of undulating topography characterised by the rugged high hills of the Hamersley Range to the south and lower hills of the Chichester Ranges to the north
  - sweeping panoramic views from vantage points and rugged ridgelines in Hamersley Ranges
  - displays of vegetation diversity such as low-lying soft spinifex, tussock grasses, colourful wildflowers, mid level acacias and tall eucalypts providing a range of textures, tones and heights
  - stark juxtaposition of flat plains with undulating hillsides/ridges with jagged rock outcrops
  - distinctive displays of colour diversity including deep red/orange surface intermittently broken up with various shades of green and brown.

Due to the distance of the Proposal from public accessible areas and residential communities, it is expected that the key view experiences and landscape values will be retained from these view locations.

5.3 CONCLUSION

The Proposal assessed in the VIA is set in a landscape with considerable beauty and an untouched, unmodified, natural sense of place. This includes a variety of landscape types with distinctive displays of diversity.

The Proposal is an iron ore mine with a Development Envelope of approximately 16,848 ha. Clearing of native vegetation will occur within a Development Footprint of 4,484 ha.

The area where the Proposal is situated currently contains very little infrastructure and is sparsely populated. The VIA was undertaken based on views human receptors could experience from surrounding roads, accessible settlements and culturally significant sites accessed by local Aboriginal people.

The potential visual impact associated with the visually significant Proposal infrastructure during operation is based on the analysis of nine representative viewpoints and associated photomontages created through 3D modelling. The level of visual impact was assessed as Negligible to Moderate as listed below:

+ Negligible: VP 6 (Highway North) and VP 7 (Highway South)
+ Low: VP 1 (Karijini), VP 2 (Nanutarra Road East), VP 3 (Nautarra Road West), VP 4 (Fortescue River), VP 8 (Youngaleena Community) and VP 9 (Wirrlimurra Community)
+ Moderate: VP 5 (Mulga Downs Homestead).

One of the main contributing factors to the generally low level of impact associated with the Proposal is its location within a sparsely populated area and siting away (distance) from publicly accessible areas. This demonstrates the effectiveness of distance as a visual mitigation strategy.

The Moderate impact experienced at the Mulga Downs homestead (VP 5) is due to the close proximity to the Proposal. However, it should be noted that the main mine area is located 3.6 km to the south east and is not expected to be visible as shown in the photo montage.

5.4 STUDY LIMITATIONS

The following limitations and assumptions are considered as part of the VIA:

+ Computer generated images were used at viewpoints 4, 5, 8, and 9. These provide an indication of how visible the Proposal may be in the landscape. However, there are limitations in assessing visual impacts using simulated images, such as the assessment of scenic quality. Therefore, assumptions were made on scenic quality and vegetation height based on the reference photos provided by JBS&G which are presented within this report
+ vegetation height is assessed in this VIA based on the condition of the vegetation as depicted in the site photographs, therefore the assessment does not consider any additional growth or loss of vegetation from fire or drought
+ the viewshed analysis is based on a 30 m resolution Digital Elevation Model (DEM) sourced from Geoscience Australia (2010). The analysis also does not include above ground objectives such as vegetation, therefore it presents the ‘worst case’ scenario of visible extent of the Proposal.
+ weather effects such as sunlight, dust, lighting and rain have not been considered
+ it can be assumed that there will be some impacts from artificial light emissions which may impact the view locations, such as a glow on the horizon line where the existing sky conditions may have been dark. An assessment of the artificial light impacts are beyond the scope of this report.

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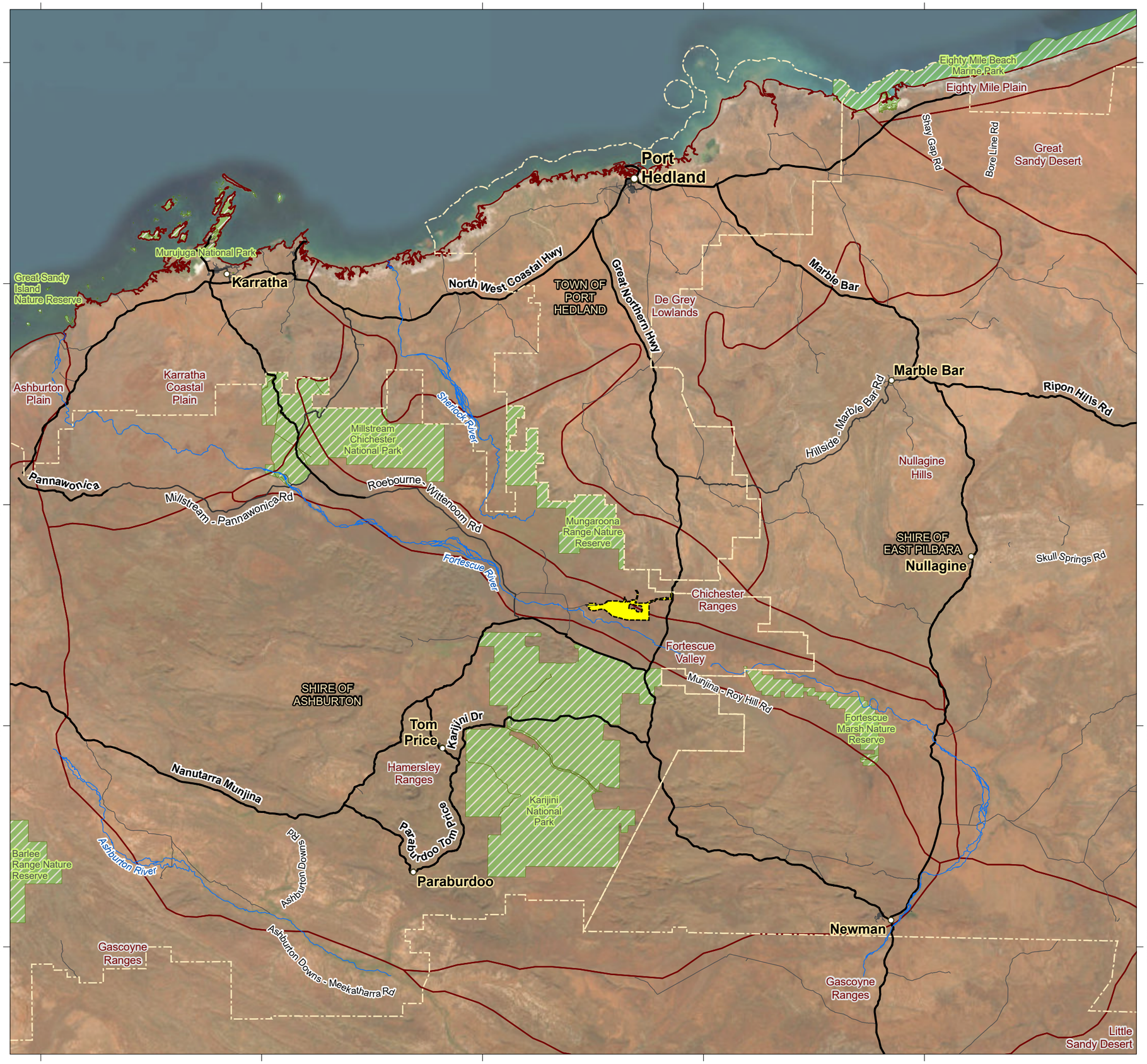
MAPS



