

Minjah Fire Ignition 17 March 2018

**Tree failure Pole 322 Hawkesdale
– Minjah Rd, Minjah**

Technical investigation report

Preface

This technical investigation report has been prepared by Energy Safe Victoria (ESV) pursuant to the objectives, powers and functions conferred on it by The Electricity Safety Act 1998 (Act).

Specifically, these include, amongst other things, to investigate events or incidents, which have implications for electricity safety and to regulate, monitor and enforce the prevention and mitigation of bushfires that arise out of incidents involving electric lines or electrical installations and to monitor and enforce compliance with this Act and the regulations.

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Summary

On 17 March 2018 a high wind event passed through Victoria's South West Region causing a tree to fail. Part of the tree fell and contacted the electrical network and is the most likely source of ignition of a fire known as the Minjah fire.

The fire originated close to Pole 322 on the Powercor Australia Limited 22 kilovolt (kV) High Voltage (HV) Koroit 012 feeder (KRT 012) near the corner of Harris Rd and Hawkesdale-Minjah Road, Minjah. Pole 322 is also known by its Line Information System number 10054 (LIS # 10054).

Upon Energy Safe Victoria's (ESV) review of the incident notification report from Powercor Australia Limited two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018.

Near pole 322 a broken tree was identified. The tree was bifurcated very low on the trunk, with sign of where large limbs had broken away from the tree. A failed large limb was lying on the ground and aligned in the direction of the powerline.

Small sections of the 22kV HV overhead conductors were lying on the ground and there was evidence of repair to the 22kV HV overhead conductors on the north side of pole 322. The repair works appeared to be consistent with a fault caused by a large tree limb falling across the 22kV HV conductors.

Fire ignition is possible either through the contact of the tree with the 22kV HV Conductor or through the broken conductor hitting the ground; both circumstances could release enough electrical energy to ignite a fire on the ground.

The Powercor HV electrical protection records indicate a phase to earth fault event occurred beyond the Winslow P107 Auto Circuit Recloser (ACR) connected upstream to the same 22kV feeder (KRT012) as pole 332. The time stamp recorded against this event in Table 1 is consistent with the time when damaging winds were experienced in the region.

ESV determined that it is highly likely that the large limb failed and fell onto the 22kV HV conductors, breaking the conductors and bringing them to ground. This resulted in the ignition of a fire at approximately 23:28 Australian Eastern Standard Time¹ (AEST) on 17 March 2018 near pole 322.

From the evidence observed on site and review of Google Maps, and LiDAR information provided by Powercor ESV determined that on 26 February 2018 the failed limbs were at a distance greater than the minimum clearance required under the Electricity Safety (Electric Line Clearance) Regulations 2015, however the limb was of sufficient length to contact the powerlines when it failed.

Based on the findings of this investigation, ESV concluded no further investigation into this incident is warranted.

¹ All time references in this report refer to Australian Eastern Standard Time

Introduction

Scope

This report details the findings of an Energy Safe Victoria (ESV) technical investigation into the causes of, and contributing factors to, a fire that originated close to the location of Pole 322 on the Powercor Australia Limited 22 kilovolt (kV) Koroit 012 feeder (KRT012) near the corner of Harris Rd and Hawkesdale-Minjah Road, Minjah.

The investigation details the evidence gathered to support the technical conclusion reached and outlines the relevant standard that applies to vegetation management near the distribution network at this location.

Objectives

ESV's investigative objectives were to:

- identify the entities involved
- establish the initial facts and possible causes of the incident
- source information from the Country Fire Authority (CFA)
- identify any standards relevant to the incident.

To meet these objectives, ESV sourced specific information that included:

- Bureau of Meteorology (BOM) data from the Hamilton weather station closest to the ignition source
- Koroit 012 (KRT012) 22kV feeder protection equipment operation records
- the Powercor Australia Limited:
 - incident report
 - protection equipment operation records
 - accepted Electric Line Clearance Management Plan
 - LiDAR records of the incident site.
- CFA information and photographs
- Google Maps images.

