



Adani Mining Pty Ltd

NORTH GALILEE BASIN RAIL PROJECT

Environmental Impact Statement

Chapter 4 Scenic amenity and lighting

November 2013

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4. Scenic amenity and lighting

4.1 Purpose of chapter

This chapter assesses the potential impacts of the North Galilee Basin Rail Project (NGBR Project) on scenic amenity and lighting. For the purposes of this chapter, scenic amenity and lighting is assessed using the industry accepted methodology for landscape and visual impact assessment. This includes an overview of the existing visual environment, identification of sensitive receptors and consideration of potential construction and operation impacts. Mitigation and management measures are also proposed for identified impacts.

A detailed existing environment report for scenic amenity and lighting was prepared for the NGBR Project and is provided in Volume 2 Appendix D Scenic amenity and lighting. The key findings of the existing environment report are summarised within this chapter.

This scenic amenity and lighting chapter was prepared in accordance with the Terms of Reference (TOR) for the NGBR Project. A table that cross-references the contents of this chapter and the TOR is included as Volume 2 Appendix A Terms of Reference cross-reference.

All mitigation and management measures identified within this chapter are included within Volume 2 Appendix P Environmental management plan framework.

The potential impacts of the NGBR Project on fauna due to lighting associated with construction and operation are briefly considered in this chapter and discussed in detail within Volume 1 Chapter 6 Nature conservation.

4.2 Methodology

4.2.1 Study area

For the purpose of this scenic amenity and lighting assessment, the study area is defined by a visual catchment that extends five kilometres from the nominally 100 m wide final rail corridor. The preliminary investigation corridor, nominally 1,000 m wide, is captured within the study area.

4.2.2 Legislation and guidelines

Legislation relevant to this scenic amenity and lighting assessment includes:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Native Title Act 1993*
- *Vegetation Management Act 1999*
- *Aboriginal Cultural Heritage Act 2003*
- *Sustainable Planning Act 2009*.

There are currently no Australian specific guidelines for the assessment of landscape and visual impacts. This assessment has followed standard industry practice which is to refer to the Guidelines for Landscape and Visual Impact Assessment 2nd edition (2002) published by The Institute of Landscape Architects and the Institute for Environmental Management and Assessment (UK).

Generally, terminology and assessment methods have been derived from Visual Landscape Planning in Western Australia, produced by the Western Australian Planning Commission (2007) and A Manual for Forest Landscape Management (2006) produced by the Forest Practice Board of Tasmania.

4.2.3 Data sources

This assessment of potential scenic amenity and lighting impacts relied on the following data sources:

- Aerial photography
- Topographic maps with 10 m contours (DERM, 2010)
- Burdekin Catchment 25 m Digital Elevation Model (DEM) (DNRM 2013)
- Hillshade (Shuttle Radar Topography Mission Shaded Relief)
- Road network maps (DERM 2010)
- Rail network maps (DERM 2007)
- Homestead locations (GA 2007)
- Cadastral maps (DERM 2012)
- Watercourse maps (GA 2007)
- Digital Cadastral Database (DCDB) to delineate protected areas (DERM 2011)
- Local Government Area (LGA) boundaries
- Interim Biogeographic Regionalisation for Australia (IBRA; DEH 2005)
- Survey maps from field work.

4.2.4 Desktop assessment

A desktop review of the data sources outlined in Section 4.2.3 was undertaken to identify potential sensitive receptors within the study area that will have fixed or transient views of the NGBR Project. For this assessment, sensitive visual receptors are considered residents or workers at homesteads, users of transport routes (road and rail) and users of public recreation spaces. For each sensitive receptor, a zone of theoretical visibility (ZTV) was determined using elevation data. The ZTV did not take into account buildings or vegetation screening and hence reflects a 'bare-earth landscape', which for the visual impact assessment represents the "worst case scenario". A total of 32 viewing locations were identified, including nine roads and 23 homesteads.

Landscape character units (common landscape types) and key landscape features were also identified in the desktop assessment. The study area was divided into six landscape character units (LCUs) based on shared common landscape features and visual characteristics. Categorisation by LCU enables general statements to be made about landscapes and their sensitivity. The elements that contribute to the identification of LCUs include landform, vegetation, surface water, land use, significant features and views of the study area.

4.2.5 Site survey

A site survey was conducted in May 2013 to verify the desktop assessment information. In particular, a representative sample of public and private viewing locations were selected,

recorded and photographed. Viewing locations were selected to represent typical views from sensitive receptors and views of particular visual features of importance.

4.2.6 Assessment of impacts

The potential impacts on landscape character are measured by the visual and emotional responses that are felt by sensitive visual receptors towards the combined effects of a development. Impacts are defined as the relative capacity of the landscape to accommodate changes to the physical landscape of the type and scale that would occur as a direct result of the development.

Impact upon landscape was defined in terms of:

- Visual impact, or the extent to which new developments can be seen within a visual catchment
- Impact to landscape character, or the response felt by sensitive visual receptors to the combined effects of the new development.

The level of the impact is evaluated considering:

- Visual modification
- Visual sensitivity.

Assessment of landscape and visual impacts is necessarily qualitative as both the values of a particular landscape and the extent to which change to landscape character are acceptable are subjective.

Visual modification

Visual modification refers to the extent of change to the landscape including features such as vegetation, built elements and topography. Features of the landscape are considered an integral part of the visual context and therefore important contributors to scenic amenity. The assessment of changes to the landscape included identification of the following:

- The degree of contrast or integration with existing features
- The scale or magnitude of change, including duration
- The nature of the change (adverse or beneficial).

For the purposes of this assessment visual modification was described using the definitions outlined in Table 4-1.

Table 4-1 Visual modification definitions

Level of modification	Definition
Large reduction or improvement	A substantial / obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed.
Moderate reduction or improvement	Discernible changes in the landscape due to partial loss of, or change to the elements, features or characteristics of the landscape. May be partly mitigated. The change would be out of scale with the landscape, and at odds with the local pattern and landform.
Small reduction or	Minor loss or alteration to one or more key landscape elements,

Level of modification	Definition
improvement	features, or characteristics, or the introduction of elements that may be visible but may not be uncharacteristic within the existing landscape.
No perceivable reduction or improvement	Almost imperceptible or no change in the view as there is little or no loss of / or change to the elements, features or characteristics of the landscape.

Source: Landscape Institute and Institute for Environmental Management and Assessment (2002)

Visual sensitivity

Visual sensitivity refers to visual receptors and their sensitivity to their visual environment. Generally, sensitivity is derived from a combination of factors including:

- Receptors' interest in the visual environment i.e. high, medium or low interest in their everyday visual environment
- Receptors' duration and viewing opportunity i.e. prolonged, regular viewing opportunities
- Number of viewers and their distance / angle of view from the source of the effect, extent of screening / filtering of the view, where relevant

For the purpose of this assessment, the terminology in Table 4-2 has been used to describe visual sensitivity.

Table 4-2 Visual sensitivity definitions

Sensitivity	Definition
High	Occupiers of residential properties with long viewing periods, within close proximity to the NGBR Project. Communities that place value upon the landscape and enjoyment of views of their landscape setting.
Medium	Outdoor workers who have a key focus on their work that may also have intermittent views of the NGBR Project. Viewers at outdoor recreation areas located within close proximity but where viewing periods are limited. Occupiers of residential properties with long viewing periods, at a distance from or screened / filtered views of the NGBR Project.
Low	Road users in motor vehicles, trains or on transport routes that are passing through or adjacent to the study area and have short-term/transient views. Viewers indoors at their place of work, or similar.
Negligible	Viewers from locations where there is screening by vegetation or structures where only occasional views are available and viewing times are short.