LEGEND

- MDIOM Development Envelope
- Local Government Boundary
- DBCA Legislated Lands and Waters
- Landscape Character Type (CALM, 1994)
- Drainage Lines

Roads (MRWA, 2023)

- Primary Access Road
- Secondary Access Road
- Local Access Road

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE (JBSG, 2024), ROADS (MRWA 2023), SURFACE HYDROLOGY LINES (NATIONAL) (GEOSCIENCE AUSTRALIA 2015), DBCA LEGISLATED LANDS AND WATERS (DBCA, 2024), LANDSCAPE CHARACTER TYPES (CALM, 1994). LOCAL GOVERNMENT BOUNDARIES (LANDGATE, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, NOAA, USGS
WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

PROPOSAL LOCATION

MULGA DOWNS IRON ORE MINE
VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:1,750,000 @ A3

0 25 50 75 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 01

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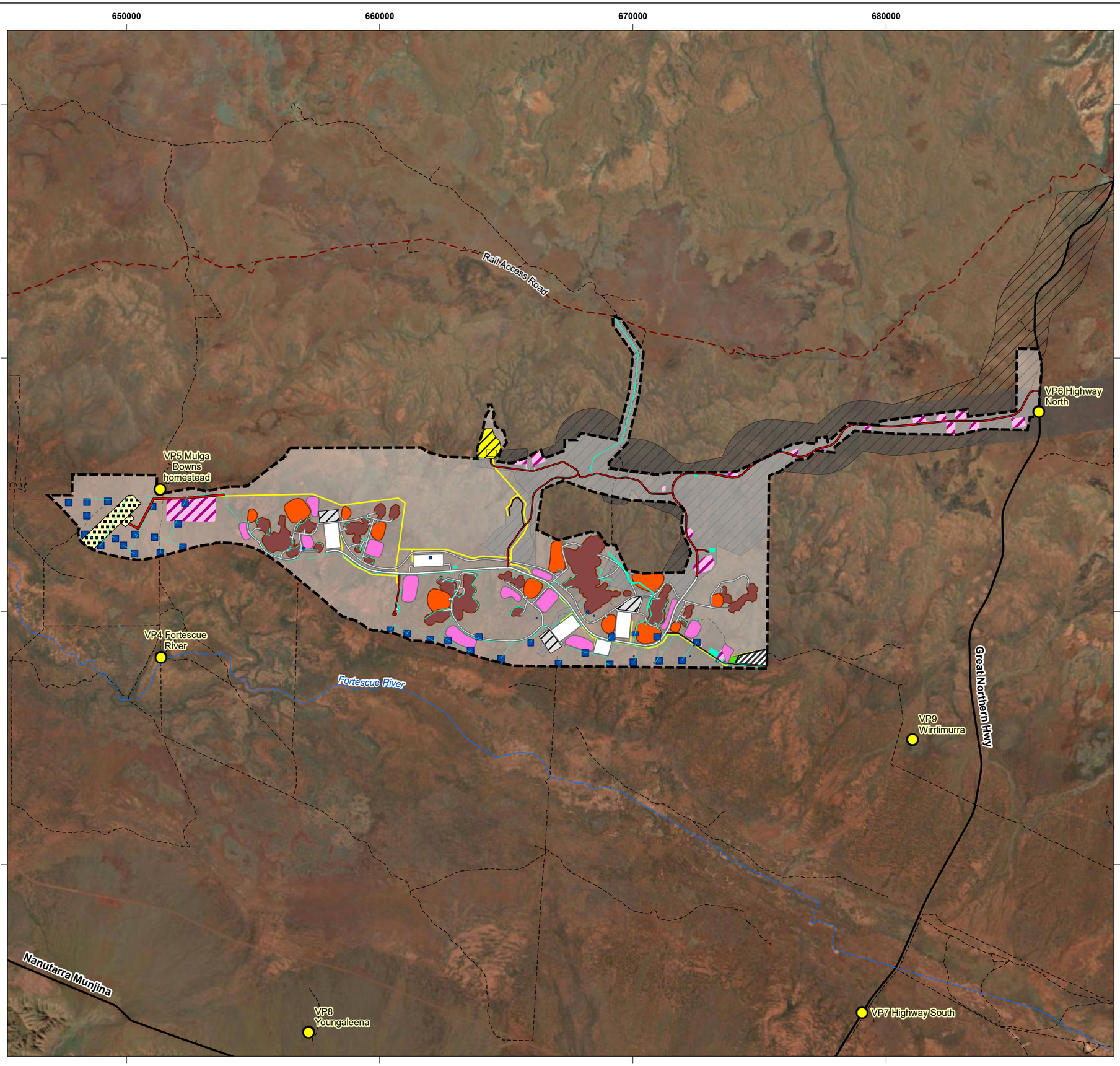


