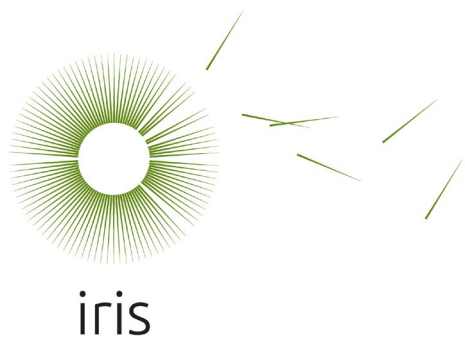




Muswellbrook Battery Energy Storage System Project

Visual Impact Assessment



July 2022

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1. Introduction

This report has been prepared to assess the visual impact of the proposed Muswellbrook Battery Energy Storage System (BESS) project (the proposal), located at 20-24 Sandy Creek Road, Muswellbrook.

This report identifies the potential visual impacts of the proposal on views from surrounding areas. This will include an assessment of the impact on views from the public domain (including the New England Highway) and nearby private properties. The assessment also considers the proposed Muswellbrook Bypass route.

1.1. Assessment requirements

This report addresses the Secretary's Environmental Assessment Requirements (SEARS) issued by the NSW Department of Planning and Environment (DPE).

For this visual impact assessment, the SEAR is:

'Visual' – including an assessment of the likely visual impacts (including night lighting) of all components of the project (including transmission lines and any other ancillary infrastructure) on surrounding residences, scenic or significant vistas and road corridors in the public domain.

To address this requirement, this assessment includes an:

- assessment of views from the public domain (including scenic or significant vistas and road corridors) (refer to section 5.3)
- assessment of views from surrounding residences (refer to section 5.5)
- assessment of visual impact at night (refer to section 5.6).

1.2. Guidance for visual impact assessment

There are no specific legislative requirements for the methodology of a visual assessment of Battery Energy Storage System (BESS) in New South Wales. However, for visual impact assessment generally, the industry typically refers to the guidance offered by:

- *Guidance note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment*, TfNSW (2020) and
- *The Guidance Note for Landscape and Visual Assessment (GNLVA)*, Australian Institute of Landscape Architects Queensland (2018).

The assessment contained in this report will draw upon the direction offered by these documents. Further detail on the methodology used for assessing the visual impact of the proposal is described in Section 5 of this report.

1.3. Project study area

An area of about five kilometres from the proposal, is the 'study area' for this assessment. This area includes a visual catchment, which varies according to the land cover (vegetation and built form) and topography of the landscape and includes the development site.

2. The proposal

The proposed Muswellbrook BESS is located on a development site of about five hectares. This site encompasses the construction and operational footprint of the proposal and is referred to as the 'development site'. The proposal includes the following key infrastructure:

- Battery enclosures (about 14 metres long x 3 metres wide x 3 metres high) and step-up transformers, separated into rows, to the east and west of the existing substation access road
- New substation compound (about 100 metres x 50 metres)
- Up to 300 metres of 132 kV overhead or underground sub-transmission line connection to the existing Muswellbrook substation
- An operations and maintenance compound that includes site office and on-site parking
- Noise walls (up to 4-5 metres tall)
- Internal access tracks,
- Up to 3-metre-tall chainmesh security fencing and access gates surrounding each cluster of battery containers
- Outdoor security lighting (activated by sensor)
- Vegetation removal within the development site, including three to four mature eucalypt trees

- Screening vegetation is proposed along the western side of the southern battery storage area.

The project would utilise the existing substation access road from Sandy Creek Road.

No external transmission lines or off-site connection works are proposed.

Construction would take up to 12 months. The batteries would be manufactured offsite and delivered ready for installation. Site preparation works would include minor earthworks to level the site and constructing a bench on which to install the battery enclosures.

The BESS would be capable of operating at any time 24 hours a day, seven days a week. Although the BESS will be monitored and controlled remotely during operation, some routine maintenance will be periodically performed on-site. On-site maintenance activities will only require limited personnel.

The BESS would be operational for a period of approximately 20 years after which time the BESS would be removed and decommissioned. Decommissioning would include the removal of all above ground infrastructure and the remediation of the development site. The infrastructure may be upgraded rather than decommissioned and the lifespan extended.

The layout of the BESS and associated infrastructure is shown on Figure 2-1. The location of proposed screening vegetation is shown on the landscape concept plan at Figure 2-2.

KEY:

- DEVELOPMENT SITE
- SHARED ACCESS ROUTE (NOTE 5)
- SUBSTATION AREA
- TEMPORARY CONSTRUCTION COMPOUND (NOTE 9)
- OPERATIONS & MAINTENANCE COMPOUND AREA
- BATTERY, INVERTER, TRANSFORMER & SWITCHGEAR AREA
- ACCESSWAYS & ASSET PROTECTION ZONE
- AUSGRID FUTURE INFRASTRUCTURE (NOTE 8)
- GRID CONNECTION INVESTIGATION AREA (NOTE 6)
- INDICATIVE CONNECTION ROUTE (NOTE 6)
- WORKS AREA IN EXISTING SUBSTATION (NOTE 7)
- EXISTING 132kV OVERHEAD LINES (NOTE 4)
- EXISTING 33kV OVERHEAD LINES (NOTE 4)
- CADASTRAL BOUNDARIES
- NOISE WALL
- SCREENING VEGETATION



FIGURE 2-1 BATTERY ENERGY STORAGE SYSTEM (BESS) GENERAL ARRANGEMENT

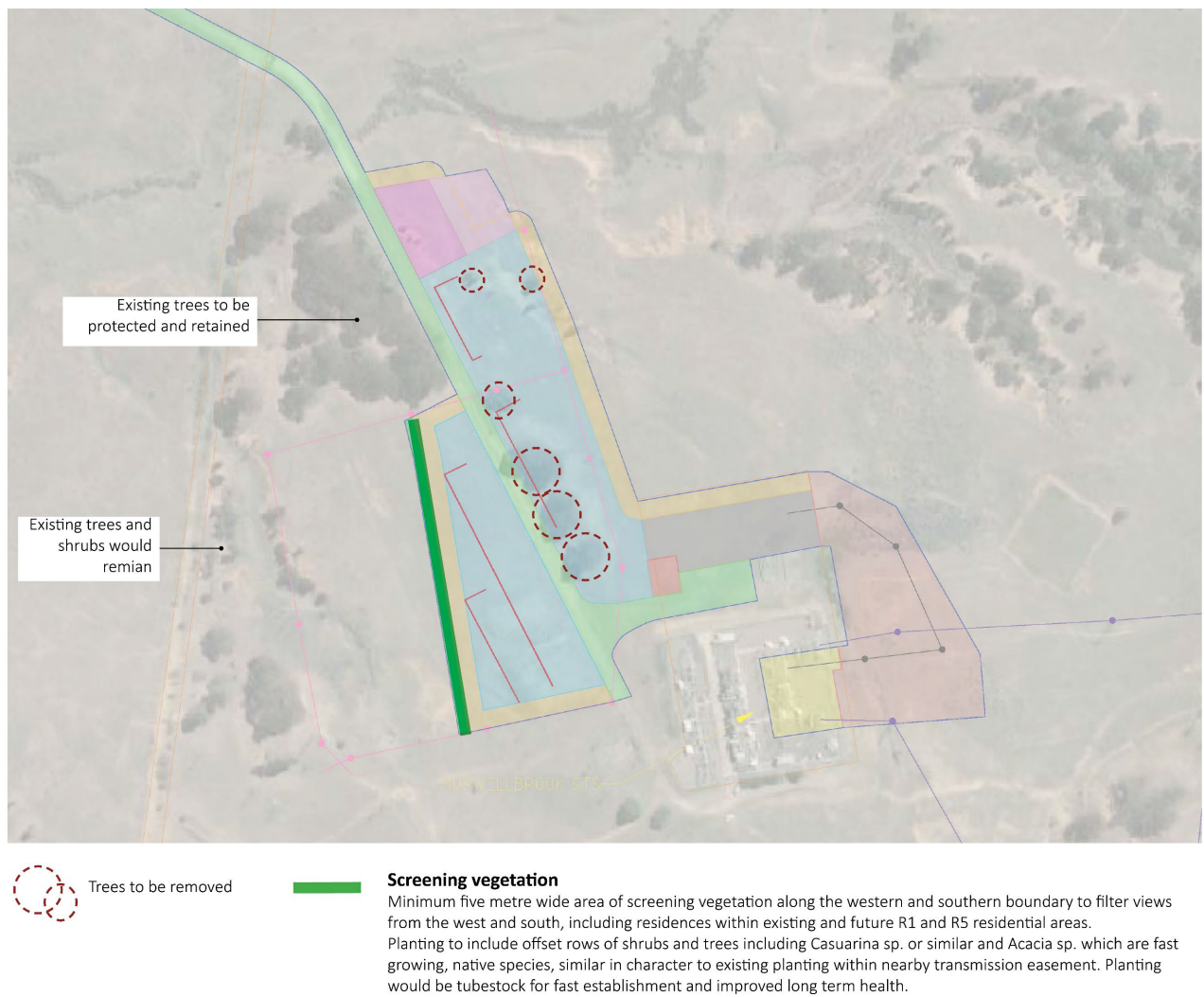


FIGURE 2-2 LANDSCAPE CONCEPT PLAN



FIGURE 2-3 INDICATIVE CHARACTER OF PROPOSED SCREENING VEGETATION

3. Planning context

There are several state and local government planning documents which provide relevant guidance for the consideration of visual impact and also set out the desired planning outcomes for the development site and surrounding area. These are summarised in the following paragraphs.

3.1.State and regional planning documents

3.1.1.Draft Hunter Regional plan 2041

The *draft Hunter Regional plan 2041* (DPIE, 2021) is the NSW Government’s strategy for guiding land use planning decisions for the Hunter Region over the next 20 years.

The plan sets out the vision for the region in 2041, supported by District-level goals and regionally focused actions to meet the vision.

