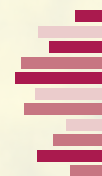


WHEATBELT EMERGENCY MANAGEMENT DISTRICT

Risk assessment report

'Highlighting potential disaster impacts'



WHEATBELT

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.

Acknowledgements:

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Front and back cover: Canola fields near Meckering - courtesy of Daniel Hill.

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Executive summary

This document summarises the results of the *State Risk Project* risk assessment workshops in the Wheatbelt Emergency Management (EM) district. It covers five priority hazards, as identified by the Wheatbelt District Emergency Management Committee (DEMC): fire (bushfire), earthquake, flood, rail crash: Brookfield Rail network, and storm. The effects of these hazards were measured against five key impact areas (economy, public administration, people, environment and social setting) using 264 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).

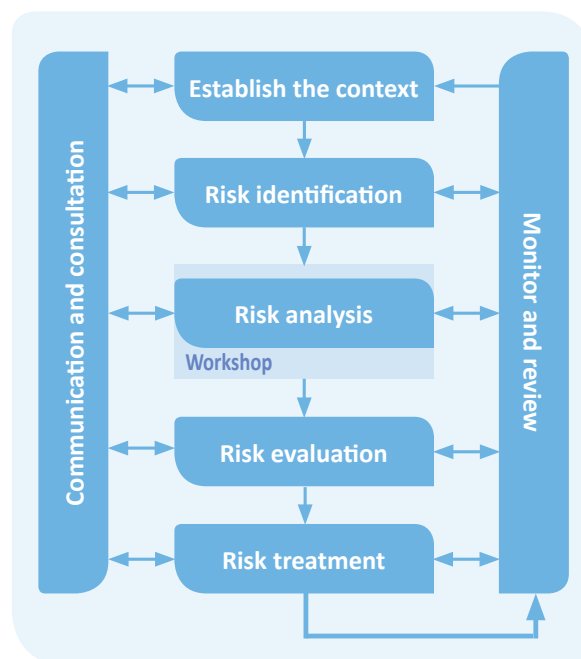


Figure 1: Emergency risk management process.¹

Twenty-two 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 a tailored *NERAG* consequence table (Appendix C), which is based on the gross area product (\$6.621 billion) and the population (58,621) of the EM district.

The results reveal that 21% of the risk statements for the district were assessed as high risks. Medium risks make up 32%, low risks 30% and 17% were assessed as very low risks. There are no extreme risks for the Wheatbelt.

The highest risks to the district, in terms of consequences, are from rail crash and earthquake. Both of these hazards have some risk statements that were assessed as

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

having catastrophic consequences. These consequences relate to anticipated deaths and injuries, increased demand on health and emergency services and damage to heritage buildings. These catastrophic consequence risks have the potential to outstrip or stretch the district's resources during an emergency.

The greatest proportion of the high risk statements relate to injuries, illness or death. Significant numbers of fatalities and casualties are expected for the earthquake and rail crash scenario and would require a rapid surge response from emergency and health services. Due to the limited surge capacity in hospitals and clinics across the district, assistance would likely be required from outside the district (i.e. Perth).

The highest risks for government activities relate to the general provision of response and recovery activities by local governments and state agencies. The risks posed to the environment are generally low overall, with the flood and bushfire scenarios posing the highest risk. The greatest risks to social setting are generated by the earthquake scenario, which has major (or catastrophic) consequences for most risk statements.

Economically, the high risks result from the natural hazards and the damage they cause to infrastructure, particularly power supply systems, roads and rail (from washouts) and buildings. The greatest impact to commercial activities in the Wheatbelt district, is the loss of commercial building and damage to agricultural, pastoral and horticultural activities. Although there are significant amounts of high value commercial freight on the rail lines, the freight passes through the district and therefore the economic benefits and losses are not held by the Wheatbelt EM district itself.

The impact of the loss of buildings from the fire or earthquake scenarios is anticipated to extend beyond the financial implications and break the district's social fabric as some people may permanently move out of the district. Additionally, the damage or destruction of heritage buildings is a high risk as the cultural loss would likely be permanent. These buildings tend to be more prone to earthquake damage because of their unreinforced masonry construction style. If they were destroyed by fire or earthquake, it is unlikely that they would be rebuilt in the same style.

The earthquake scenario impact stands out in this assessment, with 73% of its risk statements assessed as having major or catastrophic consequences. The lower likelihood of the scenario (approximately a 0.005% chance of occurrence in any given year), however, makes the majority of the risks medium; whereas they would be high risk for the other hazards. The scenario is the worst case credible earthquake for the district, but it is quite possible that a lower magnitude earthquake (with a higher likelihood) would cause the same amount of damage. Furthermore, historical records and detailed studies of earthquake frequencies are limited so likelihoods can only be estimated based on the available scientific information.

The *NERAG* uses a prioritisation system to rank risks for treatment decisions and/or for further investigation. There are no Priority 1 (highest) statements, 2% are Priority 2, 27% are Priority 3, 22% are Priority 4 and 49% of the statements are Priority 5 (lowest). The following table (Table 1) shows the Priority 1 and 2 risk statements in full along with those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.

Table 1: Risk statements for the Wheatbelt district with Priority level 2 or catastrophic consequences. Note: EQ = earthquake.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
EQ	will impact heritage buildings, churches and places of worship, resulting in a loss of cultural significance.	Social setting	Catastrophic	High	Low	2
Rail crash	will cause an increased demand (surge) on WA health services (including remote health services such as nursing posts, smaller hospitals/clinics) across the district, affecting their service provision.	Public administration	Catastrophic	High	High	2
Bushfire	will impact commercial buildings, contents and services resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact protected flora and fauna in National Parks (such as the Moore River National park and Nambung national Park.)	Environment	Major	High	Moderate	2
Rail crash	will impact response workers, affecting community wellbeing.	Social setting	Major	High	Low	2
EQ	will impact commercial buildings, contents and services, resulting in financial losses.	Economy	Catastrophic	High	High	3
EQ	will cause an increased demand (surge) on WA health services (including remote health services such as nursing posts, smaller hospitals/clinics) across the district, affecting their service provision.	Public administration	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
EQ	will cause an increased demand on emergency services and health services (including ambulance and medical transport services, hospitals, remote nursing posts and clinics, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	Moderate	3
Rail crash	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
Rail crash	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	3

1 Introduction

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

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

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

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

Table 2: Location and date of risk assessment workshops.

Hazard	Location of workshop	Date of workshop
Bushfire	Northam	20 August 2015
Earthquake	Northam	11 November 2015
Flood	Northam	27 May 2015
Rail crash	Northam	11 November 2015
Storm	Northam	27 May 2015

A range of agency representatives from across the district attended the workshops. Table 3 provides the agency representation for each workshop.

Table 3: Agencies involved in each risk assessment workshop for the Wheatbelt district, listed in alphabetical order. Note: EQ = earthquake.

Agency	Hazard				
	Bushfire	EQ	Flood	Rail crash	Storm
Association of Volunteer Bush Fire Brigades – Gingin		x		x	
Association of Volunteer Bush Fire Brigades – Northam	x				
Association of Volunteer Bush Fire Brigades – Quairading & Cunderdin		x		x	
Association of Volunteer Bush Fire Brigades – Wongan Hills, Moora & Vic Plains		x		x	
Brookfield Rail		x		x	
Bureau of Meteorology			x		x
Department of Agriculture and Food WA	x	x		x	
Department of Child Protection and Family Support	x	x	x	x	x
Department of Education	x	x	x	x	x
Department of Fire and Emergency Services	x	x	x	x	x
Department of Parks and Wildlife	x	x	x	x	x
Department of Water			x		x
Main Roads WA			x		x
Office of Emergency Management (facilitators)	x	x	x	x	x
Shire of Narembeen		x		x	
Shire of Northam	x	x		x	
St John Ambulance	x	x	x	x	x
Telstra	x				
WA Country Health Service	x				
WA Police	x	x	x	x	x
Water Corporation	x	x		x	x
Western Power	x	x	x	x	x
Wheatbelt Development Commission			x		x

2 Hazard scenarios

Five hazards were assessed for the Wheatbelt EM district. Hazard scenarios were developed with the assistance of:

- Bureau of Meteorology Western Australia (BOM)
- Department of Fire and Emergency Services (DFES)
- Department of Parks and Wildlife (P&W)
- Department of Transport (DOT)
- Department of Water (DOW)
- Geoscience Australia (GA)
- Office of Emergency Management (OEM)
- State Emergency Services (SES)
- WA Police

Bushfire scenario

The bushfire scenario was developed by BOM, DFES, P&W and SES, and has approximately a 0.995% chance of occurrence in any given year.

In mid-December there is an extreme fire weather warning in place following a hot start to the summer with little rain. At midday, a large storm with strong winds moves towards the south east causing multiple dry lightning ignitions (Figure 2). Changing wind direction causes the fires to move to the southwest and the fires enter Gingin and Toodyay.

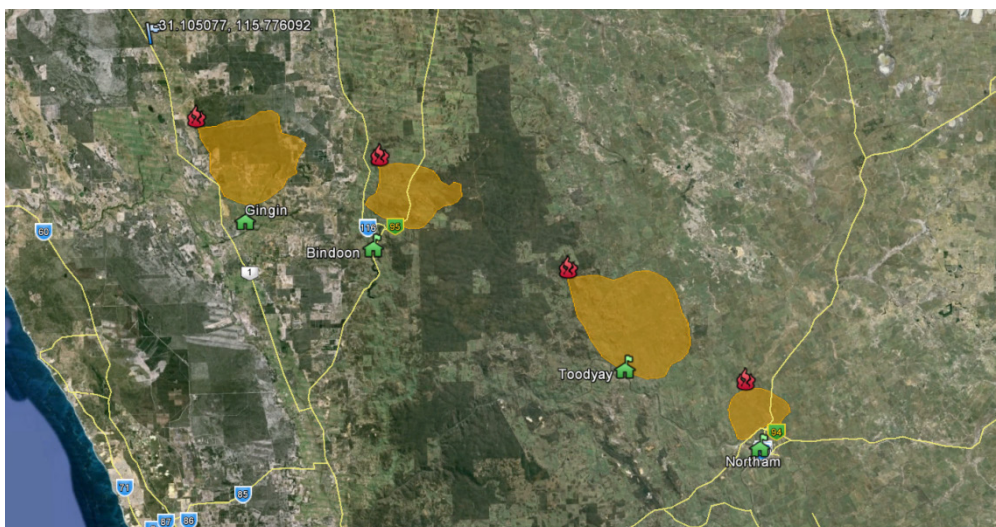


Figure 2: Extent of the four bushfires in the Wheatbelt bushfire scenario.