Source: Landscape Institute and Institute for Environmental Management and Assessment (2002)

For this assessment, the duration of the impact was considered in accordance with the terms outlined in Table 4-3.

Table 4-3 Duration of impact

Duration	Description
Temporary	Impacts lasting one year or less
Short-term	Impacts lasting one to seven years
Medium-term	Impacts lasting seven to fifteen years
Long-term	Impacts lasting fifteen to sixty years
Permanent	Impacts lasting over sixty years

Source: Landscape Institute and Institute for Environmental Management and Assessment (2002)

Significance of impact

The significance of impacts was assessed in accordance with the impact significance criteria provided in Table 4-4.

Table 4-4 Significance of impact

Sensitivity	Landscape Impact			
	Large	Moderate	Small	Negligible
High	Major significance	High significance	Moderate significance	Minor significance
Medium	High significance	Moderate significance	Minor significance	Not significant
Low	Moderate significance	Minor significance	Not significant	Not significant
Negligible	Minor significance	Not significant	Not significant	Not significant

Source: Landscape Institute and Institute for Environmental Management and Assessment (2002)

4.3 Existing environment

4.3.1 Landscape character

The NGBR Project final rail corridor predominantly traverses a rural landscape used for cattle grazing. Distinctive topographical features from north to south include the coastal floodplain, Clarke Range, Bowen River Valley, Leichhardt Range and the Suttor River floodplain. Elevation and topography undulate in association with mountains and river beds. While the majority of the study area traverses the foothills of mountains, steep low hills are crossed at chainages 71.3 km to 82.3 km. A number of rivers are crossed by the final rail corridor, including the Bowen River, Suttor River and Bogie River. Numerous smaller creeks are traversed, with the largest of these being Pelican Creek and Verbena Creek.

The presence of vegetation within the study area strongly influences the rural (agricultural) landscape character. There are two distinct vegetation patterns that dominate. The first type displays modification to the natural landscape through open, broad acre paddocks of rough grasses and scattered acacias / eucalypt clumps and woodlands. Native stands of trees are

also evident between paddocks. The second type exhibits dense and open acacia woodlands, with understories of grasses.

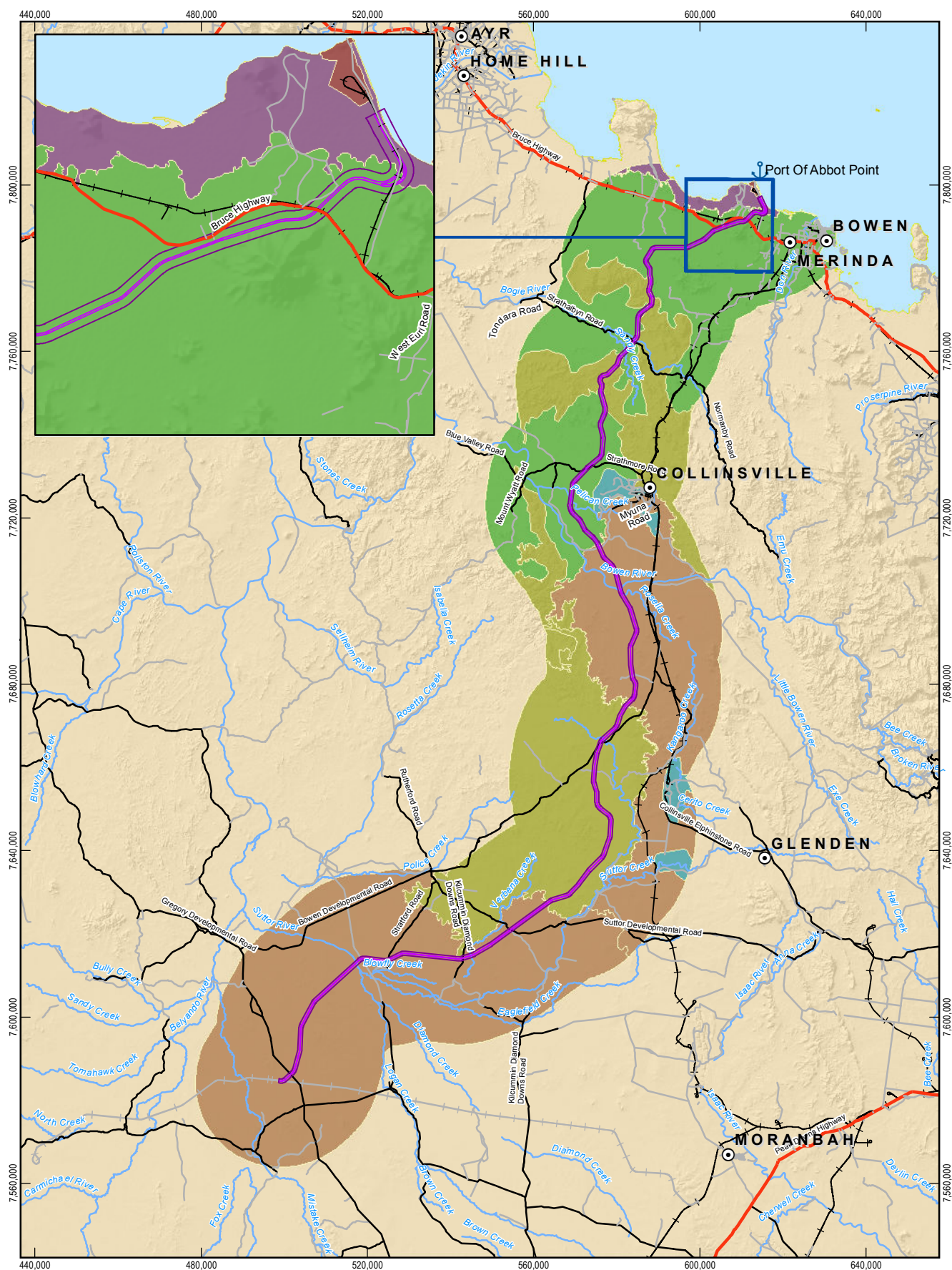
The six broad LCUs identified for the study area are summarised in Table 4-5 and mapped in Figure 4-1.

Table 4-5 Landscape character units

Landscape character units	Summary
LCU1 – Coastal	<p>LCU 1 is the coastal region in the north of the study area. This coastal zone is adjacent to the Great Barrier Reef World Heritage Area (GBRWhA).</p> <p>The NGBR Project is located within this LCU between chainage 3.49 km and 7.00 km.</p> <p>The topography is generally low and flat coastal plains (elevation less than 10 m above Australian Height Datum (mAHD)) with prominent isolated hills (280 mAHD). There are beaches along the shorelines.</p>
LCU2 – Port	<p>LCU 2 consists of the area around the Port of Abbot Point in the coastal region in the north of the study area. The Port of Abbot Point is adjacent to the GBRWhA.</p> <p>The NGBR Project preliminary investigation corridor does not traverse this LCU however it forms part of the NGBR Project's visual catchment.</p> <p>The topography is generally low and flat coastal plains (elevation less than 10 mAHD) with a hill (45 mAHD) to the north of LCU 2. There are beaches along the shorelines to the east.</p>
LCU3 – Mining	<p>LCU 3 consists of areas of commercial mining operations. There is one mine located within the five kilometre study area at Collinsville with a number of others in the wider area. The NGBR Project preliminary investigation corridor does not traverse this LCU however it forms part of the NGBR Project's visual catchment.</p> <p>The heavily modified areas in this LCU consist of deep extraction areas and large overburden berms of excess soil and materials.</p>
LCU4 – Coastal lowland valleys	<p>LCU4 is defined by coastal lowland valleys generally located between Bruce Highway in the north and west of Collinsville in the south.</p> <p>The NGBR Project preliminary investigation corridor is located within this LCU between:</p> <ul style="list-style-type: none"> • Chainage 7.00 km to 46.60 km • Chainage 52.60 km to 59.20 km • Chainage 60.70 km to 66.30 km • Chainage 76.70 km to 119.800 km. <p>The topography consists of gentle undulating low plains with isolated hills. Many views in the areas are framed by prominent hills and mountains in the distance (LCU6).</p>

