

SOUTH AUSTRALIAN GOVERNMENT RADIO NETWORK (SAGRN) PINERY FIRE REVIEW



27th June 2016

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SA Attorney-General's Department (AGD)

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Executive Summary

A review of the South Australian Government Radio Network (SAGRN) usage and performance during the Pinery Fire on the 25th November 2015 was undertaken by Mingara Australasia (Mingara), at the request of the Attorney-General's Department.

Mingara's independent review confirms that during the Pinery Fire incident there were periods where end-users would have experienced significant difficulty in effectively communicating on the SAGRN. This resulted in non-optimal operational radio communications effectiveness for the primary combatant agencies.

There are a range of reasons for end-users experiencing non-optimum operational radio communications effectiveness on the SAGRN during the Pinery Fire, including:


- The Country Fire Service (CFS) used portable radio terminals in areas not designed to deliver reliable two-way portable communications. Users are unable to communicate on the SAGRN from a portable radio terminal, including use of the emergency (duress) button, unless the radio is located within an area with portable radio coverage;
- The large number of SA Police (SAPOL) calls, combined with lengthy conversations on the network during the Pinery Fire significantly exceeded historical norms for similar events, and impacted available capacity for other agencies directly involved in the Fires;
- SAPOL's operational practice of patching multiple regional talkgroups, including those remote to the fire, remained in place during the Pinery Fire incident, adding to the already heavily congested radio sites; and
- Network statistics show no evidence of effective action to manage SAGRN radio traffic by Agencies, to optimise available network capacity during the Pinery Fire.

It is Mingara's opinion that agency and user behaviour, as well as the lack of pro-active action to effectively mitigate network traffic, significantly contributed to the lack of available SAGRN resources necessary to meet the emergency communications needs of the primary combatant agencies during the Pinery Fire.

Recommendations

Based on the findings, Mingara recommends that:

1. All agencies are provided with the latest SAGRN coverage predictions to ensure end-users have an understanding of the operational limitations of the SAGRN coverage types (i.e. outdoor mobile and outdoor portable) when being deployed to an event.
2. Agencies to include SAGRN coverage predictions in communications planning documentation, either pre-planned or for specific events.
3. Due to the infrequent nature of major events similar to the Pinery Fire, agencies include similar scenarios in their radio terminal training programs; in the case of CFS and MFS, especially immediately prior to the fire danger period.
4. SAPOL undertake an investigation to determine if the operational use of the SAGRN specifically relating to the Pinery Fires explains the high SAPOL call volumes generated in the area.
5. The impact of relatively lengthy call durations on SAGRN site capacity, especially during major events, be reinforced with SAPOL.
6. SAPOL undertake an investigation into the length of calls employed during the Pinery Fire and, where operationally feasible, implement procedures that can be used to minimise the related impact on the capacity of sites involved in future major events.
7. All agencies do not operate on patched talkgroups in the incident area where members of the patch involve operational jurisdictions well outside the affected area.
8. AGD and SAGRN user agencies engage to review the current SAGRN site talkgroup mapping to reduce the probability of remote, unrelated operational traffic occurring at the incident.
9. Agencies consider and formally document their “concept of operations” to revise and/or revalidate their talkgroup and radio terminal requirements, to ensure the SAGRN is configured to meet the operational requirements of the agencies.
10. Subject to recommendation 9, that the outcome of the “concept of operations” be used to assist in re-benchmarking the SAGRN coverage and capacity requirements.
11. Agencies reinforce with their users that emergency (duress) calls can only be processed by the SAGRN infrastructure if the terminal device is within the respective coverage type.
12. CFS and SAPOL investigate the operational role and necessity of geographically remote radio terminals communicating with the fireground.
13. The establishment of IMT locations takes into consideration access to available radio communications resources (including capacity) necessary to carry out its function, whilst not compromising frontline communications requirements.
14. Public Safety Solutions unit, AGD be engaged to provide an SAGRN advisory function to the State Controller Communications during major events;

- 
15. State Controller Communications initiate a review of the SAGRN Traffic Mitigation Agreement;
 16. The SAGRN Board initiate a review of the SAGRN Standard Conditions of Service, with a view to incorporating policies regarding expected agency radio communications behaviour when operating in the SAGRN shared environment; and
 17. AGD and the agencies review the current governance arrangements around regular reporting on SAGRN agency utilisation, and compliance with the SAGRN Standard Conditions of Service, as amended by recommendation 16.
 18. AGD review the SAGRN Upgrade Program to assess the impact of prioritising the upgrade of SAGRN site capacity in high risk areas of the State.
 19. Agencies reinforce with their users the impact of remote listening on available site capacity.
 20. Agencies reinforce with their users the impact of both large call volumes and long call durations on the availability of site capacity during major events.
 21. Due to the infrequent nature of major events similar to the Pinery Fire, agencies and the relevant area within the Communications Functional Service reflected in the SEMP (State Emergency Management Plan), include similar scenarios in their radio terminal training programs, especially the operational and OH&S impact of whole busies.

1 Scope

The scope of this report includes Mingara's analysis of the performance and use of the SAGRN voice sub-network during the Pinery Fire incident on 25th November 2015, between 10:00 to 22:00 hours (Analysis Period). The analysis is based on an extract of the SAGRN Genesis database provided by Motorola, and addresses:

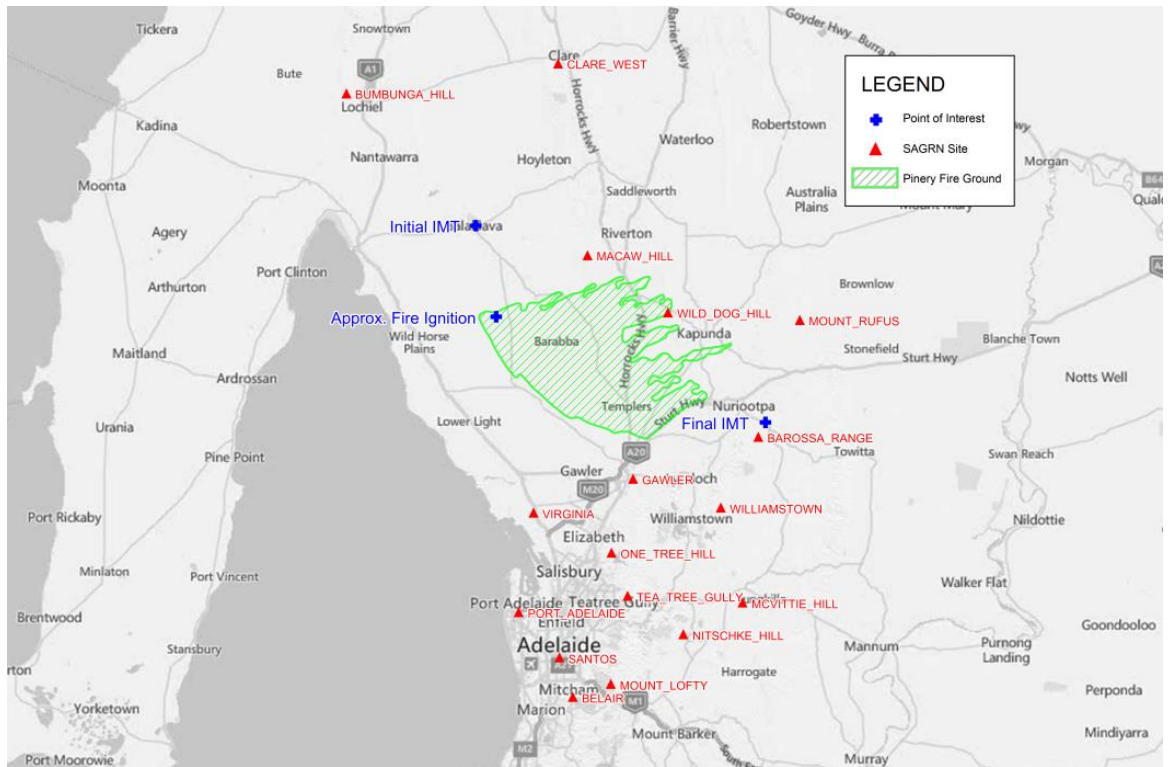
- Coverage in the Pinery Fire incident area, including the impact of –
 - Using portable terminals.
 - Environmental conditions (smoke, heat, etc.).
- Network congestion, including the effective impact on –
 - Emergency (duress) for CFS users.
 - Communications between the fire ground and the Incident Management Team (IMT).
- Traffic modelling of network activity and performance, including –
 - Communications activities of all user agencies and the traffic generated by those agencies.
 - Ingress (initiating) and egress (receiving) network traffic at regular intervals.
 - Active talkgroups and site affiliations.
 - Active (affiliated) radio terminals.
 - Timing and performance of Emergency (duress) calls.
 - Effect of talkgroup patching, private calls, Emergency (duress) calls and use of multiple talkgroups.
 - The extent to which user agencies' use of the network affected SAGRN performance and end-user experience.

The scope of this report is limited to the analysis of the following SAGRN sites that provide predicted Outdoor Mobile Radio coverage to the Pinery Fire incident area (as shown in Figure 1):

- Barossa Range
- Belair
- Bumbunga Hill
- Clare West
- Gawler
- Macaw Hill
- McVitties Hill
- Mount Lofty
- Mount Rufus
- Nitschke Hill
- One Tree Hill
- Port Adelaide
- Santos House
- Tea Tree Gully
- Virginia
- Wild Dog Hill
- Williamstown

A review of agency communications plans or concept of operations for the Pinery Fire is not included in the scope of this report.

Figure 1: Pinery Fire Incident Area



2 Consultation

Table 1 provides a list of agency and government representatives (as nominated by SA AGD) that Mingara has consulted with in undertaking the Pinery Fire analysis.

Table 1: Consultation - Agency and Government Representatives

Name	Agency/ Government Department	Title
Peter Sinclair	AGD	Manager, Operational Service Delivery, Public Safety Solutions
Gordon Young	AGD	Technical Specialist - SAGRN
Rob Sandford	CFS	Assistant Chief Officer, Director State Operations
Mario D'Agostino	CFS	Manager Telecommunications
Paul Ralphs	SAPOL	Superintendent, Officer in Charge Communications Group
S/Sgt Andrew Bruce	SAPOL	Training and Planning Coordinator, Communications Group

3 Coverage

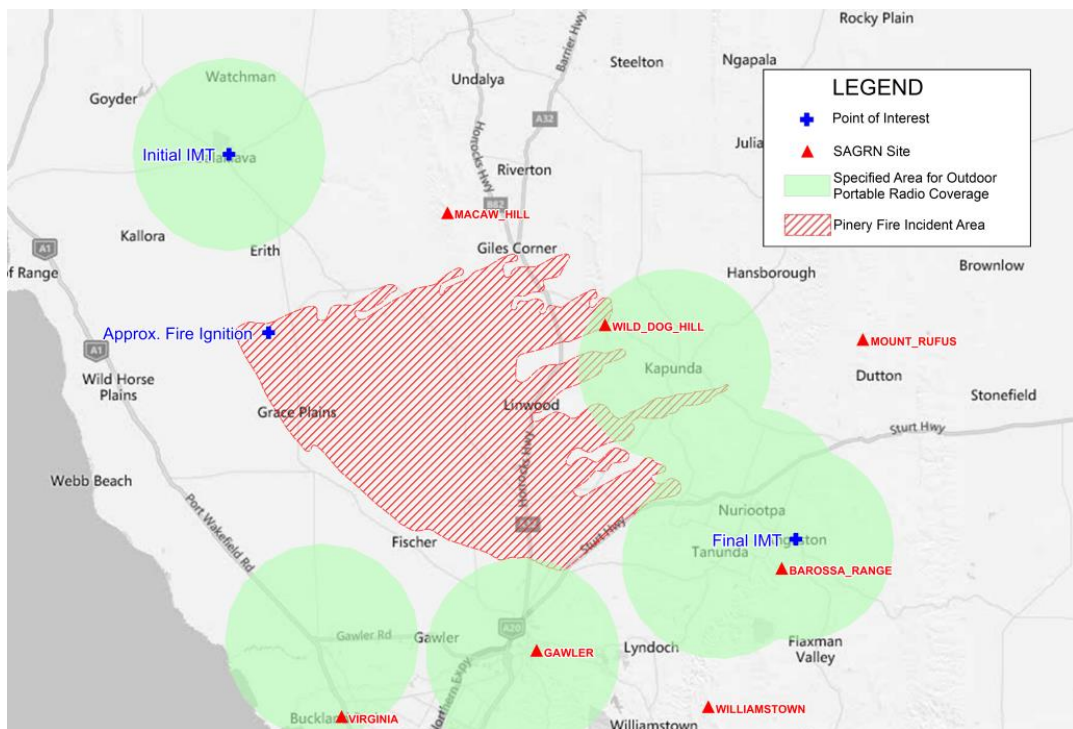
3.1 Analysis

3.1.1 SAGRN Coverage

The SAGRN is designed to deliver both outdoor mobile radio coverage and outdoor portable radio coverage. Outdoor mobile radio coverage is required to be delivered across the entire SAGRN service area (in accordance with coverage predictions agreed between Motorola and that State), which aligns with the outdoor mobile radio coverage service area. However, when the SAGRN was specified, outdoor portable radio coverage was to be delivered only to the nominated outdoor portable radio coverage service areas.

The Pinery Fire incident area is located entirely within the SAGRN service area, and is therefore fully encompassed within the specified outdoor mobile coverage service area. However, as shown in Figure 2, there is very little overlap between the Pinery Fire incident area and locations where outdoor portable coverage was specified.

Figure 2: SAGRN Contracted Area for Outdoor Portable Radio Coverage



3.1.2 SAGRN AS-Built Predicted Coverage

Figure 3 provides the predicted SAGRN outdoor mobile radio coverage (based on as-built coverage predictions) in relation to the Pinery Fire incident area.

Figure 3, indicates that there is extensive predicted outdoor mobile radio coverage across the entire Pinery Fire incident area, as well as the initial and final IMT locations at Balaklava and Angaston respectively.

Figure 3: SAGRN As-Built Predicted Outdoor Mobile Coverage

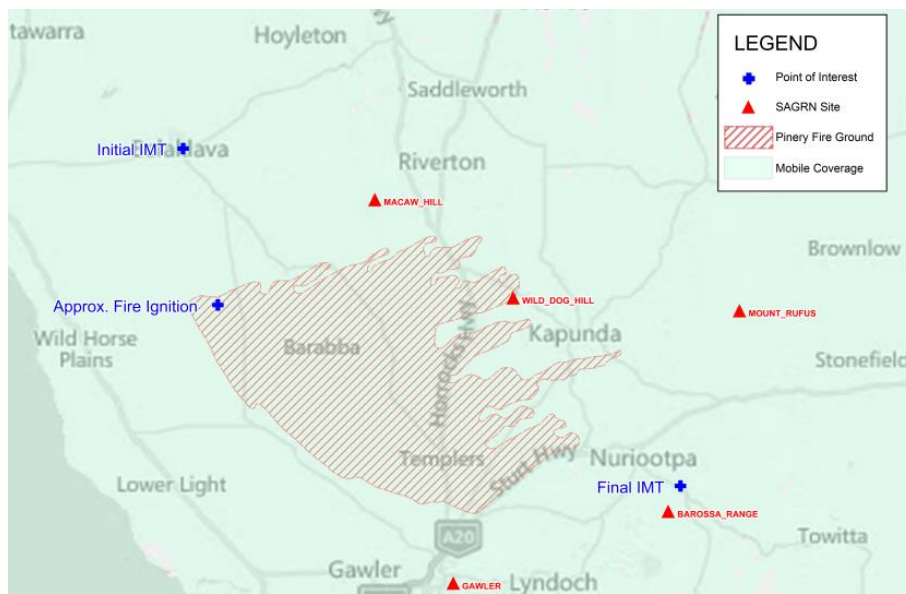
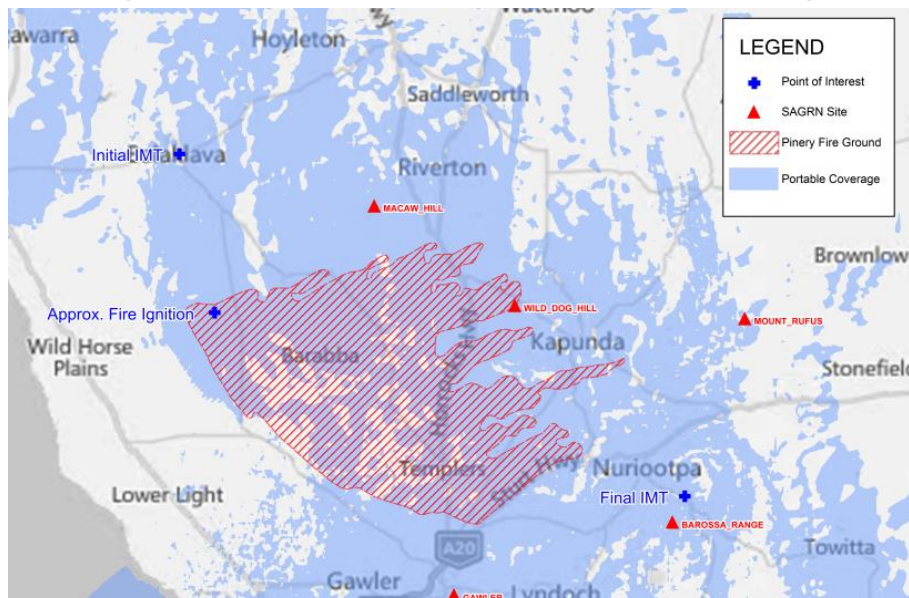


Figure 4 shows that there is predicted outdoor portable radio coverage within and around the Pinery Fire incident area, despite there being no specified requirement. This is fortuitous portable coverage from nearby SAGRN sites. However, this coverage is fragmented, indicating that there are large areas within the Pinery Fire incident area where portable radio communications is not likely to operate reliably.

Figure 4: SAGRN As-Built Predicted Outdoor Portable Coverage



3.1.3 Call Processing

When operating within the SAGRN coverage footprint, the network has been designed with parameters such that end-users will be able to participate in a call when using the correct radio terminal within the corresponding coverage type.

The difference in outdoor mobile radio and outdoor portable radio predicted coverage means that, when operating in-and-around the Pinery Fire incident area, the ability to participate in a call for mobile and portable users is not expected to be the same (i.e. mobile users could participate in calls in locations where portable users could not).

Coverage predictions for the SAGRN are generated based on a set of assumptions, including environmental conditions. These assumptions do not take into account extreme environmental conditions such as smoke and fire.

Industry research into the general effect of smoke and/or fire on radio communications indicates that:

- When attempting to use radio communications through an ionised atmosphere (e.g. direct flame), radio propagation on any frequency will be affected, however the impact of this effect cannot be theoretically predicted; and
- The composition and density of smoke (e.g. potassium content) will affect radio propagation, however the exact effect on communications cannot be reliably predicted.

Whilst it is possible that SAGRN coverage was affected by smoke and fire, it is not possible to model the impact due to the high variability and lack of fire front data.

3.1.4 Agency Consultation – Coverage Matters

Discussions with CFS and SAPOL representatives identified that:

- Personnel from both CFS and SAPOL utilised both mobiles and portables in managing the Pinery Fire incident;
- Neither CFS or SAPOL were able to definitively confirm whether or not personnel experienced coverage problems during the Pinery Fire incident; and
- CFS personnel may not have been able to distinguish between an “out-of-coverage” tone and a “busy” tone on the radio terminals.

3.2 Findings - Coverage

Mingara's findings are as follows with respect to SAGRN coverage:

- Outdoor portable radio coverage is fragmented in the Pinery Fire incident area, indicating that there are large areas where portable radio communications is not likely to operate reliably. In Mingara's opinion, the use of portable radios operating on SAGRN should have been avoided at the Pinery Fire incident area; and
- The statement by CFS that their personnel may not have understood the difference between "out of coverage" (denial of service tone) and the busy tones, highlights the need to reinforce end-user understanding of these SAGRN radio terminal features. However, it should be noted that, fire events of this type are not common place and user complacency may have occurred.

3.3 Recommendations – Coverage

Based on the findings, with respect to SAGRN coverage, Mingara recommends that:

- a) All agencies are provided with the latest SAGRN coverage predictions to ensure end-users have an understanding of the operational limitations of the SAGRN coverage types (i.e. outdoor mobile and outdoor portable) when being deployed to an event.
- b) Agencies to include SAGRN coverage predictions in communications planning documentation, either pre-planned or for specific events.
- c) Due to the infrequent nature of major events similar to the Pinery Fire, agencies include similar scenarios in their radio terminal training programs; in the case of CFS and MFS, especially immediately prior to the fire danger period.

4 Agency Network Activity and Performance Modelling

4.1 Analysis

Network activity and performance modelling has been undertaken for all agencies participating in a call during the Analysis Period involving one or more of the SAGRN sites analysed. These agencies are:

- Australian Customs and Boarder Security Service (ACBPS)
- Adelaide Convention Centre (ACC)
- Australian Federal Police (AFP)
- Courts Administration Authority (CAA)
- Country Fire Service (CFS)
- Department for Correctional Services (Corrections)
- Department of Administrative and Information Services (DAIS)
- Department of Environment, Water and Natural Resources (identified as 'DEH' in SAGRN data)
- SA Health (identified as 'DHS' in SAGRN data)
- Forestry SA
- Metropolitan Fire Service (MFS)
- Motorola
- Primary Industries and Regions South Australia (PIRSA)
- Public Transport Services (identified as 'PTB' in SAGRN data)
- South Australian Ambulance Service (SAAS)
- South Australia Police (SAPOL)
- SA Water
- State Emergency Service (SES)
- St John
- Transport SA

The agency network activity and performance modelling addresses the following areas for the Analysis Period (unless specified otherwise):

- Agency communications activity –
 - Call Volume.
 - Call Duration.
- Agency call types.
- Talkgroup Analysis.
- Emergency (Duress) calls.
- Radio terminal analysis.
- Communications between the IMT and fireground.
- Network user behaviour.
- Traffic mitigation strategy effectiveness.
- Correlation between user experience and network performance.

4.1.1 Agency Communications Activity – Call Volume

Analysis of agency communications activity includes a review of call volumes (number of calls) and call durations.

For the purpose of this report, a 'call' is defined as commencing when network resources (i.e. a channel at a site) are first assigned as a result of a push-to-talk (PTT) and ending when all network resources involved in the call are released. There can be multiple PTTs within a call, and at each site a call is either recorded as an ingress call or an egress call. This definition of a call is operationally what the user experiences in terms of one continuous two-way operational conversation; they either got all of it, part of it or none of it.

This clarification is required as the "out of the box" Calibre reporting tools provided in the SAGRN do not interpret a call in this fashion, hence it is likely some discrepancies will occur if a direct comparison of values between this report and the Calibre reports is undertaken. Mingara's definition is operationally based and is designed to reflect the user experience and/or operational impact.

An ingress call is only recorded at a site if the call originated at that site. If a site is involved in a call, but it did not originate at that site, then the call is recorded as an egress call.

Example 1:

Call is initiated by Radio 1 at Site A, radios at Site B and Site C listen to the call.

Site A = ingress call

Site B = egress call

Site C = egress call

Example 2:

Call is initiated by Radio 1 at Site A, radio at Site B listens to the call, Radio 2 at Site C responds to Radio 1 with PTT.

Site A = ingress call

Site B = egress call

Site C = egress call

Example 3:

Call is initiated by Console 1, Radio 1 at Site A responds to Console 1 with PTT, radios at Site B and Site C listen to the call.

Site A = egress call

Site B = egress call

Site C = egress call

A summary of the analysis to determine the total number of calls (ingress and egress) at each of the analysed sites is provided in Figure 5.

Figure 5 also shows that there are five (5) agencies that generated the majority of network traffic across the analysed sites. These are:

- CFS (over 1,000 calls at 17 sites).
- SAPOL (over 1,000 calls at 17 sites).
- PTB (no traffic on 8 of the sites, over 1,000 calls at 7 sites).
- SAAS (over 1,000 calls at 10 sites)
- MFS (over 1,000 calls at 7 sites, less than 10 calls at 3 sites).

Figure 5: Total Number of Calls (Ingress & Egress) per Site – 25th November (10:00 to 22:00)

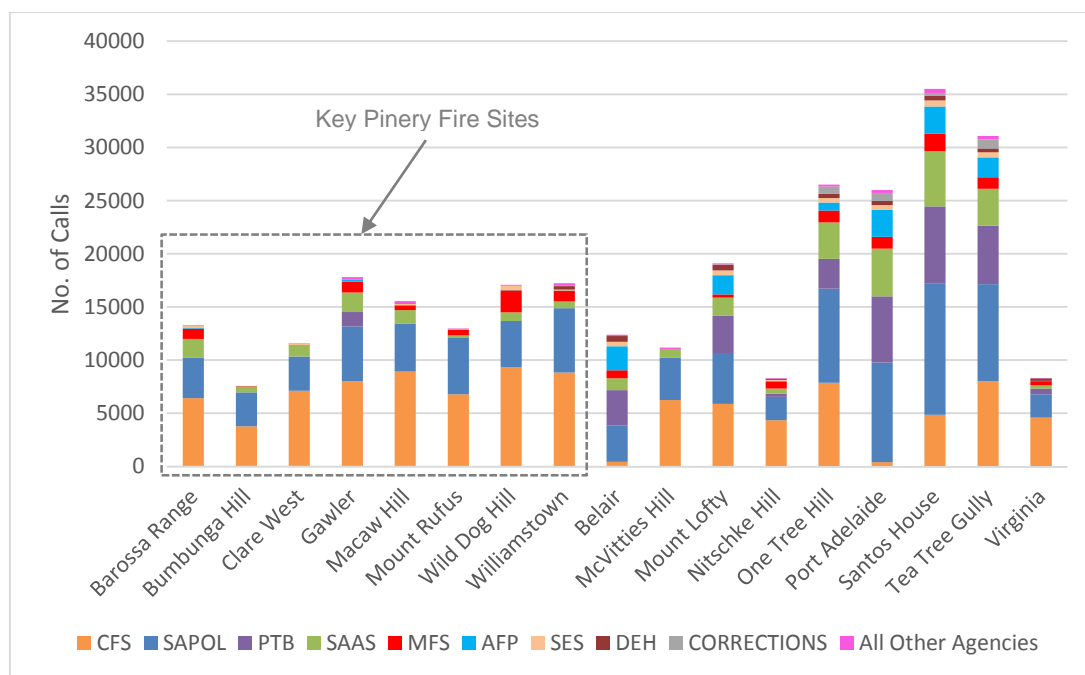


Table 2 provides a breakdown of the total number of calls at the 17 sites for the five (5) agencies generating the majority of network traffic (related data provided in Appendix A).

Table 2: Total Number of Calls (Ingress & Egress) per Site - 25th November 2015 (10:00 to 22:00)

Site	CFS	SAPOL	PTB	SAAS	MFS	Total Calls (All Agencies)
Barossa Range	6,439	3,820	-	1,756	942	13,283
Belair	424	3,408	3,359	1,121	733	12,401
Bumbunga Hill	3,780	3,199	-	537	5	7,571
Clare West	7,110	3,243	-	1,084	5	11,594
Gawler	8,027	5,144	1,352	1,857	1,003	17,801
Macaw Hill	8,932	4,499	-	1,292	441	15,541
McVitties Hill	6,263	3,979	-	813	1	11,184
Mount Lofty	5,884	4,794	3,490	1,715	311	19,123
Mount Rufus	6,795	5,357	-	178	500	12,962
Nitschke Hill	4,342	2,206	315	471	641	8,309
One Tree Hill	7,867	8,858	2,797	3,453	1,108	26,528

Site	CFS	SAPOL	PTB	SAAS	MFS	Total Calls (All Agencies)
Port Adelaide	397	9,362	6,237	4,496	1,130	26,009
Santos House	4,855	12,390	7,233	5,204	1,637	35,514
Tea Tree Gully	8,021	9,137	5,494	3,461	1,098	31,081
Virginia	4,590	2,197	537	313	404	8,293
Wild Dog Hill	9,366	4,312	-	832	2,071	17,081
Williamstown	8,842	6,064	-	618	1,023	17,232

Note 1: The total number of calls includes whole busies (i.e. calls that received a busy for the full duration of the call)

Note 2: Key Pinery Fire sites shown in RED

Two (2) SAGRN sites that experienced congestion during the Analysis Period were Barossa Range and Macaw Hill. Analysis of the SAGRN coverage predictions identify these as two (2) sites providing predicted coverage into the Pinery Fire incident area.

Macaw Hill is the closest site to the initial IMT location and also provides predicted coverage into the northern end of the fireground.

Barossa range is the closest site to the final IMT location at Angaston and provides predicted coverage into the southern end of the fireground.

Given the congestion experienced and their direct impact on the fire ground, Barossa Range and Macaw Hill have been selected as focus sites within the report; however, for completeness, analysed data for other sites are provided in respective appendices.

Figure 6 and Figure 7 provide a breakdown of the total number of calls (ingress and egress) per agency, for each hour of the Analysis Period, for Barossa Range and Macaw Hill respectively.

