POWER SYSTEM OPERATING INCIDENT REPORT
TRIP OF COLUMBOOLA NO.1 132KV BUSBAR ON 2 MAY 2011

PREPARED BY: Electricity System Operations Planning and Performance

VERSION: 1.0

DATE: 30 August 2011

FINAL

Disclaimer

Purpose

This report has been prepared by the Australian Energy Market Operator Limited (**AEMO**) for the sole purpose of meeting obligations in accordance with clause 4.8.15 (c) of the National Electricity Rules.

No reliance or warranty

This report contains data provided by third parties and might contain conclusions or forecasts and the like that rely on that data. This data might not be free from errors or omissions. While AEMO has used due care and skill, AEMO does not warrant or represent that the data, conclusions, forecasts or other information in this report are accurate, reliable, complete or current or that they are suitable for particular purposes. You should verify and check the accuracy, completeness, reliability and suitability of this report for any use to which you intend to put it, and seek independent expert advice before using it, or any information contained in it.

Limitation of liability

To the extent permitted by law, AEMO and its advisers, consultants and other contributors to this report (or their respective associated companies, businesses, partners, directors, officers or employees) shall not be liable for any errors, omissions, defects or misrepresentations in the information contained in this report, or for any loss or damage suffered by persons who use or rely on such information (including by reason of negligence, negligent misstatement or otherwise). If any law prohibits the exclusion of such liability, AEMO's liability is limited, at AEMO's option, to the re-supply of the information, provided that this limitation is permitted by law and is fair and reasonable.

Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator Ltd
CB	Circuit Breaker
EST	Eastern Standard Time
kV	kilovolt
MW	megawatt
MWh	megawatt hour (also MW·h)
NEM	National Electricity Market
NER	National Electricity Rules

1 Introduction

At 1318 hrs on 2 May 2011 the No.1 132 kV busbar at Columboola 132 kV substation in Queensland automatically tripped. Testing of transformer protection systems at Condamine power station[1] was being performed by Condamine power station staff at the time of the busbar trip. The busbar trip resulted in the off-loading of the Chinchilla – Columboola and the Roma – Columboola 132 kV lines. As a result of this there was an interruption of 28 MW of load supplied from Roma 132 kV substation, which was restored by staff from Ergon Energy Corporation Limited (EECL) at 1534 hrs.

This report has been prepared under clause 4.8.15 of the National Electricity Rules (NER) to assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security.

This report is largely based upon information provided by EECL. Data from AEMO's Energy Management System have also been used in analysing the incident.

All references to time in this report are to National Electricity Market time (Eastern Standard Time).

2 Pre-Contingent System Conditions

The status of the power system prior to the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagram.

[1] Condamine power station is operated by Queensland Gas Company (QGC)

