

2 *OPTIONS ASSESSMENT*

2.1 *CONSTRAINTS MAPPING*

In order to review the potential issues associated with infrastructure provision in the study area, the initial constraints mapping process examined the following environmental characteristics:

- planning and land use;
- ecology;
- Aboriginal and European heritage;
- acid sulphate soils
- hydrology; and
- topography.

A series of constraint maps have been developed (refer to *Figures 1a-f to 6a-f in Annex A*) in order to summarise the constraints identified from these assessments as low, moderate or potential high impact zones.

A full description of the assessments on which these maps are based is provided in *Annex B* of this report. Options for the siting of the sub-transmission line routes were then developed with a view to avoiding higher impact zones.

2.2 *DEVELOPMENT OF OPTIONS*

The study area includes extensive areas of cleared agricultural land that could provide major sections of the proposed 132kV and/or 66kV sub-transmission line routes. There are also areas with existing and likely future residential development and rural residential properties, National Park and Nature Reserve, and significant wetlands and waterways. Some sections of the study area are affected by potential flood inundation and high risk for potential acid sulphate soils.

As a result of the desktop and on-ground investigation, consideration has generally been given to the upgrade of existing infrastructure where possible to reduce the need for new corridors. Some options considered have included sections of dual circuit 66/66kV and 66/132kV.

Much of the existing 66kV line route between Mullumbimby and Ballina is situated within lower lying cleared rural land. Significant variation from this alignment would likely result in increased visual impact if located on higher ground to the west, and increase impact to vegetation and/or residential development to the east. Similarly, variation from the existing 66kV line route between Ballina and Lismore would encounter significant constraints with regard to residential development and/or the need for vegetation clearing.

A number of potential sub-options have been considered along the existing 66kV alignment between Mullumbimby to Lismore via Ballina with a view to minimising potential impacts to residential dwellings and the natural environment.

Subsequent to the preliminary environmental constraints assessment (refer *Constraints Maps* in Annex A), the design and constructability from an engineering perspective also provides guidance the selection of potential options.

2.3

OPTIONS DESCRIPTION

The proposed sub-transmission line route options are illustrated on *Figures 2.1 to 2.6* below. All of the selected options generally have good access for construction and operation as well as being constructible. For assessment purposes, the line route and study area has been divided and into six sections and are described as follows:

2.3.1 Section 1 – Mullumbimby to Ewingsdale

This section generally involves replacement of the existing 66kV sub-transmission (feeder 8505) line between Mullumbimby 132/66/11kV zone substation and the Ewingsdale 66/11kV zone substation, and construction of new 132 kV feeders to the proposed Brunswick Heads 132/11kV zone substation. The options include upgrading of the existing 66kV sub-transmission line in full or incorporating the new Brunswick Heads 132kV feeders into the proposed Lismore to Mullumbimby 132kV Network, thus negating the need to upgrade all of the 66kV line. There is potential for minor realignment to avoid residential dwellings observed to be in close proximity to the existing transmission line.

2.3.2 Section 2 – Ewingsdale to Suffolk Park

Section 2 generally involves replacement of the existing 66kV sub-transmission line (feeder 8508) between Ewingsdale and the proposed new Suffolk Park zone substation. Consideration has been given to various sub-options to avoid residential and potential environmentally sensitive areas, such in Ewingsdale (refer *Sub-option 1* in *Figure 2.2*) and Skinners Shoot (refer *Sub-option 2* in *Figure 2.2*), to the west of Byron Bay.

2.3.3 Section 3 – Suffolk Park to Lennox Head

This section generally involves the replacement of the existing 66kV sub-transmission line (feeder 8508) between the proposed new Suffolk Park zone substation and the newly constructed Lennox Head 66/11kV zone substation.

2.3.4 Section 4 – Lennox Head to near Alstonville via Ballina

Lennox Head to Ballina

This section generally involves the replacement of the existing 66kV sub-transmission line (feeder 8504) between the existing Lennox 66/11kV zone substation and the Ballina 66/11kV zone substation. Consideration has been given to potential sub-options to avoid future residential encroachment in Ballina (refer *Sub-option 3* in *Figure 2.5*) and to rationalise the existing 66kV feeders in and out of Ballina along the existing Pacific Highway alignment (refer *Sub-options 1 & 2* in *Figure 2.4*).

Ballina to near Alstonville

Option 1 – North - Ballina to near Alstonville via Tevan

This option generally involves replacement of the existing 66kV sub-transmission line (feeder 8503) exiting northward from the Ballina 66/11kV zone substation to near the Alstonville 66/11kV substation via Tevan. Consideration has been given to a number sub-options for the purpose of reducing impacts to existing residential zones to the north of Ballina (refer *Sub-options 5 & 6* in *Figure 2.4*) and at Alstonville (refer *Sub-options 4-1 to 4-3* in *Figure 2.4*).

Option 2 – South - Ballina to near Alstonville via the Bruxner Highway.

This option generally involves replacement of the existing 66kV sub-transmission line (feeder 8507) exiting westward from the Ballina 66/11kV zone substation to near the Alstonville 66/11kV substation via the Bruxner Highway (refer *Figure 2.4*). This route generally follows the existing Pacific Highway and Bruxner Highway alignments and has less potential for impacts on residential zones.

2.3.5 Section 5 – Near Alstonville to Lismore

Option 1 – Dual circuit 66/132kV on existing 66kV alignment

This option involves reconstructing the existing 66kV sub-transmission line (feeder 0897) between near Alstonville and Lismore 132/66/11kV substation to a dual circuit 66/132kV on the existing alignment (refer *Option 1* in *Figure 2.5*). Rationalisation of the line as it passes the Alstonville Zone substation will need to be considered, which could include diverting away from the existing 66kV alignment in this area (refer *Sub-options 1 & 2* in *Figure 2.5*).

Some minor realignment may also be necessary to reduce impacts to a small number of residential dwellings along the existing corridor.

Option 2 – New 132kV on new and separate alignment

This option involves construction of a new 132kV sub-transmission line along a new and separate corridor to the south of the existing 66kV alignment (refer *Option 2* in *Figure 2.5*). A short section of dual circuit has been considered to rationalise the lines near Alstonville 66/11kV zone substation. Alternatively, a new alignment bypassing Alstonville Zone Substation to the south has also been considered following existing 11kV corridor and road reserve (refer *Sub-options 1 & 2* in *Figure 2.5*).

2.3.6 Section 6 – Alstonville to Lismore, and Lismore to Lismore University

132kV sub-transmission lines from near Alstonville cont...

The proposed new 132kV line is as per *Options 1* or *2* of *Section 5* above. *Option 2* includes consideration for a section of dual circuit 66/132kV line or alternatively a new 132kV line in an existing 66kV corridor (feeder 0892) to the south of Lismore. This has been considered in order to rationalise lines feeding into the Lismore 132/66kV zone substation.