The proposal is located in the Central Hunter District. Planning priorities for this district relate to enabling alternative post-mining land uses, planning for tourism in the vineyards, facilitating housing diversity, connectivity, health care and supporting green infrastructure. The plan identifies the potential visual impact of development within the Central District landscape, stating ...

“Development proposals should ensure areas proposed for non-agricultural uses have suitable infrastructure and can be accommodated within the landscape setting. The appropriate siting, scale and design requirements for non-agricultural development should be established so development is set into the landscape and is sympathetic to its local character. Development proposals on lands adjoining scenic areas outside the vineyards region should consider how they may affect the landscape values of the vineyard region and be adapted accordingly.” (p.81)

A residential urban release area is proposed north of Muswellbrook, near the proposed development site (Muswellbrook Candidate Area B). A Place strategy will be developed for this area, as well as the nearby Health care precinct and Muswellbrook coal mine (for post-mining land use) (refer to Figure 3-1).

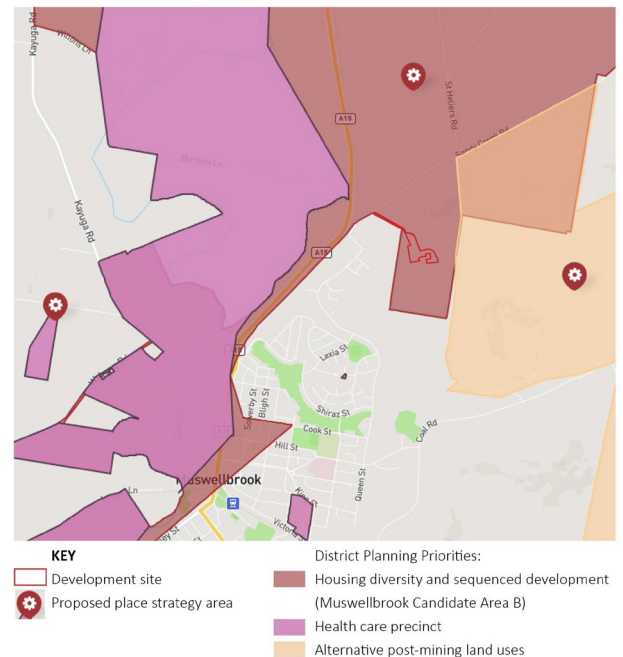


FIGURE 3-1 PROPOSED PLACE STRATEGY LOCATIONS AND DISTRICT PLANNING PRIORITIES, CENTRAL DISTRICT

3.2. Local Government planning

The proposal is located in the Muswellbrook Shire Council area. Relevant parts of the Muswellbrook Local Strategic Planning Statement 2020-2040 (LSPS), Muswellbrook Local Environmental Plan 2009 (LEP) and Muswellbrook Development Control Plan 2009 (DCP) are summarised in the following sections.

3.2.1. Muswellbrook Local Strategic Planning Statement 2020-2040

The Muswellbrook LSPS provides Council's strategy for guiding land use planning decisions for the next 20 years. It establishes a vision for the desired future state of the local area, being: *"A Community in Transition"*, with a more sustainable community, environment and economy through diversification (p.16).

The vision is supported by several planning priorities, include Planning Priority¹⁶ which aims to ensure ... *"Natural and rural landscapes are retained and enhanced"*, in particular the Shire's mountain ranges, National Parks, vineyards and horse studs.

The LSPS further states that the landscape values of land outside urban areas, particularly land adjoining transport routes should be... *"managed to provide a rural experience for visitors, potential wildlife corridors and a barrier to movement of airborne particulate matter from mining and agricultural activities"* (Planning Priority 16).

3.2.2. Muswellbrook Local Environmental Plan 2009

The LEP aims to encourage development that enhances the urban amenity and protects the areas of high scenic value in Muswellbrook Shire, including its settlements and rural areas (cl.1.2(2)(a, e)).

Land use zoning

The proposed development site is located in both the C3 Environmental Management and SP2 Infrastructure zones (refer to Figure 3-2).

The relevant objective of the C3 Environmental Management zone is to:

- *limit development that is visually intrusive and ensure compatibility with the existing landscape character* (Land Use Table, zone C3 objectives)

The relevant objective of the SP2 Infrastructure zone is to:

- *provide for infrastructure and related uses* (Land Use Table, zone SP2 objectives).

The SP2 zone in this location is intended for the proposed Muswellbrook Bypass of the New England Highway. Following more detailed design, the proposed alignment of the Muswellbrook bypass has moved further to the northeast of the SP2 zone and the existing Ausgrid substation, and the development site has been located to avoid the bypass footprint, as shown in Figure 3-3 and Figure 4-4.

To the west of the site, is the Northview Estate which is a six-stage residential subdivision development (refer to Figure 3-4 and Figure 4-4), of which Stages 1, 2 and 3 have been constructed. There are further approved stages (Stages 4, 5 and 6) which are partly sold and yet to be developed. The closest land zoned for residential

development is located at the eastern edge of this estate (Stage 6), about 200 metres from the development site boundary.

Other nearby uses include the Muswellbrook substation (directly east of the site, zoned SP2), Muswellbrook waste management facility (about 1.5 kilometres southeast of the site), Muswellbrook Coal Mine (about two kilometres the east of the site, partially zoned C3) and a place of worship located about 650 metres to the north on Sandy Creek Road.

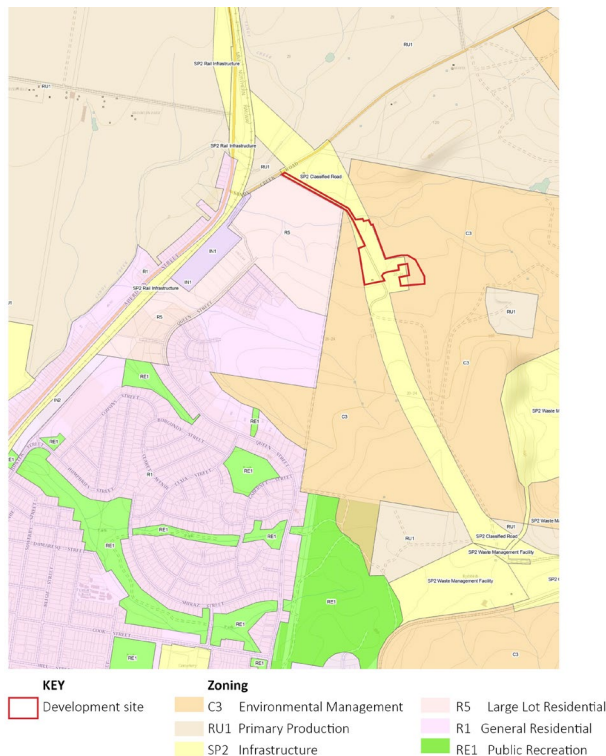


FIGURE 3-2 LAND USE ZONING

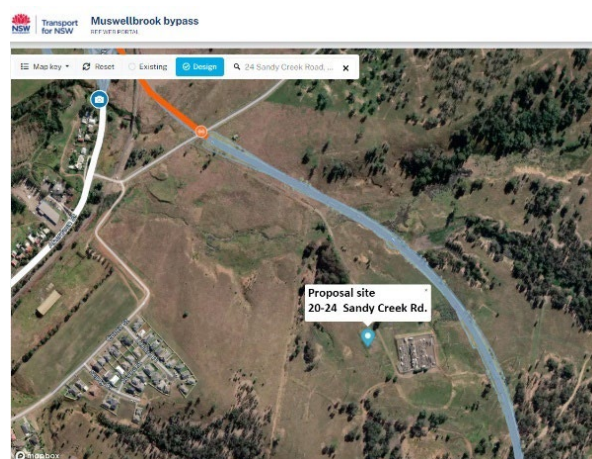


FIGURE 3-3 MUSWELLBROOK BYPASS ALIGNMENT

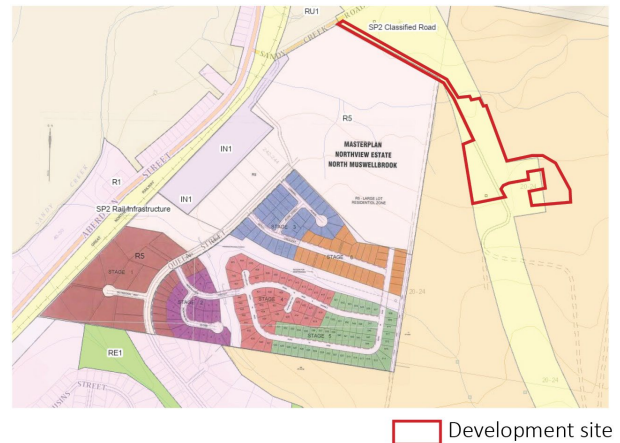


FIGURE 3-4 LOCATION OF APPROVED NORTHVIEW ESTATE RESIDENTIAL DEVELOPMENT, NEAR DEVELOPMENT SITE

Heritage

The nearest heritage items to the development site include:

- Muswellbrook Brick Works (about 290 metres southeast of the site, within the Muswellbrook Quarry lands)
- Muswellbrook Oak Milk Factory, Hunter Street (about 1.5 kilometres southwest of the site).

An objective of the heritage conservation clause is to conserve the heritage significance of heritage items including settings and views (cl.5.10).

3.2.3. Muswellbrook Development Control Plan 2009

The DCP supports the LEP by outlining requirements for development to meet community expectations and address key environmental planning issues relevant to the LGA.

Section 8 of the DCP aims to provide scenic protection of rural land (including land zoned C3) by ensuring new buildings and structures... “do not dominate the surrounding natural landscape features” or “detract from the natural or rural setting or scenic qualities of a site”, including the following controls:

- The roof line of the building must not protrude above natural ridge or tree lines when viewed from public areas and public roads.
- Substantial remnant vegetation is protected from disturbance.
- Privacy and views of neighbouring houses are reasonably retained (Section 8.2.1).