Evacuation of townsites (Gingin, Bindoon, Toodyay and Northam) and Yongah Hill Immigration Detention Centre occurs. The Great Northern and Great Eastern Highways are closed and rail lines are disrupted. Agriculture (farms, crops, vineyards, orchards, and orange groves) in the region is impacted. The fires remain uncontrolled for 3-4 days with some areas off-limits due to single entry roads.

Earthquake scenario

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

On a Sunday afternoon during a street festival in York, a magnitude 7.0 earthquake occurs on the Meckering Scarp, 28 km east of Northam (Figure 3). The fault rupture length is 41 km and the earthquake occurs at a depth of 5 km. Based on the Modified Mercalli Intensity (MMI) scale (Table 4) expected damage ranges from MMI VI (collapse of vulnerable masonry and severe cracking to other masonry structures) to IX (destruction of unreinforced masonry buildings and damage to all other building types) (Figure 3).

Agriculture, rail (freight and passenger), tourism (including historical sites in York), the Great Eastern Highway, the Goldfields Water Supply Pipeline and aged care facilities in York are all impacted. Commercial and residential buildings close to the epicentre collapse and deaths and injuries occur.

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

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

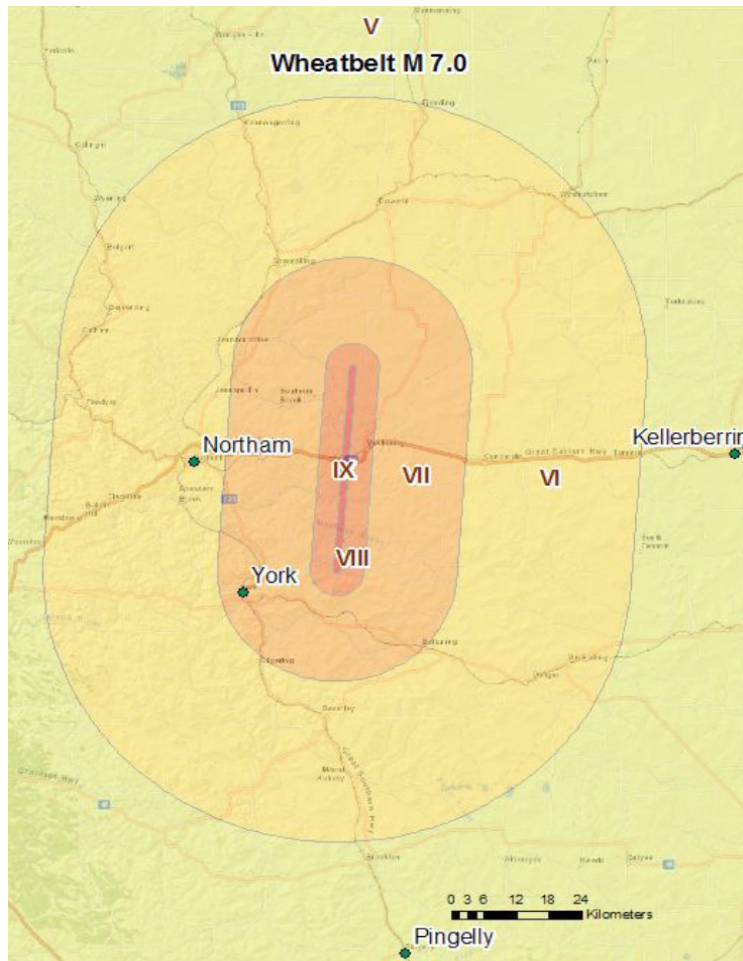


Figure 3: Potential shaking intensity map for the M 7.0 earthquake scenario in the Wheatbelt district (Image supplied by GA).

Flood scenario

The flood scenario was developed by the BOM and has approximately a 0.499% chance of occurrence in any given year.

In January, an extra-tropical cyclone results in heavy rain and significant flooding. Over the course of the weekend, rainfall totals are in excess of 100 mm with isolated totals of 140 mm (Figure 4). Above average rainfall in the preceding year and recent rainfall, has created wet catchments prior to the rainfall event. Consequently, significant stream rises and major flooding occurs in the Wheatbelt district.

The Avon River at Beverley Bridge nears its peak of 2.5 metres. Major flooding develops at Northam, York, Beverley and Toodyay (Figure 5). Elsewhere in the region flooding is minor to moderate.

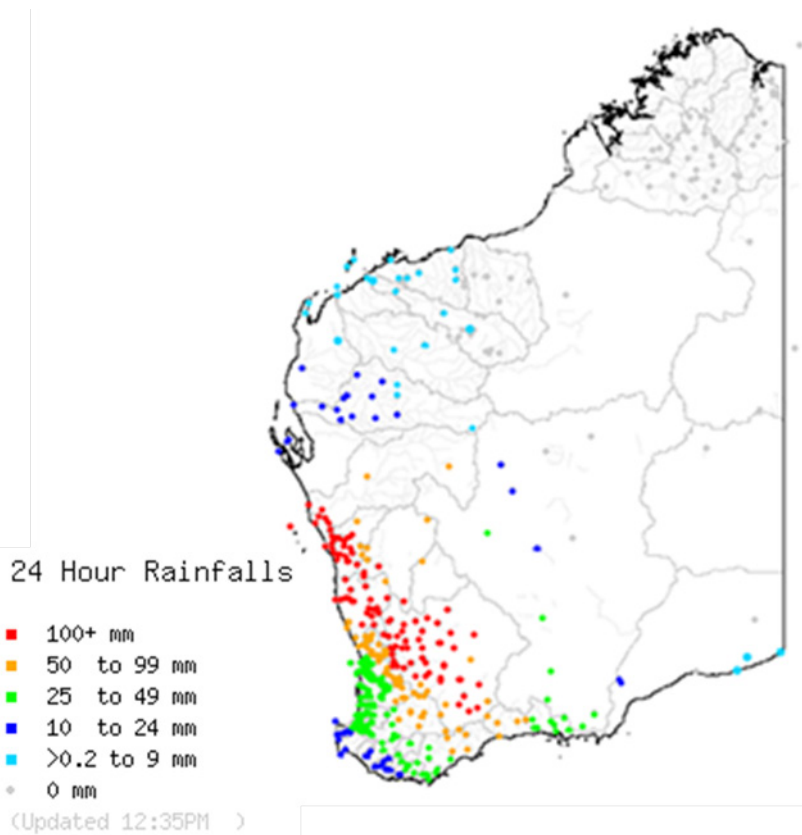


Figure 4: Rainfall across the Wheatbelt district for the flood scenario (from BOM).

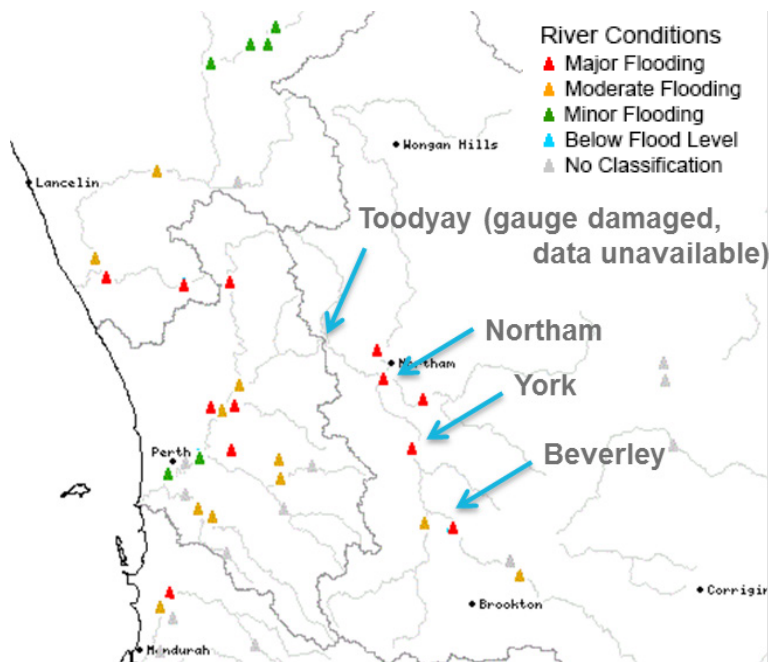


Figure 5: River conditions in the Wheatbelt district for the flood scenario (from BOM).

Rail crash: Brookfield Rail network scenario

The rail crash scenario was developed by the OEM, WA Police and DFES. The scenario has approximately a 0.725% chance of occurrence in any given year.

Around 5pm on a Sunday evening in winter, the Indian Pacific passenger train (which travels between Perth and Sydney) derailed on an overbridge east of Carrabin (Figure 6). As the train derailed, it impacts the bridge columns causing the middle section of the bridge to collapse. The train wreckage comes to rest on the Great Eastern Highway, blocking it completely for at least a week.

Passengers include mostly elderly tourists and some families with young children. A number of deaths and injuries occur.



Figure 6: Rail crash location on the West-East rail line near Carrabin.

Storm scenario

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

An extra-tropical cyclone is forecast to make landfall north of Perth at Category 3 intensity sometime in March. The cyclone is moving south-east and is expected to affect the central Wheatbelt across the York area (Figure 7). Adverse weather conditions are expected to commence in the evening and early morning and last for 6-12 hours.

Heavy rain (150-200 mm) to the south of the cyclone track is expected and on the north side hot, windy conditions are expected (Figure 8). The winds are expected to be destructive to very destructive with peak gusts of 180 km/h over Northam.

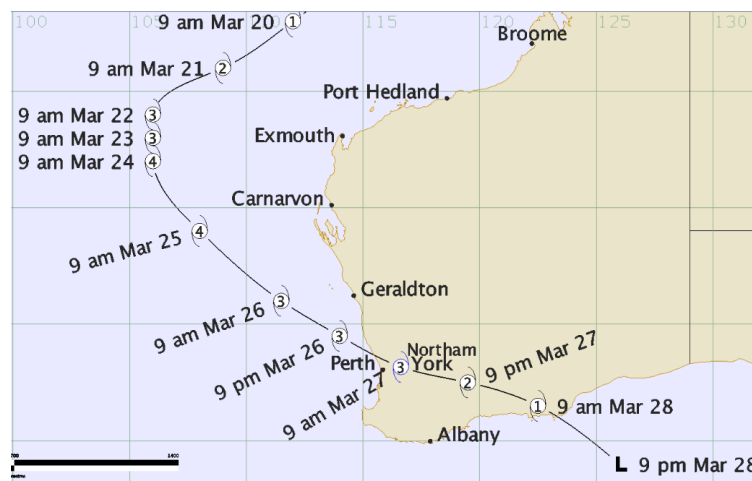


Figure 7: Cyclone track between 20-28 March for the storm scenario (Image supplied by BOM).