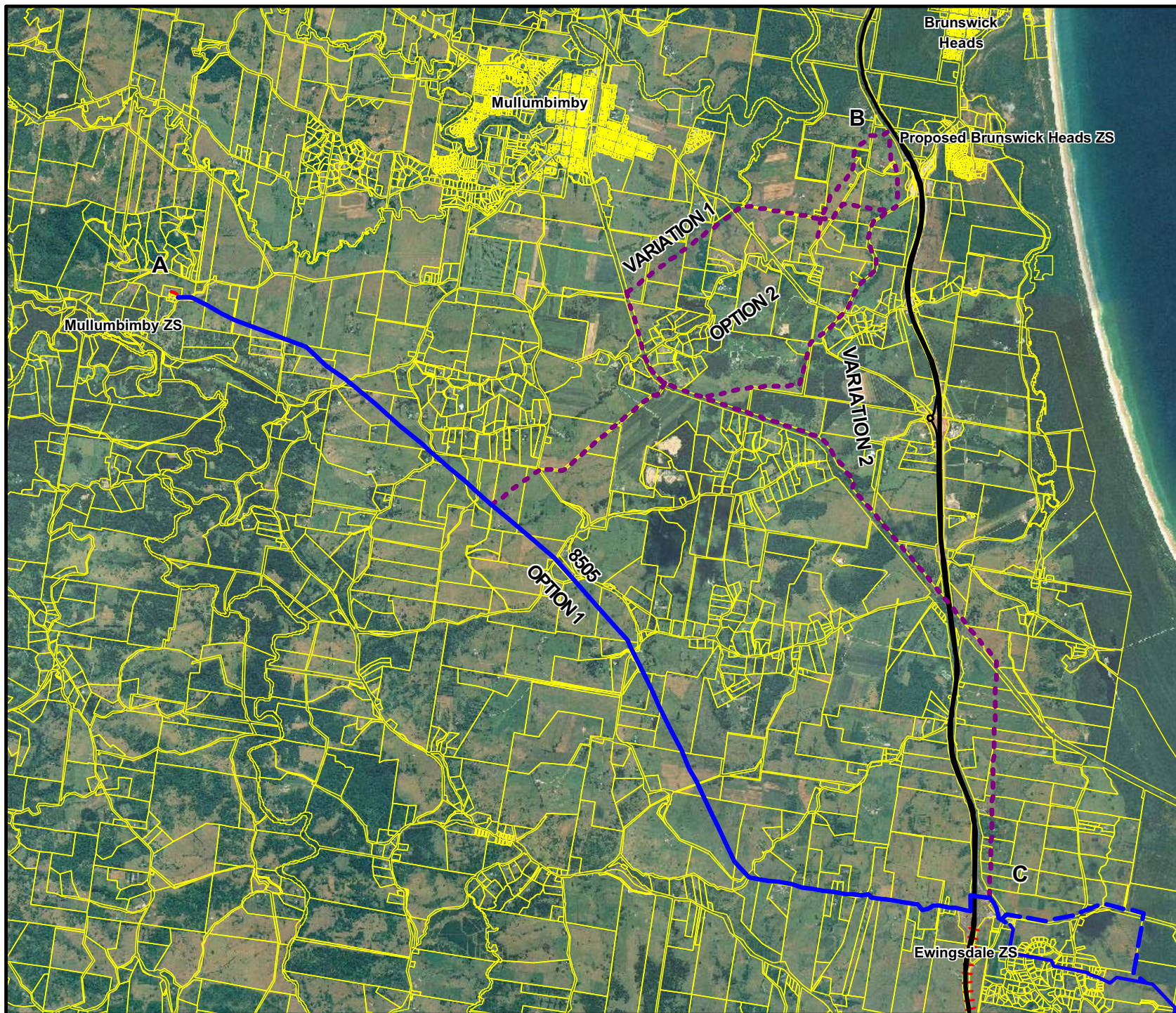
66KV feeders between Lismore 132/66/11kV zone substation and Lismore South 66kV/11kV zone substation

This option involves the construction of two new underground 66kV lines within the road reserve along Three Chain Road between Lismore 132/66kV zone substation and the existing Lismore South 66/11kV substation.

66kV sub-transmission line from Lismore South 66/11kV zone substation to Lismore University 66kV Switching Station

Two options have been identified to the south of the existing 66kV line (feeder 8501) between the Lismore South 66/11kV (*Point I*) zone substation and the proposed Lismore University Switch (*Point H2*).

Option 1 – initially follows the same alignment of the existing 66kV feeder to East Lismore 66/11kV zone substation crossing the Wilson River, then follows a new alignment further south, via the Lismore Landfill site (refer *Option 1* in *Figure 2.6*).



Legend

- New 132kV Line
Preferred Option to be determined
- Upgrade 66kV Line to 132kV
- - - New 132kV Line
Assessed by others
- Existing Substation
- Proposed Substation
- Pacific Highway
Current Alignment
- - - Pacific Highway
Preferred Route
- Cadastral Boundaries

Figure 2.1

**Mullumbimby to
Brunswick Heads
and Ewingsdale:
Aerial Photograph**

Client:	Country Energy		
Project:	Lismore to Mullum 132kV		
Drawing No:	0051706 2-1		
Date:	12/7/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		



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- Legend**
- New 132kV Line
Preferred Option to be determined
 - Upgrade 66kV Line to 132kV
 - New 132kV Line
Assessed by others
 - Existing Substation
 - Proposed Substation
 - Pacific Highway
Current Alignment
 - Pacific Highway
Preferred Route
 - Cadastral Boundaries

