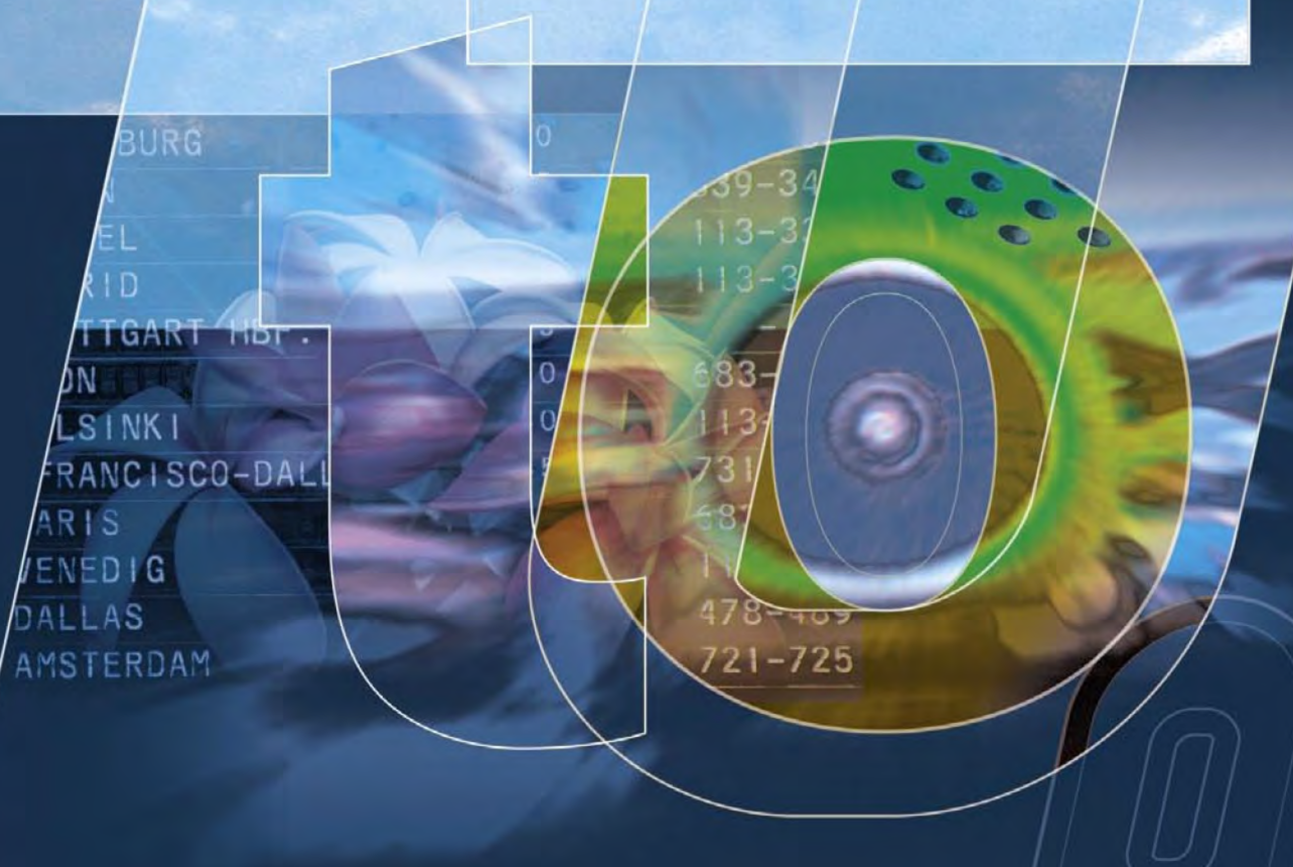
December 2015

Noise Modelling Report

Busselton-Margaret River Airport



Noise Modelling Report

Busselton-Margaret River Airport

Prepared for

City of Busselton

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North Melbourne, December 2015

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1 Introduction

The City of Busselton (COB) require the preparation of an additional Australian Noise Exposure Concept (ANEC), noise modelling and noise contour maps for Busselton-Margaret River Airport (BMRA). COB have awarded this work to To70 Aviation (Australia) Pty. Ltd. (To70). This report provides the results of the noise modelling work as well as details of the inputs and assumptions used in the noise modelling work.

1.1 Background

The COB has been awarded funding of $55.9m for the redevelopment of BMRA. This redevelopment is aimed at providing the necessary airport infrastructure to allow for interstate air services. Since the preparation of the ANECs and noise contours by To70 in 2014, some of the design characteristics of the airside infrastructure (runway, aprons and taxiways) have changed and need to be remodelled. Additionally, the COB wishes to review the aircraft traffic forecast, design aircraft and model inputs previously developed to ensure that they are still considered appropriate for the BMRA redevelopment.

BMRA is currently regulated by the Environmental Protection Authority (EPA) in accordance with Ministerial Statement 1009. The Statement 1009 and preceding statements (399, 825, 878, 887 and 901) determine the environmental conditions in which the BMRA operates, including the requirement to produce an approved Noise Management Plan. As part of the redevelopment project, environmental approvals from the Minister for Environment; Heritage and OEPA are required. The City of Busselton will therefore need to prepare an environmental review document for an Assessment on Proponent Information (Category A) (API – Category A) under the Environmental Protection Act (1986). The API – Category A review document will need to include the ANEC, N65 and N70 Contours prepared for the development project infrastructure and future (projected) aircraft operations. As a result of the changes in infrastructure, possible changes to traffic forecasts and the statutory requirements placed on the COB, To70 was engaged to review the original noise modelling assumptions, aircraft traffic forecasting and provide updated Noise Contours (ANEC, N-contours and L_{Amax}). The Noise Contours identify the predicted noise footprint of redeveloped BMRA upgrade for comparison with modelling of current operations and alternative aerodrome development scenarios.

1.2 Scope and deliverables

To70 have been contracted by COB to conduct additional noise modelling for BMRA, specifically revision of the ANEC, N-contours and L_{Amax} contours. The scope of work required a review of previous noise modelling undertaken by To70 in order to reproduce noise contours reflective of updated changes to infrastructure and traffic forecasts. Consequently, the following outputs have been produced;

- Remodelled standard ANEC for the Busselton Regional Airport Master Plan 2015 (first draft 30 Oct 2015) aerodrome infrastructure / operations projected to twenty (20) years, that is; 2038/39.
- N65, N70, N75 and N80 contours for the following scenarios:
  - Master Plan (2015) aerodrome infrastructure / operations 2018/19
  - Master Plan (2015) aerodrome infrastructure / operations 2022/23
  - Master Plan (2015) aerodrome infrastructure / operations 2028/29
  - Master Plan (2015) aerodrome infrastructure / operations 2038/39
- Single event L_{Amax} contours
  - Fokker100 (approach & departure for 03 and 21).
  - A320 (approach & departure for 03 and 21).
  - B737-800 (approach & departure for 03 and 21).

2 Inputs and assumptions

This section provides detail on the inputs and assumptions used for the noise calculations. These have been discussed and verified by COB.

2.1 General settings

The Federal Aviation Administration's (FAA) Integrated Noise Model (INM) version 7.0d is used for the calculation of the ANEC and other contours. INM 7.0d is the latest version of this software package.

Weather

INM requires the input of weather conditions observed at the airport. Average weather settings are derived from the Bureau of Meteorology (BoM) for Nov-14 to Oct-15. The annual average temperature and pressure at Busselton Airport weather station (station 009603) is used as input for this INM study.

The weather settings are as follows:

Temperature	19.6 degrees C
Pressure	764.22 mm-Hg
Relative humidity	59.3 %
Headwind	14.8 km/h (default INM value)

Terrain data has been downloaded from the NASA website. The Shuttle Radar Topography Missions digital topographic data has been converted to an INM compatible format and imported into the INM study in the World Geodetic System 1984 (WGS84) coordinates. The images below show the terrain in original and INM format.

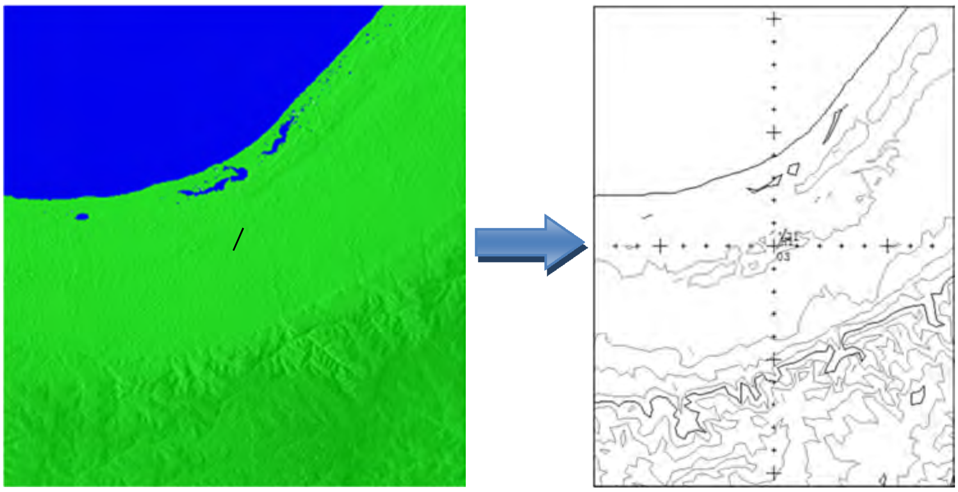


Figure 1 - Terrain

Aerodrome Reference Point

The Busselton Aerodrome Reference Point (ARP) is shown below.

Description	Latitude	Longitude	Elevation (m)
ARP	-33.692500	115.395278	17

Table 1 – Busselton ARP

Runway coordinates

To70 has modelled the revised/masterplan layout (Busselton Airport Master Plan General Arrangement - 2A), which will include a 360m extension to runway end 21 and 300m extension to runway end 03 (and not the 480m extension to the south previously modelled). There are no displaced thresholds. Details of the runway are below.

Description	Latitude	Longitude	Length × Width (m)	Elevation (m)
Runway 03	-33.697328	115.396362	2460 × 45	17
Runway 21	-33.677320	115.407818		17

Table 2 – Runway end coordinates

Helipad

The study uses the existing helipad location.

Description	Latitude	Longitude	Elevation (m)
Helipad	-33.683626	115.401024	17

Table 3 – Helipad coordinates

2.2 Traffic

Forecast

Updated aircraft traffic forecasts for the noise modelling have been provided by COB to To70 in the form of a spreadsheet containing annual movements by year. The forecasts have been reviewed and changes made based on input from To70. The detailed aircraft traffic forecasts (including day/night split) can be found in Appendix A of this document.

Class	Aircraft Type	2018/19	2022/23	2028/29	2038/39
RPT	Narrow Body Jet	**6**	**14**	**16**	**24**
Closed Charter	Regional Jet	**14**	**14**	**14**	**14**
	Turboprop	**2**	**6**	**10**	**10**
Other		**242**	**255**	**266**	**271**

Table 4 – Traffic forecast summary (weekly movements)

Aircraft and substitutes

Aircraft types used in the noise modelling have been specified by the Council and is based on historic traffic and traffic forecasts. To70 has modelled the forecast aircraft using the following INM equivalents

Class	Forecast Aircraft	INM ACFT ID
RPT	**B737-800**	**737800**
	B737-800NG	**737MAX**
Closed Charter	**Fokker100**	**F10065**
	ATR72	**DO328**
Used in L_{Amax} only	*A320*	*A320-211*

Table 5 – RPT/Charter aircraft types

.

Class	Forecast Aircraft	INM ACFT ID
Recreation	Evektor Sportstar - L S A	GASEPF
Emergency Services	PC12	PC12
	Dornier 328	DO328
	Piper - PA31	PA31
General	Cessna 180,182, 172, 210	CNA172
	Cessna Citation	CNA750
	Learjet 45	LEAR45
	Restored Aircraft (i.e Douglas C47; De Havilland DH-82A)	DC3
	Airvan GA8	CNA206
	Bombardier Dash 8	DHC8
Military	Pilatus PC9	JPATS

Table 6 – Other aircraft types

Class	Forecast Aircraft	INM ACFT ID
Helicopter	Eurocopter AS350	EC130
	Squirrel A350	EC130
	Bell 206 JetRanger	EC130
	Bell 214B	B212
	Sikorsky Seaking S61N	S61

Table 7 – Helicopter types

2.3 Operational

Runway usage

To70 has assumed the following runway use based on information provided by COB:

Runway 03	40%
Runway 21	60%

Tracks

This section shows the arrival, departure and circuit tracks that have been assigned for each runway end. Tracks are based on the existing model and have been adjusted to ensure they are flyable by the aircraft that are assigned to them.

Figure 2 – Runway 03 flight tracks

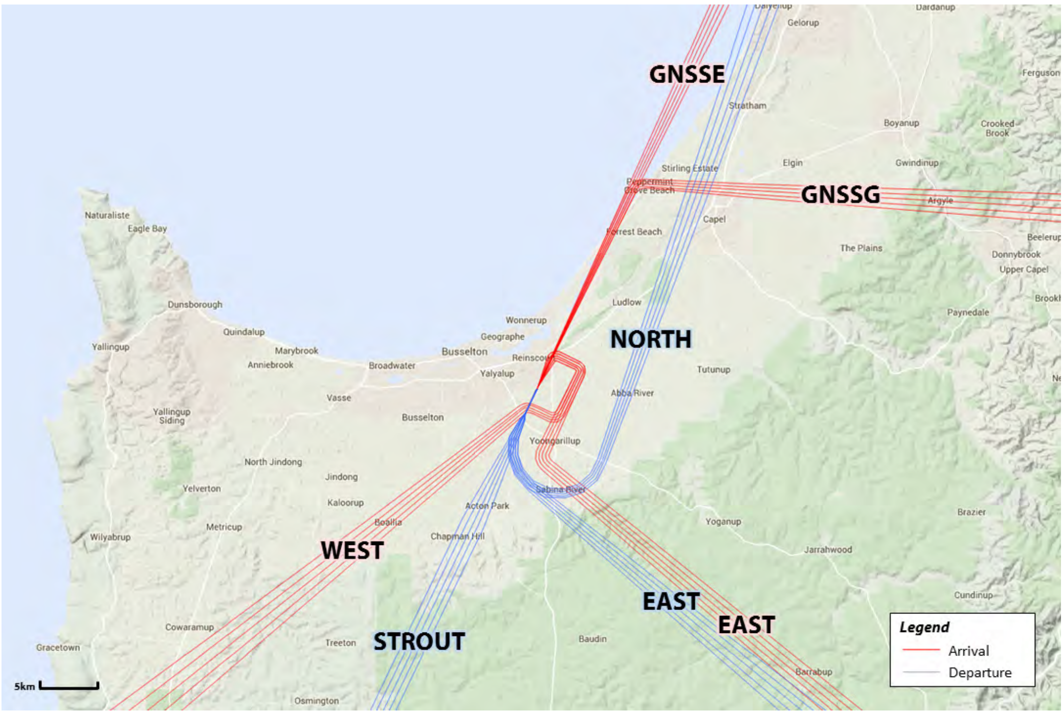


Figure 3 – Runway 21 flight tracks

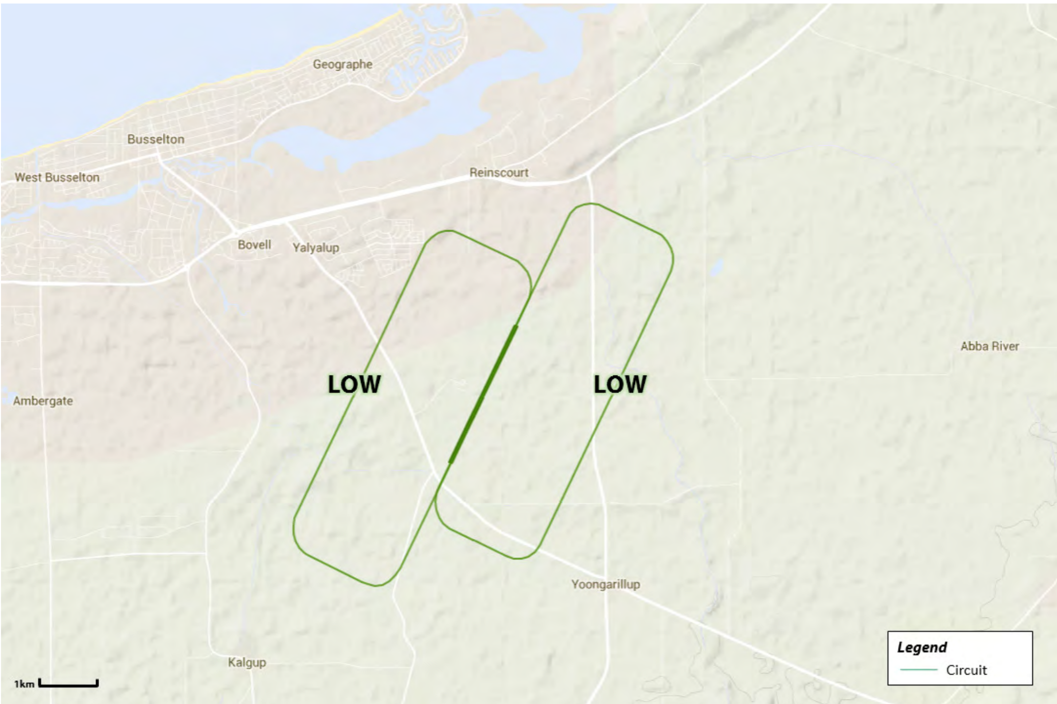


Figure 4 – Circuit flight tracks

Figure 5 – Helicopter flight tracks

Track Usage

This section shows the origin and destination of RPT and FIFO aircraft routes that services Busselton Airport.

Figure 6 – Origins/Destinations for RPT and FIFO flights

RPT, and closed charter movements are assigned to tracks based on shortest distance to origin/destination and is represented in the following table.

Origin/Destination	Runway 03 track		Runway 21 track	
	Arrivals	Departures	Arrivals	Departures
Perth, Boolgeeda, West Angeles, Jandakot, Karara	WEST	STROUT	GNSSG	NORTH
Melbourne, Sydney	GNSSA	EAST	GNSSG	EAST

Table 8 – Track allocation (RPT and closed charter)

Other traffic (such as general aviation) is assigned to tracks as follows, as per previous noise modelling.

Traffic	Runway	Operation	Track	Percentage
General Aviation / Recreation Aviation / Emergency Services	03	A	GNSSB	50%
			WEST	50%
		D	WEST	33%
			EAST	33%
			STROUT	33%
	21	A	GNSSE	33%
			WEST	33%
			EAST	33%
		D	EAST	33%
			NORTH	33%
			STROUT	33%
Military	03	A	GNSSB	50%
		D	STROUT	33%
	21	A	GNSSE	33%
		D	STROUT	33%
Helicopter	Helipad	A	HIN	100%
		D	OUT	100%

Table 9 – Track allocation (other)

3 Results

In this section, we present the results of the noise modelling and describe the metrics used to generate the contours. To70 has generated the following contours:

- ANEC for 2038/39
- N-Contours for 2018/19, 2022/23, 2028/29 and 2038/39
- Single Event L_{Amax} contours for A320, B737-800 and Fokker 100

3.1 ANEC Results

ANEC contours are used to quantify the noise impact of airport development scenarios. These maps are based on assumptions about the size, shape and demand of aircraft and airport operations, and can relate to the distant future. Because the concepts and scenarios are hypothetical and may never occur, the maps produced have no official status for land-use planning purposes. The ANEC uses the Effective Perceived Noise Level (EPNL) which applies a weighting to account for the fact that by the human ear is less sensitive to low audio frequencies.

ANEC contours are generated using the FAA-approved Integrated Noise Model (INM). The INM combines factors such as aircraft noise signatures, distance from source of the noise, duration and frequency of events to calculate the average noise levels on the ground at any point around a given airport. These noise levels are expressed as contours overlaid over an aerial map of the airport and surrounding areas where aircraft noise is likely to be relevant for planning. ANEC contours do not refer to normal decibel levels, but are the result of "averaged annual day" data inputs. ANEC contours also take into account the cumulative nature of noise exposure, for example, night time operations are weighted higher than day time operations to reflect peoples increased sensitivity to aircraft noise at night.

ANEC 2038/39

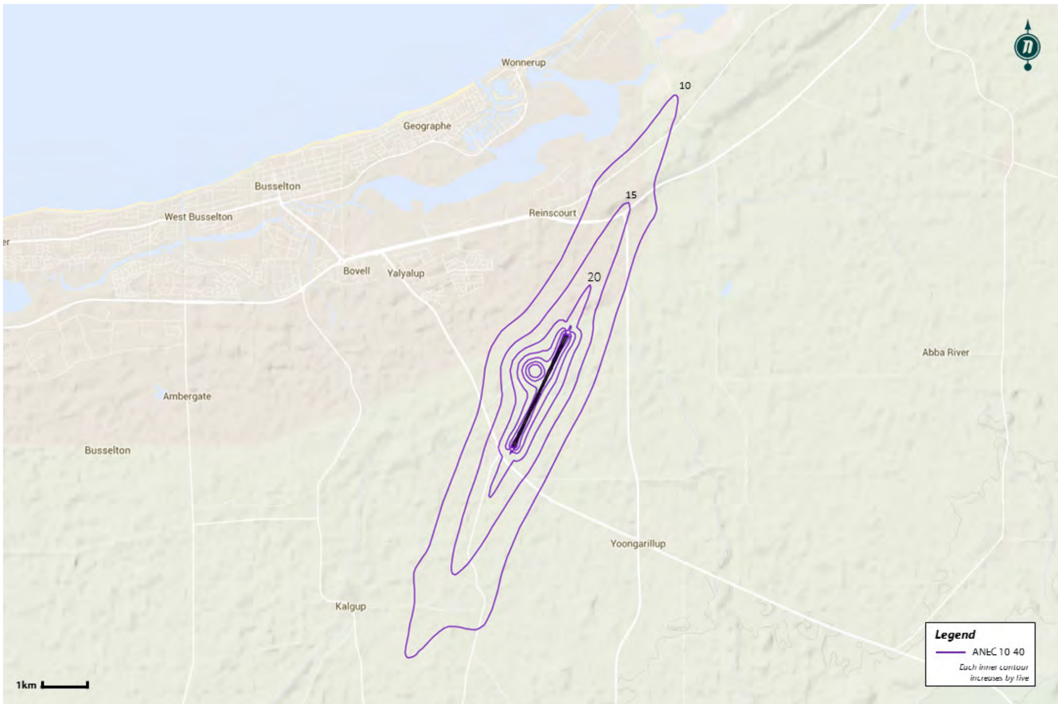


Figure 7: ANEC 2038/39

Observations

The ANEC for the BMRA is a result of consultation with the Council and expert knowledge and judgement about aircraft noise, operations and modelling. It uses robust, accurate and defensible assumptions which have come about from detailed knowledge of the operations at BMRA.

The ANEC 20 contour does not extend to any populous areas and for this reason ANEC 10 has been visualised for informational purposes. As specified in AS2021, buildings (residences) which fall within ANEC 20 are permissible and as such would apply for ANEC 10. In that regard, there is no major impact to dwellings both north and south of the runway that are situated within the ANEC,

3.2 N-Contour results

To complement the ANEF maps, Noise-Above contours (N contours) charts show the number of aircraft noise events per day exceeding specific noise levels. N contours can be used to provide information both on past and planned aircraft operations. This helps communities and individuals to visualise noise impact in specific areas as it takes a person's reaction to noise out of the equation. Further information including a detailed technical explanation of N contours can be found on the DIRD website at; https://infrastructure.gov.au/aviation/environmental/transparent_noise/expanding/4.aspx.

See next page.

