ADAPTATION IN THE NORTH

An Integrated Regional Vulnerability Assessment

VOLUME 2

Northern Alliance for Greenhouse Action

NAGA
NORTHERN ALLIANCE FOR GREENHOUSE ACTION

CONTENTS

APPENDIX A - VULNERABLE GROUPS AND INDICATORS

A1 Contextual data

LGA	LGA AREA	POPULATION		
	NUMBER OF HOUSES	2011 CENSUS POPULATION	2008 CENSUS POPULATION	CURRENT VICTORIA IN FUTURE 2011
Banyule	2,282	124,340	121,710	122,983
Darebin	4,755	141,791	137,700	142,942
Hume	1,051	175,606	162,661	174,290
Manningham	1,310	119,438	117,272	116,750
Melbourne	1,706	98,859	89,525	100,240
Moreland	3,816	152,255	146,261	154,247
Nillumbik	1,177	64,219	63,338	62,716
Whittlesea	2,200	163,539	139,595	160,800
Yarra	2,445	80,309	76,591	78,903

SLA	POPULATION	
	2011 CENSUS POPULATION	2008 CENSUS POPULATION
Banyule (C) - Heidelberg	67,116	65,555
Banyule (C) - North	57,224	56,155
Darebin (C) - Northcote	51,212	49,729
Darebin (C) - Preston	90,579	87,971
Hume (C) - Broadmeadows	66,503	65,636
Hume (C) - Craigieburn	72,445	62,041
Hume (C) - Sunbury	36,658	34,984
Manningham (C) - East	16,254	15,953
Manningham (C) - West	103,184	101,319
Melbourne (C) - Inner	15,731	14,013
Melbourne (C) - Remainder	63,976	58,831
Melbourne (C) - S'bank-D'lands	19,152	16,681
Moreland (C) - Brunswick	46,865	44,696
Moreland (C) - Coburg	53,021	51,320
Moreland (C) - North	52,369	50,245
Nillumbik (S) - South	28,693	28,676
Nillumbik (S) - South-West	25,768	24,911
Nillumbik (S) Bal	9,758	9,751
Whittlesea (C) - North	54,857	32,474
Whittlesea (C) - South-East	44,854	44,755
Whittlesea (C) - South-West	63,828	62,366
Yarra (C) - North	51,795	49,388
Yarra (C) - Richmond	28,514	27,203

A2 Emergency management

A2.1 Vulnerable groups

CODE	VULNERABILITIES / VULNERABLE GROUPS CLASSIFICATION
A	Older people
B	Socioeconomically disadvantaged / homeless
C	CALD communities
D	People with a disability
E	Children and young people
F	People with multiple and complex needs
G	People with mental health issues
H	Those with existing illnesses
I	Indigenous communities
J	Rural, urban fringe and other fire-prone communities
K	Low lying communities
L	Victims of family violence
M	Obese and overweight people
N	People with alcohol and other drug issues
O	People with poor quality housing

A2.2 Vulnerability indicators and assessment

LGA	OLDER PEOPLE				SOCIO-ECONOMICALLY DISADVANTAGED PEOPLE		PEOPLE FROM CULTURALLY AND LINGUISTICALLY DIVERSE BACKGROUNDS (CALD)		PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES	
	% AGED 70 AND OLDER	% AGED 80 AND OVER	% AGED 70 AND OLDER 2031	% AGED 80 AND OVER 2031	SEIFA IRSAD (SEIFA INDEX OF RELATIVE SO-CIO-ECONOMIC ADVANTAGE AND DISADVANTAGE - LOWER NUMBERS CORRESPOND TO GREATER DISADVANTAGE)	SEIFA IRSD (SEIFA INDEX OF RELATIVE SO-CIO-ECONOMIC DISADVANTAGE - LOWER NUMBERS CORRESPOND TO GREATER DISADVANTAGE)	% OF PEOPLE WHO SPEAK ANOTHER LANGUAGE AND SPEAK ENGLISH 'NOT WELL' OR 'NOT AT ALL'	% BORN OVERSEAS WHO SPEAK ENGLISH 'NOT WELL' OR 'NOT AT ALL'	ESTIMATED NUMBER OF PEOPLE CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, PERSONS AGED 18 YEARS AND OVER (2011-13)	ESTIMATED PERCENT (ASR PER 100) PEOPLE CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, PERSONS AGED 18 YEARS AND OVER (2011-13)
Banyule	11.2%	5.0%	16.3%	7.3%	1,044	1,047	2.0%	2.2%	2,776	2.9%
Darebin	11.3%	4.9%	11.4%	4.9%	995	990	6.4%	7.1%	3,443	3.0%
Hume	5.9%	1.8%	10.6%	4.0%	950	952	5.6%	6.3%	4,058	3.0%
Manningham	13.6%	4.9%	19.4%	9.6%	1,081	1,071	4.9%	5.4%	2,370	2.6%
Melbourne	4.2%	1.6%	5.9%	2.3%	1,051	1,026	3.9%	4.3%	2,723	3.0%
Moreland	11.8%	5.2%	10.5%	4.6%	1,000	998	5.8%	6.5%	3,693	3.0%
Nillumbik	5.6%	2.0%	18.4%	6.8%	1,099	1,098	0.3%	0.3%	1,325	2.7%
Whittlesea	7.2%	2.4%	11.5%	5.0%	983	989	5.9%	6.6%	3,653	2.9%
Yarra	6.7%	2.6%	9.4%	3.8%	1,042	1,019	5.0%	5.6%	2,093	3.0%

LGA	VICTIMS OF FAMILY VIOLENCE	PEOPLE WITH A DISABILITY		CHILDREN AND YOUNG PEOPLE			HOMELESS PEOPLE AND THOSE AT RISK
	NUMBER OF FAMILY VIOLENCE INCIDENT REPORTS – LGA TOTAL (2009-10).	PERCENTAGE OF POPULATION WITH NEED FOR ASSISTANCE WITH CORE ACTIVITY (2011)	PERCENTAGE PERSONS AGED 0 TO 64 YEARS WITH A PROFOUND OR SEVERE DISABILITY AND LIVING IN THE COMMUNITY (2011)	% AGE 0-4 YOUNG CHILDREN	% 5-19 SCHOOL AGE YOUTHS	% AGE 0-4 YOUNG CHILDREN 2031	NO. OF PERSONS HOMELESS
Banyule	877	5.0%	2.1%	6.5%	17.3%	5.6%	463
Darebin	873	6.3%	2.4%	6.5%	14.6%	5.9%	992
Hume	1,756	5.6%	3.4%	7.5%	23.0%	7.6%	782
Manningham	387	4.7%	1.6%	4.8%	18.1%	4.6%	205
Melbourne	615	2.2%	0.9%	3.4%	10.4%	4.8%	1,254
Moreland	876	6.6%	2.3%	6.5%	14.4%	6.2%	782
Nillumbik	194	2.5%	1.5%	5.9%	23.3%	5.1%	76
Whittlesea	1,231	5.4%	2.2%	7.4%	19.9%	7.4%	458
Yarra	421	4.1%	1.6%	5.2%	9.9%	5.3%	726

LGA	PEOPLE WITH MENTAL HEALTH ISSUES	THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE		INDIGENOUS COMMUNITIES	LOW LYING COMMUNITIES	RURAL, URBAN FRINGE AND OTHER FIRE-PRONE COMMUNITIES
	REGISTERED MENTAL HEALTH CLIENTS (% OF POPULATION) (2011)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2011-13)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2011-13)	OBESE PERSONS, 18 YEARS AND OVER (2011-13)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2011-13)	ABORIGINAL POPULATION, USUAL RESIDENT POPULATION (CENSUS URP)	NUMBER OF HOUSES AT RISK OF FLOOD/ COASTAL THREAT	NUMBER OF HOUSES AT RISK FROM BUSHFIRE
Banyule	0.90%	40,812	33.1%	19,038	24.5%	617	2,282	2,092
Darebin	1.14%	41,360	28.8%	22,403	25.1%	1,155	4,755	-
Hume	1.13%	47,669	27.1%	30,712	30.1%	1,047	1,051	5,267
Manningham	0.52%	32,988	27.7%	16,828	21.7%	152	1,310	8,229
Melbourne	0.89%	25,125	25.5%	7,972	13.5%	262	1,706	-
Moreland	1.14%	45,051	28.9%	24,131	25.2%	702	3,816	-
Nillumbik	0.52%	19,621	30.7%	9,659	24.6%	194	1,177	13,977
Whittlesea	0.97%	43,062	26.5%	28,658	29.6%	1,124	2,200	7,831
Yarra	1.24%	23,153	28.4%	7,933	15.5%	318	2,445	-

SLA	PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES		THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE	
	ESTIMATED NUMBER OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	ESTIMATED PERCENT (ASR PER 100) OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	OBESE PERSONS, 18 YEARS AND OVER (2007-08)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2007-08)
Banyule (C) - Heidelberg	2,151	4.3%	17,061	26.1%	7,311	14.5%
Banyule (C) - North	2,134	4.8%	14,959	26.5%	6,733	15.2%
Darebin (C) - Northcote	1,709	4.2%	12,751	25.3%	6,240	16.0%
Darebin (C) - Preston	2,660	3.9%	23,154	26.3%	12,984	19.3%
Hume (C) - Broadmeadows	1,641	3.3%	16,995	26.3%	9,227	19.4%
Hume (C) - Craigieburn	1,693	3.8%	15,567	26.3%	7,336	18.0%
Hume (C) - Sunbury	1,305	5.0%	9,604	28.1%	4,203	16.7%
Manningham (C) - East	551	4.6%	4,051	25.7%	1,740	14.3%
Manningham (C) - West	2,745	3.5%	26,548	26.0%	11,844	14.4%
Melbourne (C) - Inner	562	3.7%	3,562	24.4%	1,220	12.9%
Melbourne (C) - Remainder	2,300	4.0%	15,441	25.6%	5,470	13.2%
Melbourne (C) - S'bank-D'lands	763	4.4%	4,283	24.7%	1,607	12.9%
Moreland (C) - Brunswick	1,635	4.2%	11,735	25.4%	5,558	15.8%

SLA	PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES		THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE	
	ESTIMATED NUMBER OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	ESTIMATED PERCENT (ASR PER 100) OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	OBESE PERSONS, 18 YEARS AND OVER (2007-08)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2007-08)
Moreland (C) - Coburg	1,541	3.9%	13,570	26.5%	6,881	17.7%
Moreland (C) - North	1,377	3.8%	13,151	26.5%	7,543	20.3%
Nillumbik (S) - South	1,018	4.6%	7,431	26.1%	3,189	14.4%
Nillumbik (S) - South-West	888	4.7%	6,384	26.1%	2,731	15.0%
Nillumbik (S) Bal	378	5.0%	2,692	27.9%	1,130	14.8%
Whittlesea (C) - North	1,061	4.8%	8,356	28.4%	3,489	16.9%
Whittlesea (C) - South-East	1,335	3.8%	11,583	26.0%	5,760	17.4%
Whittlesea (C) - South-West	1,694	3.5%	15,729	25.3%	10,822	22.7%
Yarra (C) - North	2,037	4.6%	13,113	25.7%	6,166	15.6%
Yarra (C) - Richmond	1,152	4.7%	7,228	25.6%	3,424	15.7%

A3 Human services

A3.1 Vulnerable groups

CODE	VULNERABILITIES / VULNERABLE GROUPS CLASSIFICATION
A	Older people
B	Socioeconomically disadvantaged people
C	CALD people
D	People with a disability
E	Children and young people
F	People with poor quality housing
G	People with mental health issues
H	People with alcohol and other drug issues
I	Victims of family violence
J	People with multiple and complex needs

A3.2 Vulnerability indicators and assessment

LGA	OLDER PEOPLE				SOCIO-ECONOMICALLY DISADVANTAGED PEOPLE		HOUSEHOLD ECONOMIC SITUATION	PEOPLE FROM CULTURALLY AND LINGUISTICALLY DIVERSE BACKGROUNDS (CALD)	
	% AGED 70 AND OLDER	% AGED 80 AND OVER	% AGED 70 AND OLDER 2031	% AGED 80 AND OVER 2031	SEIFA IRSAD (SEIFA INDEX OF RELATIVE SOCIO-ECONOMIC ADVANTAGE AND DISADVANTAGE - LOWER NUMBERS CORRESPOND TO GREATER DISADVANTAGE)	SEIFA IRSD (SEIFA INDEX OF RELATIVE SOCIO-ECONOMIC DISADVANTAGE - LOWER NUMBERS CORRESPOND TO GREATER DISADVANTAGE)	MEDIAN TOTAL HOUSEHOLD WEEKLY INCOME	% OF PEOPLE WHO SPEAK ANOTHER LANGUAGE AND SPEAK ENGLISH 'NOT WELL' OR 'NOT AT ALL'	% BORN OVERSEAS WHO SPEAK ENGLISH 'NOT WELL' OR 'NOT AT ALL'
Banyule	11.2%	5.0%	16.3%	7.3%	1,044	1,047	$1,394	2.0%	2.2%
Darebin	11.3%	4.9%	11.4%	4.9%	995	990	$1,178	6.4%	7.1%
Hume	5.9%	1.8%	10.6%	4.0%	950	952	$1,214	5.6%	6.3%
Manningham	13.6%	4.9%	19.4%	9.6%	1,081	1,071	$1,467	4.9%	5.4%
Melbourne	4.2%	1.6%	5.9%	2.3%	1,051	1,026	$1,352	3.9%	4.3%
Moreland	11.8%	5.2%	10.5%	4.6%	1,000	998	$1,215	5.8%	6.5%
Nillumbik	5.6%	2.0%	18.4%	6.8%	1,099	1,098	$1,872	0.3%	0.3%
Whittlesea	7.2%	2.4%	11.5%	5.0%	983	989	$1,275	5.9%	6.6%
Yarra	6.7%	2.6%	9.4%	3.8%	1,042	1,019	$1,680	5.0%	5.6%

LGA	PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES		VICTIMS OF FAMILY VIOLENCE	PEOPLE WITH A DISABILITY		CHILDREN AND YOUNG PEOPLE		
	ESTIMATED NUMBER OF PEOPLE CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, PERSONS AGED 18 YEARS AND OVER (2011-13)	ESTIMATED PERCENT (ASR PER 100) PEOPLE CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, PERSONS AGED 18 YEARS AND OVER (2011-13)	NUMBER OF FAMILY VIOLENCE INCIDENT	PERCENTAGE OF POPULATION WITH NEED FOR ASSISTANCE WITH CORE ACTIVITY (2011)	PERCENTAGE PERSONS AGED 0 TO 64 YEARS WITH A PROFOUND OR SEVERE DISABILITY AND LIVING IN THE COMMUNITY (2011)	% AGE 0-4 YOUNG CHILDREN	% 5-19 SCHOOL AGE YOUTHS	% AGE 0-4 YOUNG CHILDREN 2031
Banyule	2,776	2.9%	877	5.0%	2.1%	6.5%	17.3%	5.6%
Darebin	3,443	3.0%	873	6.3%	2.4%	6.5%	14.6%	5.9%
Hume	4,058	3.0%	1,756	5.6%	3.4%	7.5%	23.0%	7.6%
Manningham	2,370	2.6%	387	4.7%	1.6%	4.8%	18.1%	4.6%
Melbourne	2,723	3.0%	615	2.2%	0.9%	3.4%	10.4%	4.8%
Moreland	3,693	3.0%	876	6.6%	2.3%	6.5%	14.4%	6.2%
Nillumbik	1,325	2.7%	194	2.5%	1.5%	5.9%	23.3%	5.1%
Whittlesea	3,653	2.9%	1,231	5.4%	2.2%	7.4%	19.9%	7.4%
Yarra	2,093	3.0%	421	4.1%	1.6%	5.2%	9.9%	5.3%

LGA	HOMELESS PEOPLE AND THOSE AT RISK	PEOPLE WITH MENTAL HEALTH ISSUES	THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE		INDIGENOUS COMMUNITIES
	NO. OF PERSONS HOMELESS	REGISTERED MENTAL HEALTH CLIENTS (% OF POPULATION) (2011)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2011-13)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2011-13)	OBESE PERSONS, 18 YEARS AND OVER (2011-13)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2011-13)	ABORIGINAL POPULATION, USUAL RESIDENT POPULATION (CENSUS URP)
Banyule	463	0.90%	40,812	33.1%	19,038	24.5%	617
Darebin	992	1.14%	41,360	28.8%	22,403	25.1%	1,155
Hume	782	1.13%	47,669	27.1%	30,712	30.1%	1,047
Manningham	205	0.52%	32,988	27.7%	16,828	21.7%	152
Melbourne	1,254	0.89%	25,125	25.5%	7,972	13.5%	262
Moreland	782	1.14%	45,051	28.9%	24,131	25.2%	702
Nillumbik	76	0.52%	19,621	30.7%	9,659	24.6%	194
Whittlesea	458	0.97%	43,062	26.5%	28,658	29.6%	1,124
Yarra	726	1.24%	23,153	28.4%	7,933	15.5%	318

SLA	PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES		THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE	
	ESTIMATED NUMBER OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	ESTIMATED PERCENT (ASR PER 100) OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	OBESE PERSONS, 18 YEARS AND OVER (2007-08)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2007-08)
Banyule (C) - Heidelberg	2,151	4.3%	17,061	26.1%	7,311	14.5%
Banyule (C) - North	2,134	4.8%	14,959	26.5%	6,733	15.2%
Darebin (C) - Northcote	1,709	4.2%	12,751	25.3%	6,240	16.0%
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Manningham (C) - West	2,745	3.5%	26,548	26.0%	11,844	14.4%
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Melbourne (C) - S'bank-D'lands	763	4.4%	4,283	24.7%	1,607	12.9%
Moreland (C) - Brunswick	1,635	4.2%	11,735	25.4%	5,558	15.8%

SLA	PEOPLE WITH ALCOHOL AND OTHER DRUG ISSUES		THOSE WITH EXISTING ILLNESSES		OBESE AND OVERWEIGHT PEOPLE	
	ESTIMATED NUMBER OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	ESTIMATED PERCENT (ASR PER 100) OF PEOPLE AGED 18 AND OVER CONSUMING ALCOHOL AT LEVELS CONSIDERED TO BE A HIGH RISK TO HEALTH, (2007-08)	PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	PERCENT (ASR PER 100) PEOPLE WITH RESPIRATORY SYSTEM DISEASES (2007-08)	OBESE PERSONS, 18 YEARS AND OVER (2007-08)	PERCENT (ASR PER 100) OBESE PERSONS, 18 YEARS AND OVER (2007-08)
Moreland (C) - Coburg	1,541	3.9%	13,570	26.5%	6,881	17.7%
Moreland (C) - North	1,377	3.8%	13,151	26.5%	7,543	20.3%
Nillumbik (S) - South	1,018	4.6%	7,431	26.1%	3,189	14.4%
Nillumbik (S) - South-West	888	4.7%	6,384	26.1%	2,731	15.0%
Nillumbik (S) Bal	378	5.0%	2,692	27.9%	1,130	14.8%
Whittlesea (C) - North	1,061	4.8%	8,356	28.4%	3,489	16.9%
Whittlesea (C) - South-East	1,335	3.8%	11,583	26.0%	5,760	17.4%
Whittlesea (C) - South-West	1,694	3.5%	15,729	25.3%	10,822	22.7%
Yarra (C) - North	2,037	4.6%	13,113	25.7%	6,166	15.6%
Yarra (C) - Richmond	1,152	4.7%	7,228	25.6%	3,424	15.7%

A4 Industry

A4.1 Vulnerable groups

CODE	VULNERABILITIES / VULNERABLE GROUPS CLASSIFICATION
A	Outdoor workers
B	Agriculture land
C	Small businesses
D	Health care and social assistance
E	Transport services
F	Postal and warehousing
G	Retail trade

A4.2 Vulnerability indicators and assessment

LGA	OLDER PEOPLE	AGRICULTURE LAND		SMALL BUSINESSES		HEALTH CARE AND SOCIAL ASSISTANCE	
	% AGED 70 AND OLDER	PROPORTION OF AGRICULTURE LAND AT RISK OF FLOOD/ COASTAL THREATS (%)	PROPORTION OF AGRICULTURE LAND AT RISK OF BUSHFIRE (%)	PROPORTION OF COMMERCIAL LAND AT RISK OF FLOOD/ COASTAL THREATS (%)	PROPORTION OF COMMERCIAL LAND AT RISK OF BUSHFIRE (%)	NUMBER OF MAJOR HEALTH CARE FACILITIES AT RISK OF FLOOD/ COASTAL THREATS (%)	NUMBER OF MAJOR HEALTH CARE FACILITIES AT RISK OF BUSHFIRE (%)
Banyule	8.4	16.1	50.7	4.8	2.0	3.6	3.6
Darebin	6.3	-	-	11.8	-	12.0	-
Hume	10.0	3.2	100.0	1.2	24.6	3.8	-
Manningham	7.5	3.8	99.9	0.2	5.9	-	23.1
Melbourne	3.0	-	-	8.5	-	4.5	-
Moreland	6.7	-	-	6.0	-	-	-
Nillumbik	12.3	1.1	100.0	3.5	49.2	11.1	77.8
Whittlesea	10.5	0.3	99.6	4.2	6.2	-	20.0
Yarra	3.8	-	-	5.1	-	-	-

LGA	TRANSPORT SERVICES				POSTAL AND WAREHOUSING	RETAIL TRADE
	KILOMETRES ROADS AT RISK OF FLOOD OR COASTAL THREAT	KILOMETRES OF ROADS AT RISK FROM BUSHFIRE	KILOMETRES RAIL AT RISK OF FLOOD OR COASTAL THREAT	KILOMETRES OF RAIL AT RISK FROM BUSHFIRE	PROPORTION OF POPULATION WORKING IN TRANSPORT, POSTAL AND WAREHOUSING INDUSTRY (%)	PROPORTION OF POPULATION WORKING IN RETAIL TRADE INDUSTRY (%)
Banyule	62.3	61.2	0.1	0.4	3.7	9.7
Darebin	71.7	-	0.7	-	4.2	9.6
Hume	36.7	847.7	1.7	39.3	10.1	11.1
Manningham	61.9	374.8	-	-	3.1	12.4
Melbourne	44.5	-	9.6	-	2.6	7.7
Moreland	77.0	-	0.3	-	5.0	8.9
Nillumbik	46.0	1,337.7	1.9	12.4	3.5	9.9
Whittlesea	54.4	933.4	2.0	30.3	6.8	12.2
Yarra	47.2	-	0.1	-	2.2	7.7

A5 Infrastructure

A5.1 Vulnerable groups

CODE	VULNERABILITIES / VULNERABLE GROUPS CLASSIFICATION
A	Ground infrastructure (road, rail, bridge)
B	Public transport services
C	Power distribution and substations
D	Telecommunications infrastructure
E	Buildings
F	Stormwater, drainage and sewerage systems
G	Community infrastructure
H	Water reservoirs/catchments
I	Airports/ports/jetties
J	Data centres

A5.2 Vulnerability indicators and assessment

LGA	ROAD INFRASTRUCTURE		RAIL INFRASTRUCTURE			
	KILOMETRES OF MAIN (STATE DECLARED) ROADS AT RISK OF FLOOD OR COASTAL THREAT	KILOMETRES OF MAIN (STATE DECLARED) ROADS AT RISK FROM BUSHFIRE	KILOMETRES RAIL AT RISK OF FLOOD OR COASTAL THREAT	KILOMETRES OF RAIL AT RISK FROM BUSHFIRE	KILOMETRES OF TRAM NETWORK AT RISK OF FLOOD OR COASTAL THREAT	KILOMETRES OF TRAM NETWORK AT RISK OF BUSHFIRE
Banyule	3.2	5.2	0.1	0.4	0.7	-
Darebin	7.6	-	0.7	-	8.0	-
Hume	4.9	137.5	1.6	39.3	-	-
Manningham	6.2	28.8	-	-	-	-
Melbourne	12.9	-	9.7	-	34.3	-
Moreland	4.4	-	0.3	-	3.1	-
Nillumbik	2.7	98.8	1.9	12.5	-	-
Whittlesea	6.0	110.2	2.0	31.0	0.4	-
Yarra	14.3	-	0.1	-	15.6	-

LGA	ELECTRICITY AND GAS DISTRIBUTION		AIRPORTS/PORTS/ JETTIES
	KILOMETRES OF ELECTRICITY NETWORKS AT RISK FROM BUSHFIRE	KILOMETRES OF GAS NETWORKS AT RISK FROM BUSHFIRE	NUMBER OF AIRPORTS/ PORTS/ JETTIES AT RISK OF FLOOD/ COASTAL THREATS
Banyule	6.9	1.8	0
Darebin	-	-	0
Hume	55.7	0.4	1
Manningham	46.4	6.7	0
Melbourne	-	-	1
Moreland	-	-	0
Nillumbik	116.3	23.9	0
Whittlesea	48.3	42.2	0
Yarra	-	-	0

A6 Natural ecosystems

A6.1 Vulnerable groups

CODE	VULNERABILITIES / VULNERABLE GROUPS CLASSIFICATION
A	Species w unique habitat/limited capacity to migrate
B	Fragmented and stressed species / ecosystems
C	Aquatic and riparian ecosystems
D	Ecosystems susceptible to frequent floods/bushfire
E	Large old trees
F	Floodplains and associated red river gums
G	Grasslands
H	Slow moving fauna
I	Young trees and revegetation areas
J	Wetland environments

A6.2 Vulnerability indicators and assessment

LGA	SPECIES WITH UNIQUE HABITAT AND LIMITED CAPACITY TO MIGRATE	ECOSYSTEMS SUSCEPTIBLE TO FREQUENT FLOODS/BUSHFIRE	
	AREA OF NATIVE VEGETATION COVER BY VEGETATION TYPE/COMMUNITY (EVCS) (SQUARE KILOMETRES)	PROPORTION OF EVCS IN FLOOD OVERLAY	PROPORTION OF EVCS IN BUSHFIRE OVERLAY
Banyule	7.7	41.9	49.7
Darebin	0.8	13.9	-
Hume	82.9	3.0	93.4
Manningham	46.4	12.5	97.7
Melbourne	2.2	10.5	-
Moreland	0.2	51.5	-
Nillumbik	290.8	2.2	98.9
Whittlesea	169.7	0.3	95.8
Yarra	2.1	61.4	-

APPENDIX B - RISK TABLES BY SECTOR

B1 Risk assessment

B1.1 Likelihood

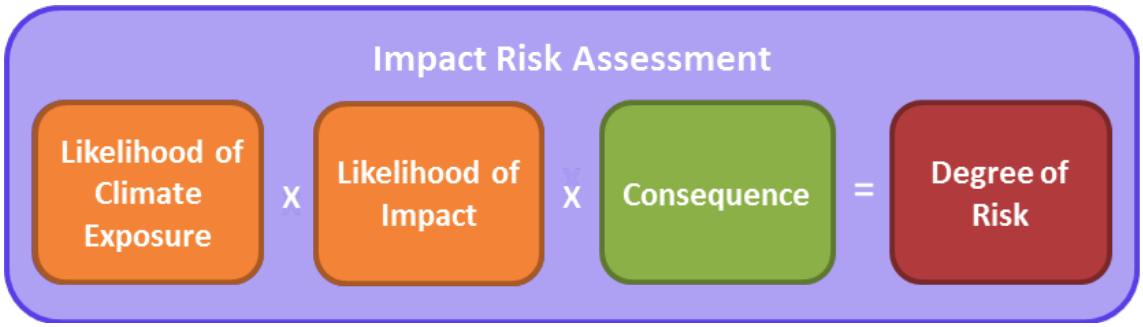
TERM	LIKELIHOOD OF THE OUTCOME	LIKELIHOOD SCORE
Virtually certain	99–100 per cent probability	9
Extremely likely	95–100 per cent probability	8
Very likely	90–100 per cent probability	7
Likely	66–100 per cent probability	6
About as likely as not	33–66 per cent probability	5
Unlikely	0–33 per cent probability	4
Very unlikely	0–10 per cent probability	3
Extremely unlikely	0–5 per cent probability	2
Exceptionally unlikely	0–1 per cent probability	1

B1.2 Consequence

TERM	SCORE	DESCRIPTION OF IMPACT BY SECTOR				
		EMERGENCY MANAGEMENT	HUMAN SERVICES	INFRASTRUCTURE	INDUSTRY	NATURAL ECOSYSTEMS
Massive	5	Emergency management would fall into decay and cease to be effective	Large numbers of serious injuries or loss of lives; and / or chronic health effect requiring medical treatment for 10-15% of population at-risk; and / or severe and widespread disruption to communities impacting a multitude of health determinants	Complete breakdown of service/s within the community	Community-wide business decline leading to widespread business losses, failure and hardship. Severe shortages of personnel and loss of key supply or distribution channels.	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage
Major	4	Emergency management would struggle to remain effective and would be seen to be in danger of failing completely	Isolated instances of serious injuries or loss of lives; and / or chronic health effect requiring medical treatment for <5-10% of population at-risk; and / or significant, widespread disruption to communities impacting numerous health determinants	Severe and widespread decline in service/s within the community	Failure or major disruption of a local industry or key businesses, creating noticeable impacts at the community level; and /or community-wide stagnation of growth. Some operations affected by significant supply chain and resource issues.	Severe loss of environmental amenity and a danger of continuing environmental damage
Moderate	3	Emergency management would be under severe pressure on several fronts	Small numbers of injuries; and / or chronic health effect requiring medical treatment for 2-5% of population at-risk; and / or significant disruption to some communities impacting several health determinants	General appreciable decline in service/s	Significant general reduction in economic performance relative to current forecasts. Cases of business failure unlikely but impacts to productivity noticed by the community.	Isolated but significant instances of environmental damage that might be reversed with intensive efforts

TERM	SCORE	DESCRIPTION OF IMPACT BY SECTOR				
		EMERGENCY MANAGEMENT	HUMAN SERVICES	INFRASTRUCTURE	INDUSTRY	NATURAL ECOSYSTEMS
Minor	2	Isolated instances of emergency management being under severe pressure	Serious near misses or minor injuries; and / or chronic health effect requiring medical treatment for >1-2% of population at-risk; and / or short-term disruption to some communities, temporarily impacting a few determinants of health	Isolated but noticeable examples of decline in service/s	Individually significant but isolated areas of reduction in economic performance relative to current forecasts. Requires adaptive/preventative responses from business owners.	Minor instances of environmental damage that could be reversed
Negligible	1	There would be minor instances of emergency management being under more than usual stress but it could be managed	Appearance of a threat but no actual harm; and / or no chronic health effect requiring medical treatment; and / or a very minor disruption to a small section of the community have no impact on determinants of health	There would be minor areas in which the region was unable to maintain its current service/s	Minor shortfall relative to current forecasts for shareholder value, growth, supply chain, human resources and / or compliance. Does not require special remedial action from business owners.	No environmental damage

B1.3 Impact risk assessment



		CONSEQUENCE				
COMBINED LIKELIHOOD	SCORE	SCORE				
TERM	0	1	2	3	4	5
Exceptionally unlikely	1	L	L	L	L	M
Exceptionally unlikely	2	L	L	L	L	M
Exceptionally unlikely	3	L	L	L	L	M
Exceptionally unlikely	4	L	L	L	L	M
Exceptionally unlikely	5	L	L	L	L	M
Exceptionally unlikely	6	L	L	L	L	M
Exceptionally unlikely	7	L	L	L	L	M
Exceptionally unlikely	8	L	L	L	L	M
Exceptionally unlikely	9	L	L	L	L	M
Extremely unlikely	10	L	L	L	M	M
Extremely unlikely	11	L	L	L	M	M
Extremely unlikely	12	L	L	L	M	M
Extremely unlikely	13	L	L	L	M	M
Extremely unlikely	14	L	L	L	M	M
Extremely unlikely	15	L	L	L	M	M
Extremely unlikely	16	L	L	L	M	M