Figure 2.2
Ewingsdale and Suffolk Park:
Aerial Photograph

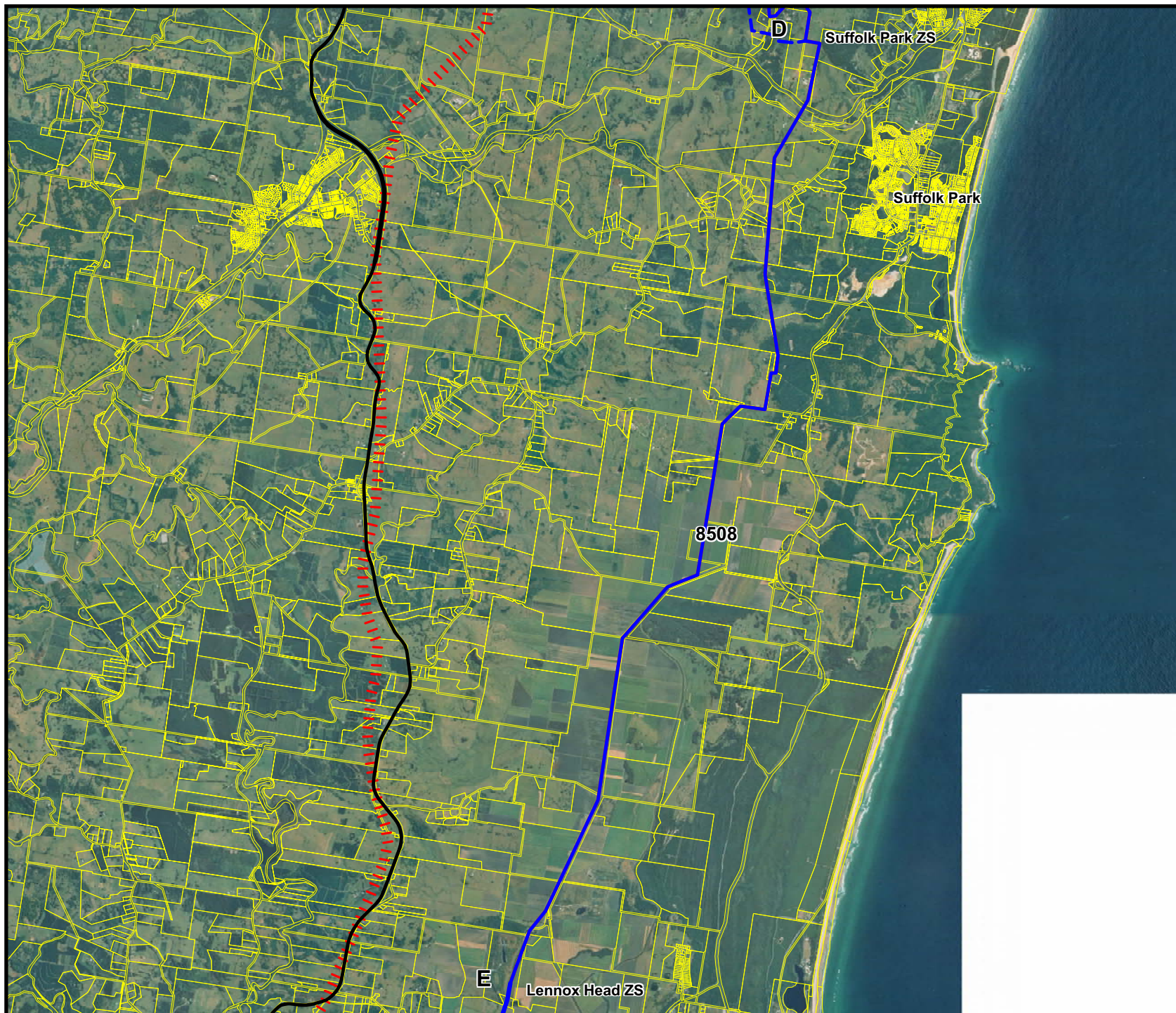
Client:	Country Energy		
Project:	Lismore to Mullum 132kV		
Drawing No:	0051706 2-2		
Date:	12/7/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		

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0
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Kilometres


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- Legend**
- — — New 132kV Line
Preferred Option to be determined
 - — — Upgrade 66kV Line to 132kV
 - Existing Substation
 - Proposed Substation
 - — — Pacific Highway
Current Alignment
 - - - - - Pacific Highway
Preferred Route
 - Cadastral Boundaries

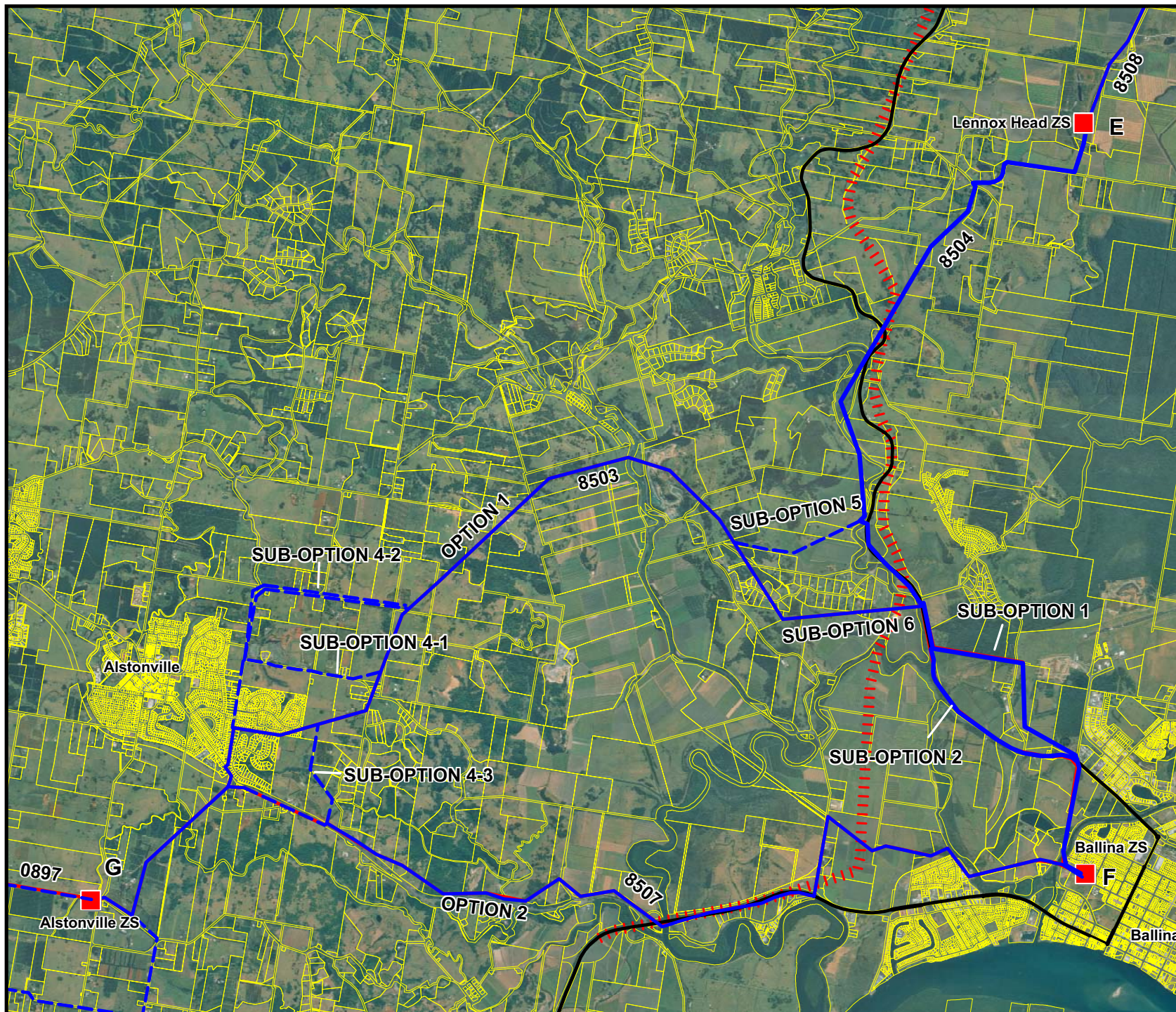
Figure 2.3
Suffolk Park to Lennox Head:
Aerial Photograph

Client:	Country Energy		
Project:	Lismore to Mullum 132kV		
Drawing No:	0051706 2-3		
Date:	12/7/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		


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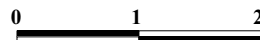


