18. LANDSCAPE AND VISUAL AMENITY

This chapter provides a summary of the landscape and visual amenity values within and surrounding the project development area and an assessment of the potential for these values to be affected by direct and indirect impacts associated with the construction, operation and decommissioning phases of the project. For the detailed findings of the project's landscape and visual amenity impacts, refer to Appendix L, Landscape and Visual Impact Assessment Report. Environmental and social protection objectives have been developed and the avoidance, mitigation and management measures to achieve these objectives identified. The residual impact assessment assumes that the proposed avoidance, mitigation and management measures have been applied.

18.1 Legislative Context

The following legislation, policy and guidance are relevant to landscape and visual amenity through all phases and activities of the project, including planning, construction, operation and decommissioning of the project.

Vegetation Management Act 1999 **(Qld).** This act aims to regulate the clearing of vegetation on freehold and leasehold land by conserving remnant endangered and regional ecosystems of concern, preventing land degradation and further loss of biodiversity, managing the environmental impacts of clearing vegetation and reducing greenhouse emissions. Petroleum activities under the *Petroleum and Gas (Production and Safety) Act 2004* are exempt from the requirement to obtain approval to clear native vegetation under the Vegetation Management Act.

Sustainable Planning Act 2009 **(SP Act).** The SP Act is a framework to integrate planning and development assessment so that development and its effects are managed in a way that is ecologically sustainable, and for related purposes.

State Forest Policy for Vegetation Management (October 2009). The state policy for vegetation management has been prepared in accordance with s. 10 of the Vegetation Management Act and aims to 'conserve and enhance networks and corridors of vegetation'. Where clearing of vegetation is permitted, the policy recommends developments to provide a 'vegetation management offset that ensures the extent of vegetation and associated environmental values are maintained or exceeded'.

Surat Basin Future Directions Statement (March 2010) (DEEDI, 2010a). The Surat Basin Future Directions Statement establishes a framework for communities, industry and all levels of government to work collaboratively to ensure growth within the Surat Basin is managed sustainably. It identifies the major issues facing the region and provides an integrated approach to how the region will address those issues. A key challenge in the area is the management of 'impacts on amenity from increased development... [and] conflicts between different land uses', particularly mining and agriculture. A key initiative of the statement has been the development of a Surat Basin Regional Planning Framework and associated preferred settlement pattern, which was released in draft format in November 2010 (see below).

Draft Surat Basin Regional Planning Framework (November 2010) (P&E Law, 2010). The Draft Surat Basin Regional Planning Framework establishes a clear direction for the regional area to manage growth, protect the environment and respond to competing land uses, while maintaining a unique lifestyle and building and maintaining liveable communities. It notes the region's strong and traditional agricultural foundation, which is facing unprecedented resource

sector growth, leading to major changes in demands on the region's infrastructure, services and character. A key objective of the draft framework will be the protection and enhancement of the region's environmental values, which enhance community lifestyles. One of the key strategies identified to achieve this is the identification, protection and management of the region's 'landscapes of natural, cultural, social and economic value to meet current and future community and environmental needs'.

Local Planning Policy and Guidance. There are three regional council areas within the project development area: Goondiwindi Regional Council, Western Downs Regional Council and Toowoomba Regional Council, none of which have regional planning policies in place to date. Previous local council planning schemes remain in effect and, although many of the local schemes do not strictly relate to maintaining and enhancing landscape character and visual amenity, their intentions have outcomes that have the potential to influence and affect the landscape and visual resource within the study area.

Material Change of Use Performance Criteria Codes. These are applicable to several planning schemes, including Chinchilla (Chinchilla Shire Council, 2006), Inglewood (Inglewood Shire Council, 2006), Murilla (Murilla Shire Council, 2006), Taroom (Taroom Shire Council, 2006), Wambo (Wambo Shire Council, 2005) and Waggamba (Waggamba Shire Council, 2006). Various rural zone codes relate to height, ridgelines and escarpments, landscaping, lighting, watercourses and lakes, vegetation retention, protected areas and extractive industry.

18.2 Assessment Methods

In the absence of national or state level guidelines for landscape and visual impact assessment, an approach to the landscape and visual assessment has been developed in accordance with The Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute & the Institute of Environmental Management and Assessment, 2002). Other relevant guidance notes and documentation used in the assessment include:

- Landscape Institute Advice Notice Note 01/11: Photography and photomontage in landscape and visual impact assessment (The Landscape Institute, 2011).
- Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity (Scottish Natural Heritage & The Countryside Agency, 2006).
- Visual Representation of Windfarms: Good Practice Guidance (Scottish Natural Heritage, 2006).

The landscape and visual assessment considered potential impacts associated with:

- Temporary activities and infrastructure associated with construction.
- Long-term activities and infrastructure associated with operations.
- Short-term activities and infrastructure associated with decommissioning.

The landscape and visual assessment method involved a desktop assessment including identification of a landscape and visual baseline, field surveys and a significance assessment.

18.2.1 Desktop Study

A preliminary desk-based analysis of the project development area's landscape and visual resource was undertaken to inform the baseline assessment, including analysis of the underlying landscape, land cover, landscape value and recognised viewing locations.

The desktop study involved a review of key information sources, including documents and maps on:

- Planning schemes from relevant local councils.
- Digital aerial photography.
- Cadastral data (showing roads and all major features, built areas, etc.).
- Hydrology/riparian corridors.
- Land use.
- Geology and soils.
- Vegetation (including Queensland regional ecosystem maps).
- Land resource area mapping (Department of Natural Resources and Mines).
- Existing infrastructure, e.g., transmission lines.
- Important cultural heritage features, e.g., Jimbour House.
- Designated tourist drives, e.g., Adventure Way.

The baseline landscape character assessment involved mapping and describing broad landscape character types and discrete landscape character areas within each type (where appropriate). Each character type considered:

- Landscape elements that contribute to defining character, e.g., pasture, crops, drainage channels, river/creek corridors, bushland, mature bushland corridors alongside roads, cultural plantings such as, planting along property entrance drives.

- Landscape character attributes (including scale, grain and perceptual characteristics such as the sense of remoteness, tranquillity and/or its perceived rural character).