N65 Contours: 2018/19

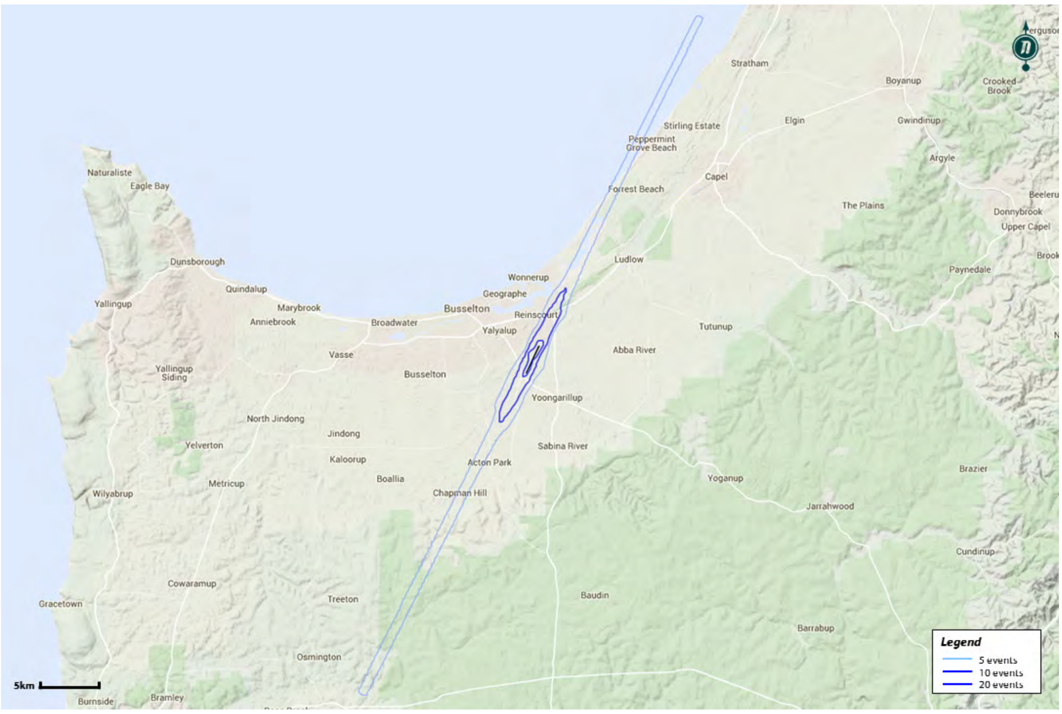


Figure 8: N65 Contours: 2018/19

N70 Contours: 2018/19

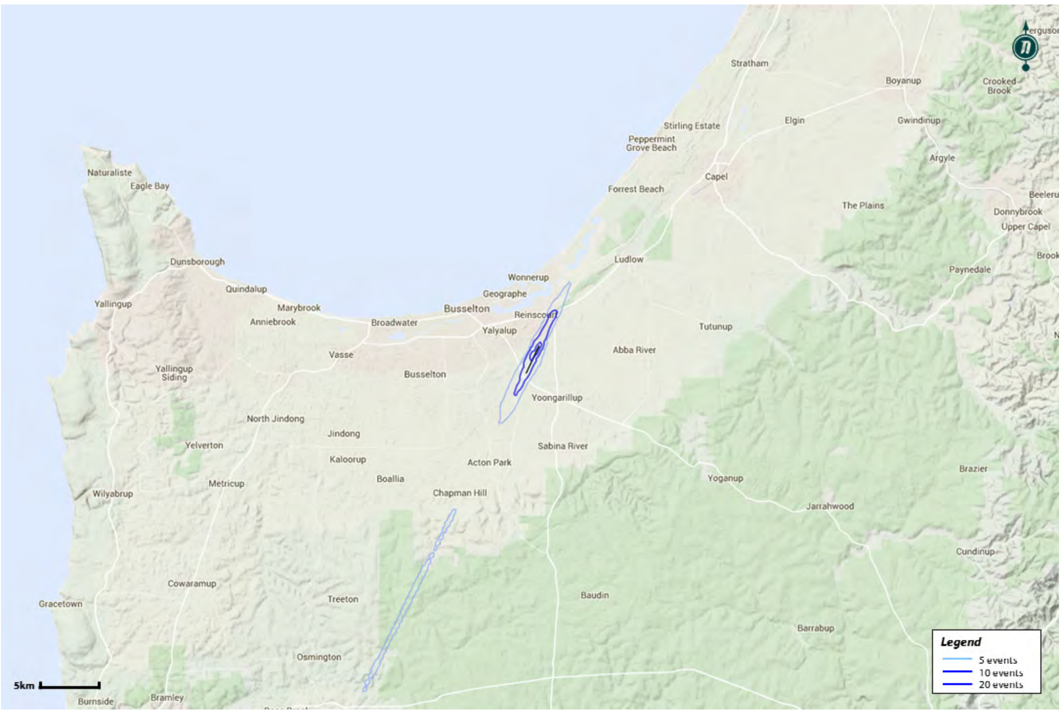


Figure 9: N70 Contours: 2018/19

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2018/19

Figure 10: N75 Contours: 2018/19

N80 Contours: 2018/19

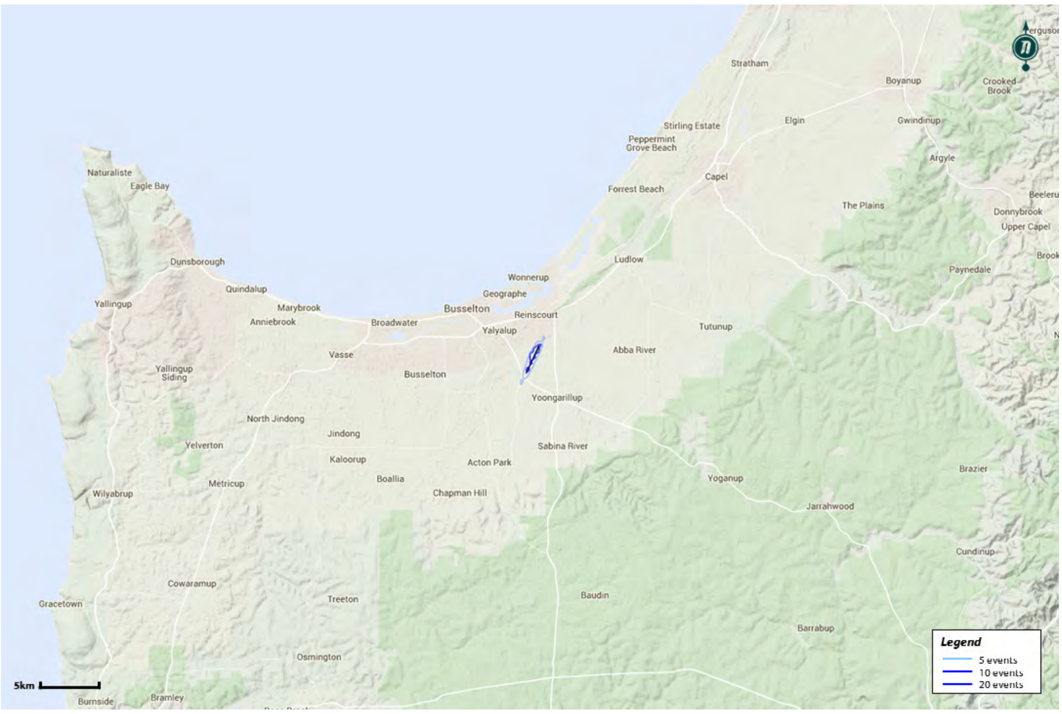


Figure 11: N80 Contours: 2018/19

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2022/23

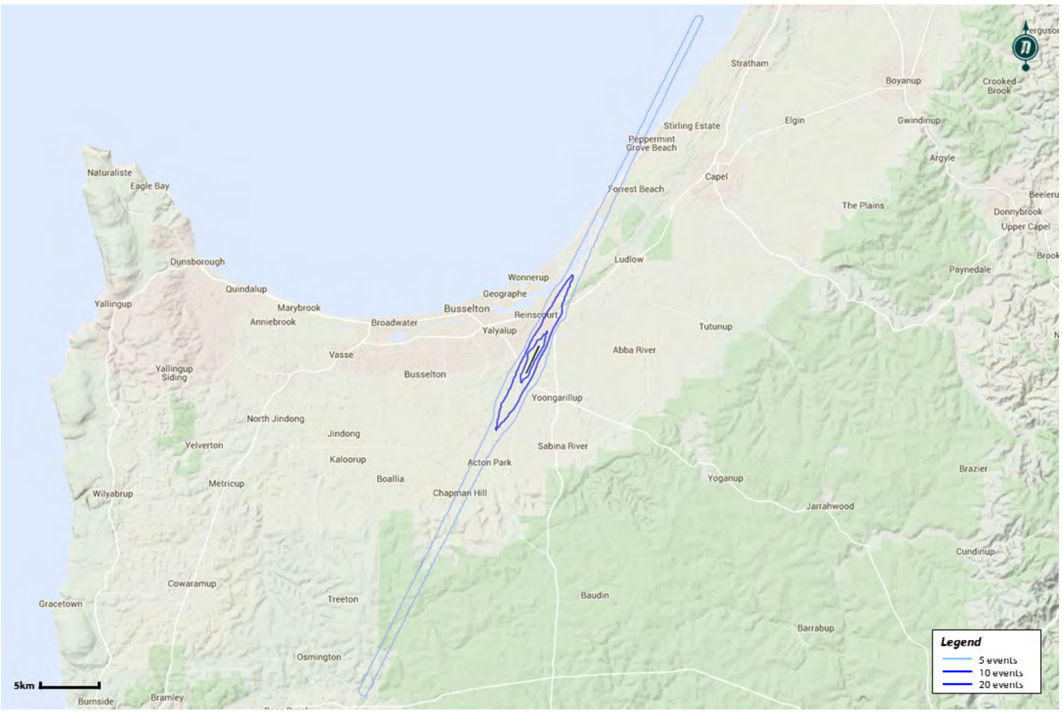


Figure 12: N65 Contours: 2022/23

N70 Contours: 2022/23

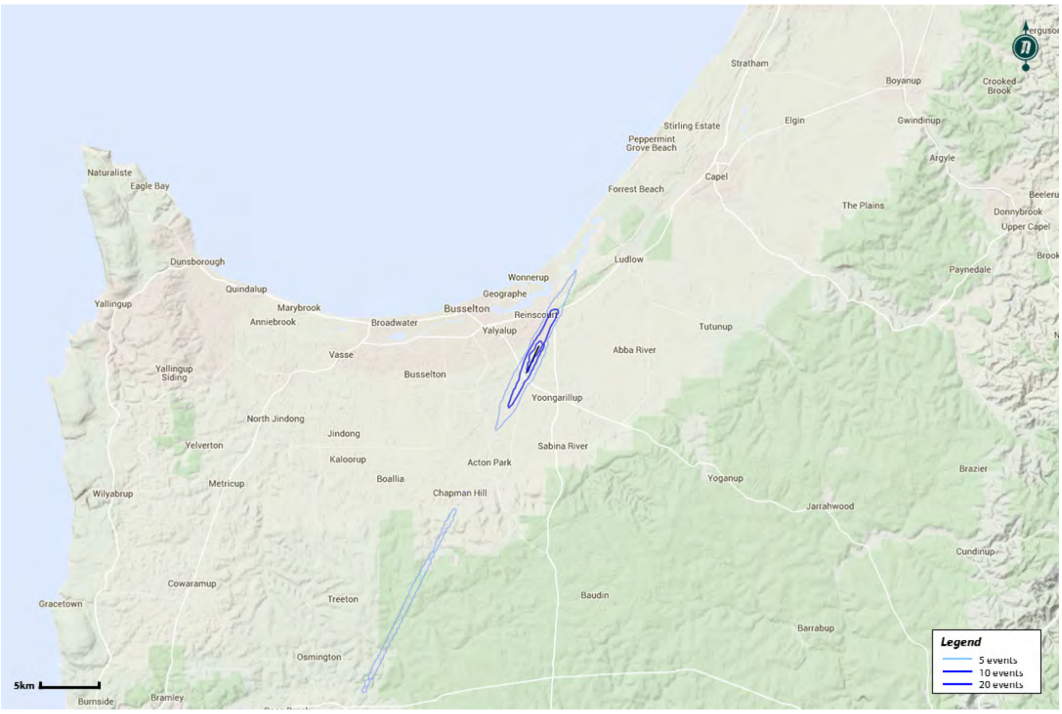


Figure 13: N70 Contours: 2022/23

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2022/23

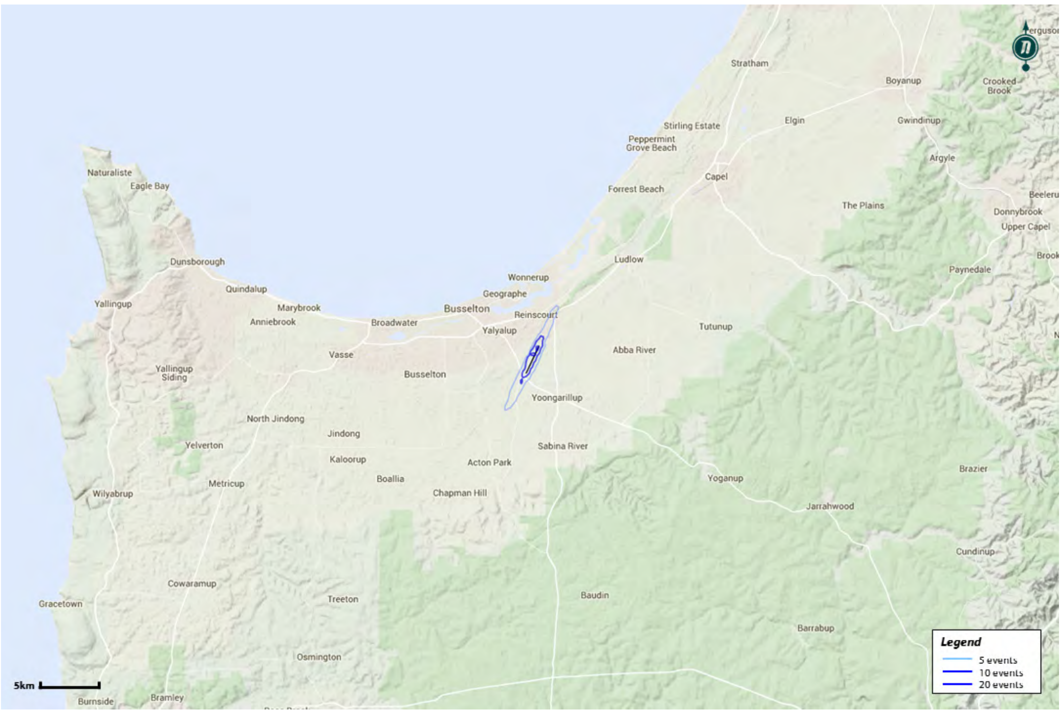


Figure 14: N75 Contours: 2022/23

N80 Contours: 2022/23

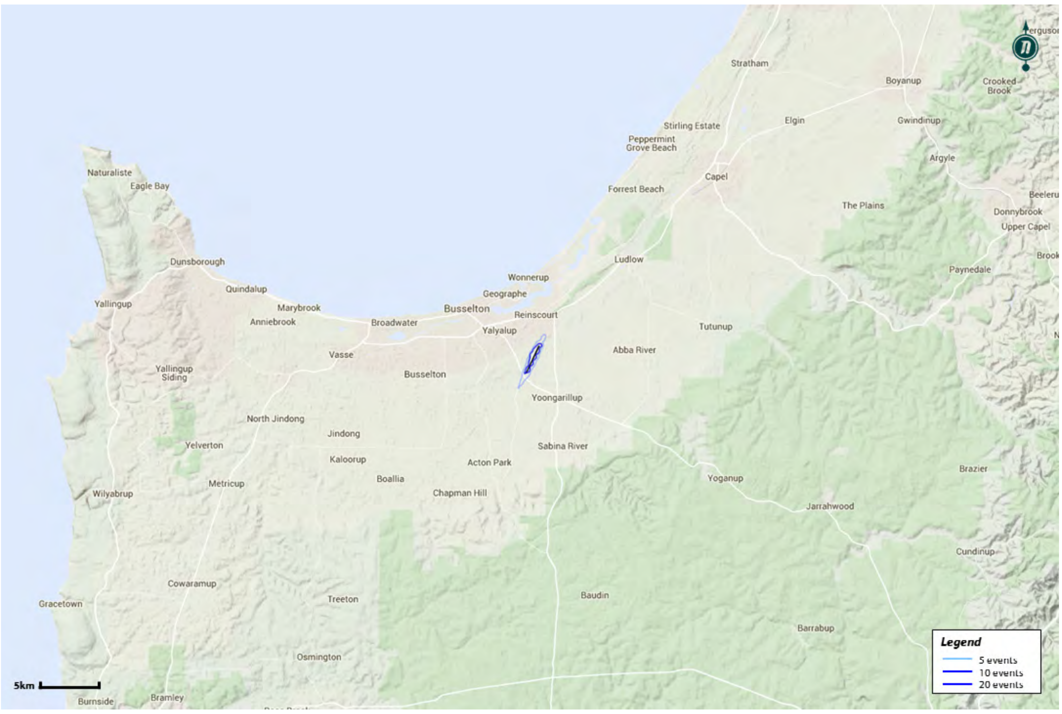


Figure 15: N80 Contours: 2022/23

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2028/29

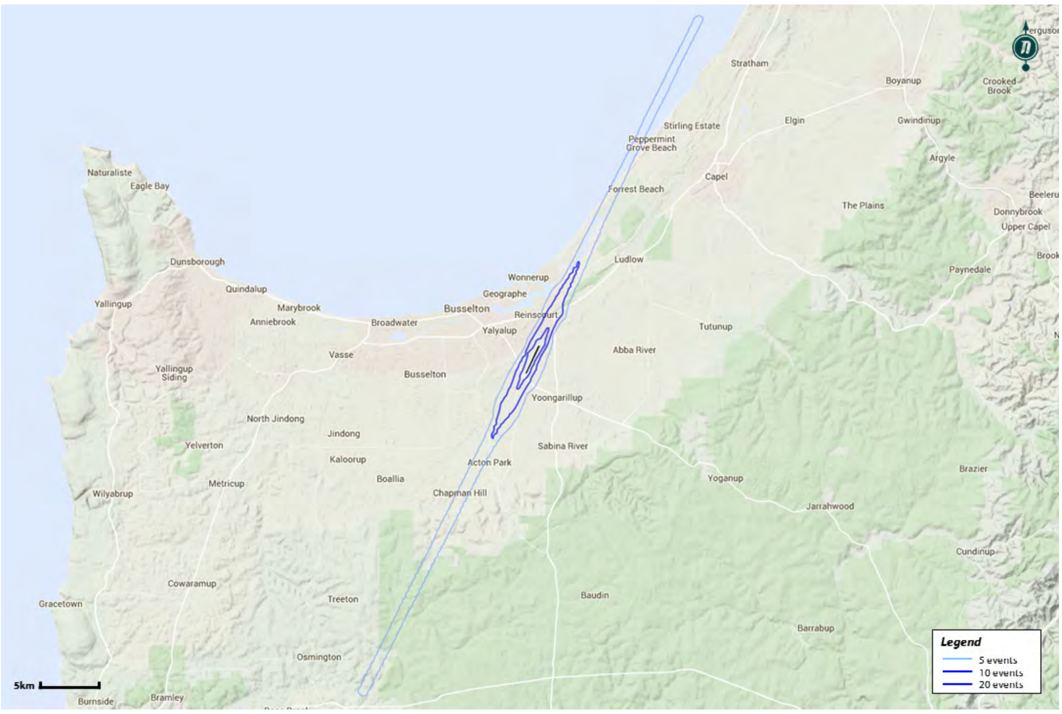


Figure 16: N65 Contours: 2028/29

N70 Contours: 2028/29

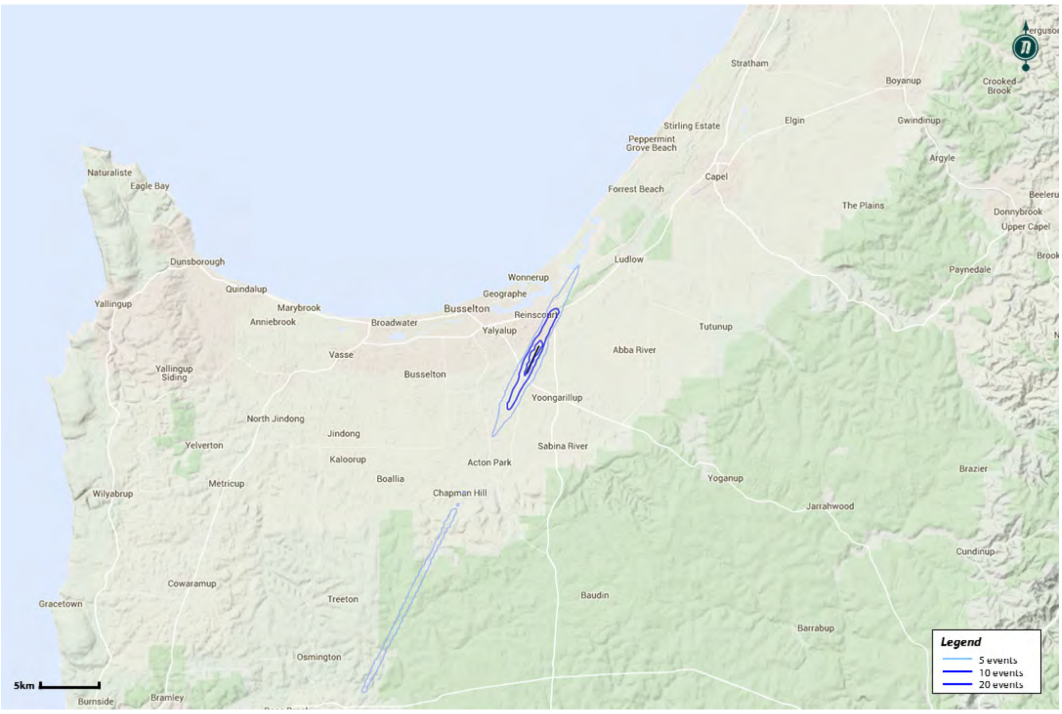


Figure 17: N70 Contours: 2028/29

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2028/29

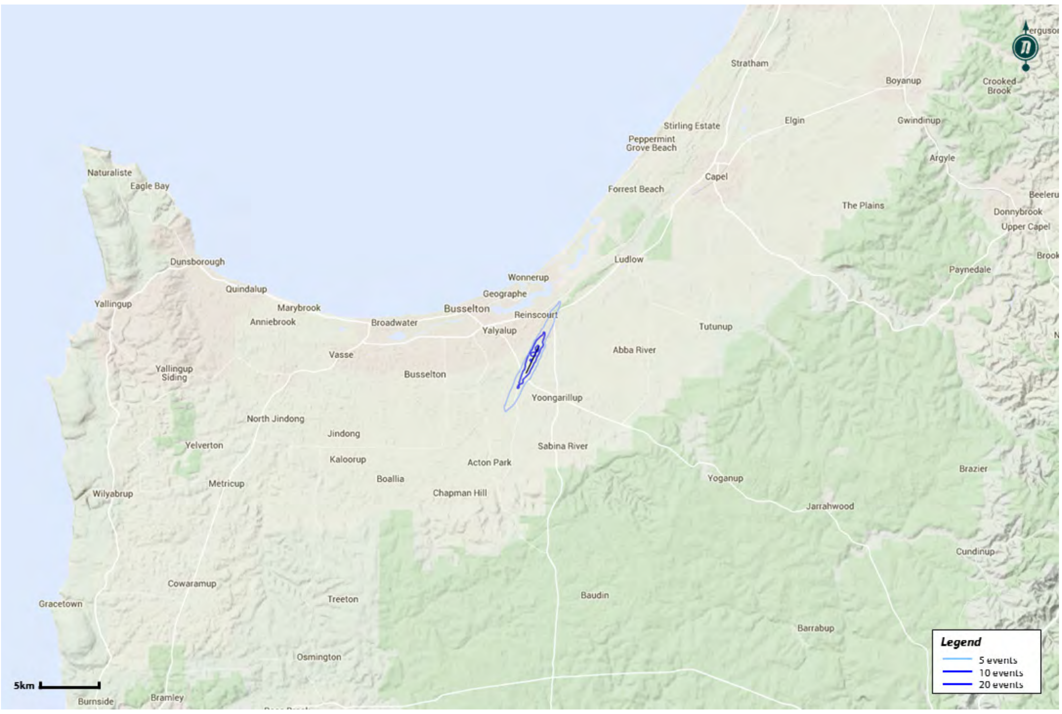


Figure 18: N75 Contours: 2028/29

N80 Contours: 2028/29

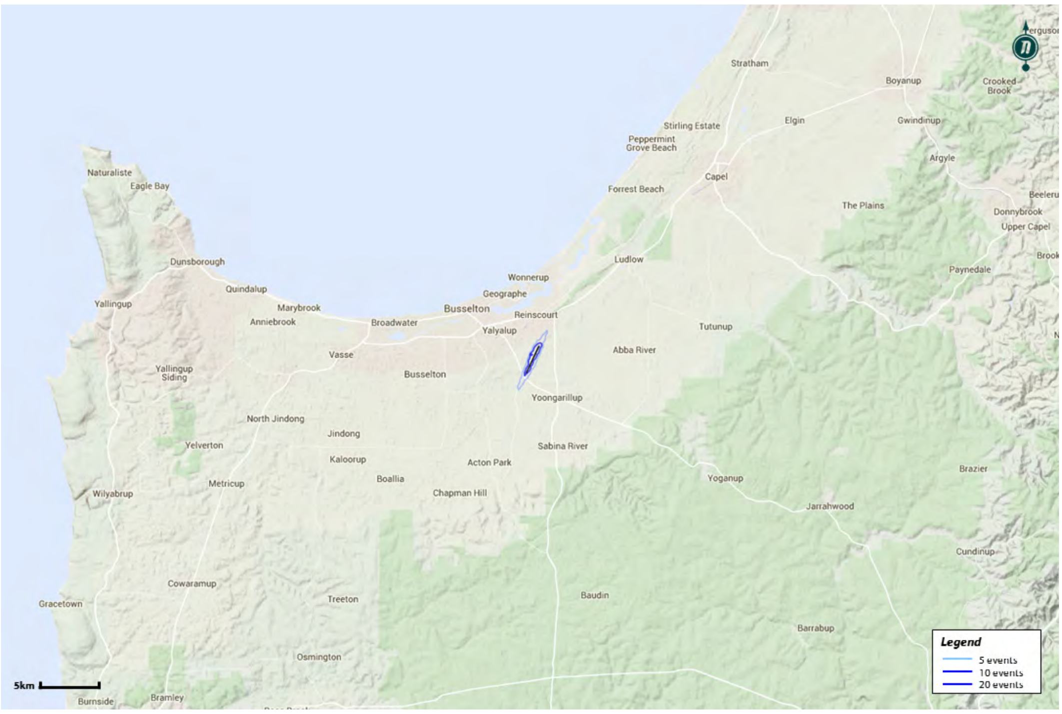


Figure 19: N80 Contours: 2028/29

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2038/39

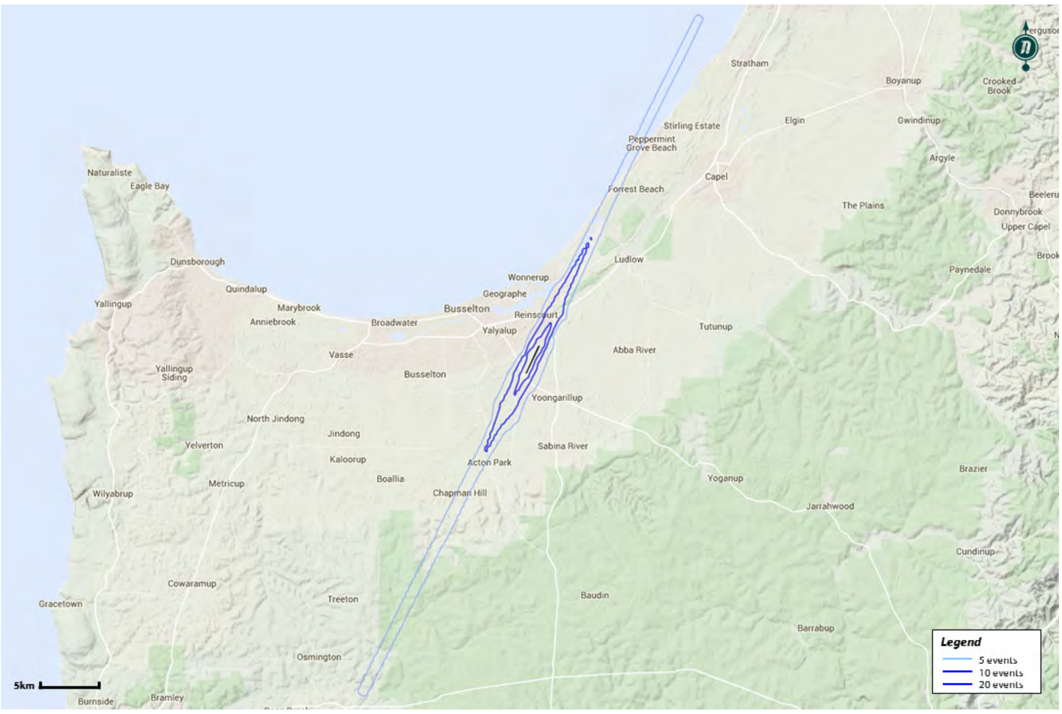


Figure 20: N65 Contours: 2038/39

N70 Contours: 2038/39

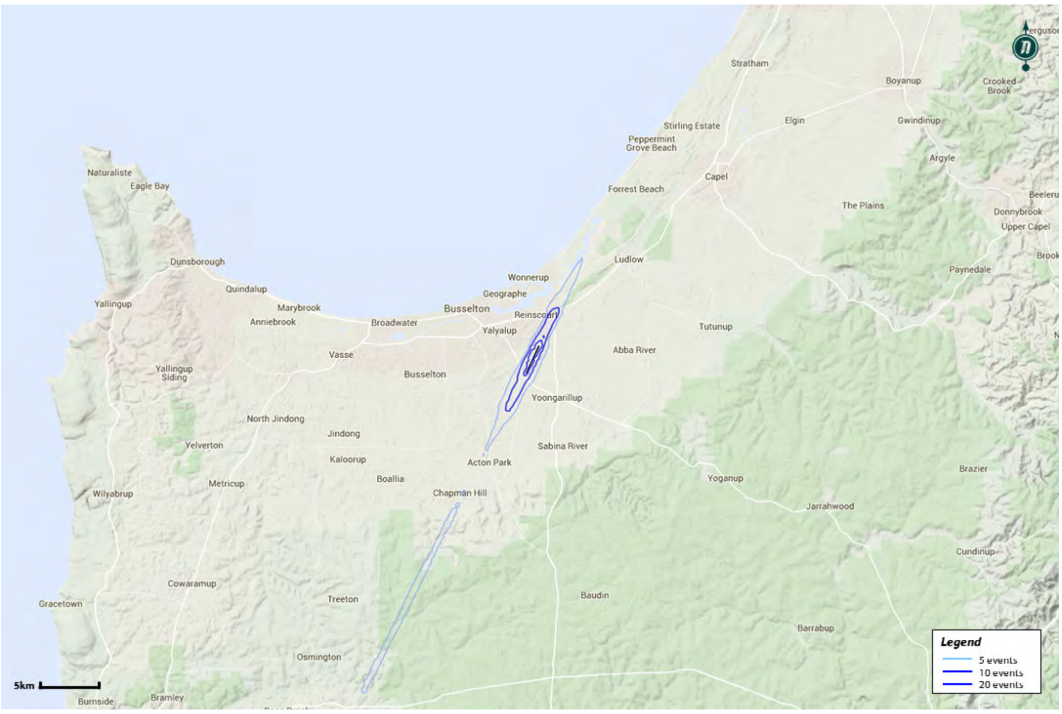


Figure 21: N70 Contours: 2038/39

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2038/39

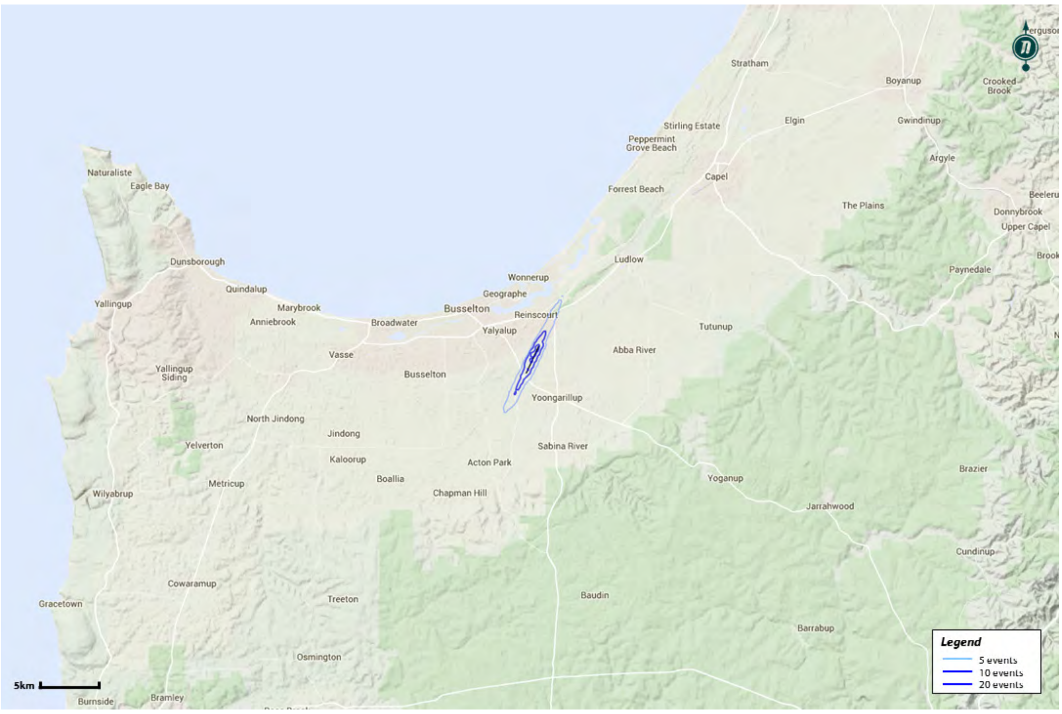


Figure 22: N75 Contours: 2038/39

N80 Contours: 2038/39

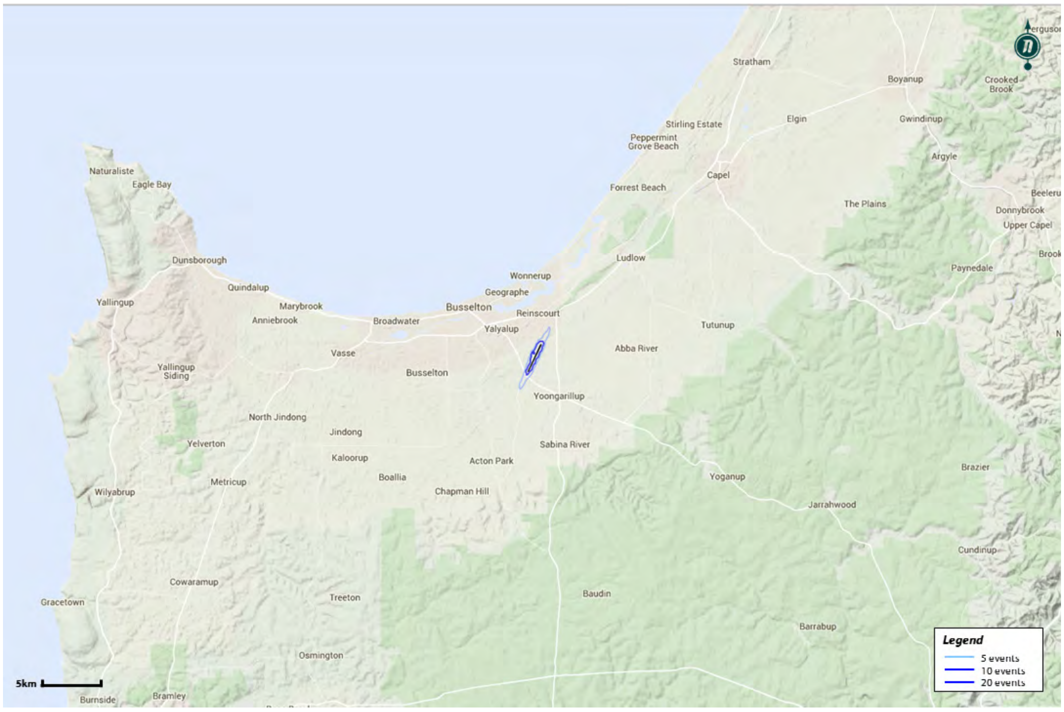


Figure 23: N80 Contours: 2038/39

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

3.3 Single event contour results

L_{Amax} Single event noise levels are a basic metric and are the maximum noise exposure (in A-weighted Decibels) during an overflight. They should only be used for indicative purposes. The figures below show the maximum noise exposure for a single arrival and departure for each runway direction using indicative straight in/straight out flight paths.