- Legend**
- New 132kV Line
Preferred Option to be determined
 - Upgrade 66kV Line to 132kV
 - Existing Substation
 - Proposed Substation
 - Pacific Highway
Current Alignment
 - Pacific Highway
Preferred Route
 - Cadastral Boundaries

Figure 2.4
Lennox Head to Alstonville
via Ballina:
Aerial Photograph

Client:	Country Energy		
Project:	Lismore to Mullumbimby		
Drawing No:	0051706 2-4		
Date:	07/11/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		


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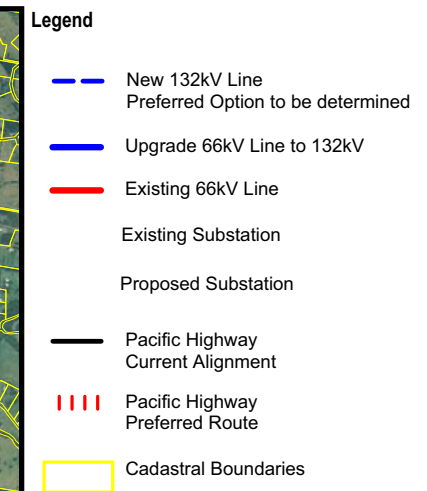
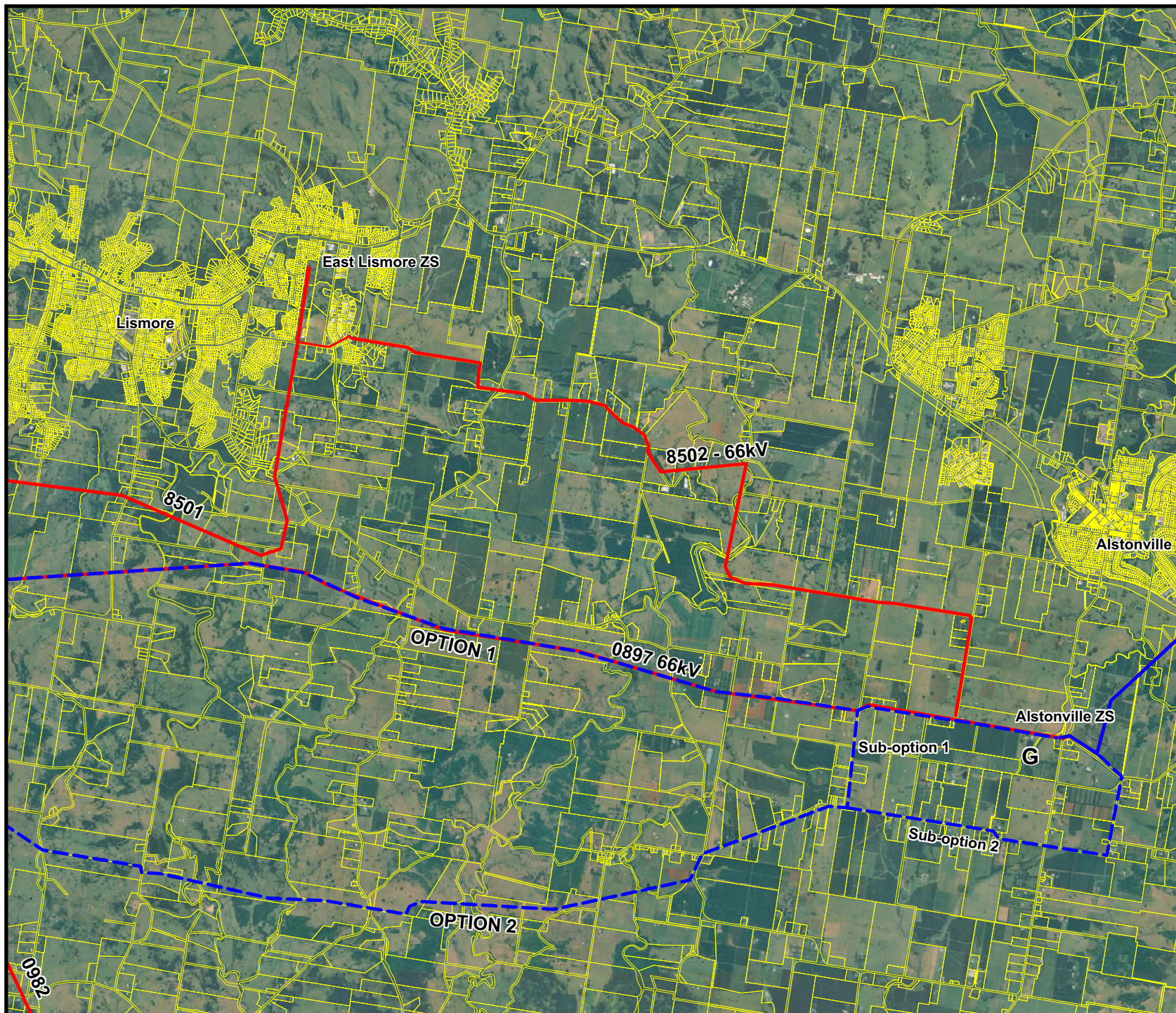
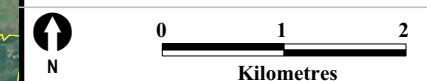


Figure 2.5
Alstonville to East Lismore:
Aerial Photograph

Client:	Country Energy		
Project:	Lismore to Mullum 132kV		
Drawing No:	0051706 2-5		
Date:	12/7/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		



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Legend

- Existing 132kV Line
- New 132kV Line
Preferred Option to be determined
- Upgrade 66kV Line to 132kV
- Proposed 66kV Line
- Existing 66kV Transmission Line
- Existing Substation
- Proposed Substation
- Cadastral Boundaries

Figure 2.6

**Lismore & Lismore University:
Aerial Photograph**

Client:	Country Energy		
Project:	Lismore to Mullum 132kV		
Drawing No:	0051706 2-6		
Date:	12/7/07	Drawing Size:	A4
Drawn By:	WW	Reviewed By:	MC
Source:	LPI 2007		
Scale:	see scale bar		



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2.4.1 Introduction

The selected transmission line options have been assessed based on the following environmental, social and engineering features:

- planning and land use;
- ecology;
- archaeology;
- flooding;
- visual sensitivity;
- property acquisition risks;
- acid sulphate soils; and
- engineering issues.

The study area and proposed main 132kV line route corridor has been divided into separate sections as identified in *Section 2.3* above for the purpose of this study.

The separate line route section descriptions below contain summaries of the assessment of the line route options using a combination of written assessment and colour coding in tabular form which indicates the significance of potential impacts. In cases where specific line route options or sub-options have been identified for comparison they appear as adjoining rows in the tables provided. Where the line is proposed for upgrade only it appears as a stand alone row in the tables.