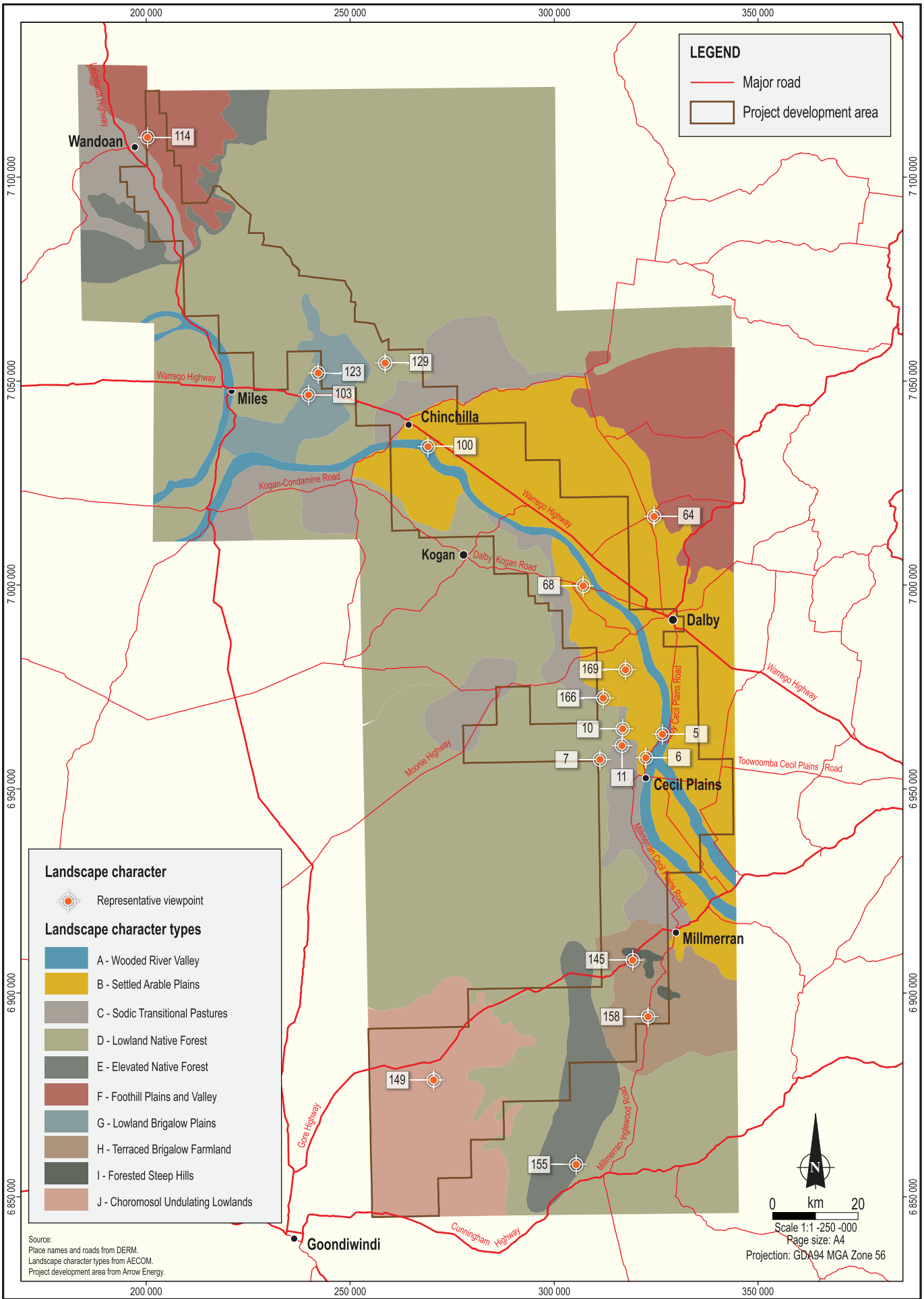
- Landscape value (e.g., landscapes designated for their scenic or landscape importance or valued recreational function).

Where appropriate, geographic information system (GIS) analysis was undertaken to assist the assessment, e.g., preparation of a digital elevation model and slope analysis. Draft landscape character types were defined using a weighted overlay analysis of the GIS data. This formed the basis of the field survey.

The baseline assessment also considered factors that had influenced landscape change in the past and factors that are likely to do so in the future.

The visual baseline assessed and described views from selected representative viewpoints within the project development area (Figure 18.1). Viewpoints were selected in each landscape type to represent the range of views and visual receptors likely to be affected by the project. Visual receptors included:

- Residents living in settlements and on rural properties.
- People working in the countryside or towns.
- Tourists passing through the study area by vehicle.
- Recreational users of the landscape on foot or vehicle.
- Travellers using major and minor roads within the study area.



coffey environments	Date: 03.11.2011 MXD: 7040AC_04_GIS132_v1_1 File Name: 7040_04_F18.01_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Representative viewpoints	Figure No: 18.1

Visualisations were compiled to illustrate the potential visual impact of the production wells and facilities in each landscape character type. Both the 'unmitigated' (i.e., does not include any mitigation measures) and 'mitigated' project components were represented. Integrated processing facilities were used in visualisations as these represented a worst case scenario.

18.2.2 Field Survey

Field visits were carried out in October and November 2009 to ground truth the findings of the desktop study, collect photographic records that portray the existing landscape character, inform the viewpoint selection and assessment of viewpoints, and provide data for the production of photographic visualisations.

Landscape and visual receptor sensitivity was the primary factor in determining which areas of the project development area were targeted for field visits, with highly sensitive landscapes and visual receptors being the focus.

18.2.3 Significance Assessment

There are no established, measurable technical thresholds for significance of change for landscape and visual impacts. For the purposes of this assessment, the significance of impacts has been determined by considering the sensitivity of the landscape or visual receptor and the magnitude of change expected as a result of the development.

The sensitivity of a landscape is based on the extent to which it can accept change of a particular type and scale without adverse effects on its character. Sensitivity varied according to the type of development proposed and the nature of the landscape, including:

- Its inherent landscape value (its condition, perceptual qualities, cultural importance and any specific values that may apply, e.g., planning designations based on scenic amenity).
- The likely congruency of the proposed change (i.e., the extent to which the proposal may fit or be 'visually absorbed' into the scale, landform, land use, pattern, texture of the existing landscape).

The sensitivity of a viewpoint is dependent upon:

- The importance of the view, i.e., the scenic qualities of the view, including the presence of other existing man-made elements in the view.
- The visual receptor (type and volume of viewers); for example, residents and visitors to important/valued landscapes or a designated lookout point, are considered to have a higher sensitivity to their visual environment than, say, visitors to non-designated areas or motorists passing through the broader landscape.

In this assessment, sensitivity is described as negligible, low, medium or high.

The magnitude of change affecting a landscape or visual receptor depends on the nature, scale and duration of the particular change that is expected to occur. In a landscape, the magnitude of change will depend on the loss, change or addition of any feature, or any change in the backdrop to, or outlook from a landscape that affects its character. The effect on a view will depend on the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the development. Magnitude of change is described as being imperceptible, noticeable, considerable or dominant.

General guidance for the determination of sensitivity and magnitude are provided in Tables 18.1 and 18.2. The significance level of potential impacts is derived from these tables and can be classified as negligible, low, moderate, high or major.

18.3 Existing Environment and Environmental Values

This section provides a description of landscapes and visual amenities within and surrounding the project development area. The project development area contains a variety of landscapes including broad open arable plains, elevated native forest and wooded river valleys. The landscapes have been shaped by variations in geology, soils, landform, vegetation and the settlement and use by people.

Topography within the project development area varies subtly, with variations often linked to changes in the underlying geology and soils. This is most apparent where the soils change from Vertosols (largely flat topography) to Sodosols (smoothly undulating topography), or where the landscape is influenced by volcanic geology associated with the Bunya Mountains, becoming more undulating and hilly. The topographic analysis of the project development area is illustrated in Figure 18.2.

Ten landscape character types have been identified within the project development area on the basis of common landscape elements, attributes and values. These landscapes are illustrated in Figure 18.3 and the key characteristics for these landscapes are summarised in Table 18.3.