		CONSEQUENCE				
COMBINED LIKELIHOOD	SCORE	SCORE				
TERM	0	1	2	3	4	5
Extremely unlikely	17	L	L	L	M	M
Extremely unlikely	18	L	L	L	M	M
Very unlikely	19	L	L	M	M	M
Very unlikely	20	L	L	M	M	M
Very unlikely	21	L	L	M	M	M
Very unlikely	22	L	L	M	M	M
Very unlikely	23	L	L	M	M	M
Very unlikely	24	L	L	M	M	M
Very unlikely	25	L	L	M	M	M
Very unlikely	26	L	L	M	M	M
Very unlikely	27	L	L	M	M	M
Unlikely	28	L	M	M	M	H
Unlikely	29	L	M	M	M	H
Unlikely	30	L	M	M	M	H
Unlikely	31	L	M	M	M	H
Unlikely	32	L	M	M	M	H
Unlikely	33	L	M	M	M	H
Unlikely	34	L	M	M	M	H
Unlikely	35	L	M	M	M	H
Unlikely	36	L	M	M	M	H
About as likely as not	37	M	M	M	M	H
About as likely as not	38	M	M	M	M	H
About as likely as not	39	M	M	M	H	H

		CONSEQUENCE				
COMBINED LIKELIHOOD	SCORE	SCORE				
TERM	0	1	2	3	4	5
About as likely as not	40	M	M	M	H	H
About as likely as not	41	M	M	M	H	H
About as likely as not	42	M	M	M	H	H
About as likely as not	43	M	M	M	H	H
About as likely as not	44	M	M	M	H	H
About as likely as not	45	M	M	M	H	H
Likely	46	M	M	H	H	E
Likely	47	M	M	H	H	E
Likely	48	M	M	H	H	E
Likely	49	M	M	H	H	E
Likely	50	M	M	H	H	E
Likely	51	M	M	H	H	E
Likely	52	M	M	H	H	E
Likely	53	M	M	H	H	E
Likely	54	M	M	H	H	E
Very likely	55	M	H	H	E	E
Very likely	56	M	H	H	E	E
Very likely	57	M	H	H	E	E
Very likely	58	M	H	H	E	E
Very likely	59	M	H	H	E	E
Very likely	60	M	H	H	E	E
Very likely	61	M	H	H	E	E

		CONSEQUENCE				
COMBINED LIKELIHOOD	SCORE	SCORE				
TERM	0	1	2	3	4	5
Very likely	62	M	H	H	E	E
Very likely	63	M	H	H	E	E
Extremely likely	64	H	H	E	E	E
Extremely likely	65	H	H	E	E	E
Extremely likely	66	H	H	E	E	E
Extremely likely	67	H	H	E	E	E
Extremely likely	68	H	H	E	E	E
Extremely likely	69	H	H	E	E	E
Extremely likely	70	H	H	E	E	E
Extremely likely	71	H	H	E	E	E
Extremely likely	72	H	H	E	E	E
Virtually certain	73	H	E	E	E	E
Virtually certain	74	H	E	E	E	E
Virtually certain	75	H	E	E	E	E
Virtually certain	76	H	E	E	E	E
Virtually certain	77	H	E	E	E	E
Virtually certain	78	H	E	E	E	E
Virtually certain	79	H	E	E	E	E
Virtually certain	80	H	E	E	E	E
Virtually certain	81	H	E	E	E	E

B2 Emergency management

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Increased demand on emergency services agencies as a result of extreme events	Regional				1					1	6	7	4	H	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct	Increased "worst case" impact bushfire events	Outer Ring Councils									1	6	5	5	H	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased medium impact heatwave events	Regional			1							6	7	2	M	Department of Justice (DoJ) (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased "worst case" impact heatwave events	Regional			1							6	4	4	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased medium impact flooding events	Regional				1						6	7	2	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased "worst case" impact flooding events	Regional				1						6	4	5	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased medium impact storm events	Regional				1				1		6	7	2	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Increased "worst case" impact storm events	Regional				1				1		6	4	5	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Direct	Increased medium impact bushfire events	Outer Ring Councils									1	6	7	2	M	DoJ (2014) Emergency Risks in Victoria: Report of the 2012-13 State Emergency Risk Assessment
Indirect	Climate change induced increased public disorder will lead to pressure on police force	Regional	1			1		1	1		1	6	5	3	M	City of Melbourne (2009) Climate Change Adaptation Strategy
Indirect	Adverse health outcomes due to emergency services being hindered by storm and flood impacts, such as flooded roads, traffic delays and other blockages	Regional				1				1		6	6	4	M	City of Melbourne (2009) Climate Change Adaptation Strategy
Indirect	Need for increased preparation with emergency management with implications for future city developments/planning (consider increased population in inner urban areas where poor infrastructure is designed for historic flooding requirements)	Regional				1						6	6	2	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Direct	Overland flow issues, including blockage of drains.	Regional				1						6	6	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Prioritisation / modification / decline in routine council services (exhaustion of staff from heat)	Regional			1							6	5	2	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Indirect	Impacts on EM personnel (e.g. ageing population makes up a significant proportion of the volunteer base, yet is one of the at risk groups)	Regional			1						1	6	5	2	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Direct	Heatwave [or emergency event] restricting the ability of staff to respond	Regional			1	1					1	6	6	2	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Direct	Impacts of heatwave on ambulance services (increased number of calls, unexpected calls, environment in which paramedics are working)	Regional			1	1					1	6	7	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Indirect	Increasing community, government and whole of economy costs of recovery	Regional				1					1	6	6	3	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Indirect	Inability to respond over the long term	Regional				1					1	6	5	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Indirect	Impact on business continuity	Regional				1					1	6	7	2	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Impact on council services due to bushfire [or floods] restricting road usage and access	Regional				1					1	6	6	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Indirect	Reduced capacity to deal with subsequent / multiple events	Regional				1					1	6	6	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Indirect	Reduced capacity of medical services during bushfire [or other emergency] event	Regional				1					1	6	6	4	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014
Direct	Smoke due to bushfires	Regional									1	6	7	3	M	NAGA IRVA – Emergency Management Workshop – 29 July 2014

B3 Human Services

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	More premature deaths	Regional			1							6	8	5	E	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Direct	Higher incidence of heat-related illnesses, such as exhaustion, heatstroke and related effects such as falls	Regional			1							6	8	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Direct	Exacerbation of existing health conditions, such as predisposition to heart attack and kidney disease	Regional			1							6	7	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Direct	Higher incidence of mental and behavioural disorders	Regional			1							6	7	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Direct	Higher incidence of respiratory illness, such as asthma attacks	Regional									1	6	8	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Higher incidence of mental health problems, including trauma and longer term disruptions to social systems	Regional									1	6	7	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Direct	Increased food- and water-borne illness due to contamination or disruption to essential services affecting fire-prone communities	Regional									1	6	7	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Injuries and deaths across a range of community members due to bushfire	Outer Ring Councils									1	6	7	5	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Exacerbation of pre-existing conditions during the event and inability to readily access treatment or medication post event	Regional									1	6	7	4	H	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Inability to communicate with vulnerable populations if power or communication network are impacted	Regional				1					1	6	7	4	H	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Inability of council / essential services to respond to flood or bushfire event, due to: • Workforce not physically able to attend work • Supply chain – good (fuel) and services (employees) for agencies are not able to be provided • Assets are damaged and not operable – power supply	Regional				1	1				1	6	7	4	H	NAGA IRVA – Human Services Workshop – 21 July 2014
Direct	People placing themselves at risk to access vulnerable individuals	Regional				1					1	6	7	4	H	NAGA IRVA – Human Services Workshop – 21 July 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Complete collapse of commercial operations due to inadequate insurance, recovery costs, lack of return custom – leading to wider socioeconomic impacts in the area	Regional				1					1	6	7	5	H	NAGA IRVA – Human Services Workshop – 21 July 2014
Direct	More injuries, drowning and other accidental deaths	Regional				1						6	7	4	H	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Higher incidence of allergies caused by pollen, affecting those with existing illnesses, those in hotter climates	Regional	1	1								6	7	3	M	Department of Health (DOH) (2012a) Climate change, health and vulnerabilities Integrated impact assessment methodology: Technical report DOH (2012b) Municipal public health and wellbeing planning - Having regard to climate change DOH (2013) Climate Change Vulnerability Benchmarking Report DOH (2008) Health impacts of climate change: Adaptation strategies for Western Australia
Indirect	Higher incidence of mosquito - borne diseases, affecting those with existing illnesses, those in hotter climates	Regional	1	1								6	5	4	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Higher incidence of food- and water-borne diseases, affecting those with existing illnesses, those in hotter climates	Regional	1	1								6	5	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Higher incidence of domestic violence	Regional		1	1							6	5	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Loss of income for casual workers who are not able to work during heatwave conditions	Regional		1	1							6	7	2	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Power disruption impacting the viability of designated 'cooling' centres.	Regional		1	1							6	5	4	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Inability to deliver services to those vulnerable due to public transport disruption, leading to wider transport network disruption.	Regional		1	1							6	6	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Individuals refusing to move to cool centres as refuse to leave pets and animals behind, resulting in impacts	Regional		1	1							6	5	4	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Confusion over interaction with bushfire 'code red' actions.	Regional		1	1						1	6	5	4	M	NAGA IRVA – Human Services Workshop – 21 July 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Loss of income during recovery phase – increased financial stress and subsequent health and social impacts	Regional									1	6	6	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Immediate loss of essential services and communications infrastructure - subsequent multiple and compounding impacts when managing vulnerable groups	Regional									1	6	6	4	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Direct	Long term impacts on essential infrastructure and building stock critical to the human services sector	Regional				1					1	6	5	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Higher incidence of infectious disease, such as from contaminated food and water supplies	Regional				1						6	6	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Higher incidence of mosquito -borne diseases, if combined with warm weather	Regional				1						6	6	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Increased risk of respiratory illness from mould	Regional				1						6	5	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Higher incidence of mental health problems due to trauma, social dislocation, loss of income and longer term disruptions to social systems	Regional				1				1		6	5	4	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Exacerbation of existing illnesses from reduced access to healthcare	Regional				1				1		6	5	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Reduced access to fresh, healthy food and clean water	Regional				1				1		6	4	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Increased food- and water-borne illness due to contamination or disruption to essential services such as electricity, water and sewerage	Regional				1				1		6	4	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Social and economic impacts associated with recovery from flood events	Regional				1						6	5	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Higher incidence of mental health problems, including suicidal behaviour, from loss of income and morale and disruptions to social systems	Regional					1					5	6	4	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Reduced access to fresh, healthy food from reduced food yield within and outside the NAGA region	Regional					1					5	6	3	M	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Higher incidence of illness from contaminated water supplies and reduced hygiene due to water shortage	Regional					1					5	4	3	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Potential for reduced physical activity due to degradation of public open space and sporting and recreation facilities	Regional					1					5	6	2	M	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)
Indirect	Reduced food security due to changing rainfall patterns, more very hot days and soil erosion	Regional	1	1	1	1	1					6	6	3	M	Burton, P et al (2013) Urban food security, urban resilience and climate change, NCCARF
Indirect	Reduced food security due to disruption to supply lines as a result of floods and very hot days	Regional	1	1	1	1						6	6	4	M	Burton, P et al (2013) Urban food security, urban resilience and climate change, NCCARF
Indirect	Major power disruption due to brown outs impacting on high rise. Not just those in public housing, but also non-traditional vulnerable groups, such as Southbank towers.	Inner Ring Councils		1	1							6	6	2	M	NAGA IRVA – Human Services Workshop – 21 July 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	School closure impacting on availability of council staff and contributing to traffic disruption.	Regional		1	1						1	6	5	1	L	NAGA IRVA – Human Services Workshop – 21 July 2014
Indirect	Injuries due to carrying buckets of grey water for garden watering	Regional					1					5	5	2	L	DOH (2012a), DOH (2012b), DOH (2013), DOH (2008)

B4 Industry

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Extreme weather leading to reduced primary production	Outer Ring Councils			1	1	1			1		6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Indirect	Extreme weather leading to power disruption	Regional			1	1	1			1		6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Extreme weather leading to property damage/increasing insurance claims, disruption of power, transport and communication. Strip retail is particularly vulnerable.	Regional			1	1				1		6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Business closure and job loss due to business interruption from storm damage and flooding	Regional				1						6	7	4	H	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Increased heat stress in employees working outdoors, such as construction, heavy industry, defence, emergency services, postal services and couriers	Regional	1	1	1							6	7	4	H	CEDA (2014) The Economics of Climate Change

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Bushfires leading to reduced primary production and property damage	Outer Ring Councils									1	6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Indirect	Bushfires leading to increasing disruption of power, transport and communication	Regional									1	6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Indirect	Bushfires leading to increasing insurance claims.	Regional									1	6	7	4	H	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Extreme weather leading to property damage	Regional			1	1	1			1		6	6	3	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Extreme weather leading to increased insurance claims	Regional			1	1				1		6	7	2	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Extreme weather leading to disruptions in communication	Regional			1	1				1		6	7	3	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria

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DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Extreme weather leading to transport disruption	Regional			1	1				1		6	7	3	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Indirect	Scale down of business operations with potential closure and job losses due to business interruption from storm damage and flooding	Regional				1						6	7	3	M	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Indirect	Lost tourism following storms or intense rainfall events	Regional				1						6	6	3	M	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Direct	Drought leading to reduced primary production, reduction in hydroelectricity generation	Outer Ring Councils					1					5	6	4	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Indirect	Climatic events that occur outside of the region and impact the ability to supply input goods and services, in particular for food processing, will impact businesses in the region.	Regional	1	1		1	1				1	6	5	3	M	NAGA IRVA – Industry Workshop – 5 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Degrading building materials leading to increased maintenance costs for infrastructure as increasing mean temperatures and CO2 concentrations will shorten life of concrete and other building materials	Regional	1	1								6	5	2	M	Commissioner for Environmental Sustainability (2012) Foundation Paper One: Climate Change Victoria
Direct	Reduced productivity due to increasing maximum daily temperatures	Regional	1	1	1							6	6	3	M	CEDA (2014) The Economics of Climate Change
Direct	Increased rate of equipment failure and maintenance costs on essential infrastructure such as electricity, communications and rail due to extreme heat	Regional	1	1	1							6	6	3	M	CEDA (2014) The Economics of Climate Change
Direct	Negative health impacts for employees and employers due to extreme heat. Can result in increased accident rates.	Regional	1	1	1							6	7	3	M	CEDA (2014) The Economics of Climate Change
Indirect	Business interruption due to electricity blackout	Regional	1	1	1						1	6	7	3	M	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Indirect	Cancellation of events and festivals due to extreme weather and/or heat	Regional	1	1	1	1					1	6	6	2	M	City of Melbourne (2009) Climate Change Adaptation Strategy

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Perishable stock reliant businesses impacted due to elevated temperatures. Impacts will differ depending on the type of business and stock.	Regional		1	1							6	7	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Change in demand for goods and services. Secondary impacts of the event on the customer experience, potentially resulting from impacts on the transport network.	Regional				1						6	6	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Increased demand for emergency response planning/ business continuity planning and the constraint on resourcing available to do so (e.g. 90% of business in the City of Whittlesea are small businesses)	Regional			1	1	1				1	6	5	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Increase in the extent of leave days taken by staff, impacts on productivity.	Regional			1	1						6	6	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Loss of horticultural assets	Outer Ring Councils			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Reduced peri-urban agricultural production	Outer Ring Councils			1		1					6	6	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Increased operational costs of air-conditioning and other cooling equipment during heatwaves	Regional			1							6	7	2	M	City of Melbourne (2014) 2014 Heatwave Business Impacts - Social Research
Direct	Reduced level of comfort for the workforce during heatwaves	Regional			1							6	6	2	M	City of Melbourne (2014) 2014 Heatwave Business Impacts - Social Research
Indirect	Reduced motivation and morale of the workforce during heatwaves	Regional			1							6	6	2	M	City of Melbourne (2014) 2014 Heatwave Business Impacts - Social Research
Direct	Decrease in the quality of output during heatwave conditions, leading to increased costs of reworking.	Regional			1							6	6	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Increased privatisation of public spaces that are required to address the UHI, negatively impacting on business.	Regional			1							6	5	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Loss of topsoil impacting agricultural productivity	Outer Ring Councils				1						6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	General disruption to customers/ operations and suppliers as other personal (e.g. pets), priorities take over.	Regional				1				1	1	6	5	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Inadequate or narrowly defined insurance coverage impacting the post-recovery of a business.	Regional				1				1	1	6	6	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Impact on business assets (e.g. equipment failure)	Regional				1					1	6	7	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Impact on essential services and traditional safe havens, such as shopping centres, leading to wider traffic and hence economic disruption (e.g. Wollert fires and the closure of the Northern Hospital and Epping Plaza)	Regional				1					1	6	7	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Opening of relief centres and the impact on council staff and their ability to undertake usual council business.	Regional				1					1	6	6	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Impact on businesses that volunteer as relief centre, e.g. Kilmore Race Track.	Regional				1					1	6	5	2	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	Reduced ability of business to recover post event and operate profitably.	Regional				1					1	6	5	3	M	NAGA IRVA – Industry Workshop – 5 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Indirect	Reduced ability of staff to function during and after an event when they may be suffering from the trauma of the actual event and its impact on their neighbourhood, surrounding community. The post event period may last significantly longer than a business will anticipate.	Regional				1					1	6	5	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Real estate values impacted by the inclusion of bushfire overlays on new areas.	Outer Ring Councils									1	6	6	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Direct	Smoke disrupting the logistical operations of a region, for example the Hume Freeway or the Melbourne to Sydney rail freight corridor.	Regional									1	6	6	3	M	NAGA IRVA – Industry Workshop – 5 August 2014
Indirect	General disruption to customers/ operations and suppliers as other personal (e.g. pets), priorities take over.	Regional			1							6	5	1	L	NAGA IRVA – Industry Workshop – 5 August 2014

B5 Infrastructure

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
TRANSPORT																
Direct	Passengers become stranded as trains to the City of Melbourne are delayed / cancelled in hot weather	Regional	1	1	1							6	8	4	H	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Direct	Disruption to transport network operations	Regional			1	1				1	1	6	8	3	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Power outage impacts on road transport – traffic light, freeway management systems, Intelligent Transport Systems (ITS) and ongoing maintenance activities. Power outage impacts on rail transport – power and substation impacts.	Regional			1	1					1	6	7	5	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Train and tram derailments / accidents result in injuries and major disruptions	Regional			1	1						6	5	5	H	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Indirect	Increased reliance on the road network if there is a cessation or truncation of PT services in a particular area.	Regional			1						1	6	7	4	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Mass stranding of people due to public transport stoppages, as a result of flooding or storm damage	Regional				1						6	8	4	H	DIICSRTE (2013) City of Melbourne Climate Change Adaptation Strategy and Action Plan
Indirect	Access to emergency shelters, medical services, automated teller machines (ATMs) impinged by impacts to the transport network.	Regional				1						6	5	5	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Tram network – 9 classes of trams, older trams more susceptible to climatic conditions. Older trams struggle with temperatures over 36 degrees.	Regional		1	1	1	1				1	6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Traffic light system can go down, which impacts transport network. Tends to be localised impact.	Regional			1						1	6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Extreme event impacts to airport operations	Regional				1				1	1	6	7	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Storm damage to bridges	Regional				1				1		6	4	4	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Tunnel flooding	Regional				1						6	6	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Impact on bridge structures, in particular wooden council bridges	Regional				1						6	6	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Downed trees blocking road ways and blocking access for emergency crews to repair services, such as power.	Regional				1						6	6	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Fuel shortages caused by blockage of the transport network impacting on the ability to use private vehicles.	Regional				1						6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Disruption to the community and economic impacts that flow from this.	Regional				1						6	6	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Salt water encroachment from sea level rise and storm surge can have significant corrosive impacts overtime and lead to short circuiting of networks.	City of Melbourne				1						6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Indirect impact through an increase in water costs leading a general reduction in economic activity and a reduction in travel / patronage.	Regional					1					5	7	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Gradual reduction in groundwater availability for activities that rely on it (e.g. construction).	Regional					1					5	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Access to emergency shelters becomes inhibited.	Regional									1	6	6	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Visibility impacts on drivers.	Regional									1	6	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Localised congestion impact on emergency and essential service delivery.	Regional									1	6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Storm impacts on ports and coastal infrastructure	City of Melbourne				1			1			5	6	4	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Rail track movement	Regional			1	1	1					6	4	2	L	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Road foundations degradation	Regional				1						6	4	2	L	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Bridge structural material degradation	Regional				1						6	3	3	L	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Positive impact on road base as it dries out overtime. Potential secondary impact as road agencies need to ensure there is sufficient funding in their budgets to account for periods of high rainfall that will increase maintenance requirements.	Regional					1					5	6	1	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Difficulty in sourcing non-potable water for construction of transport projects during drought conditions.	Regional					1					5	5	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Increased sediment flow and runoff during first rains following a drought period.	Regional					1					5	5	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Road furniture and sidings damaged. Fire has to be very hot to impact asphalt.	Regional									1	6	4	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Direct	Sea level rise impacts on port infrastructure materials	City of Melbourne							1			4	6	2	L	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
WATER																
Direct	Storm water drainage and flooding damage	Regional	1	1	1	1	1		1			6	7	4	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Damage to water supply infrastructure due to heavy rainfall events / flooding	Regional				1						6	5	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Contamination of water supplies	Regional				1						6	6	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Reduced quality of green assets (e.g. street trees and active open space)	Regional					1					5	6	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Increased urban heat island effect	Regional					1					5	6	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Water shortage	Regional	1	1	1	1	1					6	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Degradation and failure of sewer piping	Regional	1	1	1	1	1					6	6	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Sewer spills to rivers and bays	Regional				1			1			5	6	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Degradation and failure of drainage infrastructure due to heavy rainfall events / flooding	Regional				1						6	7	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Pollution of waterways due to heavy rainfall events / flooding	Regional				1						6	6	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Slumping embankments	Regional				1						6	6	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Existing stormwater quality treatment systems may become stressed as a consequence of decreased rainfall and increased evaporation	Regional					1					5	7	3	M	City of Melbourne (2009) Climate Change Adaptation Strategy

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Direct	Impacts to water quality from increased risks of algal bloom	Regional					1					5	6	4	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Tree roots intrude into drainage systems looking for water	Regional					1					5	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Blockage of drainage infrastructure due to lack of natural flushing	Regional					1					5	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Failure/cracking of drainage/ water supply/sewage infrastructure due to drought	Regional					1					5	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Bushfire damage on catchment and storage	Regional									1	6	5	4	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Pollution of waterways due to bushfire	Outer Ring Councils									1	6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Impacts to water supply infrastructure (including bushfire damage to power supply)	Outer Ring Councils									1	6	6	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Blockage of drainage systems due to bushfire ash and debris	Outer Ring Councils									1	6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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POWER																
Direct	Damage to above ground telecommunications vital points of access (e.g. access to sub-transmission, substations)	Regional				1					1	6	5	5	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Degradation and failure of foundations for buildings and structures	Regional	1	1	1	1	1					6	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Increase in demand pressure blackouts	Regional	1	1	1							6	7	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Indirect	Impacts to evaporative cooling units (e.g. cooling towers)	Regional			1							6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Disruptions for coal – supply for generation	Regional				1	1		1			5	4	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Substation flooding	Regional				1			1			5	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

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			1	2	3	4	5	6	7	8	9					
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Direct	Reduction in hydroelectricity generation	Regional				1						6	5	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Reduction of coal electricity generation	Regional				1						6	5	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Contamination of water supplies	Regional				1						6	6	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Reduced quality of green assets (e.g. street trees and active open space)	Regional					1					5	6	5	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Flooding of underground high voltage infrastructure (e.g. Brunswick)	Regional				1						6	4	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Heat impacts on sagging lines requiring increased maintenance	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Tree fall likelihood on overhead lines	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Increased demand for electricity. Impacts on service delivery	Regional					1					5	7	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Direct	Damage to above ground transmission due to heavy rainfall events, flooding and / or high winds	Regional				1				1		6	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Damage to above ground electricity/gas transmission due to bushfire	Regional									1	6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Damage to above ground electricity/gas facilities (e.g. substations, transformers)	Regional				1					1	6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	More localised failures of network infrastructure	Regional					1					5	5	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Tree root network following water and impacting underground cabling infrastructure	Regional					1					5	4	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
TELECOMMUNICATIONS																
Direct	Damage to above ground electricity/gas vital points of access (e.g. access to exchange points)	Regional				1					1	6	5	5	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Degradation and failure of foundations for buildings and structures	Regional	1	1	1	1	1					6	4	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

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Indirect	Impacts to evaporative cooling units (e.g. cooling towers)	Regional			1							6	5	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Impacts due to wind on above ground cabling/wires/networks	Regional				1				1		6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Damage to above ground transmission due to heavy rainfall events, flooding and / or high winds	Regional				1				1		6	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Temporary impacts of below ground telecommunications (fibre optics)	Regional				1					1	6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Damage to above ground telecommunications transmission due to bushfire	Regional									1	6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Flooding of exchanges and underground pits, manholes and networks	Regional				1			1			5	6	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Indirect	Increased chance of trees falling on overhead lines due to drought	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	More localised failures of network infrastructure	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
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BUILDINGS																
Direct	Increased bushfire damage to buildings and structures	Outer Ring Councils									1	6	8	3	H	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Loss of buildings to fire	Outer Ring Councils									1	6	7	4	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Degradation and failure of foundations for buildings and structures	Regional	1	1	1	1	1					6	4	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Degradation and failure of urban facilities' materials	Regional	1	1	1							6	4	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Direct	Reduced useful life expectancy of urban infrastructure leading to an increase in maintenance costs	Regional			1		1					6	6	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Increased storm and flood damage to urban facilities	Regional				1				1		6	5	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria

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Direct	Increase in demand pressure blackouts	Regional	1	1	1							6	7	2	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Indirect	Electronic building systems failure (e.g. controls stop working, ventilation locks or total HVAC failure due to inundation or power loss)	Regional				1						6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Contamination of mains water (especially for water treatment is located in a basement. Childcare at particular risk).	Regional				1						6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Increased fire risk due to dried vegetation around buildings	Outer Ring Councils					1					5	7	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Tree limbs dropping due to health decline	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Increased termite activity leading to structural damage	Regional					1					5	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Overstretched buildings (e.g. relief centres)	Regional									1	6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	HVAC unable to cope leading to loss of air quality/smoke	Regional									1	6	4	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Indirect	Under-resourced buildings unable to provide business-as-usual services due to high concentrations of people (Consider toilet paper, bottled water, etc.).	Regional									1	6	6	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Coastal storm surge and flooding to urban facilities	City of Melbourne				1			1			5	4	3	M	IPCC AR5 (2013); CSIRO, Maunsell and Phillips Fox (2006) Infrastructure and Climate Change Risk Assessment for Victoria
Indirect	Damage to building fabric, fittings and equipment (e.g. gutter overflow)	Regional				1						6	4	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	HVAC systems becoming dustier and working harder. May be less effective and require more maintenance	Regional					1					5	3	3	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Unreliable power supply resulting in the closure of services (especially air conditioning)	Regional					1					5	4	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Unserviceable outdoor areas (e.g. childcare)	Regional					1					5	4	1	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Reduced water for cooling systems	Regional					1					5	4	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Rain harvesting system degrading from a lack of use	Regional					1					5	6	1	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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COMMUNITY INFRASTRUCTURE																
Direct / Indirect	Risk to life from damaged community infrastructure	Regional				1						6	5	5	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Economic cost of rebuilding	Regional									1	6	7	4	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Damage to infrastructure of open spaces (e.g. loss of sports field surface, surface too hard or cracked)	Regional			1		1					6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Localised disruption of access to community services (including staff access)	Regional				1						6	6	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Localised essential service disruption	Regional				1						6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Community cost of infrastructure reinstatement - including the ability to react to other emergencies	Regional				1						6	5	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Loss of recreation and community events – usually long term impacts	Regional				1						6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
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Indirect	Post flood impact on infrastructure and community wellbeing (e.g. changes in soil structure)	Regional				1						6	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Unavailability of sporting ovals (impact on community sports and social networks, creates significant unease)	Regional					1					5	7	4	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Loss of function of recreational lakes and waterways – impacts fishing, boating, passive recreation, aquatic services	Regional					1					5	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Economic cost of watering and maintaining green infrastructure during drought	Regional					1					5	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Community facilities destroyed	Regional									1	6	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Loss of community access to property during fire and post recovery	Outer Ring Councils									1	6	6	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Loss of communications	Regional									1	6	6	2	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
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Direct	Loss of open space, parks and gardens due to bushfire	Outer Ring Councils									1	6	5	2	H	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Direct	Loss of green space – including trees, streetscapes, parks and gardens, community and heritage impacts	Regional					1					5	5	2	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Water features, pools and fountains emptied/ turned off – community/ amenity impacts and long term damage to infrastructure (cracking)	Regional					1					5	6	1	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Impact of fire trucks on open space and road infrastructure	Regional									1	6	5	1	L	NAGA IRVA – Infrastructure Workshop – 7 August 2014

B6 Natural ecosystems

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Destruction of habitat	Regional				1					1	6	8	5	E	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Increased threats to species with unique habitat and limited capacity to migrate	Regional	1			1	1				1	6	7	5	H	DEPI (2013) Victorian Climate Change Adaptation Plan
Indirect	Change in timing of seasonal events, such as arrival of birds and butterflies, flowering of plants, impacting on the viability of certain species	Regional	1	1								6	6	5	H	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct / Indirect	Increased fire risk	Regional			1		1				1	6	6	5	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Reduced integration of environmental assets in urban planning due to changed community perception	Regional				1						6	7	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Community impact of loss of environmental services: including wetlands (water treatment), and open space (recreation)	Regional				1						6	7	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Erosion of banks in natural waterways (General)	Regional				1						6	8	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Scouring of waterways / diversion	Regional				1						6	8	3	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	WSUD features damaged	Regional				1						6	8	3	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Sedimentation (change of structure)	Regional				1						6	8	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Flood levy	Regional				1						6	8	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Reduced stream fauna, invertebrates, and nursery and riparian habitats	Regional				1						6	7	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Shifting of waterways over time	Regional				1						6	7	4	H	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Changes to ecosystems that are unable to recover from frequent bushfires	Outer Ring Councils									1	6	6	5	H	DEPI (2013) Victorian Climate Change Adaptation Plan