Figure 6: Total Number of Calls (Ingress & Egress) per Agency per Hour – Barossa Range (25th November)

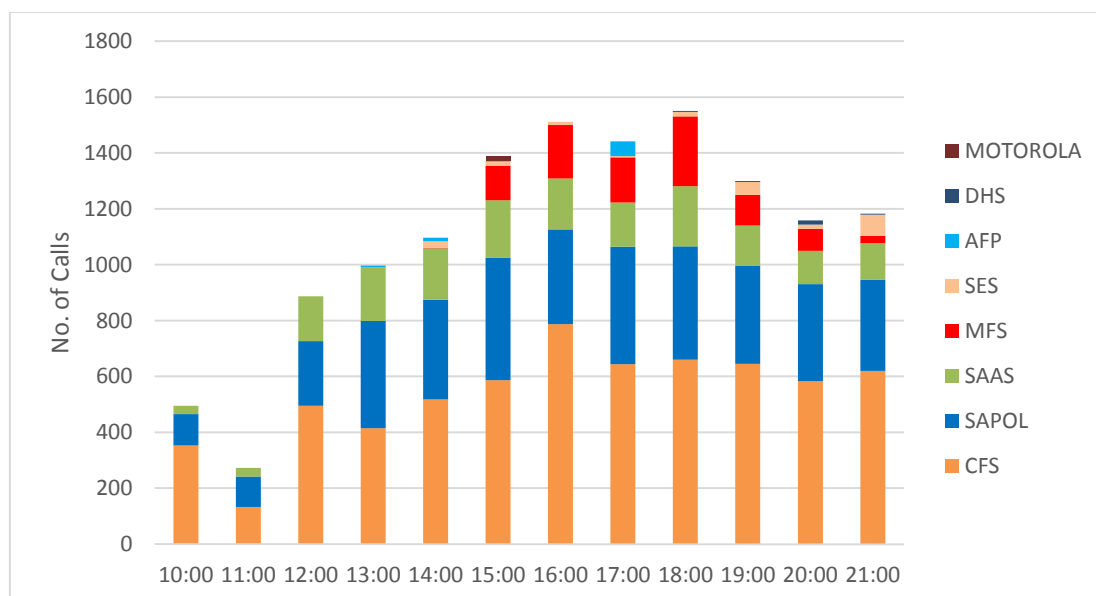


Figure 7: Total Number of Calls (Ingress & Egress) per Agency per Hour – Macaw Hill (25th November)

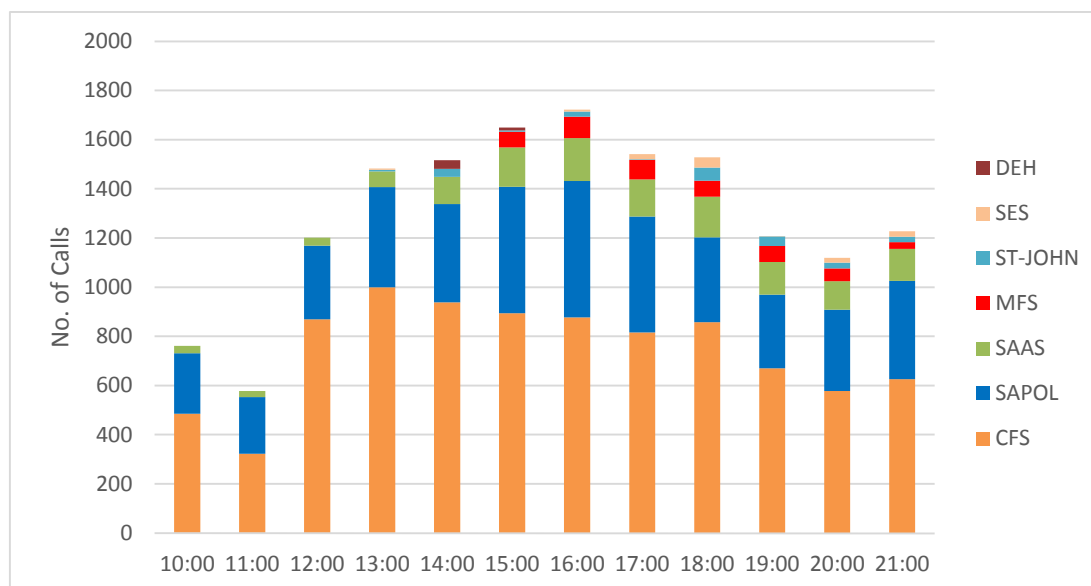


Figure 6 and Figure 7 show that CFS and SAPOL were the main contributors of network activity on the Barossa Range and Macaw Hill sites. This was also the case for the majority of the 17 analysed sites. The analysis showed that there was a significant increase in call activity on both the Barossa Range and Macaw Hill sites between 12:00 and 13:00 hours. NB: This pattern is also reflected in most of the other analysed sites.

According to information Mingara received during discussions with CFS, the Pinery Fire incident was first reported at 12:05pm on 25th November 2015. This information correlates with the increase in activity at the analysed SAGR N sites between 12:00 - 13:00 hours.

Even though the Pinery Fire incident wasn't first reported until 12:05pm, analysis of per site carried traffic show that there were reasonable levels of CFS traffic on the analysed sites from 10:00 to 12:00 hours. However, as the 25th November 2015 was declared as a day of extreme fire danger, the resulting increased operational activity for CFS is not unexpected.

During discussions with CFS, Mingara was informed that there were other fires that occurred on the 25th November 2015, including one that occurred during the morning and may have contributed to some activity observed at some other sites prior to the Pinery Fire incident.

4.1.2 Agency Communications Activity – Call Duration

4.1.2.1 Pinery Fire Analysis Period

In addition to assessing agency call volume during the Analysis Period, Mingara has analysed call duration. For the purpose of this report, call duration refers to the air-time (in seconds) of the call and excludes any delay (busy period) that may be experienced by the user.

The following measures have been assessed for call duration (the calculation excludes calls that never proceeded):

- Average call duration – defined as the sum of all call durations divided by the number of calls; and
- Median (50th percentile) call duration – defined as the value of call duration at which 50 percent of all calls achieved.

In Mingara's experience, the reporting of average call duration alone can provide a distorted view of the call length, hence we have also measured the median call duration, which provides a clearer view of the most likely call duration impacting site capacity usage. The difference between the average and median call duration also provides a high level measure of the call duration volatility.

A summary of average and median call duration measures for the five (5) agencies identified as having the highest call volumes is provided in Table 3 (NB: data for all agencies is provided in Appendix B).

Table 3: Call (Ingress & Egress) Duration Statistics per Site - Pinery Fire Analysis Period

Site	CFS Call Durations (Sec)		SAPOL Call Durations (Sec)		PTB Call Durations (Sec)		SAAS Call Durations (Sec)		MFS Call Durations (Sec)		All Agencies Call Durations (Sec)	
	Avg.	Median	Avg.	Median	Avg.	Median	Avg.	Median	Avg.	Median	Avg.	Median
Barossa Range	8.25	5.7	13.77	8.9	-	-	9.34	6.2	8.61	5.9	10.02	6.4
Belair	7.54	5.5	10.8	7.5	9.8	6.2	8.11	6.4	8.94	6.3	9.8	6.5
Bumbunga Hill	8.24	5.9	15.58	10.5	-	-	9.46	6.5	9.42	5.5	11.43	7.1
Clare West	8.37	5.8	15.45	10.4	-	-	10.14	6.7	6.1	4.4	10.52	6.6
Gawler	8.56	5.9	13.42	8.7	11.09	7.1	9.04	6.5	8.6	6.2	10.25	6.7
Macaw Hill	8.65	5.8	13.74	8.9	-	-	10.14	6.9	8.24	5.8	10.19	6.4
McVitties Hill	8.25	5.7	11.81	8	-	-	9.82	7.1	4.3	4.3	9.63	6.4
Mount Lofty	8.35	5.8	10.89	7.5	9.64	6.1	9.39	6.8	9.27	6.6	9.53	6.4
Mount Rufus	8.66	6	13.75	8.9	-	-	10.29	6.6	8.69	6.2	10.81	6.8
Nitschke Hill	8.1	5.8	11.97	8.25	8.2	6	10.4	7.1	8.86	5.9	9.32	6.3
One Tree Hill	8.59	5.9	10.57	7.2	10.26	6.5	9.08	6.5	8.52	5.95	9.48	6.4
Port Adelaide	6.78	5.6	10.65	7.3	9.89	6.3	8.66	6.4	8.71	5.95	9.82	6.7
Santos House	8.3	5.8	11.67	7.8	9.72	6.3	8.66	6.4	8.73	6	10	6.6
Tea Tree Gully	8.5	5.8	10.74	7.4	9.71	6.2	8.71	6.4	8.43	5.85	9.5	6.4
Virginia	8.59	5.8	11	7.6	12.01	7.6	9.95	6.7	8.15	5.7	9.44	6.3
Wild Dog Hill	8.85	6	13.88	9.2	-	-	10.58	7.1	8.55	5.9	10.12	6.5
Williamstown	8.59	5.9	13.4	8.8	-	-	10.45	6.9	8.55	5.9	10.28	6.6



Table 3 shows that the median call duration for all agencies is relatively consistent across the analysed sites during the Pinery Fire. However, there are universally large differences between the average and median call duration, with most analysed sites showing differences of over 30%. These large differences between average and median call durations highlights a very volatile call environment, which is very typical of incidents such as the Pinery Fire, where a diverse mix of operational communications is employed.

Of the analysed sites, Bumbunga Hill (which is located north west of the initial IMT location) had the highest average call duration (11.43 seconds) and the highest median call duration (7.1 seconds) across all agencies.

Figure 8 shows the average call duration and median call duration per site for all agencies during the Pinery Fire. It also provides the total number of calls (ingress and egress) at each of the sites.

Figure 8 shows that there is no direct correlation between the number of calls at a site and the average or median call duration. The two (2) sites with the highest average and median call duration (Bumbunga Hill and Mount Rufus) were some of the lowest for total calls.

Figure 8: All Agencies - Average Call Duration, Median Call Duration & Total Number of Calls (Ingress & Egress) per Site (10:00 to 22:00, 25th November 2015)

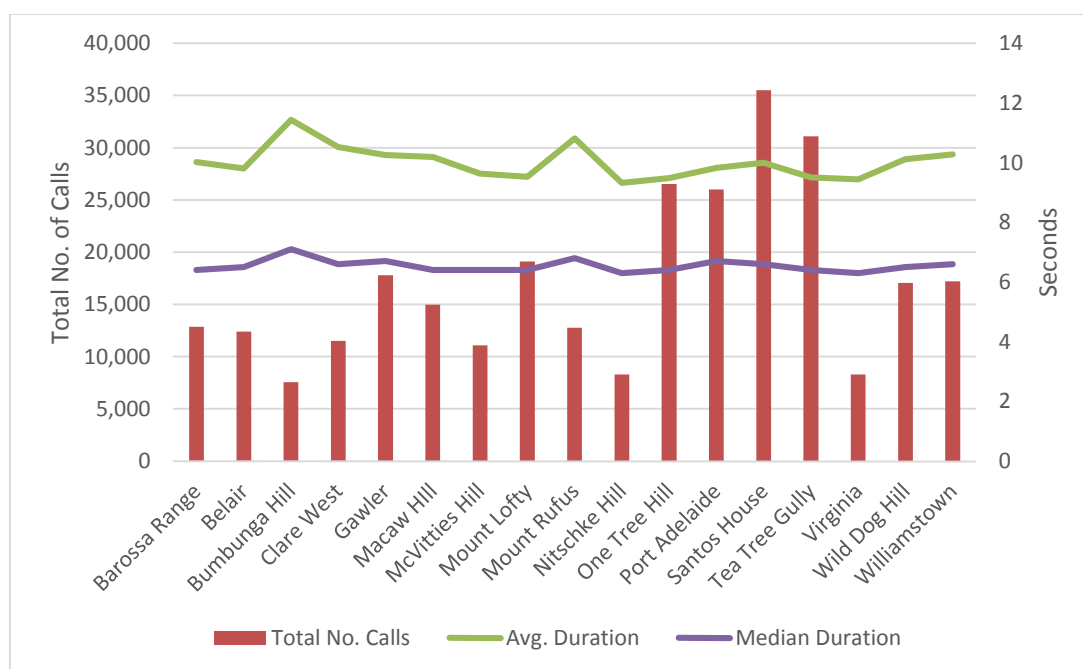
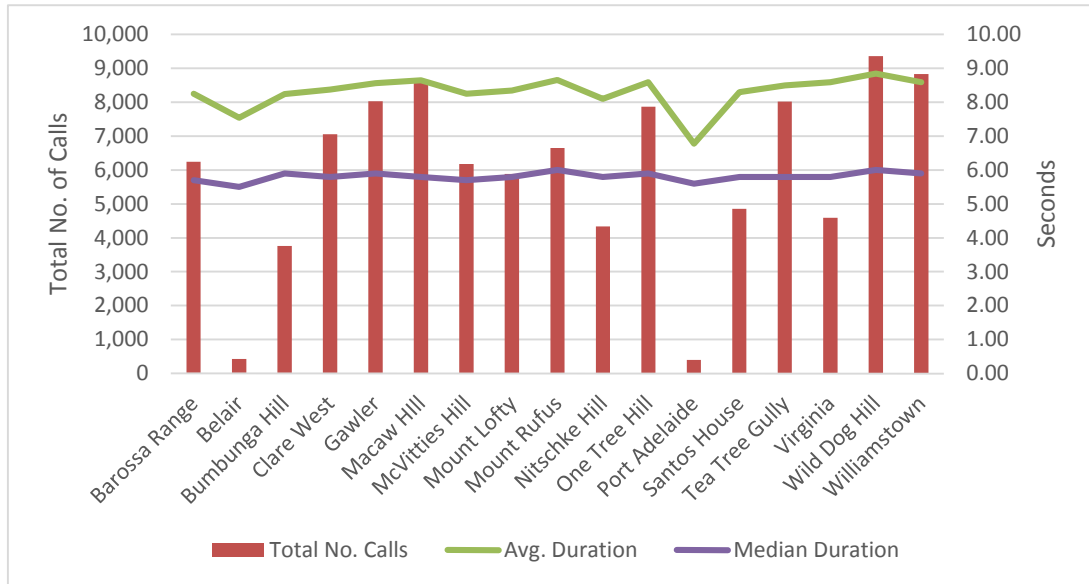


Figure 9 shows that CFS average and median call durations are reasonably consistent, with the exception of Belair and Port Adelaide (which carried very little CFS traffic). At all sites, the average call duration for CFS was below 10 seconds and none of the sites had a median call duration of more than 6 seconds.

Figure 9: CFS - Average Call Duration, Median Call Duration & Total Number of Calls (Ingress & Egress) per Site (10:00 to 22:00, 25th November 2015)



Figures provided in Table 3 show that, of the five (5) agencies that contributed the most traffic, SAPOL had the highest average and median call duration at each site during the Analysis Period. Figure 10 shows that for all 17 sites, SAPOL had an average call duration greater than 10 seconds and a median call duration greater than 7 seconds.

The site where SAPOL had the highest average (15.58 seconds) and median (10.5 seconds) call durations was Bumbunga Hill. At Barossa Range, SAPOL had an average call duration of 13.77 seconds and a median call duration of 8.9 seconds. At Macaw Hill the SAPOL average call duration was 13.74 seconds and the median call duration was 8.9 seconds.

Figure 10: SAPOL - Average Call Duration, Median Call Duration & Total Number of Calls (Ingress & Egress) per Site (10:00 to 22:00, 25th November 2015)

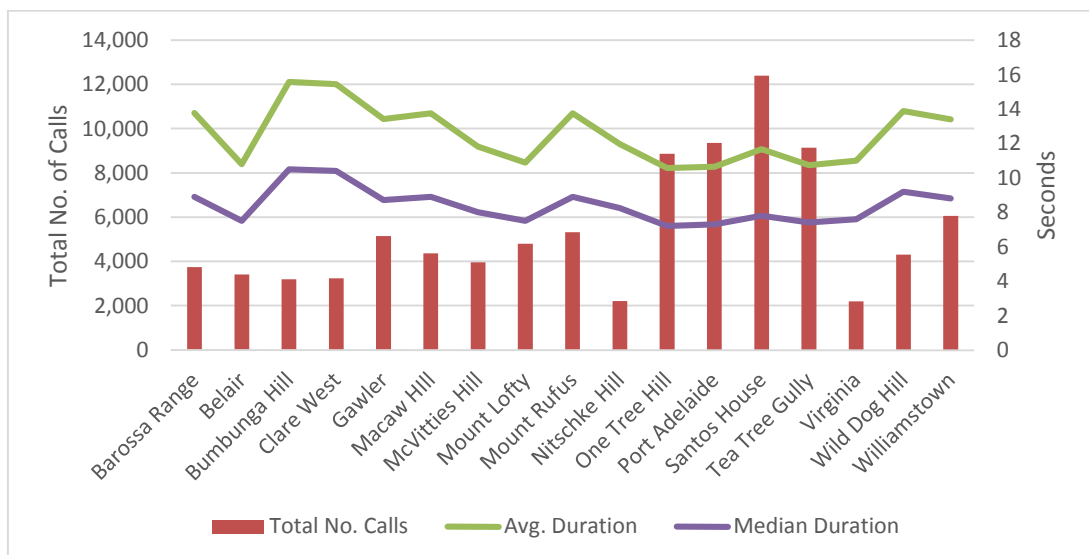


Figure 11 and Figure 12 show the average call duration, median call duration and total carried traffic for CFS and SAPOL at Barossa Range and Macaw Hill respectively. These graphs show the extent to which SAPOL average and median call durations were higher than CFS during the Pinery Fire incident. These graphs also show that, despite CFS having higher call volumes, SAPOL has higher carried traffic for 6 of the 12 hours at Barossa Range and for 2 of the 12 hours at Macaw Hill.

Figure 11: Hourly Average Call Duration, Median Call Duration & Carried Traffic (Ingress & Egress) – Barossa Range (10:00 to 22:00, 25th November 2015)

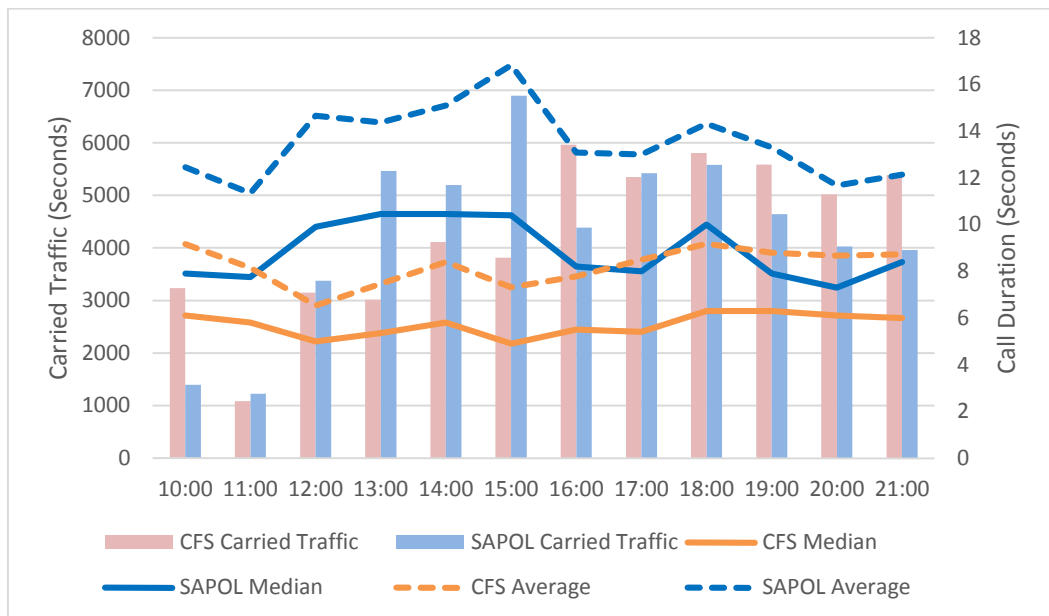
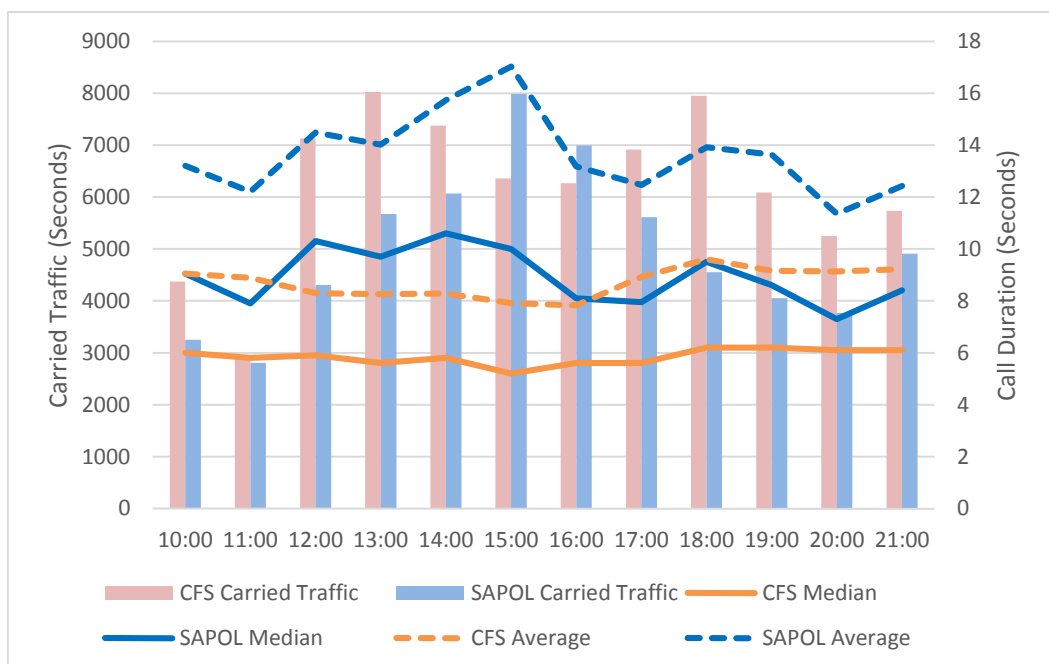


Figure 12: Hourly Average Call Duration, Median Call Duration & Carried Traffic (Ingress & Egress) – Macaw Hill (10:00 to 22:00, 25th November 2015)



4.1.2.2 Historical Benchmarking

Historical (pre Pinery Fire) average and median call duration statistics have been analysed to provide a baseline to measure any differences in user behaviour during the Pinery Fire. The Historical Analysis Period used is 12:00 on 25th October 2015 to 23:59 on 24th November 2015.

Table 4 provides a comparison of CFS and SAPOL median call duration for the Analysis Period and the Historical Analysis Period. The combined median call duration for all agencies at each site is also provided in Table 4.

Table 4: Median Call (Ingress & Egress) Duration per Site - Analysis Period & Historical Analysis Period

Site	CFS Median Call Durations (Sec)		SAPOL Median Call Durations (Sec)		All Agencies Median Call Durations (Sec)	
	Pinery Fire Analysis Period	Historical Analysis Period	Pinery Fire Analysis Period	Historical Analysis Period	Pinery Fire Analysis Period	Historical Analysis Period
Barossa Range	5.7	5.3	8.9	8	6.4	7.1
Belair	5.5	5.3	7.5	7.8	6.5	6.9
Bumbunga Hill	5.9	5.4	10.5	8.1	7.1	7.4
Clare West	5.8	5.4	10.4	8.1	6.6	7.2
Gawler	5.9	5.4	8.7	7.8	6.7	6.8
Macaw Hill	5.8	5.4	8.9	8.1	6.4	7.5
McVitties Hill	5.7	5.4	8	8.1	6.4	7.1
Mount Lofty	5.8	5.3	7.5	7.9	6.4	6.9
Mount Rufus	6	5.4	8.9	8.1	6.8	7.4
Nitschke Hill	5.8	5.4	8.25	8.1	6.3	7
One Tree Hill	5.9	5.4	7.2	7.5	6.4	6.7
Port Adelaide	5.6	4.8	7.3	7.6	6.7	6.8
Santos House	5.8	N/A	7.8	N/A	6.6	N/A
Tea Tree Gully	5.8	5.4	7.4	7.6	6.4	6.7
Virginia	5.8	5.3	7.6	8	6.3	7.3
Wild Dog Hill	6	5.4	9.2	8	6.5	7.3
Williamstown	5.9	5.4	8.8	8.1	6.6	7.4

Note: Key Pinery Fire sites shown in RED

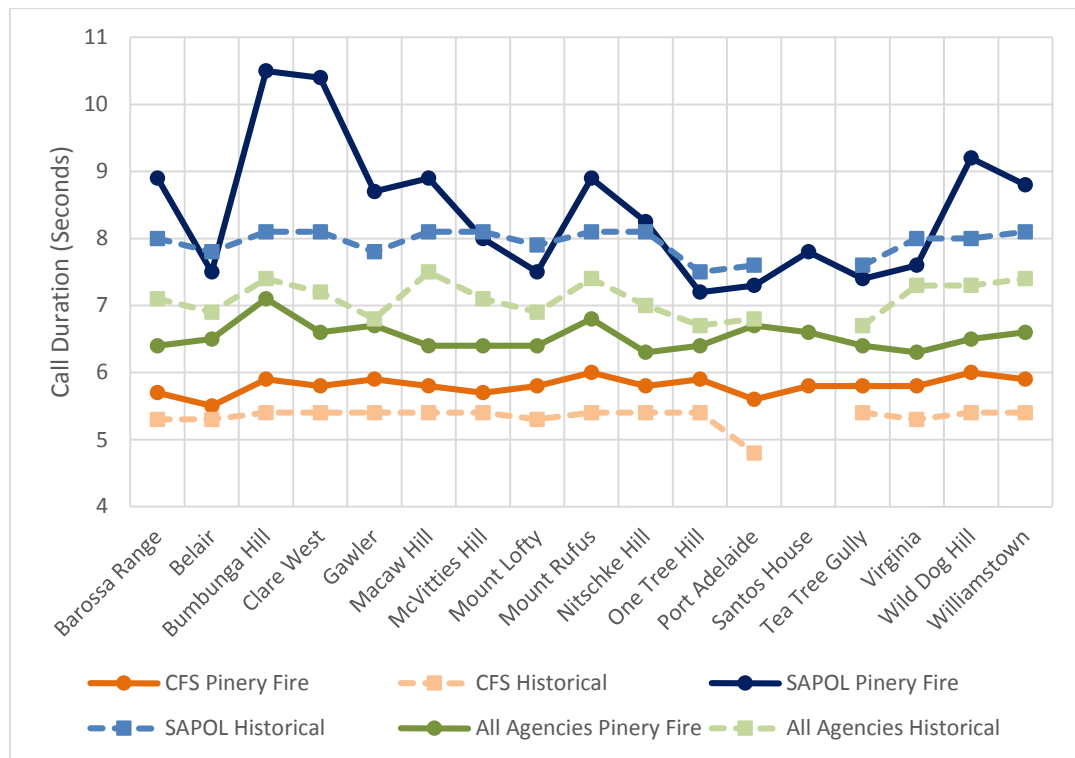
The information provided in Table 4 is graphically summarised in Figure 13, which shows that:

- The CFS median call duration during the Pinery Fire was higher than the historical median call duration at analysed sites, but within typical industry variances for fire services;
- The SAPOL median call duration during the Pinery Fire was higher than the historical median call duration at nine (9) of the 17 sites; these higher values are in excess of typical industry variances for law enforcement;

- A number of sites where the SAPOL median call duration was lower than the historical median duration were sites that appear to have had high call volume of business-as-usual activity, relative to their call activity involved with the management of the Pinery Fire (e.g. Belair, Port Adelaide); and
- The combined median call duration for all agencies was lower during the Pinery Fire incident period than for the historical analysis period at all sites. This measure indicates that most agency SARGN users exercised a level of restraint when making calls during the Pinery Fire, by keeping their calls relatively short.

Comparison of the Pinery Fire median call durations and historical median call duration, depicted in Figure 13, suggest that call durations for both CFS and SAPOL increased as a result of managing the Pinery Fire incident. However, SAPOL significantly increased their call duration on sites directly involved in the Pinery Fires.

Figure 13: Pinery Fire and Historical Median Call Duration



4.1.3 Agency Call Types

The following call types have been analysed for each agency during the Pinery Fire Analysis Period:

- Talkgroups Calls –
 - Talkgroup calls that did not involve a patch or multi-select;
 - Patched talkgroup calls; and
 - Multi-Select talkgroup calls;
- Emergency calls (NB: although these are also talkgroup calls, they have been identified separately);
- Multigroup calls; and
- Private calls.

4.1.3.1 Talkgroup Calls

Table 5 provides a summary of the total number of talkgroup calls for CFS, SAPOL, PTB, SAAS and MFS at each of the analysed sites (data for all agencies is provided in Appendix C).

Table 5 shows that, with the exception of Belair, Port Adelaide and Santos House, CFS had the highest volume of talkgroup calls at all analysed sites.

Table 5: Agency Talkgroup Calls (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Site	Talkgroup Calls (Not Patched or MultiSelect)					Patched Talkgroup Calls					MultiSelect Talkgroup Calls				
	CFS	SAPOL	PTB	SAAS	MFS	CFS	SAPOL	PTB	SAAS	MFS	CFS	SAPOL	PTB	SAAS	MFS
Barossa Range	6,246	1,799	-	1,674	879	-	1935			-	-	6		-	-
Belair	424	2,566	3,344	1,074	733	-	838		4	-	-		1	-	-
Bumbunga Hill	3,759	1,540	-	535	5	-	1646			-	-	6		-	-
Clare West	7,054	1,581	-	1,078	5	-	1641			-	-	6		-	-
Gawler	8,022	2,760	1,329	1,831	1,003	-	2371	14	26	-	-	6	1	-	-
Macaw Hill	8,593	1,707	-	1,224	420	-	2646		6	-	-	6		-	-
McVitties Hill	6,182	392	-	803	1	-	3561			-	-			-	-
Mount Lofty	5,882	2,750	3,468	1,661	311	-	2043		15	-	-			-	-
Mount Rufus	6,652	1,945	-	171	483	-	3358			-	-	6		-	-
Nitschke Hill	4,337	650	315	471	641	-	1555			-	-			-	-
One Tree Hill	7,864	6,260	2,761	3,366	1,108	-	2593	14	46	-	-		1	-	-
Port Adelaide	394	7,290	6,198	4,349	1,130	-	2070	14	45	-	-		1	-	-
Santos House	4,845	8,547	7,189	5,054	1,637	-	3830	14	46	-	-	6	2	-	-
Tea Tree Gully	8,018	6,739	5,455	3,391	1,098	-	2392	14	16	-	-		2	-	-
Virginia	4,590	493	536	303	404	-	1703		10	-	-			-	-
Wild Dog Hill	9,355	1,854	-	830	2,069	-	2443			-	-	6		-	-
Williamstown	8,828	2,464	-	608	1,017	-	3586		9	-	-	6		-	-

Note: Key Pinery Fire sites shown in RED

Table 5 shows that SAPOL generated a high volume of patched talkgroup calls at all of the analysed sites. However, both SAAS and PTB generated low volumes of patched talkgroup calls.

