POWER SYSTEM OPERATING INCIDENT REPORT – TRIP OF 132 KV BUSBAR AT WATERLOO ON 17 DECEMBER 2011

PREPARED BY: Electricity System Operations Planning and Performance

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Abbreviations and Symbols

Abbreviation	Term
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NEM	National Electricity Market

1 Introduction

At 2152 hrs on Saturday 17th December 2011, the 132 kV B busbar at Waterloo substation in South Australia tripped during the presence of a thunder storm with lightning activity in the vicinity of the substation. The operation of protection systems also tripped Mintaro – Waterloo and Hummocks – Waterloo 132 kV transmission lines. Approximately 19 MW of load was lost due to the tripping.

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 ElectraNet. Data from AEMO's Energy Management System and Electricity Market Management System has also been used in analysing the incident.

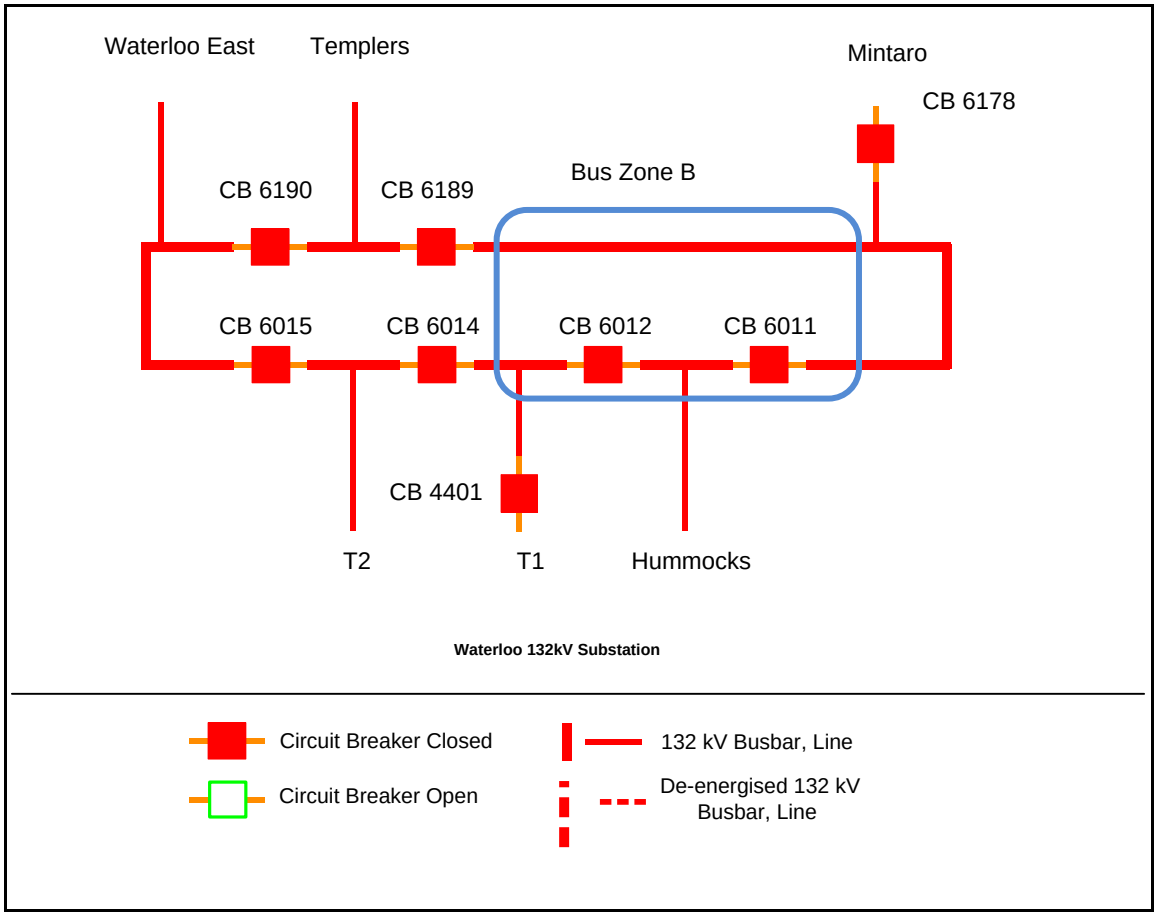
All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

2 Pre-Contingent System Conditions

Prior to the incident, a lightning strike caused the Bungama – Hummocks – Snowtown 132kV line to trip and this line remained out of service. This prior incident removed generation from Snowtown and Wattle Point wind farms.