The following provides a key for the colour coding used in the *Tables 2.1* to *2.6*:

Green/Low Impact: will create impacts that are amenable to mitigation through commonly adopted construction and operation procedures;

Amber/Medium Impact: will create impacts that can be effectively mitigated through implementation of specific mitigation measures at additional cost; and

Red/High Impact: is considered to have potential for high impacts, requiring costly financial, social or environmental mitigation measures with potential for residual impact and risk to project completion.

The following is a detailed description of the proposed line route options divided into sections and sub-options. The relevant line route sections are shown in detail in *Figures 2.1 to 2.6* above.

2.5.1 **Section 1 – Mullumbimby to Ewingsdale (via Brunswick Heads)**

Upgrade to 132kV existing 66kV between Mullumbimby and Ewingsdale

The existing 66kV corridor (feeder 8501) heads southeast from the Mullumbimby Zone sub-station (*Point A*) across mostly cleared rural land crossing a ridge at Coolomon Scenic Drive. The line then continues south east across undulating and mostly cleared rural land toward Myocum. The 66kV line crosses Myocum Road at two locations before running adjacent to this road as the line heads east to the Ewingsdale substation over the Pacific Highway (*Point C*).

The existing 66kV line passes in close proximity to several rural residences. Deviations from the existing alignment may be required in these locations. The line also spans a potentially significant stand of vegetation located along Dingo Lane. The line route is generally considered suitable for upgrading to 132kV with minimal clearing for easement requirements (if any).

An assessment of the proposed Line Route based on desktop studies and a limited site inspection is presented in *Table 2.1* below:

Brunswick Heads 132kV Feeders

Country Energy commissioned LandPartners of Lismore to undertake *Route Selection Study* for the proposed new 132kV sub-transmission line feeder in and out of the proposed new Brunswick Heads 132/11kV zone substations. LandPartners identified four potential Line Route Corridor options made up of various alternative combinations of identified corridors. The options (W, X, Y & Z) are described in the LandPartners (2006) *Route Selection Study, fc25552-Selection & Procurement of Substation & Line Routes, Brunswick Heads*.

No further options for the Brunswick Head 132kV feeders have been considered by ERM in preparing this Line Route Options Report.

Table 2.1 Line Route Options Assessment - Section 1

Feature	66kV Upgrade
Planning/ Land use	Minimal impact on agricultural use of land and rural residential areas.
Ecology	Possibly some tree clearing adjacent to the road reserve and on Dingo Lane.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Medium probability of acid sulphate soils over a small section of the line.
Flooding	Minimal potential for flood impact.
Visual sensitivity	Minimal potential impacts along existing corridor with similar or improved pole construction.
Property acquisition	Minimal land acquisition required due to most of the existing corridor being suitable width for upgrade to 132kV.
Engineering Issues	Upgrading of the line should not produce significant engineering constraints. Medium probability of acid sulphate soils over a small section of the line.

2.5.2 Section 2 – Ewingsdale to Suffolk Park 132kV

The existing 66kV line (feeder 8508) exits south from Ewingsdale zone substation before heading west through the residential area of Ewingsdale. The line then drops into low lying land via a short section of underground line.

Sub-option 1 – Bypassing Ewingsdale - A potential option for bypassing the residential area of Ewingsdale was identified to the north of the Ewingsdale Road (refer *Sub-option 1* in *Figure 2.2*). The option was also identified to avoid the land to the north of the residential area which is earmarked as the site for a new hospital. The proposed Sub-option 1 would initially cross Ewingsdale Road then follows an existing 11kV alignment to the east, adjoining Ewingsdale Road. The route would then divert to the south from Morans Hills, spanning across Ewingsdale Road and dropping into the low lying land to meet the existing 66kV line route. The proposed alignment would follow the western boundary of a stand of existing vegetation which would reduce visual impacts to receptors on the eastern fringe of Ewingsdale. The 132kV line would then follow the existing 66kV alignment toward Skinner Shoot.

The existing 66kV alignment winds through the heavily vegetated residential area of Skinners Shoot. The line enters Skinner Shoot from the west and generally follows Skinners Shoot Road before turning into Yagers Lane and on to the proposed location for the Suffolk Park zone substation. There is currently only minimal clearing of the corridor through Skinners Shoot, which has minimal pole spacing along this section of the route.

Sub-option 2 – Bypassing Skinners Shoot - A potential option for bypassing the Skinners Shoot residential area was identified further to the west (refer *Sub-option 2* in *Figure 2.2*). The proposed deviation would cross the western end of Skinners Shoot Road over the ridge and through an existing clearing in the vegetation, then onto the proposed Suffolk Park zone substation. Some vegetation clearing may be required for this sub-option, however further detailed site selection could minimise clearing impacts.

An assessment of the proposed Line Routes based on desktop studies and a limited site inspection are presented in *Tables 2.2A and 2.2B* below:

Table 2.2A *Line Route Options Assessment - Section 2*

Mullumbimby to Skinners Shoot		
Feature	Existing 66kV Alignment	Sub-option 1
Planning/ Land use	Existing impact on residential areas and minimal impact on rural land.	Minimal impact on agricultural use of land.
Ecology	Potential ecological impacts within the Skinner Shoot area with removal of vegetation.	Potential removal of some vegetation adjacent to the road reserve and within wetlands/waterways.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Sections of line within Medium Probability Acid Sulphate Soils.	Small sections of line within Medium Probability Acid Sulphate Soils.
Flooding	Potential for flood impact with low velocity flows.	Potential for flood impact with low velocity flows.
Visual sensitivity	Existing level of visual impact to continue with similar construction on existing line	Potential visual impacts along new line route sub-option, including open farmland and visibility from road. Large stand of existing vegetation can act as backdrop to the line from visual receptors to the west.
Property acquisition	Minimal land acquisition required due to most of the existing corridor being suitable for upgrade to 66kV.	Route follows some existing corridor, road reserves and paper roads, with some land acquisition likely required.
Engineering Issues	Sections of line within Medium Probability Acid Sulphate Soils and potential flood inundation. Limited corridor width in Skinners Shoot. Existing section of line is also underground.	No significant engineering constraints within sub-option itself.

Table 2.3B *Line Route Options Assessment - Section 2*

Feature	Mullumbimby to Skinners Shoot	
	Existing 66kV Alignment	Sub-Option 2
Planning/ Land use	Potential impact on residential areas and minimal impact on rural land.	Minimal impact on agricultural use of land and residential areas.
Ecology	Potential ecological impacts within the Skinner Shoot area with removal of vegetation.	Potential ecological impacts within the Skinner Shoot area with removal of vegetation.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Sections of line within Medium Probability Acid Sulphate Soils.	Small sections of line within Medium Probability Acid Sulphate Soils.
Flooding	Potential for flood impact with low velocity flows.	Potential for flood impact with low velocity flows.
Visual sensitivity	Existing level of visual impact to continue with similar construction on existing line	Potential visual impacts along new sub-option, but likely potential improvement on existing.
Property acquisition	Minimal land acquisition required due to most of the existing corridor being suitable for upgrade to 66kV.	Some land acquisition likely required.
Engineering Issues	Sections of line within Medium Probability Acid Sulphate Soils and potential flood inundation. Limited corridor width in Skinners Shoot. Existing section of line is also underground.	Small sections of sub-option line within Medium Probability Acid Sulphate Soils and potential flood inundation.