Methodology

ESV's investigative methodology involved a combination of practices, procedures, and processes that included:

- requiring and analysing specific information (including the incident report) from Powercor Australia Limited
- reviewing and analysing 22kV KRT012 feeder protection equipment operation records
- reviewing LiDAR information provided by Powercor
- reviewing weather records from the closest BOM weather stations
- reviewing photos taken at the site on the day of the ESV site visit
- reviewing photos provided by the Country Fire Authority (CFA)
- Reviewing images from Google maps.

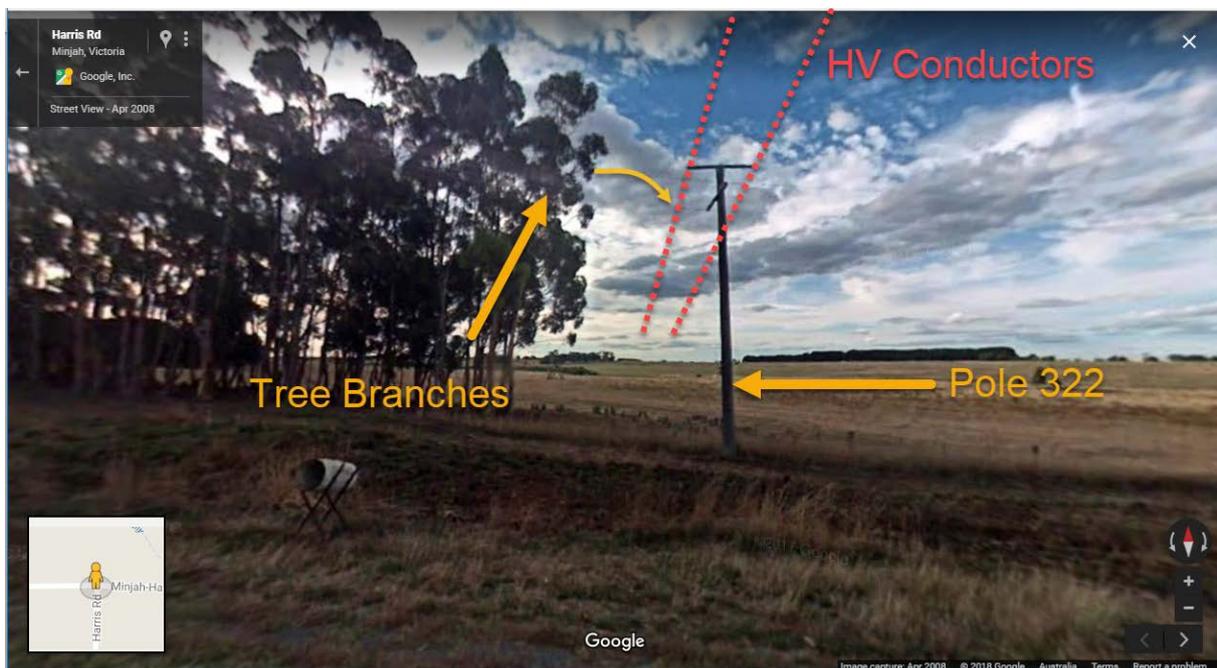
Background

On 17 March 2018 a high wind event passed through Victoria's South West Region and caused a tree to fail. Part of the tree fell and contacted the electrical network and is the most likely source of ignition of a fire.

The fire originated close to Pole 322 on the Powercor Australia Limited 22 kV Koroit 012 feeder (KRT 012) near the corner of Harris Rd and Hawkesdale-Minjah Road, Minjah. Pole 322 is also known by its Line Information System number 10054 (LIS # 10054).

Upon ESV's review of the incident notification report from Powercor Australia Limited two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the incident site on 13 April 2018.