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

At 2152 hrs on 17 December 2011, a line fault was detected by the Mintaro – Waterloo 132 kV line protection shortly followed by an earth leakage fault detected on the Waterloo Zone B protection. As a result, the following circuit breakers operated as detailed in Table 1 to clear the fault.

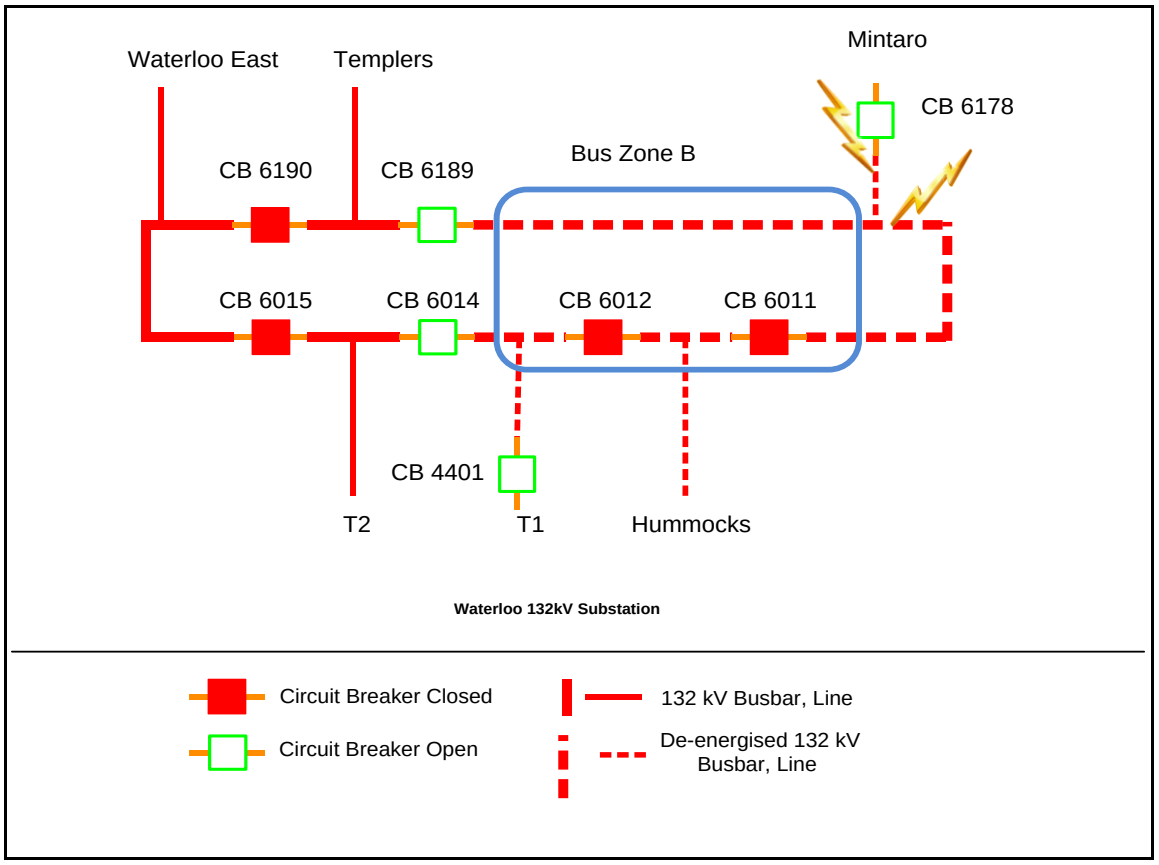
Table 1: Events at Mintaro and Waterloo

Time	Event
21:52:30.59	Mintaro – Waterloo line fault detected

21:52:30.60	CB 6178 at Mintaro opened
21:52:30.70	CB 6011 at Waterloo opened
21:52:30.73	CB 6189 at Waterloo opened
21:52:31.24	Waterloo Zone B earth leakage fault detected
21:52:31.29	CB 4401 at Waterloo opened (T1 Load)
21:52:31.30	CB 6014 at Waterloo opened
21:52:31.85	CB 6011 at Waterloo closed (auto reclosed)
21:52:31.92	CB 6189 at Waterloo closed (auto reclose)
21:52:32.02	CB 6189 at Waterloo opened (Bus Zone B protection)

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



As a consequence of the line fault, the Mintaro – Waterloo line was offloaded at Mintaro. The operation of the Bus Zone B protection scheme resulted in the loss of approximately 19 MW of load from Hummocks (Ardrossan West, Kadina East and Hummocks T1 load).

4 Immediate Actions Taken

AEMO invoked the S-HUWT constraint set from 2200 while the S-WTCB6014 set was invoked from 2235 on 17 December 2011.

ElectraNet staff isolated the Waterloo B busbar at 2205 hrs to inspect and test the relevant equipment. The Waterloo substation was ready for restoration at 2256 hrs after tests proved successful.

AEMO revoked constraint set S-WTCB6014 at 2300 hrs while constraint set S-HUWT was revoked at 2305 hrs.

In accordance with its operating procedure SO_OP 3715 Power System Security Guidelines[1], AEMO determined that it was not appropriate to declare this event as credible because the lightning activity that caused the incident had ceased.

At 0532 hrs on 18 December 2011, AEMO issued Electricity Market Notice No. 37027 advising of this non-credible contingency at the Waterloo 132 kV substation along with the associated trippings of the Waterloo – Mintaro and Waterloo – Hummocks 132 transmission lines. AEMO also advised in the market notice that it would not be classifying the event as credible because the lightning activity had ceased.