The DCP also requires consideration of suitable setbacks for development with potential land use conflict and use of colours and materials suitable, to ensure.... *“new buildings do not result in adverse visual impacts to road users or nearby properties”* and *“existing and possible future land uses on adjoining land”*, including the following controls:

- (i) Use natural colours, muted and earth tones for major areas of the building, such as walls and roof,*
- (ii) Avoid extensive use of highly reflective glass, highly reflective metal cladding (such as Zinalume and white Colorbond) and plastics on the exterior of buildings, unless it can be demonstrated that this appropriate to the particular circumstances that exist on the site. (Section 8.2.3).*

Section 22 of the DCP recommends land use buffers to help reduce the impacts from development, including use of vegetation to reduce visual impacts. There are no buffers specifically for development such as BESS, however, the massing and development character of the proposal could be compared to rural industries such as a sawmill, which requires a 1,000 metre buffer (or separation distance or setback) from residential areas and urban development (Section 22, Table 22.1). While a one kilometre buffer is not achievable given the BESS must be located adjacent to the existing substation and there are constraints to the east with the Muswellbrook Bypass, the development site has been located as far as possible (about 115 metres) away from the eastern boundary of the adjoining R5 land and further from the Northview estate (about 400 metres), to minimise land use conflicts and impacts on community amenity, including visual impact.

4. Site and setting

4.1. Study area

The development site is located within an open, rural landscape, on the northern outskirts of Muswellbrook, at 20-24 Sandy Creek Road (refer to Figure 4-1), adjacent to the Ausgrid Muswellbrook Substation.

Due to its proximity to town, there are a variety of land uses in the study area. This includes suburban residential development about 200 metres to the southwest of the development site, associated with the approved Northview Estate residential subdivision (refer to Figure 4-4). The pasture fields to the west of the proposal are zoned R5 Large Lot Residential and are expected to be developed over time to include dwellings on large lots (refer to Figure 4-4). There are also some smaller rural lifestyle holdings and a place of worship (about 600 metres to the north) in the vicinity of the site, along Sandy Creek Road. The Muswellbrook waste facility is also located about 1.5km to the southeast on Coal Road.

The land surrounding development site is mainly under rural use, including pasture fields previously used for livestock grazing, with cropping further to the west along the Hunter River and Sandy Creek valleys.

There is large scale coal mining activity in the areas surrounding the town of Muswellbrook, with the Muswellbrook coal mine, located about two kilometres to the east of the development site, the nearest to the site. These mines have resulted in large scale interventions in the natural landscape of the area and setting of the approaches to town.

The New England Highway and Main North railway line are located about 800 metres west of the site. The proposed New England Highway bypass of Muswellbrook would be located to the north of the site, including bridge structure (about 367 metres long) over Sandy Creek Road, Sandy Creek and the Main North railway line (refer to Figure 4-4).

4.2. The site

The development site is located to the east and slightly elevated above Sandy Creek valley. The landform within the site gradually slopes from the southeast, about 170-160m AHD, to the northwest towards a tributary of Sandy Creek. The development site is enclosed by a network of hills and ranges, to the north, east and south of the site. This includes Skellatar Hill (330m AHD) about 2.5km to the southeast (refer to Figure 4-2) and a small group of hills is located about 500-800 metres to the northeast, east and southeast, which rise up to between 200 and 240m AHD.

The development site is largely cleared of vegetation and adjacent to the Ausgrid existing substation.

The existing Ausgrid Muswellbrook substation, is located directly southeast of the site. The substation is raised on a platform with grassed embankments and perimeter chainmesh security fencing. An access road links between the substation and Sandy Creek Road. The existing access road also provides access to the proposed BESS and associated infrastructure and is within the development site. There are multiple transmission lines in the vicinity of the site, linking with the substation, including a 33 kV easement running parallel to the access road, extending through the site, and two sets of 132 kV transmission lines extending west of the substation.

The nearest residential dwellings are located about 370 metres to the west, at Lonhro Place. This residential area is part of the approved Northview Estate residential subdivision (Stage 3). There will be several additional residences located in this area as part of Stage 6 (refer to Figure 4-4), with future lots located about 200 metres away from the development site at the closest point.

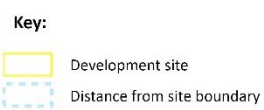
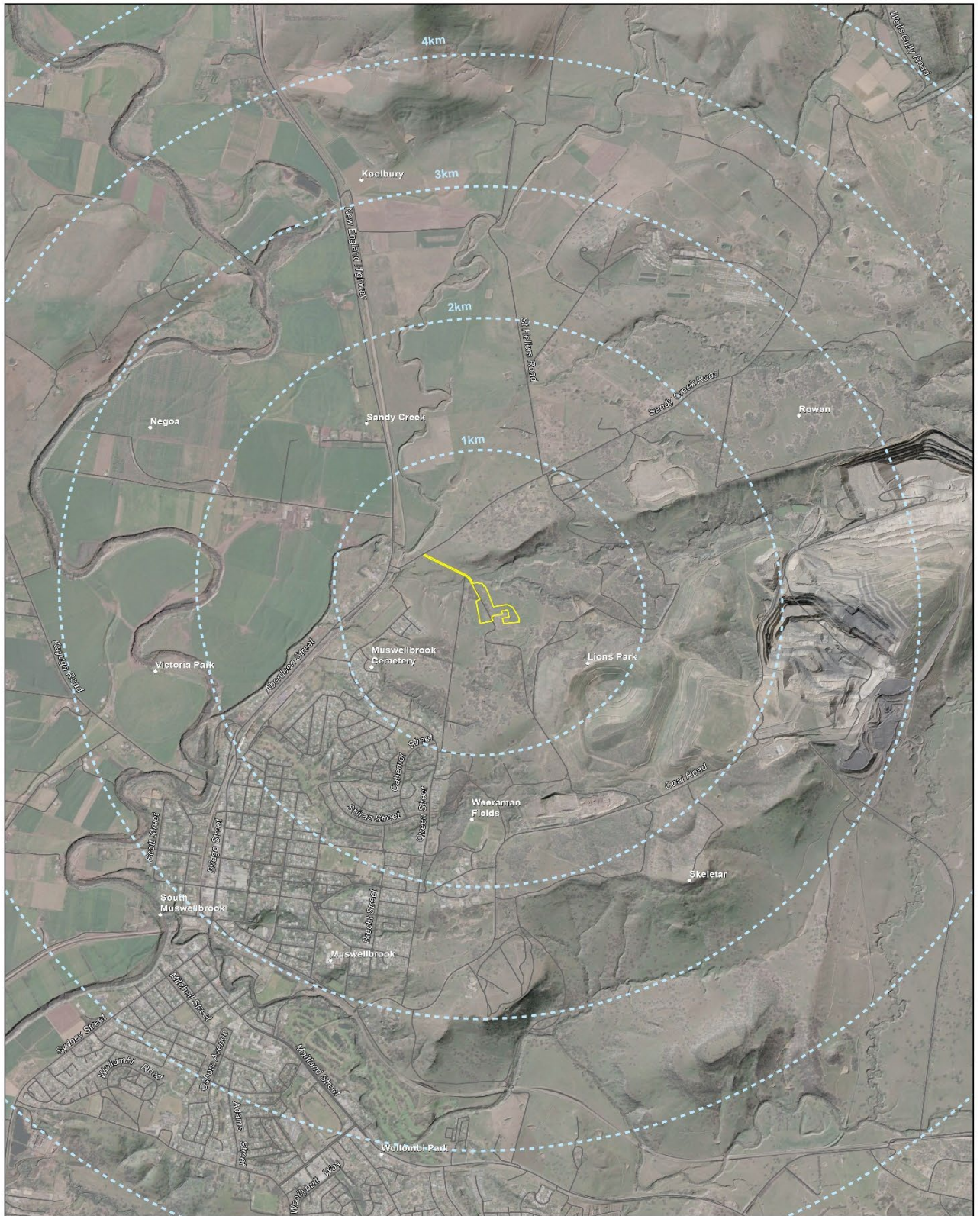
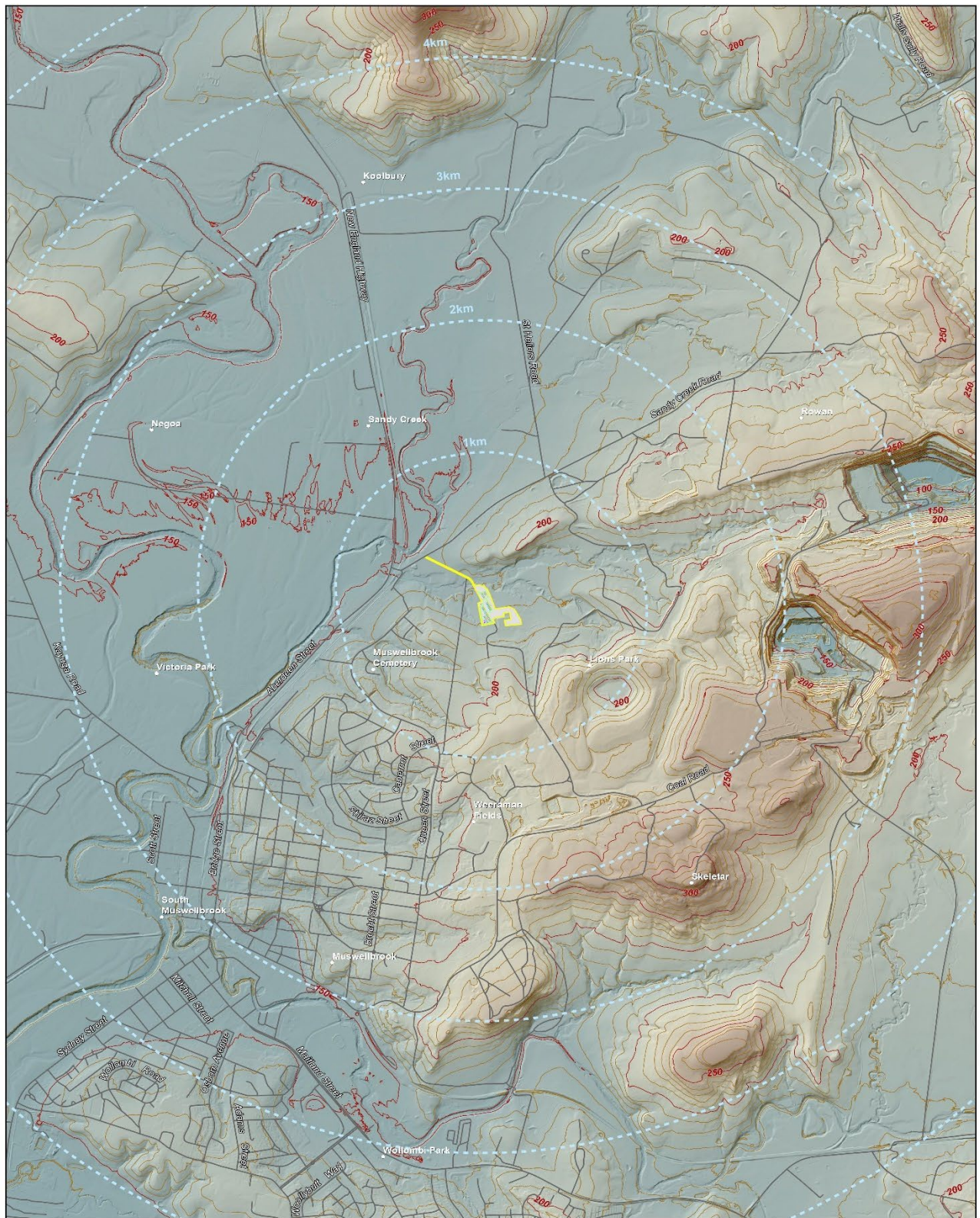