Figure 1: Site layout



Declarations

The declarations relating to the period of the incident involved a Total Fire Ban (TFB) day, a Hazardous Bushfire Risk Area (HBRA), and Powercor Australia Limited special protection settings for TFB days.

Total Fire Ban day

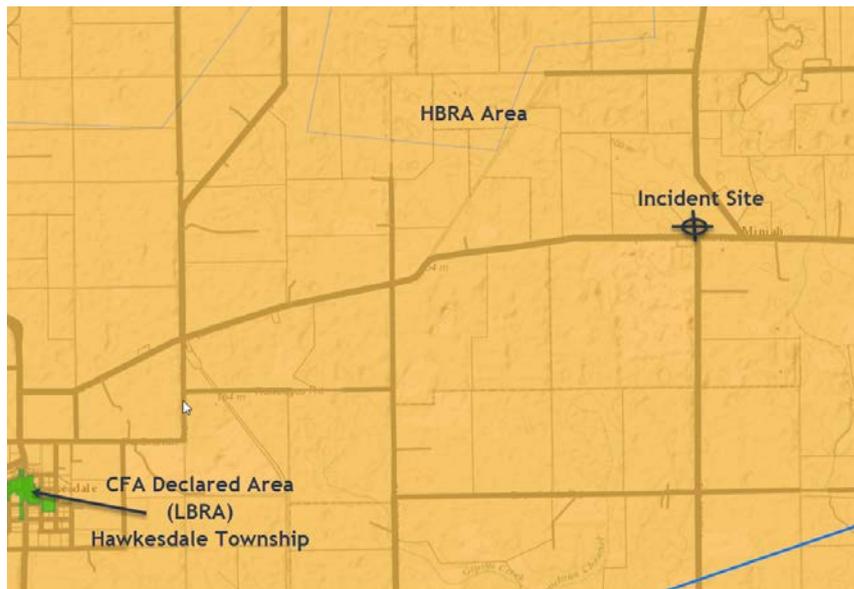
On 17 and 18 March 2018, TFB days were declared for the Southwest Fire District, which includes the Minjah area².

Hazardous Bushfire Risk Area

Figure 2 shows a map of the incident site in relation to the CFA declared Low Bushfire Risk Area (in green) and the HBRA area (in amber).

² Country Fire Authority 2018, State Government of Victoria, Melbourne, viewed 7 May 2018, www.cfa.vic.gov.au/warnings-restrictions/history-of-tfbs.

Figure 2: Incident site map



Powercor Australia Limited special protection settings

Powercor Australia Limited has an accepted (by ESV) Bushfire Mitigation Plan (including any actions required) for managing risk on TFB days. The plan, which considers a number of factors (including environmental) and includes initiating enhanced protection setting functionality for listed assets in a document referenced in the plan. For ACRs that means suppressing (deactivating) the auto-reclose function for the following identified asset:

- The Winslow P107 Auto Circuit Recloser (ACR) connected upstream to the same 22kV feeder (KRT 012) as pole 332 is listed as an asset to which TFB day settings should be applied³.

The Winslow P107 ACR protection settings were logged as applied on 17 March 2018 and removed on 18 March 2018 (as per Table 1).

This terminology means that the protection was set not to reclose/re-energise the line after an operation (as would have been the case on a normal/undeclared day). As expected the ACR only operated once and then locked open until the line had been inspected.

The Powercor HV electrical protection system records identified a phase to earth fault event on the time stamps recorded against this event which is consistent with the time when damaging winds were experienced in the region.

³ Powercor Australia Limited, Total Fire Ban Action Plan, Attachment A, 2018.

Technical investigation

Powercor post event actions

Powercor isolated the local section and repaired the HV Overhead line on 18 March 2018.

ESV site observations

Two ESV Compliance Officers (as electricity infrastructure and electric line clearance specialists respectively) attended the site on 13 April 2018.