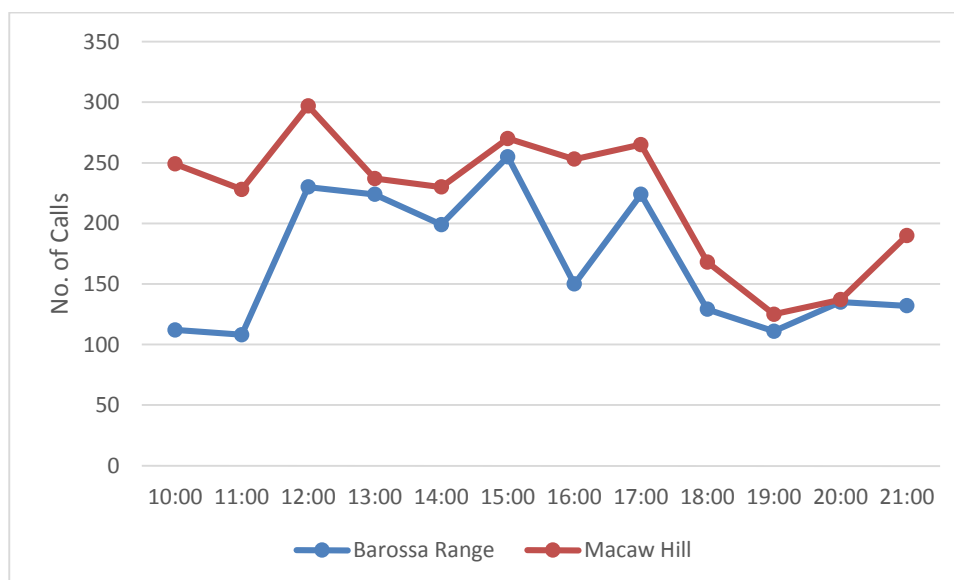
SAPOL has confirmed that the following patched talkgroups were active on the analysed sites during the Pinery Fire:

- 83-EAST-ADEL and AFP-Adelaide;
- 85-STURT and AFP-Sturt;
- 62-Barossa and 60-Elizabeth;
- 97-Limestone, 93-M-Mallee and 66-Y-M-NTH [see Note];
- 89-Hills-FL and 87-STHCOAST; and
- 78-Western, 74-Eyre and 70-Far-North.

NOTE: During discussions with SAPOL representatives, SAPOL was not able to confirm with Mingara what patches, if any, were removed and at what time. However, analysis of the data suggests that 66-Y-M-NTH was removed from its patch at some point between 13:00 to 14:00 on the 25th November, however, 97-Limestone and 93-M-Mallee remained patched together. It appears that no other patches were broken/removed during the Analysis Period.

Figure 14 shows the number of patched SAPOL talkgroup calls that involved Barossa Range and Macaw Hill during the Analysis Period. The majority of these calls involved the 62-Barossa and 60-Elizabeth patch and the 97-Limestone Coast, 93-M-Mallee & 66-Y-M-NTH patch.

Figure 14: Number of SAPOL Patched Calls per Hour – Barossa Range & Macaw Hill (10:00 to 22:00, 25th November 2015)



CFS has confirmed that 62-Barossa was the primary SAPOL operational talkgroup for the Pinery Fire. Patched calls involving this talkgroup were active on 25 sites during the Analysis Period. The majority of the calls were on 12 of the analysed sites, however a large number of calls for 62-Barossa also occurred on Mount Barker and Trott Park, hence dragging traffic from those areas to the fire ground.

Calls involving the 97-Limestone patch were active on 64 sites during the Analysis Period, 11 of these were sites analysed for the Pinery Fire. It is noted that the volume of patched calls involving the 97-Limestone patch decreased after 13:00 (this coincided with an increase in non-patched calls on the 66-Y-M-NTH talkgroup. There were no 66-Y-M-NTH calls on any site until after 13:00).

It is not possible for Mingara to separate patched call traffic relating to the Pinery Fire from business-as-usual traffic. However, analysis of the data suggests that patched calls did significantly impact the volume of calls effecting the 17 analysed sites.

4.1.3.2 Emergency Calls

Table 6 provides a summary of emergency calls (ingress and egress) for the analysed sites. During the Analysis Period there were no SAAS or MFS emergency calls that involved the analysed sites.

Table 6: Agency Emergency Calls (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Site	CFS	SAPOL	PTB	SAAS	MFS	Total Calls (All Agencies)
Barossa Range	0	6	0	0	0	6
Belair	0	4	12	0	0	16
Bumbunga Hill	0	4	0	0	0	4
Clare West	0	4	0	0	0	4
Gawler	2	7	8	0	0	17
Macaw Hill	4	6	0	0	0	10
McVitties Hill	0	2	0	0	0	2
Mount Lofty	0	1	22	0	0	23
Mount Rufus	0	6	0	0	0	7
Nitschke Hill	0	1	0	0	0	1
One Tree Hill	0	4	21	0	0	25
Port Adelaide	0	2	21	0	0	23
Santos House	7	7	26	0	0	40
Tea Tree Gully	1	5	21	0	0	27
Virginia	0	1	1	0	0	2
Wild Dog Hill	6	6	0	0	0	12
Williamstown	3	4	0	0	0	7

Note: Key Pinery Fire sites shown in RED

4.1.3.3 Multigroup Calls

Analysis of SAGRN data identified that there were a number of SAAS and Corrections multigroup calls that involved Pinery Fire impacted sites (refer Appendix C). At the time of preparing this report Mingara had not received confirmation of the talkgroups that make up the identified multigroups; however, the volume of calls involving these multigroups is relatively low and, in Mingara's opinion, not material to the overall performance of analysed sites.

4.1.3.4 Private Calls

There were very few private calls that involved the analysed sites during the Analysis Period (3 ingress and 5 egress private calls). In Mingara’s opinion private calls did not have a material impact on the overall performance of analysed sites.

4.1.3.5 Allocation of Call Types per Site

Figure 15 and Figure 16 provide an hourly breakdown of the different call types for both Barossa Range and Macaw Hill. These graphs show that the major call types that impacted the analysed sites were talkgroup calls (that were not patched or multi-selected).

Figure 15: Breakdown of Call Types (Barossa Range) - 25th November (10:00 to 22:00)

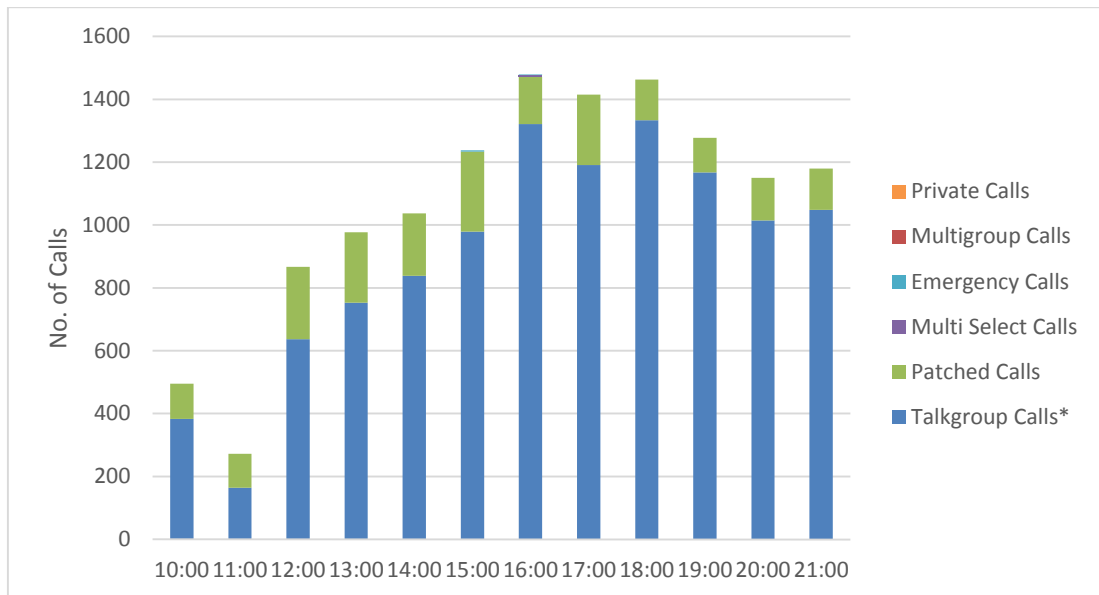
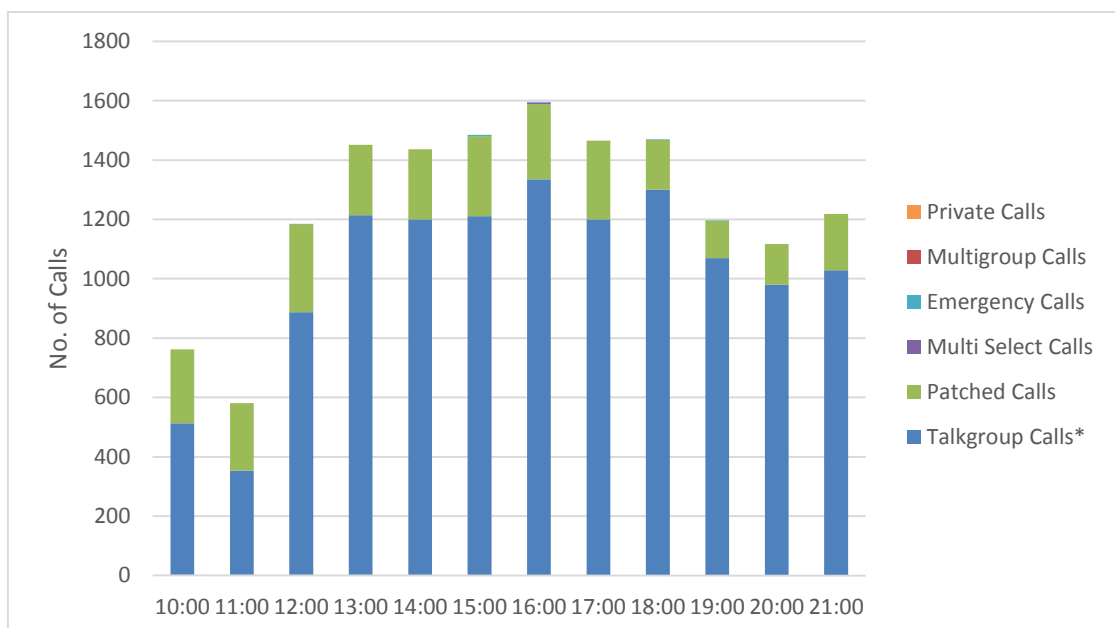


Figure 16: Breakdown of Call Types (Macaw Hill) - 25th November (10:00 to 22:00)



4.1.4 Talkgroup Analysis

4.1.4.1 Pinery Fire Analysis Sites

Over the course of the Analysis Period there were a total of 232 talkgroups that participated in a call involving one of the 17 analysed sites. Only a small sub-set of these were associated with management of the Pinery Fire.

The 17 sites analysed include some sites that did not have Grade of Service (GoS) issues during the Analysis Period. The analysis of talkgroups will be limited to the following sites that did experience poor GoS during the Analysis Period:

- Barossa Range;
- Bumbunga Hill;
- Clare West;
- Gawler;
- Macaw Hill;
- McVitties Hill;
- Mt Rufus; and
- Williamstown.

Table 7 provides details of the talkgroups that were active on the above eight (8) sites during the Analysis Period.

Table 7 shows that CFS and SAPOL had the highest number of talkgroups active on the selected sites during the Analysis Period. Of these, there were 46 unique CFS talkgroups and 26 unique SAPOL talkgroups. Details of the CFS and SAPOL talkgroups active on the eight (8) selected sites are provided in Table 8.

Table 7: Number of Active Talkgroups - 25th November 2015 (10:00 to 22:00)

	Barossa Range	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Rufus	Williamstown
AFP	2	0	0	2	1	0	0	1
CFS	21	17	24	18	24	23	23	23
Corrections	0	0	0	1	0	0	1	1
DEH	0	1	0	0	1	0	1	1
DHS	1	0	0	1	0	0	1	0
Forestry	0	0	0	0	0	2	0	1
MFS	6	1	1	4	3	1	4	7
Motorola	1	0	0	0	0	0	0	0
PIRSA	1	0	1	0	0	1	0	1
PTB	0	0	0	6	0	0	0	0
SAAS	6	5	5	12	6	3	4	7
SAPOL	9	4	4	20	11	8	6	16
SA-WATER	0	0	0	0	0	0	0	1
SES	4	3	3	3	3	0	4	3
St-John	0	0	1	1	1	0	0	1
Transport-SA	0	0	1	1	1	1	0	1



Figure 17 and Figure 18 provide a breakdown of the number of active talkgroups for CFS and SAPOL at Barossa Range and Macaw Hill respectively. These show that, for each hour of the Analysis Period, CFS had more active talkgroups than SAPOL. For CFS, the highest number of talkgroups active in any one-hour period was 15 at Barossa Range and 14 at Macaw Hill. For SAPOL, the highest number of talkgroups active in any one-hour period was 6 at Barossa Range and 7 at Macaw Hill.

Figure 17: Active Talkgroups (Barossa Range) - 25th November (10:00 to 22:00)

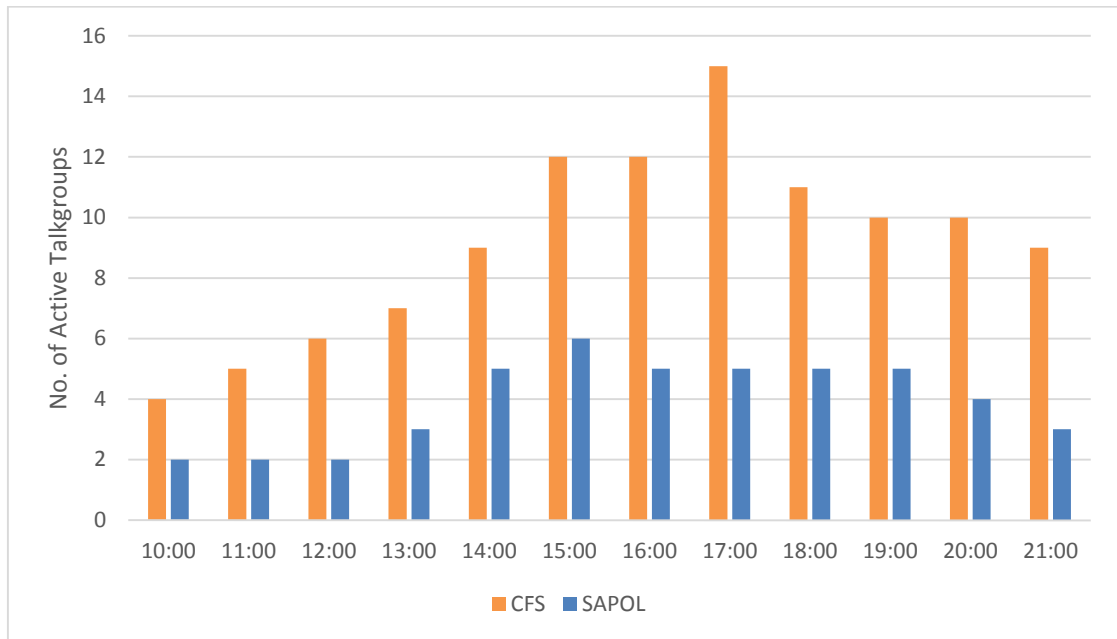


Figure 18: Active Talkgroups (Macaw Range) - 25th November (10:00 to 22:00)

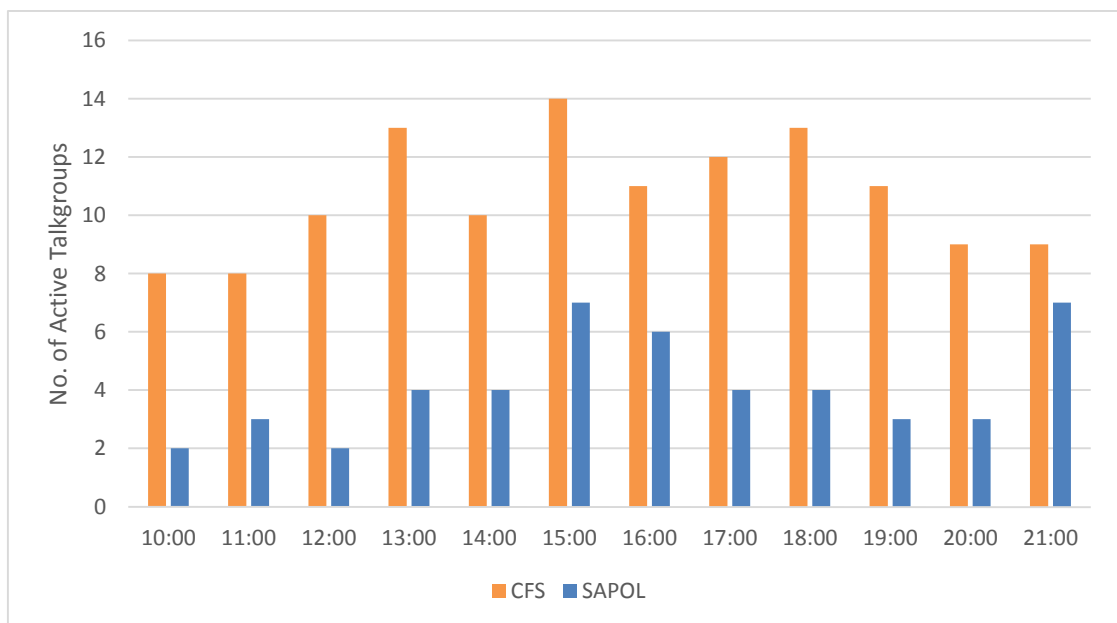


Table 8: Active Talkgroups – CFS & SAPOL
(for Sites: Barossa Range/ Bumbunga Hill/ Clare West/ Gawler/ Macaw Hill/ McVitties Hill/ Mount Rufus/ Williamstown)

CFS Talkgroups			SAPOL Talkgroups	
062-R4-OPS	089-R2-INC15	108-AIR-PRZ1	177-DRVR-TRNG	61-ELIZABETH
063-R4-LOGS	092-R2-INC18	111-STATE1-C	181-RTS	62-BAROSSA
065-BLYTH/SN	093-R2-OPS	112-STATE2-C	183-MET-EMG	63-BAROSSA
066-BUNDALEE	094-R2-LOGS	115-CFS-EMER	198-TRAFFICM	66-Y-M-NTH
067-BURRA-C	095-ANGASTON	124-R1-OPS	200-TRAFFICS	67-Y-M-NTH
069-HALLET	096-BAROSSA	125-R1-LOGS	201-TRAFFICS	85-STURT
074-SPENCER	097-GILBERT	126-E-TORREN	205-STAR	89-HILLS-FL
075-R2-INC01	098-GUMERACH	132-KYEEMA	212-RECORDS1	90-HILLS-FL
076-R2-INC02	099-HORROCKS	140-ONKAPARI	214-PSSB	94-M-MALLEE
077-R2-INC03	100-LIGHT	204-MALLEE-C	215-TCU	97-LIMESTONE
078-R2-INC04	101-N-YORKE	205-MID-MURR	222-MAJCRIME	
079-R2-INC05	102-PARA	207-RIDLEY	52-ISS	
080-R2-INC06	103-S-YORKE	209-R3-OPS	55-NTHOPSVC	
081-R2-INC07	104-WAKEFIEL	210-R3-LOGS	56-H-HILL	
082-R2-INC08	105-YORKE-VY		58-WEST-ADEL	
084-R2-INC10	106-CFS-COMM		60-ELIZABETH	

Whilst all talkgroups listed in Table 8 were active on the selected eight (8) sites during the Analysis Period, not all of them generate significant traffic volumes or were used in managing the Pinery Fire.

At the time of writing this report Mingara had not received definitive confirmation of the talkgroups used in managing the Pinery Fire. However, based on information provided by CFS and SAPOL, as well as analysis of call volumes, talkgroups that Mingara understands were used for managing the Pinery Fire have been highlighted in **RED** in Table 8.

Figure 19 to Figure 26 provide a summary of the active CFS and SAPOL talkgroups (total carried traffic) for Barossa Range and Macaw Hill.

Figure 19: Carried Traffic per CFS Talkgroup (Barossa Range) - 25th November 2015 (10:00 to 22:00)

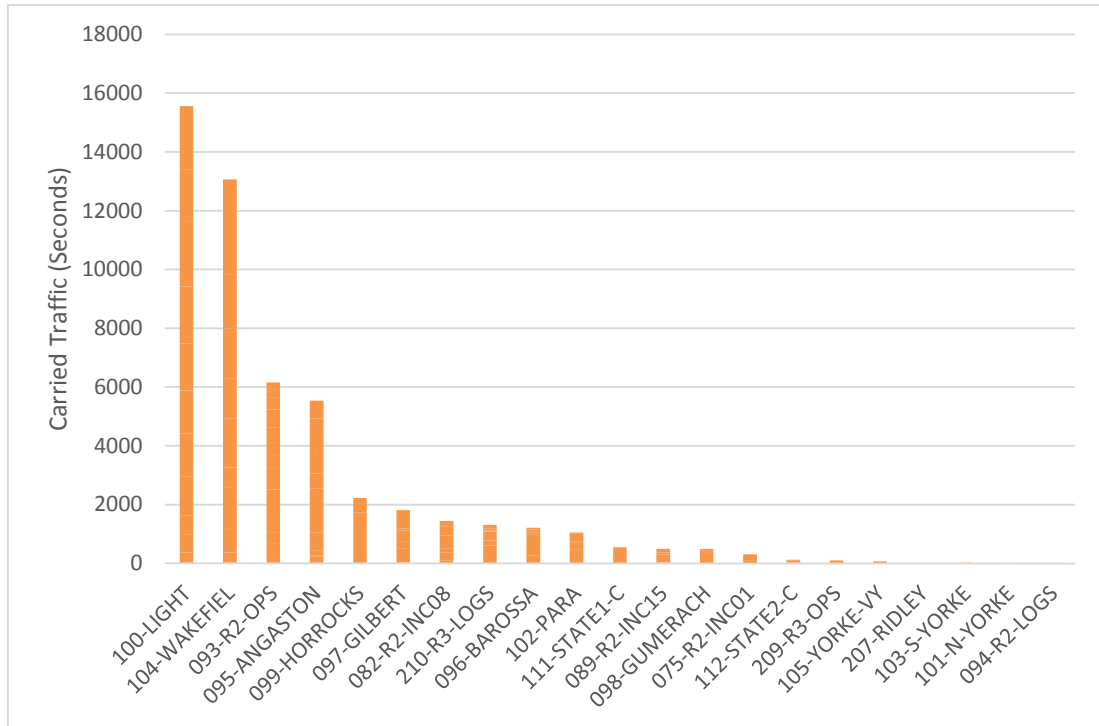


Figure 20: Carried Traffic per Hour for CFS Talkgroups (Barossa Range) - 25th November 2015

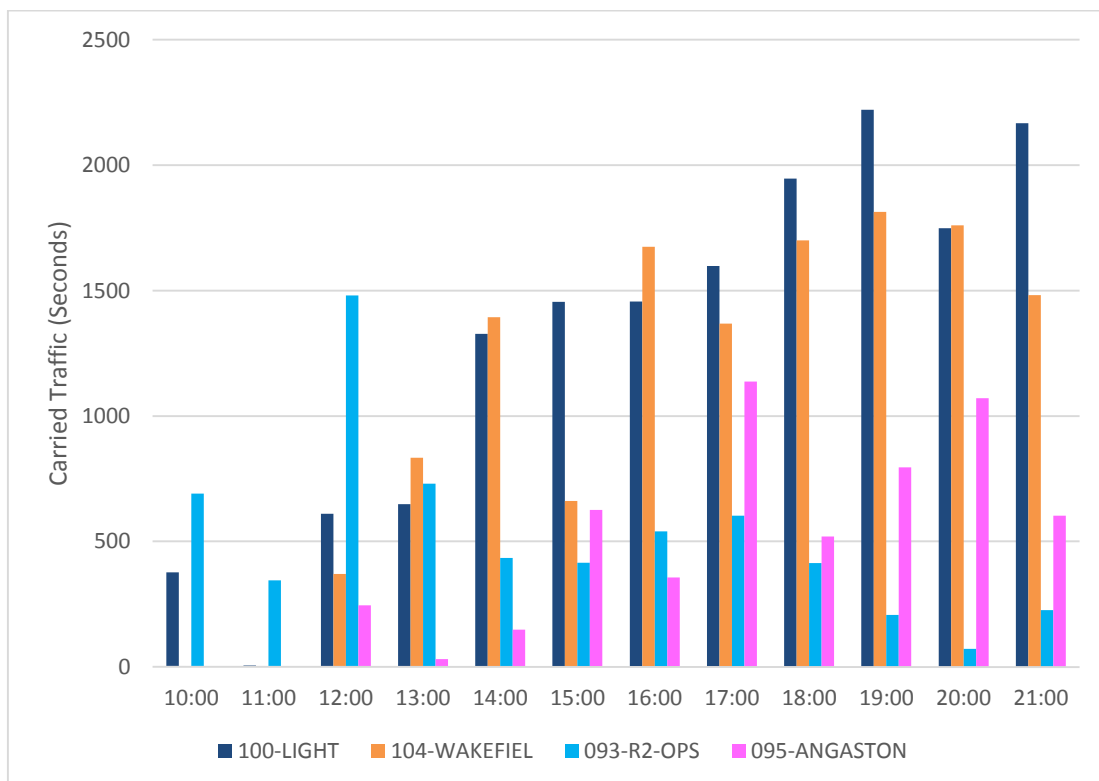


Figure 21: Total Carried Traffic per CFS Talkgroup (Macaw Hill) - 25th November 2015 (10:00 to 22:00)

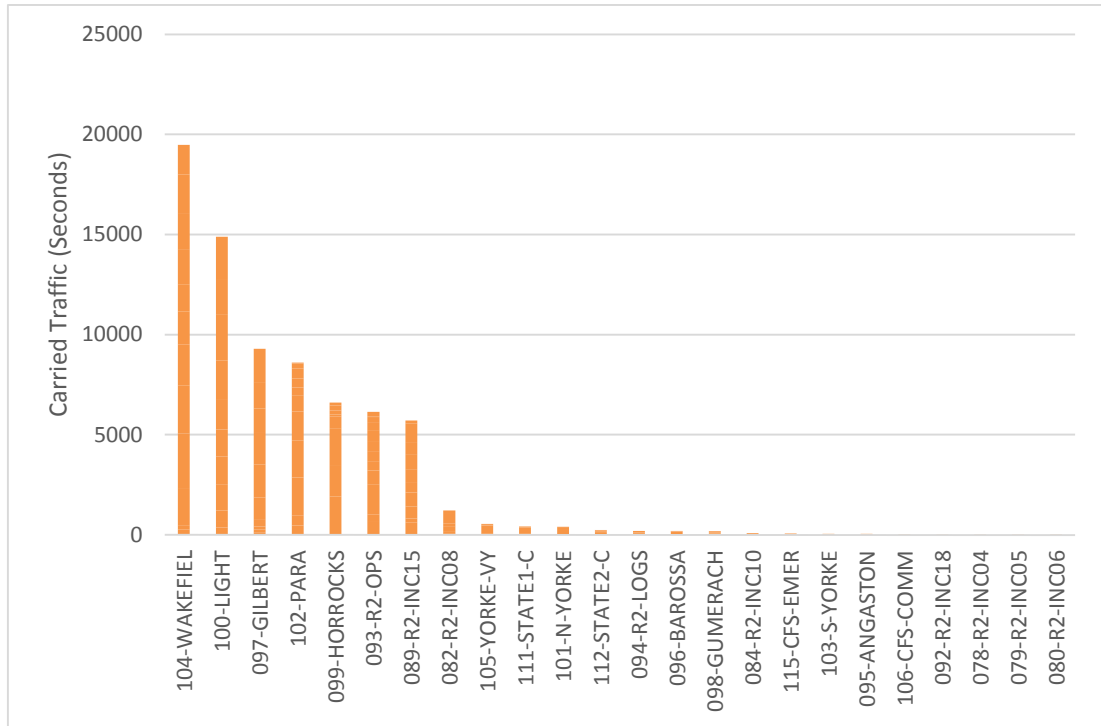


Figure 22: Carried Traffic per Hour for CFS Talkgroups (Macaw Hill) - 25th November 2015

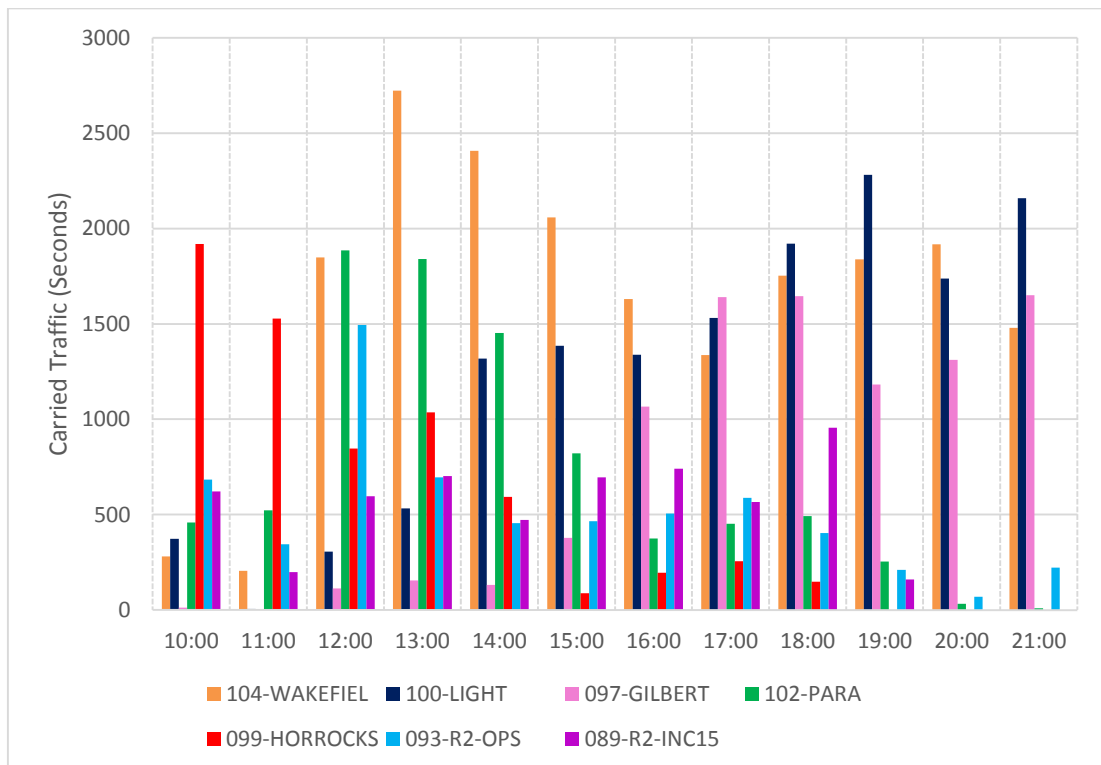


Figure 23: Total Carried Traffic per SAPOL Talkgroup (Barossa Range) - 25th November 2015 (10:00 to 22:00)