FIGURE 4-1 SITE LOCATION PLAN



Key:

- Development site
- Distance from site boundary
- Contour (50m)
- Contour (10m)

FIGURE 4-2 TOPOGRAPHY

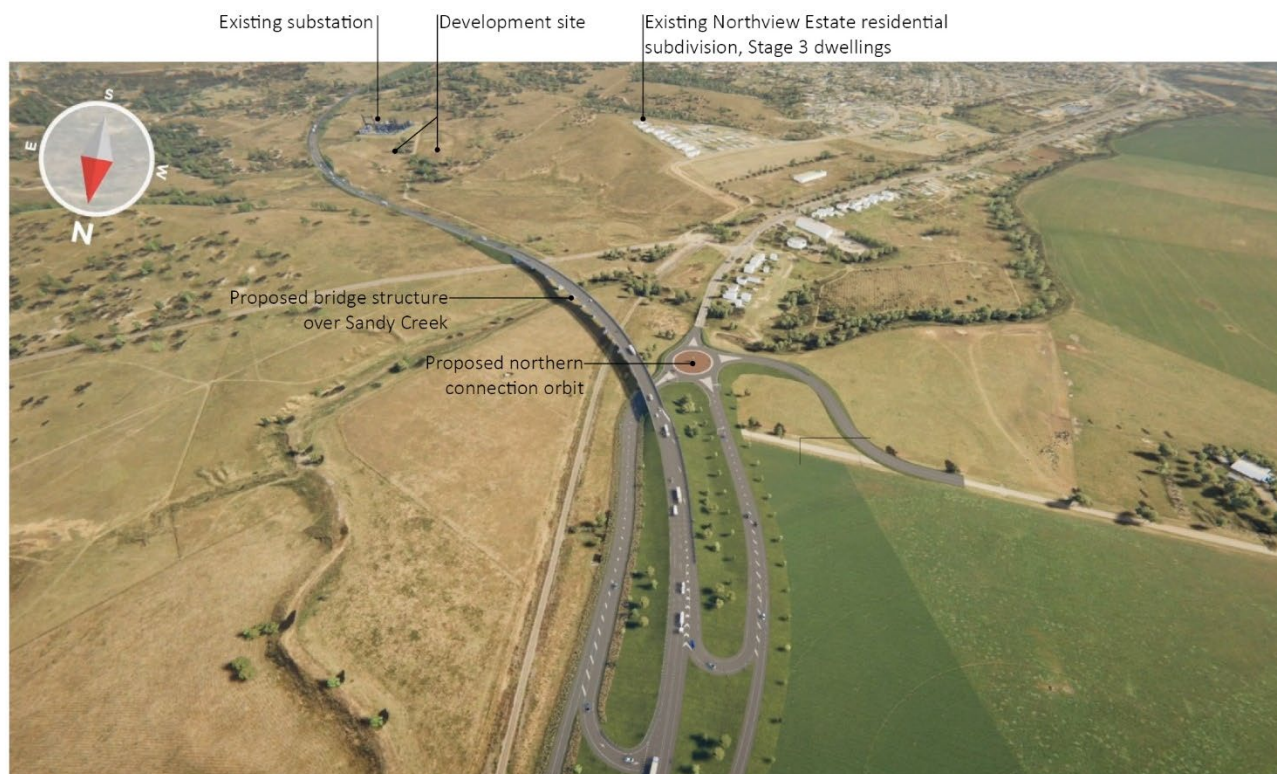
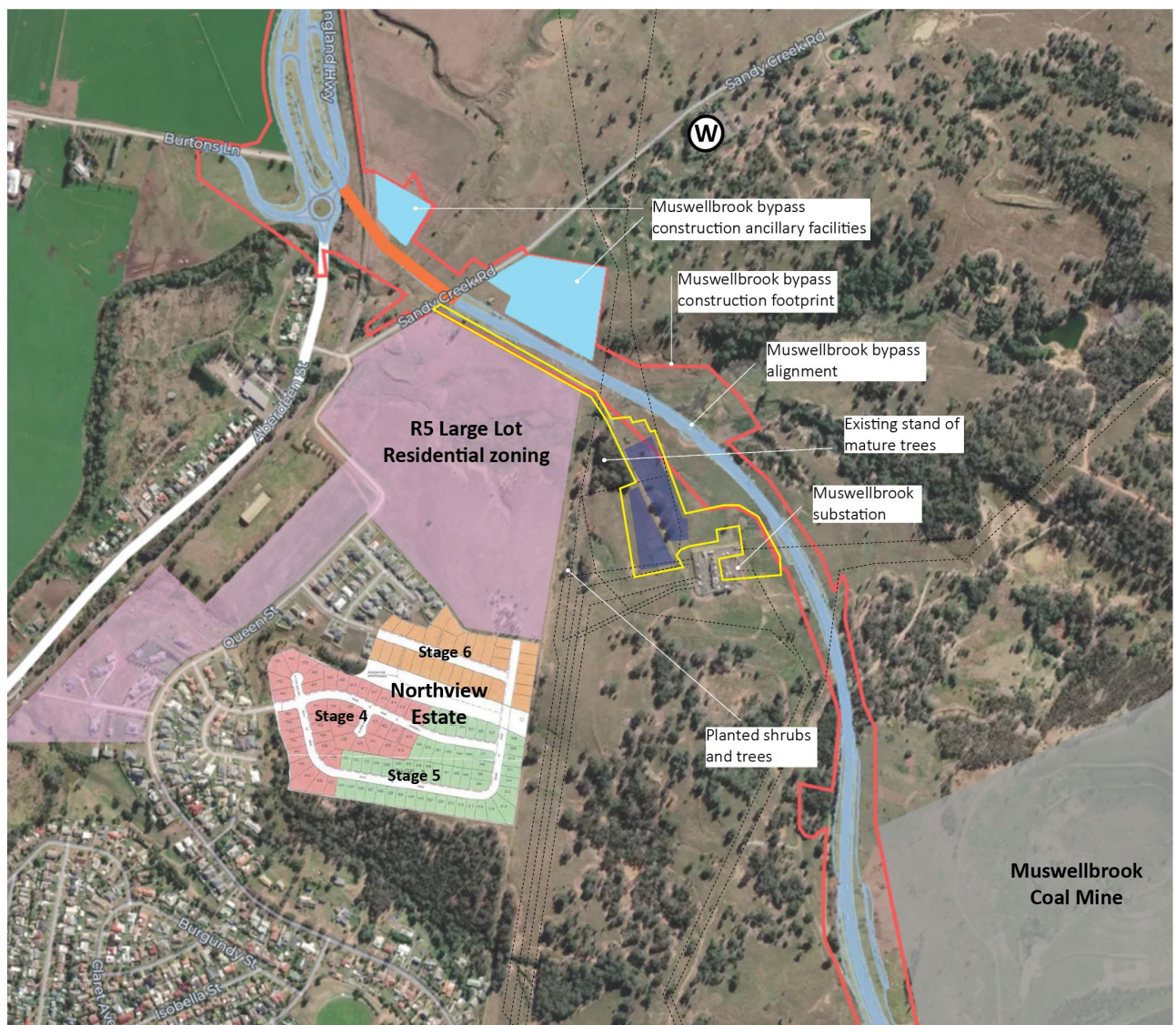


FIGURE 4-3 PROPOSED MUSWELLBROOK BYPASS (IMAGE SOURCE: TFNSW MUSWELLBROOK BYPASS REF WEB PORTA, NOTES ADDED BY IRIS)



KEY

- Development site
- Approximate location of BESS containers
- Existing transmission lines
- W Place of worship

Muswellbrook Bypass:

- Construction footprint
- Construction ancillary facilities

FIGURE 4-4 SITE CONTEXT PLAN, SHOWING NORTHVIEW ESTATE, FUTURE LARGE LOT RESIDENTIAL AND MUSWELLBROOK BYPASS (RED - CONSTRUCTION FOOTPRINT, BLUE - BYPASS, FROM EIS)



FIGURE 4-5 VIEW SOUTHEAST ACROSS DEVELOPMENT SITE SHOWING PASTURE FIELDS, TREES AND EXISTING SUBSTATION



FIGURE 4-6 EXISTING GROUP OF MATURE TREES TO THE WEST OF THE DEVELOPMENT SITE



FIGURE 4-7 EXISTING TRANSMISSION LINES AND PLANTED SHRUBS AND TREES TO THE WEST OF THE DEVELOPMENT SITE



FIGURE 4-8 EXISTING VEGETATION TO THE WEST OF DEVELOPMENT SITE

5. Visual Impact Assessment

5.1. Methodology

5.1.1. Identify the visual catchment

The visual catchment is the area from which the proposal would be seen. This area has been identified using a digital surface model (landform only) and the height of the proposed BESS enclosures in GIS software.

