POWER SYSTEM OPERATING INCIDENT REPORT – TRIPPING OF CHALUMBIN-WOREE 876 AND 877 275 KV LINES AND BARRON GORGE POWER STATION ON 2 MARCH 2013

PREPARED BY: Systems Capability

DATE: 19 April 2013

FINAL

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Abbreviations and Symbols

Abbreviation	Term
CB	Circuit Breaker
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
MW	Megawatt
NEM	National Electricity Market

Contents

Incident summary

Date and time of incident	2 March 2013 at 1828 hrs.
Region of incident	QLD
Affected regions	QLD
Event type	TT – Loss of multiple transmission elements
Primary cause	ENVI & LN – Environment and Lightning
Impact	Significant
Associated reports	N/A

1 Introduction

At 1828 hours on 2 March 2013, the Chalumbin-Woree 876 and 877 275 kV transmission lines in Queensland simultaneously tripped out of service due to lightning, separating the Far North Queensland transmission network from the main transmission network and resulting in the loss of all generation at Barron Gorge Power Station.

The generation reduction was approximately 58 MW and momentary interruption to supply of 214 MW of load occurred as a result of this incident.

This report has been prepared under clause 4.8.15 (c) 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 Powerlink and Stanwell Corporation Limited. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

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

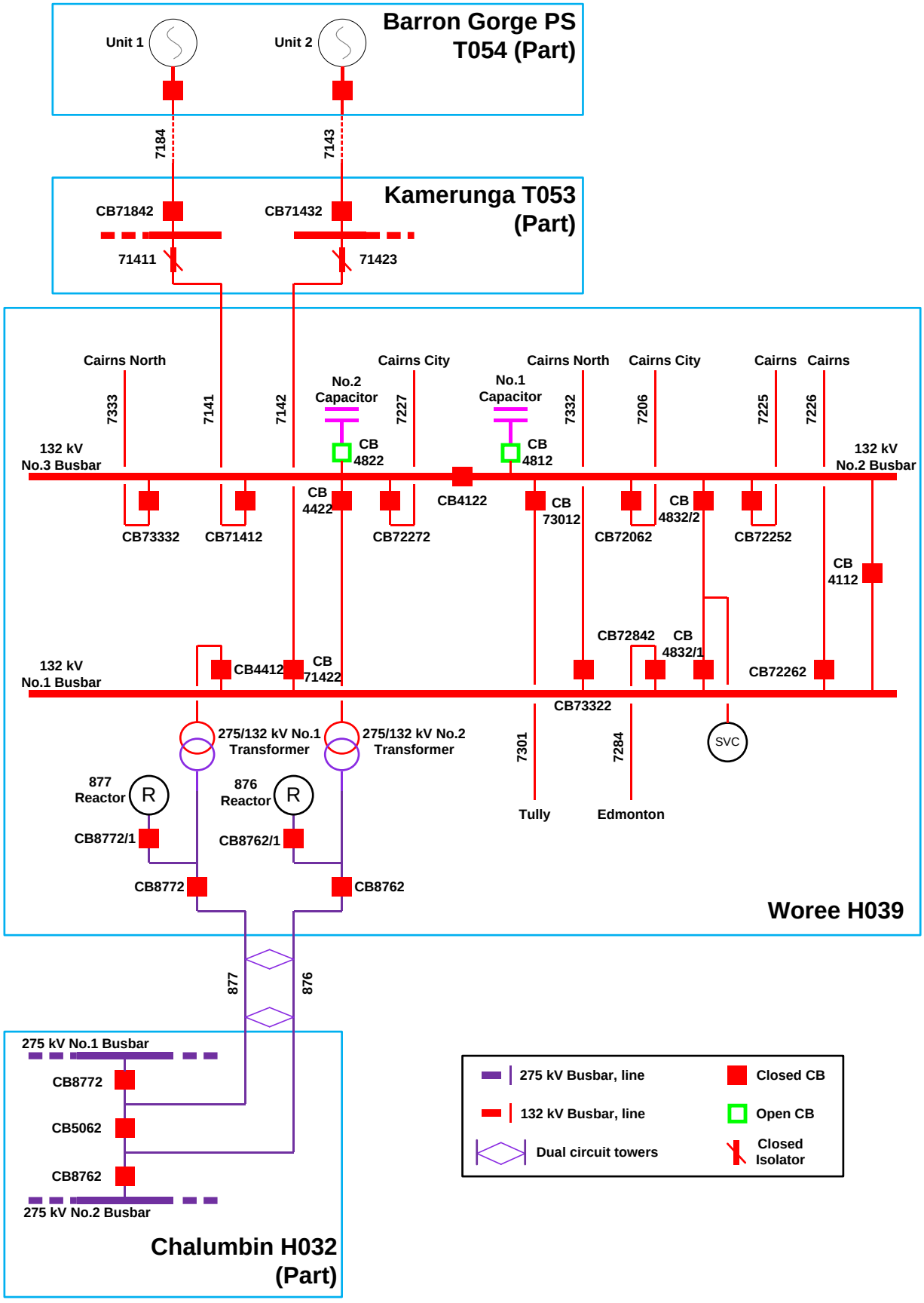
2 Pre-Contingent System Conditions

Prior to the incident, planned outages of the 132 kV lines between Tully Substation and Cardwell Substation were in progress. During these planned outages, there was no 132 kV supply to the Far North Queensland transmission network and it was solely supplied from the main transmission network via the Chalumbin-Woree 876 and 877 275 kV transmission lines.