Site observations:

- the site visit indicated a tree (Eucalyptus species) with a large limb that failed close to its base
- it is assumed that the failed limb has made contact with and caused damage to the HV overhead conductors on the north side of P 322
- much of the failed limb were missing; however there were signs of debris on the ground that indicated the alignment of where the limb may have landed
- the horizontal distance measured from the tree stump failure position to the closest HV conductor was 10.4 metres as per Figure 3
- conductor height at the assumed contact point was measured at 11.54 metres using a Suparule Cable Height Meter⁴
- an adjacent tree was measured to be 22.6 metres in height using a Laser Rangefinder⁵. Review of Google and LiDAR images estimates that the tree limb that failed was of similar height
- both HV conductors were identified as 3/4/2.5 ASCR and appeared to have recently been repaired on the northern side of the pole 322.

⁴ The Suparule Cable Height Meter is a handheld meter for measurement of cable sag, cable height, and overhead clearance.
<http://www.suparule.com/products/cable-height-meter/>

⁵ The TruePulse laser rangefinder is a handheld device which enables a user to obtain the height of a tree.
<http://www.lasertech.com/TruPulse-Laser-Rangefinder.aspx>

Figure 3: Tree position in relation to the HV conductors

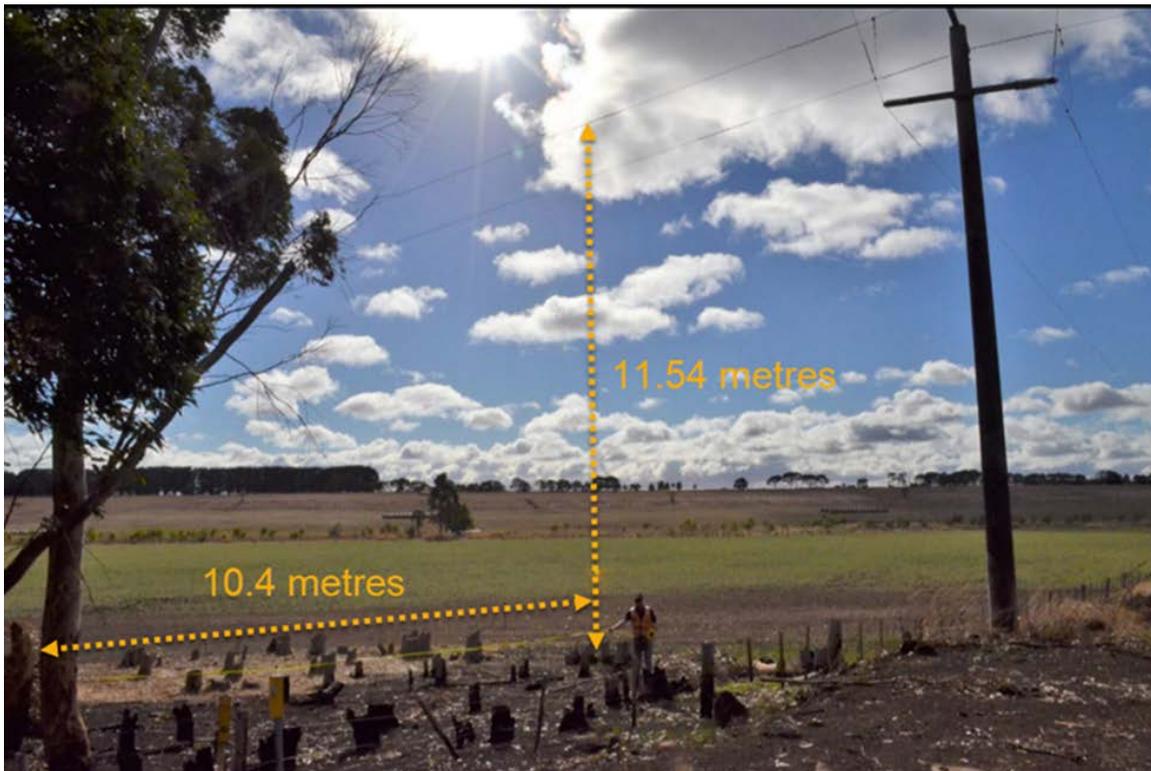


Figure 4: Image of failure point on tree



Figure 4 shows that the failure point of the tree limb is located above an old wound where the tree had been cut back prior, and subsequently regrown. The ESV arborist on site noted this as a point of structural weakness in the tree.