Landscape character units	Summary
LCU5 – Inland valleys	<p>The area defined as the inland valleys is located between Collinsville in the north to east of the Gregory Developmental Road.</p> <p>The NGBR Project preliminary investigation corridor is located within this LCU between:</p> <ul style="list-style-type: none"> • Chainage 119.90 km and 162.30 km • Chainage 220.00 km and 306.90 km. <p>The topography consists of gentle undulating plains with views to the Wyarra Hills to the west; Leichhardt ranges to the north and Redcliffe tableland to the east.</p>
LCU6 – Upland and mountains	<p>This LCU consists of the Clarke Range and its associated peaks of Mount Abbot, Mount Aberdeen, Mount Herbert, The Twins, Wyarra Hills and Leichhardt Range.</p> <p>The NGBR Project preliminary investigation corridor is located within this LCU between:</p> <ul style="list-style-type: none"> • Chainage 46.70 km and 52.50 km • Chainage 59.30 km and 60.60 km • Chainage 66.40 km and 76.60 km • Chainage 162.40 km and 219.90 km. <p>The upland and mountains LCU has raised areas with prominent ridges and steep hills with flat areas between them. These areas form part of the Great Dividing Range.</p>

Further detail regarding the LCUs is provided in Volume 2 Appendix D Scenic amenity and lighting.



LEGEND

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|---|--|--|---|--|---|
| <ul style="list-style-type: none"> Population Centres Major Port Highway | <ul style="list-style-type: none"> Main Road Local Road Carmichael Project (Rail) | <ul style="list-style-type: none"> Railway Watercourse (Major) | <ul style="list-style-type: none"> Landscape Character Areas Coastal Coastal Lowland Valleys Inland Valleys | <ul style="list-style-type: none"> Mining Port Upland & Mountains | <ul style="list-style-type: none"> North Galilee Basin Rail 1000m Corridor North Galilee Basin Rail 100m Corridor |
|---|--|--|---|--|---|

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



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Job Number 41-26457
Revision B
Date 28 Aug 2013

Landscape character units Figure 4-1

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Data source: GA: Populated Places, Railway, Watercourse/2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Rail Project/2013; DNRM: Roads/2010; GHD: Landscape Character Areas/2013, Created by:MS

4.3.2 Viewing locations and sensitive visual receptors

Within the LCUs, 32 viewing locations were selected based on a representative sample of potential views of the NGBR Project. These viewing locations included nine roads and 23 homesteads.

The representative sample of viewing locations are shown in Figure 4-2 and summarised in Table 4-6. A detailed description of each viewing location, including ZTV, is presented in Volume 2 Appendix D Scenic amenity and lighting.

4.3.3 Lighting

The study area has little existing anthropogenic lighting influences, with the exception of areas in the vicinity of existing roads, mines, rail lines and port infrastructure.

Table 4-6 Viewing locations

Viewing location	Location	Visual context
Viewing location 1 - Bruce Highway intersection	Approximately 21 km north-west of Bowen.	<p>Short to medium distance and screened/filtered by steeper topography to the south. Primarily composed of agricultural land and associated activities/infrastructure, rail infrastructure, rocky outcrops and open grasslands.</p> <p>View is experienced by local road users and rail passengers.</p>
Viewing location 2 - Strathalbyn Road intersection	Approximately 20 km west of Bowen Developmental Road intersection. Strathalbyn Road runs from the Bowen Developmental Road to Tondara Road	<p>Short to medium in distance. Views range from open views across lowland cleared pasture land to shorter views screened/filtered by steeper topography and woodland. Composed of hills, open pasture or grasslands and wooded grasslands. Mount Pleasant and Mount Aberdeen form a background to medium and long distance views to the east.</p> <p>View is experienced by local road users and landowners working their property.</p>
Viewing location 3 - Strathmore Road intersection	Approximately 14.5 km west of the intersection with the Bowen Developmental Road. Strathmore Road runs from Bowen Developmental Road to Myuna Road and Mount Wyatt Road	<p>Short to medium distance. Views range from open views across lowland cleared pasture land to shorter views screened/filtered by steeper topography and woodland. Composed of hills, open pasture or grasslands and wooded grasslands.</p> <p>View is experienced by local road users.</p>
Viewing location 4 - Myuna Road Intersection	Approximately 18 km west of Scottsville. Myuna Road runs from Collinsville to Strathmore Road.	<p>Short to medium in distance. Views range from open views across lowland cleared pasture land to shorter views screened/filtered by steeper topography and woodland. Composed of hills, open pasture or grasslands and wooded grasslands.</p> <p>View experienced by local road users.</p>
Viewing location 5 - Bowen Developmental Road intersection	Approximately 23 km south of the junction with Collinsville-Elphinstone Road.	<p>Short in distance. Views are screened/filtered by vegetation.</p> <p>View experienced by road users.</p>