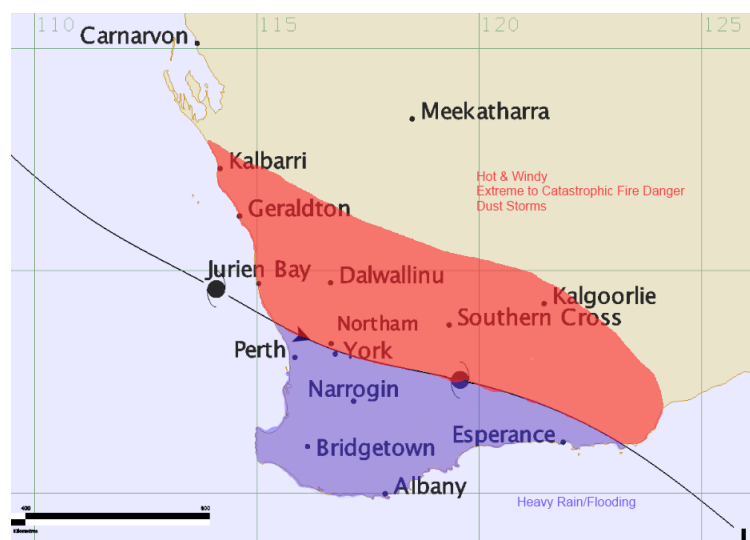


Figure 8: Cyclone track across the Wheatbelt with hot windy conditions to the north and heavy rain and flooding to the south (Image supplied by BOM).

3 Assessed risk statements

A total of 264 risk statements were assessed across the five priority hazards: bushfire (71); earthquake (45); flood (65); rail crash (27); and storm (56).

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

The statements were generated to cover all foreseen impacts of the scenario events across the five impact areas.

The risk statements were assessed using the tailored *NERAG* consequence table for the Wheatbelt EM district found in Appendix C. The consequence levels are based on the gross area product (\$6.621 billion) and the population (58,621) of the EM district.

Table 5: Number of risk statements assessed for each hazard in the Wheatbelt district.

Hazard	Impact area				
	Economy	Public administration	People	Environment	Social setting
Bushfire	17	19	5	9	21
Earthquake	12	16	3	1	13
Flood	20	16	6	8	15
Rail crash	9	7	3	3	5
Storm	18	17	4	3	14

4 Wheatbelt EM district risk profile

The risk profile for the Wheatbelt EM district for the five assessed hazards is shown in Figure 10 (following page). This diagram shows the percentage of risk statements for each hazard as they sit on the *NERAG 2015* risk matrix. The matrix is used to categorise risk statements by their likelihood, consequence and risk level. The bar graph below (Figure 9) combines the data and categorises it by hazard and risk level.

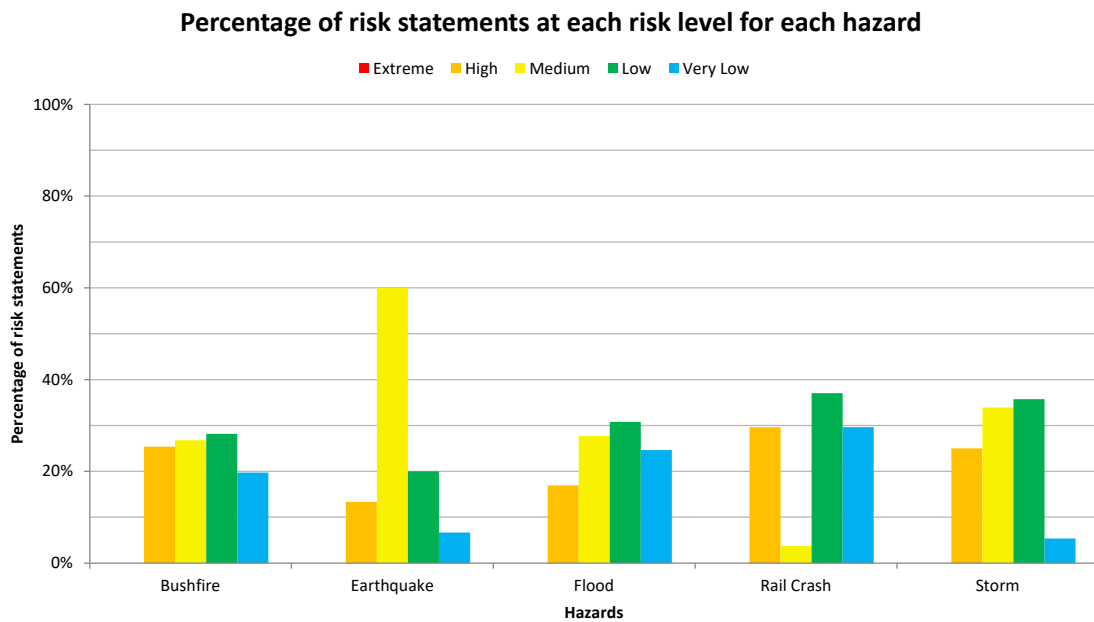
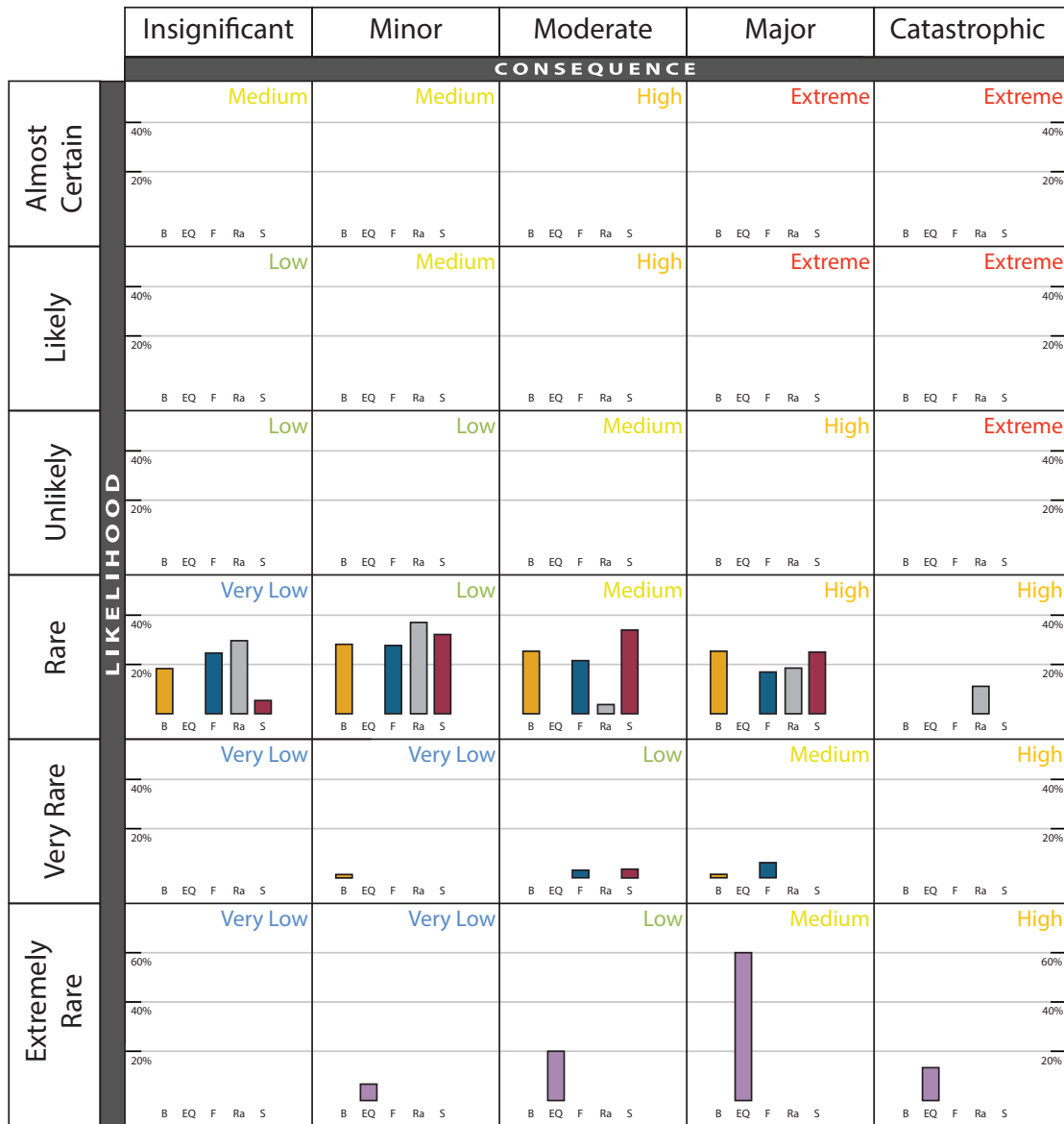


Figure 9: Percentage of risk statements in each risk level for each hazard. Note each hazard sums to 100%.

Of the 264 statements assessed for all five hazards, there are no extreme risks, 57 are high risks (21%), 84 are medium risks (32%), 79 are low risks (30%) and 44 are very low risks (17%). Individual hazard risk assessment summaries can be found in Appendix A.

Both Figure 9 and Figure 10 show that assessed risks range from very low to high, with the greatest proportion (32%) of risk statements assessed as medium risks. No extreme risks were identified in the district and 21% of the statements were assessed as high risks. As a hazard, earthquake stands out as having the greatest proportion of medium risk statements (60%). These statements, though medium risks, have major consequences for the district (Figure 10). The remaining four hazards have relatively equal proportions of each risk level, with the exception of medium risks for rail crash and very low risks for storm.

Wheatbelt EM District Risk Profile



Legend

- Bushfire (B)
- Earthquake (EQ)
- Flood (F)
- Rail Crash (Ra)
- Storm (S)

Key

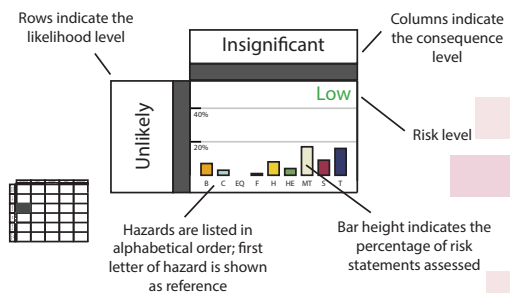


Figure 10: Percentage of risk statements for each hazard assessed in the Wheatbelt EM district, categorised by their likelihood, consequence and risk level.

