Annex D

Constructability Assessment

REPORT

ON

PROPOSED LISMORE TO MULLUMBIMBY ELECTRICITY NETWORK UPGRADE

Prepared for

ENVIRONMENTAL RESOURCES MANAGEMENT AUSTRALIA PTY LTD

Power Serve Quality System:

Document Reference	:	MP0048-001
Report Revision	:	Rev 2
Report Status	:	Submitted for Consideration
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Approved by	:	
Date Created	:	26th February 2007
Date Issued	:	12th March 2008 (Rev 2)

TABLE OF CONTENTS

SECTIONS

1. INTRODUCTION

1.1 INTRODUCTION

Country Energy require a 132kV transmission line between the Lismore 132/66kV Substation and the Mullumbimby 132/66/11kV Substation to complete a ring supply and to support the increasing load on the network and to improve reliability of supply.

Transmission line routes examined for potential uprating from 66kV to 132kV as well as options for construction of new 132kV lines to allow for minor deviations in built up areas or for new substation connections are listed in 1.3 below.

1.2 REPORT APPROACH.

This report is predominantly concentrated on the constructability issues associated with upgrading of existing transmission line and does not attempt to address the environmental, easement and landowner negotiations or community consultation activities. However, where the proposed route may traverse areas where detailed environmental investigation may be required, options for construction access, structure types and suggestions on alternative construction methods are given for consideration.

The field inspections that were carried out were restricted to public road access with no entry onto private land. As a consequence, comments on access to structures and the condition of structures was limited and would have to be carried out during the survey and design phase to achieve the most economical and practical option for uprating.

Proposed route options and photo references are identified on the attached marked up topographic maps 1 to 10 in the Appendix.

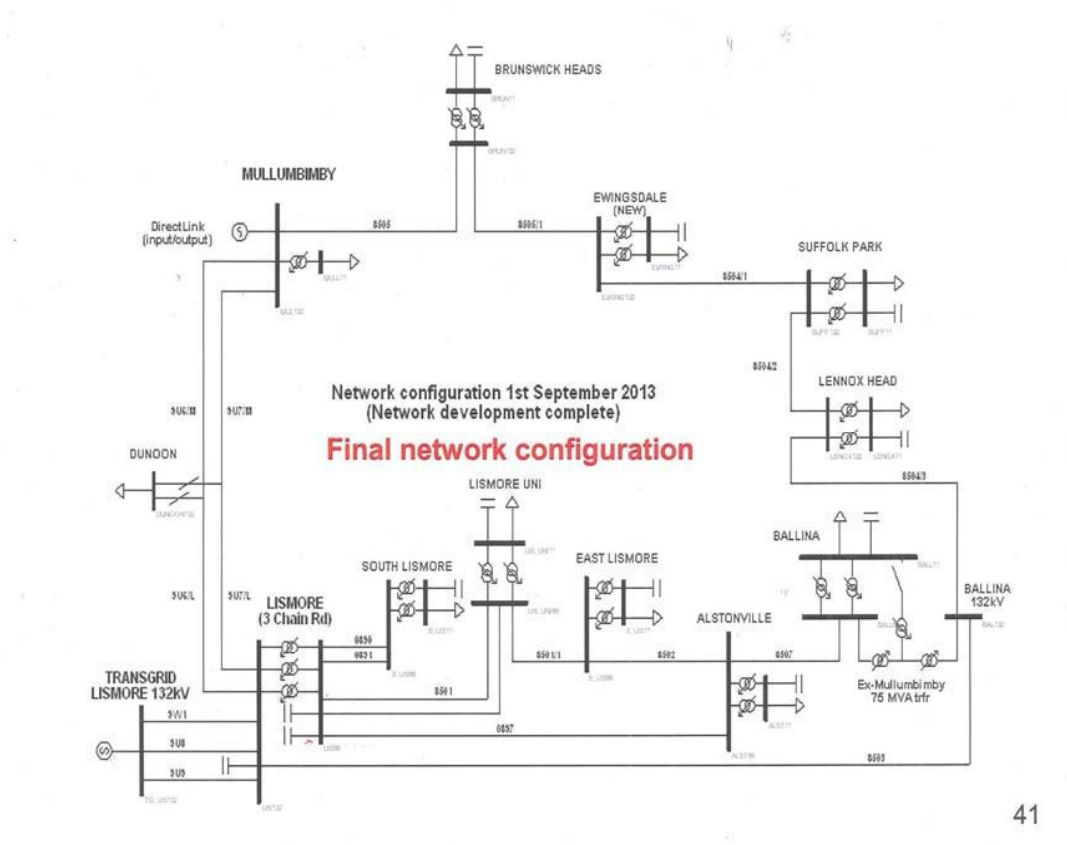
1.3 PROJECT INVESTIGATIONS.

