

MIDWEST-GASCOYNE EMERGENCY MANAGEMENT DISTRICT

Risk assessment report

'Highlighting potential disaster impacts'



**MIDWEST
GASCOYNE**

**DISTRICT EMERGENCY
MANAGEMENT COMMITTEE**

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.

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Executive Summary

This document summarises the results of the *State Risk Project* risk assessment workshops in the Midwest-Gascoyne Emergency Management (EM) district. It covers six priority hazards, as identified by the Midwest-Gascoyne District Emergency Management Committee (DEMC): animal or plant pests or diseases (animal and plant biosecurity), fire (bushfire), cyclone, earthquake, flood and road crash. The effects of these hazards were measured against five key impact areas (economy, people, public administration, social setting and environment) using 276 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).

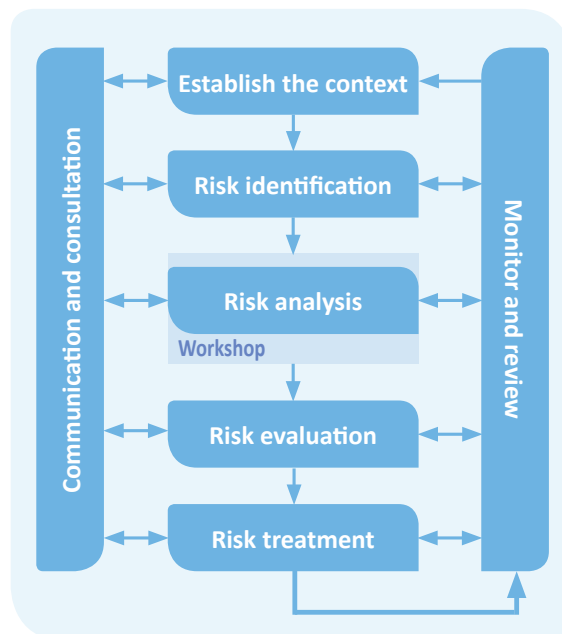


Figure 1: Emergency risk management process.¹

Twenty-four 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)*². The risk statements were assessed using the tailored *NERAG* consequence table (Appendix C), which is based on the gross area product (\$9.253 billion) and the population (64,131) of the EM district.

The assessment results for the six hazards reveal that there were no extreme risks, 27% were assessed as high risks, 30% as medium risks, 31% as low risks and 12% as very low. Five percent of the risks could produce catastrophic consequences.

All hazards posed a risk to human life, with the earthquake and road crash scenarios capable of causing catastrophic impacts of greater than seven deaths. For bushfire,

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

cyclone and flood the consequences are likely to be lower, although these hazards could still cause fatalities and stretch the health system (major consequences). The animal and plant biosecurity scenario (foot and mouth disease) does not affect people's health directly, however it may lead to mental health issues and potential suicides.

Cyclone and flood stand out as having the highest number of high risk statements: 51% and 38% respectively. These hazards are widespread across the EM district and likely to impact a large number of communities. In particular the cyclone scenario tracks along the entire Midwest-Gascoyne coastline impacting a number of communities. Road crash also has a large number of high risk statements which relate to potential deaths and injuries and the increased demand on emergency services such as the Department of Fire and Emergency Services (DFES) (first responders and HAZMAT response). However, as the road crash scenario occurs over a small geographic area there are equally as many very low risks which related to the limited disruption of transportation and business it would cause to the whole EM district.

Economically, the high risks result from the damage caused to transportation infrastructure, buildings, water supplies, marine infrastructure, disruption to tourism and impacts to agriculture activities. The greatest economic loss to the Midwest-Gascoyne district is likely from the animal and plant biosecurity hazard which could cause impacts to the export market for up to 10 years. The event would also have national and international implications and would affect a broad range of industries.

The highest risk for government activities relate to the potential surge on emergency (DFES, WA Police, ambulance) and health services (hospitals). For all of the hazards except animal and plant biosecurity, response agencies will require additional resources from outside the EM district to respond and/or manage the events. In terms of health services, Geraldton Hospital has a limited number of acute or intensive care facilities so patients would need to be taken to Perth for treatment.

Overall most of the social setting risks were low because the likely impacts from these hazard scenarios did not affect the whole district community. However, it is important to note that the social impacts to those communities directly affected by the hazards could be significant.

The earthquake scenario stood out in this assessment, with 40% of its risk statements assessed as having high or medium risk. This scenario is likely to result in catastrophic consequences for buildings and the health of people. These catastrophic consequences may stretch, or outstrip, the district's current resources and capabilities. Consideration should be given to these consequences even though the earthquake has a low likelihood of occurrence (0.005% change of occurrence in any given year) in the Midwest-Gascoyne.

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. There are no Priority 1 (highest) statements, 9% are Priority 2, 33% are Priority 3, 32% are Priority 4 and 26% of the statements are Priority 5 (lowest). The following table (Table 1) shows the Priority 2 risk statements in full and those risk statements with catastrophic consequences.

Table 1: Risk statements for the Midwest-Gascoyne district with Priority level 2 or catastrophic consequences. Note: AP Bio = animal and plant biosecurity; EQ = earthquake; R Crash = road crash.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Flood	will damage transport infrastructure such as bridges, road and rail, incurring costs to the district.	Economy	Catastrophic	High	High	2
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	High	2
AP Bio	will result in response and recovery activities (including animal destruction, environmental clean-up), resulting in costs to the district.	Economy	Catastrophic	High	Moderate	2
R Crash	will impact the health of people and cause death(s).	People	Catastrophic	High	High	2
R Crash	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	2
Cyclone	will require recovery works to be undertaken by local governments which will impact on their ability to maintain core services.	Public Administration	Catastrophic	High	High	2
Cyclone	will impact on home-based services and service providers (such as NGOs, Meals on Wheels, Silver Chain, WACHS, home-care provisions), impacting on their ability to maintain core functions.	Public Administration	Catastrophic	High	High	2
Cyclone	will impact the aviation sector (including damage to aviation infrastructure) resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact private buildings and contents, resulting in financial losses.	Economy	Major	High	High	2
Flood	will impact infrastructure required for potable water supply (e.g. dams, piping, bores, pump stations), resulting in financial losses.	Economy	Major	High	Moderate	2

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Bushfire	will cause emergency services (including ambulance and medical transport services such as RFDSWA) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
R Crash	will cause emergency services (including ambulance and medical transport services) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
R Crash	will cause health services (e.g. ICU units, hospitals, clinics, etc.) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
Bushfire	will cause health services (e.g. ICU units, hospitals, remote nursing posts, small country hospitals, clinics) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	High	2
Bushfire	will impact the health of people and cause death(s).	People	Major	High	High	2
Bushfire	will impact the health of people and cause injury and/or serious illness.	People	Major	High	High	2
Flood	will impact the health of people due to stagnant water and waterborne diseases.	People	Major	High	Moderate	2
Bushfire	will result in an increased demand (surge) on DFES services, impacting their ability to maintain core services.	Public Administration	Major	High	High	2
Bushfire	will result in an increased demand (surge) on WA Police services, impacting their ability to maintain core services.	Public Administration	Major	High	High	2
Bushfire	will require recovery or response works to be undertaken by Parks and Wildlife, impacting on their ability to maintain core services.	Public Administration	Major	High	High	2
Flood	will impact Water Corp, impacting their ability to deliver core services.	Public Administration	Major	High	Moderate	2

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Cyclone	will impact commercial retail outlets and service providers, impacting the availability of basic commercial products and services.	Social Setting	Major	High	Low	2
Bushfire	will impact communications infrastructure, resulting in costs to the district and financial losses.	Economy	Moderate	Medium	Low	2
Bushfire	will impact communication infrastructure, impacting the ability to maintain core services.	Public Administration	Moderate	Medium	Low	2
Bushfire	will result in an increased demand (surge) on WA health services, impacting their ability to maintain core services.	Public Administration	Moderate	Medium	Low	2
EQ	will impact private buildings and contents, resulting in financial losses.	Economy	Catastrophic	High	High	3
EQ	will cause emergency services (including ambulance and medical transport services) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	High	3
EQ	will cause health services (e.g. ICU units, hospitals, clinics) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	High	3
EQ	will impact the health of people and cause death(s).	People	Catastrophic	High	High	3
EQ	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	3
Cyclone	will impact sewerage systems, impacting service delivery.	Public Administration	Catastrophic	High	Highest	3

1 Introduction

A series of risk assessment workshops were conducted in the Midwest-Gascoyne Emergency Management (EM) district as part of the *State Risk Project*. The project aims to assess the risk posed to the state from all hazards prescribed in legislation 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, this approach allows for comparison and the prioritisation of future resources with an emphasis towards prevention and preparedness activities.

The highest priority hazards for each EM district are assessed first. The six priority hazards for the Midwest-Gascoyne EM district, as identified by the Midwest-Gascoyne 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), cyclone, earthquake, flood, road crash. All hazards were assessed in a workshop setting (see Table 2 for schedule). 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 vulnerabilities and impacts for the district 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 it is collectively assigned a likelihood, consequence and confidence level using the *NERAG 2015* criteria. Discussion was encouraged among participants allowing different aspects of the hazards and impacts to be evaluated. Decisions were 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	Geraldton	24 August 2016
Bushfire	Geraldton	15 June 2016
Cyclone	Geraldton	15 June 2016
Earthquake	Geraldton	14 September 2016
Flood	Geraldton	14 September 2016
Road crash	Geraldton	24 August 2016

For each workshop a range of representatives from relevant stakeholders in the district were invited. Agency attendance for the workshops is shown in Table 3.

Table 3: Agencies involved in each risk assessment workshop for the Midwest-Gascoyne district, listed in alphabetical order. Note: AP Bio = Animal and plant biosecurity; EQ = earthquake.

Agency	Hazard					
	AP Bio	Bushfire	Cyclone	EQ	Flood	Road crash
Central Regional TAFE			X			
City of Greater Geraldton	X	X	X	X	X	X
Coolina Holding Yards	X					
Department for Child Protection and Family Support				X	X	
Department of Agriculture and Food WA	X	X	X			X
Department of Corrective Services		X	X			
Department of Fire and Emergency Services		X	X	X	X	X
Department of Health		X	X			
Department of Housing				X	X	
Department of Parks and Wildlife		X	X	X	X	
Department of Planning		X	X			
Department of Transport				X	X	
Department of Water		X	X	X	X	
Dongara Vets	X					
Great Northern Rural Services	X					
Main Roads WA	X	X	X	X	X	X
Mid West Ports (Geraldton Port Authority)			X			
Midwest Vets	X					
Shire of Carnarvon				X	X	
Shire of Irwin		X	X	X	X	X
St John Ambulance	X			X	X	X
Office of Emergency Management (Facilitators)	X	X	X	X	X	X
WA Police		X	X			X
Water Corporation	X	X	X	X	X	X
Western Power				X	X	

2 Hazard scenarios

Six hazards were assessed for the Midwest-Gascoyne EM district. Hazard scenarios were developed with the assistance of:

- Bureau of Meteorology Western Australia (BOM)
- Department of Agriculture and Food WA (DAFWA)
- Department of Fire and Emergency Services (DFES)
- Department of Parks and Wildlife (P&W)
- Dr Ray Gordon of Gordon Geological Consultants
- Geoscience Australia (GA)
- Main Roads WA
- Office of Emergency Management (OEM)

Animal and plant biosecurity scenario

The animal and plant biosecurity scenario was developed by the Department of Food and Agriculture WA (DAFWA – Geraldton Office) and has approximately a 0.995% chance of occurrence in any given year.

A small rural residential block owner in the outskirts of Dongara is fattening two pigs for personal consumption. The neighbouring property is a commercial beef producer with a herd of 2000 head of cattle.

The land owners regularly provide food scraps that contain meat to their pigs. One of the owners returned from Nepal with a sealed package of meat concealed in their luggage. Ignorant of the meat being contaminated by foot and mouth disease (FMD) virus, the meat is fed to the pigs. The pigs contract FMD and the virus multiplies vigorously within the pigs but goes undetected. The cows and calves from the neighbouring commercial beef producer also contract FMD, but no clinical signs or symptoms are observed.

The commercial beef producer then moves ten cows and calves to the saleyard. These cattle are sold in two groups with each group remaining in saleyard pens for three to four hours before being transported to their new owners' properties. Approximately 620 head of cattle move through the saleyard that day before being moved throughout the district.

Two days later one of the buyers of the infected cattle notices they are showing signs of lameness and drooling. The local veterinarian inspects the cattle and defers to the Department of Agriculture and Food veterinarians for further testing. Samples are sent to Perth for initial diagnosis and these indicate FMD. FMD is confirmed by Geelong, Australian Animal Health Laboratory two days later as per national arrangements.

Following confirmation of FMD, an Australian-wide livestock standstill is implemented for at least 48 hours to eliminate further spread. Tracing of infected cattle occurs to determine the origin and spread of FMD. Once the origin is determined, four properties are placed under quarantine (Figure 2). Operations commence on these properties to destroy and dispose of all FMD-susceptible livestock.

Once FMD is identified, the Chief Veterinary Officer of Australia is obligated to inform countries that are importing animal products from Australia. This results in the closure of trade markets (Australia-wide) until the Australian authorities can confirm the country is free from FMD.

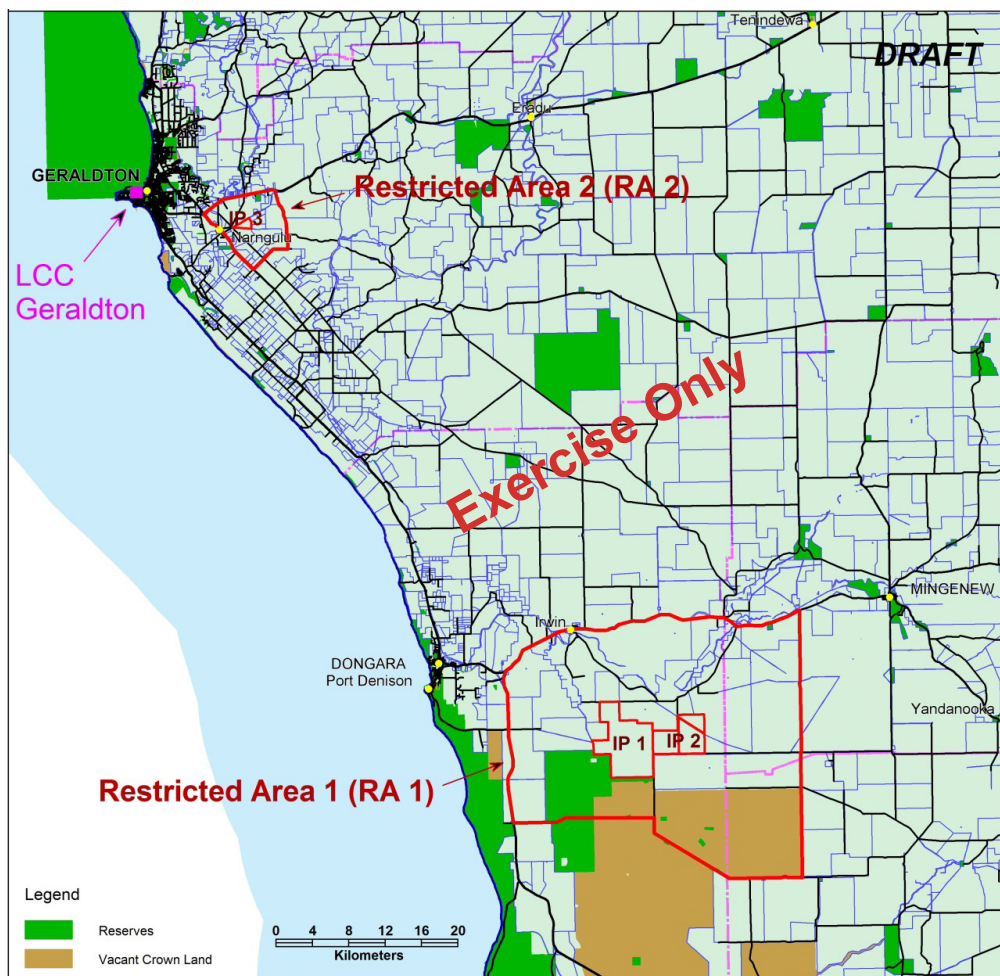


Figure 2: Map showing the two restricted areas for the foot and mouth disease scenario. Restricted Area 1 is the original source of FMD and Restricted Area 2 encompasses the sales yard. Map from DAFWA – Geraldton Office.

Bushfire scenario

The bushfire scenario was developed by DFES has approximately a 4.88% chance of occurrence in any given year.