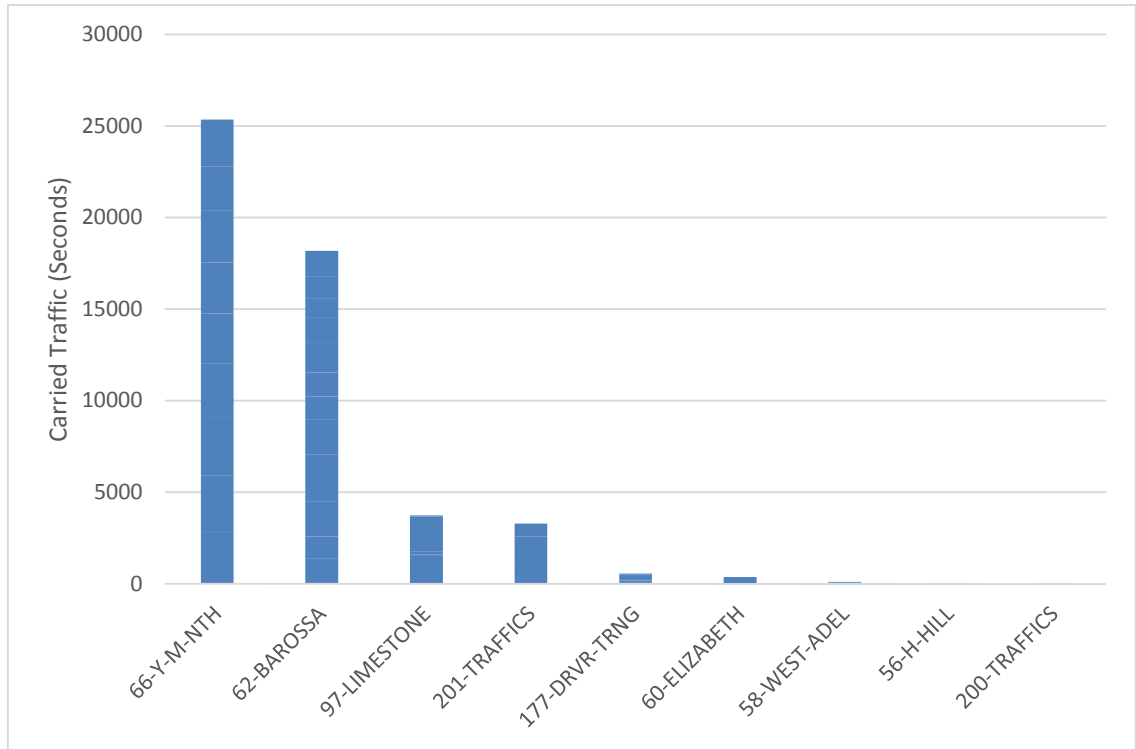


Figure 24: Carried Traffic per Hour for SAPOL Talkgroups (Barossa Range) - 25th November 2015

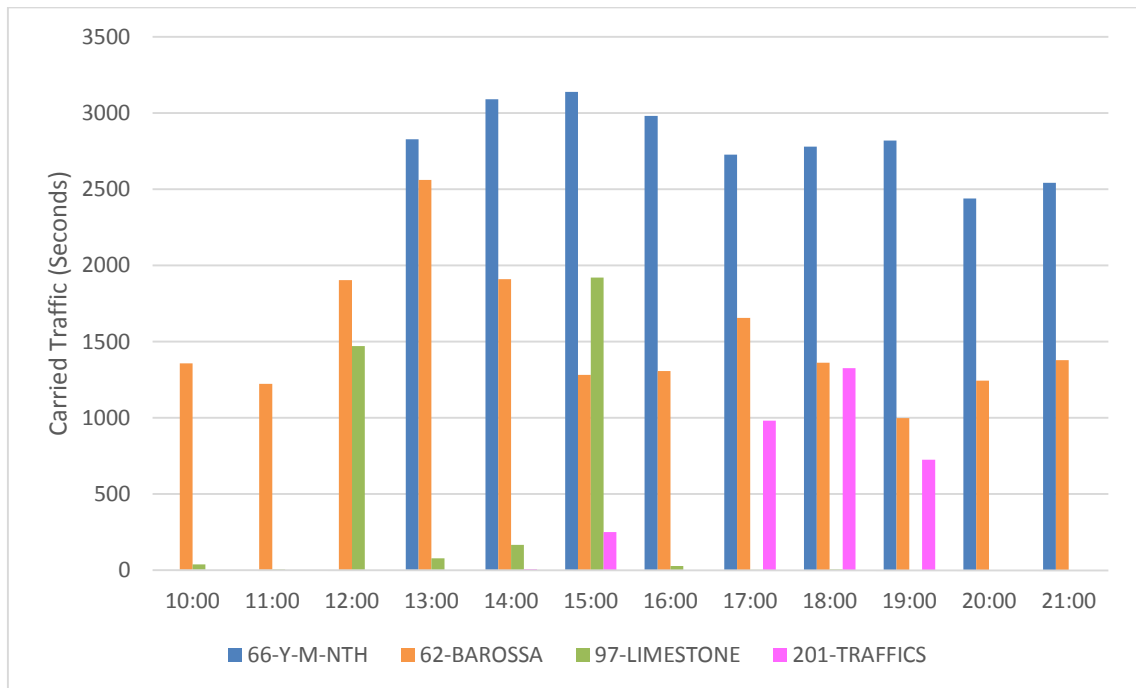


Figure 25: Total Carried Traffic per SAPOL Talkgroup (Macaw Hill) - 25th November 2015 (10:00 to 22:00)

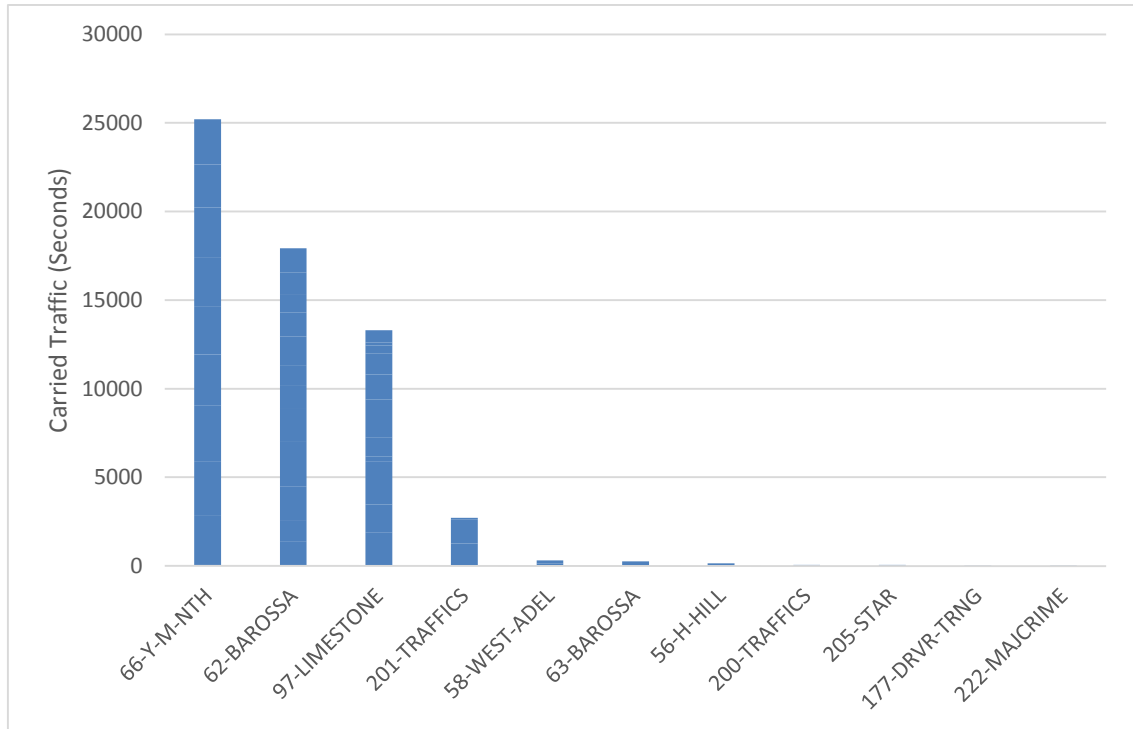


Figure 26: Carried Traffic per Hour for SAPOL Talkgroups (Macaw Hill) - 25th November 2015

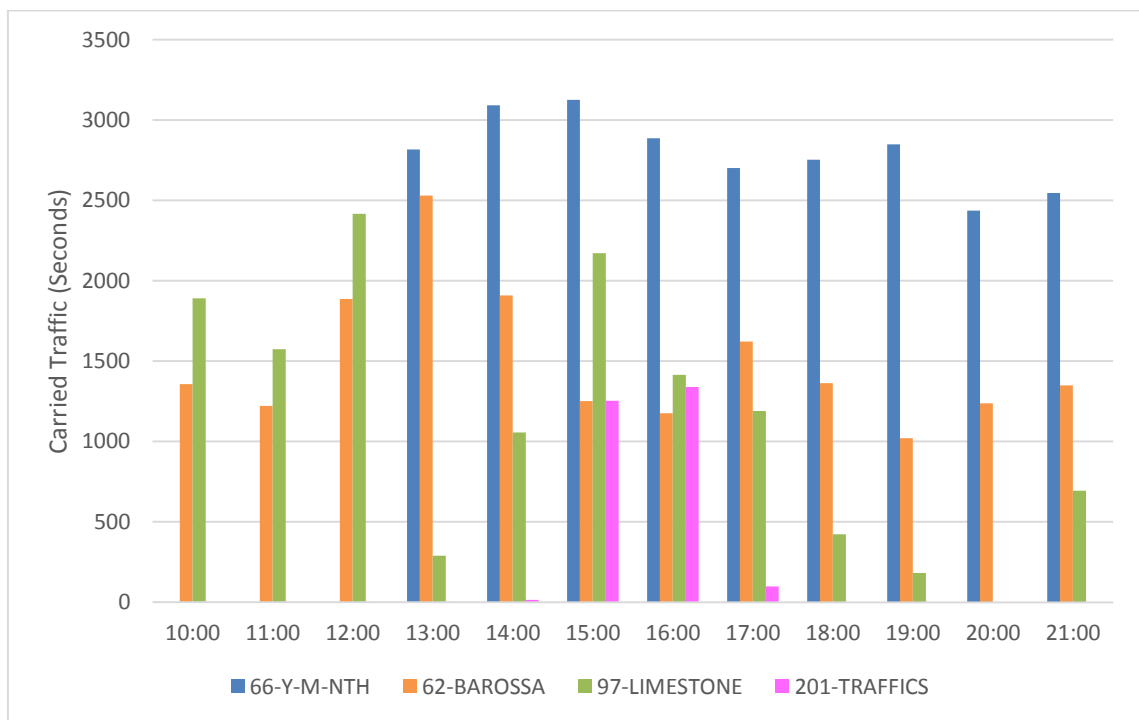


Figure 19 to Figure 26 identify that the following talkgroups generated the majority of traffic at Barossa Range and Macaw Hill:

- CFS –
 - 100-LIGHT
 - 104-WAKEFIEL
 - 093-R2-OPS
 - 095-ANGASTON
 - 102-PARA
 - 097-GILBERT
 - 089-R2-INC15
 - 099-HORROCKS
- SAPOL –
 - 62-BAROSSA
 - 66-Y-M-NTH
 - 97-LIMESTONE
 - 201-TRAFFICS

4.1.4.2 Other SAGRN Sites

Other than the 17 analysed sites, CFS and SAPOL talkgroups were also identified as being active at a number of other SAGRN sites during the Analysis Period (refer Table 9). The number of sites, other than the 17 analysed sites, that each talkgroup was active on during the Pinery Fire is also provided in Table 9.

Table 9: Number of Sites with Pinery Fire Talkgroups Active - 25th November 2015 (10:00 to 22:00)

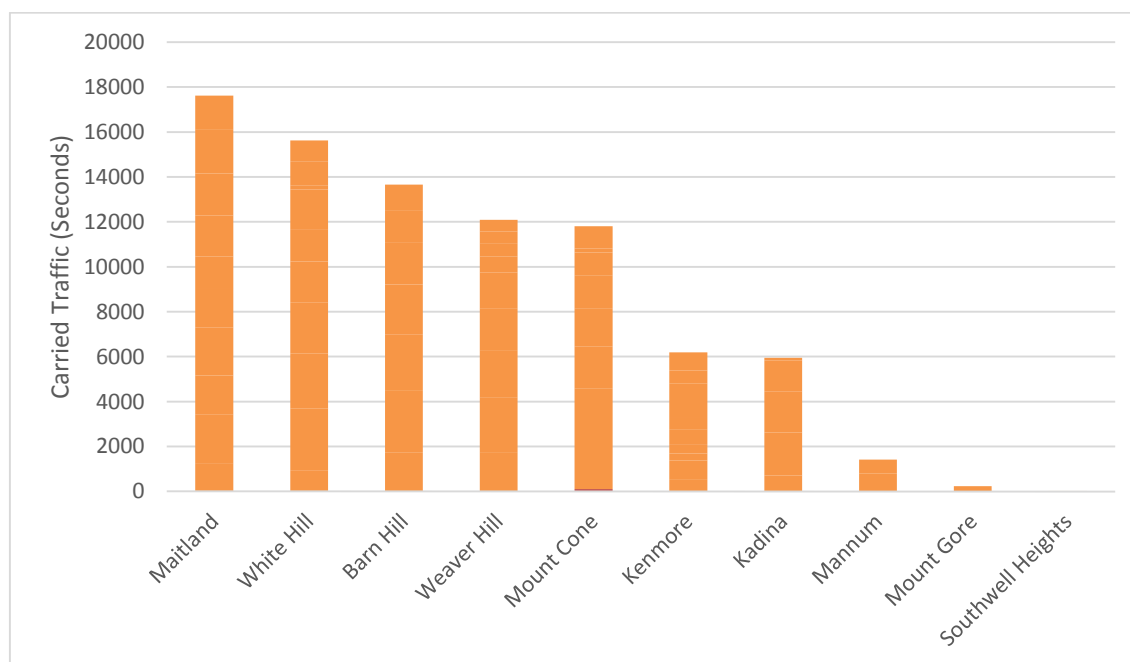
Agency	Talkgroup	No. of Sites	Site Names
CFS	100-LIGHT	9	Barn Hill, Kadina, Kenmore, Maitland, Mount Cone, Mount Gore, Southwell Heights, Weaver Hill, White Hill
	104-WAKEFIEL	10	Barn Hill, Kadina, Kenmore, Maitland, Mannum, Mount Cone, Mount Gore, Southwell Heights, Weaver Hill, White Hill
	093-R2-OPS	9	Barn Hill, Kadina, Kenmore, Maitland, Mount Cone, Mount Gore, Southwell Heights, Weaver Hill, White Hill
	095-ANGASTON	3	Barn Hill, Weaver Hill, White Hill
	102-PARA	4	Barn Hill, Kenmore, Weaver Hill, White Hill
	097-GILBERT	7	Barn Hill, Black Hill, Kenmore, Maitland, Mount Cone, Weaver Hill, White Hill
	089-R2-INC15	8	Barn Hill, Kadina, Kenmore, Maitland, Mount Cone, Southwell Heights, Weaver Hill, White Hill
	099-HORROCKS	8	Barn Hill, Kadina, Kenmore, Maitland, Mount Cone, Mount Gore, Weaver Hill, White Hill
SAPOL	62-BAROSSA	10	Black Hill, Brown Hill, Bull Creek, Cherry Gardens, Mannum, Mount Barker, Mount Terrible, Southwell Heights, Trott Park, White Hill.
	66-Y-M-NTH	22	Barn Hill, Browns Hill, Coonarie Hill, Delamere, Hahndorf, Kadina, Kenmore, MacDonald Hill, Maitland, Mount Arden, Mount Cone, Mount Edwards, Mount Gore, Mount Laura, Mucra Hill, Nantabibbie, Port Augusta, Stoke Hill, Thackaringa, The Bluff, Trott Park, Weaver Hill
	97-LIMESTONE	53	Barn Hill, Berri, Binnie Lookout, Black Hill, Bordertown, Browns

Agency	Talkgroup	No. of Sites	Site Names
			Hill, Camelback, Casterton, Coonarie Hill, Coonawarra, Dartmoor, Elgin, Hahndorf, Jip Jip, Kadina, Keith North, Kenmore, Lameroo, Loxton, MacDonald Hill, Maitland, Mannum, Mindarie, Mootatunga, Mount Arden, Mount Barker, Mount Benson, Mount Burr, Mount Cone, Mount Edwards, Mount Gambier, Mount Gore, Mount Laura, Mucra Hill, Nangwarry, Nantabibbie, Naracoorte, Notts Well, One Tree SE, Peake, Pinnaroo, Port Augusta, Renmark, Salt Creek, Stoke Hill, Taratap, Thackaringa, The Bluff, The Gap, Vincent, Waikerie, Weaver Hill, White Hill
	201-TRAFFICS	29	Berrie, Binnie Lookout, Bull Creek, Cherry Gardens, Coonawarra, Delamere, Elgin, Hahndorf, Jip Jip, Kangarilla, Keith North, Kenmore, Mannum, Mount Barker, Mount Benson, Mount Burr, Mount Gambier, Nangwarry, Naracoorte, Notts Well, Peake, Renmark, Salt Creek, Taratap, The Gap, Trott Park, Vincent, Waikerie, White Hill

Table 9 indicates that Pinery Fire related call traffic may have been broadcast to a number of sites throughout the SAGRN.

Figure 27 provides details of the carried traffic for CFS talkgroup 104-WAKEFIEL at the sites identified in Table 9 . Figure 27 shows that, of the 10 sites, seven (7) had over 5,000 seconds in total carried traffic from CFS talkgroup 104-WAKEFIEL, with Maitland and White Hill having over 15,000 seconds.

Figure 27: Carried Traffic per Site for CFS Talkgroup 104-WAKEFIEL - 25th November 2015



As shown in Figure 28, White Hill (and its associated predicted outdoor mobile radio coverage) is significantly south of the Pinery Fire incident area. Based on coverage predictions, the White Hill site is not expected to provide coverage to the



Pinery Fire incident area. Further analysis of radios that accessed talkgroup 104-WAKEFIEL is provided in Section 4.1.6.

Figure 28: Location of White Hill and Associated Predicted Outdoor Mobile Radio Coverage

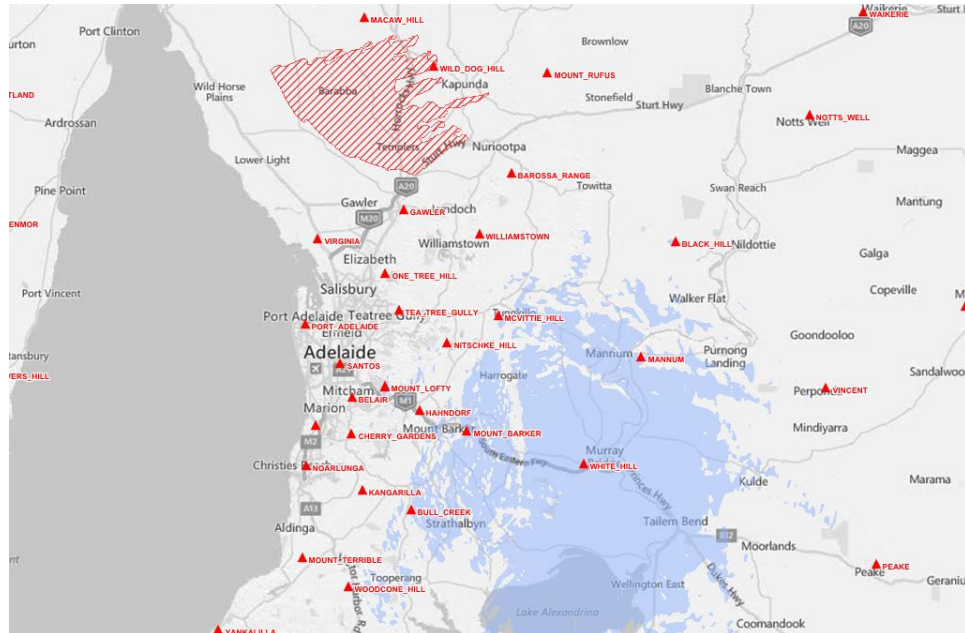
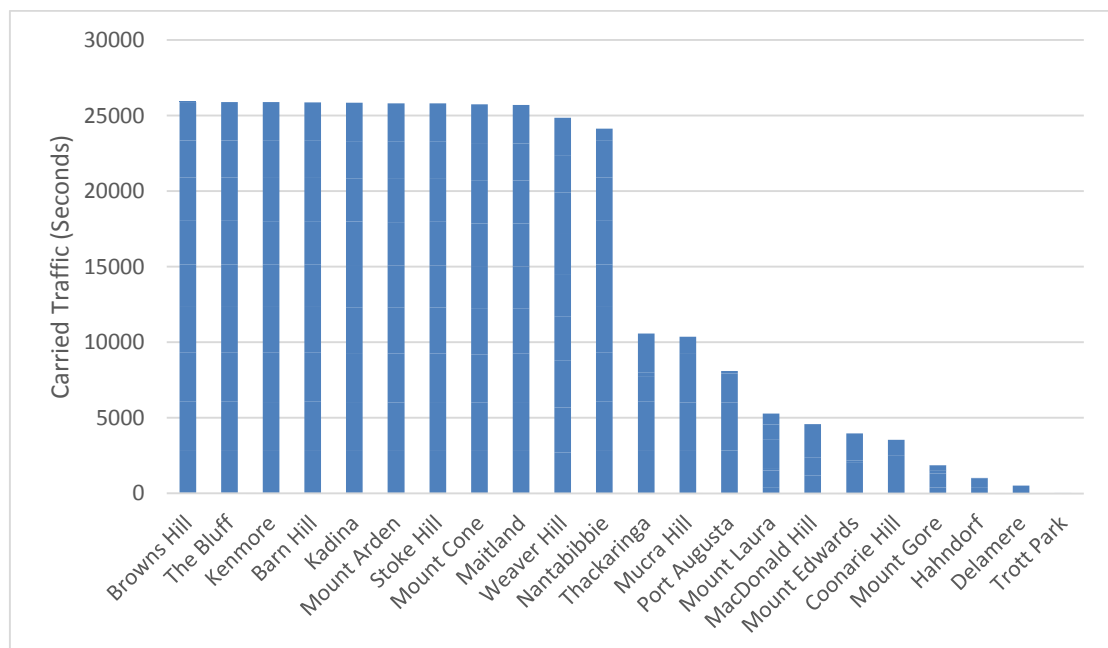


Figure 29 provides the carried traffic for SAPOL talkgroup 66-Y-M-NTH at the sites identified in Table 9 . Figure 29 shows that of the 22 sites, 15 had over 5,000 seconds in total carried traffic from SAPOL talkgroup 66-Y-M-NTH, with Browns Hill having the highest, at over 25,000 seconds.

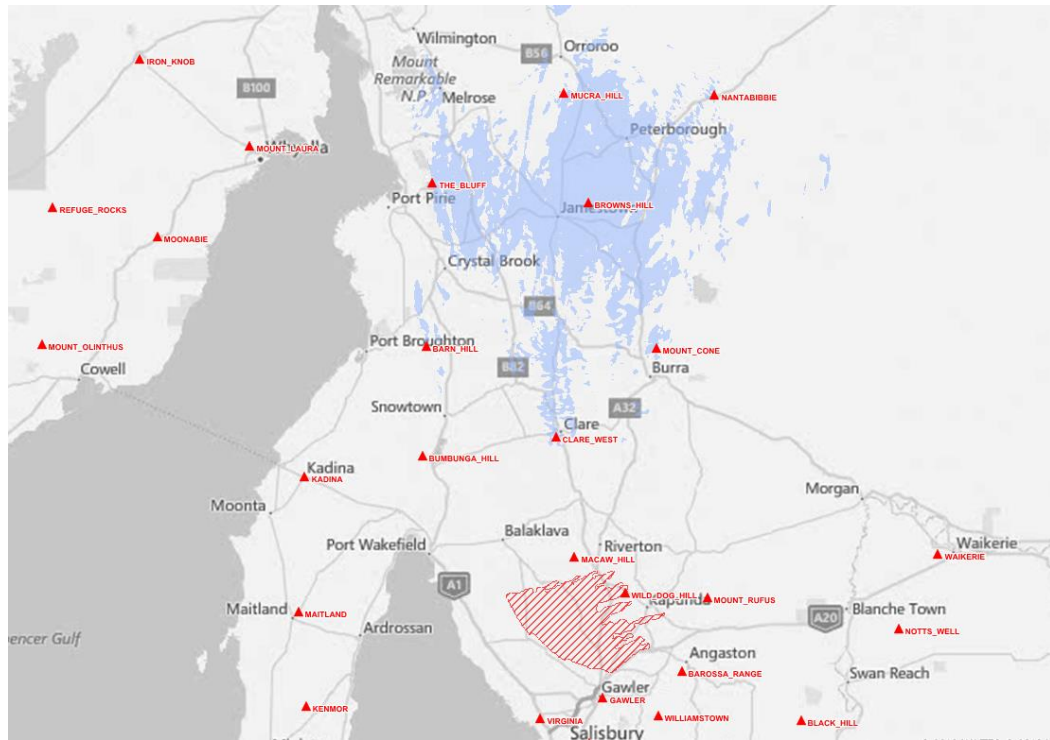
Figure 29: Carried Traffic per Site for SAPOL Talkgroup 66-Y-M-NTH - 25th November 2015





As shown in Figure 30, Browns Hill (and its associated predicted outdoor mobile radio coverage) is significantly north of the Pinery Fire incident area. Based on coverage predictions, the Browns Hill site is not expected to provide coverage to the Pinery Fire incident area. Further analysis of radios that accessed talkgroup 66-Y-M-NTH is provided in Section 4.1.6.

Figure 30: Location of Browns Hill and Associated Predicted Outdoor Mobile Radio Coverage



4.1.5 Emergency (Duress) Calls

Table 6, shows that there were a number of emergency calls during the Analysis Period that involved the analysed sites. Of these emergency calls, there were a total of 48 that were initiated from radios affiliated to one of the 17 analysed sites. A summary of the initiated emergency calls is provided in Table 10.

Table 10: Emergency (Duress) Calls (Ingress Only) - 25th November 2015 (10:00 to 22:00)

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Gawler													
CFS					2								2
SAPOL							3						3
Macaw Hill													
CFS									2	2*			4
One Tree Hill													
PTB								1					1
Port Adelaide													
PTB		1											1
Santos House													
PTB			1			1	5		1				8
Tea Tree Gully													
PTB	2			1	2	3		6			3		17
Wild Dog Hill													
CFS					5								5
Williamstown													
CFS					2				1				3
SAPOL						4							4
Total	2	1	1	1	11	8	8	7	4	2	3	0	48

* One of these emergency calls experienced a busy.

Of the 48 emergency calls identified in Table 10, 14 were CFS, 7 were SAPOL and 27 were PTB. The majority of the emergency calls were initiated by PTB by radios affiliated to the Tea Tree Gully site.

During discussions with CFS representatives, Mingara was made aware of anecdotal reports of CFS personnel pressing the emergency button and it “not working”. Analysis of SAGRN data indicates that there were no instances where an emergency call did not proceed when in SAGRN coverage. Instances of users attempting to initiate an emergency call when not in coverage are not captured within the SAGRN data.

Of the emergency calls initiated when in coverage, only one (1) did not proceed immediately. This call was queued for 0.4 seconds before it proceeded.

In Mingara's opinion:

- it is possible that CFS users who reported the emergency button as not working were not in SAGRN coverage when they attempted to initiate an emergency call; and/or
- some users may have attempted to initiate an emergency call from a portable radio in an area not provided with SAGRN portable coverage.

4.1.6 Radio Terminal Analysis

4.1.6.1 Pinery Fire Analysis Sites

Table 11 provides a summary of the number of unique radio ID's that actively participated in calls at the 17 analysed sites for each hour of the Analysis Period. For the purpose of this analysis, actively participating in a call (i.e. making a call) is defined as generating audio as opposed to listening only.