From desk top and field investigations the transmission line routes which were identified for detailed examination and substations requiring upgrading were as listed below;

1. Upgrade the existing 66kV line from Mullumbimby to Ewingsdale to 132kV.
2. Upgrade the Ewingsdale substation to 132/11kV.
3. Upgrade the existing 66kV line from Ewingsdale to Ballina to 132kV.
4. Change the 66/11kV transformers at Lennox Head Substation to 132/11kV.
5. Upgrade the existing 66kV line from Ballina to a point near the Alstonville substation to 132kV. Some sections may be required to deviate from the existing alignment.

6. Construct new 132kV line from Lismore 132/66kV substation to join the new line near Alstonville as per (5) above.
7. Construct two new 66kV feeders from the Lismore 132/66kV substation (Three Chain Rd) to the new 66kV Switching Station near the University.

An illustration of the electrical network showing existing and proposed upgrading works and proposed new construction works is given in the following diagram.



2. UPGRADE MULLUMBIMBY TO EWINGSDALE LINE TO 132KV.

2.1 UPGRADE MULLUMBIMBY TO EWINGSDALE LINE TO 132KV.

The route of this section of overhead line is depicted in Photos 2 to 19 as shown in 2.2 below. For the majority of the route it traverses open rural country until it reaches and follows Myocum Road to the Pacific Highway where it crosses to the Ewingsdale Substation.

The preferred method of upgrading this section is to reconstruct on the existing alignment where access to the existing line structures is readily accessible. Some

minor deviations may be required such as in Photos 4 and 8 where some development beneath the line in the form of sheds and a home have been constructed.

As a compromise to some property owners, the easement requirements could be minimised where an 11kV line parallels the 66kV line as shown in Photos 9 and 11. A composite 132/11kV line could be constructed in a 30m wide easement.

The section of line along Myocum Rd and across the Pacific Highway to the substation, as shown in Photos 12 to 19, is constructed within the road reserve and is a composite 66/11kV construction. Because of the Highway overpass bridge and the "on" and "off" ramps the line deviates to the north to cross the Highway at a lower level.

In carrying out the design and construction, consideration should be given to utilising some of the existing structures. The suggested structure arrangement is to utilise the Country Energy standard horizontal line post insulator in a delta configuration as shown in Appendix Fig 2.

2.2 MULLUMBIMBY TO EWINGSDALE PHOTOS.

Photo 2.

Photo 3.

Photo 4.

Photo 5.

Photo 6.

Photo 7.

Photo 8.

Photo 9.

Photo 10.

Photo 11.

Photo 12.

Photo 13.

Photo 14.

Photo 15.

Photo 16.

Photo 17.

Photo 18.

Photo 19.

3. UPGRADE THE EXISTING EWINGSDALE TO BALLINA LINE TO 132KV

3.1 UPGRADE EWINGSDALE TO LENNOX HEAD LINE TO 132KV

This section of line has a few sensitive areas for construction and may require minor deviations. This line will also connect into the proposed new Suffolk Park 132/11kV substation.

From the substation, the line which is predominantly a composite 66/11kV construction passes through the urban developed area of Ewingsdale as shown in photos 21 to 25 and on the eastern extremity of the subdivision has a section of 66kV underground cable. Whilst uprating along this route could be achieved utilising existing structures with 132kV line post insulators and an overhead earthwire riser bracket and replacing the 66kV underground cable with a 132kV cable at considerable cost.

An alternative route for consideration is to construct within the road reserve of Ewingsdale Road for approximately 1.25km east of the substation and then acquire an easement in a south easterly direction to join with the angle in the existing line approximately 1km from the road. This option avoids the need to retain a section of underground cable, although this would have to be considered in a review of environmental factors for the new section of line.