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Expand existing risk presented by pests, invasive species and diseases	Regional	1			1	1				1	6	6	3	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Indirect	Shift in vegetation community composition in wetlands towards species tolerant of drier conditions	Regional	1	1	1		1					6	6	4	M	DSE (2013) Indicative Assessment of Climate Change Vulnerability for Wetlands in Victoria
Indirect	Loss of biodiversity in wetlands if permanent wetlands dry out more frequently	Regional	1	1	1		1					6	6	4	M	DSE (2013) Indicative Assessment of Climate Change Vulnerability for Wetlands in Victoria
Indirect	Change in distribution and abundance of species due to reduced extent of refugia for native flora and fauna	Regional	1	1	1		1					6	5	4	M	Parks Victoria (2010) Climate Change Strategic Risk Assessment
Indirect	Increased pressure on aquatic or amphibious species and communities due to loss of ephemeral waterways and wetlands	Regional	1	1	1		1					6	6	4	M	Parks Victoria (2010) Climate Change Strategic Risk Assessment
Indirect	Weed invasion post drought	Regional			1		1					6	6	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Widespread deaths of sensitive species (e.g. bats, possums)	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Increase in algal blooms impacting on aquatic ecosystems	Regional			1		1					6	7	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Ecological impact to refuge water bodies, reduced base flows (e.g. increased competition and predation, temperature sensitivity)	Regional			1		1					6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Death of established trees (major long term impact which requires a specific response)	Regional			1		1					6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Economic impacts of redistribution of land management funding	Regional			1		1					6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Negative public perception of management of the landscape and environment (fire risk, loss of green space) and lower perception of value	Regional			1		1					6	6	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Loss of amenity and wellbeing value including urban heat island mitigation, loss of heat cover and impacts on cultural heritage	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Soil compaction with effects on trees / reduces water uptake	Regional			1		1					6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Change in types of plants and trees planted to adapt to increasing drought	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Overhead power lines can restrict shade trees	Regional			1		1					6	5	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Increased heat island effect due to reduced effect from parks and gardens	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Reduced amenity (rubbish dumping, loss of value)	Regional			1		1					6	5	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Increased weeds	Regional			1		1					6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Wildlife care issues in a heatwave, e.g. possums falling out of trees	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Impacts to wildlife in urban areas (which are perceived to have a reduced environmental focus).	Regional			1		1					6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Long term replanting	Regional			1		1					6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Species movement from inland to cooler coastal climates	Regional			1		1					6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Lack of water reducing public perceptions of open spaces	Regional			1		1					6	5	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Cumulative impacts to species over an extended period of time due to chronic drought/heat related impacts	Regional			1		1					6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Impacts to land management activities and reduced burning.	Regional			1		1					6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Changes in soil composition	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Reduced canopy cover/shade	Regional			1		1					6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Changes to ecosystems that are unable to recover from frequent heatwaves	Regional			1							6	6	4	M	DEPI (2013) Victorian Climate Change Adaptation Plan

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Reduced water quality in environmental waterways due to flooding and heavy rainfall events	Regional				1						6	7	3	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct	Changes to ecosystems that are unable to recover from frequent floods	Regional				1						6	6	4	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct	Backflow of raw sewerage due to flooding	Regional				1						6	6	3	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct / Indirect	Degradation and reduced biodiversity of wetlands due to influx of litter, sediment loads and contaminants from flood waters (impacts depend on system, mitigation efforts, frequency of flooding)	Regional				1						6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Amenity impacts - particularly relating to rubbish	Regional				1						6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Setbacks in native revegetation programs due to loss of newly planted vegetation	Regional				1						6	5	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Impact on aquatic biodiversity and riparian vegetation	Regional				1						6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Tree loss and damage (shade and canopy)	Regional				1						6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Damage to vegetation / increase in erosion and runoff	Regional				1						6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Loss of grass and associated amenity	Regional				1						6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Potential damage to stormwater harvesting systems	Regional				1						6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Increased frequency of plant replacement and failure of seedlings	Regional				1						6	5	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Erosion – Impacts of sediment loads on biodiversity	Regional				1						6	7	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Erosion – Loss of seed bank associated with topsoil	Regional				1						6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Erosion – Increased maintenance activities associated with plantation	Regional				1						6	6	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Direct	Developments on flood plains	Regional				1						6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Contamination (weed spread, pollutant migration)	Regional				1						6	8	2	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Reduced water quality in catchments due to bushfires and drought	Regional					1				1	6	6	3	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Direct	Parks and gardens under increasing strain due to reduced rainfall	Regional					1					5	6	2	M	City of Melbourne (2009) Climate Change Adaptation Strategy
Direct	Changes to ecosystems that are unable to recover from extended drought	Regional					1					5	6	4	M	DEPI (2013) Victorian Climate Change Adaptation Plan
Indirect	Loss of ecosystem services – wellbeing impacts, less interaction with nature, less opportunity for recreation	Regional					1					5	5	3	M	NAGA IRVA – Infrastructure Workshop – 7 August 2014
Indirect	Changes in floristic composition, habitat structure and diversity due to altered fire regimes	Outer Ring Councils									1	6	5	4	M	Parks Victoria (2010) Climate Change Strategic Risk Assessment

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Increased disturbance of ecosystems due to altered fire regimes	Outer Ring Councils									1	6	6	4	M	Parks Victoria (2010) Climate Change Strategic Risk Assessment
Indirect	Changing configuration of parks and open space over the long term	Outer Ring Councils									1	6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Ecological impacts from increase of edge effects resulting from vegetation loss and clearing of firebreaks	Outer Ring Councils									1	6	5	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Planning/wellbeing/safety impacts of loss of ability/ action in implementing planning controls due to public reaction after fire and switching off of controls during the recovery process	Outer Ring Councils									1	6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Downstream urban wellbeing and ecosystem impacts from ash and smoke in air/water	Regional									1	6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Reduced water recharge (soil uptake is enhanced and there is less runoff)	Regional									1	6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
			1	2	3	4	5	6	7	8	9					
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	Cold days and nights	Hot days and nights	Heat waves	Heavy precipitation / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Increased prevalence and impact of invasive species, pests, weeds and disease	Regional									1	6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Animal death from fire / smoke	Outer Ring Councils									1	6	7	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Impacts of fire on Indigenous sites of significance	Outer Ring Councils									1	6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Decreased recreational use of parks due to smoke (health impacts)	Regional									1	6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Loss of park infrastructure due to fire	Outer Ring Councils									1	6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Erosion due to vegetation loss	Regional									1	6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Direct	Die-offs (aquatic, riparian)	Outer Ring Councils									1	6	6	4	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Reduced water quality (ash, chemicals from fire fighting)	Outer Ring Councils									1	6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014

CLIMATE RELATED IMPACT			CLIMATE EXPOSURE EVENT/S									RISK ASSESSMENT				
DIRECT OR INDIRECT	DESCRIPTION OF IMPACT	SCOPE OF IMPACT (REGIONAL*/ INNER RING / OUTER RING / COUNCILS AFFECTED) *majority of NAGA councils	1 Cold days and nights	2 Hot days and nights	3 Heat waves	4 Heavy precipitation / flood	5 Drought	6 Tropical cyclone	7 Extreme high sea level	8 High winds	9 Bushfire	LIKELIHOOD (1) OF CLIMATE EVENT OCCURRING**	LIKELIHOOD (2) OF IMPACT OCCURRING AS A RESULT OF CLIMATE EVENT	CONSEQUENCE	RISK	REFERENCE
Indirect	Impacts to staffing in some agencies, e.g. DEPI, due to conversion to emergency roles, e.g. fire fighting.	Regional									1	6	5	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Migration of species to urban areas, risk of impacts during and post migration	Regional									1	6	6	3	M	NAGA IRVA – Natural Ecosystems Workshop – 13 August 2014
Indirect	Increased planned burning for fuel reduction producing ongoing impacts to biodiversity and exacerbating climate change	Outer Ring Councils									1	6	6	4	M	Parks Victoria (2010) Climate Change Strategic Risk Assessment
Indirect	Impacts to any other projects that require significant water quantities. Potentially resulting in significant costs and diversion of funds.	Regional			1		1					6	6	1	L	Parks Victoria (2010) Climate Change Strategic Risk Assessment

APPENDIX C - MANAGEMENT ACTIONS BY SECTOR

C1 Adaptation intervention classes

CODE	ADAPTATION INTERVENTION CLASSES	DESCRIPTION
1	Legislation and regulation	Laws and regulation designed to set standards that guide, restrain or reward actions of others
2	Capital works and infrastructure	New infrastructural projects such as a sea wall, or modification of existing structures such as roads or railways
3	Economic instruments	Taxes, charges, subsidies, grants tradeable permits, government loans, fiscal sector changes
4	Governance	Reforming the way formal or informal organisations make decisions within themselves or with others
5	Research and innovation	Investment in research to develop new innovative solutions to emerging policy challenges and opportunities
6	Capacity development	Processes through which individuals, organizations, and societies obtain, strengthen, and maintain the capabilities to set and achieve their own objectives over time
7	Information and communications	Dissemination of targeted or large scale information or communication campaigns
8	Education	Using the formal education system for the delivery of particular policy objectives

Source: Funfgeld 2012

C2 Emergency management

C2.1 Management actions

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
	Develop a program to improve emergency management communication (Enhance the resilience and breadth of communication mechanisms during shocks and stresses so that there are consistent and singular sources of messaging and those most impacted are able to readily access the required information)			Regional											
46		Address issues of translation between state and local responders. Consider risks of state responses undermining local responses which are more "in tune". Make messaging to the community more strategic, e.g. better encapsulate the lived experience of flood events which involves a lot of communication and movement outside of council's conventional avenues. Foster improvement in sending consistent messages to government, community and media outlets on behalf of the control agency.	4,7	Human services				1	1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
57		Increase awareness of emergency management.	7,8	Regional	Banyule City Council Municipal Emergency Management Plan, Banyule Community Emergency Risk Management (CERM) Plan, Moreland City Council Municipal Emergency Management Plan 2013			1	1					1	ALL GROUPS
67		Provide information on the risks associate with moving from urban to rural residential areas.	7	Human services					1					1	ALL GROUPS
68		Improve understandings of vulnerability to lack of infrastructure (e.g. no access to phone / internet / electricity) and what to do when service goes down	8,6	Human services, Infrastructure					1					1	ALL GROUPS
69		Consider the challenge of providing centralised warnings without losing local understandings of risk.	6	Human services					1					1	ALL GROUPS
70		Provide contextualised warnings / messages to the community – in different languages, using community radio, CFA / councils, linked to Facebook	7	Human services					1					1	C,J
72		Provide funding to deliver information (e.g. brochures) in different languages to access CALD groups.	3,7	Human services					1					1	C,J

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT								ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
74		Improve emergency communication by making use of existing community relationships held by the various non-emergency management organisations to deliver the messages. Strategically use strong community links to help deliver coordinated and consistent messages across sectors.	7	Human services	Banyule City Council Municipal Emergency Management Plan, Banyule Community Emergency Risk Management (CERM) Plan, Moreland City Council Municipal Emergency Management Plan 2013				1					1	ALL GROUPS
77		Address the issue of poor communication / little coordination between emergency services and local government – may double up / cross over. Opportunity to collaborate and increase efficiency, however it was recognised that this is very difficult and there is a lack of resourcing to do so.	4,6,7		Nillumbik Municipal Emergency Management Plan 2014-2017				1					1	ALL GROUPS
78		As the messages provided on heatwave and bushfire are typically provided simultaneously, there is a risk that those in urban areas treat them as a single issue and dissociate themselves on the basis that they believe it as a rural problem. They hence leave themselves more susceptible to the impacts of heatwave. Consider the scope for improved messaging around this.	7					1						1	J,K
85		Conduct regular fire safety presentations to residents who live in at risk areas of "Ember Attack" from grass and bushfires	7,8		Hume Heatwave Plan 2010									1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT								ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
203		Provide alternative communicational devices (e.g. two way radio) for emergency response and other functions. Will serve as a backup when mobile communication systems go down.	2	Human services, Infrastructure	City of Hume Climate Change Adaptation Action Plan 2013 2017				1					1	D
142		Coordinate between key state agencies, ensure there is a coordinated, whole of network response. Road closures to be managed and the implications for the road network back from the event to be considered as part of the planning process. e.g. VicRoads and council in terms of road transport closures, e.g. CFA fire messaging: culturally fire emergency management is dealt with better than flooding which is dealt with more secretly. Learn from the CFA messaging system and apply to floods.	4,7,8					1	1	1				1	ALL GROUPS
245		Ensure all programs and priorities are consistent so people know what to do during bushfire events (esp. in suburbia).	6											1	D
	Develop a program to enhance the emergency management capacity of Council														
48		Address the issue of councils not being able to respond effectively until data is available, but gathering data takes time.	7	Human services	City of Melbourne Climate Change Adaptation Strategy (2009)				1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
63		Improve the vulnerable persons register (consider the potential of an 'opt-in' vulnerability register. Also need to gather more info from community about what their needs are)	5,6,7	Human services	Manningham Municipal Emergency Management Plan 2013, Moreland City Council Municipal Emergency Management Plan 2013, City of Whittlesea Council Plan 2013-2017: Municipal Public Health and Wellbeing Plan				1					1	ALL GROUPS
64		MEMP needs to focus on partnership with the community – also improve the feedback loop.	7						1					1	ALL GROUPS
71		Leverage existing council skills / capabilities to provide services (e.g. audio / visual facilities). Take the opportunity to use established community groups for education / programs.	2,7,8	Human services					1					1	ALL GROUPS
73		Manage the issue of spikes in spontaneous, untrained volunteers.	6,8	Human services					1					1	ALL GROUPS
82		The vulnerable persons register held by council is a relatively exclusive list. Doesn't encapsulate people meeting some but not all of the vulnerability criteria. Engage those other vulnerable people in known services in order to receive assistance.	6, 7	Human services	City of Whittlesea Council Plan 2013-2017: Municipal Public Health and Wellbeing Plan			1	1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
86		Use middle ring strategy with next wave to assist (intra council coordination)	4,7	EM										1	ALL GROUPS
92		Have more/better contingency planning for cross-municipal work.	6	Human services					1					1	ALL GROUPS
97		Collaborate on fire management (capacity support, sharing resources) across the region	6,7											1	ALL GROUPS
100		Train staff to become recovery managers.	8		Banyule City Council Municipal Emergency Management Plan				1					1	ALL GROUPS
32		Establish consistent templates for operations between municipalities to enable workers from across borders to more easily pick up work in emergency scenarios.	7	Human services					1					1	-
	Clarify the roles and responsibilities for emergency management across the NAGA Region														
58		EM Victoria can provide material for region, also potentially coordinate responses.	8,7,4					1	1					1	ALL GROUPS
65		Consider emergency planning for the NDIS and HACC programs.	6						1					1	A,D

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
75		Advocate for peak bodies (MAV) and State Government to review international and national emergency response case studies to identify best practice risk reduction measures to address the duplication in different sectors dealing with extreme weather impacts. Particular overlap with emergency management and municipal health plans, however other plans need to be addressed too.	5,6, 7,8		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009				1					1	ALL GROUPS
88		Better understand how DHS-based case management services are managed in the longer term, particularly in light of them being pushed down to the council level, or being contracted out to agencies. Improve understandings of how scalable these organisations are in the event of increased workloads post-disaster.	5,8						1					1	ALL GROUPS
89		Have state government provide proper definitions of recovery. Consider improved scope for state to enable recovery.	1,4						1					1	ALL GROUPS
91		Advocate for further research into the stages of recovery (i.e. after 6 weeks, 1 year, etc.) and understand what decisions need to be made at each stage and by which key stakeholders to facilitate recovery.	4,5,8	Human services					1					1	ALL GROUPS
93		Seek better definitions on the role of DHS in post-recovery management.	4,6,8	Human services					1					1	ALL GROUPS
94		Establish better communication on what is needed at State Government policy level vs. local council level	1,7						1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
95		Develop an education program for the community on what they can do to assist their local community pre and post event (e.g. the San Francisco Community Emergency Response Team for a basic community response, including spontaneous volunteers, reduces issues – also street wardens in Tokyo, Japan)	8						1					1	ALL GROUPS
30		Support and encourage staff and residents to be involved in CFA & State Emergency Service support agencies.	6,7		Manningham (2012) Securing the Future									1	ALL GROUPS
138		Create regional agreement on trigger points for response (State Emergency Services (SES) takes lead on this, or Country Fire Authority (CFA) for fire)	4						1					1	ALL GROUPS
	Engage external stakeholders to support emergency management in the NAGA region														
53		Target large service providers (transport, utilities, and homeless network groups) to develop policies.	6	Industry					1					1	ALL GROUPS
80		Consider the scope for better coordination of non-council building operators and industry in the event of heatwave. E.g. better engagement with shopping centres, libraries and cinemas to ensure they are open and able to fulfil respite requirements.	2,6,7	Industry				1							ALL GROUPS
	Enhance legislation to support emergency management in the NAGA region														

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
60		Address the gap that there is no emergency planning legislation related to the environment.	1						1					1	-
99		Take advantage of the opportunity to get the next Emergency Management bill (early 2015) to cover municipal roles and responsibilities and to influence underlying guidelines.	6						1					1	ALL GROUPS
51		Local councils can feed back into state legislation / policies via MAV	1, 7						1					1	ALL GROUPS
	Improve preparedness for flooding in the NAGA region														
50		Address the considerable challenge of early warnings in the case of flash floods.	7		Banyule Community Emergency Risk Management (CERM) Plan, City of Melbourne Climate Change Adaptation Strategy (2009)				1						ALL GROUPS
54		Improve the detail of flood management down to the lot level.	6						1						ALL GROUPS
	Enhance the emergency management approach to better deal with extreme events														

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
55		Address the emergency management structure – look at communities at risk rather than taking a hazard led approach.	6						1					1	ALL GROUPS
62		Address the gap in emergency management of infrastructure assets (i.e. evacuation / access to state roads, private roads, lack of council resources to maintain access roads)	1, 6	Infrastructure					1					1	ALL GROUPS
221		Implement a process to ensure lessons learned are recorded and acted upon, with regard to emergency management	5,7					1	1	1				1	B,D
233		Recognise and appreciate the risks in growth areas / urban fringes change on a year to year basis	7	Infrastructure										1	A,D,E

C2.2 Contextual issues arising

ISSUES
Consider the risk of the emergency management sector being too focused on logistics and resources in response to impacts requiring a more "human" understanding/approach.
Perform proactive (rather than reactive) maintenance
Build resilience within the community, particularly among older populations. Factor resilience into primary school education.
Recognise that emergency planning can better encapsulate people's behaviour and social networks that determine how they respond. For example, understanding that people won't necessarily travel to the nearest evacuation centre because they know people in another town, or tend to shop elsewhere.
Recognise that the privatisation of key infrastructure such as the rail system reduces council's ability to manage certain impacts.
Recognise that weekends and code red days create additional risks due to closed schools and a limited available workforce.
Recognise that the community's expectations since Black Saturday may exceed the improvements that have been implemented in the meantime, leading to potential complacency or unreasonable perceptions on the balance between personal and council responsibilities.
Recognise that state systems can be heavy handed.
Recognise the challenges of time bound funding. (Commonwealth funding two full years after the event, timeframe was extended for Black Saturday).

C3 Human Services

C3.1 Management actions

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT								ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
31	Design and deliver programs that facilitate strong, informed, capable, self-reliant, connected and willing communities in response to climate change.		6		Manningham (2012) Securing the Future			1	1	1				1	ALL GROUPS
	Develop a program to improve communications related to climate shocks and stresses														
1		Clarify the role of door-knockers post event. Establish their skill sets and objectives so that it is clear whether they are providing assistance or simply gathering information.	7,8					1	1					1	A,D,G,J
2		Improve the way information sharing is managed, as it currently relies on personal relationships between staff of different organisations. Learn from the actions of councils in particularly flood-prone areas, such as Queensland and rural Victoria. Share knowledge with councils having good historical knowledge in the area (e.g. those in Gippsland)	6,7						1						ALL GROUPS
3		Make better use of multilingual TV and radio channels to improve pre-heatwave messaging	7					1							C

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
33		Draw upon community leaders to deliver messages, look more clearly at the community for how to target communications	7						1					1	ALL GROUPS
43		Consult with relevant advisory committees prior and post the heatwave period to review messages and campaign effectiveness at a regional level, in support of existing frameworks. Improve distribution of messaging via key community stakeholders such as medical centres, neighbourhood houses, senior citizens groups, and public transport providers.	7,8		Darebin Heatwave Strategy 2013-2017			1						1	ALL GROUPS
44		Develop a regional flyer/information sheet template to avoid the overlap of information. Individual councils can then add specific information to this as needed.	7,8					1	1	1				1	ALL GROUPS
181		Improve consultation with the community specifically in regards to managing expectations and how responses should be delivered.	7						1					1	-
183		Provide information to communities around behaviours in fire events. Not all the community needs to leave as this can have significant transport network impacts.	7,8	EM, Infrastructure										1	A,B
163		Improve public education on water management, preparedness for drought and behaviour change for saving water.	8	Infrastructure						1					G,H
257		Develop better communication across Council and between different groups within the Council during the long term response to bushfire impacts	7											1	D,I

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
	Develop a program to help the community better prepare for heatwave impacts														
5		Develop and distribute informative heatwave preparation pamphlets in English and a range of other languages to community buildings (e.g. Libraries)	7		Darebin Heatwave Strategy 2013-2017			1							ALL GROUPS
6		Identify core services that are likely to be oversubscribed during a Heat Alert period (e.g. swimming pools, libraries) and work with them to develop strategies to deal with extra demand.	2,6	EM	Darebin Heatwave Strategy 2013-2017			1							ALL GROUPS
7		Clarify and/or better document who notifies which groups ahead of a heatwave between council and state government.	4					1							ALL GROUPS
12		Improve planning to reflect the impacts of long-term heatwaves (beyond the 1-3 days events currently envisioned)	4,6					1							ALL GROUPS
13		Improve planning to provide cross-regional surge capacity during heatwave periods	1	EM				1							A,B,D,E
16		Focus on pre heatwave event planning with a range of NGO and other state government agencies that may come into contact with vulnerable groups during heatwave conditions	6,8					1							ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
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19		Address concerns held by the public around the costs of heatwave management	7,8					1							
20		Further develop local social networks, e.g. with CALD Groups. Maintain a heatwave related telephone tree.	6,7, 8					1							ALL GROUPS
21		Improve the documentation on roles and responsibilities of non-council organisations in heatwave plans.	7					1							ALL GROUPS
	Develop a program to help the community better manage heatwave impacts														
4		Develop a community heatwave program that distributes free / reduced price items (e.g. pedestal fans, external window shades) to eligible Council residents that assist with the climatic event.	6,7, 8		Darebin Heatwave Strategy 2013-2017			1							ALL GROUPS
8		Identify a 'stop work' temperature.	4					1							-
9		Develop a regional 'Safe System of Work' policy	4					1							-
15		Coordinate better with community organisations. Address the potential conflict between council extended working hours and closing of community organisations during heatwaves	6,8					1	1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
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23		Consider developing a work-related health monitoring system to note any trends related to heat stress	5,7		Manningham (2012) Securing the Future			1							-
	Develop a program to improve community preparedness for extreme events														
25		Put post-Black Saturday Bushfire procedures in a "drill"-like scenario to test their effectiveness and staff knowledge.	6,7, 8											1	ALL GROUPS
26		Develop a food security plan to ensure Council can deliver services (e.g. Meals on Wheels, internal catering and viability of a function centre), particularly in the event of a sudden disruption to food supply and/or food shortages.	4		Manningham (2012) Securing the Future, Moreland City Council Municipal Emergency Management Plan 2013		1	1	1	1				1	A,B,D,F, G
27		Establish partnerships with State Government and other community agencies to prepare for increase in demand for community based services	4,6		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009					1				1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
28		Develop internal steering committee to meet quarterly to prioritise adaption actions and review progress.	4		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009					1				1	ALL GROUPS
143		Identify Council's role in establishing a sustainable local food system	4		Draft Hume Health and Wellbeing Action Plan, City of Yarra Health Plan 2013-2017				1						B
	Develop a program to help the community to recover post-event														
34		Improve staging: identify where the recovery needs to be and where the impacts will be	5	EM					1					1	ALL GROUPS
36		Identify measures to cope with loss of property value.	3						1					1	B
37		Regionally coordinate assistance for people to relocate away from dangerous areas permanently, with associated risk education. Improve practices around not approving rebuilds in dangerous areas.	1,4	Infrastructure					1					1	All except F
39		Develop plans for long-term support and recovery, dealing with potential impacts from depression and suicide. Ensure support continues for the time required	6					1	1	1				1	B, G, H, I, J

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
41		Design programs that acknowledge people will be living in temporary accommodation for an extended period of time.	5,6						1					1	ALL GROUPS
42		Streamline the post-fire door knocker training program to ensure that volunteers can provide services in a timely fashion.	8											1	A,D,G,J
29		Strengthen knowledge and understanding of environmental factors that lead to poor mental health and develop a response strategy that targets these specific mental health needs.	5,6		Darebin Community Health & Wellbeing Plan 2009-2013			1		1				1	G

C2.2 Contextual issues arising

None recorded.

C4 Industry

C4.1 Management actions

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
	Develop a program to improve communication in relation to industry														
110		Indicate whether individual businesses are open or closed during an event. Such information could be of great importance to the community, depending on how crucial a particular business is during a bushfire event.	2,7						1					1	C,D,E,F,G
114		Engage in marketing of council areas post-disaster to ensure continued tourism and business operations. This marketing strategy could operate at a regional level to improve reach and deliver a consistent message. Key messages for industry include 'we are open for business' and 'buy local'.	7						1					1	B,C,E,G
130		Send clear communications to industry in post-recovery around what to expect from government at each stage of post-recovery, there is currently no clear procedure.	7						1					1	ALL GROUPS
126		Recognise that businesses must be consulted and involved in deciding community priorities, needs and long term response during post recovery.	6,7						1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
115		Better manage relationships with media outlets to ensure that they don't spread views that could affect local businesses. Councils need to develop a reputation as media content creators, so that they are consulted in response to extreme climate events and have greater control over the messages delivered. In addition, social media should be better managed and understood in order to a) improve information provision and b) tap into the community's own communication networks to understand their behaviour during extreme weather events.	7						1					1	C,G
	Improve support for industry post-event														
119		Support local businesses operations post event through ensuring that goods and services are supplied locally, or that they are supplying the goods that are required. Note as an example Black Saturday and the extensive need for farm posts.	4,6						1					1	ALL GROUPS
120		Ensure coordination of assistance in terms of donation from businesses of goods and services and that these are what is actually required post event.	4,7						1					1	ALL GROUPS
116		Enhance recovery by establishing a database of local businesses that are able to support post-impacts.	6,7						1					1	C,E,F,G
113		Consider assisting in business recovery by temporarily reducing rates (ensuring that the landlord passes on the savings)	3						1	1				1	C,F,G

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
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117		Set up a funding mechanism for emergency supplies/ items/equipment (e.g. generators, appliances) and a system for recording stock could reduce recovery time (previously relied on donations).	3,6						1					1	C,F,G
118		Focus of Economic Development units within council has not been on assisting business and commercial enterprises recover from climatic events. Take advantage of the opportunity to both understand and quantify the impact and understand the potential role of council to assist.	6						1					1	ALL GROUPS
121		Give specific consideration to agricultural businesses that are particularly impacted by bushfire events when formulating packages/approaches.	2,3,6						1					1	A,B
122		Consider the long term implications for businesses that do not want to re-establish, or are not able to afford insurance in areas considered to be of bushfire risk.	2,3						1					1	C,D,F,G
125		Strengthen the council role in going out to small businesses during post-recovery to ensure they have the right resources and know what the 'next steps' are.	7						1					1	C
127		Enhance supporting infrastructure alongside messaging that facilitates return of tourism (e.g. public toilets).	2,7	Infrastructure					1					1	A,B,C,G
129		Take advantage of opportunities to access state government resources and funds for residents.	3						1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
101		Establish a formal economic recovery process when an emergency is declared over.	5,6		Banyule City Council Municipal Emergency Management Plan				1					1	ALL GROUPS
	Develop a program to help prepare industry to deal with events														
104		Implement and review OH&S Policy and Procedures to ensure all staff are safe while working on days of heatwave conditions. Consider the following: flexible working hours and modified breaks (including working from home options); adequate PPE resources such as sunscreen, zinc cream, first aid kits and hats; Access to water sources.	1		Darebin Heatwave Strategy 2013-2017.pdf, Hume Heatwave Plan 2010			1	1					1	ALL GROUPS
128		Help businesses do vulnerability assessments and facilitate bulk-buying of essential equipment, goods, etc.	6					1	1	1				1	B,C,D,G
131		Identify and review the effectiveness of heatwave action plans and revise where appropriate	6		Hume Heatwave Plan			1	1					1	ALL GROUPS
132		Provide education/information on risk prevention, better building standards and design improvements and extend this to SMEs.	7,8					1	1					1	C,G
105		Develop a Heatwave Management and Information Plan to be communicated to all staff of the dangers of heatwaves and how to remain safe throughout the event. Consider delivering this at the beginning of summer, a week before the event and on the event day.	7,8		Hume Heatwave Plan 2010			1							ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
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103		Improve business resilience by councils developing special rates schemes that contribute funds to developments in the urban landscape. At present, such schemes are run on a strip-by-strip basis and aim to improve the marketability of an area, but they don't necessarily fund flood or climate resilience infrastructure. Such schemes could be adapted to do so.	2,3	Infrastructure					1					1	A,B,C,F,G
112		Develop incentive based policies and programs for community and business to adopt climate change resilience measures (e.g. facilitate insulation, energy efficient technologies)	3,4	Human services	City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, Manningham Climate 2020 Action Plan (2009), Towards Zero Net Emissions by 2020: Update (2014), Climate Change Action Plan (CAP) 2007-2012 - No Longer Business as Usual, Moreland Zero Carbon Evolution Summary Document		1	1							C,D,G
201		Develop a contingency / business continuity plan to minimise disruption	5,7		City of Darebin Climate Change and Peak Oil Adaptation Plan 2012				1					1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
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152		Expand business continuity plans beyond council operations, e.g. moving service to other appropriate buildings.	6					1	1					1	E
	Enhance industry's role in supporting the community post-event														
108		Regionally coordinate businesses/infrastructure that are capable of providing respite services in the event of a heatwave (e.g. pools and shopping centres as well as council buildings).	2	Infrastructure				1							C,E,F,G
111		Improve engagement with certain businesses to ensure they can provide services during bushfire events, although they will need to balance risks to their own staff, vs. duty of care to customers and the community.	6,7						1					1	C,D,E,F,G
123		Use post recovery as an opportunity to build additional resilience.	2,6	Infrastructure					1					1	ALL GROUPS

C4.2 Contextual issues arising

ISSUES
Recognise that there are issues with engaging businesses prior to heatwaves becoming a noticeable financial burden to them.
Recognise that council lacks influence on big businesses. There is a need to be realistic about what they can achieve with their big business engagement. Greater scope for improved council assistance among small businesses.
Recognise that in some circumstances, businesses have been known to take advantage of people who are fire effected and vulnerable, or take advantage of grant money which they are not entitled to.