Table 11: Unique Radios Actively Participating in Calls (Initiating Audio) per Hour - 25th November 2015 (10:00 to 22:00)

Site / Radio ID	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
Barossa Range	6	1	15	21	24	51	46	59	60	35	46	48
Belair	16	19	17	21	25	28	13	18	12	10	15	15
Bumbunga Hill	12	-	7	4	12	10	15	7	2	-	-	2
Clare West	30	28	26	21	20	41	12	14	9	7	4	5
Gawler	13	10	26	30	51	61	64	65	50	61	50	39
Macaw Hill	21	8	41	53	57	82	70	59	70	56	37	33
McVitties Hill	-	9	10	12	14	3	7	2	-	4	1	-
Mount Lofty	29	35	39	36	45	52	38	26	20	20	12	15
Mount Rufus	6	3	6	5	11	15	12	19	21	27	8	13
Nitschke Hill	4	24	22	11	3	3	13	5	1	8	3	3
One Tree Hill	97	109	132	155	167	160	152	138	109	100	96	77
Port Adelaide	108	123	130	124	127	137	104	92	83	83	55	59
Santos House	205	197	202	216	240	217	211	209	160	129	106	100
Tea Tree Gully	80	82	93	120	127	126	102	90	100	88	78	71
Virginia	6	5	13	12	21	7	6	11	9	12	5	8
Wild Dog Hill	12	13	27	42	54	62	62	79	94	104	69	60
Williamstown	9	12	41	49	39	57	47	37	27	30	37	34

Note: Key Pinery Fire sites shown in RED

Table 11 shows that the large sites of Santos House, One Tree Hill, and Port Adelaide had the highest number of unique radios actively participating in calls each hour. It is assumed that a large number of these unique radios were business-as-usual related and not associated with the Pinery Fire.

The number of unique radios actively participating in calls at Barossa Range and Macaw Hill increased from 12:00 (the Pinery Fire was first reported at ~12:05).

4.1.6.2 Other Sites

In Section 4.1.4 it was identified that talkgroups that generated large volumes of traffic at the 17 analysed sites during the Analysis Period also generated large volumes of traffic at other SAGRN sites. Two (2) of these talkgroups were 104-WAKEFIEL (a CFS talkgroup) and 66-Y-M-NTH (a SAPOL talkgroup).

4.1.6.2.1 CFS

Table 12 identifies the alias (and affiliated site) of radios that actively participated in a call on talkgroup 104-WAKEFIEL during the Analysis Period at sites other than the 17 analysed. This shows that despite the large volume of traffic generated by talkgroup 104-WAKEFIEL at sites other than the 17 analysed, there were only seven (7) unique CFS radios (spread across 4 sites) that actively participated in calls.

Table 12 highlights that most calls made by these terminals did not occur until 18:00.

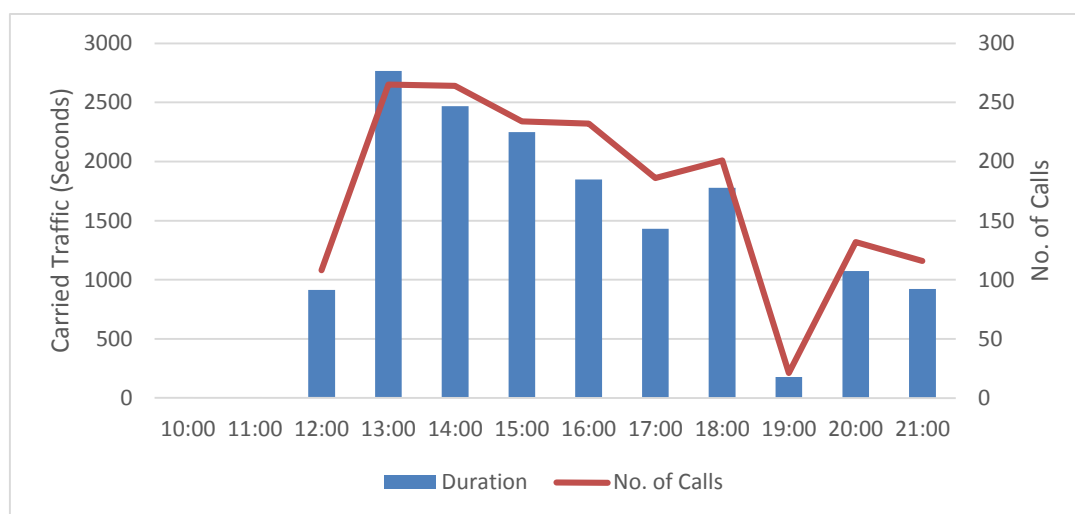
Table 12: Radios Actively Participating in CFS Talkgroup 104-WAKEFIEL Calls - 25th November 2015 (10:00 to 22:00)

Site / Radio Alias	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
Barn Hill												
SPCG-LOGS- M1	-	-	1	-	-	-	-	-	-	-	-	-
Kenmore												
WAKG-CAR1-M1	-	-	-	-	-	-	-	8	2	-	-	-
WAKG-CAR1-M2	-	-	-	-	-	-	-	-	-	8	-	-
RHYN-14-M1	-	-	-	-	-	-	5	-	-	-	-	-
Maitland												
WAKG-CAR1-M1	-	-	-	-	-	-	-	3	17	-	-	4
PTWK-24P-M1	-	-	-	-	-	-	-	-	-	-	3	-
BALA-24P-M1	-	-	-	-	-	-	-	-	3	-	-	-
SPCG-LOGS- M1	-	-	-	-	-	-	-	-	1	-	-	-
WAKG-CAR1-M2	-	-	-	-	-	-	-	-	12	-	-	-
YORG-LOGS-M1	-	-	-	-	-	-	-	-	1	-	-	-
Mount Cone												
PTWK-24P-M1	-	2	-	-	-	-	-	-	-	-	-	-

Other than the 17 analysed sites, one of the sites identified as carrying high levels of traffic associated with talkgroup 104-WAKEFIEL was White Hill (refer Figure 27).

Figure 31 shows the number, and total duration per hour, of 104-WAKEFIEL talkgroup calls during the Analysis Period. Table 12 shows that despite the large volume of traffic generated at White Hill (Murray Bridge) from talkgroup 104-WAKEFIEL, there are no radios that actively participated in a call for the talkgroup during the Analysis Period. This indicates that all 104-WAKEFIEL traffic at White Hill during the Analysis Period can be attributed to radios only listening to the talkgroup; however, it did compromise available capacity at this site due to Pinery Fire call activity.

Figure 31: Total Carried Traffic and Number of Calls Associated with Talkgroup 104-WAKEFIEL - White Hill (25th November 2015)



4.1.6.2.2 SAPOL

Table 13 identifies the alias (and affiliated site) of radios that actively participated in a call on talkgroup 66-Y-M-NTH during the Analysis Period at sites other than the 17 analysed. This shows that, despite the large volume of traffic generated by talkgroup 66-Y-M-NTH at sites other than the 17 analysed, there were only 14 unique radios (spread across 6 sites) that actively participated in calls.

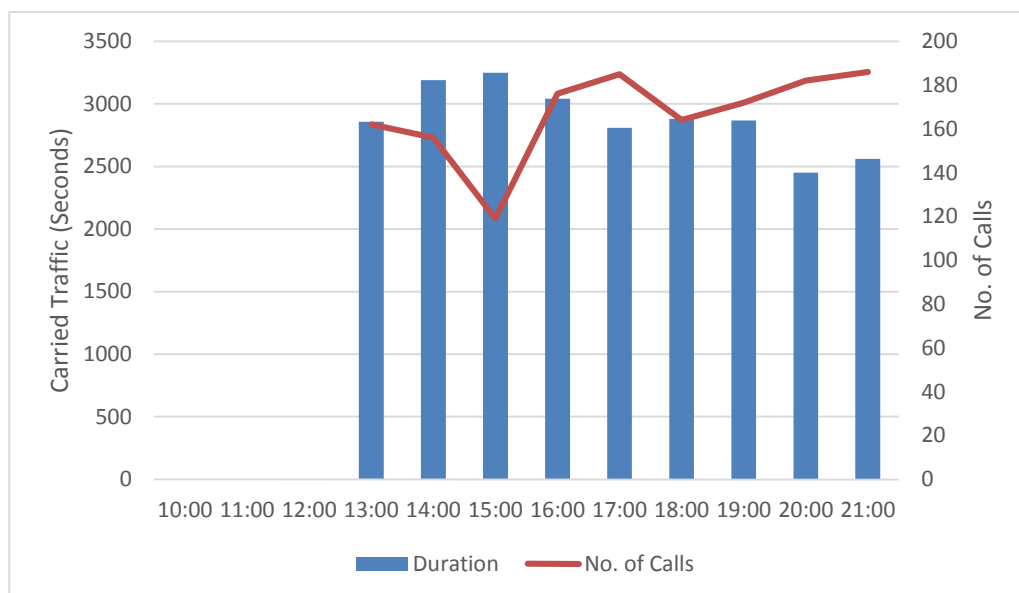
Table 13: Radios Actively Participating in SAPOL Talkgroup 66-Y-M-NTH Calls - 25th November 2015 (10:00 to 22:00)

Site / Radio ID	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
Barn Hill												
Y/MID-NTH-C03						12	1		15	3		
140240902033							1					
Kadina												
Y/MID-NTH-64				1		1						
Y/MID-NTH-C32					1				1			
Kenmore												
STATE-TRAF-60					1							
Y/MID-NTH-M31				1								
WEST-ADEL-M62				1								
Maitland												
Y/MID-NTH-54							3					
H/HILL-M07							1					
Y/MID-NTH-44									2			
Mount Cone												
Y/MID-NTH-M30											2	3
The Bluff												
140240902033					1							
Y/MID-NTH-38				8	27						1	
Y/MID-NTH-06				3					6		2	
Y/MID-NTH-M11							2					

Other than the 17 analysed sites, the site identified as carrying the highest level of traffic associated with talkgroup 66-Y-M-NTH was Browns Hill (refer Figure 29).

Figure 32 shows the carried traffic and number of calls per hour for the 66-Y-M-NTH talkgroup during the Analysis Period. Table 12 shows that, despite the large volume of traffic generated at Browns Hill (Jamestown) from talkgroup 66-Y-M-NTH, there are no radios that actively participated in a call for the talkgroup during the Analysis Period. This indicates that all 66-Y-M-NTH traffic at Browns Hill during the Analysis Period can be attributed to radios only listening to the talkgroup; however, it did compromise available capacity at this site due to Pinery Fire call activity.

Figure 32: Carried Traffic and Number of Calls Associated with Talkgroup 66-Y-M-NTH - Browns Hill (25th November 2015)



4.1.6.2.3 Summary

As shown in Figure 31 and Figure 32 there were large volumes of traffic from CFS talkgroup 104-WAKEFIEL and SAPOL talkgroup 66-Y-M-NTH at White Hill and Browns Hill, respectively.

There were no radios identified as actively participating in a 104-WAKEFIEL call at White Hill or a 66-Y-M-NTH call at Browns Hill during the Analysis Period. However, the following radios (identified by Radio Alias) were identified as having affiliated with either the 104-WAKEFIEL talkgroup at White Hill or the 66-Y-M-NTH talkgroup at Browns Hill during the Analysis Period:

➤ CFS:

- 104-WAKEFIEL (at White Hill) -
 - SWNG-DGO1-P1
 - HEYG-GCCO-P1
 - MBKR-STN-B1
 - CRGG-CAR2-M1
 - MNNM-STN-B1
 - HQTR-WHS1-M1

➤ SAPOL:

- 66-Y-M-NTH (at Browns Hill) -
 - Y/MID-NTH-14
 - Y/MID-NTH-23
 - Y/MID-NTH-32
 - RADIO-TECH-M74
 - Y/MID-NTH-M25
 - Y/MID-NTH-M11

- NAIR-STN-B1
- SWNG-LOGS-M2
- ETTR-CAPT-P1
- MACC-STN-B1
- Y/MID-NTH-17
- Y/MID-NTH-M19
- Y/MID-NTH-35
- PSBB-M16
- Y/MID-NTH-M13
- Y/MID-NTH-C11
- Y/MID-NTH-C15

4.1.7 Communications between IMT and Fireground

Discussions with CFS representatives have confirmed that there were two (2) IMT locations (Incident Control Centres, (ICC)) used for the Pinery Fire incident during the Analysis Period. The initial IMT location was at Balaklava (located to the north of the fireground, refer Figure 1). The second, and final, IMT location was at Angaston (located to the south/east of the fireground, refer Figure 1).

The initial IMT was established during the early stages of the incident and remained at Balaklava until early evening on the 25th November, at which point the IMT was relocated to Angaston. CFS indicated that the decision to relocate the IMT from Balaklava to Angaston was made due to the Balaklava location not having sufficient space to accommodate everyone required for management of the incident.

A staging ground (where resources gather to be tasked to an incident) at Nuriootpa was also established in the evening of the 25th November. Until the establishment of the staging ground, all resources were being dispatched directly to the fire.

According to CFS, the communications between the IMT (ICC) and the fireground followed a command and control structure as represented in Figure 33. In this command and control structure, a dedicated talkgroup is used to communicate between the IMT and the Sector Commanders (CFS indicated there were up to seven (7) sectors for the Pinery Fire). Separate talkgroups are then used to communicate between each Sector Commander and the Strike Team Leaders within the sector. Communication within the Strike Teams is conducted using VHF simplex (direct mode).

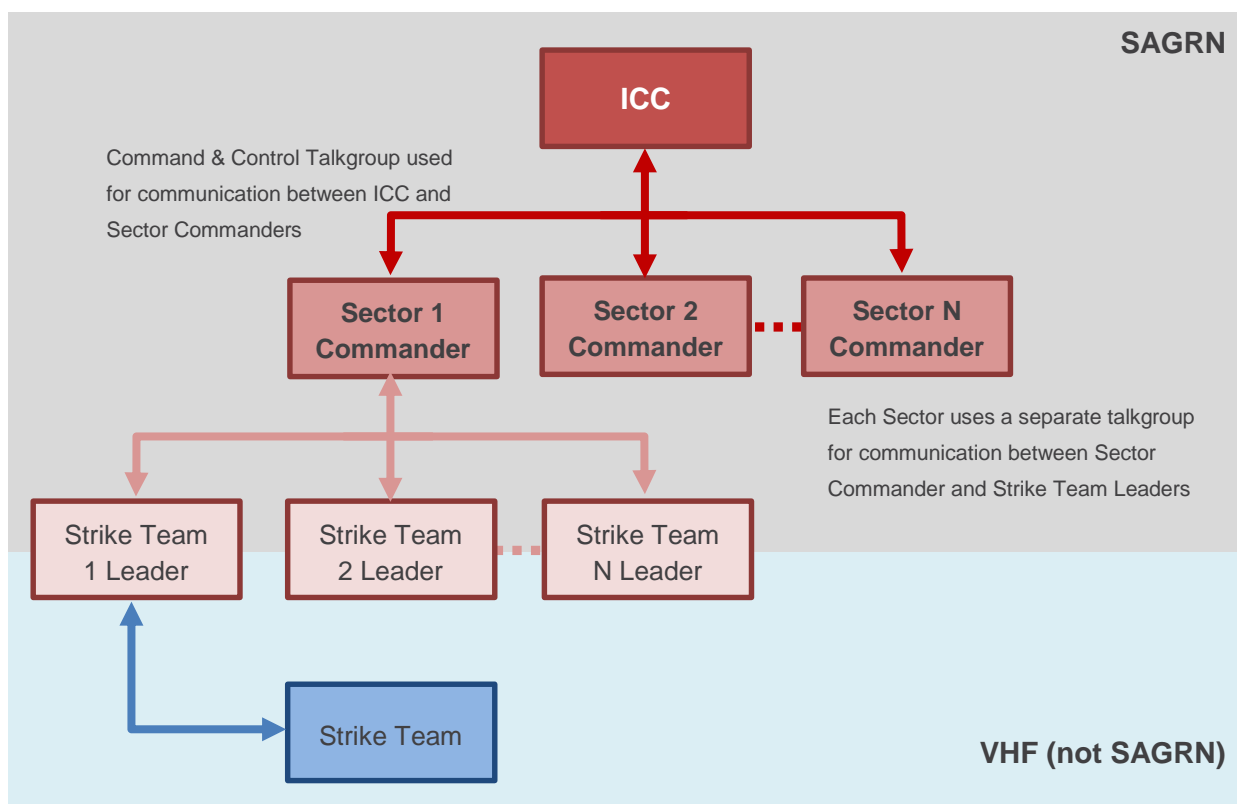


Figure 33: CFS Command & Control Communications Structure – Pinery Fire

Analysis of GRN coverage predictions has showed that the IMT locations (initial & final) were within the same SAGRN site(s) coverage footprint as the fire-ground. It is difficult to definitively identify if the location of the IMT impacted on the effectiveness of the communications. However, given the proximity of the IMT to the fire ground, and the coverage predictions for analysed sites, Mingara considers it highly likely that fire ground users and IMT users would have been competing for resources on the same sites

Mingara has not received radio ID's of personnel operating from the IMT during the Pinery Fire. It is therefore difficult to verify the reported experiences of users communicating between the IMT and fireground. However, analysis of egress busies (refer Section 5.1.4) supports reports of users initiating calls and receiving no response.

In Mingara's opinion, the combination of multiple agencies operating from a location that was likely utilising site capacity being accessed for CFS command and control, contributed to the number of busies experienced.

4.1.8 Mitigation Strategy Effectiveness

The State Controller Communications indicated that he monitored the SAGRN network performance during the Pinery Fire using specialised near real time reporting tools provided at the SEC.



SAGRN network statistics analysed by Mingara confirmed that there was no evidence of effective action to mitigate traffic on the SAGRN during the Pinery Fires, despite the State Controller Communications stating that he requested agencies to reduce network usage where possible.

SAGRN network statistics also confirm that no direct network based intervention was used to assist in traffic mitigation during the Pinery Fires.

4.1.9 Correlation between User Experience and Network Performance

AGD confirmed that the SAGRN experienced no planned or unplanned outages during the Pinery Fire, hence it operated within design parameters during the Analysis Period. This confirms that SAGRN network infrastructure delivering capacity to the Pinery Fire incident did not contribute to any GoS issues experienced.

Previous analysis undertaken on the SAGRN by Mingara has shown there is a high correlation between a user having a poor experience using a site that is also experiencing a poor GoS. When this occurs, the effectiveness of operational radio communications is impacted.

At the time of writing this report, no agency field reports were available to confirm a correlation between a user having a poor experience using a site that is also experiencing a poor GoS. However, GoS analysis has shown that sites involved in the Pinery Fire experienced poor GoS from 12:00 hours to 22:00 hours, with one site having a GoS of 40%, which meant that four (4) out of every ten (10) calls were busied out for no less than two (2) seconds.

4.2 Findings – Agency Network Activity and Performance Modelling

4.2.1 Agency Communications – Call Volume

Mingara's findings with respect to Agency Communications – Call Volume are as follows:

- CFS, SAPOL and SAAS generated the highest number of calls at the sites directly involved in the Pinery Fire during the Analysis Period; and
- CFS had the highest total number of calls at Barossa Range and Macaw Hill (~50% and ~55% respectively); however, the total number of calls by SAPOL was approximately 30% at both sites. In Mingara's opinion, the number of calls generated by SAPOL at these sites appears to be significantly higher than expected (based on similar historical events in South Australia) and contributed significantly to the reduction in available site capacity for CFS field communications.

4.2.2 Agency Communications – Call Duration

Mingara's findings are as follows with respect to Agency Communications – Call Duration:

- For the analysed sites there was typically a difference between the average and median call duration (for CFS, SAPOL, PTB, SAAS and MFS); in excess of 30% for the Analysed Period. This indicates a very volatile call environment, where there is a large mixture of calls with varying call lengths. This is typical for incidents such as the Pinery Fire, where a mix of operational communications is employed;
- There was no correlation between the call duration (average and median) per site and the total number of calls at the same sites. This indicates that the operational communications mix was consistent across all the affected sites;
- During the Analysis Period the average and median call duration for SAPOL significantly exceeded that of CFS. SAPOL's high call volumes associated with long call duration significantly degraded the trunking efficiency of the analysed sites, which reduced the availability of site capacity for all other users;
- CFS median call duration during the Analysis Period was higher than the historical median call duration at analysed sites, but within typical industry variances for fire services;
- The SAPOL median call duration during the Analysis Period was higher than the historical median call duration at 9 of the 17 sites, these higher values are in excess of typical industry variances for law enforcement;

- A number of sites where the SAPOL median call duration was lower than the historical median duration were sites that appear to have had high call volume of business-as-usual activity, relative to their call activity involved with the management of the Pinery Fire (e.g. Belair, Port Adelaide); and
- The combined median call duration for all agencies was lower during the Analysis Period than for the Historical Analysis Period at all sites. This measure indicates that most agencies exercised a level of restraint when making calls during the Pinery Fire.

4.2.3 Agency Call Types

Mingara's findings are as follows with respect to Agency Call Types:

- Talkgroup Calls (not Patched or Multi-Select) -
 - The call type that generated the highest number of calls during the Analysis Period were talkgroup calls. CFS generated the highest number of talkgroup calls at the majority of analysed sites, followed by SAPOL and SAAS. This is not unexpected given that CFS was the primary combatant agency.
- Talkgroup Calls (Patched) -
 - SAPOL generated the largest number of patched talkgroup calls at the analysed sites during the Analysis Period, which involved patching SAPOL operational talkgroups designed for use well outside the geographical area associated with the Pinery Fire. This patching of remote talkgroups into the fireground had a material impact on available site capacity serving the fireground;
 - SAPOL patched talkgroup calls contributed in excess of 15% of the total calls at Barossa Range and Macaw Hill, which in Mingara's opinion was adding remote unrelated operational traffic to the fireground; and
 - SAPOL did remove talkgroup 66-Y-M-NTH from the 97-LIMESTONE, 93-M-MALLEE and 66-Y-M-NTH patch during the Analysis Period. However, Mingara's analysis showed no corresponding material reduction in call volumes at Barossa Range and Macaw Hill, as the remaining patched talkgroups, 97-LIMESTONE and 93-M-MALLEE, remained active. This indicates that SAPOL still had radio terminals operating on 97-LIMESTONE and 93-M-MALLEE in the Pinery Fire incident area.
- Emergency Calls –
 - There were emergency calls generated on the analysed sites by SAPOL, CFS and PTB, however only one emergency call experienced a busy. It should be noted, however, that emergency call requests by terminals operating outside the SAGRN coverage areas will not appear in the SAGRN metadata provided for analysis.

- Multigroup Calls –
 - There were multigroup calls generated on the analysed sites by SAAS and Corrections. The volume of multigroup calls was low and, in Mingara’s opinion, did not have a material impact on the overall performance of analysed sites.
- Private Calls –
 - There were very few private calls that involved analysed sites during the Analysis Period. In Mingara’s opinion private calls did not have a material impact on the overall performance of analysed sites.

4.2.4 Talkgroup Analysis

Mingara’s findings are as follows with respect to Talkgroup Analysis:

- Of the active talkgroups on analysed sites that experienced poor GoS during the Analysis Period, CFS had the highest number (46), followed by SAPOL (26). For both CFS and SAPOL, the active talkgroups included business-as-usual talkgroups as well as those being used for the Pinery Fire. In Mingara’s opinion, this indicates that analysed sites were impacted by non-incident related traffic;
- The majority of CFS carried traffic at Barossa Range and Macaw Hill was generated by seven (7) talkgroups. The most carried traffic at Barossa Range was generated by 100-LIGHT, while 104-WAKEFIEL generated the most carried traffic at Macaw Hill;
- The majority of SAPOL carried traffic at Barossa Range and Macaw Hill was generated by four (4) talkgroups. Of these, 66-Y-M-NTH generated the most carried at both Barossa Range and Macaw Hill; and
- Both CFS and SAPOL talkgroups that were used operationally to manage the Pinery Fire, generated traffic during the Analysis Period at sites other than those analysed. In Mingara’s opinion, this indicates that SAGRN sites not serving the Pinery Fire incident area were unnecessarily impacted by incident traffic, increasing the probability of site congestion occurring in other parts of the State.

4.2.5 Emergency (Duress) Calls

Mingara’s findings are as follows with respect to Emergency (Duress) Calls:

- There were 48 separate emergency calls initiated from the analysed sites during the Analysis Period. Of these, 14 were from CFS radios, 7 from SAPOL radios and 27 from PTB radios;
- Of the 48 emergency calls initiated, only one did not proceed immediately. This call was queued for 0.4 seconds before proceeding; and
- In Mingara’s opinion, it is possible that CFS users who reported the emergency button as not working were not in SAGRN coverage when they

attempted to initiate an emergency call. At the time of preparing this report CFS had not provided any field reports that would permit verification against SAGRN call data.

4.2.6 Radio Terminal Analysis

Mingara's findings are as follows with respect to Radio Terminal Analysis:

- The number of unique radios that actively participated in calls at Barossa Range and Macaw Hill peaked between 15:00 hours and 17:00 hours;
- CFS talkgroup 104-WAKEFIEL generated high volumes of carried traffic at White Hill during the Analysis Period. However, there were no calls initiated on this talkgroup at White Hill (Murray Bridge) during the Analysis Period. In Mingara's opinion, users affiliated with White Hill may have been unnecessarily listening to activity on 104-WAKEFIEL and compromising site capacity at that site;
- Ten (10) unique CFS radios have been identified as having been affiliated to 104-WAKEFIEL at White Hill during the Analysis Period;
- SAPOL talkgroup 66-Y-M-NTH generated high volumes of carried traffic at Browns Hill (Jamestown) during the Analysis Period. However, there were no calls initiated on this talkgroup at Browns Hill during the Analysis Period. In Mingara's opinion, users affiliated with Browns Hill may have been unnecessarily listening to activity on 66-Y-M-NTH; and
- Thirteen (13) unique SAPOL radios have been identified as having been affiliated to 66-Y-M-NTH at Browns Hill during the Analysis Period.

4.2.7 Communication between IMT and Fireground

Mingara's findings are as follows with respect to Communication between IMT and Fireground:

- Analysis of egress busies supports reports of users initiating calls and receiving no response. In Mingara's opinion, the combination of multiple agencies operating from a location that was likely utilising site capacity being accessed for CFS command and control, contributed to the number of busies experienced. The extent to which the IMT located radio terminals contributed to site busies cannot be validated as, at the time of preparing this report, CFS had not provided details of the radio IDs used at the relative IMT locations.

4.2.8 Mitigation Strategy Effectiveness

Mingara's findings are as follows with respect to Mitigation Strategy Effectiveness:

- Analysis of call data from effected sites shows no clear evidence of proactive traffic mitigation taking place on sites directly involved with the Pinery Fire. Given the extent of unrelated operational traffic on these sites,

the lack of proactive traffic mitigation contributed to the extent of traffic congestion and lack of capacity at these sites; and

- The lower overall combined median call time of most agencies during the Analysis Period (as compared to the Historical Analysis Period) aligns with a statement that a general request by the State Controller Communications for agencies to reduce usage was issued.

4.2.9 Correlation between User Experience and Network Performance

Mingara's findings are as follows with respect to Correlation between User Experience and Network Performance:

- Based on information provided by AGD, the SAGRN experienced no planned or unplanned outages during the Pinery Fire. Hence, all sites and associated coverage/capacity was available to users at all times during the Pinery Fire; and
- Previous analysis undertaken on the SAGRN by Mingara has shown there is a high correlation (typically in excess of 90%) between a user having a poor experience using a site that is also experiencing a poor GoS. When this occurs, the effectiveness of operational radio communications is impacted. During the Pinery Fire most sites directly involved in the incident experienced poor GoS; however, at the time of preparing this report no agency field reports were available to confirm any related correlation.

4.3 Recommendations – Agency Network Activity and Performance Modelling

4.3.1 Agency Communications – Call Volume

Based on the findings, with respect to Agency Communications – Call Volume, Mingara recommends that:

- a) SAPOL undertake an investigation to determine if the operational use of the SAGRN specifically relating to the Pinery Fires explains the high SAPOL call volumes generated in the area.

4.3.2 Agency Communications – Call Duration

Based on the findings, with respect to Agency Communications – Call Duration, Mingara recommends that:

- a) The impact of relatively lengthy call durations on SAGRN site capacity, especially during major events, be reinforced with SAPOL; and
- b) SAPOL undertake an investigation into the length of calls employed during the Pinery Fire and, where operationally feasible, implement procedures that can be used to minimise the related impact on the capacity of sites involved in future major events.

4.3.3 Agency Call Types

Based on the findings, with respect to Agency Call Types, Mingara recommends that:

- a) All agencies do not operate on patched talkgroups in the incident area where members of the patch involve operational jurisdictions well outside the affected area.

4.3.4 Talkgroup Analysis

Based on the findings, with respect to Talkgroup Analysis, Mingara recommends that:

- a) AGD and SAGRN user agencies engage to review the current SAGRN site talkgroup mapping to reduce the probability of remote, unrelated operational traffic occurring at the incident.
- b) Agencies consider and formally document their “concept of operations” to revise and/or revalidate their talkgroup and radio terminal requirements, to ensure the SAGRN is configured to meet the operational requirements of the agencies.
- c) Subject to recommendation 4.3.4(b), that the outcome of the “concept of operations” be used to assist in re-benchmarking the SAGRN coverage and capacity requirements.

4.3.5 Emergency (Duress) Calls

Based on the findings, with respect to Emergency (Duress) Calls, Mingara recommends that:

- a) Agencies reinforce with their users that emergency (duress) calls can only be processed by the SAGRN infrastructure if the terminal device is within the respective coverage type.

4.3.6 Radio Terminal Analysis

Based on the findings, with respect to Radio Terminal Analysis, Mingara recommends that:

- a) CFS and SAPOL investigate the operational role and necessity of geographically remote radio terminals communicating with the fireground.

4.3.7 Communication between IMT and Fireground

Based on the findings, with respect to Communication between IMT and Fireground, Mingara recommends that:

- a) The establishment of IMT locations takes into consideration access to available radio communications resources (including capacity) necessary to carry out its function, whilst not compromising frontline communications requirements.

4.3.8 Mitigation Strategy Effectiveness

Based on the findings, with respect to Mitigation Strategy Effectiveness, Mingara recommends that:

- a) Public Safety Solutions unit, AGD be engaged to provide an SAGRN advisory function to the State Controller Communications during major events;
- b) State Controller Communications initiate a review of the SAGRN Traffic Mitigation Agreement;
- c) The SAGRN Board initiate a review of the SAGRN Standard Conditions of Service, with a view to incorporating policies regarding expected agency radio communications behaviour when operating in the SAGRN shared environment; and
- d) AGD and the agencies review the current governance arrangements around regular reporting on SAGRN agency utilisation, and compliance with the SAGRN Standard Conditions of Service, as amended by recommendation 4.3.8(c).