The visual catchment area does not include the screening effect of existing trees or future proposed trees and screening vegetation. However, this identifies the areas where there is the potential for a direct line of sight between the BESS and surrounding areas. This area was the basis for field investigations.

5.1.2. Identifying receptors

Views have been selected from within the visual catchment to represent the range of locations from which the proposal would be seen from the public domain. These viewing locations have prioritised locations where there would be a larger number of potential viewers, such as the highway, but also includes views from local streets and lanes of existing and proposed residences.

5.1.3. Assessment steps

An assessment of each view has been undertaken in the following steps:

- Describe the existing conditions seen in the view
- Identify the sensitivity of the viewer (refer Table 6-1)
- Identify the magnitude of change created by the proposal (refer Table 6-2)
- Combine these characteristics to assign a level of visual impact (refer Table 6-3).

Visual sensitivity

Visual sensitivity combines the nature of the viewer and quality of the view. The nature of the view takes into account the number of viewers and duration of a view, as well as the activity taking place at the viewing location. Locations from which a view would potentially be seen for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers, would be regarded as having a higher visual sensitivity.

In addition, any views recognised by local, state or federal planning regulations would, by nature of their recognition in these documents, increase the sensitivity level of the view. Table 6-1 describes the sensitivity levels that have been used for this assessment.

TABLE 5-1 VISUAL SENSITIVITY LEVELS

Sensitivity	Description
High	Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or a designated view in a natural area to a landscape of high visual amenity. It may be a view from of regional open space or designated viewpoint for example. These views are generally unique or uncommon within the regional landscape.
Medium	Views experienced by a concentration of residents and/or local recreational users, views identified in the planning provisions as having value to the wider community, and / or views with moderate level of visual amenity and visual coherence. These may be a gateway view, view from an identified scenic route and/or large numbers of road or rail users, and or/ views to important visual features. These views are less common within the landscape.
Low – medium	Views from a moderate number of receptors, and / or views including local features which are identified in the planning provisions as having value to the local community, and / or views with a minor to moderate level of visual amenity and visual coherence. These may be views seen from the entry to a place, a local collector road, a view with some landscape features, and views from larger groups of residences.
Low	Views from a small number of receptors, and / or views not including features identified in the planning provisions as having value to the wider community, and / or views which have a lower or fragmented quality and lacks coherence. These may be views seen from local roads, briefly glimpsed views to landscape features, and views from small groups of residences. These views are likely to be common within the landscape.

Magnitude of change

Magnitude is the ... “*measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.*” (TfNSW 2020)

The magnitude of change considers the extent of change resulting from the proposal and the compatibility of these new elements with the surrounding landscape.

Magnitude of change will be determined by characteristics of the view, such as distance, landform, backdrop, intervening vegetation etc. There are also characteristics of the proposal which are: scale, form and line/alignment. Changes to a view can result in an improvement or reduction in visual amenity.

A high magnitude of change would result if the development contrasts strongly with the existing characteristics of the view. A low magnitude of change occurs if there is a high level of integration of form, line, shape, pattern, colour or texture values between the proposal and its visual setting.

In some circumstances, there may be a visible change to a view which does not alter the amenity of the view. This would be due to the compatibility of the proposal and capacity of the view to accommodate the change without losing valued elements. Table 7-2 lists the categories used to describe the magnitude of change.

TABLE 5-2 MAGNITUDE LEVELS

Magnitude	Description
High	The proposal is visually dominant and / or contrasts substantially with the character of the view. It would result in a substantial change in the amenity of the view.
Medium	The proposal is somewhat prominent and / or is not compatible with the character of the view. It would result in a noticeable change in the amenity of the view.
Low	The proposal is not visually prominent and / or is visually compatible with the character of the view. It would result in a slight change in the amenity of the view.
Negligible	The proposal is not visible, is not visually prominent in the view and / or is compatible with the character of the view. It would result in no perceived change in the amenity of the view.

Assigning impact levels

A visual impact level has been determined for each view by combining the sensitivity and magnitude level according to the matrix presented in Table 6-3.

This matrix is based on the ‘Landscape character and visual impact rating matrix’ contained in the *Guidance note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment* (Figure 7, p.12, TfNSW, 2020).

TABLE 5-3 VISUAL IMPACT LEVELS

	High sensitivity	Medium sensitivity	Low - medium sensitivity	Low sensitivity
High magnitude of change	High adverse	High – moderate adverse	Moderate adverse	Moderate – minor adverse
Medium magnitude of change	High – moderate adverse	Moderate adverse	Moderate – minor adverse	Minor adverse
Low magnitude of change	Moderate adverse	Moderate-minor adverse	Minor adverse	Minor adverse
Negligible magnitude of change	Negligible	Negligible	Negligible	Negligible

5.2. Description of visual catchment

The visual catchment for this proposal is limited by the surrounding undulating landform (refer to Figure 4-2 and Figure 5-1). Generally, it extends:

- About 200 metres to the north of the site, across fields to a small ridgeline
- A short distance to the east and southeast, including rural fields and west facing low hills extending between the terraces of Muswellbrook Coal mine and Skeletar Hill, including the areas that would be the future Muswellbrook Bypass
- A short distance to the south of the development site including pasture fields zoned C3 Environmental Management
- To the west of the development site, about 370 to 700 metres across the fields located between the development site and the Main North railway line (zoned R5), across the northern section of Queens Street and extending to a small ridgeline southwest of the site, at the edge of the dwellings in Northview Estate
- There are some areas to the northwest, where the valley opens up, that extend across the New England Highway to the fields extending along the Hunter River over several kilometres.

This visual catchment was used to inform fieldwork and the selection of viewpoints for the assessment of public domain views and views from private dwellings.

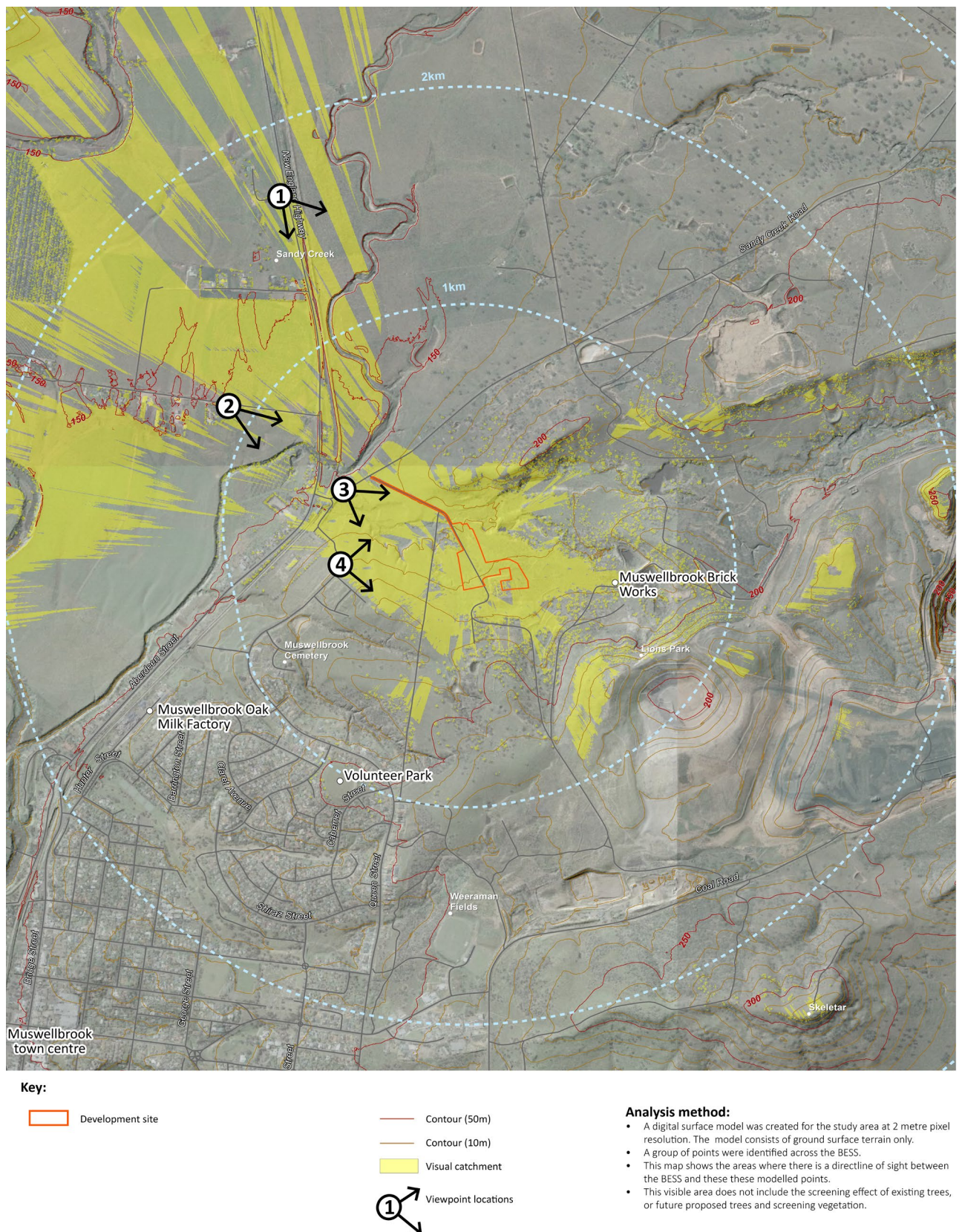


FIGURE 5-1 VISUAL CATCHMENT AND VIEWPOINT LOCATIONS

5.3. Assessment of representative viewpoints – Public Domain

Viewpoints from the public domain were selected to represent the views from nearby roads such as the New England Highway and Sandy Creek Road, and nearby rural and urban dwellings, including along Queen Street and Burton Lane.