See next page.

L_{Amax} F100: Runway 03

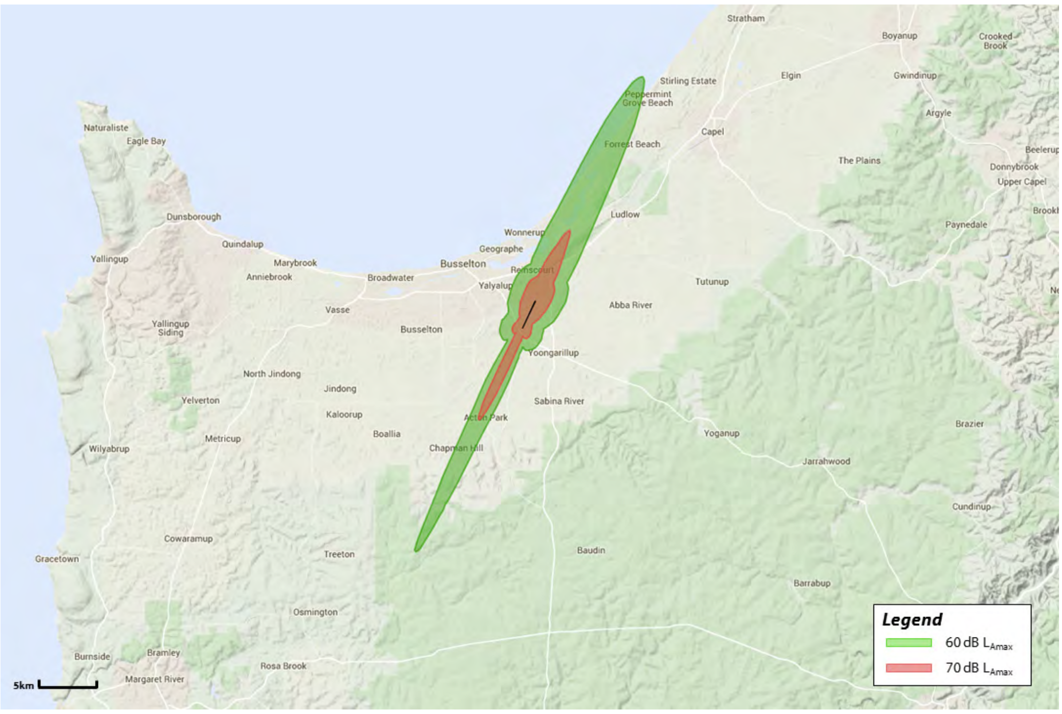


Figure 24: L_{Amax} F100: Runway 03

L_{Amax} F100: Runway 21

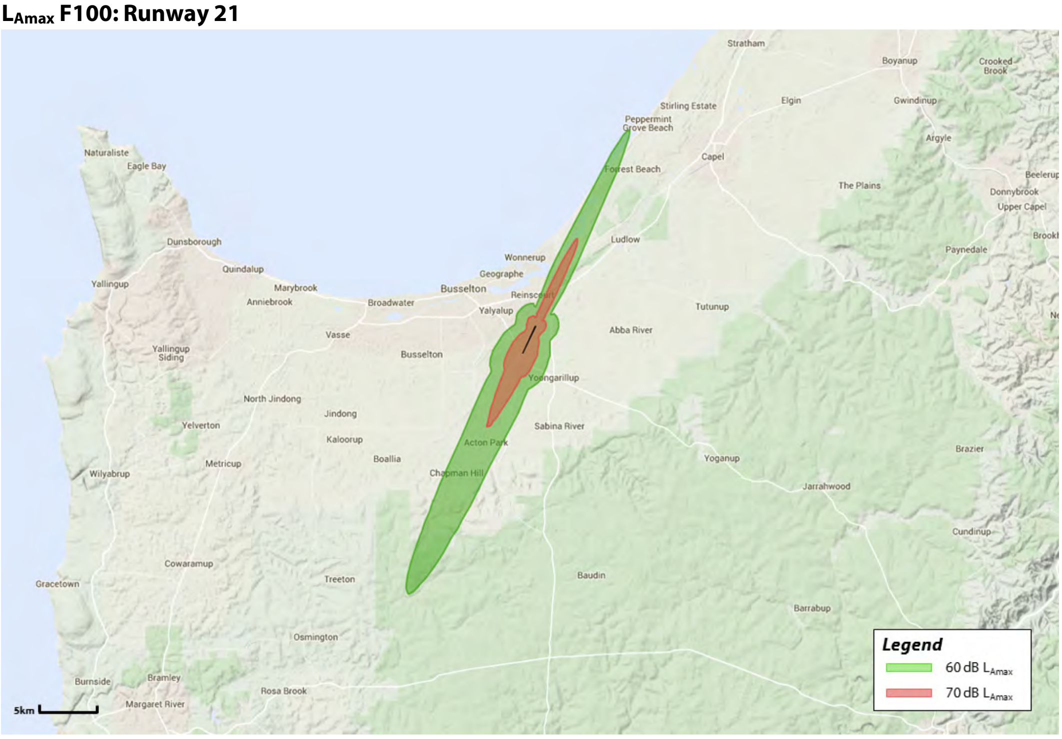


Figure 25: L_{Amax} F100: Runway 21

The 60 dB contour reaches part of Reinscourt and part of Yalyalup. The 70 dB contour reaches part of Reinscourt.

L_{Amax} A320: Runway 03

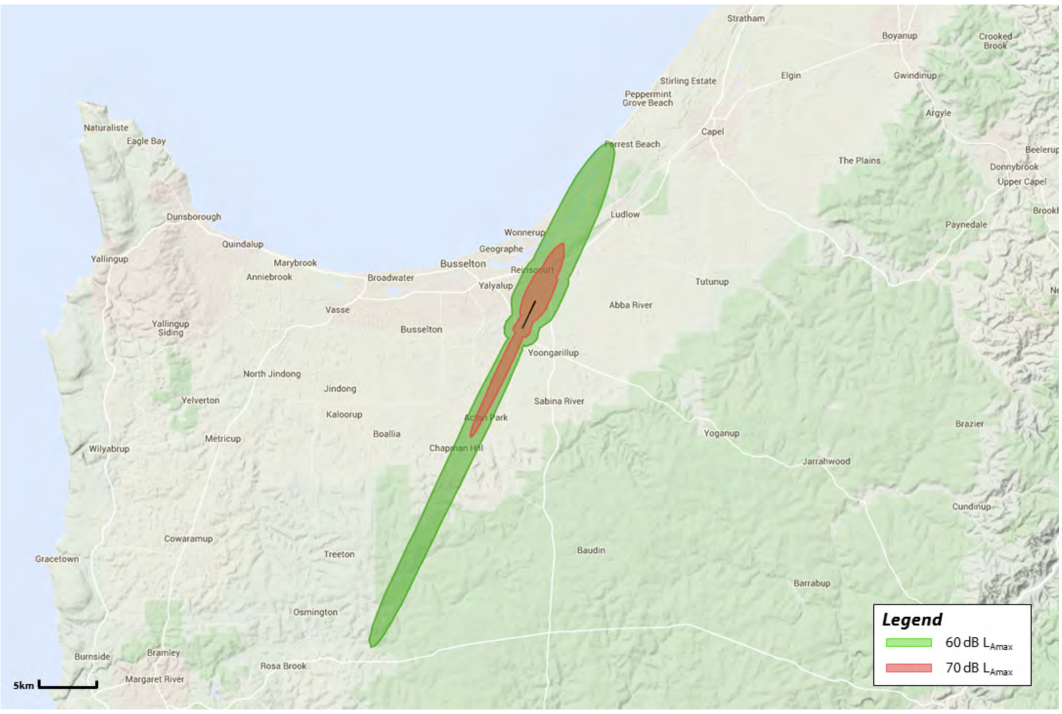


Figure 26: L_{Amax} A320: Runway 03

L_{Amax} A320: Runway 21

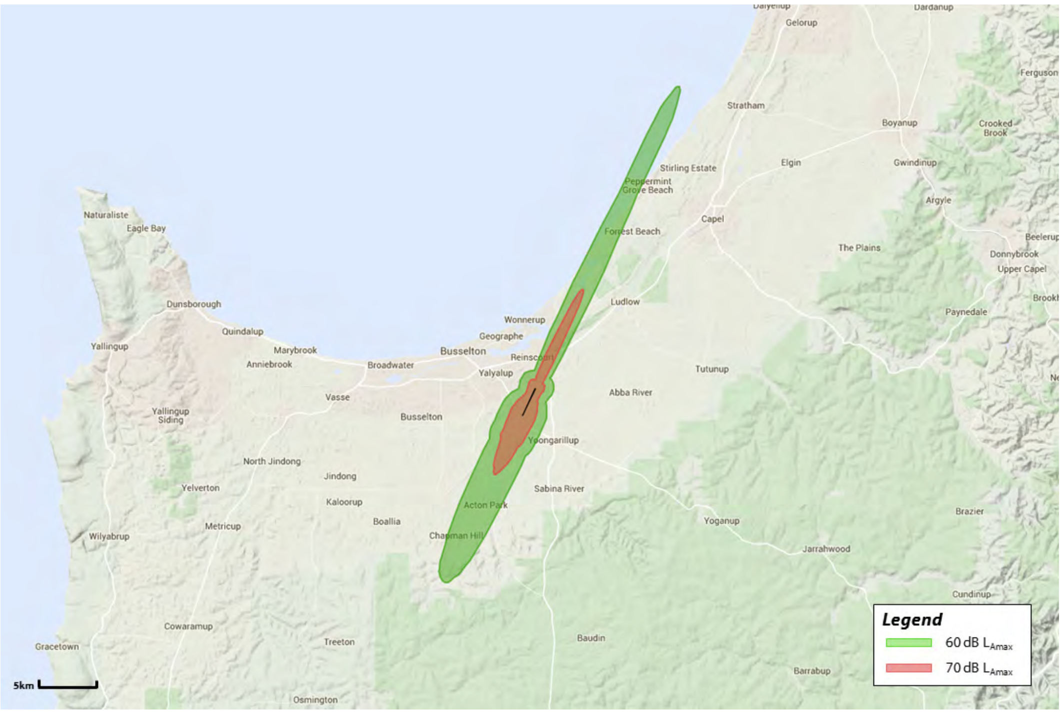


Figure 27: L_{Amax} A320: Runway 21

The 60 dB contour reaches part of Reinscourt. The 70 dB contour does not extend to any populous areas.

L_{Amax} B737-800: Runway 03

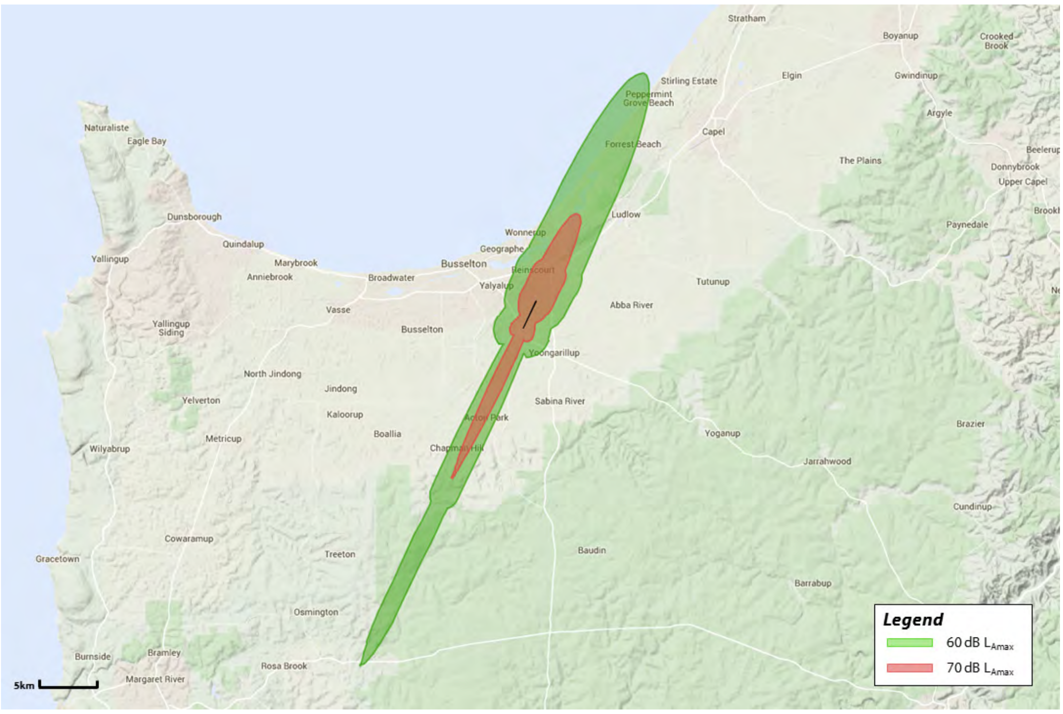


Figure 28: L_{Amax} B737-800: Runway 03

L_{Amax} B737-800: Runway 21

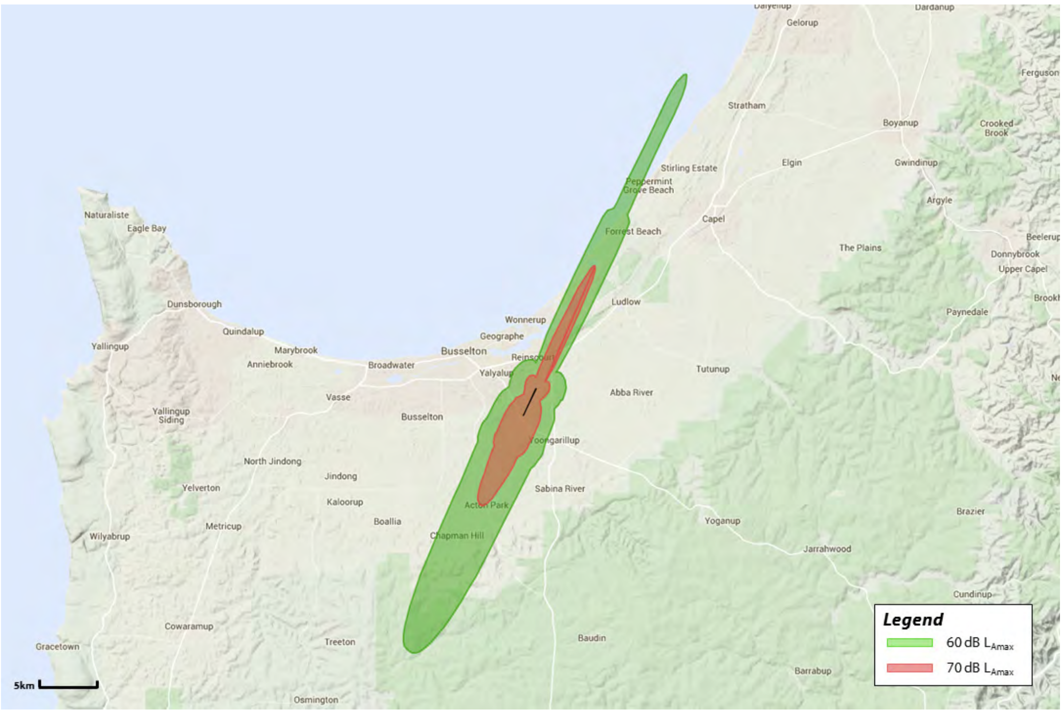


Figure 29: L_{Amax} B737-800: Runway 21

The 60 dB contour reaches Reinscourt and part of Yalyalup. The 70 dB contour reaches part of Reinscourt.

Appendix A: Traffic Forecasts

				2018/19					2022/23					2028/29					2038/39				
				Annual			Day/Night		Annual			Day/Night		Annual			Day/Night		Annual			Day/Night	
Class	Aircraft	INM ID	Destination	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N
CLOSED CHARTER				416	416	832			520	520	1,040			624	624	1,248			624	624	1,248		
	Fokker100	F10065	Perth.	156	208	364	85%	15%	156	208	364	85%	15%	156	208	364	85%	15%	156	208	364	85%	15%
	Fokker100	F10065	Boolgeeda	104	52	156	85%	15%	104	52	156	85%	15%	104	52	156	85%	15%	104	52	156	85%	15%
	Fokker100	F10065	West Angeles	104	104	208	85%	15%	104	104	208	85%	15%	104	104	208	85%	15%	104	104	208	85%	15%
	ATR72	D0328	Perth	52	52	104	85%	15%	156	156	312	85%	15%	260	260	520	85%	15%	260	260	520	85%	15%
RPT				156	156	312			364	364	728			416	416	832			624	624	1,248		
	B737-800	737800	Melbourne	156	156	312	0%	100%	104	104	208	25%	75%	130	130	260	50%	50%	234	234	468	70%	30%
	B737-800NG	737MAX	Melbourne	0	0	0			104	104	208	25%	75%	130	130	260	50%	50%	234	234	468	70%	30%
	B737-800	737800	Sydney	0	0	0			78	78	156	33%	67%	78	78	156	67%	33%	78	78	156	67%	33%
	B737-800NG	737MAX	Sydney	0	0	0			78	78	156	33%	67%	78	78	156	67%	33%	78	78	156	67%	33%
OTHER				6,288	6,288	12,577			6,635	6,635	13,270			6,911	6,911	13,822			7,046	7,046	14,092		
Emergency Services				*377*	*377*	*754*			*413*	*413*	*827*			*413*	*413*	*827*			*413*	*413*	*827*		
	PC12	PC12	Jandakot	364	364	728	70%	30%	400	400	801	70%	30%	400	400	801	70%	30%	400	400	801	70%	30%
	Dornier 328	D0328	Perth	10	10	21	75%	25%	10	10	21	75%	25%	10	10	21	75%	25%	10	10	21	75%	25%
	Piper - PA31	PA31	Perth	3	3	5	100%	0%	3	3	5	100%	0%	3	3	5	100%	0%	3	3	5	100%	0%
Recreation Aviation				*1,508*	*1,508*	*3,016*			*1,583*	*1,583*	*3,167*			*1,583*	*1,583*	*3,167*			*1,583*	*1,583*	*3,167*		
	Evektor Sportstar - LSA	GASEPF	Various (local)	1,508	1,508	3,016	80%	20%	1,583	1,583	3,167	80%	20%	1,583	1,583	3,167	80%	20%	1,583	1,583	3,167	80%	20%
General Aviation				*1,903*	*1,903*	*3,806*			*2,063*	*2,063*	*4,127*			*2,211*	*2,211*	*4,421*			*2,211*	*2,211*	*4,421*		
	Cessna 150,182, 172, 210	CNA172	Various	208	208	416	90%	10%	218	218	437	90%	10%	218	218	437	90%	10%	218	218	437	90%	10%
	Cessna Citation	CNA750	Various, Perth	52	52	104	100%	0%	55	55	109	100%	0%	57	57	115	100%	0%	57	57	115	100%	0%
	Learjet 45	LEAR45	Perth, Sydney, Brisbane, Port Hedland	26	26	52	90%	10%	27	27	55	90%	10%	29	29	57	90%	10%	29	29	57	90%	10%
	Restored Aircraft	DC3	Local (coastline: Margaret River /Bunbury)	312	312	624	100%	0%	328	328	655	100%	0%	328	328	655	100%	0%	328	328	655	100%	0%
	Airvan GA8	CNA208	Local (Busselton Jetty)	1300	1300	2,600	90%	10%	1,430	1,430	2,860	90%	10%	1,573	1,573	3,146	90%	10%	1,573	1,573	3,146	90%	10%
	Bombardier Dash 8	DHC8	Perth, North West WA	5	5	10	80%	20%	5	5	11	80%	20%	6	6	11	80%	20%	6	6	11	80%	20%
Military				*4*	*4*	*8*			*4*	*4*	*8*			*4*	*4*	*8*			*4*	*4*	*8*		
	Pilatus PC9	JPATS	Pearce Airbase (Perth)	4	4	8	100%	0%	4	4	8	100%	0%	4	4	8	100%	0%	4	4	8	100%	0%
Helicopter				*2,496*	*2,496*	*4,992*			*2,571*	*2,571*	*5,142*			*2,699*	*2,699*	*5,399*			*2,834*	*2,834*	*5,669*		
	Eurocopter AS350	EC130	Local (coastline)	728	728	1,456	90%	10%	750	750	1,500	90%	10%	787	787	1,575	90%	10%	827	827	1,653	90%	10%
	Bell 206 JetRanger	EC130	Local	416	416	832	100%	0%	428	428	857	100%	0%	450	450	900	100%	0%	472	472	945	100%	0%
	Bell 206 JetRanger	EC130	Margaret River; Sw region coastline	208	208	416	100%	0%	214	214	428	100%	0%	225	225	450	100%	0%	236	236	472	100%	0%
	Eurocopter AS350	EC130	Margaret River	104	104	208	100%	0%	107	107	214	100%	0%	112	112	225	100%	0%	118	118	236	100%	0%
	Bell 214B	B212	60%local: 40%Perth	520	520	1,040	100%	0%	536	536	1,071	100%	0%	562	562	1,125	100%	0%	590	590	1,181	100%	0%
	Sikorsky Seaking S61N	S61	60%local: 40%Perth	520	520	1,040	100%	0%	536	536	1,071	100%	0%	562	562	1,125	100%	0%	590	590	1,181	100%	0%
TOTAL				6,860	6,860	13,721			7,519	7,519	15,038			7,951	7,951	15,902			8,294	8,294	16,588		

Add 52 annual daytime training circuits for the EVEKTOR SPORTSTAR for all years

Appendix B: N-Contour results (alternative zoom)