During the Australia Day weekend in January, an extreme fire weather danger warning is in place. Two fires are ignited by dry lightning.

One fire begins east of Eneabba, close to the town and highway. The second fire begins north-east of Dongara. Wind conditions throughout the day change from north-east to north-west to west through to south-west, causing both fires to spread (Figure 3 and Figure 4). Since the harvest has finished there are limited resources on farms and many people are on leave, including firefighters, because of the public holiday.

The Dongara fire crosses over the Brand Highway and Midlands Road causing their closure for at least three days. The town is impacted by smoke and partially evacuated. Eneabba is evacuated as the fire threatens the town. The following roads are closed for at least three days: Brand Highway from Indian Ocean Drive to the north; Three Springs Road to the east; and Coorow Green Head Road to the south. Indian Ocean Drive is closed near Eneabba, even though the fire does not cross it.

In addition to limited resources in the Midwest-Gascoyne district over the holiday period, there is also a fire in Perth, so metropolitan resources are not able to attend these two fires.

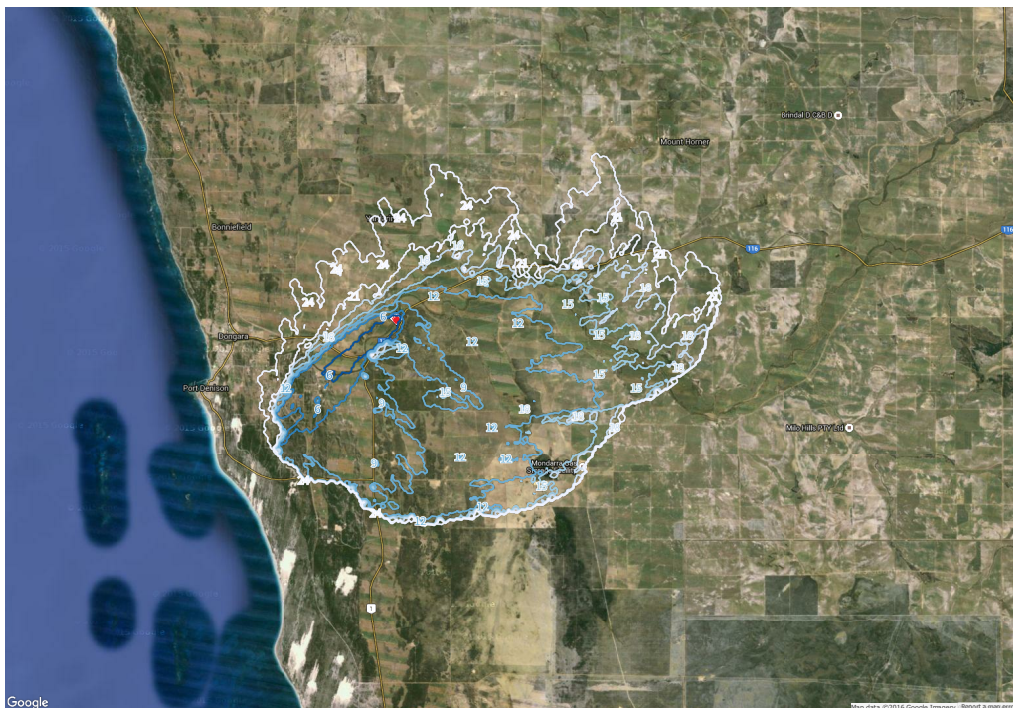


Figure 3: Fire shape after 24 hours for the fire which begins north-east of Dongara. Fire spreads as the wind changes direction from north-east to north-west, to west through to south-west. The dark blue outline shows the oldest fire shape and the white is the most recent.

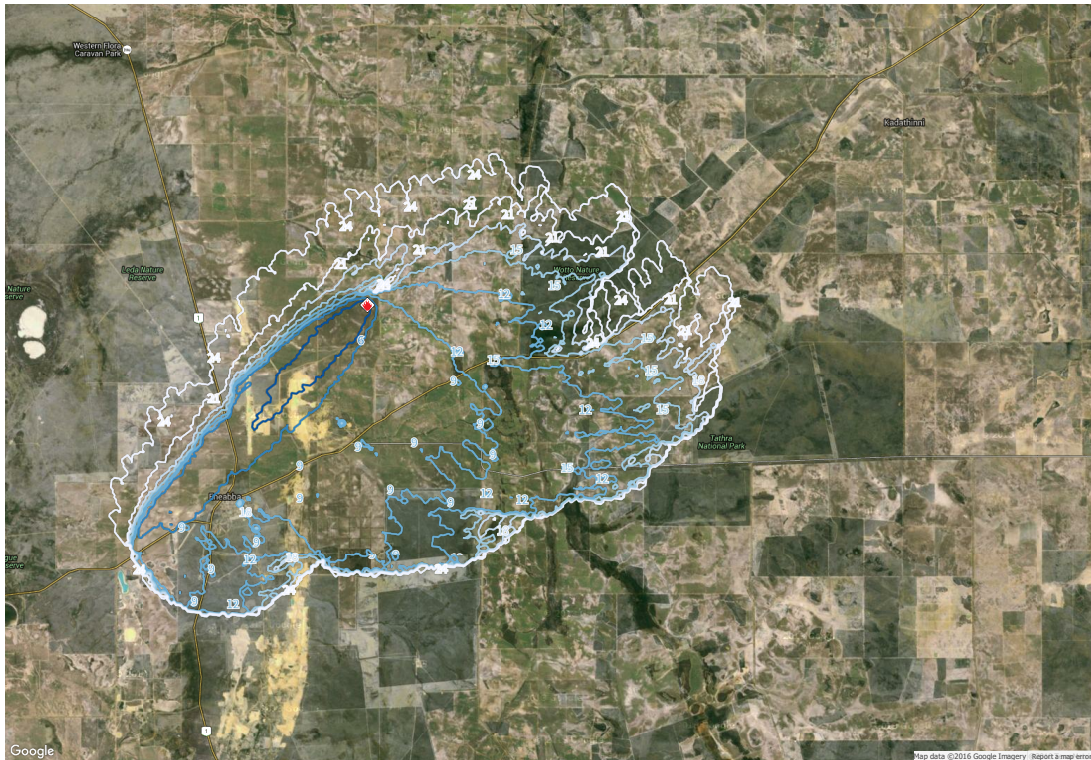


Figure 4: Fire shape after 24 hours for the fire which begins north-east of Eneabba. Fire spreads as the wind changes direction from north-east to north-west, to west through to south-west. The dark blue outline shows the oldest fire shape and the white is the most recent.

Cyclone scenario

The cyclone scenario was developed by BOM and has approximately a 0.995% chance of occurrence in any given year.

Over the Australia Day weekend a Category 4 tropical cyclone moves down the Midwest-Gascoyne coastline (Figure 5). Between Coral Bay and Carnarvon, the cyclone is Category 4 (240 km/h winds). It decreases in intensity (Category 3) south of Carnarvon and becomes Category 2 (150 km/h winds) just north of Geraldton.

The heaviest rain occurs near the cyclone track. Storm surge is experienced in Carnarvon (4 m above high tide) and Denham (5.5 m above high tide). A storm surge is also experienced in Geraldton; however the height cannot be modelled and is unknown.

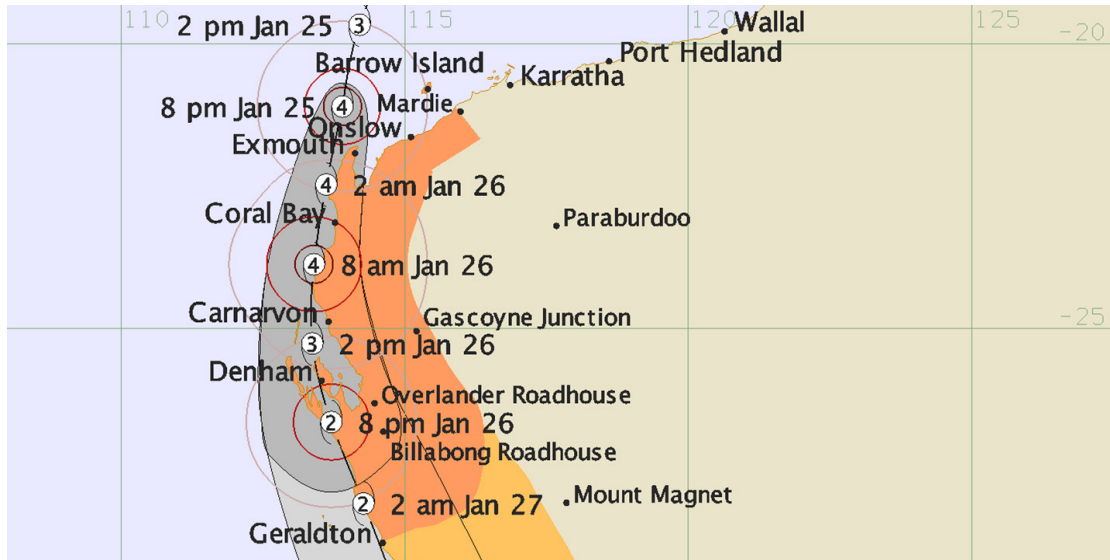


Figure 5: Movement of the cyclone as it tracks along the Midwest-Gascoyne coastline. The numbers in circles represent the cyclone intensity. Note the northern extent of the Midwest-Gascoyne EM district is 20 km north of Coral Bay (i.e. Exmouth is not within the Midwest-Gascoyne EM district). Map provided by BOM.

Earthquake scenario

The earthquake scenario was developed by OEM, GA and Dr Ray Gordon and has approximately a 0.005% chance of occurrence in any given year.

At 12:37pm on a Tuesday in June, a magnitude 6.0 earthquake occurs 10 km north of Geraldton (Figure 6). Geraldton experiences shaking of MMI IX (9) (Figure 7 and Table 4); Carnarvon experiences shaking of MMI IV (4). Approximately 80% of buildings within Geraldton are likely to be impacted, with 20% completely damaged (Table 5). Fatalities, critical and serious injuries occur as a result of the earthquake.

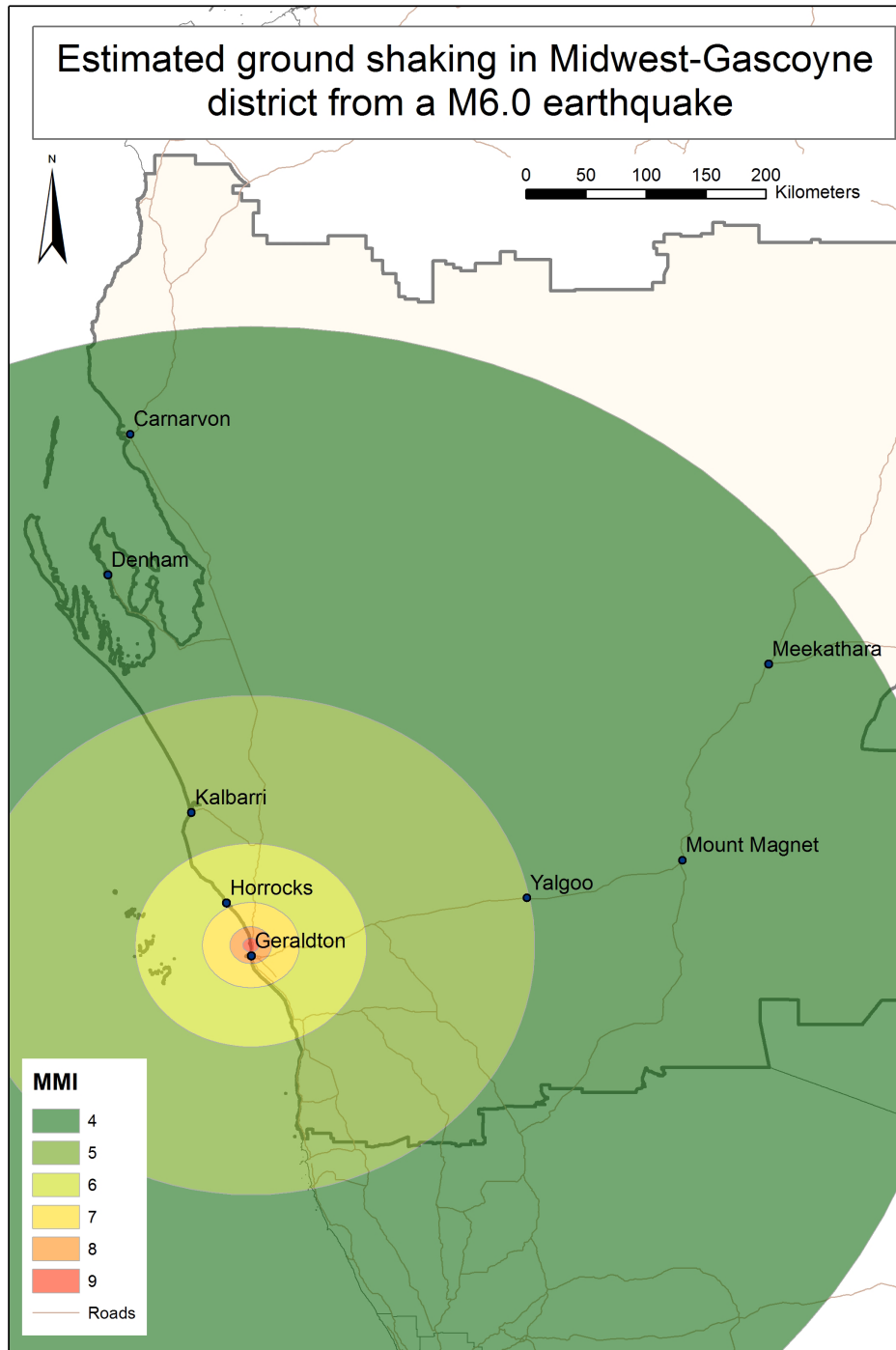


Figure 6: Estimated Modified Mercalli Intensity (MMI) shaking for the M6.0 earthquake scenario in the Midwest-Gascoyne district. Epicentre is 10 km north of Geraldton. Refer to Table 4 for likely impacts at each MMI level.

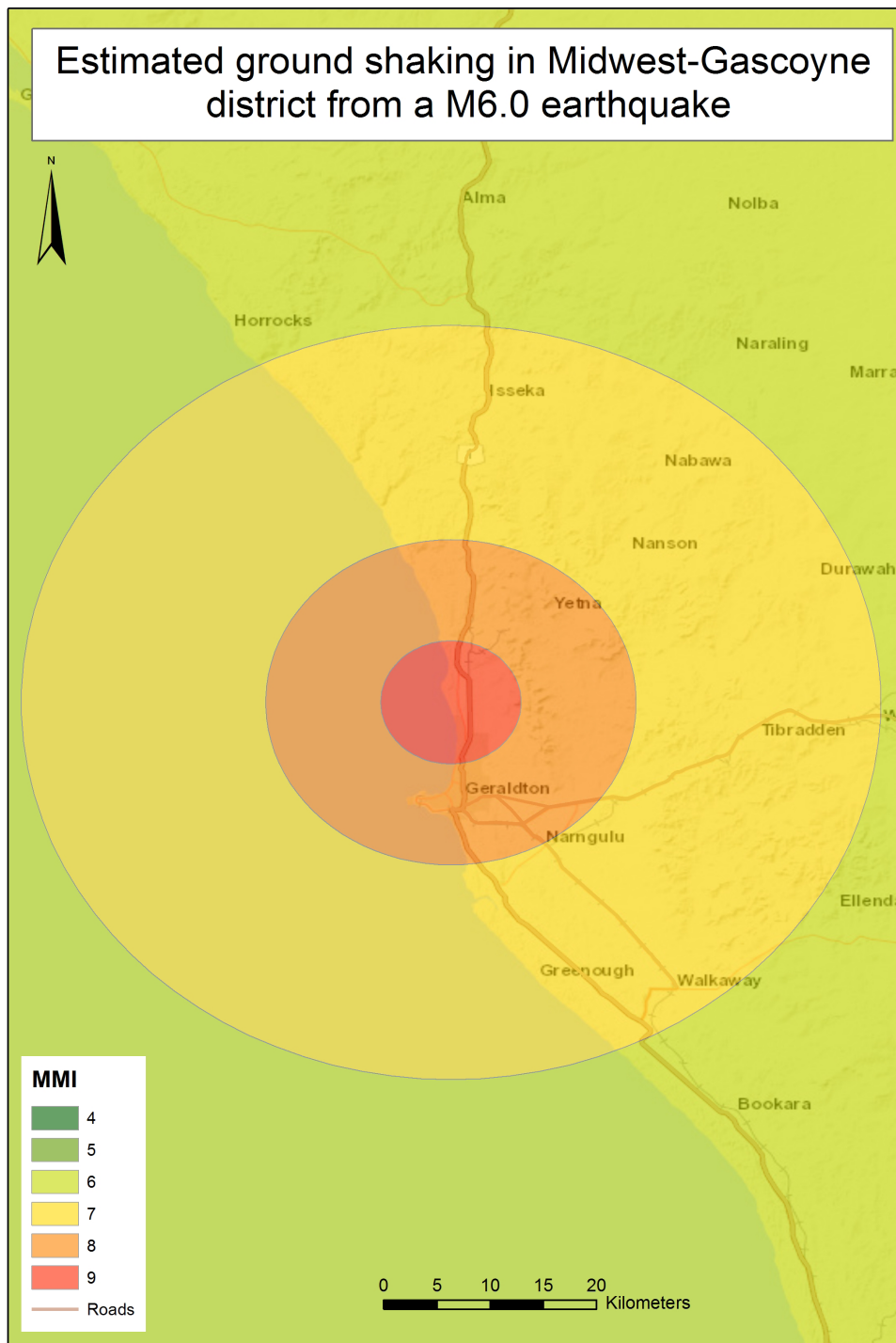


Figure 7: Estimated Modified Mercalli Intensity (MMI) shaking for the M6.0 earthquake scenario close to Geraldton.