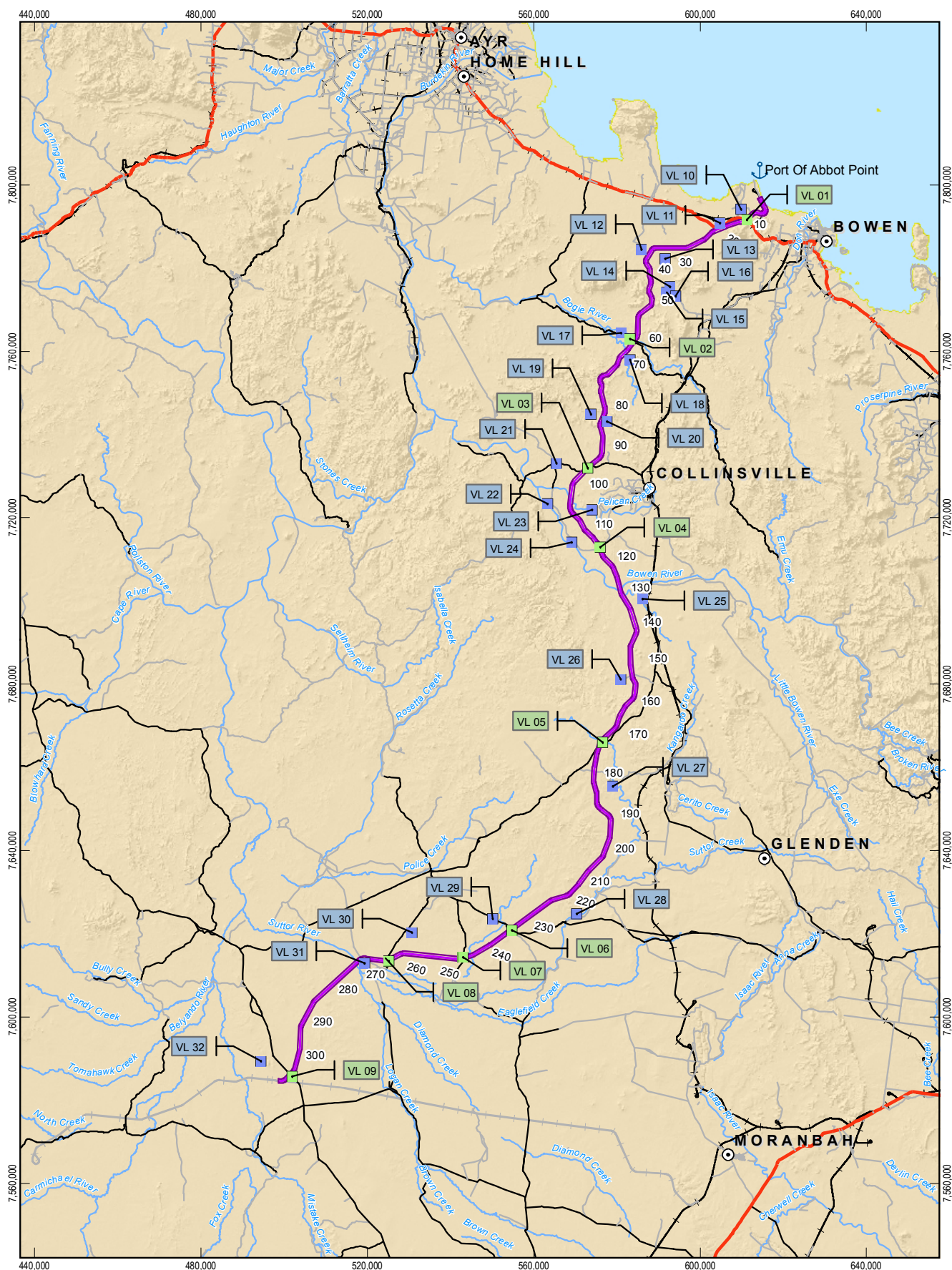
Viewing location	Location	Visual context
Viewing location 6 - Suttor Developmental Road intersection	Approximately 25 km southeast of Mount Coolon.	Short to medium in distance. Views are screened/filtered by vegetation. Composed of wooded grasslands. View experienced by local road users
Viewing location 7 - Glenavon Road intersection	Approximately 14 km south of the intersection with Suttor Developmental Road.	Short to medium in distance. Views are screened/filtered by vegetation. Composed of wooded grasslands. View experienced by local road users.
Viewing location 8 - Stratford Road	Approximately 19.5 km south-west of intersection with Suttor Developmental Road.	Short to medium in distance. Views are screened/filtered by vegetation. Open grassland plains with isolated and grouped trees and shrubs. View experienced by local road users.
Viewing location 9 - Gregory Developmental Road intersection	Approximately 39 km south of the Belyando Crossing service station / rest area.	Scattered vegetation allows for long and wide views to low lying hills. The Dense woodlands provide enclosed, immediate views. View experienced by regional and local road users.
Viewing location 10 - Homestead 1	25 km north-west of Bowen on the Bruce Highway. Homestead is located approximately 2.5 km north-east of the property entrance on the Highway.	Approximately 2.7 km north-west of the NGBR Project final rail corridor. Short to medium distance views screened/filtered by steeper topography to the south. Agricultural land and associated activities/infrastructure, rail line and the highway, rocky treed outcrops and open grasslands. View experienced by residents and workers on Homestead 1.
Viewing location 11 - Homestead 2	28 km north-west of Bowen on the Bruce Highway. There are a number of homesteads on this property which is located to the north of the highway.	Approximately 1.2 km north of the NGBR Project final rail corridor. Short to medium distance. Views are screened/filtered by steeper topography to the south. Agricultural land and associated activities/infrastructure, rail line and the highway, rocky treed outcrops and open grasslands. View experienced by residents and workers on Homestead 2.

Viewing location	Location	Visual context
Viewing location 12 - Homestead 3	48 km north-west of Bowen on the Bruce Highway. Homestead is approximately 15 km south of the Bruce Highway accessed via Nevada Road.	Views to the east are of a short distance and screened/filtered by dense vegetation. View experienced by occupants of Homestead 3
Viewing location 13 - Homestead 4	45 km north-west of Bowen on the Bruce Highway. Homestead is approximately 16 km south of the highway accessed via Glenore Road.	Views to the north are of a middle distance and screened/filtered by vegetation. Mount Elliot, Mount Mackenzie and Mount Abbot form a background to long distance views to the south-east and south-west. View experienced by occupants of Homestead 4.
Viewing location 14 - Homestead 5	Approximately 16 km west on Thurso Road. This viewpoint is located at the entrance gate to Homestead 5 which is approximately 1.2 km south of the homestead.	The short distance views are filtered by vegetation and topography. The middle ground view is dominated by two prominent hills that rise steeply in contrast to the surrounding flat plains. View experienced by the occupants of Homestead 5.
Viewing location 15 - Homestead 6	Approximately 14 km west on Thurso Road. This viewpoint is located at the entrance gate to Homestead 6 which is approximately 950 m south-east of the homestead.	Views to the west are open with some filtered by vegetation. The short distance views are filtered by vegetation along the creek alignment. The middle ground distance view is dominated by two prominent hills that rise steeply in contrast to the flat plains and these form the background to the views in this direction. Experienced by the occupants of Homestead 6.
Viewing location 16 - Homestead 7	Approximately 11 km west on Thurso Road. This viewpoint is located at the entrance gate to Homestead 7 which is approximately 800 m south-east of the homestead.	Views to the west are open with some filtered by vegetation. Some short distance views are filtered by vegetation along the creek alignment. The middle ground distance view is dominated by two prominent hills that rise steeply in contrast to the flat plains and these form the background to the views in this direction. Views are experienced by the occupants of Homestead 7.

Viewing location	Location	Visual context
Viewing location 17 - Homestead 8	Located on Strathalbyn Road approximately 23 km west of Bowen Developmental Road intersection. Homestead is directly adjacent to the road.	<p>Short to medium in distance. Views range from screened/filtered by steeper topography and woodland to open views across lowland cleared pasture land. Views are composed of hills, open pasture or grasslands and wooded grasslands. Mount Pleasant and Mount Aberdeen form a background to medium to long distance views to the east.</p> <p>These views are experienced by occupants of Homestead 8 and users of Strathalbyn Road.</p>
Viewing location 18 - Homestead 9	Located on a private road approximately 5 km to the south of Strathalbyn Road approximately 19 km west of Bowen Developmental Road intersection.	<p>Short to medium in distance. Views range from short views screened/filtered by steeper topography and woodland to open views across lowland cleared pasture land. Hills, open pasture or grasslands and wooded grasslands.</p> <p>Views are experienced by the occupants of Homestead 9.</p>
Viewing location 19 - Homestead 10	Located on a private road approximately 15 km to the north of Strathmore Road and approximately 9 km west of Bowen Developmental Road intersection.	<p>Short to medium in distance. Views range from short views screened/filtered by steeper topography and woodland to open views across lowland cleared pasture land. Hills, open pasture or grasslands and wooded grasslands.</p> <p>Views are experienced by the occupants of Homestead 10.</p>
Viewing location 20 - Homestead 11	Located on a private road approximately 12 km to the north of Strathmore Road and approximately 9 km west of Bowen Developmental Road intersection.	<p>Short to medium in distance. Views range from short views screened/filtered by steeper topography and woodland to open views across lowland cleared pasture land. Hills, open pasture or grasslands and wooded grasslands.</p> <p>View experienced by the occupants of Homestead 11.</p>
Viewing location 21 - Homestead 12	Located on Strathmore Road approximately 22 km west of the intersection with Bowen Developmental Road. Homestead is directly adjacent to the road.	<p>Short to long in distance. Views range from short views screened/filtered by vegetation and topography to open views across lowland cleared pasture. Hills, open pasture or grasslands and wooded grasslands.</p> <p>View experienced by occupants of Homestead 12 and road users of Strathmore Road.</p>