Figure 5: Images of burnt branches found onsite

ESV concludes that the local damaging winds were strong enough to cause the limb to break and fall towards the powerlines.

From the evidence remaining on site it appears that the failed tree limb was outside the minimum tree clearance distance required by the Electricity Safety (Electric Line Clearance) Regulations 2015, however it was of sufficient length to contact the powerlines when it fell.

Powercor incident report

ESV received an incident notification (20180423PWA_03) from Powercor on 24 April 2018 regarding the failure of a tree branch causing a fire. The report states that the HV Line was contacted by a tree falling from outside the required clearance requirements.

The details of the notification report are consistent with observations made by ESV during its site visit of 13 April 2018.

Powercor Protection equipment operation information

The Powercor HV electrical protection system records identified a phase to earth fault event on the Winslow P107 Auto Circuit Recloser (ACR) connected to (KRT012) 22kV feeder at 23:28 AEST.

Table 1: Excerpt KRT012 – Winslow ACR P107 - 17 March 2018

Time (ACR)	Time (AEST) (+1)	Type	Magnitude @ Trip	Reclose
10:28:50.94 PM	11:28:50.94 PM	B Phase ¹ to ground	141 A	No (single shot trip)

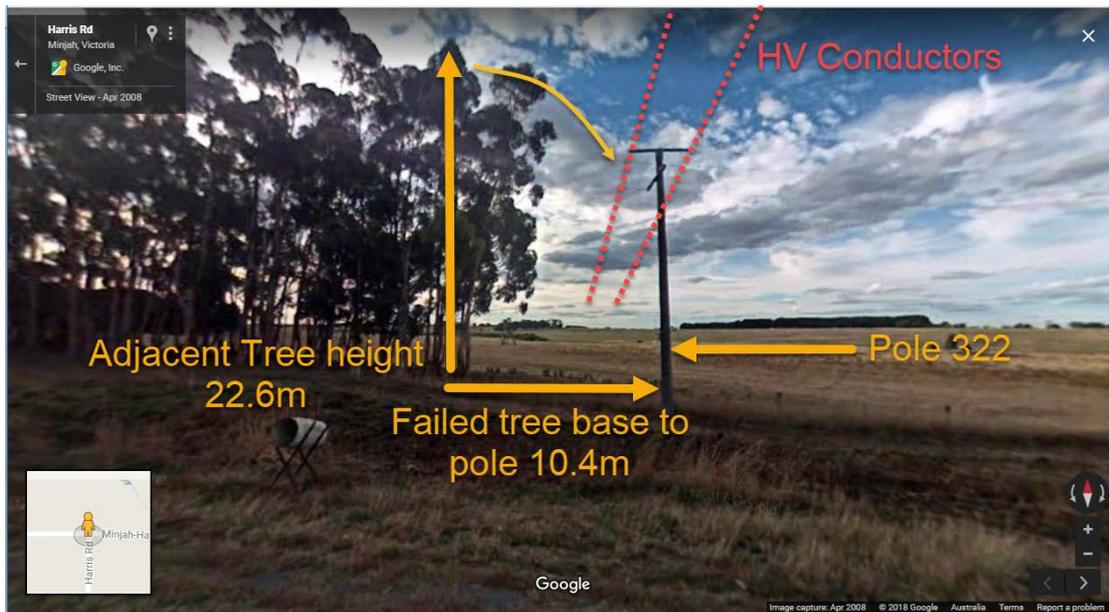
This information was provided by Powercor Australia Limited following a request from ESV. This confirms that the ACR protection was set not to reclose/re-energise the line after an operation (as would be the case on a normal/undeclared day). The ACR operated once (as per Table 1) and then locked open until the line had been inspected in line with Powercor policy.

