

GREAT SOUTHERN EMERGENCY MANAGEMENT DISTRICT

# Risk assessment report

*'Highlighting potential disaster impacts'*



*Disclaimer:*

The risk assessment results discussed in this report are based explicitly on the credible worst-case hazard scenarios outlined in Section 2 and the views of those who participated in each risk assessment workshop. Risks and impacts other than those discussed here are possible depending on the nature of future hazards.

*Acknowledgements:*

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## Executive summary

This document summarises the results of the *State Risk Project* risk assessment workshops in the Great Southern (EM) district. It covers six priority hazards, as identified by the Great Southern District Emergency Management Committee (DEMC): animal or plant pests or diseases (animal and plant biosecurity), fire (bushfire), earthquake, flood, marine transport emergency (MTE) and storm. The effects of these hazards were measured against five key impact areas (economy, public administration, people, environment and social setting) using 316 specific risks, called risk statements.

Within the larger emergency risk management process, this report sits between the risk analysis and risk evaluation steps as it presents the results of the analysis to stakeholders in order for them to evaluate which risks require treatment (Figure 1).

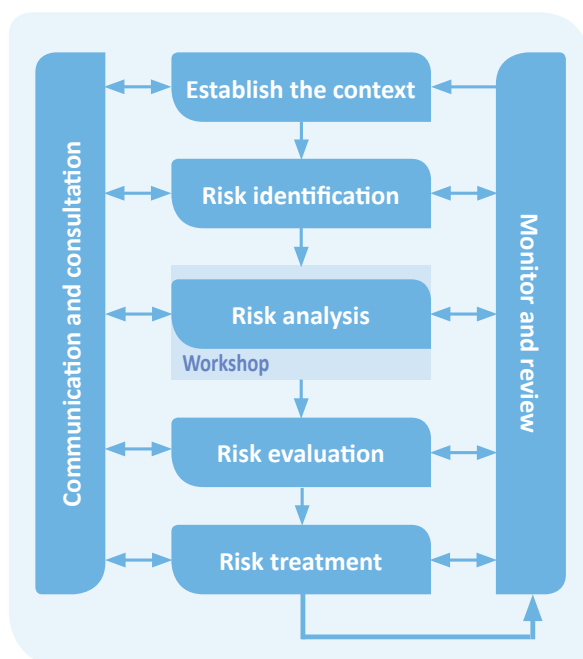


Figure 1: Emergency risk management process.<sup>1</sup>

Twenty-seven agencies were represented throughout the workshop series which followed the methodology and criteria outlined in the *WA Emergency Risk Management Guide 2015* and the *National Emergency Risk Assessment Guidelines 2015 (NERAG)*<sup>2</sup>. The risk statements were assessed using a tailored *NERAG* consequence table (Appendix C), which is based on the gross area product (\$6.091 billion) and the population (75,691) of the EM district.

The assessment results for the six hazards reveal that 1% (2 statements) of the risks were assessed as extreme and 18% as high, 29% as medium, 40% as low and 12% as very low risks. Five percent of the risks could produce catastrophic consequences.

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<sup>2</sup> *National Emergency Risk Assessment Guidelines* (2015) Australian Government Attorney-General's Department

Risk statements assessed as extreme and high primarily related to economic and health impacts whereas low risks relate to the environment and social setting. The two extreme risks relate to bushfire damage to private and commercial buildings and contents leading to potentially catastrophic consequences and economic losses of >\$244 million for the Great Southern district.

All hazards assessed posed a risk to human life, with earthquake and the marine transport emergency scenarios assessed as potentially able to cause a catastrophic impact (greater than eight fatalities). In these two instances, the health system would be stretched and emergency services would struggle to quickly access individuals involved in the marine incidents.

Marine transport emergencies pose a significant hazard to the Great Southern. Seventy percent of the risk statements were assessed as either high (36%) or medium (34%) risks. Most of the high risk statements related to public administration: increased demand on government, emergency and port authority services impacting the ability to provide core services. Unique to this hazard is the increased demand for accommodation and public facilities to shelter both victims and response personnel.

The animal and plant biosecurity scenario also has a significant number of high (22%) and medium (31%) risk statements. Most of the high risk statements for this hazard relate to the economy, with significant economic losses expected, particularly in the agriculture and pastoral sectors. The event would have national and international implications and the impacts would affect a broad spectrum of the industry.

The natural hazard scenarios (bushfire, earthquake, flood, storm) have a higher percentage of low and very low risks compared to animal and plant biosecurity and marine transport emergency. Nevertheless, the natural hazards also create impacts to buildings and infrastructure, and are anticipated to result in people permanently relocating from the district community.

There were no high risks to the social setting, suggesting that the community fabric is strong. The highest risks in the social setting impact area relate to the loss of agricultural reputation, long-term displacement from the area, impacts to culturally significant areas (marine environment) and buildings, loss of incomes and associated emotional stress.

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. There are no Priority 1 (highest) statements, 2% are Priority 2, 17% are Priority 3, 21% are Priority 4 and 60% of the statements are Priority 5 (lowest). The following table (Table 1) shows the Priority 1 and 2 risk statements in full along with those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.

**Table 1: Risk statements for the Great Southern district with Priority level 2 or catastrophic consequences. Note: AP Bio = animal and plant biosecurity; EQ = earthquake; MTE = marine transport emergency.**

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Bushfire	will damage private buildings and contents, resulting in financial losses.	Economy	Catastrophic	Extreme	Highest	2
Bushfire	will damage commercial buildings, contents and services resulting in financial losses.	Economy	Catastrophic	Extreme	Highest	2
Flood	will damage transport infrastructure such as road and rail, incurring costs to the district.	Economy	Major	High	Moderate	2
Flood	will cause damage/inundation of bridges, or approaches to bridges such that sections of many roads will be closed, causing recovery/reconstruction costs and disrupting transport routes, incurring losses.	Economy	Major	High	Moderate	2
Storm	will impact the health of people and cause death(s).	People	Major	High	Moderate	2
AP Bio	will impact farm revenues.	Economy	Catastrophic	High	Highest	3
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	Highest	3
AP Bio	will result in business failures across the district.	Economy	Catastrophic	High	Highest	3
MTE	will result in a high demand for response and recovery vessels to assist in the hazard event.	Public Administration	Catastrophic	High	Highest	3
MTE	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
MTE	will impact the health of people and cause injury/illness.	People	Catastrophic	High	Highest	3
MTE	will cause debris and pollutants to enter marine environments, impacting the marine ecology.	Environment	Catastrophic	High	Highest	3
EQ	will damage private buildings and contents, resulting in financial losses.	Economy	Catastrophic	High	Highest	4
EQ	will damage commercial buildings, contents and services, resulting in financial losses.	Economy	Catastrophic	High	Highest	4

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
EQ	will prevent commercial and small businesses from functioning, resulting in financial losses and business failure.	Economy	Catastrophic	High	Highest	4
EQ	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	4
EQ	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	4



# 1 Introduction

A series of risk assessment workshops were conducted in the Great Southern Emergency Management (EM) district as part of the *State Risk Project*. The project aims to assess the risks posed to the state from all prescribed hazards using a consistent and comprehensive approach. This approach follows the ISO 31000:2009 standard and the methodology outlined in the *National Emergency Risk Assessment Guidelines (NERAG) 2015*. By assessing risks at state, district and local levels, it allows for comparison and the prioritisation of future resource allocation with an emphasis towards prevention and preparedness activities.

Initially, the highest priority hazards for each district are assessed. The six priority hazards for the Great Southern EM district, as identified by the District Emergency Management Committee (DEMC) are: animal and plant biosecurity, fire (for this assessment only bushfire was considered and is hereafter referred to as bushfire), earthquake, flood, marine transport emergency (MTE) and storm. All hazards were assessed within a workshop setting (see Table 2 for schedule) and used a credible worst-case hazard scenario. The credible worst-case scenarios were developed by relevant hazard experts and are chosen with the rationale that planning and risk reduction activities for the largest event will address impacts of smaller events, even if the smaller events are more frequent.

During each workshop, presentations were given by relevant experts to provide the hazard context, outline the anticipated district vulnerabilities and impacts and describe the scenario. Following this, as a group, the participants worked through a series of risk statements to estimate the potential consequences of the scenario event. Each risk statement depicts an impact that is likely to eventuate given the scenario (see Table 1 for examples) and is collectively assigned a likelihood, consequence and confidence level using the *NERAG 2015* criteria. Discussion was encouraged among participants allowing the hazards and impacts to be fully evaluated, with decisions based on group consensus. Risk statements are grouped into five impact areas: economy; people; public administration; social setting; and environment with an average of 50 risk statements assessed per hazard.

Data were captured and analysed following the workshop. The results are presented in this report.

**Table 2: Location and date of risk assessment workshops.**

Hazard	Location of workshop	Date of workshop
Animal and plant biosecurity	Albany	23 July 2015
Bushfire	Albany	11 June 2015
Earthquake	Albany	11 June 2015
Flood	Albany	14 May 2015
Marine transport emergency	Albany	23 July 2015
Storm	Albany	14 May 2015



A range of agencies from across the district were invited to attend the workshops. Agency representation is shown in Table 3.

**Table 3: Agencies involved in each risk assessment workshop for the Great Southern district, listed in alphabetical order. Note: AP Bio = animal and plant biosecurity; EQ = earthquake; MTE = marine transport emergency.**

Agency	Hazard					
	AP Bio	Bushfire	EQ	Flood	MTE	Storm
Brookfield Rail				x		x
Bureau of Meteorology				x		x
City of Albany	x				x	
Department for Child Protection & Family Support		x	x	x		x
Department of Agriculture and Food WA	x	x	x	x		x
Department of Fire & Emergency Services	x	x	x	x	x	x
Department of Fisheries					x	
Department of Health	x				x	
Department of Parks and Wildlife	x	x	x	x	x	x
Department of Planning	x	x	x		x	
Department of Transport	x	x	x	x	x	x
Department of Transport – Marine Safety					x	
Fletchers International Abattoir	x					
Main Roads WA		x	x			
Office of Emergency Management (facilitators)	x	x	x	x	x	x
Oldfield Contracting	x					
Port of Albany						x
Shire of Denmark	x			x	x	
Shire of Katanning		x	x			
Shire of Plantagenet		x	x			
Silver Chain		x	x			
Southern Ports Authority	x	x	x	x	x	
St John Ambulance	x	x	x	x	x	x
WA Country Health Services	x	x	x	x		x
WA Police	x	x	x	x	x	x
Water Corporation		x	x	x		x
Western Power		x	x	x		x

## 2 Hazard scenarios

Six hazards were assessed for the Great Southern EM district. Hazard scenarios were developed with the assistance of:

- Bureau of Meteorology Western Australia (BOM)
- Department of Fire and Emergency Services (DFES)
- Department of Food and Agriculture (DAFWA)
- Department of Parks and Wildlife (P&W)
- Department of Transport, Marine Safety
- Geoscience Australia (GA)
- Office of Emergency Management (OEM)
- Southern Ports Authority
- WA Police

### Animal and plant biosecurity scenario

*The animal and plant biosecurity scenario was developed by DAFWA and has approximately a 0.995% chance of occurrence in any given year.*

A small rural residential block owner in the outskirts of Narrikup is fattening two pigs for personal consumption. The neighbouring property is a commercial beef producer with a herd of 200 Murray Grey cattle.

Someone who lives on the residential block travels back from Nepal with processed meat in their luggage (illegally imported) which contains the foot and mouth disease (FMD) virus. The contaminated meat is fed to the pigs. The virus incubates in the pigs and spreads to neighbouring cattle without the knowledge of either owner. The cattle are then taken to the Mount Barker Saleyard and transported out of the Shire of Plantagenet.

The newly purchased cattle do not look as healthy as expected and are checked by a veterinary officer. Three days after the sale, fluid samples have tested positive for FMD. DAFWA activates their emergency response plans and trace the origin of FMD four days after sale (Figure 2). Five days after sale there is a national standstill of all livestock movement to eliminate further spread. Ongoing tracing of livestock movements, and testing and destruction of infected animals occurs. Due to potential stock movement, it would not take long for FMD to be spread throughout WA, should an infected animal go through a saleyard with no physical symptoms and spread the virus (Figure 3).

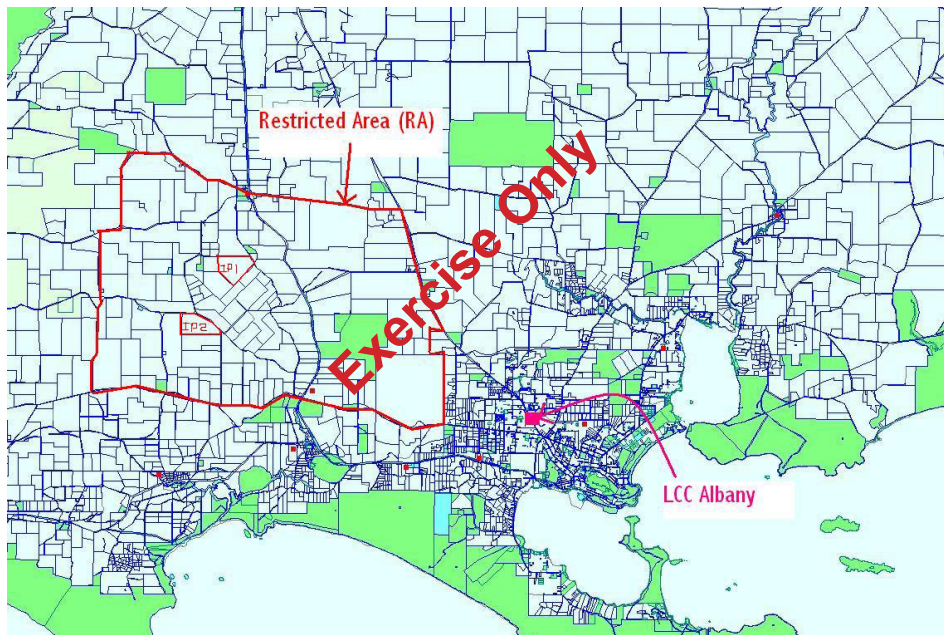


Figure 2: Potential impacted area for the animal and plant biosecurity scenario in the Great Southern district (Image supplied by DAFWA).