The location of these views is shown in Figure 5-1 and an assessment of visual impact has been summarised in the following pages.

These representative views are:

- Viewpoint 1: View south from the New England Highway
- Viewpoint 2: View east from Burtons Lane
- Viewpoint 3: View east from Sandy Creek Road
- Viewpoint 4: View east from Queen Street.

Note, the visual catchment map (refer section 5.2 of this report) and site investigations confirmed that there would not be a view to the proposal from the following locations, and therefore there would not be a visual impact from these locations:

- Nearby recreational facilities including Volunteer Park and the Weeraman Sporting Fields
- Coal Road and northern parts of Sandy Creek Road
- Muswellbrook cemetery
- Muswellbrook Brick Works and Muswellbrook Oak Milk Factory (Local heritage items, Muswellbrook LEP 2009)
- Town centre of Muswellbrook, including Muswellbrook Railway Station (State Heritage Register item).

5.3.1. Viewpoint 1: View south from the New England Highway

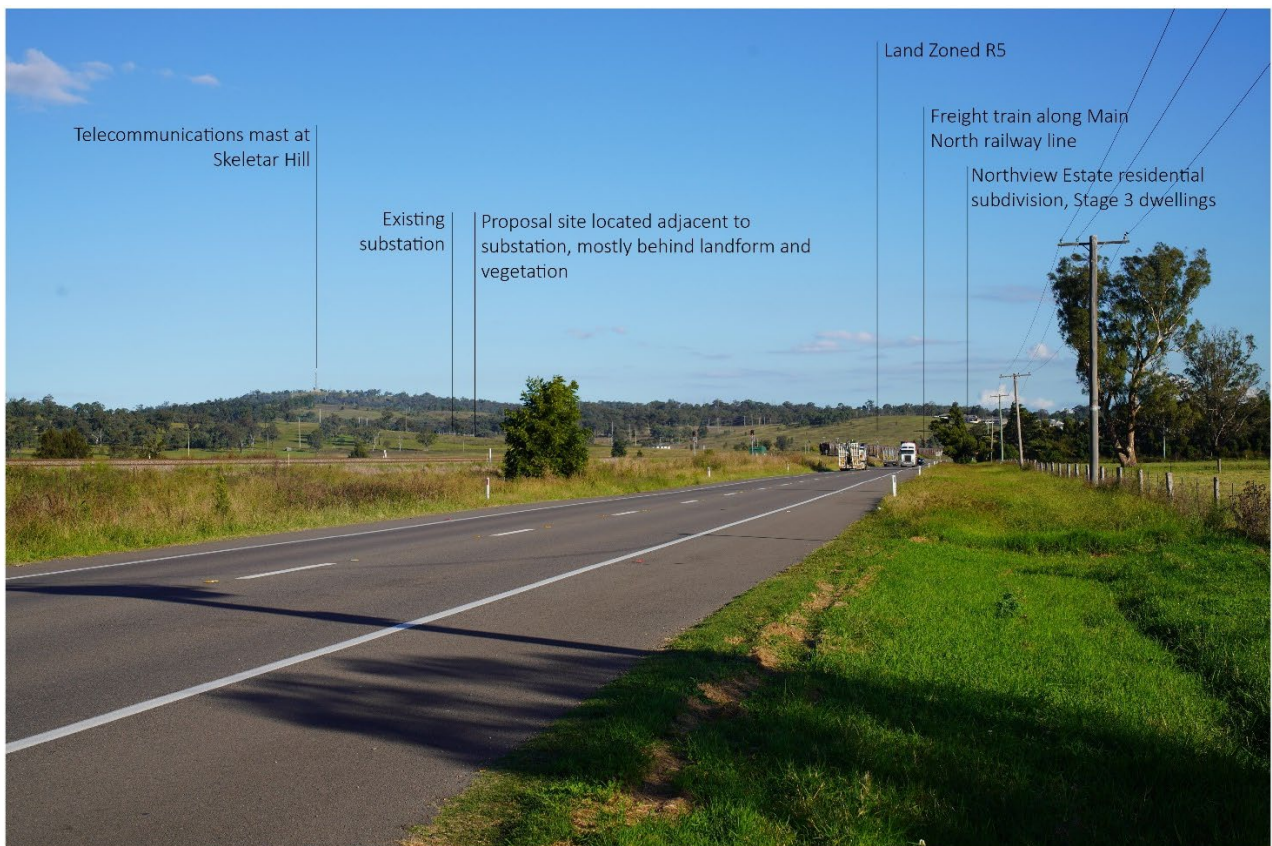


FIGURE 5-2 VIEWPOINT 1: VIEW SOUTH FROM THE NEW ENGLAND HIGHWAY

Existing conditions: This view shows the northern approach to Muswellbrook, along the New England Highway. The highway is two lanes wide, with scattered vegetation, allowing clear views to the adjacent fields. The Main North railway line is visible to the east (left of view), aligned parallel to and slightly elevated from the highway, which carries freight and passenger trains regularly. There is a glimpse to the upper part of Muswellbrook substation, rising above the undulating landform in the middle ground of view. There are also a variety of transmission line structures and overhead wires converging on the existing substation. Skeletar Hill forms a backdrop to this view and includes a telecommunication mast which rises above the surrounding vegetation.

This section of the Highway would be upgraded as a part of the Muswellbrook Bypass, and the proposed northern connection orbit would be seen in the middle ground of this view, including a long bridge structure over Sandy Creek, east of the highway, that would largely block views to the substation and development site.

Sensitivity: The New England Highway provides one of the main entries into Muswellbrook from rural areas to the north including Scone. The view includes intermittent views to local landscape features including a backdrop of partly vegetated ridgelines including Skeletar Hill. This view is of **medium** visual sensitivity.

Visual impact during operation: The BESS would be glimpsed in the middle to background of this view, at a distance of about 1.7 kilometres. From this location the landform and vegetation to the north west of the development site would mostly screen views to the ground level, including the majority of the enclosures, noise walls and operations and maintenance building. There may be glimpses to the proposed BESS substation, which may be seen immediately to the north of the existing substation and be of similar character. The height of the proposed substation infrastructure would not rise as high as the adjacent existing substation, which is on a platform raised above the development site.

It would be viewed against a backdrop of vegetation and hills, including Skeletar Hill. It would be viewed in the context of an existing substation and network of transmission lines, as well as the traffic passing in each direction along the highway and rail corridor.

This impact would be experienced from vehicles on the highway moving at speeds of up to 100 km/hr so that it is seen for only a few seconds on the journey to Muswellbrook.

Overall, the proposal would comprise a small part of this panoramic view and would not detract from the landscape features of the surrounding partly vegetated ridgelines and hills which are seen from this location. There would be a negligible magnitude of change and a **negligible visual impact** from this location.

As this view is transformed by the Muswellbrook Bypass, the BESS is likely to be completely blocked from view and there would continue to be a **negligible visual impact** from this location.

5.3.2.Viewpoint 2: View east from Burtons Lane



FIGURE 5-3 VIEWPOINT 2: VIEW EAST FROM BURTONS LANE

Existing conditions: This view shows the rural landscape on the northern outskirts of Muswellbrook, extending along the Hunter River and Sandy Creek valleys. The New England Highway is visible in the middle ground of view. Beyond this, the Main North railway line can be seen on a small embankment, with freight and passenger trains seen regularly crossing the view. The rolling hills around Skeletar Hill provide a scenic backdrop to the view. Further to the north, a small part of Muswellbrook Coal Mine can be seen on the ridgeline which encloses this view, including part of an exposed rock terrace.

The proposed northern connection orbit of Muswellbrook Bypass would transform the fore and middle ground of this view. This would include a large roundabout and bridge structure extending over Sandy Creek.

Sensitivity: This view is from a small rural road which provides access to several rural properties. The view includes local landscape features including the rolling hills around Skeletar Hill. This view is of **low visual sensitivity**.

Visual impact during operation: The BESS would be located in the middle ground of this view, about one kilometre from this location. The intervening landform to the north of the site, vegetation along Sandy Creek and the group of trees immediately northwest of the development site would mostly screen views to the proposal, including the battery enclosures, noise walls, operations and maintenance building and proposed substation.

Where visible, the BESS infrastructure would be viewed against a backdrop of vegetation and hills and would be absorbed into the surrounding view. The proposal would also be viewed in the context of traffic passing in each direction along the highway and rail corridor. Overall, there would be a negligible magnitude of change and **negligible visual impact**.

In the future, a large new roundabout and bridge structure associated with the proposed Muswellbrook Bypass, which would further screen views to the BESS. As this view is transformed by the Muswellbrook Bypass, the BESS is likely to be completely blocked from view and there would be a **negligible visual impact** from this location.

5.3.3. Viewpoint 3: View east from Sandy Creek Road



FIGURE 5-4 VIEWPOINT 3: VIEW EAST FROM SANDY CREEK ROAD

Existing conditions: This view is possible from a short section of Sandy Creek Road on the outskirts of Muswellbrook. This view includes rolling pasture fields, together with the existing substation (centre of view), and a glimpse to the low density residential development (Northview Estate, right of view). The northeast facing fields (right of view), are zoned R5 Large Lot Residential. The partly vegetated hills beyond, between Skeletar Hill and Muswellbrook Coal Mine, provide a backdrop to this view.