5 Follow-up Actions

ElectraNet conducted further visual checks of the 132 kV busbar on 18 December 2011 and did not find any obvious causes for the plant failure. ElectraNet also conducted an aerial patrol on 20 December 2011 to check the integrity of the equipment at Waterloo substation.

A review of the high speed data records indicated a one phase to ground fault on one of the phases of the Mintaro – Waterloo transmission line. The likely cause of the fault was a lightning strike on the line. Another one phase to ground fault was also recorded on or close to the Waterloo substation immediately following the first fault, during the auto-reclose “dead time” of the Mintaro – Waterloo transmission line. This second fault initiated the B busbar trip and has been attributed to a second lightning strike.

6 Power System Security Assessment

Approximately 21 MW of load was interrupted as a result of the busbar and line trips.

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 of ElectraNet were adequate to maintain power system security.

7 Conclusions

At 2152 hrs on 17 December 2011, the Waterloo 132 kV B busbar tripped successfully to clear the faults caused by lightning strikes in the area. The Mintaro – Waterloo and Hummocks – Waterloo 132 kV transmission lines were off-loaded as a consequence and approximately 21 MW of load was lost from Hummocks substation and Waterloo T1 load.

ElectraNet was able to check and return the equipment to service by 2300 hrs. Further checks of the plant and equipment recorders confirmed that lightning was the cause of the faults.

AEMO is satisfied that ElectraNet carried out the appropriate work to mitigate the risk of a similar incident occurring in the future.

[1] Clause 4.2.3B of the NER requires that AEMO establish criteria to use when considering whether a non-credible contingency event is reasonably possible. This is published in AEMO operating procedure SO_OP 3715 Power System Security Guidelines, which is available at: http://www.aemo.com.au/electricityops/3715.html

AEMO correctly applied the criteria published in section 12 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

There are no recommendations arising from this incident.