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 (5)	Cracking of vulnerable masonry (e.g. parapets & chimneys) with minor falls. Minor cracking to masonry houses.	Kalgoorlie CBD - 20 Apr 2010
VI (6)	Collapse of vulnerable masonry and severe cracking to other masonry structures.	Boulder CBD - 20 Apr 2010
VII (7)	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 (8)	Severe to complete damage to URM buildings, severe damage to low-ductility buildings.	Christchurch - 22 Feb 2011
IX (9)	Destruction of URM and low-ductility framed buildings, damage to all other types.	Meckering - 14 Oct 1968

Table 5: Estimated number of buildings in each damage class and number of human casualties as a result of the earthquake scenario. Note these values are based on Geoscience Australia estimates for a M5.6 earthquake in Kalgoorlie which has a similar population to Geraldton and similar ground shaking. As such these values are a guide only.

Estimated percentage of buildings in each damage class			
Slight damage	Moderate damage	Extensive damage	Complete damage
15-20%	15-20%	10-15%	15-20%

Estimated number of human casualties		
Minor injuries	Major injuries	Fatalities
557	75	19

Flood scenario

The flood scenario was developed by BOM and has approximately a 0.499% chance of occurrence in any given year. While a similar weather event (same cyclone track) was used for both the flood and cyclone 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.

There is above average rainfall in the year preceding event which results in saturated soils. A slow moving tropical cyclone (same track as in Figure 5) with rainband results in heavy rainfall in the Gascoyne area (Gascoyne River) over three days in January. Over 400 mm of rain is expected with a daily peak of 250 mm.

Major flooding is expected in across the Midwest-Gascoyne district (Table 6) with flood intensity higher than expected due to already wet catchments.

Table 6: Estimated flood severity over the course of the rainfall event for catchments in the Midwest-Gascoyne district.

Flood severity	Below minor			Minor		Moderate		Major	
Catchments	22/1	23/1	24/1	25/1	26/1	27/1	28/1	29/1	30/1
Lyndon Minilya	Below minor	Minor	Moderate	Moderate	Minor	Below minor	Below minor	Below minor	Below minor
Upper Ashburton	Below minor	Minor	Minor	Moderate	Moderate	Minor	Below minor	Below minor	Below minor
Wooramel	Below minor	Below minor	Minor	Moderate	Minor	Below minor	Below minor	Below minor	Below minor
Murchison	Below minor	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Below minor	Below minor
Hutt, Chapman, Greenough and Irwin River	Below minor	Below minor	Minor	Moderate	Major	Major	Moderate	Minor	Below minor
Yarra Yarra	Below minor	Below minor	Minor	Moderate	Moderate	Minor	Below minor	Below minor	Below minor
Gascoyne	Below minor	Minor	Minor	Moderate	Major	Major	Major	Moderate	Minor

Road crash scenario

The road crash scenario was developed by OEM and WA Police and has approximately a 0.3% chance of occurrence in any given year.

A tourist bus travelling north on the Brand Highway has stopped at the traffic lights on the Brand and North West (NW) Coastal Highways overpass. A fully loaded road train (with four trailers) crashes into the back of the bus. The bus falls off the overpass (Figures 6 and 7) and comes to rest on the NW Coastal Highway, blocking it. One of the trailers of the road train spills its load onto the railway line below and the truck and other trailers end up on the western onramp to the NW Coastal Highway. The truck is carrying an unknown mixed load and hazmat material spills out of one of the trailers and forms a plume. The plume blows to the north-west towards Geraldton Hospital, Geraldton Universities Centre and Juniper Hillcrest aged care facilities.

The Brand Highway and the NW Coastal highway are closed, as is the railway line, for at least three days. The incident occurs at approximately 3 pm when schools are finishing for the day.

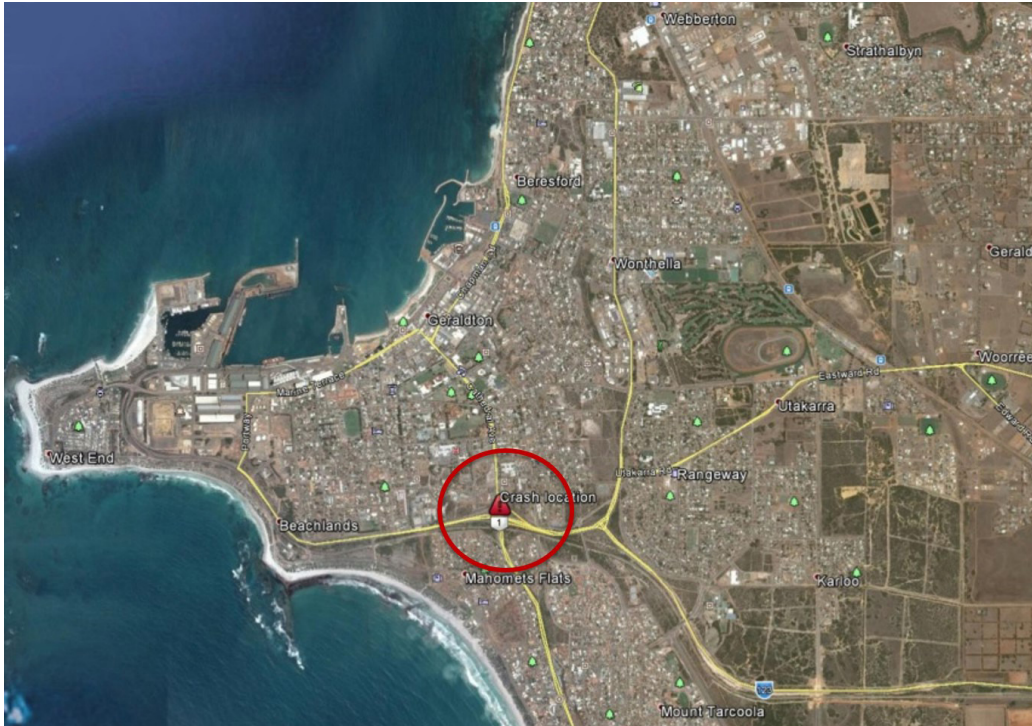


Figure 8: Location of road crash at the interchange between Brand and the NW Coastal Highways in Geraldton.



Figure 9: Location of tourist bus and road train after the road train crashed into the back of the bus. Hazmat plume is travelling to the north-east towards Geraldton Hospital, Geraldton Universities Centre and Juniper Hillcrest aged care facilities.

3 Assessed risk statements

A total of 276 risk statements were assessed across the six assessed hazards: animal and plant biosecurity (39); bushfire (48); cyclone (49); earthquake (58); flood (53); and road crash (29).

Table 7 shows the number of risk statements for each hazard separated into the five impact areas (economy, people, public administration, social setting and environment). The statements were generated to cover all foreseen impacts of the scenario events across the five categories.

The risk statements were assessed using the tailored *NERAG* consequence table for the Midwest-Gascoyne EM district found in Appendix C. The consequence levels are based on the gross area product (\$9.253 billion) and the population (64,131) of the EM district.

Table 7: Number of risk statements assessed for each hazard in the Midwest-Gascoyne district.
Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Hazard	Impact area				
	Economy	People	Public administration	Social setting	Environment
AP Bio	14	2	11	9	3
Bushfire	14	4	16	12	2
Cyclone	17	4	15	9	4
EQ	16	4	23	13	2
Flood	14	4	20	11	4
Road crash	8	4	10	5	2

4 Midwest-Gascoyne EM district risk profile

The risk profile for the Midwest-Gascoyne EM district for the six assessed hazards is shown in Figure 11 (on page 24). 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 10) combines the data and categorises it by hazard and risk level.

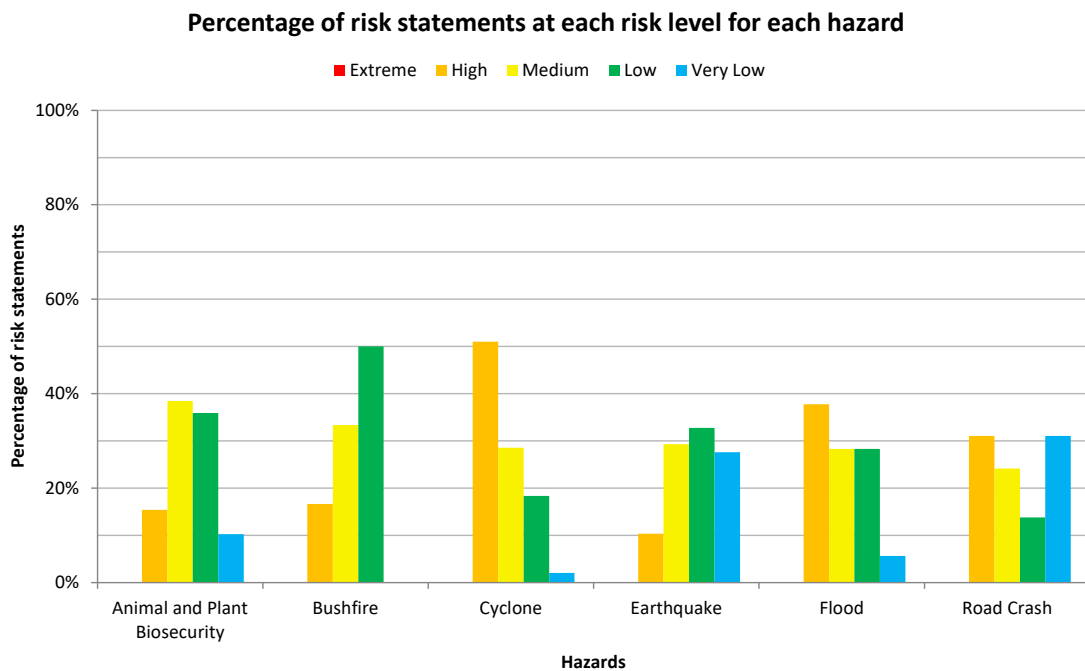


Figure 10: Percentage of risk statements at each risk level for each hazard. Note each hazard sums to 100%.

Of the 276 statements assessed for all six hazards, 27% are high risks, 30% are medium, 31% are low and 12% are very low. Individual hazard risk assessment summaries can be found in Appendix A.

The highest risks for the Midwest-Gascoyne EM district are from cyclone, flood and road crash (Figure 10). Flood and cyclone stand out as hazards with a large number of high risk statements: 38% and 51% respectively. This is because these hazards are widespread across the district and likely to impact a large number of communities, especially the cyclone scenario which tracks along the coastline of the district. The road crash scenario has a large number of high risk statements, primarily due to the potential number of deaths and injuries. However, there were an equal number of very low risk statements because the crash scenario only impacted a localised area and did not cause impacts across the district.

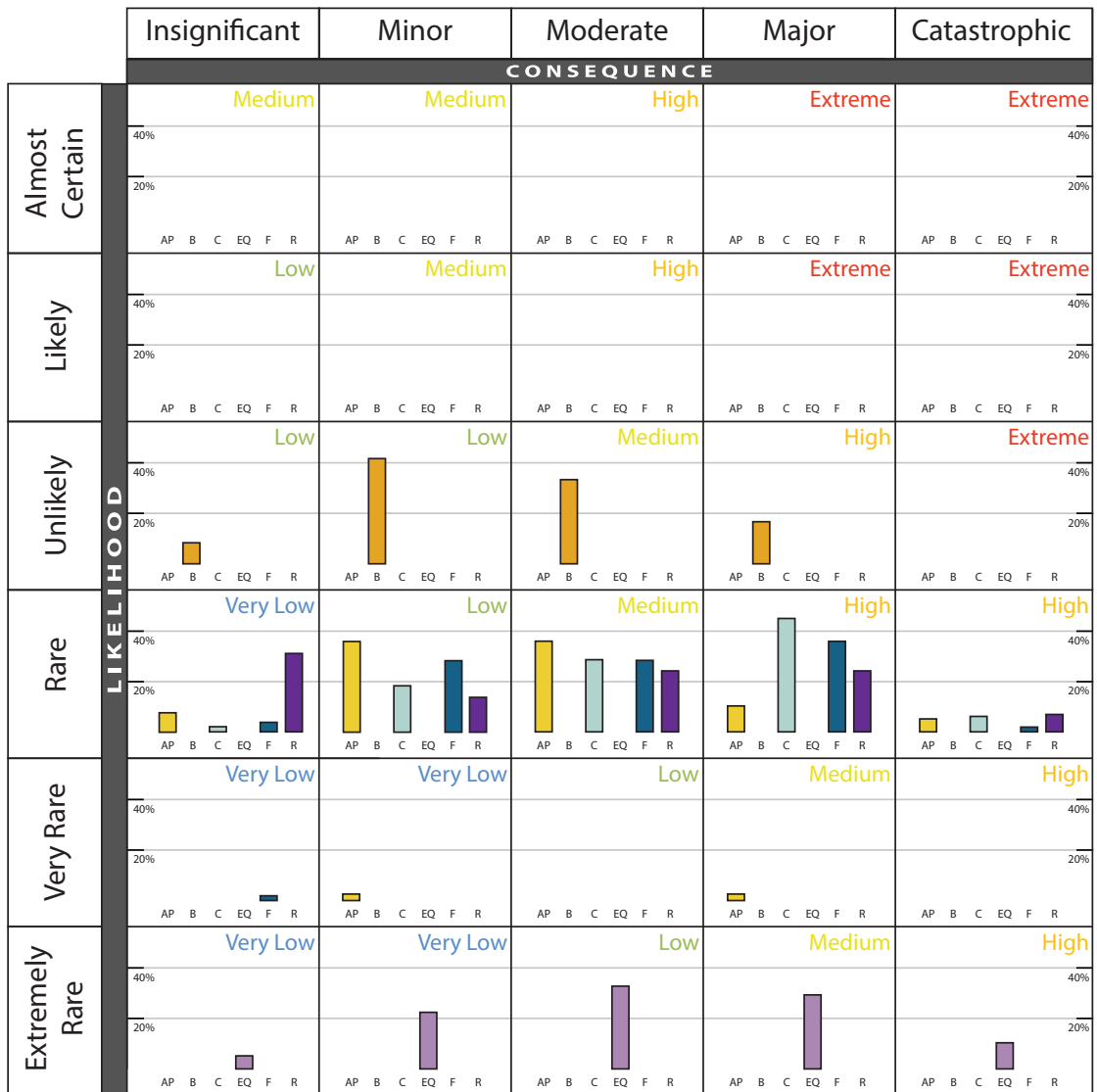
Five per cent of the risks assessed could produce catastrophic consequences. Figure 11 shows that these catastrophic consequences come from animal and plant biosecurity, cyclone, earthquake, flood and road crash. Catastrophic consequences may stretch or outstrip the district's current resources and capabilities; these risks should be considered during the treatment phase.

Figure 11 also clearly highlights the different occurrence likelihoods of the six hazards. The majority of the statements (61%) plot as rare (0.1-<1% chance in any given year). It is worthwhile noting the low likelihood, yet significant consequences (29% major; 10% catastrophic) of the earthquake hazard.

Road crash also stands out as having a high percentage of high, medium and very low risks. The high risks relate to potential deaths and injuries and the increased demand on emergency services such as DFES (first responders and HAZMAT response). The very low risks relate to disruption of business, transportation, tourists and schools. These risks were very low because the road crash was confined to a relatively small geographic area.