The line passes through Skinners Shoot which is small acreage and heavily wooded area. This section of line is shown in photos 26, 27 and 28 and mainly follows the narrow roadway with relatively short spans. Reconstruction using the existing poles is a possibility using 132kV line post insulators and an overhead earthwire riser bracket. Increased tree trimming will be required but is preferred over trying to obtain an alternative route through the area where significant tree removal would be required.

The following section of line depicted in photos 29 and 30 traverses private property past a piggery where the proposed Suffolk Park Substation may be located before crossing the railway and up the steep hillside to cross Bangalow Road where photos 31 and 32 were taken. Access along this section of line for reconstruction appears to be good.

Continuing further South, the line traverses predominantly rural country or within road reserves as shown in photos 33 to 37 to reach the new Lennox Head substation. Access along this section is good and reconstruction by replacing structures with concrete poles or if the design is suitable, reuse some of existing structures with line post insulators is possible to minimise the uprating costs.

3.2 EWINGSDALE TO LENNOX HEAD PHOTOS.

Photo 21.

Photo 22.

Photo 23.

Photo 24.

Photo 25.

Photo 26.

Photo 27.

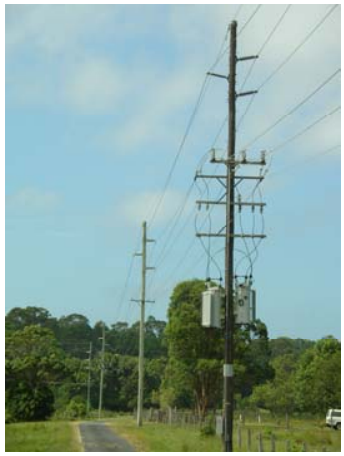


Photo 28.

Photo 29.

Photo 30.

Photo 31.

Photo 32.

Photo 33.

Photo 34.

Photo 35.

Photo 36.

Photo 37.

4. UPGRADE LINE FROM LENNOX HEADS TO BALLINA TO 132KV

4.1 UPGRADE LINE FROM LENNOX HEAD TO BALLINA TO 132KV

The new structures erected adjacent to the new Lennox Head substation have been constructed on concrete poles using 132kV horizontal line post insulators as shown in photo 38. From the substation the line follows Newrybar Swamp Rd and then Ross Lane to the intersection with Dufficys Lane where it goes cross country to the Pacific Highway. The form of construction is mainly Wishbone structures as shown in the background of photo 42.

The line crosses the Highway and remains on the Western side crossing Emigrant Creek numerous times till it again crosses and follows the Highway to a point approximately 0.6km South of Deadmans Creek Rd where it angles East and crosses private property.

Note that the 66kV line from Alstonville via Teven, which is also to be considered for uprating to 132kV, also runs adjacent to the Highway on the Western side from adjacent to Deadmans Creek Rd.

Both these 66kV lines converge on the Pacific Highway near the Caravan Park and head due south in parallel in a corridor before crossing North Creek Canal as shown in photos 42 and 43.

At the creek crossing a third 66kV line from Alstonville joins into the corridor which runs into the Ballina Substation as shown in photo 44 and 45.

Reconstruction of the Lennox Head to Ballina line at 132kV in its present location is feasible and some existing structures could be utilised. Access along the route is considered good although traffic control along parallel sections and crossings of the busy Highway will have to be considered. It should be noted that the Ballina area has a high water table and generally poor foundation properties which may require special attention for new concrete pole installations.

4.2 LENNOX HEAD TO BALLINA PHOTOS.

Photo 38.

Photo 42.

Photo 43.

Photo 44.

Photo 45.

Photo 46.

5. UPGRADE 66KV FROM BALLINA TO NEAR ALSTONVILLE TO 132KV. (ROUTE VIA PACIFIC HIGHWAY)

5.1 UPGRADE BALLINA TO NEAR ALSTONVILLE TO 132KV.

In the initial scope of investigation, this route was considered to be the preferred route for uprating over the route via Teven and therefore in the time spent on site a closer inspection was carried out.

On leaving the Ballina substation and crossing North Creek Canal, as shown in photo 43 above, the line heads west and crosses Fishery Creek and onto a termination structure on Barlows Rd as shown in photo 51. The line is a composite 66kV and 11kV construction which could possibly be uprated using the existing structures with an overhead earthwire riser bracket. Alternatively existing poles would have to be replaced with concrete poles. Again it is noted that special foundations would have to be considered for new structures.