The visual baseline is described in terms of views from selected representative viewpoints, which correspond to the location of residents, settlements, work places, recreational features, recognised vantage points, tourist trails and roads.

Key sensitive visual receptors in the project development area are shown on Figure 18.4. With the exception of panoramic southwesterly views from Jimbour House and panoramic northerly views over Millmerran from Commodore Peak lookout, there are no ‘known’ prominent elevated locations or lookouts identified within the study area.

Table 18.1 Significance levels of landscape impacts

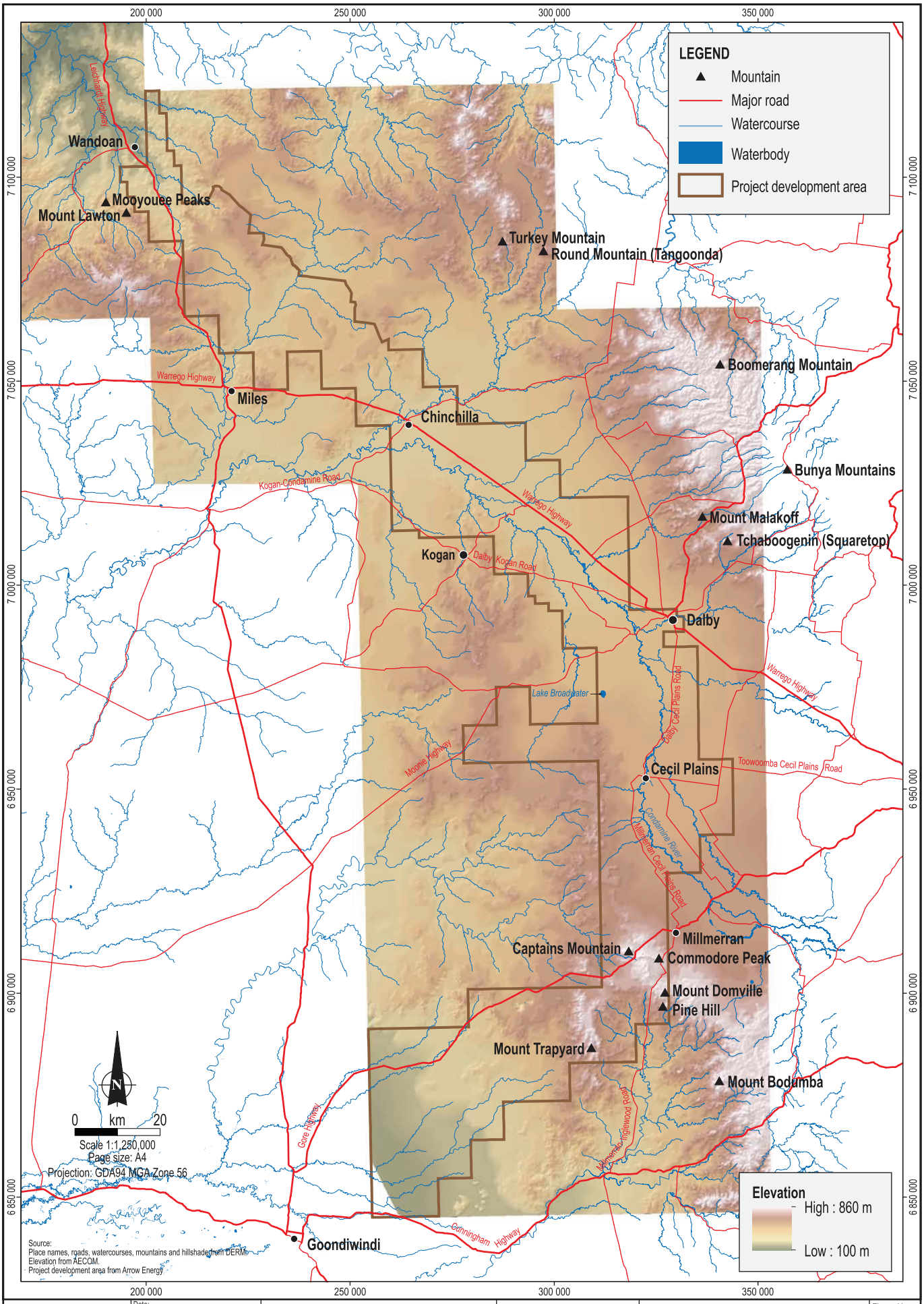
			Magnitude of Change in Landscape Caused by Proposed Development			
			Dominant Change	**Considerable Change**	**Noticeable Change**	**Imperceptible Change**
			A clearly evident and frequent/continuous change in landscape characteristics affecting an extensive area, which is likely to fundamentally change the character of the landscape.	A considerable change in landscape characteristics, frequent or continuous and over a wide area or a clearly evident (or dominant) change over a restricted area.	A noticeable change in landscape characteristics over a wide area or a considerable change over a restricted area, but will not fundamentally change the character of the landscape.	An imperceptible, barely or rarely perceptible change in landscape characteristics.
Sensitivity of Landscape to Change	**High**	A landscape protected by national designation and/or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged.	Major	High	Moderate	Moderate
	Medium	A moderately valued landscape, perhaps a regionally important landscape and/or protected by regional/state designation, or where its character, land use, pattern and scale may have some capacity to accommodate a degree of the type of change envisaged.	High	Moderate	Moderate	Low
	Low	A landscape valued to a limited extent, perhaps a locally important landscape, or where its character, land use, pattern and scale is likely to have the capacity to accommodate the type of change envisaged.	Moderate	Moderate	Low	Low
	Negligible	A landscape that is not valued for its scenic quality or where its character, existing land use, pattern and scale are tolerant of the type of change envisaged, and the landscape has capacity to accommodate change.	Moderate	Low	Low	Negligible

Note: Significance in this matrix has been aligned with the approach described in Chapter 7, Impact Assessment Method, and therefore differs in significance as shown in Appendix L, Landscape and Visual Impact Assessment Report.