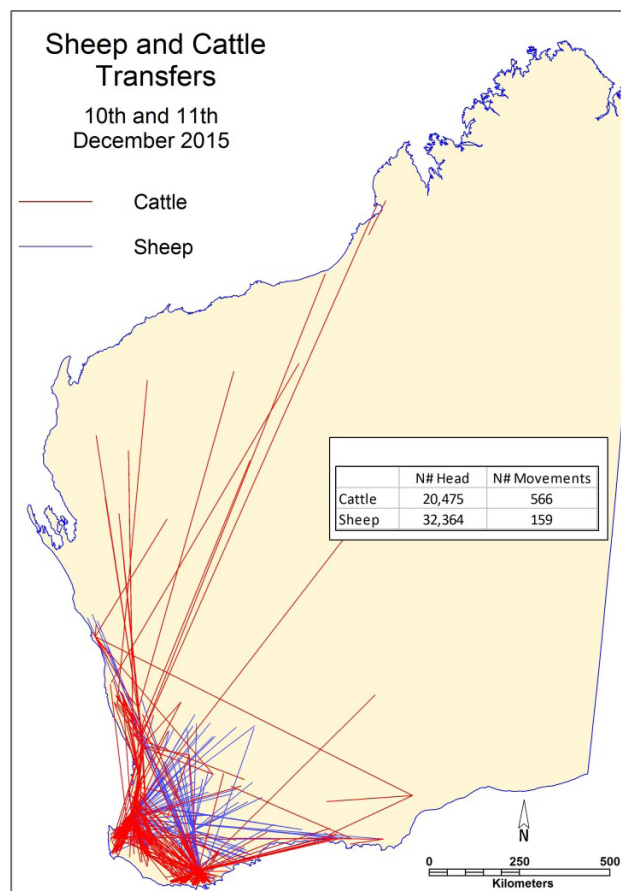


Figure 3: Sheep and cattle transfers around WA for two days in December 2015. Indicates potential for spread of FMD (Image supplied by DAFWA).

## Bushfire scenario

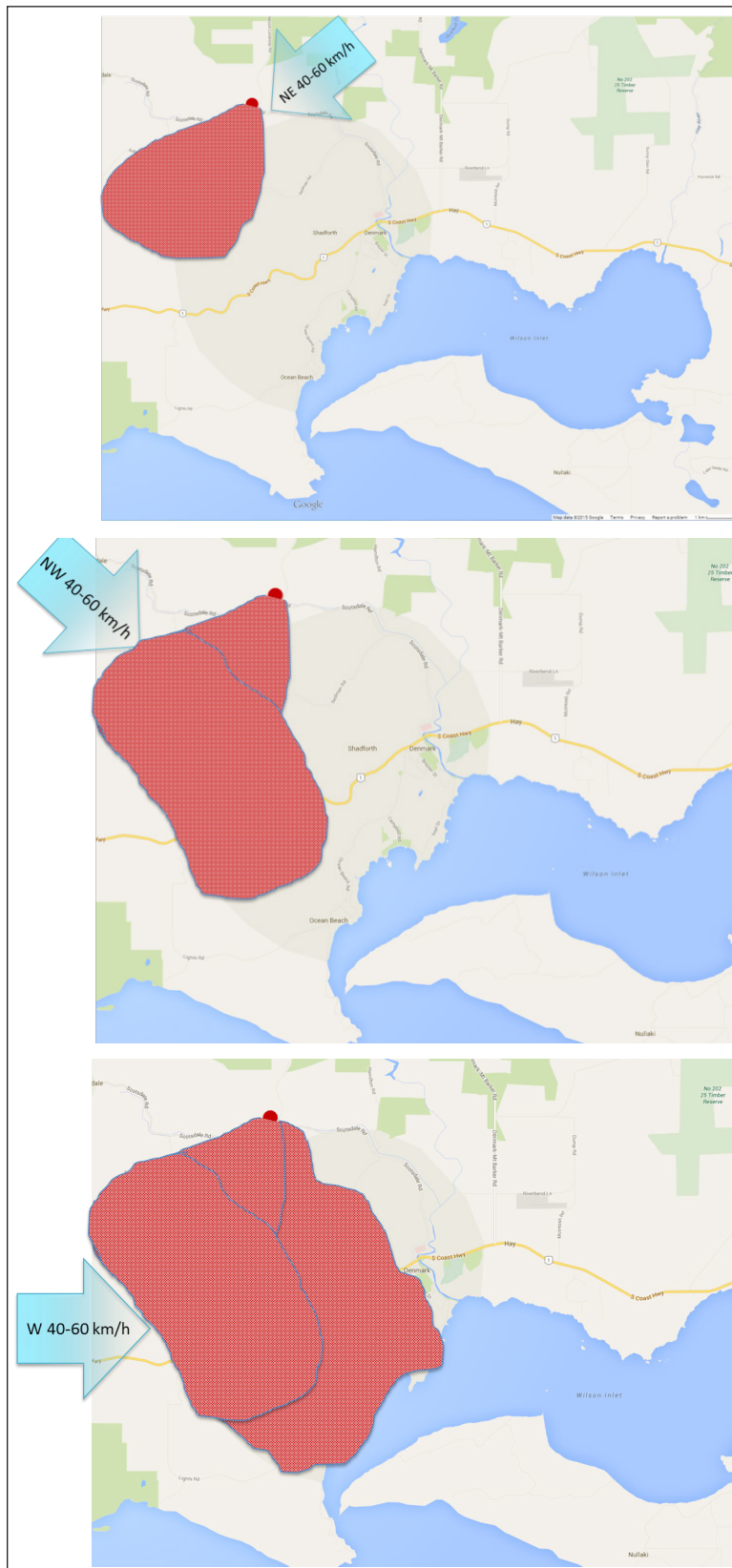
*The bushfire scenario was developed by BOM, DFES, P&W, WA Police and the OEM and has approximately a 1.98% chance of occurrence in any given year.*

The Great Southern district has had extreme fire weather conditions during January, including the Australia Day long weekend. Over the long weekend, the winds in the district begin as north-easterly (40-60 km/hour), turning to north-westerly and then to westerly (still at 40-60 km/hour) throughout the day. Dry lightning ignites a fire in the late morning of the Saturday near Scotsdale and Mt. Lindsay Roads (northwest of Denmark). One hour later, another fire is ignited in Little Grove (southwest of Albany), causing some resources to be diverted from the Denmark fire.

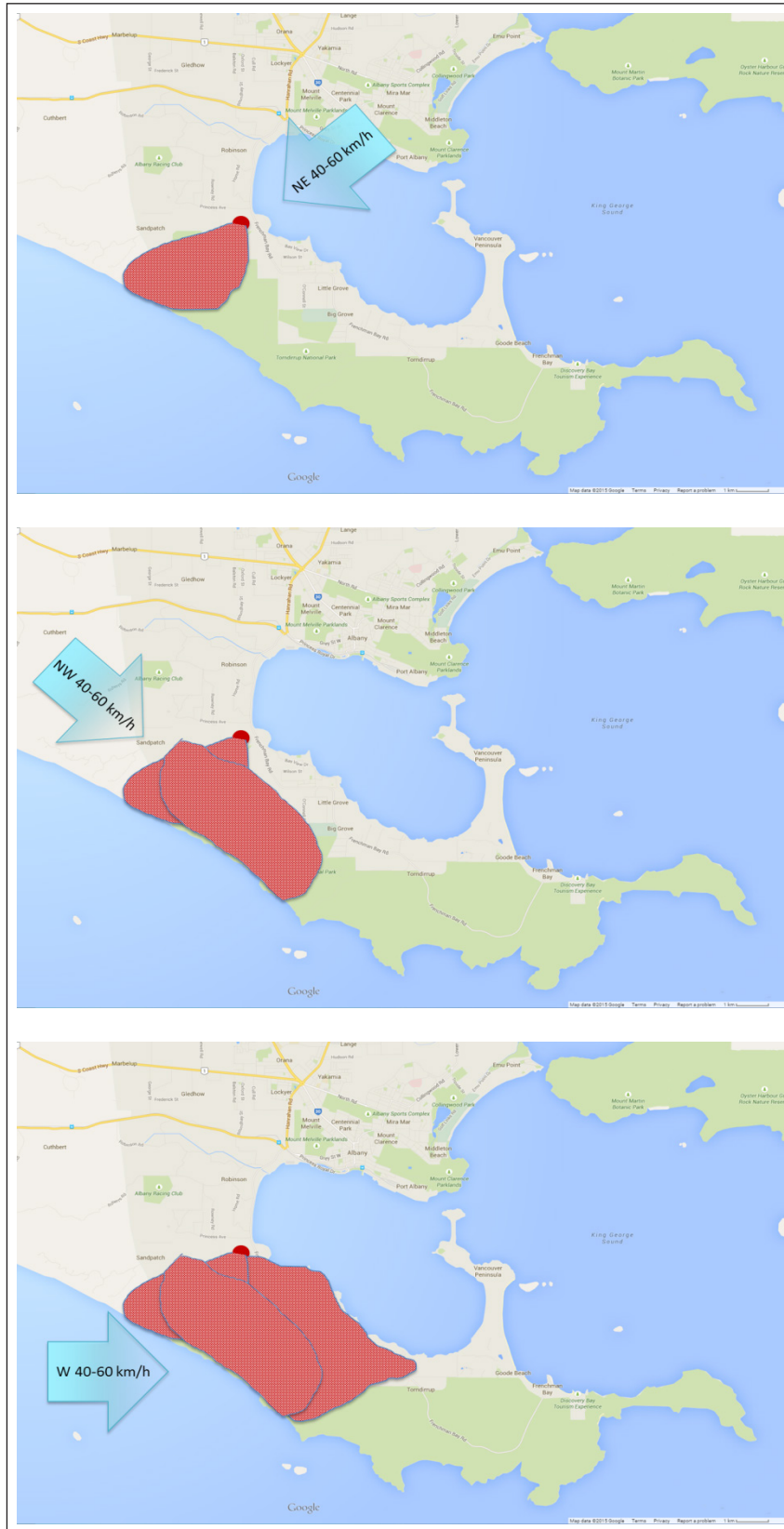
The Denmark fire soon becomes out of control. The changing wind creates a large fire front (moving at 13 km/hour) that covers Denmark town and cuts off the South Coast Highway and Ocean Beach Road, creating access issues (Figure 4). These wind conditions cause the Little Grove fire to progress through Little Grove and residential properties (Figure 5).

The fires spread fast due to steep topography and high fuel load. The town centre of Denmark is burnt and fatalities are suffered in rural areas.





**Figure 4: Denmark fire scenario sequence. Blue arrows show wind direction change from a north-easterly to a westerly throughout the day. Red areas show the progression of the fire scar.**



**Figure 5: Little Grove fire scenario sequence. Blue arrows show wind direction change from a north-easterly to a westerly throughout the day. Red areas show the movement of the fire scar.**

## Earthquake scenario

The earthquake scenario was developed by GA and has approximately a 0.0067% chance of occurrence in any given year.

At 12:09 pm on a Thursday in June, a magnitude 5.7 earthquake occurs in the centre of Albany at a depth of 5 km (Figure 6). The fault rupture length is 7 km; it does not appear on the ground surface.

The earthquake results in extensive damage within the district. Older buildings do not withstand the earthquake and a number of fatalities occur. Based on the Modified Mercalli Intensity Scale (MMI) (Table 4), expected damage varies from MMI V (cracking of vulnerable masonry) to MMI VIII (severe to complete damage of unreinforced masonry (URM) buildings). Albany hospital, airport and port silo structures are damaged. Asbestos-lined water pipes are impacted along with the York Street pump station.

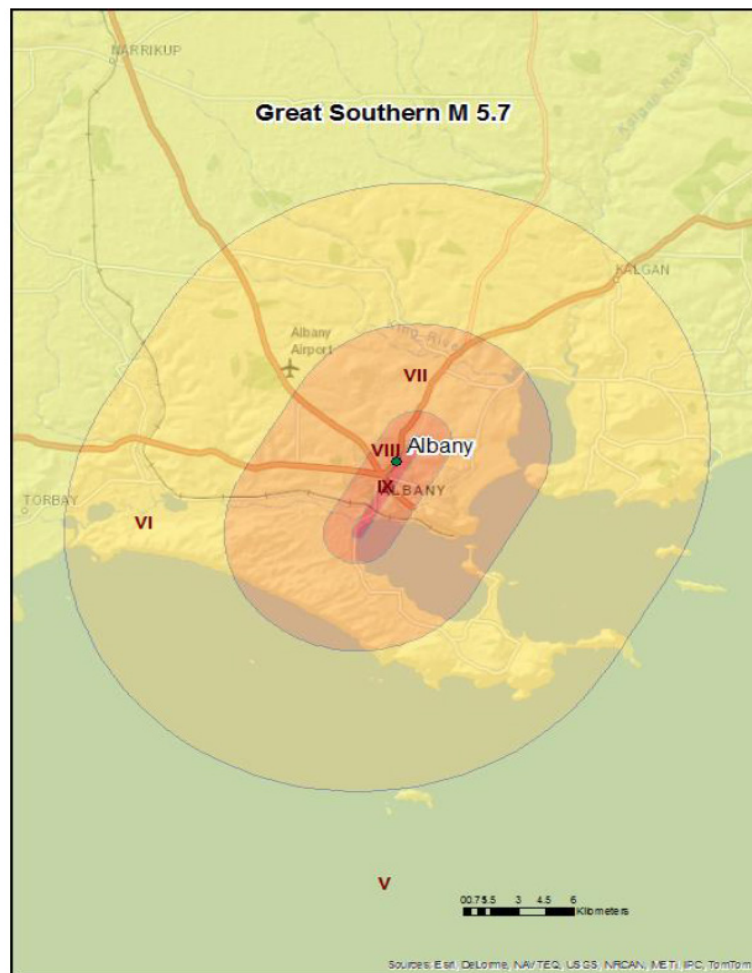


Figure 6: Potential shaking intensity map for the M 5.7 earthquake scenario in the Great Southern district (Image supplied by Geoscience Australia).

**Table 4: Modified Mercalli Intensity (MMI) scale showing expected damage and example earthquake events for shaking intensity V (5) to IX (9).**

MMI	Expected impacts	Example event
V	Cracking of vulnerable masonry (e.g. parapets & chimneys) with minor falls. Minor cracking to masonry houses.	Kalgoorlie CBD - 20 Apr 2010
VI	Collapse of vulnerable masonry and severe cracking to other masonry structures.	Boulder CBD - 20 Apr 2010
VII	Severe damage to unreinforced masonry (URM) buildings, some damage to housing, damage to low-ductility framed buildings, particularly irregular buildings, with some collapses.	Newcastle - 27 Dec 1989
VIII	Severe to complete damage to URM buildings, severe damage to low-ductility buildings.	Christchurch - 22 Feb 2011
IX	Destruction of URM and low-ductility framed buildings, damage to all other types.	Meckering - 14 Oct 1968

## Flood scenario

*The flood scenario was developed by BOM, DFES, P&W, WA Police and the OEM and has approximately a 0.499% chance of occurrence in any given year.*

*While the same weather event was used for both the flood and storm scenarios, the flood event has a lower likelihood of occurring because the ground (soils) need to be saturated prior to the rainfall for it to lead to more severe flooding. As such, the likelihood of the flood takes into account the lower probability of saturated soils.*

A strong, slow-moving storm and associated rainband resulting in heavy rainfall is expected in the Great Southern district with over 300 mm of rainfall over five days, with peak daily rainfall of 150 mm (Figure 7). Above average rainfall in the year preceding the event and wet catchments from rainfall a few days before the storm have exacerbated the flooding severity. Significant stream rises and major flooding is expected in Frankland River, Kent River, Denmark River and Albany Coastal catchments (Figure 8).