Figure 10 shows that there are nine risk statements (3% of total) with catastrophic consequences, arising from the earthquake and rail crash. These consequences relate to the economy, public administration, people and the social setting impact areas. Major consequences were assessed to result from 30% of the risk statements.

The likelihood of the hazard scenarios ranges between extremely rare and rare with earthquake having a lower likelihood (approximately a 0.005% chance of occurrence in any given year) than the other four hazards (0.5-1%). The lower likelihood of earthquake is why the major consequence statements (60% of the earthquake statements) are medium risks; whereas for the other hazards, a major consequence level would result in a high risk.

Figure 11 shows the percentage of all risk statements at each risk level for the five impact areas. The greatest proportion of the risk statements assessed as high risk are within the people impact area. This impact area considers the impact to people’s health causing injuries, illness or death. Most of the low and very low risks are within the social setting and environment impact areas.

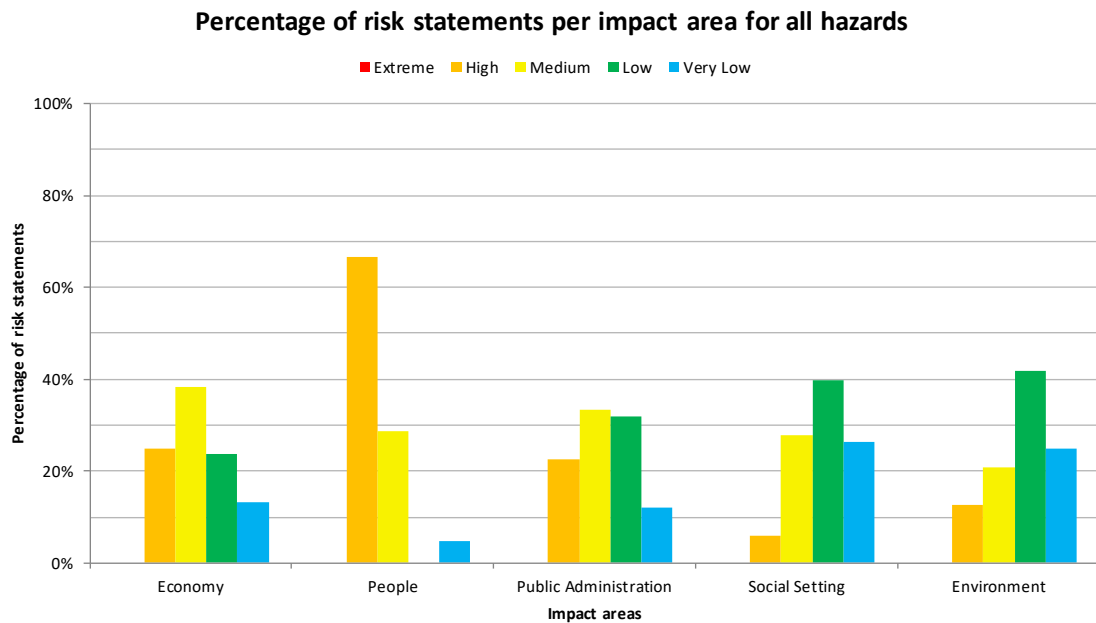







Figure 11: Percentage of risk statements per risk level, by impact area for all hazards. Note: each impact area sums to 100%.

Common themes from high risk statements

<p>ECONOMY</p>		<ul style="list-style-type: none"> • Damage to private and commercial buildings and contents. • Damage to power and transportation (including bridges) infrastructure. • Damage to agriculture infrastructure and related activities. • Require response and recovery activities which stretch resources and incur costs.
<p>PEOPLE</p>		<ul style="list-style-type: none"> • Emergency events causing injuries/illnesses (<i>catastrophic consequences for rail crash and earthquake</i>). • Emergency events causing deaths (<i>catastrophic consequences for rail crash and earthquake</i>). • Increased demand on emergency and health services resulting in further deaths.
<p>PUBLIC ADMINISTRATION</p>		<ul style="list-style-type: none"> • Response and recovery works by state agencies and local governments affecting their ability to provide their core services. • Increased demand for emergency, health and home-based services, reducing their service provision and delivery. • Damage to power and transportation infrastructure impacting their ability to provide core services and transportation routes.
<p>SOCIAL SETTING</p>		<ul style="list-style-type: none"> • Impacts to heritage buildings, art galleries, museums and libraries, resulting in loss of objects of cultural significance. • Impact to response workers affecting community wellbeing.
<p>ENVIRONMENT</p>		<ul style="list-style-type: none"> • Impacts to protected flora and fauna in national parks. • Influx of debris and pollutants into marine, estuarine and riverine environments. • Development of algal blooms in rivers and estuaries.

5 Analysis of risk profile

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

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

Risks to economy

There were 76 statements assessed across the five hazards that addressed economic impacts (Table 6), such as a decline in economic activity, loss of revenue or impact to a significant industry (see Appendix C for criteria).

Table 6: Impacts to economy by hazard and risk level.

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

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to marine infrastructure and industry</i>			Storm		Flood (2)
<i>Impacts to mining infrastructure and industry</i>					Flood
<i>Impacts to power supply infrastructure</i>		Bushfire Storm	Earthquake Flood		
<i>Impacts to private buildings and contents</i>		Bushfire Flood Storm	Earthquake		
<i>Impacts to sewerage systems</i>			Storm	Bushfire Earthquake Flood	
<i>Impacts to tourism</i>			Bushfire (2) Earthquake (2) Flood Storm	Flood Storm	Rail crash
<i>Impacts to transport infrastructure</i>		Flood Storm	Earthquake	Rail crash	
<i>Impacts to water supply infrastructure</i>			Bushfire Earthquake Flood Storm		
<i>Response and recovery activities</i>		Flood Storm	Bushfire Earthquake	Rail crash	
<i>Workforce productivity losses</i>					Rail crash

The high risk economic statements largely result from the natural hazards and their impacts on infrastructure. Earthquake was assessed to have catastrophic consequences on commercial buildings within the district. The other natural hazards – flood, bushfire and storm – pose high risks to commercial buildings, private buildings and agricultural activities due to the wide geographic spread of the events. Similarly, the storm winds and bushfire are anticipated to impact power infrastructure across the district. Flood poses high risks to the transport infrastructure, bridges in particular, as the floodwaters could cause major damage.

Overall, rail crash is a low to very low risk to the economy of the district because rail freight typically transits through the Wheatbelt rather than directly contributing to its economic activity. Any losses from the rail crash event and subsequent delays would not impact the district's economic activity; and in fact, economic activity may increase as local contract services would likely be required in the response and recovery.

The response and recovery activities are high risks for flood and storm hazards as these activities would be costly due to the spread of damage. Earthquake was assessed to result in similar costs, but with a lower likelihood of occurrence.

Risks to people

Twenty-one risk statements assessed the impact to people across the five workshops. These statements addressed deaths, injuries or illnesses; further deaths or illnesses/injuries resulting from the event's impact on emergency services (primarily medical transport); or health services. The level of risk posed to each of these elements by the assessed hazards is shown in Table 7.

Table 7: Impacts to people by hazard and risk level.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Earthquake Flood Rail crash Storm			
<i>Disease Outbreak</i>			Flood (2)		
<i>Emergency services</i>		Storm	Bushfire Flood		Bushfire
<i>Health services</i>		Bushfire Earthquake Rail crash Storm	Flood		
<i>Injuries or illnesses</i>		Earthquake Flood Rail crash Storm	Bushfire		

The Wheatbelt consequence table states that 'at least one death' is a major consequence, therefore if any death was likely to occur in the hazard scenarios, a major consequence had to be selected. Because of these high consequences, the majority of the risks for people fall into the high risk level. For the earthquake scenario, however, death of people was assessed as a catastrophic consequence; because of the low likelihood of the earthquake the risk is calculated as medium. Deaths in the rail crash scenario were also assessed as a catastrophic consequence (high risk) due to the high number of deaths expected.

The potential for health services to become overwhelmed for all hazards, with the exception of flood, is high. This is due to the limited number of hospitals and health professionals in the district. Assistance from outside the district (i.e. Perth) would be required.

Risks to public administration

Seventy-five statements were assessed for public administration impacts (Table 8). These 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 8: Impacts to public administration by hazard and risk level.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>		Bushfire	Rail crash	Earthquake	
<i>Demand on public facilities</i>			Bushfire Earthquake Flood	Rail crash Storm	
<i>Disruption to aviation services</i>				Storm	Bushfire Flood
<i>Emergency services</i>		Bushfire (2) Rail crash Storm	Earthquake (2) Flood	Earthquake Flood (2) Storm (2)	Bushfire
<i>Government services</i>		Rail crash	Bushfire Earthquake (3) Storm	Bushfire Earthquake	Bushfire
<i>Health services</i>		Bushfire Earthquake Rail crash		Storm	Flood
<i>Home care services</i>		Bushfire	Flood (2)	Storm (2)	
<i>Impacts to communication service delivery</i>			Bushfire Storm	Flood	Earthquake
<i>Impacts to port and marina services</i>				Storm	Flood
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm		Earthquake	

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Impacts to public transport services</i>				Bushfire	Flood Storm
<i>Impacts to sewerage service delivery</i>			Earthquake	Bushfire Flood Storm	
<i>Impacts to water supply service delivery</i>			Bushfire Earthquake Storm	Flood	
<i>Public unrest</i>				Bushfire	
<i>Response and recovery activities</i>		Bushfire (2) Rail crash Storm	Earthquake (2) Flood (2) Storm	Rail crash	

The impact and increased demand on the emergency and health services is a high risk for the bushfire, earthquake, rail crash and storm hazard scenarios. This is due to the limited surge capacity in hospitals and clinics across the district. This would be exacerbated during the rail crash scenario when there is the possibility of a high number of deaths/injuries in one location or for the earthquake scenario where there are a high number of deaths/injuries spread across the district.

Disruption to the power supply was found to be a high risk for the bushfire, flood and storm hazards. Significant resources from outside the district would be required to restore services due to the widespread nature of the networks and events. The disruption of transport networks was a high risk from bushfire because of the closure of main highways such that the delivery of essential supplies would be disrupted.