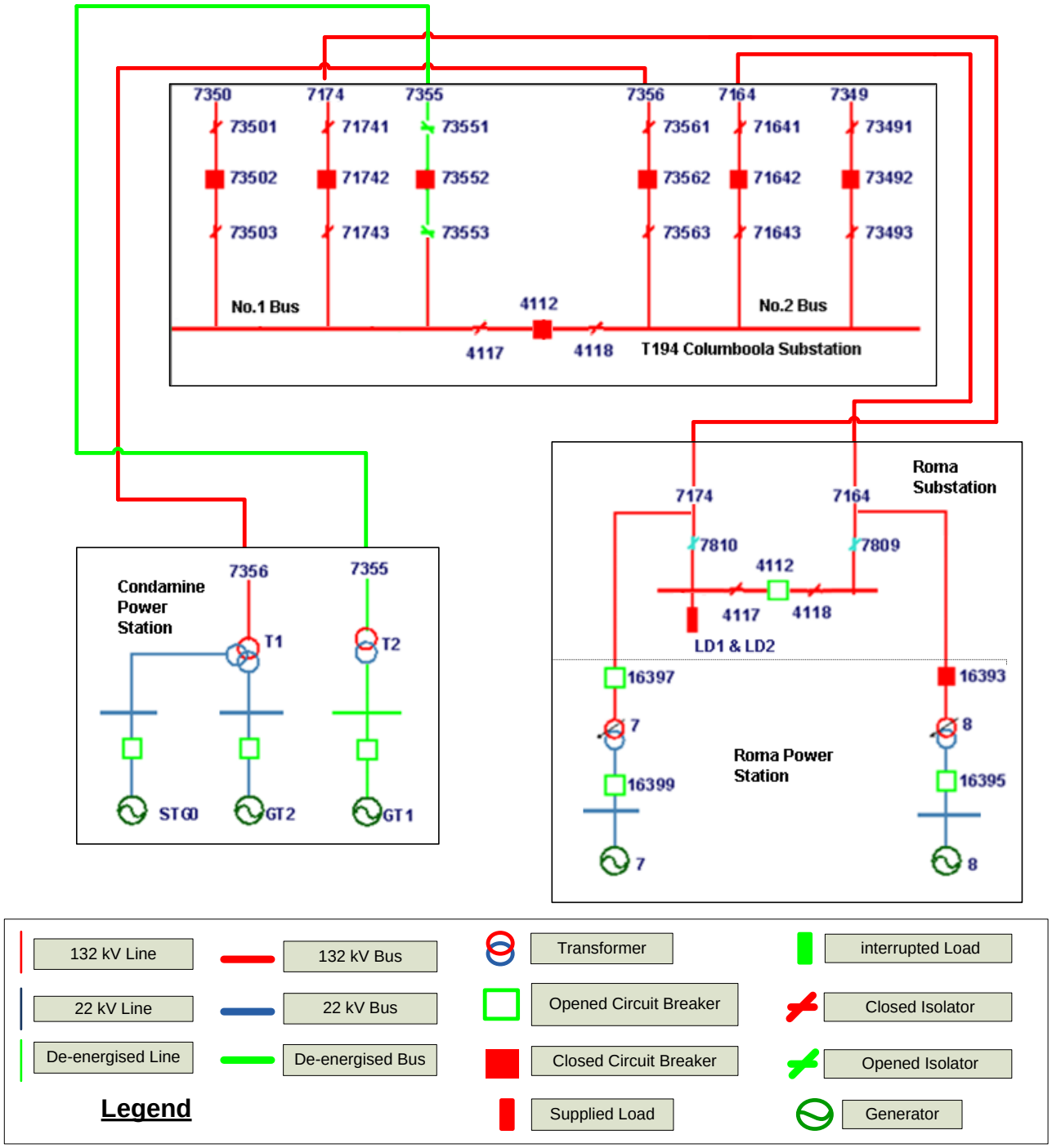

Figure 1 – Status of the power system prior to the incident

Prior to the incident the generating units at Condamine and Roma power stations were off-line, with Roma No.8 generating unit available for 34 MW while the Roma No.7 and the Condamine generating units were unavailable. The load at Roma 132 kV substation was being solely supplied via feeder 7174 from Columboola 132 kV substation due to augmentation project work at Roma. Both the No.1 and 2 132 kV busbars at Columboola 132 kV substation were in service.

3 Summary of Events

On 2 May 2011 maintenance staff at the Condamine power station was doing planned maintenance on the T2 132/11 kV transformer and associated protection systems. Concurrent to this work EECL staff at the Columboola 132 kV substation was doing planned maintenance on the Condamine – Columboola line isolator 73551 and associated earth switches. EECL work practices

require the associated line circuit breaker (CB) 73552 at Columboola to be locked in the closed position to allow work at the Condamine power station and Columboola 132 kV substation to proceed concurrently. Although the planned maintenance work by EECL at Columboola 132 kV substation had been completed at the time of the incident, restoration switching had not yet commenced.

At 1318 hrs the Columboola No.1 132 kV busbar tripped on the operation of circuit breaker fail protection after receiving a protection intertrip from Condamine power station. Condamine power station maintenance team then advised EECL that they had been performing protection testing at the time of the trip.

Under normal operating conditions CB 73552 at Columboola 132 kV substation would trip on the receipt of a protection intertrip from the Condamine end, but the work practices followed on this day required CB 73552 to be closed and locked, resulting in the trip of the Columboola No.1 132 kV busbar.

The busbar trip resulted in the off-loading of the 7350 Chinchilla – Columboola and 7174 Roma – Columboola 132 kV lines.