Google Maps image review

A search and review of images⁶ provided by Google maps shows the site with tree branches clear of the HV conductors at that time (April 2008). The image also provides detail supporting the assertion that the failed limb was significant in height to make contact with the powerlines if it failed.

⁶ <https://www.google.com.au/maps/@-38.0717928,142.4397701,3a,75y,0.67h,89.1t/data=!3m6!1e1!3m4!1s5thQD99d5INThx5lfPvyZq!2e0!7i3328!8i1664> as viewed 4 June 2018

Figure 6: Image from Google maps street view



LiDAR Information

Powercor provided ESV with a copy of the most recent LiDAR (Light Detection and Ranging) measurements that was recorded of the incident site. The information/data has been provided from the flight data recorded on 26 February 2018.

This indicates that the closest vegetation was assessed at 2.17 metres horizontally from the closest HV conductor as per Figure 7.

Figure 7: LiDAR image of site provided by Powercor



Analysis of photos and images

Photos taken at the site by ESV on 13 April 2018 indicate:

- a number of tree branches were charred
- adjacent trees were of similar height
- new conductors and conductor sleeves have been installed following the incident at pole 322.

Further reviews of images from other sources indicate:

- Google images show significant clearance from HV conductors at that time.
- recent (to the incident date) LiDAR data provides measurement of clearance from trees to the HV conductors and confirms that regulatory requirements were met.

Electric Line Clearance Regulations 2015

Section 84 of the Electricity Safety Act 1998 identifies Powercor as responsible for keeping trees appropriately clear of the electric line that is the subject of this technical investigation report. The electric line has been identified to be an uninsulated high voltage electric line that existed in a hazardous bushfire risk area (HBRA) as defined by the CFA.

Section 28 and Graph 5 of the Code of Practice for Electric Line Clearance (the Code) prescribes the minimum distance that trees should be kept clear from uninsulated high voltage electric lines (other than a 66,000 volt electric line) in HBRA. The Code is a schedule to the Electricity Safety (Electric Line Clearance) Regulations 2015.

Sub clause (3) states that “The applicable distance for the first and last sixths of the span is 1500mm”.

The tree of concern existed within the first sixth of the span therefore a minimum clearance distance of 1500mm (1.5 metres) was required in all directions from the HV overhead conductors.

From the evidence gathered and analysed, site observations made and review of available images ESV estimates the tree was more than 2 metres from the HV conductor and therefore ESV is satisfied that the minimum clearance distance has been maintained prior to the incident.

Prevailing weather information

Bureau of Meteorology Information

On the afternoon of 17 March 2018 damaging winds had passed though the Hamilton area and South West region of Victoria.

The closest weather station to the investigation site was Hamilton. The information from this station has been collected by accessing the Bureau of Meteorology Internet site.

Figure 8 shows that Hamilton weather station records recorded on 17 March 2018 at 19:00 AEST winds with a maximum gust of 109 km/h coming from a West North Westerly direction.

Figure 8: Excerpt of Hamilton weather record for March 2018

Hamilton, Victoria March 2018 Daily Weather Observations									
Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust		
		Min °C	Max °C				Dirn	Spd km/h	Time local
1	Th	12.6	22.9	1.0			SSE	33	14:39
2	Fr	10.1	30.0	0			ENE	30	10:50
3	Sa	12.8	24.6	0			SW	44	14:33
4	Su	9.8	20.1	0			SW	39	13:16
5	Mo	7.1	20.4	0			SSE	46	14:45
6	Tu	8.6	25.4	0			SSE	48	16:01
7	We	10.8	30.8	0			S	46	17:21
8	Th	12.2	32.7	0			SSE	39	16:52
9	Fr	13.5	33.8	0			SSE	44	17:21
10	Sa	15.1	35.3	0			WNW	44	14:02
11	Su	14.0	22.8	0			S	44	12:38
12	Mo	11.3	21.3	0			S	43	15:03
13	Tu	11.8	21.6	0			SSE	52	12:22
14	We	11.7	23.5	0			S	31	14:33
15	Th	8.2	21.4	0			SW	31	11:29
16	Fr	7.7	24.8	0			NNW	43	13:37
17	Sa	12.8	31.6	0			WNW	109	19:00
18	Su	11.6	20.2	1.6			WNW	72	09:08

See Appendix A for more information.