Recovery works for both local governments and state agencies would require significant external assistance (major consequence) for all hazards, apart from flood. The impact to government offices and works depots for the rail crash scenario was due to the increased demand on these facilities during the response and recovery phases.

Risks to social setting

The sixty-eight social setting statements (Table 9) focus on the community wellbeing, community services and culturally important activities and objects (see Appendix C for criteria).

Table 9: Impacts to social setting by hazard and risk level.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Availability of essential supplies</i>			Earthquake Flood	Bushfire (3) Flood Rail crash (2) Storm	Earthquake Flood
<i>Breakdown of social networks</i>			Bushfire Earthquake	Storm	Bushfire Flood
<i>Community services and events</i>			Earthquake		Bushfire
<i>Culturally significant facilities and customs</i>		Bushfire (2) Earthquake	Flood Storm	Bushfire	Bushfire Flood Storm
<i>Death/injury of animals</i>				Storm	Bushfire Earthquake Flood
<i>Displacement or isolation of communities</i>			Bushfire Earthquake	Flood (2) Storm (2)	Bushfire Storm
<i>Educational facilities</i>			Earthquake	Bushfire Flood Storm	
<i>Facilities for vulnerable people</i>			Earthquake	Bushfire Flood Storm	
<i>Impacts to people's health</i>			Earthquake	Bushfire Flood Storm	
<i>Impacts to tourism</i>				Bushfire	Rail crash
<i>Loss of income</i>			Earthquake Storm	Flood	Bushfire Rail crash
<i>Psychological and emotional stress</i>		Rail crash			
<i>Public information</i>					Bushfire
<i>Residential building damage</i>			Bushfire Earthquake Flood Storm		
<i>Social service providers</i>			Bushfire	Earthquake Storm	Flood

The greatest social setting risks are generated by the earthquake scenario, which has major (or catastrophic) consequences for most risk statements. While the statements appear as medium risks because of the lower likelihood, they still have a greater social impact than the other hazards.

Three of the four high risk statements relate to the damage or permanent loss of heritage buildings or other structures (e.g. historic bridges) from bushfire or earthquake. The buildings tend to be more prone to earthquake damage because of their unreinforced masonry construction style. If they were destroyed by fire or earthquake, it is unlikely that they would be rebuilt (in the same style). The fourth high risk considers the psychological and emotional stress placed on response and recovery workers in the rail crash scenario.

Risks to environment

Twenty-four risk statements were assessed for the environment (table 10). These statements address impacts to ecosystems, species and landscapes (see Appendix C for criteria).

Table 10: Impacts to environment by hazard and risk level.

Category	Risk level				
	Extreme	High	Medium	Low	Very Low
<i>Contamination from toxic substances</i>				Bushfire Earthquake Rail crash	
<i>Debris or pollutants entering the riverine or marine environment</i>		Flood		Flood	Bushfire
<i>Flora and fauna</i>		Bushfire	Storm (3)	Bushfire (4) Flood	Bushfire Flood (2) Rail crash (2)
<i>Invasive non-native flora and fauna</i>		Flood	Flood	Bushfire	
<i>Soil erosion</i>			Flood		

The risks posed to the environment are generally low overall, with the flood and bushfire scenarios having the highest risk. Four of the five hazards are natural processes and the landscape has and will be shaped by these events. The high risks related to flood are from agricultural chemicals being washed into waterways and the development of algal blooms in rivers and estuaries, which could impact on fish and marine life populations. The high risk bushfire statement relates to the impact the fire will have on protected flora and fauna in national parks (such as the Moore River National Park and Nambung National Park).

While the rail crash scenario will impact the environment through contamination, the impact is anticipated to be localised to the immediate area and therefore the risk to the district is low.

Risks by theme

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

The ten themes identified for the Wheatbelt EM district are: buildings; community; education; environment; government; health; industry/commercial; tourism; transport; and utilities. These tables only contain the relevant risk statements; not all risk statements appear in this section.

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

Buildings

The financial losses from building damage caused by bushfire, flood, storm and earthquake are the highest risks related to building infrastructure (Table 11). The loss of these buildings is expected to break the district's social fabric as some permanent dispersal may occur. Additionally, the damage or destruction of heritage buildings is a high risk as the cultural loss would likely be permanent.

Increased demand on public buildings such that their core services are significantly reduced is anticipated for the bushfire, flood and earthquake scenarios. The buildings may be used for welfare or command centres or in place of other damaged buildings.

The damage to emergency services buildings from earthquake is expected to significantly affect core service delivery as building damage may be extensive and other facilities may not be easily or quickly available.

Table 11: Risks related to buildings.

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

Government

The highest risks for government activities relate to the general provision of response and recovery activities and government services (Table 12). The majority of these government risk statements have major consequences which equate to high risks for all hazards, except for earthquake due to its low likelihood. Interestingly, flood, storm and earthquake were assessed to have higher response and recovery costs compared with bushfire and rail crash.

Table 12: Risks related to government activities.

Government activities					
Category	Extreme	High	Medium	Low	Very Low
<i>Emergency services</i>		Bushfire Rail crash Storm	Earthquake Flood		

Government activities					
Category	Extreme	High	Medium	Low	Very Low
<i>Government services</i>		Rail crash	Bushfire Earthquake (3) Storm	Bushfire Earthquake	Bushfire
<i>Response and recovery activities</i>		Bushfire (2) Rail crash Storm	Earthquake (2) Flood (2) Storm	Rail crash	
<i>Response and recovery activities</i>		Flood Storm	Bushfire Earthquake	Rail crash	

Health

The majority of risks related to health are high, with all hazard scenarios contributing (Table 13). These health risks relate to direct injuries and death from the hazards and from the overwhelming of emergency and health services, affecting their service provision. While the risks of injuries and death are high, the impact of these health impacts on the community's wellbeing is medium to low (purple box).

Table 13: Risks related to health.

Health					
Category	Extreme	High	Medium	Low	Very Low
<i>Deaths</i>		Bushfire Earthquake Flood Rail crash Storm			
<i>Disease outbreak</i>			Flood (2)		
<i>Emergency services</i>		Storm	Bushfire Flood		Bushfire
<i>Health services</i>		Bushfire Earthquake Rail crash Storm	Flood		
<i>Health services</i>		Bushfire Earthquake Rail crash		Storm	Flood

Health					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to people's health</i>			Earthquake	Bushfire Flood Storm	
<i>Injuries or illnesses</i>		Earthquake Flood Rail crash Storm	Bushfire		

Industry/commercial

The greatest impact to commercial activities in the Wheatbelt district, apart from commercial building loss, is damage to agricultural, pastoral and horticultural activities (Table 14). This is likely due to the prevalence of agricultural activities and available land in the Wheatbelt and the ability for bushfires, floods and storms to easily cause damage to land. Risks to other commercial activities are medium to very low risk. Although there are significant amounts of high value commercial freight on the rail lines, the economic benefits and losses are not held by the Wheatbelt EM district itself.

Table 14: Risks related to industry and commerce activities.

Industry/commercial					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to agricultural and pastoral activities</i>		Bushfire (2) Flood Storm (2)	Bushfire (2) Storm	Flood	Flood
<i>Impacts to commercial activities</i>			Storm	Flood	Bushfire Rail crash
<i>Impacts to marine infrastructure and industry</i>			Storm		Flood (2)
<i>Impacts to port and marina services</i>				Storm	Flood
<i>Impacts to mining infrastructure and industry</i>					Flood
<i>Workforce productivity losses</i>					Rail crash

Transport

Flood, storm and bushfire are responsible for the highest risks to transport (Table 15) in the district, causing physical damage and delays/disruption of transportation networks. However, the majority of the risks to transportation are low.

Table 15: Risks related to transport.

Transport					
Category	Extreme	High	Medium	Low	Very Low
<i>Disruption to aviation services</i>				Storm	Bushfire Flood
<i>Disruption to transport routes</i>			Bushfire (2)	Earthquake Flood Rail crash (2) Storm	Rail crash
<i>Emergency services</i>		Bushfire		Earthquake Flood Storm	
<i>Impacts to aviation</i>					Flood
<i>Impacts to bridges or their approaches</i>		Flood	Bushfire Storm	Earthquake Rail crash	
<i>Impacts to public transport services</i>				Bushfire	Flood Storm
<i>Impacts to transport infrastructure</i>		Flood Storm	Earthquake	Rail crash	

Utilities

The cost of damage to utilities (pink rows in Table 16) seems to correlate well to the decrease in service provision (orange rows), which may indicate that damaged assets will be the greatest problem in these events; in some instances, the asset repair cost is a lower risk than the administrative burden as significant external resources are required to restore services.

Table 16: Risks related to utilities.

Utilities					
Category	Extreme	High	Medium	Low	Very Low
<i>Impacts to communication infrastructure</i>			Earthquake Storm	Bushfire Flood	
<i>Impacts to communication service delivery</i>			Bushfire Storm	Flood	Earthquake
<i>Damage to power supply infrastructure</i>		Bushfire Storm	Earthquake Flood		
<i>Impacts to power supply service delivery</i>		Bushfire Flood Storm		Earthquake	
<i>Impacts to sewerage systems</i>			Storm	Bushfire Earthquake Flood	
<i>Impacts to sewerage service delivery</i>			Earthquake	Bushfire Flood Storm	
<i>Impacts to water supply infrastructure</i>			Bushfire Earthquake Flood Storm		
<i>Impacts to water supply service delivery</i>			Bushfire Earthquake Storm	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 12).

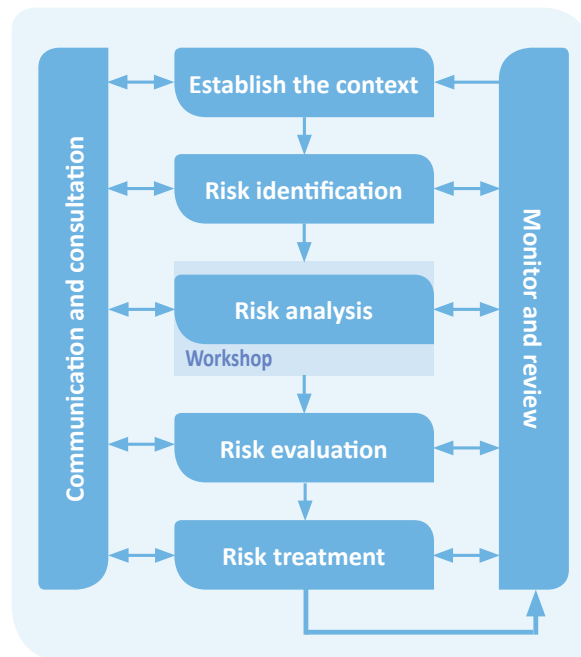


Figure 12: Emergency risk management process³.