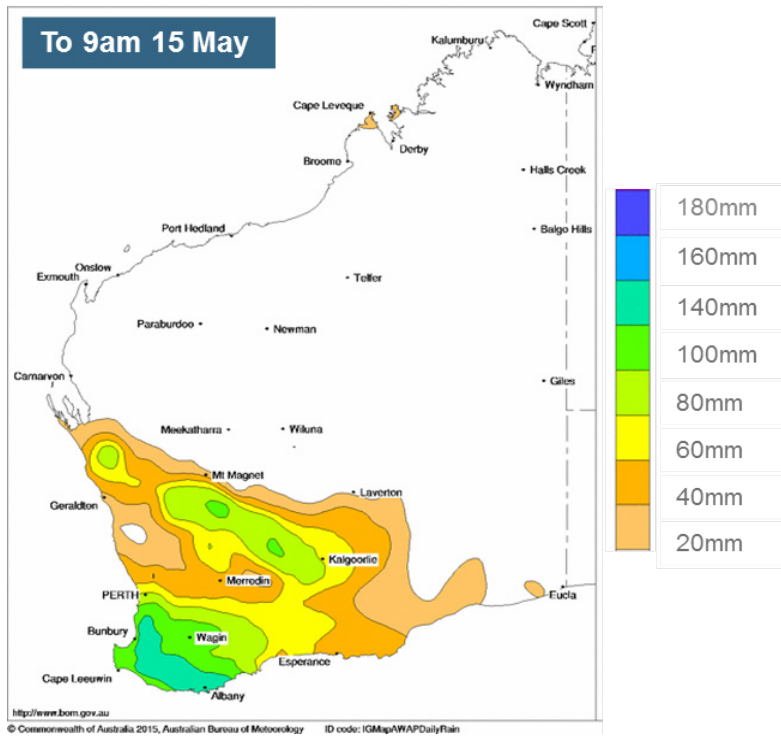


Figure 7: Forecast rainfall to 9am 15<sup>th</sup> May over the Great Southern district (Image supplied by BOM).

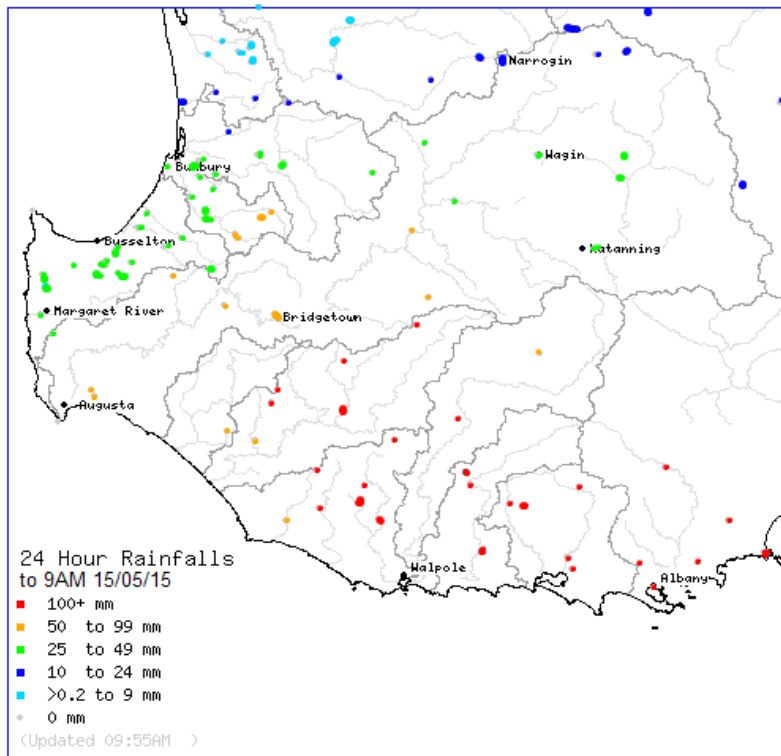


Figure 8: 24 hour rainfall rates at each river in the district on day 3 of the storm (Image supplied by BOM).

## Marine transport emergency scenario

The marine transport emergency scenario was developed by Southern Ports Authority and the Department of Transport, Marine Safety and has approximately a 0.995% chance of occurrence in any given year.

On the morning of 4 January the passenger ship *MV Costa Lot* (approximately 4,800 persons on board including guests and staff) struck Gio Batta Reef at 15 knots while inbound to the Port of Albany to pick up the pilot. Currently the ship is sitting one mile south of Cheyne Head (Figure 9), sinking (in 16 meters of water) with a heavy list to starboard with the starboard anchor cable out.

The ship master has ordered the ship to be abandoned and most passengers and crew have disembarked the vessel. The ship master has reported approximately 150 passengers and crew are unaccounted for, with a number of passengers on the life boats with serious injuries requiring immediate medical attention.

Recreational boating people have reported to Albany Sea Rescue that they have seen bodies floating in the water. A very heavy black oil slick is leaking from the vessel heading towards Middleton Beach and up into both Oyster and Princess Royal Harbours.

Being the height of the summer tourist season there is no accommodation available in Albany and the port is operating under a skeleton staff because of the Christmas/New Year holiday period.

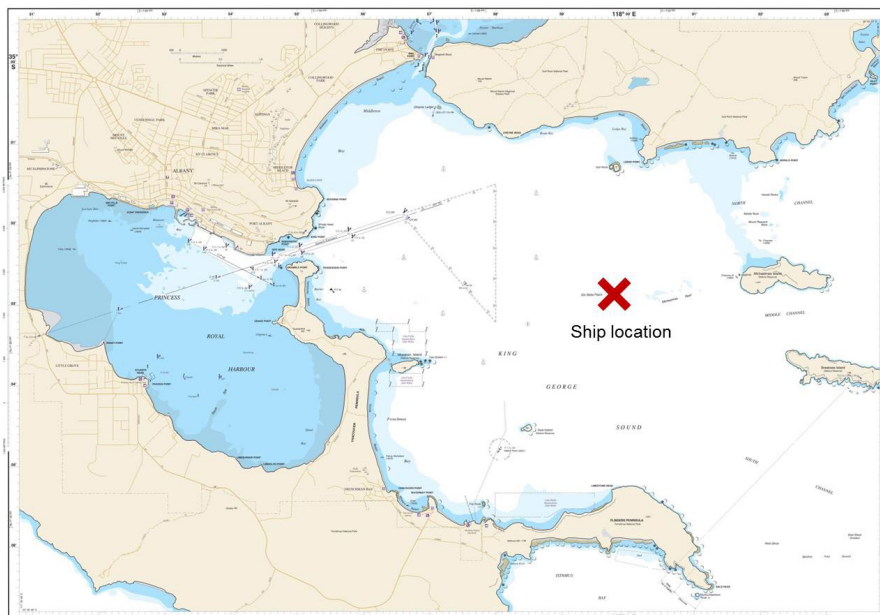


Figure 9: Location of the grounded *MV Costa Lot* ship, on the Gio Batta Reef (Image supplied by Southern Ports Authority – Port of Albany).

## Storm scenario

The storm scenario was developed by BOM, DFES, P&W, WA Police and the OEM and has approximately a 1.98% chance of occurrence in any given year.

A strong, slow-moving cold front moves over the south-west of the state extending in a line from Bunbury to Albany late in the morning. Heavy rainfall is expected ahead of the front with daily rain totals of up to 150 mm causing localised flash flooding. Conditions are conducive to the generation of cool season tornadoes with destructive wind gusts up to 150 km/hour.

A tornado passes through the Yakamia and Spencer/Centennial Parks areas of Albany (Figure 10). The tornado has affected the power supply, damaged or destroyed many residential homes and impacted a number of schools within the area.

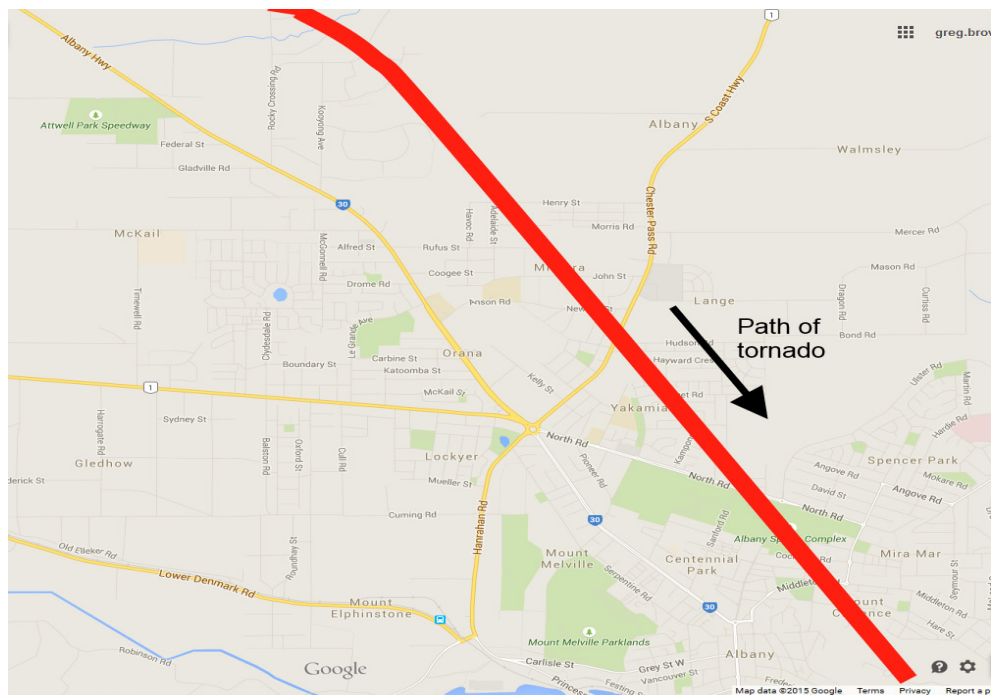


Figure 10: Anticipated path of the tornado for the Great Southern district storm scenario.

### 3 Assessed risk statements

A total of 316 risk statements were assessed across the six priority hazards: animal and plant biosecurity (36); bushfire (64); earthquake (57); flood (60); marine transport emergency (44); and storm (55).

Table 5 shows the number of risk statements for each hazard separated into the five impact areas (economy, public administration, people, environment and social setting).

The statements were generated to cover all foreseen impacts of the scenario events across the five categories. No environment statements were assessed for earthquake as risks to ecosystems and/or species were not foreseen at the time of the workshop.

The risk statements were assessed using the tailored *NERAG* consequence table for the Great Southern EM district found in Appendix C. The consequence levels are based on the gross area product (\$6.091 billion) and the population (75,691) of the EM district.

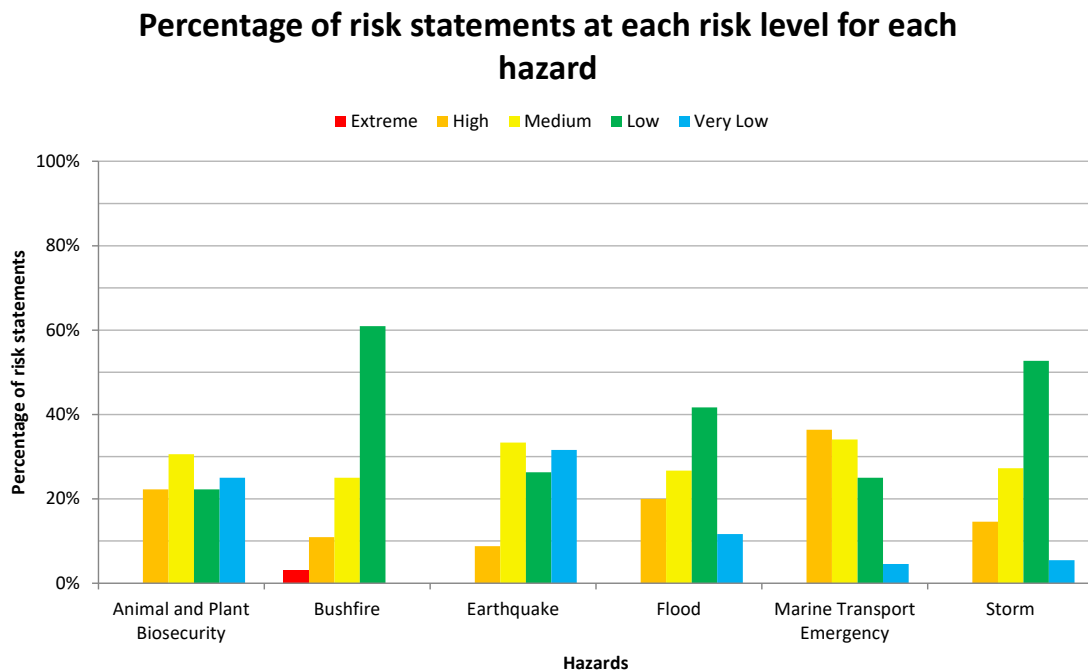
**Table 5: Number of risk statements assessed for each hazard in the Great Southern district. Note: AP Bio = animal and plant biosecurity; EQ = earthquake; MTE = marine transport emergency.**

Hazard	Impact area				
	Economy	Public administration	People	Environment	Social setting
AP Bio	12	8	2	2	12
Bushfire	17	18	4	8	17
EQ	19	18	4	0	16
Flood	21	11	5	9	14
MTE	12	15	6	4	7
Storm	19	13	4	6	13



## 4 Great Southern EM district risk profile

The risk profile for the Great Southern EM district for the six assessed hazards is shown in Figure 12 (following page). This diagram shows the percentage of risk statements for each hazard as they sit on the *NERAG 2015* risk matrix. The matrix is used to categorise risk statements by their likelihood, consequence and risk level. The bar graph below (Figure 11) combines the data and categorises it by hazard and risk level.