Barron Gorge Power Station generating units 1 and 2 were generating 58 MW in total at the time of the incident.

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.

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



3 Summary of Events

The key events that took place during the incident are summarised in Table 1 below.

Table 1: Summary of Events

Date/Time	Event
02/03/2013 18:28:11 hrs.	• Chalumbin-Woree 876 and 877 275 kV transmission lines tripped. • Barron Gorge Power Station units 1 and 2 tripped (Units tripped during the auto reclose dead time of the Chalumbin-Woree 876 and 877 275 kV transmission lines).
02/03/2013 18:28:12 hrs.	• Chalumbin-Woree 876 275 kV Transmission Line auto reclosed at both ends. • Chalumbin-Woree 877 275 kV Transmission Line auto reclosed at Chalumbin end.
02/03/2013 18:29 hrs.	Chalumbin-Woree 877 275 kV Transmission Line manually closed at Woree end.
02/03/2013 18:52 hrs.	AEMO issued Market Notice No.41705.
02/03/2013 18:57 hrs.	AEMO issued Market Notice No.41706.
02/03/2013 19:35 hrs.	AEMO issued Market Notice No.41707.
02/03/2013 22:27 hrs.	Barron Gorge Power Station Unit 2 was returned to service.
02/03/2013 22:47 hrs.	Barron Gorge Power Station Unit 1 was returned to service.
02/03/2013 23:13 hrs.	AEMO issued Market Notice No.41709.

Powerlink advised that the trip of the Chalumbin-Woree 876 and 877 275 kV transmission lines was due to lightning. The protection systems on the lines detected high voltage faults and tripped the lines by opening the following circuit breakers.

- Chalumbin 275 kV Circuit Breaker 8762
- Chalumbin 275 kV Circuit Breaker 8772
- Chalumbin 275 kV Circuit Breaker 5062
- Woree 275 kV Circuit Breaker 8762
- Woree 275 kV Circuit Breaker 8772