N65 Contours: 2018/19

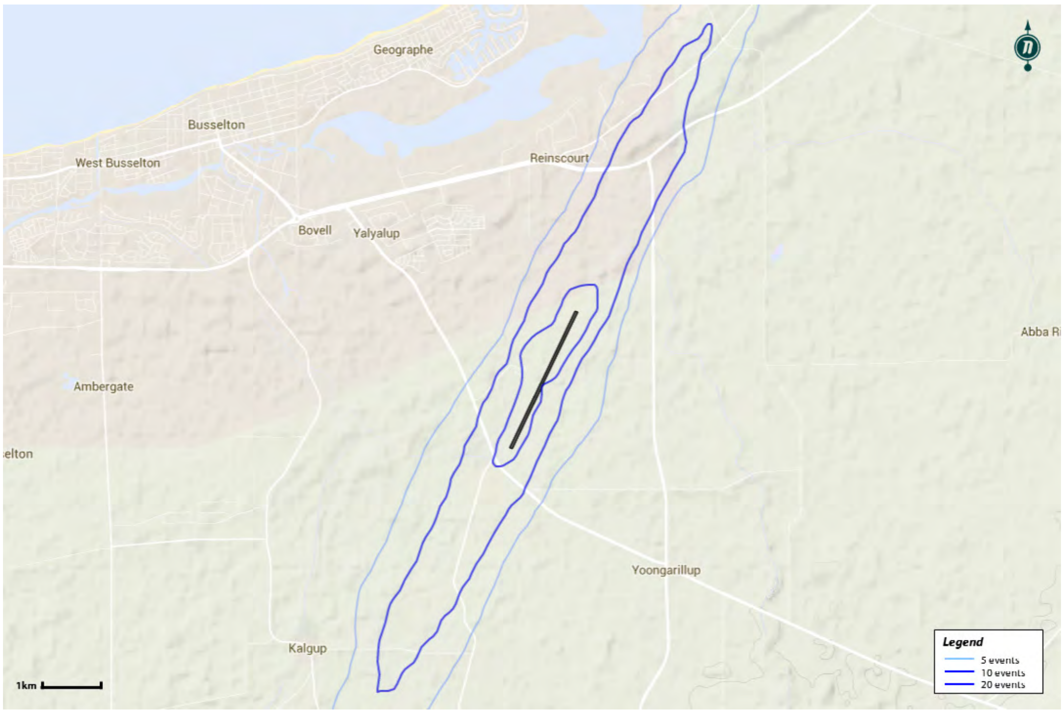


Figure 30: N65 Contours: 2018/19

N70 Contours: 2018/19

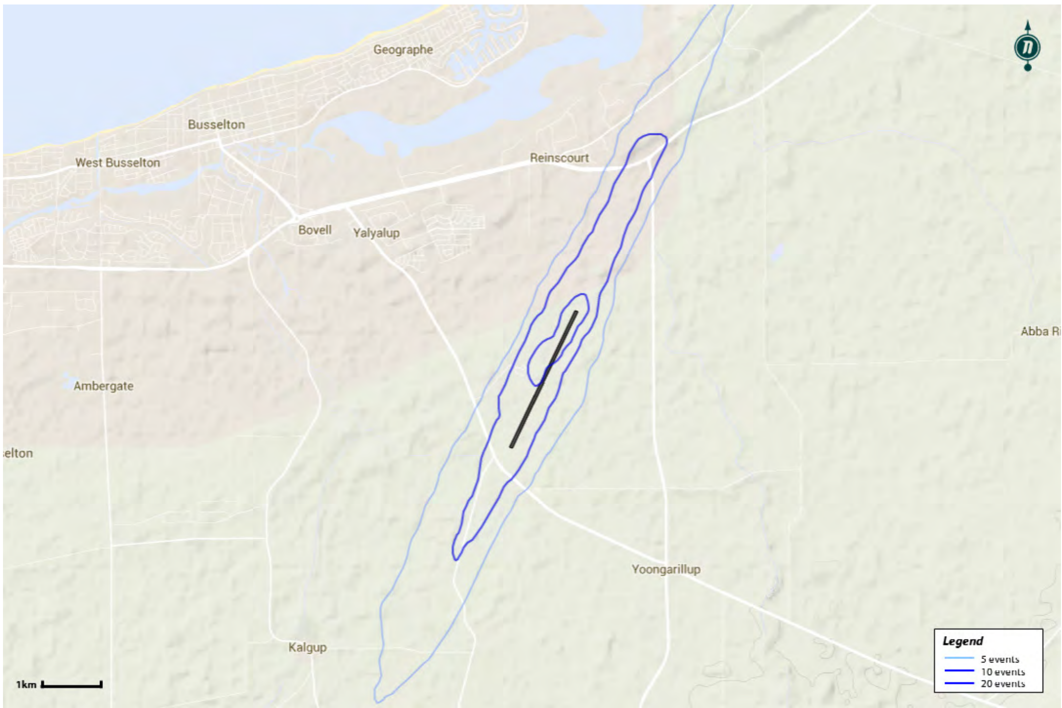


Figure 31: N70 Contours: 2018/19

N75 Contours: 2018/19

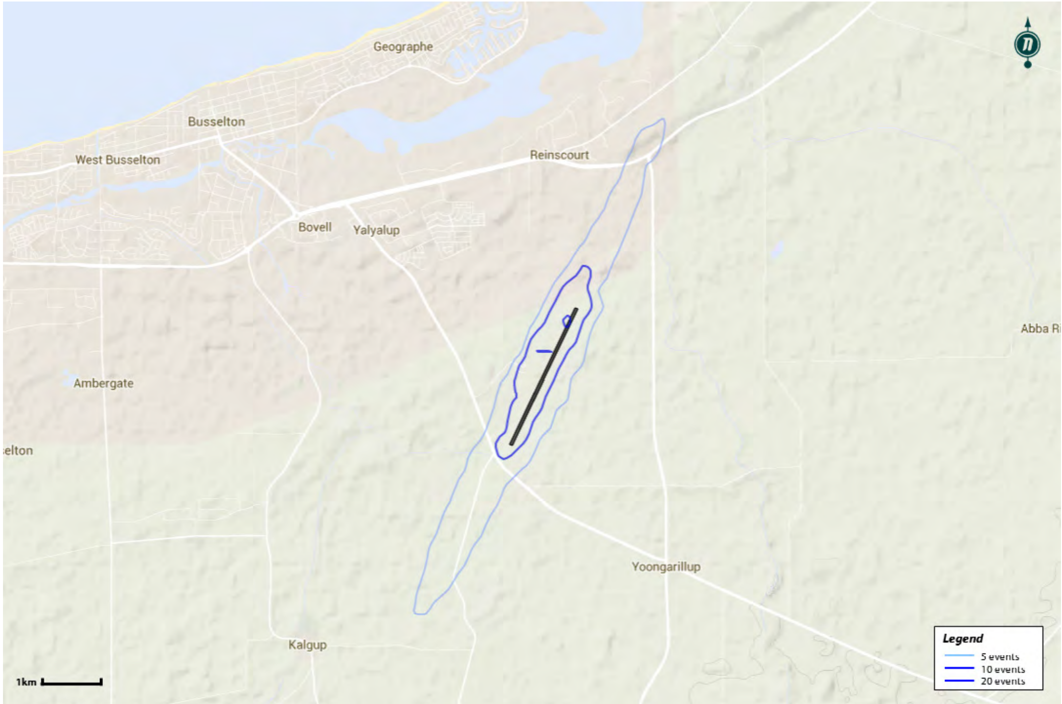


Figure 32: N75 Contours: 2018/19

N80 Contours: 2018/19

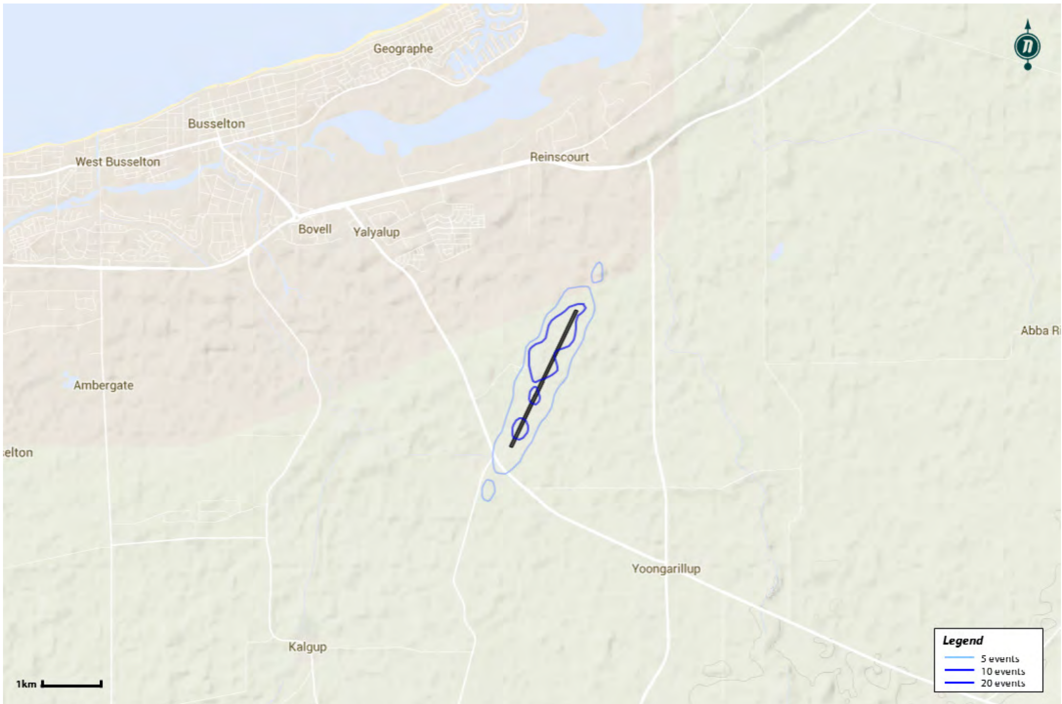


Figure 33: N80 Contours: 2018/19

N65 Contours: 2022/23

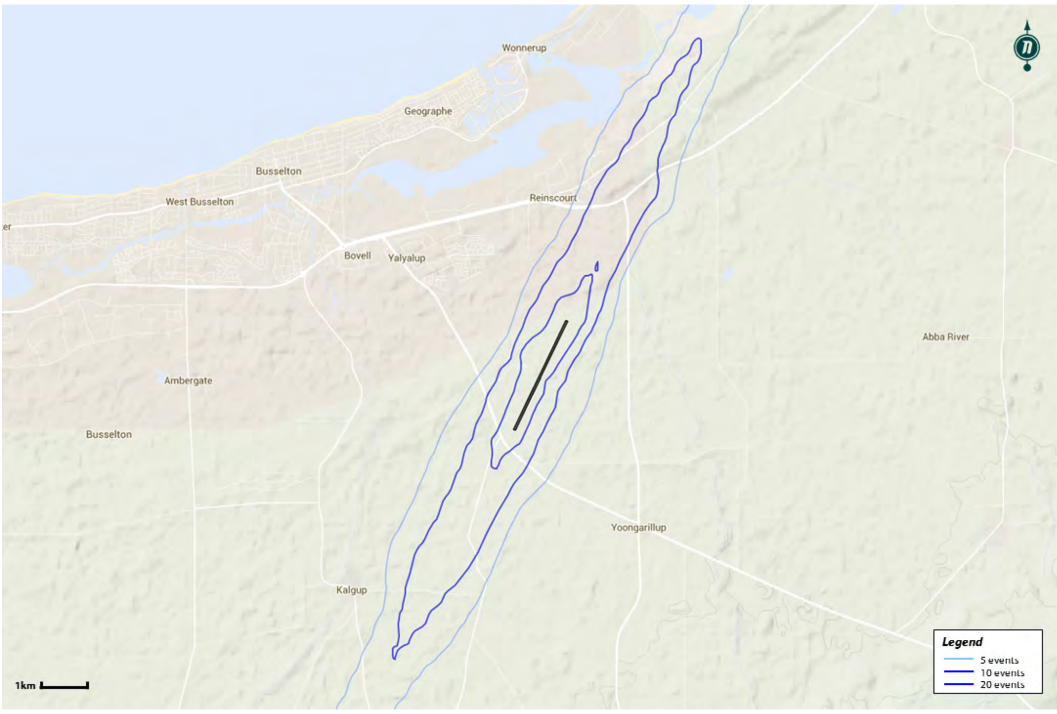


Figure 34: N65 Contours: 2022/23

N70 Contours: 2022/23

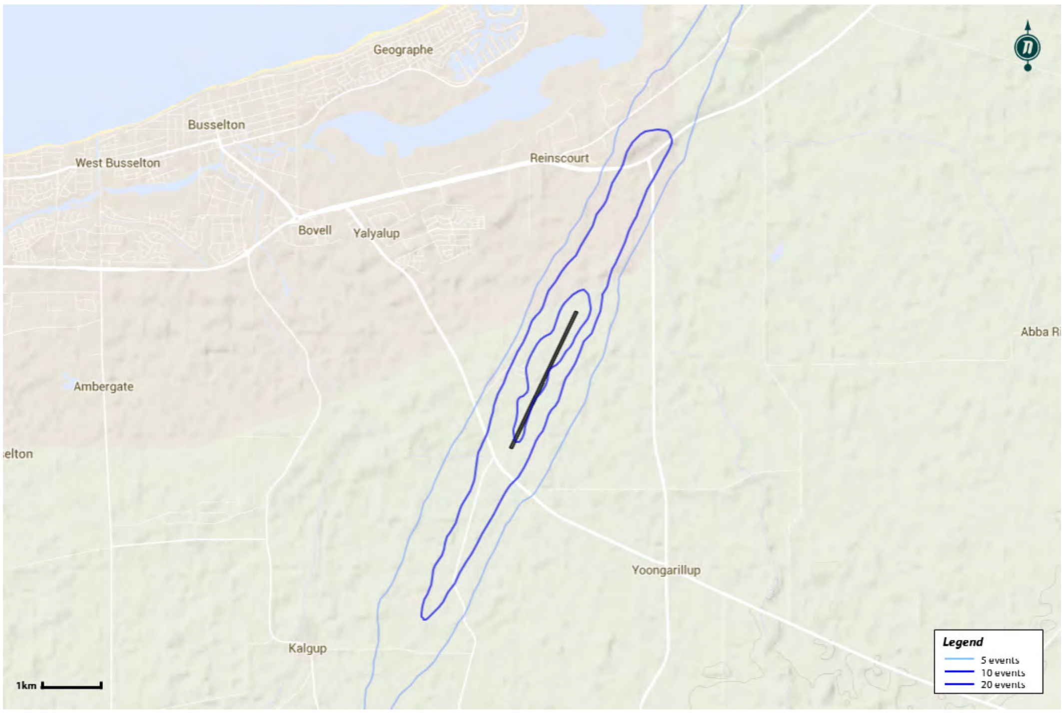


Figure 35: N70 Contours: 2022/23

N75 Contours: 2022/23

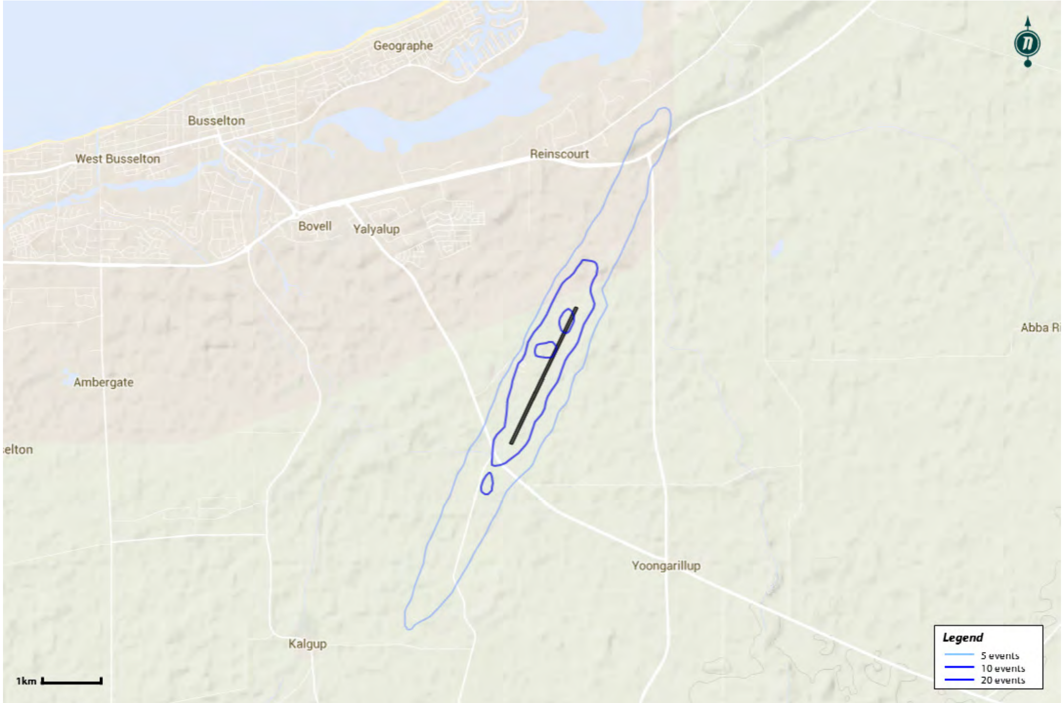


Figure 36: N75 Contours: 2022/23

N80 Contours: 2022/23

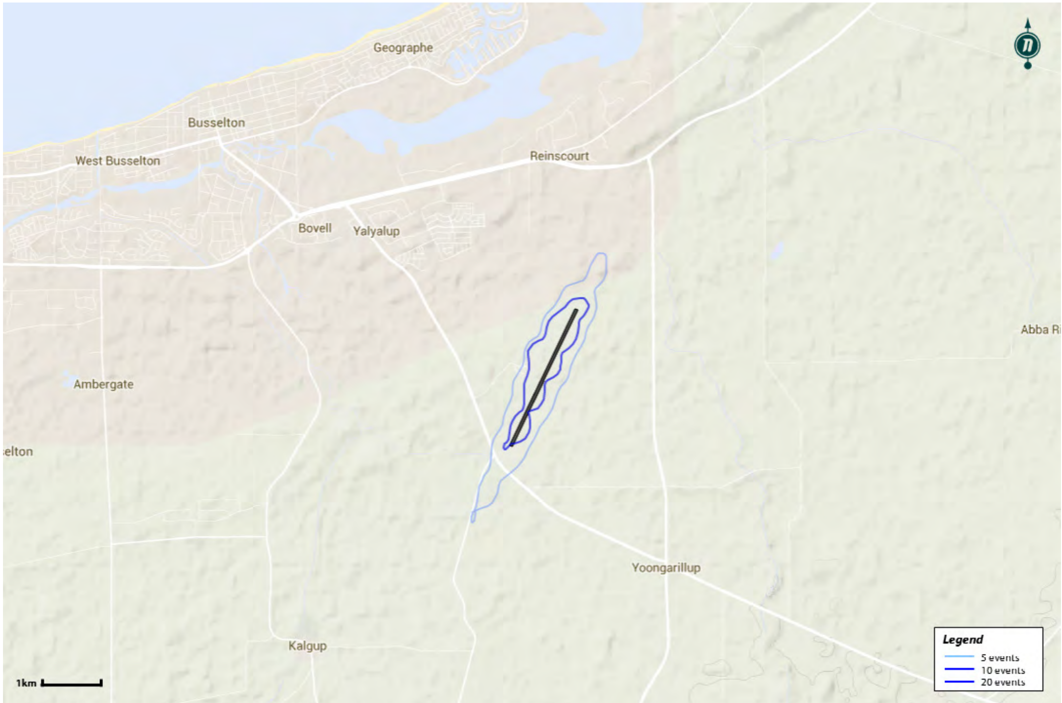


Figure 37: N80 Contours: 2022/23

N65 Contours: 2028/29

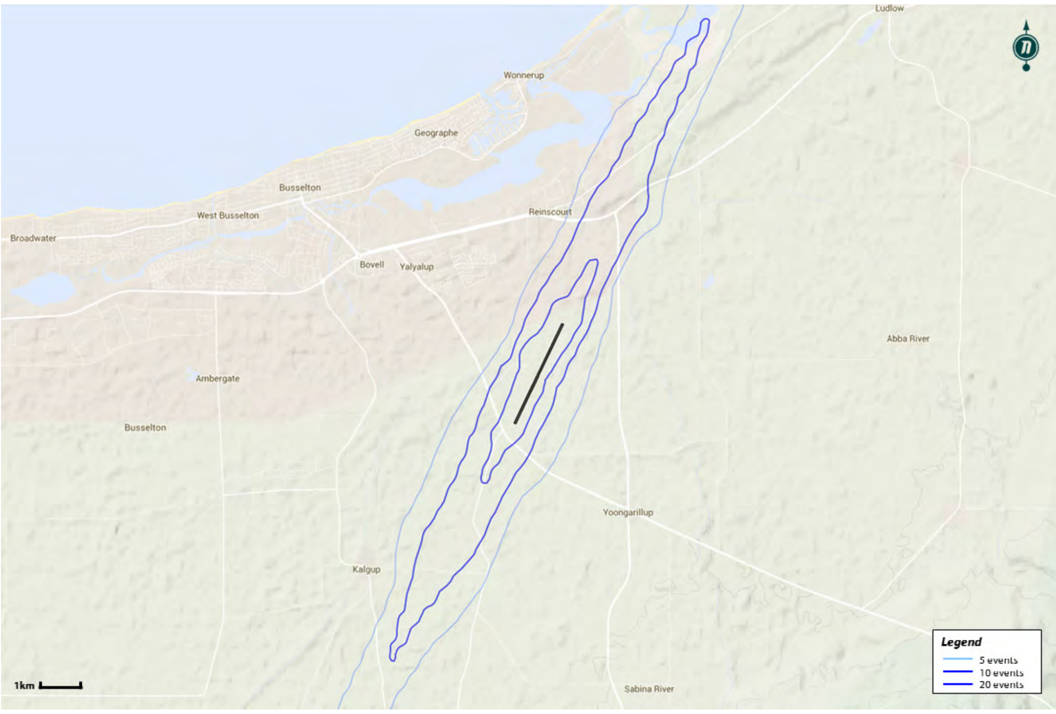


Figure 38: N65 Contours: 2028/29

N70 Contours: 2028/29

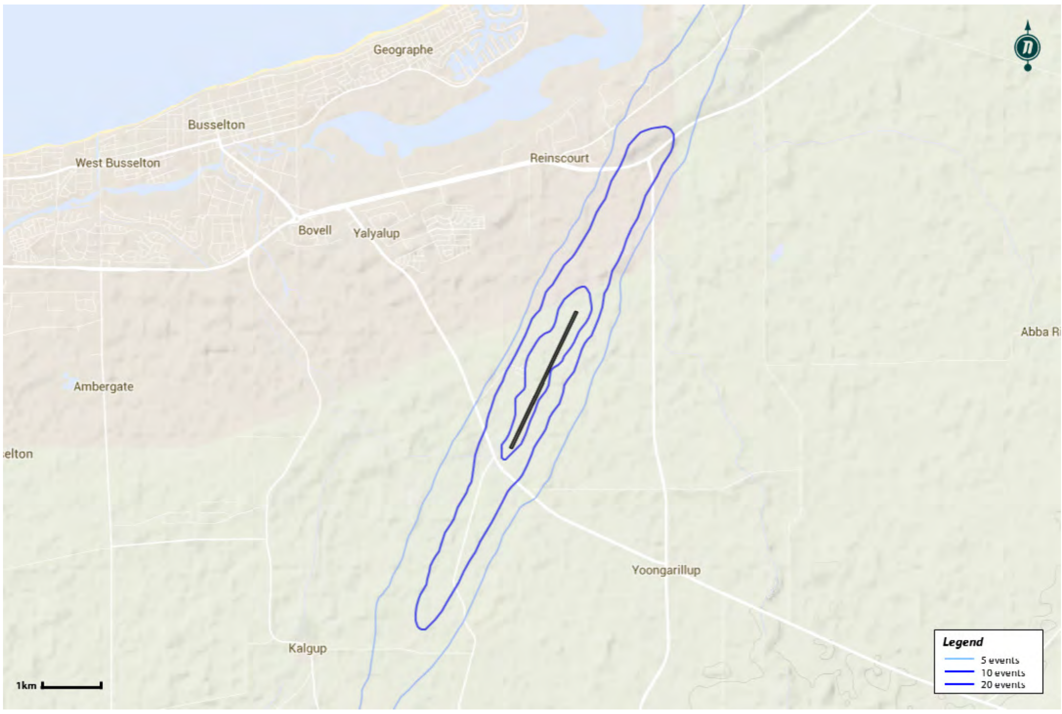


Figure 39: N70 Contours: 2028/29

N75 Contours: 2028/29

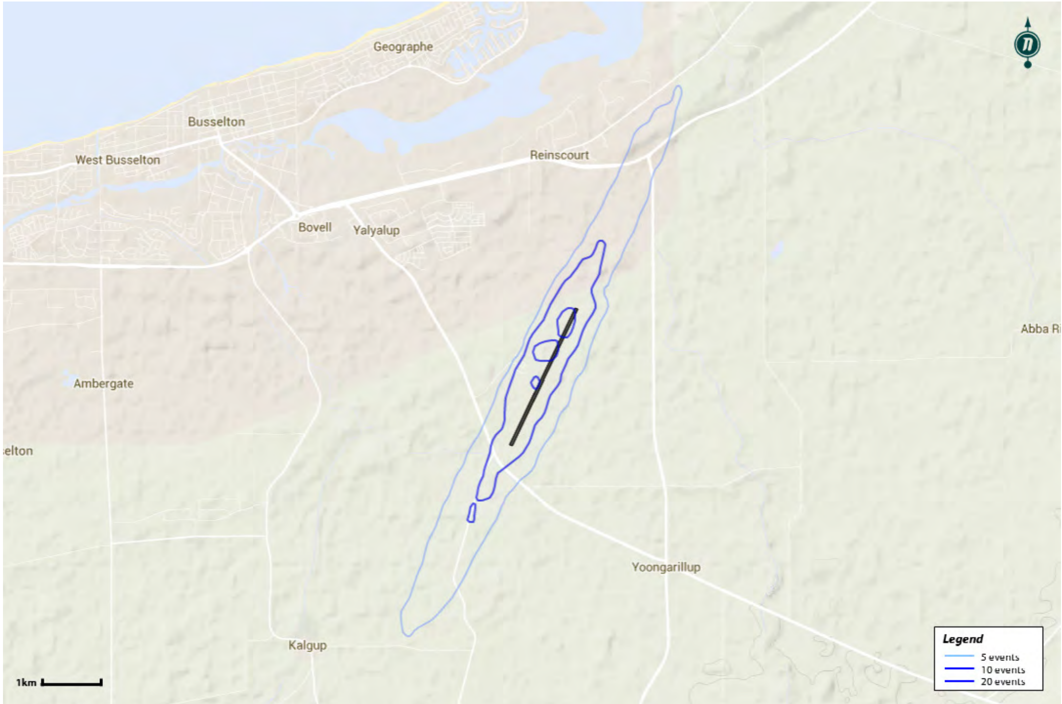


Figure 40: N75 Contours: 2028/29

N80 Contours: 2028/29

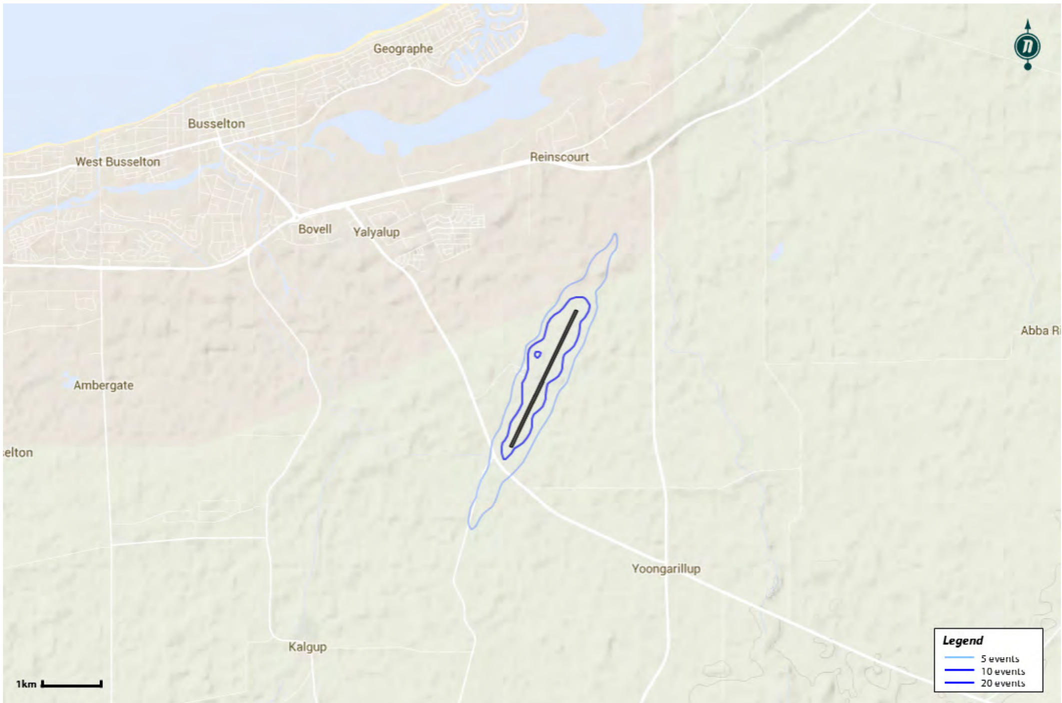


Figure 41: N80 Contours: 2028/29

N65 Contours: 2038/39

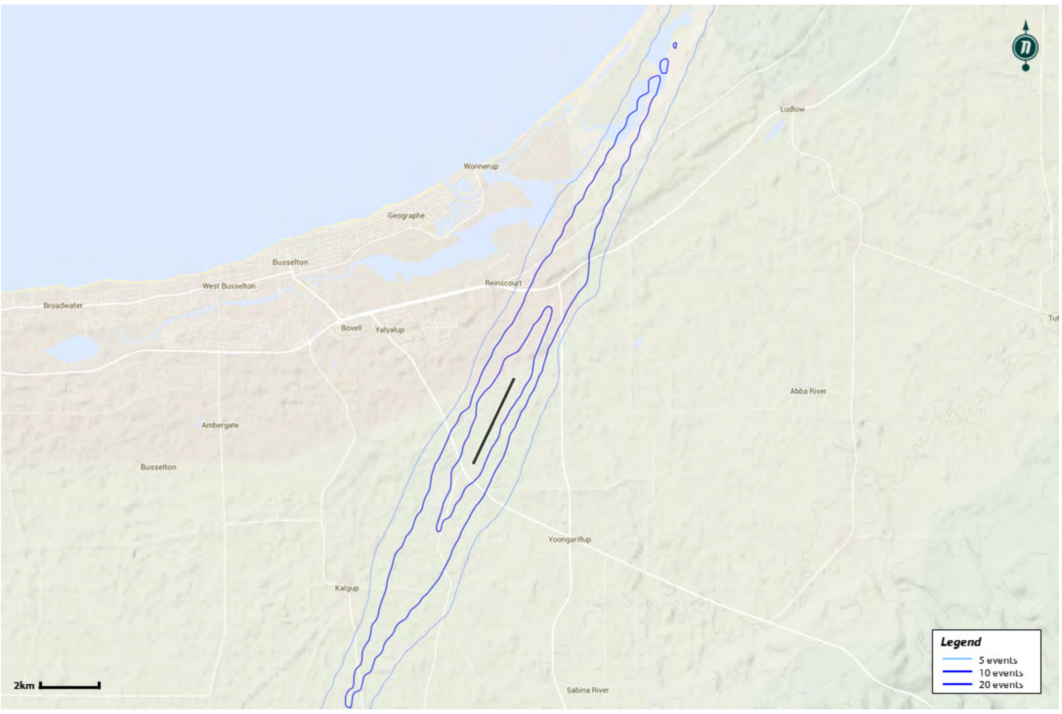


Figure 42: N65 Contours: 2038/39

N70 Contours: 2038/39

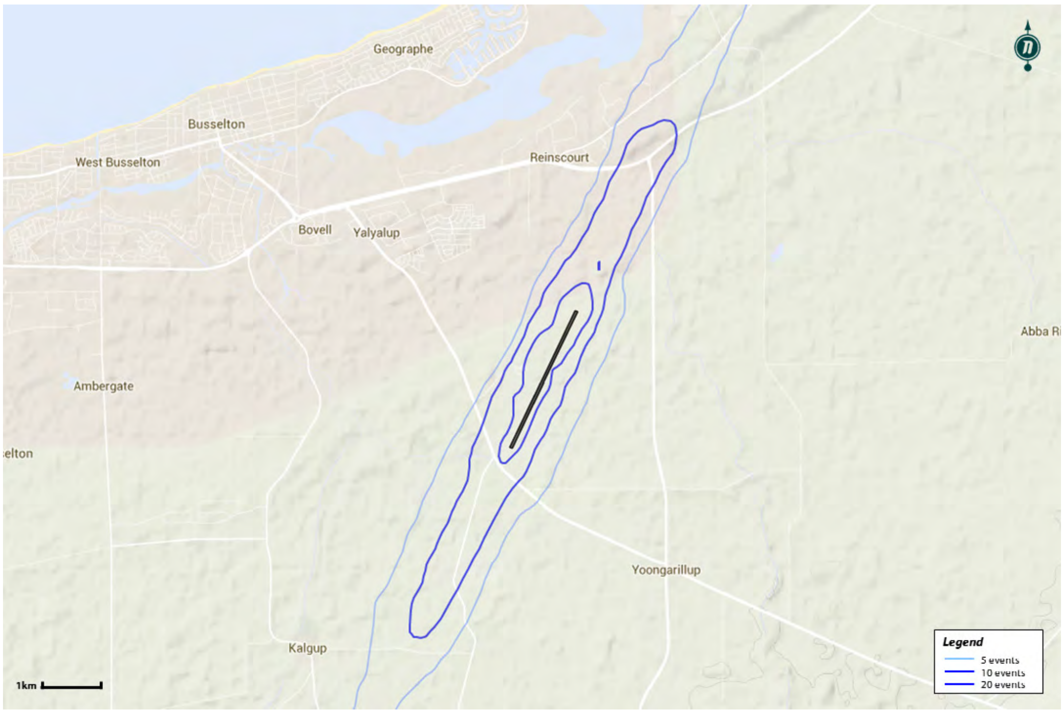


Figure 43: N70 Contours: 2038/39

N75 Contours: 2038/39

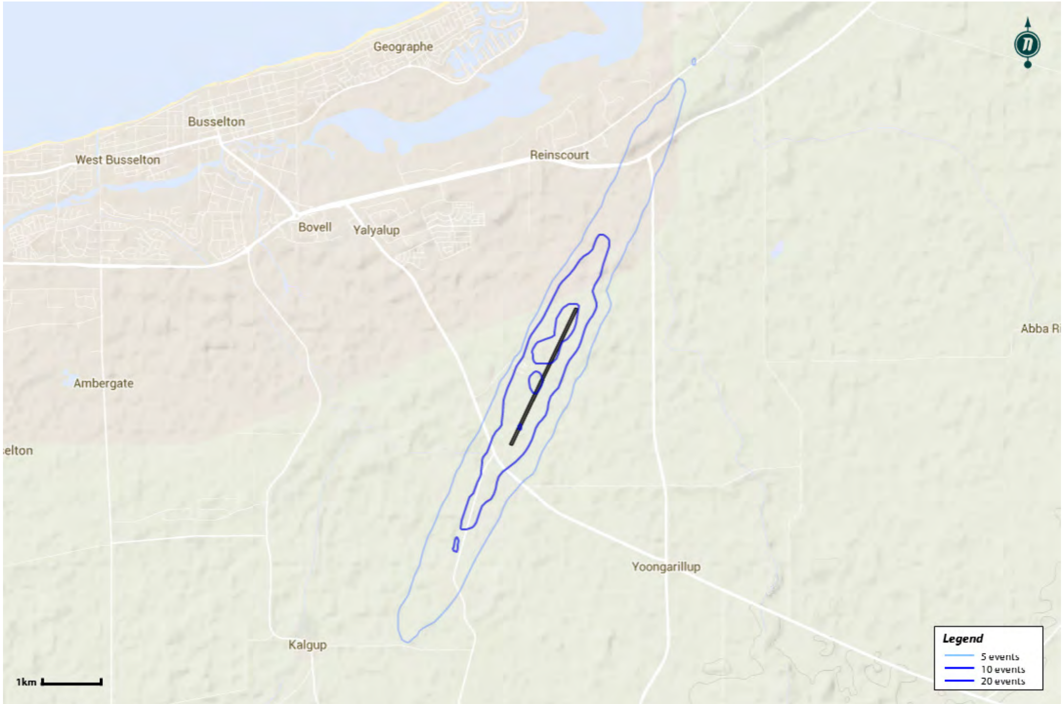


Figure 44: N75 Contours: 2038/39

N80 Contours: 2038/39

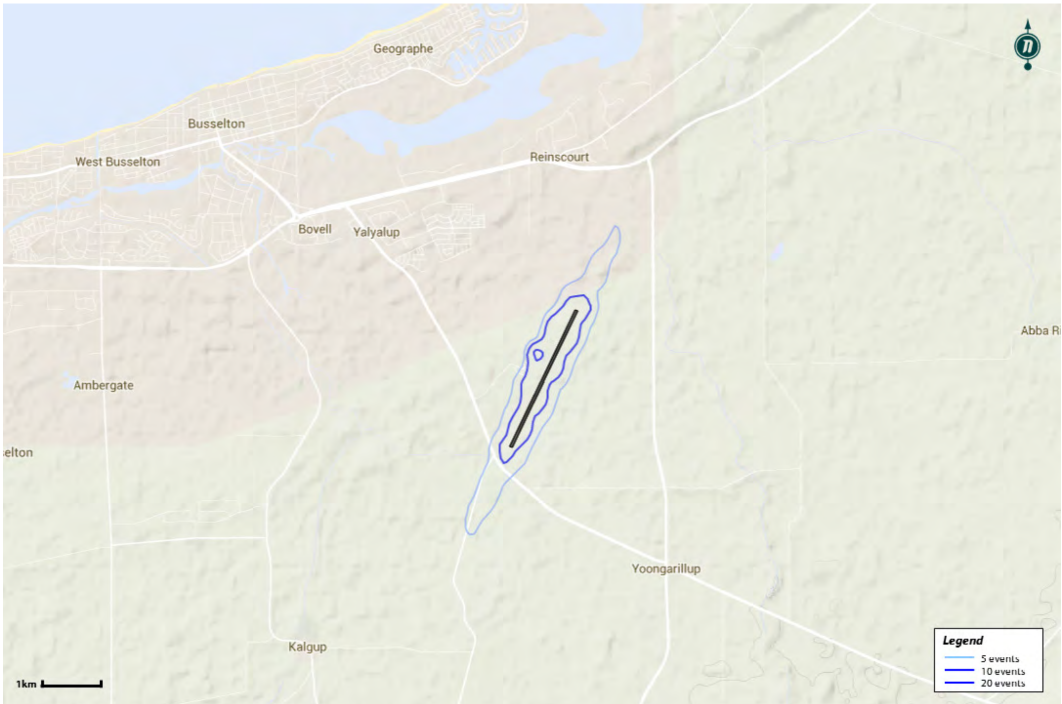
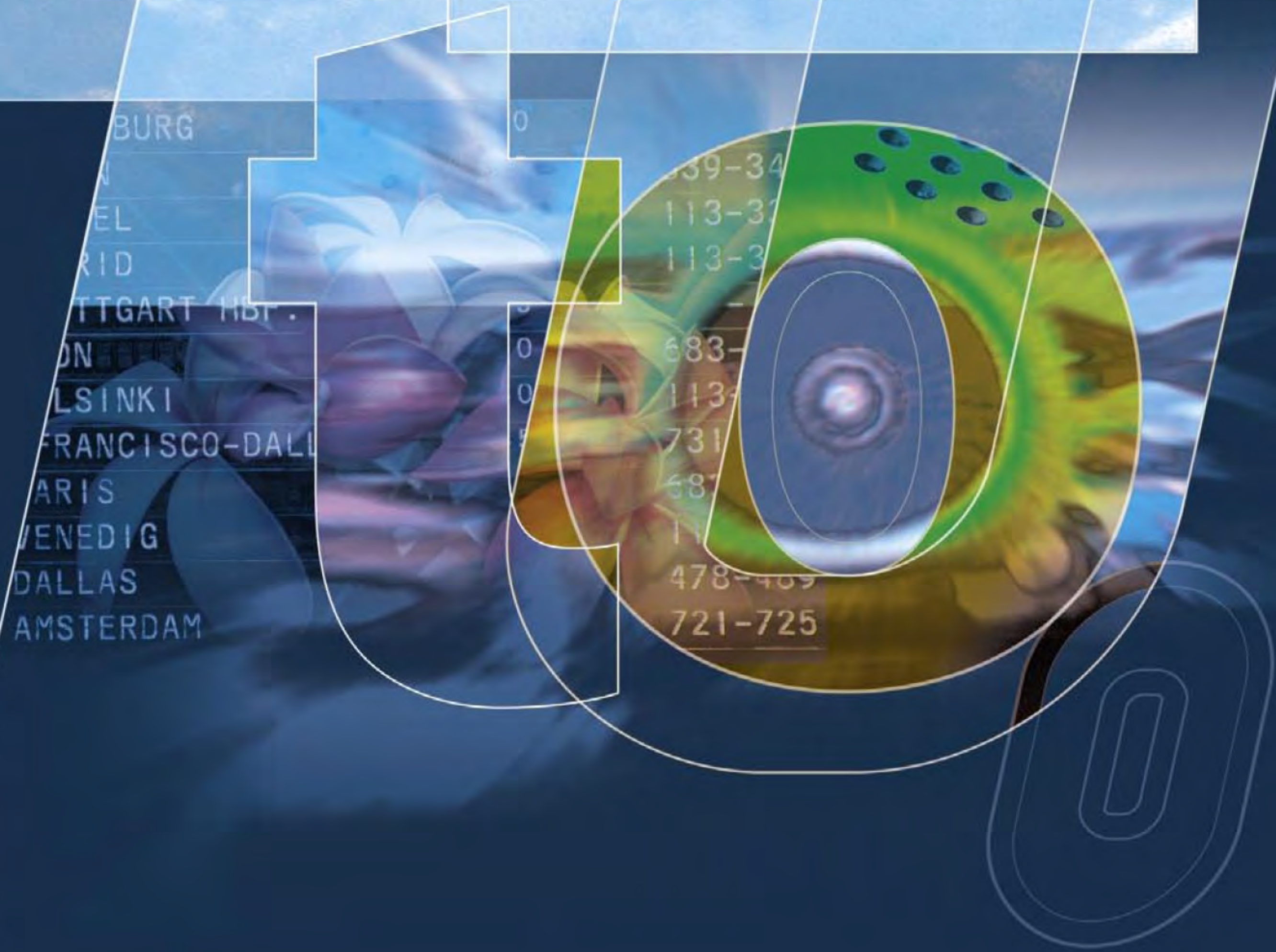


Figure 45: N80 Contours: 2038/39

May 2016

Noise Modelling Report - Freighters

Busselton Margaret River Regional Airport



Noise Modelling Report - Freighters

Busselton Margaret River Regional Airport

Prepared for

City of Busselton

2 Southern Drive

Busselton

Western Australia 6280

Prepared by

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North Melbourne, May 2016

Table of contents

1 Introduction

The City of Busselton (COB) require the preparation of an additional Australian Noise Exposure Concept (ANEC), noise modelling and noise contour maps for Busselton Margaret River Regional Airport (BMRRA) with the addition of B737-300 freighters. COB have awarded this work to To70 Aviation (Australia) Pty Ltd (To70). This report provides the results of the noise modelling work as well as details of the inputs and assumptions used in the noise modelling work. The report includes updates based on the peer review of the report and INM model provided to BMRRA in December 2015 which was performed by GHD.

1.1 Background

The COB has been awarded funding of $55.9m for the redevelopment of BMRA. This redevelopment is aimed at providing the necessary airport infrastructure to allow for interstate air services. Since the preparation of the ANECs and noise contours by To70 in 2014, some of the design characteristics of the airside infrastructure (runway, aprons and taxiways) have changed and need to be remodelled. Additionally, the COB wishes to review the aircraft traffic forecast, design aircraft and model inputs previously developed to ensure that they are still considered appropriate for the BMRRA redevelopment.

BMRRA is currently regulated by the Office of the Environmental Protection Authority (OEPA) in accordance with Ministerial Statement 1009. The Statement 1009 and preceding statements (399, 825, 878, 887 and 901) determine the environmental conditions in which the BMRRA operates, including the requirement to produce an approved Noise Management Plan. As part of the redevelopment project, environmental approvals from the Minister for Environment; Heritage and OEPA are required. The COB will therefore need to prepare an environmental review document for an Assessment on Proponent Information (Category A) (API – Category A) under the Environmental Protection Act (1986). The API – Category A review document will need to include the ANEC, N65 and N70 Contours prepared for the development project infrastructure and future (projected) aircraft operations. As a result of the changes in infrastructure, possible changes to traffic forecasts and the statutory requirements placed on the COB, To70 was engaged to review the original noise modelling assumptions, aircraft traffic forecasting and provide updated Noise Contours (ANEC, N-contours and L_{Amax}).

1.2 Scope and deliverables

To70 have been contracted by COB to conduct additional noise modelling for BMRRA, specifically revision of the ANEC, N-contours and L_{Amax} contours. The scope of work required a review of previous noise modelling undertaken by To70 in order to reproduce noise contours reflective of updated changes to infrastructure and traffic forecasts. Consequently, the following outputs have been produced;

- Remodelled standard ANEC for the Busselton Margaret River Regional Airport Master Plan 2015 (first draft 30 Oct 2015) aerodrome infrastructure / operations projected to twenty (20) years, that is; 2038/39.
- N65, N70, N75 and N80 contours for the following scenarios:
  - Master Plan (2015) aerodrome infrastructure / operations 2018/19
  - Master Plan (2015) aerodrome infrastructure / operations 2022/23
  - Master Plan (2015) aerodrome infrastructure / operations 2028/29
  - Master Plan (2015) aerodrome infrastructure / operations 2038/39
- Single event L_{Amax} contours
  - Fokker 100 (approach & departure for 03 and 21).
  - A320 (approach & departure for 03 and 21).
  - B737-800 (approach & departure for 03 and 21).

- B737-300 freighter aircraft (approach & departure for 03 and 21).

2 Inputs and assumptions

This section provides detail on the inputs and assumptions used for the noise calculations. These have been discussed and verified by COB. Forecasts and aircraft type assumptions are based on COB input, which are based on the State Government business case. This is to maintain consistency between the business case and environment approvals for the project, which is based on the business case. Further modelling may be completed on completion of the project and commencement of interstate operations.

2.1 General settings

The Federal Aviation Administration's (FAA) Integrated Noise Model (INM) version 7.0d is used for the calculation of the ANEC and other contours. INM 7.0d is the latest version of this software package.

Weather

INM requires the input of weather conditions observed at the airport. Average weather settings are derived from the Bureau of Meteorology (BoM) for Nov-14 to Oct-15. The annual average temperature and pressure at BMRRA weather station (station 009603) is used as input for this INM study.

The weather settings are as follows:

Temperature	19.6 degrees C
Pressure	764.22 mm-Hg
Relative humidity	59.3 %
Headwind	14.8 km/h (default INM value)

Terrain data has been downloaded from the NASA website. The Shuttle Radar Topography Missions digital topographic data has been converted to an INM compatible format and imported into the INM study in the World Geodetic System 1984 (WGS84) coordinates. The images below show the terrain in original and INM format.

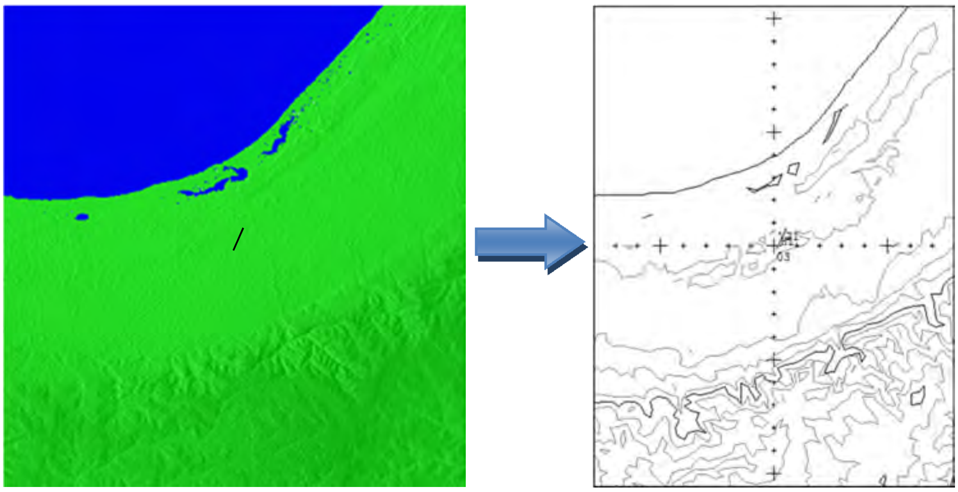

Figure 1 - Terrain

Aerodrome Reference Point

The BMRRA Aerodrome Reference Point (ARP) is shown below.

Description	Latitude	Longitude	Elevation (m)
ARP	-33.692500	115.395278	17

Table 1 – BMRRA ARP

Runway coordinates

To70 has modelled the revised/masterplan layout (Busselton Margaret River Regional Airport Master Plan General Arrangement - 2A), which will include a 360m extension to runway end 21 and 300m extension to runway end 03 (and not the 480m extension to the south previously modelled). There are no displaced thresholds. Details of the runway are below.

Description	Latitude	Longitude	Length × Width (m)	Elevation (m)
Runway 03	-33.697328	115.396362	2520 × 45	17
Runway 21	-33.677320	115.407818		17

Table 2 – Runway end coordinates

Helipad

The study uses the existing helipad location.

Description	Latitude	Longitude	Elevation (m)
Helipad	-33.683626	115.401024	17

Table 3 – Helipad coordinates

2.2 Traffic

Forecast

Updated aircraft traffic forecasts for the noise modelling have been provided by COB to To70 in the form of a spreadsheet containing annual movements by year. The forecast data is based on the State Government Business Case forecasts to maintain consistency between the business case and environmental approvals for the redevelopment project. The detailed aircraft traffic forecasts (including day/night split) can be found in Appendix A of this document. Note that the day/night split have been determined by COB based on existing operations.