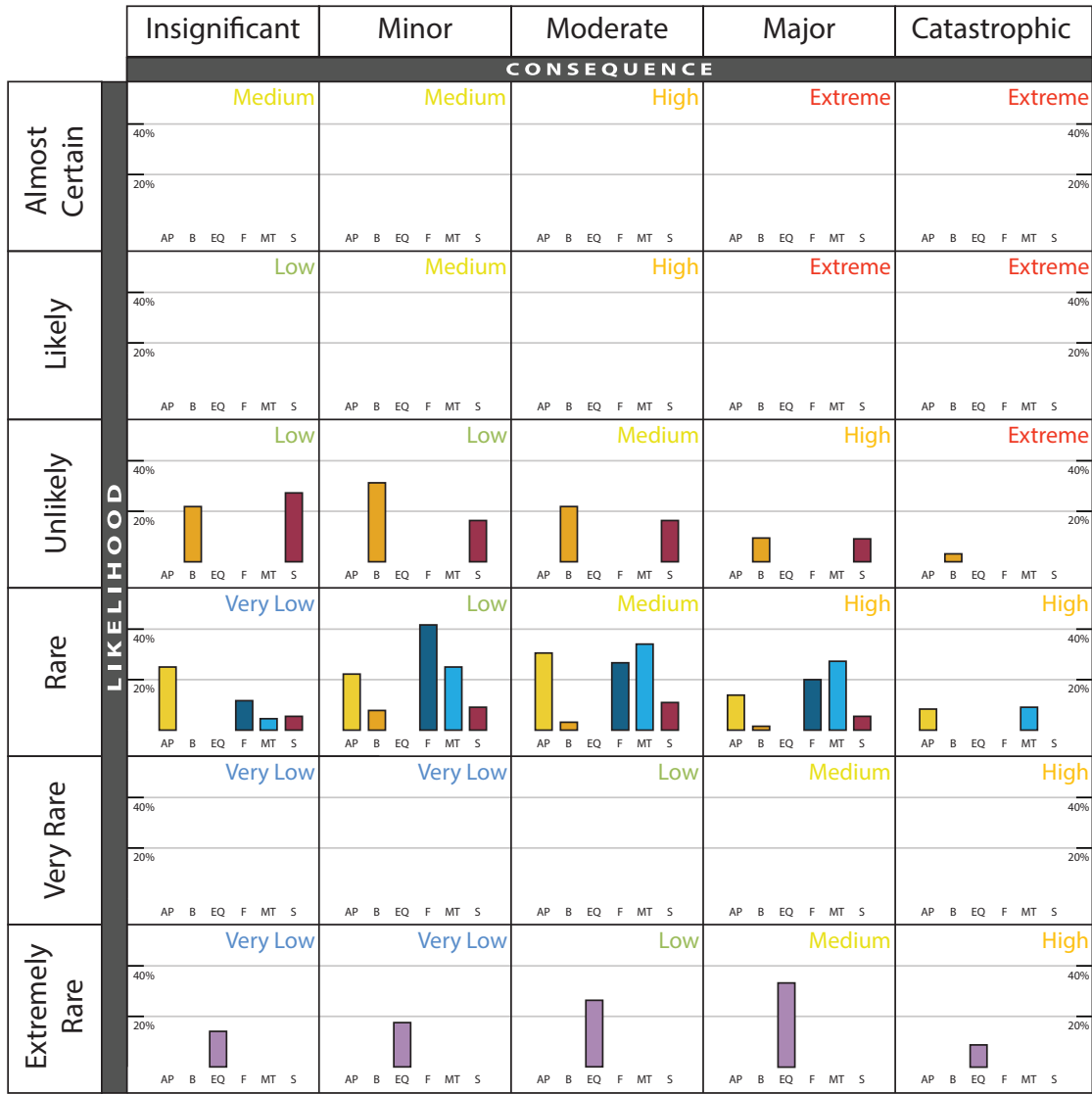


**Figure 11: Percentage of risk statements at each risk level for each hazard. Note: each hazard sums to 100%.**

Of the 316 risk statements, 1% are assessed as extreme, 18% as high, 29% as medium, 40% as low and 12% as very low risks. Individual hazard risk assessment summaries can be found in Appendix A.

A dominant feature of Figure 11 is the high proportion of low risks assessed for bushfire, flood and storm scenarios. Bushfire has the highest percentage (61%) of low risk statements of all the hazards, though it also has the only extreme risks. The proportion of low risks for these three hazards may indicate that these types of events occur more often, though on a smaller scale, and the existing control measures are effective. Marine transport emergency (which occurs less often) is the opposite, with more high risks than medium or low risks.

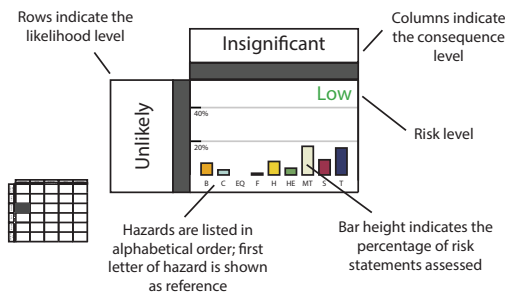
## Great Southern EM District Risk Profile



### Legend

- Animal & Plant Biosecurity (AP)
- Bushfire (B)
- Earthquake (EQ)
- Flood (F)
- Marine Transport Emergency (MT)
- Storm (S)

### Key



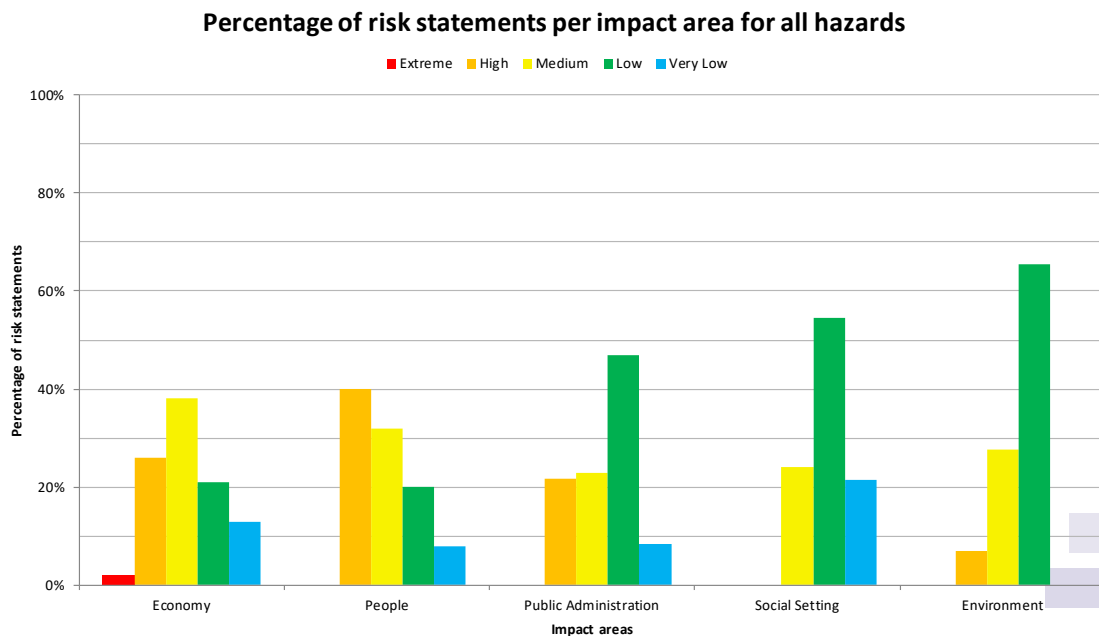
**Figure 12: Percentage of risk statements for each hazard assessed in the Great Southern EM district, categorised by their likelihood, consequence and risk level.**

The extreme risks related to the bushfire scenario (Figures 11 and 12) stem from impacts to the economy (Figure 13). These statements address damage to private and commercial buildings and contents resulting in financial losses. They were assessed to have catastrophic consequences resulting in potential financial losses of greater than \$244 million for the district.

Five per cent of the risks could produce catastrophic consequences. The risk matrix (Figure 12) shows there are high risks from the animal and plant biosecurity (3 statements), earthquake (5) and marine transport emergency (4) which have catastrophic consequences. These catastrophic consequences can strain and outstrip the district’s resources and should be considered during the treatment phase. Major consequences were assessed to result from 20% of the risk statements.






The majority (52%) of risk statements have a rare likelihood (0.1-<1% chance of occurrence in any given year). However, it is important to consider hazards with a lower probability of occurrence, such as earthquake which has a 0.0067% chance of occurrence in any given year.

Figure 13 shows how the risks are spread across the five impact areas. The two extreme risk statements appear in the economy impact area as they would have financial implications. Most of the high risk statements are within the people and economy impact areas, due to the high impact the six hazards have on the population’s health and the district’s economy. The environment impact area has a high proportion of low risk statements as does the public administration and social setting impact areas.



**Figure 13: Percentage of risk statements per risk level, by impact area for all hazards. Note: each impact area sums to 100%.**

## Common themes from extreme and high risk statements

<p>ECONOMY</p>		<ul style="list-style-type: none"> <li>• Damage to private and commercial buildings and contents resulting in asset loss (<i>extreme risk for bushfire</i>).</li> <li>• Significant reduction in business activity possibly resulting in failure of businesses, either from direct impact or from damaged buildings.</li> <li>• Damage and disruption of transportation networks incurring financial costs.</li> <li>• Loss of production and revenue in agriculture and horticulture sectors.</li> </ul>
<p>PEOPLE</p>		<ul style="list-style-type: none"> <li>• Emergency events cause injuries/illnesses (<i>for earthquake and marine transport emergency these are catastrophic consequences</i>).</li> <li>• Emergency events cause deaths (<i>for earthquake and marine transport emergency these are catastrophic consequences</i>).</li> </ul>
<p>PUBLIC ADMINISTRATION</p>		<ul style="list-style-type: none"> <li>• Surge on emergency services reducing their service provision and delivery.</li> <li>• Damage to power supply infrastructure impacting the power company's ability to provide power.</li> <li>• Response and recovery works by some state agencies (hazard dependant) and local governments impacting their ability to provide core services.</li> <li>• Increased demand for some services (vessels, accommodation, welfare) for public and response personnel.</li> </ul>
<p>SOCIAL SETTING</p>		<ul style="list-style-type: none"> <li>• <i>No social setting risk statements were ranked as extreme or high risks.</i></li> </ul>
<p>ENVIRONMENT</p>		<ul style="list-style-type: none"> <li>• Decrease in the health of the marine environment.</li> </ul>



## 5 Analysis of risk profile

In order to understand any potential relationships, the assessed risks have been grouped into categories to determine common themes or if certain areas and sectors are at higher risk.

In the following tables, risk statements are represented by showing the hazard name under the assigned risk level. Where a number follows the hazard name, more than one statement from that hazard fits into that category and risk level. There may also be more than one statement for a hazard in a category. For example, statements addressing horticulture, crops and agriculture infrastructure would all appear in the impacts to agriculture and pastoral activities category. Risk statements were written for each hazard to address anticipated impacts; therefore there are categories where not all hazards appear.

### Risks to economy

One hundred economy risk statements were assessed across the six hazards (Table 6). The statements address impacts to a significant industry or the decline in economic activity across the district (see Appendix C for criteria).

**Table 6: Impacts to economy by hazard and risk level. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Disruption to transport routes</i>		MTE Storm	Flood	Bushfire	AP Bio Earthquake
<i>Impacts to agricultural and pastoral activities</i>		AP Bio (4) Bushfire Flood (3)	AP Bio Bushfire (2) Flood (2) Storm (2)	Bushfire Storm	AP Bio Earthquake (3)
<i>Impacts to aviation services</i>				Storm	Earthquake Flood
<i>Impacts to bridges or their approaches</i>		Flood Storm	Bushfire	Earthquake	
<i>Impacts to commercial activities</i>		AP Bio (2) Earthquake Storm	Bushfire Earthquake	MTE (2)	Earthquake
<i>Impacts to commercial buildings, contents and services</i>	Bushfire	Earthquake Flood Storm			

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>			Earthquake Storm	Bushfire Flood	
<i>Impacts to marine infrastructure and industry</i>			Flood MTE (2) Storm	MTE (2) Storm	Flood MTE
<i>Impacts to natural gas distribution</i>			Storm		Flood
<i>Impacts to people's health</i>					AP Bio
<i>Impacts to power supply infrastructure</i>			Bushfire Flood Storm	Earthquake	
<i>Impacts to private buildings and contents</i>	Bushfire	Earthquake	Flood Storm		
<i>Impacts to sewerage systems</i>			Bushfire	Earthquake Flood Storm	
<i>Impacts to tourism</i>		Bushfire	AP Bio Bushfire Earthquake (2) MTE (2)	Flood (2) Storm	
<i>Impacts to transport infrastructure</i>		Flood Storm	Bushfire Earthquake		
<i>Impacts to water supply infrastructure</i>		Flood	Bushfire Earthquake Storm		
<i>Response and recovery activities</i>		MTE	Bushfire Flood Storm	Earthquake MTE	
<i>Workforce productivity losses</i>		AP Bio			

The only extreme risk statements for the Great Southern impact the economy. Damage to private and commercial buildings and their contents by the bushfire scenario were assessed as having catastrophic consequences, such that asset loss was expected to be greater than \$244 million.

The extreme economy risk statements are mainly a result of fire impacts to the townsite of Denmark and the surrounding area, particularly to the west of Denmark. Denmark and surrounding areas, such as Shadforth and Ocean Beach, are popular tourist destinations with a number of residential and commercial properties including shops, wineries and orchards. In this bushfire scenario, these properties would be destroyed or damaged. Consequently, the financial impacts to tourism from the bushfire scenario were assessed as a high risk. In addition, the fire in Little Grove (Albany) would impact several residential pockets.

Commercial buildings were seen to be at greater risk than private buildings for other hazards. While earthquake was assessed as a high risk for both categories of building, flood and storm were assessed to cause greater impacts (high risks) to commercial buildings. This may be due to the high cost of commercial buildings and stock replacement, and the location of some commercial areas.

A number of high risks result from impact to agricultural and pastoral activities and broader commercial activities. The animal and plant biosecurity scenario generated seven high risks relating to business failures, decreases in farm revenues and livestock movement, workforce labour mobility, reputational damage, loss of exports and price drops in the domestic market due to an oversupply of red meat. On average, agricultural products from the Great Southern makes up to a third of the State's agricultural commodities<sup>4</sup>. It should be noted that these impacts would be expected nation-wide.

Flood and bushfire also pose high risks to agricultural activities. Flood has the potential to cause animal disease and destroy agricultural and horticultural infrastructure, particularly dams. Depending on the time of the event, bushfire could cause significant damage to crops.

The cost of infrastructure damage from flood and storm was assessed as a high risk in some instances. If water infrastructure is damaged during a flood, there is a high risk of loss of potable water. Storm and flood damage to bridges and transport infrastructure were assessed as a high risk. The financial impact of the disruption of transport routes from storm was assessed to be high for storm and medium for flood. The reasoning behind these decisions was that the length of time it would take to remove the storm debris (e.g. vegetation) from roads is greater than the time it would take for flood waters to recede from roadways.

Disruption of marine transport routes, primarily access to the Albany port, was assessed as a high economic risk for the marine transport emergency scenario. Response and recovery activity costs from this scenario were also assessed as a high risk. Typically for the marine oil pollution incidents, the costs are covered by the ship owner ("the polluter pays"); however, clarity would need to be sought to determine if the passenger welfare and processing costs would be covered as well.

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<sup>4</sup>ABS 2011.

## Risks to people

Twenty-five risk statements assessed the impact to people across the six hazards. These statements addressed both deaths, injuries or illnesses, and their impact on emergency services (primarily medical transport) and on health services. The risk posed to each of these categories by the hazards is shown in Table 7.

**Table 7: Impacts to people by hazard and risk level. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Earthquake Flood MTE Storm			AP Bio
<i>Emergency services</i>			Earthquake MTE	Bushfire Flood Storm	
<i>Health services</i>			Earthquake MTE (2)	Bushfire Flood	Storm
<i>Injuries or illnesses</i>		Bushfire Earthquake Flood (2) MTE	AP Bio MTE Storm		

The risk of death from all hazards is high, (apart from animal and plant biosecurity) within the Great Southern. It was assessed that there would be at least one fatality (major consequence) for these scenarios, with at least eight fatalities for earthquake and marine transport emergency (catastrophic consequence). Animal and plant biosecurity poses a very low risk to the population because the disease in the scenario does not affect human health; however it was anticipated that injuries may occur when dealing with the incident (moving and destroying animals) and mental illness would result from the loss of livelihoods. Suicides were not considered in the workshop.