C5 Infrastructure

C5.1 Management actions

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
	Enhance the resilience and breadth of communication mechanisms during shocks and stresses so that those most impacted are able to readily access the required information.														
139		Ensure there is linkage between all the relevant information websites (VicRoads, CFA, etc.) so it is easy to find.	7					1	1	1				1	-
148		Recognise that if the power goes down, the immediate reactive actions become exposed to issues on power outages such as pumping and radio communications. Emergency communications channels need to provide accurate and up to date information. At times this can be more important than a return to electricity itself.	7	EM				1	1					1	C,D
149		Create alternative communications abilities, as council is moving to IT-based communication systems.	2,6,7					1	1					1	D

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
	Increase the resilience of the power network to projected climatic shocks and stresses														
144		Facilitate more distributed power generation to minimise the spread of power loss from a single disruption. Foster increased decentralisation of the energy grid (in particular solar PV). Examine power alternatives. Distributed generation should be investigated as a means to reducing dependence on large transmission lines and exchanges.	2		City of Melbourne Climate Change Adaptation Strategy (2009), Climate Change Action Plan (CAP) 2007-2012 - No Longer Business as Usual, Moreland Zero Carbon Evolution Summary Document, Climate Change Action Plan 2010-2015 (2010), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012), Manningham Climate 2020 Action Plan (2009), Towards Zero Net Emissions by 2020: Update (2014)			1	1	1				1	C,D
145		Target the distributed power generation on highly energy dependent locations such as aged care homes.	2					1	1					1	C,E,G

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172		Increase the reliability of power, e.g. implementing UPS systems, solar systems with batteries, and voltage optimisation.	2					1	1	1				1	C,E
193		Keep a watching brief on the development (technological, financial) of various renewable energy micro generation opportunities, particularly solar PV and wind. Complete investigation and prepare business cases for appropriate Council facilities if appropriate.	2,3,5		Moreland Zero Carbon Evolution Summary Document, Climate Change Action Plan 2010-2015 (2010)									1	D
10		Establish better provision/planning of generator power to build resilience	1,2					1							-
246		Develop an action plan to switch off the grid in the event of a bushfire	5											1	D
	Perform vulnerability assessments of local infrastructure														
150		Perform vulnerability assessments of council buildings and services. Use this as a template for a regional resource.	5,6, 7,8					1	1	1				1	E
		Perform vulnerability assessments of community infrastructure.													
	Improve infrastructure resilience to flood impacts														

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133		Strengthen developer contributions for drainage infrastructure.	1,2,3						1						F
134		Educate the community on preventative infrastructure/ building design and planning, perception and understanding of the costs and need to control flooding.	8						1						E
135		Better communicate the risk to services associated with flooding.	7		City of Melbourne Climate Change Adaptation Strategy (2009)				1						ALL GROUPS
136		Give better consideration at a regional scale of downstream impacts. Understand who is catering for downstream impacts of significant growth.	4,5					1	1	1				1	ALL GROUPS
141		Increase the prevalence of WSUDs and other approaches to reduce downstream flow.	2		City of Melbourne Climate Change Adaptation Strategy (2009), Moreland Zero Carbon Evolution Summary Document, City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012)				1						A,B,F
146		Rely less on pump-assisted water flow in favour of gravity for engineered flood management systems.	2						1						E,F

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147		Do more to protect key infrastructure from extreme events. Investigate engineered flood defence systems (flood walls/dikes) that could be hydro powered as well. Water Sensitive Urban Design (WSUD) principles can be better integrated with at risk infrastructure.	2,5		City of Melbourne Climate Change Adaptation Strategy (2009)				1						ALL GROUPS
153		Ensure that climate change projections are included in designs to account for the most up to date understandings of rainfall. Council water engineers and developers design infrastructure/drainage infrastructure to make use of this information.	5,7						1						F
154		Improve access to information. And improve the messaging/guidance from council as many don't know that they are in flood prone areas.	7	Human services					1						-
155		Design PSP drainage infrastructure appropriately upstream, in new growth areas. Developers pushback on Melbourne Water guidelines – push back often related to water quality not flooding as much	1,2						1						F
157		Minimise hard surface areas where necessary – impose maximums on impermeable cover.	1,2		City of Melbourne Climate Change Adaptation Strategy (2009), Urban Forest Strategy (2012 - 2032)				1						F

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158		Provide more WSUD areas and rainwater tanks. Deliver with education programs for residents so that they know how to properly maintain them.	2,8		Manningham Green Wedge Action Plan 2020 (2011), Urban Forest Strategy (2012 - 2032), Moreland Zero Carbon Evolution Summary Document, City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012)				1	1					F
102		Improve planning around sub ground level infrastructure, e.g. underground car parks for flash flooding.	1,2	Industry	City of Melbourne Climate Change Adaptation Strategy (2009)				1						C,D,E,F,G
	Improve infrastructure resilience to drought impacts														
161		Establish low to mid-level water restrictions as water use standards	1	Natural ecosystems	City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, City of Melbourne Climate Change Adaptation Strategy (2009)					1					H

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162		Consider low water turf replacement in sports fields. Consider artificial turf where appropriate with adequate drainage.	2		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, City of Melbourne Climate Change Adaptation Strategy (2009)					1					G,H
164		Establish regional level collaborations on drought response, in particular in relation to sporting clubs and recreational groups.	4							1					G,H
165		Continue to learn from previous drought experiences in the development of better regional responses.	6							1					G,H
168		Ensure that the water network is able to provide sufficient supply for transport operations.	2							1					B,H,I
169		Foster more localised water management and storage. This may indirectly help to manage cooling demands.	2		City of Melbourne Climate Change Adaptation Strategy (2009)					1				1	C,H

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171		Extend stormwater capture and storage.	2		Manningham Green Wedge Action Plan 2020 (2011), City of Melbourne Climate Change Adaptation Strategy (2009), Urban Forest Strategy (2012 - 2032), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012)					1					F,H
173		Increase utilisation of appropriate materials and strategic landscaping around buildings.	2							1					E
174		Develop fact sheets/guidelines that document local knowledge and advise on designs for drought impacts (e.g. termite barriers) and how to go beyond Australian standards, to be shared regionally.	7,8							1					E

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175		Improve/increase the availability of alternate water sources	2		Manningham Green Wedge Action Plan 2020 (2011), City of Melbourne Climate Change Adaptation Strategy (2009), Melbourne Council Plan 2013-2017, City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012), Yarra Climate Change Adaptation Plan 2013-2014 (2013)					1					G,H
177		Improve regulations for new developments.	1		City of Melbourne Climate Change Adaptation Strategy (2009)					1					E,G,H
	Improve infrastructure resilience to heat impacts														

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166		Audit / measure the urban heat island effect in critical areas and commence preparation of a strategy to ensure that temperature in these areas are mitigated.	2,5		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, City of Melbourne Climate Change Adaptation Strategy (2009), Urban Forest Strategy (2012 - 2032), Moreland Zero Carbon Evolution Summary Document, Yarra Climate Change Adaptation Plan 2013-2014 (2013)			1		1					A,B,E,G
167		Incorporate strategies to increase shade and reduce heat in Council area, especially in playground areas, car parks, walking and cycling paths.	2		Darebin Heatwave Strategy 2013-2017, City of Melbourne Climate Change Adaptation Strategy (2009), Urban Forest Strategy (2012 - 2032), City of Yarra Health Plan 2013-2017			1		1					G

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106		Impose council regulations that ensure better building design for heatwaves, although the increased cost of designs may be difficult to manage with landlords.	1		City of Melbourne Climate Change Adaptation Strategy (2009)			1							A,B,E
	Develop a program to reduce the impacts of bushfire														
178		Improve the planning and delivery of controlled burns.	2,5	Natural ecosystems										1	ALL GROUPS
179		As per recommendations from the Black Saturday Royal Commission, establish community refuge areas.	2	Human services					1					1	-
180		Share intellectual property and experiences with other councils.	6,7,8					1	1	1				1	ALL GROUPS
184		Ensure bushfire and heatwave havens are separate.	2											1	A,B
186		Ensure there is adequate access for emergency services.	2,7	EM										1	A
195		Design buildings to be multifunctional so that relief centres can work/serve the community during recovery.	2	Human services										1	E
	Increase the resilience of telecommunications systems to projected climatic shocks and stresses														

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187		Assess and protect key telecom towers, with backup systems if necessary. They need to be in place to ensure SMS/alert systems are maintained.	2											1	D
188		Convert cables/lines to underground in bushfire overlay areas.	2											1	C,D
189		Perform an analysis of overlays to see where extensions are occurring.	5											1	C,D
	Employ energy / telecommunications systems for emergency communications														
191		Extend signalling/alert systems.	2											1	D
192		Utilise smart meter for communications during an emergency.	2,7											1	-
	Enhance the preparedness of infrastructure and associated services to deal with climate shocks and stresses														
197		Identify infrastructure and assets at risk and infrastructure that poses risk (e.g. street debris, vulnerable trees) to develop a long-term plan to increase resilience.	2		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009					1				1	ALL GROUPS

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198		Investigate and prioritise critical Council and community infrastructure to ensure its resilience during extreme weather events and energy disruptions	2		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009				1					1	ALL GROUPS
199		Conduct a comprehensive analysis of future budget requirements, taking into consideration: possible changes in revenue from rates, increased demand for services, and increased costs of infrastructure maintenance.	3		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009				1					1	ALL GROUPS
200		Collaborate with insurers to remove or retrofit potential hazards	2		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009				1					1	ALL GROUPS
202		Investigate and implement engineering solutions to increase capacity of existing waste disposal facilities to withstand extreme weather conditions.	2		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009				1					1	Waste disposal facilities
211		Ensure that strategic assets, such as hospitals, have alternate transport access identified to prepare for future events.	2					1	1					1	A,B
61		Asset management is limited to conservative maintenance of assets. Take actions to base it on improvement, building resilience and building capacity (maintain but not improve is the current approach).	3, 6						1					1	-

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	Enhance the recovery process from an infrastructure perspective														
204		Improve consultation with community and local government regarding how to deliver the right community infrastructure during post recovery, and better manage community expectations around this	7	Human services					1					1	G
205		Facilitate regional agreement/ coordination to pool resources and deliver better infrastructure and services.	4						1					1	ALL GROUPS
206		Transfer control to state government for high fire risk areas and phase out settlement on the grounds that in the long term, the cost-benefit pays off.	4						1					1	ALL GROUPS
207		Improve awareness and understanding of the costs of the service levels provided.	7,8						1					1	-
208		Provide better regional consideration of where to relocate, and better awareness of the risks of living in or developing in fire prone/ non defensible areas	7,8						1					1	ALL GROUPS
209		Establish contingency plans for the movement of council services if key infrastructure is impacted.	7						1					1	ALL GROUPS
210		Recognise the shortcomings of like for like funding replacement in the context of a changing climate and the potential to enhance the resilience of replaced assets considered as part of any recovery funding.	3						1					1	-

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212		Implement distributed energy systems during post-recovery.	2						1					1	C
213		Ensure water supply comes from a variety of sources during post recovery which are recorded on a database that is reviewed and updated regularly.	2						1	1					F,H
214		Use post-recovery as an opportunity to review council service delivery.	5,6,7					1	1					1	-
35		Develop rebuilding guidelines: give advice on when to rebuild, how to navigate the permit system, how to rebuild more resiliently	7	Human services					1					1	A,B,C
201		Establish a contingency fund to respond to an increasing frequency and severity of events.	3					1	1	1				1	ALL GROUPS
101		Clarify understandings on the boundaries for responsibility when it comes to damage to property. While council is not responsible for impacts to private property, they do manage the stormwater infrastructure that may have failed during an event.	2,7						1					1	ALL GROUPS

C5.2 Contextual issues arising

ISSUES
Recognise that if the power goes down, the immediate reactive actions become exposed to issues on power outages such as pumping and radio communications. Emergency communications channels need to provide accurate and up to date information. At times this can be more important than a return to electricity itself.
Change maintenance approach to be less reactive.
Allow operating plans to inform the design of buildings.
Recognise that tree preservation policies may compromise bushfire risk reduction efforts
Recognise the issue of reservoir storage best being high for drought, but low for flooding.
Recognise the significant role that occurs organically through social media to communicate key messages to the affected community.
Demonstrate/develop a common understanding of the benefits of going beyond Australian standards/ minimum compliance.
Change the culture that leads to a lot of councils being wary to give out flood information because of litigation.

C6 Natural ecosystems

C6.1 Management actions

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	Implement processes that enhance the resilience of natural ecosystems to climate shocks and stresses														
199		Undertake more research into the necessary responses for ecology for a particular emergency event, as there is potentially too much focus on 'iconic' species when a more holistic approach is needed.	5	EM					1					1	B,C,D,E,F,G,I,J
203		Develop interrelationships between natural ecosystems management and SES/CFA/Council Emergency Management. Emergency Management can therefore take further account of ecosystem perspectives.	7	EM					1	1					ALL GROUPS
242		Address the lack of understanding of impacts to biodiversity via further research to better inform management actions.	5		Manningham Green Wedge Action Plan 2020 (2011)									1	A,D,E,H
243		Enhance the network of habitat corridors to prevent isolated patches occurring	2					1		1				1	A,B,H

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208		Address the steady loss of tree canopy cover resulting from infill development.	1,2		Urban Forest Strategy (2012 - 2032), Moreland Zero Carbon Evolution Summary Document			1		1					A,B,E,F
239		Construct a regional database of significant tree species	5											1	ALL GROUPS
229		Develop a tree data base including identification and schedule treatment of vulnerable trees to adapt to low water conditions, heat island reduction and reduce risk from climatic events.	5		City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, Urban Forest Strategy (2012 - 2032)			1		1					A,B,E,I
260		Develop a regional urban forest strategy that links in with the existing council strategies	5		Urban Forest Strategy (2012 - 2032)			1		1					A,B,C,D,E,F,H,I,J
	Improve the resilience of natural ecosystems to flood impacts														

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248		Develop a regional approach to biodiversity mapping for local government. Draw upon on existing techniques currently being developed by individual Councils and implement knowledge sharing across the Region through workshops. Establish biodiversity data gathering protocol and monitoring program of current natural assets to monitor change over time and manage accordingly.	4,5,6		Manningham Green Wedge Action Plan 2020 (2011), Hume City Council Climate Change Adaptation Action Plan 2013-2017			1	1	1				1	ALL GROUPS
251		Implement a process to ensure lessons learned are recorded and acted upon, with regard to natural ecosystems	5											1	A,B,D,I
252		Develop quarantine protocols for emergency response workers to prevent the spread of diseases and weeds	5	EM					1					1	ALL GROUPS
253		Encourage the recovery, re-growth and resilience of affected areas through the development and/or improvement of conservation area management.	5,6						1	1				1	D,I
255		Consider extending the funding over the duration of the recovery period to better understand and adequately meet unexpected issues	3						1					1	I
	Implement a program to enhance the resilience of trees to climate shocks and stresses														

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185		Address the lack of real infrastructure spending on open space (which provides impermeable area) in favour of roads and developments. Open areas should consider multiple flooding events.	2	Infrastructure	Urban Forest Strategy (2012 - 2032)				1						All except H
186		Develop a flood map of Council to identify flood prone areas for future planning	5	Infrastructure, Planning	City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, Manningham Municipal Emergency Management Plan 2013				1						C,D,F,J
188		Implement weed mats to prevent erosion at a large scale.	2						1					1	C,D,F,J
191		Ensure urban flood modelling is accurate and up to date	6	Infrastructure, EM, Planning					1						C,D,F
192		Utilise land use planning to inhibit runoff through the use of biodiversity enriched retention basins.	1,2	Planning					1						B,C,F,I,J
195		Design breeding habitats for aquatic species that are offset from major waterways	2						1						A,B,C,D,J
196		Develop a strategy for flood management of regional reserves. Address the need for a framework for resilient planning and flood retention. (Engage with DEPI?)	5	Planning					1						D,F

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204		Enhance and support the health of waterways and wetlands via appropriate vegetation to reduce the effects of erosion	2		Banyule Planet Environmental Sustainability Policy and Strategy 2013-17				1						A,C,D,F,J
205		Conduct a study to identify what environmental attributes are lost post-flood	7,8						1						A,C,D,F,J
	Improve the resilience of natural ecosystems to drought and heatwave impacts														
209		Ensure adequate water saving measures are embedded	2,4	Infrastructure	City of Darebin Climate Change and Peak Oil Adaptation Plan 2009, Melbourne Council Plan 2013-2017, City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012)			1		1					B,C,E,I,J

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210		Identify stormwater harvesting opportunities to provide water to natural ecosystems during drought periods	2	Infrastructure	City of Hume Climate Change Adaptation Action Plan 2013 2017, Manningham Green Wedge Action Plan 2020 (2011), Melbourne Council Plan 2013-2017, Urban Forest Strategy (2012 - 2032), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012), Yarra Climate Change Adaptation Plan 2013-2014 (2013)			1		1					B,D,E,F,I,J
211		Develop and implement an integrated water management plan including: water sensitive urban design; waterway protection measures; water conservation; alternative water sources for open space and sports grounds.	4	Infrastructure, Planning	City of Hume Climate Change Adaptation Action Plan 2013 2017, Manningham Green Wedge Action Plan 2020 (2011), Yarra Climate Change Adaptation Plan 2013-2014 (2013)			1		1					All except H

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213		Identify opportunities to use alternative water sources (e.g. recycled water) to provide water to natural ecosystems during drought periods	2	Infrastructure	Manningham Green Wedge Action Plan 2020 (2011), Melbourne Council Plan 2013-2017, Urban Forest Strategy (2012 - 2032), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012), Yarra Climate Change Adaptation Plan 2013-2014 (2013)			1		1					A,B,C,E,F,I,J
215		Identify opportunities to use waste water sources (e.g. industrial, residential) to provide water to natural ecosystems during drought periods	2	Industry	City of Melbourne Climate Change Adaptation Strategy (2009), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012), Yarra Climate Change Adaptation Plan 2013-2014 (2013)			1		1					A,B,C,E,F,I,J
216		Identify moisture retention (greening) opportunities	5		Urban Forest Strategy (2012 - 2032)			1		1					B,E,I

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218		Consider opportunities to improve stormwater diversion for residents to keep their soils hydrated. Stormwater diversions can be considered in property values.	2,3	Infrastructure				1		1					B,E
219		Develop seed banks for vulnerable and affected areas	2					1		1					B,D,I
220		Consider enhancing nurseries to assist affected areas	2					1		1					B,D,I
223		Ensure third pipe facilities are connected	4	Infrastructure				1		1					C,I,J
224		Address the need to retrofit established areas with third pipe facilities	2	Infrastructure	City of Melbourne Climate Change Adaptation Strategy (2009), City of Whittlesea Environmental Sustainability Strategy 2012-2022 (2012)			1		1					C,I,J
225		Conduct an advanced monitoring investigation to establish a baseline against which impacts of a drought can be measured.	5					1		1					B,D
226		Restore and support ecosystem services and environmental wellbeing through better designed infrastructure.	2	Infrastructure	Urban Forest Strategy (2012 - 2032)			1		1					ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
228		Develop an education and awareness program on how the response to droughts and heatwaves should be managed. Aim is to alter community perceptions/prioritisations to the importance of supporting the ecology/biodiversity rather than just sporting fields.	5,7,8	Human services				1		1					D
230		Conduct climate change impact assessment for Council's most vulnerable open spaces (including wildlife reserves and wetlands) to identify and address issues.	5		City of Darebin Climate Change and Peak Oil Adaptation Plan 2010			1		1					ALL GROUPS
217		Improve communications on water usage	7					1		1					B,C
	Improve the resilience of natural ecosystems to bushfire impacts														
206		Ensure approaches to controlled burns are based on management rather than mandatory targets.	4					1		1					D,I
232		Conduct further community education and training in fire management and response actions (esp. grass fires)	8	Human services, EM										1	D,G
234		Conduct assessments on the ecological/ biodiversity impacts of fire clearing breaks for stronger environmental management	5											1	A,D,H,I
237		Develop a regional, long-term approach for land management and fire risk.	5							1				1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
238		Develop an urban fire management program	5	Infrastructure, Industry										1	D
240		Consider the possibility of using trees as firebreaks	2											1	D
241		Consider understorey management as a method of limiting bushfire risk	2											1	D
244		Improve bushfire mitigation actions with a stronger emphasis on protecting biodiversity and cultural heritage	6											1	A,D,H
249		Develop better education regarding burnt trees / tree clearing	8											1	D,I
254		Develop and/or improve active landscape management to reduce the risk and vulnerability of bush fire zones	5,6	Planning						1				1	D,I
258		Ensure appropriate weed management practices are designed and in place to be implemented in the post-fire period.	5,6											1	ALL GROUPS

C6.2 Contextual issues arising

ISSUES
Consider reducing reactive planning
Develop a rainwater tank offset scheme
Ensure infrastructure planning methods incorporate biodiversity
Consider increasing fire drain resources to mitigate future impacts and risk
Alter existing planned management actions to move towards bushfire response.
Consider the impacts to habitats arising from species extinctions
Consider that current 'top of bank set backs' for new developments are too weak
Take advantage of regional opportunities for leadership and advocacy around flooding among councils
Understand that issues around who pays for assets (e.g. Melbourne Water vs. Council) complicate the achievement of WSUD objectives.
Recognise that it's typically very difficult to do the work required after event immediately. It's more likely to happen months later which makes accessing funds difficult (moving on to the next event) – also not covered by insurance.
Recognise that "Friends" / "Water Watch" groups are important.
Consider how open space is created in new developments.

C7 Planning

C7.1 Management actions

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
P31	Improve quality and direction of planning policy and strategy to address expected climatic impacts, risks and vulnerabilities across the NAGA region.		1,2						1	1				1	ALL GROUPS
	Improve resilience to heatwave impacts through the planning scheme														
P03		Broaden focus on ESD policies to include heatwave issues	1	Infrastructure	Related to Local Planning Policy			1							ALL GROUPS
P07		Mandate percentage of shading through the scheme	1	Infrastructure	Related to Local Planning Policy			1							ALL GROUPS
P10		Create heatwave overlay	4		Related to council planning overlays			1							ALL GROUPS
P11		Map UHI hotspots through heat mapping	4	Infrastructure				1							ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
P17		Improve passive design to minimise heatwave impact	2	Infrastructure	Related to the State Planning Policy Framework			1							A,C,D,G
	Improve resilience to flood impacts through the planning scheme														
P02		Limit development in flood prone areas	1	Infrastructure	Related to Local Planning Policy				1						ALL GROUPS
P05		Remove residential areas from existing urban floodway zones	1		Related to council zoning				1						ALL GROUPS
P18		Include quantity in WSUD policy and precinct based rainwater capture and reuse	1	Infrastructure	Related to Local Planning Policy					1					C,D,F,G
P19		Review flood data to update flood overlay	4		Related to council planning overlays				1						C,D,E,F,G
P20		Melbourne Water to upgrade 'storm' tool to include quantity	4						1						C,D,E,F,G
P23		Allocate more WSUD (including ovals) near creek/ waterways	2	Infrastructure					1						F,G,H
P28		Increase permeability requirements for new devel-opments	1	Infrastructure					1						E,F,H
	Improve resilience to bushfire impacts through the planning scheme														

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
P04		Include bushfire issues in schemes for councils without bushfire controls	1		Related to Local Planning Policy									1	ALL GROUPS
P06		Impose minimum lot area on existing rural zones	1		Related to council zoning									1	ALL GROUPS
P08		Use community garden as fire buffer, ovals as fire refuge	2											1	ALL GROUPS
P24		Plan for solar farm for off-grid generation in bushfire zone to keep grass down and reduce load	2	Infrastructure										1	C
P27		Use roads as buffer to bushfire overlay	2	Infrastructure										1	E
182		Improve land use planning to consider evacuation scenarios. This planning should further consider several decades into the future the likely population, transport and climatic scenarios.	5,7	EM										1	A,B
236		Address the poor planning of peri-urban development in fire risk zones through better planning and better methods of enforcement of the planning scheme	1,2,4	Infrastructure										1	D
	Improve community resilience to climate shocks and stresses through the planning scheme														
P01		Plan for community refuges in urban renewal area	1,2	Infrastructure, EM				1	1		1			1	ALL GROUPS

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
P09		Create precinct refuges from natural disasters to protect vulnerable households	2	Infrastructure, EM	Related to Local Planning Policy				1					1	ALL GROUPS
P12		Enable the use of public buildings as refuges. Improve refuge strategy to better inform the communities on the location and types of suitable refuges, as well as expand SES capability	1,4, 6,7	Infrastructure, EM				1	1					1	ALL GROUPS
P14		Group vulnerable buildings (e.g. aged care) near refuges (e.g. hospital)	2	Human services, Infrastructure				1	1					1	ALL GROUPS
P15		Develop climate change triggers and facilitate decision led adaptation (e.g. flexible use buildings and whole of life considerations)	4	Infrastructure		1	1	1	1	1	1	1	1	1	ALL GROUPS
P26		Incorporate cool roofs, permeable paths, compulsory eaves, evaporative cooling, rainwater harvesting in commercial and residential buildings	1	Infrastructure				1	1						E,G
P29		To address projected climatic impacts, risks and vulnerabilities for the NAGA region strengthen ESD policy/requirements for: • Council facilities • Public realm, infrastructure and streetscapes; and • Commercial and residential buildings.	1	Infrastructure					1						G
P22		Plans for shifts in food production areas	1,3	Industry	Related to the State Planning Policy Framework				1	1					B

ACTION REF	MANAGEMENT ACTION	SPECIFIC ACTION	ADAPTATION INTERVENTION CLASSES	CROSS SECTOR APPLICABILITY	COUNCIL DOCUMENT	COUNCIL DOCUMENT									ADDRESSING WHICH VULNERABILITIES / VULNERABLE GROUPS?
						Cold days and nights	Hot days and nights	Heat waves	Heavy rains / flood	Drought	Tropical cyclone	Extreme high sea level	High winds	Bushfire	
250		Address the need for better response and enforcement of the planning scheme in how rebuilding takes place (rebuilding may not be suitable).	4,6	Infrastructure					1					1	B,D,I
256		Design and implement better planning controls for rebuilding and better mechanisms to enforce them. Pay particular attention to prevention and safety.	4,5	Infrastructure					1					1	I

C7.2 Contextual issues arising

ISSUES
Create native vegetation overlay
North face housing to maximise solar exposure (minimise lighting requirements) and minimise heating requirements
Ensure that the planning scheme and design requirements take into account future climate, not just current climate.
Recognise private property opportunities for better land planning
Take into consideration coastal impacts and soil degradation
Convert grassland at risk from fire to conservation area

APPENDIX D - WORKSHOP SUMMARY BY SECTOR

D1 Emergency management

Flash Flood

Management Actions

Key message on the state of current actions:

- Flood strategies in place among multiple organisations and levels. States, Local, Melbourne Water, Urban planning, WSUD/Catchment design all considers flooding.
- Response dominated by SES. Relief centres established.

Key improvements and regional opportunities available:

- Issues of translation between state and local responses. There is a risk that state responses undermine the local responses which are more “in tune”.
- Risk of the emergency management sector being too focused on logistics and resources in response to impacts that potentially require a more “human” understanding that could be provided in other sectors.
- Councils can’t provide assistance until impact assessments are done. Data gathering is important to target further measures, but takes time.
- Messaging to the community needs to be more strategic, e.g. better encapsulating the lived experience of flood events which involves a lot of communication and movement outside of council’s control.
- Early warning is challenging in the flash flood case

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	SEVERITY	RISK SCORE
Key changes to existing categories:				
Increased medium flooding impact events	Direct	6	2	M
Increased "worst case" flooding events – Noted that this is a situation with multiple consequences	Direct	4	4 → 5	M
Increased "worst case" storm events	Direct	4	4 → 5	M
Addition of new impact categories:				
Inability to respond over the long term				
Need for increased preparation with emergency management • Implications for future city developments/planning • Increased population in inner urban areas where poor infrastructure is designed for historic flooding requirements				
Overland flow issues, including blockage of drains.				
Notes or take-home messages: • Heatwave emergency management is much more advanced than flooding at the municipal level. This is influenced by costs to the state. • The most critical consequences should be targeted with a holistic response.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Top vulnerability factors

- Timing of events (e.g. kids at school, parents at work)
- Low income households have less capacity to recover, also can have higher exposure due to location and quality of residence
- Level of income, isolation, language skills
- Homeless have high exposure due to location
- Capacity of individuals to support themselves
- Socially isolated, working illegally
- Use of electronic communication (real time updates, potentially limited audience, some groups excluded)

Scenarios of greatest concern

- Rapid onset events
- Unprecedented events (more acute / severe)
- People putting themselves at risk to help others
- When evacuation is required

Most common experiences among vulnerable groups

- General sense of confusion suggested for disabled persons, elderly citizens and recent migrants.
- People with intellectual disabilities having potentially limited ability for forward thinking. People wanting knowledge of where services are available.
- Concerns around usual services that may not be available any more, finance and health.
- Mobility issues for a range of house-bound vulnerable groups
- Sense of reliance on support services
- Significant fear and anxiety over potential risk and not knowing what is happening, lack of information
- Certain vulnerable groups may be reluctant to leave their homes, particularly those with pets, they may have a fear of the unknown or be worried about the financial impact of leaving their homes
- Fear of financial hardship – sense of having nowhere to go
- There are potential cultural issues- sense of distrust of authority for recent migrants, may be unwilling to accept help
- The experience will depend on the level of family/ community support and connectedness, and access to that support

- A common issue is that Council only knows about vulnerable persons if they are already accessing a support service; however many vulnerable persons have no support and therefore will not be accounted for

Most common expectations from council

- Expectations for council to provide locations safe from the floods or to step in and evacuate. May expect these messages from the state government or NGO's, but either way expecting the message to be clear. Want to be told personally what to do.
- Expectations are likely to vary depending of the level of self-reliance of persons within a defined vulnerable group.
- Migrants are likely to expect messaging in their native language. People in uniforms may be an issue due to trust, depending on their reasons for migrating. Resilience could be higher in this group (or expectations of government assistance lower).
- Non-supported vulnerable groups may have little understanding of expectations of assistance available from council.
- Expectation of easily accessed, clear communications regarding what to do, what resources/ support services/ evacuation will be provided
- Expect properly equipped evacuation centres, DDA compliant, hoists, properly trained staff
- Many will look to friends, family and neighbours, or community leaders and the church for primary help
- Expectation is to return to normality as soon as possible
- Many groups may expect direct financial support or grants
- Provision of short term accommodation, food and clothing,
- Many expect support services to come to them, rather than having to go to support

Emergency Prevention and Preparedness

Prevention

Current Actions

- Planning controls (e.g. bushfire overlay)
- New building standards (bushfire attack level)
- EM Act – community emergency risk assessment (mitigation, control activity)
- Urban Planning Strategy Documents (design principles – how to design for low heat / cool suburbs)
- Maintenance regimes of council owned infrastructure
- Fire Prevention Plan (annual property inspections in rural / bushfire overlay zone)
- Community forums (CFA about prevention and how to protect assets)
- Heat-health alerts (e.g. DSE, SES)

- Drop down guard rails on bridges
- Engineered solutions such as levies and drainage infrastructure
- Mulch washed off from playground during floods
- Maintenance of parks, trees and roads
- Council buildings, bushfire attack zones, building code
- Emergency management manual for Victoria mandates council's framework for response (includes four prongs: prevent, prepare, respond and recover)
- Each Council has their own emergency management plan (recognises cross boundary response)
- Municipal health plan is a statutory requirement
- Roadside vegetation management strategy (e.g. tree planting – who is responsible for the clearing of power lines?)
- Individual fire prevention plans (property inspections, fines)
- Flood management works and infrastructure
- Boroondara / Home community sustainability workshops (strong links with preparedness, linked with CFA)

Gaps / Opportunities / Collaborations

- Opportunity for local councils to feedback into state legislation / policies via MAV
- Opportunity for proactive maintenance (rather than reactive)
- Target large service providers (transport, utilities, homeless network groups) to develop policies
- Detailed flood management to lot level
- Emergency management structure – look at communities at risk rather than a hazard led approach
- There are opportunities to build resilience within the community, particularly among older populations. Resilience can also be factored into primary school education
- Opportunity for increased awareness of emergency management (not all communications are appropriate)
- Opportunity for collaboration between councils / different agencies (reduce duplication of effort, regional duplication)
- Opportunity for EM Victoria to provide material for region, also to coordinate responses
- Emergency planning can better encapsulate people's behaviour and social networks that determine how they respond. For example, understanding that people won't necessarily travel to the nearest evacuation centre because they know people in another town, or tend to shop elsewhere.
- Opportunity to share resources regionally
- Gap that there is no emergency planning legislation related to the environment

- Asset management is limited to conservative maintenance of assets, but should be based on improvement, building resilience and building capacity (maintain but not improve is the current approach)
- Gap in emergency management of infrastructure assets (i.e. evacuation / access to state roads, private roads, lack of council resources to maintain access roads)
- Opportunity for urban greening and WSUD / integrated water management
- Opportunities to improve vulnerable persons register (potential for 'opt-in' vulnerability register, need to gather more info from community about what their needs are)

Preparedness

Current Actions

- Municipal Emergency Management Plan (MEMP) for each council
- Specific sub plans (e.g. heatwave, flood, pandemic, evacuation)
- Reliance on government for information may provide false sense of security about risk
- Preparedness part of lifestyle rather than a reaction to events
- Internal dialogue within council on planning changes
- Knowing who to feed info to
- Local laws (community preparedness)
- Fire preparedness activities undertaken
- Need to take ownership (shared responsibility)
- HACC services
- Council lists (e.g. vulnerable service, vulnerable persons), overlap with DHS (more stringent guidelines – don't meet DHS criteria)
- Community perception of council will influence its ability to provide alerts to the public
- Community communication avenues (e.g. social media) can leave council out of the loop. Similarly, informal assistance efforts may stymy council actions and deliver less than ideal outcomes.
- No legislative requirement for preparedness for local government
- Voluntary local government policy attempts to 'fill the gaps'

Gaps / Opportunities / Collaborations

- MEMP needs to focus on partnership with the community – also the feedback loop can be improved
- Emergency planning needs to be considered for the NDIS and HACC programs
- Minimum standards for safety in growth areas
- Information on the risk associated with moving from urban to rural residential areas

- Not enough understanding of vulnerability to lack of infrastructure (e.g. no access to phone / internet / electricity) and what to do when service goes down
- Warnings need to be increasingly centralised but requires local understanding to manage risk
- Contextualised warnings / messages to the community – different languages, community radio, CFA / councils, linked to Facebook
- Policies need to consider local circumstances and reflect different urban areas
- Socially vulnerable lists at the council level Opportunity for different delivery methods for programs / services (e.g. based on demographic analysis, working with community hubs)
- Leveraging existing council skills / capabilities to provide services (e.g. audio / visual facilities) Opportunity to use established community groups for education / programs Funding to deliver information (e.g. brochures) in different languages to access CaLD
- A spike in spontaneous volunteers has been an issue in the past when not properly managed
- Emergency communication can be improved by making use of existing community relationships held by the various non-emergency management organisations to deliver the messages. Strategically using strong community links can help deliver coordinated and consistent messages across sectors.
- There is some duplication in different sectors dealing with extreme weather impacts. Particular overlap with emergency management and municipal health plans. Need an integrated approach that takes advantage of synergies between sectors.
- Currently there is poor communication / little coordination between emergency services and local government – may double up / cross over (opportunity to collaborate and increase efficiency, however this is very difficult and there is a lack of resourcing to do so)
- Opportunity to make better use of local networks and existing systems
- Opportunity for community gathering places / refuges

Heatwave

Management Actions

Key message on the state of current actions:

- All councils have heatwave plans and significant improvements have been observed since 2009.
- Challenges exist in messaging and encouraging people to modify their behaviour in the event of hot weather.