This incident took place during augmentation work at Roma 132 kV substation, which had been reconfigured by EECL such that both the 66 kV and 33 kV loads at Roma were being solely supplied via the 7174 Roma – Columboola 132 kV line. As a result of the loss of the 7174 line approximately 28 MW of load supplied from Roma 132 kV substation was interrupted.

Figure 2 below shows the status of the power system immediately after the incident.

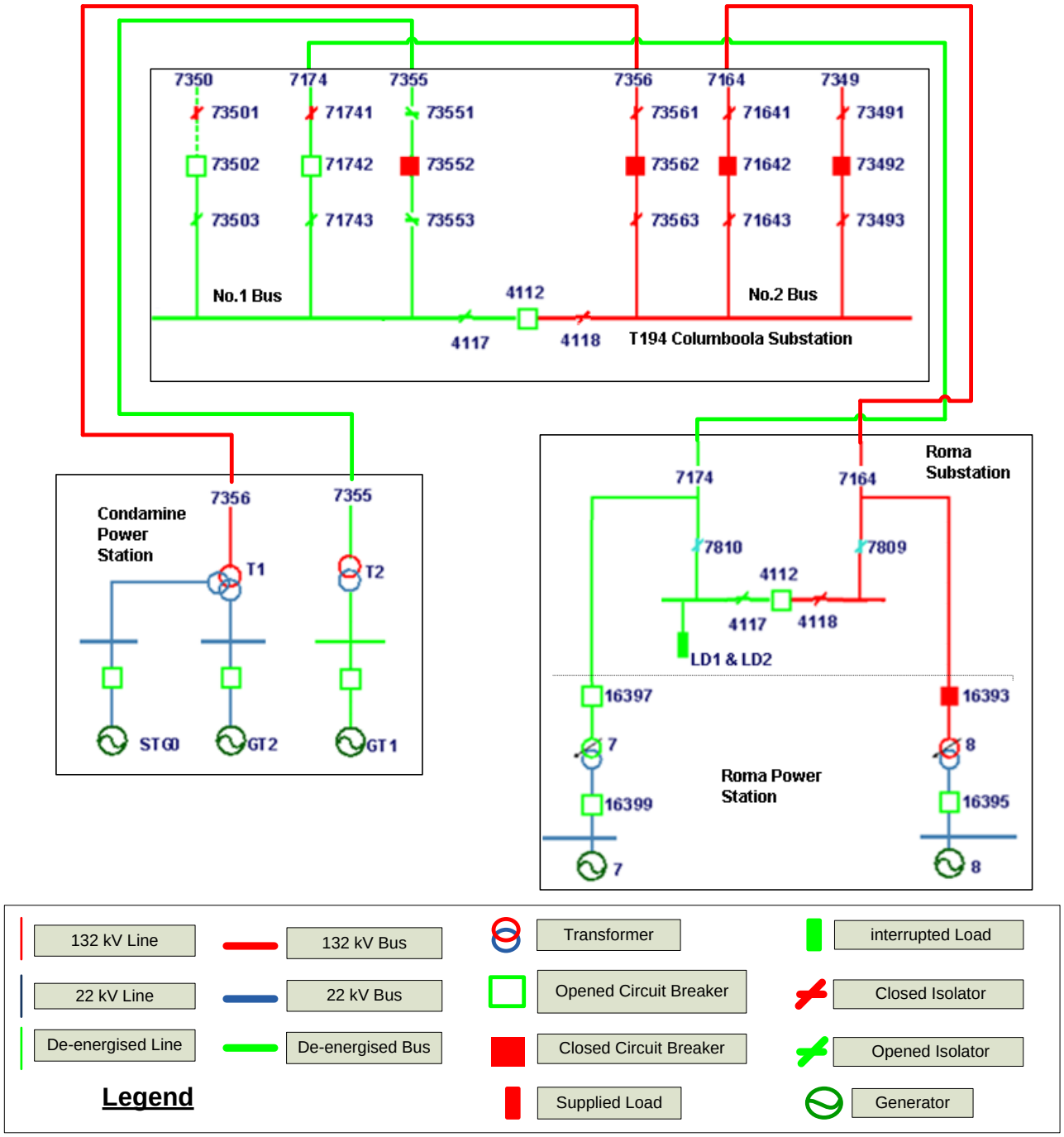

Figure 2 - Status of the power system immediately after the incident

4 Immediate Actions Taken

At 1342 hrs AEMO invoked the constraint set Q-CLBRM_7174 (effective from dispatch interval ending 1350 hrs), followed by the constraint set Q-CLBCN_7350 at 1345 hrs (effective from dispatch interval ending 1355 hrs), both applying in central dispatch until dispatch interval ending 1555 hrs. Constraint set Q-CLBRM_7174 was invoked for the outage of the 7174 Columboola – Roma 132 kV line to dispatch Roma No. 7 generating unit output to zero, while constraint set Q-CLBCN_7350 was invoked for the outage of the 7350 Chinchilla – Columboola 132 kV line to manage the output from the Condamine generating units to within the rating of the remaining Chinchilla – Columboola 132 kV line. Because the Roma No. 7 and Condamine generating units were already out of service, the constraint equations in the two constraint sets did not bind or violate during the incident and hence had no impact on market outcomes.

The preliminary investigation by EECL revealed that insufficient isolation of secondary systems at Columboola 132 kV substation allowed a busbar trip to occur when a protection intertrip was received from Condamine power station. Maintenance staff at Condamine power station had not advised EECL that their work was likely to send an intertrip to Columboola 132 kV substation. After the cause of the busbar trip was identified, EECL instructed Condamine power station staff to suspend further protection work.

At 1348 hrs AEMO issued Market Notice No.35163 advising the occurrence of this incident as a non-credible contingency event. Because the work on protection systems at Condamine power station was suspended AEMO assessed that there was no above normal risk of trip of the Columboola No.1 132 kV busbar, and therefore did not reclassify the trip of that busbar as a credible contingency event.

At 1402 hrs EECL made several attempts to restore load by closing bus section CB 4112 at Roma 132 kV substation. These were unsuccessful because check synchronising was required before closing the bus section CB. EECL then decided to de-energise the 7164 Columboola – Roma 132 kV line as this was the most suitable option to satisfy the check synchronising logic.