The earthquake and marine transport emergency scenarios have a medium risk of overwhelming health and emergency services leading to further deaths. The widespread nature of the earthquake impacts and the number of people (4800) on the marine vessel could result in enough serious injuries to overwhelm the system. The combination of the limited number of potential rescue vessels along with the oil in the King George Sound would prevent boats from getting in and out of the harbour and likely contribute to delays in medical transport services.

Injuries (e.g. burns) are anticipated in a bushfire event and waterborne disease is expected to cause illnesses following a flood event.

## Risks to public administration

Eighty-three risk statements were assessed across the six hazards that addressed public administration impacts (Table 8). These statements pertain to the continuity of public services, for example, at medium risk or higher, either a reduction in services would occur or external assistance (from outside the district) would be required to maintain service levels (see Appendix C for criteria).

**Table 8: Impacts to public administration by hazard and risk level. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire	Earthquake
<i>Demand for accommodation</i>		MTE			
<i>Demand on Australian Border Force</i>		MTE			
<i>Demand on Port Authority services</i>			MTE		
<i>Demand on public facilities</i>		MTE		Bushfire Earthquake Storm	Flood
<i>Disruption to aviation</i>				Bushfire Storm	Earthquake
<i>Emergency services</i>		Bushfire MTE (2) Storm	Earthquake Flood	AP Bio Bushfire (2) Flood Storm (2)	Earthquake (2) Flood
<i>Facilities for vulnerable people</i>			Bushfire	Earthquake	
<i>Government services</i>		AP Bio MTE (2)	AP Bio (2) Earthquake (2)	AP Bio Bushfire (2)	
<i>Health services</i>			Earthquake	Bushfire Flood Storm	
<i>Home-care services</i>				Bushfire Earthquake Flood (2) Storm (2)	
<i>Impacts to communication service delivery</i>			Flood Storm	Bushfire Earthquake	



Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to port and marina services</i>			Earthquake	Storm	
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm		Earthquake	
<i>Impacts to public transport services</i>				Bushfire	
<i>Impacts to sewerage service delivery</i>				Bushfire Earthquake	
<i>Impacts to water supply service delivery</i>			Bushfire	Earthquake	
<i>Public information</i>			MTE (2)	AP Bio	
<i>Public unrest</i>				MTE	
<i>Response and recovery activities</i>		Bushfire Flood MTE (2)	AP Bio Bushfire Earthquake (2)	Flood MTE Storm (2)	AP Bio
<i>Social services</i>		MTE			

Overall, most risks to the public administration are medium and low risks. There are, however, a number of high risks that should be considered during the risk treatment phase. The animal and plant biosecurity scenario would overwhelm DAFWA, requiring significant assistance from outside the district.

The overwhelming of emergency services and their subsequent decrease in core service provision is ranked as a high risk for bushfire, marine transport emergency and storm hazard scenarios. The high risk for bushfire is because the fires occur during the Australia Day public holiday/weekend when there are a large number of people in the area and because there are two concurrent incidents (Little Grove and Denmark). In comparison, the increased demand on health services is lower risk, suggesting that the health sector is either slightly more resilient compared to emergency services, or less health services are likely to be required across the six hazard scenarios.

The impacts to local government and the Department of Environmental Regulation (DER) services are medium risks for Animal and Plant Biosecurity as they would require external assistance to assist with the response and recovery efforts.

Disruptions to essential service provision as a result of infrastructure damage are low risks in most cases with the exception of the power supply infrastructure. Impacts from

the bushfire, flood and storm scenarios have a high risk of causing a decrease in power supply provision due to the widespread nature of the power supply network and the potential for these hazards to cause significant network damage.

The greatest risks to the public administration stem from the marine transport emergency event. Demand for accommodation, welfare services and public facilities is high because of the large number of people involved. There would a significant number of response and recovery personnel in the area responding to the emergency and there are approximately 4800 persons on board the ship, including guests and staff, who all require shelter and welfare provision. Increased demand on Australian Border Force, WA Police, Department of Transport Marine Safety, emergency services and other state agencies involved would be substantial. This demand would extend into the recovery and clean-up for some agencies as spontaneous volunteers would need to be managed, which is another high risk.

The MTE event also sees hazardous materials released into the King George Sound and surrounding area which would exacerbate accessibility issues for emergency services and would require specialist equipment to be outsourced from another district, most likely Perth or Esperance. In addition, external resources to the district would likely be required as there is a limited number of recovery vessels available.

### **Risks to social setting**

Seventy-nine risk statements assessed the impact to the social setting across the six hazards. The social setting focuses on the impacts to community wellbeing, community services and culturally important activities and objects (see Appendix C for criteria).

Overall, the risk to the social setting of the district is lower than the other four impact categories, having no high risks. The potential events are not expected to break the social fabric of the community. The highest risks to the community relate to the loss of reputation, displacement of communities, impacts to the marine environment, impacts to tourism, loss of income, loss of cultural significance, emotional stress, impacts to social services and the impact of building damage on community wellbeing.

**Table 9: Impacts to social setting by hazard and risk level. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire (3) Flood (3) Storm (2)	Earthquake (3)
<i>Breakdown of social networks</i>					AP Bio
<i>Community services and events</i>					Earthquake
<i>Culturally significant facilities and customs</i>			AP Bio Earthquake (3) MTE Storm (2)	Bushfire (4) Flood (3)	
<i>Death/injury of animals</i>				Bushfire	Earthquake Flood Storm
<i>Demand for accommodation</i>					MTE
<i>Displacement or isolation of communities</i>			AP Bio Bushfire Earthquake Storm (2)	Flood (2)	AP Bio
<i>Education facilities</i>				Bushfire Earthquake Flood Storm	
<i>Facilities for vulnerable people</i>				Bushfire Flood Storm	Earthquake
<i>Flora and fauna</i>			MTE		
<i>Impacts to people's health</i>				AP Bio Bushfire (2) Earthquake Flood MTE	Storm
<i>Impacts to tourism</i>			Bushfire	AP Bio MTE (2)	AP Bio Earthquake
<i>Loss of income</i>			AP Bio	Bushfire Earthquake Storm	
<i>Psychological and emotional stress</i>			AP Bio (2)	AP Bio MTE	AP Bio

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Residential building damage</i>			Flood	Bushfire Earthquake Storm	
<i>Social services providers</i>			Bushfire	Storm	Earthquake Flood

The damage to the district’s reputation caused by either the animal and plant biosecurity or marine transport emergency events could potentially cause longer term impacts to the community’s wellbeing. The oil pollution and damage to marine wildlife and the aesthetics of the area were assessed to cause a loss of community identity/morale.

The animal and plant biosecurity scenario is likely to impact the agricultural reputation of the district and cause significant permanent displacement outside the district because of the loss of livelihoods: not only for farmers but also the meat packing and livestock transport industry, which would more than likely become insolvent. The psychological and emotional stresses associated with these changes were ranked as medium risks.

Bushfire, earthquake, flood and storm scenarios are expected to cause displacement because of damage to buildings and infrastructure services. In all four scenarios, permanent dispersal of the district community is expected when homes are lost due to the insurance and building recovery times and the related ongoing stress. Moreover, post-traumatic stress for individuals may cause them to leave the area, particularly for the earthquake hazard as it is less common than bushfire and storm. Loss of cultural buildings—heritage buildings, churches, museums, art galleries or libraries—from an earthquake or tornado/storm damage were also assessed as medium risks.

### Risks to environment

Twenty-nine environmental risk statements were assessed across five of the hazards. These statements address impacts to ecosystems, species and landscapes (see Appendix C for criteria). Environment statements are assessed for the district as a whole, not necessarily for specific sites. No environment statements were assessed for earthquake as risks to the ecosystem or species were not foreseen at the time of the workshop. With the exception of increased sedimentation in water bodies, environmental impacts from an earthquake are likely to be limited to specific sites where chemical or asbestos contamination may occur.

**Table 10: Impacts to environment by hazard and risk level. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Contamination from toxic substances</i>				Bushfire	
<i>Debris or pollutants entering the riverine or marine environment</i>		MTE	Flood (2) MTE	Bushfire Storm	
<i>Flora and fauna</i>		MTE	Flood (2) MTE	Bushfire (4) Flood Storm (3)	
<i>Invasive non-native flora and fauna</i>			Flood (2)	Bushfire	
<i>Issues with carcass disposal</i>				AP Bio	
<i>Soil erosion</i>				AP Bio Flood Storm	
<i>Spread of diseases</i>				Bushfire Flood Storm	

The highest risks to the environment are posed by the marine transport emergency scenario. This scenario was assessed to result in catastrophic consequences from oil and other pollutants entering the marine environment, with major consequences to marine flora and fauna. Due to the location of the oil spill, a number of national parks and marine reserves would be impacted, including impacts to penguin and sea lion colonies, with long recovery periods expected.

The flood scenario also poses a series of medium risks to the environment. A surge of non-native flora and fauna (along with algal blooms) would affect the native flora, fauna and marine life species. The introduction of debris, pollutants, increased turbidity and sediment plumes in waterways is expected to impact the marine ecosystem.



## Risks by theme

Risk statements were assessed across the five impact areas (economy, public administration, people, social setting and environment) following the *NERAG* consequence criteria. However, some risks crosscut multiple impact areas. By combining them into themes, common risks are highlighted for different sectors and actors.

The ten themes identified for the Great Southern EM district are: buildings; community; education; environment; government; health; industry/commercial; tourism; transport; and utilities. The environment category is not shown here as the data are the same as Table 10.

The colour coding in these table follows the impact areas: pink – economy; orange – public administration; blue – people; and purple – social setting.

## Buildings

The only extreme risk statements for the Great Southern relate to damage of private and commercial buildings by the bushfire scenario (Table 11). Bushfire and earthquake are the highest risks relating to building damage. The effect on the community wellbeing as a result of losing these buildings is a lower risk but does merit attention as permanent dispersal from the district would be likely.

**Table 11: Risks related to buildings. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Buildings					
Category	Extreme	High	Medium	Low	Very Low
<i>Demand on public facilities</i>		MTE		Bushfire Earthquake Storm	Flood
<i>Emergency services</i>				Bushfire Storm	Earthquake Flood
<i>Impacts to commercial buildings, contents and services</i>	Bushfire	Earthquake Flood Storm			
<i>Impacts to private buildings and contents</i>	Bushfire	Earthquake	Flood Storm		
<i>Residential building damage</i>			Flood	Bushfire Earthquake Storm	

## Community

The highest risk to the community is caused by the expected demand for accommodation services for response and recovery personnel responding to the marine transport emergency scenario. Resources would have to be diverted in order to manage this demand. It was not anticipated that the increased demand for shelter, food and water for passengers would impact on community wellbeing as it was ranked a very low risk (purple row – demand for accommodation, Table 12).

The next highest risks relate to animal and plant biosecurity which impact upon a number of aspects of the community, causing a loss of income and possible relocation out of the district for employment reasons (a large percentage of the population is employed in the agricultural sector). The emotional and psychological stress from these impacts and from having to euthanise animals (including healthy animals) also present notable risks.

**Table 12: Risks to the community. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Community					
Category	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire (3) Flood (3) Storm (2)	Earthquake (3)
<i>Availability of essential supplies</i>				Bushfire	Earthquake
<i>Breakdown of social networks</i>					AP Bio
<i>Community services and events</i>					Earthquake
<i>Culturally significant facilities and customs</i>			AP Bio Earthquake (3) MTE Storm (2)	Bushfire (4) Flood (3)	
<i>Death/injury of animals</i>				Bushfire	Earthquake Flood Storm
<i>Demand for accommodation</i>		MTE			
<i>Demand for accommodation</i>					MTE
<i>Displacement or isolation of communities</i>			AP Bio Bushfire Earthquake Storm (2)	Flood (2)	AP Bio

Community					
Category	Extreme	High	Medium	Low	Very Low
<i>Facilities for vulnerable people</i>				Bushfire Flood Storm	Earthquake
<i>Facilities for vulnerable people</i>			Bushfire	Earthquake	
<i>Home-care services</i>				Bushfire Earthquake Flood (2) Storm (2)	
<i>Loss of income</i>			AP Bio	Bushfire Earthquake Storm	
<i>Psychological and emotional stress</i>			AP Bio (2)	AP Bio MTE	AP Bio
<i>Public unrest</i>				MTE	
<i>Social services</i>			Bushfire	Storm	Earthquake Flood

## Education

Only the four natural hazards caused impacts to education facilities (Table 13) as marine transport emergency and animal and plant biosecurity scenarios are unlikely to impact these facilities. The risk is considered low as it is anticipated that students are relatively mobile and can be transferred to other operational schools if their schools are closed and/or damaged.

**Table 13: Risks related to education. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Education					
Category	Extreme	High	Medium	Low	Very Low
<i>Education facilities</i>				Bushfire Earthquake Flood Storm	

## Government

There is a wide spread of risk levels for all government categories from high to very low risk (Table 14).

The highest risks for the government sector are from the marine transport emergency scenario which has higher risk for all categories. Since Albany would unexpectedly become the cruise ship's first port of call in Australia, a significant number of government services, including federal, would be involved. In addition, the large number of passengers on board coming ashore would increase demand on all relevant government services, including transport, temporary housing, food and welfare.

Similarly, the logistic and organisational requirements of the animal and plant biosecurity scenario would create a significant impost on involved agencies and require external assistance.

**Table 14: Risks related to government activities. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Government					
Category	Extreme	High	Medium	Low	Very Low
<i>Demand on Australian Border Force</i>		MTE			
<i>Demand on Port Authority services</i>			MTE		
<i>Emergency services</i>		Bushfire MTE (2) Storm	Earthquake Flood	AP Bio	
<i>Government services</i>		AP Bio MTE (2)	AP Bio (2) Earthquake (2)	AP Bio Bushfire (2)	
<i>Public information</i>			MTE (2)	AP Bio	
<i>Response and recovery activities</i>		MTE	Bushfire Flood Storm	Earthquake MTE	
<i>Response and recovery works</i>		Bushfire Flood MTE (2)	AP Bio Bushfire Earthquake (2)	Flood MTE Storm (2)	AP Bio

## Health

The highest health-related risks to the Great Southern district for all scenarios, barring animal and plant biosecurity, (Table 15) are deaths or injuries. It is expected that the health system would struggle and require significant external assistance for the earthquake and marine transport emergency scenarios, but would be more likely to cope for the other hazard scenarios.

**Table 15: Risks related to health. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Health					
Category	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Earthquake Flood MTE Storm			AP Bio
<i>Emergency services</i>			Earthquake MTE	Bushfire Flood Storm	
<i>Health services</i>			Earthquake MTE (2)	Bushfire Flood	Storm
<i>Health services</i>			Earthquake	Bushfire Flood Storm	
<i>Impacts to people's health</i>					AP Bio
<i>Impacts to people's health</i>				AP Bio Bushfire (2) Earthquake Flood MTE	Storm
<i>Injuries and illnesses</i>		Bushfire Earthquake Flood (2) MTE	AP Bio MTE Storm		
<i>Social services</i>		MTE			



## Industry/commercial

All aspects of commercial activities within the district, especially agricultural and pastoral activities, are affected by all hazards (Table 16).