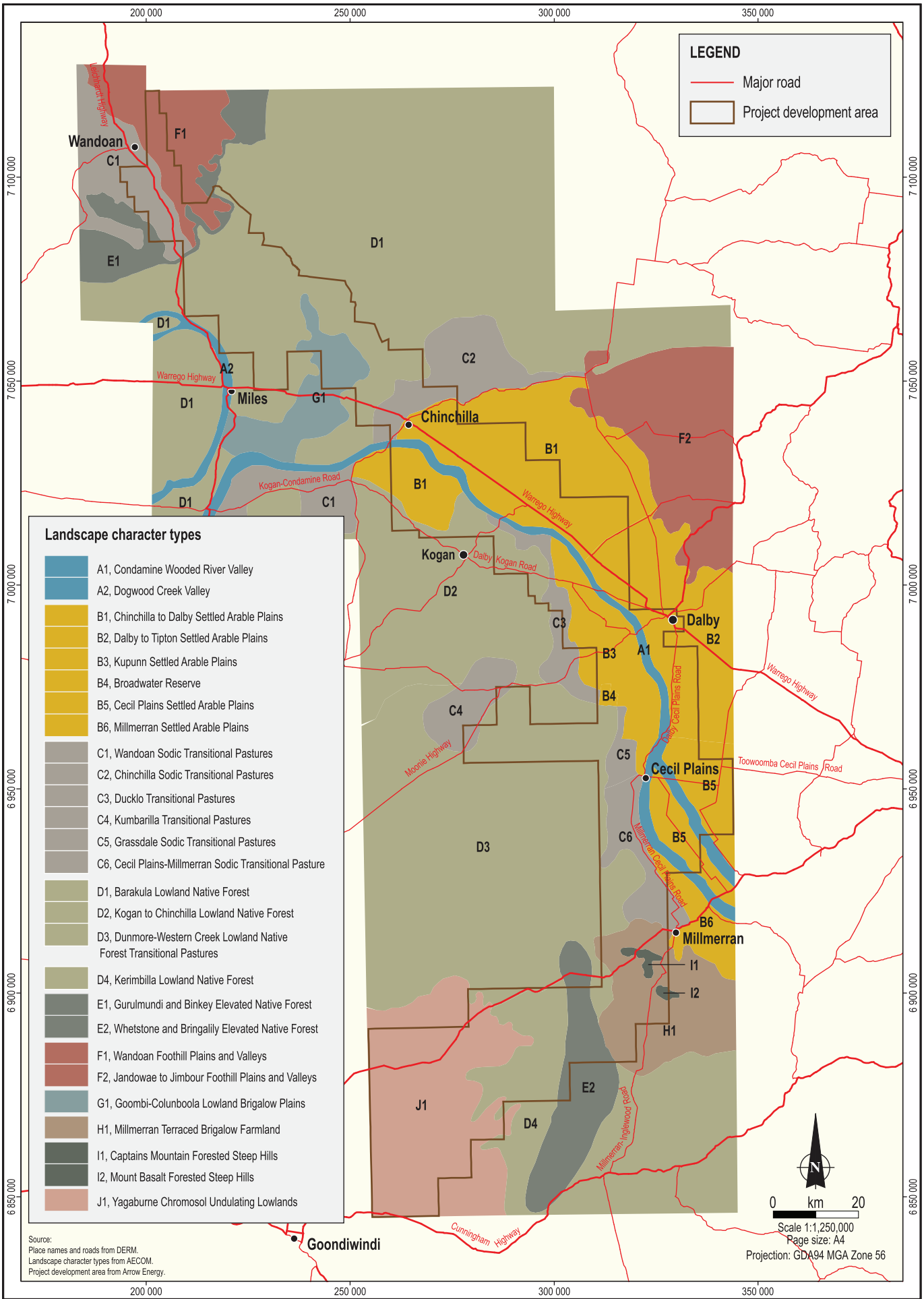
Table 18.2 Significance levels of visual impacts

			Magnitude of Change in View Caused by Proposed Development			
			Dominant Change	**Considerable Change**	**Noticeable Change**	**Imperceptible Change**
			Major changes in view at close distances, affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of view.	Clearly perceptible changes in view at intermediate distances, resulting in either a distinct new element in a significant part of the view, or a more wide-ranging, less concentrated change across a wider area.	Minor changes in view, at long distances or visible for a short duration, and/or are expected to blend in with the existing view to a moderate extent.	Change which is barely visible, at a very long distance, or visible for a very short duration, and/or is expected to blend with the existing view.
Sensitivity of Viewpoint to Proposal	**High**	Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users of attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape, e.g., Jimbour House, Lake Broadwater Conservation Park.	Major	High	Moderate	Moderate
	Medium	Medium numbers of residents and moderate numbers of visitors with an interest in their environment, e.g., visitors to state forests, including bush walkers, horse riders, trail bikers. Larger numbers of travellers with an interest in their surroundings, e.g., designated scenic routes such as 'Adventure Way'.	High	Moderate	Moderate	Low
	Low	Small numbers of visitors with a passing interest in their surroundings e.g., those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape, e.g., workers, commuters.	Moderate	Moderate	Low	Low
	Negligible	Very occasional numbers of viewers with a passing interest in their surroundings, e.g., those travelling along minor roads.	Moderate	Low	Low	Negligible

Note: Significance in this matrix has been aligned with the approach described in Chapter 7, Impact Assessment Method and therefore differs to significance as shown in Appendix L, Landscape and Visual Impact Assessment Report.



coffey environments	Date: 12.12.2011 MXD: 7040AC_04_GIS129_v1_2 File Name: 7040_04_F18.02_GIS_HU	Arrow Energy Surat Gas Project	arrow energy go further	Topography	Figure No: 18.2



coffey environments	Date: 16.11.2011 MXD: 7040AC_04_GIS130_v1_2 File Name: 7040_04_F18.03_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Landscape character types and area	Figure No: 18.3