Viewing location	Location	Visual context
Viewing location 22 - Homestead 13	Located on Myuna Road approximately 10 km south of Strathmore Road intersection. Homestead is located directly adjacent to the road.	Medium in distance. Views are open across cleared pasture lowland. Open pasture or grasslands and wooded grasslands. View experienced by occupants of Homestead 13 and users of Myuna Road.
Viewing location 23 - Homestead 14	Located south-west of Collinsville Mine operated by Xstrata Coal, Itochu Coal Resources and Sumitomo.	Short in distance. Views range from short views screened/filtered by steeper topography and woodland to open views of lowland cleared pasture. Open cut mining and associated activities/infrastructure, rocky treed outcrops, open pasture or grasslands and wooded grasslands. View experienced by occupants of Homestead 14.
Viewing location 24 - Homestead 15	Located on Myuna Road approximately 22 km south of Strathmore Road intersection. Homestead is directly adjacent to the road.	Medium in distance. Views are open across cleared pasture lowland. Open pasture or grasslands and wooded grasslands. View experienced by occupants of Homestead 15 and users of Myuna Road.
Viewing location 25 - Homestead 16	Located on a private road approximately 1.5 km to the south-west of the Bowen Developmental Road entrance.	Views to the east are short in distance due to the presence of tall vegetation associated with the riparian zone of Rosella Creek. Views experienced by the occupants of Homestead 16. The Newlands System is a freight rail line that runs in a north-south direction from Newlands mine to Goonyella mine and is located at the entrance to the property.
Viewing location 26 - Homestead 17	Located on a private road approximately 8.5 km to the west of Bowen Developmental Road.	Short to medium in distance. Views are screened/filtered by topography and woodland to the east and open cleared pasture land to the north. View experienced by the occupants of Homestead 17.
Viewing location 27 - Homestead 18	Located on a private road approximately 10 km to the east of Bowen Developmental Road and approximately 47 km north-west of Mount Coolon.	Short to medium in distance. Views are screened/filtered by densely wooded grasslands. View experienced by occupants of the Homestead 18.

Viewing location	Location	Visual context
Viewing location 28 - Homestead 19	Located on a private road approximately 4 km to the north of Suttor Developmental Road and approximately 39 km south-east of Mount Coolon.	Short in distance. Views to north-west are screened/filtered by medium height vegetation. View experienced by occupants of Homestead 19.
Viewing location 29 - Homestead 20	Located on Suttor Developmental Road approximately 20 km south-east of Mount Coolon. Homestead is located adjacent to the road.	Short to medium in distance. Views screened/filtered by vegetation. Composed of wooded grasslands. View experienced by occupants of Homestead 20 and local road users.
Viewing location 30 - Homestead 21	Located on a private road approximately 1.5 km to the south-east of Stratford Road. Homestead is approximately 12 km from the entrance to the junction with Suttor Developmental Road.	Short to medium in distance. Views screened/filtered by vegetation. Open grassland plains with isolated and grouped trees and shrubs that become denser and filter views in the distance. View experienced by occupants of Homestead 21.
Viewing location 31 - Homestead 22	Located on Stratford Road. Homestead is approximately 30 km from the entrance to the junction with Suttor Developmental Road.	Short to medium in distance. Views screened/filtered by vegetation. Composed of open grassland plains with isolated and grouped trees and shrubs that become denser and filter views in the distance View experienced by occupants of Homestead 22.
Viewing location 32 - Homestead 23	Located on a private road approximately 3.3 km to the south-west of the entrance on Gregory Developmental Road. The entrance is approximately 28 km from to the junction with Bowen Developmental Road.	Short to medium in distance. Views are screened/filtered by the vegetation cover and topography. Composed of open grassland plains with isolated and grouped trees and shrubs that become denser and filter views in the distance. View experienced by occupants of Homestead 23.

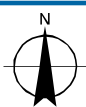


LEGEND

- Population Centres
- Sensitive Visual Receptor Locations
- Highway
- Carmichael Project (Rail)
- North Galilee Basin Rail 1000m Corridor
- Road Intersections
- Main Road
- Local Road
- Railway
- Watercourse (Major)
- Homesteads
- North Galilee Basin Rail 100m Corridor

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 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



adani

Adani Mining Pty Ltd
 North Galilee Basin Rail Project

Job Number 41-26457
 Revision A
 Date 29 Aug 2013

Viewing locations

Figure 4-2

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 Data source: GA: Populated Places, Railway, Watercourse 2007; Adani: NGBR Corridor 13/05/2013, NGBR Corridor 06/06/2013, Carmichael Rail Project 2013, Chainage 2013; DNRM: Roads 2010; GHD/GA/Adani: Sensitive Visual Receptor Locations/2013. Created by:MS

4.4 Potential impacts and mitigation measures

4.4.1 Construction

Construction of the NGBR Project would result in changes to the landscape of the final rail corridor due to vegetation clearing and earthworks. In particular, areas associated with large cut and fill activities will experience the greatest change. Construction would also require the establishment of the rail embankment on which the rail ballast, sleepers and tracks would be placed. The embankment would be up to 25 metres high in some locations.

Deep cuts (>15 m) and deep fills (>15 m) will occur over a relatively small portion of the NGBR Project. The need for deep cuts is required at nine locations, with approximately 3.4 km of cut greater than 15 m in depth. The need for deep fills is required at 11 locations, with approximately 4.5 km of fill greater than 15 m in depth. The rail embankment would reach a maximum height of approximately 25 m in some locations. The majority of these significant cut and fill locations are concentrated around the Leichhardt Range and Clarke Range (refer Volume 1 Chapter 2 Project description).

Sensitive receptors

During construction, the final rail corridor and ancillary infrastructure will be viewed from a number of locations within the study area. This includes views from sensitive receptors such as homesteads and motorists travelling along the local road network. Views from some local roads include long sections of the final rail corridor, interrupted by occasional screening. Other views of the final rail corridor can be experienced from a range of nearby residential homesteads and associated properties. The majority of views from homesteads are only available from a medium to long distance and typically incorporate some degree of vegetative or topographic screening.

Construction work within the final rail corridor is anticipated to negatively impact on views currently available from some sensitive receptors within the study area however these impacts will vary greatly depending on the location of the sensitive receptor. While some receptors will experience negligible change to their existing views, those with minimal screening are likely to observe a range of changes including increased traffic movements, light spillage, dust generation, modification to the landscape through earthworks, vegetation clearing, the presence of large machinery and trucks, construction camps, concrete batching plants and laydown areas.

A total of 32 viewing locations were selected based on a representative sample of potential views of the NGBR Project including nine roads and 23 homesteads (refer Figure 4-2 and Table 4-6). Using the methodology outlined in Section 4.2.6, a number of viewing locations were assessed to have no perceivable reduction in visual amenity as no elements of the NGBR Project will be visible from those locations during construction. The viewing locations anticipated to experience no visual impacts during construction are summarised in Table 4-7

Viewing locations anticipated to experience a minor or moderate degree of visual impact during construction are summarised in Table 4-8. No sensitive receptors are anticipated to experience a high level of visual impact during construction.

Fauna are also considered sensitive receptors due to their potential susceptibility to artificial light sources, particularly those with light-sensitive nocturnal habits. The potential impact of artificial lighting on fauna is generally considered to be low, particularly as a result of limited and localised proposed use of artificial lighting during construction. The potential impacts of artificial light disrupting fauna behaviour are assessed in Volume 1 Chapter 6 Nature conservation.