**Table 16: Risks related to industrial/commercial activities. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Industry/commercial					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption to transport routes</i>		MTE			
<i>Impacts to agricultural and pastoral activities</i>		AP Bio (4) Bushfire Flood (3)	AP Bio Bushfire (2) Flood (2) Storm (2)	Bushfire Storm	AP Bio Earthquake (3)
<i>Impacts to commercial activities</i>		AP Bio (2) Earthquake Storm	Bushfire Earthquake	MTE (2)	Earthquake
<i>Impacts to marine infrastructure and industry</i>			Flood MTE (2) Storm	MTE (2) Storm	Flood MTE
<i>Impacts to port and marina services</i>			Earthquake	Storm	
<i>Workforce productivity losses</i>		AP Bio			

## Tourism

All hazards impact the economic aspects of tourism in the district (pink row – Impacts to tourism, Table 17) whereas non-economic impacts to the community are lower risk (purple row – Impacts to tourism, Table 17). This could suggest that the non-economic aspects of tourism do not play a significant role in the community.

**Table 17: Risks related to tourism. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Tourism					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to tourism</i>		Bushfire	AP Bio Bushfire Earthquake (2) MTE (2)	Flood (2) Storm	
<i>Impacts to tourism</i>			Bushfire	AP Bio MTE (2)	AP Bio Earthquake

## Transport

Flood and storm are the highest risk to transportation networks, resulting in financial losses incurred through either delays or the physical damage of infrastructure (Table 18).

**Table 18: Risks related to transport. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Transport					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption to aviation services</i>				Bushfire Storm	Earthquake
<i>Disruption to transport routes</i>		Storm	Flood	Bushfire	AP Bio Earthquake
<i>Emergency services</i>				Bushfire Flood Storm	Earthquake
<i>Impacts to aviation</i>				Storm	Earthquake Flood
<i>Impacts to bridges or their approaches</i>		Flood Storm	Bushfire	Earthquake	
<i>Impacts to public transport services</i>				Bushfire	
<i>Impacts to transport infrastructure</i>		Flood Storm	Bushfire Earthquake		

## Utilities

All risks that impact utilities are a result of natural events (Table 19). The costs incurred from these natural events seem to correlate well to impacts in service provision: generally financial loss (pink lines) is a higher risk for each hazard than corresponding loss in service provision for that hazard (orange lines), with the exception of power supply where impacts to service provision are higher risk than the economic losses.

**Table 19: Risks related to utilities. Note: AP Bio = animal and plant biosecurity; MTE = marine transport emergency.**

Utilities					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>			Earthquake Storm	Bushfire Flood	
<i>Impacts to communication service delivery</i>			Flood Storm	Bushfire Earthquake	
<i>Impacts to natural gas distribution</i>			Storm		Flood
<i>Impacts to power supply infrastructure</i>			Bushfire Flood Storm	Earthquake	
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm		Earthquake	
<i>Impacts to sewerage systems</i>			Bushfire	Earthquake Flood Storm	
<i>Impacts to sewerage service delivery</i>				Bushfire Earthquake	
<i>Impacts to water supply infrastructure</i>		Flood	Bushfire Earthquake Storm		
<i>Impacts to water supply service delivery</i>			Bushfire	Earthquake	

## 6 Risk evaluation

The next step in the risk management process is to evaluate the risks, determining whether the identified risks are acceptable or require treatment (Figure 14).

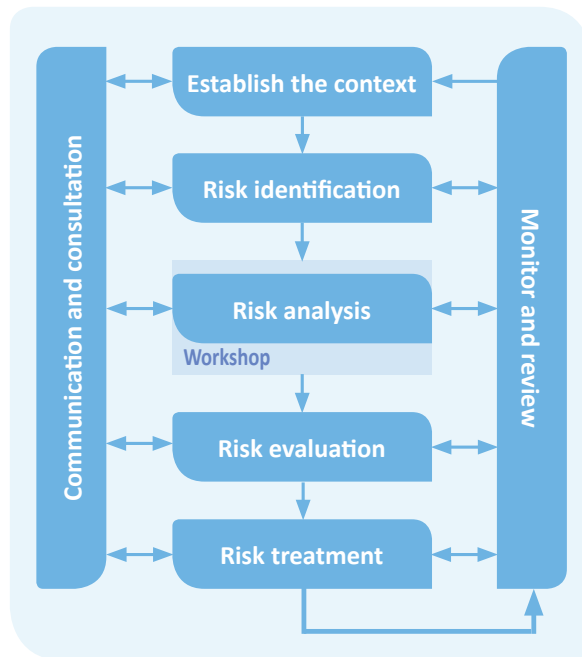


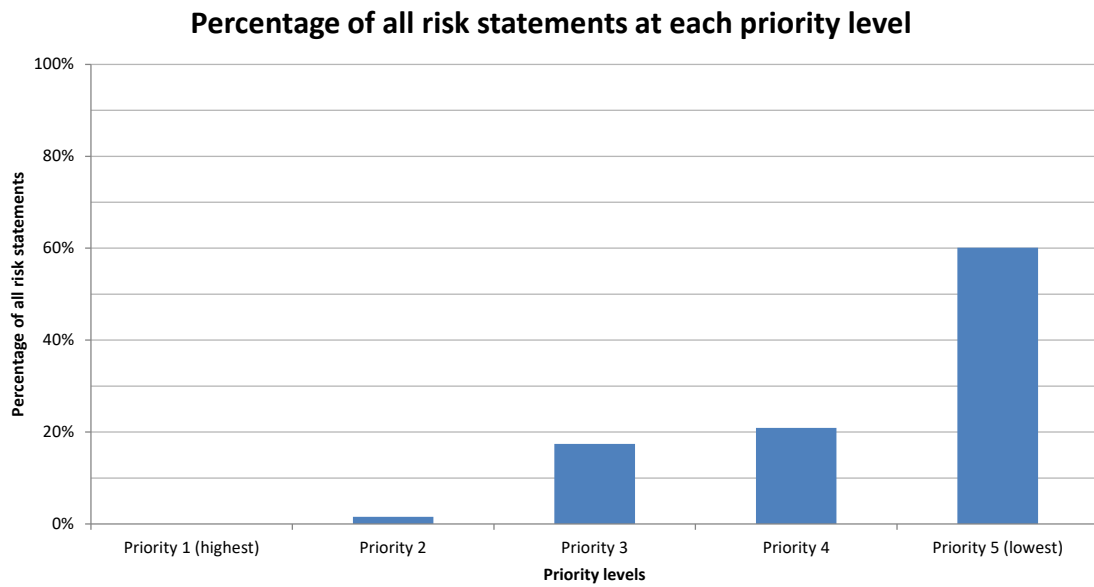
Figure 14: Emergency risk management process.<sup>4</sup>

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. *NERAG* priority is based on the risk level and confidence associated with each assessed risk. Priority ranges from 1 (highest priority) to 5 (lowest priority). The following prioritisation of risks is a helpful tool to focus attention on the more significant risks. However, the determination of whether a risk is acceptable or should be treated has governance, financial and societal implications and is best administered by the appropriate level(s) of government.

Figure 15 shows that the majority (60%) of the Great Southern risk statements are classified as Priority 5, meaning that these are low priority and require monitoring during the risk assessment review phase. Five risk statements (2%) have been classified as Priority level 2, indicating that these risks have a high priority for further investigation and/or treatment. Two of these risk statements, related to bushfire, have been classified as Priority 2 because of their extreme risk level, while the other three statements (2 flood and 1 storm) were classified as Priority 2 based on their confidence level. Because of their moderate confidence level, these three statements should be investigated further to improve confidence in the assigned consequence and risk levels. None of the Great Southern risk statements assessed have a Priority level of 1.

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Table 20 contains the Priority 2 risk statements in full and those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.



**Figure 15: Percentage of all risk statements at each priority level. Priority 1 – highest; Priority 2 – high; Priority 3 – medium; Priority 4 – low; Priority 5 – lowest.**



**Table 20: Risk statements for the Great Southern district with Priority level 2 or catastrophic consequences. Note: AP Bio = animal and plant biosecurity; EQ = earthquake; MTE = marine transport emergency.**

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Bushfire	will damage private buildings and contents, resulting in financial losses.	Economy	Catastrophic	Extreme	Highest	2
Bushfire	will damage commercial buildings, contents and services resulting in financial losses.	Economy	Catastrophic	Extreme	Highest	2
Flood	will damage transport infrastructure such as road and rail, incurring costs to the district.	Economy	Major	High	Moderate	2
Flood	will cause damage/inundation of bridges, or approaches to bridges such that sections of many roads will be closed, causing recovery/reconstruction costs and disrupting transport routes, incurring losses.	Economy	Major	High	Moderate	2
Storm	will impact the health of people and cause death(s).	People	Major	High	Moderate	2
AP Bio	will impact farm revenues.	Economy	Catastrophic	High	Highest	3
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	Highest	3
AP Bio	will result in business failures across the district.	Economy	Catastrophic	High	Highest	3
MTE	will result in a high demand for response and recovery vessels to assist in the hazard event.	Public Administration	Catastrophic	High	Highest	3
MTE	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
MTE	will impact the health of people and cause injury/illness.	People	Catastrophic	High	Highest	3
MTE	will cause debris and pollutants to enter marine environments, impacting the marine ecology.	Environment	Catastrophic	High	Highest	3
EQ	will damage private buildings and contents, resulting in financial losses.	Economy	Catastrophic	High	Highest	4
EQ	will damage commercial buildings, contents and services, resulting in financial losses.	Economy	Catastrophic	High	Highest	4

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
EQ	will prevent commercial and small businesses from functioning, resulting in financial losses and business failure.	Economy	Catastrophic	High	Highest	4
EQ	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	4
EQ	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	4

## 7 Future actions

A preliminary treatment discussion was held on 17 November 2016 in Albany with relevant agencies to review the risk assessment results and begin the conversation concerning risk tolerability and potential treatment strategies.

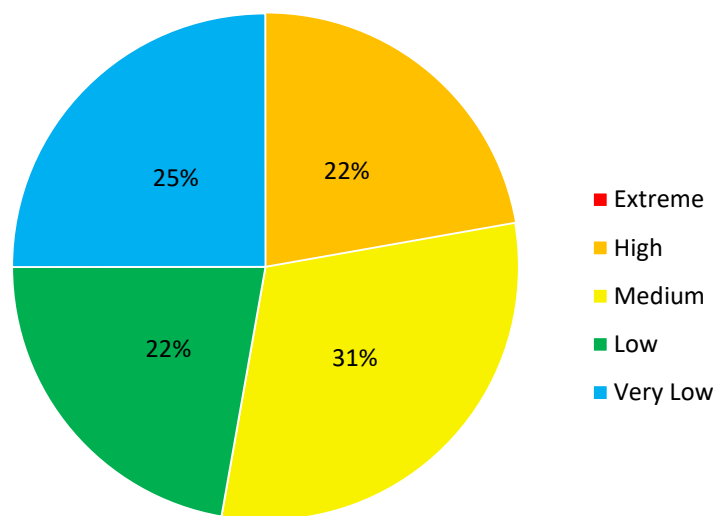
## Appendix A: Individual hazard risk assessment summaries

This appendix contains a summary of the assessed risks for each of the hazards separated into the five impact categories.

### Animal and plant biosecurity

This section summarises the risk to the Great Southern EM district from the animal and plant biosecurity scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 16.

**Percentage of risk statements at each risk level for animal and plant biosecurity**



**Figure 16: Percentage of risk statements at each risk level for animal and plant biosecurity.**

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## Animal and plant biosecurity risk assessment

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ECONOMY



### Extreme risks

Nil.

### High risks

Decreasing farm revenues, impacts to exports due to restrictions and business failure across the district. Four other risk statements were also ranked as high risk but with lower consequences; these are related to impacts to the mobility of labour and livestock in the district, the oversupply of red meat on the domestic market and reputational damage to the district.

### Medium risks

The reduced number of tourists travelling in the district, and the impact on the poultry industry reducing the consumption of meat, will lead to economic losses.

### Low risks

Nil.

### Very Low risks

Disruption to the freight routes, disruption to control programs to control feral pigs (pigs can carry FMD) and medical impacts on many individuals.

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PEOPLE



### Extreme and High risks

Nil.

### Medium risks

The impact on the health of people causing injuries and illness.

### Low risks

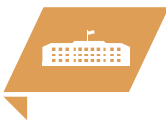
Nil.

### Very Low risks

The impact on the health of people causing death(s).

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PUBLIC ADMINISTRATION



### Extreme risks

Nil.

### High risks

Impact to the Department of Agriculture and Food, Western Australia (DAFWA) resources, impacting their ability to maintain core services, was the only high risk.

### Medium risks

Impacts to other governing bodies such as the local government, Department of Environmental Regulation, other state bodies (excluding DAFWA), limiting their ability to provide core services.


### Low risks

Low risks relate to the need for public relations management impacting each governing bodies ability to maintain core services; the impact on P&W resources for the management of feral pigs (pigs can carry FMD) in national parks.

### Very Low risks

The demand for earthmoving equipment for carcass burial.

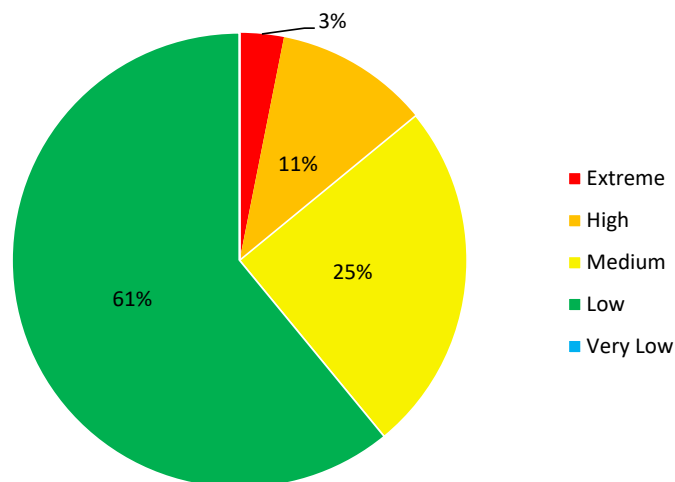
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<b>Animal and plant biosecurity risk assessment</b>	
SOCIAL SETTING 	<p><b>Extreme and High risks</b></p> <p>Nil.</p> <p><b>Medium risks</b></p> <p>Farmers experiencing psychological and emotional stress, loss of employment, abandonment of farms and damage to the district's reputation</p> <p><b>Low and Very Low risks</b></p> <p>Mental health issues, distress from viewing images of slaughter, isolation of community members due to quarantine and impacts to farmers markets across the district.</p>
	<p><b>Extreme, High and Medium risks</b></p> <p>Nil.</p> <p><b>Low risks</b></p> <p>Increase in livestock numbers on farms, resulting in resource pressures creating wind and water erosion, and the unmanaged disposal of carcasses were the only two environment statements for this hazard.</p> <p><b>Very Low risks</b></p> <p>Nil.</p>

## Bushfire

This section summarises the risk to the Great Southern EM district from the bushfire scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 17.