Findings and conclusions

ESV's findings and conclusions specifically relate to the source of the Minjah fire and the role played by the electricity infrastructure.

The source of the Hawkesdale-Minjah Road fire

The most likely source of the Minjah fire ignition was either by the contact of the tree with the 22kV HV Conductor, or the result of the broken conductor hitting the ground on the North West side of pole 322 (LIS #10054) of the (KRT012) 22kV feeder. Either of the circumstances could have released enough electrical energy to ignite a fire on the ground.

Auto Circuit Recloser operations

The protection settings on the Winslow P107 Auto Circuit Recloser (ACR) connected to KRT012 22kV feeder were set to cause the ACR not to reclose/re-energise the line after an operation (as would be the case on a normal/undeclared day) the ACR only operated once and then locked open until the line had been inspected in accordance with the current approved Powercor Bushfire Mitigation Plan.

Vegetation clearances

From the evidence gathered and analysed, ESV concludes that the failed limb made contact with the 22kV HV conductors, breaking the conductors and bringing them to ground resulted in the ignition of a fire at approximately 23:28 on 17 March 2018 near pole 322 of the 22kV KRT012 feeder.

From the evidence remaining on site it appears that the base of the tree was 10.4 metres away from the closest conductor, and therefore ESV determines that the failed limb was well outside the minimum clearance requirements under the Electricity Safety (Electric Line Clearance) Regulations 2015, however it was of sufficient length to contact the powerlines when it failed.

ESV determines that the limb that failed was compliant to the minimum Code clearance requirements under the Electricity Safety (Electric Line Clearance) Regulations 2015.

Therefore ESV will not investigate this incident further.