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 13 shows that most (48%) of the Wheatbelt risk 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 phase. There is a high percentage (27%) of Priority 3 risk statements which need further investigation and/or development of treatment plans.

There are no Priority 1 risk statements for the Wheatbelt district, however, 2% of the statements are categorised as Priority 2 (Table 17), meaning they need further investigation and/or treatment.

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Table 17 contains the Priority 2 risk statements in full and those risk statements with catastrophic consequences. Catastrophic consequence statements are included because if these impacts do occur they could potentially stretch or outstrip the district's resources and therefore should be considered during the treatment phases.

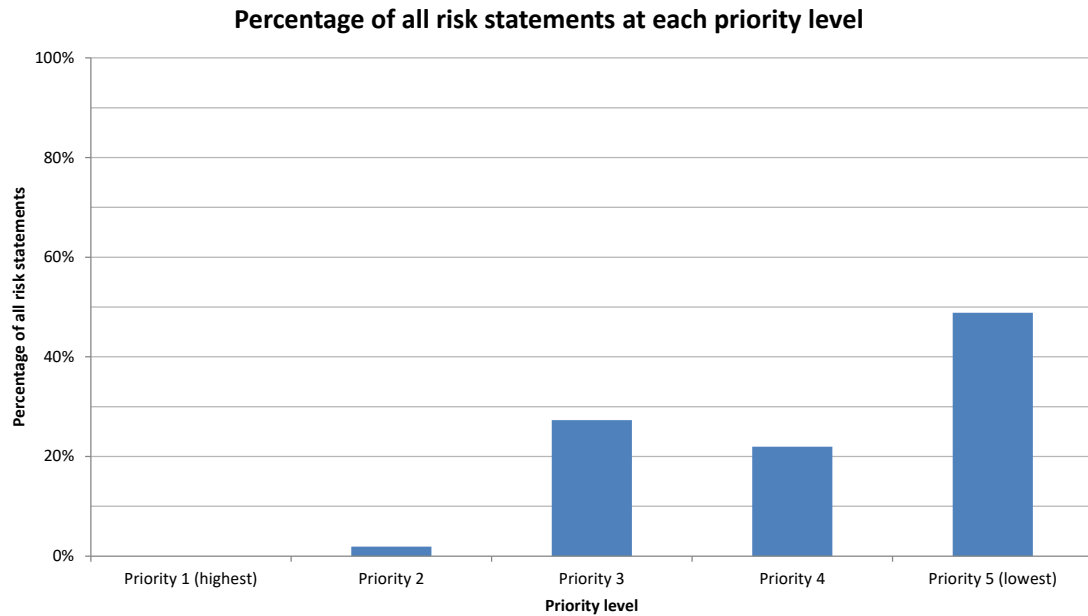


Figure 13: Percentage of all risk statements at each priority level. Priority 1 – highest; Priority 2 – high; Priority 3 – medium; Priority 4 – low; Priority 5 – lowest.

Table 17: Risk statements for the Wheatbelt district with Priority level 2 or catastrophic consequences. EQ = Earthquake.

Hazard	Risk statement	Impact area	Consequence	Risk level	Confidence level	Priority level
EQ	will impact heritage buildings, churches and places of worship, resulting in a loss of cultural significance.	Social setting	Catastrophic	High	Low	2
Rail crash	will cause an increased demand (surge) on WA health services (including remote health services such as nursing posts, smaller hospitals/clinics) across the district, affecting their service provision.	Public administration	Catastrophic	High	High	2
Bushfire	will impact commercial buildings, contents and services resulting in financial losses.	Economy	Major	High	Moderate	2
Bushfire	will impact protected flora and fauna in National Parks (such as the Moore River National park and Nambung national Park.)	Environment	Major	High	Moderate	2
Rail crash	will impact response workers, affecting community wellbeing.	Social setting	Major	High	Low	2
EQ	will impact commercial buildings, contents and services, resulting in financial losses.	Economy	Catastrophic	High	High	3
EQ	will cause an increased demand (surge) on WA health services (including remote health services such as nursing posts, smaller hospitals/clinics) across the district, affecting their service provision.	Public administration	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
EQ	will cause an increased demand on emergency services and health services (including ambulance and medical transport services, hospitals, remote nursing posts and clinics, resulting in further deaths directly attributable to the hazard event.	People	Catastrophic	High	Moderate	3
Rail crash	will impact the health of people and cause death(s).	People	Catastrophic	High	Highest	3
Rail crash	will impact the health of people and cause injury and/or serious illness.	People	Catastrophic	High	Highest	3

7 Future actions

A preliminary treatment discussion was held on 3 November 2016 in Northam 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 areas.

Bushfire

This section summarises the risk to the Wheatbelt EM district from the bushfire scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 14.

Percentage of risk statements at each risk level for bushfire

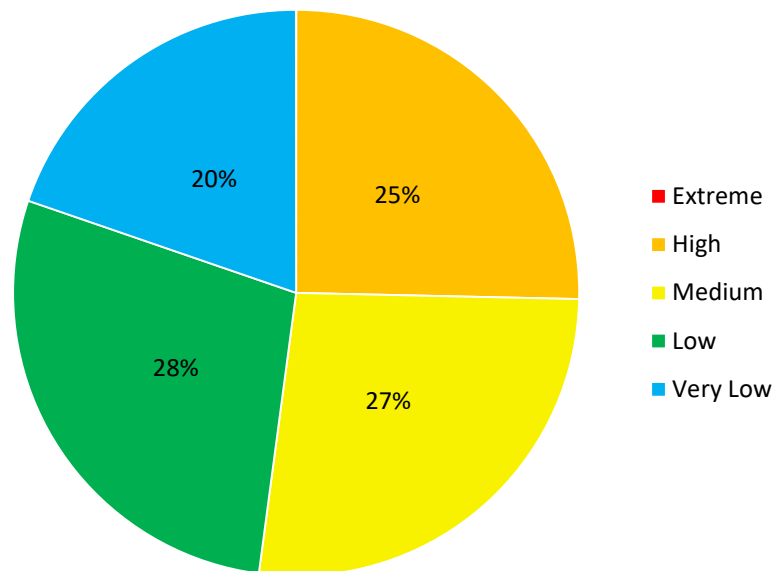


Figure 14: Percentage of risk statements at each risk level for bushfire.

Bushfire risk assessment

ECONOMY



Extreme risks

Nil.

High risks

Impacts to both private and commercial buildings, damage to power infrastructure and impacts to agricultural and horticultural infrastructure were assessed as high risks.

Medium risks

Impacts to aspects of transport, tourism and agriculture were assessed as medium risks. These include impacts to the main rail and road routes, bridges, aspects that support the tourism industry, cropping, plantations and livestock.

Low risks

The two low risk statements regard impacts to communications and sewerage systems resulting in recovery costs and financial losses.

Very Low risks

The only very low risk statement relates to interruptions to major events which impacts the district revenue.

PEOPLE



Extreme risks

Nil.

High risks

Impacts to people's health which causes death and the potential for health services to be overwhelmed, resulting in further deaths were assessed as high risks to the district.

Medium risks

Impacts to people's health causing injuries and/or serious illness and reduction in emergency services due to lack of access are both medium risks for the district.

Low risks

Nil.

Very Low risks

The potential for emergency services to be overwhelmed by the bushfire scenario resulting in further deaths was assessed as a low risk.

Bushfire risk assessment

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

High risk statements relate to increased demand (surge) on emergency and health services, reducing their ability to provide core services. There is a high risk that state and district agencies will need to undertake recovery works, impacting their core service. Impacts to power and transport infrastructure are also high risk.

Medium risks

An increased demand on public facilities, impacts to communication infrastructure, reduction/loss of water supplies and an increased backlog in government service provision have been ranked as medium risks.

Low risks

Impacts to government offices, transport infrastructure which reduces the availability of public transport, and sewerage systems are low risks. There is also a low risk that the bushfire scenario could lead to social unrest.

Very Low risks

Impacts to emergency service buildings, aviation infrastructure and the potential evacuation of the Yongah Hill Immigration Detention Centre are assessed as very low risk.

SOCIAL SETTING



Extreme risks

Nil.

High risks

The loss of cultural significance through damage to heritage buildings, art galleries, museums, libraries and local government buildings are the highest risks to the social setting in the district.

Medium risks

Impacts to community wellbeing as a result of building damage and reduction of existing social service providers are medium risks. There is also a medium risk that family networks will break down and that the community will disperse due to evacuation.

Low risks

Impacts to services for vulnerable people, educational facilities, tourism and the aesthetics of the area have a low risk of affecting the community's wellbeing. Isolation of towns, impacts to arterial roads and impacts to commercial retail outlets reducing the availability of essential supplies and products, were assessed as low risks.

Very Low risks

Risk statements addressing loss of places of worship, loss of power affecting delivery of public warnings, increased demand on public buildings, loss of employment and isolation of small towns were assessed as very low risks.

Bushfire risk assessment

ENVIRONMENT



Extreme risks

Nil.

High risks

Bushfire impacts to protected flora and fauna in National Parks was the highest risk to the environment.

Medium risks

Nil.

Low risks

Impacts to the health of wildlife and flora and the contamination of the environment from the release of toxic substances were low risks. The potential for impacts to native vegetation degrading the aesthetics in the area and the impact of flora in areas of Unallocated Crown Land along the Moore and Avon Rivers are also low risks.

Very Low risks

Very low risks are related to the pollution of the Moore and Avon Rivers impacting river ecology and the impact of fauna in areas of Unallocated Crown Land along these rivers.