Another way to look at the risks to the Midwest-Gascoyne EM district is by separating the risks into the five impact areas. Figure 12 shows how the risks sit across the five impact areas for all hazards. Within the people impact area there is a large proportion (91%) of high risk statements related to deaths and injuries for bushfire, cyclone, earthquake, flood and road crash. Road crash and earthquake were assessed to produce catastrophic consequences for fatalities (>7) and injuries. Earthquake also has the potential to overwhelm the health and emergency services such that there are further deaths, resulting in catastrophic consequences (>7 deaths). All other hazards, except animal and plant biosecurity, could result in a least one death and likewise overwhelm emergency services or health services but with lower consequences (1-7 deaths). The social setting and environment impact areas are dominated by low risks (Figure 12).

Midwest-Gascoyne EM District Risk Profile



Legend

- Animal & Plant Biosecurity (AP)
- Bushfire (B)
- Cyclone (C)
- Earthquake (EQ)
- Flood (F)
- Road Crash (R)

Key

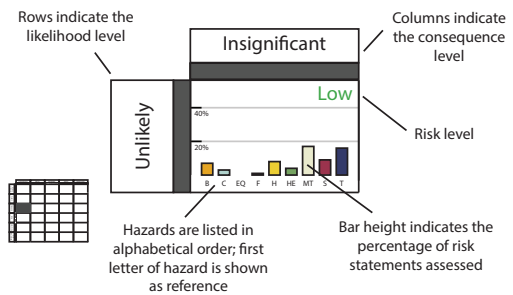


Figure 11: Percentage of risk statements for each hazard assessed in the Midwest-Gascoyne EM district categorised by their likelihood, consequence and risk level.

Percentage of risk statements per impact area for all hazards

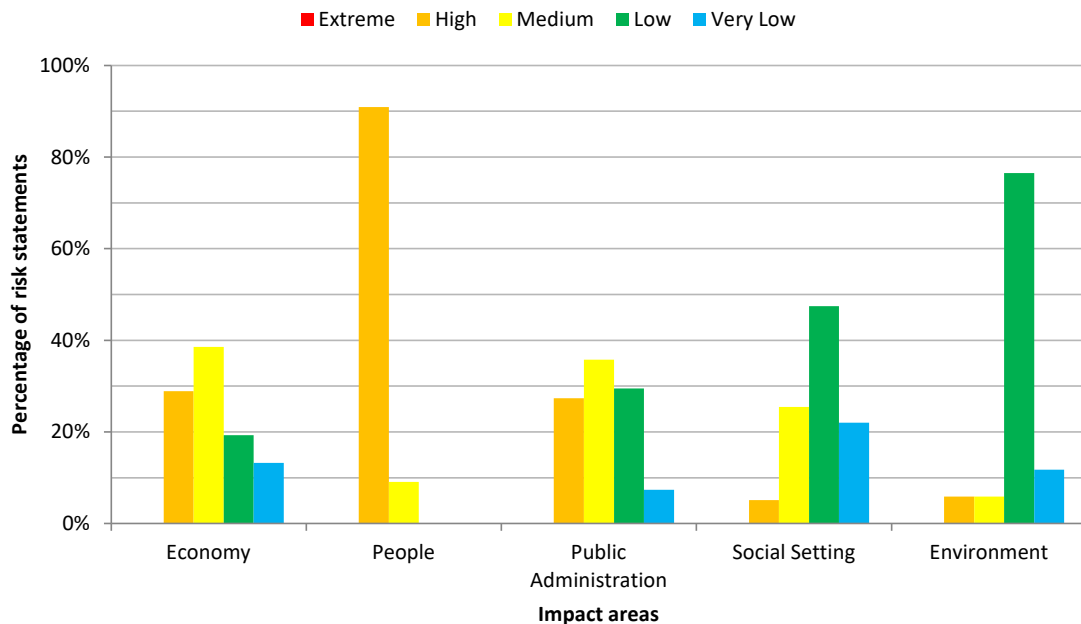


Figure 12: Percentage of risk statements per risk level, by impact area for all hazards. Note: each impact area sums to 100%.

Common themes from high risk statements

ECONOMY



- Damage and disruption to transport routes and infrastructure.
- Impacts to agriculture and pastoral activities resulting in a loss of revenue and disruption.
- Impacts to aviation infrastructure (*cyclone only*).
- Damage to private and commercial buildings and contents resulting in financial losses.
- Damage to marine infrastructure (marinas, boat ramps, ports) (*cyclone only*).
- Disruption to tourism activities resulting in financial losses (*flood only*).
- Response and recovery activities will be required, resulting in costs to the district.

PEOPLE



- Emergency events causing injuries/illnesses (*for earthquake and road crash these are catastrophic consequences*).
- Emergency events causing deaths (*for earthquake and road crash these are catastrophic consequences*).
- Increased surge on emergency (ambulance, medical transport) and health (hospitals) services (*for earthquake these are catastrophic consequences*).
- Impacts to people's health from waterborne diseases (*flood only*).

PUBLIC ADMINISTRATION



- Surge on emergency and health services, reducing their normal service provision and delivery.
- Increased demand on government services (e.g. Centrelink).
- Disruption to aviation services (*cyclone only*).
- Increased demand on public facilities for use as welfare sites.
- Impacts to the provision of home-based service providers.
- Disruption to the supply of water (*flood only*) and sewerage services.
- Response and recovery activities will be required by local governments and state agencies resulting in disruption to their normal services.

SOCIAL SETTING



- Decreased availability of essential supplies especially for remote Aboriginal communities (*cyclone only*).
- Increased psychological and emotional stress (*road crash only*).

ENVIRONMENT



- Increased soil erosion on the flood plains (*flood only*).

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 impact; therefore there are categories where not all hazards appear.

Risks to economy

Eighty-two economy risk statements were assessed across the six hazards (Table 8). The statements address impacts to a significant industry or a decline in economic activity across the district (see Appendix C for criteria).

Table 8: Impacts to economy by hazard and risk level. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

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

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>			Bushfire Cyclone	Flood	EQ
<i>Impacts to marine infrastructure and industry</i>		Cyclone	EQ	Bushfire Cyclone	
<i>Impacts to mining infrastructure and industry</i>				Flood	
<i>Impacts to natural gas distribution</i>			Bushfire		EQ Flood
<i>Impacts to power supply infrastructure</i>			Bushfire Cyclone Flood	EQ	
<i>Impacts to private buildings and contents</i>		Bushfire Cyclone EQ Flood			
<i>Impacts to sewerage systems</i>			Cyclone EQ Flood	Bushfire	
<i>Impacts to tourism</i>		Flood	AP Bio Cyclone (2)	Bushfire EQ	Road Crash
<i>Impacts to transportation infrastructure</i>		Cyclone Flood	Road Crash		
<i>Impacts to water supply infrastructure</i>		Cyclone Flood	Bushfire EQ		
<i>Response and recovery activities</i>		AP Bio Cyclone	Bushfire EQ Road Crash		
<i>Workforce productivity losses</i>				AP Bio	

Overall, most of the economy risk statements were assessed as either high or medium risk, equating to consequences between moderate and catastrophic (financial losses of between \$3.7 million to \$370 million).

Animal and plant biosecurity poses a high economic risk to the Midwest-Gascoyne if an outbreak of FMD occurs. It was anticipated that such an outbreak would impact all farms in the district as the stock standstill that would be put in place would prevent the movement of any stock within the district. This standstill, along with the presence of the disease, would cause the closure of the Australian meat export market for at least one year. Proof of freedom from the disease is required before market access is granted, significantly impacting related commercial activities. It should be noted that the impacts to the export market would be expected nation-wide and it could take up to 10 years to fully recover.

Other service industries related to agriculture (such as meat processing) would be affected, but the impact to the district would be to a lesser extent as these are not significant industries in the Midwest-Gascoyne. Response and recovery activities are likely to be significant and result in large costs related to setting up road blocks, quarantine sites, the destruction of infected animals and compensation for destroyed animals. There are cost sharing arrangements for this hazard and they are contained within the Emergency Animal Disease Response Agreement (EADRA), an agreement between federal, state and territory governments and livestock industry groups. For FMD the costs are shared for the response and 'proof of freedom' stages: 20% industry and 80% government (Commonwealth Government shares 50% of this total).

The high risks resulting in disruption to transportation routes arise in two different ways: damage to the road network or from road closure during an event. The flood and cyclone hazards would inundate a number of roads, possibly damaging the infrastructure; while FMD would result in road closure to prevent cattle movement. Similar road blocks during bushfires are of lower consequence: a medium risk.

Cyclone has a number of high and medium risks statements across multiple economy themes (agriculture, aviation, buildings, marine and transportation infrastructure). This is primarily related to the widespread nature of this hazard. In this particular scenario, the cyclone tracks along the coast of the Midwest-Gascoyne EM district, impacting all coastal towns and communities along its path; consequently the response and recovery activities are anticipated to be significant.

During the risk assessment, buildings were separated into private and commercial buildings due to the difference in construction and replacement costs. Damage to both private and commercial buildings were assessed as high risks from all natural hazards, with the exception of commercial buildings for the bushfire scenario which was assessed as a medium risk. There are fewer commercial buildings in the two areas impacted by the bushfire scenario.

The flood scenario poses a high risk to tourism and water infrastructure; in particular the evacuation of camping and accommodation sites could cause high financial losses. Similarly the inundation of wastewater pump stations and water treatment plants (particularly the chlorination facility in Carnarvon) would result in significant repair costs.

Risks to people

Twenty-two risk statements assessed the impact to people across the six workshops. These statements addressed deaths, injuries or illnesses; further deaths or illnesses/injuries as a result of the event's impact on emergency services (primarily medical transport); and on health services. The risk posed to each of these elements by the assessed hazards is shown in Table 9.

Table 9: Impacts to people by hazard and risk level. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Cyclone EQ Flood Road Crash	AP Bio		
<i>Disease outbreak</i>		Flood			
<i>Emergency services</i>		Bushfire Cyclone EQ Flood Road Crash			
<i>Health services</i>		Bushfire Cyclone EQ Road Crash			
<i>Injuries and illnesses</i>		Bushfire Cyclone EQ Flood Road Crash	AP Bio		

The risks to people were all assessed as high, with the exception of two risks from the animal and plant biosecurity hazard.

Deaths and injuries for the earthquake and road crash scenarios were assessed to have catastrophic consequences. For the Midwest-Gascoyne EM district a catastrophic consequence is at least seven deaths, or more than seven critical injuries with permanent incapacitation, or more than 65 serious injuries (Appendix C). Bushfire, cyclone and flood were assessed as having major consequences (at least one death or one critical injury or seven serious injuries). FMD does not affect human health so deaths and injuries from the animal and plant biosecurity scenario are lower risks. The deaths and injuries could result from suicide, mental health issues or accidents.

Health and emergency services are likely to be stretched during response for all hazards with the exception of animal and plant biosecurity where these services will not be required. The increased demand arises from the large number of people that could be affected, particularly in the cyclone and earthquake scenarios, which are widespread. Potential damage to health facilities (e.g. hospitals) or isolation of people could result in delays of medical treatment or transport.

Risks to public administration

Ninety-five statements assessed public administration impacts. These statements pertain to the continuity of an agency's core services. For example, at medium risk or higher, either a significant reduction in services would occur or external assistance from outside the EM district would be required to maintain service levels (see Appendix C for criteria).

Table 10: Impacts to public administration by hazard and risk level. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire	
<i>Demand on public facilities</i>		Cyclone Flood		Bushfire EQ	
<i>Disruption of educational services</i>				EQ Flood	
<i>Disruption to aviation services</i>		Cyclone		Bushfire	
<i>Disruption to supply of natural gas</i>					EQ
<i>Emergency services</i>		Bushfire (2) Cyclone (4) Road Crash (3)	EQ (3) Flood (3)	AP Bio Bushfire (2) EQ Flood	Road Crash
<i>Government services</i>		AP Bio Flood (2)	EQ (2) Flood (2) Road Crash (3)	AP Bio EQ (6) Road Crash (2)	EQ (2) Flood
<i>Health services</i>		Cyclone Road Crash	Bushfire EQ Flood		

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Home care services</i>		Cyclone Flood		Bushfire	
<i>Impacts to communication service delivery</i>			Bushfire Cyclone	Flood	EQ
<i>Impacts to port and marina services</i>				Cyclone	
<i>Impacts to power supply service delivery</i>			Bushfire Cyclone EQ	Flood	
<i>Impacts to sewerage service delivery</i>		Cyclone Flood	EQ	Bushfire	
<i>Impacts to water supply service delivery</i>		Flood	Bushfire Cyclone EQ Flood		
<i>Public information</i>			AP Bio		
<i>Response and recovery activities</i>		Bushfire Cyclone (2) Flood	AP Bio (4) Bushfire (2) Flood	AP Bio (3)	EQ

Of these public administration risk statements, three were assessed as having catastrophic consequences; meaning that the organisations are unable to provide their normal services. These statements were the result of the cyclone and related to recovery activities by local governments (LGs), sewerage systems and home-based services. As the cyclone tracks along the Midwest-Gascoyne coast it impacts a number of communities and local governments, all of whom will need to carry out various recovery activities. It was suggested that bigger LGs, such as the City of Greater Geraldton, would be able to manage providing both recovery activities and normal business services; whereas smaller LGs would only be able to focus on recovery. Sewerage systems are unlikely to cope with the scale of the water inundation (rain and storm surge) and would have to spill sewage into the ocean.

Statements pertaining to the provision of home care or home-based services such as those provided by NGOs, Meals on Wheels and Silver Chain were all assessed as high risk. This is because many of these organisations are small and do not have the capacity to bring in additional resources to provide their services as most use volunteers. These volunteers may also be occupied with other tasks during an emergency event, such as helping at evacuation centres.

The high risk for government services for animal and plant biosecurity is related to the increased demand on DAFWA services. As DAFWA is the hazard management agency (HMA) for this hazard they will be the lead response agency and will likely not be able to provide their other services. Also, because FMD could cause state and national-wide impacts, it was suggested that this scenario would be immediately managed at a state level (i.e. it would be beyond the Midwest-Gascoyne district's capacity).

One of the high risk flood statements for government services relates to an increased demand on the Department for Child Protection and Family Support (CPFS). It is anticipated that for a flood of this size additional resources from outside the district would need to be brought in to respond to the event, especially if large evacuations take place. Evacuations for the flood and cyclone events would not only cause an increased demand on CPFS resources but would also cause an increased demand on public facilities for use as evacuation sites.

The emergency service risk statements relate to DFES (fire and HAZMAT response), WA Police and ambulance response to these hazard scenarios. The risks that were assessed as high risk for bushfire, cyclone and road crash are due to limited resources. These three agencies indicated that response to these hazards would put a strain on their resources and they would need to pull in additional resources from outside the district, such as from Perth. In the case of cyclone, state resources would be requested immediately because of the widespread and sustained response required. For the road crash scenario, there would be a high demand for resources for the first 3-4 hours after which the demand would decrease.

Health services within the district also have limited resources and would need to bring in additional resources from outside the district.

While not a high risk, the supply of public information about FMD is critical to managing this scenario as it is not a hazard that occurs frequently. Much of this public information would come from DAFWA at the state level (i.e. outside of the Midwest-Gascoyne district).

Risks to social setting

Fifty-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).

Table 11: Impacts to social setting by hazard and risk level. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>		Cyclone		Bushfire Flood (2)	EQ Road Crash
<i>Breakdown of social networks</i>				Bushfire EQ	EQ Road Crash
<i>Community services and events</i>					EQ
<i>Culturally significant facilities and customs</i>				AP Bio Bushfire EQ	
<i>Death/injury of animals</i>				Bushfire	EQ
<i>Displacement or isolation of Aboriginal communities</i>		Flood			
<i>Displacement or isolation of communities</i>			Cyclone EQ Flood	Bushfire Flood	AP Bio
<i>Educational facilities</i>				Bushfire Cyclone Flood	EQ Road Crash
<i>Facilities for vulnerable people</i>			EQ	Bushfire Cyclone Flood	
<i>Impacts to people's health</i>			EQ	Bushfire Flood	Cyclone
<i>Impacts to tourism</i>			Cyclone	AP Bio Bushfire	AP Bio Road Crash
<i>Loss of income</i>			AP Bio Cyclone Flood	Bushfire EQ	
<i>Psychological and emotional stress</i>		Road Crash	AP Bio (2)	AP Bio	AP Bio
<i>Residential building damage</i>			Bushfire Cyclone Flood	EQ	
<i>Social service providers</i>			Flood	Bushfire Cyclone EQ	

There are only three high risk statements for the social setting (Table 11) which relate to the availability of essential supplies, isolation of Aboriginal communities and psychological stress. The cyclone is likely to impact commercial retail outlets and service providers, affecting the availability of essential supplies (e.g. food, water). However, it was anticipated that this would not dramatically reduce people’s quality of life, but would mean they would need to travel further to get supplies. This would be a major impact along the coast where most of the cyclone damage would be.