Appendix A – Weather Observations

Hamilton, Victoria
March 2018 Daily Weather Observations



Date	Day	Temps		Rain	Evap	Sun	Max wind gust					9am					3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP	
																						°C
1	Th	12.6	22.9	1.0			SSE	33	14.39	13.0	93	8	SSW	17	1018.1	20.5	51	4	SSE	19	1017.5	
2	Fr	10.1	30.0	0			ENE	30	10.50	12.9	93	1	ESE	17	1014.4	26.0	25		ESE	7	1011.6	
3	Sa	12.8	24.6	0			SW	44	14.33	16.9	65		W	19	1009.4	23.3	43	2	WSW	26	1010.4	
4	Su	9.8	20.1	0			SW	39	13.16	12.8	92		SSW	9	1017.0	19.2	42	7	S	20	1016.7	
5	Mo	7.1	20.4	0			SSE	46	14.45	14.2	73	8	S	17	1020.2	19.5	39	7	S	30	1021.3	
6	Tu	8.6	25.4	0			SSE	48	16.01	13.2	77		SE	20	1025.3	24.3	33		SE	30	1023.6	
7	We	10.8	30.8	0			S	46	17.21	14.0	88		ESE	17	1025.1	28.9	26		NW	9	1022.8	
8	Th	12.2	32.7	0			SSE	39	16.52	20.3	54		NNE	6	1024.5	31.5	18		SW	13	1022.2	
9	Fr	13.5	33.8	0			SSE	44	17.21	20.7	46		N	6	1025.3	32.4	17		ENE	9	1023.0	
10	Sa	15.1	35.3	0			WNW	44	14.02	22.3	35		NNW	13	1024.0	34.1	14		N	17	1021.8	
11	Su	14.0	22.8	0			S	44	12.38	17.4	81	7	S	19	1024.5	21.0	54	4	S	20	1024.4	
12	Mo	11.3	21.3	0			S	43	15.03	14.0	67	8	SSW	22	1025.1	19.8	47	1	SSW	24	1023.6	
13	Tu	11.8	21.6	0			SSE	52	12.22	13.5	78	8	SSW	15	1024.5	20.4	46	3	SSW	22	1022.8	
14	We	11.7	23.5	0			S	31	14.33	14.1	68	8	SSE	17	1021.1	22.6	36		SSE	15	1017.4	
15	Th	8.2	21.4	0			SW	31	11.29	10.9	88	5	Calm		1015.8	19.8	49	8	SSW	17	1015.3	
16	Fr	7.7	24.8	0			NNW	43	13.37	12.8	95	7	E	13	1015.4	23.5	33	8	NNW	22	1012.5	
17	Sa	12.8	31.6	0			WNW	109	19.00	19.1	66	3	N	24	1010.4	30.4	22	4	NNW	44	1006.2	
18	Su	11.6	20.2	1.6			WNW	72	09.08	12.9	78		WNW	37	1006.2	18.5	37	8	W	33	1011.7	
19	Mo	11.2	21.0	0.2			WNW	52	11.27	13.4	91	7	NNW	28	1014.7	20.1	57	8	WNW	31	1014.9	
20	Tu	10.5	16.9	0.8			S	52	15.20	12.8	73	8	SSE	13	1026.8	15.9	43	8	SSE	31	1028.1	
21	We	8.8	25.4	0			E	56	18.41	11.2	68		ESE	20	1027.7	21.8	43	6	E	30	1023.9	
22	Th	10.8	28.6	0			E	50	23.25	16.4	59	4	ENE	19	1023.2	27.2	32		NNE	26	1020.4	
23	Fr	15.2	29.3	0			N	52	13.51	21.5	50	7	N	30	1020.1	28.0	29		N	33	1016.0	
24	Sa	16.1	25.9	9.6			SW	59	04.08	16.6	93	8	NE	13	1013.0	25.2	41	8	NW	15	1009.5	
25	Su	14.9	21.5	0.2			WNW	80	14.01	16.0	80	5	NW	31	1002.8	20.5	37	8	WNW	46	1000.4	
26	Mo	6.8	16.8	3.0			SW	48	10.09	9.7	84		W	17	1010.5	15.3	51		WSW	30	1012.5	
27	Tu	6.4	20.4	0			NNW	46	12.27	8.8	89		N	17	1015.1	18.8	42		NNW	28	1012.5	
28	We	8.8	24.0	0			N	52	04.00	17.5	47		NW	20	1012.2	22.7	52		SW	19	1014.2	
29	Th	10.9	22.1	0			W	39	14.24	13.2	80		W	9	1017.6	21.0	43		WNW	22	1015.4	
30	Fr	13.0	22.7	0			W	43	10.05	14.5	87		W	17	1016.7	20.5	46		WSW	24	1017.0	
31	Sa	6.2	21.2	0			NW	31	14.33	9.9	95		SSW	2	1019.2	19.4	37		SW	11	1016.6	
Statistics for March 2018																						
Mean	11.0	24.5								14.7	75	6		16	1018.3	23.0	38	5		23	1017.0	
Lowest	6.2	16.8								8.8	35	1		Calm	1002.8	15.3	14	1	ESE	7	1000.4	
Highest	16.1	35.3	9.6				WNW	109		22.3	95	8	WNW	37	1027.7	34.1	57	8	WNW	46	1028.1	
Total			16.4																			

Observations were drawn from Hamilton Airport (station 090173)

Some cloud observations are from automated equipment, these are somewhat different to those made by a human observer and may not appear every day.

IDC:JDW3032-201803 Prepared at 13:01 UTC on 21 Apr 2018
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