Table 18.3 Summary of the existing landscape

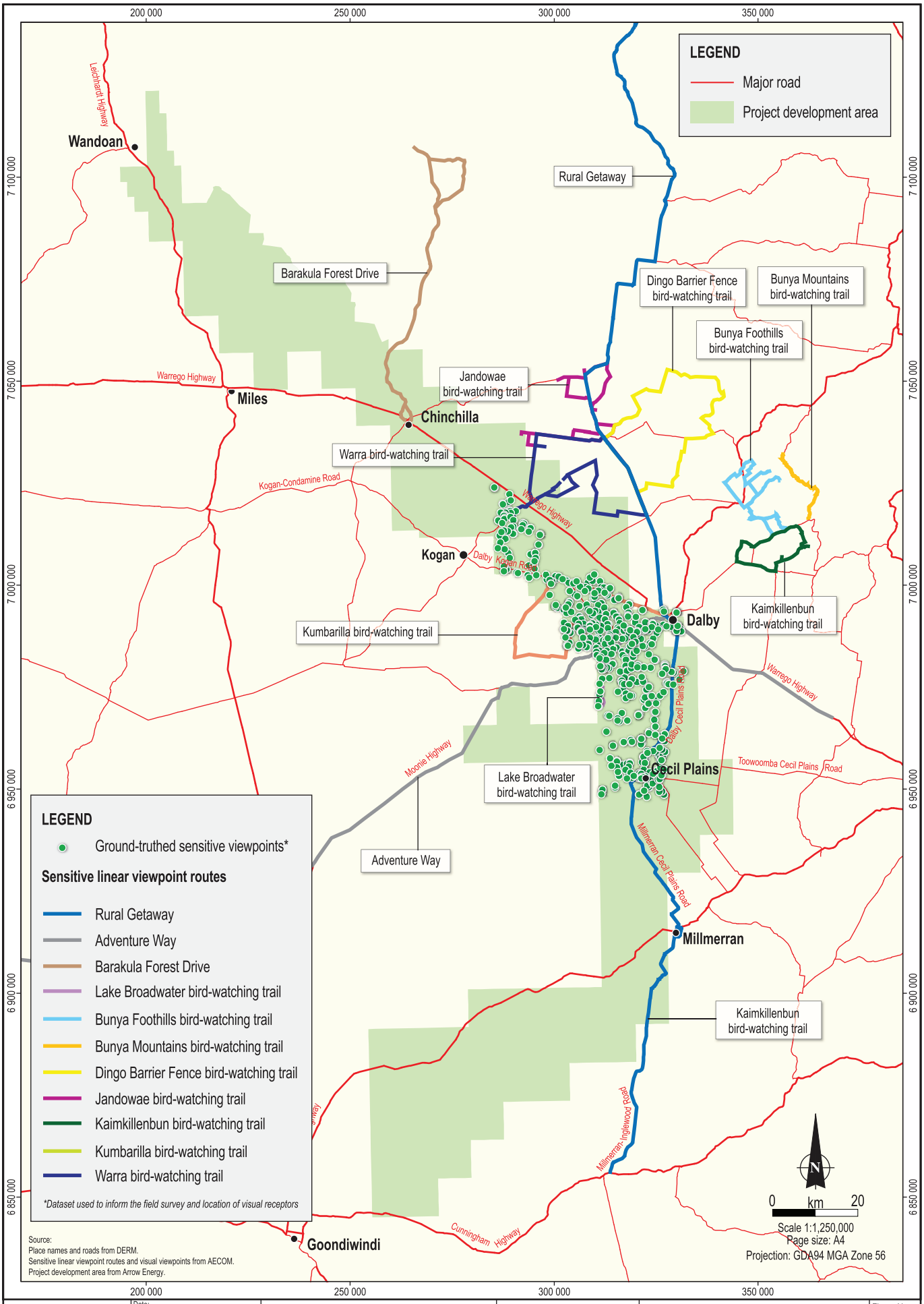
Location	Key Characteristics
Landscape Type A: Wooded River Valley	
Wide U-shaped valleys of the Condamine River and Dogwood Creek.	• Wide, shallow river valley with broad sweeping meanders and steep valley sides. • An intimate, 'well-treed' character. • Occasional riverside lagoons, which contain an ephemeral wetland character. • Strong sense of tranquillity, high level of naturalness. • Trees along river corridor contribute to a strong sense of visual continuity. • Character of the river valley strongly influenced by the seasons and climatic conditions.
Landscape Type B: Settled Arable Plains	
Broad low-lying level plains of primarily arable farmland with small tributaries, extending in a northwest/southeast band between Chinchilla, Dalby, Cecil Plains and Millmerran.	• Flat, large-scale landscape with an open and exposed character and long-distant views. • Small tributaries indicated by swathes of trees, shrubs and grassland. • Land use is primarily arable farmland (both dryland and irrigation) with a variety of crops. • Very structured and controlled landscape, primarily used for arable farmland. • Large, rectangular fields lined by irrigation channels. • Straight transport corridors reflecting the flat topography and minimal roadside vegetation. • Key regional centres include Chinchilla, Dalby and Cecil Plains. • Towns often located at road and railway junctions, comprising train stations and silos. • Harmonious rural character, which is valued and celebrated by local communities and visitors.
Landscape Type C: Sodic Transitional Pastures	
Between the Settled Arable Plains and Lowland Native Forest, providing a gradual transition between these strongly contrasting landscapes.	• Gently undulating plains on sandstone, with predominantly sodosol soils. Sparsely settled landscape. • A mosaic of open woodland, rough pastures, dryland arable farmland and scattered farm buildings. • High degree of variation of land cover and landform contributes to enclosed views through trees. • Vegetation dominated by groves of poplar box and grey box open woodland amongst pasture fields, road side verges, tributaries. Callitris forest at western edges. • Contains several unsealed local roads (often private). • Noticeable presence of existing gas wells within arable and pasture fields. • Fairly rural character with a moderate sense of remoteness in areas away from roads and gas wells.
Landscape Type D: Lowland Native Forest	
Large areas of western and northern project development area. Covers several state forests (Barakula, Kumbarilla, Western Creek and Whetstone).	• Smoothly undulating landform incised by several narrow dry gullies and creeks. • Creek valleys contain a muddy character, with distinctive rocky outcrops and well-treed valley sides. • Dominant species are cypress pine, wilga and poplar box. Tree heights in the range of 8 to 12 m. • Occasional cleared areas used for native pasture grazing. • Sparsely settled character, with only small towns and property homesteads and cottages. • Forest encroached by power infrastructure and CSG facilities. • Generally comprises a high level of naturalness with a strong sense of remoteness away. • Dense forest has a strong sense of visual continuity, providing an important natural element.

Table 18.3 Summary of the existing landscape (cont'd)

Location	Key Characteristics
Landscape Type E: Elevated Native Forest	
Located in the northern and southern part of the project development area, partly covering Binkey State Forest and Wondul Range National Park, respectively.	• Elevated sandstone landscape (above 400 m) with some upland rocky areas. • Landform typified by elevated plateaus, ridges, escarpments, deeply incised valleys and dry gullies. • Braemar, Kumbarilla and Danndine state forests are key features. • Key species include white cypress pine, buloke, narrow-leaved ironbark and rusty gum. • Forest provides a strong sense of naturalness and enclosure. • General absence of infrastructure, excepting cleared corridors for transmission pylons. • Generally comprises a high level of naturalness with a strong sense of remoteness. • Dense forest has a strong sense of visual continuity, providing an important natural element.
Landscape Type F: Foothill Plains and Valleys	
Located in the northern part of the project development area, at the western foothills of the Great Dividing Range, east of Wandoan. It is also located at the western foothills of the Bunya Mountains, east of Jandowae.	• Fairly open, elevated smoothly rolling plains with gentle undulations associated with watercourses. • Located at the foothills of the Bunya Mountains and Great Dividing Range. • Watercourses comprise a shallow narrow valley with rocky valley floors, fringed by open woodland and grassland. • Predominantly open plains of grazing pastures for cattle. • Some remnant natural areas, including Mahen and Jandowae state forests. • Groups of mature bottle trees amidst pasture. • Sparsely settled landscape with long-distant views and strong skylines. • Jimbour House is a key landmark, which sits on an elevated plateau east of Jimbour town. • Strong rural character with a perceived sense of remoteness and tranquillity away from main road.
Landscape Type G: Lowland Brigalow Plains	
Located on broad low-lying level plains with remnant native forest between Goombi, Columboola and Barakula State Forest (west of Chinchilla).	• A flat to gently rolling large-scale landscape with an open character and strong horizons. • Open plains with noticeable remnant belts of brigalow, belah and wilga forest. • Layered open forest in elevated areas and plateaus. • Some grazing pastures contain areas of Brigalow regrowth, providing a shrubby character. • Concentration of dryland arable farmland in southern parts, alongside the Condamine River. • Isolated bottle trees are a prominent feature south of the Warrego Highway, west of Goombi. • Sparsely settled character, with small towns and a scattering of property homesteads and cottages. • Roads are straight in character, often lined with belts of Brigalow and Wilga forest. • Moderate sense of remoteness and tranquillity away from transport and infrastructure corridors.