Class	Aircraft Type	2018/19	2022/23	2028/29	2038/39
RPT	Narrow Body Jet	**6**	**14**	**16**	**24**
Closed Charter	Regional Jet	**20**	**20**	**20**	**20**
	Turboprop	**2**	**6**	**10**	**10**
Freight	Narrow Body Jet	**4**	**6**	**6**	**8**
Other		**242**	**255**	**266**	**271**

Table 4 – Traffic forecast summary (weekly movements)

Aircraft and substitutes

Aircraft types used in the noise modelling have been specified by the Council and is based on historic traffic and traffic forecasts. To70 has modelled the forecast aircraft using the INM equivalents detailed below.

Class	Forecast Aircraft	INM ACFT ID
RPT	**B737-800**	**737800**
	B737-800NG	**737MAX**
Closed Charter	**Fokker 100**	**F10065**
	ATR72	**DO328**
Used in L_{Amax} only	*A320*	*A320-211*

Table 5 – RPT/Charter aircraft types

.

Class	Forecast Aircraft	INM ACFT ID
Recreation	Evektor Sportstar - L S A	GASEPF
Emergency Services	PC12	CNA208
	Dornier 328	DO328
	Piper - PA31	PA31
General	Cessna 180,182, 172, 210	CNA172
	Cessna Citation	CNA55B
	Learjet 45	LEAR35
	Restored Aircraft (i.e Douglas C47; De Havilland DH-82A)	DC3
	Airvan GA8	CNA206
	Bombardier Dash 8	DHC8
Military	Pilatus PC9	JPATS

Table 6 – Other aircraft types

Class	Forecast Aircraft	INM ACFT ID
Helicopter	Eurocopter AS350	EC130
	Squirrel A350	EC130
	Bell 206 JetRanger	EC130
	Bell 214B	B212
	Sikorsky Seaking S61N	S61

Table 7 – Helicopter types

Class	Forecast Aircraft	INM ACFT ID
Freight	B737-300	737300

Table 8 - Freighter aircraft types

Where substitute aircraft are required for the INM modelling, To70 have utilised the suggested aircraft types within the INM tool. For aircraft where a substitute is not available such as the 737MAX, these have been substituted using a surrogate methodology which is acknowledged and accepted by Airservices Australia (McLeod & Latimore, 2014)[1].

It is worthy to note that some helicopter noise data does not include Effective Perceived Noise data (EPNL) and this is due to the limitations of INM. Helicopter types with EPNL data have been selected to model helicopters with one or two engines as appropriate. The Cessna Citation has been modelled as the Cessna Citation 550 Bravo, as it was noted by the COB as being the most common version of the Citation that operates at BMRRA. The INM GASFP aircraft is a suitable representative of low performance, single engine aircraft and is therefore has been selected to model the Evektor Sportstar. The PC9 is modelled using the JPATS as this represents the military version of the PC9.

[1] McLeod, I., & Latimore, M. (2014). Challenges in Producing an Australian Noise Exposure Forecast. Retrieved April 5th, 2016, from http://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p607.pdf

2.3 Operational

Track Usage

This section shows the origin and destination of RPT, FIFO and freight aircraft routes that services BMRRA. Figure 2 below illustrates the schematic route and does not reflect the actual flight tracks. Flight destinations can be found in the forecast data in Appendix A. The destination of freighter aircraft is planned to be Singapore, however this may have several interim stops.

Figure 2 – Origin/Destinations for RPT and FIFO flights

The table below outlines the assumptions for the stage lengths used in the INM model, based on destination provided by the COB.

Stage Lengths	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Distance (nm)	<500	501 - 1000	1001-1500	1501-2500	2501-3500
Destination	ALH, EPR, GET, KGI	KTA, PHE, ZNE	ADL, ASP	BNE, CGK, DPS, MEL, SYD	KUL, SIN

Table 9 - Stage length assumptions

The B737-300 aircraft is a Stage 4 aircraft and not suitable for the planned Stage 5 flights to Singapore, however, high level discussions held between COB and freight forwarding companies suggested that the B737-300 will be a suitable aircraft for the trip to Singapore (CoB). The freighters to Singapore will be modelled as Stage 4 instead of Stage 5, as this is the maximum stage available in INM for this aircraft type. It has been assumed that the aircraft would make multiple stops on route to the destination in line with many freighter operations.

RPT, and closed charter movements are assigned to tracks based on shortest distance to origin/destination and is represented in the following table.

Origin/Destination	Runway 03 track		Runway 21 track	
	Arrivals	Departures	Arrivals	Departures
Perth, Boolgeeda, West Angeles, Jandakot	WEST	STROUT	GNSSG	NORTH
Melbourne, Sydney	GNSSA	EAST	GNSSG	EAST

Table 10 – Track allocation (RPT and closed charter)

Other traffic (such as general aviation) is assigned to tracks as follows, as per previous noise modelling. As an assumption, freight tracks to Singapore are assigned to the RPT and Charter tracks to the north.

Traffic	Runway	Operation	Track	Percentage
General Aviation / Recreation Aviation / Emergency Services	03	A	GNSSB	50%
			WEST	50%
		D	WEST	33%
			EAST	33%
			STROUT	33%
	21	A	GNSSE	33%
			WEST	33%
			EAST	33%
		D	EAST	33%
			NORTH	33%
			STROUT	33%
Military	03	A	GNSSB	100%
		D	STROUT	100%
	21	A	GNSSE	100%
		D	STROUT	100%
Helicopter	Helipad	A	HIN	100%
		D	OUT	100%

Table 11 – Track allocation (other)

Traffic	Runway	Operation	Track	Percentage
Freight	03	A	WEST	100%
		D	STROUT	100%
	21	A	GNSSG	100%
		D	NORTH	100%

Table 12 - Track allocation (freighters)

Runway usage

To70 has assumed the following runway use based on information provided by COB based on current operations:

Runway 03	40%
Runway 21	60%

Tracks

This section shows the arrival, departure and circuit tracks that have been assigned for each runway end. Tracks are based on the existing model produced by To70 in 2014, which were developed with a local expert and have been adjusted to ensure they are flyable by the aircraft that are assigned to them. An assumption has been made for RPT operations conducting a 270 degree turn to the east for departures, this is based on the separation requirements between RPT and GA aircraft types. In addition to this, an assumption has been made on the separation requirements flown by jet and non-jet RPT aircraft due to performance characteristics and the ability for smaller aircraft to conduct a smaller radius turn.

The spread of the GNSS arrival tracks are assumed to be 0.1 NM as the aircraft operating at BRMA will conduct an RNAV approach, which is a very narrow approach path when compared to visual approach.

Figure 3 – Runway 03 flight tracks

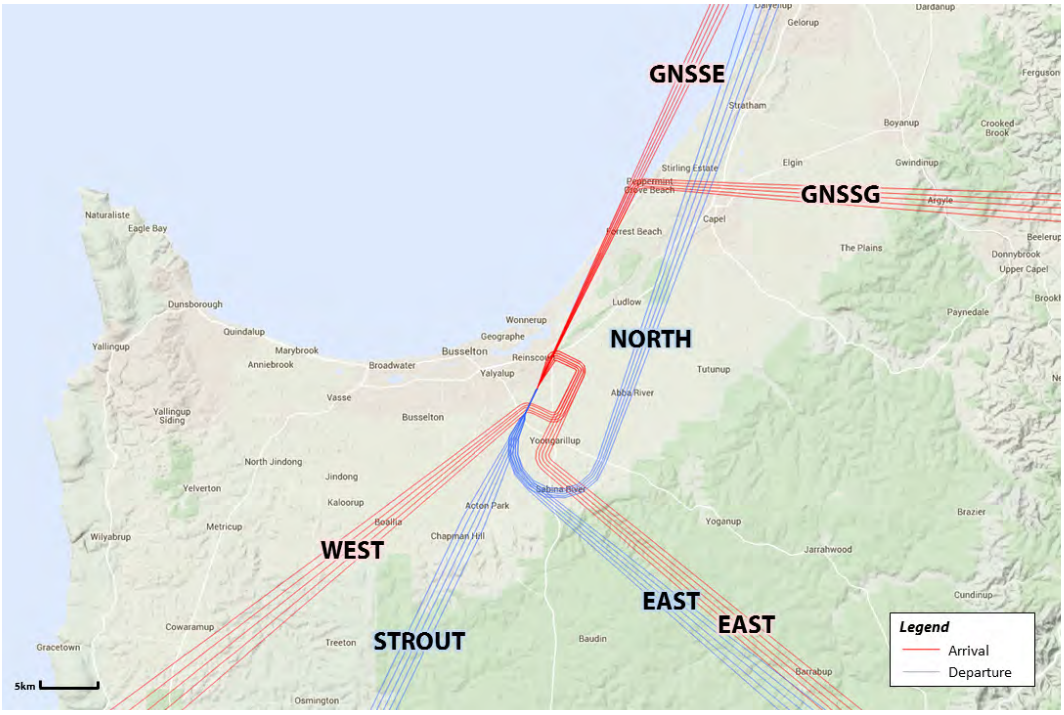

Figure 4 – Runway 21 flight tracks

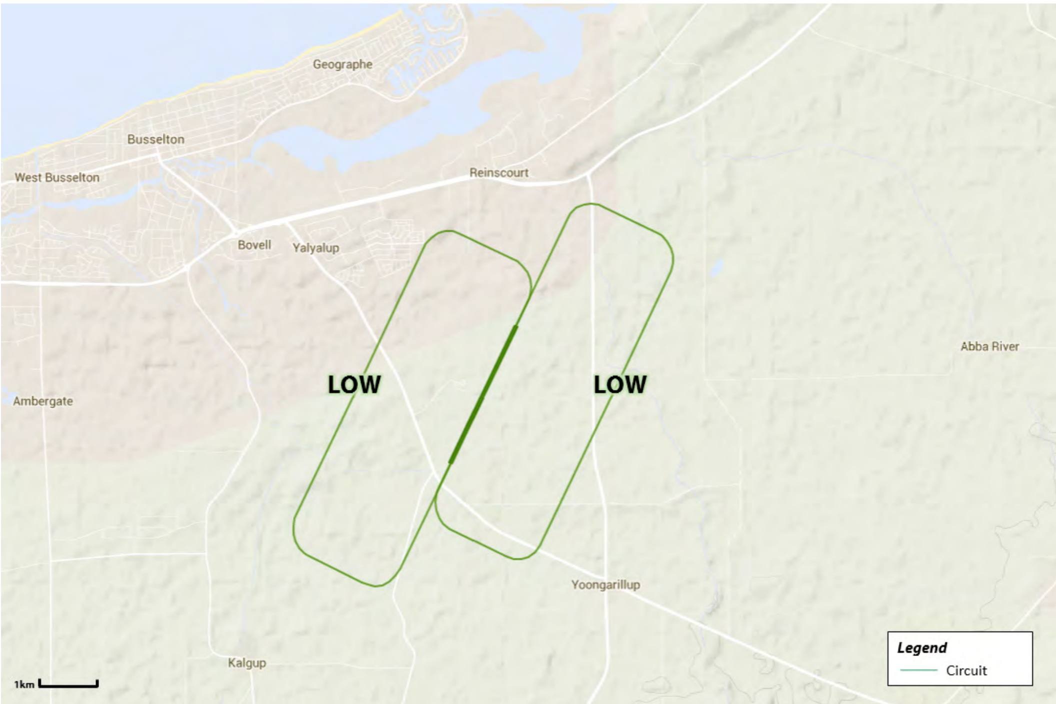

Figure 5 – Circuit flight tracks

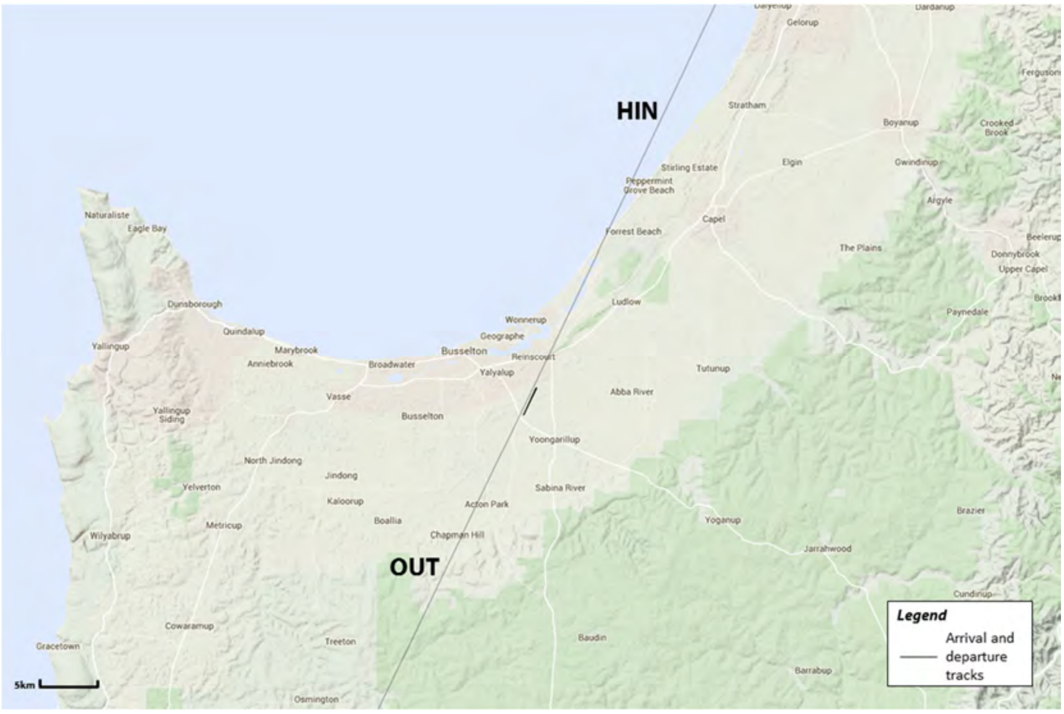

Figure 6 – Helicopter flight tracks

2.4 Items amended in model

The following settings are amended following the GHD peer review:

- Addition of B737 Freighters based on forecast provided by COB
- Amended Fokker 100 charter forecast based on COB input
- GNSS approach track spread are reduced to 0.1NM from the previous spread of 0.3-0.5NM
- The High performance GA tracks (MED) are removed as they are not required in the INM model
- Cessna Citation remodelled as Cessna Citation 550 Bravo based on input from COB
- The INM model uses a recursive grid with a refinement of 12 rather than 10 as used previously
- The bank-angle effects are removed
- The profile ID of the 737MAX is renamed from STANDARD to USER

3 Results

In this section, we present the results of the noise modelling and describe the metrics used to generate the contours. To70 has generated the following contours:

- ANEC for 2038/39
- N-Contours for 2018/19, 2022/23, 2028/29 and 2038/39
- Single Event L_{Amax} contours for A320, B737-800, Fokker 100 and B737-300

3.1 ANEC Results

ANEC contours are used to quantify the noise impact of airport development scenarios. These maps are based on assumptions about the size, shape and demand of aircraft and airport operations, and can relate to the distant future. Because the concepts and scenarios are hypothetical and may never occur, the maps produced have no official status for land-use planning purposes. The ANEC uses the Effective Perceived Noise Level (EPNL) which applies a weighting to account for the fact that the human ear is less sensitive to low audio frequencies.