The isolation of Aboriginal communities as a result of the flood event is likely and resupply of goods may be required for multiple communities. Typically, the roads into these communities are not sufficient for the delivery of goods and they get damaged in smaller recurring floods. Resources and services from outside the Midwest-Gascoyne would be required but the services that these communities require are not well understood.

There is a high risk that the road crash scenario would result in psychological and emotional stress for victims and responders. It was suggested that local counselling resources would be overwhelmed and additional resources from outside of the district would be required.

Most (47%) of the social setting risk statements were assessed as low risks indicating that the district community only requires some external resources to restore it back to normal function and that there would be limited or temporary reductions in services. Individual communities may experience higher consequences than the district as a whole.

Risks to environment

Seventeen risk statements were assessed across the six hazards for the environment (Table 12). These statements address impacts to ecosystems, species and landscapes (see Appendix C for criteria).

Table 12: Impacts to environment by hazard and risk level. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Coastal erosion</i>				Cyclone	
<i>Contamination from toxic substances</i>				Bushfire EQ (2) Road Crash (2)	

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Debris or pollutants entering the riverine or marine environment</i>				Cyclone Flood	
<i>Flora and fauna</i>			Cyclone	Bushfire Flood	Flood
<i>Issues with carcass disposal</i>				AP Bio	AP Bio
<i>Soil erosion</i>		Flood		AP Bio Cyclone	

The highest risk to the environment is from soil erosion on the flood plains caused by the flood scenario. The floods would cause scouring and removal of top soils across the district; although the greatest impact would likely be in the Carnarvon area near the Gascoyne River. After the 2010 Gascoyne River flood, the river bed increased in height by about 2 m because of the deposition of eroded material. If this flood scenario occurred a restoration program would be required to recover and return top soil. It was stated that top soil is stockpiled in some places as part of flood planning programs.

The next highest risk was to the impact of flora and fauna from the cyclone event. The district has a number of rare flora species that could be lost during the cyclone. There is also a potential for the spread of invasive or unwanted species.

Contamination from toxic substances was assessed as a low risk for bushfire, earthquake and road crash. In the bushfire and earthquake scenarios, buildings which contain asbestos could be damaged, releasing it into the environment. Areas where this could be a problem would need to be assessed and resources brought in to assist with recovery. It was determined that asbestos could be a significant impact to Geraldton for the earthquake scenario; however it would not be a district-wide impact, which the criteria require for it to be rated a higher consequence (Appendix C).

The potential for contamination of the environment, particularly groundwater, from the disposal of carcasses infected with FMD was assessed as a low risk. The impact is dependent on a number of variables such as the location of the burial site (which will be decided when required), number of animals within each burial site, depth to groundwater and treatment undertaken with carcasses.

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 eleven themes identified for the Midwest-Gascoyne EM district are: Aboriginal communities and cultural activities; buildings; community; education; environment; government; health; industry/commercial; tourism; transport; and utilities. Not all themes are shown here and the environment theme is the same as Table 12.

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

Buildings

Cyclone and flood hazards pose the greatest risks to buildings due to the widespread nature of these hazards and the likely impacts they will cause across the district (Table 13). In addition, because these hazards will result in evacuations, there will be an increased demand on public facilities and buildings for use as evacuation centres. This will mean that these facilities cannot be used for their normal activities (e.g. sports); however, sport activities are likely to be cancelled during such events.

While the likelihood of the earthquake is low (0.005% chance in any given year) the risk of building damage is high as it is anticipated that up to 80% of all buildings (private and commercial) in Geraldton could be impacted by this earthquake scenario. The two earthquake risk statements for building damage are the only statements with catastrophic consequences in Table 13.

The effect on the community wellbeing as a result of destroyed or damaged buildings in the district is a lower risk because it is anticipated that most people impacted would stay in the district. In some cases, there may be a positive impact with the injection of insurance payouts into the impacted areas. This occurred in Carnarvon after the 2010 Gascoyne River flood.

Table 13: Risks related to buildings. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

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

Community

The highest risks to the community are from the lack of availability of essential supplies, home care service provision and increased psychological and emotional stress (Table 14). The potential limited availability of essential supplies and lack of provision of home care services for cyclone and flood scenarios result from limited road access and resources. It was suggested that home-care providers would struggle because they have limited resources and use volunteers who may have other roles during these events. Coupled with the limited availability of essential supplies this could result in reduced quality of life for those impacted communities.

There is a high risk that the road crash scenario would result in psychological and emotional stress for victims and responders. Local counselling resources would be likely be overwhelmed and additional resources would be required. While assessed as a moderate risk, stress for farmers impacted by FMD could occur over time (6-9 months) especially if farmers lose their entire stock.

Table 14: Risks to the community. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Community					
Category	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>				Bushfire	
<i>Availability of essential supplies</i>		Cyclone		Bushfire Flood (2)	EQ Road Crash
<i>Breakdown of social networks</i>				Bushfire EQ	EQ Road Crash
<i>Community services and events</i>					EQ
<i>Culturally significant facilities and customs</i>				AP Bio Bushfire EQ	
<i>Death/injury of animals</i>				Bushfire	EQ
<i>Displacement or isolation of communities</i>			Cyclone EQ Flood	Bushfire Flood	AP Bio
<i>Facilities for vulnerable people</i>			EQ	Bushfire Cyclone Flood	
<i>Home care services</i>		Cyclone Flood		Bushfire	
<i>Loss of income</i>			AP Bio Cyclone Flood	Bushfire EQ	
<i>Psychological and emotional stress</i>		Road Crash	AP Bio (2)	AP Bio	AP Bio
<i>Social service providers</i>			Flood	Bushfire Cyclone EQ	

Education

Only five hazards caused impacts to education facilities (Table 15) as the animal and plant biosecurity scenario is unlikely to impact these facilities and functions. The risk is considered low as three of the hazard scenarios (bushfire, cyclone and flood) take place during the summer holidays and there would be limited impact during this time. It is anticipated that if these scenarios occurred during school term students and teachers

could be moved to other operational schools if their schools are closed and/or damaged, or materials could be delivered by online methods.

In the case of earthquake, multiple school buildings could be damaged which would limit the number of suitable locations to move students for learning activities. As such this disruption was assessed as a moderate consequence, however because of the low likelihood of this scenario occurring (0.005% chance in any given year) it came out as a low risk.

The road crash statement relates to the disruption of TAFE facilities as the crash scenario and associated HAZMAT plume occur near their facilities. It was anticipated that if there were to be any impact it would be for one day and they could either close for the day or move students to another location.

Table 15: Risks related to education. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Education					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption of educational services</i>				EQ Flood	
<i>Education facilities</i>				Bushfire Cyclone Flood	EQ Road Crash

Government

There is a wide spread of risk levels for all government themes from high to very low risk (Table 16) with the highest risks related to emergency and government services, and response and recovery activities.

The high risks to emergency and government services typically resulted from limited resources to either solely respond to the event or respond and provide their normal services. Many of the agencies in the Midwest-Gascoyne would have to bring in additional resources from outside of the district due to limited resources in the district. For example, there are ten DFES staff members for the district, some of whom provide training to other DFES staff across the state and are therefore unavailable.

The logistic and organisational requirements of the animal and plant biosecurity scenario would create a significant impost on involved agencies and require external assistance. Also, because it would have Australian-wide impacts, the response and management of this scenario would be at state level.

While the large response and recovery effort for the animal and plant biosecurity scenario would have significant costs, the actual activities would be spread across a number of different industries/agencies (public administration). Thus, with the exception of DAFWA which would experience a significant surge, the total economic risk is greater than the administrative burden.

Table 16: Risks related to government activities. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Government					
Category	Extreme	High	Medium	Low	Very Low
<i>Emergency services</i>		Bushfire (2) Cyclone (2) Road Crash (2)	EQ (2) Flood (2)	AP Bio Bushfire	
<i>Government services</i>		AP Bio Flood (2)	EQ (2) Flood (2) Road Crash (3)	AP Bio EQ (6) Road Crash (2)	EQ (2) Flood
<i>Public information</i>			AP Bio		
<i>Response and recovery activities</i>		AP Bio Cyclone	Bushfire EQ Road Crash		
<i>Response and recovery activities</i>		Bushfire Cyclone (2) Flood	AP Bio (4) Bushfire (2) Flood	AP Bio (3)	EQ

Health

The majority of the health-related risks were assessed as high (Table 17). Deaths and injuries for the earthquake and road crash scenarios were assessed as having catastrophic consequences (at least seven deaths) which resulted in these being high risks. While the consequences for bushfire, cyclone and flood were assessed as major (at least one death) their higher likelihood meant they also are high risks.

Some of the public administration statements (orange rows in Table 17) rate as high risks and are related to the overwhelming of emergency and health services such that further deaths may occur. Additionally, with the emergency services, the cyclone and flood scenarios may damage or close roads such that emergency services cannot reach people to provide medical aid or remove people from dangerous areas.

The social setting risks (purple row in Table 17) refer to how deaths and injuries from these hazards would affect the district community's wellbeing. While there is a high risk of a number of people being killed in these events, there is a medium to very low risk that this would affect the entire district community.

Table 17: Risks related to health. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Health					
Category	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Cyclone EQ Flood Road Crash	AP Bio		
<i>Disease outbreak</i>		Flood			
<i>Emergency services</i>		Bushfire Cyclone EQ Flood Road Crash			
<i>Emergency services</i>		Cyclone Road Crash	EQ Flood		
<i>Health services</i>		Bushfire Cyclone EQ Road Crash			
<i>Health services</i>		Cyclone Road Crash	Bushfire EQ Flood		
<i>Impacts to people's health</i>			EQ	Bushfire Flood	Cyclone
<i>Injuries and illnesses</i>		Bushfire Cyclone EQ Flood Road Crash	AP Bio		

Industry/commercial

All aspects of commercial activities within the district are affected, including agricultural and pastoral activities and the marine industry (Table 18).

Impacts to agriculture activities from the animal and plant biosecurity hazard were anticipated to be significant. It would initially impact all agriculture activities immediately when the 72-hour stock standstill is put in place to stop the spread. The impact would then flow through to commercial activities that rely on or support the agriculture industry, such as meat processors. The export market would be affected for at least a year until the disease is eradicated and proof of freedom is achieved. The cyclone and flood scenarios are also anticipated to impact the agriculture industry through wind and water damage of crops and pastures.

Damage to the port could be a significant cost during a cyclone, particularly if a ship load was damaged, with losses of \$40-50 million. However, the likelihood of this particular impact was assessed as low. The risks of disruption to services at the port were low and these are expected following the event (orange row in Table 18).

Table 18: Risks related to industrial/commercial activities. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Industry/commercial					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to agricultural and pastoral activities</i>		AP Bio Cyclone (2) Flood	AP Bio (4) Bushfire (2) Cyclone Flood	AP Bio Bushfire	EQ (2)
<i>Impacts to commercial activities</i>		AP Bio (2)	EQ Road Crash	AP Bio (2)	Road Crash (3)
<i>Impacts to marine infrastructure and industry</i>		Cyclone	EQ	Bushfire Cyclone	
<i>Impacts to mining infrastructure and industry</i>				Flood	
<i>Impacts to port and marina services</i>				Cyclone	
<i>Workforce productivity losses</i>				AP Bio	

Tourism

The economic impacts from flood and cyclone could result from hotels being evacuated and accommodation providers losing money, though non-refundable bookings may stem losses (Table 19). Impacts would also depend on the area impacted. For example, the Gascoyne Junction Caravan Park was still being restored five years after the 2010 Gascoyne River flood. Reduced tourism was not thought to significantly impact the community as the impacts are likely to be localised (medium to very low risks).

Table 19: Risks related to tourism. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

Tourism					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to tourism</i>		Flood	AP Bio Cyclone (2)	Bushfire EQ	Road Crash
<i>Impacts to tourism</i>			Cyclone	AP Bio Bushfire	AP Bio Road Crash

Transport

Animal and plant biosecurity, cyclone and flood hazards pose the highest risk to transportation networks (road and air) and result in financial losses from either delays or the physical damage of infrastructure (Table 20).

Both the flood and cyclone scenarios are expected to result in significant road and rail infrastructure repair costs. In the case of Carnarvon airport, the storm surge generated by the cyclone would completely flood the airport; however in the flood scenario, the levee system is expected to provide some protection. When assessing the disruption to transport routes, flood was ranked as a high risk due to the widespread damage of roads and bridges inland. The cost of transporting goods to and around the district is also expected to increase. Conversely, the disruption caused by the cyclone to transport routes was assessed as a lower risk as much of the damage would be coastal and have a greater impact on the rail system. The degree of the decline of economic activity could not be agreed by the participants so it was assessed instead from an industry perspective (Appendix C) and deemed to result in short-term profit reductions.

The disruption from the animal and plant biosecurity scenario results from the 72-hour stock standstill that would be put in place to prevent the spread of FMD. This standstill would involve roadblocks on all major freight routes in the district. Trucks that are transporting goods other than animals would likely be able to go through the road block if

they have not been on or near farms. This would increase travel times for freight across the district, causing significant disruption and additional costs. In addition, permanent containment zones (with 2 to 10 km buffer zones) would be in place around infected farms. Depending on where the infected farms are located this could cause further disruption if a farm was near a major freight route.

Table 20: Risks related to transport. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

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

Utilities

The majority of the risks to utilities have been assessed as medium risks, with the highest risks being caused by cyclone and flood impacts to sewerage and water supply networks (Table 21). While these systems are designed to work in a wet environment, the control systems are not and if inundated with water they would shut down. In addition, if power was lost, pumps would not be able to operate. If sewerage treatment facilities have no power, then sewage would have to be spilled into the ocean where the large volume of ocean water would dilute contaminants.

For their water supply systems, the Water Corporation has invested in additional back-up power generators for pumps, and employs systems that can isolate damaged sections of pipe so they can be repaired. In Carnarvon, the chlorination facility at the water treatment plant is protected by a levee structure; however for the assessed scenario this was likely

to be breached which would inundate the chlorination facility, resulting in the loss of potable water in Carnarvon.

The risks assessed as medium are because either there would be limited impact to infrastructure, the infrastructure is designed to withstand impacts, the utility providers have sufficient resources to provide temporary services or restore services, or the cost would be borne by the utility provider at the state or national level, not by the district.

Table 21: Risks related to utilities. Note: AP Bio = animal and plant biosecurity; EQ = earthquake.

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

6 Risk evaluation

The next step in the risk management process is to evaluate the risks, determining whether the risk is acceptable or requires treatment (Figure 13).

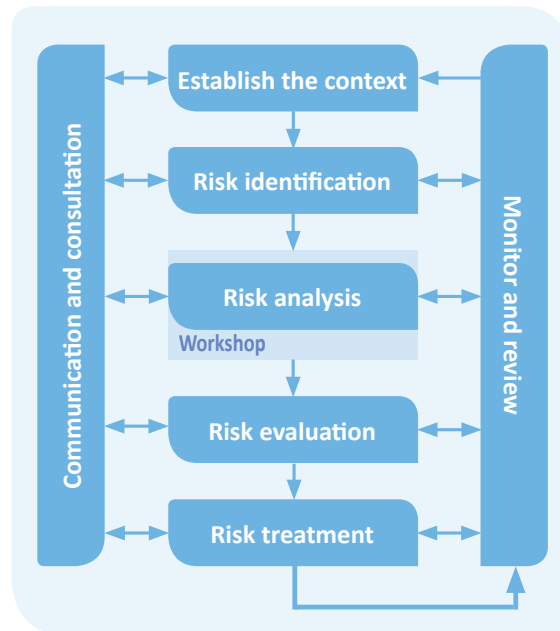


Figure 13: Emergency risk management process.³

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 14 shows that most of the Midwest-Gascoyne risk statements are classified as either Priority 3 (33% of statements) or 4 (32%), meaning that these have medium and low priority for further investigation and/or treatment. Twenty-six per cent of the statements are classified as Priority 5, meaning that these are broadly acceptable risks which require no further action other than monitoring and review during the next risk assessment review phase.

Twenty-five (~9%) risk statements have been classified as Priority level 2 (Figure 14) indicating that these risks have a high priority for further investigation and/or treatment. Of these, four statements (1 cyclone and 3 bushfire) have been classified as Priority 2 because of their low confidence level (Table 22). Another eight statements have been assessed with moderate confidence. Because of the low and moderate confidence

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levels, these 12 statements should be investigated further so that the level of risk can be refined. The remaining 13 Priority 2 statements have been assessed as Priority 2 based on their catastrophic or major consequences.