Table 18.3 Summary of the existing landscape (cont'd)

Location	Key Characteristics
Landscape Type H: Terraced Brigalow Farmland	
Covers the smoothly undulating mosaic of brigalow-belah forest, terraced arable plains and lowland pastures south-west of Millmerran.	• Large-scale smoothly undulating plains and low hills. • A settled landscape complex mosaic of brigalow forest, terraced dryland arable fields, lowland pastures with scattered farmhouses and sheds. • Gently sloping hillsides are often cultivated through use of contour banks, which accentuate the variation in landform. • Low-lying pasture fields have often been cleared from the dense brigalow-belah forest. • Brigalow-belah forest formed by mature and young trees, dead trees and shrubs. • Arable and pasture fields often contain remnant copses and belts of brigalow-belah forest. • Millmerran power station stack is a prominent skyline feature in northern parts of the landscape. • Introduction of belts of Ironbark, buloke, cypress pine and poplar box woodland. • Frequent panoramic views over smoothly undulating plains from elevated vantage points. • Strong rural character with a general absence of large-scale infrastructure.
Landscape Type I: Forested Steep Hills	
Located south of Millmerran. Comprises a series of isolated peaks, including Captains Mountain and Mount Domville.	• Steep-sided, isolated hills and ridges in an otherwise low-lying, smoothly undulating landscape. • Large blocks of mountain coolibah and ironbark open woodland dominate. • Woodland cover on Mount Domville is partly clear for grazing pastures and interspersed with scrub. • Commodore Peak lookout is a key vantage point, offering panoramic northerly views over Millmerran. • The telecommunication tower atop Mount Domville is a highly prominent feature.
Landscape Type J: Chromosol Undulating Lowlands	
Located on broad low-lying level plains of mixed farmland, located below the Whetstone and Bringalily Elevated Native Forest, extending in a south-west direction.	• Gently undulating to shelving lowland plains topography lying between 240 m and 360 m. • Large land holdings subdivided by occasional fence lines. • Generally open and rough tussocky pastures with solitary gums and localised patches of scrub. • Forested tributary creeks exhibit rocky and gravelly characteristics and are frequently dry. • Roadside shelterbelts, vegetated tributaries and remnant stands of native eucalypt woodland and sclerophyll forests combine to create wooded horizons. • Brigalow and belah vegetation prominent with some cypress pines and patches of grass trees. • Few buildings or built elements generate a strong sense of remoteness.



coffey environments	Date: 12.12.2011 MXD: 7040AC_04_GIS131_v1_2 File Name: 7040_04_F18.04_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Sensitive visual receptors	Figure No: 18.4

18.3.1 Environmental Values

The characteristics and visual resources within the above landscape types dictate the overarching value of each landscape and form the basis for the assessment from which the sensitivity of the value was determined. The values of each of the landscapes include visual amenity and landscape characteristics.

Sensitivity levels vary for each development component (see Appendix L, Landscape and Visual Impact Assessment Report) and, in Table 18.4, sensitivities have been averaged for each landscape type.

Table 18.4 Landscape and visual amenity value sensitivity

Landscape Type	Landscape and Visual Amenity Value Sensitivity
Landscape Type A: Wooded River Valley	Medium
Landscape Type B: Settled Arable Plains	Medium
Landscape Type C: Sodic Transitional Pastures	Low
Landscape Type D: Lowland Native Forest	Medium
Landscape Type E: Elevated Native Forest	Medium
Landscape Type F: Foothill Plains and Valleys	Medium
Landscape Type G: Lowland Brigalow Plains	Low
Landscape Type H: Terraced Brigalow Farmland	Medium
Landscape Type I: Forested Steep Hills	High
Landscape Type J: Chromosol Undulating Lowlands	Low

18.4 Issues and Potential Impacts

The significance of potential impacts on the landscape and visual amenity values has been assessed using the sensitivity of the value and the magnitude of the potential change in landscape and visual amenity (as described in Section 18.3, Existing Environment and Environmental Values). Potential impacts on the values are related to the type and nature of the activity and the associated change in landscape characteristics and diminished visual amenity.

Activities with the potential to cause adverse impacts on landscape and visual amenity values during the construction, operation and decommissioning phases of the project are described below.

18.4.1 Construction

The primary construction activity that could impact landscape and visual amenity values is the construction of production wells, gathering lines, production facilities and associated infrastructure (e.g., temporary workforce accommodation facilities, power lines). This activity will involve:

- Excavation, trenching, drilling, earthmoving, vegetation clearance/trimming and temporary lighting that will disrupt landscape character, views and visual amenity.
- Presence of workforce, construction camps and associated transport (e.g., large trucks, 4WD vehicles, graders, excavators and tractors).

The impact of the activity will vary depending on the nature of the construction activity (e.g., construction of a production well versus construction of a production facility), type of landscape and location of visual receptors.

18.4.2 Operation

During operations, the following project activities could impact upon landscape and visual amenity values:

- Presence and operation of production wells, gathering lines, power distribution, production facilities and associated infrastructure that will disrupt landscape character, views and visual amenity.
- Presence of maintenance crew, their accommodation and associated transport.

The nature of the impact will largely be determined by the size of the infrastructure and type of landscape.

18.4.3 Decommissioning

Impacts upon landscape and visual amenity values during decommissioning include:

- Decommissioning, deconstruction and removal of production wells, gathering lines, power reticulation, production facilities and associated infrastructure that will disrupt landscape character, views and visual amenity.
- Presence of workforce, possible construction camps, and associated transport (e.g., large trucks, 4WD vehicles, graders, excavators and tractors).

Table 18.5 lists the potential impacts, causes, significance of impact, proposed mitigation measures and significance of residual impact.

18.5 Environmental and Social Protection Objectives

Environmental and social protection objectives for landscape and visual amenity include:

- Avoiding or minimising the impact on sensitive viewsheds within the project area.
- Avoiding or minimising moderate to high impacts to landscape character.

18.6 Avoidance, Mitigation and Management Measures

Avoidance, mitigation and management measures have been proposed to achieve the identified environmental and social protection objectives. The primary means by which avoidance is achieved is through design and site selection. Arrow's environmental framework approach focuses on early identification of sensitive locations that should be avoided by project activities, as described within Chapter 8, Environmental Framework.

The following avoidance, mitigation and management measures will be implemented for each phase of the project to minimise the potential impacts to changes in landscape character and diminished visual amenity.