2.5.3 Section 3 – Suffolk Park to Lennox Head 132kV

The proposed upgrade would generally follow the 66kV existing alignment (feeder 8508) from the proposed Suffolk Park zone substation to the newly constructed Lennox Head zone substation. The line rises up the valley from Yagers Lane to cross Bangalow Road and the North Coast Railway. It then progress south through mostly cleared undulating farmland on high ground

The existing 66kV line passes through an existing cleared corridor through stand of vegetation to the north of Blackbutt Road. On-route to the Lennox Head zone substation it passes in close proximity to the Newrybar Swamp, which is a State significant wetland, as the line route runs along Newrybar Road. No alternative routes we deemed necessary for this section.

An assessment of the proposed Line Route based on desktop studies and a limited site inspection is presented in *Table 2.3* below:

Table 2.4 Line Route Options Assessment - Section 3

Feature	Section 1
Planning/ Land use	Minimal impact on agricultural use of land and residential areas.
Ecology	Minimal potential ecological impacts expected along the route. Possibly some minor clearing adjacent to the road reserve and within existing cleared corridors.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Sections of line within Medium probability acid sulphate soils.
Flooding	Potential flood impact.
Visual sensitivity	Existing corridor or potential improvement on existing.
Property acquisition	Minimal land acquisition required due to the existing corridor being suitable for upgrade to 132kV.
Engineering Issues	Significant proportion of line within medium probability acid sulphate soils.

2.5.4 *Section 4 – Lennox Head to Alstonville via Ballina 132kV*

Lennox Head to Ballina 132kV

The existing 66kV line route (feeder 8504) to be upgraded to 132kV continues from the Lennox Head zone substation along Newrybar Swamp Road to Ross Lane. The existing line follows a steep incline on Ross Lane near residences before heading south towards Ballina. The existing route crosses the Pacific Highway and the proposed Highway realignment then dropping to lower land along Emigrant Creek.

The existing 66kV route then follows the existing Pacific Highway alignment before crossing the proposed Highway realignment and then the Pacific Highway itself. The route then diverts east across low lying land over Gallans Road (*Sub-Option 1*) away from the Highway before again heading south to cross the Highway. It then joins in parallel with the 66kV feeder to Alstonville to cross North Creek Canal and on into the Ballina substation.

The existing 66kV feeders in and out of the Ballina substation currently pass through a proposed residential subdivision.

(Note - An opportunity to rationalise the existing line routes in and out of Ballina zone substation could include constructing a separate 132kV line along the Gallans Road approach – see *Sub-option 1* in *Figure 2.4*)

Option 1 - Ballina to Alstonville via Tevan 132kV

Exits Ballina via the existing 66kV route *as* described above. It would then generally follow the existing alignment along the Pacific Highway heading north (*Sub-option 2*) or alternatively via the Gallans Road alignment (*sub-option 1*).

The existing line then crosses the Pacific Highway and heads west toward Tevan on the existing 66kV alignment (feeder 8503). The line passes through a new residential area as it climbs steeply crossing Pacific Heights Drive in close proximity to residences.

Sub-Option 5 – in order to avoid the residences along Pacific Heights Drive, a realignment further to the north has been considered. The proposed realignment would traverse a low valley before climbing to meet the existing 66kV line at Beacons Road.

The existing line then spans from the top of the hill over an operational quarry. The potential impact on quarry operation would need to be considered in consultation with the quarry operators. The line then continues west toward Alstonville with existing cleared vegetation corridors along the route.

The existing 66kV alignment has a corridor through the middle of a residential area before heading south along Tevan Road. The line then crosses the Bruxner Highway and joins the existing 66KV from Ballina which shares the corridor into the Alstonville zone substation. The lines span a Crown Reserve and have some existing cleared corridors through vegetation.

Three options to minimise impacts on the residential development in east Alstonville have been considered. These involve realigning either along the Gap Road (*Sub-option 4-1*) or Leadbeatters Lane (*Sub-option 4-2*) to the north then along Tevan Road, or alternatively diverting from the existing alignment to the eastern side of the developed area (*Sub-option 4-3*).

Sub-option 4-3 would generally follow the eastern boundary of the Department of Primary Industries research facility and meet the existing southern approach 66kV line from Ballina (feeder 8507) before crossing the Bruxner Highway and heading toward the Alstonville zone substation.

Option 2 - Ballina to Alstonville via Bruxner Highway 132kV

An alternative to the above would be to upgrade the existing 66kV line (feeder 8507) that exits the Ballina zone substation to the west along the Pacific and Bruxner Highways.

The existing line spans state significant wetlands to the west of Ballina. The line then crosses the proposed Pacific Highway realignment in several locations. The 66kV corridor adjoins the Bruxner Highway and is mostly visible from the road all the way into Alstonville with a span across Emigrant Creek and a large span across the southern end of the Gap Road. The line joins the 66kV line from Teven before heading southwest toward the Alstonville zone substation.

An assessment of the proposed Line Routes based on desktop studies and a limited site inspection are presented in *Tables 2.4A to 2.4D* below:

Table 2.5A *Line Route Options Assessment - Section 4 - Lennox to Ballina*

Feature	Lennox to Ballina (feeder 8504)
Planning/ Land use	Minimal impact on agricultural use of land and residential areas, including new residential estate at Ballina. Sub-option may need to be considered to minimise impacts.
Ecology	Minimal potential ecological impacts expected along the route. Possibly some tree clearing adjacent to the road reserve and within existing cleared corridors.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction
Acid Sulphate Soils	A significant portion of line within High Probability Acid Sulphate Soils zone.
Flooding	Significant areas of potential flood impact.
Visual sensitivity	Largely existing corridor or potential improvement on existing. Some potential for impacts along new sub-options, but likely to be improvements.
Property acquisition	Minimal land acquisition required due to most of the existing corridor being suitable for upgrade to 132kV.
Engineering Issues	A significant portion of line within High Probability Acid Sulphate Soils zone, waterways and flood zone.

Table 2.6B *Line Route Options Assessment - Section 4 - Ballina to near Alstonville*

Ballina to Alstonville		
Feature	Option 1 - via Tevan (feeder 8503)	Option 1 - via Bruxner Highway (feeder 8507)
Planning/ Land use	Minimal impact on agricultural use. Existing impacts on residential areas, including potential new residential estate near Tevan and residential area of Alstonville. Sub-options may need to be considered to minimise impacts. Operational quarry may impact on proposed line.	Minimal impact on use of land and residential areas.
Ecology	Minimal potential ecological impacts expected along the route. Possibly some minor tree clearing adjacent to the road reserve and within existing cleared corridors.	Potential for significant ecological impacts within SEPP14 wetlands. Possibly some minor clearing adjacent to the road reserve and within existing cleared corridors.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	A portion of line near Ballina within high probability acid sulphate soils zone.	A portion of line near Ballina within high probability acid sulphate soils zone.
Flooding	Flood impact on portion of the line near Ballina.	Flood impact on portion of the line near Ballina.
Visual sensitivity	Largely existing corridor or potential improvement on existing. Existing impacts within residential areas.	Largely existing corridor with minimal visual impact to residential areas.
Property acquisition	Minimal land acquisition required due to most of the existing corridor being suitable for upgrade to 132kV.	Minimal to no land acquisition required due to most of the existing corridor being suitable for upgrade to 132kV.
Engineering Issues	Portion of line within High Probability acid sulphate soils zone, and flood zone near Ballina.	Portion of line within High Probability acid sulphate soils zone, and flood zone near Ballina.