Table 4-7 Viewing locations with no anticipated impact during construction

Viewing location	Visible project elements
Viewing location 12 Homestead 3	Located approximately 2.2 km north-west of the NGBR Project final rail corridor. No elements of the final rail corridor are likely to be seen during construction from this homestead due to the proximity of tall vegetation.
Viewing location 13 Homestead 4	<p>The NGBR Project final rail corridor is located to the north of the homestead (in an east-west alignment) at an approximate distance of 2.7 km curving around to the west of the homestead (in a north-south alignment) at an approximate distance of 4.5 km.</p> <p>No elements of the final rail corridor are likely to be seen from the homestead during construction due to distance, topography and medium height vegetation.</p> <p>However, the rolling stock maintenance yard, a track laydown area and bridge laydown area will be located to the north of the homestead at the gate to the main driveway (chainage 34.1 km). While these may not be visible from the homestead they will be viewed upon entry and exit of the property.</p>
Viewing location 14 Homestead 5	Located approximately 4.7 km east of the NGBR Project final rail corridor. No elements of the NGBR Project are likely to be seen during construction due to local undulating topography, medium height vegetation and distance.
Viewing location 16 Homestead 7	Located approximately 5.7 km east of the NGBR Project final rail corridor. There are no views anticipated towards the final rail corridor during construction due to distance, topography and the presence of medium height vegetation.
Viewing location 18 Homestead 9	Located approximately 2.1 km east of the NGBR Project final rail corridor. There are no views anticipated towards the final rail corridor during construction due to the presence of medium height vegetation in proximity to the homestead.
Viewing location 19 Homestead 10	Located approximately 2.9 km west of the NGBR Project final rail corridor. Project elements are not likely to be visible during construction due to the undulating nature of the topography in this location.
Viewing location 21 Homestead 12	Located approximately 6.2 km west of the NGBR Project final rail corridor. Project elements are not likely to be visible during construction due to distance, topography and the presence of medium height vegetation.
Viewing location 22 Homestead 13	Located approximately 5.3 km west of the NGBR Project final rail corridor. There will be no views towards the final rail corridor during construction due to the topography in the area.
Viewing location 23 Homestead 14	Located approximately 3.9 km east of the NGBR Project final rail corridor. There will be no views towards the NGBR Project during construction due to distance, topography and the presence of medium height vegetation.

Viewing location	Visible project elements
Viewing location 24 Homestead 15	Located approximately 4.3 km west of the NGBR Project final rail corridor. There will be no views towards the NGBR Project during construction due to distance, topography and the presence of medium height vegetation.
Viewing location 25 Homestead 16	Located approximately 3.8 km east of the NGBR Project final rail corridor. The topography of the area inhibits views towards the NGBR Project during construction.
Viewing location 26 Homestead 17	Located approximately 2.8 km west of the NGBR Project final rail corridor. There will be no views towards the final rail corridor during construction due to undulating local topography and the presence of medium height vegetation. However the final rail corridor and associated construction activities would be viewed when accessing the homestead via the main private driveway. The final rail corridor crosses the private driveway at chainage 154 km.
Viewing location 27 Homestead 18	Located approximately 4.1 km east of the NGBR Project final rail corridor. There will be no views towards the NGBR Project during construction due to distance, local undulating topography and the presence of dense medium height vegetation in close proximity to the homestead. However, the final rail corridor and associated construction activities would be viewed when accessing the homestead via the main driveway. The final rail corridor crosses the driveway at chainage 180 km. This crossing would be an at grade (passive) crossing. The existing road will be realigned due to its current alignment intersecting the NGBR Project at a location where a 6.8 m cutting will be required.
Viewing location 28 Homestead 19	Located approximately 4.9 km east of the NGBR Project final rail corridor. Due to distance, local undulating topography to the north-west of the homestead and the presence of medium height vegetation in close proximity to the homestead, there would be no views towards the NGBR Project final rail corridor from this homestead during construction.
Viewing location 29 Homestead 20	Located approximately 4.7 km north-west of the NGBR Project final rail corridor. Due to distance and the presence of dense medium height vegetation in close proximity to the homestead there would be no views towards the final rail corridor from this homestead during construction.
Viewing location 30 Homestead 21	Located approximately 5.2 km north of the NGBR Project final rail corridor. There will be no views towards the NGBR Project during construction due to distance, local undulating topography and the presence of dense medium height vegetation in close proximity to the homestead.
Viewing location 32 Homestead 23	Located approximately 6.6 km west of the NGBR Project final rail corridor. Due to the elevated topography in the area there would be no views towards the final rail corridor from this homestead during construction.

Table 4-8 Viewing locations anticipated to be impacted during construction

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 1 Bruce Highway intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Construction camp 1 • Concrete batching plant • Bridge laydown area • Track laydown • Fence surrounding construction areas • Construction of rail over road bridge • Lighting from construction camp and construction personnel 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view would be short-term.</p>	Minor
Viewing location 2 Strathalbyn Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Construction camp 2 (major camp 300 – 400 workers) • Concrete batching plant • Bridge laydown area 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 3 Strathmore Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction area • Bridge laydown area • Turning circle 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 4 Myuna Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Turning circle 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 5 Bowen Developmental Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Track laydown area • Bridge laydown area 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 6 Suttor Developmental Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Bridge laydown area 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 7 Glenavon Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Track laydown area 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 8 Stratford Road	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Construction camp 5 • Concrete batching plant 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 9 Gregory Developmental Road intersection	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Construction depot area • Rail precinct area • Bridge laydown area 	<p>The receptor sensitivity at this location is considered low due to the short-term/transient nature of views experienced by road users.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 10 Homestead 1	<ul style="list-style-type: none"> • Vegetation clearing • Earthworks • Large machinery, trucks and other vehicles • Fence surrounding construction areas • Construction camp 1 • Lighting from construction camp 1 <p>Concrete batching plant</p> <p>There may be potential visibility of the construction camp, batching plant and cut between chainage 14.9 km to 15.25 km which are 3.4 km to the south. The cutting at this location ranges from 5.3 m to 7.5 m.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for screened or filtered views from a residential property at a distance of over 2.7 km.</p> <p>During construction, the magnitude of the change within this view is considered to be small due the nature of construction activities and the presence of existing infrastructure in the view.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 11 Homestead 2	<ul style="list-style-type: none"> Vegetation clearing Earthworks Large machinery, trucks and other vehicles <p>This viewing location is approximately 1.2 km north of the NGBR Project. There is potential for views of the raised rail embankment between chainage 19.6 km and 20.7 km. The embankment would be approximately 5 m to 7 m in this area. The bridge laydown area and track laydown area between chainage 19.5 km and 20.15 km would not be visible if constructed at grade. The Bruce Highway is located between the homestead and the NGBR Project.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1.1 km from the residential property. During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Moderate
Viewing location 15 Homestead 6	<ul style="list-style-type: none"> Vegetation clearing Earthworks Large machinery, trucks and other vehicles <p>This viewing location is approximately 3.8 km east of the final rail corridor. There may be some limited views at a distance of 4 km to the west of the homestead. This would be in the areas between chainage 47.6 km to 48.4 km. In this location the alignment changes from a raised embankment of approximately 6 m to 11 m in height (47.6 km to 47.85 km) to a cut of 4 m to 15 m (47.9 km to 48 km) changing to an embankment of between 7 m and 21 m (48.05 km to 48.45 km).</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for screened or filtered views from a residential property at a distance of over 4 km.</p> <p>During construction, the magnitude of the change within this view is considered to be small due the nature of construction activities and the limited views of works.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 17 Homestead 8	<p>This viewing location is located approximately 3.6 km west of the final rail corridor. Due to vegetation and the undulating nature of topography to the east there would be no views toward the final rail corridor during.</p> <p>As the homestead is directly adjacent to the Strathalbyn Road, there may be a decrease in visual amenity at this location due to increased traffic on this road.</p> <p>There may also be impacts from night-time lighting at the construction camp which would be located at the intersection of the final rail corridor and Strathalbyn Road.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for screened or filtered views from a residential property at a distance of over 3.8 km.</p> <p>During construction, the magnitude of the change within this view is considered to be small due the nature of construction activities and the limited views of works</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Minor
Viewing location 20 Homestead 11	<p>This viewing location is located approximately 1.2 km east of the final rail corridor. There would be potential for limited views of cuttings between chainage 82.25 km to 82.45 km, to the north of the homestead.</p> <p>The homestead is at a slightly higher elevation than the final rail corridor. There is existing medium height vegetation located around the homestead which filters some of the views but there would still be potential for views of construction activities and impacts associated with removal of vegetation within the final rail corridor.</p> <p>There would also be potential views of large machinery, trucks and other vehicles, and the track laydown area at chainage 84.7 km, east of the homestead.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1.5 km from the residential property.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Moderate