18.6.1 Planning and Design

Mitigation measures to be implemented in the design of facilities, wells and gathering lines, and in the planning of site selection include the requirement to:

- Use shrouded, downcast lighting to minimise spill and restrict it to the minimum required for safety and security. Design lighting in accordance with AS 4282-1997, Control of the Obtrusive Effects of Outdoor Lighting (Standards Australia, 1997). [C262]

- Co-locate facilities where practicable and design infrastructure layouts to minimise the footprint (taking into consideration the elements that contribute to landscape character) to reduce visibility of the facilities. [C263]
- Site each production facility in the landscape of lowest sensitivity, where practicable, such as next to existing industrial developments or existing coal seam gas facilities. [C264]
- Avoid visually sensitive locations and landscapes when siting facilities, where practicable. Seek backdrops when siting facilities to protect the skyline in distant views. Avoid siting facilities within view of sensitive viewpoints, particularly the bird hide and camping area at Lake Broadwater, Captains Mountain, Jimbour House, the Cunningham Highway, towns, schools and private residences. [C265]
- When siting production facilities, maintain an appropriate distance from, and minimise visual disturbance to, the most sensitive visual receptors. [C266].
- Hide or screen the facility using natural landscape features or planted native vegetation barriers, where appropriate to the landscape sensitivity. Avoid removal of mature trees and other woodland features that screen views to facilities. Establish screening barriers using endemic species in advance of construction of the facilities. [C267]
- Integrate facilities into the landscape setting considering building and structure colour, texture and lines, where screening is not practical. Use matt and low-glare finishes two shades darker than the prevalent shading of the site, having regard to sun angles throughout the day and year, and to the harvesting of crops, where possible. Consider camouflage paints/finishes in highly sensitive landscapes. [C268]
- Consult with potentially impacted visual receptors (landowners and neighbours) in locating facilities. Seek to reduce the form and shape of facilities visible to landowners and residents. [C269]
- Minimise the disturbance footprint and vegetation clearing. [C020]
- Conduct planned maintenance flaring during daylight hours to minimise light spill, where practicable. [C270]
- Where it is not practicable to screen or integrate a facility into the landscape, consider designing the facility to be a feature in the landscape, taking into consideration the form, texture and arrangement of buildings and structures. [C271]
- When clearing vegetation, seek to avoid creating gaps in stands or patches and isolating parcels of remnant vegetation from more continuous tracts. [C272]
- Adhere to the following mitigations specific to Landscape Type I: forested steep hills, Captains Mountain (comprising Captains Mountain, Commodore Peak and Mt Domville):
  - Avoid locating production facilities adjacent to and on Captains Mountain.
  - Avoid locating production wells and gathering systems on the forested steep slopes and ridges of Captains Mountain.
  - Avoid ROWs perpendicular to the slope when locating production wells and gathering systems adjacent to the forested steep hills of Captains Mountain. [C200]

18.6.2 Construction

During construction, mitigation measures to be implemented will include the requirement to:

- Plan the movement of equipment and materials during times of least visual impact (i.e., work day start and end) where practicable. [C273]
- Target dry weather periods when undertaking construction in sensitive landscape areas (e.g., waterway crossings), where feasible to minimise visual impacts due to sedimentation and erosion. [C274]
- Clear areas progressively and implement rehabilitation as soon as practicable following construction and decommissioning activities. [C015]
- Locate topsoil and spoil mounds in visually unobtrusive locations, where practicable. [C275]
- Incorporate excess spoil from site excavations into bunding at the base of a planted vegetation screening barrier to increase the overall height of the barrier. [C276]
- Use existing roads and tracks, where practicable. [C032]
- Utilise landscape features and contours, where practicable, to integrate linear infrastructure (access tracks, gathering lines) into the landscape. [C277]
- Minimise the length and width of roads and tracks. [C278]
- Avoid roads traversing highly visible hills. [C279]
- Minimise construction time near sensitive visual receptors. [C280]
- Maintain the integrity of private roads and tracks and minimise dust generation, where appropriate, in consultation with relevant landowners and council. [C031]
- Develop and implement waste management procedures in accordance with the Environmental Protection (Waste Management) Policy 2000. [C281]

18.6.3 Operation

Operations management and mitigation measures to be implemented include:

- Develop an erosion and sediment control plan and install and maintain appropriate site-specific controls. [C034]
- Maintain visual amenity controls used to reduce landscape and visual impacts. Replace lost trees/shrubs in screening barriers to ensure they establish and maintain an effective barrier. [C282]
- Implement dust suppression measures for roads and construction sites to ensure that dust does not cause a nuisance. [C012]

18.6.4 Decommissioning

Remove surface infrastructure and if practicable, reinstate disturbed areas as soon as practicable to predisturbance landscape characteristics or consult with landowners regarding reinstatement objectives. [C283]

18.6.5 Visualisations

Visualisations portraying the unmitigated scenario and mitigated scenario for landscape types B, D, F, G, and J are presented as examples of how vegetation may be used to screen an integrated production facility in Plates 18.1 to 18.10. The use of vegetative screening aims to minimise the impacts of landscape and visual amenity. However, Arrow will also need to minimise the risk of fire and will need to maintain buffer zones free of combustible materials around production facilities. In some cases the need to minimise the risk of fire will preclude the use of vegetative screening as a mitigation of visual impacts.

It should also be noted that vegetation screening can take up to 10 years to be established such that the trees and plants are tall enough to mitigate effectively and screen infrastructure.

18.7 Residual Impacts

The avoidance, mitigation and management measures outlined above will reduce the severity of potential impacts on landscape and visual amenity values. The significance of residual impacts associated with project activities are described below.

18.7.1 Construction

Modification of landscape and visual amenity will occur during construction. Implementation of the above mitigation and management measures will reduce the magnitude of the residual landscape and visual amenity impacts caused by the construction of infrastructure and movement of workforce and equipment. The significance of the residual impacts will range from **low** to **high** (note that only Landscape Type I was high) depending on the type of landscape and nature of construction activity. Potential impacts of production well construction are expected to be lower than production facility construction, due mainly to the shorter duration and smaller footprint of production well construction activities.

18.7.2 Operation

The significance of the landscape and visual amenity residual impacts associated with the operations of the project will reduce with the implementation of mitigation and management measures.

The magnitude of potential impacts from pipelines will be negligible as they will be buried and the surface rehabilitated. The magnitude of impact from the operation of production wells will generally reduce to imperceptible depending on the landscape. The residual magnitude of impacts from production facilities will also decrease but are generally greater than production wells due their larger footprint and vertical profile.

The residual significance of impacts from operations will range from **low** to **moderate** depending on the facility type and landscape type.

18.7.3 Decommissioning

Residual impacts associated with decommissioning will generally be negligible as the activities are short in duration, the surface facilities will be removed and sites will be rehabilitated to pre-existing conditions or to the satisfaction of the landowner.

Plate 18.1 Settled Arable Plains (Landscape Type B): IPF visualisation prior to mitigation

Plate 18.2 Settled Arable Plains (Landscape Type B): IPF visualisation post mitigation

Plate 18.3 Lowland Native Forest (Landscape Type D): IPF visualisation prior to mitigation

Plate 18.4 Lowland Native Forest (Landscape Type D): IPF visualisation post mitigation

Plate 18.5 Foothill Plains and Valleys (Landscape Type F): IPF visualisation prior to mitigation

Plate 18.6 Foothill Plains and Valleys (Landscape Type F): IPF visualisation post mitigation

Plate 18.7 Lowland Brigalow Plains (Landscape Type G): IPF visualisation prior to mitigation

Plate 18.8 Lowland Brigalow Plains (Landscape Type G): IPF visualisation post mitigation

Plate 18.9 Chromosol Undulating Lowlands (Landscape Type J): IPF visualisation prior to mitigation

Plate 18.10 Chromosol Undulating Lowlands (Landscape Type J): IPF visualisation post mitigation

18.7.4 Summary of Residual Impacts

Table 18.5 summarises the potential impacts prior to mitigation, along with proposed mitigation and management measures and the subsequent residual impacts.