**Percentage of risk statements at each risk level for bushfire**



**Figure 17: Percentage of risk statements at each risk level for bushfire.**

---

## Bushfire risk assessment

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### ECONOMY



#### **Extreme risks**

The extreme risk statements specifically regard the impact of bushfire to private buildings, commercial buildings and building contents, resulting in economic losses.

#### **High risks**

Decrease in tourism to the district such that revenue declines and impacts on crops/cropping/plantations in the district, resulting in financial losses.

#### **Medium risks**

Damage to power, transport, sewerage, potable water, horticulture and agriculture infrastructure, resulting in financial losses. In addition, impacts to the aspects that support the tourism industry (e.g. infrastructure, food and fuel outlets) may disrupt major events. The bushfire will result in recovery costs and financial losses.

#### **Low and risks**

Damage to communications infrastructure, disruption to major freight routes and impact livestock, resulting in financial losses.

#### **Very Low risks**

Nil.

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### PEOPLE



#### **Extreme risks**

Nil.

#### **High risks**

Impacts to the health of people causing death(s) and injuries and/or serious illness.

#### **Medium risks**

Nil.

#### **Low risks**

The overwhelming of the emergency services (including medical transport) and health services (hospitals, remote nursing posts, etc) resulting in further deaths directly attributed to the hazard event, was considered a low risk.

#### **Very Low risks**

Nil.

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## Bushfire risk assessment

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PUBLIC ADMINISTRATION



**Extreme risks**

Nil.

**High risks**

Increased demand on emergency services, local government recovery works and disruption to the power supply impacting on their service provision.

**Medium risks**

Recovery works by state agencies at the local level, disruption in the provision of potable water supply and provision of care at aged care facilities.

**Low risks**

Infrastructure impacts (transport, aviation, communications, sewerage systems), increased demand of WA health services and home-based services (e.g. Meals on Wheels) and the local government's ability to provide core services.

**Very Low risks**

Nil.

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SOCIAL SETTING



**Extreme and High risks**

Nil.

**Medium risks**

Dispersal of communities due to displacement, impact to social service providers impacting the community's wellbeing and the decrease in tourism.

**Low risks**

Impacts to the community wellbeing from deaths, building damage, and loss of income and employment. Other low risks include: impacts to educational facilities, care for vulnerable people, damage to churches, art galleries and heritage buildings, and isolation of towns causing resupply difficulties.

**Very Low risks**

Nil.

---

ENVIRONMENT



**Extreme, High and Medium risks**

Nil.

**Low risks**

Impact of the bushfire on flora and fauna, soil erosion, the spread of diseases and contamination.

**Very Low risks**

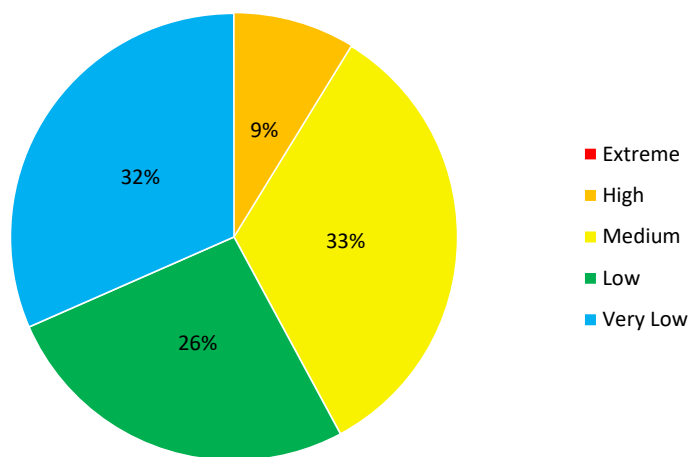
Nil.

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## Earthquake

This section summarises the risk to the Great Southern EM district from the earthquake scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 18.

**Percentage of risk statements at each risk level for earthquake**



**Figure 18: Percentage of risk statements at each risk level for earthquake.**

Earthquake risk assessment	
<b>ECONOMY</b> 	<p><b>Extreme risks</b> Nil.</p>
	<p><b>High risks</b> Damage to private and commercial buildings resulting in financial losses and the inability of small businesses to function, resulting in financial losses and possible business failure.</p>
	<p><b>Medium risks</b> Damage to transport, communications and potable water supply infrastructure, resulting in financial losses. The decrease in tourism in the district, damage to aspects that support the tourism industry (e.g. facilities, caravan parks, fuel outlets) and disruption to the hospitality and entertainment industry.</p>
	<p><b>Low risks</b> Damage to bridges and approaches, power and sewerage systems infrastructure, resulting in financial losses. The earthquake scenario will cause response and recovery activities where resources will be stretched, resulting in costs to the district.</p>
	<p><b>Very Low risks</b> Damage to aviation, agriculture infrastructure. Impacts to crops/cropping/ plantations, livestock and disruption to major events, resulting in financial losses.</p>

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## Earthquake risk assessment

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PEOPLE



### Extreme risks

Nil.

### High risks

Impacts to the health of people causing death(s) and injuries and/or serious illness.

### Medium risks

Overwhelming of the emergency services (including medical transport) and health services (e.g. hospitals, remote nursing posts) resulting in further deaths directly attributed to the earthquake event.

### Low and Very Low risks

Nil.

---

PUBLIC ADMINISTRATION



### Extreme and High risks

Nil.

### Medium risks

Increased demand on emergency and health services and recovery works to be undertaken by local government and state agencies at a district level. The local government's ability to provide core services and government service provisions (court, disability, licensing services) while helping to manage local impacts.

### Low risks

The ability of infrastructure (power, communications, potable water, sewerage) agencies to maintain their service. Impacts to home-based service providers and aged care facilities impacting their ability to maintain their core functions.

### Very Low risks

Impacts to the transport, arterial roads network and aviation infrastructure affecting core service provision and impact to emergency service buildings.

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SOCIAL SETTING



### Extreme and High risks

Nil.

### Medium risks

The displacement of people from their homes and the loss of cultural significance due to damage to places of worship, heritage buildings and public buildings (art galleries, museums, libraries).

### Low risks

Damage to residential buildings, the impact on day-to-day functionality of educational facilities and loss of employment impacting the wellbeing of the community.

### Very Low risks

The functionality of facilities for vulnerable people, social service providers, displacement of animals, decrease in tourism, isolation of towns, impact to community buildings and damage to commercial services impacting community wellbeing.

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**Earthquake risk assessment**

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ENVIRONMENT



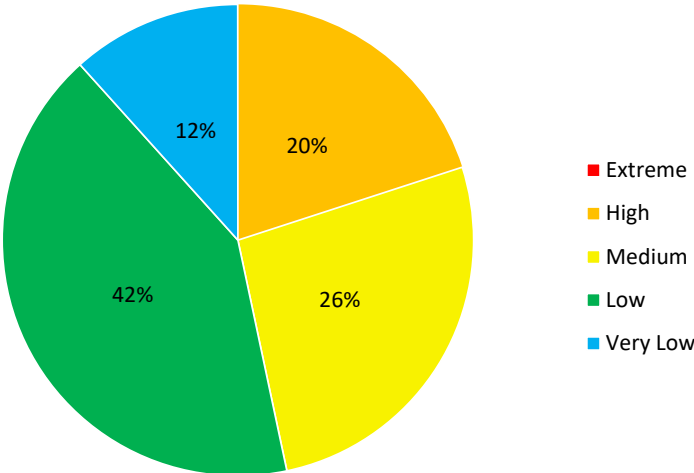
*There were no environment risk statements assessed.*

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**Flood**

This section summarises the risk to the Great Southern EM district from the flood scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 19.

**Percentage of risk statements at each risk level for flood**



**Figure 19: Percentage of risk statements at each risk level for flood.**

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## Flood risk assessment

---

### ECONOMY



#### **Extreme risks**

Nil.

#### **High risks**

Impacts to the transport network (including road, rail and bridges and their approaches), damage to commercial buildings, loss of potable water supply, damage to agricultural and horticultural infrastructure and damage to the crops themselves, and animal disease, resulting in financial loss.

#### **Medium risks**

Impacts to commercial operations (fisheries and plantations), disruption to major freight routes, damage to power infrastructure and inundation and damage to private residential buildings.

#### **Low risks**

Damage/inundation of communications, sewerage infrastructure and aspects that support the tourism industry (e.g. access routes, facilities, fuel outlets) as well as a decrease in tourism in the district.

#### **Very Low risks**

Damage to the natural gas distribution infrastructure and damage to marinas, marine infrastructure and vessels.

---

### PEOPLE



#### **Extreme risks**

Nil.

#### **High risks**

Death(s), injuries and serious injuries as a result of the flood.

#### **Medium risks**

Nil.

#### **Low risks**

Further deaths attributed to the flood event due to emergency services (medical transport services) and health services (hospitals, remote nursing posts) being overwhelmed.

#### **Very Low risks**

Nil.

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## Flood risk assessment

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### PUBLIC ADMINISTRATION



#### Extreme risks

Nil.

#### High risks

Recovery works undertaken by local government which impact on their core service provision and damage to power supply infrastructure, causing supply disruption.

#### Medium risks

Increased demand on emergency services. Damage to mobile and landline communication infrastructure, affecting service provision.

#### Low risks

Response and recovery works undertaken by state agencies impacting their ability to provide core services. Increased demand on WA health services, interruptions to health and home-based care and impacts to social service providers (e.g. Meals on Wheels). Limited capacity on transportation routes for emergency services.

#### Very Low risks

Damage to emergency services buildings affecting their response. Increased demand on public buildings.

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### SOCIAL SETTING



#### Extreme and High risks

Nil.

#### Medium risks

Damage to residential buildings and contents impacting the community wellbeing.

#### Low risks

Damage to public buildings, heritage buildings and indigenous sites. Damage to commercial retail outlets resulting in lack of products, resupply issues of basic needs, affecting wellbeing. Short and long-term displacement and reduced function of facilities for vulnerable people.

#### Very Low risks

Widespread displacement, death or injury to domestic animals and the impacts on existing social service providers (e.g. Rotary, Salvation Army, etc.) impacting the wellbeing of the community.

---

### ENVIRONMENT



#### Extreme and High risks

Nil.

#### Medium risks

Impacts to the health of wildlife and destruction of protected flora and fauna. Pollutants flowing into marine environments. Algal blooms and the spread of non-native flora and fauna impacting native flora and fauna.

#### Low risks

Flood impacts to the district's flora and fauna, soil erosion of the flood plain and river catchments, and the spread of vegetative diseases.

#### Very Low risks

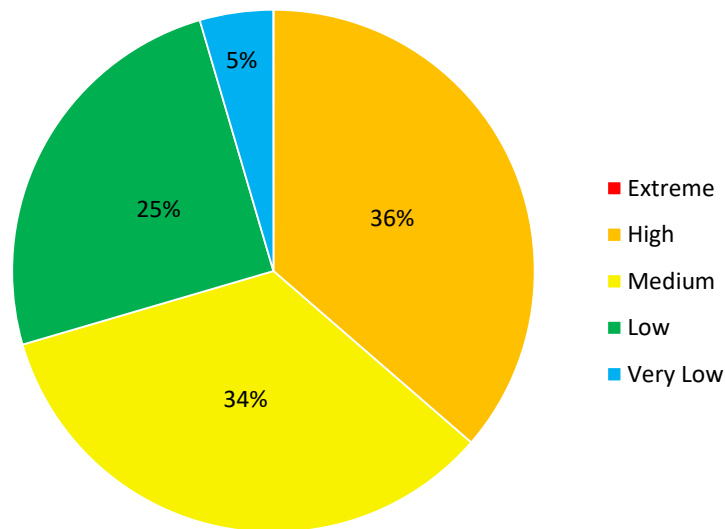
Nil.

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## Marine transport emergency

This section summarises the risk to the Great Southern EM district from the MTE scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 20.

**Percentage of risk statements at each risk level for marine transport emergency**



**Figure 20: Percentage of risk statements at each risk level for marine transport emergency.**

<b>Marine transport emergency risk assessment</b>	
<b>ECONOMY</b> 	<p><b>Extreme risks</b></p> <p>Nil.</p>
	<p><b>High risks</b></p> <p>Response and recovery activities (ship retrieval, oil clean-up) and disruption to transported goods (e.g., grains) resulting in financial losses.</p>
	<p><b>Medium risks</b></p> <p>Disruption of both the recreational and commercial fishing industries. For commercial fisheries, financial losses are due to reputational damage by direct or indirect impacts. The immediate impact to the tourism industry and the longer-term impacts to the services that support the tourism industry (e.g. accommodation, shops).</p>
	<p><b>Low risks</b></p> <p>Impacts to marina and port infrastructure and damage to the coastal environment such that marine events would be disrupted and with resulting financial losses to fisheries.</p>
	<p><b>Very Low risks</b></p> <p>Financial loss due to the diversion of vessels for clean-up operations. This was ranked as the lowest risk because vessel operators are likely to be able to make money in these operations.</p>



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## Marine transport emergency risk assessment

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PEOPLE



### Extreme risks

Nil.

### High risks

Death(s) and injuries caused by the marine transport emergency were ranked as high risks, with catastrophic consequences for the district such that there are at least eight deaths or more than eight critical injuries or more than 76 serious injuries.

### Medium risks

Deaths and injuries of response personnel from hazardous chemicals and ship retrieval which are directly attributable to the hazard, with the potential to overwhelm emergency and health services, resulting in further deaths/injuries.

### Low and Very Low risks

Nil.

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PUBLIC ADMINISTRATION



### Extreme risks

Nil.

### High risks

The majority of the public administration risk statements are ranked as high risks: increased demand of border control services (Albany is the ship's first port of call), DoT services, and WA Police services; welfare services for passengers; emergency services; transportation and accommodation for recovery personnel and recovery vessels.

### Medium risks

The requirement for governing bodies to provide the public and media with information about the hazard and the management of this information: these agencies will encounter significant reduction in the delivery of their core services in order to provide this information. An increased demand on the Port Authority services, impacting their core service provision.

### Low risks

Public unrest (e.g. activist groups) across the district. Response and recovery works to be undertaken by local governments, affecting their ability to maintain core services.

### Very Low risks

Nil.

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SOCIAL SETTING



### Extreme and High risks

Nil.

### Medium risks

Damage to the aesthetics of the area resulting in a loss of community identity/morale. Degradation of the habitats and health of marine wildlife is also possible, impacting community wellbeing.

### Low risks

Reputation of the district: decrease in tourism and the possibility of long-term clean-up activities resulting in permanent damage to the district.

### Very Low risks

The demand for shelter, food and water for the influx of passengers and crew.