The line follows Barlows Rd for 0.5km as shown in photo 52 across the frontages of urban development in West Ballina before entering open space as show in photos 53, 54 and 55 to reach Teven Rd. Access through this area is good and again reuse of existing structures may be possible. The section of line down Teven Rd to the Pacific Highway is within the road reserve as shown in photo 56 with good access and reconstruction potential. It was noted that road civil works which will cross Teven Rd had commenced on what appeared to be the start of a new Ballina bypass road which could provide a corridor to realign sections of this line.

The remaining description of this portion of line commences with photo 90 adjacent to the Alstonville substation where the two existing 66kV feeders to Ballina are constructed as a dual circuit line through to the Bruxner Highway where they separate into single circuit lines as shown in photo 96. This section of line crosses private property and some orchards. The difficulty in uprating along this section would be having outages on both circuits and having Ballina substation supplied via a single 66kV feeder from Lennox Head. An option is to establish a new dual circuit line along some paper roads to bypass some of the line and to build adjacent to the remaining section and dismantle the old line. Alternatively a single circuit line could be built on the paper roads and reconstruct the existing dual circuit to a single circuit; however this increases the easement requirements and may make negotiations more difficult.

The line to Ballina from where photo 96 was taken predominantly follows the Bruxner Highway as shown in photos 97 and 98 till it reaches and follows the Pacific Highway shown in photo 101. Along the Bruxner Highway the line deviates into private property in a couple of locations and there is one long span adjacent to Gap Road intersection where there is a three pole and a two pole structure as shown in photos 100 and 99 respectively. Reconstruction along this section of the line could possibly be achieved by reconstruction on existing structures subject to design and replacement of unsuitable structures.

5.2 BALLINA TO NEAR ALSTONVILLE PHOTOS.

Photo 51.

Photo 52.

Photo 53.

Photo 54.

Photo 55.

Photo 56.

Photo 90.

Photo 96.

Photo 97.

Photo 98.

Photo 99.

Photo 100.

Photo 101.

6. UPGRADE 66KV FROM BALLINA TO NEAR ALSTONVILLE TO 132KV. (ROUTE VIA ALSTONVILLE AND TEVEN)

6.1 UPGRADE BALLINA TO NEAR ALSTONVILLE TO 132KV.

This section of line commences from the dual circuit line where it separates into single circuit line on the Bruxner Highway shown in photo 96.

The line crosses the Bruxner Highway and runs north down the road reserve of Teven Road before turning east as shown in photo 93 where it runs through a corridor between two recently developed subdivisions. Photos 94 and 95 show the close proximity of the line to the development. A further inspection was carried out west of the Pacific Highway near Cumbalum where the line crosses Pacific Heights Drive in very close proximity to some large rural homes on small acreage properties.

In this location upgrading may be difficult and deviations may have to be further considered. Unfortunately no photos were taken in this vicinity.

From the topographic maps it would appear that access across the rural sections of the line would be suitable for reconstruction. If the structures across the rural section are similar to that shown in photo 94 then it would be necessary to fully reconstruct the line.

From the point where the line parallels the Pacific Highway back towards the Ballina substation upgrading along the existing centre line would be the preferred arrangement and to join in the corridor from the Highway with the line from Lennox Head Substation through to the Ballina Substation as discussed in Section 4.

Further examination of this route is recommended to identify other construction difficulties.

6.2 BALLINA TO NEAR ALSTONVILLE PHOTOS.

Photo 93.

Photo 94.

Photo 95.

Photo 96.

7. ESTABLISH NEW 132KV LINE FROM LISMORE TO NEAR ALSTONVILLE

7.1 ESTABLISH NEW 132KV LINE FROM LISMORE TO NEAR ALSTONVILLE

The route length of a new line from the Lismore Substation to adjacent to the Alstonville Substation is approximately 20km and would take considerable time for approval and compensation to acquire easements.

From the site inspection the existing direct route 66kV line to Alstonville appears to have high reliability with relatively low risk of damage or outage from bush fire, vehicular impact or property usage such as orchards. With Alstonville having three 66kV incoming feeders the opportunity to take the direct route line out of service for reconstruction as a dual circuit 132kV line appears to be the most practical, economic and time saving option.