Viewing location	Visible project elements	Visual impact assessment	Significance of impact
Viewing location 31 Homestead 22	<p>This viewing location will have potential filtered views northwest towards the final rail corridor including a bridge laydown at a distance of approximately 1.2 km. The potential visible areas would be between chainage 270.6 km and 269.1 km</p> <p>The final rail corridor and associated construction activities would also be viewed when accessing the homestead via the main driveway at chainage 262.94 km (refer to Viewing Location 8 for further description). Vegetation clearing, earthworks, large machinery, trucks and other vehicles would also be visible.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1 km from the residential property.</p> <p>During construction, the magnitude of the change within this view is considered to be moderate due to the nature of the construction activities.</p> <p>The duration of construction works in this view are anticipated to be short-term.</p>	Moderate

Lighting

Construction of the NGBR Project would aim to minimise the visual impact on sensitive receptors (including light sensitive fauna) through the mitigation and management measures outlined in Section 4.4.3. These measures would include using directional lighting during night works to minimise light spill and minimising vegetation clearing to preserve natural screening of construction works.

4.4.2 Operation

During operation, permanent changes would be experienced at major cut and fill locations along the final rail corridor as well as areas where the rail embankment exceeds approximately five metres in height above existing ground surface. Such a change to visual amenity will continue for the duration of operations and is considered to be a permanent impact over this period.

Sensitive receptors

During operation, bridge structures over major waterways, cut and fill locations, the rail embankment, freight trains carrying coal, and the rolling stock maintenance yard all have the potential to impact scenic amenity and lighting for sensitive receptors.

The viewing locations considered to have no perceivable reduction in visual quality during operation of the NGBR Project are summarised in Table 4-9. Operation of the NGBR Project would result in permanent changes in the visual amenity for these sensitive receptors however the sensitivity of their view is considered low due to the short-term/transient nature of views by road users or limited views from homestead.

Table 4-9 Viewing locations with no anticipated impact during operation

Viewing location	Visible project elements
Viewing location 1 Bruce Highway intersection	<ul style="list-style-type: none"> • Grade-separated rail over road crossing and associated infrastructure • Freight trains carrying coal • Fence surrounding final rail corridor.
Viewing location 2 Strathalbyn Road intersection	<ul style="list-style-type: none"> • An at grade (passive) crossing and associated infrastructure • Freight trains carrying coal • Fence surrounding final rail corridor.
Viewing location 3 Strathmore Road intersection	<ul style="list-style-type: none"> • An at grade (passive) crossing and associated infrastructure • Stock crossing with associated stock holding yards either side of railway • Freight trains carrying coal • Fence surrounding final rail corridor.
Viewing location 4 Myuna Road intersection	<ul style="list-style-type: none"> • An at grade (passive) crossing and associated infrastructure • Freight trains carrying coal • Fence surrounding final rail corridor.
Viewing location 5 Bowen Developmental Road	<ul style="list-style-type: none"> • Grade-separated road over rail crossing and associated infrastructure • Freight trains carrying coal

Viewing location	Visible project elements
intersection	<ul style="list-style-type: none"> Fence surrounding final rail corridor.
Viewing location 6 Suttur Developmental Road intersection	<ul style="list-style-type: none"> An at grade road over rail crossing and associated infrastructure Freight trains carrying coal Fence surrounding final rail corridor.
Viewing location 7 Glenavon Road intersection	<ul style="list-style-type: none"> An at grade (passive) crossing and associated infrastructure Freight trains carrying coal Fence surrounding final rail corridor.
Viewing location 8 Stratford Road	<ul style="list-style-type: none"> An at grade (passive) crossing and associated infrastructure Freight trains carrying coal Fence surrounding final rail corridor.
Viewing location 9 Gregory Developmental Road intersection	<ul style="list-style-type: none"> Grade-separated road over rail crossing and associated infrastructure Freight trains carrying coal Fence surrounding final rail corridor.
Viewing location 12 Homestead 3	No elements of the NGBR Project are likely to be seen during operation from the homestead due to tall vegetation.
Viewing location 13 Homestead 4	No elements of the NGBR Project are likely to be seen during operation from homestead due to distance, topography and medium height vegetation.
Viewing location 14 Homestead 5	Due to local undulating topography, medium height vegetation and overall distance, there would be no visible elements of the NGBR Project during operation.
Viewing location 16 Homestead 7	Due to distance, topography and the presence of medium height vegetation there would be no views of the NGBR Project from this homestead during operation.
Viewing location 17 Homestead 8	Due to the vegetation and the undulating nature of the topography to the east there would be no views towards the final NGBR Project from this homestead during operation.
Viewing location 18 Homestead 9	Due to the presence of medium height vegetation in proximity to the homestead there would be no views of the NGBR Project from this homestead during operation.
Viewing location 19 Homestead 10	Due to the undulating nature of the topography in this location there would be no views of the NGBR Project from this homestead during operation.
Viewing location 21 Homestead 12	Due to distance, topography and the presence of medium height vegetation there would be no views of the NGBR Project from this homestead during operation.
Viewing location 22	Due to the topography in the area there would be no views of the

Viewing location	Visible project elements
Homestead 13	NGBR Project from this homestead during operation.
Viewing location 23 Homestead 14	Due to distance, topography and the presence of medium height vegetation there would be no views of the NGBR Project from this homestead during operation.
Viewing location 24 Homestead 15	Due to distance, topography and the presence of medium height vegetation there would be no views of the NGBR Project from this homestead during operation.
Viewing location 25 Homestead 16	Due to the topography in the area there would be no views of the NGBR Project from this homestead during operation.
Viewing location 26 Homestead 17	Due undulating local topography and the presence of medium height vegetation there would be no views of the NGBR Project from this homestead during operation.
Viewing location 27 Homestead 18	Due to distance, local undulating topography and the presence of dense medium height vegetation in close proximity to the homestead there would be no views of the NGBR Project from this homestead during operation.
Viewing location 28 Homestead 19	Due to distance, local undulating topography to the northwest of the homestead and the presence of medium height vegetation in close proximity to the homestead there would be no views of the NGBR Project from this homestead during operation.
Viewing location 29 Homestead 20	Due to distance and the presence of dense medium height vegetation in close proximity to the homestead there would be no views of the NGBR Project from this homestead during operation.
Viewing location 30 Homestead 21	Due to distance, local undulating topography and the presence of dense medium height vegetation in close proximity to the homestead there would be no views of the NGBR Project from this homestead during operation.
Viewing location 32 Homestead 23	Due to the elevated topography in the area there would be no views towards the NGBR Project from this homestead during the operation.