The proposed Muswellbrook Bypass would transform this view, with the new highway passing over Sandy Creek Road to the north of this location and extending across the view, beyond the site.

Sensitivity: This view is from a local road which provides access to local rural properties and community facilities including a place of worship. The view includes a glimpse to Skeletar Hill which is local landscape feature. This view is of **low visual sensitivity**.

Visual impact during operation: The BESS would be visible in the middle ground of this view, about 500 metres at the closest point. From this location, the

trees immediately northwest of the development site would screen views to the northern areas of the proposal, including the operations and maintenance compound, northern area of battery enclosures, and proposed BESS substation. There would be a glimpse to the southern area of the BESS, including noise barriers which would surround the battery enclosures and site fencing.

Where visible, the BESS would be viewed against a backdrop of vegetation and hills, and in the context of an existing substation and network of transmission lines. The proposal would comprise a small part of this view. Overall, there would be a low magnitude of change and **minor adverse visual impact** from this location.

The proposed screening vegetation along the southwestern boundary of the development site would establish over time and provide further screening of the noise walls and fencing. When the vegetation establishes, the BESS would be screened and there would be a negligible magnitude of change and a **negligible visual impact**.

5.3.4. Viewpoint 4: View east from Queen Street



FIGURE 5-5 VIEWPOINT 4: VIEW EAST FROM QUEEN STREET

Existing conditions: The development site is not visible from most of Queen Street due to screening by intervening landform and vegetation within the fields to the northwest and west of the site (refer to visual catchment, Figure 6-1). The development site can be seen, however, from the northern end of Queen Street, between Sandy Creek Road and Lonhro Place, where the road rises from Sandy Creek, and there are broader views across the Hunter River and Sandy Creek valleys.

The field in the foreground of the view is zoned R5 Large Lot residential. Beyond this field, the upper section of Muswellbrook substation can be seen, viewed against a backdrop of vegetation as well as a glimpse to the upper exposed terraced of Muswellbrook Coal Mine. Further to the north, Bells Mountain provides a scenic backdrop to this view.

Sensitivity: This view is from a local road which provides access to nearby residences at Northview Estate. This area will be transformed to include dwellings on large lot residential properties. The view includes local landscape features including the rolling hills around Bells Mountain. This view is of **low visual sensitivity**.

Visual impact during operation: The BESS would be seen in the middle ground of this view, at a distance of about 450 metres at the closest point. From this location, the northern and southern parts of the development site would be screened by the trees immediately northwest of the site and intervening landform, in the view foreground.

The central part of the proposal would, however, be visible. Several large trees would be removed and there would be a noise wall surrounding the battery storage area and security fencing around the perimeter of the site. Beyond the noise wall, the upper portion of the proposed substation would be visible, which would rise several metres above the site and have a similar character to the adjacent existing substation.

These elements would comprise a small portion of the view and would be viewed against a backdrop of vegetation and hills, and in the context of an existing substation and network of transmission lines. In the future, the proposed Muswellbrook Bypass would transform this view, with the new highway passing over Sandy Creek Road and across the view to the north of

the site. Overall, there would be a low magnitude of change and **minor adverse visual impact** from this location.

The proposed screening vegetation along the southwestern boundary of the development site would establish over time and provide further screening of the noise walls and fencing. From this location this additional vegetation would also provide some additional screening of the existing substation and would provide some localised screening of the future Muswellbrook Bypass.

When the vegetation establishes, the BESS would be mostly screened and there would be a negligible magnitude of change and **negligible visual impact** on views from this location.

5.3.5. Summary of visual impacts - Public domain

The site investigations confirmed that there would be a limited number of locations in the public domain from which the project would be seen. From these locations there would be a **minor adverse to negligible visual impact**. The following table (Table 5-4) summarises the impacts identified in the viewpoint assessment.

There were no scenic or significant vistas impacted by the project.

TABLE 5-4 SUMMARY OF VIEWPOINT ASSESSMENT

Viewpoint number and location	Sensitivity	Magnitude	Visual impact	Visual impact with screening vegetation
Viewpoint 1: View south from the New England Highway	Medium	Negligible	Negligible	Negligible
Viewpoint 2: View east from Burtons Lane	Low	Negligible	Negligible	Negligible
Viewpoint 3: View east from Sandy Creek Road	Low	Low	Minor adverse	Negligible
Viewpoint 4: View east from Queen Street	Low	Low	Minor adverse	Negligible

5.4. Visual Impact Assessment – Private domain

This section provides an assessment of the impact on views from private residences in close proximity to the proposal.

5.4.1. Methodology

Due to the limited potential for a view from private dwellings, the following assessment has been undertaken in the following steps:

- Identify potential dwellings within 2 kilometres of the site
- Identify the potential views from dwellings in this area (based on observations from adjacent publicly accessible areas)
- Describe the potential change to views from these areas
- Determine whether there would be a potential visual impact from these locations.
- Describe the mitigation measures proposed to reduce any impacts.

If the potential for a moderate to high visual impact is identified, further detailed visual assessment would be required.

5.4.2. Identify private dwellings

Figure 5-6 identifies the dwellings within two kilometres of the site. It shows:

- Scattered rural dwellings in areas to the northwest, mostly outside the potential visual catchment of the proposal
- Scattered rural dwellings in areas to the northeast of the development site are outside the potential visual catchment of the proposal
- There are no dwellings to the east and south of the development site (areas zoned C3 and including Muswellbrook coal mine)

- There are a large number of dwellings to the southwest of the development site within the Northview Estate. These dwellings are mostly outside the potential visual catchment of the site, however, there is the potential for views from dwellings on the northern side of Lonhro Place
- To the southwest of the development site there is a row of dwellings along the western side of the New England Highway and Aberdeen Street. Some of these dwellings are within the potential visual catchment of the site.

Note, the church at 88 Sandy Creek Road is not within the potential visual catchment of the site. There would be no view to the proposal from this place due to intervening landform.

5.4.3. Assessment of views from residential properties

The assessment of views from residential properties is contained in Table 5-4. Figure 5-6 shows the location of residential properties within two kilometres of the development site.

This analysis identifies negligible visual impact from existing dwellings to the northwest, north and southwest. There would be the potential for a minor visual impact from existing dwellings to the south and southwest of the development site in Northview Estate along the northern side of Lonhro Place. However, this impact would be reduced to negligible with the implementation of the proposed screening vegetation.

There is also the potential for views from future private dwellings if they were to be developed on the fields between the Northview Estate and the development site, on R5 Large Lot Residential zoned land and within future stages of Northview Estate (refer to Figure 5-6. Screening vegetation has been proposed to reduce any potential view to the proposal from these future dwellings.

TABLE 5-5 SUMMARY OF VIEWPOINT ASSESSMENT

Dwelling location	Existing view	Potential magnitude of change	Visual impact	Mitigation measure
A. Northwest of the development site - Dwellings on Burtons Lane and Koolbury Flats Row (about 11 dwellings)	View to surrounding rural landscape including views towards the site and to Bells Mountain and Skeletar Hill. Existing vegetation within the gardens of these and along intervening fields together with intervening landform, would restrict views towards the site. The view includes the existing highway and railway line in the middle ground. There would also be a large intersection and elevated highway bridge in the middle ground of views, proposed as part of the proposed Muswellbrook Bypass.	Any glimpses to the proposal would be seen at about one kilometre from the site and would not alter the amenity of this view.	Negligible	The proposed landscape screening would further reduce visibility of the proposal
B. West of the development site - Dwellings along the New England Highway and Aberdeen Street (about 8 dwellings)	Views from these dwellings would include the highway and railway in the foreground. The embankments along the Main North railway line, undulating fields and existing vegetation would limit views to the site. The hills and mountains to the north and east of the site would enclose these views. This view would be altered with a proposed intersection and elevated highway bridge in the middle ground of views, proposed as a part of the proposed Muswellbrook Bypass.	Any glimpses to the proposal would be seen at about 700 metres from the site and would not alter the amenity of this view.	Negligible	The proposed landscape screening would further reduce any visibility of the proposal
C. Southwest of the development site - Dwellings on the northern side of Lonhro Place, in the Northview Estate (about 8 dwellings)	There is the potential for views to the development site from the upper-level windows of these dwellings across the fields (zoned R1 General residential) north and northeast towards Bells Mountain and Skeletar Hill. Existing vegetation to the northwest of the site would provide some screening of the northern areas of the site. There would also be some localised screening provided by the existing screening vegetation along the southwestern boundary of the site. These views would include the existing substation and existing transmission lines. In the future there would also be a new highway, the Muswellbrook Bypass, including noise walls, an elevated highway bridge and large orbital intersection with the existing highway (west of view).	The northern areas of the BESS would be screened by the existing vegetation, and any glimpses to the noise barriers in this area would be absorbed into the background of the view. The southern areas of the BESS would be visible, including the noise barriers, fencing and additional substation. These elements would be seen in the context of the existing substation and transmission lines and would have a similar character.	Minor adverse	The proposed landscape screening along the southwestern boundary would further reduce visibility of the proposal. Upon establishment of this vegetation, the residual visual impact would be negligible.

Dwelling location	Existing view	Potential magnitude of change	Visual impact	Mitigation measure
D. Southwest of the development site -Future R5 Large lot residential development	There is the potential for additional views to the development site from future dwellings in the northeast facing fields directly adjacent to the site, currently zoned R5 Large lot residential. These views would include a backdrop of Bells Mountain and Skeletar Hill. The existing vegetation to the northwest of the site would provide some screening of the northern areas of the site. There would also be some localised screening provided by the existing screening vegetation along the southwestern boundary of the site. These views would include the existing substation and existing transmission lines. In the future there would also be a new highway, the Muswellbrook Bypass, including noise walls, an elevated highway bridge and large orbital intersection with the existing highway (west of view).	The northern areas of the BESS would be screened by the existing vegetation, and any glimpses to the noise barriers and upper portion of the substation in this area would be absorbed into the background of the view. The southern areas of the BESS would be visible, including the noise barriers, fencing and additional substation. These elements would be seen in the middle ground of these views, and seen in the context of the existing substation, transmission lines and future Muswellbrook Bypass. It is expected that these dwellings would include vegetation within their properties to screen views to this infrastructure.	Minor adverse	The proposed landscape screening along the southwestern boundary would further reduce visibility of the proposal. After this vegetation reaches a height of about five metres, the residual visual impact would be negligible.