The suggested structure arrangement would be to use horizontal line post insulators with fabricated gain bases to achieve live line working clearances so that work can be carried out on one isolated circuit whilst the other circuit remains in service. At angles and termination locations two single pole vertical structures would be required. Construction along the existing centre line would also allow the existing conductors to be reused as one circuit and transferred onto the new structures progressively as structures are erected allowing for a minimum recall time should the line be required to be placed back into service.

Photos 57 and 72 to 89 show the existing line route and terrain indicating the open access to structures for reconstruction. There are a couple of locations as shown in photos 81 and 85 where the line is relatively close to rural homesteads and where minor deviations may be required.

This 132kV line would then connect to the uprated line to Ballina as described previously in Section 5 and 6 via the Pacific Highway or Teven respectively.

7.2 LISMORE TO ALSTONVILLE PHOTOS.

Photo 57.

Photo 72.

Photo 73.

Photo 74.

Photo 75.

Photo 76.

Photo 77.

Photo 78.

Photo 79.

Photo 80.

Photo 81.

Photo 82.

Photo 83.

Photo 84.

Photo 85.

Photo 86.

Photo 87.

Photo 88.

Photo 89.

8. ESTABLISH NEW 66KV LINES FROM LISMORE 132/66KV SUBSTATION TO NEW 66KV SWITCHING STATION NEAR LISMORE UNIVERSITY.

8.1 ESTABLISH NEW 66KV LINES FROM LISMORE SUBSTATION TO NEW 66KV SWITCHING STATION NEAR LISMORE UNIVERSITY.

The existing Lismore South Zone Substation is supplied via two 66kV Feeders (0890 & 0891) direct from the Lismore 132/66kV Substation as shown in photos 58 to 61.

Feeder 8501 interconnects the South Lismore and East Lismore Zone Substations. Photos 62 to 64 and 69 show portion of the existing line. To establish supply to the proposed University 66kV Switching Station it is proposed to establish two new circuits from the Lismore 132/66kV Substation. One feeder is to connect to the 8501 Feeder near the South Lismore Substation and the other to run direct to the new University 66kV Switching Station. The 8501 Feeder will be cut into on the southern side of Skyline Road and the two new sections of line run north adjacent to Military Road together with the new direct feeder as shown in photos 68 and 71. The suggested line construction along this route would be one single circuit and one dual circuit line using horizontal line post insulators on concrete poles.

The new feeders out of the Lismore 132/66kV Substation are planned to be underground cables.

The new direct underground feeder would connect to a new overhead feeder south east of the South Lismore Substation and run parallel to the existing 8501 feeder before diverging further south to avoid the subdivision and orchards as shown in photos 65 and 66. The new circuit is proposed to traverse through the northern side

of the Waste Depot and crossing Wyrallah Road where it can follow the roadway north or run cross country to the University 66kV Switching Station.

8.2 LISMORE UNIVERSITY LINE PHOTOS

Photo 58.

Photo 59.

Photo 60.

Photo 61.

Photo 62.

Photo 63.

Photo 64.

Photo 65.

Photo 66.

Photo 67.

Photo 68.

Photo 69.

Photo 70.

Photo 71.

9. APPENDICES

9.1 TOPOGRAPHIC MAPS SHOWING LINE ROUTES AND PHOTO LOCATIONS

The attached maps are based on 1:25,000 topographic maps produced by the Central Mapping Authority of NSW and show the highlighted transmission line routes and the locations and directions in which photographs were taken to depict structure arrangements and terrain. The maps when assembled as shown below, give an overview to the total line route from Mullumbimby to Lismore

			Map 1	Map 2
				Map 3
				Map 4
				Map 5
Map 10	Map 9	Map 8	Map 7	Map 6

9.2 TYPICAL STANDARD CONSTRUCTION DRAWINGS

The following drawings illustrate standard construction arrangements for Country Energy's 66kV and 132kV transmission lines.

- Fig 1 - 66kV Intermediate Structure
  This is the Country Energy current standard construction arrangement for 66kV structures.

- Fig 2 - 132kV Intermediate Structure
  This is the typical standard arrangement recommended for new 132kV constructions and where practical, within structure design loadings, could be installed on some existing structures to allow the upgrading works to be achieved faster and more economically.

- Fig 3 - 66kV & 132kV Structure Comparison
  This diagram shows the relative spacing differences between 66kV and 132kV insulator arrangements and demonstrates that 132kV insulators can be retrofitted to existing 66kV structures using available pole head height and an overhead earthwire riser bracket installed to provide earthwire support.