4.3.9 Correlation between User Experience and Network Performance

There are no recommendations with respect to Correlation between User Experience and Network Performance.

5 Network Activity and Performance Modelling

5.1 Analysis

The Network Activity and Performance Modelling addresses the following areas for the Analysis Period (unless specified otherwise):

- Site Capacity;
- Calls –
 - Ingress;
 - Egress;
- Air-time; and
- Grade of Service.

5.1.1 Site Capacity

Table 14 provides details of the current capacity (number of voice channels, excluding control channels) and the proposed voice capacity included in the SAGRN upgrade project.

Table 14: Current and Proposed (SAGRN Upgrade) Site Capacity

Site	Current Capacity – excl. Control Channel (As at 19/04/2015)	SAGRN Upgrade Proposed Voice Capacity - excl. Control Channel
Barossa Range	5	6
Belair	11	12
Bumbunga Hill	4	5
Clare West	5	7
Gawler	8	8
Macaw Hill	5	7
McVitties Hill	5	7
Mount Lofty	16	17
Mount Rufus	5	8
Nitschke Hill	6	7
One Tree Hill	13	13
Port Adelaide	15	15
Santos House	16	17
Tea Tree Gully	14	14
Virginia	7	7
Wild Dog Hill	8	8
Williamstown	8	8

Of the analysed sites, the six (6) that experienced the worst GoS (highlighted in **RED** in Table 14) during the Analysis Period all have five (5) or less voice channels (refer to Section 5.1.5).

The voice capacity at all six (6) sites that experienced the worst GoS performance during the Pinery Fire Analysis Period is proposed to be increased.

5.1.2 Ingress / Egress Calls

Analysis of the SAGRN data has identified that the majority of all calls impacting the 17 analysed sites during the Analysis Period were egress calls. A summary of the total ingress calls and egress calls at each site for the Analysis Period is provided in Figure 34 (related data provided in Appendix D).

Figure 34: Total Number of Ingress & Egress Calls per Site - 25th November (10:00 to 22:00)

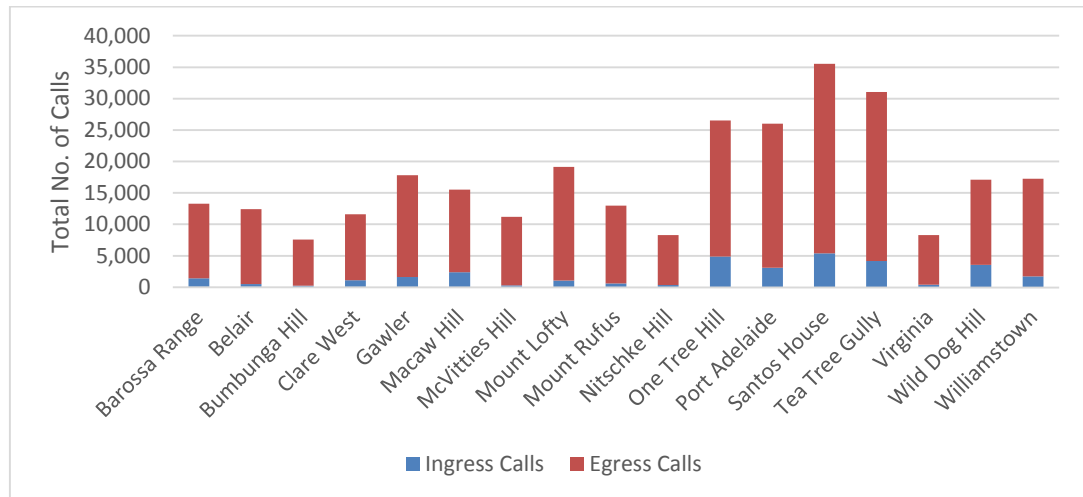


Figure 35 and Figure 36 show the breakdown of ingress calls and egress calls per hour at Barossa Range and Macaw Hill respectively. These graphs show that there are significantly more egress calls than ingress calls at Barossa Range and Macaw Hill for each hour of the day. This is also observed for all the other analysed site.

The observation that there are more egress calls than ingress calls is expected for a number of reasons, including: talkgroup calls are usually one-to-many across multiple sites and calls initiated at a console do not register as an ingress call at any site. It is also possible egress call traffic is generated by active call participation as well as people listening to talkgroup calls without any legitimate operational reason to do so (refer to 4.1.6).

Figure 35: Total Number of Ingress & Egress Calls per Hour (Barossa Range) - 25th November (10:00 to 22:00)

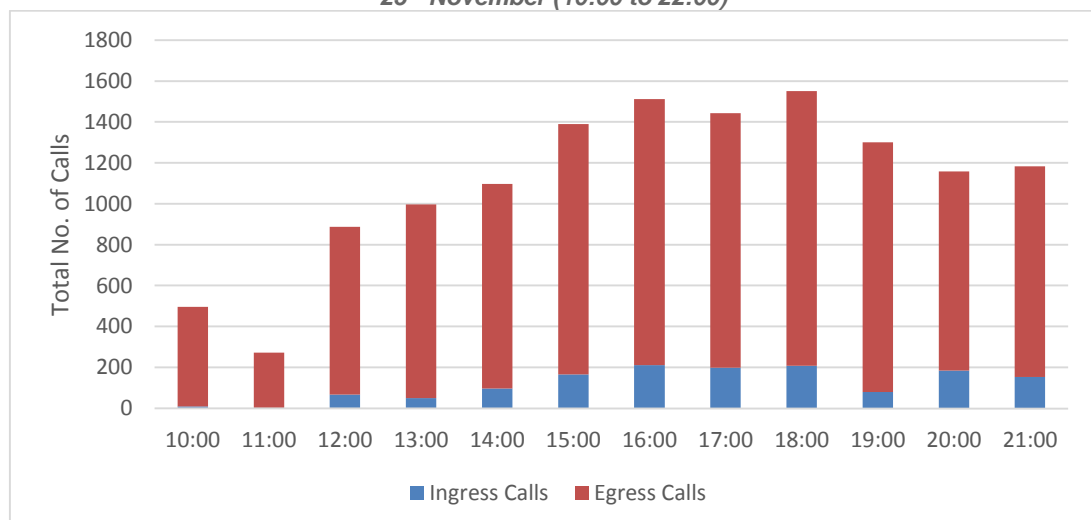
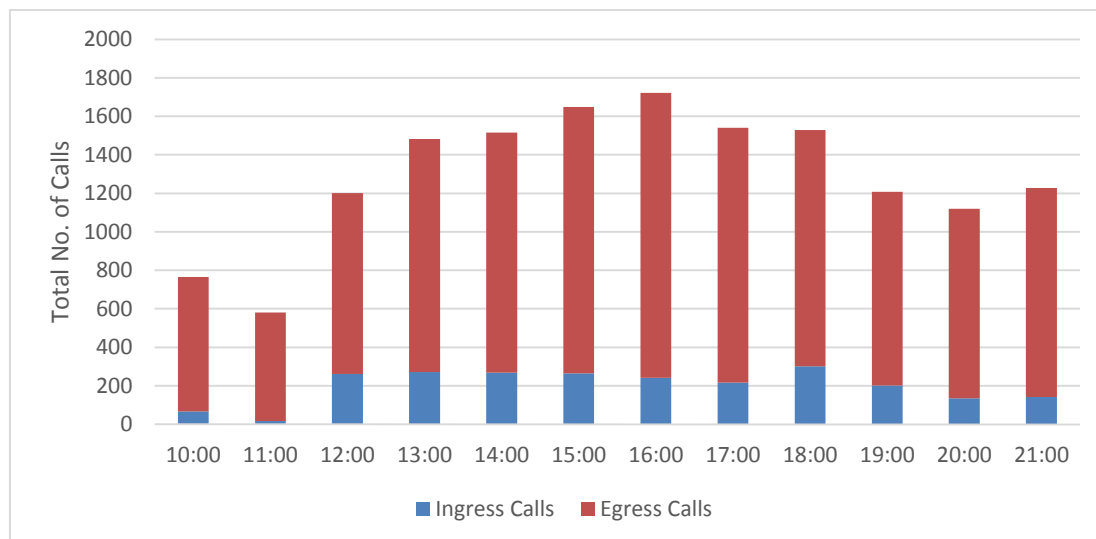


Figure 36: Total Number of Ingress & Egress Calls per Hour (Macaw Hill) - 25th November (10:00 to 22:00)



5.1.3 Air-Time

For the purpose of this document, air-time is a measure of the total carried traffic at a site for a given time period, irrespective of call start time or call end time.

Figure 37 provides the total air-time for each of the analysed sites over the Analysis Period (related data provided in Appendix F). As Figure 37 shows, Santos House had the highest total air-time of the 17 sites. However, the total air-time at a site needs to be considered in conjunction with site capacity.

Santos House has an available capacity of 16 voice channels, as compared to Barossa Range which has a capacity of five (5). This means that sites like Santos House can carry much larger volumes of traffic without experiencing any busies compared to sites directly involved in the Pinery Fires.

Of the 17 sites analysed, six (6) have a capacity of five (5) voice channels or less (Bumbunga Hill has 4 voice channels). These are six (6) of the eight (8) sites that experienced a 2 second and 4 second GoS over 2% during the Analysis Period.

Figure 37: Air-Time (Seconds) - 25th November (10:00 to 22:00)

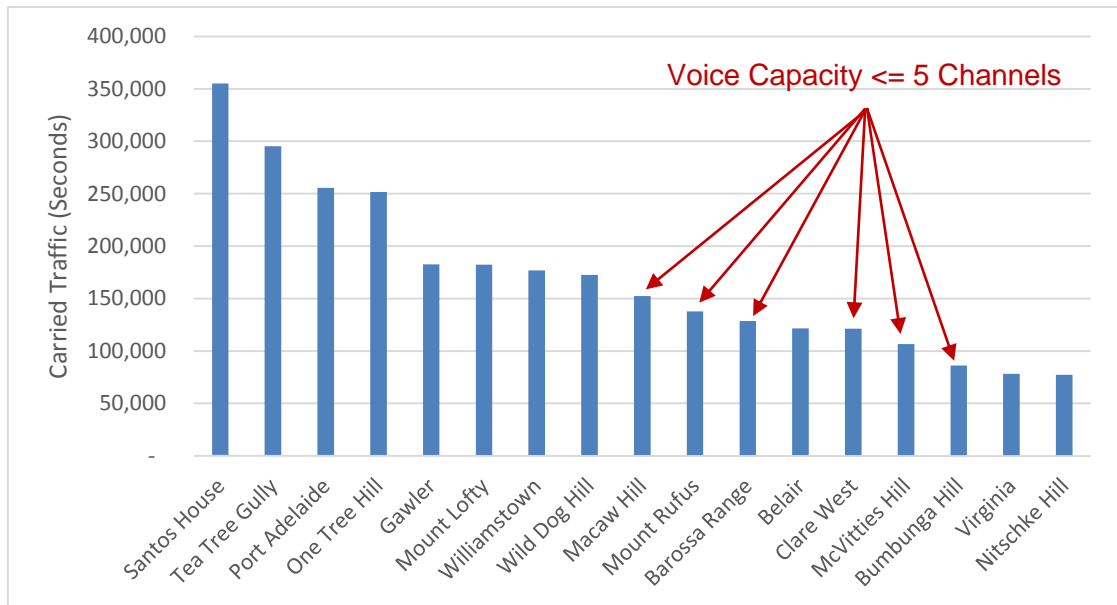


Figure 38 provides an hourly representation of carried traffic at Macaw Hill and Barossa Range. This shows that the total carried traffic at these sites increased substantially from 12:00 and stayed at high levels for the remainder of the Analysis Period.

Figure 38: Air-Time (Seconds) per Hour - 25th November (10:00 to 22:00)

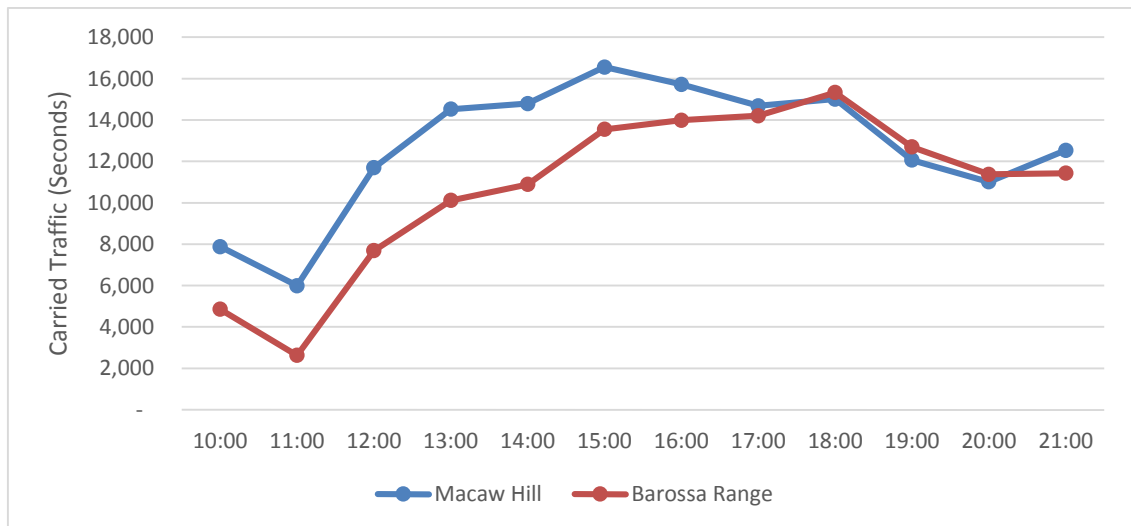


Figure 39, Figure 40 and Figure 41 provide air-time per agency over the Analysis Period for Barossa Range, Macaw Hill and Mount Rufus; three (3) sites that had poor GoS during the Analysis Period. For all three (3) sites the biggest contributors to total air-time were CFS and SAPOL.

At Barossa Range, CFS and SAPOL had approximately the same total air-time over the Analysis Period (51,528 seconds for SAPOL and 51,522 seconds for CFS).



For Macaw Hill, CFS had 74,320 seconds of air-time which was higher than SAPOL, who had 59,931 seconds.

For Mount Rufus, SAPOL had higher total air-time (with 73,038 seconds) than CFS (with 57,600 seconds).

As shown in Figure 39, Figure 40 and Figure 41, the air-time generated by agencies other than CFS and SAPOL was significantly lower than the two (2) main contributing agencies. The total air-time by agencies other than CFS and SAPOL at Barossa Range, Macaw Hill and Mount Rufus was:

- Barossa Range - 25,646 seconds (20% of the total).
- Macaw Hill - 18,198 seconds (12% of the total).
- Mount Rufus – 7,202 seconds (5% of the total).

Figure 39: Air-Time per Agency (Barossa Range) - 25th November (10:00 to 22:00)

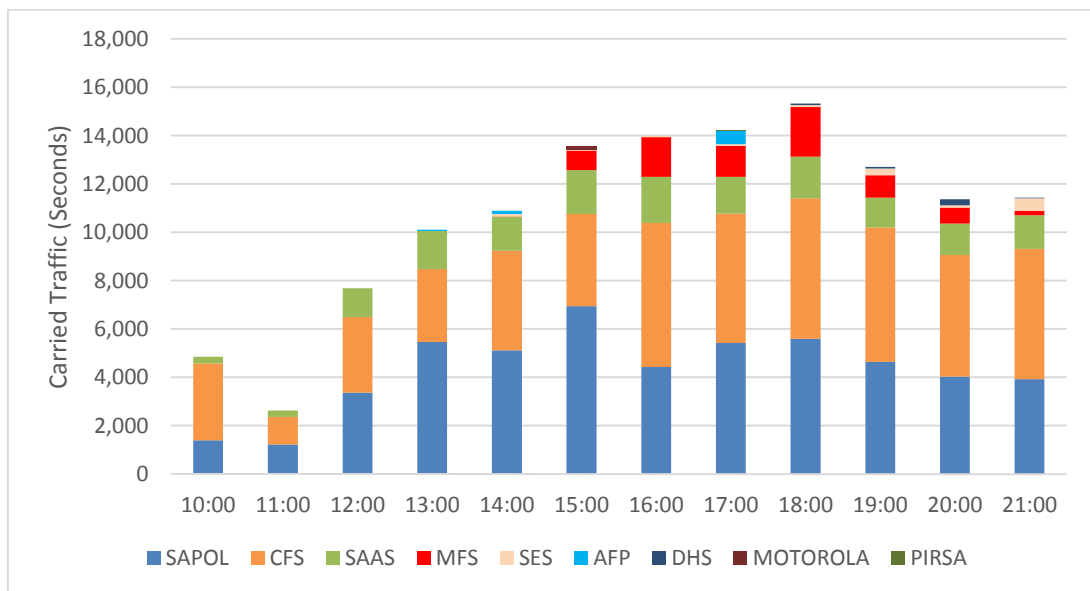


Figure 40: Air-Time per Agency (Macaw Hill) - 25th November (10:00 to 22:00)

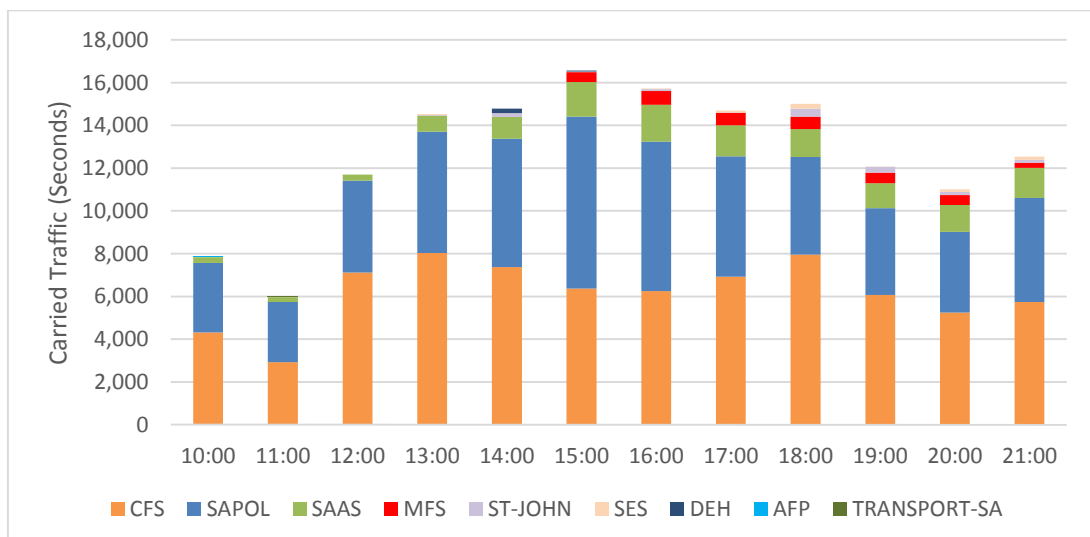
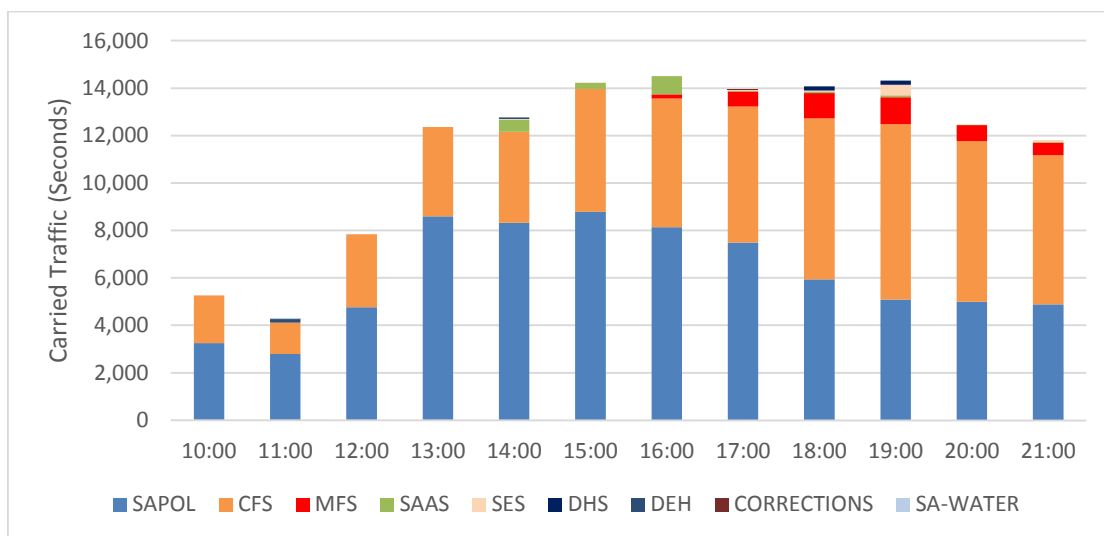


Figure 41: Air-Time per Agency (Mount Rufus) - 25th November (10:00 to 22:00)



5.1.4 Busies

AGD and CFS both reported that, during the Analysis Period, there was a significant degradation in the call success rate on the SAGR N. It was reported to Mingara that this degradation in call success rate on the SAGR N directly impacted CFS operational communications for the Pinery Fire.

Review of traffic data for the 17 analysed sites has identified that, over the Analysis Period, 15 experienced ingress or egress busies. Of these 15, seven (7) experienced more than 500 busies each. A summary of the total number of busies (ingress and egress) that occurred at each of the 17 analysed sites is provided in Figure 42.

Figure 42 shows that the sites most effected by busies during the Analysis Period were Barossa Range, Macaw Hill and Mount Rufus. Macaw Hill had over 4,600 busies, while Barossa Range had over 3,400.

Macaw Hill, Barossa Range and Mount Rufus are all sites that provide predicted outdoor mobile radio coverage to both the fireground incident area and either the initial or final IMT location.

Figure 42: Total Number of Buses (Ingress & Egress) per Site - 25th November (10:00 to 22:00)

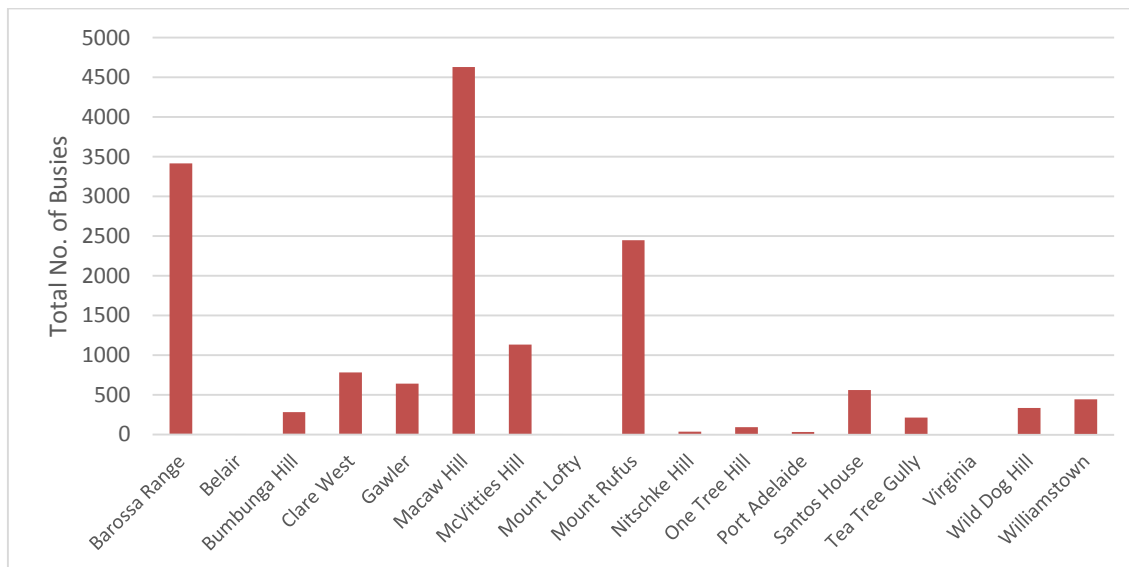


Figure 43, which provides an hourly breakdown for the five (5) sites that had the highest total number of buses during the period of 10:00 to 22:00, shows that buses started to impact sites during the hour commencing at 12:00 and peaked in the hour starting at 15:00.

The increase in total buses during the hour commencing 12:00 aligns with the information provided by CFS, that the Pinery Fire was first reported at 12:05.

Figure 43: Buses (Ingress & Egress) per Hour - 25th November (10:00 to 22:00)

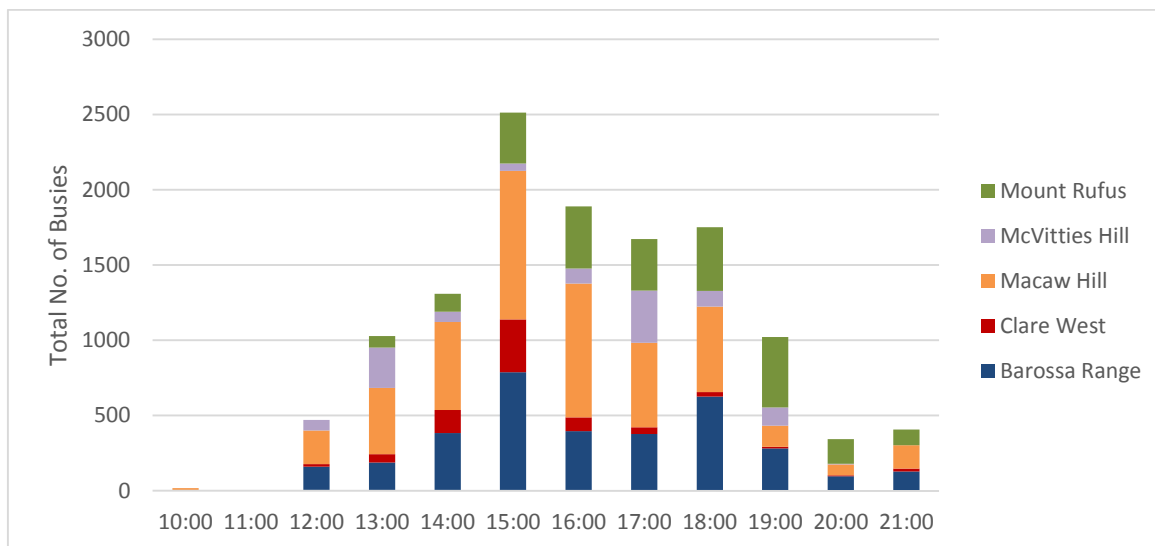


Figure 44, which provides a breakdown of ingress buses and egress buses that occurred at each of the analysed sites during the Analysis Period (related data provided in Appendix E), shows that the majority of buses experienced at all sites were egress buses.

Users affiliated with sites that experience an egress busy do not receive any audible or visual notification of the egress busy and will miss either part or all of the call.



During discussions with CFS, Mingara was informed that users on the fireground were reporting that when they made a call, they were often not receiving any response. In Mingara’s opinion, this user experience is most likely due to extensive egress busies.

Figure 44: Total Number of Ingress & Egress Busies per Site - 25th November (10:00 to 22:00)

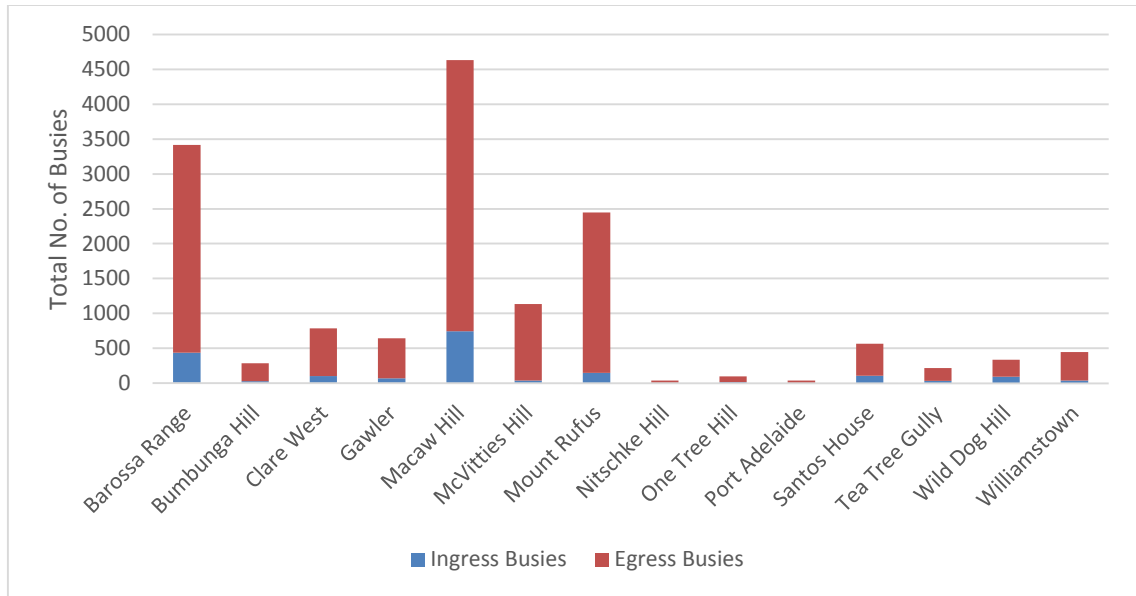


Figure 45 and Figure 46, which depict the hourly breakdown of egress and ingress busies for Barossa Range and Macaw Hill, show that both sites experienced far more egress busies than ingress busies. For both sites, the hour commencing 15:00 had the most busies. This coincided with the hour in which SAPOL’s average and median call duration peaked.