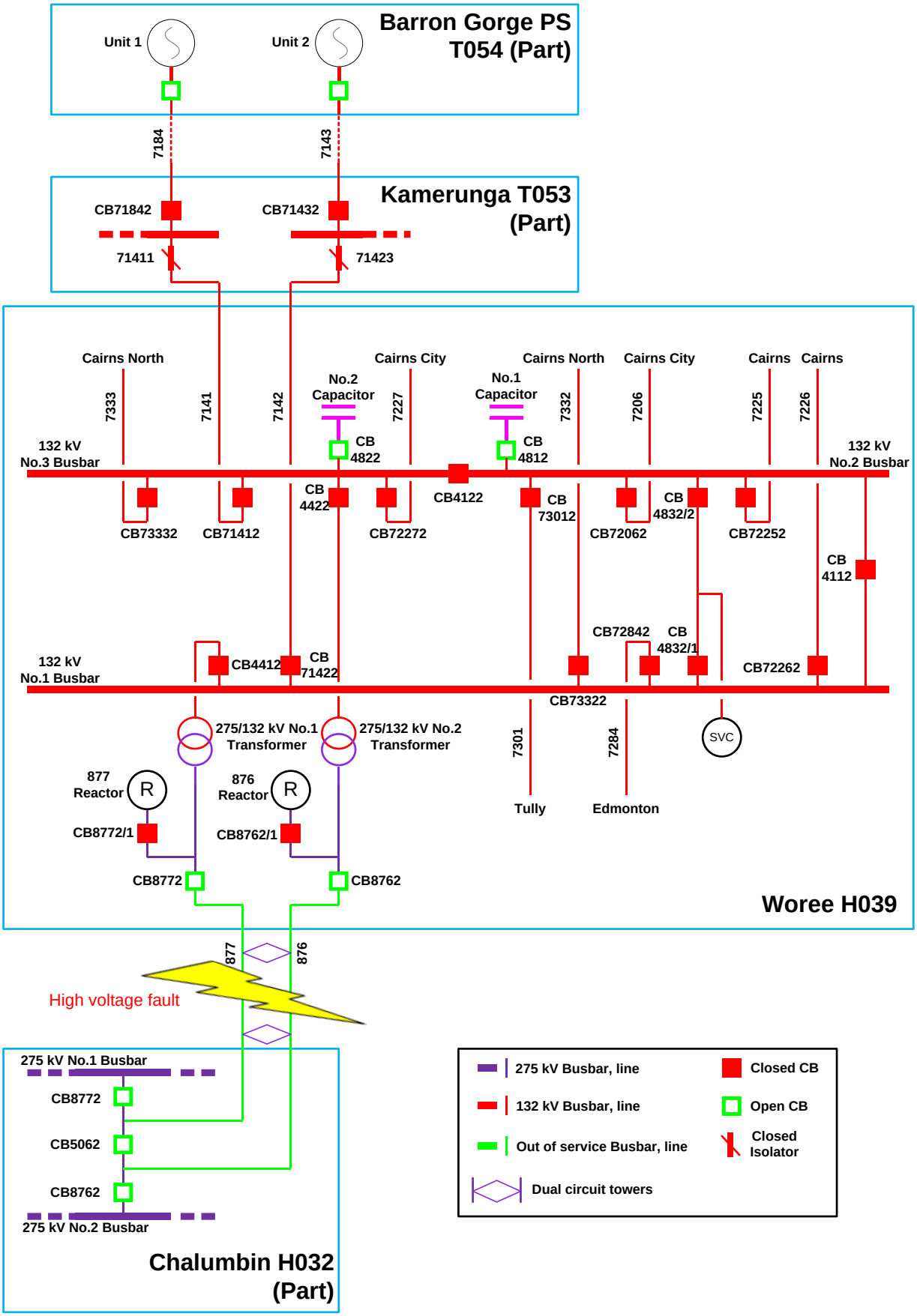
Auto-reclose functions successfully operated at both Chalumbin and Woree Substations, re-energising the Chalumbin-Woree 876 275 kV Transmission Line approximately 1 second after it tripped. The re-energisation of the line resulted in the restoration of supply to the loads at the Far North Queensland transmission network.

Auto-reclose functions at Chalumbin Substation operated and re-energised the Chalumbin-Woree 877 275 kV Transmission Line from the Chalumbin Substation end. The line did not auto reclose at Woree Substation due to a logic issue in the substation control system. The logic issue was then resolved by Powerlink on 6 March 2013.

Following the trip of both Chalumbin-Woree 275 kV transmission lines, the Barron Gorge Power Station units 1 and 2 were included in an electrical island that formed and was of brief duration (less than 1 second). This island was not sustainable because of the imbalance between generation and load. This imbalance subsequently led to voltage and frequency collapse in the island and shut down of Barron Gorge Power Station. Both Barron Gorge Power Station generating units tripped on the action of their under-voltage protection schemes and loss of auxiliary supply to their automatic voltage regulators.