Key improvements and regional opportunities available:

- As the messages provided on heatwave and bushfire are typically provided simultaneously, there is a risk that those in urban areas treat them as a single issue and dissociate themselves on the basis that they believe it is a rural problem. They hence leave themselves more susceptible to the impacts of heatwave. Scope for improved messaging.
- Potential discord in motivations for investment in air conditioning/fans between landlord, tenants and rental agencies.

- There is scope for better coordination of non-council building operators and industry in the event of heatwave. E.g. better engagement with shopping centres, libraries and cinemas to ensure they are open and able to fulfil respite requirements.
- Privatisation of key infrastructure such as the rail system reduces council's ability to manage certain impacts.

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	SEVERITY	RISK SCORE
Key changes to existing categories:				
N/A				
Addition of new impact categories:				
Impacts on EM personnel (e.g. ageing population makes up a significant proportion of the volunteer base, yet is one of the at risk groups)				
Heatwave restricting the ability of staff to respond				
Impacts of heatwave on ambulance services (increased number of calls, unexpected calls, environment in which paramedics are working)				
Prioritisation / modification / decline in routine council services (exhaustion of staff from heat)				
Notes or take-home messages: • Media could play more of a role in heatwave education (e.g. keeping hydrated) • Community needs to respond appropriately (requires education, understanding of the difference between a hot day vs. a heatwave, effectiveness of heat alerts important)				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Top vulnerability factors

- Maternal health appointments (esp. after midday)
- Those relying on council services / district nurses / family

Scenarios of greatest concern

- Failure of medical system
- Extended events (e.g. over five days) ability to cope is further stressed

Most common experiences among vulnerable groups

- General confusion around what actions to take
- Experiences are highly dependent on the level of family or community connection, isolation will increase the tension with other vulnerabilities
- Comfort (i.e. air conditioning) comes at a price, low income groups or pensioners may be reluctant to use it
- Feeling of being trapped and intense discomfort
- People become set in their ways/ routines, especially elderly, so may not take the necessary actions to protect their health/ wellbeing, low ability to adapt
- The homeless experience total exposure, are not welcomed in many refuge areas (e.g. shopping centres)
- Difficulty to get to refuge areas – lack of transport
- Exacerbation of existing health conditions
- Equipment failure and power disruption
- Mental illness is exacerbated, along with family violence and drug/ alcohol abuse
- Confusion about where to go
- Impacts on PT services limiting mobility of low income groups or pensioners
- Impacts on community services (activities and events)

Most common expectations from council

- If a person is registered in a system of assistance, they'll expect this to continue uninterrupted
- Those with primary carers will look to them for support, expect home services and care to continue, however this may not be possible during heat waves (e.g. many home carers are themselves vulnerable groups)
- Persons in aged care and other facilities expect backup generators/ resilient power supply
- People need information regarding how to care for themselves

- Higher expectation that emergency services, especially health services, will step in
- Many elderly persons have a perception that they don't want to bother friends/ family and won't ask for the help that they need
- Low income householders will expect little to nothing in the way of assistance, main service providers are Centrelink and they are not equipped to provide support
- Homeless will expect open doors and refuges – churches, shelters
- Increased service from support networks (e.g. government, council, carers)
- Expectation of increased communications, spreading public awareness
- Expectation that services should continue as per business as usual (e.g. power)
- Expectation of provision of 'cool places' by council (e.g. council swimming pools)

Bushfire

Management Actions

Key message on the state of current actions:

- Again, significant improvements and changes since Black Saturday.
- Current responses include fire hazard reduction (DEPI), fire ready plans, communication strategies, relief centres, council liaison officers on the ground, establishment of MECCs, post-impact assessments, etc.
- There is some reliance on community services to address certain vulnerable groups.

Key improvements and regional opportunities available:

- The vulnerable persons register held by council is a relatively exclusive list. Doesn't encapsulate people meeting some but not all of the vulnerability criteria. Those other vulnerable people need to be engaged in known services in order to receive assistance.
- Weekends and code red days create additional risks due to closed schools and a limited available workforce.
- The control agency could improve in sending consistent messages to government, community and media outlets.
- Middle ring strategy with next wave to assist (intra council coordination)

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	SEVERITY	RISK SCORE
Key changes to existing categories:				
N/A				
Addition of new impact categories:				
Smoke due to bushfires				
Impact on business continuity				
Impact on council services due to bushfire restricting road usage and access				
Reduced capacity to deal with subsequent / multiple events				
Reduced capacity of medical services during bushfire event				
Notes or take-home messages: • There are a number of additional indirect and compounding impacts to be considered.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Top vulnerability factors

- Lack of knowledge and preparedness
- Limited social network, don't know neighbours
- Changed environment – don't recognise the risk
- Time limited – haven't done preventative works
- Limited connectedness – no phone, TV or internet
- Limited mobility – either physical or lack of transport / car
- Overconfident in their ability to stay and defend their property
- Those with poor English skills

Scenarios of greatest concern

- Multiple fires in multiple locations
- Road closures, traffic gridlock
- Confusion as to whether people should leave
- Increased risk due to decrease in agricultural activity, vegetation surrounding land banked properties not maintained

Most common experiences among vulnerable groups

- Sense of fear and confusion, not knowing what action to take or where to go, need direction
- Some vulnerable groups may overestimate their ability to cope
- Personal historic experience can be a drawback – perception of safety
- Elderly citizens may be better prepared from having attended more community/ information meetings
- High isolation, less access to vehicles, especially low income householders
- Low income householders/ new immigrants are less likely to have a fire plan
- Issue of separation of families- teens and children are vulnerable
- Risk that low income householders will stay to defend their properties because they have no insurance
- Restricted mobility for disabled people
- Highly power dependent
- Communication issues (e.g. mentally disabled people correctly interpreting warning messages, language barrier for immigrants)
- Gap in services for people in detention centres, the homeless, illegal immigrants etc.
- For recent immigrants, bushfire could be a completely new experience

Most common expectations from council

- Expect information regarding whether it's safe to travel and where
- Family may need support in trying to reach elderly relatives
- Persons with an illness will need information regarding alternative medical support services
- Disabled, elderly people etc. will expect someone to come to assist (e.g. carer, services, HACCs, nurse etc.)
- Recent immigrants may expect to be told what to do and that there would be somewhere safe to go
- Emergency relief centres / neighbourhood safety centres (assessed by CFA / council to be safe)
- Expectation of provision of 'cool places' by council (e.g. council swimming pools)

Post-recovery

Key experiences in and comment on the effectiveness of existing systems:

- During Black Saturday, the key issues identified were staff training and resourcing.
- It is difficult to conceptualise how effective the current system will be in producing the best post-recovery outcomes in a future fire scenario that creates risks more extreme than what was observed for black Saturday.
- A number of existing recovery committees
- Community lead is often dependent upon others and may be powerless
- Individuals are very reliant on information that is gathered
- Information regarding power, how to get help, and how to offer help (i.e. volunteering opportunities) very important
- Communications breakdowns impacting on business continuity
- Lots of confusion on accessibility and safe routes immediately post-event
- Whittlesea – Health Dept. became Health and Recovery Dept. after Black Saturday
- Emergency Management Victoria brought together response (Police) and recovery (human services)
- Recovery of council assets – rebuilding bridges again and again

Key improvements and regional opportunities for better post-recovery:

- There is concern that the community's expectations since Black Saturday exceed the improvements that have been implemented in the meantime, leading to potential complacency or unreasonable perceptions on the balance between personal and council responsibilities.
- Need to better understand how DHS-based case management services are managed in the longer term, particularly in light of them being pushed down to the council level, or being contracted out to agencies. We lack an understanding of how scalable these organisations are in the event of increased workloads post-disaster.
- Recovery needs to be better defined by State Government
- There is a challenge to maintain ongoing recovery at a community level
- Timelines need to be flexible
- State systems can be heavy handed
- Opportunities for local empowerment through proper regional structures
- Study into what are the stages of recovery (e.g. first week, 6 months, 1 year) – what are the decisions that need to be made, this could be coordinated as a regional study
- Needs to be more contingency planning for cross-municipal work
- DHS role could be better defined
- Better regional understanding that disaster creates new vulnerabilities

- Need to work out regionally 'what can we do for you" rather than "where's your recovery plan?"
- Better communication on what is needed at State Government policy level vs. local council level
- Education on what community can do to assist the local community (e.g. the San Francisco Community Emergency Response Team for a basic community response, including spontaneous volunteers, reduces issues – also street wardens in Tokyo, Japan)
- Funding is time bound (Commonwealth funding two full years after the event, timeframe was extended for Black Saturday)
- How to support cross-boundary activities
- Fire management collaboration (capacity support, sharing resources) across the region
- Most support services only during event, disappear during recovery
- More scope for state government to enable recovery
- Opportunity during next Emergency Management bill (early 2015) to cover municipal roles and responsibilities and to influence guidelines that sit underneath
- Opportunity to train staff to be recovery managers
- Expectation that local government will provide ongoing support
- Government funding occurs in blocks, and drops off, while recovery period continues
- Opportunity through the North West Metro Regional Group
- Standardise / adopt similar approaches (3 year contract, project officer, training, EM audits, post impact assessment, data collection, guidelines / procedures)
- Pool regional resources
- Lessons learnt from previous events to enhance future recovery
- Formal economic recovery process when emergency declared over

D2 Human services

NAGA IRVA – Human Services Workshop Summary – 21 July 2014

Flash Flood

Management Actions

Key message on the state of current actions:

- There is a strong focus on communication with community leaders and building their capacity in disaster response.
- WSUD and land use controls dominate the "prepare" suite of responses. "Response" most commonly in the form of door knocking.

Key improvements and regional opportunities available:

- The role of door-knockers is unclear: Rapid impact assessment or support provision? People expecting help when knockers arrive. Door knockers consequently ill-prepared and need better training. (Council)
- Scope for further learning from councils in Queensland and rural Victoria. (NAGA/Council)

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
Reference to 'electricity, water and sewerage' combined in one term as 'essential services' in relation to impacts associated with increased food and water-borne illness.				
Addition of new impact categories:				
Social and economic impacts associated with recovery from flood events	I			H
Long term impacts on essential infrastructure and building stock	D			M
Inability to communicate with vulnerable populations if power or communication network are impacted	I			H

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Inability of council / essential services to respond to flood event, due to: • Workforce not physically able to attend work • Supply chain – good (fuel) and services (employees) for agencies are not able to be provided • Assets are damaged and not operable – power supply	I			H
People placing themselves at risk to access vulnerable individuals	D			H
Complete collapse of commercial operations due to inadequate insurance, recovery costs, lack of return custom – leading to wider socioeconomic impacts in the area	I			M
Notes or take-home messages: • In a flood event there are multiple aspects of this event that can impinge the ability of those who provide response or recovery services for vulnerable populations (council or organisations that provide essential infrastructure (power) or services (nursing / hospital)).				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Most common vulnerability factors/pathways:

Top factors (exposure or sensitivity):

- Children – separate location of parents/care-takers at time of flooding, limited physical ability to cope, lower cognitive ability to perceive or be aware of danger, limitations due to particular social constraints (such as pre-existing custody or family violence issues), further health exposure due to water damage and exposure to damp conditions
- Elderly citizen – place of residence in low-lying areas, physical inability to drive, limited physical ability or mobility
- Those with poor physical or mental health – physical inability to drive, limited physical ability or mobility
- Low-income householder – physical damage to homes more likely or vulnerable to damage (assumed lower building quality), lower financial capacity to respond, limited or no insurance cover, limited ability to cope with displacement (financially and resources)

- Culturally and linguistically diverse communities – reduced access or perception to warning communications (communicated in English) combined with no / limited historical exposure to events

Other identified vulnerable groups (which may be a sub-set of the above groups)

- Transient populations (including visitors, homeless) – physically exposed to physical location at the time of flooding, limited access to communication of warnings
- Low-lying communities – this could include businesses (such as health facilities, food stores, doctors, pharmacists) that limit the provision of needs and resources to the population
- Isolated people – limited access to warning communications
- Council staff – conflict of responsibility (unclear HS policies and protocols), impact on ability to provide services (operations, health care)
- Persons in prison, juvenile detention, detention centres – existing security and lock-down protocols may prevent mobility and evacuation, perception as a low priority during event

Scenario aspects of greatest concern:

- For all vulnerable communities – the combination of vulnerable groups living in low-lying areas, including the limited physical ability (or pre-existing conditions) will pose the greatest concern
- Particular concerns are post-event impacts, i.e. access to safe water, health food and containing or preventing public health outbreaks (particular vulnerabilities will be on Primary Health Organisations that may become resource strained)

Most common experiences & expectations from council:

Experiences:

- Disabled person – housing issues reducing mobility, especially in older DoH housing, lack of resources such as backup food stores, difficulty in evacuating, isolation and fear, much disabled equipment (e.g. wheelchairs) is not compatible with flooding. First contact will be from local government, media (e.g. radio), mobile phone (SMS), and friends and family for safety. For those that are isolated, there is greater reliance on neighbours or EM
- Elderly citizen – isolation (often living alone), scared and reluctant to leave (fear of theft/ vandalism), many are bedridden and disabled (limited mobility is a concern), may have low English proficiency, confusion and low ability to make decisions for themselves, not sure who to ask for help, can't access vital services such as medical care, escalating risk of disease/ health issues. First contact will be with HACC/DHS on the vulnerable persons list.
- Low-income householder – fear of finances, 'what will it cost to evacuate?', higher impact on housing/ living conditions, unlikely to have insurance, poor mobility (may not have a car and public transport is restricted), low food security, can't replace essentials (e.g. school uniforms), longer-term health and wellbeing impacts compared to others. May not know where to go (emergency evacuation). Their direct contact with services will be different: Centrelink particularly for recovery assistance; Maternal and Child Health, Youth Services may need management processes; and other services such as Community Health Care, Drug and Alcoholic Services, Housing.

- Recent migrant – Fear of not understanding what is happening, low community connection, isolation, lack of way finding, fear of asking for help or taking help from authority, low level of trust in government. First response would be to family and friends
- People suffering an illness – parents/carers may not be able to get back home, can health providers reach you to do evacuation, shortage of specialist vehicles (e.g. maxi taxis), identifying the ill could be difficult, limited access to and transportation of required medications.

Expectations:

- Disabled person – expectation of rescue and physical evacuation, expects that someone should know that they need help (shouldn't have to ask), neighbour support, clear communication, early warning. Refuges need to be assessed for the appropriate scenario (one good for heatwaves may not be good for flooding)
- Elderly citizen – evacuation, in home support, expect familiar faces (community, neighbours), emphasis on community connection. Will expect a degree of communication including; a sense on timing of how long the incident will last, consistency (messaging is consistent and with one voice), emergency management plans to be implemented.
- Low-income householder – community support and relief agencies, expect and need cash relief/ government grants, food parcels, a place to go in the long term if their house is unliveable, government health services, difficulty in covering basic needs and essentials (support for food is not enough), timely repairs to housing. Their direct point of contact (listed above) may not have sufficient training for emergency situation. May not have any contact with the council (as most likely they are renters).
- Recent migrant – doesn't know what to expect! May look to their community rather than government – especially community leaders, church/mosques/faith organisations, or migrant resource centres (do these groups know how to respond to these situations?), community connection is vital (note: relief centres may not be equipped properly to cater for different religions/ cultures)
- Person suffering an illness – should people make a plan for how they should cope, do people think about their neighbours, information needs to be tailored to the event type

Pre-heatwave

Key experiences in pre-heatwave preparation:

- Difficult to communicate that it's not just hot weather, but seriously dangerous
- Issues with managing heat impacts in certain types of buildings, e.g. high-rises
- Very difficult to engage the community in heatwave planning during colder months
- The biggest issue is the low reliability of the power supply which has implications for every type of response – e.g. it is difficult to plan to keep air conditioned facilities open for longer
- All essential services that are located in fire risk areas are shut down in extreme heatwave for safety reasons (e.g. all of Nillumbik's resources north of Diamond Creek) – this is necessary but makes planning and delivering responses to bushfires much more difficult = 'tension between providing care to the community and the duty of care to shut down services in high risk areas'

- Low reliability of staff makes planning for heatwaves difficult – many community service workers are disproportionally made up of vulnerable groups (e.g. many HACC workers are elderly), and cannot work during heatwaves
- There isn't any clarity around a "stop work" temperature for staff
- Planning can't benefit from cross-regional surge capacity resourcing because all neighbouring councils are experiencing the same problems
- A major recurring problem is providing shelter/ help to people with pets – pet owners are a vulnerable group
- Buildings with ESD features can struggle in heatwave conditions and are not recommended as shelters
- As part of current plan council increases the opening hours of certain 'cool' facilities, e.g. swimming pools and libraries
- Focus of strategy is on self-care – need to ensure that not all obligations are placed on council
- It is not always 'vulnerable populations' at risk, physically fit workers / joggers can also experience health impacts
- Those on council vulnerable list contacted during January 2014 heatwave
- Dependant on the Council, awareness of the heatwave by staff is communicated differently (some ad-hoc communication, whilst others have the Heatwave Plan only being owned by a small group of staff within Council)
- Council staff were physically strained – many had lack of sleep
- Good existing links with State Departments
- Aged Care direct service staff are well-prepared (drivers and personnel are warned and equipped)
- For many councils, Heatwave Preparedness and Plans are now in place
- Focus for councils is on direct service delivery
- Relief teams existing in Council
- Heatwave plan triggered by overnight temperatures
- Vulnerable persons list (some Council lists are very restrictive, e.g. in one Council there are 7 people on the list, in reality it is hundreds of people)
- Local radio contact – multiple languages
- Ongoing work to improve the households of HACC clients (install and upgrade infrastructure)
- Alerted libraries – supplied with water – that there would be more people
- Shopping centres as refuges

Key improvements and regional opportunities available for pre-heatwave preparation:

- Issues w' communicating risks to migrants and particularly tourists. Make good use of multilingual TV and radio channels
- Council notifies some groups and state government notifies others. Not 100% sure who notifies who. Could potentially be better documented
- Need to identify a 'stop work' temperature
- All Councils (or the region as a whole) should develop 'Safe System of Work' Policies
- Better provision/planning of generator power would be a major step to build resilience
- Much of planning should be at a housing level – building resilience by improving conditions of living
- Planning for financial assistance for most vulnerable people, many have resources (e.g. air conditioning) that they can't afford to use
- Need to improve on planning for long-term heatwaves, at the moment the response can only provide support for 1-3 day events and longer events are becoming increasingly frequent
- Better planning is needed to provide cross-regional surge capacity
- Opportunity: sub-regional electricity load sharing to increase the resilience of the power network
- Better coordination with community organisations. Noted potential conflict between council extended working hours and community organisations closing down during heatwave conditions
- Focus on pre heatwave event planning with a range of NGO and other state government agencies that may come into contact with vulnerable groups during heatwave conditions
- Public is not aware of the locations of relief centres, which is due to these centres being decided closer to event time, and were not advertised publicly
- Certain councils have good historical knowledge (such as those in Gippsland) that can share knowledge
- There may be room for expansion of existing plans, given that further extended periods of heatwaves are expected Identifying opportunities for education people about how to change behaviours / routines during heatwaves
- Maturing within local social networks (e.g. USA, CALD Groups), phone tree

Heatwave

Management Actions

Key message on the state of current actions:

- Most of the "prevent" actions are covered by building standards and urban design. Creating well vegetated, cool spaces with water provision seems to be an effective solution.

Key improvements and regional opportunities available:

- Some council buildings are at risk due to not having generators in the event of a power outage. **(Council)**
- There is a significant amount of reliance on other organisations during a heatwave, however the precise roles and responsibilities of all these organisations are not well documented, and not covered in the existing heat wave plans. **(Council / Regional)**
- Information sharing could be better managed, as it currently relies heavily on personal relationships. **(Council/Regional)**

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
'Higher incidence of mental and behavioural disorders', split to include a new category of 'Higher incidence of domestic violence'.	I			
Addition of new impact categories:				
Loss of income for casual workers who are not able to work during heatwave conditions	I			M
Major power disruption due to brown outs impacting on high rise. Not just those in public housing, but also non-traditional vulnerable groups, such as Southbank towers.	I			M-H
Power disruption impacting the viability of designated 'cooling' centres.	I			H
Inability to deliver services to those vulnerable due to public transport disruption, leading to wider transport network disruption.	I			M-H

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
School closure impacting on availability of council staff and contributing to traffic disruption.	I			M
Confusion over interaction with bushfire 'code red' actions.	I			M
Individuals refusing to move to cool centres as won't leave pets and animals behind, resulting in impacts	I			H
Notes or take-home messages: • A heatwave in invisible and it is not just the direct impacts on those vulnerable, but the complex interaction with the urban form that can also impact non-traditional vulnerabilities.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Most common vulnerability factors/pathways:

Top factors (exposure or sensitivity):

- Children – limited parent and caretaker access (working hours, etc.), childcare and educational services not opening due to heat, limited physical ability and capacity to cope with heat
- Elderly citizen – level of isolation, exacerbation of pre-existing medical conditions
- Low-income householder – lower quality housing standards (community housing) and appliances leading to poor ability to cope with heat (lack of air-conditioning and fans)
- Those with poor physical or mental health – particular requirements of individuals leading to further impacts (such as requiring jumpers, or certain environmental conditions)
- Culturally and linguistically diverse communities – no or limited historical exposure to issues
- Related to all vulnerable groups – limited or reduced running of community services (due to constrained or overwhelmed services), power outages lead to reduced access to air conditioning, reduced access to supplies for relief (e.g. unable to go outside to access food stores)

Other identified vulnerable groups (which may be a sub-set of the above groups)

- Young population – greater exposure to outdoors due to summer events and activities, pre-existing ideas on coping with heat (lack of rehydration)

Scenario aspects of greatest concern:

- For all vulnerable communities – restricted physical activity and pre-existing medical conditions can exacerbate vulnerabilities. A combination of poor housing condition and limited transport access to cool-relief areas (shopping centres, pools) or health services (for medications or treatment)

Most common experiences and expectations from council:

Experiences:

- Responses for different groups are very different
- Can't classify 'disabled persons' as one group – need to be treated differently: 3 major groups – sensory impairment, mobility impairment, cognitive impairment
- Isolation and disconnection is a major theme
- Physical frailty
- Fear – of how to evacuate, how to access basic resources, how carers will access them to help
- Confusion
- Limited financial resources to help themselves
- Limited capacity to identify their own needs
- Vulnerably is exacerbated in the heat, especially health problems
- Migrants: limited experience in what to do or how to get information
- Also consider the homeless population as another vulnerable group: they are not welcome anywhere (tolerance is even less during heatwave), even emergency shelters, very difficult to trace (no register) or communicate with
- Key characteristics of vulnerability: what is their capacity to cope, how isolated are they, how well can they be communicated with, what resources do they have and how well can they use them

Expectations:

- Disabled/ elderly: municipal response, council advice, need comfort and a sense of protection, perception of safety is crucial
- Homeless: expect equal access to cool spaces
- Recent migrant: informal and community networks may break down, low expectations of government, won't seek information from Council, may not accept support from Council, more self-reliant
- People suffering an illness: expect to be identified and accounted for – 'vulnerable persons register' – need to refine this process, far too limited in who it identifies

Bushfire

Management Actions

Key message on the state of current actions:

- Many issues faced during Black Saturday have since been addressed. General feeling of sufficient preparedness for future bushfire scenarios in light of what happened.

Key improvements and regional opportunities available:

- Regional emergency management plans are developing, but require more work. **(Regional)**
- Post Black Saturday bushfire procedures have been developed, but never tested. Similarly, the procedures have never been run through in a "fire drill" type scenario to test their effectiveness or test staff knowledge. **(Council/NAGA/Regional)**

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
'Injuries and deaths' – note that it's not just 'vulnerable groups', but a range of community members that may be impacted	D		4 → 5	
Addition of new impact categories:				
Loss of income during recovery phase – increased financial stress and subsequent health and social impacts	I			M-H
Immediate loss of essential services and communications infrastructure - subsequent multiple and compounding impacts when managing vulnerable groups	I			H
Exacerbation of pre-existing conditions during the event and inability to readily access treatment or medication post event	I			H
Notes or take-home messages: • General lack of preparedness in the inner and middle ring suburbs for bushfires and the potential socio-economic impacts this may have.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Most common vulnerability factors/pathways:

Top factors (exposure or sensitivity):

- Children – located in areas away from parent/carer during bushfire, easily disorientated/distressed, cautious interaction with other adults (strangers, particularly in post-fire events)
- Elderly citizen – co-located (such as nursing homes) makes it hard to co-ordinate moving and evacuation of groups, access to required medications for pre-existing conditions, easily disorientated, requires immediate medical attention during event
- Low-income householder – sub-standard housing materials (not as fireproof), unable to move for recovery due to financial constraints – potential fear of losing possessions
- Those with poor physical or mental health –
- Culturally and linguistically diverse communities – not aware of verbal warnings (lack of language or understanding), limited ability to interpret and comprehend danger, limited places to seek refuge (due to cultural issues or barriers, e.g. male-female interactions, etc.)

Scenario aspects of greatest concern:

- For all vulnerable communities – those residents located in bushfire overlay areas, socially isolated people, those disconnected with family, those reliant on others for transport, general response of disorientation and panic, decision-making based on pre-existing ideas (such as protecting of possessions or pets, etc.)

Most common experiences and expectations from council:

Experiences:

- Disabled person – biggest issue is evacuation, support to evacuate at the right time, fear regarding whether the evacuation centre can meet their needs (e.g. staff assistance, hoists, HACC workers), support services may no longer be available, dependence on primary carers who may not have access to bushfire zones,
- Elderly citizen – mobility issues, isolation/ fear, services are shut down, lack of access to basic needs/ medication, fear of the unknown, unwillingness to evacuate, effects of smoke and smog on vision/ health, confusion/mental impairment/ disorientation
- Recent migrant (or any migrant with low English proficiency) – may not know the event is happening! e.g. Black Saturday was not on Lebanese TV, difficulty of communication (need for the message to be simple and clear)

Expectations:

- Disabled person – expects priority access for carers to get to them and provide help , need early warning to evacuate before resources are shut down, need to have a personal evacuation plan, expect to have somewhere to go with proper disabled access/resources

- Elderly - reliance on council for evacuation/ transport, expect to be checked in with - there needs to be a better vulnerability register
- Recent migrant – clear and simple messaging, fear of asking for help or taking help from authority, low level of trust in government

Post-recovery

Key experiences in and comment on the effectiveness of existing systems:

- Post bushfire is well prepared for, as it extends from the comprehensive (albeit untested) bushfire plan. Strong reliance on emergency services and the Red Cross.
- There is a very high reliance on grants
- There is a burn out of staff resources – high stress and pressure
- Support services are designed for the short-term and often become strained in the long term
- Providing proper information to the community in this phase is crucial, 'where to go for what,' the role of Council
- Even once resources are funded, they may be difficult to access
- Difficulty in bridging immediate assistance vs. long term recovery
- Willingness of the community to volunteer goods and services immediately after an event
- A range of 'non-traditional' services are required, such as vets to treat animals, personnel to clean water tanks impacted by soot and smoke from fires
- Inability / unwillingness of certain groups to contact support services (e.g. proud rural landowner), despite the provision of council / agency services
- Gippsland fires was a very good example of the potential of the sharing of resources between LGAs across Victoria
- Positive response for volunteer help and community response
- Need more resources to co-ordinate volunteers and organise and distribute services/donations (clothes, equipment, re-building process, etc.)
- Immediate need for temporary accommodation, resources and supplies
- Needed to organise Council groups to go back and find people who stayed (need documentation and information) Responding to the situation was largely ad-hoc, rather than planned
- Have good plans and trained people to respond to emergencies, and whilst some plans exist they did not totally cover all areas
- Monetary donations appeared to not be managed, particularly with external organisations that were involved
- Disconnect from community and people on the ground, particularly regarding feedback to management/leadership which lead to an overall gap of information

- Council provided great resources for community groups in the recovery phase (extreme positive), particularly the community-led / grass-roots initiatives that were resourced
- Councils shared resources (provided other officers to assist with office-work)

Key improvements and regional opportunities for better post-recovery:

- A consistent template for operations between municipalities to enable workers from across borders to pick up each other's work would be ideal. E.g. A worker in an affected region addresses immediate emergencies while a worker from another region comes in and helps with their regular duties.
- Communication is the key area for improvement – often it is too technical, too specific, and not understood
- Draw upon community leaders to deliver messages, look more clearly at the community for how to target communications
- Improved staging: identify where the recovery needs to be and where the impacts will be
- A need for rebuilding guidelines: advice on when to rebuild, how to navigate the permit system, how to rebuild more resiliently
- Council's role in not approving rebuilding in dangerous areas; how to encourage people to live elsewhere
- Finding ways to cope with issues around loss of property value
- Regionally: there needs to be a coordinated response as assistance for people to relocate away from a dangerous area permanently, and to help people understand why they need to move
- Regional cross-council use of major recovery resources, shelters
- Need for a Regional Response Plan, better pooling of resources in providing ongoing support
- Need to have in place a plan for long term support and recovery from events, potential impacts from depression and suicide as people rebuild
- Ensure donations are the goods and services that are required for the event and providing a means by which these donations are coordinated
- Ensuring support continues for the time required
- Ensuring giving addresses seasonal requirements for long recovery, i.e. jumpers and blankets for winter conditions
- Acknowledging that people may be living in temporary accommodation for a long time and designing programs for these requirements
- At a regional level there are benefits in having consistent messaging / information available
- Post fire door knocking by volunteers can occur too late to assist. Need to ensure there is an induction package available to bring volunteers up to speed quickly on how to engage with vulnerable communities

- What processes are available to learn from post recovery experiences and apply to the next event
- A community-led recovery is most effective as they know their needs and can pool together as a community (rather than a one-size fits all grant application approach)
- Recognise that not all regions are the same and need the same resources or recovery initiatives
- Community will not necessarily come to Councils, need to be proactive in reaching out to community
- Each Council brought out own information sheets and flyers individually, leading to an overlap of information. Region could have a general information sheet, and Councils can work to expand or highlight individual information in these
- There is a need to have a regional publication of relief centres (across all Councils, regardless of location) as this is particularly needed for transient communities or people who were in another location at the time of event. Difficult to get information from residents who were in different council zones).