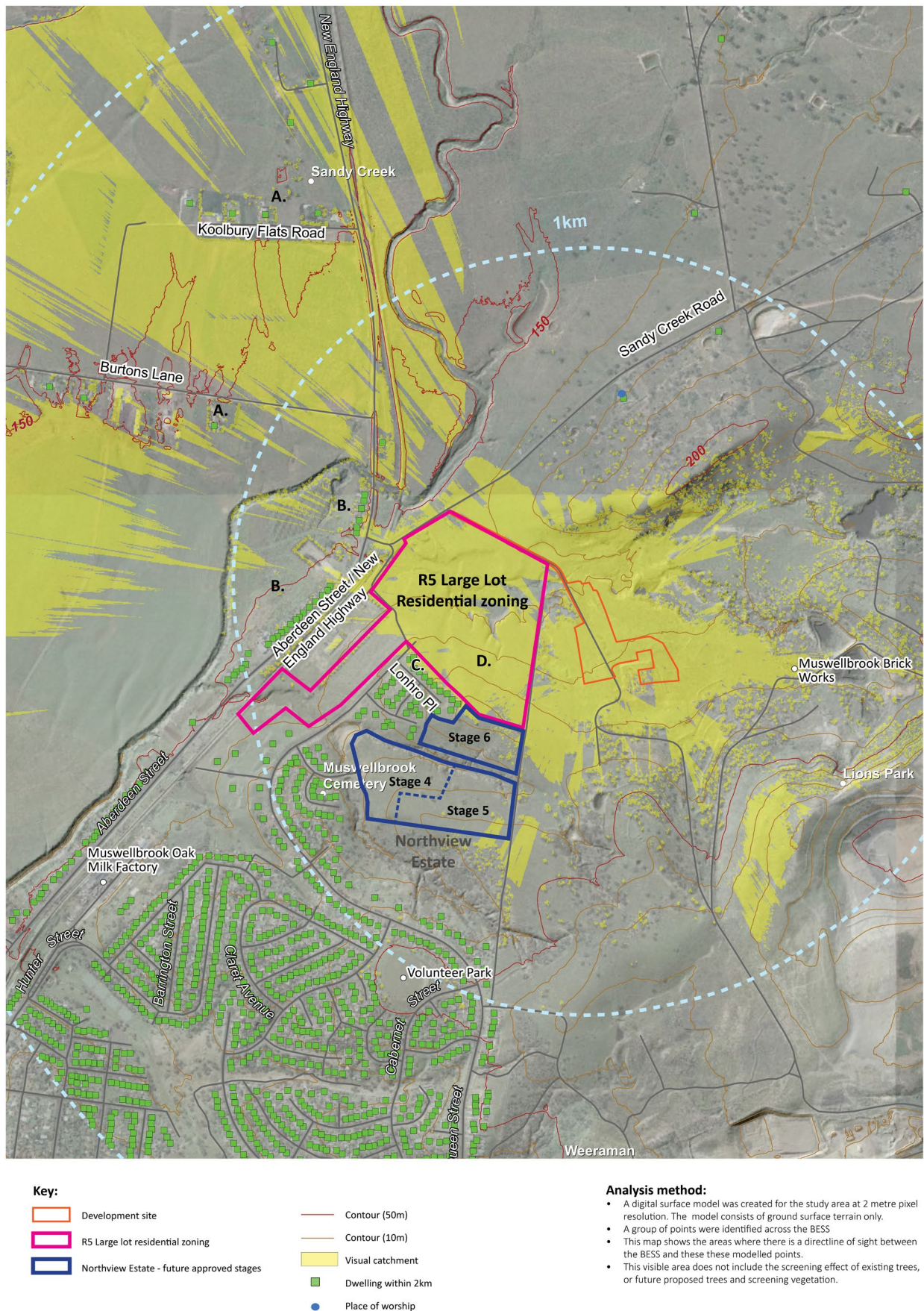


FIGURE 5-6 LOCATION OF RESIDENTIAL DWELLINGS NEAR THE DEVELOPMENT SITE

5.5. Views at night

5.5.1. Methodology

The assessment of night-time impact has been carried out with a similar methodology to the daytime assessment. However, the assessment also draws upon the guidance contained within AS4282 *Control of the obtrusive effects of outdoor lighting* (2019).

AS4282 identifies environmental zones which are useful for categorising night-time landscape settings. This methodology uses these environmental zones to describe the existing night-time visual condition and assign a sensitivity to these settings.

5.5.1.1. Night-time visual sensitivity

The environmental zone (defined in AS4282) which best describes the existing night-time visual condition of the development site has been selected. These zones are typical night-time settings and reflect the predominant light level of each landscape character area. Each environmental zone is assigned a level of sensitivity as described in Table 4-3.

TABLE 4-3: ENVIRONMENTAL ZONE SENSITIVITY – NIGHT-TIME

Environmental Zones (AS4282:2019)		
Sensitivity level	Description	Examples
High	A0: Intrinsically dark	UNESCO Starlight Reserve IDA Dark Sky Parks Major optical observatories No road lighting – unless specifically required by the road controlling authority
High	A1: Dark	Relatively uninhabited rural areas No road lighting – unless specifically required by the road controlling authority
Medium	A2: Low district brightness	Sparsely inhabited rural and semi-rural areas
Low - medium	A3: Medium district brightness	Suburban areas in towns and cities
Low	A4: High district brightness areas	Town and city centres and other commercial areas Residential areas abutting commercial areas

5.5.1.2. Night-time magnitude of change

The magnitude of change that would be expected within each landscape character area at night is then identified. Table 4-4 lists the categories used to describe the visual magnitude of change at night.

TABLE 4-4: VISUAL MAGNITUDE OF CHANGE LEVELS – NIGHT-TIME

Magnitude of change	Description
High	Substantial change to the level of skyglow, glare or light spill expected, and / or The lighting of the project would transform the character of the surrounding setting at night, and / or The effect of lighting would be experienced over an extensive area and / or
Medium	Considerable change to the level of skyglow, glare or light spill and / or The lighting of the project would noticeably contrast with the surrounding landscape at night and / or The effect of lighting would be experienced across a large portion of the landscape.
Low	Alteration to the level of skyglow, glare or light spill would be expected, and / or The lighting of the project would not contrast substantially with the surrounding landscape at night, and or The effect of lighting would be experienced across a small portion of the landscape.
Very Low	Either the level of skyglow, glare and light spill is unchanged or if it is altered, the change is generally unlikely to be perceived by viewers or compatible with the existing or intended future use of the area.

5.5.2. Assigning impact levels

An assessment of visual impact has been made by combining the visual sensitivity and magnitude of change levels for each representative viewpoint and assigning an impact level (refer to Table 4-5).

5.6. Assessment of views at night

Sensitivity of views at night: At night, the development area and surrounding landscape would have relatively low light levels. There would be some denser clusters of residences in the vicinity of Sandy Creek Road and the Northview Estate where there would be more dwellings and vehicles travelling along local roads, contributing to the light levels. There would also be additional light sources along the Highway where there would be headlights from moving traffic.

Overall, the development is proposed for an area of low district brightness (A2) and has a **medium visual sensitivity** at night.

With the introduction of the Muswellbrook bypass there would be further lighting, particularly at the proposed intersection with the existing highway.

Visual impact during construction: There is not expected to be any construction at night. Therefore, there would be a **negligible visual impact** at night during construction.

Visual impact during operation: During operation, there would be some minor security lighting provided at the BESS facility (lighting mounted outside the maintenance and operation building). There may also be some sensor lighting associated with the battery storage areas. This lighting would not noticeably alter the prevailing light levels in this area. As a result, there would be a negligible magnitude of change to an area of high visual sensitivity, and a **negligible visual impact** at night.

6. Ability to avoid, mitigate or offset the impacts of the project

This section summarises the ability to avoid, mitigate or offset the impacts of the project on visual amenity based on the assessment in section 5 above.

6.1. How potential impacts have been avoided/minimised

The co-location of the project adjacent to the existing Ausgrid substation has minimised visual impact relative to a greenfield development.

The proposal includes screening vegetation on the western boundary of the southern area of the development area, to respond to the potential for this area to be visible from areas to the southwest of the development area, including the future R5 Large lot residential area and Sandy Creek Road (refer to Figure 2-2). The proposal has also been located as far as possible away from the existing and proposed residences within Northview Estate.

6.2. Proposed additional mitigation measures

The application of good practice during construction and operation of the project would further minimise impacts. The following mitigation measures should be considered to further reduce the potential visual impacts identified in this assessment (refer to Table 6-1 and 6-3).

TABLE 6-1 MITIGATION MEASURES – CONSTRUCTION

ID	Identified mitigation measure
LV1	Opportunities for the retention and protection of existing trees within the development site would be identified during detailed construction planning, where practicable.
LV2	Temporary and permanent access would be designed to minimise changes to landform and visual impacts where practicable.
LV3	Lighting at the construction compound would be designed and operated in accordance with AS4282-2019 Control of the obtrusive effects of outdoor lighting.

TABLE 6-2 MITIGATION MEASURES – OPERATION

ID	Identified mitigation measure
LV4	Lighting at the BESS would be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.
LV5	The battery enclosures to be neutral colour, such as grey, to reduce their prominence where visible.
LV6	The noise barriers would be painted a dark neutral shade (such as Colourbond Woodland grey) to reduce their prominence in the landscape.

7. References

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