ANEC contours are generated using the Airservices Australia approved Integrated Noise Model (INM). The INM combines factors such as aircraft noise signatures, distance from source of the noise, duration and frequency of events to calculate the average noise levels on the ground at any point around a given airport. These noise levels are expressed as contours overlaid over an aerial map of the airport and surrounding areas where aircraft noise is likely to be relevant for planning. ANEC contours do not refer to normal decibel levels, but are the result of "averaged annual day" data inputs. ANEC contours also take into account the cumulative nature of noise exposure, for example, night time operations are weighted higher than day time operations to reflect peoples increased sensitivity to aircraft noise at night.

ANEC 2038/39

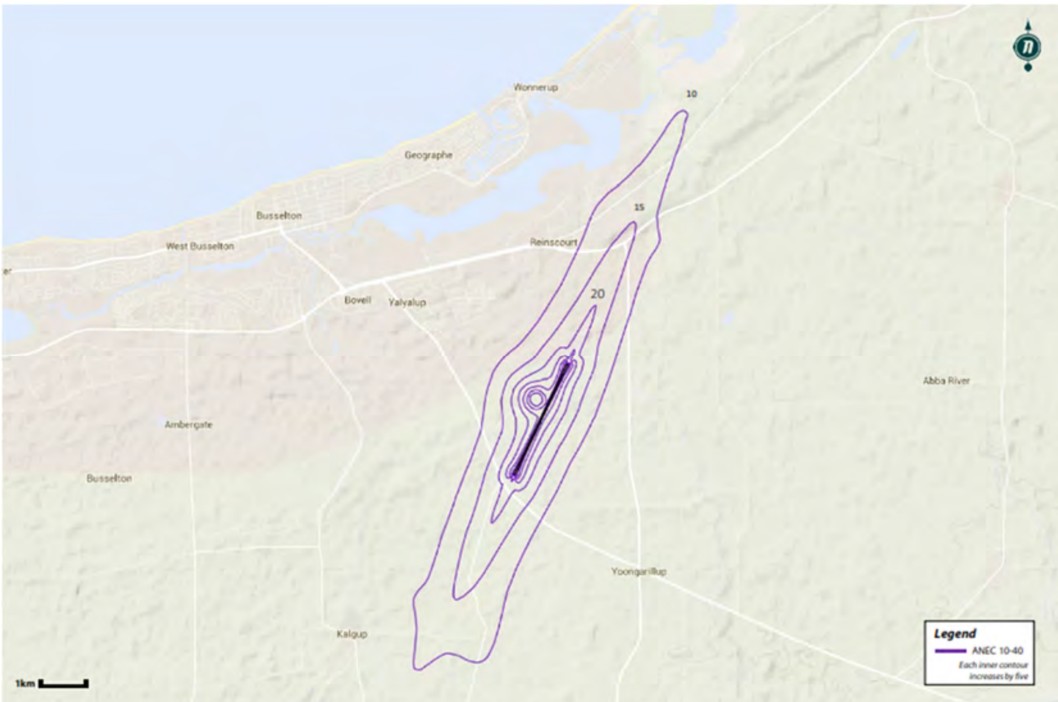

Figure 7: ANEC 2038/39

Observations

The ANEC for the BMRRA is a result of consultation with the Council and expert knowledge and judgement about aircraft noise, operations and modelling. It uses robust, accurate and defensible assumptions which have come about from detailed knowledge of the operations at BMRRA.

The ANEC 20 contour does not extend to any populous areas and for this reason ANEC 10 has been visualised for informational purposes. As specified in AS2021, buildings (residences) which fall within ANEF 20 are permissible and as such would apply for ANEC 10. In that regard, there is no major impact to dwellings both north and south of the runway that are situated within the ANEC.

3.2 N-Contour results

To complement the ANEF maps, Noise-Above contours (N contours) charts show the number of aircraft noise events per day exceeding specific noise levels. N contours can be used to provide information both on past and planned aircraft operations. This helps communities and individuals to visualise noise impact in specific areas as it takes a person's reaction to noise out of the equation. Further information including a detailed technical explanation of N contours can be found on the DIRD website at; https://infrastructure.gov.au/aviation/environmental/transparent_noise/expanding/4.aspx.

See next page.

N65 Contours: 2018/19

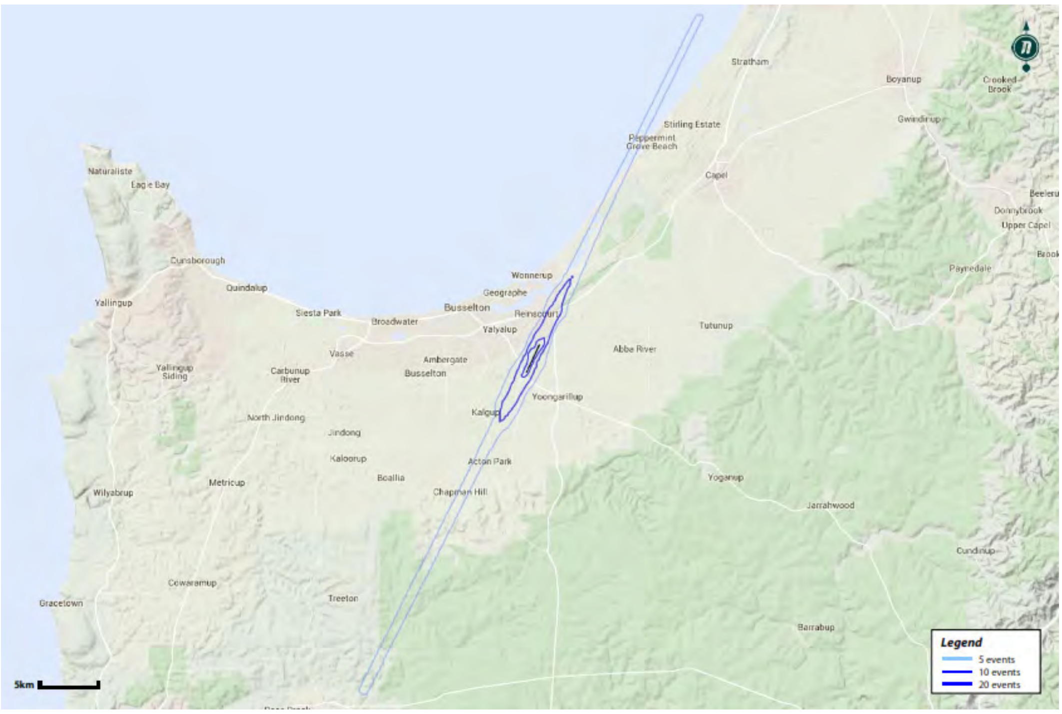

Figure 8: N65 Contours: 2018/19

N70 Contours: 2018/19

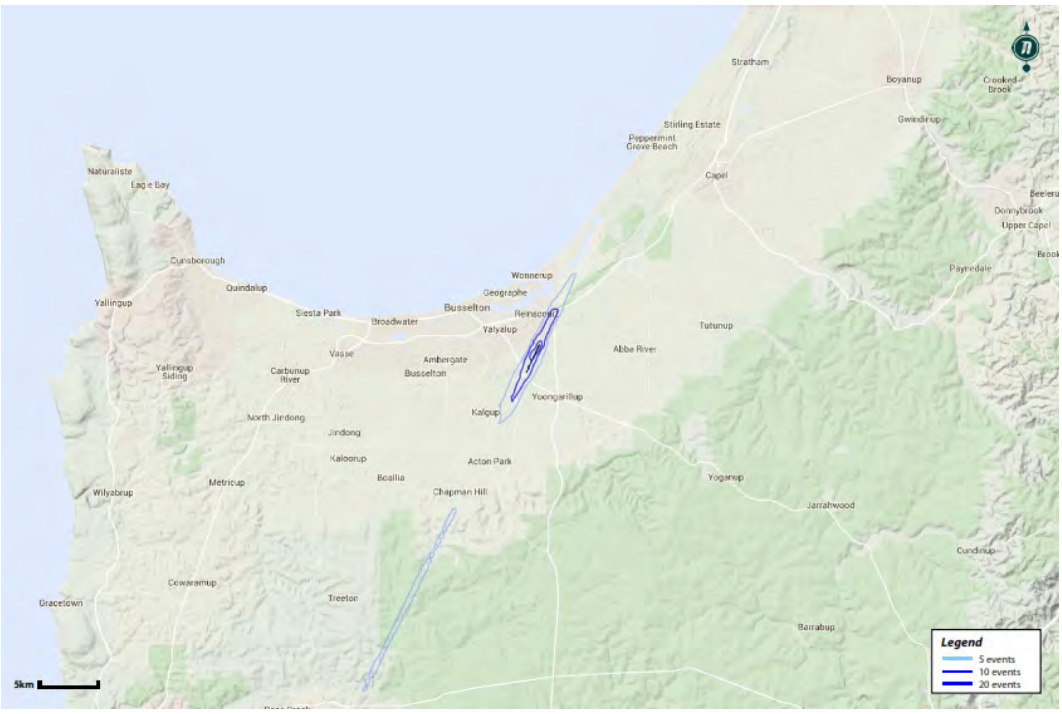

Figure 9: N70 Contours: 2018/19

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2018/19

Figure 10: N75 Contours: 2018/19

N80 Contours: 2018/19

Figure 11: N80 Contours: 2018/19

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2022/23

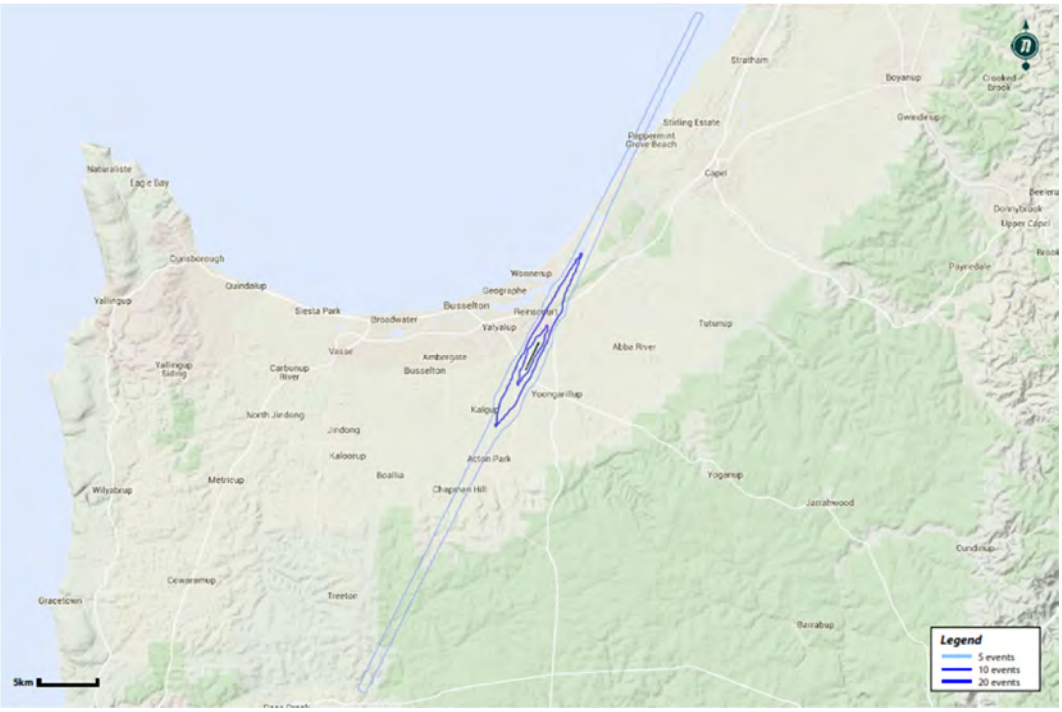

Figure 12: N65 Contours: 2022/23

N70 Contours: 2022/23

Figure 13: N70 Contours: 2022/23

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2022/23

Figure 14: N75 Contours: 2022/23

N80 Contours: 2022/23

Figure 15: N80 Contours: 2022/23

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2028/29

Figure 16: N65 Contours: 2028/29

N70 Contours: 2028/29

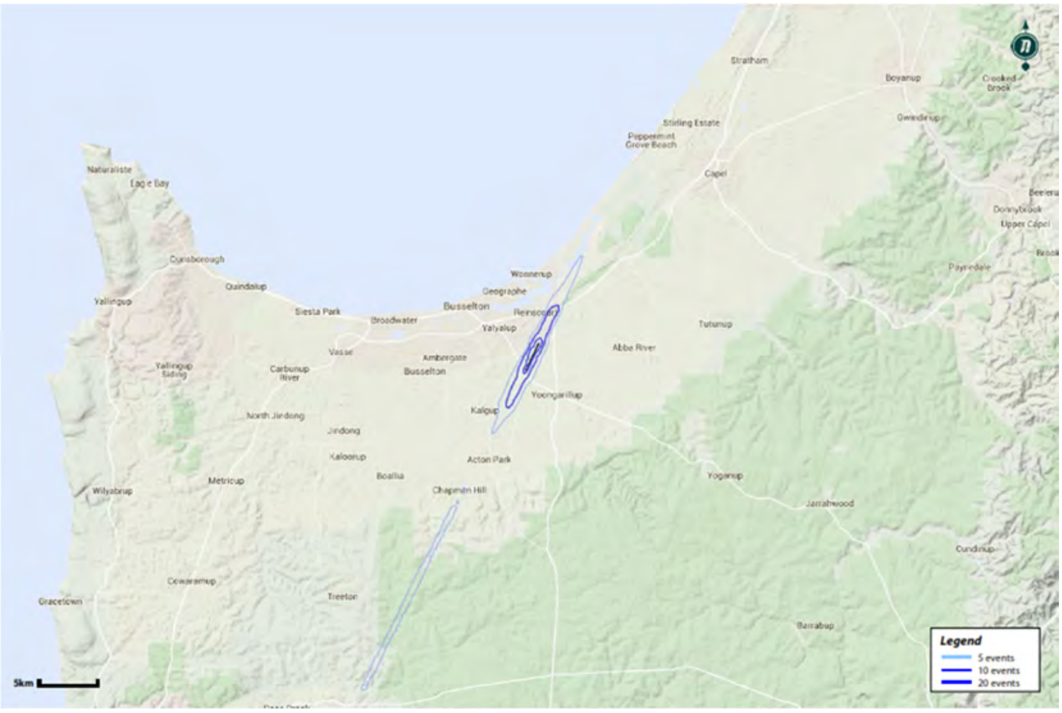

Figure 17: N70 Contours: 2028/29

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2028/29

Figure 18: N75 Contours: 2028/29

N80 Contours: 2028/29

Figure 19: N80 Contours: 2028/29

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

N65 Contours: 2038/39

Figure 20: N65 Contours: 2038/39

N70 Contours: 2038/39

Figure 21: N70 Contours: 2038/39

Similar to ANEC findings, both the N65 and N70 10 event noise contours do not extend to any populous areas.

N75 Contours: 2038/39

Figure 22: N75 Contours: 2038/39

N80 Contours: 2038/39

Figure 23: N80 Contours: 2038/39

Similar to ANEC findings, both the N75 and N80 10 event noise contours do not extend to any populous areas.

3.3 Single event contour results

L_{Amax} Single event noise levels are a basic metric and are the maximum noise exposure (in A-weighted Decibels) during an overflight. They should only be used for indicative purposes. The figures below show the maximum noise exposure for a single arrival and departure for each runway direction using indicative straight in/straight out flight paths.

See next page.

L_{Amax} F100: Runway 03

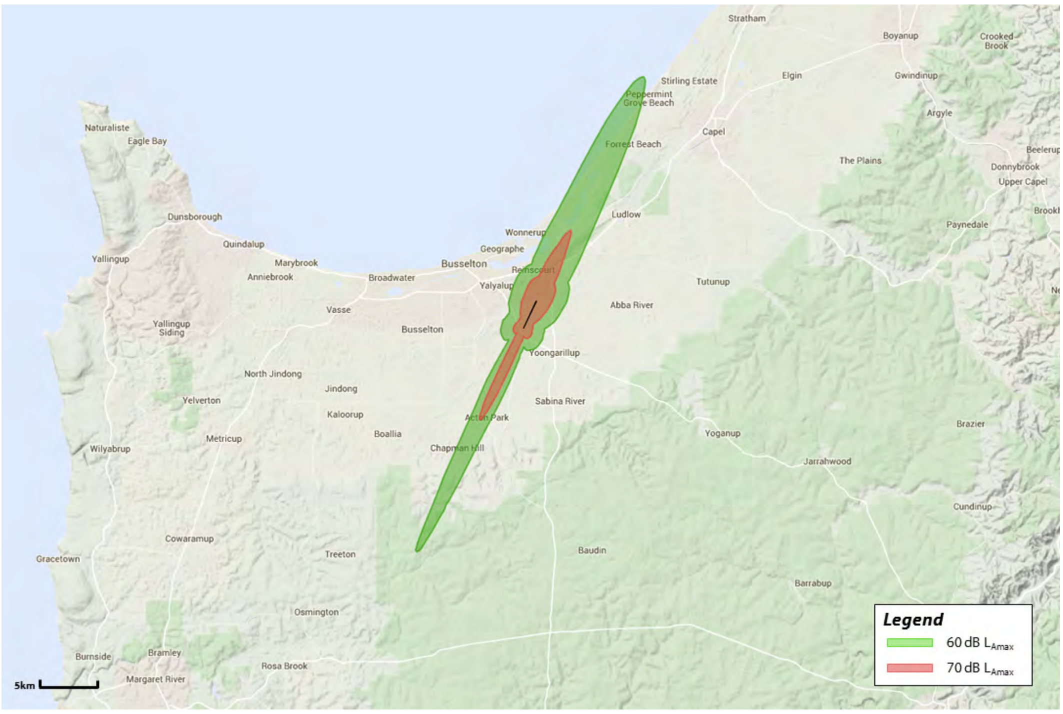

Figure 24: L_{Amax} F100: Runway 03

L_{Amax} F100: Runway 21

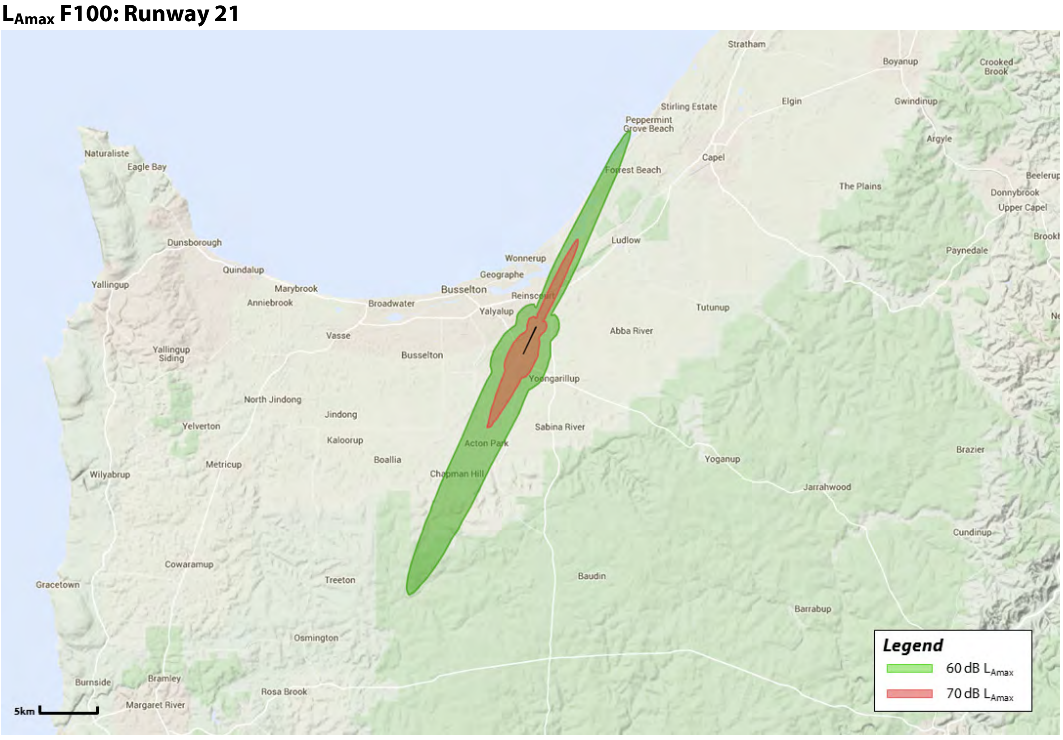

Figure 25: L_{Amax} F100: Runway 21

The 60 dB contour reaches part of Reinscourt and part of Yalyalup. The 70 dB contour reaches part of Reinscourt.

L_{Amax} A320: Runway 03

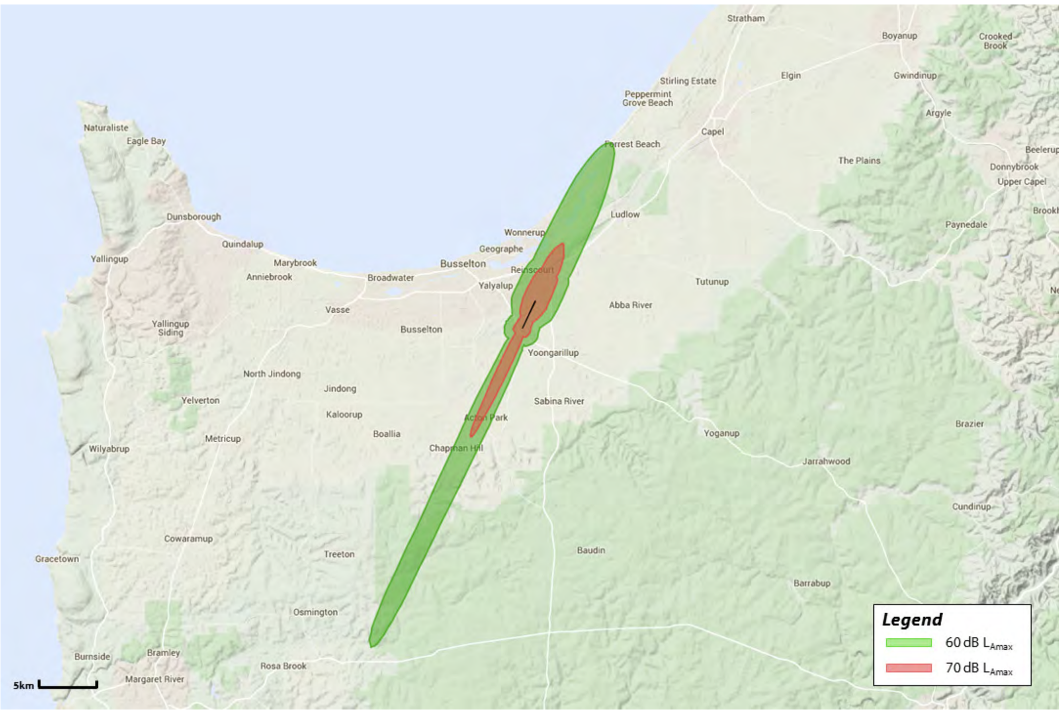

Figure 26: L_{Amax} A320: Runway 03

L_{Amax} A320: Runway 21

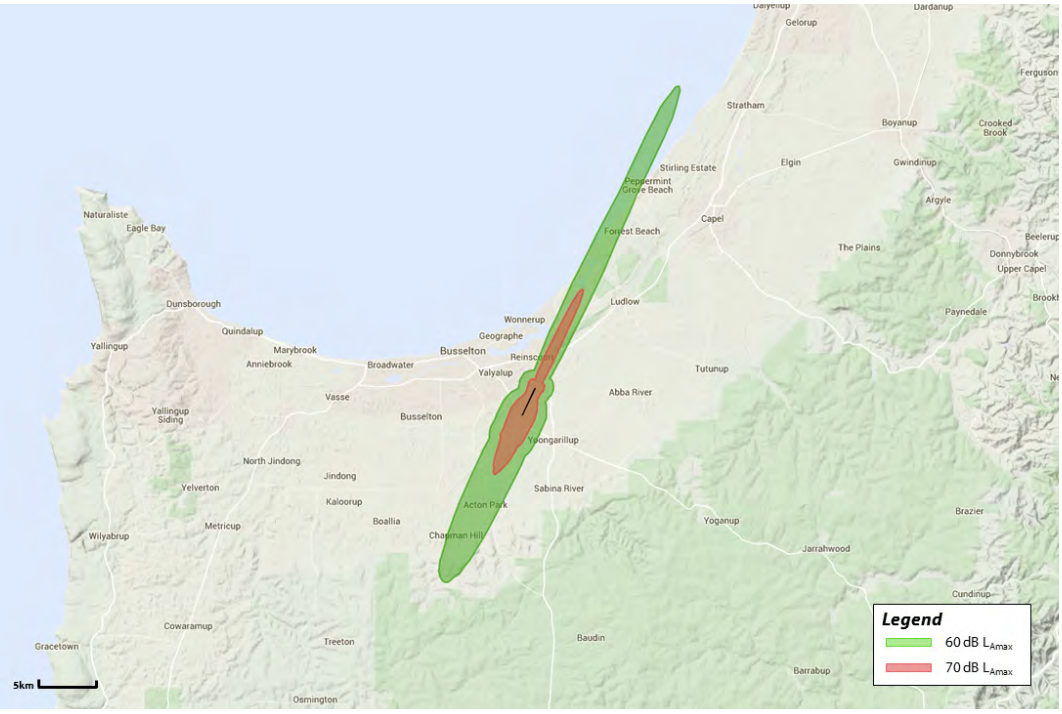

Figure 27: L_{Amax} A320: Runway 21

The 60 dB contour reaches part of Reinscourt. The 70 dB contour does not extend to any populous areas.