The EECL procedures require visual checks to be performed before restoring network elements that have tripped on the operation of circuit breaker failure protection. EECL staff had to be dispatched to Columboola 132 kV substation for this purpose and the travel time also contributed to the time taken to restore Roma load.

At 1521 hrs, on satisfactory completion of their visual checks, EECL manually closed CB 4112 at Columboola 132 kV substation, re-energising the Columboola No.1 132 kV busbar. At 1532 hrs EECL returned the 7174 and 7164 Columboola – Roma 132 kV lines to service, restoring the Roma load.

5 Follow-up Actions

Following this incident, EECL decided to take additional precaution of placing permanent cautionary SCADA tags on their control room displays for CBs that are required to be locked in the closed position in accordance with the work practices. These SCADA tags will highlight the need for complete isolation of the protection systems associated with the relevant circuit breaker when they are locked in the closed positions.

EECL reviewed the need for check synchronising before closing bus section CB 4112 at Roma 132 kV substation and determined that it would only be required after completing the augmentation project at Roma. EECL has disabled the check synchronising logic pending completion of that project.

6 Power System Security Assessment

The power system voltages and frequencies remained within the normal operating bands and the power system remained in a secure operating state throughout the incident.

7 Conclusions

At 1318 hrs on 2 May 2011 the No. 1 132 kV busbar at Columboola 132 kV substation automatically tripped following the unexpected operation of the circuit breaker fail protection after receiving a protection intertrip from Condamine power station. The unexpected protection operation was caused by insufficient isolation of secondary systems at Columboola 132 kV substation while protection checks were being performed at Condamine power station.

There was an interruption of 28 MW of load supplied from Roma 132 kV substation as a result of this incident, which was restored by EECL at 1534 hrs.

AEMO is satisfied that EECL and QGC have taken appropriate actions to mitigate the risk of a similar incident occurring in the future.

AEMO correctly applied the criteria published in section 11 of its Power System Security Guidelines in assessing that the circumstances of this incident did not warrant reclassifying similar incidents as a credible contingency event.

8 Recommendations

EECL and QGC will review the operational communication procedures used in co-ordinating planned outages to avoid similar incidents in the future. This action will be completed by the end of November 2011.