LEGEND

- MDIOM Development Envelope
- Hub & Rail 1B Development Envelope*
- Hub & Rail 8B Development Envelope*
- Viewpoint (VP) Locations
- Minor Track
- Rail Maintenance Track
- Drainage Lines

MDIOM Development Footprint

- Powerline
- Solar Farm
- Pit
- Stockpile; Topsoil Stockpile
- Waste Dump
- Crusher Pad and Haul Road
- ROM Pad
- Borrow Pit
- Bore: Injection; Bore: Monitoring; Bore: Water Supply
- Spray Field
- Airport
- Camp
- Roads
- Other low height infrastructure

* The Hub & Rail Corridor (1B & 8B), are shown for context, however they are not part of this assessment.

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), HUB AND RAIL 1B AND 8B (JBSG, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS (MRWA 2023), VIEWPOINT LOCATIONS (JBSG, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

MINE LAYOUT

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:150,000 @ A3

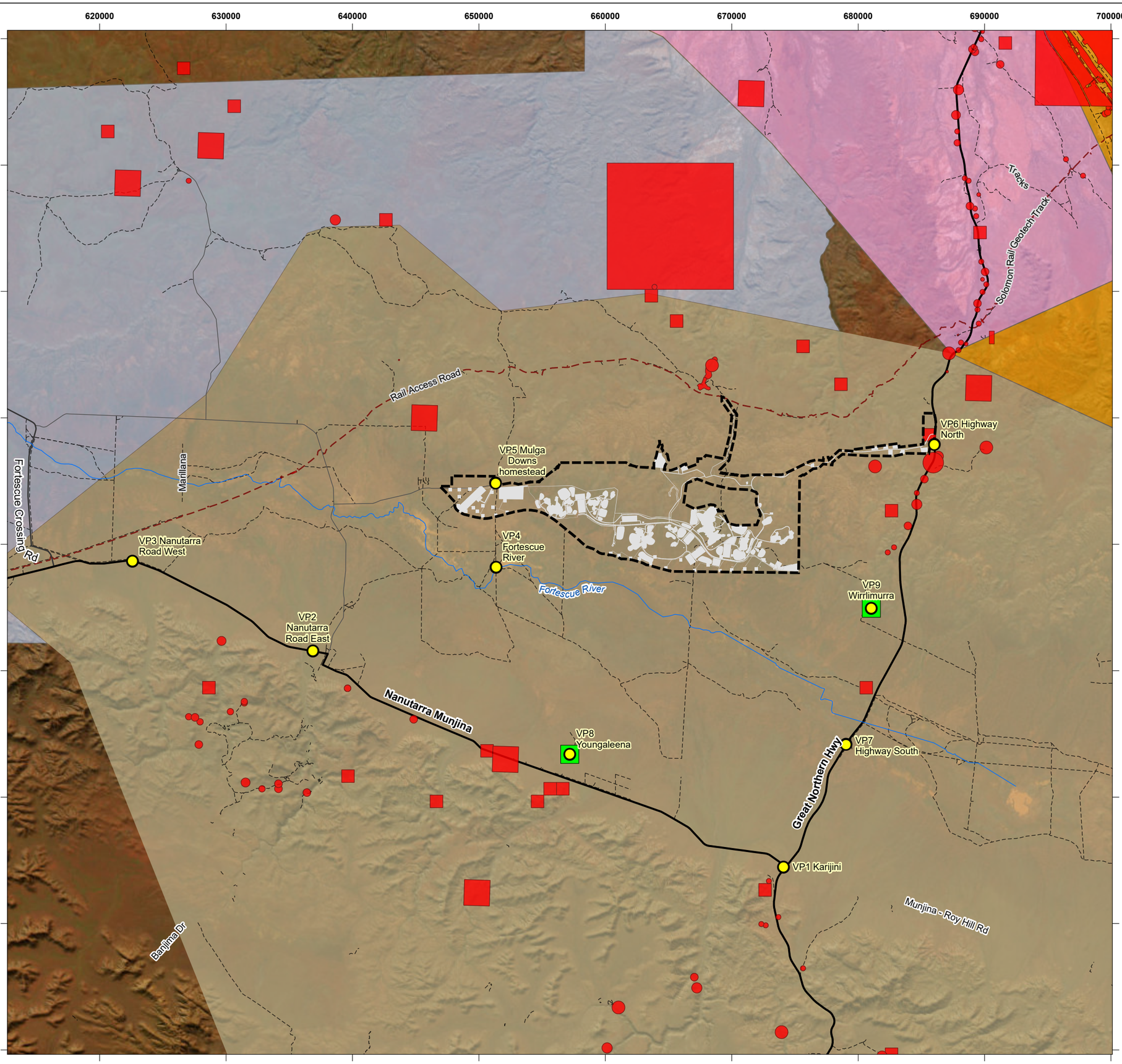
0 3 5 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 02