L_{Amax} B737-800: Runway 03

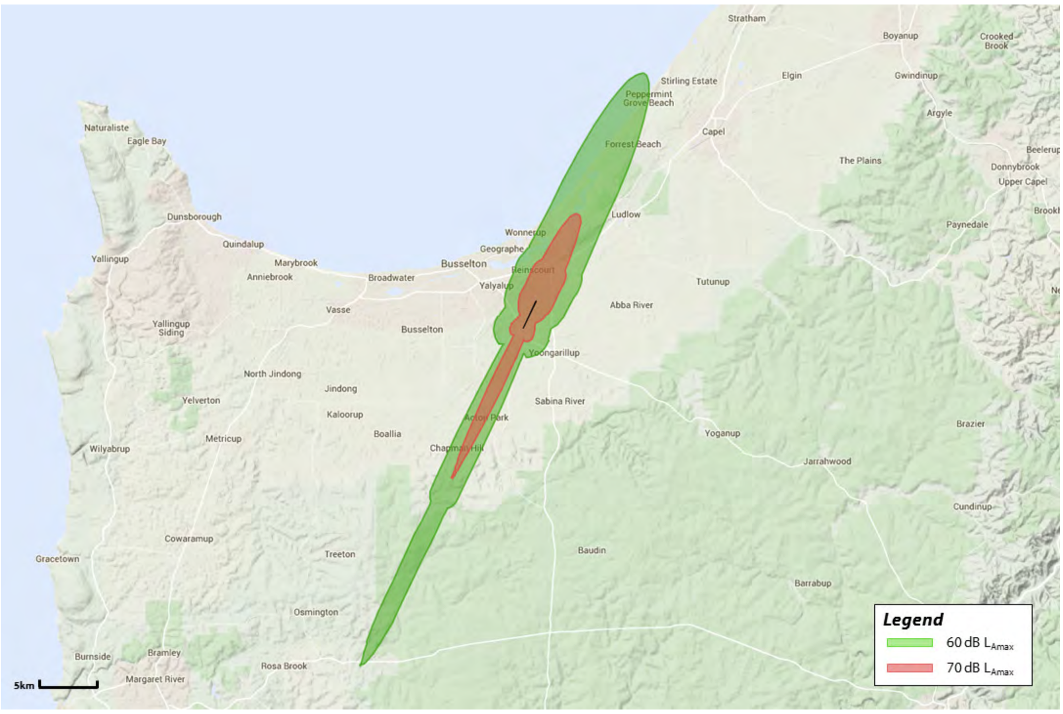

Figure 28: L_{Amax} B737-800: Runway 03

L_{Amax} B737-800: Runway 21

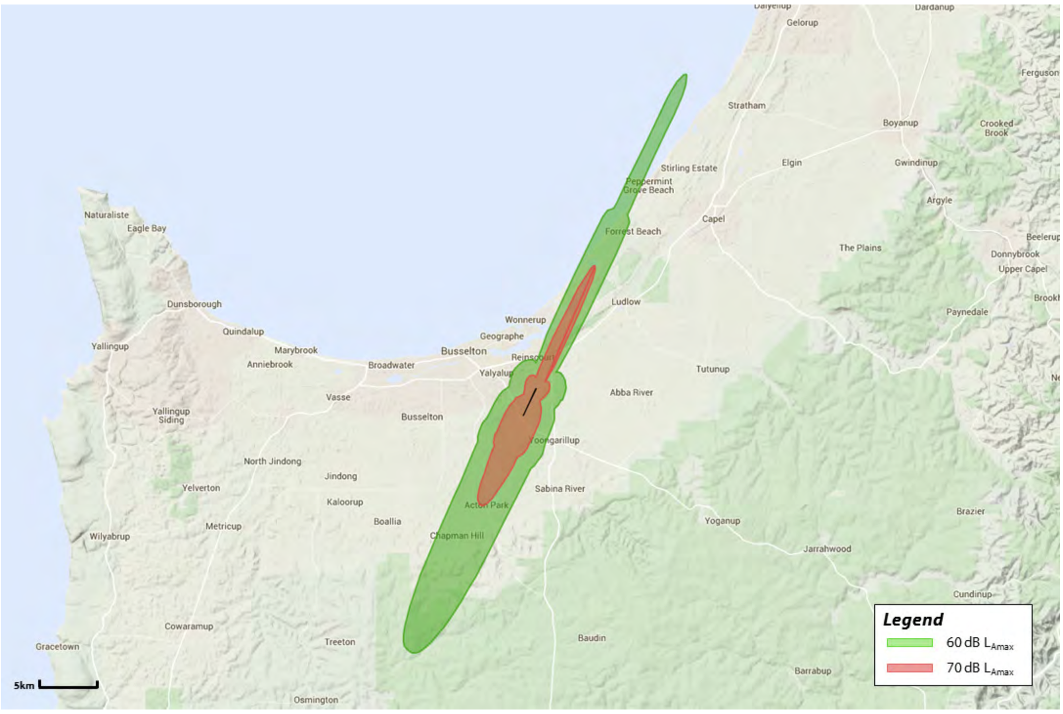

Figure 29: L_{Amax} B737-800: Runway 21

The 60 dB contour reaches Reinscourt and part of Yalyalup. The 70 dB contour reaches part of Reinscourt.

L_{Amax} B737-300: Runway 03

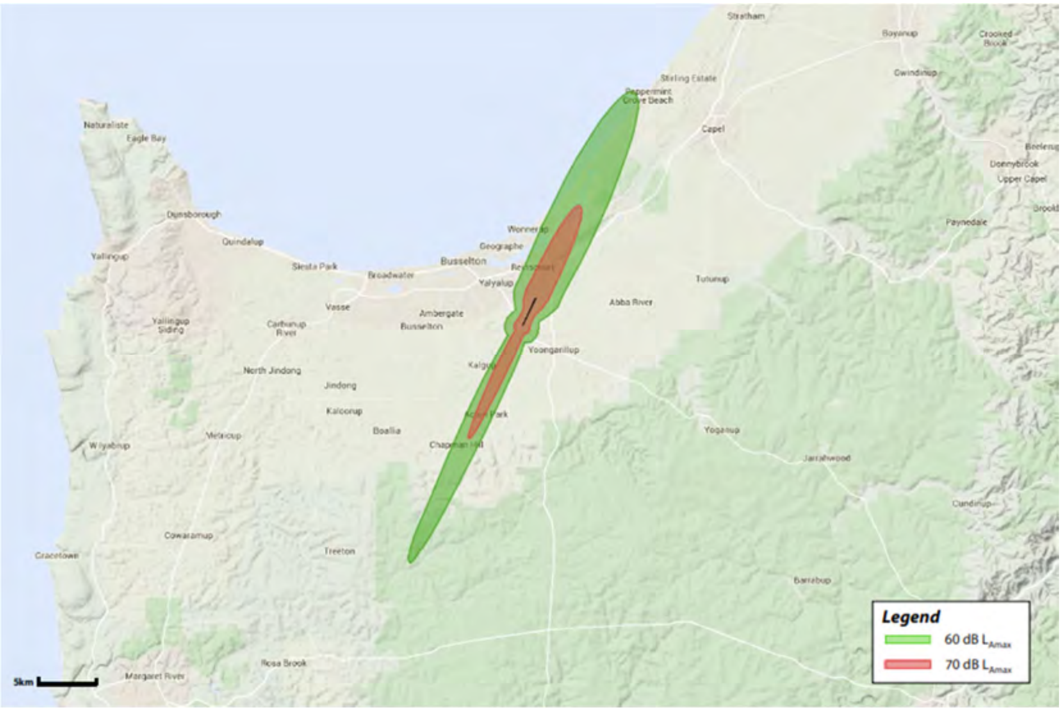

Figure 30: L_{Amax} B737-300: Runway 03

L_{Amax} B737-300: Runway 21

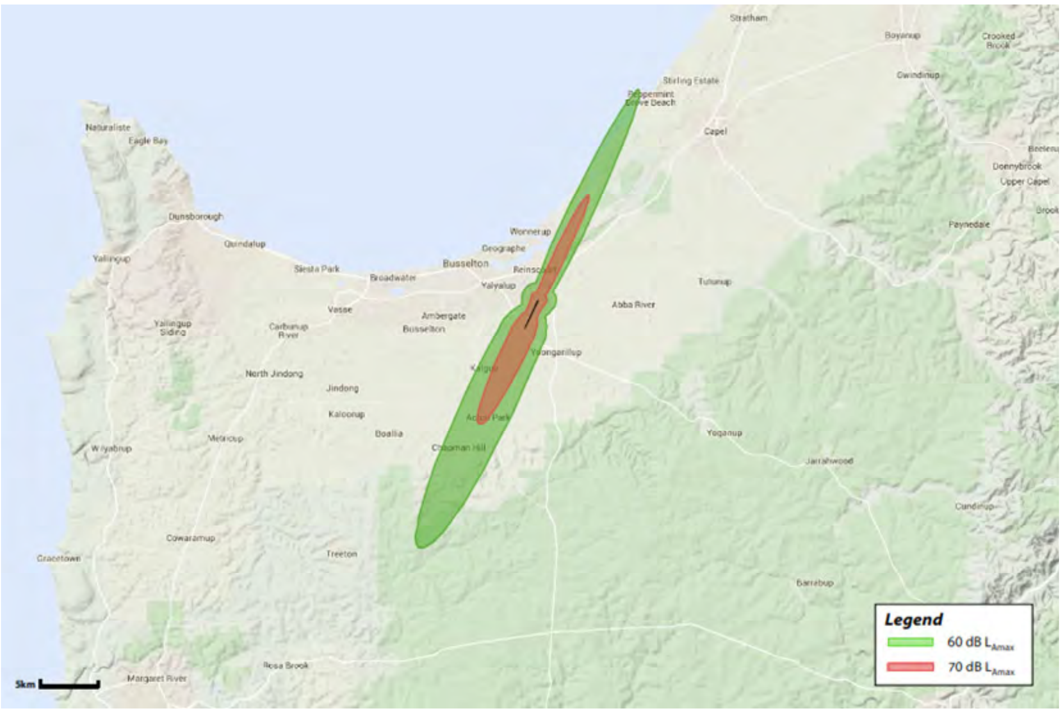

Figure 31: L_{Amax} B737-300: Runway 21

Appendix A: Traffic Forecasts

			2018/19					2022/23					2028/29					2038/39				
			Annual			Day/Night		Annual			Day/Night		Annual			Day/Night		Annual			Day/Night	
Aircraft	INM ID	Destination	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N	ARR	DEP	TOT	D	N
CLOSED CHARTER			**572**	**572**	**1,144**			**676**	**676**	**1,352**			**780**	**780**	**1,560**			**780**	**780**	**1,560**		
Fokker100	F10065	Perth,	**208**	**312**	**520**	85%	15%	**208**	**312**	**520**	85%	15%	**208**	**312**	**520**	85%	15%	**208**	**312**	**520**	85%	15%
Fokker100	F10065	Boolgeeda	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%
Fokker100	F10065	West Angeles	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%	**156**	**104**	**260**	85%	15%
ATR72	DO328	Perth	**52**	**52**	**104**	**85%**	**15%**	**156**	**156**	**312**	**85%**	**15%**	**260**	**260**	**520**	**85%**	**15%**	**260**	**260**	**520**	**85%**	**15%**
Beech 1900	1900D	Jandakot, Karara	**0**	**0**	**0**			**0**	**0**	**0**			**0**	**0**	**0**			**0**	**0**	**0**		
RPT			**156**	**156**	**312**			**364**	**364**	**728**			**416**	**416**	**832**			**624**	**624**	**1,248**		
B737-800	737800	Melbourne	**156**	**156**	**312**	**0%**	**100%**	**104**	**104**	**208**	**25%**	**75%**	**130**	**130**	**260**	**50%**	**50%**	**234**	**234**	**468**	**70%**	**30%**
B737-800NG	737MAX	Melbourne	**0**	**0**	**0**	**0%**	**100%**	**104**	**104**	**208**	**25%**	**75%**	**130**	**130**	**260**	**50%**	**50%**	**234**	**234**	**468**	**70%**	**30%**
B737-800	737800	Sydney	**0**	**0**	**0**			**78**	**78**	**156**	**33%**	**67%**	**78**	**78**	**156**	**67%**	**33%**	**78**	**78**	**156**	**67%**	**33%**
B737-800NG	737MAX	Sydney	**0**	**0**	**0**			**78**	**78**	**156**	**33%**	**67%**	**78**	**78**	**156**	**67%**	**33%**	**78**	**78**	**156**	**67%**	**33%**
OTHER			**6,288**	**6,288**	**12,577**			**6,635**	**6,635**	**13,270**			**6,911**	**6,911**	**13,822**			**7,046**	**7,046**	**14,092**		
Emergency Services			***377***	***377***	***754***			***413***	***413***	***827***			***413***	***413***	***827***			***413***	***413***	***827***		
PC12	PC12	Jandakot	364	364	**728**	70%	30%	400	400	**801**	70%	30%	400	400	**801**	70%	30%	400	400	**801**	70%	30%
Dornier 328	DO328	Perth	10	10	**21**	75%	25%	10	10	**21**	75%	25%	10	10	**21**	75%	25%	10	10	**21**	75%	25%
Piper - PA31	PA31	Perth	3	3	**5**	100%	0%	3	3	**5**	100%	0%	3	3	**5**	100%	0%	3	3	**5**	100%	0%
Recreation Aviation			***1,508***	***1,508***	***3,016***			***1,583***	***1,583***	***3,167***			***1,583***	***1,583***	***3,167***			***1,583***	***1,583***	***3,167***		
Evektor Sportstar - LSA	GASEPF	Various (local)	1,508	1,508	**3,016**	80%	20%	1,583	1,583	**3,167**	80%	20%	1,583	1,583	**3,167**	80%	20%	1,583	1,583	**3,167**	80%	20%
General Aviation			***1,903***	***1,903***	***3,806***			***2,063***	***2,063***	***4,127***			***2,211***	***2,211***	***4,421***			***2,211***	***2,211***	***4,421***		
Cessna 180,182, 172, 210	CNA172	Various	208	208	**416**	90%	10%	218	218	**437**	90%	10%	218	218	**437**	90%	10%	218	218	**437**	90%	10%
Cessna Citation	CNA55B	Various, Perth	52	52	**104**	100%	0%	55	55	**109**	100%	0%	57	57	**115**	100%	0%	57	57	**115**	100%	0%
Learjet 45	LEAR45	Perth, Sydney, Brisbane, Port Hedland	26	26	**52**	90%	10%	27	27	**55**	90%	10%	29	29	**57**	90%	10%	29	29	**57**	90%	10%
Restored Aircraft (i.e Douglas C47; De Havilland DH-82A)	DC3	Local (coastline: Margaret River /Bunbury)	312	312	**624**	100%	0%	328	328	**655**	100%	0%	328	328	**655**	100%	0%	328	328	**655**	100%	0%
Airvan GA8	CNA206	Local (Busselton Jetty)	1,300	1,300	**2,600**	90%	10%	1,430	1,430	**2,860**	90%	10%	1,573	1,573	**3,146**	90%	10%	1,573	1,573	**3,146**	90%	10%
Bombardier Dash 8	DHC8	Perth, North West WA	5	5	**10**	80%	20%	5	5	**11**	80%	20%	6	6	**11**	80%	20%	6	6	**11**	80%	20%
Military			***4***	***4***	***8***			***4***	***4***	***8***			***4***	***4***	***8***			***4***	***4***	***8***		
Pilatus PC9	JPATS	Pearce Airbase (Perth)	4	4	**8**	100%	0%	4	4	**8**	100%	0%	4	4	**8**	100%	0%	4	4	**8**	100%	0%
Helicopter			***2,496***	***2,496***	***4,992***			***2,571***	***2,571***	***5,142***			***2,699***	***2,699***	***5,399***			***2,834***	***2,834***	***5,669***		
Eurocopter AS350	EC130	Local (coastline)	728	728	**1,456**	90%	10%	750	750	**1,500**	90%	10%	787	787	**1,575**	90%	10%	827	827	**1,653**	90%	10%
Bell 206 JetRanger	EC130	Local	416	416	**832**	100%	0%	428	428	**857**	100%	0%	450	450	**900**	100%	0%	472	472	**945**	100%	0%
Bell 206 JetRanger	EC130	Margaret River; Sw region coastline	208	208	**416**	100%	0%	214	214	**428**	100%	0%	225	225	**450**	100%	0%	236	236	**472**	100%	0%
Eurocopter AS350	EC130	Margaret River	104	104	**208**	100%	0%	107	107	**214**	100%	0%	112	112	**225**	100%	0%	118	118	**236**	100%	0%
Bell 214B	B212	60% local: 40% Perth	520	520	**1,040**	100%	0%	536	536	**1,071**	100%	0%	562	562	**1,125**	100%	0%	590	590	**1,181**	100%	0%
Sikorsky Seaking S61N	S61	60% local: 40% Perth	520	520	**1,040**	100%	0%	536	536	**1,071**	100%	0%	562	562	**1,125**	100%	0%	590	590	**1,181**	100%	0%
Freighters																						
B737	737300	Singapore	**104**	**104**	**208**	**100%**	**0%**	**156**	**156**	**312**	**100%**	**0%**	**156**	**156**	**312**	**100%**	**0%**	**208**	**208**	**416**	**100%**	**0%**
TOTAL			7,120	7,120	**14,241**			7,831	7,831	**15,662**			8,263	8,263	**16,526**			8,658	8,658	**17,316**		

Add 52 annual daytime training circuits for the EVEKTOR SPORTSTAR for all years

Note that destinations of locally based aircraft are listed as various, however COB have indicated generally light aircraft will head to the coastline or in a southerly direction.

Appendix B: N-Contour results (alternative zoom)