Earthquake

This section summarises the risk to the Wheatbelt EM district from the earthquake scenario. 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 earthquake

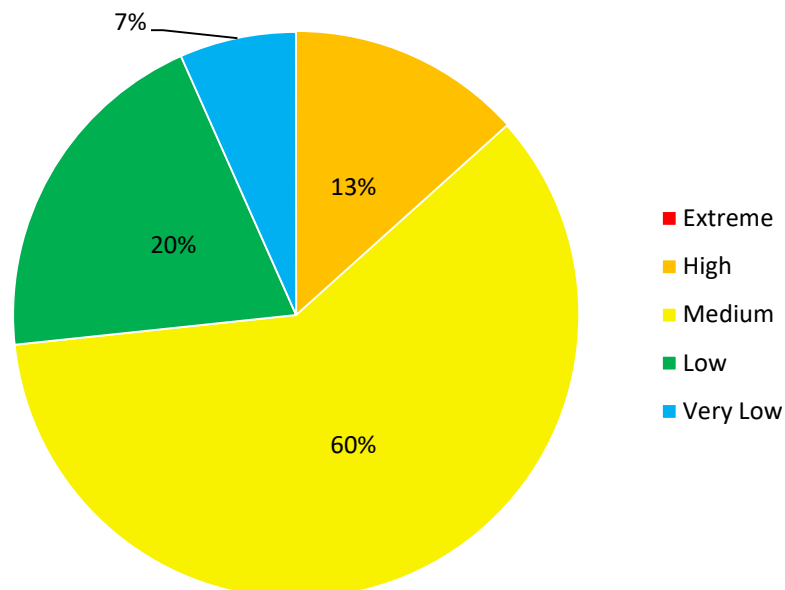


Figure 15: Percentage of risk statements at each risk level for earthquake.

Earthquake risk assessment

ECONOMY



Extreme risks

Nil.

High risks

The only high economic risk is from the damage of commercial buildings, their contents and services.

Medium risks

Damage to infrastructure services (transport, communications, power and the Goldfields Water Supply Pipeline), private buildings and aspects that support the tourism industry are ranked as medium risks.

Low risks

Disruption to major freight routes, impacts to bridges and the sewerage system were assessed as low risks to the district.

Very Low risks

Nil.

PEOPLE



Extreme risks

Nil.

High risks

The three people risk statements were all assessed as high risks. Statements concern injury/illness, death and the increased demand on emergency and health services resulting in further deaths.

Medium, Low and Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

The highest risk to the district's public administration is from the increased demand (surge) on WA health services across the district during and after the earthquake.

Medium risks

Increased demand on emergency services and public facilities and damage to emergency service buildings and government buildings are ranked as medium risks. As a result of damage, both district and state agencies will need to undertake recovery works. Damage to water and sewerage infrastructure were both assessed as medium risks.

Low risks

Damage to transport and power infrastructure are low risks, although damage to transport has been assessed with the lowest confidence. There is a low risk that the lives of public administration staff will be affected, impacting on their ability to maintain core services.

Very Low risks

The only very low risk is from impacts to the communication infrastructure affecting the ability to maintain core services.

Earthquake risk assessment

SOCIAL SETTING



Extreme risks

Nil.

High risks

The only high risk for the social setting is from the loss of cultural significance as a result of the impact to heritage buildings and places of worship. This risk statement has been assessed with low confidence.

Medium risks

Medium risks include displacement of people, reduction in the availability of commercial products, reduced services for vulnerable people, breakdown of family networks and loss of income/employment.

Low risks

Impacts to the social service providers in the district have a low risk of affecting the community's wellbeing.

Very Low risks

Displacement/death of animals and impacts to arterial roads reducing the supply of essential goods to the district were very low risks.

ENVIRONMENT



Extreme, High and Medium risks

Nil.

Low risks

The contamination of the surrounding environment from the release of toxic substances (e.g. non-natural materials) was ranked as a low risk to the district.

Very Low risks

Nil.

Flood

This section summarises the risk to the Wheatbelt EM district from the flood scenario. The percentage of risk statements at each risk level for the scenario is shown in Figure 16.

Percentage of risk statements at each risk level for flood

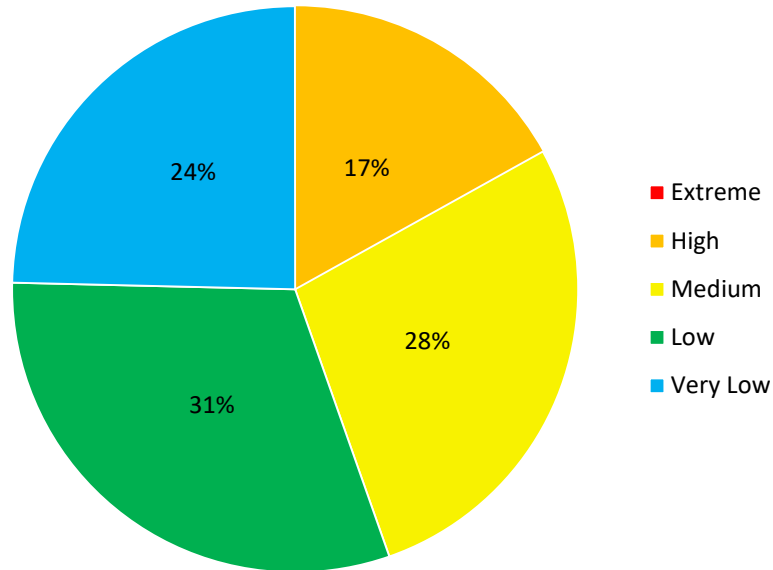


Figure 16: Percentage of risk statements at each risk level for flood.

Flood risk assessment

ECONOMY



Extreme risks

Nil.

High risks

Damage and inundation of transport routes including bridges and the inundation of agricultural infrastructure (e.g. grain storage bins, fencing, machinery) were assessed as high risk.

Medium risks

Impacts to the district's power and water infrastructure and aspects that support the tourism industry (e.g. access routes, facilities, caravan parks, fuel outlets) are medium risks.

Low risks

Risk statements regarding damage to communication and sewerage infrastructure, disruption of major tourism events, damage to crops and disruption to major freight routes were assessed as low risk.

Very Low risks

Damage to aviation, port, fisheries, mining and horticulture infrastructure were assessed as very low risks to the district.

Flood risk assessment

PEOPLE



Extreme risks

Nil.

High risks

Impacts to people's health causing injury, serious illness and/or death were assessed as high risk for the Wheatbelt.

Medium risks

The potential for emergency and health services to become overwhelmed, resulting in further deaths directly attributed to the flood event, were assessed as medium risks. The increase in mosquito-borne diseases and contaminated floodwaters resulting in health issues were also medium risks.

Low and Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

The highest risk to the public administration is from the damage to power infrastructure affecting service delivery.

Medium risks

Local government and state agencies would be required to undertake recovery activities. As a result, there is a medium risk that their core service provision will be reduced. Other medium risks include increased demand (surge) on emergency services and public facilities, and interruptions to health care and social service providers.

Low risks

Damage to communication, transport, water and sewerage infrastructure and emergency service buildings are ranked as low risks.

Very Low risks

Increased demand on WA health services and damage to aviation and port infrastructure are assessed to be very low risks.

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

Damage to buildings (private, commercial and places of worship) impacting the community's wellbeing were ranked as medium risk.

Low risks

Low risks to the community wellbeing result from evacuation away from people's homes, reduced function of educational facilities and a reduction in supply of essential goods.

Very Low risks

Displacement or death of domestic animals, impacts on social service providers, damage to indigenous sites, damage to arterial road networks and the breakdown of community wellbeing were very low risks.

Flood risk assessment

ENVIRONMENT



Extreme risks

Nil.

High risks

The contamination of the marine/riverine environment by debris and pollutants, including algal blooms, was assessed to be a high risk for the district.

Medium risks

Soil erosion on the floodplain and river catchment areas and the spread of non-native flora and fauna are medium risks.

Low risks

Impacts to the health of wildlife and turbidity affecting the marine environment were both low risks.

Very Low risks

Impacts to flora and fauna, including protected flora and fauna in national parks in the district, was assessed to be very low risks.

Rail crash

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

Percentage of risk statements at each risk level for rail crash

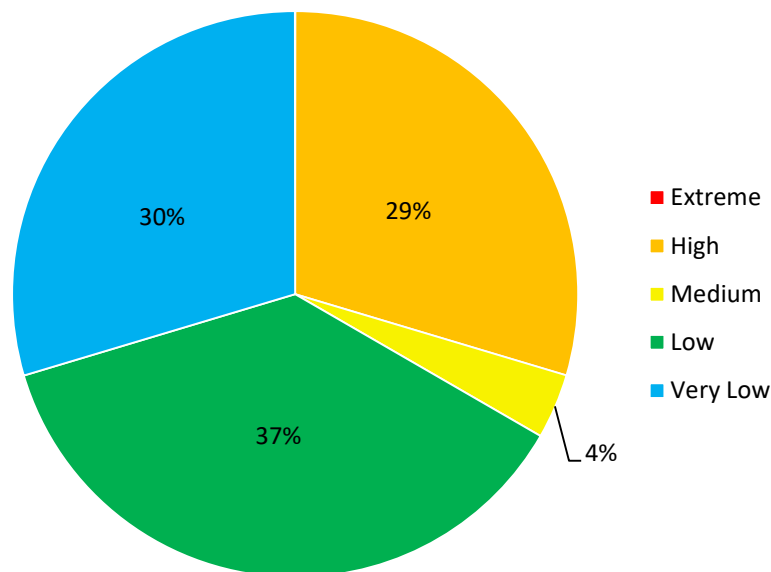


Figure 17: Percentage of risk statements at each risk level for rail crash.

Rail Crash risk assessment

ECONOMY



Extreme, High and Medium risks

Nil.

Low risks

Financial losses resulting from damage and disruption to transport infrastructure and freight routes and the requirement for recovery activities to take place, are all low risks for the district.

Very Low risks

Financial losses from disruption of passenger rail routes, impacts to tourism, impacts to the mobility of workers in the area and disruption to major events, were ranked as low risks.

PEOPLE



Extreme risks

Nil.

High risks

All three risk statements regarding people were ranked as high risk. These include impacts to people's health causing injury/illness and death, and the increased demand on emergency and health services resulting in further deaths.

Medium, Low and Very Low risks

Nil.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

High risks to the district include increased demand on emergency and health services, and the response required by state agencies affecting their provision of core services.

Medium risks

The only medium risk is from the impact of arterial road networks resulting in the disruption to the supply of essential goods and services.

Low risks

Increased surge on public facilities affecting core services and the requirement by local governments to undertake recovery works were considered low risk.

Very Low risks

Nil.

Rail Crash risk assessment

SOCIAL SETTING



Extreme risks

Nil.

High risks

The impact of response workers affecting the community's wellbeing is the only high risk to the district.

Medium risks

Nil.

Low risks

Impacts to arterial road networks reducing the availability of essential goods was ranked as a low risk.

Very Low risks

Impacts to tourism and the loss of employment/income affecting the community's wellbeing were ranked as low risks.