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx



LEGEND

- Aboriginal community
- Viewpoint (VP) Locations
- MDIOM Development Envelope
- MDIOM Development Footprint
- Minor Track
- Rail Maintenance Track
- Drainage Lines
- Aboriginal Heritage Places

Native Title Determination

- BANJIMA PEOPLE
- KARIYARRA PEOPLE
- PALYKU PART A
- YINDJIBARNDI #1

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS (MRWA 2023), ELEVATION (GEOSCIENCE AUSTRALIA DEM-S, 2015), VIEWPOINT LOCATIONS (JBSG, 2024), ABORIGINAL HERITAGE PLACES (DPLH, 2024), NATIVE TITLE DETERMINATION (LANDGATE, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

ABORIGINAL HERITAGE

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:300,000 @ A3

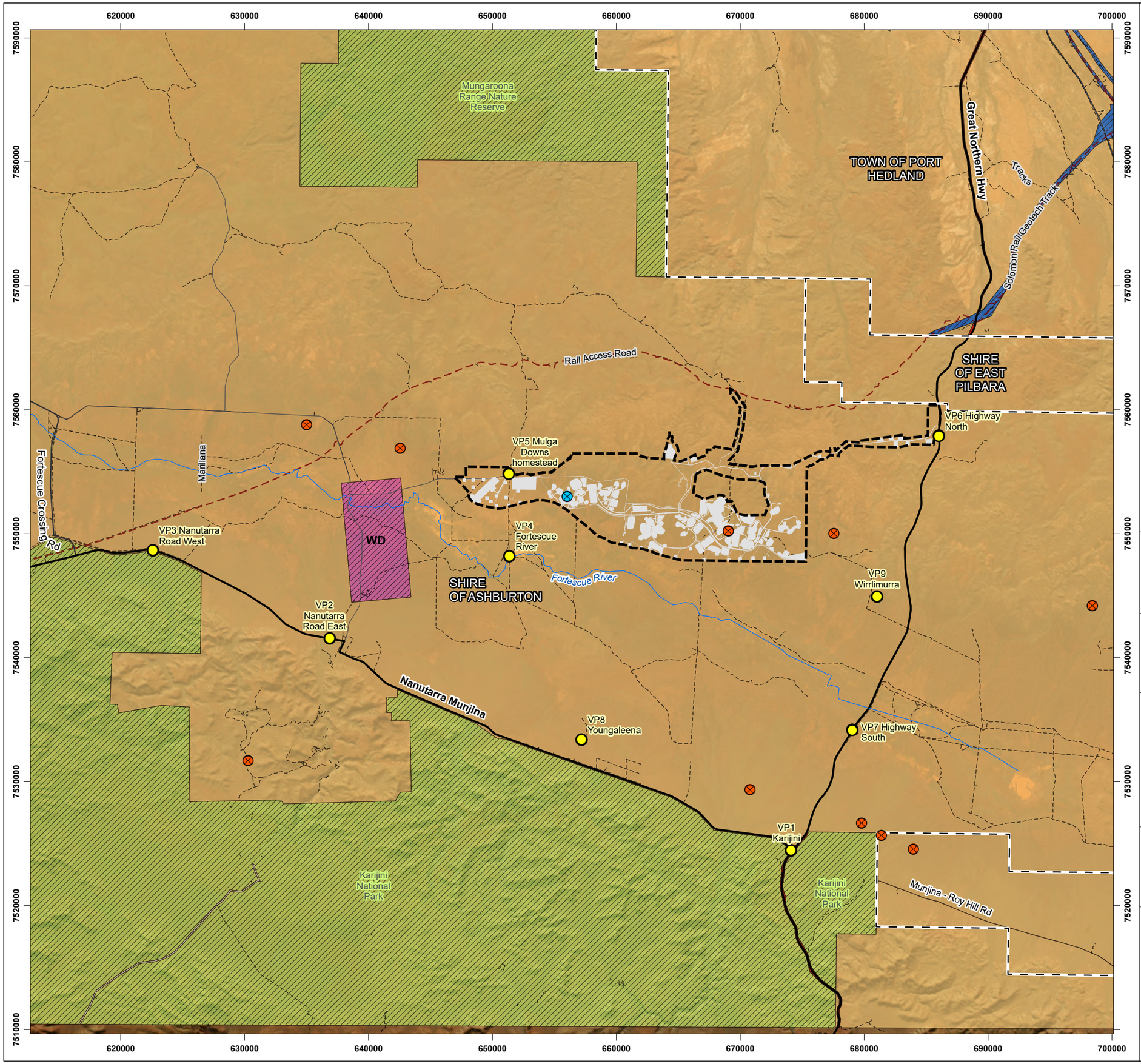
0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 03

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx



LEGEND

- Viewpoint (VP) Locations

Iron Ore Mine Development

- Proposed
- Undeveloped
- Minor Track
- Rail Maintenance Track
- Drainage Lines
- MDIOM Development Envelope
- MDIOM Development Footprint
- Local Government Boundary

Local Planning Scheme - Zones and Reserves

- Conservation, recreation and nature landscape
- Local road
- Major road
- Other purposes
- Primary distributor road
- Public purposes
- Railways
- Rural
- State/regional road

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS(MRWA 2023), ELEVATION (GEOSCIENCE AUSTRALIA DEM-S, 2015), VIEWPOINT LOCATIONS (JBSG, 2024), LOCAL PLANNING SCHEME (DPLH, 2024), MINES (MINDEX, DMIRS, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