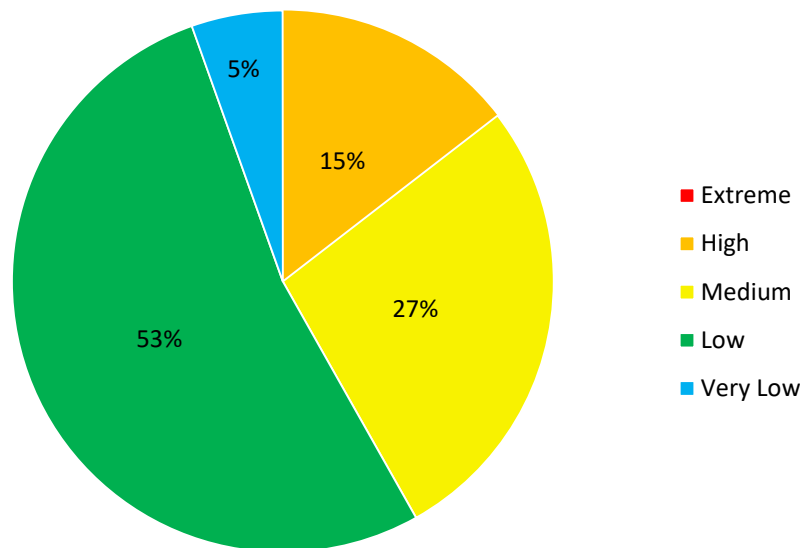
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Marine transport emergency risk assessment	
ENVIRONMENT 	<b>Extreme risks</b> Nil.
	<b>High risks</b> Debris and pollutants impacting the marine ecosystem, including impacting the health of marine wildlife and fauna.
	<b>Medium risks</b> Impacts to vulnerable ecosystems or critically endangered species and contamination of the environment by the disposal of oil waste.
	<b>Low and Very Low risks</b> Nil.
	Nil.

### Storm

This section summarises the risk to the Great Southern EM district from the storm scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 21.

**Percentage of risk statements at each risk level for storm**



**Figure 21: Percentage of risk statements at each risk level for storm.**

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## Storm risk assessment

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### ECONOMY



#### Extreme risks

Nil.

#### High risks

Damage to transport infrastructure (road, rail, bridges) resulting in disruption and recovery costs. Damage to commercial buildings and contents and the subsequent loss/failure of business.

#### Medium risks

Damage to infrastructure services such as communications, power supply, natural gas distribution, marine (marinas, boat ramps, vessels) and potable water supply, resulting in recovery costs and financial losses. Damage to agricultural and horticultural infrastructure and damage to private buildings and contents.

#### Low risks

Aspects which support tourism, the fishing industry, damage to aviation and sewerage systems. Damage to crops resulting in financial losses are ranked as low risk; however, agricultural impact is dependent on the season and could potentially be much worse during the growing season (September to February).

#### Very Low risks

Nil.

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### PEOPLE



#### Extreme risks

Nil.

#### High risks

An impact to people's health causing death(s) is the only high risk to people in the Great Southern district. This was assessed with major consequences because one death was a possibility for the storm scenario.

#### Medium risks

Impacts to people's health causing injury and/or serious illness.

#### Low risks

The potential for emergency services to become overwhelmed, resulting in further deaths directly attributable to the hazard event.

#### Very Low risks

The potential for health services to become overwhelmed, resulting in further deaths directly attributable to the hazard event.

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## Storm risk assessment

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### PUBLIC ADMINISTRATION



#### Extreme risks

Nil.

#### High risks

Increased demand on emergency services and damage to power infrastructure affecting their core service provision.

#### Medium risks

Damage to landline and mobile communication infrastructure, affecting their service delivery.

#### Low risks

Surge on public facilities and health services, interruptions to health care and home-based services. The need for recovery works to be undertaken by local governments and state agencies. Impacts to aviation and port, limited capacity of the transportation network preventing emergency response, and damage to emergency service buildings.

#### Very Low risks

Nil.

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### SOCIAL SETTING



#### Extreme risks

Nil.

#### High risks

No risk statements were assessed as high risk.

#### Medium risks

Damage to places of worship and heritage buildings resulting in a loss of cultural significance and short to long-term displacement of people resulting in dispersal of the community.

#### Low risks

Impacts to the functionality of facilities for vulnerable people and education facilities, damage to residential dwellings, disruption to social services, isolation of towns, loss of income and damage to commercial retail outlets, limiting the availability of basic products.

#### Very Low risks

Impacts to the community wellbeing due to widespread displacement, death or injury to domestic animals and deaths or serious injury/illness of people.

---

### ENVIRONMENT



#### Extreme, High and Medium risks

Nil.

#### Low risks

Impacts to flora and fauna, inside and outside national parks. Significant soil erosion to flood plains. Debris and pollutants flowing into marine/estuarine/riverine environments leading to contamination and causing the spread of vegetative diseases.

#### Very Low risks

Nil.

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## Appendix B: District profile

The Great Southern district is a world-recognised biodiversity hotspot. Covering approximately 100,000 km<sup>2</sup> (Figure 22), the 28 shires have a combined population of approximately 76,000 people. Natural assets include the Porongurup and Stirling Ranges, the Fitzgerald National Park, Dryandra woodlands, Wave Rock and a significant coastline.

The area contributes significantly to Western Australia's economy with a gross regional product of some \$6 billion. Industries include mining, viticulture, horticulture, agriculture, fishing, tourism and food processing.

The Great Southern has a diverse climate with typical Mediterranean conditions in the northern half, through to a mild south coastal climate with the influence of the Albany Doctor across much of the district. The coastal zone has a large population increase over the summer and Easter holiday periods that brings additional risk management challenges to the district.

The Great Southern experiences a diverse range of hazard events throughout the region, across both man-made and natural hazards. The highest priority hazards, as identified by the Great Southern DEMC are: animal and plant biosecurity, bushfire, earthquake, flood, marine transport emergency and storm.

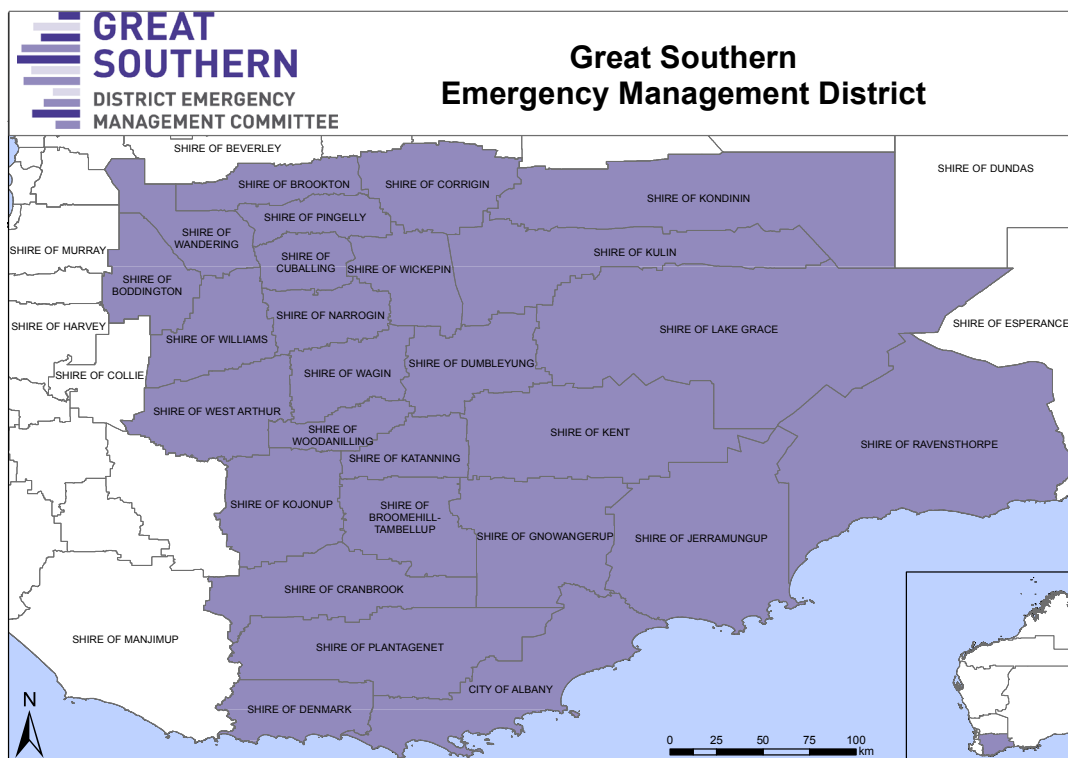


Figure 22: Great Southern EM district map.

# Appendix C: Great Southern EM district consequence table

(based on population: 75,691; gross area product: \$6.091 billion)

People*	Insignificant	Minor	Moderate	Major	Catastrophic
<b>Mortality</b>	Not Applicable.	At least 1 death.	At least 1 death.	At least 1 death.	At least 8 deaths.
<b>Injuries / illness</b>	1 serious injury or any minor injuries.	1 person critically injured with long-term or permanent incapacitation or 1 person seriously injured.	1 person critically injured with long-term or permanent incapacitation or 1 person seriously injured.	1 person critically injured with long-term or permanent incapacitation or more than 8 serious injuries.	More than 8 critical injuries with long-term or permanent incapacitation or more than 76 serious injuries.
<b>Economy</b>					
<b>Loss in economic activity and/or asset value</b>	Decline of economic activity and/or loss of asset value less than \$243,640.	Decline of economic activity and/or loss of asset value between \$243,640 and \$2,436,400	Decline of economic activity and/or loss of asset value between \$2,436,400 and \$24,364,000	Decline of economic activity and/or loss of asset value between \$24,364,000 and \$243,640,000.	Decline of economic activity and/or loss of asset value greater than \$243,640,000.
<b>Impact on important industry</b>	Inconsequential business sector disruption.	Significant industry or business sector is impacted by the emergency event, resulting in short-term (i.e. less than one year) profit reductions.	Significant industry or business sector is significantly impacted by the emergency event, resulting in medium-term (i.e. more than one year) profit reductions.	Significant structural adjustment required by identified industry to respond and recover from emergency event.	Failure of a significant industry or sector.
<b>Environment</b>					
<b>Loss of species and/or landscapes</b>	No damage to ecosystems at any level.	Minor damage to ecosystems and species recognised at the state, local or regional level and/or	Minor damage to ecosystems and species recognised at the national level. and/or	Permanent destruction of an ecosystem or species recognised at the local/regional level. and/or	Permanent destruction of an ecosystem or species recognised at the national or state level. and/or
<b>Loss of environmental value</b>	Inconsequential damage to environmental values of interest.	Minor damage to environmental values of interest.	Significant damage to environmental values of interest.	Severe damage to environmental values of interest.	Permanent destruction of environmental values of interest.
<b>Public Administration</b>					
<b>Governance Functions</b>	Governing bodies' delivery of core functions is unaffected or within normal parameters.	Governing bodies encounter limited reduction in delivery of core functions.	Governing bodies encounter significant reduction in the delivery of core functions. and/or	Governing bodies encounter severe reduction in the delivery of core functions. and/or	Governing bodies are unable to deliver their core functions.
<b>Social Setting</b>					
<b>Community wellbeing</b>	<ul style="list-style-type: none"> <li>Community social fabric is disrupted</li> <li>Existing resources sufficient to return the community to normal function</li> <li>No permanent dispersal.</li> </ul>	<ul style="list-style-type: none"> <li>Community social fabric is damaged</li> <li>Some external resources required to return the community to normal function</li> <li>No permanent dispersal.</li> </ul>	<ul style="list-style-type: none"> <li>Community social fabric is broken</li> <li>Significant external resources required to return the community to normal function</li> <li>Some permanent dispersal.</li> </ul>	<ul style="list-style-type: none"> <li>Community social fabric is significantly broken</li> <li>Extraordinary external resources are required to return the community to functioning effectively</li> <li>Significant permanent dispersal.</li> </ul>	<ul style="list-style-type: none"> <li>Community social fabric is irreparably broken</li> <li>Community ceases to function effectively, breaks down</li> <li>Community disperses in its entirety</li> </ul>
<b>Community Services</b>	Inconsequential / short term impacts.	Isolated / temporary reductions.	Ongoing reductions.	Reduced quality of life.	Community unable to support itself.
<b>Culturally important objects</b>	Minor damage to objects of cultural significance.	Damage to objects of identified cultural significance.	Damage or localised widespread damage to objects of identified cultural significance.	Widespread damage or localised permanent loss of objects of identified cultural significance.	Wide-spread and permanent loss of objects of identified cultural significance.
<b>Culturally important activities</b>	Minor delay to a culturally important community event.	Delay to or reduced scope of a culturally important community event.	Delay to a major culturally important community event.	Temporary cancellation or significant delay to a major culturally important community event.	Permanent cancellation of a major culturally important community activity.

\*Criteria for people have been rounded up to the nearest whole person.

## Appendix D: Glossary and risk matrix

Annual Exceedance Probability (AEP)	The probability of an emergency event of a given size or larger occurring in any given year, expressed as a percentage.
AS/NZS ISO 31000:2009	International standard for risk management which forms the basis of the Emergency Risk Management process.
Consequence	Impact(s) of an event on the five key areas: environment, economy, people, social setting and public administration.
Emergency	The occurrence or imminent occurrence of a hazard which is of such a nature or magnitude that it requires a significant and coordinated response.
Emergency Risk Management (ERM)	A systematic process which contributes to the wellbeing of communities and the environment. The process considers the likely effects of hazardous events and the controls by which they can be minimised.
Hazard	Source of potential harm or a situation with a potential to cause loss.
Impact	To have a noticeable or marked effect on.
Level of risk (risk level)	Magnitude of a risk or a combination of risks, expressed in terms of the combination of consequences and their likelihood.
Likelihood	Chance of something happening. It is used as a general descriptor of probability and may be expressed qualitatively or quantitatively.
Recovery	The support of emergency affected communities in the reconstruction and restoration of physical infrastructure, the environment and community, psychological and economic wellbeing.
Response	The combatting of the effects of an emergency, provision of emergency assistance for casualties, reduction of further damage, and help to speed recovery.
Risk	The combination of the probability of an event and its negative consequences.

The matrix<sup>5</sup> below calculates risk levels based on the consequence and likelihood levels assigned to a risk statement. Please note the likelihood of a statement in this report is determined by multiplying the scenario probability (AEP) by the probability of the risk statement occurring (as determined in workshops).

	Consequence level				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
<b>Almost Certain</b> (63% per year or more)	Medium	Medium	High	Extreme	Extreme
<b>Likely</b> (10% to <63% per year)	Low	Medium	High	Extreme	Extreme
<b>Unlikely</b> (1% to <10% per year)	Low	Low	Medium	High	Extreme
<b>Rare</b> (0.1% to <1% per year)	Very low	Low	Medium	High	High
<b>Very Rare</b> (0.01% to <0.1% per year)	Very low	Very low	Low	Medium	High
<b>Extremely rare</b> (<0.01% per year)	Very low	Very low	Low	Medium	High

<sup>5</sup> from the *National Emergency Risk Assessment Guidelines* (2015) Australian Government Attorney-General's Department







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