D3 Industry

NAGA IRVA – Industry Workshop Summary – 5 August 2014

Flash Flood

Management Actions

Key message on the state of current actions:

- Council has a role in educating industries about their flood-associated risks. The way in which this information is presented to the public is, however, crucial because there is a risk of creating a flood-related stigma on certain areas. Must find a balance between ensuring the safety of the public and minimising impacts to businesses in flood-prone areas.
- Some councils provide infrastructure that builds flood resilience, e.g. rainwaters tanks, but not all.
- Much of the 'prevent' suite of responses is dominated by planning provisions, regulations and use of overlays. Councils conduct focus groups to assist in the identification of risks.
- 'Response' entails follow up with businesses to see how they're faring. This process facilitates data collection for future planning, but has previously revealed gaps in understanding of the council's role.

Key improvements and regional opportunities available:

- There is an issue with understanding the boundaries for responsibility when it comes to damage to property. While council is not responsible for impacts to private property, they do manage the stormwater infrastructure that may have failed during an event.
- There is some scope for better planning around sub-ground level infrastructure, e.g. underground car parks.
- Business resilience can be improved by councils developing special rates schemes that contribute funds to developments in the urban landscape. At present, such schemes are run on a strip-by-strip basis and aim to improve the marketability of an area, but they don't necessarily fund flood or climate resilience infrastructure. Such schemes could be adapted to do so.

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
Business closure and job loss. Amend to indicate it is a scale and rather than closure the impact may be economic downturn.				
Noted that flooding can be highly localised and can occur without other parts of a local government area / region being aware of the impacts being experienced. Elizabeth Street in City of Melbourne cited as an example.				
Addition of new impact categories:				
Change in demand for goods and services. Secondary impacts of the event on the customer experience, potentially resulting from impacts on the transport network.				
Impacts will differ depending on the type of business. Noted that a key criterion that will influence the extent of impact is the location and type of stock. Perishable stock reliant businesses will be most impacted.				
Inadequate or narrowly defined insurance coverage will impact the post-recovery of a business.				
Resourcing available to business to have in place a well formed planned in response to emergency and climatic event will influence the extent of an impact. Noted that 90% of business in the City of Whittlesea are small businesses.				
Climatic events that occur outside of the region and impact the ability to supply input goods and services, in particular for food processing, will impact businesses in the region.				

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
The impact that relief centres have over the long term in the provision of free or discounted goods have on businesses in the vicinity.				

Notes or take-home messages:

- There are generic impacts which are applicable at a regional level, but there are a range of factors, such as the type of business, its stock, supply chain, resourcing and insurance that will moderate the level of impact.
- There is a significant opportunity for the Economic Development units within council to improve their understanding of the potential role that can be played in supporting local business in the context of climatic events.

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Businesses

Key vulnerability factors for different aspects of industry:

Key operations vulnerabilities (e.g. infrastructure, utilities, staff):

- Flood damage to key infrastructure such as roads and service-providing buildings is critical.
- Health care and social assistance centres at particular risk due to duty of care for patients.
- Agriculture should not be forgotten as there is limited support for privately held land.

Key supplier vulnerabilities:

- Direct destruction of stock.
- Impacts from the accumulation of waste.
- Risks to business relationships.
- Indirect wastage of stock and resources due to limited distribution capabilities.
- Vulnerability is affected by the degree of centralisations of warehouses and transport infrastructure.

Key Customer vulnerabilities:

- Patients at risk in health care centres.
- Customers not receiving goods due to hindered delivery/distribution network. Relevant to multiple stakeholders along retail chains from wholesale to end user.
- Health issues arising from limited medical supplies.

Most common experiences & expectations from council:

Experiences:

- Staff have difficulty accessing place of work
- Loss of productivity
- Disruptions to work and schedules
- Potential for stock/equipment to be damaged
- Questions about whether covered by insurance
- Some businesses may have capacity as a refuge (e.g. big box retail)
- Particularly strong impacts on the health system and associated industries
- Major issues in distributing freight – routes interrupted, supply chain issues, spoiling of stock
- Warehouses may be damaged – stock damage and nowhere to store or redistribute stock, significant implications for food security
- Safety of staff (or students) is the paramount concern – close if necessary and then protect assets to minimise damage if possible
- Huge impacts on TAFEs and Universities- e.g. extensive loss of electronic equipment
- Issues around hygiene – water borne disease, damp equipment – supply chain impacts
- There may be confusion for businesses around when to shut down and knowing when there are safety issues
- Some businesses may continue to work in unsafe conditions to minimise loss of revenue – this is difficult to regulate

Expectations:

- (Proactive) provision of information (e.g. emergency information, how to get help, when businesses are back up and running), proper media coordination – especially around transport routes and access
- Clean up by council/State Emergency Services (SES) (e.g. silt, streets, debris)
- Provision of waste services for items damaged by floods (e.g. damaged carpets)
- Potential provision of counselling services, if warranted
- Government should be taking long term action to prepare businesses for these kinds of scenarios, especially in at-risk areas
- Big box retail will be responsible for disseminating the proper information to their staff, they'll want this information provided to them
- Looking to insurers to provide prompt support/ payouts

- Some businesses may expect staff to continue working under unsafe conditions
- Larger businesses will need more resources than smaller businesses to recover, but will look to their parent company for support
- There may be an expectation that the government provide assistance to staff where insurance can't help

Heatwave

Management Actions

Key message on the state of current actions:

- The main council initiatives discussed include: greening the city to reduce the Urban Heat Island (UHI) effect, engagement with businesses on Ecologically Sustainable Development (ESD) measures in their building designs, providing information to smaller businesses on their insurance options and providing respite infrastructure that can ensure a maintained customer base in certain areas during a heatwave.
- Council can also provide incentives for measures that create indirect resilience, e.g. more solar panels reducing the risk of brownout for the region.

Key improvements and regional opportunities available:

- Council can impose regulations that ensure better building design for heatwaves, although the increased cost of designs may be difficult to manage with landlords.
- There are issues with engaging businesses prior to heatwaves becoming a noticeable financial burden to them.
- Councils can regionally coordinate businesses that are capable of providing respite services in the event of a heatwave (e.g. pools and shopping centres as well as council buildings).
- Council lacks influence on big businesses. There is a need to be realistic about what they can achieve with their big business engagement. Greater scope for improved council assistance among small businesses.

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
Strip retail suffers a particular downturn during these events due to the inability to offer customers respite from the heat.				

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
In relation to heat stress. Other occupations identified include; emergency services, postal services and couriers.				
Negative health impacts. Noted that increased stress levels during heatwave conditions can result in an increase in accident rates.				
Addition of new impact categories:				
Increase in the extent of leave days taken by staff, impacts on productivity.				
Increase in the quality of output during heatwave conditions, leading to increased costs of reworking.				
Increased privatisation of public spaces that are required to address the UHI, negatively impacting on business.				
General disruption to customers/ operations and suppliers as other, personal (e.g. pets) priorities take over.				
Businesses that promote access to air conditioning, or have products that respond to heatwave conditions can benefit.				
Climatic events that occur outside of the region and impact the ability to supply input goods and services, in particular for food processing, will impact businesses in the region.				

Notes or take-home messages:

- Potential for multiple impacts and those businesses where either the personnel or customers are exposed to the heatwave conditions are likely to suffer the most from a human health and economic perspective.

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Key vulnerability factors for different aspects of industry:

Key operations vulnerabilities (e.g. infrastructure, utilities, staff):

- Warehouses lacking air conditioning creates occupational health and safety (OHS) risks to staff and can potentially impact the held stock.
- Extreme heat can lead to operations shutdowns across virtually all industries except health care and social assistance providers. School shut downs create increased burdens on other systems.
- Shut downs/disruptions create scheduling issues. This is a particular issue with construction.
- General lack of staff motivation may be observed. Health may be affected and reduction in productivity may result. Australia post in particular is an interesting case as it must address both the OHS and logistics issues.
- Loss of customers for some small and medium enterprises (SMEs)
- Some equipment may be inoperable under certain temperature, limiting service provision.
- Hospitals observing sharp increases in patient numbers and hence resources are stretched.
- Restaurants and nurseries affected by water restrictions.

Key supplier vulnerabilities:

- Delivery and stock of perishables may be difficult. Refrigeration power increasing considerably and higher risk of loss.
- Supply of critical good and services entails continued work throughout extreme heat conditions. Increased OHS risks.
- Businesses losses due to altered schedules.

Key customer vulnerabilities:

- Home delivery services may be rescheduled, putting individuals at risk.
- Customers likely to congregate around perceived respite areas.
- Events cancelled due to extreme heat, e.g. festivals and sports events, leaving customers heading to other open, but ill-prepared areas.

Most common experiences & expectations from council:

Experiences:

- Staff and customer access
- Reduction in productivity, especially when working outside or not in offices
- Staff exhaustion and health concerns – staff welfare is a major concern for businesses
- Lack of backup generators in the case of power failure

- Power failure impacting on air conditioning (cannot run on backup power), operations, productivity and security
- Potential shift from smaller to larger (and presumably more resilient) retailers
- Some businesses may have capacity as a refuge (e.g. big box retail) – these will benefit from increased sales but experience increased huge strain on air conditioning systems, almost certain to experience failure at some point
- Disruptions to work and schedules
- Potential loss of stock if temperature dependant (e.g. food industry)
- Mechanical/equipment failure, plant equipment must be reliable
- Small business having to close doors due to lack of customers
- TAFE/ University campuses may need to shut down- unlikely to be able to provide cooling to scale of students and staff (note, less likely as heatwaves are usually during holiday periods)
- Lack of clarity around 'a too hot/ stop work' temperature for businesses and educational institutes
- Outdoor workers are particularly at risk
- Huge expense to business associated with HVAC
- Businesses currently undertaking construction and maintenance will be impacted (especially Universities/ TAFES – construction in summer months)
- Hygiene is a huge concern – especially for food industries, smaller businesses may not have backup generation – shutting down these operations or spoiling of food has wider supply chain impacts

Expectations:

- Provision of information
- Businesses/industry themselves expected to help themselves before asking for assistance (e.g. altering staff arrangements, operations)
- Mobile heat stress unit (provided by State Government, SES?)
- Tenants will look to their franchisee for support and information – business continuity, HVAC, onsite technicians, proper contracts in place
- Industry/ businesses are relatively self-sufficient in heat wave events – will need to accept the financial impacts
- Insurance not really applicable in heat wave events
- Customers will expect extra help – water in shopping centres
- Big box retail needs to work with its retail (e.g. cinemas) to ensure they're acting correctly
- General support expected from heatwave policies
- Huge demand for building services – expect prompt service

- Employees may look to their unions for support – especially around stop work temperatures and safe working conditions
- Employees may expect flexible working hours, and flexibility to leave and care for family if necessary
- Financial assistance for manufacturing industries is crucial

Bushfire

Management Actions

Key message on the state of current actions:

- Council systems and plans to deal with bushfire in the home or at the broad community level are well advanced in comparison to measures to deal with business risks. It was however not known in this group whether "business fire ready plans" exist. If not, they should.
- Council can play an advocacy role for directly or indirectly bushfire-affected businesses. They cannot, however, provide funding or direct assistance to businesses claiming to be indirectly affected.
- Council may also facilitate business-specific information sessions. Such sessions can cover topics like: access to grants and return to business strategies.

Key improvements and regional opportunities available:

- Council provides information on relief centres, but doesn't indicate whether individual businesses are open or closed during an event. Such information could be of great importance to the community, depending on how crucial a particular business is during a bushfire event.
- There is scope for improved engagement with certain businesses to ensure they can provide services during bushfire events, although they will need to balance risks to their own staff, vs. duty of care to customers and the community.

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Key changes to existing categories:				
Split out the impacts from bushfires on primary production, property damage etc., into individual impacts to enable an assessment of the likelihood and consequence.				
Addition of new impact categories:				
Direct impact on business assets.				

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Smoke disrupting the logistical operations of a region, for example the Hume Freeway or the Melbourne to Sydney rail freight corridor.				
Impact on essential services and traditional safe havens, such as shopping centres, leading to wider traffic and hence economic disruption. Wollert fires and the closure of the Northern Hospital and Epping Plaza noted.				
Opening of relief centres and the impact on council staff and their ability to undertake usual council business.				
Impact on businesses that volunteer as relief centre, e.g. Kilmore Race Track.				
Ability of business to recover post event and operate profitably.				
Ability for staff to function during and after an event when they may be suffering from the trauma of the actual event and its impact on their neighbourhood, surrounding community. The post event period may last significantly longer than a business will anticipate.				
Real estate values impacted by the inclusion of bushfire overlays on new areas.				
Notes or take-home messages: • Significant impacts on growth municipalities, but there can also be disruptive impacts on middle ring councils. • Understanding the economic impacts of recent bushfire events and post recovery efforts represents an opportunity area.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerable Groups

Key vulnerability factors for different aspects of industry:

Key operations vulnerabilities (e.g. infrastructure, utilities, staff):

- The Industries of Education and training, Manufacture and Construction were identified as generally lower risk than Retail trade, Transport, postal and warehousing, and Health care and social assistance.
- There are significant risks associated with reliance on power for service provision, particularly for the health care sector. Health care faces other challenges like increased burden due to fire-related injuries and safe passage for workers.
- Blocked roads are another significant risk, affecting all other industries. There may be an associated lack of information spread to other industries/business on movement restrictions.
- Local retail may be at greater risk due to being located in high fire-risk townships as opposed to urban centres.

Key supplier vulnerabilities:

- Significant construction supplies may be necessary during post-recovery, but limited in availability or accessibility.
- Questions were raised as to whether manufacturing and construction workers understood their roles/potential during and after a fire, particularly in relation to volunteering.

Key customer vulnerabilities:

- Mobility issues, particularly for access to essential services.
- Contractual issues – broken and affecting both customers and suppliers.
- Customers faced with a lack of options due to closures of businesses.

Most common experiences & expectations from council:

Experiences:

- Safety of staff (e.g. proximity, escape routes) paramount, and also staffing issues for businesses which continue to operate even outside of fire zones
- Access to workplace/business compromised
- Utilities loss may result in reducing output, business shutdown, damage to stock/equipment
- Disruptions to supply chain - deliveries/freight/schedules, perishables may be spoiled
- Security concerns for small business (e.g. theft, looting)
- More resource intensive operation for industries directly contributing to the response, e.g. healthcare, total inundation of services
- Big box retail will experience a large number of people seeking refuge

- Businesses may be disrupted by telecommunications issues
- Priority for industry: need to create normalcy
- Note that Melbourne's Fruit and Vegetable wholesale markets are in Epping: fire risk, huge food security and supply chain issues, no back up location
- Home based businesses are especially vulnerable

Expectations:

- Provision of real time information
- Strong, accurate coordinated communication: what is the situation, who is coming, what access is there?
- The message should be coordinated between emergency organisations/government/council etc.
- Emergency packs (State Government?)
- Reopening of roads as soon as possible
- Support from government (medical, food, waste, info, traffic) if business used as refuge
- Large businesses will look directly to their parent company and business networks to provide support, whereas small to medium businesses may have no support and need Government assistance
- Freight businesses will need accurate route and access information
- Council to prioritise access to businesses so they can resume operation

Post-recovery

Key experiences in and comment on the effectiveness of existing systems:

- There is a current focus on the quick return and recovery of public infrastructure.
- Traders associations are the primary avenues for communication with businesses and key stakeholders, however they have been described as dysfunctional. There is scope for improvements in the way information is disseminated to business networks.
- It wasn't known at the table whether or not current council post-recovery strategies explicitly deal with business interests.
- Only specific people within Council are aware of the emergency management and post-recovery measures
- Council have sent general information out (email, social media, council reps) to allow businesses to contact them when ready (if impacts have been severe)
- Westfield working with local council to assist in coordinating access to assistance as it becomes a default community centre
- Recovery funding and assistance is determined by the extent of the event for a discrete period of time and may not be sufficient for all relevant impacts.
- Local government has in place a system for sharing of resources in response to events.

- Smaller, rural councils with large land areas struggle to provide staff resources during events, leading to significant stress on officers, who may not have appropriate training. Leads to high attrition rate.
- Coordination between state agencies could be improved during events, inability to understand and provide the type of supplies critically required immediately post event, in particular for rural communities.
- Immediately after an event there is a relative dynamism to the response. As time increases the responses by agencies become increasingly bureaucratic.
- There are systems in place where local government economic teams go out to local businesses to ensure they are 'doing OK'.
- The focus is on rebuilding the economy and reinvesting in the local economy, not just providing 'free stuff,'
- The regional tourism body may assist in an economic development response.
- There are regional grants for industry from state government.
- Support and money which goes to the community is one of the best ways to benefit industry – boosts local economic activity.
- Key messages to the local community: shop local, and 'we are open for business'
- There is a need to decouple emergency response and emergency recovery. Currently most council plans deal with emergency response, and only some councils have plans that adequately document a transition to a recovery phase.
- Specific actions taken are dependent on location. E.g. depending if it is council infrastructure/land or privately owned.

Key improvements and regional opportunities for better post-recovery:

- Council could assist in business recovery by temporarily reducing rates, although they would need to ensure that the landlord passes it on.
- Council has a role to play in marketing their areas post-disaster to ensure continued tourism and business operations. This marketing strategy could operate at a regional level to improve reach and deliver a consistent message.
- Relationships with media outlets could be better managed to ensure that they don't spread views that could affect local businesses. Councils need to develop a reputation as media content creators, so that they are consulted in response to extreme climate events and have greater control over the messages delivered. In addition, social media should be better managed and understood in order to a) improve information provision and b) tap into the community's own communication networks to understand their behaviour during extreme weather events.
- Could attempt to source more recovery related supplies/items/equipment from local area.
- A database of local businesses that are able to support post-impacts could enhance recovery.
- A funding mechanism for emergency supplies/items/equipment (e.g. generators, appliances) and a system for recording stock could reduce recovery time (previously relied on donations).

- Focus of Economic Development units within council has not been on assisting business and commercial enterprises recover from climatic events. Opportunity area to both understand and quantify the impact and understand the potential role of council to assist.
- Need to support local businesses operations post event through ensuring that goods and services are supplied locally, or that they are supplying the goods that are required, Black Saturday and the extensive need for farm posts noted as an example.
- Need to ensure coordination of assistance in terms of donation from businesses of goods and services and that these are what is actually required post event.
- Agricultural businesses are particularly impacted by bushfire events and consideration should be given to specific packages / approaches.
- Long term implications for businesses that do not want to re-establish, or are not able to afford insurance in areas considered to be of bushfire risk.
- When funding that is provided post recovery, the vision should be to ensure that as infrastructure and social cohesiveness is rebuilt, it is done so with a view to building resilience amongst the community that has been impacted. From recovery to resilience.
- In some circumstances businesses have been known to take advantage of people who are fire effected and vulnerable, or take advantage of grant money which they are not entitled to.
- Local government could strengthen their role in going out to small businesses during post-recovery to ensure they have the right resources and know what the 'next steps' are.
- Local government could provide long term education to businesses so they know how to respond.
- Businesses must be consulting and involved in deciding community priorities, needs and long term response during post recovery.
- There should be a regional coordinated approach to messaging to the community for industry in the post recovery stage, key messages are: 'we are open for business,' ' buy local,' and to encourage tourism.
- There should also be clear communication to industry in post-recovery: what to expect from government at each stage of post-recovery, there is currently no clear procedure.
- To ensure tourism can re-establish, prioritise rebuilding supporting infrastructure (e.g. public toilets).
- Regional opportunities for business support: regional business networks, bringing key industry stakeholders together.
- There is scope to help businesses do vulnerability assessments and facilitate bulk-buying of essential equipment, goods, etc.
- Regionally linked refuges can be developed and implemented as part of a regional emergency response plan.
- Opportunities exist to access state government resources and funds for residents and to send messages to tourism operators.
- Councils can provide education/information on risk prevention, better buildings standards and design improvements and extend this to SMEs.

D4 Infrastructure

NAGA IRVA – Infrastructure Workshop Summary – 7 August 2014

Flash Flood – Community Infrastructure

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Localised disruption of access to community services (including staff access)	Direct	7	3	High
Localised essential service disruption	Direct	7	3	High
Risk to life from damaged community infrastructure	Direct and Indirect			
Community cost of infrastructure reinstatement - including the ability to react to other emergencies	Indirect			
Loss of recreation and community events – usually long term impacts	Indirect			
Post flood impact on infrastructure and community wellbeing (e.g. changes in soil structure)	Indirect			
Notes or take-home messages: • Recent learnings from Toowoomba Floods where no warning signals were in place, huge impacts				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Public open space (specially that adjacent to waterways)
- Often community infrastructure is located near waterways
- Downstream network impacts

Implications for service delivery:

- Localised interruption only
- Particularly strong impacts for passive recreation

Groups worst affected:

- Families with young children
- Recreation users
- Elderly persons

Interdependencies between infrastructure classes:

- Transport infrastructure, access is crucial

Management Actions

Key messages on the state of current actions:

Prevent:

- There is some distributed energy generation built with consideration of climate hazards.
- Clearing of trees takes place to minimise impacts on distributions lines.
- Land-use planning facilitates drainage pathways and ensures buildings aren't placed in high risk areas.
- General mitigation initiatives to reduce carbon emissions assist in reducing the risk of future flash flood events.
- Council buildings are currently being upgraded to minimise power loss impacts to information and communication technology (ICT) data centres.

Prepare:

- None recorded

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- More distributed power generation to minimise the spread of power loss from a single disruption.
- Target the distributed power generation on highly energy dependent locations such as aged care homes.
- Engineered flood management systems must rely less on pump-assisted water flow in favour of gravity.
- There should be less reliance on areas at risk of septic contamination.

Prepare:

- More can be done to protect key infrastructure from extreme events. Engineered flood defence systems (flood walls/dikes) that could be hydro powered as well. Water Sensitive Urban Design (WSUD) principles can be better integrated with at risk infrastructure.

Respond:

- If the power goes down, the immediate reactive actions become exposed to issues on power outages such as pumping and radio communications. Emergency communications channels need to provide accurate and up to date information. At times this can be more important than a return to electricity itself.
- Alternative communications abilities are needed, as council is moving to IT-based communication systems.

Flash Flood – Buildings

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Electronic building systems failure (e.g. controls stop working, ventilation locks or total HVAC failure due to inundation or power loss)	Indirect	6	2-3	M
Contamination of mains water (especially for water treatment is located in a basement. Childcare at particular risk).	Direct	5	4	M
Damage to building fabric, fittings and equipment (e.g. gutter overflow)	Indirect	9	2	M

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Contamination of potable water in buildings
- Damage to ceilings, wall and floors
- Ground level boilers – HVAC infrastructure and gas supply

Implications for service delivery:

- Building closed and unable to functions
- Inhabitable and/or unsafe.

Groups worst affected:

- Young children in childcare/pre-school.
- Civic centres (consider business continuity).

- Server rooms.
- Aquatic facilities (due to the cost of repair).

Interdependencies between infrastructure classes:

- Energy, Water, Transport.
- Loss of hot water.

Management Actions

Key messages on the state of current actions:

Prevent:

- Back-up power/generators.
- Strategic location of respite/critical buildings.
- Location of critical equipment above flood level.
- Periodic maintenance (e.g. gutters).
- Drainage system improvement to reduce likelihood of retained water.

Prepare:

- Business continuity plans developed.

Respond:

- Manual override of doors.

Key improvements and regional opportunities available:

Prevent:

- None recorded

Prepare:

- Perform vulnerability assessments of council buildings and services. Use this to be a template for a regional resource.
- Demonstrate/develop a common understanding of the benefits of going beyond Australian standards/minimum compliance.
- Expand business continuity plans beyond council operations, e.g. moving service to other appropriate buildings.

Respond:

- None recorded

Flash Flood – Water

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Pollution of waterways	Direct	9	3	E
Slumping embankments	Direct	9	4	E
Damage to water supply infrastructure	Direct	6	5	H
Contamination of water supplies	Indirect	5	5	H

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Underground drainage systems
- Above ground drainage systems
- Waterways

Implications for service delivery:

- Failure to provide drainage services.
- Flow on impacts to other services due to high demands and customer requests, e.g. a focus on clean up take away from normal service delivery.
- Insurance claims post-event.

Groups worst affected:

- Child care, aged care and disability services
- Hospitals
- Council maintenance staff
- Emergency response teams.

Interdependencies between infrastructure classes:

- Power/transport/buildings/community services/telecommunications.
- Emergency response.

Management Actions

Key messages on the state of current actions:

Prevent:

- Good drainage design in new growth areas
- Flow and drainage strategy implemented to understand risk
- Collaborations with different stakeholders
- A large amount of government policy formation.

Prepare:

- Resilience assessments undertaken.
- Signage and warning information in particularly high risk areas.

Respond:

- Use of media
- Response plans and "rapid actions".

Key improvements and regional opportunities available:

Prevent:

- Ensure that climate change projections are included in designs to account for the most up to date understandings of rainfall. Council water engineers and developers design infrastructure/drainage infrastructure to make use of this information.
- Improve access to information. And improve the messaging/guidance from council. Many don't know that they are in flood prone areas.
- Design PSP drainage infrastructure appropriately upstream, in new growth areas. Developers pushback on Melbourne Water guidelines – push back often related to water quality not flooding as much

Prepare:

- A lot of Councils area wary to give out flood information because of litigation – change this
- Minimise hard surface areas where necessary – have maximums allowed
- WSUD areas, gardens, rainwater tanks provided > education for residents to know how to properly look after

Respond:

- Better coordinated approach like the CFA fire messaging: culturally fire emergency management is dealt with better than flooding which is dealt with more secretly. Learn from the CFA messaging system and apply to floods.

Drought – Community Infrastructure

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Unavailability of sporting ovals (impact on community sports and social networks, creates significant unease)	Indirect	4	4	M
Loss of green space – including trees, streetscapes, parks and gardens, community and heritage impacts	Direct	8	2	H
Water features, pools and fountains emptied/ turned off – community/ amenity impacts and long term damage to infrastructure (cracking)	Indirect	8	1	M
Loss of function of recreational lakes and waterways – impacts fishing, boating, passive recreation, aquatic services	Indirect	4	3	M
Loss of ecosystem services – wellbeing impacts, less interaction with nature, less opportunity for recreation	Indirect	8	2	H
Economic cost of watering and maintaining green infrastructure during drought	Direct	8	2	H

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Sport & recreation ovals and associated community recreation infrastructure

Implications for service delivery:

- Community health, wellbeing and connection significantly compromised – people will look to alternative s for recreation and socialising

Groups worst affected:

- Families, youth, active persons or those with a particular need for regular outdoor exercise

Interdependencies between infrastructure classes:

- None recorded

Management Actions

Key messages on the state of current actions:

Prevent:

- Reclaiming of water and new aquifers
- Drought proofing recreational fields / sports ovals
- Resilient power supply
- Desalination/ water storage
- Connecting of water networks

Prepare:

- Rural road grading budget increased
- Public education

Respond:

- Rural financial relief
- Managing the impacts of shutting down sports and recreational facilities and services – coordinate and communicate with stakeholders

Key improvements and regional opportunities available:

Prevent:

- None recorded

Prepare:

- Public education – understanding water management, preparedness, behaviour change

Respond:

- Better coordination of re-established costs
- Regional collaboration on communication of response and adaptation for sporting clubs and recreational groups
- Pick up the learnings from the last drought and develop better regional responses

Drought – Transport

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Positive impact on road base as it dries out overtime. Potential secondary impact as road agencies need to ensure there is sufficient funding in their budgets to account for periods of high rainfall that will increase maintenance requirements.				
Indirect impact through an increase in water costs leading a general reduction in economic activity and a reduction in travel / patronage.				
Trams – Older trams struggle with temperatures over 36 degrees.				
Drying of soil may have small incremental changes over time.				
Significant vegetation in transport corridors that may be impacted over time.				
Difficulty in sourcing non-potable water for construction of transport projects during drought conditions.				
Gradual reduction in groundwater availability for those processes, such as construction, that rely on it.				
Increased sediment flow and runoff during first rains following a drought period.				
Notes or take-home messages: • Drought in general has minimal negative and some positive impacts for the transport network				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Aspects that rely on water supply. Minimal, main impact is on construction processes.

Implications for service delivery:

- None recorded

Groups worst affected:

- None recorded

Interdependencies between infrastructure classes:

- Water – ability of water network to provide sufficient supply for operations.

Management Actions

Key messages on the state of current actions:

Prevent:

- Green depot facilities that have low water use.
- Desalination plant will mean the next drought period will be managed differently by the government.
- Water efficiency approaches to design and operations.
- Behaviour change programs.

Prepare:

- Understanding the aspects of the network that have the greatest susceptibility to projected climatic changes.

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- None recorded

Prepare:

- None recorded

Respond:

- None recorded

Drought – Energy / Telecommunications

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Tree root network following water and impacting underground cabling infrastructure	Indirect	6	2	M
More localised failures of network infrastructure	Direct	6	2	M
Heat impacts on sagging lines requiring increased maintenance	Direct	6	2	M
Tree fall likelihood on overhead lines	Indirect	6	2	M
Increased demand for electricity. Impacts on service delivery.	Indirect	6	2	M
Degradations to key service buildings (aged care, child care)	Direct	6	3	M
Impacts to evaporative cooling units (e.g. cooling towers)				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Aged/older infrastructure. Lines/connections that have not been replaced recently.
- Substations (in particular relating to their issues with their foundations).
- Trees that are already vulnerable.
- Electricity/energy infrastructure requiring high water inputs.