LOCAL PLANNING SCHEME AND SURROUNDING MINES

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:300,000 @ A3

0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 04

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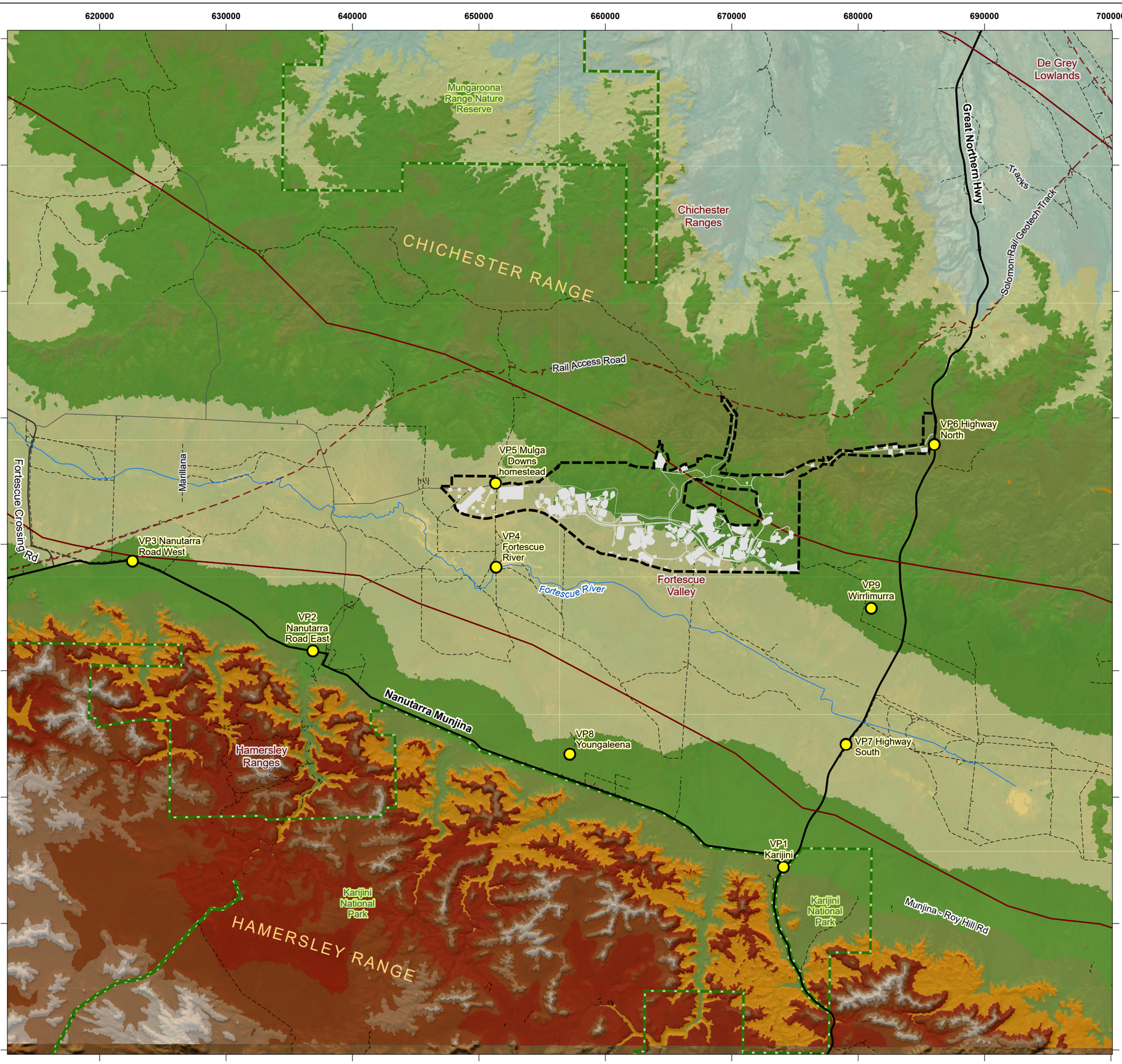


LEGEND

- MDIOM Development Envelope
- MDIOM Development Footprint
- Viewpoint (VP) Locations
- Minor Track
- Rail Maintenance Track
- Drainage Lines
- DBCA Legislated Lands and Waters
- Landscape Character Type (CALM, 1994)

Elevation (m AHD)

- 242 - 355
- 356 - 423
- 424 - 469
- 470 - 542
- 543 - 641
- 642 - 713
- 714 - 774
- 775 - 854
- 855 - 964
- 965 - 1,212

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DBCA, LEGISLATED LANDS AND WATERS (DBCA, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS (MRWA 2023), ELEVATION (GEOSCIENCE AUSTRALIA DEM-S, 2015), VIEWPOINT LOCATIONS (JBSG, 2024), LANDSCAPE CHARACTER TYPE (CALM, 1994).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