ENVIRONMENT



Extreme, High and Medium risks

Nil.

Low risks

The only low risk statement is from the contamination of the surrounding environment from the release of toxic substances.

Very Low risks

Impacts to wildlife and flora in the area were ranked as very low risks.

Storm

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

Percentage of risk statements at each risk level for storm

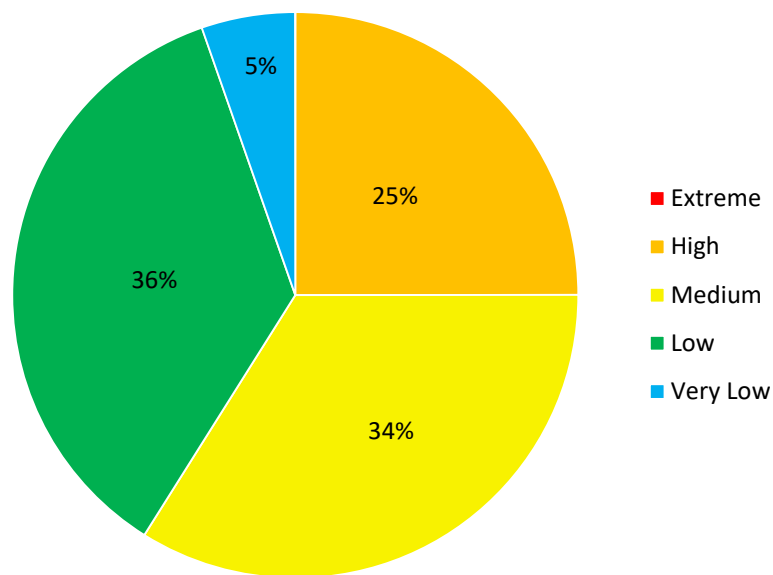



Figure 18: Percentage of risk statements at each risk level for storm.

Storm risk assessment	
ECONOMY 	<p>Extreme risks Nil.</p>
	<p>High risks Damage to private and commercial buildings, transport infrastructure, power networks and agriculture infrastructure, were ranked as high risks for the district. Impacts to the season’s cropping and harvest resulting in financial losses was also a high risk.</p>
	<p>Medium risks Damage to communication, sewerage, water supply, marine and bridge infrastructure resulting in financial losses were ranked as medium risks. Other medium risks include business failure, interruptions to major events and impacts to livestock, including their availability to feed and pasture.</p>
	<p>Low risks A decrease in tourism in the district such that revenues decline, and disruption to major freight routes, were assessed as low risk.</p>
	<p>Very Low risks No risk statements were assessed as very low risk.</p>

Storm risk assessment

PEOPLE



Extreme risks

Nil.

High risks

All people-related risk statements are ranked as high risks for the district. These include injuries/illnesses, deaths and overwhelming of health and emergency services, resulting in further deaths.

Medium, Low and Very Low risks

No risk statements were assessed as medium, low or very low risk.

PUBLIC ADMINISTRATION



Extreme risks

Nil.

High risks

Increased demand on emergency services, damage to power infrastructure and the requirement of recovery works to be undertaken by local governments were ranked as high risks.

Medium risks

Damage to communication and water infrastructure, an increased backlog in government service provisions and recovery works by state agencies resulting in an impact to their core services, were all medium risks.

Low risks

Increased demand on emergency, health and social services and damage to sewerage, aviation and marine infrastructure reducing the provision of core services, were ranked as low risks.

Very Low risks

The only very low risk for the district is from the damage of transport infrastructure resulting in reduced public transport services.

SOCIAL SETTING



Extreme and High risks

Nil.

Medium risks

Damage to residential and heritage buildings and loss of income leading to a loss of community morale, are ranked as medium risks.

Low risks

Low risks to community wellbeing concerning displacement of animals, short to long-term displacement of persons due to evacuation, impacts to social service providers, impacts to the day-to-day function of educational facilities and the breakdown of social networks.

Very Low risks

Damage to indigenous sites of cultural significance and the isolation of towns were ranked as very low risks.

ENVIRONMENT



Extreme and High risks

Nil.

Medium risks

All environmental risk statements were assessed as medium risks. These include impacts to wildlife, flora and protected flora and fauna in National Parks.

Low and Very Low risks

Nil.

Appendix B: District profile

The Wheatbelt Emergency Management District (Figure 19) encompasses 28 local government areas, stretching from the pristine coastline in the Shires of Gingin and Dandaragan, to vast cropping areas, to mining and pastoral areas of the Shire of Yilgarn in the east. It includes the historic and picturesque communities along the Avon Valley and many unique country towns and scenic sights. This great diversity is part of the district's appeal and given its relative proximity to Perth, the area attracts many visitors each year.

The population of the Wheatbelt is approximately 59,000. Agriculture is the major industry in the area, although light industry, mining and tourism also contribute strongly to the local economy, which has a gross regional product of approximately \$6.6 billion per annum.

The Wheatbelt district provides the major freight route (by road and rail) into Western Australia from the eastern states.

Natural and man-made hazard events occur throughout the region. The highest priority hazards, as identified by the Wheatbelt DEMC are: bushfire, earthquake, flood, rail crash and storm.

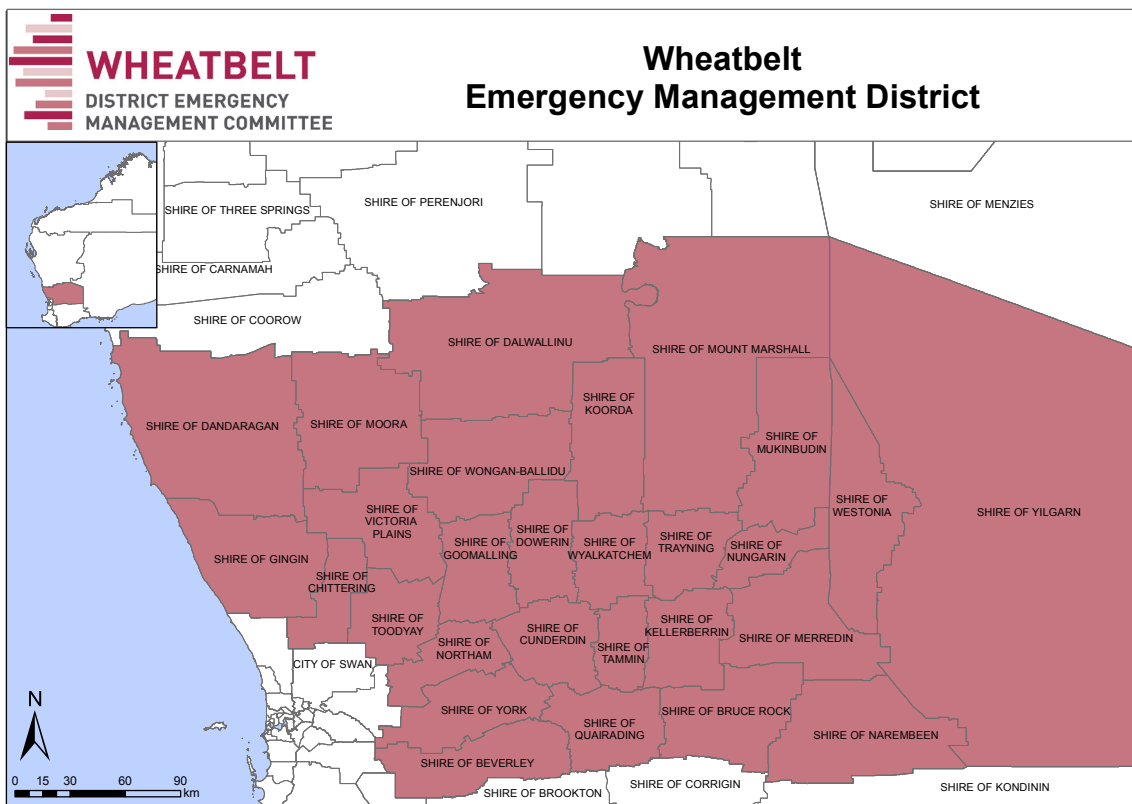


Figure 19: Wheatbelt EM district map.

Appendix C: Wheatbelt EM district consequence table

(based on population: 58, 621; gross area product: \$6.621 billion)

	Insignificant	Minor	Moderate	Major	Catastrophic
People*					
Mortality	Not Applicable.	At least 1 death.	At least 1 death.	At least 1 death.	At least 6 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 6 serious injuries.	More than 6 critical injuries with long-term or permanent incapacitation or more than 59 serious injuries.
Economy					
Loss of economic activity and/or asset value	Decline of economic activity and/or loss of asset value less than \$264,840.	Decline of economic activity and/or loss of asset value between \$264,840 and \$2,648,400	Decline of economic activity and/or loss of asset value between \$2,648,400 and \$26,484,000	Decline of economic activity and/or loss of asset value between \$26,484,000 and \$264,840,000.	Decline of economic activity and/or loss of asset value greater than \$264,840,000.
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 state, local or regional level and/or and/or Minor damage to ecosystems and species recognised at the state level	Significant loss or impairment of an ecosystem or species recognised at the state level and/or and/or Severe damage to or loss of ecosystems and species recognised at the local/regional level.	Severe damage to or loss of an ecosystem or species recognised at the state level and/or and/or Significant loss or impairment of an ecosystem or species recognised at the national level.	Permanent destruction of an ecosystem or species recognised at the national or state level. and/or Severe damage to or loss 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. and/or Governing bodies are required to divert some available resources to deliver core functions or seek external assistance to deliver some of their core functions.	Governing bodies encounter severe reduction in the delivery of core functions. and/or Governing bodies are required to divert a significant amount of available resources to deliver core functions or seek external assistance to deliver the majority of their core functions.	Governing bodies are unable to deliver their core functions.
Social Setting					
Community wellbeing	Community social fabric is disrupted	Community social fabric is damaged	Community social fabric is broken	Community social fabric is significantly broken	Community social fabric is irreparably broken
Community Services	Existing resources sufficient to return the community to normal function	Some external resources required to return the community to normal function	Significant external resources required to return the community to normal function	Extraordinary external resources are required to return the community to functioning effectively	Community ceases to function effectively, breaks down
Culturally important objects	No permanent dispersal.	No permanent dispersal.	Some permanent dispersal.	Significant permanent dispersal.	Community disperses in its entirety
Culturally important activities	Inconsequential / short term impacts.	Isolated / temporary reductions.	Ongoing reductions.	Reduced quality of life.	Community unable to support itself.
	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.
	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

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