None of the Midwest-Gascoyne risk statements assessed have a Priority level of 1.

Table 22 contains the Priority 2 risk statements in full and the Priority 3 risk statements which have catastrophic consequences; 32 statements in total. 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.

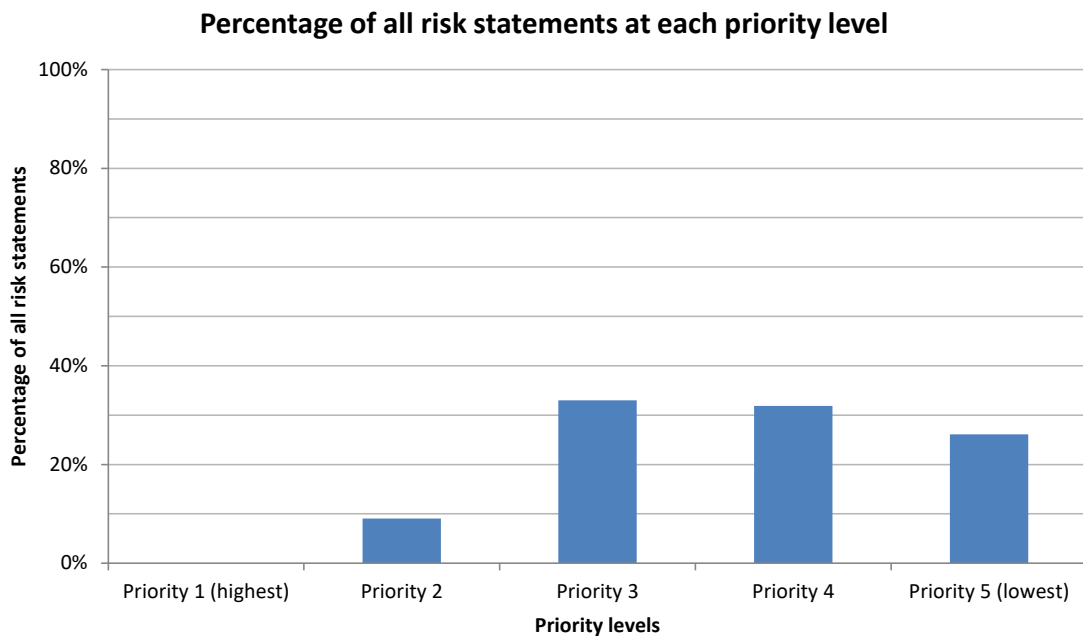


Figure 14: Percentage of all risk statements at each priority level. Priority 1 – highest; Priority 2 – high; Priority 3 – medium; Priority 4 – low; Priority 5 – lowest.

Table 22: Risk statements for the Midwest-Gascoyne district with Priority level 2 or catastrophic consequences. AP Bio = animal and plant biosecurity; EQ = earthquake; R Crash = road crash.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Flood	will damage transport infrastructure such as bridges, road and rail, incurring costs to the district.	Economy	Catastrophic	High	High	2
AP Bio	will impact exports (e.g. due to restrictions imposed by importing countries), resulting in financial losses.	Economy	Catastrophic	High	High	2
AP Bio	will result in response and recovery activities (including animal destruction, environmental clean-up), resulting in costs to the district.	Economy	Catastrophic	High	Moderate	2
R Crash	will impact the health of people and cause death(s).	People	Catastrophic	High	High	2
R Crash	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	2
Cyclone	will require recovery works to be undertaken by local governments which will impact on their ability to maintain core services.	Public Administration	Catastrophic	High	High	2
Cyclone	will impact on home-based services and service providers (such as NGOs, Meals on Wheels, Silver Chain, WACHS, home-care provisions), impacting on their ability to maintain core functions.	Public Administration	Catastrophic	High	High	2
Cyclone	will impact the aviation sector (including damage to aviation infrastructure) resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact private buildings and contents, resulting in financial losses.	Economy	Major	High	High	2
Flood	will impact infrastructure required for potable water supply (e.g. dams, piping, bores, pump stations), resulting in financial losses.	Economy	Major	High	Moderate	2

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Bushfire	will cause emergency services (including ambulance and medical transport services such as RFDSWA) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
R Crash	will cause emergency services (including ambulance and medical transport services) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
R Crash	will cause health services (e.g. ICU units, hospitals, clinics, etc.) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	Moderate	2
Bushfire	will cause health services (e.g. ICU units, hospitals, remote nursing posts, small country hospitals, clinics) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Major	High	High	2
Bushfire	will impact the health of people and cause death(s).	People	Major	High	High	2
Bushfire	will impact the health of people and cause injury and/or serious illness.	People	Major	High	High	2
Flood	will impact the health of people due to stagnant water and waterborne diseases.	People	Major	High	Moderate	2
Bushfire	will result in an increased demand (surge) on DFES services, impacting their ability to maintain core services.	Public Administration	Major	High	High	2
Bushfire	will result in an increased demand (surge) on WA Police services, impacting their ability to maintain core services.	Public Administration	Major	High	High	2
Bushfire	will require recovery or response works to be undertaken by Parks and Wildlife, impacting on their ability to maintain core services.	Public Administration	Major	High	High	2
Flood	will impact Water Corp, impacting their ability to deliver core services.	Public Administration	Major	High	Moderate	2

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
Cyclone	will impact commercial retail outlets and service providers, impacting the availability of basic commercial products and services.	Social Setting	Major	High	Low	2
Bushfire	will impact communications infrastructure, resulting in costs to the district and financial losses.	Economy	Moderate	Medium	Low	2
Bushfire	will impact communication infrastructure, impacting the ability to maintain core services.	Public Administration	Moderate	Medium	Low	2
Bushfire	will result in an increased demand (surge) on WA health services, impacting their ability to maintain core services.	Public Administration	Moderate	Medium	Low	2
EQ	will impact private buildings and contents, resulting in financial losses.	Economy	Catastrophic	High	High	3
EQ	will cause emergency services (including ambulance and medical transport services) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	High	3
EQ	will cause health services (e.g. ICU units, hospitals, clinics) to be overwhelmed, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	High	3
EQ	will impact the health of people and cause death(s).	People	Catastrophic	High	High	3
EQ	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	High	3
Cyclone	will impact sewerage systems, impacting service delivery.	Public Administration	Catastrophic	High	Highest	3



7 Future actions

A preliminary treatment discussion will be held 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 Midwest-Gascoyne EM district from the animal and plant biosecurity scenario for the five impact areas. The percentage of risk statements at each risk level for the scenario is shown in Figure 15.

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

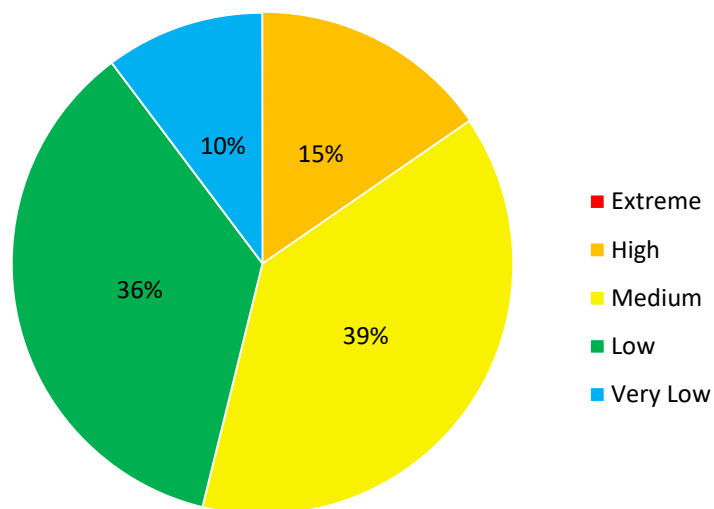


Figure 15: Percentage of risk statements at each risk level for animal and plant biosecurity.

Animal and plant biosecurity risk assessment

Extreme risks

Nil.

High risks

Response and recovery activities will be required by state agencies and affected industry groups. Cost sharing arrangements are outlined in the Emergency Animal Disease Response Agreement (EADRA): such costs are shared 80% government (the Commonwealth share is 50% of this total) and 20% industry. Restrictions to the export market will cause financial losses for businesses within the district and will cause farm revenues to decline. Freight routes for trucks carrying animals will be disrupted during the 72-hour stock standstill that will be put in place.

Medium risks

There will be significant costs associated with the destruction of infected animals (e.g. cattle, sheep). There will likely be some loss of reputation within the district however this was not anticipated to be widespread. Tourists might be disrupted by road blocks and the stock standstill. The other medium risk relates to the oversupply of red meat on the domestic market because it cannot be exported.

Low risks

The stock standstill and roads blocks could disrupt the mobility of workers, however the standstill only relates to animals and vehicles that have been on farms. The meat processing and retail market will have minimal impacts as the community will still purchase meat products. Because FMD does not affect poultry, there is low risk to financial impacts to this industry.

Very Low risks

Nil.

Extreme and High risks

Nil

Medium risks

Impact to people's health causing death and injury is a medium risk because FMD does not directly affected people's health. There is some risk that it can affect the mental health of people and potentially cause suicides.

Low and Very Low risks

Nil.

ECONOMY



PEOPLE



Animal and plant biosecurity risk assessment

Extreme risks

Nil.

High risks

The only high risk was to the increased demand on DAFWA impacting their ability to maintain core services. It was anticipated that the response would be managed from Perth and additional resources would be brought into the district.

Medium risks

Response and recovery activities will be required by local governments which may strain smaller local governments' resources. Public messaging and media management will impact DAFWA's resources, although the management of the event will operate from Perth. St John Ambulance will have slightly increased response times due to road blocks around the district. Other medium risks: increased demand on earthmoving equipment for assistance with carcass burial; and increased demand on veterinary services.

Low risks

Police resources may be required to initially set up road blocks; however their involvement was not considered to be great. Main Roads WA would assist in obtaining heavy machinery for carcass burial but this would not impact on their core services. P&W could be involved if the FMD infected wild animals; however this is unlikely. The Water Corporation would not be involved in this scenario unless water infrastructure is impacted.

Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme and high risks

Nil.

Medium risks

Impacts to farmers causing emotional stress and loss of income were assessed as medium risks because of the potential loss of farmers' entire stock. Impacts to the transportation industry resulting in emotional stress could last six to nine months.

Low risks

Any reputational damage from this scenario was anticipated to be economic only and not affect the community wellbeing. Farmers walking off their land was assessed as low risk, as this would only affect a few depending on their situation and the number of animals they would have to destroy.

Very Low risks

Nil.

SOCIAL SETTING





Animal and plant biosecurity risk assessment

Extreme, high and medium risks

Nil.

Low risks

As cattle are likely to remain on farms because they cannot be exported there may be increased erosion on farms. Water tables are unlikely to be impacted by carcass burial because pits are lined and the main aquifer is very deep in the district.

Very Low risks

Unmanaged burial of carcasses is unlikely to occur because if this was to occur people would probably not be compensated.

Bushfire

This section summarises the risk to the Midwest-Gascoyne EM district from the bushfire scenario for the five impact areas. 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 bushfire

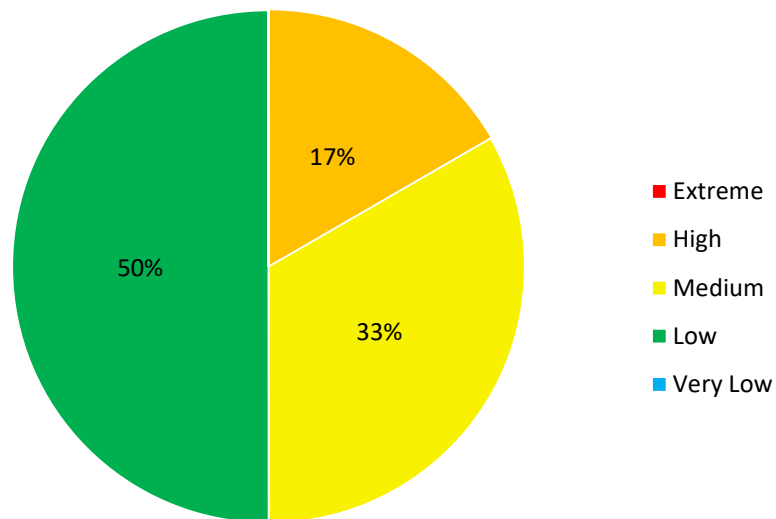


Figure 16: Percentage of risk statements at each risk level for bushfire.

Bushfire risk assessment

ECONOMY



Extreme risks

Nil.

High risks

The only high risk statement for the economy impact area is related to the damage to private buildings in both Dongara and Eneabba fires. There is a low likelihood that all 200-250 houses in the two towns would be completely damaged but if they were then the financial losses could be greater than \$37 million (major consequence).

Medium risks

Impacts to commercial buildings are a lower risk than private buildings because there are less commercial buildings in the impacted areas. Within Dongara and Eneabba there are about 20 agriculture properties and livestock (sheep and cattle) properties that could be impacted. There could also be significant impacts to machinery used on farms. Damage to infrastructure services such as power, water, communications, road and gas were all assessed as medium risks. In addition, roads around the area would be closed for safety reasons. Recovery and response activities would need to be carried out, costing the district.

Low risks

Impacts to the fisheries industry was assessed as a low risk as any road closures would only have minor impacts because the quota based arrangements the industry uses has the flexibility to work around any short-term impacts. The impacts to tourism and sewerage systems were assessed as low risk. Tourism is not a large industry in Eneabba and the caravan park in Dongara is unlikely to be damaged. Sewerage systems in both locations are septic tanks which are located underground and protected from bushfire impacts.

Very Low risks

Nil.

PEOPLE



Extreme risks

Nil.

High risks

All four risk statements concerning people were assessed as high risks. These pertain to the death and injury of people and further deaths from the overwhelming of emergency and health services. Smoke inhalation could cause a number of injuries which could be exacerbated if there are chemicals from industrial properties burning in the fire. In addition, the elderly population who live in Eneabba and Dongara are potentially more vulnerable to smoke inhalation requiring medical treatment. Geraldton Hospital has no intensive care unit but does have the capacity for two major burns patients.

Medium, Low and Very Low risks

Nil.

Bushfire risk assessment

Extreme risks

Nil.

High risks

DFES and P&W indicated that they would be at the fires and would struggle to provide their normal core services. DFES stated that they would need to bring in additional resources from outside the Midwest-Gascoyne EM district to manage the fire. WA Police would also need to bring in additional resources from outside the district to manage the event. Home-based and social service providers would be unable to provide their services in Eneabba or Dongara for the duration of the fires and so were assessed to pose a high risk.

Medium risks

Impacts to the service provision of water, communications and power were all assessed as medium risks. Impacts would largely depend on the exact location and extent of the two fires. Power lines and poles could be burnt although it is more likely that power supplies could trip due to smoke, causing widespread outages. If communications were damaged, temporary infrastructure could be set up quickly. The bore fields supplying water to the two towns are outside of the fire ground so would unlikely to be damaged. However, water restrictions could be enforced in order to conserve water for firefighting purposes as the hydrants are supplied by this potable water supply. There is a medium risk that there would be an increased demand on WA Health services especially with the elderly population and potential for smoke inhalation issues.

Low risks

There were seven risk statements that were assessed as low risk. These related to local government recovery works, increased demand on public buildings, impacts to sewerage systems affecting service, increased demand on St John Ambulance and disruption to transportation routes (including airports). Most of the governing bodies responsible for these services would suffer some impact to their service provision and would need additional resources to manage, and in some cases the resources may come from outside of the district.

Very Low risks

Nil.



Bushfire risk assessment

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

The only medium risk statement for the social setting was the impact to community wellbeing as a result of damage to residential buildings. There could be at least one person that would leave the district as a result of their home being destroyed; the criteria to reach this risk level.

Low risks

All the remaining social setting risk statements were assessed as low risks. Impacts to the community wellbeing as a result of any deaths, especially in Dongara and Eneabba, will be significant as these are both small communities. However, when considering the whole district, the community fabric is unlikely to be broken. The day-to-day functionality of educational facilities and those for vulnerable people are likely to have limited and isolated reductions. Given the scenario occurs in January, school has not started for the year so the impact is less than if these fires were to occur in February. Evacuations would likely occur in Eneabba as the fire approaches the town so residents would probably be displaced for up to a week. This could cause some impacts to the local social fabric but not to the wider district. Tourist numbers might decrease for the period of the fires but are unlikely to have any long-term impact on the community or tourism industry. Widespread loss of income was anticipated during the fire event, only lasting a few days.

Very Low risks

Nil.