ELEVATION

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:300,000 @ A3

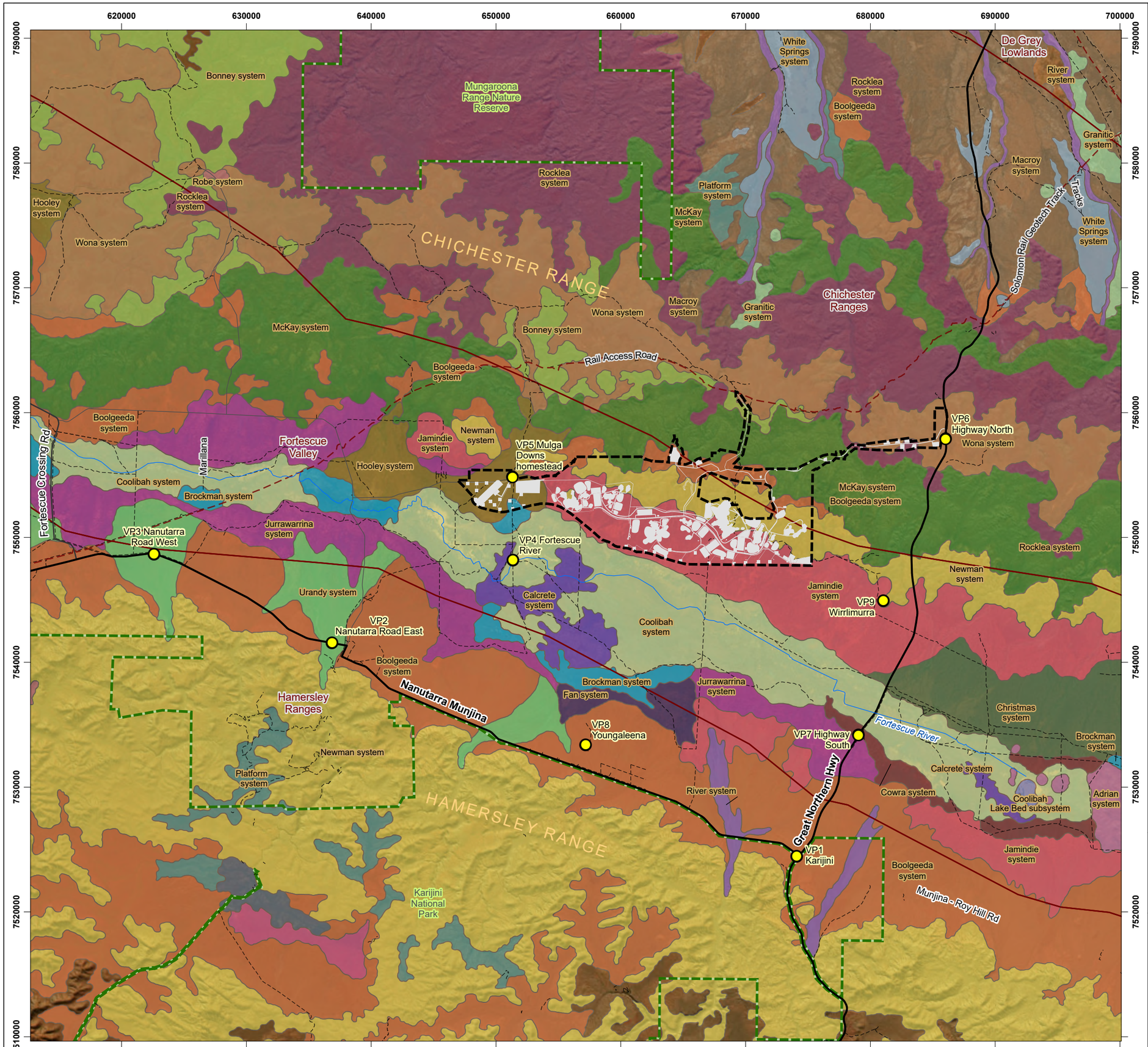
0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 05

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx



LEGEND

- MDIOM Development Envelope
- MDIOM Development Footprint
- Viewpoint (VP) Locations
- Minor Track
- Rail Maintenance Track
- Drainage Lines
- DBCA Legislated Lands and Waters
- Landscape Character Type (CALM, 1994)

Land Systems within MDIOM Development Envelope

- Bonney system,Low rounded hills and undulating stony plains supporting soft spinifex grasslands
- Boolgeeda system,Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands
- Brockman system,Gilgai alluvial plains with cracking clay soils supporting tussock grasslands and low woodlands
- Coolibah system,Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey
- Hooley system,Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands
- Jamindie system,Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey
- Jurrawarrina system,Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses
- McKay system,Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts
- Newman system,Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands
- Rocklea system,Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs
- Wona system,Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DBCA LEGISLATED LANDS AND WATERS (DBCA, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS(MRWA 2023), SOIL LAND SYSTEMS (DPIRD, 2022), VIEWPOINT LOCATIONS (JBSG, 2024), LANDSCAPE CHARACTER TYPE (CALM, 1994).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