The status of the power system immediately after the incident is shown in Figure 2.

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



4 Immediate Actions Taken

At 1829 hours on 2 March 2013, the 275 kV Circuit Breaker 8772 at Woree Substation was closed, returning the Chalumbin-Woree 877 275 kV line to service.

At 1852 hours on 2 March 2013, AEMO issued Market Notice No.41705 advising the occurrence of the non-credible contingency. The market notice also advised that the trip was caused by lightning, and informed that AEMO reclassified the simultaneous trip of the two Chalumbin-Woree 275 kV lines as a credible contingency event when lightning is detected in proximity of the lines.

At 1857 hours on 2 March 2013, AEMO issued Market Notice No.41706 advising the correction to the time of reclassification from 18:26 hours to 18:28 hours.

5 Follow-up Actions

At 1935 hours on 2 March 2013, AEMO issued Market Notice No.41707 advising that the two Chalumbin-Woree 275 kV lines have been added to the 'Probable' category with respect to the likelihood of a lightning trip. AEMO has updated its Power System Security Guidelines SO_OP3715 to include these two lines as vulnerable lines with respect to reclassification due to lightning strikes.

At 2227 hours on 2 March 2013, Barron Gorge Power Station Unit 2 was returned to service.

At 2247 hours on 2 March 2013, Barron Gorge Power Station Unit 1 was returned to service.

At 2313 hours on 2 March 2013, AEMO issued Market Notice No.41709 advising the cessation of the reclassification because the lightning activity stopped in the vicinity of the two Chalumbin-Woree 275 kV lines.

Powerlink checked that the protection systems on the two Chalumbin-Woree 275 kV lines operated due to the existence of high voltage faults on each line. Powerlink advised that the faults occurred immediately following a severe lightning strike recorded by its Lightning Tracker System.

Powerlink investigated the line fault location systems for both lines and reported that the high voltage faults occurred at similar physical locations on each line. Powerlink advised that the location of lightning strike recorded by its Lightning Tracker System was consistent with the location identified by the fault location systems.

On 6 March 2013, Powerlink resolved the logic issue associated with the station control system at Woree Substation.

6 Power System Security Assessment

Following the trip of both Chalumbin-Woree 275 kV lines, Barron Gorge Power Station and the Far North Queensland transmission network were islanded for less than 1 second during the auto reclose dead time of the Chalumbin-Woree 876 and 877 275 kV transmission lines . This island was not sustainable because of the imbalance between generation and load. This imbalance subsequently led to voltage and frequency collapse in the island. As a result of the voltage and frequency collapse, Barron Gorge Power Station was shut down and supply of 214 MW of load was momentarily interrupted. This combination of generation and load losses did not impact power system security.

Elsewhere in 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.

The provision and response of facilities and services were adequate to maintain power system security.

7 Conclusions

At 1828 hours on 2 March 2013, the Chalumbin-Woree 876 and 877 275 kV transmission lines in Queensland simultaneously tripped due to lightning. The Chalumbin-Woree 876 transmission line successfully auto reclosed at both ends in less than 1 second.

The Chalumbin-Woree 877 transmission line auto reclosed at Chalumbin end in less than 1 second but it failed to auto reclose at the Woree end due to logic issues. The line was manually closed at the Woree end 1 minute later.

On 6 March 2013, Powerlink resolved the logic issue associated with the station control system at Woree Substation.

Due to the auto reclose dead time of the lines, the Far North Queensland transmission network was separated from the main transmission network for less than 1 second resulting in the loss of all generation at Barron Gorge Power Station.

Generation was reduced by approximately 58 MW and momentary interruption to supply of 214 MW of load occurred as a result of this incident.

AEMO correctly applied the criteria published in section 12 of its Power System Security Guidelines in assessing the reclassification of the Chalumbin-Woree 876 and 877 275 kV transmission lines as a credible contingency event when lightning is detected in the vicinity of the lines.

8 Recommendations

There are no recommendations arising from this incident.