Table 2.4C Line Route Options Assessment - Section 4

Ballina to Alstonville via Tevan		
Feature	Sub Option 5	Sub Option 6
Planning/ Land use	Minimal impact on agricultural use of land.	Existing impacts within residential area.
Ecology	No significant ecological impacts expected along the route. Possibly some minor clearing to create new corridor.	No significant ecological impacts expected along the route. Possibly some minor clearing to create new corridor.
Archaeology/ Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Small portion of line within high probability acid sulphate Soils zone.	Small portion of line within high probability acid sulphate Soils zone.
Flooding	A portion of the line within Flood zone.	A portion of the line within Flood zone.
Visual sensitivity	New corridor on east facing hill slope. The line would be below the line of site from the residential area and would likely be seen as improvement to existing situation.	Existing visual impact within new residential area.
Property acquisition	Land acquisition required.	Existing corridor.
Engineering Issues	A significant portion of line within High Probability acid sulphate Soils zone, and flood zone.	A significant portion of line within High Probability acid sulphate Soils zone, and flood zone.

Table 2.4D Line Route Options Assessment - Section 4

Ballina to Alstonville via Tevan			
Feature	Sub-option 4-1	Sub-option 4-2	Sub-option 4-3
Planning/ Land use	Minimal impact on agricultural use. Existing impacts on residential area of Alstonville.	Minimal impact on agricultural use of land as constructed mainly in road reserve and sections of existing corridor. Portion of the line remains in residential area within existing corridor. Would likely be seen as improvement by many residents in Alstonville.	Proposed sub-option passes within the vicinity of Dept. of Primary Industries research facility. Would likely be seen as improvement by many residents in Alstonville.
Ecology	Minimal potential ecological impacts expected along the route. Possibly some tree clearing adjacent to the road reserve and within existing cleared corridors.	Minimal potential ecological impacts expected along the route. Possibly some tree clearing adjacent to the road reserve and within existing cleared corridors.	Minimal potential ecological impacts expected along the route. Possibly some tree clearing adjacent to the road reserve and within existing cleared corridors.
Archaeology/ Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	No acid sulphate soils along route.	No acid sulphate soils along route	No acid sulphate soils along route
Flooding	No flood impact.	No flood impact.	No flood impact.
Visual sensitivity	Largely existing corridor or potential improvement on existing. Existing impacts within residential areas. Undergrounding may be considered for residential zone.	New 132kV corridor along existing distribution line corridors within rural setting. Would likely be seen as improvement by residents situated on existing corridor. Undergrounding may be considered for residential zone.	New 132kV corridor within rural setting. Would likely be seen as improvement by residents situated on existing corridor. Some visual impact for nearby east facing residences.
Property acquisition	Minimal land acquisition required due to most of the route within existing distribution and 132kV corridor.	Minimal land acquisition required due to most of the route within existing distribution and 132kV corridor.	Land acquisition required.
Engineering Issues	No significant engineering constraints. Some underground line could be considered in residential areas.	No significant engineering constraints. Some underground line could be considered in residential areas.	No significant engineering constraints

2.5.5 Section 5 – Alstonville to Lismore

Option 1 – Rebuild dual circuit 66/132kV on existing 66kV alignment

This option involves rebuilding the existing 66kV line (feeder 0897) from Alstonville zone substation to dual circuit 132/66kV. The existing 66kV exits the Alstonville zone substation to the west on a short section of common corridor to Lismore South 66kV line. The lines diverge with the subject line heading west across undulating rural land including orchards.

The line spans orchards in several locations and passes in close proximity to some residences. Minor deviation may be required to minimise impacts on these residences.

The line route aligns with Monaltrie Lane and then crosses Wilsons River and continues through grazing properties before changing direction to head north to Three Chain Road, then west into the Lismore zone substation.

This option would require the procurement of easement over the existing line route corridor.

Option 2 – Build a new 132 kV Line

Sub-option 1 (refer *Figure 2.5*) initially shares the same corridor out of Alstonville as a dual circuit, with the new 132kV line then diverging to the south along Beesons Road. The route would then follow Rous Linkwood Road to the west then south west avoiding a Nature Reserve. The proposed route then traverses similar rural land to that encountered in *Option 1* before meeting up with the an existing 66kV line (feeder 0982) from Lismore zone substation. The route would then be constructed along the same corridor or as a dual circuit in order to rationalise the lines into the Lismore zone substation. The route would require procurement of new easements over a large number of properties and would require some clearing of vegetation for the corridor.

Alternatively, *Sub-option 2* diverges from the existing 66kV line (feeder 8503) east of Alstonville zone substation following an unformed road and Dees Lane before heading west along road reserve and an existing distribution corridor. The line then meets with the *Option 2* main alignment at Beesons Road before heading west toward Lismore.

An assessment of the proposed Line Routes based on desktop studies and a limited site inspection is presented in *Table 2.5* below:

Table 2.5A Line Route Options Assessment -Section 5

Alstonville to Lismore		
Feature	Option 1	Option 2
Planning/ Land use	Impact on agricultural use of land and rural residential areas. Minor deviation may need to be considered.	Impact on agricultural use of land and rural residential areas requiring procurement of new easements.
Ecology	Possibly some minor clearing of corridor for increased easement width.	Potential removal of some tree vegetation adjacent to the road reserve and within proposed new corridor.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	A minor portion of the line within medium risk acid sulphate soil zone.	A minor portion of the line within medium risk acid sulphate soil zone.
Flooding	A portion of the line within Flood zone.	A portion of the line within Flood zone.
Visual sensitivity	Doubling number of power lines within existing corridor.	Potential visual impacts along new line route, including open farmland, and rural residential areas.
Property acquisition	The existing corridor being suitable for upgrade to dual circuit 132/66kV. Easement procurement along existing corridor would be required.	Route follows some existing corridors, road reserves and paper roads, with significant land acquisition likely required.
Engineering Issues	Some areas require relatively large spans on the existing route due to Hilly terrain and considering line to be dual circuit. Need to rationalise lines around Alstonville substation.	Some areas require relatively large spans due to hilly terrain. Need to rationalise lines around Alstonville substation.