ENVIRONMENT



Extreme, High and Medium risks

Nil.

Low risks

Impacts to flora and fauna and the potential contamination of the surrounding environment from the release of toxic substances. Both of these risk statements were assessed as low risk because there would be minor impacts that would be localised, not district wide.

Very Low risks

Nil.

Cyclone

This section summarises the risk to the Midwest-Gascoyne EM district from the cyclone scenario for the five impact areas. 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 cyclone

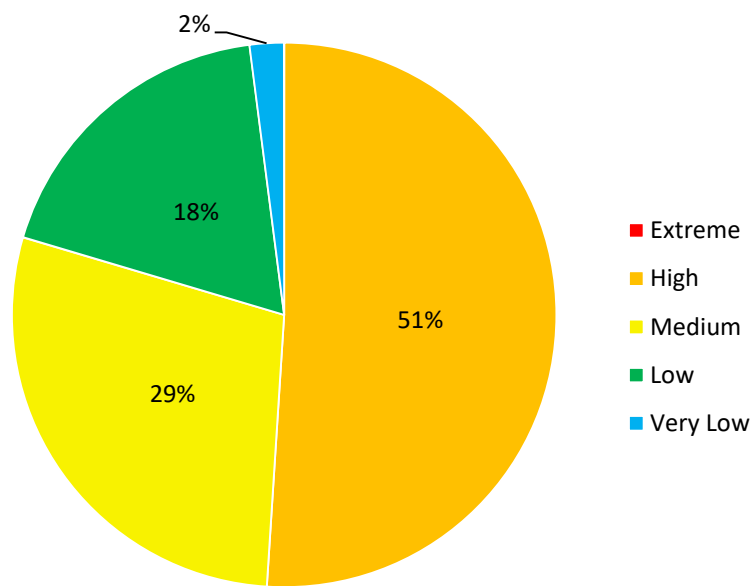


Figure 17: Percentage of risk statements at each risk level for cyclone.

Cyclone risk assessment

Extreme risks

Nil.

High risks

The cyclone scenario would cause significant damage to both private and commercial buildings in the district. Town sites along the coast would be impacted by winds and storm surge, resulting in significant damage. In addition, storm surge would impact the central business district in Geraldton and Carnarvon. Transportation including road, rail, bridges and airports would be impacted. Given the number of roads that could be impacted, the cost could easily exceed \$37 million (major consequence). Impacts to marina and port infrastructure could be substantial given the high winds and storm surge. Impacts to agriculture and horticulture industries (valued at over \$100 million/year) were assessed as a high risk because it is likely that these industries would need a significant structural adjustment to recover from the cyclone.

Medium risks

Risks to communication, power supply, water supply and sewerage networks were assessed as medium risks. It was anticipated that these systems would sustain some damage such as inundation of components and damage to above ground components (e.g. power poles, water supply bores). Damage to the power supply network could cause disruption to other critical infrastructure that relies upon electricity, such as communications. Impacts to livestock were assessed as a medium risk because cattle might not be in the appropriate sale weight category due to limited feed availability. Tourism might decline; however many of the Australia Day bookings would have already been made.

Low risks

The two statements assessed as low risk related to disruption of major freight routes and impacts to the fisheries industry. It was anticipated that if major roads were damaged they could be replaced by dirt tracks, such that the route could be used again. Rail lines would be more difficult to repair quickly and this would cause delays in the export of iron ore. However mining sites would likely stockpile ore and eventually recover costs once rail lines were repaired.

Very Low risks

Nil.

ECONOMY



Cyclone risk assessment

PEOPLE



Extreme risks

Nil.

High risks

All four of the people risk statements were assessed as high risks. During the assessment, it was anticipated that at least one death (catastrophic consequence) was possible from the cyclone. Deaths could result from people ignoring warnings and driving through flooded and impacted areas or if they are camping in remote areas. There is likely to be a significant number of injuries/illnesses as a result of this scenario given that the cyclone could impact five towns along the coast. Emergency and health services are likely to be stretched during this event by the number of people that need to be attended to and those who present at hospitals. Because these services are stretched, further fatalities may occur. There are limited acute and intensive care facilities in the Midwest-Gascoyne district and people would need to be transported to Perth if possible.

Medium, Low and Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

The cyclone scenario poses a high risk to all emergency response and recovery agencies in terms of their ability to deliver their core services. DFES, WA Police and St John Ambulance all have limited resources in the Midwest-Gascoyne and would need to bring in additional resources (people and equipment) from outside of the district to help deliver their core services. As a result of this cyclone, some response agencies buildings would be impacted (damaged and/or flooded) which would further hinder their ability to respond to the event and provide their services. During the cyclone, airports are likely to be closed and planes will not be flying, which will cause disruption across the district. Runways may also need to be checked by engineers, causing further delays. CPFS would be significantly affected by this event as they would need to set up 5-6 evacuation centres and would need to bring additional staff into the district to assist with the response. Sewerage services would be impacted such that these systems would struggle to cope and it is likely that sewerage could be spilled into the ocean. In addition, a number of treatment plants would likely be inundated by flood waters, particularly the treatment plant located at the mouth of the Gascoyne River in Carnarvon.

Medium risks

Impacts to power, communications and water supply infrastructure and subsequent service delivery were all assessed as medium risks. Previous cyclones (5-6 cyclones across WA in the last 2-3 years) have had minimal impact on communication infrastructure. Normally communications are lost because of electricity outages; however this would either be fixed quickly or a temporary solution would be used. Water supplies are likely to be restored in about 36 hours, depending on the amount of damage.

Low risks

Low risks relate to the impact to port and marina facilities and services.

Very Low risks

Nil.

Cyclone risk assessment

SOCIAL SETTING



Extreme risks

Nil.

High risks

The only high risk to the social setting comes from the impact to commercial and retail outlets affecting the availability of basic commercial products. People across the district would not be able to get all the supplies they require or they would have to travel further to get supplies, reducing their quality of life.

Medium risks

The impact to people's welfare due to damage to their homes and displacement (i.e. evacuation) out of the area was assessed as a medium risk. Displacement for this event is most likely to be short term and most people would come back to the area. There may be some loss of employment due to damage of work premises; however, it is more likely that there will be a disruption to employment and in fact there may be an increase immediately after the event due to recovery activities. As this cyclone scenario occurs over the Australia Day weekend, it is likely that events and celebrations would be cancelled, especially those in towns along the coast. No other events would be impacted as the main tourist season is in winter.

Low risks

Social service providers would be impacted as some of them rely on volunteers to provide their services, however, it was anticipated that these would be isolated, temporary reductions and not widespread across the district. The day-to-day function of some education and aged care facilities would be affected although these impacts would be localised.

Very Low risks

The only very low risk statement concerned the impact to the district community's wellbeing as a result of any deaths. Even though it was assessed that there is a potential for at least one death in this scenario, this would not affect the whole district's wellbeing.

Cyclone risk assessment

ENVIRONMENT



Extreme and High risks

Nil.

Medium risks

Impacts to the flora and fauna in the Midwest-Gascoyne district were assessed to be a medium risk. The Midwest-Gascoyne district has a number of rare and native species and there is a potential that some of these could be lost as a result of this event. It is also possible that this event could cause the spread of invasive or unwanted species into different areas.

Low risks

The other environment risk statements, which concern debris entering the waterways, ocean surges and soil erosion, were all assessed as low risks as they all create minor impacts to the environment. It is likely that some sewerage would spill into the ocean but the volume of ocean water would rapidly dilute the sewerage and reduce the environmental impact.

Very Low risks

Nil.

Earthquake

This section summarises the risk to the Midwest-Gascoyne EM district from the earthquake scenario for the five impact areas. 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

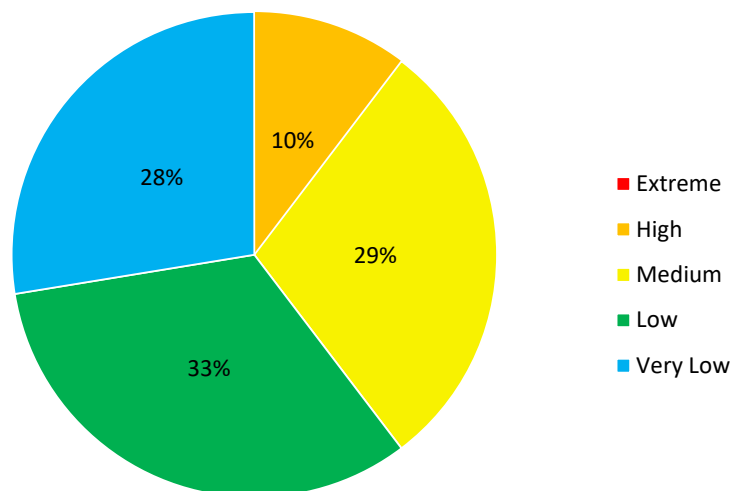


Figure 18: Percentage of risk statements at each risk level for earthquake.

Earthquake risk assessment

ECONOMY



Extreme risks

Nil.

High risks

Damage to private and commercial buildings was assessed to result in catastrophic consequences for the district. Potentially up to 80% of all buildings in Geraldton would sustain some amount of damage.

Medium risks

Damage to port infrastructure (buildings, storage facilities) was assessed as a medium risk because they may collapse and full recovery could take up to one year. This damage would have flow-on impacts to business activities such as mining and agriculture which use the port for export. Impacts to the water supply distribution network could be substantial depending on the number of breaks. The scenario epicentre is below a wastewater treatment plant which would cost about \$1 million to fix. The low ductility pipes in Geraldton would be damaged and significant repair would be required.

Low risks

Power infrastructure would be damaged and repairs would take some time and additional resources would be required. Major substations would be prioritised. Tourism could be impacted by loss of accommodation if these buildings are destroyed, although typically tourists pass through Geraldton rather than staying for extended periods. The airport may experience disruption after the earthquake due to inspections by structural engineers.

Very Low risks

Six risk statements were assessed as very low risk: impacts to roads, bridges, communications, natural gas, agriculture infrastructure and crops.

PEOPLE



Extreme risks

Nil.

High risks

The four risk statements for people were assessed as high risks. It was anticipated that there could be 19 fatalities. In addition, it was assessed that there was potential for at least seven deaths as a result of emergency services, (such as ambulance and medical transport services and health services), being overwhelmed. Contributing factors to this were lack of access to the injured especially if trapped by debris, or people not receiving treatment in time when arriving at hospital. It was suggested that this consequence would be time critical.

Medium, Low and Very Low risks

Nil.

Earthquake risk assessment



Extreme and High risks

Nil.

Medium risks

The increased demand on DFES services was assessed as a medium risk because they would need to bring in additional resources from outside the district. Police anticipate that they would need to deal with looting and security for buildings that are damaged. CPFS would be stretched as there would be a large number of people that need food, clothing and shelter. Increased demand on ambulance and WA Health services was anticipated with a large number of fatalities and injuries. Demand on the Water Corporation would be significant, especially if there is significant damage to their infrastructure.

Low risks

The earthquake would cause an increased demand on local governments, particularly waste management services. Not all local governments would be affected but the recovery time is anticipated to last many years. Damage to buildings which house government agencies and emergency services could cause minor disruption to their service provision but emergency services can also set up mobile command facilities. The Department of Education would need to relocate students to other schools within the district if there is significant damage to schools.

Very Low risks

Impacts to the service provision of communications and gas were assessed as low risk as these are unlikely to be damaged. Other very low risks are: recovery works by P&W and the increased demand on the Department of Transport services.

Earthquake risk assessment

Extreme and High risks

Nil.

Medium risks

The impact to the district community as a result of deaths and/or injuries was considered a medium risk as earthquakes are unexpected and there is potential for deaths of children which may have a greater impact on the community. Displacement was also considered medium risk as a number of people would need re-housing for an extended period of time. Although most houses may be liveable, there may not be services in the area. People may stay with friends and family and essentially 'reshuffle' within or outside of the district. It was suggested that the emotional and psychological impacts of the earthquake event may have a greater impact on the elderly and children. Nursing homes are already at capacity and may receive overflow patients from hospitals and would therefore require assistance from other districts to return to normal function.

Low risks

The social impact from the damage to residential dwellings and contents was assessed as low risk. It was suggested that people might leave the district because of losing their homes or possessions; however, the earthquake event could just be a catalyst for persons who were already considering leaving the district for other reasons. The impact to social service providers in the district was considered low as they would bring in external organisations such as the Australian Red Cross and amalgamate resources. A number of heritage buildings in Geraldton would likely be impacted but the impact would be minimal district wide. Risks to family and community support networks were considered low district wide. Potential increases in domestic violence and alcohol consumption were mentioned as possible impacts due to stress. But equally, the shared experience could bring the community together.

Very Low risks

Risks assessed as very low considered: displaced animals (domestic pets were considered more of an issue than livestock); the impact to the availability of basic goods and services; the impact on educational facilities across the district; and the impact to community buildings.

SOCIAL SETTING



Extreme, High and Medium risks

Nil.

Low risks

The two environment statements were assessed as low risks. These statements addressed contamination to the surrounding environment from the release of toxic (non-natural materials) and non-toxic (e.g. sediment, debris) substances. It was suggested that there may be some issues with asbestos, particularly in certain areas of Geraldton and the surrounds, that would need to be assessed and may require a program for recovery. At the district level, it would have minimal impact. A wastewater treatment plant lies above the earthquake's epicentre. As a result, wastewater would be washed in to the sea but it is likely to be diluted and have a minimal short-term impact.

Very Low risks

Nil.

ENVIRONMENT



Flood

This section summarises the risk to the Midwest-Gascoyne EM district from the flood scenario for the five impact areas. 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

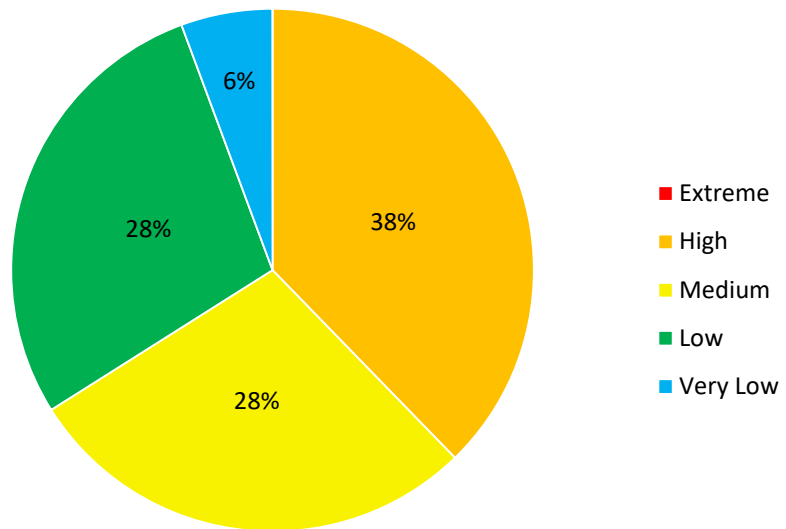


Figure 19: Percentage of risk statements at each risk level for flood.

Flood risk assessment

Extreme risks

Nil.

High risks

Damage to private and commercial buildings was assessed as a high risk, based on previous floods where damage exceeded \$50 million. Damage and disruption to transport routes are likely, especially towards the south of the district where roads are generally smaller and more susceptible. This damage would disrupt the supply of goods around the district for an extended period of time. Water supply infrastructure could sustain damage although it was suggested that it is more likely that the loss of power would disrupt the supply of water. The greatest impact to agriculture and horticulture would be in those areas along rivers, particularly the Gascoyne River. Flood waters would inundate storage buildings and cause erosion of productive soils. Tourism was anticipated to be affected especially if accommodation sites had to be evacuated.

Medium risks

Repair costs for power infrastructure would be significant and widespread. Western Power may turn off certain sections before damage occurs. Main towns have a better chance of recovering power quickly compared to more remote areas where access is difficult. The wastewater treatment plant in Carnarvon is located next to the Gascoyne River and the plant could be severely damaged, in addition to the inundation and damage of pumping stations across the district. Wastewater would need to be spilled into the river and ocean. As the scenario occurs in January there would be limited impact to crops because they are typically harvested before January.

Low risks

Damage to communication is anticipated to be able to be fixed quickly by swapping out any damaged components. Exchanges would also be sandbagged before the event to protect these from flooding. Airports could be closed, disrupting air travel. Impacts to mining were expected to be low as mines are outside of the flood scenario used.

Very Low risks

The only very low risk statement relates to impacts to gas supply infrastructure such as the Dampier-Bunbury Pipeline. The pipe is underground for most of the length and it was stated that there have been no historical impacts to the pipeline from floods.

ECONOMY



Flood risk assessment

PEOPLE



Extreme risks

Nil.