N65 Contours: 2018/19

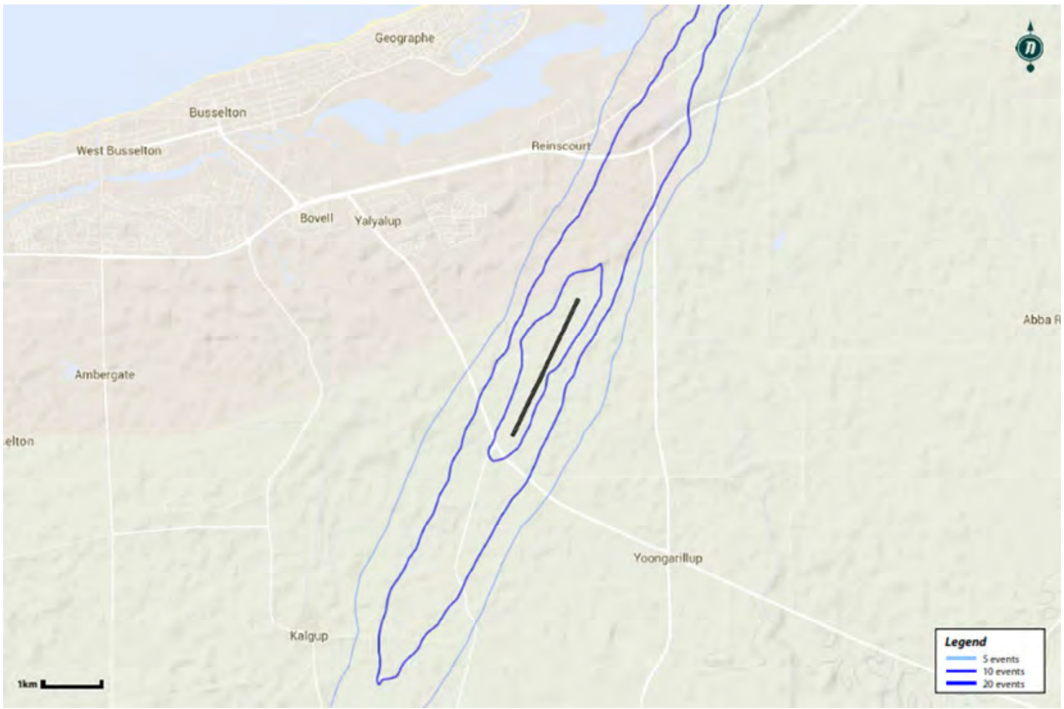

Figure 32: N65 Contours: 2018/19

N70 Contours: 2018/19

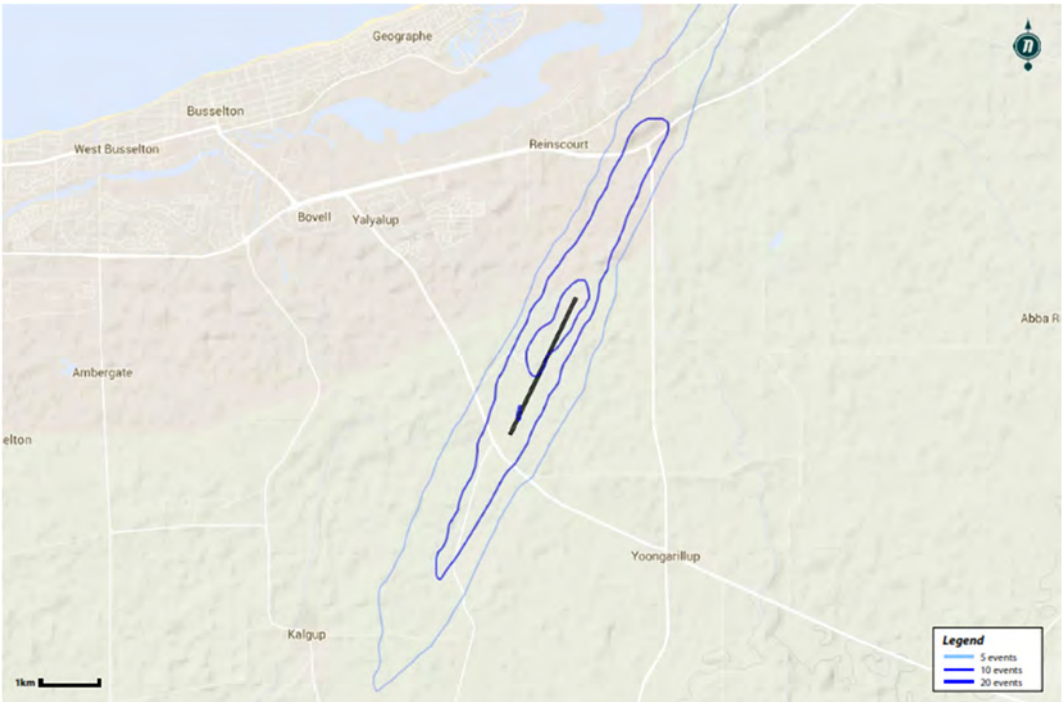

Figure 33: N70 Contours: 2018/19

N75 Contours: 2018/19

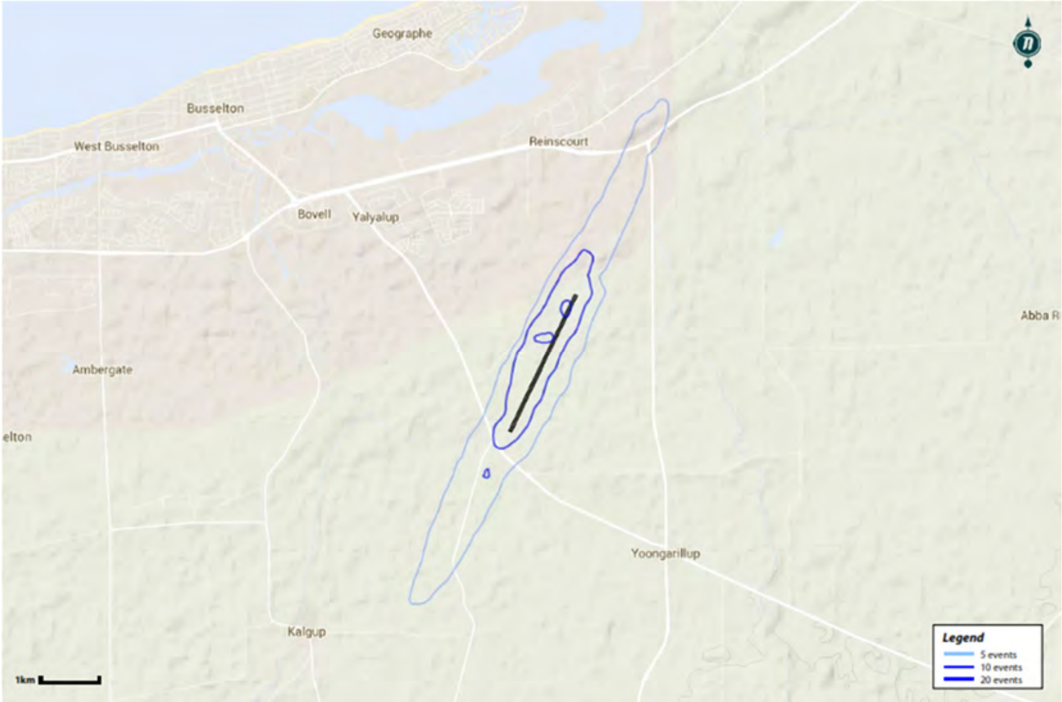

Figure 34: N75 Contours: 2018/19

N80 Contours: 2018/19

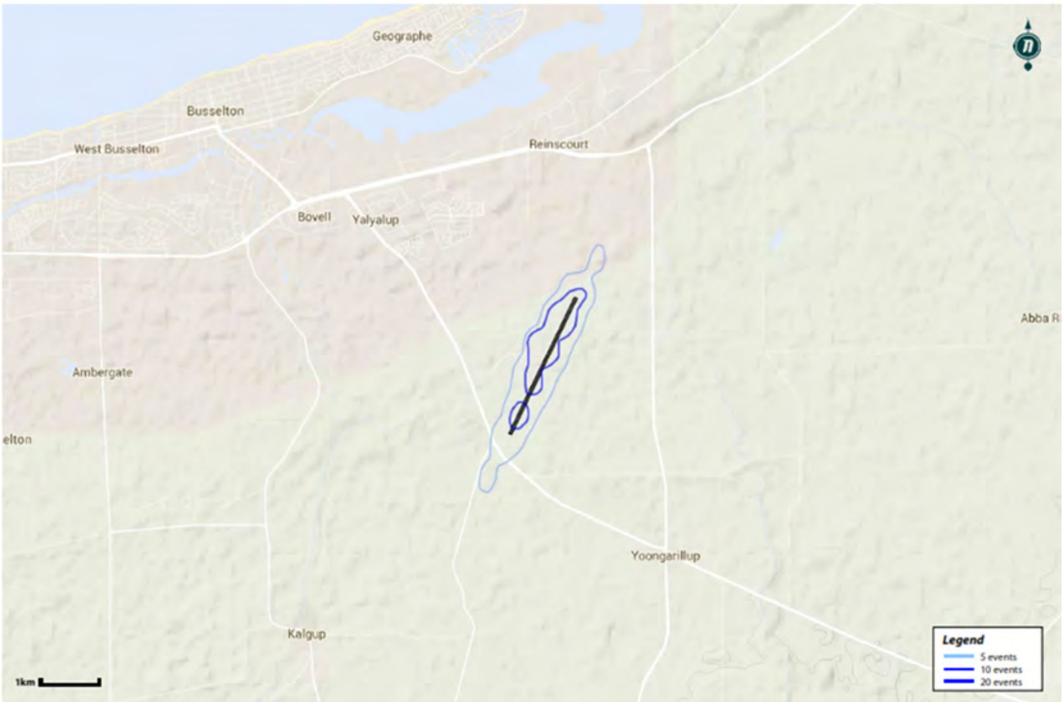

Figure 35: N80 Contours: 2018/19

N65 Contours: 2022/23

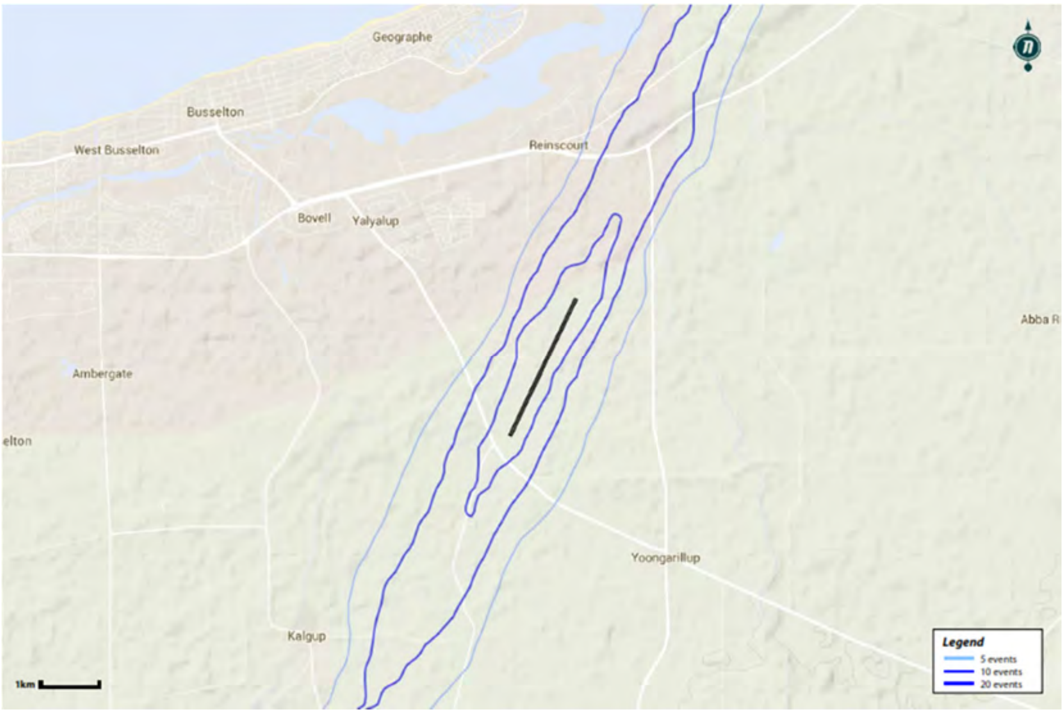

Figure 36: N65 Contours: 2022/23

N70 Contours: 2022/23

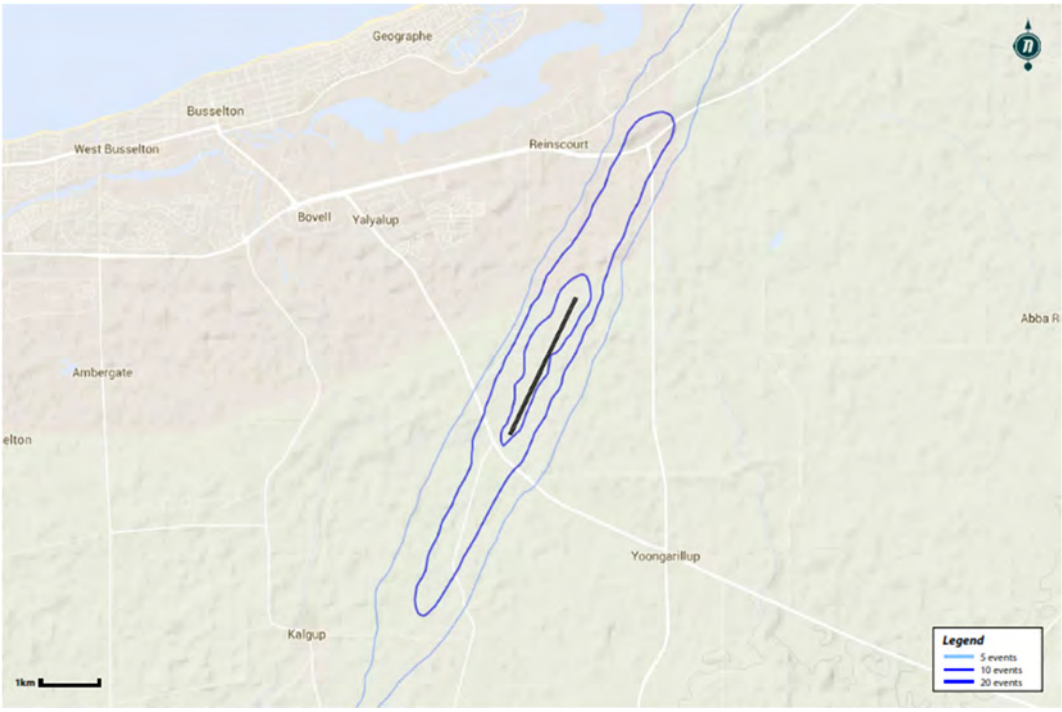

Figure 37: N70 Contours: 2022/23

N75 Contours: 2022/23

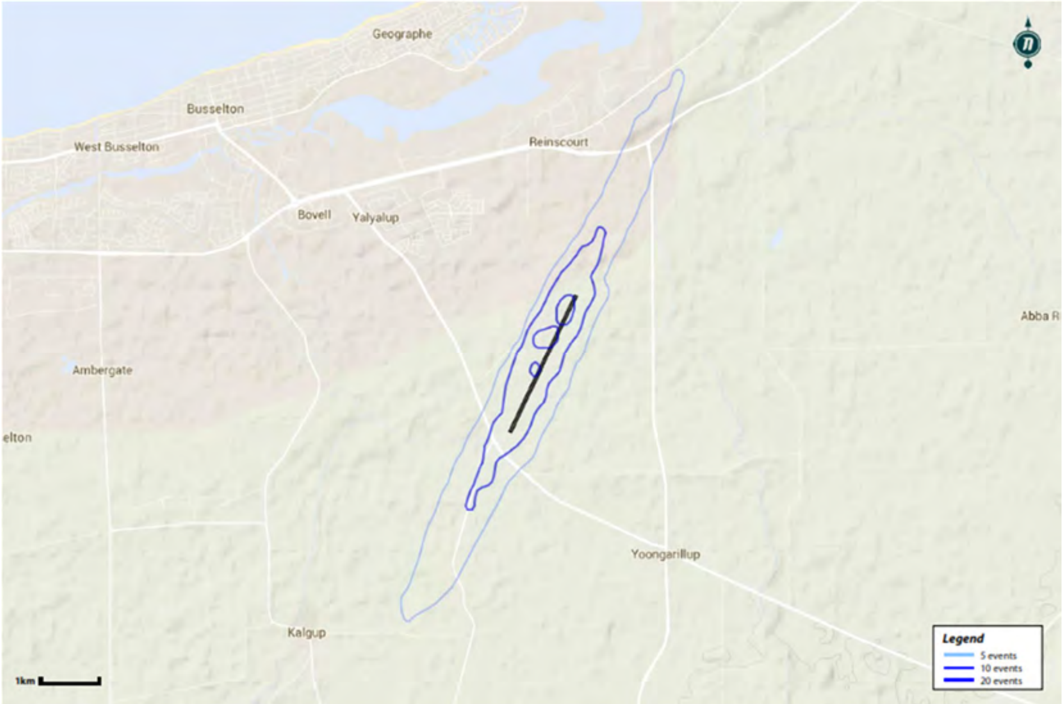

Figure 38: N75 Contours: 2022/23

N80 Contours: 2022/23

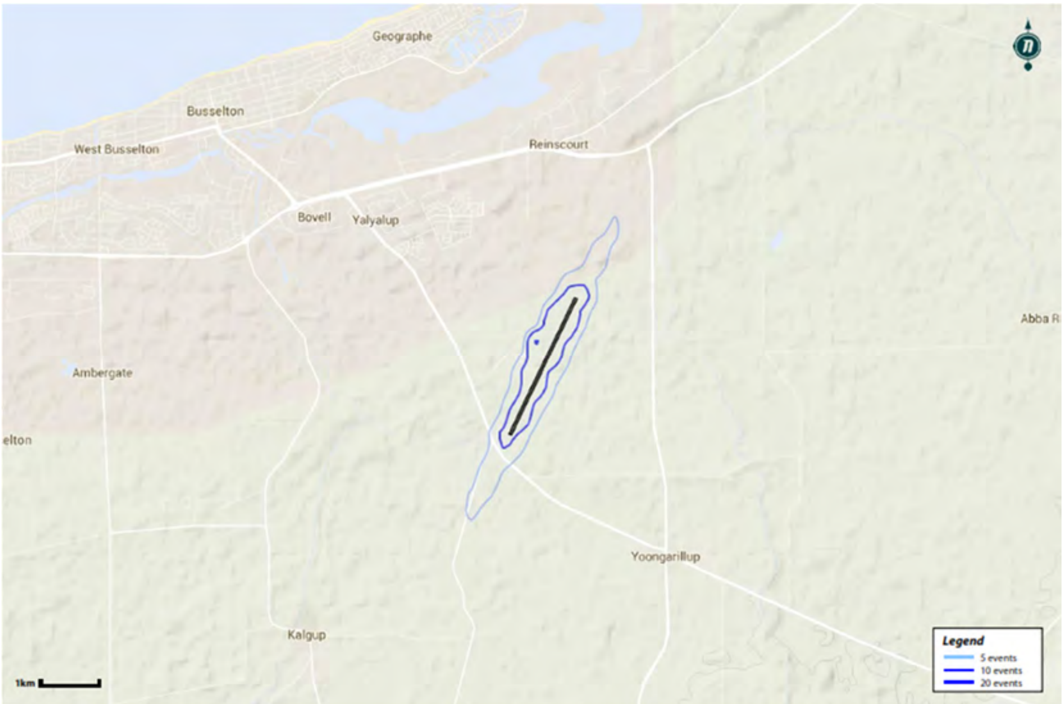

Figure 39: N80 Contours: 2022/23

N65 Contours: 2028/29

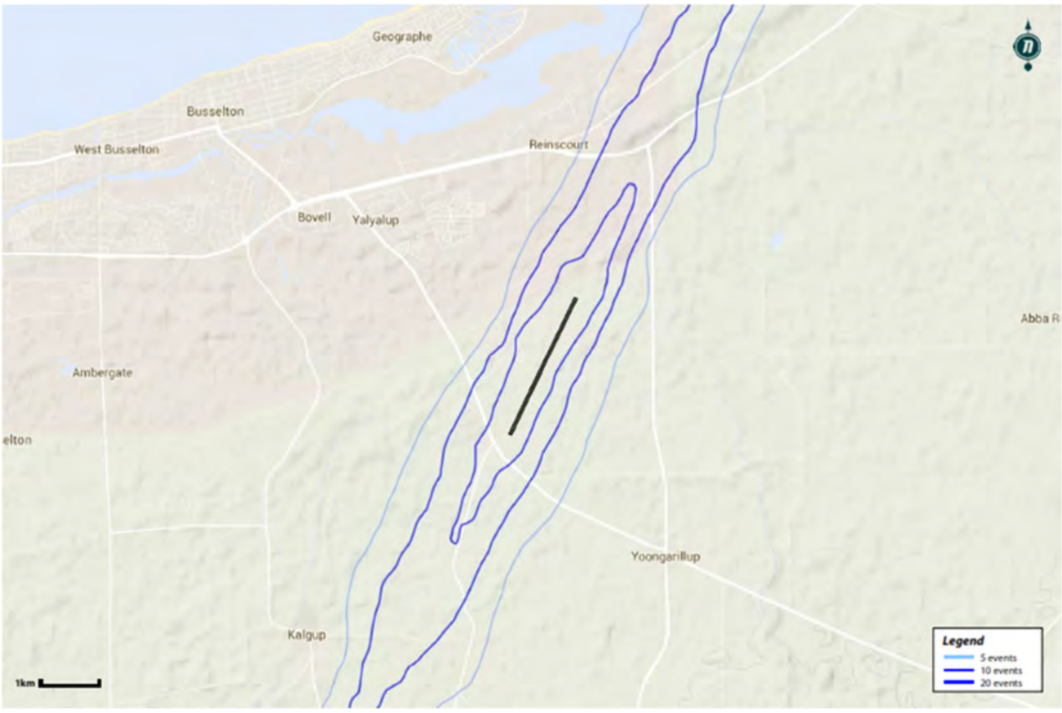

Figure 40: N65 Contours: 2028/29

N70 Contours: 2028/29

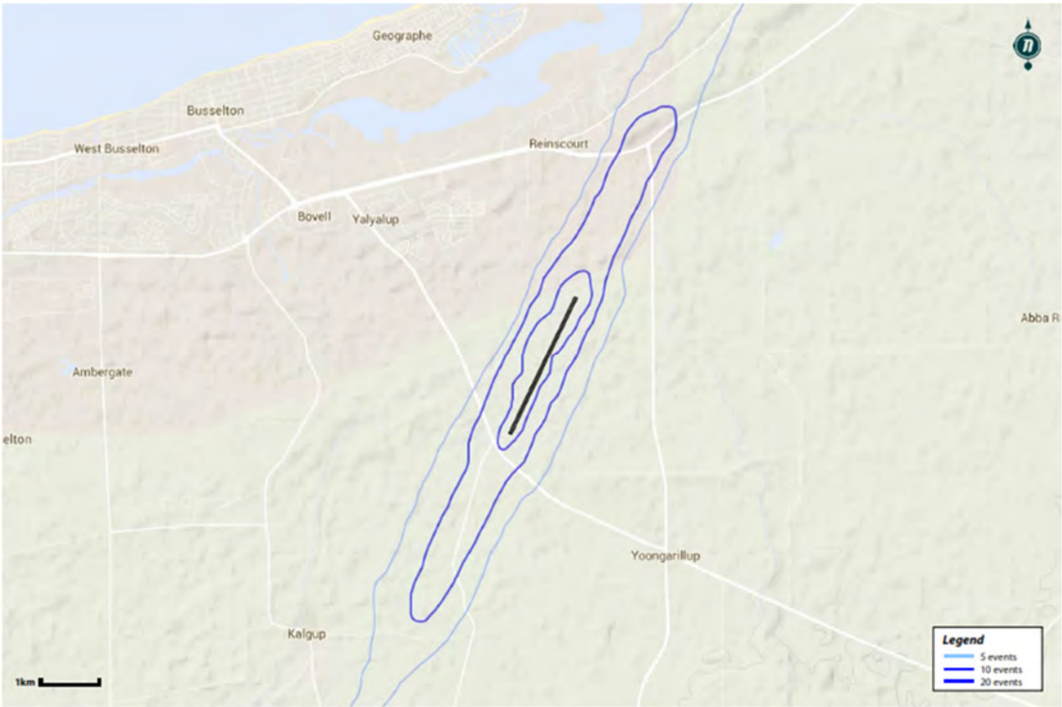

Figure 41: N70 Contours: 2028/29

N75 Contours: 2028/29

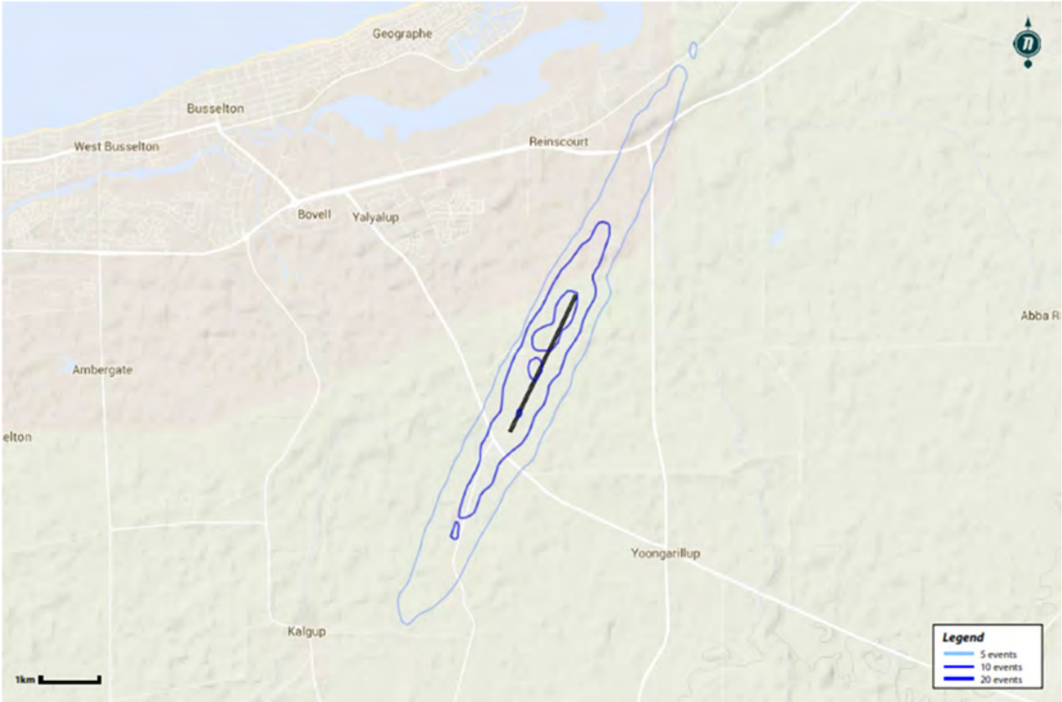

Figure 42: N75 Contours: 2028/29

N80 Contours: 2028/29

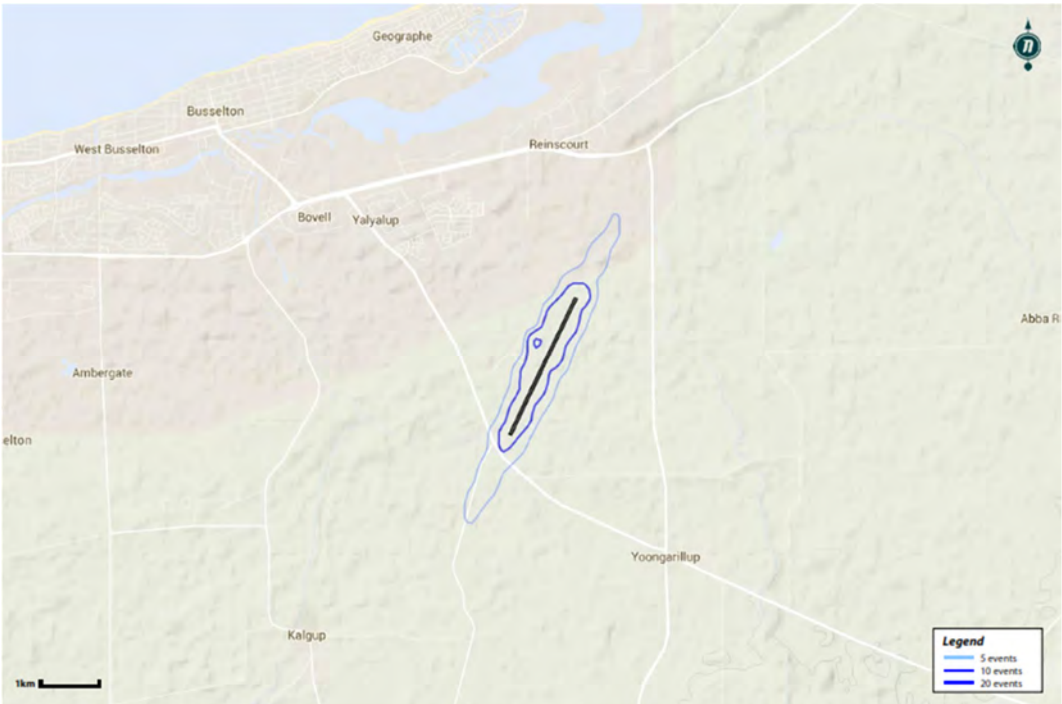

Figure 43: N80 Contours: 2028/29

N65 Contours: 2038/39

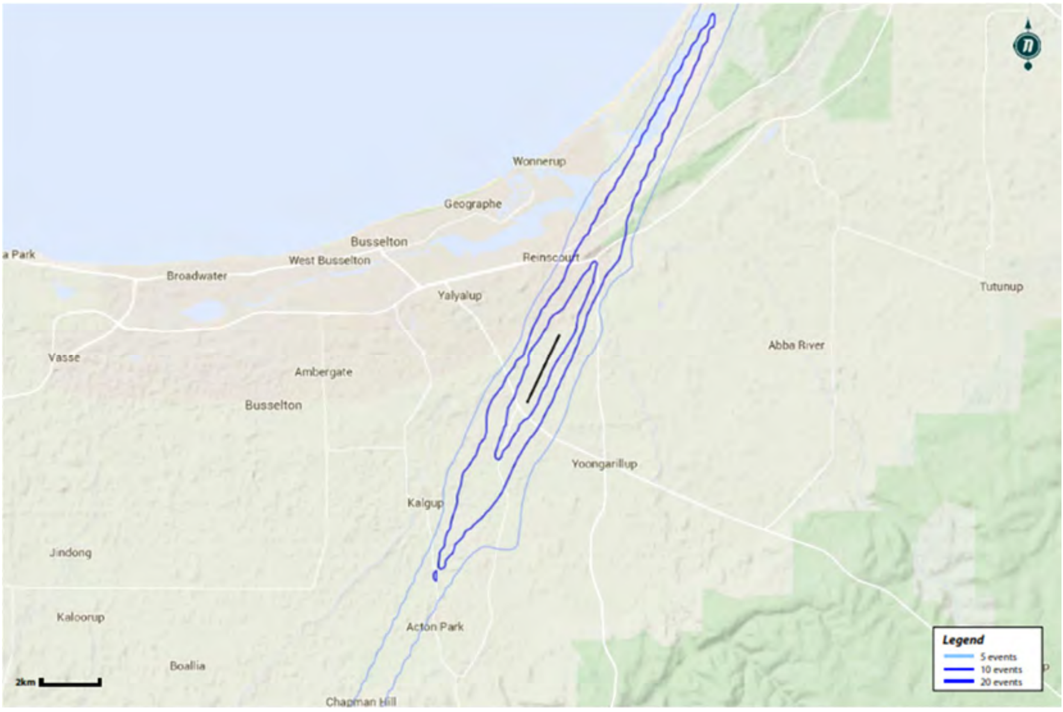

Figure 44: N65 Contours: 2038/39

N70 Contours: 2038/39

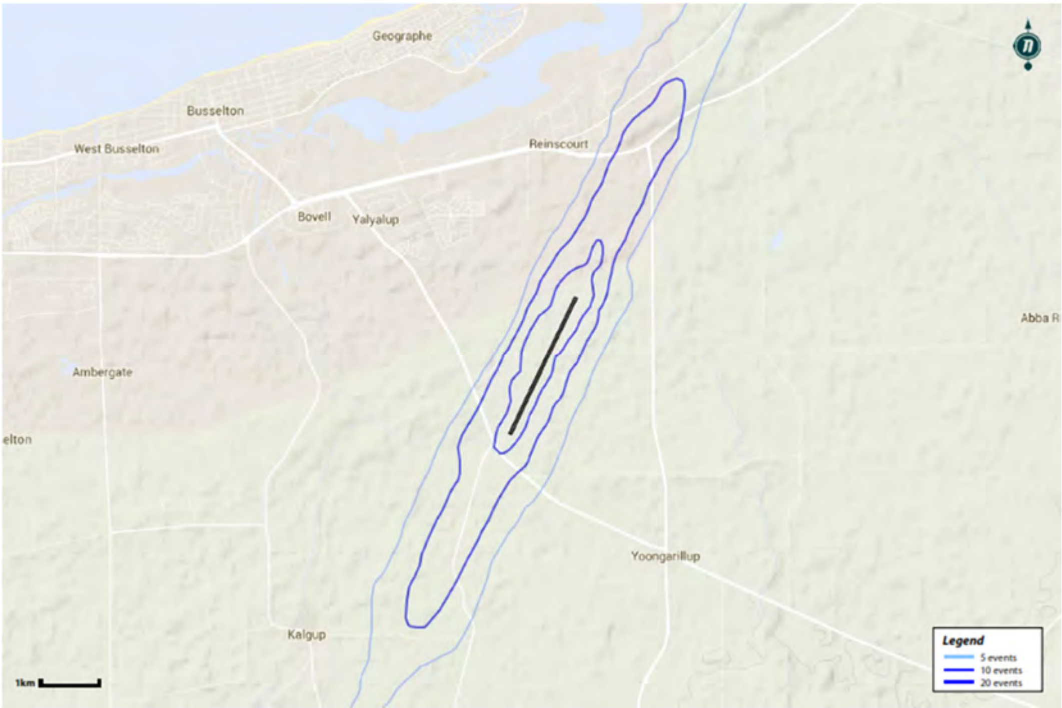

Figure 45: N70 Contours: 2038/39

N75 Contours: 2038/39

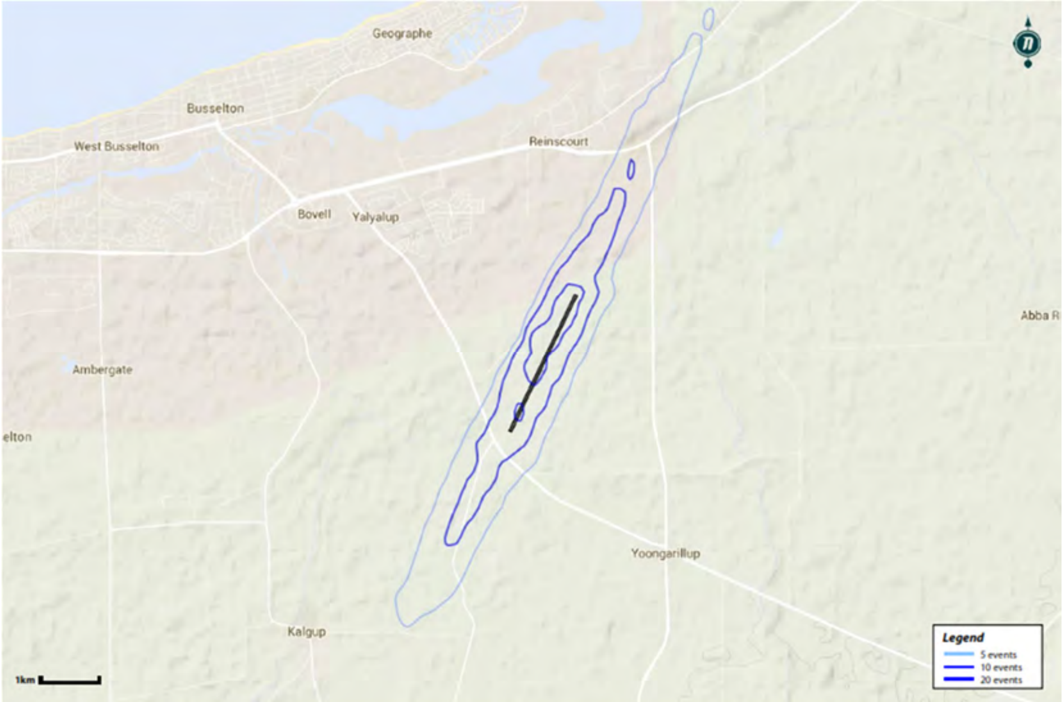

Figure 46: N75 Contours: 2038/39

N80 Contours: 2038/39

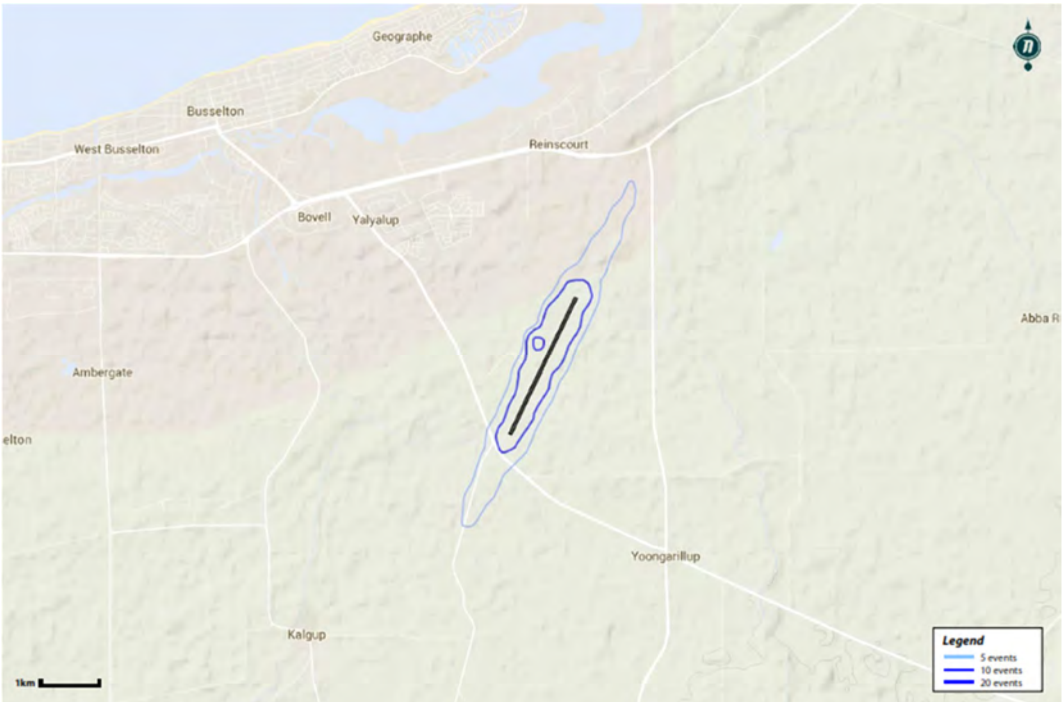

Figure 47: N80 Contours: 2038/39