Viewing locations anticipated to experience a minor or moderate level of visual impact during operation of the NGBR Project are summarised in Table 4-10. Additional context in relation to these viewing locations is presented in Table 4-8. No sensitive receptors are anticipated to have a high level of visual impact during operation.

Artificial light sources can have adverse impacts on native fauna by disrupting their capacity to forage, breed, nest and sleep, interrupting circadian rhythms and altering normal predator-prey relationships (Rich and Longcore 2006). Light sources can create an artificial foraging source for birds, amphibians and insectivorous bats, by attracting large concentrations of insects (Rich and Longcore 2006). The final rail corridor will not contain artificial light sources, with the exception of the maintenance facility. Impacts of light pollution on wildlife behaviour are therefore expected to be relatively localised and minor (refer Volume 1 Chapter 6 Nature conservation).

Table 4-10 Viewing locations impacted during operation

Viewing location	Visible project elements	Landscape and visual impact	Significance of impact
Viewing location 10 Homestead 1	<p>There may be potential visibility of the cut between chainage 14.9 km to 15.25 km. This cut is located 3.4 km to the south of the homestead.</p> <p>Other elements of the NGBR Project that will be visible include a grade separated road over rail crossing and freight trains carrying coal, including lighting emitted from headlights during travel at night</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for screened or filtered views from a residential property at a distance of over 2.7 km.</p> <p>During operation, the magnitude of the change within this view is considered to be small due to the nature of the permanent infrastructure at this location.</p>	Minor
Viewing location 11 Homestead 2	<p>There are potential views of the raised rail embankment between chainage 19.6 km and 20.7 km. The embankment would be approximately 5 m to 7 m high in this location. The bridge laydown area and track laydown area between chainage 19.5 km and 20.15 km would not be visible if constructed at grade.</p> <p>Other elements of the NGBR Project that will be visible include freight trains carrying coal and cuttings.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1.1 km from the residential property.</p> <p>During operation, the magnitude of the change within this view is considered to be small due to the nature of the permanent infrastructure at this location.</p>	Minor
Viewing location 15 Homestead 6	<p>There may be limited views in the area between chainage 47.6 km to 48.4 km. In this location the alignment changes from a raised embankment of approximately 6 m to 11 m high (47.6 km to 47.85 km) to a cut approximately 4 m to 15 m high (47.9 km to 48 km) changing to an embankment approximately 7 m to 21 m high (48.05 km to 48.45 km).</p> <p>Freight trains carrying coal would also be visible.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for screened or filtered views from a residential property at a distance of over 4 km.</p> <p>During operation, the magnitude of the change within this view is considered to be small due to the nature of the permanent infrastructure at this location.</p>	Minor

Viewing location	Visible project elements	Landscape and visual impact	Significance of impact
Viewing location 20 Homestead 11	<p>There would be potential limited views of the rail cutting between chainage 82.25 km to 82.45 km, north of the homestead.</p> <p>Freight trains carrying coal would also be visible.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1.5 km from the residential property.</p> <p>During operation, the magnitude of the change within this view is considered to be moderate due to the nature of the permanent infrastructure at this location.</p>	Moderate
Viewing location 31 Homestead 22	<p>This viewing location will have potential filtered views north-west towards the final rail corridor including a bridge laydown at a distance of approximately 1.2 km. The potential visible areas would be between chainage 270.6 km and 269.1 km.</p> <p>The final rail corridor would also be viewed when accessing the homestead via the main driveway at chainage 262.94 km (refer Viewing Location 8 for further description).</p> <p>Freight trains carrying coal would also be visible.</p>	<p>The receptor sensitivity at this viewing location is considered medium due to the potential for a prolonged viewing period that would be screened or filtered, at a distance of over 1 km from the residential property.</p> <p>During operation, the magnitude of the change within this view is considered to be moderate due to the nature of the permanent infrastructure at this location.</p>	Moderate

4.4.3 Summary of mitigation and management measures

The mitigation and management measures outlined Table 4-11 will be implemented to minimise and avoid the potential impacts of the NGBR Project on scenic amenity and lighting. These mitigation and management measures will be implemented in combination with measures outlined in other chapters, including:

- Volume 1 Chapter 5 Topography geology, soils and land contamination
- Volume 1 Chapter 6 Nature conservation
- Volume 1 Chapter 10 Air quality
- Volume 1 Chapter 14 Transport.

Table 4-11 Summary of mitigation and management measures

Project phase	Mitigation measure
Detailed design	Where feasible, detailed design would incorporate the following measures: <ul style="list-style-type: none"> • Positioning security lighting at permanent facilities to minimise the potential for lighting impacts • Landscape planting around maintenance facilities.
Construction	Materials and machinery will be stored tidily.
Construction	Plan construction works to avoid the need for night works in the vicinity of sensitive receptors which are likely to be moderately impacted during construction.
Construction	Lighting during night works will be positioned to minimise light spillage beyond the boundaries of construction areas. This includes consideration of directional lighting and shields where sensitive receptors (including light-sensitive fauna) may be affected.
Construction	Liaise with adjoining land owners with the potential to be moderately impacted during construction on minimising the impacts from on-site lighting prior to works commencing.
Construction	Clearing of mature landscape trees will be avoided within temporary construction laydown areas not required for operation.
Construction	Temporary boarding, barriers and traffic management signage will be removed as soon as practical after construction.
Construction	Monitoring and reporting activities will include a regular check on tidiness of access roads and worksites.

4.5 Conclusion

During construction, changes to the landscape within the final rail corridor will occur due to vegetation clearing and earthworks. In particular, areas associated with large cut and fill activities will experience the greatest change. Construction would also require the establishment of the rail embankment on which the rail ballast, sleepers and tracks would be placed (up to 25 m high). During operation, changes to landscape character due to cut and fill activities and the rail embankment would be permanent. While the changes would be permanent, they are not considered significant in the context of the broader local area due to the low lying topography and overall lack of significant landscape elements.

A total of 32 viewing locations were selected to assess the potential visual impacts of the NGBR Project based on a representative sample of potential views, including nine roads and 23 homesteads. During construction, the final rail corridor and ancillary infrastructure will be viewed from a number sensitive receptors such as homesteads and motorists travelling along adjacent roads. The majority of views from homesteads are only available from a medium to long distance and typically incorporate some degree of vegetative or topographic screening.

During operation, bridge structures over major waterways, cut and fill locations, the rail embankment, freight trains carrying coal, and the rolling stock maintenance yard all have the potential to impact scenic amenity for sensitive receptors. However, no sensitive receptors are anticipated to have a high level of visual impact during operation due to the distance of the NGBR Project to sensitive receptors (1.1 km to the closest homestead).

The majority of sensitive receptors within the study area would experience a minor or negligible level of visual impact as a result of the NGBR Project, during construction and operation. In summary, three sensitive receptors would experience a moderate visual impact. The moderately impacted sensitive receptors are as follows:

- Viewing location 11 (Homestead 2)
- Viewing location 20 (Homestead 11)
- Viewing location 31 (Homestead 22).

The scenic amenity and lighting mitigation measures outlined in Table 4-11 will be implemented during construction and operation to minimise the potential visual impacts on these sensitive receptors.