Implications for service delivery:

- Maintenance costs increasing, requiring increased budget.
- Council emergency response initiatives are reactive. Potentially weak as they focus on maintenance.
- Similar impacts to flooding from lack of electricity. The main issue is long-term restrictions, or continual disruption/degradation.
- High peak demand and/or overall energy demand during drought period.

- Heat island effect on increasing system pressure. Worsened by general decline in the amenity of green infrastructure in a drought.

Groups worst affected:

- Reduced service capacities for elderly, hospitals and non-English speakers.
- Sustained periods of heat affecting staff that care for vulnerable groups. Exacerbated by poor building design.
- Poor building design also contributing to increased demand for electricity and water. Oldest building stock inhabited by lower income groups.

Interdependencies between infrastructure classes:

- Water services and Buildings. Considerable number of indirect impacts (refer to affected groups and implications for service delivery).

Management Actions

Key messages on the state of current actions:

Prevent:

- Council requires tree replacement with non-exotic/more native and varied tree species. The variation in species assists in building resilience into the vegetation as a whole.

Prepare:

- Stormwater capture and storage takes place.

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- More localised water management and storage could take place. This may indirectly help to manage cooling demands.
- More decentralisation of the energy grid is recommended (in particular solar PV).

Prepare:

- Stormwater capture and storage could be extended.

Respond:

- None recorded

Drought – Buildings

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
HVAC systems becoming dustier and working harder. May be less effective and require more maintenance		8	3	H
Unreliable power supply resulting in the closure of services (especially air conditioning)	Indirect	7	2-3	M
Unserviceable outdoor areas (e.g. childcare)		6	1	L
Reduced water for cooling systems		3	2	L
Rain harvesting system degrading from a lack of use		4-5	1	L
Increased fire risk due to dried vegetation around buildings		8	2	H
Tree limbs dropping due to health decline		8	2	H
Increased termite activity leading to structural damage		8	3	H

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- HVAC Systems.

Implications for service delivery:

- Decreased thermal comfort of occupants

Groups worst affected:

- Those with poorer quality housing.

Interdependencies between infrastructure classes:

- Energy - particular relevance due to brownouts.

Management Actions

Key messages on the state of current actions:

Prevent:

- Good building design, e.g. verandahs, energy efficient/insulating materials, resilient HVAC systems.

Prepare:

- Vegetation management to reduce fire risk

Respond:

- Monitoring schedule for observed cracks.
- Repairs/underpinning/root barriers.

Key improvements and regional opportunities available:

Prevent:

- Increase the reliability of power, e.g. implementing UPS systems, solar systems with batteries, and voltage optimisation.
- Increase utilisation of appropriate materials and strategic landscaping around buildings.

Prepare:

- Develop facts sheets/guidelines that document local knowledge and advise on designs for drought impacts (e.g. termite barriers) and how to go beyond Australian standards, to be shared regionally.

Respond:

- Consider all options for redesign in the event of a drought-related building issue.

Drought – Water

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Impacts to water quality from increased risks of algal bloom	Direct	7	4	H
Tree roots intrude into drainage systems looking for water	Indirect	7	4	H
Blockage of drainage infrastructure due to lack of natural flushing	Indirect	6	3	H
Reduced quality of green assets (e.g. street trees and active open space)	Direct	9	5	E
Failure/cracking of drainage/water supply/sewage infrastructure	Direct	6	4	H
Increased UHI effect	Direct	8	5	E

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Water supply reservoirs
- Water treatment plants
- Open space – green assets
- Drainage systems
- Stormwater capture systems

Implications for service delivery:

- Open areas become unappealing and/or unusable.
- Failure to supply fresh or recycled water.

Groups worst affected:

- Sporting groups / kids
- Physically vulnerable groups.

Interdependencies between infrastructure classes:

- None recorded

Management Actions

Key messages on the state of current actions:

Prevent:

- Currently making use of synthetic and warm season turf.
- Water harvesting
- Some alternative water sources available.

Prepare:

- Local government planning.
- PSP planning and planning controls.

Respond:

- Water restrictions
- Inspecting drainage assets.
- Increased use of alternative water sources.

Key improvements and regional opportunities available:

Prevent:

- Improving/increasing the availability of alternate water sources
- Maintenance is currently quite reactive
- Improved regulations for new developments.
- More whole of cycle

Prepare:

- None recorded.

Respond:

- None recorded.

Bushfire – Community Infrastructure

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Community facilities destroyed	Direct	9	2	H
Impact of fire trucks on open space and road infrastructure	Indirect	8	1	M
Loss of open space, parks and gardens	Direct	8	1	M
Loss of transport infrastructure – bridges, road, signs, rail	Direct	9	3-4	E
Loss of community access to property during fire and post recovery	Direct	9	3	E
Loss of communications	Indirect	5	2	M
Economic cost of rebuilding	Indirect	9	4	E
Notes or take-home messages: • Impact varies significantly across the region				

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Roads, bridges and transport infrastructure

Implications for service delivery:

- Access to services disrupted
- Access to family and homes disrupted

Groups worst affected:

- Rural and remote communities
- Outer growth municipalities and peri urban areas
- Groups without mobility/ drivers licence, especially the poor, elderly and disabled

Interdependencies between infrastructure classes:

- None recorded

Management Actions

Key messages on the state of current actions:

Prevent:

- Control burns
- Safety education
- Fire breaks/ fire access roads
- Planning scheme and other planning controls, location of resettling/ rebuilding
- Building standards

Prepare:

- Maintain access to water + fire dams to fight fire
- Provision of staging areas – CFA and local government
- Relief centre provision
- Community education
- Good management of fire access roads
- Evacuation plans
- Regional scenario planning

Respond:

- Advance warning systems
- MECC & MEMP
- Communications
- Relief centres
- State government support including financial support
- Social and community services – role in response
- Regional cooperative agreements

Key improvements and regional opportunities available:

Prevent:

- Better pre-planning
- Better planning and delivery of control burns

Prepare:

- Community refuge areas – finding from the Royal Commission (Black Saturday), this hasn't been implemented

Respond:

- How other Councils can better offer assistance to those more badly impacted
- Sharing of intellectual property and experiences
- Need better consultation with community regarding how to deliver the response, and better manage community expectations

Bushfire – Transport

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Power cut off				
Increased reliance on the road network if there is a cessation or truncation of PT services in a particular area.				
Access to emergency shelters becomes inhibited.				
Visibility impacts on drivers.				
Road furniture and sidings damaged. Fire has to be very hot to impact asphalt.				
Traffic light system can go down, which impacts transport network. Tends to be localised impact.				
Localised congestion impact on emergency and essential service delivery.				
Notes or take-home messages: • Localised congestion can impact on the ability of emergency services to carry out their roles.				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Areas in proximity to a specific event.

Implications for service delivery:

- None recorded

Groups worst affected:

- Those who are mobility impaired, e.g. elderly.
- Groups that gather in response to bushfire events become vulnerable as they may be trapped.

Interdependencies between infrastructure classes:

- Power

Management Actions

Key messages on the state of current actions:

Prevent:

- Strategic land use planning to ensure there are sufficient access points from communities.
- Vegetation clearance at strategic points on roadsides.
- Grade separations to improve the flow of both the PT and road transport network.

Prepare:

- None recorded

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- Improved land use planning to consider these evacuation scenarios. This planning should consider several decades into the future the likely population, transport and climatic scenarios.

Prepare:

- Provision of information to communities around behaviours in fire events. Not all the community needs to leave as this can have significant transport network impacts.
- Ensure bushfire and heatwave havens are separate.

Respond:

- Need to ensure there is a coordinated, whole of network response. Road closures are managed and the implications for the road network back from the event are considered as part of the planning process.
- Ensure there is adequate access for emergency services.

Bushfire – Energy / Telecommunications

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Damage to above ground electricity/ gas/telecommunications transmission	Direct	6	4	H
Damage to above ground electricity/ gas/telecommunications facilities (e.g. substations, towers, transformers)	Direct	6	4	H
Damage to above ground electricity/ gas/telecommunications vital points of access (access to sub-transmission, substations, exchange points)	Direct	6	5	H
Temporary impacts of below ground telecommunications (fibre optics)	Direct	6	3	M
Disruptions for coal – supply for generation	Indirect	6		

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Transmissions lines
- Key points of access/exchanges
- Telecommunications towers (including radio - critical)
- Roads, transport and railway lines.
- Street/public lighting.

Implications for service delivery:

- Resource depletion (particularly in rural areas) as a result of bushfire impacts to people/staff.
- Emergency relief efforts may be hindered by lack of power/communication abilities. May not be able to communicate emergency issues/warnings to locals. May need to rely on internet usage, mobile phone messages or others.
- Emergency relief centres may suffer from a lack of power.

Groups worst affected:

- Isolated communities in bushfire prone areas.
- People directly affected by the bushfire or located in adjacent areas.
- CFA volunteers/response teams.
- People migrating en mass.

Interdependencies between infrastructure classes:

- None recorded

Management Actions

Key messages on the state of current actions:

Prevent:

- Controlled burns take place to prevent fire risks.
- Actions taken on behalf of the energy/telecom companies as a result of bushfire risk areas (? – Unknown)
- Strategic planting of trees for wind breaks.
- Bushfire overlays an BCA building codes.
- MFB/CFA fire mapping to identify high risk areas.

Prepare:

- Local government efforts to increase awareness.
- Use of vulnerable people registers.
- Local preparation/education – 'Township Protection Plans'
- Codes and signals. Public alerts.
- Construction of more resilient buildings. Some departments have mandatory bushfire plans.

Respond:

- SMS regional updates/messaging systems

Key improvements and regional opportunities available:

Prevent:

- Assessing and protecting key telecom towers, with backup systems if necessary. Needs to be in place to ensure SMS/alert systems are maintained.
- Converting cables/lines to underground in bushfire overlay areas.
- Analysis of overlays to see where extensions are occurring.
- Examining power alternatives. Distributed generation to reduce dependence on large transmission lines and exchanges.

Prepare:

- Vulnerable people registers could be improved.
- Retrofits of buildings could take place.
- Signalling/alert systems could be extended.
- Many building bushfire plans are voluntary – even among councils. Could extend to make mandatory.

Respond:

- Using smart meters for communications during an emergency.

Bushfire – Buildings

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Overstretched buildings (e.g. relief centres)		7	4	H
HVAC unable to cope leading to loss of air quality/smoke		7	3-4	H
Loss of buildings to fire		7	3-4	H
Under-resourced buildings unable to provide business-as-usual services due to high concentrations of people (Consider toilet paper, bottled water, etc.).		7	3	M-H

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Relief centres/community buildings designated as relief centres.
- Buildings designated as MECCs – municipal emergency control centres.
- HVAC, power, water.

Implications for service delivery:

- Front line with community affected. Ripple effect due to resourcing burden would be observed.

Groups worst affected:

- Kids need quick recovery to minimise trauma. Increased onus to return service levels to normal ASAP.

Interdependencies between infrastructure classes:

- Energy

Management Actions

Key messages on the state of current actions:

Prevent:

- New buildings in a bushfire overlay area have design criteria including landscapes.
- More underground power instead of overhead power lines.
- Redundancy embedded into power systems.

Prepare:

- Operating plans developed for emergency management centres.
- Council sharing of staff (e.g. traffic management and health officers).
- Training of staff to work in emergency management centres.

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- None recorded

Prepare:

- Operating plans can inform the design of the buildings.
- Buildings can be designed to be multifunctional so that relief centres can work/serve the community during recovery.

Respond:

- Response dealt with to the extent possible.

Bushfire – Water

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Pollution of waterways	Direct	6	2	M
Impacts to water supply infrastructure (including bushfire damage to power supply)	Direct	7	4	H
Blockage of drainage systems	Indirect	6	2	M

Vulnerabilities

Most vulnerable parts of infrastructure network:

- Reservoirs
- Catchments

Implications for service delivery:

- Failure to supply water

Groups worst affected:

- All are affected by reduced water supply. Farmers may be particularly hard hit from a business perspective.

Interdependencies between infrastructure classes:

- Power, Telecommunications, Transport.

Management Actions

Key messages on the state of current actions:

Prevent:

- New buildings in a bushfire overlay area have design criteria including landscapes.
- More underground power instead of overhead power lines.
- Redundancy embedded into power systems.

Prepare:

- Operating plans developed for emergency management centres.
- Council sharing of staff (e.g. traffic management and health officers).
- Training of staff to work in emergency management centres.

Respond:

- None recorded

Key improvements and regional opportunities available:

Prevent:

- Tree preservation policies maybe compromise bushfire risk reduction efforts.
- Telecommunications failures are to be avoided. E.g. where warning messages are working, but sending people to evacuation locations that aren't necessarily safe to be at or travel to from some points.

Prepare:

- Increase awareness among councillors of fire fighting requirements.

Respond:

- Improve information dissemination

Post-recovery

Key experiences in and comment on the effectiveness of existing systems:

- Recovery is the single greatest and most long term social and economic impact
- Gap – post recovery not delivered with proper consideration of community needs, poor reinstatement of services, e.g. Murrindindi was given a massive regional sports centre which it now cannot afford to operate or maintain
- Biggest challenge is infrastructure reinstatement and also reinstating community services
- There is low awareness of the actions of other organisations due to overloading and poor communication during the emergency response

- Certain areas of the region shouldn't be redeveloped (high fire risk), people are reluctant to move away from their homes but otherwise it creates a cycle of disaster
- VicRoads prioritisation of road response (A, B and C class roads).
- Access to bus fleets to address longer term transport impacts.
- When electricity transmission is rebuilt as overhead, there is a lost opportunity for the prevention of future impacts that could be offered by underground.
- There may be issues with repairing/replacing old infrastructure to its original form, as opposed to investigating and installing new, more resilient technologies.
- Past responses have focussed heavily on large centralised solutions as opposed to localised solutions. These have been largely reactive.
- There have been drainage capacity issues in established areas. Additionally, water supply planning has been poor, but water restrictions are effective.

Key improvements and regional opportunities for better post-recovery:

- Need better consultation with community and local government regarding how to deliver the right community infrastructure during post recovery, and better manage community expectations around this
- Better communication across agencies during the emergency response for more effective response
- Regional agreement/ coordination needed to pool resources and deliver better infrastructure and services
- State Government should take on role of acquisition of high fire risk areas and phase out settlement, in the long term the cost-benefit pays off
- Improve awareness and understanding of the cost of the service level provided – manage community expectations
- Need better regional consideration of where to relocate, and better awareness of the risks of living in or developing in fire prone/ non defensible areas
- Clear prioritisation of infrastructure response, between council infrastructure and community infrastructure.
- Scenarios in place for the movement of council services, if key council infrastructure is impacted
- Incorporation of potential transport vulnerabilities into future asset management plans.
- The shortcomings of like for like funding replacement needs to be recognised in the context of a changing climate and the potential to enhance the resilience of replaced assets considered as part of any recovery funding.
- Need to ensure that strategic assets, such as hospitals, have alternate transport access identified to prepare for future events.
- Energy/Telecom response teams need to be properly prepared and have roles well established.
- Distributed energy systems can be implemented in post-recovery. This should involve a co-ordinated roll-out of infrastructure across councils.

- Processes of system/infrastructure innovation during post-recovery should take into account improvements for specific equipment, buildings and entire systems. The planning, design and consultation around these improvements should occur at the regional level.
- Water supply should come from a variety of sources during post recovery, and these should be recorded on a database that is reviewed and updated regularly.
- A proactive water management response should entail improved planning/regulations on water supply and strong cross-sectoral collaboration to achieve water cycle management at the regional scale.
- There is scope to better manage the politics of reinvestment in assets. Actions need to be taken to minimise overreaction and address the consolidation of services.
- Emergency relief funds require better direction to minimise the risk of fraud.
- Future service provision needs to the community should be communicated prior to the crisis.
- Disaster can be seen as opportunities to revisit how councils deliver services.

D5 Natural ecosystems

NAGA IRVA – Natural Ecosystems Workshop Summary – 13 August 2014

Flash Flood – Community Infrastructure

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Degradation and reduced biodiversity of wetlands due to influx of litter, sediment loads and contaminants from flood waters (impacts depend on system, mitigation efforts, frequency of flooding)	Direct / Indirect	7	3-4	H
Loss of topsoil impacting agricultural productivity	Indirect			
Reduced integration of environmental assets in urban planning due to changed community perception	Indirect	7	3	H
Amenity impacts - particularly relating to rubbish	Direct			
Setbacks in native revegetation programs due to loss of newly planted vegetation	Indirect			
Community impact of loss of environmental services: including wetlands (water treatment), and open space (recreation)	Indirect	8	4	E
Impact on aquatic biodiversity and riparian vegetation	Direct			
Tree loss and damage (shade and canopy)	Direct	6	4	H
Damage to vegetation / increase in erosion and runoff	Direct	6	4	H
Loss of grass and associated amenity	Direct	5	4	M
Potential damage to stormwater harvesting systems	Direct	6	3	M

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Increased frequency of plant replacement and failure of seedlings	Direct	5	2	M
Erosion of banks in natural waterways (General)	Direct	8	4	E
Erosion – Impacts of sediment loads on biodiversity				
Erosion – Loss of seed bank associated with topsoil				
Erosion – Increased maintenance activities associated with plantation				
Developments on flood plains				
Scouring of waterways / diversion	Direct	9	3	E
WSUD features damaged	Direct	9	3	E
Sedimentation (change of structure)	Direct	9	4	E
Destruction of habitat	Direct	9	5	E
Contamination (weed spread, pollutant migration)	Direct	9	2	H
Flood levy	Indirect	9		
Reduced stream fauna, invertebrates, and nursery and riparian habitats				
Shifting of waterways over time				

Notes or take-home messages:

- There is a much higher impact if there is a sequence of 2 or more events
- Soil types in the north are generally very resilient to flooding – only issues in isolated areas

Vulnerabilities

Vulnerable aspects of the environment:

- Big old trees (high winds, storm)
- Stream side environmental values due to weeds being spread, sediments and nutrients, eutrophication, erosion
- Ephemeral creeks becoming all year round, resulting in niches lost

- Wetlands/ waterways/ reserves which have been designed for a particular species habitat or ecosystem service
- Floodplains and associated red river gums (consider cultural heritage impacts also)
- Peri-urban wildlife habitat (e.g. platypus habitat in Whittlesea)
- Grasslands (prone to sedimentation)
- Low lying areas adjacent to waterways (esp. used for other uses – e.g. golf courses, trails)
- Riparian vegetation
- Fragmented and stressed species / ecosystems
- Urban catchments
- Higher value stretches, pockets of biodiversity
- Constructed areas, culverts
- Species with unique environments are particularly susceptible

Factors that contribute to this vulnerability:

- Topography
- Species inhabiting the floodplain
- Increasing urbanisation
- Timing of flooding events, outside existing regime
- By definition endangered species/ ecosystems are more sensitive (smaller populations, low health/ genetic diversity)
- Isolated populations/ ecosystems
- Species for which there is a lack of knowledge or understanding re: how to plan/ protect
- Elevation of land
- Current level of stress and fragmentation
- Level of permeability (depending on level of development)

Management Actions

Key messages on the state of current actions:

Prevent:

- Controls to slow down waters (e.g. wetlands, retention and filtration basins) to moderate flooding
- Increased surveillance of tree populations (esp. high risk areas such as activity nodes)
- CoM (laneways classed as open space) use porous pavements and stormwater systems
- 'Healthy Riparian Zones' programs – tackling erosion

- Catchment management: good WSUD and design in urban growth areas and upstream basins
- Retrospective installation of flood retarding basins
- 'Top of bank setbacks' for new developments (current Hume planning scheme review for this)
- Planning controls – Melbourne Water and the CMA are driving design standards
- Changes to the way that mulching is undertaken during revegetation
- Section 32 (local government act) – treating runoff and containing on site
- Water Sensitive Urban Design
- Stormwater treatment systems
- Retarding basins
- Planning requirements
- WSUD and Integrated Water Management

Prepare:

- Managing public access
- Information provision
- Ensuring habitats are diverse and designing for multiple species
- Putting databases in place to understand where vulnerable communities are located so follow-up recovery can be delivered, including the State Wide Biodiversity Interactive Maps
- More reactive management
- Gates are closed on paths
- Signs for diversion (usually permanent)

Respond:

- Initial focus on damage to 'people infrastructure' (e.g. BBQs, paths etc.)
- Growing focus on regional linkages and wildlife corridors
- Gathering appropriate resources to respond
- Inspection of changed habitats
- Levy

Key improvements and regional opportunities available:

Prevent:

- Lack of real infrastructure spending on open space (e.g. drains), focus is on roads, developments etc.
- Actions currently mostly reactive
- Design of open space (and associated access – e.g. paths under bridges) not considering multiple flooding events
- Catchment management / flood mitigation design approach differs across LGAs and even within an LGA (e.g. with different developers)
- Regional research opportunities (e.g. WSUD) happening but fragmented, lack of funds to implement
- Regional opportunities for leadership and advocacy among councils
- Ensure that the planning scheme and design requirements take into account future climate, not just current climate
- Current 'top of bank set backs' for new developments are too weak
- Urban flood modelling may not be up to date and accurate
- Widespread implementation of weed mats to prevent erosion
- Potential improvement for water retention in urban developments (e.g. apartment dwellings)
- Could also look at total retention requirements for some land purposes
- Land use planning to inhibit runoff, including the use of biodiversity enriched retention basins
- There are mixed objectives for urban green space that can produce adverse environmental outcomes. For example, having useable open space vs. providing habitat. Social objectives around engagement and safety can compete with protection and wildlife management objectives.
- This can be addressed through advocacy of compromise options which in turn require encouragement of the mindset to live within the environment
- Issues around who pays for assets (e.g. Melbourne Water vs. Council) complicates the achievement of WSUD objectives

Prepare:

- Design breeding habitats for aquatic species that are offset from major waterways
- Better cross-sector multi-disciplinary communication and collaboration
- No strategy currently in place for flood management of regional reserves, need a framework for resilient planning and flood retention (DEPI?)
- Could put equipment in place to be able to get people out to areas, to respond
- Opportunities to consider improved use of apps

Respond:

- Very difficult to do the work required after event immediately, would happen months later which makes accessing funds difficult (moving on to the next event) – also not covered by insurance
- Improve accessibility of information, there isn't currently a way to feed this into disaster response for a particular event
- More research needs to be undertaken into the necessary responses for ecology for a particular emergency event, there is potentially too much focus on 'iconic' species, needs a holistic view
- Is it possible to value and insure against habitat?
- Contingency fund (beyond BAU) to respond to increasing frequency and severity of events (to manage budget impacts)
- Seed banks/nurseries
- 'Friends' / Water Watch groups are important
- Scope for development of interrelationships between natural ecosystems management and SES/CFA/Council Emergency Management. Emergency Management to take further account of ecosystem perspectives
- Absence of knowledge around what environmental attributes are lost post-flood

Potential for natural ecosystems sector to reduce impacts on other sectors:

- Diversion of waters to storage, then using water when needed (particularly for active open space)

Drought and Heatwave

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Increased threats to species with unique habitat and limited capacity to migrate	D	7	4 → 5	H → E
Change in timing of seasonal events, such as arrival of birds and butterflies, flowering of plants, impacting on the viability of certain species	I → D	6	4 → 5	H
Parks and gardens under increasing strain due to reduced rainfall	D	7	2 → 4	M → H
Addition of new impact categories:				
Loss of horticultural assets	D	7	4	H

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Weed invasion post drought	I	7	4	H
Widespread deaths of sensitive species (e.g. bats, possums)	D	7	4	H
Increase in algal blooms impacting on aquatic ecosystems	I	8	3	H
Damage to infrastructure of open spaces (e.g. loss of sports field surface, surface too hard or cracked)	D	7	3	H
Ecological impact to refuge water bodies, reduced base flows (e.g. increased competition and predation, temperature sensitivity)	I			
Death of established trees (major long term impact which requires a specific response)	D			
Reduced peri-urban agricultural production	D	8	2	
Economic impacts of redistribution of land management funding	D	5	3	
Negative public perception of management of the landscape and environment (fire risk, loss of green space) and lower perception of value	I			
Loss of sports fields and recreation activities	I			
Loss of amenity and wellbeing value including urban heat island mitigation, loss of heat cover and impacts on cultural heritage	I	8	4	E
Soil compaction with effects on trees / reduces water uptake				
Change in types of plants and trees planted to adapt to increasing drought				
Overhead power lines can restrict shade trees				
Increased heat island effect due to reduced effect from parks and gardens				

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Reduced amenity (rubbish dumping, loss of value)	D			
Increased fire risk	D/I			
Increased weeds				
Wildlife care issues in a heatwave, e.g. possums falling out of trees				
Reduced useful life expectancy of urban infrastructure leading to an increase in maintenance costs				
Impacts to wildlife in urban areas (which are perceived to have a reduced environmental focus).				
Long term replanting				
Species movement from inland to cooler coastal climates				
Lack of water reducing public perceptions of open spaces				
Cumulative impacts to species over an extended period of time due to chronic drought/heat related impacts				
Impacts to any other projects that require significant water quantities. Potentially resulting in significant costs and diversion of funds.				
Impacts to land management activities and reduced burning.				
Changes in soil composition				
Reduced canopy cover/shade				

Notes or take-home messages:

- It is difficult to carry money forward in Government to allow Council to deal effectively with these kind of events when they happen (i.e. not every year, so the funds aren't in place)
- There is no 'drought response' funding bucket in Council
- Knowledge base around environmental/ ecological impacts of heatwave and drought is extremely poor
- Note some species actually benefit from drought and heatwave –may become weeds

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Vulnerable aspects of the environment:

- Older trees
- Young trees and revegetation areas
- Natural areas relying on flowering plants to support biodiversity
- Refuge water bodies (very high vulnerability)
- Established trees (very high vulnerability)
- Agricultural land (existing stresses such as compaction and water stress)
- Urban food gardens – food security
- Newly revegetated sites
- Generally aquatic biodiversity
- Native animals
- Anything that relies on permanent water
- Goes beyond stress levels (recurring events)
- Wetland environments (billabongs)
- Any species maladapted to dry conditions
- Isolated communities as a result of fragmentation of habitats. Areas lacking corridors for migration
- Areas without access to infrastructure that could provide additional water when needed
- Scattered red gum woodlands

Factors that contribute to this vulnerability:

- Age of trees
- Water requirements (e.g. seasonal flooding, wet feet) and adaptations (e.g. stomata control) of the species
- Temperature sensitivity
- Isolated species/ communities
- Poor dispersal /mobility
- Habitat areas located on edges
- Poor health going into a drought due to previous impacts/ environmental factors
- Locations where there is poor funding for ecological/ open space /species management – lower health
- Physiology

Management Actions

Key messages on the state of current actions:

Prevent:

- Increase species / genetic diversity
- Selection of turf type / removing turf
- GIS based adaptation model to help determine where funds most effectively spent
- Urban planning
- Drip irrigation / mulch for significant trees
- Species selection of plants (e.g. drought tolerant grasses)
- Artificial turf
- Alternative water sources (treated / recycled water)
- Water Sensitive Urban Design
- Stormwater harvesting
- Water tanks/drums for collection
- Priority areas for planning

Prepare:

- Third pipe facilities – re piping water
- Active watering of species (e.g. bats) to help them survive
- Incentive programs/ grants for land owners to protect vegetation and waterways through land management, e.g. fencing off waterways
- More consideration of species diversity when revegetating
- Temporary tanks for recycled water during droughts
- Manage outdoor staff during total fire ban days
- Environmental flows
- Recycled water
- Biodiversity mapping
- Establishment of nature links
- Use of drought tolerant species
- Conservation areas

Respond:

- Water retention systems
- Plant replacement
- Different management techniques (e.g. using herbicide to reduce weeds and therefore need for cutting)

Key improvements and regional opportunities available:

Prevent:

- Mandatory targets for burning aren't necessarily appropriate (e.g. burning not appropriate in stressed environments), management approaches are better
- Different thinking around how we create open space in new developments
- Steadily losing tree canopy with infill development
- Reduce reactive planning
- Increased capture of alternative water sources (e.g. recycled water)
- Rainwater tank offset scheme
- Waste water capture (industrial, residential)
- Retain moisture (greening)
- Improved communications – especially to use water where required
- Improved stormwater diversion for residents to keep soils hydrated. Considered in property values
- Enhanced nurseries/seed banks for affected areas

Prepare:

- It is currently difficult to carry lessons from previous events forward into preparation
- Lots of current investment in infrastructure for purpose but not in biodiversity, needs better planning
- Third pipe facilities aren't yet connected
- Need to retrofit established areas with third pipe facilities (not just new development areas)
- Advanced monitoring to take place to establish a baseline against which the impacts of drought can be measured

Respond:

- Better design of infrastructure to support ecosystem services/ environmental wellbeing moving forward
- Long term vision for funding of infrastructure response to ecological/ environmental impacts
- Education and awareness to change community perception/ prioritisation of how the response is managed (e.g. water should be used for supporting ecology/ biodiversity rather than just sporting fields)

Bushfire

Impacts

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Addition of new impact categories:				
Reduced water quality in catchments due to bushfires and drought	I	6	3 → 5	M → H
Reduced water quality in environmental waterways due to bushfires and drought	I	6	3	M
Addition of new impact categories:				
Changing configuration of parks and open space over the long term	I	6	4	H
Ecological impacts from increase of edge effects resulting from vegetation loss and clearing of firebreaks	I			
Planning/wellbeing/safety impacts of loss of ability/ action in implementing planning controls due to public reaction after fire and switching off of controls during the recovery process	I			
Downstream urban wellbeing and ecosystem impacts from ash and smoke in air/water	I			
Reduced water recharge (soil uptake is enhanced and there is less runoff)				
Increased prevalence and impact of invasive species, pests, weeds and disease	I			

IMPACT	DIRECT / INDIRECT	LIKELIHOOD	CONSEQUENCE	RISK SCORE
Animal death from fire / smoke				
Impacts of fire on Indigenous sites of significance				
Decreased recreational use of parks due to smoke (health impacts)				
Loss of park infrastructure due to fire				
Erosion due to vegetation loss				
Die-offs (aquatic, riparian)				
Reduced water quality (ash, chemicals from fire fighting)				
Impacts to staffing in some agencies, e.g. DEPI, due to conversion to emergency roles, e.g. fire fighting.				
Migration of species to urban areas, risk of impacts during and post migration				
Increased planned burning for fuel reduction producing ongoing impacts to biodiversity and exacerbating climate change				

Note that not all risks were fully completed during the workshops, indicated by the blank cells above

Vulnerabilities

Vulnerable aspects of the environment:

- Legislators, acting on public perception / fear, making decisions resulting in serious environmental damage that can't be prevented
- Large remnant areas
- Habitat connections (can allow fire to spread)
- Native tree stands on agricultural land which aren't being properly managed
- Level of urbanisation / interface with fire prone areas
- Properties not well maintained
- Vegetation selection in parks (e.g. non-native species killed in fire)
- Species closer to urban areas where fires are more prominent

- Longer lived species that require mature/complex systems to propagate
- Slow moving species
- EPBC listed pockets in Melbourne's North

Factors that contribute to this vulnerability:

- Species isolation
- Lack of mobility in particular species
- Species which have a long term lifecycle/ long establishment requirements
- Species with low heat/ fire tolerance
- Geographic proximity to fire
- Presence of combustible vegetation / materials on site

Management Actions

Key messages on the state of current actions:

Prevent:

- Improved communication between agencies
- Strategic fire breaks (public and private land)
- Fire mowing
- Training staff in fire management
- Emergency / fire management integration within councils
- DTPLI – bare ground firebreaks
- Integrated fire management – urban fringe
- Controlled burning
- Power line undergrounding
- Tree inspections
- EMCs assess vulnerabilities across municipalities
- Planned burning of park vegetation
- Fire prevention maintenance (esp. on roadside)
- Fire breaks and maintenance tracks (incl. along new subdivisions, and sometimes around high value habitat)
- Static water supply available around municipality esp. where there is no main water supply
- Zoning and management overlays

- Building Council of Australia (BCA) Changes to improve standards

Prepare:

- Moreland – fire risk planning for open space – helps to identify vulnerabilities
- Modifying planned works on high fire risk days
- Fill tankers with water
- Put contractors on standby
- Vulnerable persons register to contact

Respond:

- Increased weed management post event
- NRM – a model on which to base future fire disaster responses, community recovery model, fairly effective in engaging community on environmental issues as part of this
- Note – ecology /open space is low priority during response for obvious reasons
- Hume – fact sheets for recovery including tree removal
- DEPI feed lots on specific areas
- Adapt management of land based on fire experience
- Inspection when safe to do so but emphasis on infrastructure, tress and dead animals (limited wildlife recovery)
- Putting up roadblocks, sending out tree crews
- Lending staff to other councils for recovery

Key improvements and regional opportunities available:

Prevent:

- Increased fires drains resources, results in less funding to mitigate future impacts and therefore increases risk
- Further community education / training in fire management / response actions (esp. grass fires)
- Appreciation of risks in growth areas / urban fringes (esp. as these risks are changing year to year)
- Better consideration/ management of the ecological/biodiversity impacts of clearing fire breaks
- Recognition of private property opportunities in better land planning
- Current poor planning of peri-urban development in fire risk zones, need better planning and ways to better enforce the planning scheme
- Need a regional approach to planning for land management and fire risk, change short term thinking
- Urban fire management program

- Regional database
- Trees as fire breaks
- Understorey management
- Impacts to biodiversity poorly understood. More research required to provide a basis that informs actions
- Improve the network of corridors to prevent isolated patches

Prepare:

- Protecting biodiversity and cultural heritage not necessarily well considered during mitigation efforts (compared to protecting property and people)
- Need better consistency of programs and priorities
- People knowing what to do during fires (esp. in suburbia)
- Turn off grid
- Consider impacts to habitats arising from species extinctions
- Improve biodiversity mapping

Respond:

- Better education regarding burnt trees / tree clearing
- Need a more strict and better response in how rebuilding takes place and enforcing the planning scheme – don't necessarily rebuild
- Need more long term thinking – e.g. many post Black Saturday Royal Commission findings/ recommendations have been abandoned after just a couple of years, this is major issue
- There are no quarantine protocols for emergency response workers – this often causes the spread of disease and weeds across entire regions after fire events
- Conservation area management (encourage recovery and re-growth)
- Active landscape management

Potential for natural ecosystems sector to reduce impacts on other sectors:

- Undergrounding power infrastructure will increase impact on environment where digging occurs but could reduce risk of bushfires occurring (also eliminates risk of tree falling on power lines and disrupting service)

Post-recovery

Key experiences in and comment on the effectiveness of existing systems:

- Ecological recovery programs are generally implemented after big events but not usually for the smaller events
- Educational fact sheets distributed for next steps, particularly rebuilding and planning scheme guidance
- Parks often low on list of priority to reinstate – usually fenced off (for safety)
- Focus on replacing built amenities (e.g. fences, paths, toilets, picnic facilities)
- Council role to remove debris and work with private landowners to provide information
- Resources set aside for post recovery managements

Key improvements and regional opportunities for better post-recovery:

- Extending the funding over the duration of the recovery period and better understanding the issues
- Better planning controls for rebuilding and better mechanisms to enforce them (prevention, safety)
- Better communication across Council and between different groups within Council during the long term response
- Management of weeds is important during the post-fire period
- Alter existing planned management actions to move towards bushfire response

D5 Planning

NAGA IRVA – Planning Workshop Summary – 24 July 2014

Master Planning for Urban Renewal and Greenfields Sites

Urban Renewal Area – A-Gate climate change planning considerations

PLANNING LEVEL	CLIMATE CHANGE CONSIDERATIONS
Broader master planning context	• Building over railway to increase connections • Climate change has to be addressed with value-led thinking (challenge the objectives stated for the site)
Master planning	• Ovals flooding can be expensive to maintain • Grass is not as effective as tree cover at mitigating the UHI • Arranging taller buildings towards the south of the area, to minimise shading on other buildings • Affordable housing spread throughout (20% affordable) • Lots of WSUD at north end near creek and flooding overlay (including placement of oval) • Estuarine species for bay flood zone • A community facility at each end for use as community refuges • Use building heights to break up dominant wind • Consider that flood and bushfire overlays are based on old data, should consider projections • There is a need for robust climate change information and projections
Building orientation	• Tallest buildings next to freeway, overshadowing road • Oriented so that even southward dwellings have dual aspect for better amenity • North facing for solar access • Consideration of height and surrounding impacts • Opportunity to elevate buildings from flooding (construction industry charge)?
Individual buildings	• Mixed-use clustered around foot bridge to North Melbourne • Substation at south end of site near tram, away from flood risk • Any building over five storeys has landscaped roof • Solar micro grid for 'emergency' power? • Consider if resilience is impacted as a result of climate change • Consider embodied energy of building materials


Oval
North Melbourne
Abbotsford St
Ireland St
Adderley St
Hawke St
50
Tramstop
Railway Pl
Roden St
Adderley St
Arterial Road
Arterial Road
Arterial Road
32
Canal
Costco Wholesale Australia - Docklands
Observation Drive
Hall
55


Oval
North Melbourne
Tramstop
Footbridge
Adderley St
Arterial Road
Roden St
Hawke St
Railway Pl
Observation Drive
Festival Hall
ARUP

Greenfields – Donnybrook climate change planning considerations

PLANNING LEVEL	CLIMATE CHANGE CONSIDERATIONS
Broader master planning context	• Grid structure to maximise transport connections to and from the area (facilitate easy evacuation) • North facing housing as much as possible (for solar exposure and to minimise heating requirements) • Important to understand the bushfire overlay and associated risk (temporary / permanent risk, severity) • Design for ESD – not only relevant to climate change • Arterial roads for emergency access • Connection of development to railway station • Opportunity to create new sustainable development in greenfield site (high expectations) • Solar farm for off-grid generation (in bushfire zone to keep grass down and reduce load)
Master planning	• Walking and cycling paths align with arterial roads and waterways • Road crosses rail and creek at one point to minimise cost • Leave space at risk from flood undeveloped (if the oval was located there and flooded there would be a loss of amenity) • Grassland at risk from fire becomes a conservation area • Additional buffer zones from bushfire / flood overlays added to account for potential increases or changes in risk areas • Buildings likely to contain vulnerable groups were co-located with health facilities, and away from risk zones. They were additionally located close to main roads and public transport infrastructure • Allowing for additional flooding area • Consideration of location of allied care vs. hospitals • Health facilities located away from bushfire risk areas to the north of the site • Road as buffer to bushfire overlay • Low density residential housing in proximity to bushfire overlay • Community garden as a fire buffer, oval as place of refuge for fire events (also for water harvesting) • Trees to alleviate UHI • Native vegetation overlay should be considered • Shading walking and cycling paths with trees

PLANNING LEVEL	CLIMATE CHANGE CONSIDERATIONS
Building orientation	• Orientating buildings to maximise solar (minimise lighting and heating requirements) • Access to escape routes • Keeping out of high risk zones altogether • Grouping of vulnerable buildings (e.g. aged care) near refuges (e.g. shopping centres)
Individual buildings	• Bushfire risk assessment – avoid large scale buildings near the bushfire risk • Consideration of cool roofs, permeable paths, compulsory eaves, evaporative cooling, rainwater harvesting (commercial and residential) • All buildings to be 7 star (or equivalent)


ARUP
Arterial Road
Arterial Road
Connector St
Arterial Road
Connector St
Arterial Road
Footbridge
Walking + Cycling Track
Connector Street
Connector Street
Connector St
Arterial Road
Walking and cycling tracks
Oval


ARUP
N
Arterial Road
Connector Street
Oval
Footbridge
Arterial Road
Connector Street


Arterial Road
Arterial Road
Connector Street
Arterial Road
Walking and cycling tracks
Oval
Walking and cycling tracks
Arterial Road
SOLAR
1:100 flood overlay
Future flood zone
Green/open space
Transport/access
Bushfire risk
solar

Climate Change Planning for Council Sectors

Natural Ecosystems: Key opportunities and comments on climate change planning

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
SPPF	Flood	Integrated water cycle management is now well embedded in the planning scheme
All	All	It was discussed that the planning scheme broadly covers or offers opportunity to cover most natural ecosystems issues. Challenges exist in effectively using the tools available under the planning scheme. The quality and direction of planning policy and strategy more broadly is a key issue/opportunity to improve natural ecosystem outcomes.

Human Services: Key opportunities and comments on climate change planning

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
SPPF	All	Clause 13 of the SPPF (Environmental Risks) addresses climate change related risks
LPP	Flood	Opportunity to limit development in flood prone areas
LPP	Heatwave	Existing focus on ESD policy, passive design and neighbourhood character policies. Current emphasis on energy, but could be broadened to heatwave issues. Potential for councils go further on ESD (e.g. C187).
LPP	Bushfire	Some councils address bushfire risk issues in scheme. Opportunity for councils without bushfire controls in scheme to include them.
Zones	Flood	Potential to remove residential areas from existing urban floodway zones
Zones	Bushfire	Existing rural zone imposes minimum lot area

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
Zones	Long term climatic changes	Potential to restrict the expansion of growth area zones into food bowl zones
Overlays	All	A range of relevant overlays currently in place
Overlays	Heatwave	Potential for overlay of UHI
Overlays	Bushfire	Bushfire Management Overlay requires assessment of the bushfire hazard
Non-planning scheme	Flood	Flood addressed in building code (individual building design)
Non-planning scheme	Heatwave	Existing council position on passive design can address heatwave impacts (not part of planning scheme).
Non-planning scheme	Bushfire	BCA mandates that all buildings be assessed for Bushfire Attack Level
Non-planning scheme	Long term climatic changes	Range of opportunities to influence through municipal policies

Infrastructure: Key opportunities and comments on climate change planning

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
SPPF	All	Opportunities for strategic initiatives
SPPF	Long term climatic changes	Opportunity to address vulnerable groups
LPP	Flood	Opportunity to increase permeability requirements
LPP	Heatwave	Opportunity for policies to address UHI (structure planning, deciduous trees)
LPP	Long term climatic changes	Opportunity for precinct refuges from natural disasters to protect vulnerable households
Overlays	All	A range of relevant overlays currently in place

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
Overlays	Flood and bushfire	Opportunity for a flexible approach to locating buildings in risk areas
Overlays	Heatwave	Potential for a heatwave overlay
Overlays	Long term climatic changes	Potential for ESD requirements to be strengthened over time
Non-planning scheme	Flood	Opportunity to remove barriers (e.g. paving driveways)
Non-planning scheme	Heatwave	Heatwave strategies currently exist (asset / capital works strategies may also be of relevance). Potential for ESD policy for council facilities.
Non-planning scheme	Bushfire	Bushfire attack levels currently exist.

Industry: Key opportunities and comments on climate change planning

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
SPPF	All	Potential for public buildings to be used as refuges
SPPF	Flood and bushfire	SPPF includes section on environmental risk (e.g. sea level rise, bushfire)
SPPF	Heatwave	SPPF currently can mitigate heatwave impacts through the provision of open space, amenity and permeability. Potential for better passive design to reduce heatwave impacts.
SPPF	Long term climatic chang-es	Currently in draft – Responding to a Changing Climate
LPP	Flood	Opportunity for WSUD policy to include quantity (in addition to quality) and for precinct based rainwater capture and reuse

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
LPP	Heatwave	Existing Sustainable Design Assessment in the Planning Process (SDAPP). Potential to require canopy trees (e.g. Moreland) or mandate percentage shading through the scheme.
Overlays	Flood	Existing land subject to inundation and special buildings overlays. Potential to review flood data to update overlays.
Overlays	Heatwave	Potential for design and development overlays that incorporate climate change considerations.
Non-planning scheme	Flood	Opportunity for Melbourne Water to be more proactive (upgrade 'storm' tool to include quantity)
Non-planning scheme	Long term climatic chang-es	Examples of programs include City of Port Phillip's Weather Ready Program and the Design for Future Climate Program

Emergency Management: Key opportunities and comments on climate change planning

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
All	All	Opportunity to bring in (and develop) climate change triggers. Also potential for decision led adaptation (incl. flexible use buildings and whole of life considerations).
All	All	General comment that planning is based on historical climate data (e.g. flood zones based on historical 1 in 100 year floods) – need to consider future projections
All	Flood	Flooding is currently addressed throughout the planning scheme
All	Heatwave	Heatwaves are not currently well addressed throughout the planning scheme (except perhaps through ESD at the LPP level)

PLANNING SCHEME LEVEL	CLIMATIC EVENT (FLOOD, HEATWAVE, BUSHFIRE, OR LONGER TERM CHANGES)	COMMENTS/OPPORTUNITIES
All	Bushfire	Bushfires are currently addressed throughout the planning scheme
SPPF	Flood, Bushfire	Could be strengthened
SPPF	Long term climatic changes	Currently considers coastal impacts and soil degradation. Opportunity to plan for shifts in food production areas and biodiversity impacts.
LPP	Heatwave	Opportunity to offset UHI with green roofs
LPP	Bushfire	Opportunity to restrict development in bushfire prone areas
LPP	Long term climatic changes	More emphasis on impervious surfaces and rainwater collection (could have targets)
Zones	All	Does zoning consider access during emergency?
Overlays	Heatwave	Could map UHI hotspots through heat imaging
Non-planning scheme	All	Refuge strategy – to inform where and type of suitable refuge. Also could look to expand SES capability / more volunteers

APPENDIX E - REGIONAL PROFILE

E1 Regional Overview

It is necessary to understand the particular urban form, population and socioeconomic characteristics, and forecasted trends when considering the impacts of climate change. These are particularly useful in informing the assessment of climate change risks, impacts and vulnerabilities specific to a region. The following section describes the particular characteristics of the NAGA region across the six sectors as consistent with our methodology in Section 3.3.

NAGA is an alliance of the Moreland Energy Foundation and the councils covering the northern region of Metropolitan Melbourne, from the central business district (CBD) to the rural / urban fringe. The NAGA region spans major industrial, commercial and residential areas, as well as forests, agriculture and water catchments on the urban fringe (NAGA: 2010).

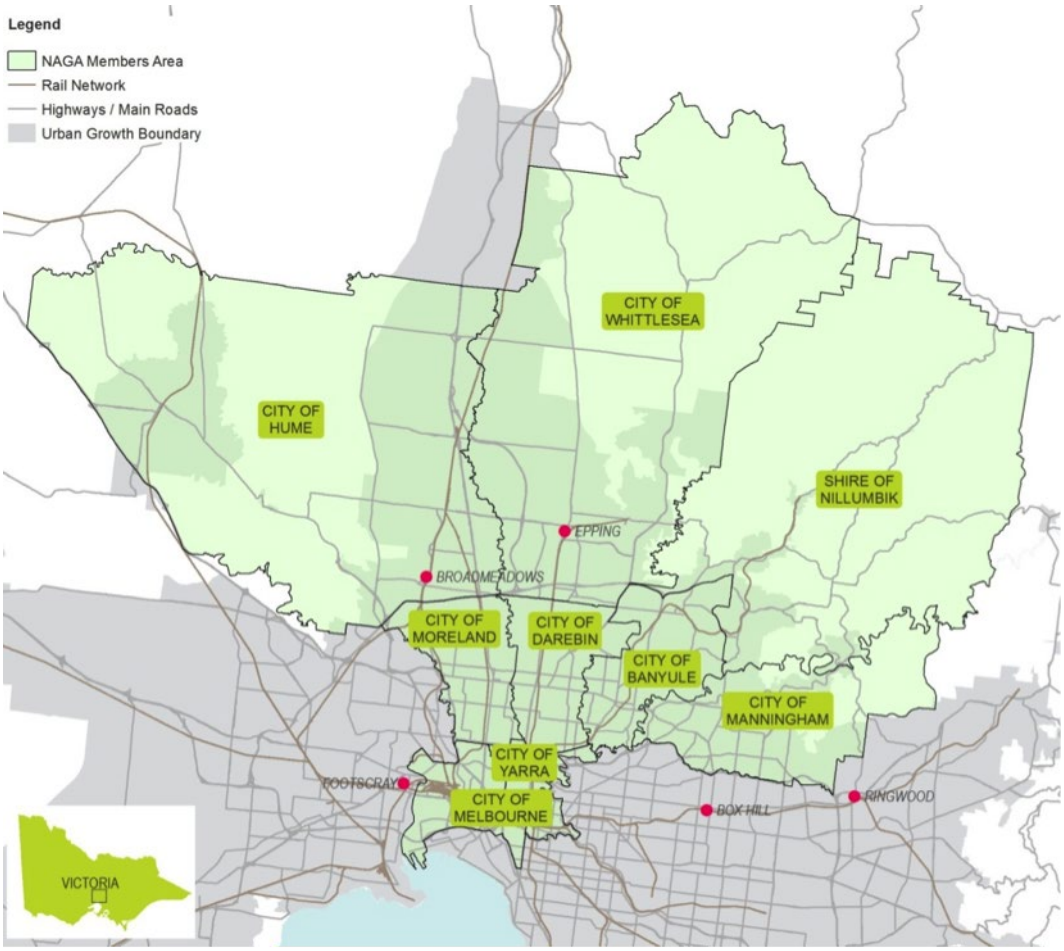

Figure 1: NAGA IRVA Study Region

The NAGA region currently covers just over a quarter of Greater Melbourne's population. This proportion will grow to almost 30 per cent by 2031 as the region's population grows by over 50 per cent. The demographic profile in Figure 2 shows that the NAGA region will experience strong and relatively even population growth across the various age groups. The strongest population growth is expected amongst those aged 35-49 (DTPLI: 2014b), and the region is also anticipated to experience an aging population. This is highlighted in the projections outlined in Table 1, showing that the proportion of the total population aged above 65 steadily increases from 2011 to 2031.

AGE	2011		2021		2031	
	NO.	PER CENT OF TOTAL	NO.	PER CENT OF TOTAL	NO.	PER CENT OF TOTAL
0-4	68,116	6.1	96,172	6.8	104,297	6.2
5-9	61,333	5.5	85,435	6.0	103,222	6.1
10-14	58,335	5.2	73,884	5.2	98,858	5.8
15-19	67,206	6.0	78,089	5.5	99,033	5.9
20-24	101,738	9.1	102,908	7.2	112,173	6.6
25-29	108,417	9.7	124,165	8.7	125,150	7.4
30-34	94,547	8.5	135,478	9.5	133,182	7.9
35-39	84,498	7.6	123,391	8.7	136,208	8.0
40-44	80,867	7.3	96,503	6.8	135,123	8.0
45-49	73,463	6.6	84,402	5.9	120,181	7.1
50-54	67,645	6.1	82,077	5.8	95,229	5.6
55-59	58,329	5.2	73,898	5.2	83,232	4.9
60-64	51,937	4.7	66,686	4.7	79,421	4.7
65-69	40,620	3.6	55,722	3.9	70,056	4.1
70-74	32,884	3.0	48,517	3.4	61,969	3.7
75-79	26,522	2.4	37,286	2.6	51,513	3.0
80-84	20,335	1.8	27,506	1.9	41,749	2.5
85+	17,079	1.5	27,752	2.0	42,246	2.5

Table 1 NAGA Demographic Projection *Source: DTPLI 2014b*

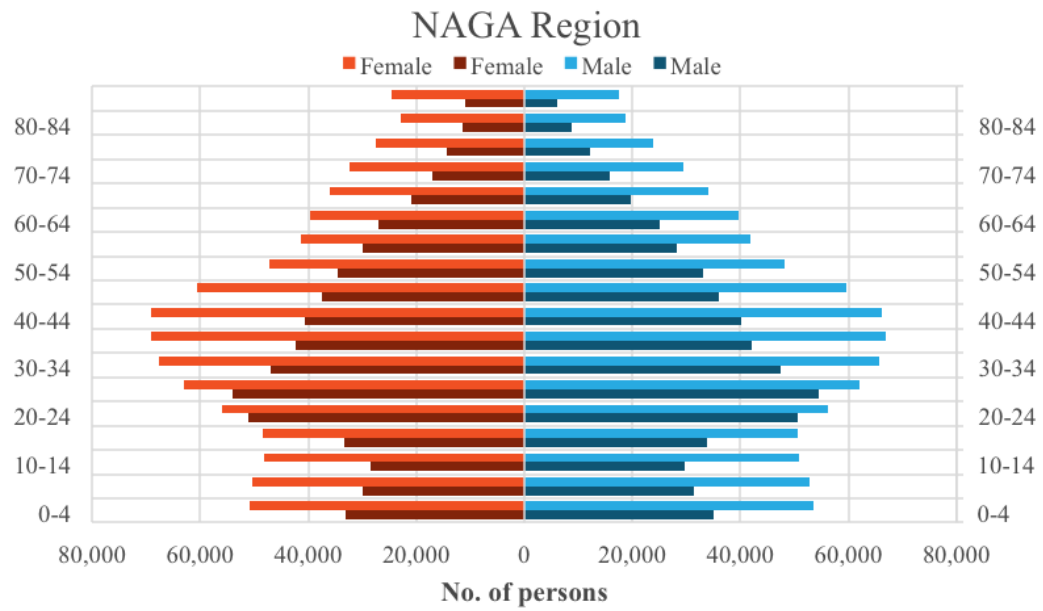

Figure 2 NAGA Demographic Chart (Source: DTPLI 2014b)

E2 Natural ecosystems

Current profile

Open space makes up 11.9 per cent of area in Metropolitan Melbourne. All of the NAGA region municipalities compare favourably in terms of open space, with the exception of Moreland with 10.3 per cent of area. The LGAs with the greatest proportion of open space include Nillumbik, Whittlesea and Manningham at 56.9, 34.2 and 24.6 per cent respectively.

Most NAGA councils have a similar number of parks and gardens per 1,000 population to the Metropolitan Melbourne average. The exceptions are Hume and Whittlesea at the higher end at around 4 per 1,000 population, and Darebin and Moreland at the lower end at 1.2 per 1,000 population.

The area of protected land varies widely across the NAGA region, with the Metropolitan Melbourne average being 63.7 hectares protected per 1,000 hectares of land. Banyule, Melbourne, Moreland and Yarra have no conservation land or nature reserves. Darebin, Hume and Manningham have between 15 to 50 hectares protected per 1,000 hectares of land, while Nillumbik and Whittlesea both have around 175 hectares protected per 1,000 hectares of land.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Ecological vegetation classes (per cent of area classed as EVCs)	12.3	1.5	16.4	41.0	5.9	0.3	67.3	34.6	10.9	21.1	34.8
Proportion of area as public open space (per cent of area)	15.2	15.5	14.2	24.6	16.6	10.3	56.9	34.2	16.2	22.6	11.9
Number of parks and gardens (no. per 1,000 population)	1.7	1.2	4.1	2.4	2.2	1.2	2.7	4.0	1.7	2.4	2.3
Protected areas – conservation land and nature reserves (ha per 1,000 ha of land)	0	17.8	11.3	46.4	0	0	181.0	170.1	0	47.4	63.7

Table 2 Natural Ecosystems Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

As a general trend, the NAGA municipalities of Banyule, Darebin, Melbourne, Moreland and Yarra will have limited opportunities for the creation of new public open space due to population growth and the existing coverage of built up areas (VEAC: 2011). The remaining municipalities are less restricted in this sense.

E3 Human services

Current profile

On the SEIFA Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) Nillumbik and Manningham lead the NAGA region, in the 97th and 94th percentile in Australia respectively. Hume is ranked last amongst the NAGA region, in the 41st percentile in Australia (ABS: 2011b).

The proportion of full time participation in secondary school at age 16 varies to a limited extent across the NAGA region, with all councils within 10 per cent of the Metropolitan Melbourne average. Melbourne has the lowest participation at 71.5 per cent while Manningham has the highest rate at 91.4 per cent.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Access to GP clinics (GP clinics per 1,000 population)	0.79	0.52	0.35	0.5	2.12	1.12	1.13	1.16	1.87	1.06	N/A
Access to community facilities (per cent of population within 800m of library, community centre or sports facility)	95.9	94.6	85.0	92.6	99.6	94.2	78.7	88.0	93.7	91.4	92.1
Per cent secondary education (per cent full time participation in secondary school at age 16)	87.2	83.3	77.3	91.4	71.5	80.7	86.9	80.7	81.0	82.2	82.8
Households with internet access (per cent of total)	79.1	72.3	77.5	82.2	88.1	73.4	88.3	76.1	82.1	79.9	79.1

Table 3 Human Services Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

Full time participation in secondary school education at age 16 has increased by 2.5 per cent from the 2006 to the 2011 Census across Metropolitan Melbourne. Over this same period, households with internet access have increased by 15.3 per cent. These trends are expected to continue across the NAGA region as higher levels of education increases opportunities for choice of occupation and for income and job security, and the internet continues to permeate into various aspects of society and become a necessity of everyday life.

E4 Infrastructure

Current profile

The NAGA region is served to varying degrees by a range of train, tram and bus routes. Public transport usage for commuter trips for Metropolitan Melbourne is at 14.2 per cent and varies across the NAGA region. Darebin, Melbourne, Moreland and Yarra all compare well in terms of public transport, with between 22 to 27 per cent of commuter trips. Hume, Nillumbik and Whittlesea are at the lower end, at around 9 per cent of commuter trips.

The NAGA region is served, to varying extents, by electricity distributors CitiPower, Jemena, Powercor, SP AusNet and United Energy. Gas distribution network operators include Envestra, Jemena / Multinet / Alinta and SP AusNet. The water authorities are Yarra Valley Water, Western Water and City West Water.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Public transport usage (per cent of commuter trips)	14.6	22.2	9.2	11.1	26.4	23.8	8.7	9.1	26.8	16.9	14.2
Kilometres of road network	737	706	2,019	870	575	704	1,452	2,040	352	1,051	39,258
Kilometres of rail network	28	27	108	0	233	33	14	56	32	59	1,272

Table 4 Infrastructure Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

Major future transport links listed in Plan Melbourne for the NAGA region include the Melbourne Rail Link, East West Link, a potential North East Link and a potential Outer Metropolitan Road and Rail link (DTPLI: 2014a).

E5 Planning

Current profile

The Metropolitan Melbourne average household size is 2.59 persons per household. Most of the NAGA councils have a similar density, with Melbourne being at the lower end with 1.91 persons per household and Hume, Nillumbik and Whittlesea being on the higher end with around 3 persons per household.

Yarra has the highest zoning of commercial land at 13.3 per cent while Manningham, Nillumbik and Whittlesea all have less than one per cent. The City of Melbourne has the highest zoning of industrial land at 9.9 per cent while Manningham and Nillumbik have less than one per cent.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Household size (persons per household)	2.54	2.42	3.04	2.74	1.91	2.44	2.98	2.94	2.12	2.57	2.59
Proportion of Commercial zoned land (per cent)	1.3	2.5	1.9	<1	4.3	3.3	<1	<1	13.3	3.0	N/A
Proportion of Industrial zoned land (per cent)	2.1	6.2	3.6	<1	9.9	6	<1	1.5	3	3.6	N/A

Table 5 Planning Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

The NAGA region lies mainly within the Northern Subregion as defined in Plan Melbourne. The City of Melbourne and Yarra sit within the Central Subregion while Manningham sits within the Eastern Subregion.

E6 Industry

Current profile

The Metropolitan Melbourne average household weekly income is $802. The NAGA region councils vary significantly either side of this average, with Hume having the lowest at $680 and Yarra having the highest at $1,149.

The City of Melbourne and Hume have the highest proportion of local employment, at 62.7 and 41.4 per cent respectively. Moreland is the lowest at 18.7 per cent.

The proportion of people employed in highly skilled occupations varies to a limited extent across the NAGA region, with most councils within 10 per cent of the Metropolitan Melbourne average. Hume has the lowest proportion at 46.8 per cent while Melbourne has the highest rate at 69.2 per cent.

The unemployment rate varies significantly across the NAGA region. Nillumbik has the lowest rate at 2.3 per cent while Whittlesea has the highest rate at 8.0 per cent.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Household income (median equivalised gross weekly household income)	$853	$744	$680	$850	$1,002	$759	$990	$716	$1,149	$860	$802
Local employment (per cent of people working and living in the same LGA)	26.8	22.1	41.4	23.4	62.7	18.7	23.4	30.7	23.8	30.3	30.5
Workforce skills (per cent of people employed in highly skilled occupations)	61.2	54.3	46.8	52.9	69.2	55.4	57.7	49.2	65.3	56.9	58.1
Proportion of unemployment (per cent of labour force)	3.9	6.6	7.0	4.7	4.9	4.5	2.3	8.0	5.5	5.3	5.6

Table 6 Industry Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

The most significant changes from the 2006 to the 2011 Census have been the increase in employment in the health care and social assistance sector and the decline in manufacturing jobs (ABS: 2011a). These trends are expected to continue across the NAGA region as the population continues to age and traditional manufacturing declines across the country. This is reflected in Plan Melbourne, which forecasts growth in employment in population services from 43 to 48 per cent and a decline in manufacturing employment from 11 to 6 per cent, over the period of 2011 to 2031 (DTPLI: 2014a).

E7 Emergency management

Current profile

As required by the E*mergency Management Act 1986*, all NAGA councils have developed a Municipal Emergency Management Plan in order to detail the agreed arrangements for the prevention of, the response to and the recovery from emergencies that could occur in the LGA.

Access to public hospital emergency departments varies widely between the NAGA councils. The best access is in Melbourne and Yarra, at 100 per cent and 93.7 per cent respectively. The poorest access is in Hume and Nillumbik, both at approximately zero per cent.

All of the NAGA councils fare well in terms of access to emergency services, with rates in the mid to high nineties.

The total number of hospital beds per 1,000 population varies widely between the NAGA councils. Melbourne and Yarra fare best, with around 20 beds per 1,000 population each. Darebin, Hume, Manningham, Moreland, Nillumbik and Whittlesea all have close to zero beds per 1,000 population.

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Access to public hospital emergency departments (per cent of population within 5km of a hospital emergency dept.)	51.8	45.6	1.0	50.0	100	32.5	0	57.1	93.7	48.0	53.6

INDICATOR	BANYULE	DAREBIN	HUME	MANNINGHAM	MELBOURNE	MORELAND	NILLUMBIK	WHITTLESEA	YARRA	NAGA AVERAGE	METROPOLITAN MELBOURNE
Access to emergency services (per cent of population within 5km of police, fire or ambulance)	96.4	95.4	95.1	95.2	100	95.0	97.8	96.2	93.7	96.1	99.5
Total number of hospital beds (no. of public and private hospital beds per 1,000 population)	9.9	1.4	0.8	0.7	23.8	1.5	0	3.0	19.8	6.8	3.9

Table 7 Emergency Management Indicators *Source: Refer to Appendix B1 Indicator data sources*

Trends to 2030

Looking forward, more frequent rapid-onset events such as bushfire, severe storms, flash floods and particularly heatwaves due to climate change will stress the emergency management sector to effectively respond and protect against these impacts (OESC: 2012

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