LAND SYSTEMS

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:300,000 @ A3

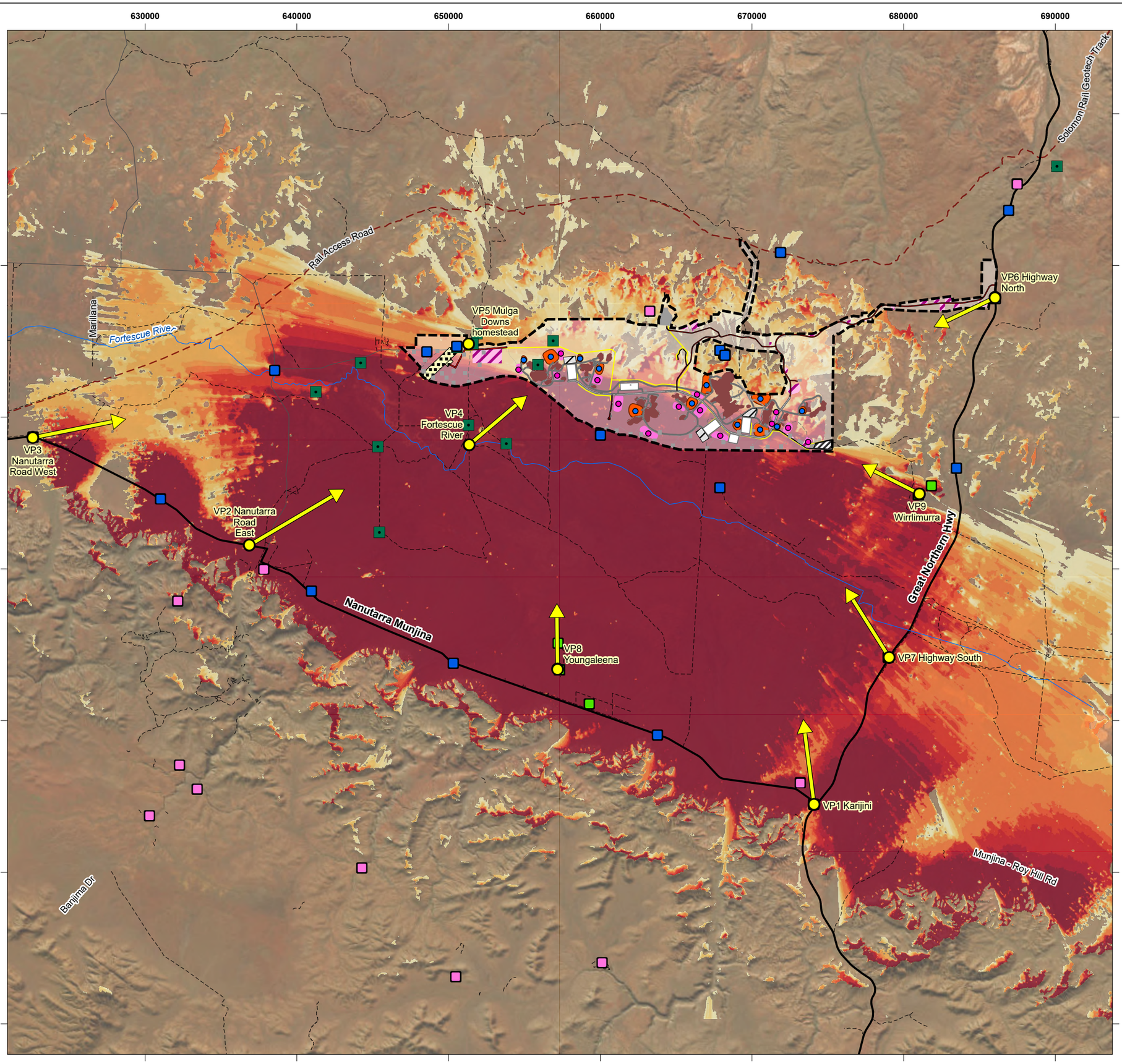
0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 06

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx



LEGEND

- MDIOM Development Envelope
- Viewpoint (VP) Locations
- VP View Direction
- Minor Track
- Rail Maintenance Track
- Drainage Lines

MDIOM Visually Significant Proposal Elements

- Powerline
- Pit
- Stockpile; Topsoil Stockpile
- Waste Dump
- Crusher Pad and Haul Road
- ROM Pad
- Borrow Pit
- Airport
- Camp
- Roads
- Low Height Infrastructure

Sensitive Receptor Type

- Culturally Significant
- Residential
- Tourism
- Transient

Viewshed Observer Point

- Stockpile
- Waste Rock Dump

Viewshed from Waste Rock Dumps (WRD) (35 m AHD)

Number of WRD observer points visible

- 12 Observers
- 1

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS (MRWA 2023), SENSITIVE RECEPTORS (JBSG, 2022), VIEWSHED GENERATED USING THE DEM-S (GEOSCIENCE AUSTRALIA, 2015), VIEWPOINT LOCATIONS (JBSG, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