Figure 45: Total Ingress & Egress Busies (Barossa Range) – 25th November 2015

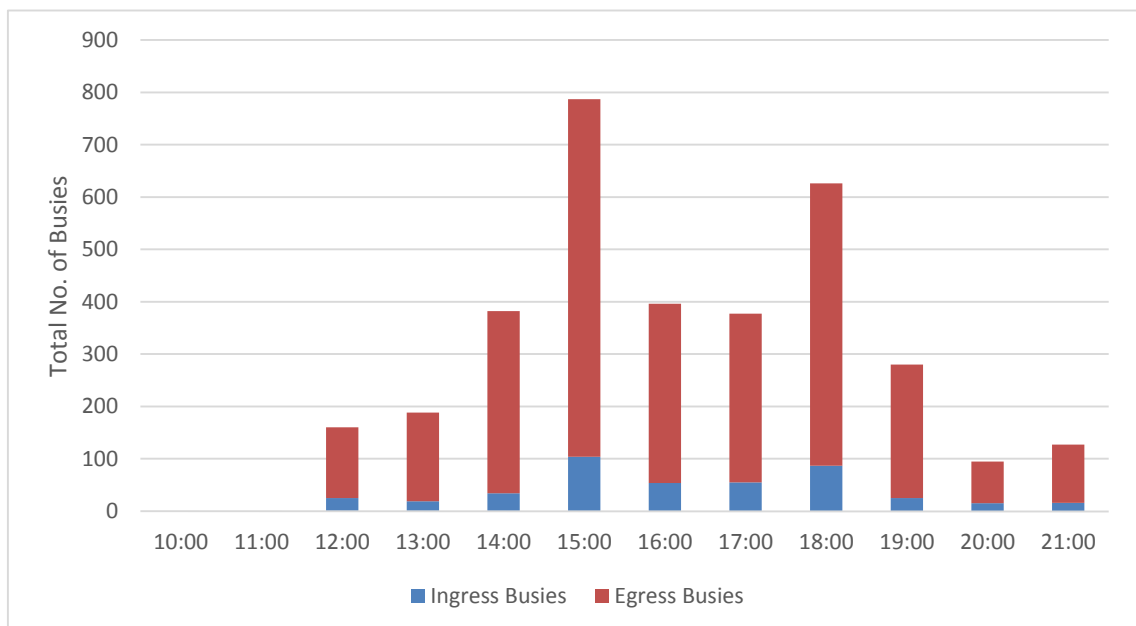
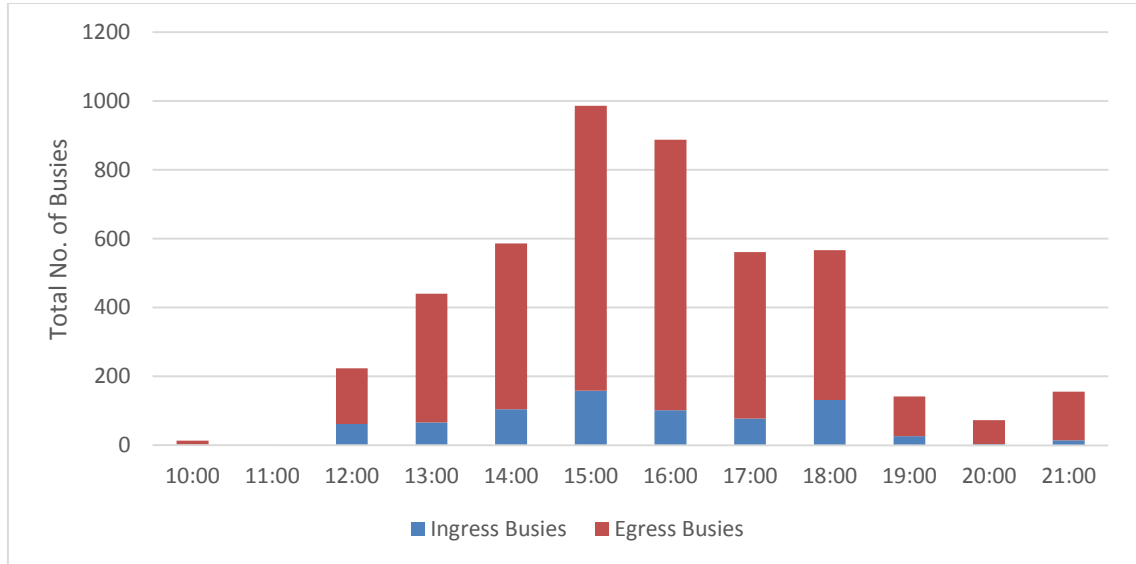




Figure 46: Total Ingress & Egress Busies (Macaw Hill) – 25th November 2015



As identified in Figure 44, the majority of busies that were experienced at the analysed sites during the period of 10:00 to 22:00 were egress busies; of these there were a large number that were whole busies (meaning a site was busy for the full duration of a call). Figure 47 provides an hourly breakdown of whole egress busies at Barossa Range, Macaw Hill and the total for all 17 analysed sites.

Figure 47: Whole Egress Busies per Hour – 25th November 2015 (10:00 to 22:00)

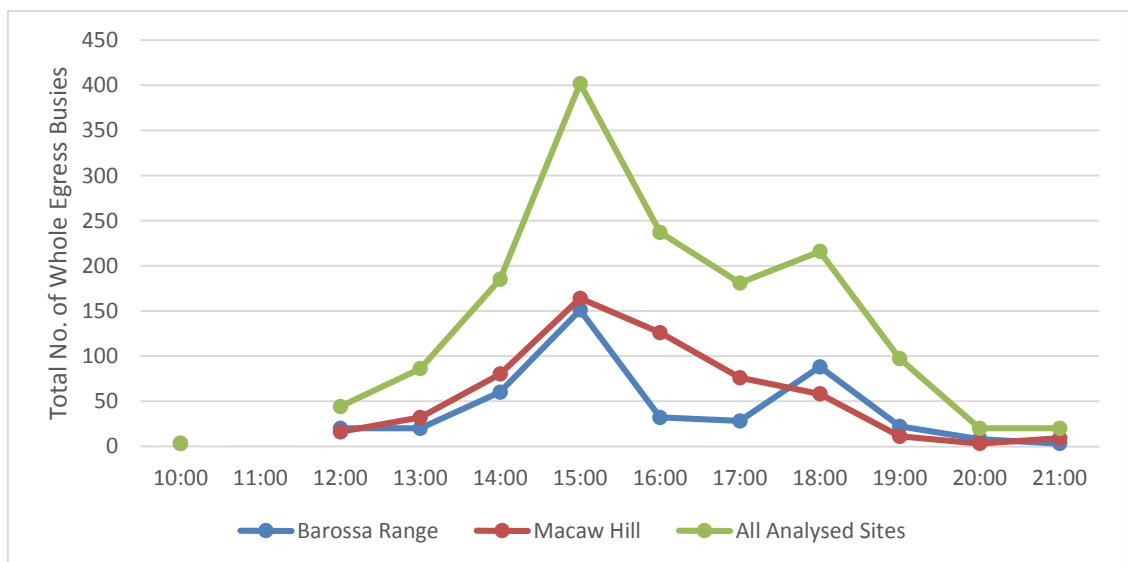


Figure 48 provides an hourly breakdown of whole egress busies that occurred at Barossa Range. Of these, CFS experienced the highest number, peaking at 64 during the hour commencing 15:00 (33 of these occurred in the 15-minute period of 15:15 to 15:30) and SAPOL experienced the second highest number; however other agencies were also significantly impacted (in the hour commencing 15:00 SAAS experienced 23 whole busies and MFS experienced 22).

Figure 48: Whole Egress Buses per Hour (Barossa Range) – 25th November 2015 (10:00 to 22:00)

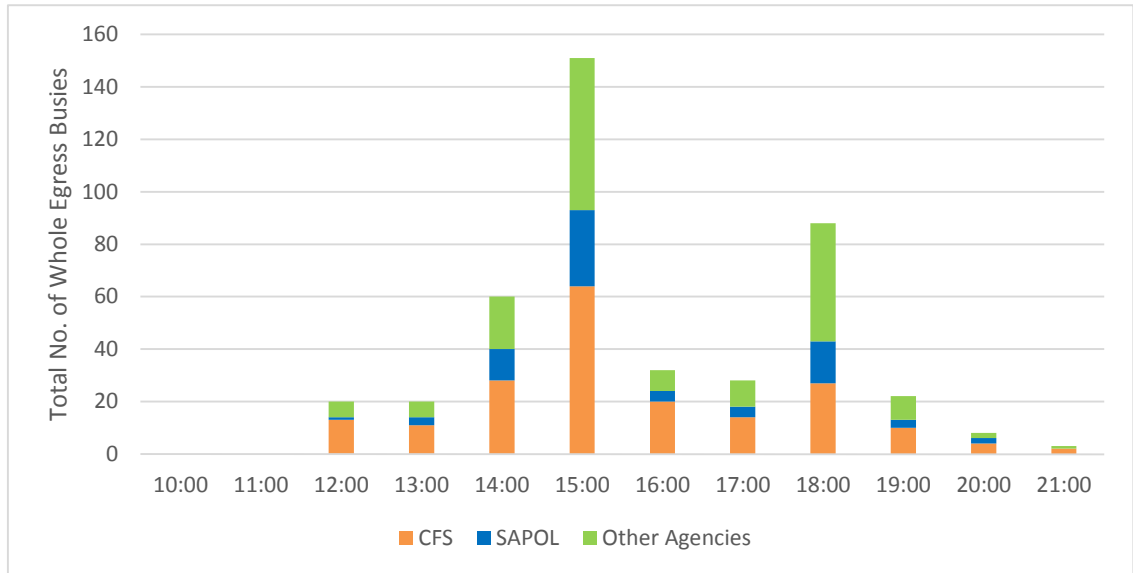
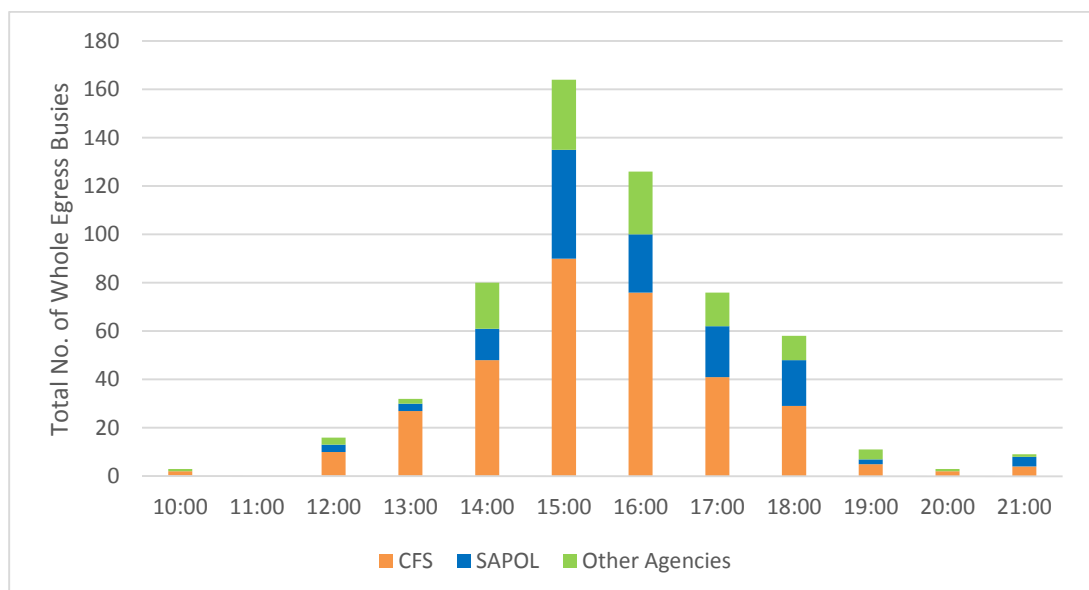


Figure 49 provides the hourly breakdown of whole egress buses that occurred at the Macaw Hill site. As with Barossa range, CFS experienced the highest number of whole buses at Macaw Hill. The most whole buses occurred in the hour commencing 15:00, during which time CFS experienced 90 whole egress buses (23 from 15:15 to 15:30, 24 from 15:30 to 15:45 and 34 from 15:45 to 16:00). SAPOL experienced 45 whole buses during the hour commencing 15:00.

In Mingara’s opinion, one of the reasons CFS experienced a far higher number of whole egress buses than SAPOL is because the CFS median (and average) call duration was lower than SAPOL’s. The longer a call, the more likely a partial busy will be experienced, rather than a whole busy.

Figure 49: Whole Egress Buses per Hour (Macaw Hill) – 25th November 2015 (10:00 to 22:00)



5.1.5 Grade of Service

Figure 50 and Figure 51 provide an hourly breakdown of the two (2) second and four (4) second GoS measures at analysed sites. Only sites that experienced a GoS of greater than 2% for any single hourly period have been included in Figure 50 and Figure 51.

Figure 50 shows that eight (8) of the 17 analysed sites experienced a GoS (2 seconds) of greater than 2% during the Analysis Period. 2% (2 seconds) is the minimum acceptable industry value for Public Safety Agency (PSA) GoS below which poor end-user experience is minimal.

The hour commencing 15:00 was the worst, with approximately 40% of all calls at both Barossa Range and Macaw Hill experiencing a busy of at least two (2) seconds.

Figure 50: 2 Second Grade of Service – 25th November 2015

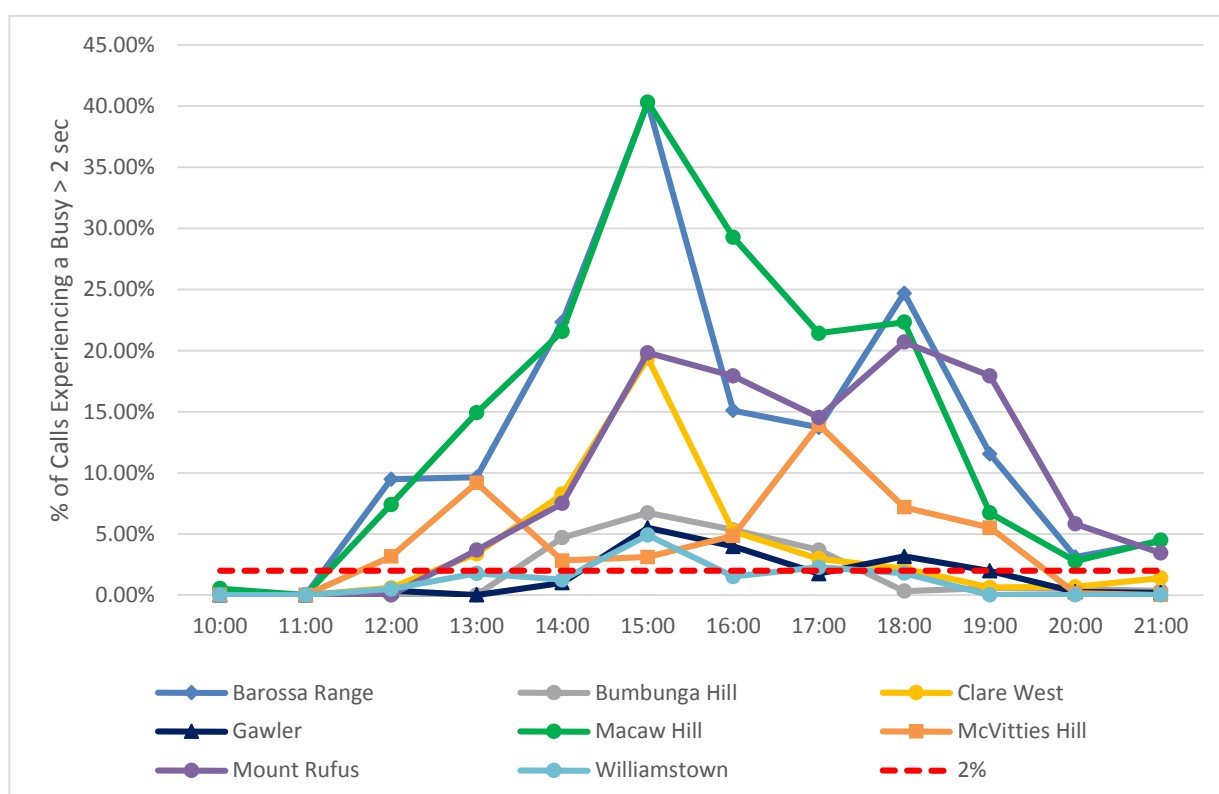
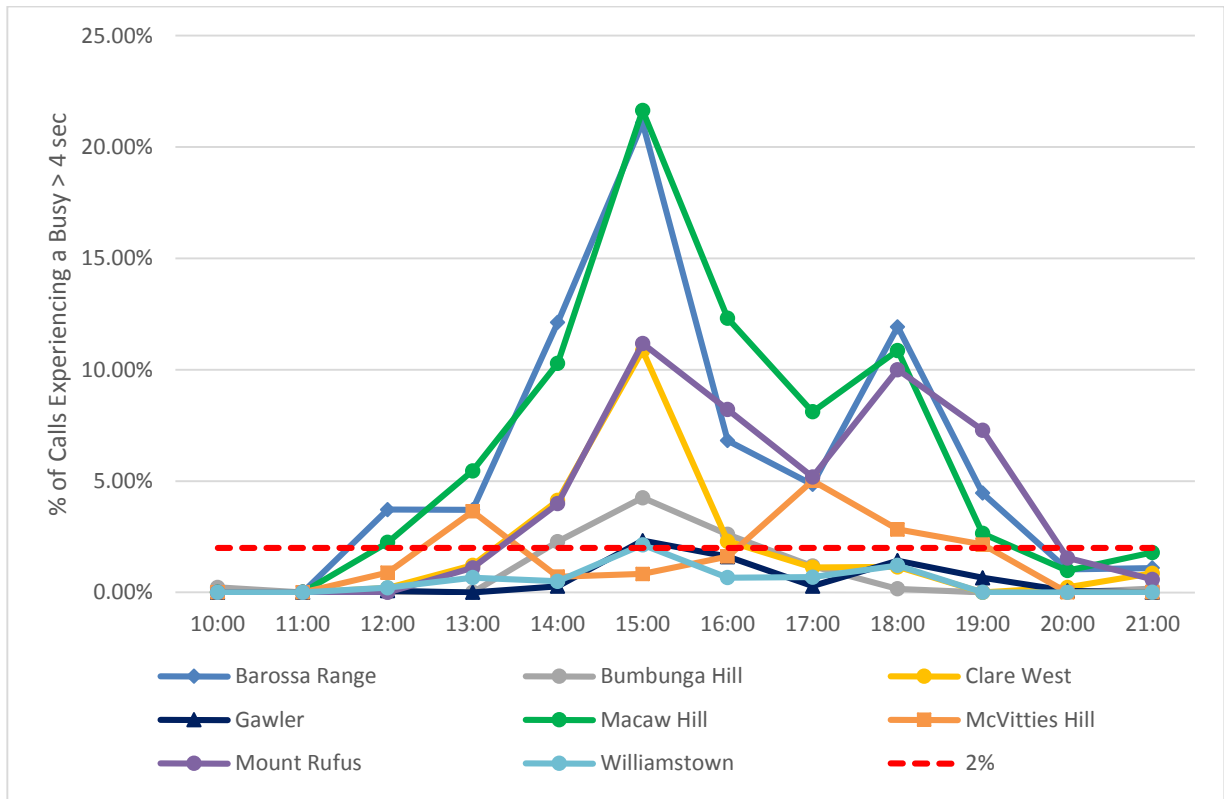


Figure 51 shows that eight (8) of the 17 analysed sites experienced a GoS (4 seconds) of greater than 2% during the Analysis Period.

As with the two (2) second GoS, the hour commencing 15:00 was the worst, with over 20% of all calls at both Barossa Range and Macaw Hill experiencing a busy of at least four (4) seconds. A GoS of 2% (4 seconds) is deemed within tolerance under extreme conditions for infrequent events types.

The longest busy experienced by CFS during the Analysis Period was an ingress busy at Barossa Range, which lasted for over 30 seconds (i.e. no new calls were possible at Barossa Range for the entire 30 seconds).

Figure 51: 4 Second Grade of Service – 25th November 2015



5.2 Findings – Network Activity and Performance Modelling

5.2.1 Site Capacity

Mingara's findings with respect to Site Capacity are as follows:

- Three (3) of the analysed sites (Gawler, Wild Dog Hill and Williamstown) have a capacity of eight (8) voice channels. For the majority of the Analysis Period, these sites experienced higher carried traffic volumes than Barossa Range and Macaw Hill. The number of active talkgroups and unique radios actively participating in calls at Wild Dog Hill was also comparable to Macaw Hill and Barossa Range, yet Wild Dog Hill did not suffer from poor GoS;
- It is Mingara's opinion that, based on analysis of the non-optimum operational radio communication practices employed by some agencies during the Pinery Fire, in conjunction with a lack of proactive traffic mitigation and governance, a minimum capacity of eight (8) voice channels would have been required at key sites to adequately manage the incident traffic volumes.

It is also Mingara's opinion that if proactive traffic mitigation and governance had been employed during the Pinery Fire, the extent of congestion and busies would have been significantly reduced.

- Of the analysed sites, the five (5) that experienced the worst GoS during the Pinery Fire all have five (5) or less voice channels. All of these sites are proposed to receive a capacity increase through the SAGRN Upgrade project. However, in Mingara's opinion, even the proposed capacity upgrade would not have been sufficient to remove all GoS issues, if the non-optimum operational radio communication practices and lack of proactive traffic mitigation and governance during the Pinery Fire remained.

5.2.2 Ingress / Egress Calls

Mingara's findings with respect to Ingress / Egress Calls are as follows:

- The majority of calls at analysed sites during the Analysis Period were egress calls. This is expected for a number of reasons, including: talkgroup calls are usually one-to-many and calls initiated at a console do not register as an ingress call at any site. In Mingara's opinion, it is also possible that egress call traffic was generated by people listening to Pinery Fire related traffic without any legitimate operational reason to do so; and
- Analysis of ingress and egress calls per site showed that the highest number of ingress and egress calls were experienced during the 18:00 hour at Barossa Range and the 16:00 hour at Macaw Hill. At the time of preparing this report, no agency field reports had been provided to permit an analysis of any operational events that may have occurred at these times.

5.2.3 Air-Time

Mingara's findings with respect to Air-Time are as follows:

- Sites that experienced the worst GoS performance during the Analysis Period (including Barossa Range and Macaw Hill) had a lower total air-time than sites which experienced good GoS performance. The difference between sites that experienced good and poor GoS performance was the available voice channel capacity;
- The highest total air-time experienced at Macaw Hill during the Analysis Period was for the 15:00 hour, which coincided with the hour of worst GoS performance at Macaw Hill;
- The highest total air-time experienced at Barossa Range during the Analysis Period was for the 18:00 hour. This did not coincide with the hour of worst GoS performance at Barossa Range;
- At Barossa Range, CFS and SAPOL contributed approximately the same total air-time over the Analysis Period (51,528 seconds for SAPOL and 51,522 seconds for CFS);
- At Macaw Hill, CFS contributed 74,320 seconds of air-time, compared to SAPOL who contributed 59,931 seconds;
- At Mt Rufus, SAPOL contributed 73,038 seconds of air-time compared to 57,600 seconds for CFS; and
- In Mingara's opinion, the volume of air-time contributed by SAPOL in comparison to CFS is higher than expected, based on assessment of similar historical incidents, and in Mingara's opinion played a significant role in the extent of congestion at the sites directly involved with the fire.

5.2.4 Busies

Mingara's findings with respect to Busies are as follows:

- Of the analysed sites, seven (7) experienced more than 500 busies (each) over the Analysis Period;
- Macaw Hill, Barossa Range and Mount Rufus experienced the highest number of busies for the Analysis Period (Macaw Hill over 4,500, Barossa Range over 3,000 and Mount Rufus over 2,000);
- The sites that experienced the highest number of busies all have a capacity of five (5) voice channels and provide predicted outdoor mobile coverage to both the Pinery Fire incident area and either the initial or final IMT location;
- 15:00 to 16:00 was the period that sites experienced the highest number of busies (over 2,500 busies were experienced across the analysed sites during this 1hour period);

- The majority of busies experienced were egress busies. During the hour commencing 15:00, over 85% of all busies at Macaw Hill and Barossa Range were egress busies;
- During the Analysis Period, there were a large number of whole busies (meaning a site was busy for the full duration of a call). Over 400 whole egress busies were experienced across the analysed sites between 15:00 and 16:00. Barossa Range and Macaw Hill each experienced approximately 150 whole egress busies in this time period; and
- CFS experienced the highest number of whole egress busies across the Analysis Period. In Mingara's opinion, one of the reasons CFS experienced a far higher number of whole egress busies than SAPOL is because the CFS median (and average) call duration was lower than that of SAPOL, and the longer a call, the more likely a partial busy will be experienced rather than a whole busy. Whole busies on the network is a serious issue and may compromise field personal safety.

5.2.5 Grade of Service

Mingara's findings are as follows with respect to Grade of Service:

- Of the analysed sites, eight (8) experienced a two (2) second and four (4) second GoS of over 2% (measured per hour) during the Analysis Period; and
- The worst GoS for analysed sites was observed during the hour commencing 15:00. Both Macaw Hill and Barossa Range experienced a two (2) second GoS of approximately 40% and a four (4) second GoS of over 20%. This means that during the hour 15:00 to 16:00, four (4) of every ten (10) calls experienced a busy of at least two (2) seconds and two (2) out of every ten (10) calls experienced a busy of at least four (4) seconds.

5.3 Recommendations – Network Activity and Performance Modelling

5.3.1 Site Capacity

Based on the findings, with respect to Site Capacity, Mingara recommends that:

- a) AGD review the SAGRN Upgrade Program to assess the impact of prioritising the upgrade of SAGRN site capacity in high risk areas of the State.

5.3.2 Ingress / Egress Calls

Based on the findings, with respect to Ingress / Egress Calls, Mingara recommends that:

- a) Agencies reinforce with their users the impact of remote listening on available site capacity.

5.3.3 Air-Time

Based on the findings, with respect to Air-Time, Mingara recommends that:

- a) Agencies reinforce with their users the impact of both large call volumes and long call durations on the availability of site capacity during major events.

5.3.4 Busies

Based on the findings, with respect to Busies, Mingara recommends that:

- a) Due to the infrequent nature of major events similar to the Pinery Fire, agencies and the relevant area within the Communications Functional Service reflected in the SEMP (State Emergency Management Plan), include similar scenarios in their radio terminal training programs, especially the operational and OH&S impact of whole busies.

5.3.5 Grade of Service

There are no recommendations with respect to Grade of Service.