High risks

All four risk statements for people were assessed as high risks. It was anticipated that there would be at least one death (catastrophic consequence) as a result of the flood. This death may be the result of persons not adhering to safety advice (e.g. driving through flood waters), people camping out in isolated areas, persons trying to save their possessions or animals, or potential suicides. Based on historical evidence, there is likely to be at least one death through direct or indirect impacts to mental health. It was suggested there would likely be more than seven serious injuries directly as a result of the flood event itself. In addition, the lack of emergency service access is also expected to lead to more than seven serious injuries. Stagnant water and waterborne diseases was assessed to potentially cause illness.

Medium, Low and Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

The flood event would lead to an increased demand on CPFS services. As a result CPFS would need to bring in resources from other districts to assist with this event especially if Carnarvon is evacuated. Affected local governments would need to carry out recovery works which, for small governments, could significantly impact their normal service provision. As a result of potential damage to the water and wastewater networks, the Water Corporation would be undertaking repair works or putting temporary measures in place to continue their services. Home-care services such as Meals on Wheels and Silver Chain are likely to be disrupted as there are not enough resources within the district to operate. The other two high risks concerned the increased demand on public buildings and the backlog of government services (e.g. Centrelink).

Medium risks

Police, DFES and ambulance services would all be responding to the event and would need to bring in additional resources from outside the district. Their response and need for resources would depend on which areas are flooded. Other agencies such as WA Health, Main Roads WA, P&W, Department of Housing and Department of Water would have increased demands on their services, affecting their service provision.

Low risks

Impacts to power infrastructure was anticipated to have minor impacts to the provision of power for the district. Disruption to educational facilities is not anticipated to be high unless schools are used as evacuation centres. Schools could be closed for up to one week and learning materials could be delivered by teachers using other means, such as online.

Very Low risks

Impacts to communication infrastructure were not anticipated to impact Telstra or their service provision. Department of Transport – Marine Safety would be involved with public safety around marinas and jetties but they would be able to manage without additional resources.

Flood risk assessment

SOCIAL SETTING



Extreme risks

Nil.

High risks

Only one social setting statement was assessed as high risk. It was expected that the flood event would lead to remote Aboriginal communities becoming isolated with limited services and supplies. A resupply may be required for multiple communities, yet it was suggested that current road structures are not sufficient to do so. Multiple historical events have led to the isolation of communities, including events considered 'minor'. Resources external to the district would be required to assist and there may be some controversy as to who would be responsible for this.

Medium risks

The medium social setting risks centre on damage to residential buildings and contents, displacement, loss of income and the impact to social service providers. It was suggested that damage to residential dwellings and long-term displacement (>14 days) away from people's homes and work places would result in a number of people permanently dispersing from the Midwest-Gascoyne EM district. A loss of income/employment as a direct result of the flood would vary across the region, depending on the employment sector. Some are likely to benefit (e.g. construction/repair works), while others may be negatively impacted. It was suggested that people may diversify their business to meet the emerging demands; however, contractors external to the district would also likely be employed.

Low risks

Statements assessed as low risk centre on the impacts to health, community and education. Damage to commercial retail outlets, contents and services and arterial road networks was expected to result in isolated and temporary reductions in the availability of essential supplies. It was suggested that short term displacement would be a low risk as people are unlikely to move out of the district if they can be accommodated nearby. Other low risks: the social consequences of deaths and injuries; and disruption of day-to-day functionality of facilities for vulnerable people.

Very Low risks

Nil.

Flood risk assessment

ENVIRONMENT



Extreme risks

Nil.

High risks

The only high risk to the environment is from soil erosion on the flood plains. The floods would cause scouring and the removal of top soils across the district. The greatest impact would likely be in the Carnarvon area near the Gascoyne River, which would require a significant restoration program to restore the top soil.

Medium risks

Nil.

Low risks

Flora within the district are resilient and adaptable to floods and would flourish quickly after this flood event. The risk of environmental contamination is low as any contaminants would be diluted by the large volume of water.

Very Low risks

Fauna could be impacted in the short term but likely to recover quickly. In some cases floods can be important for animal life cycles due to the increase in nutrients.

Road crash

This section summarises the risk to the Midwest-Gascoyne EM district from the road crash scenario for the five impact areas. 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 road crash

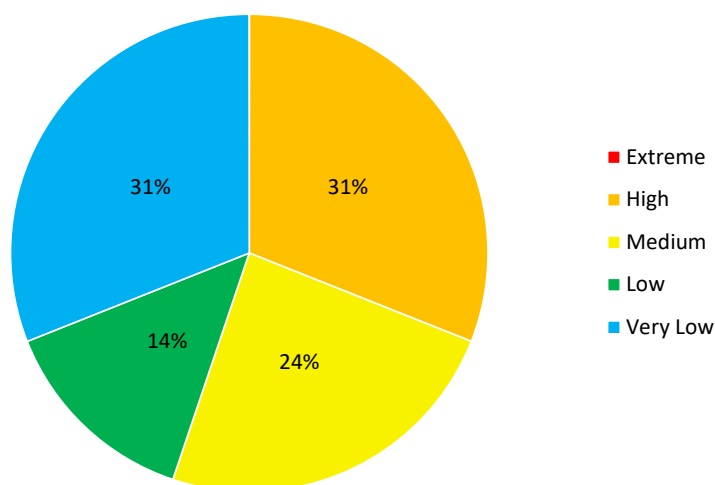


Figure 20: Percentage of risk statements at each risk level for road crash.

Road crash risk assessment

ECONOMY



Extreme and High risks

Nil.

Medium risks

The greatest risk from this scenario is the cost associated with response and recovery activities, including environmental clean-up, special equipment requirements, and personnel resources. In addition, the damage to transport infrastructure, both road and rail, and the resultant disruption to freight networks was expected to result in financial losses of up to \$37 million (moderate consequences). Exports from the region (e.g. mining and agricultural) would be impacted due to the disruption to the rail service. Ships may be waiting to dock whilst the incident is being cleared, resulting in financial losses.

Low risks

Nil.

Very Low risks

The impact to tourism and the disruption to major events incurring losses would depend on the timing of the incident. Tourists would be able to take alternative routes and the disruption would likely only be for a few days. The disruption to commercial and small businesses was estimated to result in less than \$370,000 in associated losses (insignificant consequence). The greatest impact would be to businesses within the radius of the HAZMAT plume, but operations could begin again once the plume has dispersed, likely within a few hours.

PEOPLE



Extreme risks

Nil.

High risks

It was expected that the road crash would result in at least seven deaths (catastrophic consequences). It is likely there would be deaths of passengers on the tourist bus and potentially the truck driver. The number of deaths could also increase as a result of the HAZMAT plume. Due to the nature of the incident, there is likely to be several critical injuries including spinal and crush injuries. Injuries to responders and those in the surrounding areas are also possible. It was suggested that as a result of emergency services not being able to access the incident site until the plume is cleared, there may be further deaths directly attributable to the road crash. They could also result from the demand placed on health services as a number of the injured may need to be transported to Perth and treatment would be time critical.

Medium, Low and Very Low risks

Nil.

Road crash risk assessment



Extreme risks

Nil.

High risks

The increased demands on WA Police, DFES HAZMAT, St John Ambulance (SJA) and WA Health services, impacting their ability to deliver core services were assessed as high risks. The initial Police response would severely reduce their ability to deliver core functions and would require an initial demand for resources. The demand on DFES HAZMAT would drain the district of most DFES resources and therefore their core service delivery would be severely reduced. With a large number of people involved, SJA would likely require resources from external to the district to assist. There are about six ambulances in the district, one of which would be required to be available for other incidents. WA Health service suggested that hospitals and aged care facilities (nearby to the HAZMAT plume), would not be evacuated, as it would be impractical in this case and cause greater issues

Medium risks

The impacts to CPFS, the Department of Education and Main Roads WA were assessed as medium risks. Main Roads would assist with traffic management and issue public information, which it is well resourced to do. CPFS would be required to activate to support concerned relatives and transport those who did not require medical treatment. Their primary role would be to assist those who were on the bus, through emergency accommodation, personal support and contacting relatives. The Department of Education acts as a conduit to contact schools. In this scenario, the crash occurs near schools and requires an environmental clean-up so the schools could be closed for up to two days.

Low risks

The impact to the Department of Environment Regulation (DER) and local governments across the district was considered low risk. DER Pollution response would travel from Perth to fulfil its role under WestPlan HAZMAT, with the nature of the chemical dictating their response. The road crash incident would likely only impact the City of Greater Geraldton, and whilst it would be a major incident for them, at the district level the impact would be minimal.

Very Low risks

The impact to transport infrastructure preventing or delaying emergency services were assessed as insignificant.

Road crash risk assessment

SOCIAL SETTING



Extreme risks

Nil.

High risks

The only high risk social setting statement concerns psychological and emotional stress within the district, particularly to victims and their relatives. It was suggested that external resources would be required from outside of the district to assist. Counselling would be required for those involved in the incident including responders, passengers, pedestrians and school children. District resources for this would be outstretched as most of these services stem from Geraldton.

Medium and Low risks

Nil.

Very Low risks

The remaining four social setting statements were assessed as very low risk. These related to the impact to tourism, impact to the availability of basic commercial products and services, the impact to the day-to-day functionality of educational facilities and the breakdown of existing family and support networks.

ENVIRONMENT



Extreme, High and Medium risks

Nil.

Low risks

Both risk statements addressing the environment were considered low risk. An environmental clean-up would be required as a result of the HAZMAT plume. Depending on the chemicals within the plume, there may be some impact to ecosystems but it is expected to be confined to a small, localised area. Recovery would be unassisted and there would be minimal impact at the district level. It was noted that if the material were a liquid or oil, the impact may be greater.

Very Low risks

Nil.

Appendix B: District profile

The Midwest-Gascoyne Emergency Management District spans 414,221 km² with 19 local governments and a population of 64,131 (Figure 21).

Major industries include mining, agriculture, aquaculture, pastoralism, fishing, horticulture, tourism, retail and manufacturing. The Midwest-Gascoyne contributes to the Western Australian economy, with the Midwest-Gascoyne region having a gross regional product of \$9.253 billion (representing approximately 4.9% of gross state product).

Natural and man-made hazard events occur throughout the region. The highest priority hazards, as identified by the Midwest-Gascoyne DEMC are: animal and plant biosecurity, bushfire, cyclone, earthquake, flood and road crash.

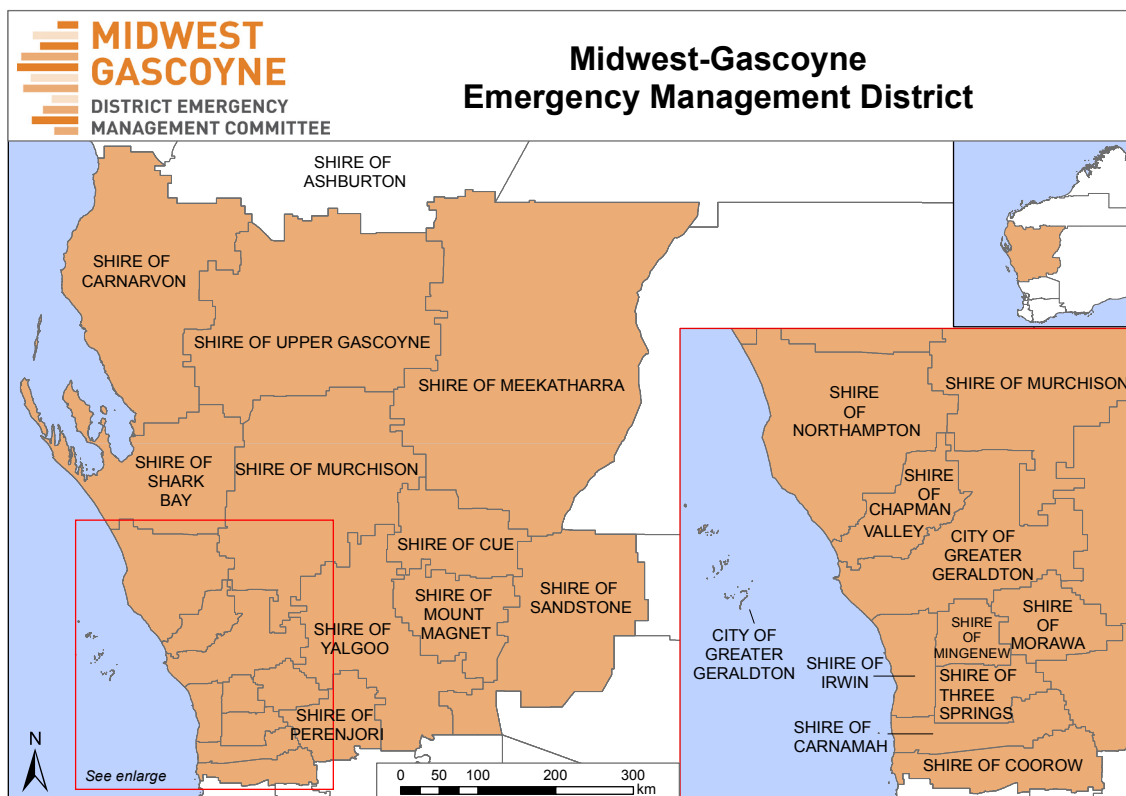


Figure 21: Midwest-Gascoyne EM district map.

Appendix C: Midwest-Gascoyne EM district consequence table

(based on population: 64,131; gross area product: \$9.253 billion)

	Insignificant	Minor	Moderate	Major	Catastrophic
People*					
Mortality	Not Applicable	At least 1 death	At least 1 death	At least 1 death	At least 7 deaths
Injuries / illness	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 7 serious injuries	More than 7 critical injuries with long-term or permanent incapacitation or more than 65 serious injuries
Economy					
Loss in economic activity and/or asset value	Decline of economic activity and/or loss of asset value < \$370,120	Decline of economic activity and/or loss of asset value > \$370,120	Decline of economic activity and/or loss of asset value > \$3,701,200	Decline of economic activity and/or loss of asset value > \$37,012,000	Decline of economic activity and/or loss of asset value > \$370,120,000
Impact on important industry	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
Environment					
Loss of species and/or landscapes	No damage to ecosystems at any level	Minor damage to ecosystems and species recognised at the local or regional level	<ul style="list-style-type: none"> Minor damage to ecosystems and species recognised at the state level Significant loss or impairment of an ecosystem or species recognised at the local or regional level 	<ul style="list-style-type: none"> Minor damage to ecosystems or species recognised at the national level Significant loss or impairment of an ecosystem or species recognised at the state level Severe damage to or loss of an ecosystem or species recognised at the local or regional level 	<ul style="list-style-type: none"> Permanent destruction of an ecosystem or species recognised at the local, regional, state or national level Severe damage to or loss of an ecosystem or species recognised at the national or state level Significant loss or impairment of an ecosystem or species recognised at the national level
Loss of environmental value	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
Public Administration					
Governance Functions	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	Governing bodies encounter severe reduction in the delivery of core functions	Governing bodies are unable to deliver their core functions
Social Setting					
Community wellbeing	<ul style="list-style-type: none"> Community social fabric is disrupted Existing resources sufficient to return the community to normal function No permanent dispersal 	<ul style="list-style-type: none"> Community social fabric is damaged Some external resources required to return the community to normal function No permanent dispersal 	<ul style="list-style-type: none"> Community social fabric is broken Significant external resources required to return the community to normal function Some permanent dispersal 	<ul style="list-style-type: none"> Community social fabric is significantly broken Extraordinary external resources are required to return the community to functioning effectively Significant permanent dispersal 	<ul style="list-style-type: none"> Community social fabric is irreparably broken Community ceases to function effectively, breaks down Community disperses in its entirety
Community Services	Inconsequential / short term impacts	Isolated / temporary reductions	Ongoing reductions	Reduced quality of life	Community unable to support itself
Culturally important objects	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	Widespread and permanent loss of objects of identified cultural significance
Culturally important activities	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 matrix⁵ 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
Almost Certain (63% per year or more)	Medium	Medium	High	Extreme	Extreme
Likely (10% to <63% per year)	Low	Medium	High	Extreme	Extreme
Unlikely (1% to <10% per year)	Low	Low	Medium	High	Extreme
Rare (0.1% to <1% per year)	Very low	Low	Medium	High	High
Very Rare (0.01% to <0.1% per year)	Very low	Very low	Low	Medium	High
Extremely rare (<0.01% per year)	Very low	Very low	Low	Medium	High

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

State Emergency Management
Committee

20 Stockton Bend
Cockburn Central WA 6164

E. info@semc.wa.gov.au

W. www.semc.wa.gov.au



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