COMPOSITE VIEWSHED WASTE ROCK DUMPS - 35 M AHD

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:250,000 @ A3

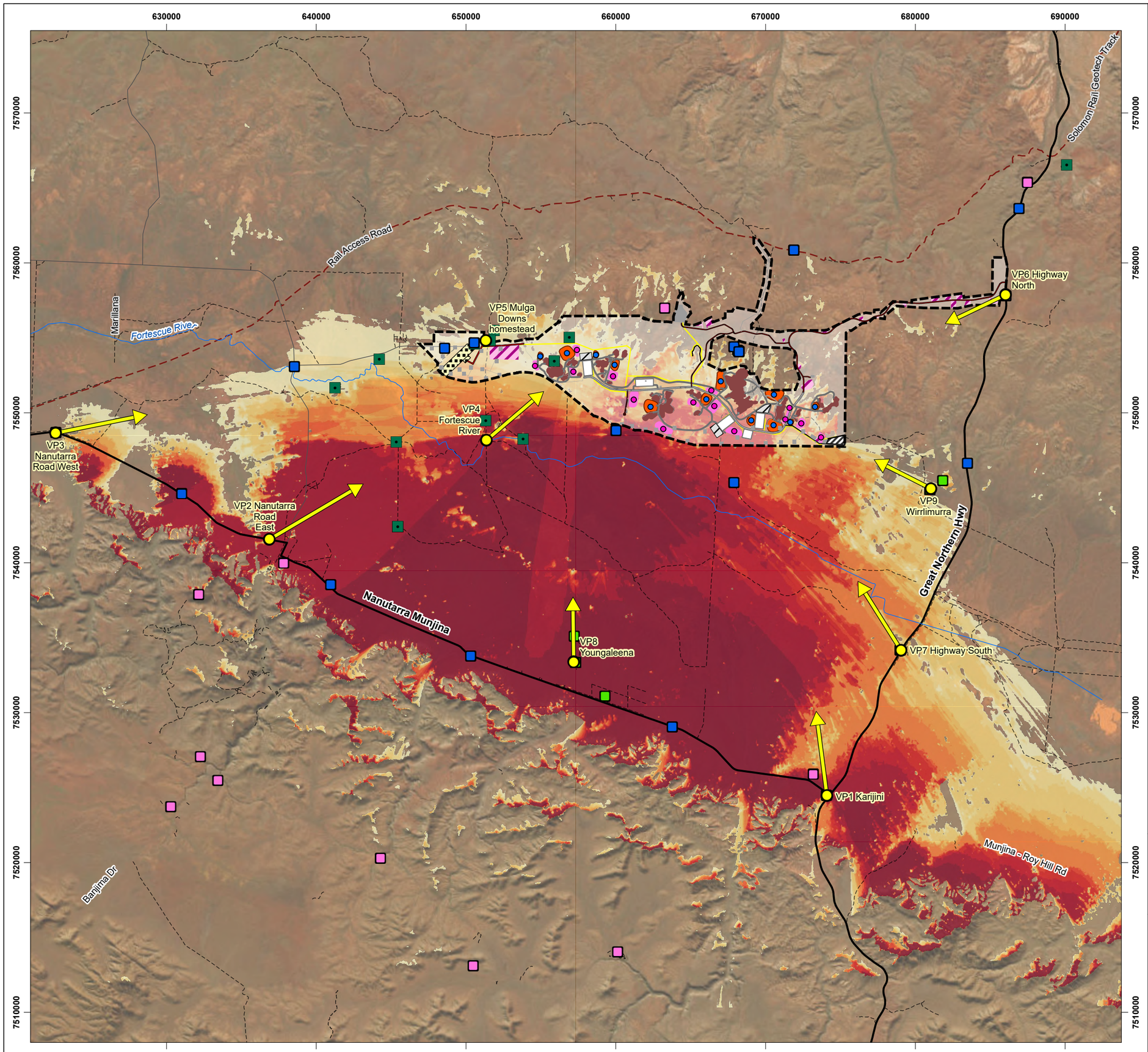
0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 07

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx



LEGEND

- MDIOM Development Envelope
- Viewpoint (VP) Locations
- VP View Direction
- Minor Track
- Rail Maintenance Track
- Drainage Lines

MDIOM Visually Significant Proposal Elements

- Powerline
- Pit
- Stockpile; Topsoil Stockpile
- Waste Dump
- Crusher Pad and Haul Road
- ROM Pad
- Borrow Pit
- Airport
- Camp
- Roads
- Low Height Infrastructure

Sensitive Receptor Type

- Culturally Significant
- Residential
- Tourism
- Transient

Viewshed Observer Point

- Stockpile
- Waste Rock Dump

Viewshed from Stockpiles (5m AHD)

Number of Stockpile observer points visible

14 Observers

1

DATA SOURCES:
SOURCE DATA: MDIOM DEVELOPMENT ENVELOPE AND FOOTPRINT (JBSG, 2024), DRAINAGE LINES (GEOSCIENCE AUSTRALIA, 2015), ROADS(MRWA 2023), SENSITIVE RECEPTORS (JBSG, 2022), VIEWSHED GENERATED USING THE DEM-S (GEOSCIENCE AUSTRALIA, 2015), VIEWPOINT LOCATIONS (JBSG, 2024).
BASEMAP: ESRI BASEMAP
SERVICE LAYERS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS

ecoscape

COMPOSITE VIEWSHED STOCKPILES - 5 M AHD

MULGA DOWNS IRON ORE MINE VISUAL IMPACT ASSESSMENT

JBS&G

COORDINATE SYSTEM: GDA2020 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA2020
UNITS: METER

N

SCALE: 1:250,000 @ A3

0 5 10 km

PROJECT NO: 5056-24

REV	AUTHOR	APPROVED	DATE
0	SB	PJ	15/11/2024

MAP 08

Path: Y:\01_Projects\5056-24 Mulga Downs VIA\Maps\APRXs\GDA_2020_Templates\Report_Maps_5056_GDA2020.aprx

APPENDIX ONE PREFERENCE INDICATORS

The table below lists the preference indicators for natural landscapes (WAPC, 2007).

Most preferred natural characteristics
+ high degrees of perceived naturalness
+ high degree of topographic variety (dramatic relief, ruggedness, rock outcrops, outstanding ridgelines and beach forms)
+ vegetative diversity (distinctive patterns, species composition, height, colour and texture)
+ diversity of vegetation age and density (structural complexity)
+ unusually expansive landforms or vast horizontal scale (desert landscapes, beach and dune fields, rolling hills)
+ presence of water bodies (waterfalls, rivers, estuaries, oceans, lakes, inundated areas)
+ distinctive displays of colour: soils, vegetation (often seasonal), topography, rock formations or water bodies
+ distinctive landscape features (waterfalls, unique plants, reefs, geological formations, cliff faces and granite outcrops)
+ outstanding combinations of landform, vegetation patterns and water features in one area
+ seascapes (combinations of ocean, reefs, beach, dune formation, coastal rocks, coastal vegetation)
+ areas frequently prone to ephemeral features (fauna, water or wave conditions, beach erosion scarps, climatic conditions).
Least preferred natural characteristics
+ disturbed areas with little evidence of naturalness
+ areas of diseased, dead or dying vegetation
+ areas with severe weed infestations in a natural landscape
+ areas of soil erosion (especially where human-induced)
+ water bodies with degraded banks, weed infestations, stagnation, eutrophication, algae or litter
+ evidence of mining (gravel pits, sand mines, limestone).