Appendix A:
CALLS PER AGENCY PER SITE



Table 15: Total Number of Calls (Ingress & Egress) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
ACBPS	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-	-
ACC	-	-	-	-	-	-	-	-	-	-	-	81	88	19	-	-	-
AFP	75	2,254	-	-	153	4	-	1,795	-	87	745	2,506	2,552	1,867	20	5	1
CAA	-	-	-	-	-	-	-	59	-	-	-	2	59	-	-	-	-
CFS	6,439	424	3,780	7,110	8,027	8,932	6,263	5,884	6,795	4,342	7,867	397	4,855	8,021	4,590	9,366	8,842
Corrections	-	4	-	-	2	-	-	1	1	7	695	773	203	842	1	-	7
DAIS	-	50	-	-	-	-	-	-	-	-	-	4	33	5	-	-	-
DEH	-	556	15	-	-	47	-	567	32	71	393	395	443	356	218	25	338
DHS	26	-	-	-	56	-	-	-	24	-	-	-	56	-	-	-	-
Forestry	-	-	-	-	-	-	122	12	-	66	-	-	-	-	-	-	225
MFS	942	733	5	5	1,003	441	1	311	500	641	1,108	1,130	1,637	1,098	404	2,071	1,023
Motorola	17	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-
PIRSA	2	2	-	2	-	-	1	-	-	-	-	17	1	-	-	-	1
PTB	-	3,359	-	-	1,352	-	-	3,490	-	315	2,797	6,237	7,233	5,494	537	-	-
SAAS	1,756	1,121	537	1,084	1,857	1,292	813	1,715	178	471	3,453	4,496	5,204	3,461	313	832	618
SAPOL	3,820	3,408	3,199	3,243	5,144	4,499	3,979	4,794	5,357	2,206	8,858	9,362	12,390	9,137	2,197	4,312	6,064
SA-Water	-	2	-	-	-	-	-	-	1	1	3	4	15	9	-	-	9
SES	206	419	35	124	27	119	-	446	74	91	420	449	557	491	10	449	92
ST-JOHN	-	28	-	2	154	203	-	18	-	-	115	60	128	215	-	1	3
Transport-SA	-	41	-	24	26	4	5	31	-	11	74	75	58	66	3	19	9
Total	13,283	12,401	7,571	11,594	17,801	15,541	11,184	19,123	12,962	8,309	26,528	26,009	35,514	31,081	8,293	17,081	17,232

Appendix B: CALL DURATION STATISTICS



**Table 16: Call (Ingress & Egress) Duration Statistics per Site –
Pinery Fire Incident period (25th November 2015, 10:00 to 22:00) & Historical (25th November 2014 to 24th November 2015)**

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVities Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
ACBPS																	
Total Carried Traffic (Sec)												229.4					
Avg. Duration (Sec)												10.92					
Historical Avg. Duration (Sec)		08.11	06.70	11.43	04.35	07.90		07.68			07.91	07.88		07.21	07.60	06.25	
Median Duration (Sec)												5.2					
Historical Median Duration (Sec)		05.20	05.20	08.90	04.35	06.45		05.50			05.40	05.30		05.20	05.20	06.25	
ACC																	
Total Carried Traffic (Sec)												495.4	536.8	112.3			
Avg. Duration (Sec)												6.12	6.10	5.91			
Historical Avg. Duration (Sec)											06.14	06.56		06.51			
Median Duration (Sec)												4.8	4.8	4.6			
Historical Median Duration (Sec)											04.80	05.00		05.00			

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
AFP																	
Total Carried Traffic (Sec)	745.8	25971.5			1848.6	39.3		20949.4		1018.8	8261.8	28782.5	29258.8	21869.8	228.4	11.9	3.0
Avg. Duration (Sec)	10.08	11.52			12.08	13.10		11.67		11.71	11.09	11.49	11.47	11.71	11.42	2.38	3.00
Historical Avg. Duration (Sec)	10.72	11.17			10.64	10.29	11.06	11.17	11.25	11.17	11.26	11.17		11.19	11.21	10.77	11.10
Median Duration (Sec)	6.85	8			8.8	17.7		8.1		9	7.7	7.9	7.9	8.2	8.25	2.4	3
Historical Median Duration (Sec)	07.40	07.90			07.80	07.10	07.45	08.00	07.80	07.90	08.00	08.00		07.90	08.00	07.20	08.10
CAA																	
Total Carried Traffic (Sec)								390.4				5.4	390.4				
Avg. Duration (Sec)								6.62				2.70	6.62				
Historical Avg. Duration (Sec)		03.25						05.23			04.22	03.21					
Median Duration (Sec)								4.5				5.4	4.5				
Historical Median Duration (Sec)		03.25						04.30			03.80	03.15					
CFS																	
Total Carried Traffic	51525.8	3196.1	30992.9	59092.1	68682.2	74329.9	51011.4	49119.1	57619.6	35141.4	67590.3	2691.4	40302.3	68141.3	39444.7	82870.9	75842.6

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
(Sec)																	
Avg. Duration (Sec)	8.25	7.54	8.24	8.37	8.56	8.65	8.25	8.35	8.66	8.10	8.59	6.78	8.30	8.50	8.59	8.85	8.59
Historical Avg. Duration (Sec)	06.90	07.30	06.94	07.08	07.24	07.15	06.99	07.41	07.11	07.34	07.27	06.51		07.30	07.27	06.98	07.10
Median Duration (Sec)	5.7	5.5	5.9	5.8	5.9	5.8	5.7	5.8	6	5.8	5.9	5.6	5.8	5.8	5.8	6	5.9
Historical Median Duration (Sec)	05.30	05.30	05.40	05.40	05.40	05.40	05.40	05.30	05.40	05.40	05.40	04.80		05.40	05.30	05.40	05.40
Corrections																	
Total Carried Traffic (Sec)		34.4			20.4			4.7	17.6	50.6	5274.3	5840.4	1510.4	6296.0	5.4		50.6
Avg. Duration (Sec)		8.60			10.20			4.70	17.60	7.23	7.59	7.56	7.44	7.48	5.40		7.23
Historical Avg. Duration (Sec)	09.43	06.76	08.12	06.90	09.13	06.99		06.72	07.74		07.35	07.35		07.34	07.40	07.69	07.23
Median Duration (Sec)		7.15			10.2			4.7	17.6	3.9	5.7	5.7	5.9	5.6	5.4		3.9
Historical Median Duration (Sec)	08.95	05.60	07.10	05.65	09.10	05.90		05.40	06.15		05.60	05.60		05.60	05.80	06.30	07.00
DAIS																	
Total Carried Traffic (Sec)		153.9										18.3	102.3	16.2			
Avg. Duration (Sec)		3.08										4.58	3.10	3.24			

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Historical Avg. Duration (Sec)	08.18	06.21		06.42	07.70	04.49	07.59	06.30	09.46	07.18	06.80	06.11		06.92	06.92	07.85	07.88
Median Duration (Sec)		1.95										4.2	1.9	2.9			
Historical Median Duration (Sec)	07.50	04.40		05.70	05.70	04.50	05.50	04.50	04.40	05.20	05.05	04.50		04.50	05.55	06.10	05.70
DEH																	
Total Carried Traffic (Sec)		3602.7	139.7			261.9		3773.8	223.9	463.3	2834.6	2937.7	3056.3	2527.7	1485.9	130.9	2319.9
Avg. Duration (Sec)		6.48	9.31			7.08		6.66	7.00	6.53	7.21	7.44	6.90	7.10	6.82	5.24	6.90
Historical Avg. Duration (Sec)	07.47	06.53	06.55	05.90	07.18	07.81	07.30	06.47	08.71	06.09	07.47	07.35		07.47	07.89	07.32	07.58
Median Duration (Sec)		4.8	6.4			4.6		4.9	4.95	5.1	5.2	5.3	5.2	5.2	5.05	4	5.15
Historical Median Duration (Sec)	05.60	05.00	05.50	04.60	05.40	05.80	05.60	04.90	05.90	04.80	05.60	05.50		05.50	05.60	05.40	05.65
DHS																	
Total Carried Traffic (Sec)	398.3				812.7				352.2				797.0				
Avg. Duration (Sec)	15.32				14.51				14.68				14.23				
Historical Avg. Duration (Sec)												04.60		02.10			

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Median Duration (Sec)	10.15				10.1				10.95				9.6				
Historical Median Duration (Sec)												04.60		02.10			
Forestry																	
Total Carried Traffic (Sec)							940.8	91.1		529.5							1671.1
Avg. Duration (Sec)							7.78	7.59		8.02							7.43
Historical Avg. Duration (Sec)	05.46	06.56		06.10	06.67		06.27	06.16		06.33	06.35	06.37		06.03	08.70		06.35
Median Duration (Sec)							5.3	6.05		4.3							5.1
Historical Median Duration (Sec)	04.70	04.80		04.80	04.80		04.85	04.90		05.00	05.85	04.80		04.80	06.35		04.90
MFS																	
Total Carried Traffic (Sec)	7571.9	6555.5	47.1	30.5	8627.8	3459.5	4.3	2883.4	4196.9	5676.2	9445.2	9837.6	14297.2	9256.2	3293.1	17683.3	8694.8
Avg. Duration (Sec)	8.61	8.94	9.42	6.10	8.60	8.24	4.30	9.27	8.69	8.86	8.52	8.71	8.73	8.43	8.15	8.55	8.55
Historical Avg. Duration (Sec)	09.40	09.35	07.94	08.08	09.36	09.27	08.59	09.22	09.42	09.40	09.31	09.28		09.24	09.67	09.37	09.19
Median Duration (Sec)	5.9	6.3	5.5	4.4	6.2	5.8	4.3	6.6	6.2	5.9	5.95	5.95	6	5.85	5.7	5.9	5.9

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Historical Median Duration (Sec)	06.70	06.60	05.30	05.30	06.60	06.30	06.20	06.40	06.60	06.70	06.50	06.40		06.50	06.70	06.60	06.70
Motorola																	
Total Carried Traffic (Sec)	125.5												10.6			5.2	
Avg. Duration (Sec)	11.41												5.30			5.20	
Historical Avg. Duration (Sec)	02.50	08.41			07.17	07.87	07.85	08.27		09.08	09.22	08.08		07.01	05.27	06.50	08.29
Median Duration (Sec)	6.1												5.3			5.2	
Historical Median Duration (Sec)	02.50	05.00			05.20	05.20	05.60	05.15		07.10	06.30	05.30		05.30	03.45	03.80	05.80
PIRSA																	
Total Carried Traffic (Sec)	1.8	8.2		6.8			1.8					128.6	1.8				1.8
Avg. Duration (Sec)	1.80	4.10		3.40			1.80					7.56	1.80				1.80
Historical Avg. Duration (Sec)	05.34	05.34	06.62	06.73		07.89		08.12	08.26		07.58	08.55		08.10	08.21	08.36	08.18
Median Duration (Sec)	1.8	4.1		3.4			1.8					5.6	1.8				1.8
Historical Median Duration (Sec)	03.90	03.90	06.10	05.90		06.30		05.90	07.60		06.30	07.30		06.80	08.10	07.80	06.10

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
PTB																	
Total Carried Traffic (Sec)		32934.3			14994.2			33655.7		2582.7	28707.2	61684.0	70301.9	53318.1	6449.8		
Avg. Duration (Sec)		9.80			11.09			9.64		8.20	10.26	9.89	9.72	9.71	12.01		
Historical Avg. Duration (Sec)		10.05			10.06	11.20		10.36		09.31	10.06	10.05		10.11	10.58		08.84
Median Duration (Sec)		6.2			7.1			6.1		6	6.5	6.3	6.3	6.2	7.6		
Historical Median Duration (Sec)		06.30			06.80	11.20		06.40		06.70	06.30	06.30		06.30	06.90		08.00
SAAS																	
Total Carried Traffic (Sec)	15636.6	9088.5	5060.0	10934.6	16795.7	12475.5	7882.7	16108.0	1759.0	4899.0	31357.7	38931.0	45087.7	30137.6	3113.1	8783.2	6444.7
Avg. Duration (Sec)	9.34	8.11	9.46	10.14	9.04	10.14	9.82	9.39	10.29	10.40	9.08	8.66	8.66	8.71	9.95	10.58	10.45
Historical Avg. Duration (Sec)	08.76	07.78	08.40	09.43	07.73	08.95	08.57	08.19	08.99	08.48	07.86	07.79		07.84	08.48	08.86	09.64
Median Duration (Sec)	6.2	6.4	6.5	6.7	6.5	6.9	7.1	6.8	6.6	7.1	6.5	6.4	6.4	6.4	6.7	7.1	6.9
Historical Median Duration (Sec)	06.50	06.30	06.50	06.60	06.20	06.50	06.50	06.30	06.60	06.60	06.30	06.20		06.30	06.30	06.60	06.40
SAPOL																	
Total Carried Traffic	51573.7	36801.8	49795.9	49945.0	69059.4	59976.3	46692.5	52224.1	73083.9	26402.1	93590.0	99712.3	144639.7	98095.9	24173.6	59818.2	81226.8

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
(Sec)																	
Avg. Duration (Sec)	13.77	10.80	15.58	15.45	13.42	13.74	11.81	10.89	13.75	11.97	10.57	10.65	11.67	10.74	11.00	13.88	13.40
Historical Avg. Duration (Sec)	11.39	11.23	11.53	11.52	11.23	11.46	11.45	11.27	11.44	11.57	10.86	10.94		11.00	11.51	11.37	08.10
Median Duration (Sec)	8.9	7.5	10.5	10.4	8.7	8.9	8	7.5	8.9	8.25	7.2	7.3	7.8	7.4	7.6	9.2	8.8
Historical Median Duration (Sec)	08.00	07.80	08.10	08.10	07.80	08.10	08.10	07.90	08.10	08.10	07.50	07.60		07.60	08.00	08.00	08.10
SA-Water																	
Total Carried Traffic (Sec)		6.2							4.5	4.5	26.4	14.80	79.6	46.8			58.1
Avg. Duration (Sec)		3.10							4.50	4.50	8.80	3.70	5.31	5.20			6.46
Historical Avg. Duration (Sec)	05.00	05.99	06.42	05.72	05.66	06.04	05.46	05.54	06.18	05.52	05.79	05.81		05.81	05.98	05.17	05.63
Median Duration (Sec)		3.1							4.5	4.5	3.9	3.05	3.6	3.6			3.6
Historical Median Duration (Sec)	04.05	04.60	04.60	04.05	04.00	04.50	04.50	04.20	04.70	04.40	04.30	04.50		04.40	04.70	04.00	04.35
SES																	
Total Carried Traffic (Sec)	1207.8	2467.7	225.1	933.3	255.7	642.3		2665.0	647.9	557.1	2748.5	3030.6	3257.0	3164.6	53.6	3273.8	643.2
Avg. Duration (Sec)	6.23	5.89	6.43	7.59	9.47	5.49		5.98	8.88	6.12	6.54	6.75	5.85	6.45	5.36	7.29	6.99

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Historical Avg. Duration (Sec)	08.20	06.40	06.92	06.67	04.40	06.83	05.88	07.93	07.96	05.53	06.65	07.64		07.58	06.19	07.27	06.27
Median Duration (Sec)	5	4.7	4.6	4.8	6.3	4.5		4.8	5.3	5	4.7	5.2	4.6	5	6	5.2	5.05
Historical Median Duration (Sec)	05.90	04.80	04.90	05.00	04.20	05.05	04.50	06.10	05.50	04.60	05.00	05.70		05.50	05.00	05.30	04.50
ST-JOHN																	
Total Carried Traffic (Sec)		227.3		10.3	1092.1	1305.4		174.2			853.3	422.8	912.5	1571.3		3.20	12.3
Avg. Duration (Sec)		8.12		5.15	7.09	6.91		9.68			7.42	7.05	7.13	7.31		3.20	4.10
Historical Avg. Duration (Sec)	06.59	06.49	05.96	07.36	06.57	06.04	06.94	06.41	06.47	07.06	06.52	06.58		06.59	05.49	06.49	05.80
Median Duration (Sec)		6.25		5.15	5	5		7.25			5.5	4.7	5.1	5.3		3.2	4.3
Historical Median Duration (Sec)	05.10	05.10	05.00	05.20	05.10	05.05	05.00	05.00	04.80	05.10	05.10	05.10		05.20	05.00	05.00	04.60
Transport-SA																	
Total Carried Traffic (Sec)		431.3		247.8	354.4	18.1	23.2	239.2		117.8	872.1	708.2	591.6	660.8	40.2	109.8	45.1
Avg. Duration (Sec)		10.52		10.77	13.63	4.53	4.64	7.72		10.71	11.79	9.44	10.20	10.01	13.40	5.78	5.01
Historical Avg. Duration (Sec)	11.03	10.93	12.56	10.24	13.19	10.12	10.58	10.80	10.97	09.01	11.61	11.24		11.42	11.10	09.80	08.56

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Median Duration (Sec)		5.7		5.5	7.45	4.35	4.6	5.2		5.7	6.3	5.9	5.9	6.4	17.3	5.1	4.6
Historical Median Duration (Sec)	06.55	06.70	07.75	06.50	08.30	06.60	06.60	06.60	06.35	06.20	07.20	07.00		06.90	07.30	06.00	05.20
Total																	
Total Carried Traffic (Sec)	128787.2	121479.4	86260.7	121200.4	182543.2	152508.2	106556.7	182278.1	137905.5	77443.0	251561.4	255470.4	355133.9	295214.6	78287.8	172690.4	177014.0
Avg. Duration (Sec)	10.02	9.80	11.43	10.52	10.25	10.19	9.63	9.53	10.81	9.32	9.48	9.82	10.00	9.50	9.44	10.12	10.28
Historical Avg. Duration (Sec)	10.33	10.23	10.76	10.54	09.70	10.81	10.36	10.30	10.71	10.17	09.80	09.98		09.94	10.88	10.56	10.75
Median Duration (Sec)	6.4	6.5	7.1	6.6	6.7	6.4	6.4	6.4	6.8	6.3	6.4	6.7	6.6	6.4	6.3	6.5	6.6
Historical Median Duration (Sec)	07.10	06.90	07.40	07.20	06.80	07.50	07.10	06.90	07.40	07.00	06.70	06.80		06.70	07.30	07.30	07.40

Appendix C: AGENCY CALL TYPES



Table 17: Agency Talkgroup*Calls (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
ACBPS	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0
ACC	0	0	0	0	0	0	0	0	0	0	0	81	88	19	0	0	0
AFP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAA	0	0	0	0	0	0	0	59	0	0	0	2	59	0	0	0	0
CFS	6246	424	3759	7054	8022	8593	6182	5882	6652	4337	7864	394	4845	8018	4590	9355	8828
CORRECTIONS	0	4	0	0	2	0	0	1	0	7	617	698	203	764	1	0	7
DAIS	0	50	0	0	0	0	0	0	0	0	0	4	33	5	0	0	0
DEH	0	556	15	0	0	37	0	567	32	71	393	395	443	356	218	25	336
DHS	26	0	0	0	56	0	0	0	24	0	0	0	56	0	0	0	0
FORESTRY	0	0	0	0	0	0	121	12	0	66	0	0	0	0	0	0	225
MFS	879	733	5	5	1003	420	1	311	483	641	1108	1130	1637	1098	404	2069	1017
MOTOROLA	11	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0
PIRSA	1	2	0	2	0	0	1	0	0	0	0	17	1	0	0	0	1
PTB	0	3344	0	0	1329	0	0	3468	0	315	2761	6198	7189	5455	536	0	0
SAAS	1674	1074	535	1078	1831	1224	803	1661	171	471	3366	4349	5054	3391	303	830	608
SAPOL	1799	2566	1540	1581	2760	1707	392	2750	1945	650	6260	7290	8547	6739	493	1854	2464
SA-WATER	0	2	0	0	0	0	0	0	1	1	3	4	15	9	0	0	9
SES	194	419	35	123	27	117	0	446	73	91	420	449	557	491	10	449	92
ST-JOHN	0	28	0	2	154	189	0	18	0	0	115	60	128	215	0	1	3
TRANSPORT-SA	0	41	0	23	26	4	5	31	0	11	74	75	58	66	3	19	9
Total	10830	9243	5889	9868	15210	12291	7505	15206	9381	6661	22981	21167	28915	26626	6558	14603	13599

* = Total Calls – Patched calls - Multi-Select Calls – Emergency Calls – Private Calls

Table 18: Agency Patched Calls (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
AFP	74	2254			153	3		1795		87	745	2506	2552	1867	20	5	1
CFS																	
PTB					14						14	14	14	14			
SAAS		4			26	6		15			46	45	46	16	10		9
SAPOL	1935	838	1646	1641	2371	2646	3561	2043	3358	1555	2593	2070	3830	2392	1703	2443	3586
Total	2009	3096	1646	1641	2564	2655	3561	3853	3358	1642	3398	4635	6442	4289	1733	2448	3596

Table 19: Agency Multi-Select Call Summary (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
CFS				2	3	1		2		2	3	3	3	2			3
CORRECTIONS											78	75		78			
PTB		1			1						1	1	2	2			
SAPOL	6		6	6	6	6			6				6			6	6
Total	6	1	6	8	10	7	0	2	6	2	82	79	11	82	0	6	9

Table 20: Agency Emergency Call Summary (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
CFS					2	4							7	1		6	3
CORRECTIONS									1								
PTB		12			8			22			21	21	26	21	1		
SAPOL	6	4	4	4	7	6	2	1	6	1	4	2	7	5	1	6	4
Total	6	16	4	4	17	10	2	23	7	1	25	23	40	27	2	12	7

Table 21: Agency Multigroup Call Summary (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
Corrections											78	75		78			
SAAS		43						39			41	102	104	54			
Total	0	43	0	0	0	0	0	39	0	0	119	177	104	132	0	0	0

Table 22: Agency Private Call Summary (Ingress & Egress inclusive) per Site - 25th November 2015 (10:00 to 22:00)

Agency	Barossa Range	Belair	Bumbunga Hill	Clare West	Gawler	Macaw Hill	McVitties Hill	Mount Lofty	Mount Rufus	Nitschke Hill	One Tree Hill	Port Adelaide	Santos House	Tea Tree Gully	Virginia	Wild Dog Hill	Williamstown
PTB		2										3	2	1			
SAPOL					1												
Total	0	2	0	0	1	0	0	0	0	0	0	3	2	1	0	0	0

Appendix D: INGRESS & EGRESS CALL DATA



**Table 23: Total Calls (Ingress & Egress) -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	495	272	887	997	1097	1389	1511	1443	1551	1300	1158	1183	13,283
Belair	1091	1044	1082	1273	1333	1350	1299	1124	762	725	728	590	12,401
Bumbunga Hill	448	229	511	733	788	729	882	760	629	692	602	568	7,571
Clare West	709	516	1003	1070	1162	1279	1132	980	961	965	887	930	11,594
Gawler	892	878	1395	1459	1794	1886	1989	1776	1676	1519	1486	1051	17,801
Macaw Hill	765	581	1201	1483	1516	1649	1722	1541	1528	1208	1120	1227	15,541
McVitties Hill	376	465	1017	1483	1134	966	1179	1414	989	1069	612	480	11,184
Mount Lofty	1260	1370	1873	1880	1828	1890	1814	1707	1535	1560	1178	1228	19,123
Mount Rufus	480	398	742	1088	1053	1216	1401	1349	1300	1455	1289	1191	12,962
Nitschke Hill	372	615	856	991	1015	663	702	785	540	727	479	564	8,309
One Tree Hill	1617	1649	2320	2459	2773	3049	2543	2431	2304	2138	1709	1536	26,528
Port Adelaide	1959	2309	2404	2522	2753	2989	2481	2188	1939	1754	1392	1319	26,009
Santos House	2490	2849	3583	3632	3662	3793	3354	3302	2745	2498	1768	1842	35,514
Tea Tree Gully	2270	2376	3022	3218	3218	3265	3065	2582	2303	2304	1843	1615	31,081
Virginia	353	352	713	756	944	1048	886	883	758	575	500	525	8,293
Wild Dog Hill	691	714	1332	1658	1566	1699	1603	1866	1765	1667	1262	1258	17,081
Williamstown	878	970	1420	1811	1607	1874	1649	1758	1573	1307	1210	1175	17,232

**Table 24: Total Calls (Ingress Only) -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	9	1	67	50	96	166	211	198	207	80	185	153	1,423
Belair	31	59	30	71	65	67	29	35	33	12	37	30	499
Bumbunga Hill	43		24	10	48	18	84	15	4			2	248
Clare West	161	130	108	118	91	196	53	73	58	43	33	44	1,108
Gawler	30	27	83	73	133	197	189	257	205	175	125	145	1,639
Macaw Hill	66	16	262	272	268	265	242	217	301	202	134	141	2,386
McVitties Hill		69	50	86	28	7	16	9		15	1		281
Mount Lofty	98	112	111	127	160	164	84	47	42	40	29	58	1,072
Mount Rufus	11	11	16	9	57	45	40	54	118	114	58	52	585
Nitschke Hill	9	118	75	35	4	4	55	14	2	27	6	3	352
One Tree Hill	254	284	587	554	514	564	518	431	344	284	288	244	4,866
Port Adelaide	230	284	302	317	389	493	269	185	202	194	109	115	3,089
Santos House	461	494	571	510	668	473	443	485	418	316	263	302	5,404
Tea Tree Gully	343	355	469	456	500	346	326	319	313	270	294	175	4,166
Virginia	31	19	39	42	82	20	6	21	48	29	23	15	375
Wild Dog Hill	38	27	77	153	277	399	342	476	558	573	348	277	3,545
Williamstown	20	46	128	322	133	225	177	133	71	82	165	214	1,716

**Table 25: Total Calls (Egress) -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	486	271	820	947	1001	1223	1300	1245	1344	1220	973	1030	11,860
Belair	1060	985	1052	1202	1268	1283	1270	1089	729	713	691	560	11,902
Bumbunga Hill	405	229	487	723	740	711	798	745	625	692	602	566	7,323
Clare West	548	386	895	952	1071	1083	1079	907	903	922	854	886	10,486
Gawler	862	851	1312	1386	1661	1689	1800	1519	1471	1344	1361	906	16,162
Macaw Hill	699	565	939	1211	1248	1384	1480	1324	1227	1006	986	1086	13,155
McVitties Hill	376	396	967	1397	1106	959	1163	1405	989	1054	611	480	10,903
Mount Lofty	1162	1258	1762	1753	1668	1726	1730	1660	1493	1520	1149	1170	18,051
Mount Rufus	469	387	726	1079	996	1171	1361	1295	1182	1341	1231	1139	12,377
Nitschke Hill	363	497	781	956	1011	659	647	771	538	700	473	561	7,957
One Tree Hill	1363	1365	1733	1905	2259	2485	2025	2000	1960	1854	1421	1292	21,662
Port Adelaide	1729	2025	2102	2205	2364	2496	2212	2003	1737	1560	1283	1204	22,920
Santos House	2029	2355	3012	3123	2994	3320	2911	2817	2327	2182	1505	1540	30,115
Tea Tree Gully	1927	2021	2553	2762	2718	2919	2739	2263	1990	2034	1549	1440	26,915
Virginia	322	333	674	714	862	1028	880	862	710	546	477	510	7,918
Wild Dog Hill	653	687	1255	1505	1289	1300	1261	1390	1207	1094	914	981	13,536
Williamstown	858	924	1292	1489	1474	1649	1472	1625	1502	1225	1045	961	15,516

Appendix E: INGRESS & EGRESS BUSIES DATA



**Table 26: Total Number of Buses (Ingress & Egress) -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	0	0	160	188	382	787	396	377	626	280	95	127	3418
Belair	0	0	0	0	0	0	0	0	0	0	0	0	0
Bumbunga Hill	3	0	0	1	65	69	84	46	2	9	3	3	285
Clare West	3	0	17	55	154	352	92	44	30	11	7	20	785
Gawler	0	0	15	1	42	208	142	70	91	61	6	6	642
Macaw Hill	13	0	223	440	586	986	888	561	567	141	72	155	4632
McVitties Hill	0	0	71	268	68	48	100	347	105	122	4	0	1133
Mount Lofty	0	0	0	0	0	0	0	0	0	0	0	0	0
Mount Rufus	0	0	0	77	119	338	413	343	423	467	164	105	2449
Nitschke Hill	0	0	11	1	9	7	0	0	0	9	0	0	37
One Tree Hill	0	0	0	3	21	54	6	7	2	2	0	0	95
Port Adelaide	0	0	0	11	0	24	0	0	0	0	0	0	35
Santos House	0	1	33	112	271	111	15	17	0	2	0	0	562
Tea Tree Gully	0	0	68	21	38	41	33	11	0	1	0	0	213
Virginia	0	0	0	0	0	2	0	0	0	0	0	0	2
Wild Dog Hill	0	0	0	15	9	45	8	117	102	39	0	0	335
Williamstown	0	0	21	70	45	170	39	58	41	1	0	0	445

**Table 27: Total Number of Ingress Buses -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	0	0	25	19	34	104	54	55	87	25	15	16	434
Belair	0	0	0	0	0	0	0	0	0	0	0	0	0
Bumbunga Hill	0	0	0	1	8	2	15	2	0	0	0	0	28
Clare West	0	0	2	5	10	75	7	1	0	0	0	1	101
Gawler	0	0	0	0	3	19	14	7	11	13	0	1	68
Macaw Hill	1	0	61	66	104	158	101	77	131	26	3	14	742
McVitties Hill	0	0	6	20	6	0	2	1	0	2	0	0	37
Mount Lofty	0	0	0	0	0	0	0	0	0	0	0	0	0
Mount Rufus	0	0	0	2	7	15	12	11	39	49	8	3	146
Nitschke Hill	0	0	1	0	1	0	0	0	0	0	0	0	2
One Tree Hill	0	0	0	0	2	10	0	2	1	0	0	0	15
Port Adelaide	0	0	0	1	0	3	0	0	0	0	0	0	4
Santos House	0	0	3	15	62	15	6	3	0	0	0	0	104
Tea Tree Gully	0	0	14	3	7	3	3	2	0	0	0	0	32
Virginia	0	0	0	0	0	0	0	0	0	0	0	0	0
Wild Dog Hill	0	0	0	2	3	13	2	30	29	12	0	0	91
Williamstown	0	0	2	10	3	16	4	1	0	1	0	0	37

**Table 28: Total Number of Egress Buses -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	0	0	135	169	348	683	342	322	539	255	80	111	2984
Belair	0	0	0	0	0	0	0	0	0	0	0	0	0
Bumbunga Hill	3	0	0	0	57	67	69	44	2	9	3	3	257
Clare West	3	0	15	50	144	277	85	43	30	11	7	19	684
Gawler	0	0	15	1	39	189	128	63	80	48	6	5	574
Macaw Hill	12	0	162	374	482	828	787	484	436	115	69	141	3890
McVitties Hill	0	0	65	248	62	48	98	346	105	120	4	0	1096
Mount Lofty	0	0	0	0	0	0	0	0	0	0	0	0	0
Mount Rufus	0	0	0	75	112	323	401	332	384	418	156	102	2303
Nitschke Hill	0	0	10	1	8	7	0	0	0	9	0	0	35
One Tree Hill	0	0	0	3	19	44	6	5	1	2	0	0	80
Port Adelaide	0	0	0	10	0	21	0	0	0	0	0	0	31
Santos House	0	1	30	97	209	96	9	14	0	2	0	0	458
Tea Tree Gully	0	0	54	18	31	38	30	9	0	1	0	0	181
Virginia	0	0	0	0	0	2	0	0	0	0	0	0	2
Wild Dog Hill	0	0	0	13	6	32	6	87	73	27	0	0	244
Williamstown	0	0	19	60	42	154	35	57	41	0	0	0	408

Appendix F: SITE AIR-TIME DATA



**Table 29: Site Airtime (Seconds) -
25th November 2015 (10:00 to 22:00)**

Site	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Total
Barossa Range	4,851	2,629	7,681	10,110	10,887	13,548	13,986	14,205	15,327	12,700	11,370	11,428	128,727
Belair	10,592	10,182	11,806	12,283	13,454	12,831	11,529	11,216	7,181	7,342	7,291	5,753	121,465
Bumbunga Hill	4,566	2,510	5,124	8,823	9,832	9,640	9,787	8,175	7,390	7,853	6,476	6,029	86,210
Clare West	6,827	4,973	8,741	11,419	12,682	14,134	12,203	10,443	10,548	10,454	9,340	9,374	121,143
Gawler	9,290	8,840	13,894	14,802	18,255	19,858	19,479	18,720	18,487	15,760	14,587	10,501	182,477
Macaw Hill	7,880	5,988	11,692	14,521	14,789	16,557	15,721	14,685	15,010	12,060	11,007	12,533	152,449
McVitties Hill	3,463	4,556	9,603	12,829	10,395	9,094	10,094	13,647	10,950	10,312	6,481	5,087	106,516
Mount Lofty	12,212	13,771	17,760	16,843	17,156	18,346	15,876	17,017	14,807	14,993	11,633	11,755	182,174
Mount Rufus	5,259	4,267	7,833	12,357	12,768	14,242	14,503	13,950	14,077	14,319	12,457	11,803	137,840
Nitschke Hill	3,441	6,309	7,994	8,900	10,344	6,598	5,732	7,025	5,110	6,495	4,355	5,113	77,422
One Tree Hill	15,028	16,010	21,935	22,379	25,710	29,408	23,232	24,190	22,382	20,153	16,544	14,521	251,498
Port Adelaide	18,882	23,356	24,853	24,726	26,819	29,176	24,079	21,969	18,415	16,838	13,822	12,473	255,413
Santos House	24,251	27,931	35,630	36,524	38,096	38,193	31,933	32,659	27,377	26,057	18,072	18,256	354,985
Tea Tree Gully	21,453	23,472	28,949	30,072	30,418	30,948	28,135	25,134	22,100	21,887	17,614	14,970	295,160
Virginia	3,427	3,522	6,611	7,168	8,786	9,738	8,239	8,527	7,343	5,286	4,518	5,086	78,259
Wild Dog Hill	7,193	7,330	12,938	17,106	16,164	17,393	15,324	18,379	18,816	17,030	12,395	12,540	172,614
Williamstown	8,737	10,022	13,427	18,075	17,415	19,830	16,037	17,830	17,629	13,575	12,441	11,899	176,924