Sensitivity of the values has been aligned with the approach described in Chapter 7, Impact Assessment Method, and therefore differs in sensitivity as shown in Appendix L, Landscape and Visual Impact Assessment Report. Sensitivity levels have also been averaged for each landscape type (see Table 18.4).

18.8 Inspection and Monitoring

Inspect erosion and sediment control measures following significant rainfall events to ensure effectiveness of measures is maintained. [C505]

Table 18.5 Summary of landscape and visual amenity impact assessment

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Pre-mitigated Impact		Summary of Mitigation Measures	Residual Impact	
			Magnitude	Significance		Magnitude	Significance
Changes in Landscape Character							
Construction • Construction of production wells, gathering lines, production facilities and associated infrastructure will alter landscape character. • Presence of workforce, accommodation and associated transport. **Operations** • Presence and operation of production wells, gathering lines, production facilities and associated infrastructure will disrupt landscape character. • Presence of workforce, accommodation and associated transport.	Landscape Type A	Medium	Considerable to dominant	Moderate to high	**Planning:** • Where practicable, locate project infrastructure in the landscape of lowest sensitivity and maintain the maximum distance practicable from (and minimise visual disturbance on) the most sensitive visual receptors. • Avoid visually sensitive locations and landscapes, where practicable. • Where appropriate to the landscape sensitivity, hide or screen project infrastructure using natural landscape elements. • Consult with potentially impacted visual receptors in locating project infrastructure. • Avoid locating production facilities and wells and gathering systems in Landscape Type I. **Construction:** • Restrict lighting to the minimum required for safety and security during drilling. • Minimise footprint disturbance and vegetation clearing to reduce the magnitude of change on the affected landscape. • Implement progressive rehabilitation as soon as practicable following construction. • Locate topsoil and spoil mounds in visually unobtrusive locations. • Where practicable, use existing roads.	Noticeable to considerable	Moderate
	Landscape Type B	Medium	Noticeable	Moderate		Imperceptible	Low
	Landscape Type C	Low	Noticeable to considerable	Low to moderate		Imperceptible to noticeable	Low
	Landscape Type D	Medium	Noticeable to considerable	Moderate		Imperceptible to noticeable	Low to moderate
	Landscape Type E	Medium	Noticeable to considerable	Moderate		Imperceptible to noticeable	Low to moderate
	Landscape Type F	Medium	Noticeable to considerable	Moderate		Imperceptible to noticeable	Low to moderate

Table 18.5 Summary of landscape and visual amenity impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Pre-mitigated Impact		Summary of Mitigation Measures	Residual Impact	
			Magnitude	Significance		Magnitude	Significance
Changes in Landscape Character (cont'd)							
Decommissioning • Decommissioning of production wells, gathering lines, production facilities and associated infrastructure will disrupt landscape character. • Presence of workforce and associated transport (e.g., large trucks, 4WD vehicles, graders, excavators and tractors).	Landscape Type G	Low	Noticeable to considerable	Low to Moderate	• Maximise alignment of roads with existing landscape features such as fencing and natural drainage. • Minimise the length and width of roads. • Implement erosion control measures during construction of well pads and access roads. • Minimise construction time near sensitive visual receptors. **Operation:** • Maintain erosion control measures. • Minimise dust and rutting along roads. • Ensure screening barriers adhere to required vegetation heights at different distances for fire mitigation measures. **Decommissioning:** • Remove surface infrastructure and reinstate disturbed areas as soon as practicable to pre-disturbance landscape characteristics; or consult with landowners regarding reinstatement objectives.	Imperceptible to noticeable	Low
	Landscape Type H	Medium	Considerable to dominant	Moderate		Noticeable to considerable	Moderate
	Landscape Type I	High	Dominant	Major		Considerable	Moderate
	Landscape Type J	Low	Noticeable to considerable	Low to moderate		Imperceptible to noticeable	Low

Table 18.5 Summary of landscape and visual amenity impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Pre-mitigated Impact		Summary of Mitigation Measures	Residual Impact	
			Magnitude	Significance		Magnitude	Significance
Diminished Visual Amenity							
Construction • Construction of production wells, gathering lines, production facilities and associated infrastructure will alter landscape character. • Presence of workforce, accommodation and associated transport. **Operations** • Presence and operation of production wells, gathering lines, production facilities and associated infrastructure will disrupt landscape character. • Presence of workforce, accommodation and associated transport. **Decommissioning** • Decommissioning of production wells, gathering lines, production facilities and associated infrastructure will disrupt views and visual amenity.	Landscape Type A	Medium	Considerable to dominant	Moderate to high	**Planning:** • Where practicable, locate project infrastructure in the landscape of lowest sensitivity and maintain the maximum distance practicable from (and minimise visual disturbance on), the most sensitive visual receptors. • Avoid visually sensitive locations and landscapes, where practicable. • Where appropriate to the landscape sensitivity, hide or screen project infrastructure using natural landscape elements. • Consult with potentially impacted visual receptors in locating project infrastructure. • Avoid locating production facilities and wells and gathering systems in Landscape Type I. **Construction:** • Restrict lighting to the minimum required for safety and security during drilling. • Minimise footprint disturbance and vegetation clearing to reduce the magnitude of change on the affected landscape. • Implement progressive rehabilitation as soon as practicable following construction. • Locate topsoil and spoil mounds in visually unobtrusive locations. • Where practicable, use existing roads.	Noticeable to considerable	Moderate
	Landscape Type B	Medium	Noticeable to considerable	Moderate		Imperceptible to noticeable	Low to Moderate
	Landscape Type C	Low	Noticeable to considerable	Low to moderate		Imperceptible to noticeable	Low
	Landscape Type D	Medium	Imperceptible to noticeable	Low to moderate		Imperceptible	Low
	Landscape Type E	Medium	Noticeable	Moderate		Imperceptible	Low
	Landscape Type F	Medium	Noticeable to considerable	Moderate		Imperceptible to noticeable	Low to moderate

Table 18.5 Summary of landscape and visual amenity impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Pre-mitigated Impact		Summary of Mitigation Measures	Residual Impact	
			Magnitude	Significance		Magnitude	Significance
Diminished Visual Amenity (cont'd)							
• Presence of workforce and associated transport (e.g., large trucks, 4WD vehicles, graders, excavators and tractors).	Landscape Type G	Low	Noticeable to considerable	Low to moderate	• Maximise alignment of roads with existing landscape features such as fencing and natural drainage. • Minimise the length and width of roads. • Implement erosion control measures during construction of well pads and access roads. • Minimise construction time near sensitive visual receptors. **Operation:** • Maintain erosion control measures. • Minimise dust and rutting along roads. **Decommissioning:** • Remove surface infrastructure and reinstate disturbed areas as soon as practicable to pre-disturbance landscape characteristics; or consult with landowners regarding reinstatement objectives.	Imperceptible to noticeable	Low
	Landscape Type H	Medium	Considerable to dominant	Moderate to high		Noticeable to considerable	Moderate
	Landscape Type I	High	Considerable to dominant	High to major		Noticeable to considerable	Low to moderate
	Landscape Type J	Low	Noticeable to considerable	Low to moderate		Imperceptible to noticeable	Low