Table 2.5B **Line Route Options Assessment -Section 5**

Alstonville to Lismore		
Feature	Sub-option 1	Sub-option 2
Planning/ Land use	Minor potential impact on agricultural use of land and rural residential areas.	Impact on agricultural use of land and rural residential areas requiring procurement of new easements.
Ecology	Potential removal of some tree vegetation adjacent to the road reserve and within proposed new corridor.	Potential removal of some tree vegetation adjacent to the road reserve and within proposed new corridor.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	No acid sulphate soil along route.	No acid sulphate soil along route.
Flooding	No flood impact.	No flood impact.
Visual sensitivity	Increasing number of power lines within existing corridor. Potential visual impacts along Beesons Road.	Potential visual impacts along new line route, including open farmland, and rural residential areas.
Property acquisition	Route follow some existing corridors, road reserves and paper roads, with some minor land acquisition potentially required.	Route follow some existing corridors, road reserves and paper roads, with some land acquisition likely required.
Engineering Issues	No significant engineering constraints. Need to rationalise lines around Alstonville substation.	No significant engineering constraints.

2.5.6 *Section 6 – Lismore to Lismore South 66kV and Lismore to Lismore University 66kV*

Lismore to Lismore South underground 66kV (Three Chain Road)

This section involves the installation of two underground 66kV feeders between the Lismore zone substation and the Lismore South zone substation. The lines would be trenched along Three Chain Road within the road reserve.

Lismore South to Lismore University Switching Station

Option 1 (refer *66kV Option 1* in *Figure 2.6*) - this option involves dual circuit construction along the existing 66kV line (feeder 8501) via Lismore South zone substation and crossing Wilsons River. The lines would then diverge at East Gundurimba Road with a new line route constructed to the south of the ridgeline and around the northern boundary of the Lismore landfill site. The line would then head north on Wyrallah Road and behind the existing industrial complexes to the proposed Lismore university Switching Station. ERM understands that Lismore Council is proposing to develop a materials recovery facility at the landfill site, which will need to be considered with regard to siting of this option.

Option 2 (refer *66kV Option 2* in *Figure 2.6*) - would follow the same alignment as the Lismore to Alstonville 66kV line route (feeder 0897). The line would be constructed on new poles to run parallel with existing 66kV (i.e. proposed 66/132kV dual circuit line). The line would then diverge and head north along Wyrallah Road and follow the same proposed route into the Lismore University Switching Station. It is noted that if the 66kV/132kV (refer *132kV Option 1* in *Figure 2.6*) dual circuit option is to be considered along with the 66kV *Option 2* then this would mean three separate lines would be within this corridor.

Lismore University Switching Station to Lismore University zone substation (Military Road).

This involves construction of new under ground 66kV feeders in and out of the proposed Lismore University 66/11kV zone substation from the Lismore University Switch. The lines would be trenched within the road reserve along Military Drive.

An assessment of the proposed Line Routes based on desktop studies and a limited site inspection are presented in *Tables 2.6A* and *2.6B* below:

Table 2.6A Line Route Options Assessment (Section 6)

Lismore to Lismore South	
Feature	Three Chain Road
Planning/ Land use	Minimal impact
Ecology	Minimal ecological impacts.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	No identified acid sulphate soils.
Flooding	Potential flood impact.
Visual sensitivity	No visual impact
Property acquisition	No property acquisition
Engineering Issues	Cost of underground construction.

Table 2.6B Line Route Options Assessment (Section 6)

Lismore South to Lismore University				
Feature	Option 1	Option 2		Military Road
Planning/ Land use	Minimal impact on agricultural use of land and residential areas.	Some impact on agricultural use of land and rural residential areas. Will likely require procurement of wider and new easement.		Minimal impact
Ecology	Potential removal of some vegetation adjacent to the road reserve and along new corridor.	Potential removal of some vegetation adjacent to the road reserve and along new corridor.		Minimal ecological impacts.
Archaeology /Heritage	Any potential archaeological impacts likely to be mitigated through design and construction.	Any potential archaeological impacts likely to be mitigated through design and construction.		Any potential archaeological impacts likely to be mitigated through design and construction.
Acid Sulphate Soils	Minor acid sulphate soils	Minor acid sulphate soils		No identified acid sulphate soils
Flooding	Potential flood impact.	Potential flood impact.		Minor potential flood impact.
Visual sensitivity	Potential visual impacts along new line route, including open farmland. Line is below the skyline.	Significant visual impacts along new line route, including open farmland and rural residences. May result in multiple lines within single corridor.		No visual impact
Property acquisition	Route mainly follows existing corridors, road reserves and paper roads, with some land acquisition likely required.	Will likely require procurement of wider and new easement for line duplication or construction or dual circuit.		No property acquisition
Engineering Issues	Potential flood impact.	Potential flood impact. Longer route than Option 1		Cost of underground construction.

CONCLUSION

Line route options across the six sections of the study area have been considered including various sub-options with a view to minimising potential impacts. The initial option selection process avoided land that displayed major constraints to development including high risk areas.

The existing 66kV sub-transmission line between Mullumbimby and Lismore, via Ballina, can largely be upgraded to 132kV on the existing alignment. Some minor deviation may be necessary to avoid residential dwellings or environmental sensitive areas. Major variations from the existing alignment would likely result in significant social impacts due to the need to procure new easements. The majority of the existing 66kV sub-transmission line between Mullumbimby and Ballina is located within low lying open rural land. Diverting this line to higher ground to the west would significantly increase visual impacts and likely require significant vegetation clearing.

There is likely to be a number of potential options for 132kV feeders in and out of Brunswick Heads. A comprehensive assessment of the feeders to Brunswick Heads is understood to have been undertaken by others in a separate report.

Various sub-option have been considered, namely in Ewingsdale, Skinners Shoot and Alstonville to reduce impacts to existing residential areas. All of the sub-options are considered to have favourable characteristics for construction and reducing existing impacts of the current alignment. However, consideration will need to be given to the impacts of procurement of new easements in these areas.

The 132kV line route option from Astonville to Lismore will necessitate the procurement of easements where it crosses private property. From a visual perspective, and with consideration for landowner and environmental impacts, it is considered that the option to reconstruct the existing 66kV line between Alstonville and Lismore to a dual circuit 66/132kV is likely to be the more feasible option.

The proposed construction of short sections of underground 66kV is not likely to have a significant impact with regard to the constraints assessed. Two 66kV aboveground options were identified for linking Lismore zone substation to the proposed Lismore University switch. Both of the options are considered to be feasible depending on the selected 132kV line route option. The route near the Lismore landfill is a significantly shorter route. The option in the vicinity of the Lismore Landfill will need to consider future development of the landfill site.

It is concluded that, based on the preliminary environmental and social constraints assessment, the proposal to largely upgrade to 132kV on the existing 66kV alignment would be the lowest risk option. This is primarily because there is expected that there will be virtually no significant change to the visual amenity along most of the existing corridor, and also as no significant additional vegetation clearing is likely to be required.

Some deviations from the existing alignment, as have been proposed in this report, which may represent an improvement over the existing alignment, particularly in built up areas. In those areas where dual circuit lines are proposed they are considered likely to represent less overall impact than the construction new lines in new corridors.